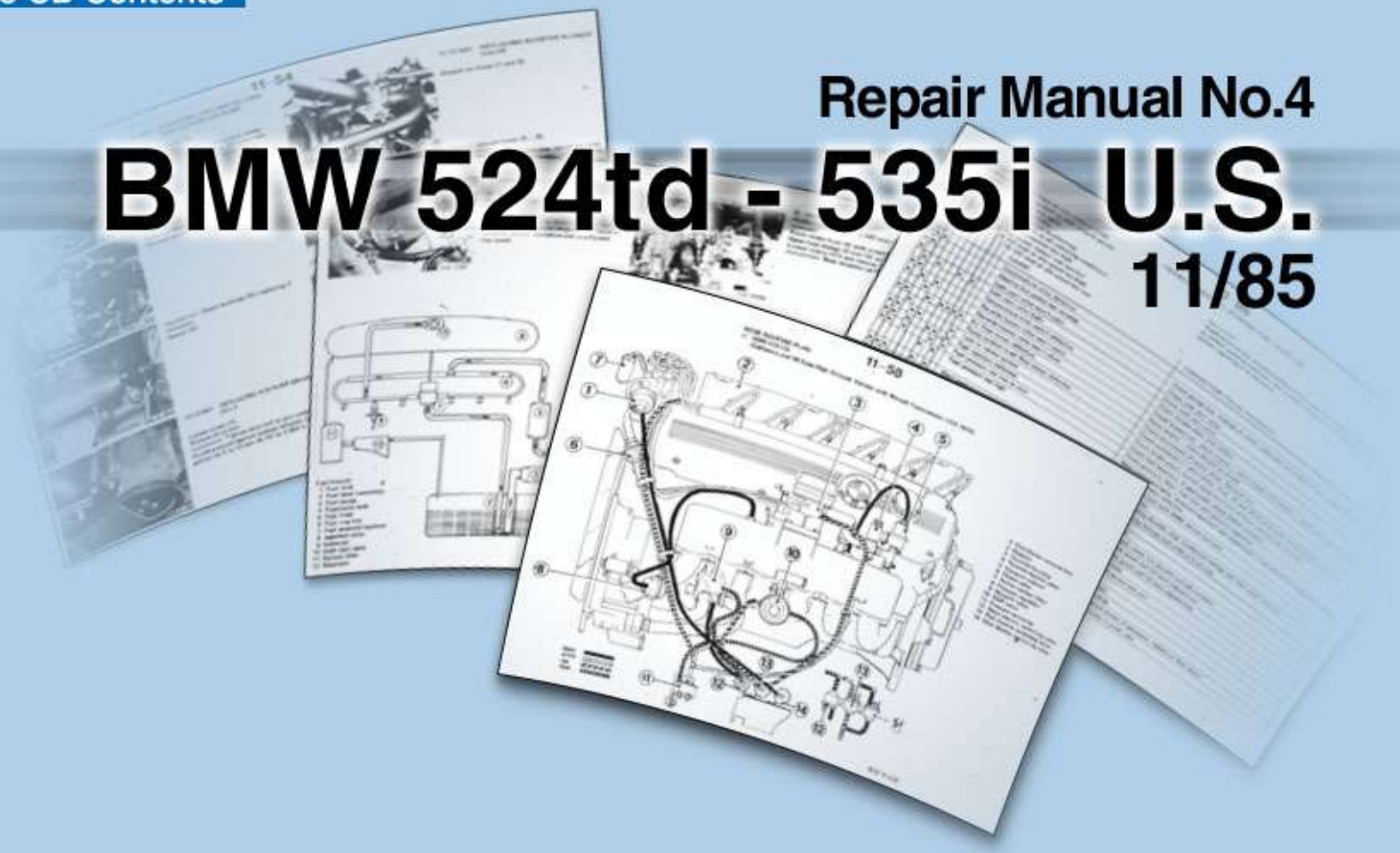
Back to CD Contents



Repair Manual No.4

BMW 524td - 535i U.S.

11/85

Main contents

00 Maintenance and general data

Introduction

The repair manual microfilm is to assist you in performing the necessary maintenance and repair work expertly and correctly. It must be placed at the disposal of workshop foremen and mechanics, and will complement the practical and theoretical training offered by our Service training schools.

Specifications and adjusting values are shown on the technical data and nominal value microfilms.

This repair manual microfilm is in reference to a standard production car free from accident damage and not subsequently modified in any way.

The group system has been adopted from the flat rate manual.

The job numbers used in the text are meant for use as cross reference. They will frequently contain job procedures, which must not be used for extension of the flat rates. They are only provided to make the finding of repair procedures easier.

The individual page numbering, for example 32-6, means:

32 - main group

6 - page number (in ascending numerical order)

The special tools essential for correct repair work are summarized on the special tool microfilm, Order number 01 99 9 699 422. Their use is illustrated in the descriptions of the various repair jobs.

The removal work is described for each repair job in this manual. If installation does not take place in the reverse order of work, an “installation” note is provided.

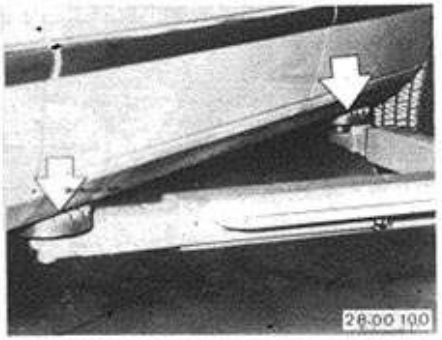
In addition to the improvements supplied to you regularly in the form of “Service Information”, you are recommended to consult the parts microfilms for additional illustrated data.

BAYERISCHE MOTOREN WERKE AG
SERVICE DEPARTMENT

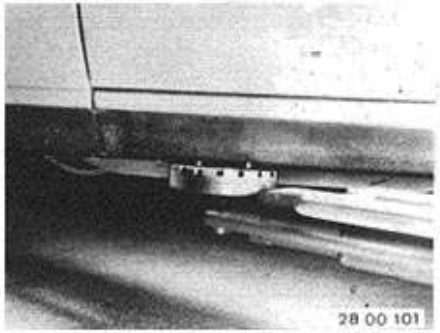
GENERAL INFORMATION

LIFTING VEHICLE ON A LIFTING PLATFORM

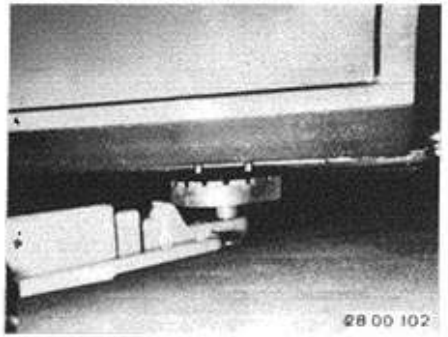
Before driving a car on the platform, make sure that there is sufficient space (clearance) between the lifting platform and vehicle (if applicable spoiler, splash guard, etc.).



Lifting platforms must conform with local and national legislative measures concerning accident prevention and maintenance.
Arms of a lifting platform must always be applied only on the reinforced points of the frame members.



Front: Apply rubber block of lifting arm on the front perpendicular reinforcement of the frame member, which is also provided for application of the car's jack.

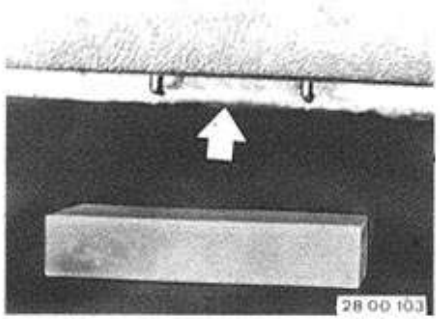


Rear: Apply rubber block of lifting arm on the rear perpendicular reinforcement of the frame member, which is also provided for application of the car's jack.

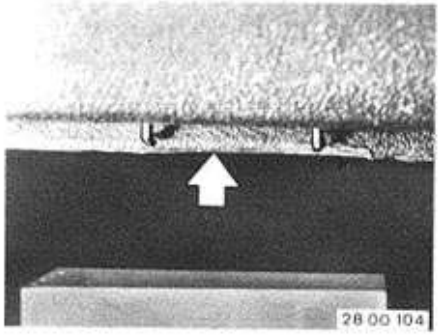
LIFTING VEHICLE ON A WORKSHOP TROLLEY JACK

A workshop trolley jack may also only be applied for lifting the vehicle on the same take-up points described for the lifting platform.

A suitable liner (rubber, wood or plastic) must be used between the jack and vehicle to avoid damage to the undercoating, frame members or floor plate.



Front Take-up Point



Rear Take-up Point

TOWING

Please conform with local and national legislative measures concerning the towing of vehicles as applicable.

Turn the ignition key to position "1" to unlock the steering wheel and be able to use the turn signals, horn and possibly windshield wipers.

Since the brake booster only works with the engine running, greater force will be required on the brake pedal of cars with a brake booster when the "engine is stopped".

The towing cable should be elastic to protect the towing and towed vehicles. Consequently only use plastic fiber cables or cables with elastic links.

Cars with Automatic Transmission:

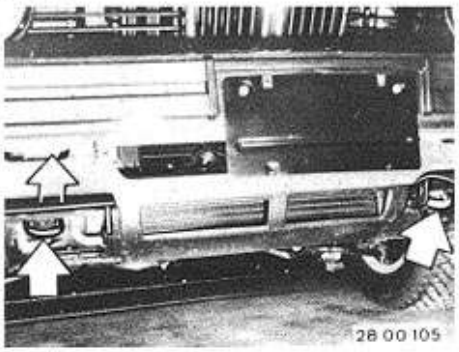
Selector lever in "N".

Max. towing speed: 50 km/h (30 mph).

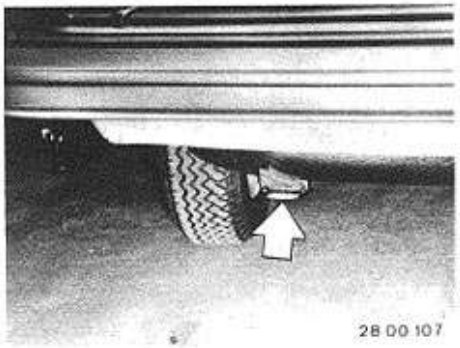
Max. towing distance: 40 to 50 kilometers (25 to 30 miles).

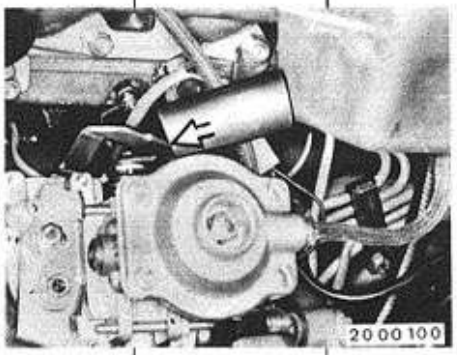
If the car has to be towed further than 50 km (30 miles) add an extra liter (2 pints) of ATF than the specified oil volume for automatics or remove the propeller shaft.
After repairing the car it is absolutely essential to correct the ATF volume to the specified amount.

Towing eyes front



Towing eye rear



00 00 009 Pre-Delivery Inspection	General Information					Important Instructions!
	Repair Manuel	Specifications	Nominal Values	Service Information	Owner's Manual	
Check engine oil level (check for dilution of lubricating oil), replacing oil and oil filter if necessary				Gr. 00	+	Use approved oil only! oil change 524 td see below
Check seal of filler cap						
Check coolant-hoses for leaks and correct routing						Visual inspection
Check tightness of hose clamps						
Check coolant level and antifreeze protection correcting if necessary				Gr. 00	+	Longterm antifreeze and corrosion inhibitor
Check battery acid level, adding distilled water if necessary Check tightness of battery terminals						
Check spark plugs and replace or clean and adjust electrode gaps	Gr. 12	Gr. 12				
Check fuel lines, tank, tank cap and filter for tight fit and leaks Check fuel injection parts for tight fit or leaks						Visual inspection
Check exhaust system for correct installation						Visual inspection
						Caution! 524 td: When starting the engine first time after an oil change, push lever on injectionpump to "stop" (arrow) until oil pressure control light goes off.

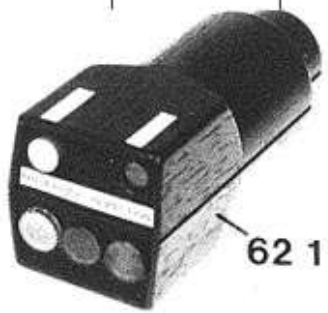
00 00 009 Pre-Delivery Inspection	General Information					Important Instructions!
	Repair Manuel	Specifications	Nominal Values	Service Information	Owner's Manual	
Check nuts and bolts of steering box, coupling, tie rods, front axle for tightness, or presence of cotter pins		Gr. 32/34				Check locks and cotter pins
Check power steering for leaks						Visual inspection Use approved brake fluids only; tightening torque
Check fluid level in tank for hydraulic brake and clutch systems		Gr. 34		Gr. 00		
Check connections and lines of brake system for leaks, damage or wrong routing						Visual inspection
Check tire condition, tire size and type as well as tire inflation pressure (also spare wheel)		Gr. 36		Gr. 36	+	
Check wheel bolts for specified tightening torque		Gr. 36				
Check function of lights: parking lights, turn signals, tail lights, stop lights, high and low beam headlights, side marker lights, backup light(s), license plate lights, passenger compartment light and delay system, glove box light, trunk light and engine compartment light					+	
Check aiming of headlights	Gr. 63					
Check function of horns, headlight flasher and hazard light and control					+	
Adjust digital clock					+	
Program on board computer and check operation of lever and push button control						

00 00 009 Pre-Delivery Inspection	General Information					Important Instructions!
	Repair Manuel	Specifications	Nominal Values	Service Information	Owner's Manual	
Check instument and sign lights, and brightness control					+	
Check indicator and warning lamps, clock, buzzer and check control: alternator, oil pressure, coolant temperature, turn signal indicator, fog light indicator, oxygen sensor, seat belt lamps, ignition key warning buzzer, high beam indicator, fuel gauge, ABS and SRS light, Check control function						
524 td: check indicator lights of glow plug system					+	
Fill supply tank for windshield washing system, check antifreeze protection				Gr. 00	+	Fill with antifreeze additive if necessary
Check function of windshield wipe/wash system and aiming of spray jets, remove protective sleeves on wiper blades					+	
Check rear window defogger						
Check function of cigar lighter						
Check function of headlight cleaners					+	
Radio: check antenna, trimming, tune in station, check shielding with engine running while switching all electric equipment on and off check cassette tape player	Gr. 65					
Check function of other special equipment, e.g.: electric windows front and rear, sun roof in all positions, fog lights and aiming, electric radio antenna and speaker balance control. Check other equipment installed by dealer						
Check outside mirrors						
Check operation of central locking system					+	
Check seat adjustment manual/electric						
Check seat belts						

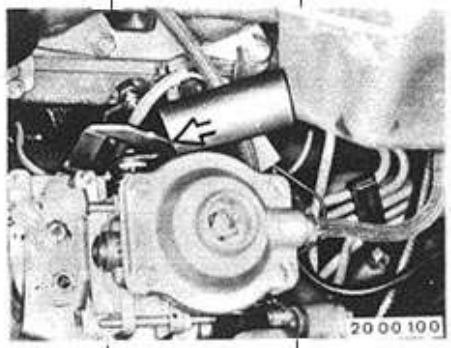
BMW MAINTENANCE SYSTEM	General Information					
00 00 009 Pre-Delivery Inspection	Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	Important Remarks!
Check data plate, chassis and engine numbers						
Compare ordered car equipment against delivered car equipment						
Install wheel covers, if applicable ornamental rings and tailpipe extension						
Place car tools in toolbox, secure jack and wheel bolt wrench						
Mount label for annual brake fluid change						
Place owner's manual, list of BMW service stations, spare keys and key case in glove box.						
Battery and accessory warranty cards,						
Radio operating manual (if equipped)						
Factory Invoice (Monroney Label)						
Tape unit cleaning cassette kit						

00 00 009 Pre-Delivery Inspection	General Information					Important Instructions!
	Repair Manuel	Specifications	Nominal Values	Service Information	Owner's Manual	
Test drive: check acceleration, coasting, brake system (before and during road test)						Caution: On systems with Po-litex brake linings, increased braking effect
Check idle RPM			+			
Check function of Motronic						
Check car for rattling and squeaking noise						
Check handling and wheel balance						
Check function of engine, clutch, transmission, rear axle, steering (wheel in straight ahaed position), cars with rear disc brakes: breaking in parking brake	Gr. 34					
Heater, fresh air ventilation/air condition						
Check function of all instruments						
Cruise control						

BMW MAINTENANCE SYSTEM	General Information					
00 00 009 Pre-Delivery Inspection	Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	Important Remarks!
After Test Drive:						
Leak test on: engine, transmission, steering, final drive, dust covers on output shafts, fuel system, clutch and brake hydraulic systems and Cooling system						Visual inspection
Check interrior of car and clean						
Car cleaned and polished No damage on underside Car without scratches or damage						Visual inspection
Remove seat and protective covers						
Important! The service indicator (SI) must be reset after completion of the pre-delivery inspection as follows. Switch off all electrical equipment. Turn on ignition. Do not run engine. Plug SI-R * in diagnosis socket. Push in and hold recessed, red INSPECTION button - green lamp (function control) comes on. Red lamp also comes on after approx 3 sec. and goes out after approx. 12 sec. Release inspection button - green lamp goes out.						
Checking Service Indicator (SI): All five green diode lights must be on. Yellow and possibly red diodes as well as INSPECTION sign should go out.						
* SI-R = Service indicator resetter, Order No. 62 1 100.						

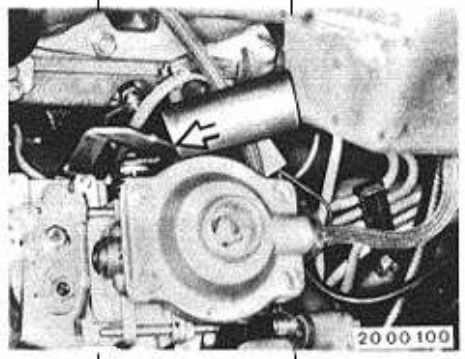


20 00 005

BMW MAINTENANCE SYSTEM	General Information					
00 00 210 1200 Mile Inspection	Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	Important Remarks!
Replace engine oil and oil filter at operating temperature	Gr. 11			Gr. 00	+	Use approved oil only see below
Check and adjust valve clearance	Gr. 11	Gr. 11				
Check coolant hoses and connections as well as heater hoses for leaks; check coolant level and concentration, correcting if necessary				Gr. 00	+	Longterm anti-freeze and corro-sion inhibitor
Replace oil in manual transmission at operating temperature (not applicable to automatic transmission)	Gr. 23			Gr. 00/23	+	Use approved oil only
Check ATF level in automatic transmission correcting if nec.	Gr. 24			Gr. 00/24	+	Use approved ATF only
Check exhaust system and catalytic converter for correct installation, routing, damage or leaks						Visual inspection
Tighten nuts and bolts of steering, brake calipers, output shafts and wheel bolts		Gr. 32/33/34 36				Tightening torque check locks and cotter pins
Check power steering for leaks and oil level, correcting if necessary	Gr. 32					
			 20 00 100			Caution! 524 td: When starting the engine first time after an oil change, push lever on injectionpump to "stop" (arrow) until oil pressure control light goes off.

BMW MAINTENANCE SYSTEM	General Information					
00 00 210 1200 Mile Inspection	Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	Important Remarks!
Replace final drive oil at operating temperature		Gr. 33		Gr. 00		Use approved oil only
Check fluid level in tank for brake and clutch hydraulic systems				Gr. 00		Use approved brake fluid only
Check connections and lines of brake system for leaks and damage	Gr. 34					Visual inspection
Check tire inflation pressure, correcting if necessary (including spare wheel)				Gr. 36		
Fill supply tank for windshield washing system / check antifreeze protection				Gr. 00		

BMW MAINTENANCE SYSTEM 00 00 210 1200 Mile Inspection	General Information					Important Remarks!
	Repair Manuel	Technical Data	Nominal Values	Service Information	Owner's Manual	
Check function of following equipment:						
Lights: headlights, parking lights, backup lights, license plate lights, interrior lights and delay system, glove box light, engine compartment light and trunk light						
Aiming of headlights, adjust if necessary	Gr. 63					
Indicators: turn signals, hazard lights, stop lights, headlight flasher and headlight dimmer switch					+	
Inspect check control panel operation. ABS and SRS lights						
524 td: check indicator lights of glow plug system					+	
Check instrument lights, indication lamps, windshield wipe/wash system and aiming of spray jets, heater and air conditioner blowers, rear window defogger					+	
Final inspection and test drive with check of fuel inspection system and operational safety of: brakes, steering, clutch or automatic transmission and mirrors, break in parking brake	Gr. 34					Caution: On systems with Politex brake linings, increased braking effect. See Rep.-Manual Gr. 34 10 014 breaking in p. brake

BMW MAINTENANCE SYSTEM 00 00 220 BMW Inspection I	General Information					Important Remarks!
	Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	
Replace engine oil and oil filter at operating temperature	Gr. 11			Gr. 00	+	Use approved oil only see below
Check and adjust valve clearance	Gr. 11	Gr. 11				
Lubricate joints and bearings of accelerator linkage, rotary shaft and throttle linkage with oil; lubricate bearings of throttle lever and gate with grease						
Check fuel tank, tank cap, lines and connections for leaks						Visual inspection
Check cooling system and all connections as well as heater hoses for leaks. Check coolant level and concentration, correcting if necessary. *Important!* Coolant must be drained completely and replaced every 2 years.				Gr. 00	+	
Check condition, routing, suspension and leaks on exhaust assembly	Gr. 18					
Replace automatic transmission fluid at operating temperature (only in Inspection I)	Gr. 24	Gr. 24		Gr. 00		Use approved ATF only
Replace oil filter screen in automatic transmission (only in Inspection I)	Gr. 24	Gr. 24				
						Caution! 524 td: When starting the engine first time after an oil change, push lever on injectionpump to "stop" (arrow) until oil pressure control light goes off.

BMW MAINTENANCE SYSTEM	General Information					
00 00 220 BMW Inspection I	Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	Important Remarks!
Check manual transmission oil level, correcting if necessary		Gr. 23		Gr. 00		Use approved oil only
Check power steering for leaks and oil level, correcting if necessary	Gr. 32			Gr. 00		
Check condition of tie rods, front axle joints, drop arms and coupling	Gr. 31/34/36					Tightening torque/ visual inspection of cotter pins
Check mechanical steering play, in straight ahead possition	Gr. 32					
Check final drive oil level, correcting if necessary				Gr. 00		Use approved oil only
Remove and install front and rear disc brake pads, check total thickness, if necessary replace, check surface condition of brake discs.	Gr. 34	Gr. 34				
Lubricate aluminum wheel rim centers	Gr. 36			Gr. 36		
Check fluid level in tank for hydraulic brake and clutch systems, correcting if necessary Important: replace brake fluid annually at latest.	Gr. 34			Gr. 00		Use approved brake fluids only
Check brake calipers and dust boots for leaks	Gr. 34			Gr. 00		visual inspection

BMW MAINTENANCE SYSTEM 00 00 220 BMW Inspection I	General Information					Important Remarks!
	Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	
Check brake lines and connections for leaks damage or distortion. Check movement of parking brake cables. Adjust parking brake.	Gr. 34					
Check tire inflation pressure, correcting if necessary (including spare wheel). Check trunk for gasoline odor.				Gr. 36	+	
Check condition of tires.						
Tighten bolts and nuts of door locks and strikers. Lubricate door hinges and hood hinges with oil; lubricate door locks with grease and check function.						
Check battery acid level, adding distilled water if necessary				Gr. 00		
Check function of air conditioner and Freon charge	Gr. 64					
Tighten mounting bolts of A/C compressor		Gr. 64				Tightening torque
524 td: check indicator lights of glow plug system					+	
524 td: with the 4th Inspection I replace toothed belt	Gr. 11					
524 td: with the 4th Inspection I replace glow plugs (necessary for California version only)	Gr. 12					

BMW MAINTENANCE SYSTEM 00 00 220 BMW Inspection I	General Information Repair Manuel	 Technical Data	 Nominal Values	 Service Information	 Owner's Manual	 Important Remarks!
Check function of following equipment: Lights: headlights, parking lights, backup lights, license plate lights, interrior light and delay system, glove box light, engine compartment light and trunk light. Indicators: turn signals, hazard lights, stop lights, horn, headlight flasher and dimmer switch. Check aiming of headlights, correcting if necessary. Test check control panel operation ABS and SRS lights.	Gr. 63					
Check ground conn. of SRS-front sensor screws to body	Gr.32					
Fill supply tank for windshield washing system, check antifreeze protection				Gr. 00		
Check function of windshield wipe/wash system and aiming of spray jets						
Check instruments lights, control lights, heater and air conditioner blower and rear window defogger						
Check condition and function of seat belts						
Final inspection and test drive with check of operational safety: brakes, steering, clutch or automatic transmission and mirrors, break in parking brake	Gr. 34					Caution: On systems with Politex brake linings increased braking effect See Rep. Manual Gr. 34 10 014 breaking in p. brake
Important! The Service Indicator (SI) must be reset after completion of inspection I as follows. Switch off all electrical equipment. Turn on ignition. Do not run engine. Plug SI-R* in diagnoses socket. Push in and hold recessed, red INSPECTION button - green lamp (function control) comes on. Red lamp also comes on after approx. 3 sec. and goes out after approx. 12 seconds. Release inspection button - green lamp goes out. Checking Service Indicator (SI): All five green diode lights must be on. Yellow and possibly red diodes as well as INSPECTION sign should go out.	Gr.62					524 td: The time factor is uncoupled from the wear factor. The time factor activates only the "INSPECTION" sign. The wear factor also switches off the green LED'S.
Note: 524 td: If the time factor has activated the INSPECTION sign, the green LED's do not change after the first reset, only the sign INSPECTION goes off. If time factor and wear factor have simultaneously activated the INSPECTION sign, the reset has to be carried out twice in order.						
* SI-R = Service Indicator resetter, Order No. 62 1 100						

2@00 006

BMW MAINTENANCE SYSTEM 00 00 230 BMW Inspection II = Inspection I + Additional Jobs	General Information					Important Remarks!
	Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	
Check all drive belts, adjust tension if necessary	Gr. 12/32/64					
Replace spark plugs		Gr. 12			+	
Air cleaner: replace air filter cartridge Replace filter cartridge more frequently when car is operated in dusty regions.	Gr. 13					
Replace fuel filter Shorten intervals when contaminated fuel was used	Gr. 16				+	
Check clutch drive plate for wear	Gr. 21					
Replace manual transmission oil at operating temperature		Gr. 23		Gr. 00		Use approved oil only
Check automatic transmission oil level correcting if necessary (only in inspection II)		Gr. 24		Gr. 00		Use approved oil only
Check front wheel bearing play	Gr. 31					
524 td: check injection timing	Gr. 13					
524 td: check idle rpm						
524 td: check and adjust toothed belt, change toothed belt every second inspection II, or every 4 years.	Gr. 11					
524 td: with the 2nd Inspection II replace glow plugs (on 49 states model only, but recommended for California version)	Gr. 12					

BMW MAINTENANCE SYSTEM 00 00 230 BMW Inspection II = Inspection I + Additional Jobs	General Information Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	Important Remarks!
Replace final drive oil at operating temperature		Gr. 33		Gr. 00		Use approved oil only
Check condition of dust covers on output shafts						
Car with rear brake discs: Check parking brake liner thickness	Gr. 34	Gr. 34				
Important! The Service Indicator (SI) must be reset after completion of inspection II as follows. Switch off all electrical equipment. Turn on ignition. Do not run engine. Plug SI-R * in diagnosis socket. Push in and hold recessed, red INSPECTION button - green lamp (function control) comes on. Red lamp also comes on after approx. 3 sec. and goes out after approx. 12 sec. Release inspection button - green lamp goes out. Checking Service Indicator (SI): All five green diode lights must be on. Yellow and possibly red diodes as well as INSPECTION sign should go out. *Note:* 524 td: If the time factor has activated the INSPECTION sign, the green LED's do not change after the first reset, only the sign INSPECTION goes off. If time factor and wear factor have simultaneously activated the INSPECTION sign, the reset has to be carried out twice in order. * SI-R = Service Indicator resetter, Order No. 62 1 100	Gr.62					524 td: The time factor is uncoupled from the wear factor. The time factor activates only the "INSPECTION" sign. The wear factor also switches off the green LED'S.

62 1 100

20 00 005

BMW MAINTENANCE SYSTEM	General Information					
00 00 240 BMW Annual Check (after every 11 to 13 months)	Repair Manuel	Technical Data	Nominal Values	Service Information	Owner's Manual	Important Remarks!
Important: renew brake fluid annually	Gr. 34			Gr. 00		Use approved brake fluids only
Check operation of master cylinder and servo, and inspect for leaks. Check and adjust headlights and auxiliary driving lights. Check Steering: Lock angle limits, threaded connections, power assistance.						
Important: coolant must be drained completely and renewed every 2 years, check antifreeze protection (against extra charge)				Gr. 00		Use approved anti-freeze additives only
Inspect body according to the terms of the BMW 6 year limited warranty-rust perforation					+	Register check or repair on Owners Handbock
Reminder only! Replace oxygen sensor every 50 000 Miles or 80 000 km	Gr. 11					
528 e: replace oxygen sensor every 30 000 Miles or 48 000 km, reset oxygen sensor indicator light.	Gr. 11					528 e: Reset oxygen sensor indicator light. Press recessed button on control box, mounted behind l eft dash panel cover, near pedal cluster.

BMW MAINTENANCE SYSTEM

00 00 249 BMW Engine Oil Service

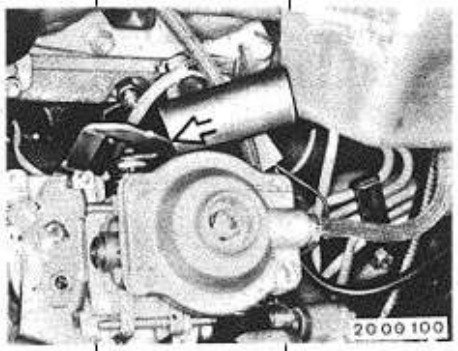
General Information					
Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	Important Remarks!

Engine oil and oil filter – replace at operating temperature

Gr. 00

Only use approved oil

Important!
The Service Indicator (SI) must be reset after completion of the oil service as follows.
Switch off all electrical equipment.
Turn on ignition.
Do not run engine
Plug SI-R * in diagnosis socket.
Push in and hold yellow OIL SERVICE ** button - green lamp (function control) comes on.
Yellow lamp also comes on after approx. 10 sec. and goes out after approx. 3 sec.
Release oil service button - green lamp goes out.



Caution!
524 td:
When starting the engine first time after an oil change, push lever on injectionpump to "stop" (arrow) until oil pressure control light goes off.

Checking Service Indicator (SI) after 10 Seconds:
At least one green diode light (however more than before) should come on.
Yellow (possibly red) diode and OIL SERVICE sign must go out.

* SI-R = Service indicator resetter, Order No. 62 1 100.

** *Caution!*
Resetting with the wrong button cannot be corrected.
Service Intervals would be mixed up - also refer to BMW Technik information of Group 62.

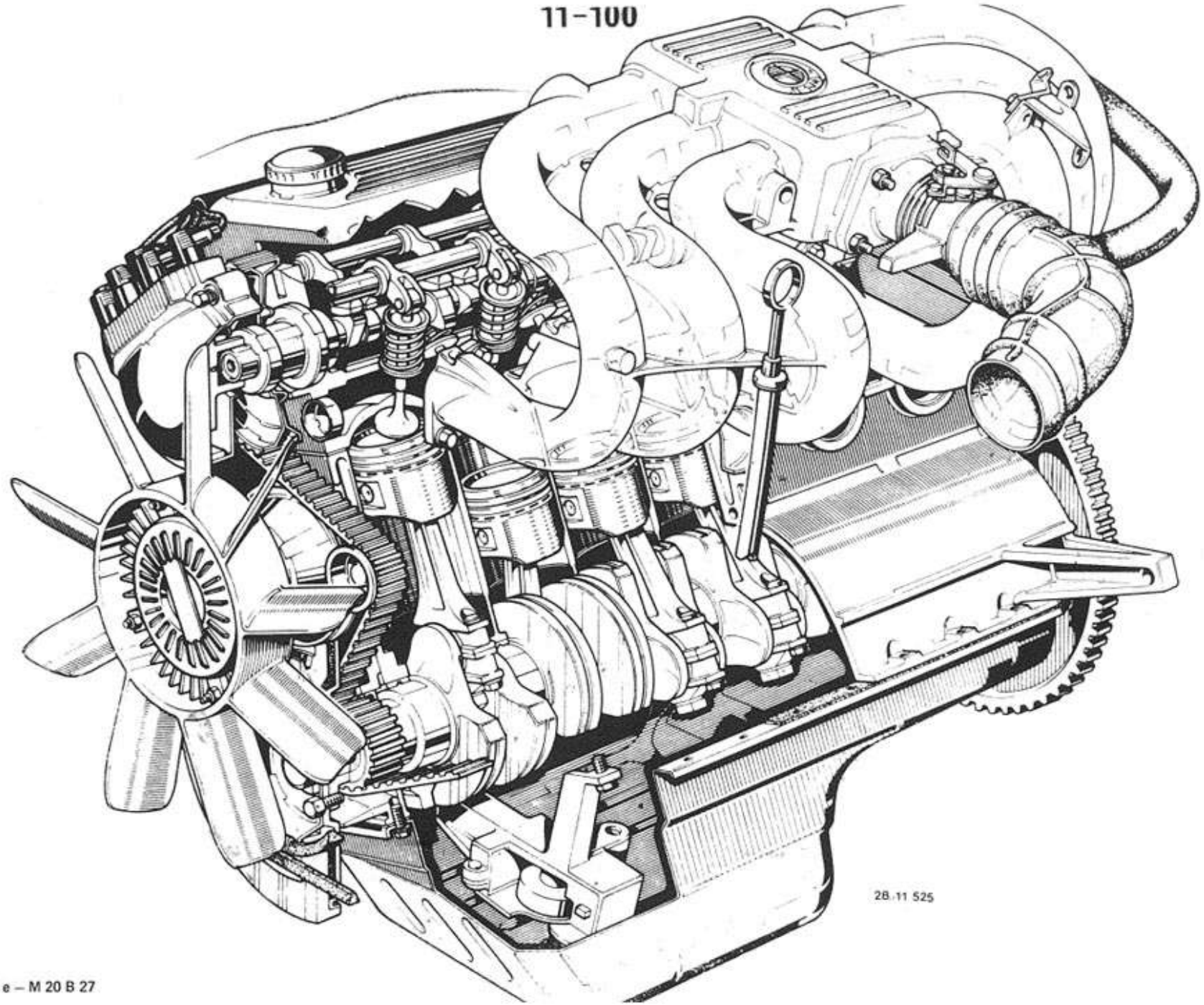
20 00 006

BMW MAINTENANCE SYSTEM 00 00 259 Additional Recommended Service (To be invoiced seperately)	General Information					Important Remarks!
	Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	
Steering Test: Steering gear, linkage, coupling, connetions, leaks, oil volume and condition for power steering	Gr. 32			Gr. 00		Use only approved oil
Brake Test: Brake pads (remove and install wheels), brake discs, lines, hoses, connetions, brake fluid level parking brake	Gr. 34					
Important! Replace brake fluid at least annually.				Gr. 00		Use only approved brake fluids
Tire and Wheel Rim Test: Condition, tire inflation pressure and specified size (including spare wheel)		Gr. 36		Gr. 36		
Light Test: Headlights, additional headlights (also aiming), parking lights, tail Lights,backup lights, license plate lights, instrument and sign lights, indicator and warning lamps interrior lights.also delay system,glove box, engine and luggage compartment lights Signal Test: Horns, headlight flasher, turn signals, hazard lights, stop lights Check control panel operation ABS-, SRS light.	Gr. 63					
Wipers and Washer/Cleaners Test: Wiper blades, waher (windshield and, if applicable, headlights), tank (fluid level/antifreeze), spray jet aiming (windshield and, if applicable, headlights). If equipped, intensive cleanser level.				Gr. 00	+	
Seat Belt Test: Condition and function	Gr. 72					
Clean cassette tape head capstan and pinch rollers every 50 - 100 hours of operation or earlier if quality of sound is impaired						
Final inspection and test drive with check of operational safety: brakes, steering, clutch or automatic transmission and mirrors 524 td: Drain water from seperator in fuel filter						Caution: On systems with Politex brake linings, increased braking effect
Remarks: Repairs and adjustments against extra charge.						

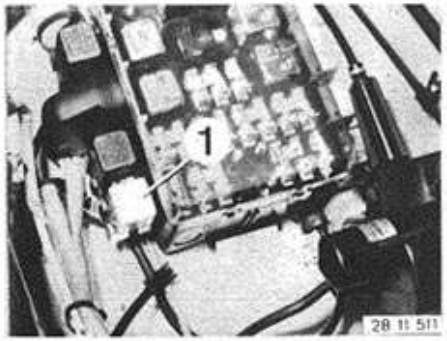
11 Engine

11 Engine

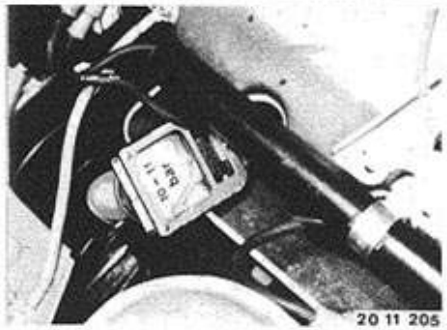
BMW 528e


28.11 525

11 00 039 CHECKING COMPRESSION OF ALL CYLINDERS



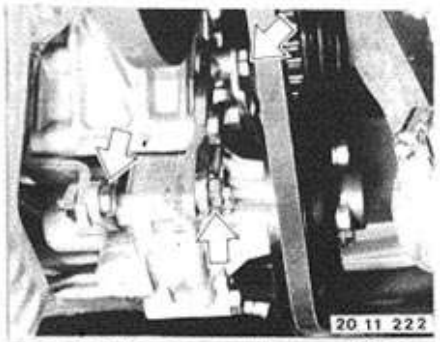
Pull off main relay (1).



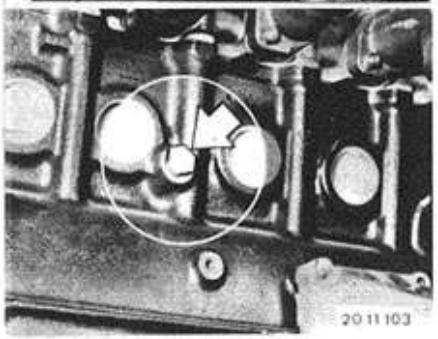
Unscrew spark plugs.
Test compression*.
Installation:
Tightening torque**.

* See Specifications
** See Specifications of Gr. 12

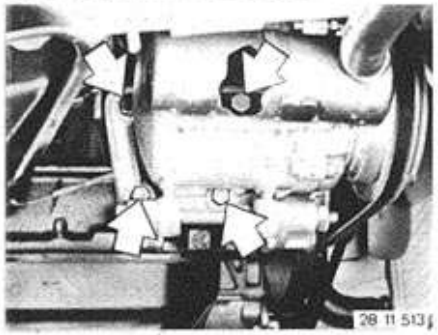
11 00 050 REMOVING AND INSTALLING ENGINE



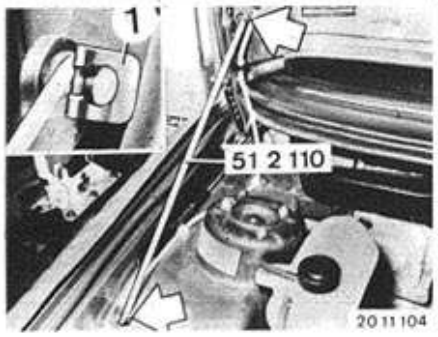
Remove transmission – see Group 23 or 24.
Unscrew power steering pump.
Pressure hoses remain connected.
Installation:
Tighten drive belt, see 32 41 060.



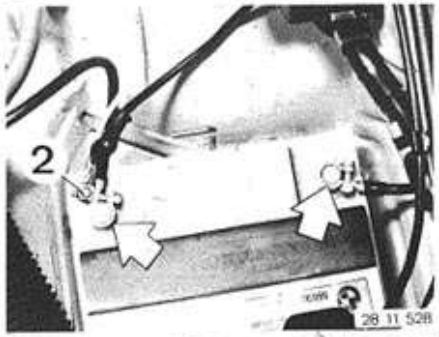
Unscrew plug and drain coolant.
Remove radiator 17 11 000.



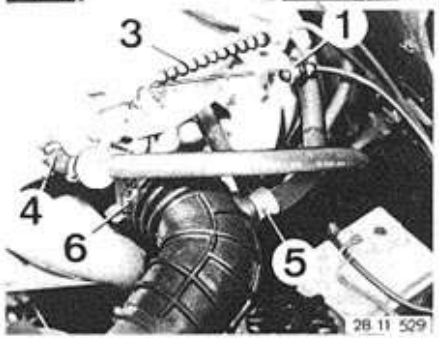
Unscrew compressor.
Refrigerant hoses remain connected.
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.



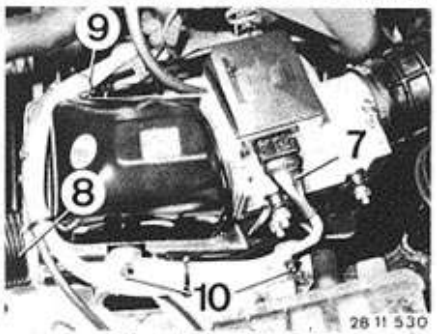
Unscrew ground wire for hood.
Disconnect or remove gas pressure props and prop engine hood with Special Tool 51 2 110.
Caution!
Use locks (1).



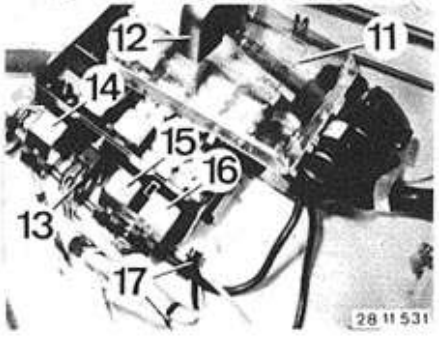
Disconnect negative and positive leads on battery.
Unscrew wire (2).



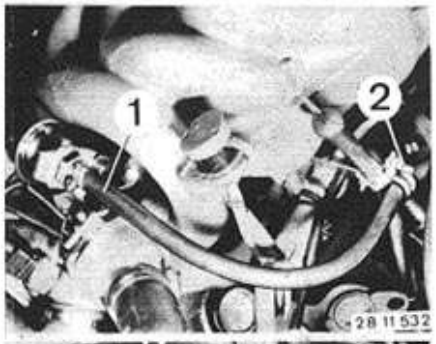
Disconnect accelerator cable (1) and cruise control cable (3).
Pull off vacuum hose (4) and hoses (5).
Loosen clamp (6).
Installation:
Adjust accelerator cable – see 35 41 421.
Adjust cruise control cable – see Group 65.



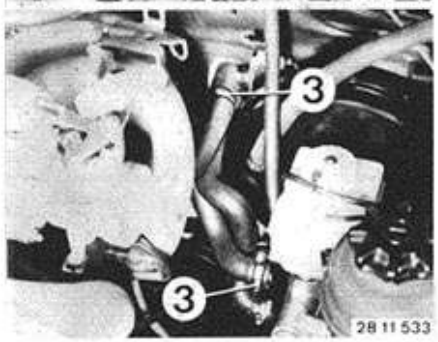
Pull off plug (7).
Pull out hose (8) and loosen strap (9).
Unscrew nuts (10) and remove air cleaner with air flow sensor.



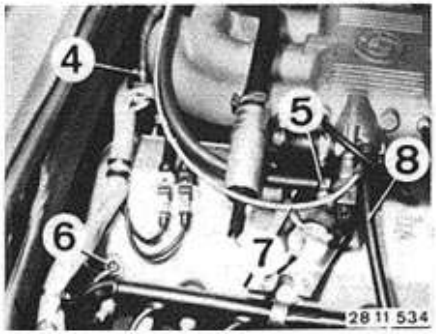
Take off cover (11) and lift off cap (12).
Pull off plug (13).
Lift out relays (14 ... 16).
Loosen straps (17).



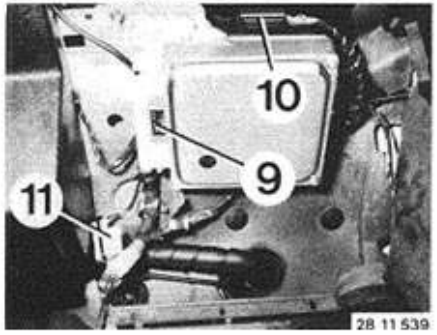
Unscrew fuel line (1) and holder (2).



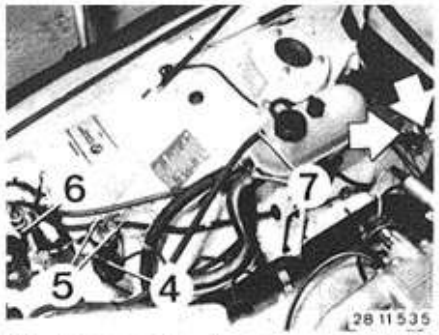
Disconnect heater water hoses (3).



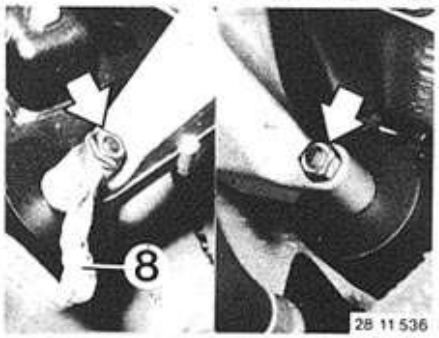
Unscrew fuel lines (4 and 5).
Unscrew ground strap (6).
Pull off hoses (7 and 8).



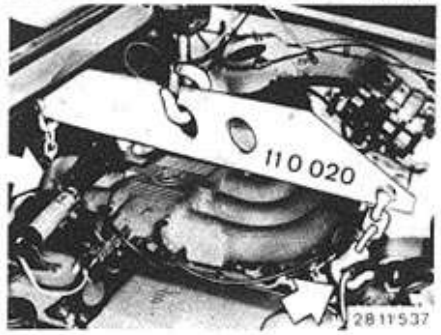
Pull off plugs (9 and 10) on control units in glove box.
Disconnect lead (11).



Unscrew wire straps on firewall and pull out wire harness into engine compartment.
Pull off wire (4).
Disconnect wire (5).
Pull off plug (6).
Disconnect hoses (7).
Disconnect wire harnesses.
Installation:
Use new squeeze-hose clamp.

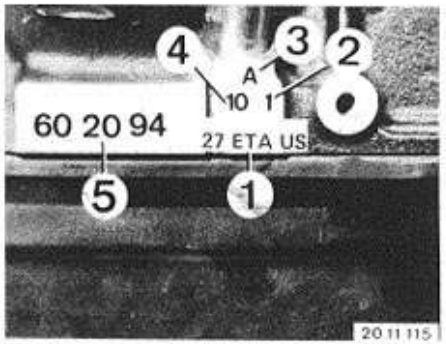


Unscrew ground strap (8) and both engine mounts.
Installation:
Tightening torque*.



Apply Special Tool 11 0 020 and lift out engine.
Installation:
Adjust engine idle speed/CO 13 00 054.

* See Specifications



11 00 091 INSTALLING EXCHANGE ENGINE

Remove engine 11 00 050.
Exchange Engine Identification On The Crankcase:
1 = Type designation/displacement*
2 = Year of manufacture (1981)
3 = "A" for exchange or "N" for new
4 = Month of manufacture

Stamp engine number (5).

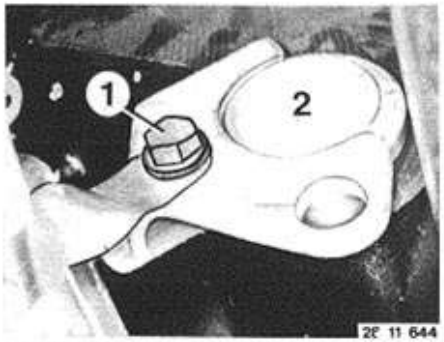
Drive in supplied oil dipstick guide tube (see 11 43 101) and transfer parts from the old engine to the exchange engine.
Fill exchange engine with oil**.
Important!
Remove pilot bearing in crankshaft, see 11 21 571, if the car has an automatic transmission.

Install engine.

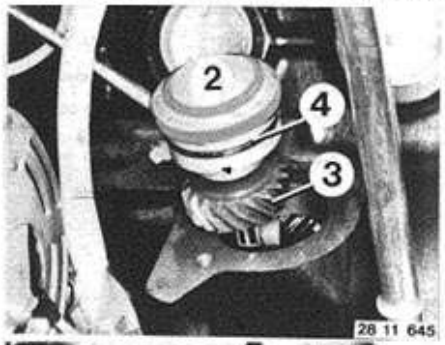
Adjust engine idle speed/CO 13 00 054.

* See BMW Technik/Serv. Inform. of Gr. 11
** See Service Information of Group 00

11 11 160 REPLACING BEARING FOR OIL PUMP DRIVE SHAFT

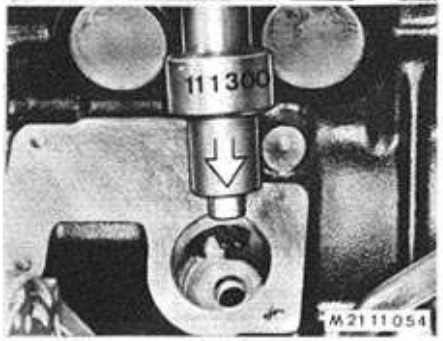


Remove oil pump 11 41 000.
Unscrew bolt (1) and take off cover (2).



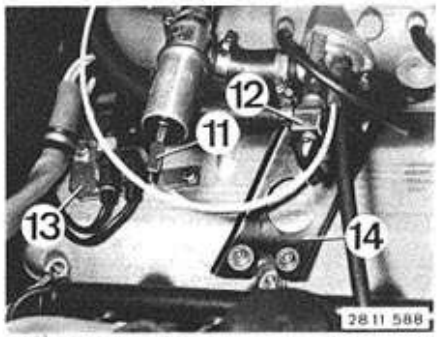
Remove gear (3).
Installation:
Open end of gear shaft faces down.
Check seal (4), replacing if necessary.

Drive out needle bearing from bottom upwards with Special Tool 11 1 310.

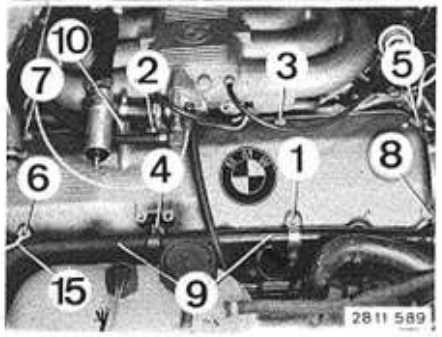


Installation:
Lubricate needle bearing with grease.
Drive in needle bearing against stop with Special Tool 11 1 300.

11 12 000 REMOVING AND INSTALLING CYLINDER HEAD COVER

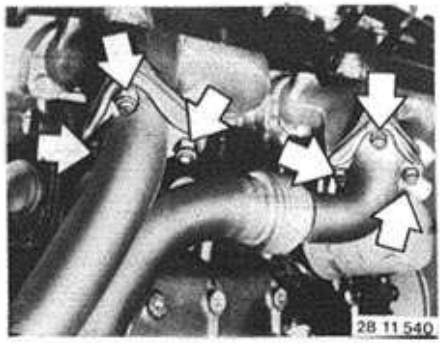


Pull off plugs (11 and 12) and unscrew holder (13).
Unscrew support (14).



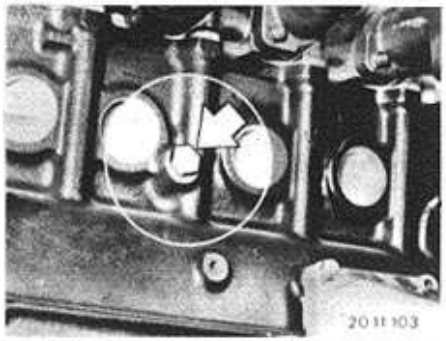
Disconnect ignition lead tube (9) and vent hose (10).
Take off cylinder head cover.
Installation:
Check gasket, replacing if necessary.
Tighten nuts in order of 1 through 8.
Mount ground strap (15).

* See Specifications

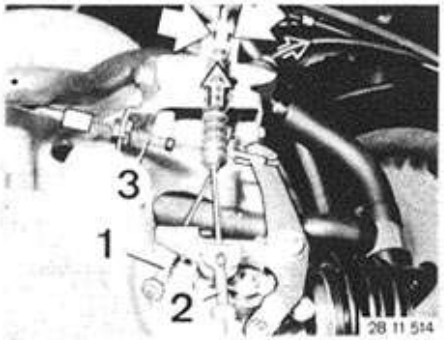


11 12 100 REMOVING AND INSTALLING CYLINDER HEAD

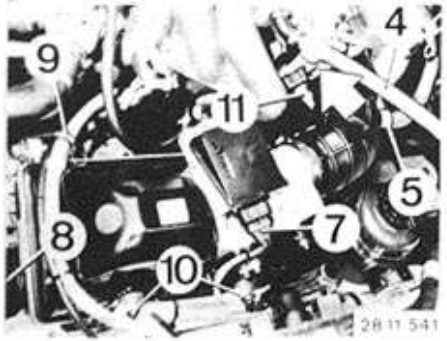
Unscrew exhaust pipes on exhaust manifolds and pipe clamp on transmission.
Installation:
Check gaskets, replacing if necessary.
Coat studs with copper paste "CRC"***.
Replace self-locking nuts.
Tightening torque*.



Unscrew plug and drain coolant.
Disconnect battery ground lead.
Installation:
Fill cooling system with coolant*** and bleed 17 00 039.
Replace engine oil***.

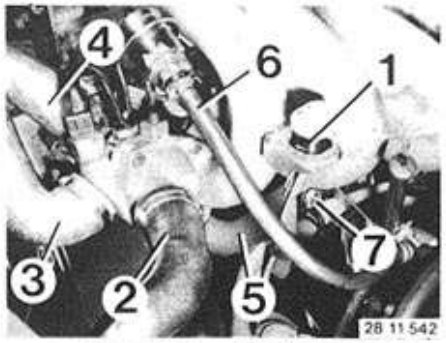


Disconnect throttle cable (1) and cruise control cable (2).
Installation:
Adjust throttle cable – see 35 41 421.
Adjust cruise control cable – see Group 65.
Disconnect accelerator cable (3).
Installation:
Adjust accelerator cable s. Gr. 24 .

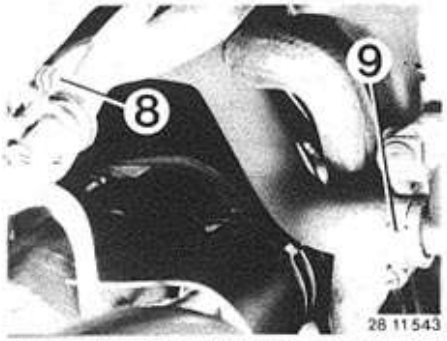


Pull off vacuum hose (4) and hoses (5).
Pull off plugs (7 and 11).
Pull out hose (8) and loosen strap (9).
Unscrew nuts (10) and remove air cleaner with air flow sensor.

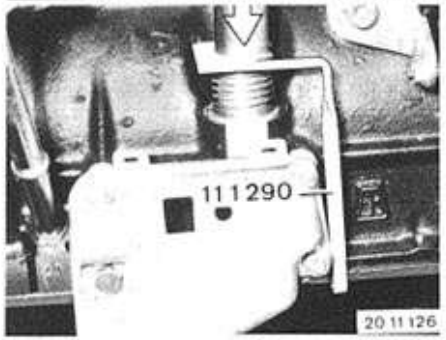
* See Specifications
*** Source: HWB
*** See Service Information of Gr. 00



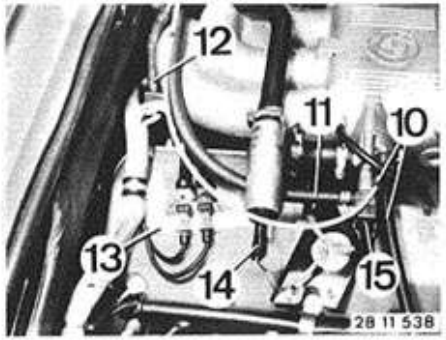
Disconnect diagnosis plug (1).
Disconnect radiator hoses (2 ... 5).
Pull off fuel line (6).
Unscrew holder (7).



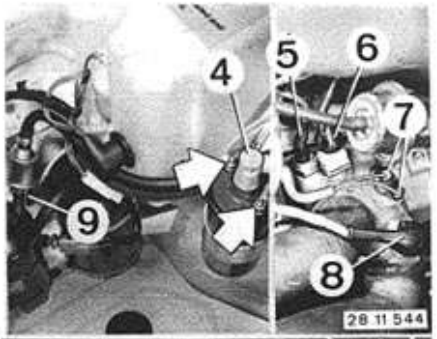
Unscrew holder (8).
Disconnect hose (9).



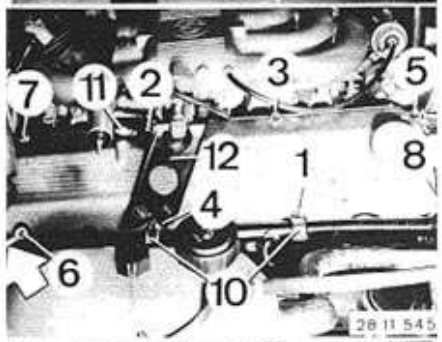
Press vent tube down and hold down with Special Tool 11 1 290.
Installation:
Check seal, replacing if necessary.
Check vent tube for correct fit after removing Special Tool 11 1 290.



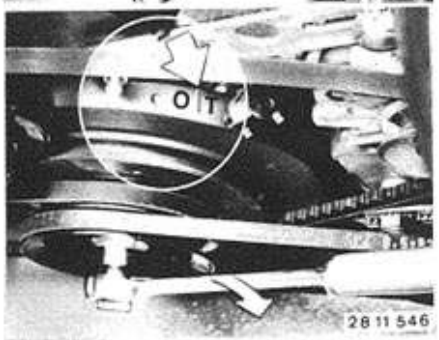
Pull off hoses (10).
Unscrew fuel lines (11 and 12).
Unscrew holder (13).
Pull off plugs on fuel injectors 4, 5 and 6.
Pull off plugs (14 and 15).
Installation:
Use new squeeze hose clamps.



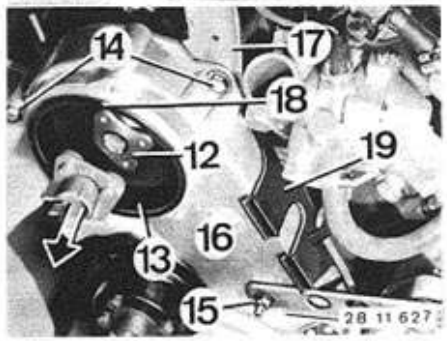
Pull off plugs on fuel injectors 1, 2 and 3.
Pull off plugs (5 ... 8).
Pull off wire (4) and disconnect ignition coil.
Pull off wire (9) on solenoid and wires on oil pressure switch.
Disconnect wire harness and pull out to the left side.



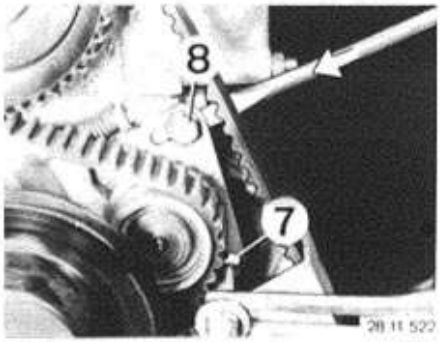
Pull off spark plug end caps and unscrew ignition lead tube (10).
Disconnect vent hose (11).
Unscrew holder (12).
Unscrew nuts (1 ... 8) and take off cylinder head cover.
Installation:
Check gasket, replacing if necessary.
Tighten nuts in order of 1 through 8.



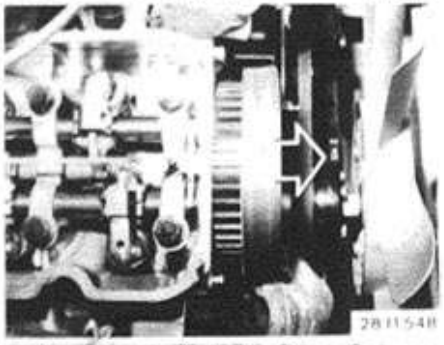
Turn crankshaft to set cylinder no. 1 to TDC; valves of cylinder no. 6 overlap.
Remove distributor cap.



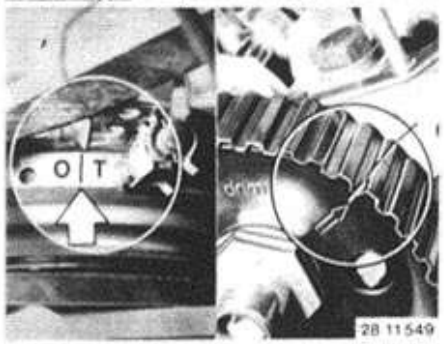
Remove distributor rotor.
Unscrew adapter (12).
Remove cover (13).
Unscrew bolts (14).
Unscrew nut (15).
Remove guard (16).
Installation:
Screw on holder (17).
Check rubber ring (18).
Insert rubber cover (19).



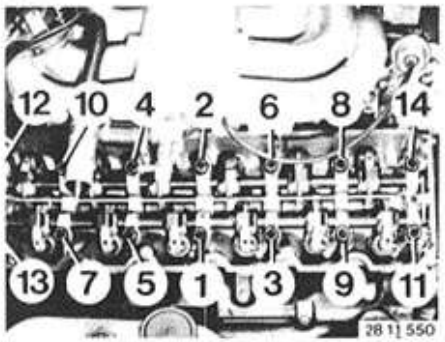
Loosen bolts (7 and 8).
Press in tensioning roller.
Tighten bolt (6).



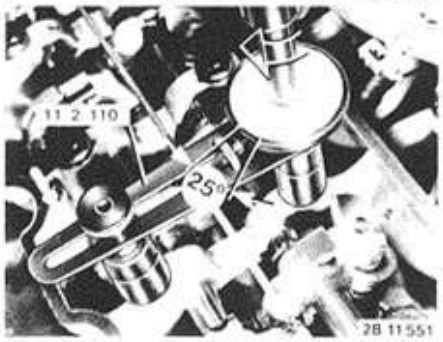
Take off drive belt on camshaft sprocket.
Caution!
Never crank engine after removing drive belt.
Installation:
Check/tighten drive belt 11 31 100.



Installation:
Before installing the cylinder head, turn the camshaft that mark on camshaft sprocket is facing mark on cylinder head.
Cylinder no. 1 is in TDC.
Also install the drive belt in this position.

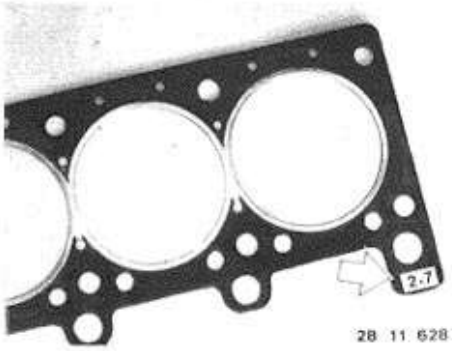


Unscrew bolts in order of 14 through 1 and remove cylinder head.
Installation:
Keep oil out of cavities, since otherwise bolts tightened to specified torque would not exert sufficient pressure on the cylinder head and, in addition, the crankcase could be cracked.
Clean cylinder head bolts.
Apply a light coat of oil on threads and bearing surfaces of bolt heads.
Always replace the cylinder head gasket.



Tighten bolts in order of 1 through 14 in 3 steps. Tightening torque*.
Adjust valve clearance 11 34 004.
Adjust ignition timing 12 11 004.
Adjust engine idle speed/CO 13 00 054.
In the 3rd step (cylinder head cover removed again after running engine warm) tighten cylinder head bolts to torque angle with Special Tool 11 2 110 regardless of the engine temperature.
Note:
Cylinder head need not be tightened again after driving car 1,000 km (600 miles).

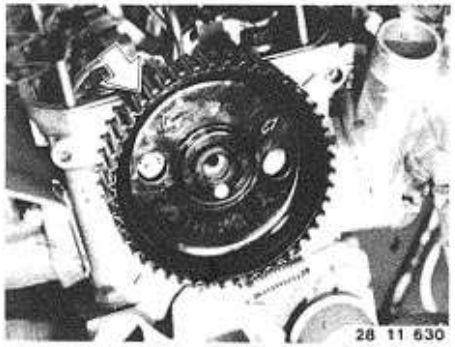
* See Specifications



28 11 628

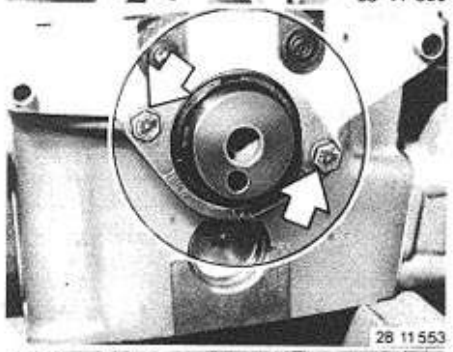
11 12 101 REPLACING CYLINDER HEAD GASKET

Remove cylinder head 11 12 100.
Clean sealing surfaces on cylinder head and crankcase – using sealant remover** and a hard wood scraper.
Check levelness with a standard steel ruler, grinding cylinder head sealing surface if necessary 11 12 719.
Installation:
Only use original cylinder head gaskets, of which the openings for coolant are matched precisely.
Identification: 2.7 stamped.
Important!
A 0.3 mm (0.012") thicker gasket must be installed after grinding the cylinder head to prevent reduction in combustion chamber size.

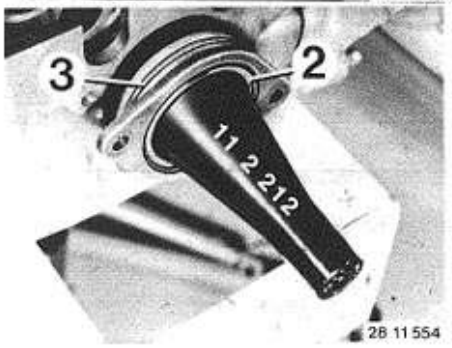

28 11 630

11 12 240 REPLACING RADIAL OIL SEAL IN END COVER

Remove drive belt 11 31 110.
Take off sprocket.

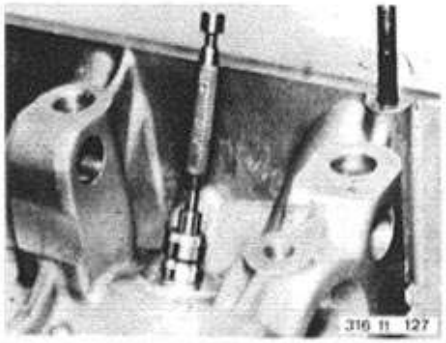

28 11 553

Unscrew cover.



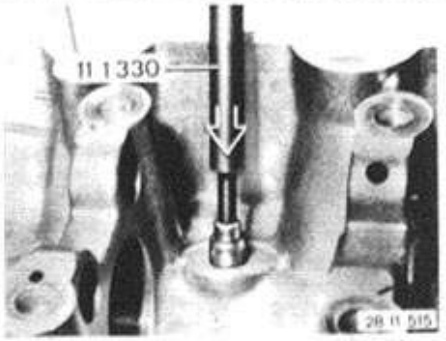
28 11 554

Replace radial oil seal (2) and round cord seal (3).
Installation:
Use Special Tool 11 2 212 to install the cover.

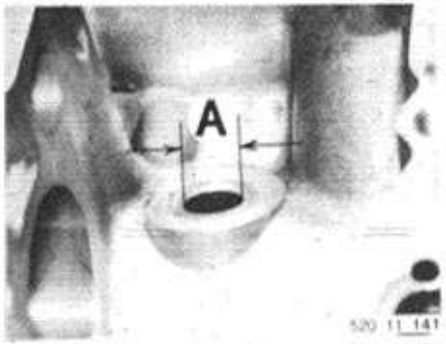


11 12 561 REPLACING VALVE GUIDE
– Valve Removed –

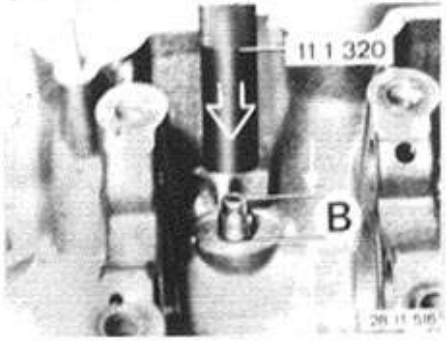
Check wear* of valve guide with Special Tool 00 4 300.



Drive out valve guide (cold) into the combustion chamber with Special Tool 11 1 330.



Inspect bore in cylinder head with Special Tool 00 4 530.
If permissible diameter A is exceeded, ream out the bore with a standard reamer and install an oversize* valve guide.

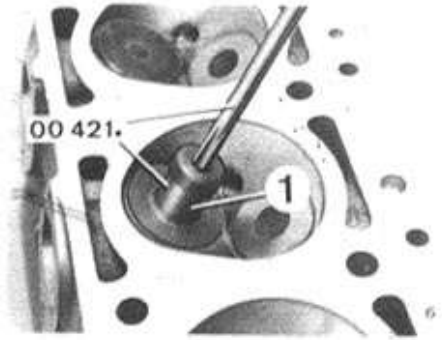


Heat* cylinder head.
Drive valve guide into the combustion chamber from the camshaft side with Special Tool 11 1 320.
Stepped end of valve guide faces the camshaft.
Important!
The bore in the special tool determines the installed depth B = 14.5 ± 0.5 mm (0.571 ± 0.020").
Ream out valve guide to 7 mm H 7 diameter with Special Tool 00 4 200.
Machine valve seats, see 11 12 607.

* See Specifications

11 12 595 CHECKING VALVE GUIDE FOR WEAR
– Valve Removed –

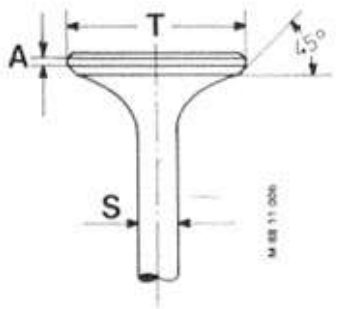
To measure, insert a new valve that its stem end is flush with the valve guide.
Apply dial gage and measure the tilt clearance.
Max. permissible tilt clearance*.



11 12 600 REAMING OUT VALVE GUIDE
– Valve Removed –

If there is excessive play between the valve guide and valve stem, see 11 12 595, ream out the valve guide and install a valve with a larger stem diameter "S"*.
The valve seat must then also be machined in conjunction with this, see 11 12 607.
Press guide pad (1) on to valve seat and ream out valve guide from the combustion chamber end – turning down the reamer once.

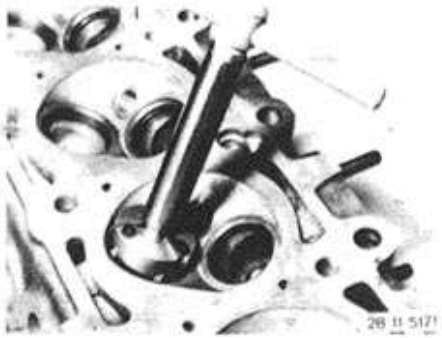
* See Specifications



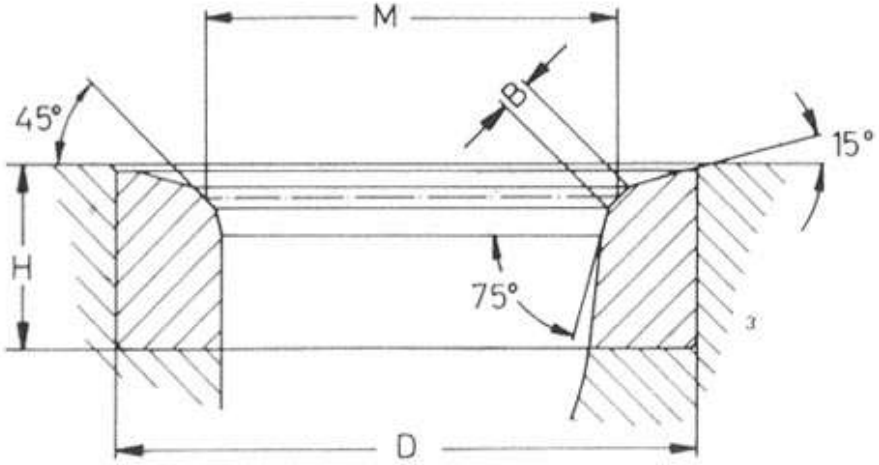
11 12 607 MACHINING VALVE SEATS AND VALVES

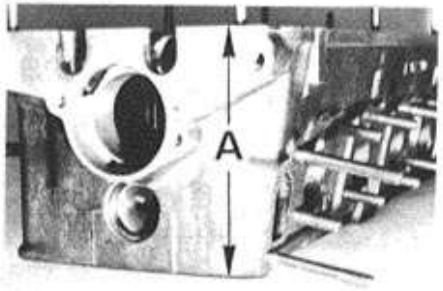
– Valves Removed –

The valve has to be replaced, if the minimum edge thickness A* cannot be held.



Produce the valve seat diameter M* and valve seat width B* by machining correction angles* after machining the valve seat angle*. Grind in valves with grinding paste and check for leaks, see 11 34 509.

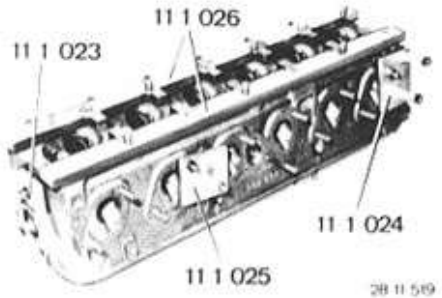




11 12 719 GRINDING CYLINDER HEAD SEALING SURFACE

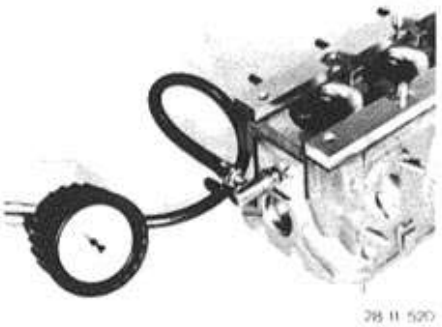
– Cylinder Head Disassembled –

The original total thickness (A) of the cylinder head is 125.1 ± 0.1 mm (4.925 ± 0.004") and not more than 0.3 mm (0.012") may be ground off.
Use a 0.3 mm (0.012") thicker gasket on a reground cylinder head (also refer to 11 12



11 12 729 CHECKING CYLINDER HEAD FOR CRACKS IN WATER TEST

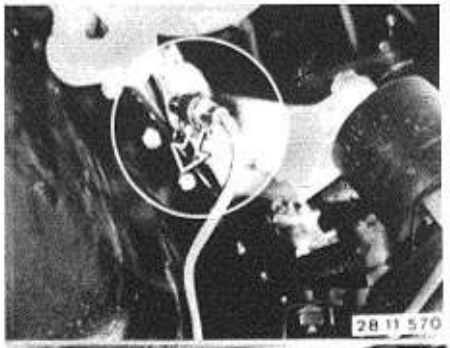
Mount Special Tools 11 1 026 on the cylinder head, using cylinder head bolts.
Close off water circuit on the cylinder head with Special Tools 11 1 023, 11 1 024 and 11 1 025.



Apply compressed air on cylinder head.
Pressure: 4.5 bar (64 psi).
Place cylinder head in a water bath and check for cracks.
Note:
If necessary, relax water bath with a detergent.

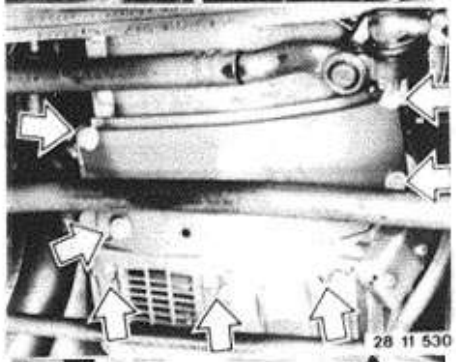
* See Specifications

* See Specifications



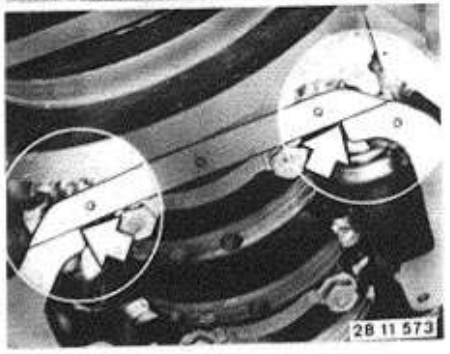
11 13 000 REMOVING AND INSTALLING OIL PAN

Lift out and disconnect plug.
Drain oil.
Installation:
Add engine oil***.



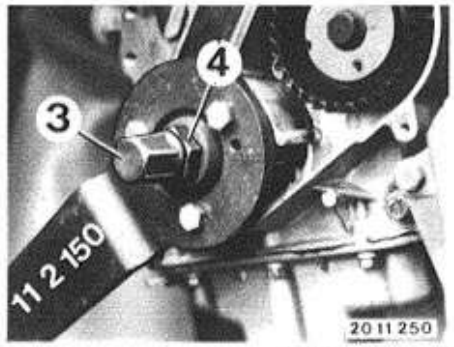
Unscrew cover/reinforcement plate.

Unscrew oil pan.
Unscrew oil pump and remove oil pan.
Installation:
Insert oil pump drive shaft, see 11 41 000.
Replace gasket.



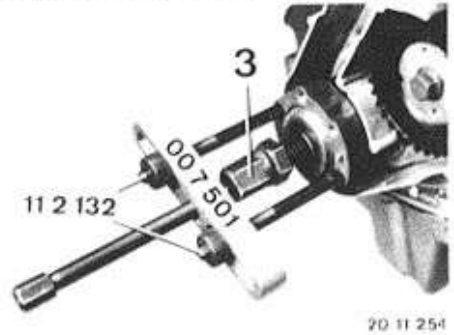
Installation:
Clean sealing surfaces.
Coat joint surfaces on timing case covers and end cover with a brush-on universal sealing compound**.

** Source: HWB
*** See Service Information of Gr. 00

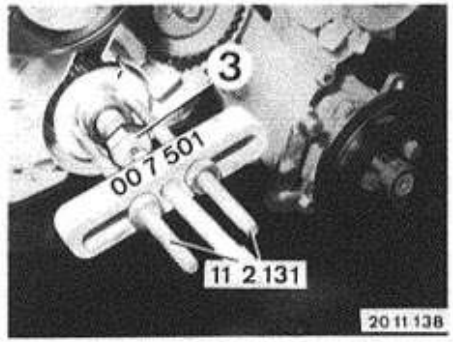


11 14 175 REMOVING AND INSTALLING FRONT END COVER

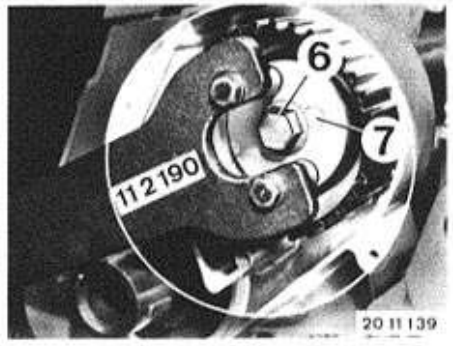
Remove radiator, see Group 17.
Remove toothed drive belt 11 31 110.
Single piece Hub/Drive Belt Sprocket:
Hold drive belt sprocket with Special Tool 11 2 150.
Unscrew bolt (3).
Take off collar washer (4).
Installation:
Tightening torque*.



Screw in bolt (3) about three turns.
Pull hub/sprocket off of the crankshaft with Special Tools 00 7 501 and 11 2 132.
Important!
Woodruff key.

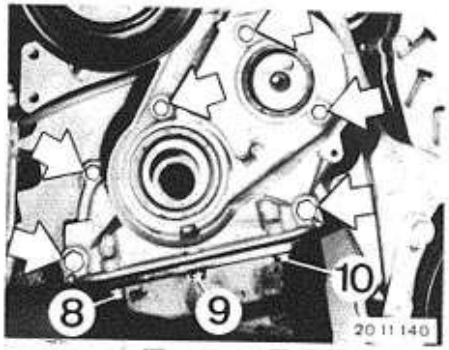


Two-piece Hub/Drive Belt Sprocket:
Screw in bolt (3).
Pull sprocket off of the crankshaft with Special Tools 00 7 501 and 11 2 131.
Important!
Woodruff key.
Installation:
Mount sprocket that lettering faces forward.

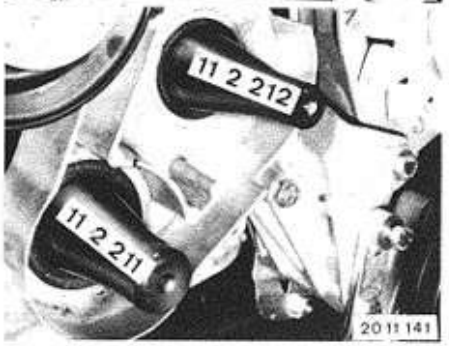


Hold sprocket of the intermediate shaft with Special Tool 11 2 190.
Unscrew bolt (6).
Take off washer and sprocket.
Installation:
Guide centering pin (7) into bore.

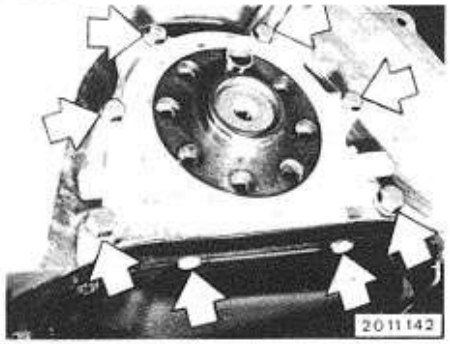
* See Specifications



Unscrew bolts (8 ... 10).
Only loosen the other oil pan bolts.
Loosen oil pan gasket on end cover carefully with a knife.
Take off cover.
Installation:
If oil pan gasket was damaged, remove oil pan and replace gasket – see 11 13 000.
Coat bores of oil pan gasket with a brush-on universal sealing compound/Three Bond Silicone 1207**.
Replace gasket.

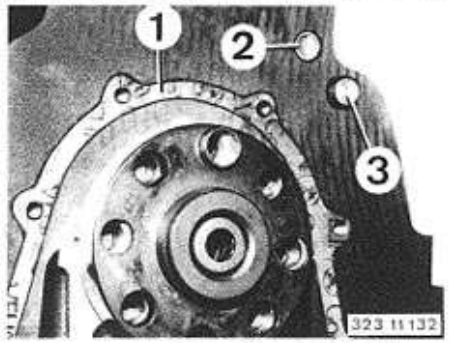


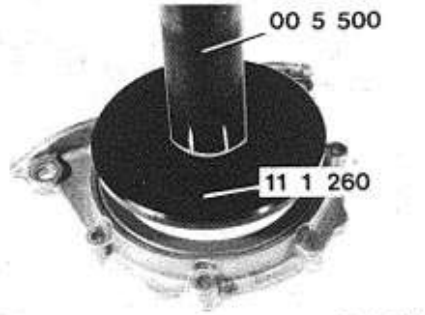
Check radial oil seals, replacing if necessary.
Important!
Always use Special Tools 11 2 211 (crankshaft) and 11 2 212 (intermediate shaft) for installation of the end cover.



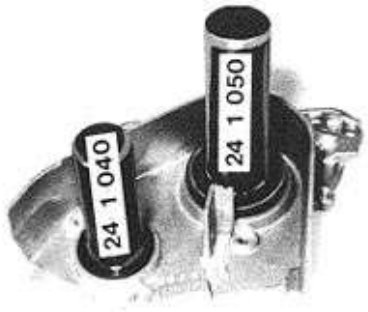
11 14 605 REPLACING RADIAL OIL SEAL IN CLUTCH END COVER
– Transmission Removed –

Remove flywheel 11 22 000.
Unscrew oil pan/end cover bolts.
Only loosen the other oil pan bolts.
Loosen oil pan gasket on end cover carefully with a knife.
If oil pan gasket was damaged, remove oil pan and replace gasket – see 11 13 000.
Take off end cover.
Replace gasket (1).
Important!
Check cover (2) of main oil bore for leaks, replacing with a new plug (3) if necessary.
Install plug with Loctite No. 270**.



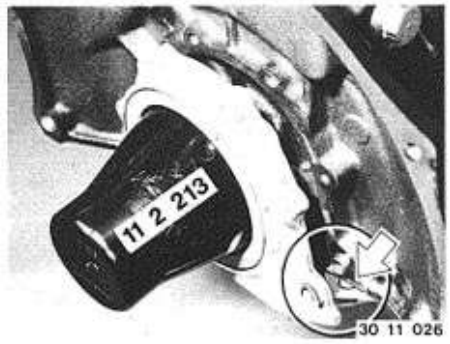


Press in the radial oil seal with Special Tools 11 1 260 and 00 5 500.
Press in the new radial oil seal approx. 1 to 2 mm (0.039 to 0.079") deeper, in contradiction to the standard seal which had been installed flush.
Lubricate sealing lip with oil.



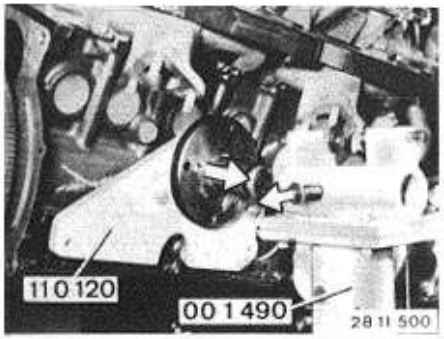
11 14 180 REPLACING RADIAL OIL SEAL IN END COVER

Remove end cover 11 14 175.
Press radial oil seals out of the cover.
Press in radial oil seals with Special Tools 24 1 050 and 24 1 040.
Press in the new radial oil seals approx. 1 to 2 mm (0.039 to 0.079") deeper, in contradiction to the standard seal which had been installed flush.
Lubricate sealing lips with oil.



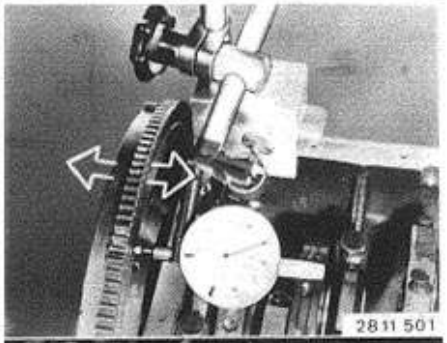
Coat end cover/oil pan joint with a brush-on universal sealing compound / Three Bond Silicone 1207**.
Use Special Tool 11 2 213 to avoid damage on the radial oil seal.

** Source: HWB

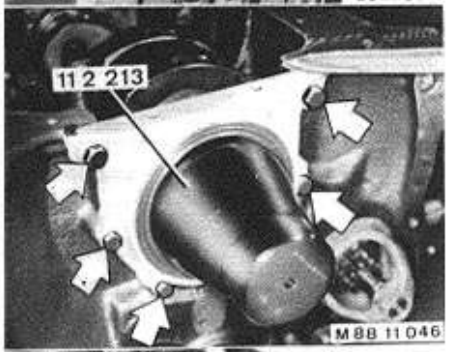


11 21 000 REMOVING AND INSTALLING CRANKSHAFT

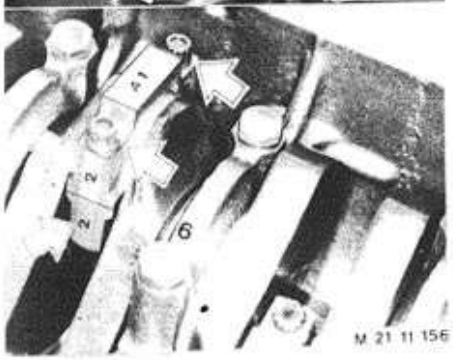
Remove the engine 11 00 050.
Mount engine block in assembly stand 00 1 490 with Special Tool 11 0 120.



Remove the clutch 21 21 000.
Take off the cylinder head 11 12 100.
Remove front end cover 11 14 175.
Remove the oil pump 11 41 000.
Check axial play* before removing the crankshaft.
Check / replace the thrust bearing, if the maximum permissible play is exceeded.

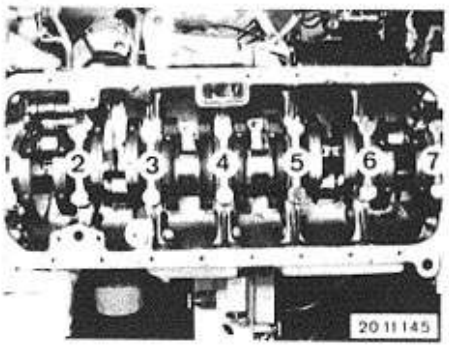


Remove flywheel 11 22 000.
Take off the end cover.
Installation:
Replace the gasket.
Use Special Tool 11 2 213 to avoid damage on the radial oil seal.
Cut off gasket on the oil pan sealing surface.



Unscrew the conrod bearing caps.
Installation:
Replace conrod bearing shells and measure the conrod bearing play, see 11 24 571.
The pairing code (0 to 99) must be the same on the connecting rods and caps.

* See Specifications



Remove crankshaft bearing caps and lift out the crankshaft.
Installation:
Do not mix up the bearing caps.
Bearing cap no. 1 is on the drive belt end.
Bearing no. 6 is the thrust bearing.
Install bearing shells and check the bearing play, see 11 21 531.

Installation:
Measure axial play with the crankshaft installed – loosen thrust bearing no. 6.
Center the thrust bearing by applying knocks from a plastic hammer on the front and rear ends of the crankshaft.
Tighten the thrust bearing to specifications.
Measure the axial play*.
If the crankcase is replaced, clean the oil and water bores again thoroughly to remove casting sand.

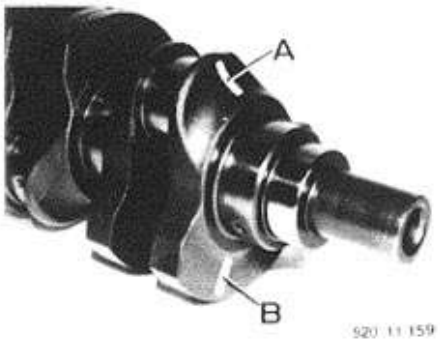
* See Specifications

28 11 30

11 21 501 REPLACING CRANKSHAFT
– Crankshaft Removed –

Identification of Crankshafts:
Standard ground size* with one red or blue paint dot on side of counterweights.
Crankshaft Identification:

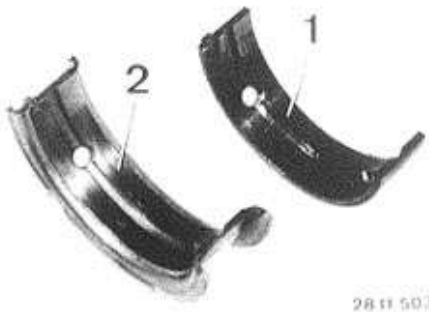
Type	Throw (cast on cheek 6)	Code
M 20 B 27	H 81 mm (3.189")	W



520 11 159

Reground crankshafts are marked with stripes of paint.
Check machined sizes!
Connecting Rod Bearing Journals (A)
1 paint stripe = size 1*
2 paint stripes = size 2*
Main Bearing Journals (B)
1 paint stripe = size 1*
2 paint stripes = size 2*
Important!
The crankshaft is surface treated and can only be reground in the plant.
Crankshafts are supplied with corresponding bearing shells.
Install bearing shells and check bearing play, see 11 21 531.
Install pilot bearing for cars with a manual transmission, see 11 21 571.

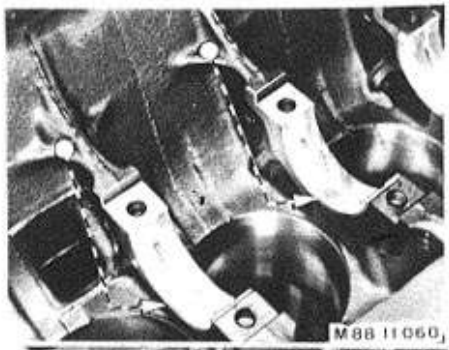
* See Specifications



28 11 503

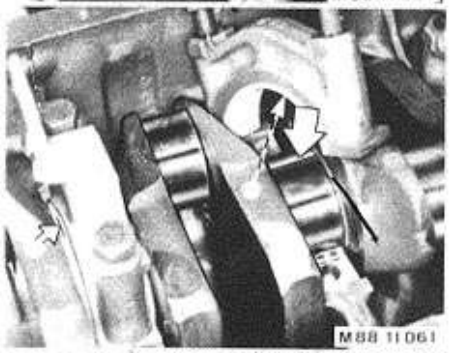
11 21 531 REPLACING CRANKSHAFT MAIN BEARING SHELLS
– Engine Disassembled –

Bearing shells are marked with color codes.
Double classification: red/blue.
Triple classification: yellow/green/white.
1 = Bearing shell 1 2 3 4 5 7
2 = Bearing shell 6 (thrust bearing)
Check machined size (main bearing diameter).



M88 11 060

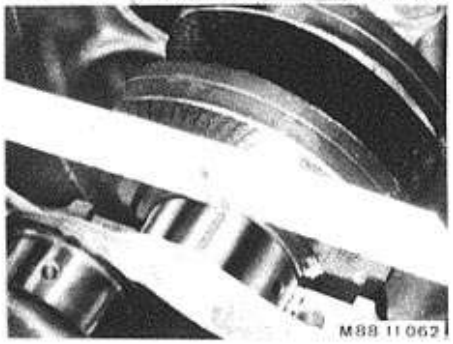
Bearing shells are installed in the crankcase according to color code of the crankcase.
If color code has been washed off of the crankcase, both shells are installed according to the crankshaft color code.
Install the crankshaft.



M88 11 061

Bearing shells are installed in bearing caps according to color code of the crankshaft.
Only Double Classification:
If red and blue bearing shells are required on one bearing journal, bearing shells must be installed that all shells of same color on all bearing journals are in one plane (down or up).
Place Plastigage (Type PG-1) on crankshaft wiped clean of oil and bolt down bearing caps to specified torque*.
Don't turn the crankshaft.

Source for Plastigage:
Cartool
Alfred-Brehm-Str. 5
D–8070 Ingolstadt / West Germany



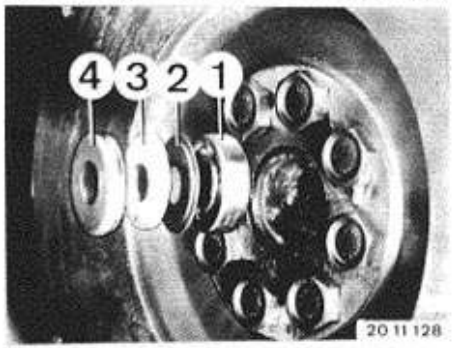
M88 11 062

Take off the bearing caps.
Read bearing play* from width of flattened Plastigage with help of supplied scale.
Correct bearing play by installing new bearing shells, bearing shells of different machined size or with different color codes.

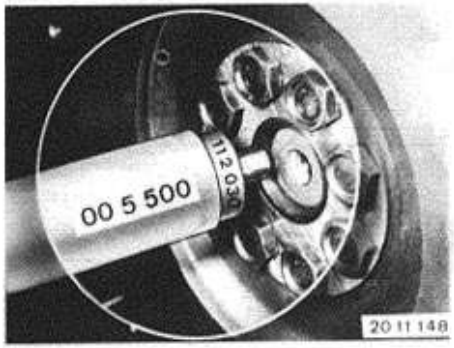
* See Specifications

11 21 571 REPLACING PILOT BEARING IN CRANKSHAFT

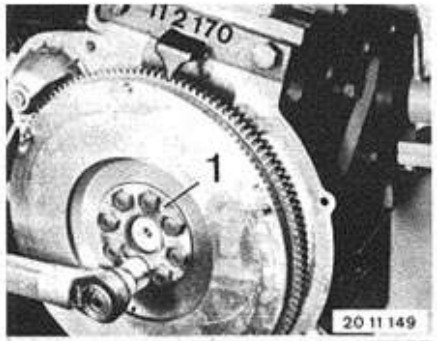
Remove clutch disc 21 21 000.
Pull out ball bearing with Special Tool 11 2 010.

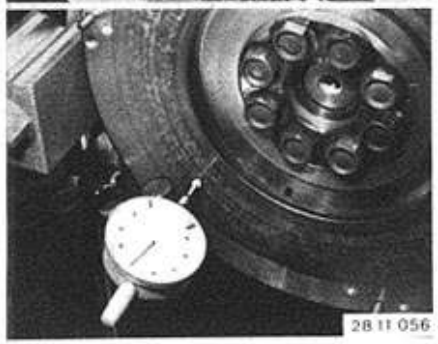


Installed Order:
Ball bearing (1), cover (2), felt ring (3) and capsule (4).
Install cover (2) with embossment facing out.



Pack bore in crankshaft with approx. 1 gram of lubricating grease.
Drive in pilot bearing with Special Tools 11 2 030 and 00 5 500.



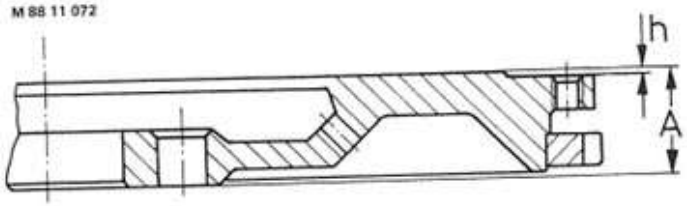


11 22 000 REMOVING AND INSTALLING FLYWHEEL

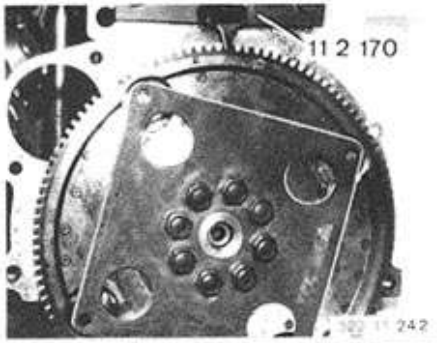
Remove clutch 21 21 000.
Hold flywheel with Special Tool 11 2 170.
Unscrew bolts and take off flywheel .
Installation:
Clean tapped bores.
Insert ring (1).
Replace and install expansion bolts with Loctite No. 270**.
Tightening torque*.

Check flywheel for axial runout*.

Friction surface may be machined to minimum distance A*.
If machining the friction surface reduces distance "h" to zero, the flange surface (distance "h") has to be machined.

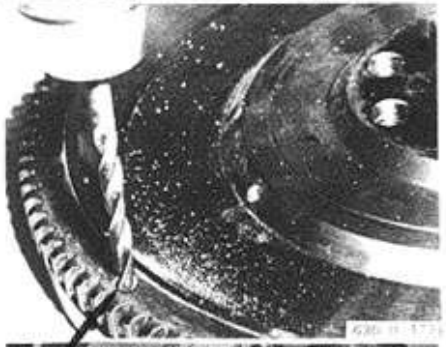


* See Specifications
** Source: HWB



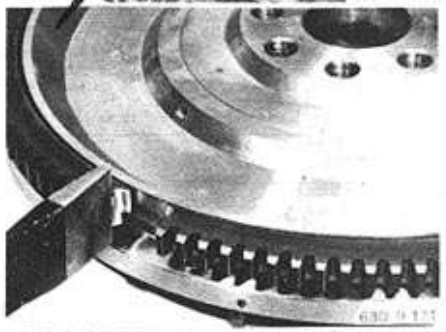
11 22 051 REPLACING DRIVE PLATE FOR TORQUE CONVERTER

Remove transmission – see Group 24.
Hold flywheel with Special Tool 11 2 170.
Unscrew bolts and take off flywheel.
Installation:
Clean tapped bores.
Replace and install expansion bolts with Loctite No. 270**.
Tightening torque*.

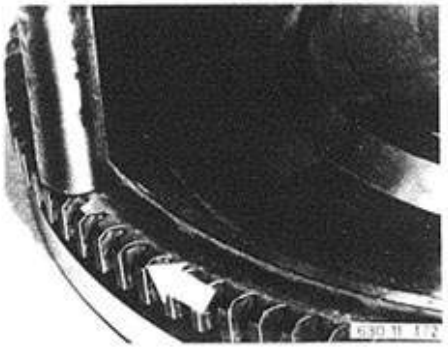


11 22 541 REPLACING STARTER GEAR RING

Drill a 6 mm (0.236") dia. hole about 8 mm (0.315") deep underneath a tooth gap to make removal of gear ring easier.

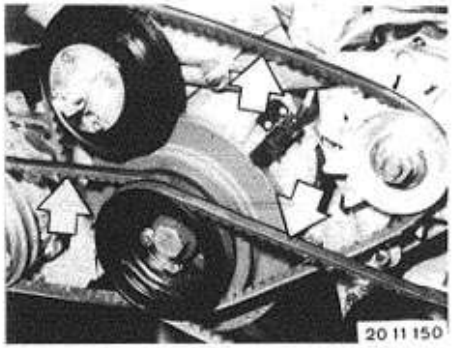


Break starter gear ring a drilled point with a chisel.



Installation:
Heat new starter gear ring to 200 ... 230° C (395 to 445° F), checking temperature with a thermo color pencil.
Tooth bevel faces engine.
Drive on starter gear ring to fit tight with a brass mandrel.

* See Specifications
** Source: HWB

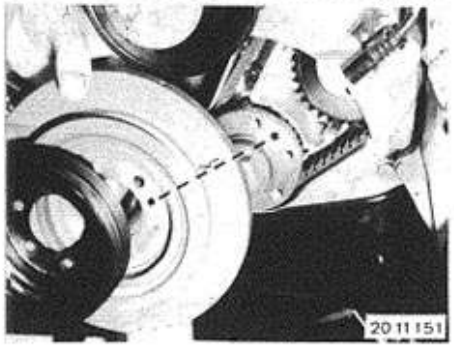


11 23 010 REPLACING VIBRATION DAMPER

Take off drive belts on the alternator, power steering pump and, if applicable, compressor for the air conditioner.

Installation:

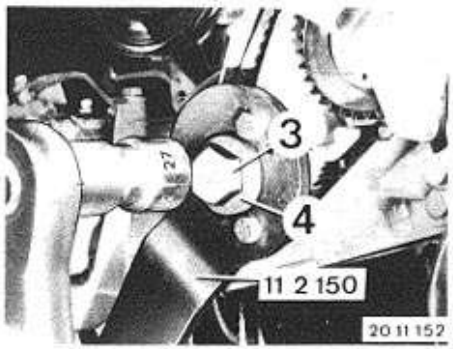
Tighten drive belt and check tightness with Special Tool 11 5 020.



Take pulley and vibration damper off of the hub.

Installation:

Centering pin must be in the bore of the vibration damper.



11 23 031 REPLACING HUB FOR VIBRATION DAMPER

Two-piece Hub/Drive Belt Sprocket:

Remove the radiator 17 11 000.

Remove the vibration damper 11 23 010.

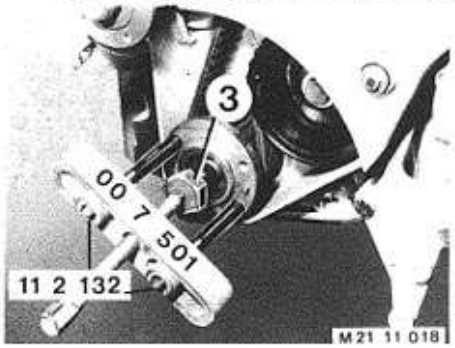
Hold hub with Special Tool 11 2 150.

Unscrew bolt (3).

Take off collar washer (4).

Installation:

Tightening torque*.

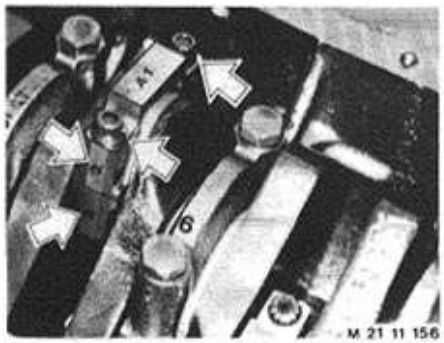


Screw in bolt (3) about three turns.

Pull the hub off of the crankshaft with Special Tools 00 7 501 and 11 2 132.

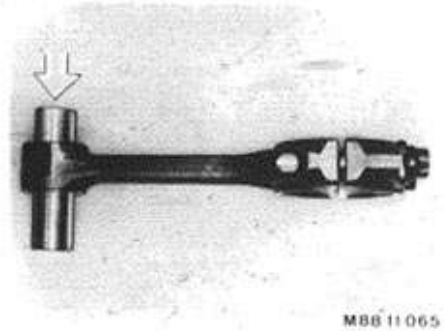
Remove bolt (3).

* See Specifications

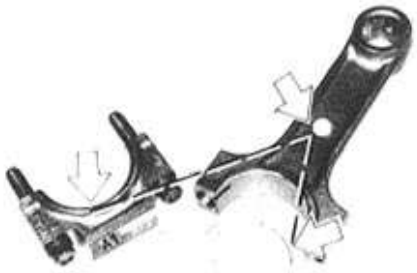


11 24 521 REPLACING CONNECTING RODS
– Pistons Removed –

Important!
Only use connecting rods of the same weight group in one engine.
The weight group is stamped in the machined conrod bearing cap surface.
Connecting rods may not be machined!
Check length of connecting rods!

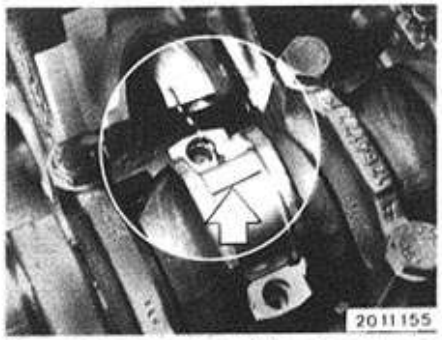


The piston pin must slide through the conrod bushing under light pressure.



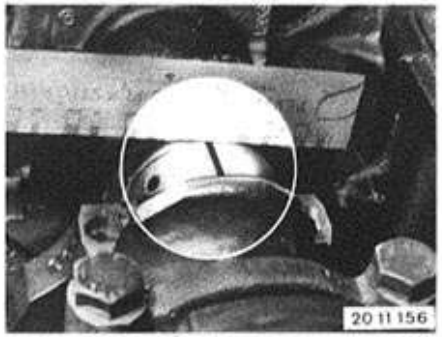
11 24 571 REPLACING CONNECTING ROD BEARING SHELLS
– Engine Disassembled –

Install the conrod bearing shells in the rods and caps.
Double Classification:
Install red or blue conrod bearing shells according to the color code on the connecting rods.
Important!
Check machined size (conrod bearing diameter).

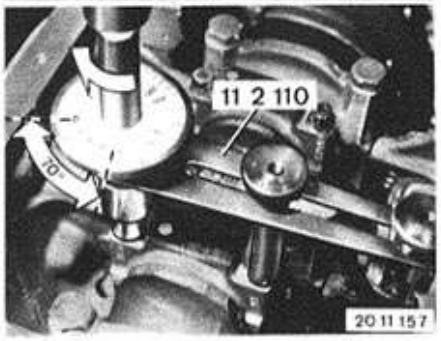


Turn to BDC, place Type PG-1 Plastigage on crankshaft wiped clean of oil and mount conrod bearing caps that grooves are on one side.
The pairing code (0 to 99) must be the same on the connecting rod and cap.

Source for Plastigage:
Cartool
Alfred-Brehm-Str. 5
D–8070 Ingolstadt / West Germany



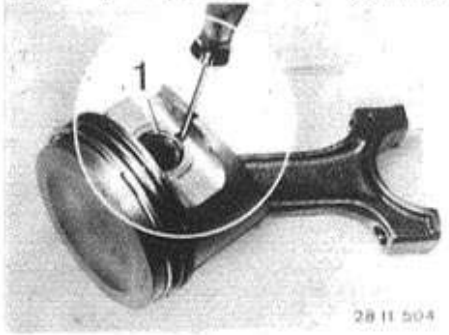
Tighten the bolts in two steps (use the old conrod bolts).
1st step 20 Nm (14.4 ft. lbs.)
2nd step 70° torque angle
Important!
Don't turn the connecting rods or crankshaft.
Take off the bearing caps.
Read the bearing play* from the width of the flattened Plastigage with help of the supplied scale.
Correct the bearing play by installing new bearing shells, bearing shells of different machined size or with a different color code.
Replace the conrod bolts for final installation and tighten the conrod bearing caps in two steps (see above).



* See Specifications

11 25 000 REMOVING AND INSTALLING PISTON

Remove engine.
Take off cylinder head, oil pan and oil pump.
Removing connecting rod bearing cap and press out the piston with connecting rod upwards.
Important!
Mark installed position of connecting rod to the crankshaft, if connecting rod bearing shells do not have to be replaced.



Remove circlip (1).
Press out piston pin.
Installation:
Piston pin is matched with piston and must not be mixed up.
Important!
If the clearance between the piston pin and conrod bushing is excessive (which will sound like acceleration knock), check the conrod bushing diameter and replace the connecting rod or bushing if necessary.

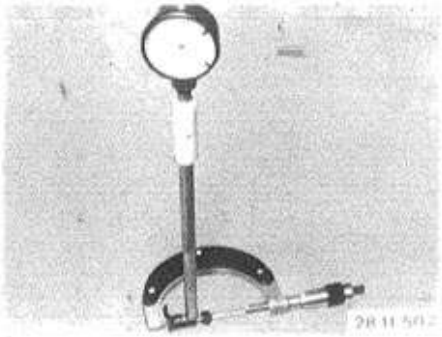
Only install piston of same make and same weight class.
Weight class is stamped with "+" or "–" in piston crown.
Important!
Check machined size (piston diameter)*.

Type	E*	Piston Bowl	Diameter
M 20 B 27	9	3.5 mm (0.138")	84 mm (3.307")

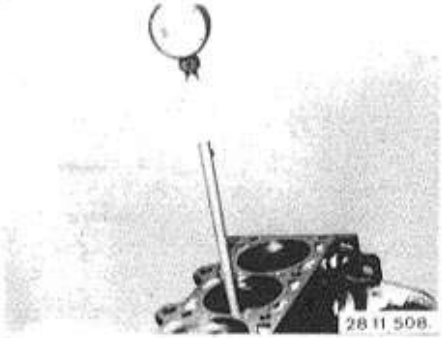
Check piston installed clearance*.

Type	Make	Checkpoint A
Pistons with total height: 68.7 mm (2.705")		
M 20 B 27	Mahle	8 mm (0.315")
	KS	14 mm (0.551")
Pistons with total height: 77.7 mm (3.059")		
M 20 B 27	Mahle	23 mm (0.905")
	KS	23 mm (0.905")

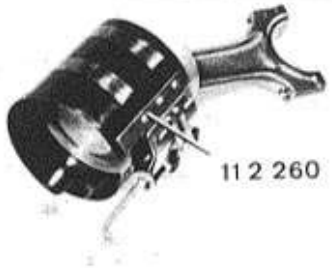
* See Specifications



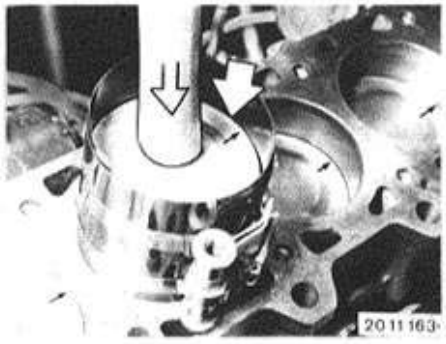
Set internal calipers to zero on the micrometer with the measured piston diameter.



Measure cylinder bore at bottom, middle and top with internal calipers in forward and rotating directions.
Check piston installed clearance*.



Lubricate the piston and piston rings with oil.
Offset piston ring end gaps by 120° to each other.
Compress piston rings with Special Tool 11 2 260.



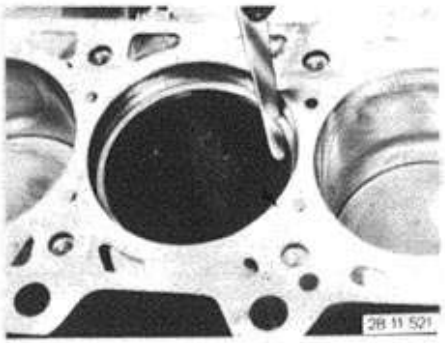
Install the piston that the arrow faces the drive belt.
Install the connecting rod, see 11 24 521.

* See Specifications

11 25 651 REPLACING PISTON RINGS OF ONE PISTON – PISTON REMOVED –

28 11 509

Measure side clearance* of piston rings.



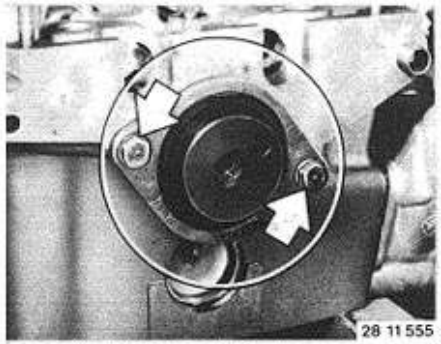
28 11 521

Remove piston rings and measure end clearance*.

28 11 510

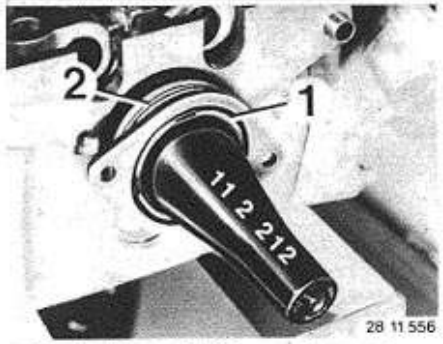
Installation:
Install piston rings that word "TOP" faces piston crown.
1 Plain compression ring
2 Taper face ring
3 Oil scraper ring

* See Specifications

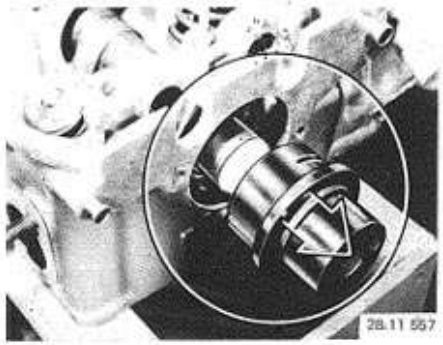


11 31 000 REMOVING AND INSTALLING CAMSHAFT

Remove rocker arm shafts 11 33 020.
Unscrew end cover.

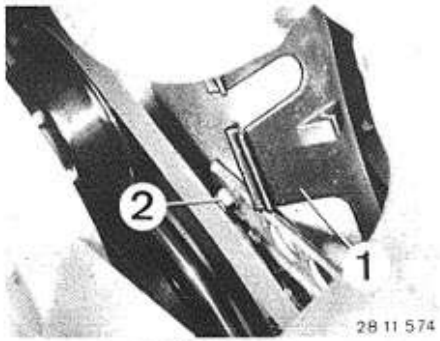


Check radial oil seal (1) and round cord seal (2), replacing if necessary.
Installation:
Use Special Tool 11 2 212 for installation of the end cover.
Check axial clearance*.



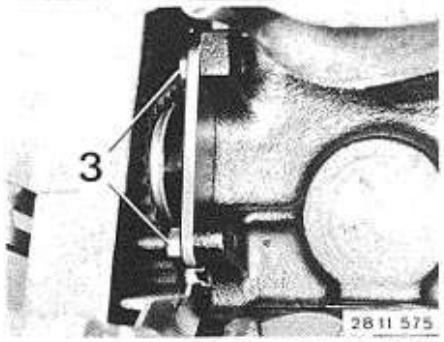
Pull out the camshaft.

* See Specifications

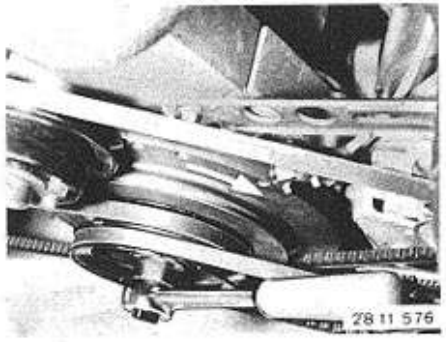


11 31 100 TIGHTENING DRIVE BELT

Do not tighten an used drive belt – replace a loose drive belt.
Tighten drive belt with a coolant temperature of 15 to 35° C (60 to 95° F).
Remove rubber guard (1).
Unscrew nut (2).
Installation:
Tightening torque*.

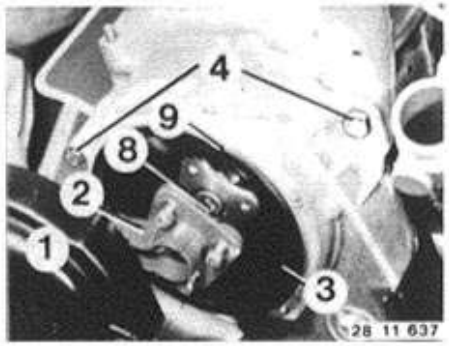


Unscrew bolts (3).



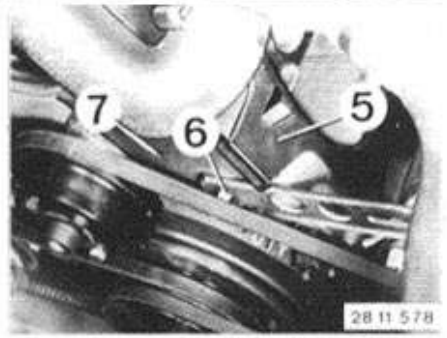
Crank the engine on the crankshaft in running direction of the engine – this tightens the drive belt.
Tighten bolts (3).
Tightening torque*.

* See Specifications

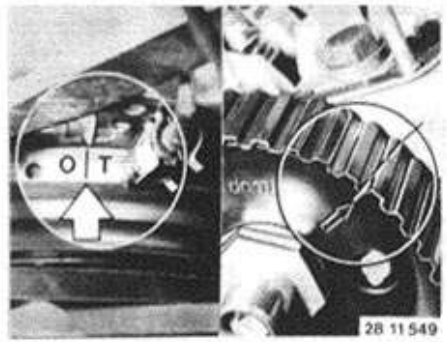


11 31 110 REMOVING AND INSTALLING DRIVE BELT

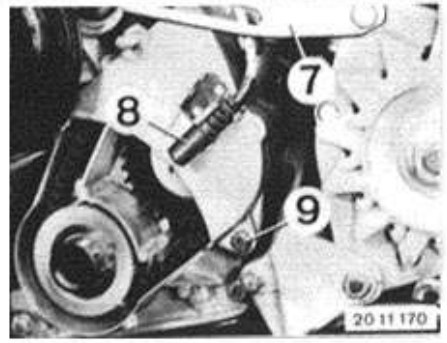
Remove distributor cap (1).
Remove distributor rotor (2).
Old Version:
Unscrew adapter (8).
Remove cover (3).
Unscrew bolts (4).
Installation:
Check seal (9), replacing if necessary.
Tightening torque*.



Take off rubber guard (5).
Unscrew nut (6).
Remove cover (7).
Install adapter (8).

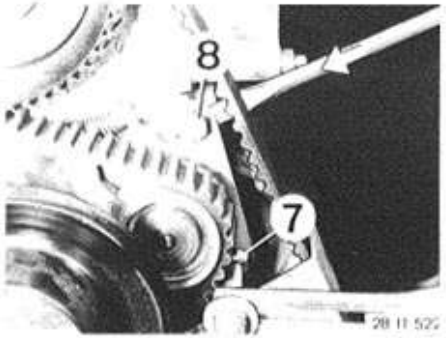


Turn the crankshaft to set cylinder no. 1 to TDC – arrow on camshaft sprocket faces the mark on the cylinder head.
Remove the vibration damper 11 23 010.

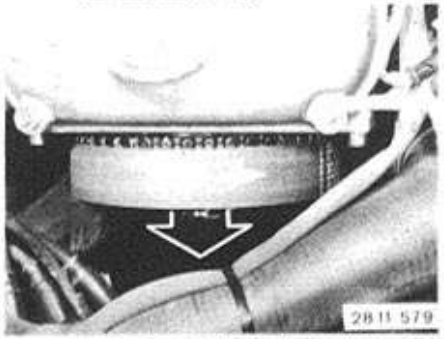


Two-piece Hub/Drive Belt Sprocket:
Remove hub for the vibration damper – see 11 23 031.
Swing away the tensioning bar (7).
Lift out TDC transmitter (8).
Unscrew bolt (9) and take off the cover.

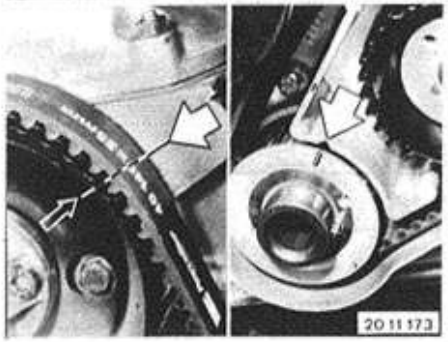
* See Specifications



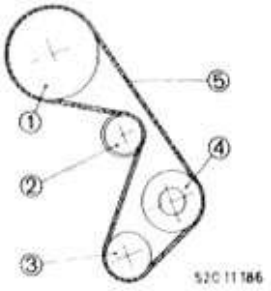
Loosen bolts (7 and 8).
Press in the tensioning roller.
Tighten bolt (8).
Installation:
Tighten drive belt 11 31 100.



Mark running direction of the drive belt and take off belt.
Installation:
Check drive belt, replacing if necessary.
Install drive belt in opposite direction of the engine's turning direction, beginning on the crankshaft sprocket.

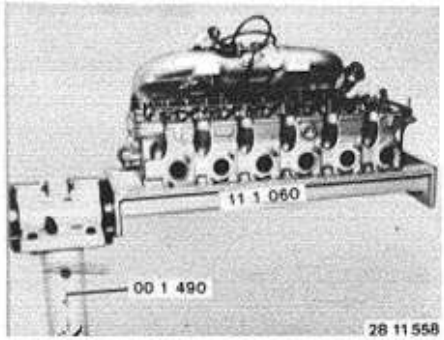


Installation:
Turn engine again in turning direction and recheck timing after installation of the drive belt.
Adjust ignition timing 12 11 004.

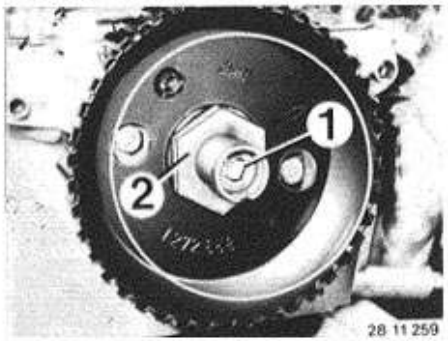


Drive Belt Layout:
1 Camshaft sprocket
2 Tensioning roller
3 Crankshaft sprocket
4 Intermediate shaft sprocket
5 Drive belt

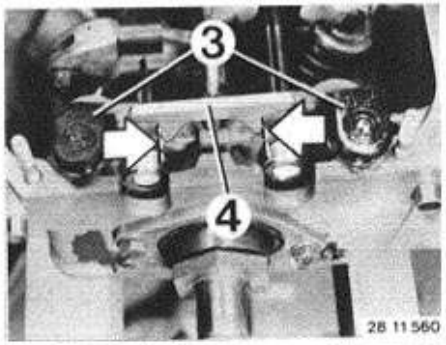
11 33 020 REMOVING AND INSTALLING ROCKER ARM SHAFTS – PLUGGED DISTRIBUTOR ROTOR –



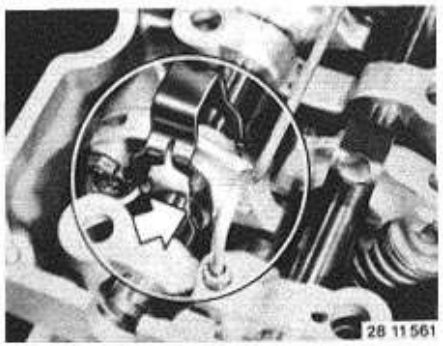
Remove cylinder head 11 12 100.
Set up Special Tool 11 1 060 on Special Tool 00 1 490 and mount cylinder head with one cylinder head bolt.



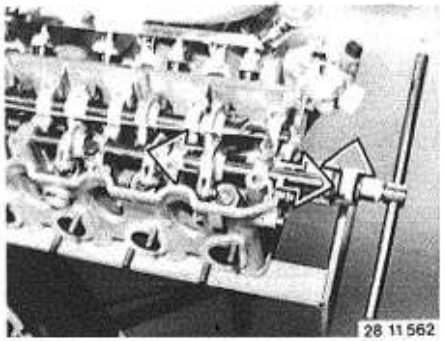
Unscrew bolt (1) and take off sprocket.
Press adapter (2) out of sprocket and install sprocket again.
Adjust valve clearance of all valves to greatest value.



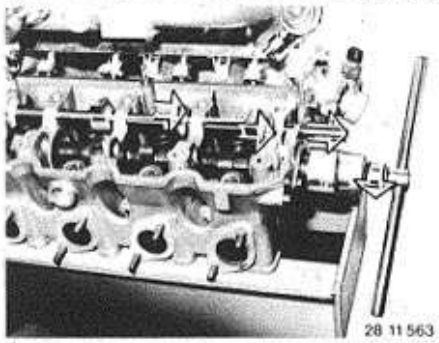
Remove front and rear plugs (3).
Remove guide plate (4).
Installation:
Guide plate (4) must fit in grooves of rocker arm shafts.



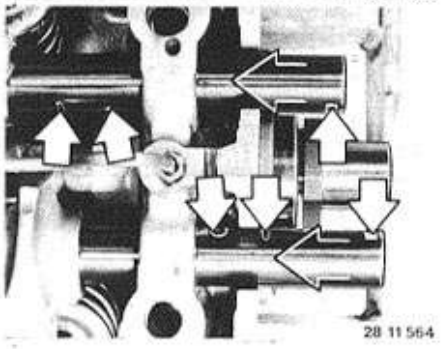
Remove spring clamps.
Installation:
Straight surfaces of spring clamps must fit in grooves of rocker arm shafts.



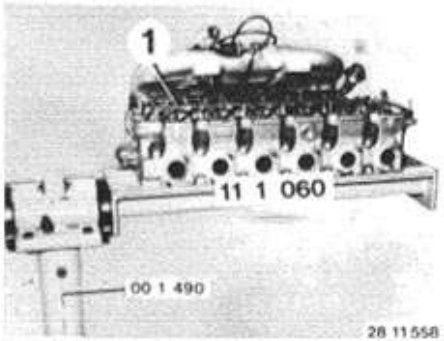
Remove rocker arm shafts.
1) Exhaust Side:
Cylinder no. 6 must overlap.
Push in rocker arms of cylinder no. 1 and turn camshaft on adapter to intake side until rocker arms (all) are relaxed.
Pull out rocker arm shaft.



2) Intake Side:
Turn camshaft on the adapter to exhaust side and move rocker arms until all rocker arms are relaxed.
Pull out rocker arm shaft.
Replace worn (scored) rocker arm shafts and rocker arms.

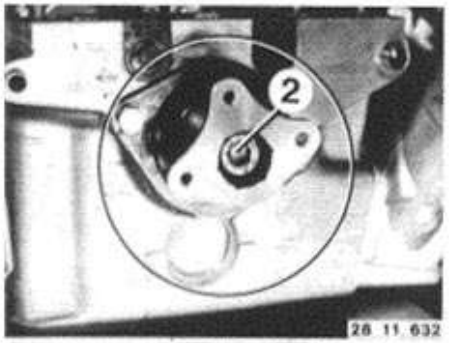


Installation:
Install rocker arm shafts that large oil bores face down to valve guides and small oil bores as well as grooves for guide plate face in.

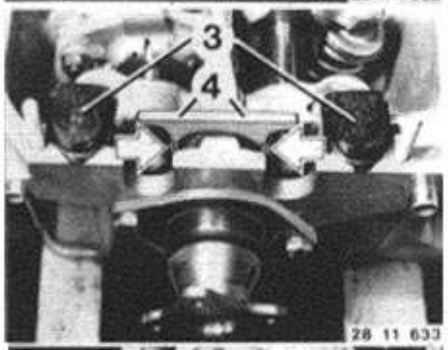


11 33 020 REMOVING AND INSTALLING ROCKER ARM SHAFTS – BOLTED DISTRIBUTOR ROTOR –

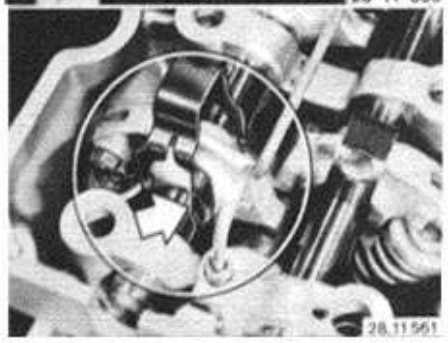
Remove cylinder head 11 12 100.
Set up Special Tool 11 1 060 on Special Tool 00 1 490 and mount cylinder head with one cylinder head bolt.



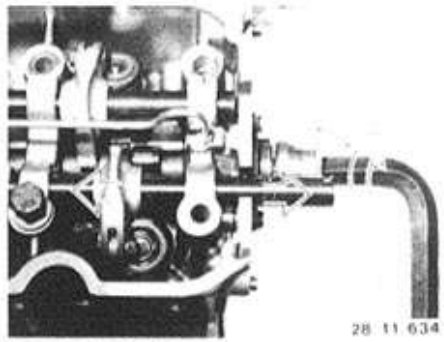
Mount adapter (2) again.
Adjust valve clearance of all valves to greatest value.



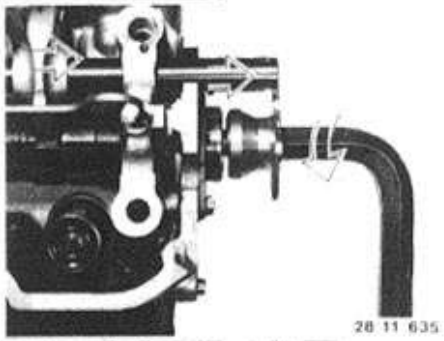
Remove front and rear plugs (3).
Remove guide plate (4).
Installation:
Guide plate (4) must fit in grooves of rocker arm shafts.



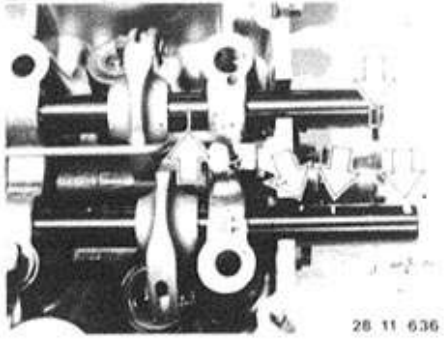
Remove spring clamps.
Installation:
Straight surfaces of spring clamps must fit in grooves of rocker arm shafts.



Remove rocker arm shafts.
1) Exhaust Side:
Cylinder no. 6 must overlap.
Push in rocker arms of cylinder no. 1 and turn camshaft on adapter to intake side until rocker arms (all) are relaxed.
Pull out rocker arm shaft.

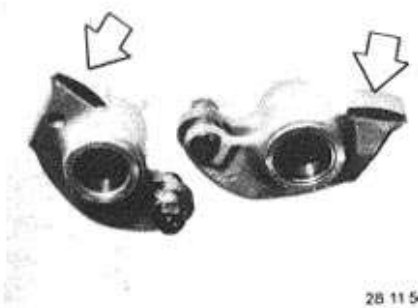


2) Intake Side:
Turn camshaft on the adapter to exhaust side and move rocker arms until all rocker arms are relaxed.
Pull out rocker arm shaft.
Replace worn (scored) rocker arm shafts and rocker arms.

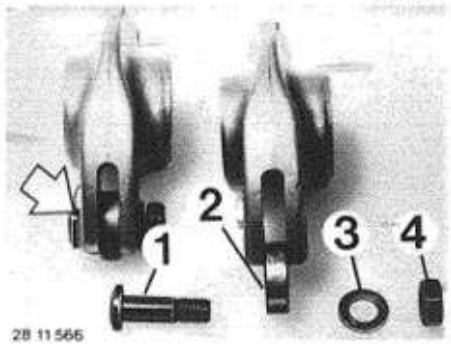


Installation:
Install rocker arm shafts that large oil bores face down to valve guides and small oil bores as well as grooves for guide plate face in.

11 33 031 REPLACING ROCKER ARMS


28 11 565

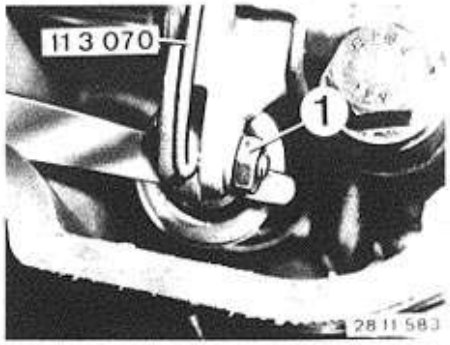
Remove rocker arm shafts 11 33 020.
Replace worn rocker arms or rocker arms with loose guides.
Loose guides will be noticed as excessively loud valve noise.



28 11 566

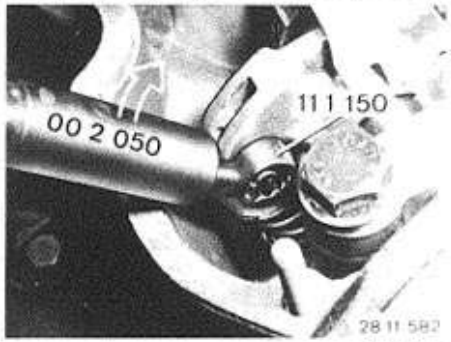
Transfer screw (1), eccentric (2), washer (3) and nut (4) to new rocker arm.
Replace a worn eccentric.
Important!
Screw and nut have M 6 x 0.75 fine threads.
Bore faces out and thick side down.
Bevelled surface of screw faces tab on rocker arm.

11 34 004 ADJUSTING VALVE PLAY



28 11 583

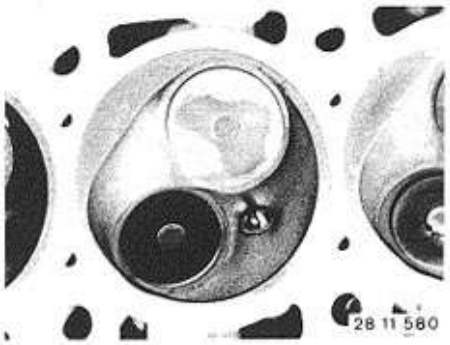
Remove cylinder head cover 11 12 000.
Crank engine with a wrench socket on the crankshaft (vibration damper).
Adjusting order is same as the firing order (1 5 3 6 2 4) in compression top dead center (TDC).
Adjust valve clearance* between valve and eccentric after loosening nut (1).



28 11 582

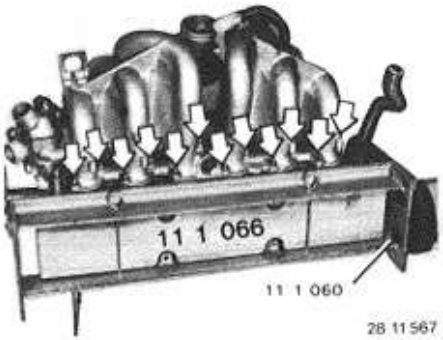
Tighten nut (1) with Special Tools 11 1 150 and 00 2 050.
Tightening torque*.

11 34 509 CHECKING ALL VALVES FOR LEAKS – CAMSHAFT REMOVED –


28 11 580

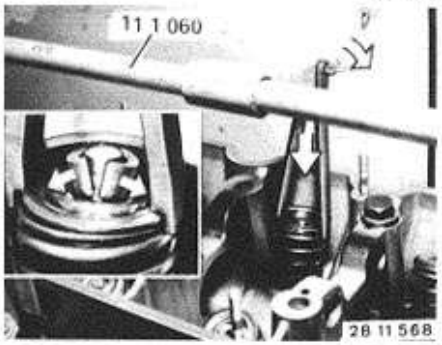
Spark plugs remain installed.
Fill combustion chamber with gasoline outdoors or indoors with strict conformance with fire prevention regulations.
If the gasoline runs past the valve heads, check valves and valve seats.
Remove and install valves 11 34 550.
Machine valve seats 11 12 607.

* See Specifications



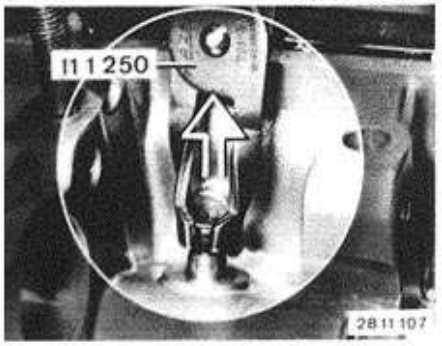
11 34 550 REMOVING AND INSTALLING VALVES

Remove rocker arm shafts 11 33 020.
Place tray 11 1 066 in assembly stand 11 1 060.
Unscrew intake.
Installation:
Replace gaskets.

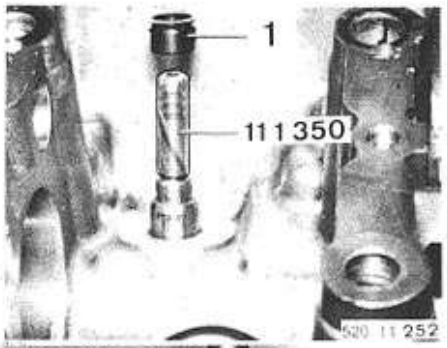


Press down the valve springs with Special Tool 11 1 060 and remove the valve collets.

Remove the upper spring retainer, valve springs and lower spring retainer.
Take the tray out of the assembly stand and pull out the valve.
Installation:
Only use valve springs with same color code, wire gage size and length.
Lubricate valve guide and valve stem with oil.

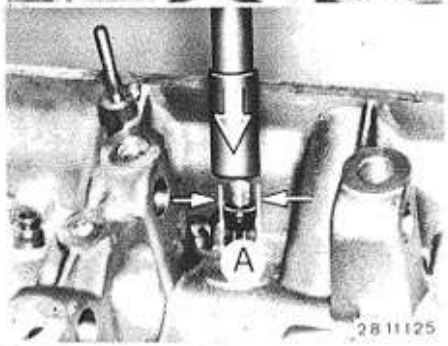


Pull off valve stem seal with Special Tool 11 1 250.

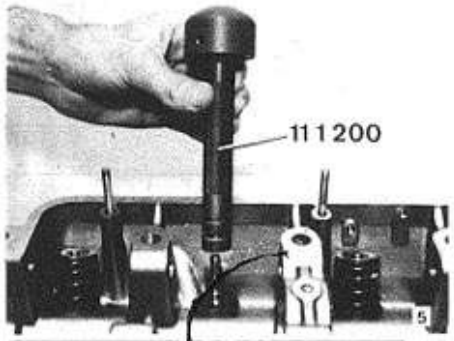


Install valve.
Always use Special Tool 11 1 350 to avoid damage on the valve stem seal.
Lubricate valve stem seal (1) with oil and install.

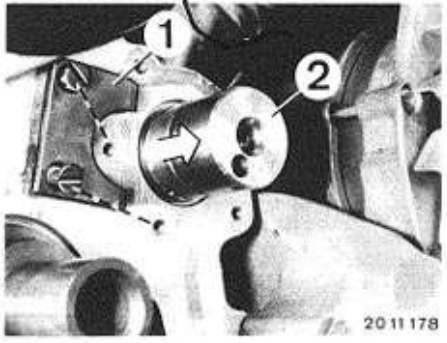
Source for Special Special Tool Sleeves:
Cartool
Alfred-Brehm-Str. 5
D–8070 Ingolstadt / West Germany



"Goetze" Seals:
Press on the valve stem seal to fit tight with Special Tool 11 1 140.
Dia. A = 12.8 mm (0.504").
"Elring" Seals:
Press on the valve stem seal to fit tight with Special Tool 11 1 080.
Dia. A = 13.5 mm (0.531").

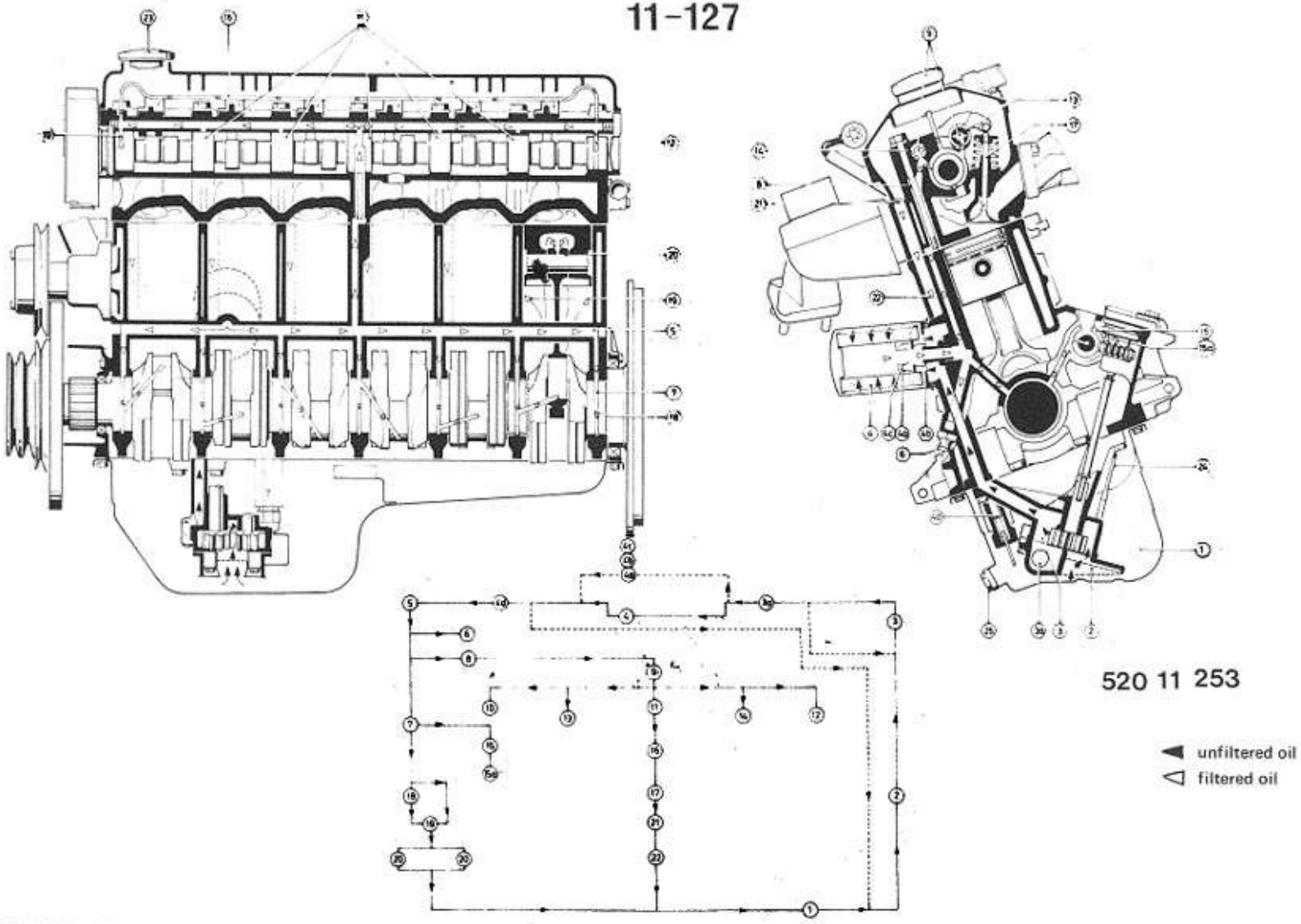


The new, improved valve stem seals (internal grooving) are pressed on by hand with Special Tool 11 1 200.
Special Tool 11 1 200 has two diameters – for 7/8 mm (0.276/0.315") valve stem seals.



11 35 020 REMOVING AND INSTALLING DISTRIBUTOR INTERMEDIATE SHAFT

Remove fuel pump 13 31 030.
Remove distributor 12 11 060.
Remove front end cover 11 14 175.
Remove guide plate (1).
Pull out the intermediate shaft (2).
Installation:
Check sprocket, replacing the intermediate shaft if necessary.
The bearings in the crankcase cannot be replaced.

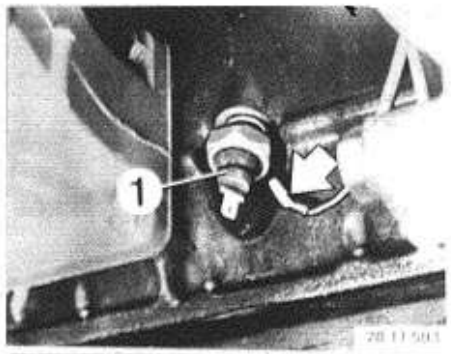


520 11 253

◀ unfiltered oil
◁ filtered oil

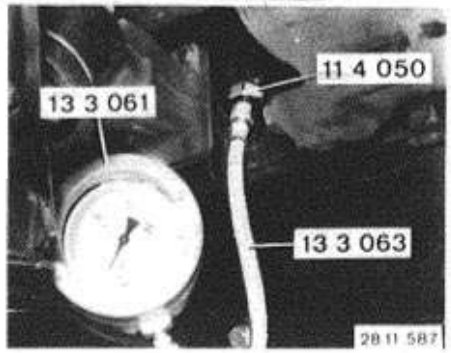
ENGINE OIL CIRCUIT

1 Oil pan
2 Intake with filter screen
3 Oil pump
3 a Pressure relief valve
4 Oil filter
4 a Safety valve (oil filter)
4 b Check valve – unfiltered side) prevents draining of oil filter
4 c Check valve – filtered side) when engine is stopped
4 d Pressure relief valve
5 Main distribution bore
6 Transmitter for oil pressure ind. lamp
7 Crankshaft bearings
8 Oil bore in cylinder head
9 Hollow rocker arm shaft
10 Front camshaft bearing
11 Camshaft bearing
12 Rear camshaft bearing
13 Rocker arm bearing (intake valve)
14 Rocker arm bearing (exhaust valve)
15 Intermediate shaft bearings
16 Oil line for cams
17 Valve guide
18 Connecting rod bearings
19 Spray oil
20 Piston pin / cylinder wall
21 Overflow from cylinder head
22 Oil return
23 Oil filler neck
24 Oil dipstick
25 Oil drain plug



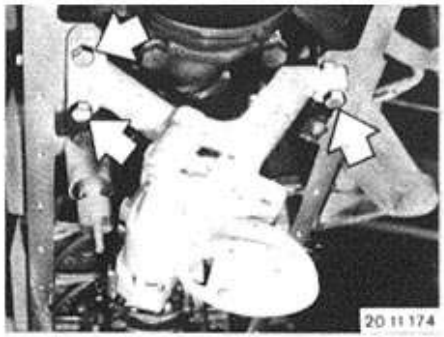
11 40 000 CHECKING ENGINE OIL PRESSURE

Pull off wires on oil pressure switch.
Unscrew oil pressure switch (1).
Installation:
Check gasket, replacing if necessary.



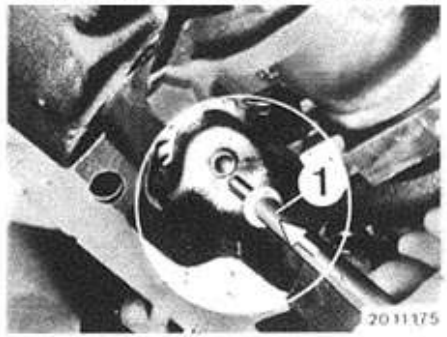
Screw in Special Tool 11 4 050 (adapter).
Connect Special Tools 13 3 063 (hose) and 13 3 061 (pressure tester).
Check oil pressure*.

* See Specifications

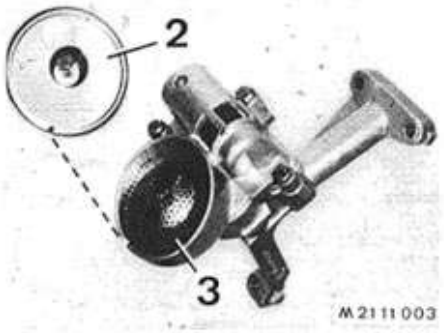


11 41 000 REMOVING AND INSTALLING OIL PUMP

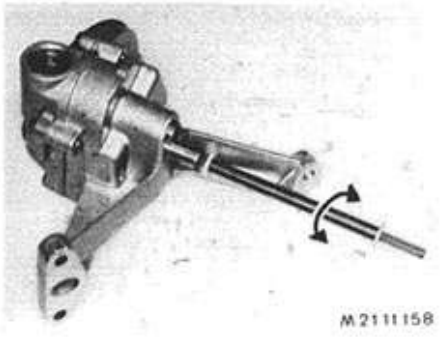
Remove oil pan 11 03 000
Unscrew oil pump.



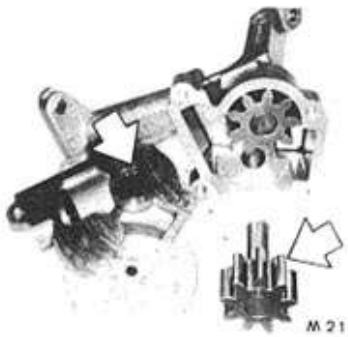
Installation:
Guide in drive shaft (1).
Replace bearing, see 11 11 160.



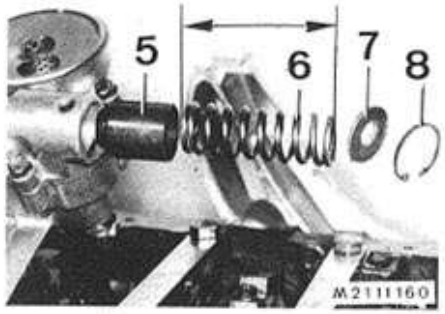
Testing and Servicing:
Unscrew cover (2) and clean oil filter screen (3).



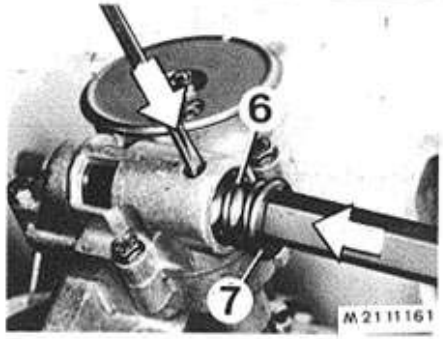
Check whether gears turn easily by turning the drive shaft.



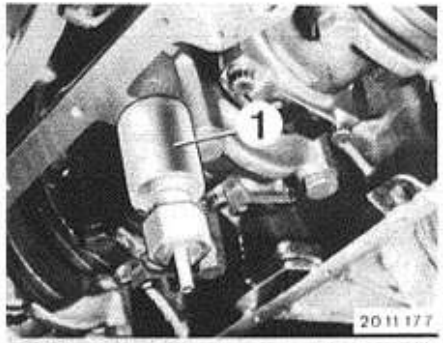
Unscrew oil pump cover and check oil pump for wear.
– Scoring in body/cover
– Wear on gears



The overload valve regulates oil pressure in front of the oil filter and prevents oil filter leakage.
Check that piston (5) moves easily.
Check length of spring (6) = 44 ± 0.2 mm (1.732 ± 0.008").

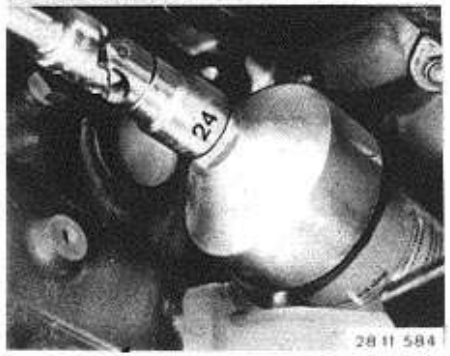


Installation:
Press in and hold spring (6) and washer (7) with a screwdriver.
Install circlip (8).



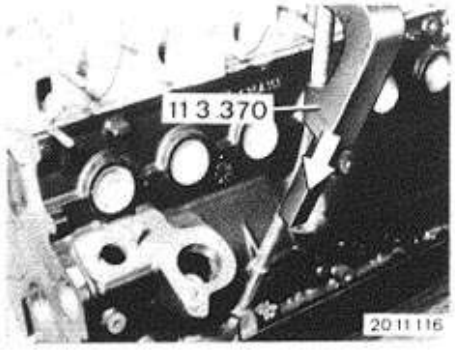
11 41 110 REMOVING AND INSTALLING PRESSURE RELIEF VALVE

The pressure relief valve is installed in the main bore and regulates the engine oil pressure* after the oil filter.
Remove oil pan 11 13 000.
Unscrew pressure relief valve.
Take off the sleeve (1).



11 42 020 REPLACING FULL FLOW OIL FILTER

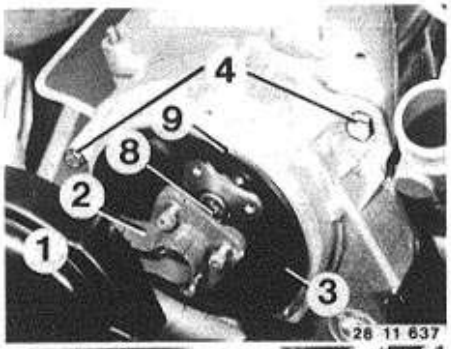
Unscrew filter with Special Tools 11 4 020/ 11 4 650.
Installation:
Give gasket a light coat of oil.
Screw on the oil filter by hand until the gasket touches – then tighten by hand with one half turn.
Add oil, start engine and check oil level and for leaks.
If the engine no longer builds up oil pressure after replacement of the oil filter cartridge, stop the engine, loosen the filter cartridge by approx. 90° and start the engine.
Tighten the filter again after oil has run out briefly (bleeding procedure).



11 43 101 REPLACING GUIDE TUBE FOR OIL DIPSTICK

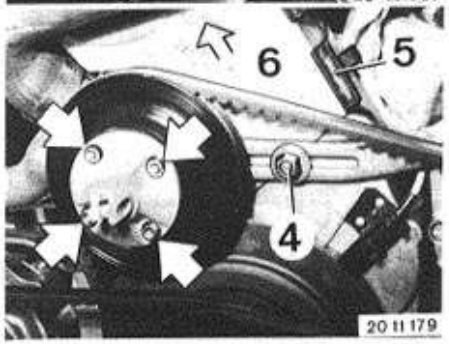
Install the guide tube with Loctite No. 270** and drive it in against the stop.

* See Specifications
** Source: HWB

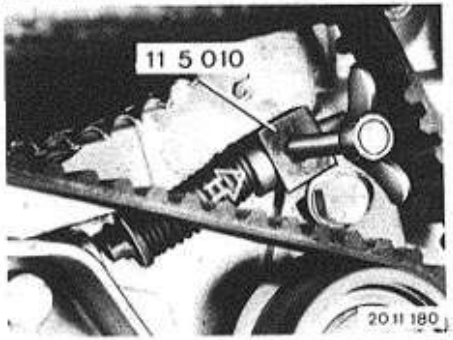


11 51 000 REMOVING AND INSTALLING WATER PUMP

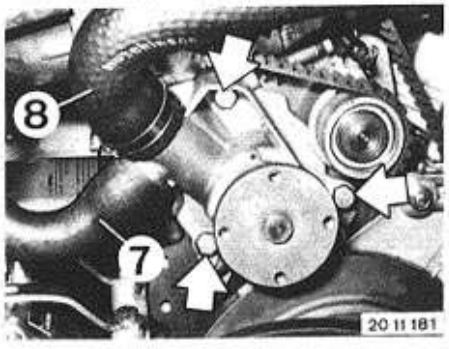
Drain coolant.
Remove distributor cap (1).
Remove distributor rotor (2).
Unscrew adapter (8).
Remove cover (3).
Unscrew bolts (4).
Remove fan 11 52 000.
Installation:
Pour in coolant and bleed the cooling system 17 00 039.
Check seal (9), replacing if necessary.



Remove pulley.
Unscrew nut (4) and take off the drive belt.
Lift out rubber part (5) and pull out the protective cover (6).
Installation:
Tighten the drive belt and check the tightness with Special Tool 11 5 020.

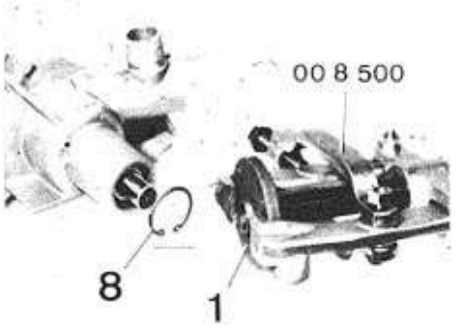


Compress the spring and clamp the pin with Special Tool 11 5 010.
Installation:
Check installed position of the pin to the water pump.



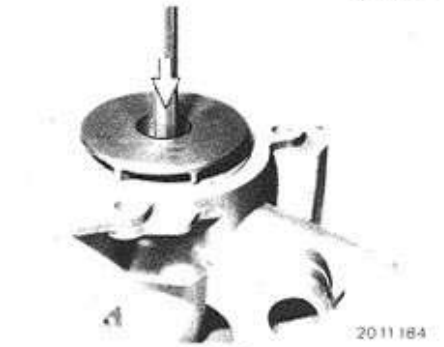
Disconnect coolant hoses (7 and 8).
Remove the water pump.
Installation:
Replace the gasket.

11 51 502 OVERHAULING WATER PUMP
– WATER PUMP REMOVED –



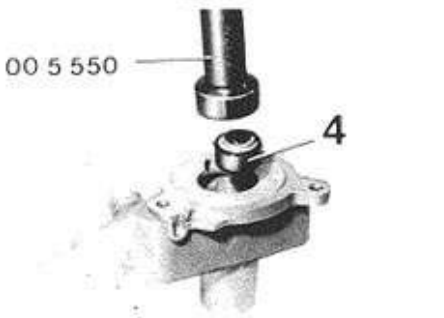
20 11 182

Pull off hub (1) with Special Tool 00 8 500.
Remove circlip (8).



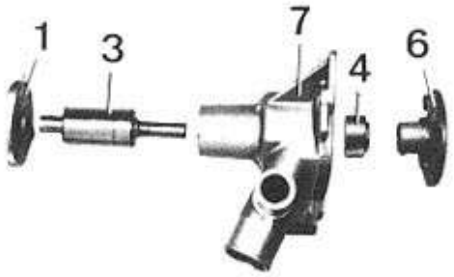
20 11 184

Press out water pump bearing.



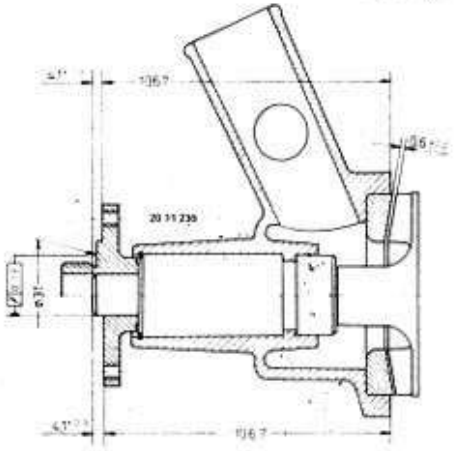
20 11 185

Drive out seal (4).
Installation:
Press in seal (4) with Special Tool 00 5 550.

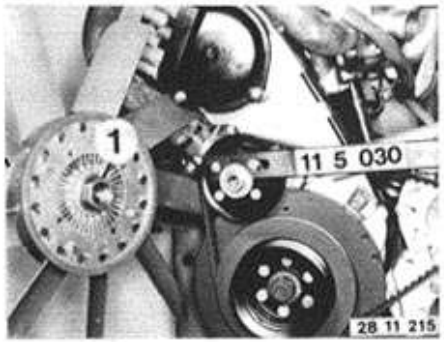


20 11 186

Replace bearing (3) and seal (4).
Check impeller (6), replacing if necessary.
1 = hub
7 = Water pump body
Installation:
Press in bearing (3) against stop.
Press on impeller (6).

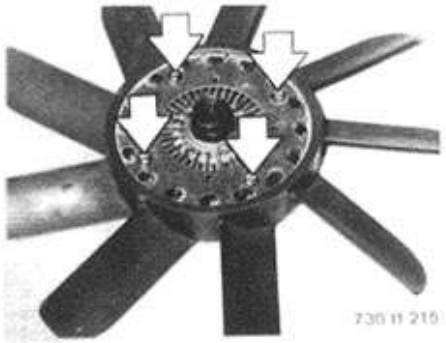


Check dimensions after assembling.



11 52 000 REMOVING AND INSTALLING FAN

Temperature Dependent Visco Fan Cutch:
Hold pulley with Special Tool 11 5 030 and unscrew the coupling nut (1).
Important!
Left-hand threads – nut turned clockwise to unscrew.
Tightening torque*.

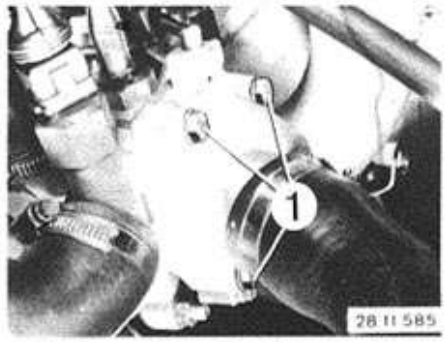


11 52 020 REPLACING FAN CLUTCH

Remove fan 11 52 000.
Reasons for Replacing the Fan Clutch:
a) Hub has seized – fan of stopped engine cannot be turned or is hard to turn.
b) Fan clutch has axial/radial play or is losing oil.

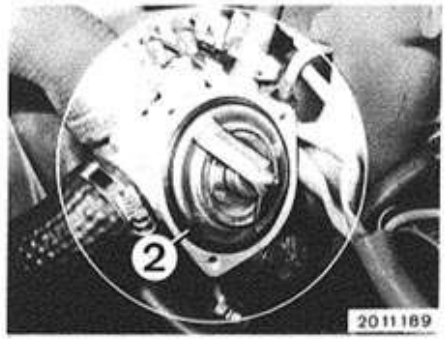
Check the switching points* with a Vibrocard***.
Unscrew the fan mounting bolts and take off the fan clutch.

* See Specifications
*** See Workshop Equipment Catalog

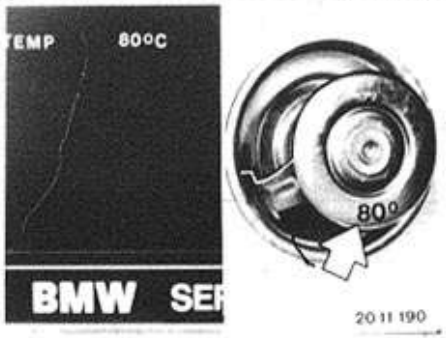


11 53 000 REMOVING AND INSTALLING COOLANT THERMOSTAT

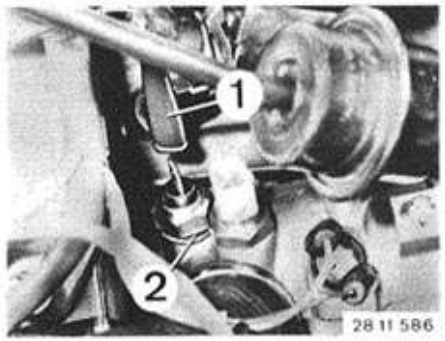
Drain some of the coolant.
Unscrew cover (1).
Installation:
Bleed the cooling system 17 00 039.



Remove thermostat.
Installation:
Clamp on the thermostat faces out.
Replace rubber ring (2).
Since 1986 Models:
New thermostat housing:
Install thermostat no. 1 713 040 (smaller valve seat diameter).

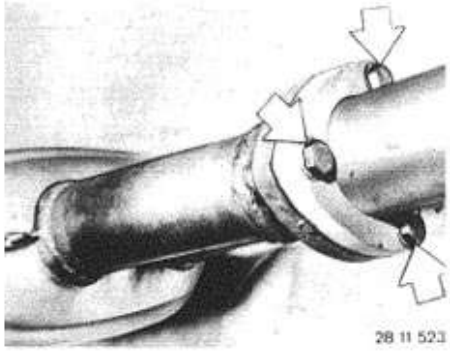


Checking Thermostat:
Check whether opening temperature agrees with the value in the Specifications.
Check opening temperature in a hot water bath and compare value with the stamped opening temperature value.



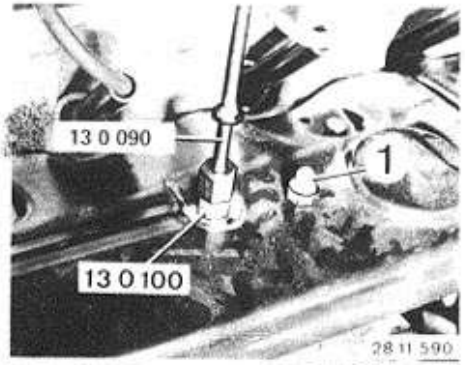
11 53 080 REPLACING TEMPERATURE TRANSMITTER

Pull off wire (1).
Unscrew the transmitter.
Installation:
Replace seal (2).
Bleed the cooling system 17 00 039.

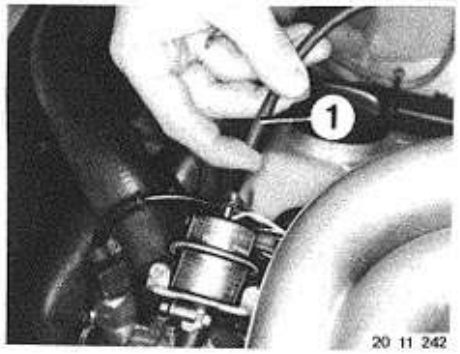

28 11 523

11 76 010 REMOVING AND INSTALLING CATALYTIC CONVERTER

Remove the exhaust assembly 18 00 020.
Unscrew the triangular flange.
Pull off the catalytic converter.
Installation:
Replace the gasket.
Check catalytic converter for damage on the outside, cracks and loose parts on the inside.
Important!
Replace the oxygen sensor and catalytic converter, if the car had been operated on gasoline containing lead.



28 11 590

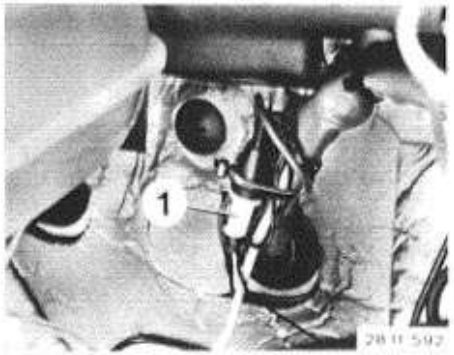


20 11 242

11 78 010 CHECKING FUNCTION OF OXYGEN SENSOR

Unscrew plug (1).
Screw in Special Tool 13 0 100 and mount Special Tool 13 0 090.
Connect the BMW service tester.
Measure the CO level.
Specifications: 0.2 to 1.2 % by volume.
Refer to 13 00 054 for other information.

Pull off vacuum hose (1) on the pressure regulator and plug.
The CO level will rise briefly and be regulated back to the original value immediately = the oxygen sensor is working.
Defective:
Check power supply to the oxygen sensor via the relay according to the wiring diagram.
See Group 13 for additional information.

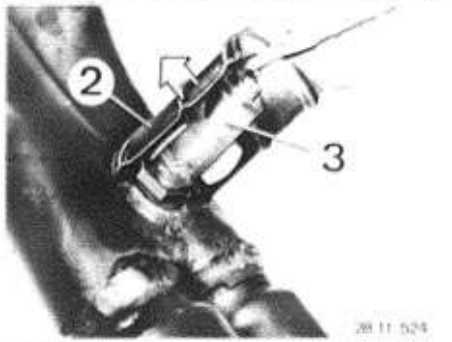


11 78 510 REPLACING OXYGEN SENSOR

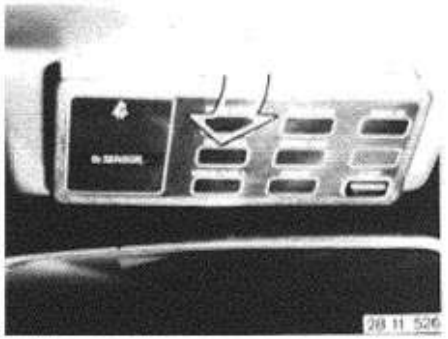
Oxygen sensors have to be replaced at intervals of 30,000 miles – see "O_2 SENSOR" lamp in check control.

- Do not clean the oxygen sensor or let it come in contact with lubricants.
- Only use "Anti-Seize"** on threads.
- Protect the oxygen sensor when undercoating the car.

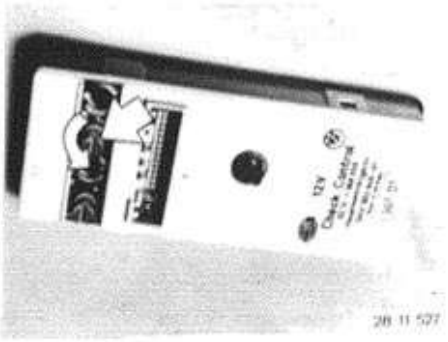
Disconnect plugs (1).
Lift wires out of clips.



Pull off plate (2).
Unscrew the oxygen sensor (3).
Installation:
Coat threads with "Anti-Seize"**.

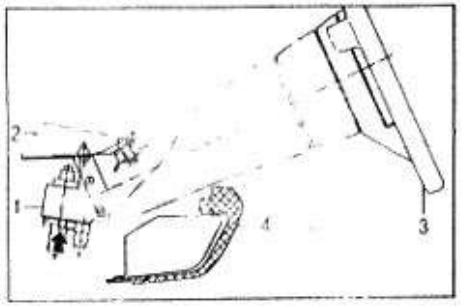


Until 1984 Models:
However, the "O_2 SENSOR" sign will light up only after the first 30,000 miles.
Lift out the check control.



Remove lamp for the "O_2 SENSOR" sign.

** Source: HWB, No. 81 22 9 400 088

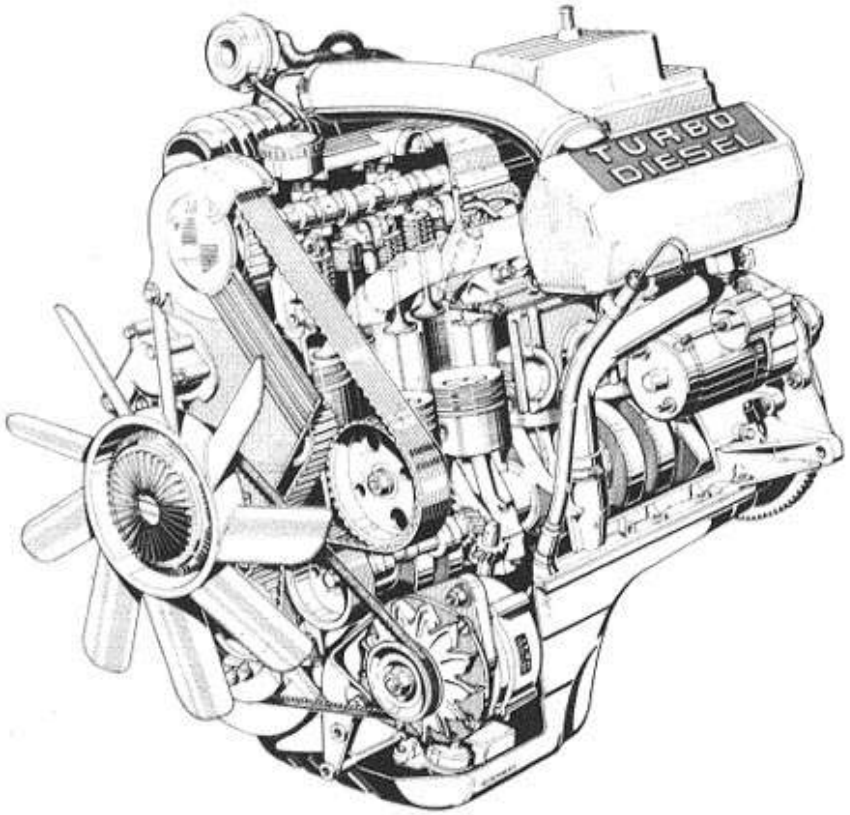


Since 1985 Models:
Reset the oxygen sensor indicator by pressing the resetter (arrow) – the "O_2 SENSOR" lamp goes out.

1 Resetter
2 Steering column support
3 Steering wheel
4 Impact guard

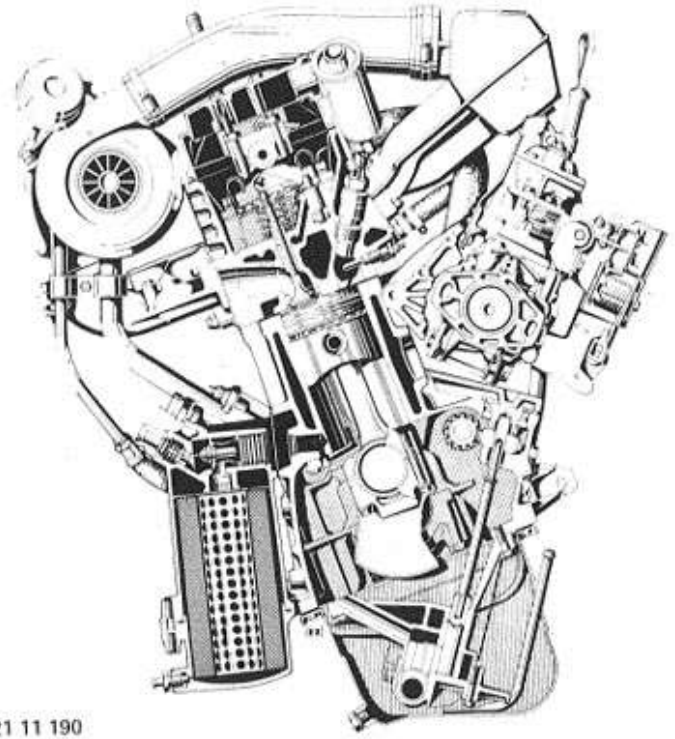
11 Engine

BMW 524td



M21 11 191

M 21 D 24 = BMW 524 td



M21 11 190

WORKING INSTRUCTIONS

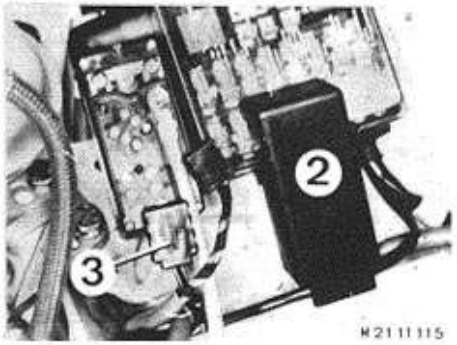
These instructions concern cleanliness when working on fuel supply and control systems.

- Clean area around repair point thoroughly – e.g. before disconnecting lines, switches, etc..
- Place removed parts only on clean surfaces and cover with plastic sheet – never use cloths losing lint.
- Cover or inert plugs in open lines and openings in parts immediately – do not work with compressed air.
- Only install cleaned parts.
  Take new replacement parts out of their packaging only shortly before installing.
- Keep diesel fuel off of coolant hoses – or wash off immediately with water if applicable.

EXPLANATIONS OF ABBREVIATIONS

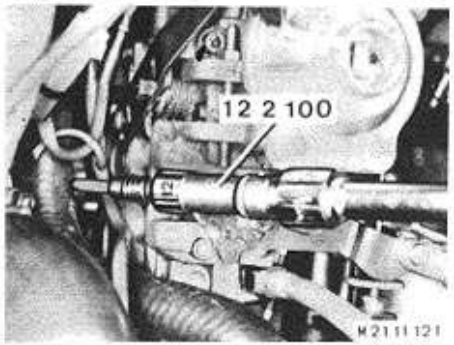
Injection Pump Attachments:

TLA	– Temperature dependent idle speed boost
ALDA	– Atmospheric and charging air pressure dependent full load stop
AGR	– Exhaust gas recirculation (EGR)

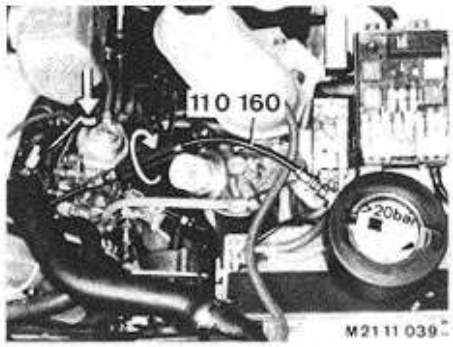


11 00 039 CHECKING COMPRESSION

Testing Conditions:
Battery in perfect charged condition – check acid density if necessary.
Engine temperature = max. 35° C (95° F) coolant temperature.
Lift off cover (2) and pull off plug (3) on the heating time control unit.



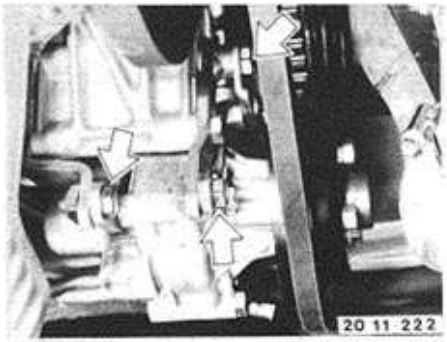
Unscrew the glow plugs with Special Tool 11 2 100 – see Group 12.
Installation:
Screw in the glow plugs with copper paste "CRC"**.
Tightening torque***.



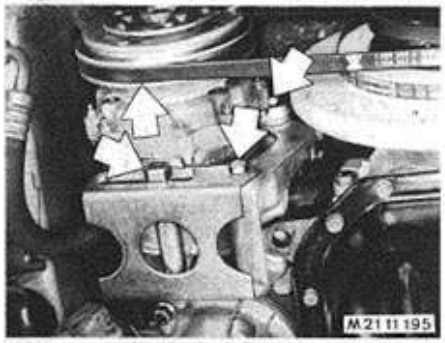
Screw in compression tester 11 0 160 together with an adapter completely and tighten slightly by hand.
Press the manual stopping lever forward and measure the compression pressure*.
Operate the starter so long, until the pressure stops rising – the compression tester has completed the test.

* See Specification
** Source: HWB
*** See Specifications of Gr. 12/23

11 00 050 REMOVING AND INSTALLING ENGINE

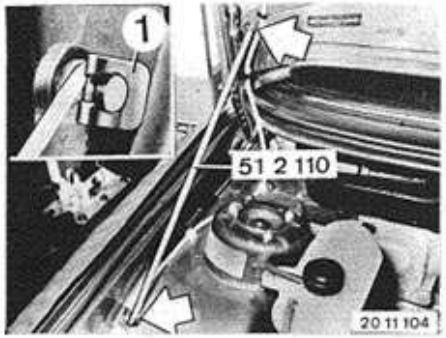


Remove transmission – see Group 23 or 24.
Unscrew power steering pump.
Pressure hoses remain connected.
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.

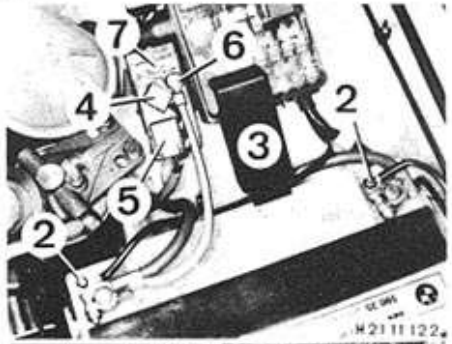


Unscrew compressor.
Refrigerant hoses remain connected.
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.

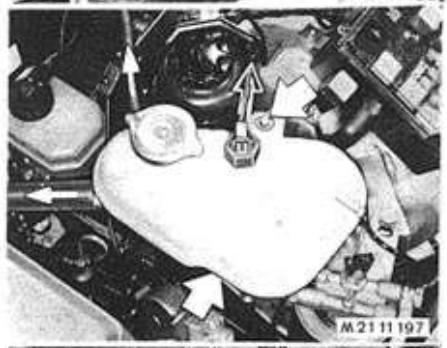
Unscrew plug (2) and drain coolant.
Remove radiator 17 11 000.
Remove circlip and disconnect power lead.



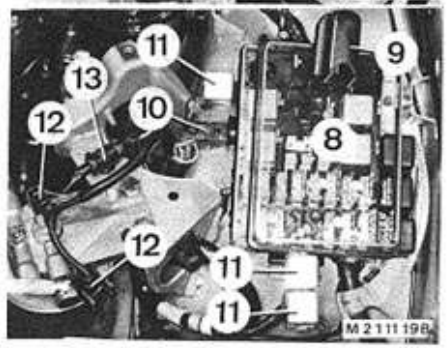
Unscrew ground wire for hood.
Disconnect or remove gas pressure props and prop up engine hood with Special Tool 51 2 110.
Caution!
Use locks (1).



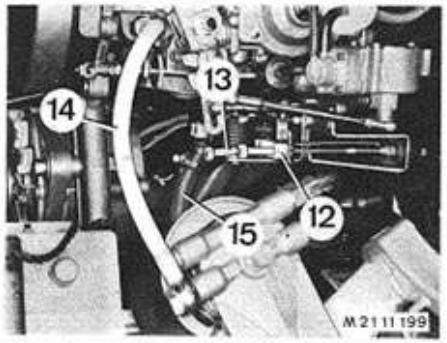
Disconnect negative and positive leads on battery.
Unscrew wire (2).
Lift off cover (3) and pull off plugs (4 and 5).
Unscrew wire (6).
Remove preheating time control unit (7).



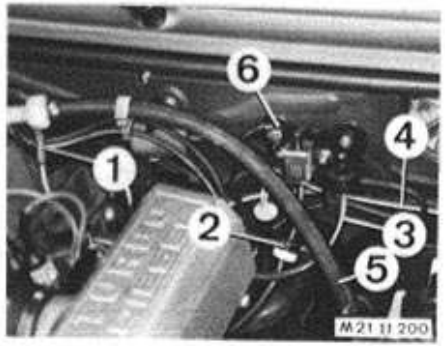
Remove tank.



Take off cover (8) and lift off cap (9).
Pull off plug (10) and lift out relay (11).
Pull off plug (12).
Disconnect plug (13).
Unscrew wire harness on body.

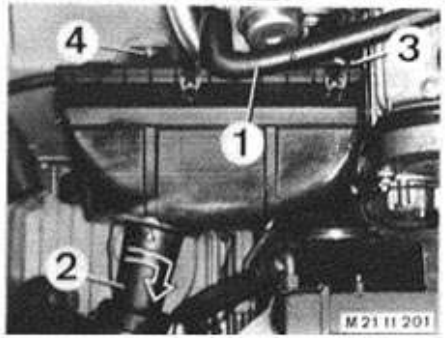


Disconnect accelerator cable (12) and cruise control cable (13).
Disconnect fuel hoses (14 and 15).
Installation:
Adjust accelerator cable, see 35 41 421.
Adjust cruise control cable, see Group 65.

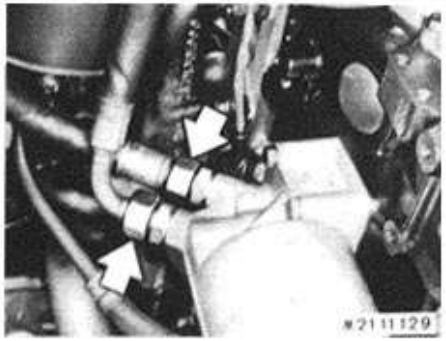


Disconnect hoses (1 ... 5).
Pull off plug (6) and disconnect wire.

Disconnect water hoses for heater.

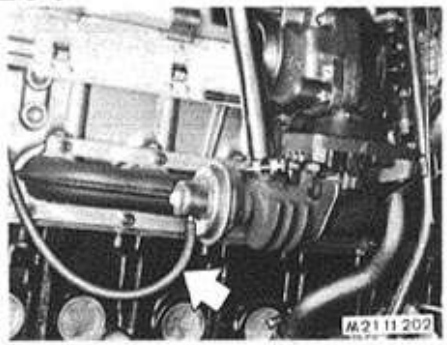


Disconnect hose (1).
Turn out hose (2).
Loosen clamp (3).
Unscrew nut (4) and remove air cleaner.
Installation:
Turn arrow to face up.



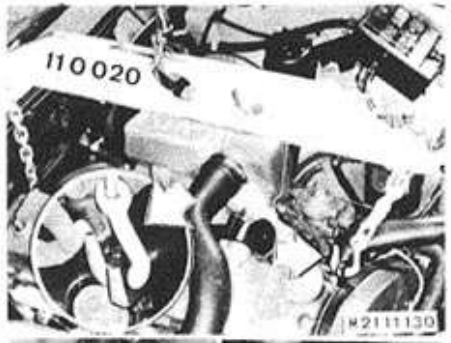
Unscrew oil lines on oil cooler.
Installation:
Pour in engine oil***.

*** See Service Information of Gr. 00

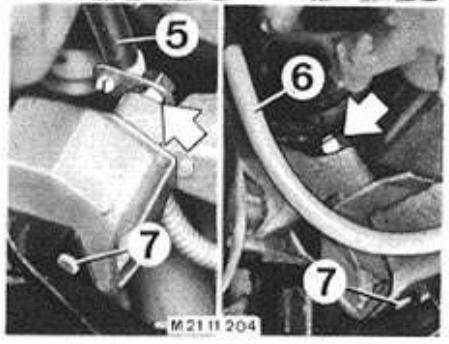


Pull off hose.

Pull off plug (5) on control unit in glove box.
Disconnect engine wire harness and pull it into engine compartment.

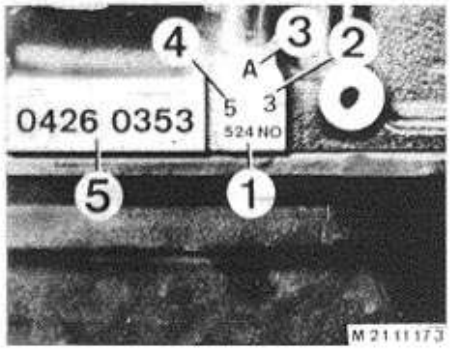


Attach Special Tool 11 0 020 on engine.



Unscrew wire (5) and ground strap (6).
Unscrew both engine mounts and lift out engine.
Installation:
Guide pin (7) into bore of axle carrier.
Tightening torque*.
Check engine performance 13 00 050.

* See Specifications



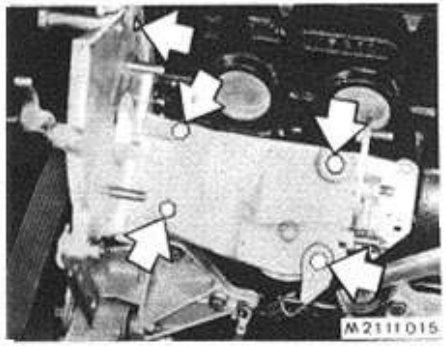
11 00 091 INSTALLING EXCHANGE ENGINE

Remove engine 11 00 050.
Exchange Engine Identification on Crankcase:
1 = Type/delivery scope
NO = Normal version
AB = Stripped version
2 = Manufacturing year (1983)
3 = "A" = exchange, "N" = new part
4 = Manufacturing month
Die stamp engine number (5).
Transfer parts from old to new engine.

Pour in engine oil***.
Important!
If car has an automatic transmission, remove pilot bearing in crankshaft – see 11 21 571.

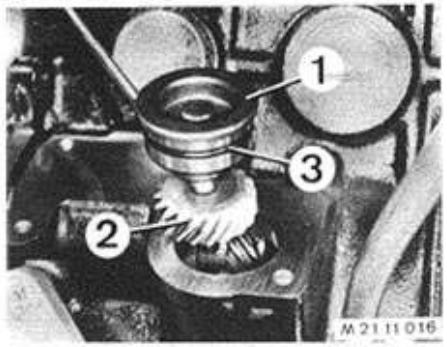
Install engine.
Check static adjustment of injection pump, see 13 51 005.
Check engine performance, see 13 00 050.

* See Specifications
*** See Service Information of Gr. 00

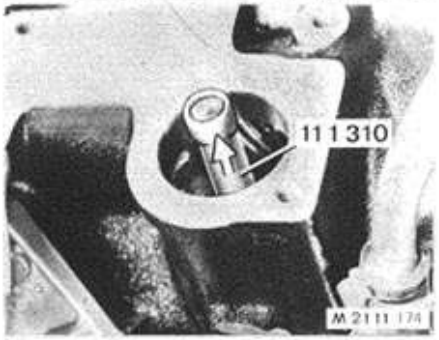


11 11 160 REPLACING BEARING FOR OIL PUMP DRIVE SHAFT

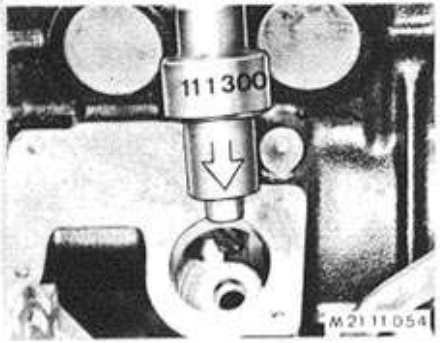
Remove oil pump 11 41 000.
Remove injection pump, see Group 13.
Unscrew the console.



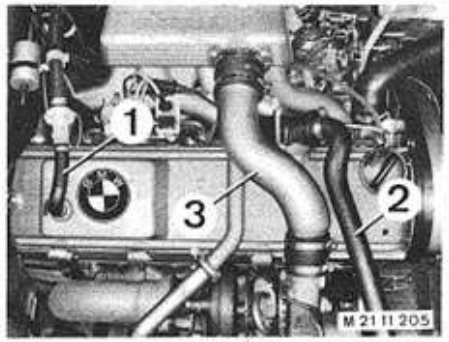
Lift out cover (1).
Remove gear (2).
Installation:
The open end of the gear shaft faces down.
Check bearing in cover (1) and seal (3), replacing if necessary.



Drive out needle bearing from bottom to top with Special Tool 11 1 310.

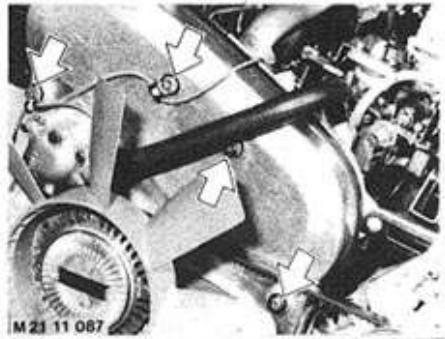


Installation:
Lubricate the needle bearings.
Drive in needle bearing against the stop with Special Tool 11 1 300.

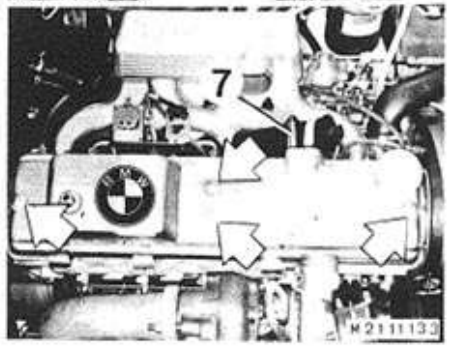


11 12 000 REMOVING AND INSTALLING CYLINDER HEAD COVER

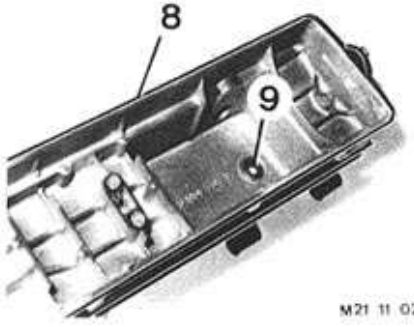
Disconnect hoses (1 and 2).
Remove pipe (3).



Loosen protective cover screws.
Installation:
First tighten cylinder head cover and then the protective cover.



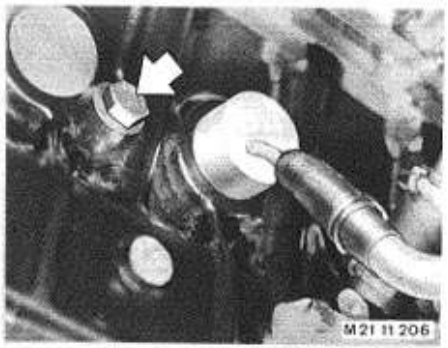
Unscrew oil trap (7).
Unscrew threaded sleeves and take off the cylinder head cover.
Installation:
Install the threaded sleeves with seals.
Check seal on the oil trap, replacing if necessary.



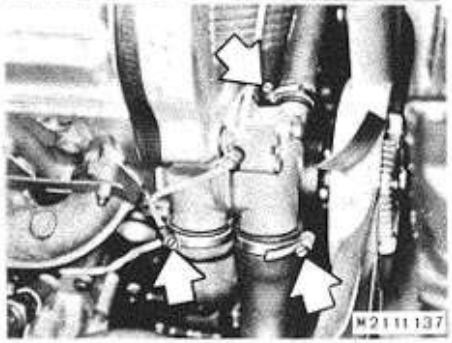
Installation:
Check cylinder head cover gasket (8) and rubber ring (9), replacing if necessary.
Insert rubber ring (9) in cover and lubricate with oil.
Tightening torque*.

* See Specifications

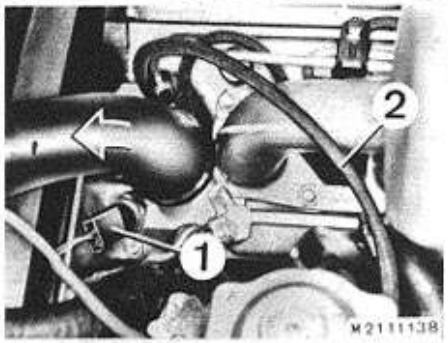
11 12 100 REMOVING AND INSTALLING CYLINDER HEAD



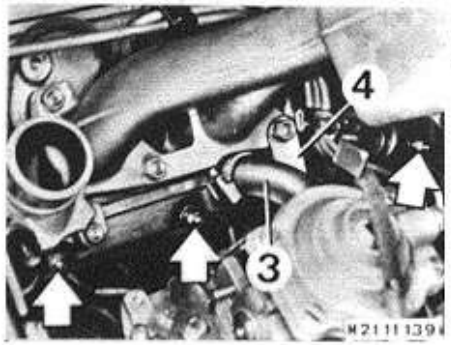
Remove turbocharger, see 11 65 020.
Unscrew plug and drain coolant.
Disconnect battery ground lead.
Installation:
Pour in coolant*** and bleed cooling system 17 00 039.
Replace engine oil***.



Remove fan, see 11 52 000.
Disconnect coolant hoses.

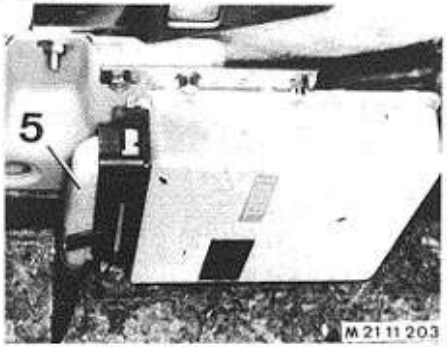


Disconnect coolant hose.
Pull off plug (1).
Pull off leak oil line (2).

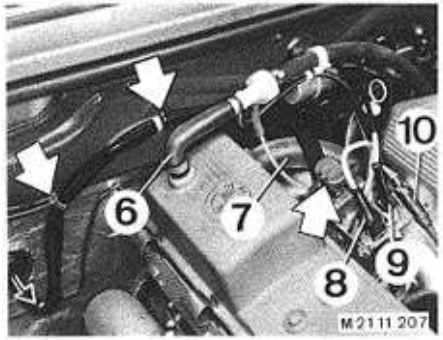


Disconnect coolant hose (3).
Unscrew holder (4).
Unscrew wires on heater plugs.

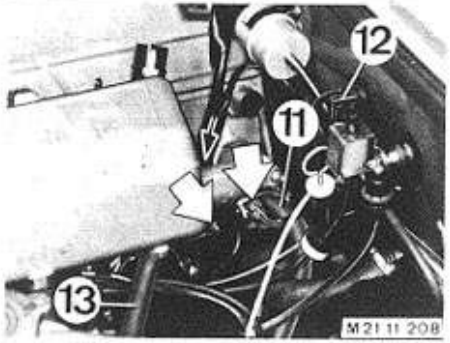
*** See Service Information of Gr. 00



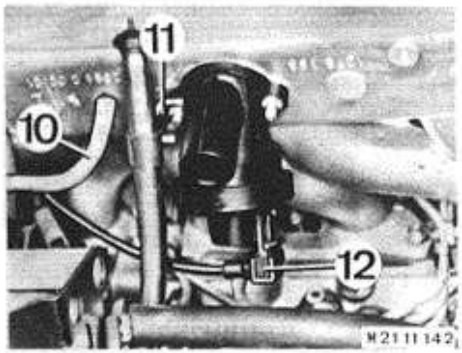
Pull off plug (5) on control unit in glove box.



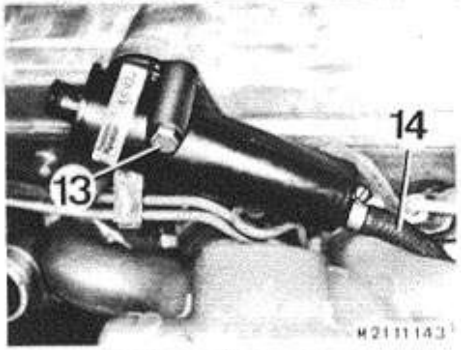
Disconnect engine wire harness and pull into engine compartment.
Pull off hoses (6 and 7).
Disconnect plugs (8 ... 10).
Disconnect diagnosis plug.
Installation:
Always connect two gray plugs (9) together.



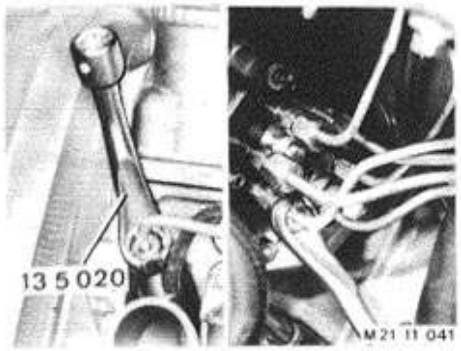
Disconnect coolant hose (11).
Unscrew wires on heater plugs.
Pull off plugs on temperature sensors.
Pull off plug (12).
Unscrew support (13).
Disconnect wire harness and lead it down.



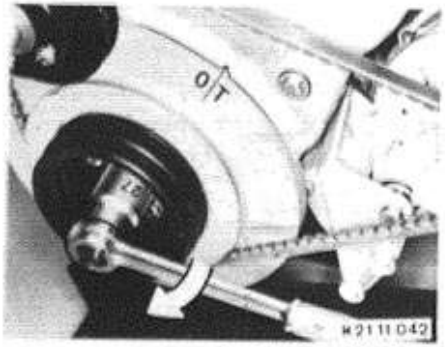
Pull off hose (10).
Unscrew holder (11).
Pull off plug (12).



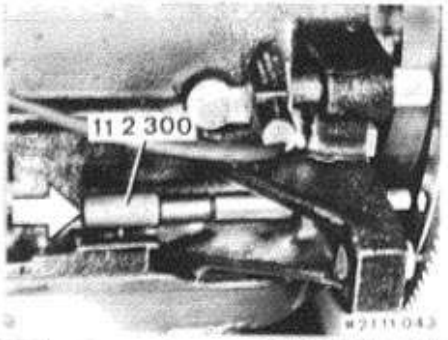
Unscrew oil trap (13).
Pull off hose (14).
Installation:
Check seal, replacing if necessary.



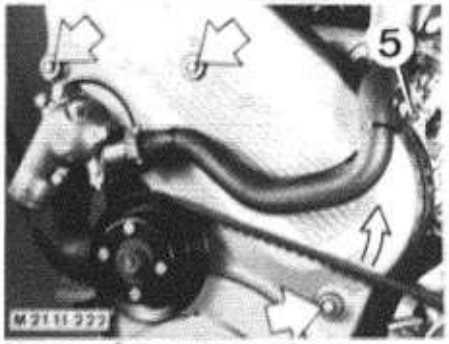
Unscrew injection lines on fuel injectors and injection pump with Special Tool 13 5 020.
Install protective caps.
Remove cylinder head cover, see 11 12 000.
Installation:
Tightening torque: 20 to 25 Nm (14 to 18 ft. lbs.).
Screw on injection lines and bleed fuel system, see 13 51 . . ..



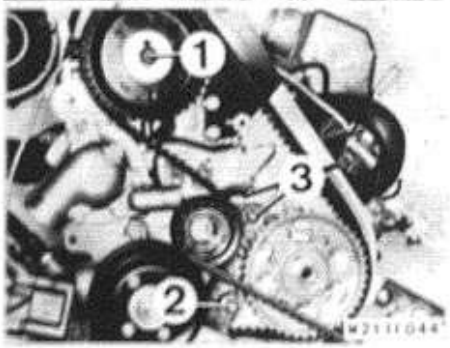
Turn cylinder no. 1 to TDC – cyl. no. 6 overlaps.



Hold the crankshaft with Special Tool 11 2 300.

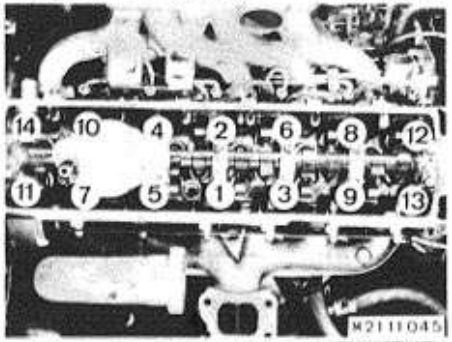


Remove hose (5) and the protective cover.
Installation:
First tighten the cylinder head cover and then the protective cover.

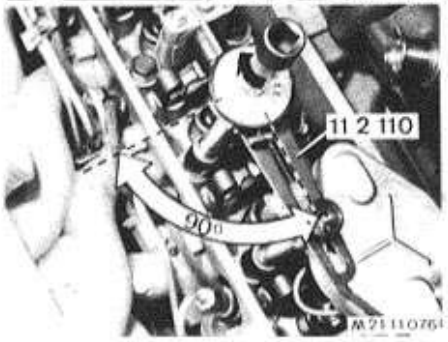


Loosen screws (1 and 2) and nut (3).
Loosen the drive belt and take it off of the camshaft sprocket.

Installation:
Turn in the camshaft to have the valves of cylinder no. 6 overlapping before mounting the cylinder head – hold the camshaft with Special Tool 11 3 090.
Install and tighten the drive belt, see 11 31 110.



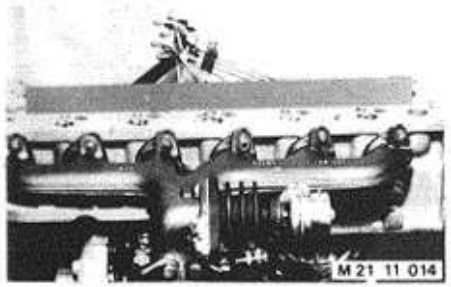
Unscrew the bolts in order of 14 to 1 and take off the cylinder head.
Installation:
Keep oil out of the cavities, since otherwise the bolts tightened with the correct torque will not exert sufficient force on the cylinder head and, in addition, the crankcase might be cracked.
Clean the cylinder head bolts and give the threads and bolt head bearing surface a light coat of oil.
Replace the cylinder head gasket.
Measure the piston protrusion, see 11 12 101.



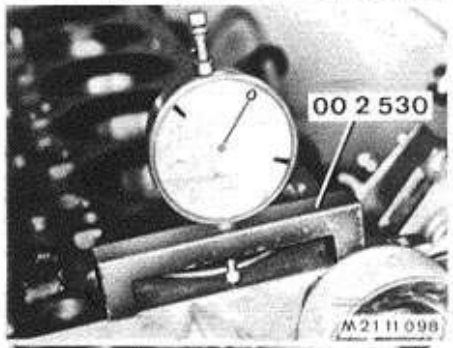
Tighten the bolts in three steps in order of 1 to 14.
Tightening torque*.
Adjust the valve clearance 11 34 004.
Check the static adjustment of the injection pump 13 51 005.
In the third step (cylinder head cover removed again after running the engine warm) the cylinder head bolts are tightening to the correct torque angle* with Special Tool 11 2 110 regardless of the engine temperature.

* See Specifications

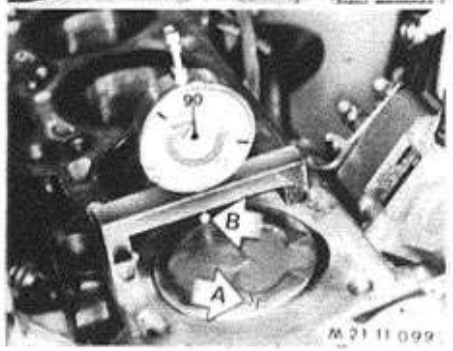
11 12 101 REPLACING CYLINDER HEAD GASKET



Remove the cylinder head 11 12 100.
Clean the sealing surfaces on the cylinder head and crankcase thoroughly with a sealant remover** and hard wood scraper carefully (even slight scoring would render the engine to leak due to the high compression).
Check the levelness with a standard steel ruler*.
The cylinder head may not be reground.
A cylinder head gasket must be installed which conforms with the maximum piston protrusion of all six pistons.

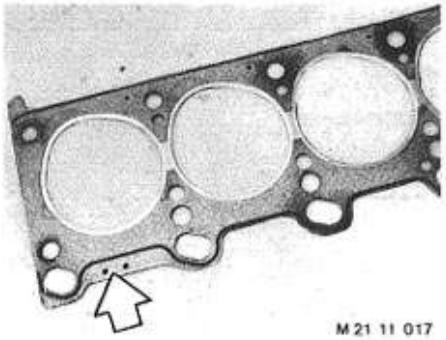


Measuring Piston Protrusion:
Set up a dial gage with Special Tool 00 2 530 on the cleaned cylinder head sealing surface and set the dial gage to zero with preload.



Place the dial gage on checkpoint "A" of the cleaned piston and find the highest point by turning the crankshaft.
Note the displayed value = "piston protrusion A".
Set up the dial gage on checkpoint "B" and note "piston protrusion B".
The mean value of "A" + "B" is the "piston protrusion" of a piston.
Repeat these measurements on all six pistons.

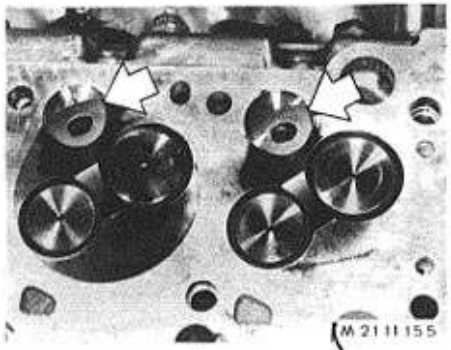
* See Specifications
** Source: HWB



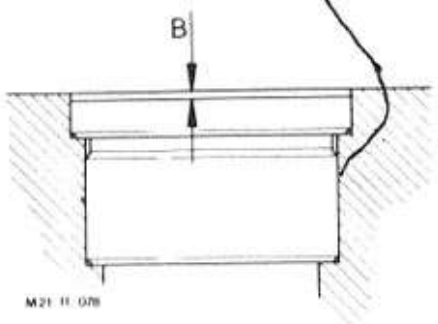
The piston with the highest "piston protrusion" determines the thickness of the cylinder head gasket.

Cylinder Head Gaskets:

Max. Piston Protrusion of All Six Pistons	Identification of Cyl. Head Gasket Number of Holes
0.64 ... 0.78 mm (0.025 ... 0.030")	1
0.79 ... 0.91 mm (0.031 ... 0.035")	2
0.92 ... 1.08 mm (0.036 ... 0.042")	3



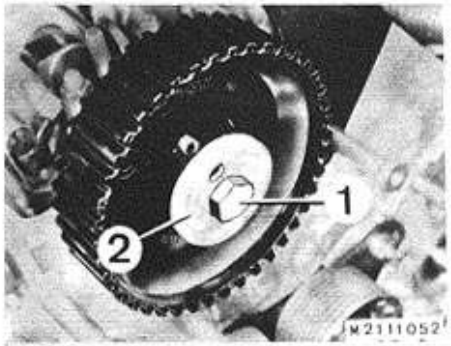
The burners have a shrink-fit in the cylinder head.
The cylinder head has to be replaced, when burners are loose or damaged.



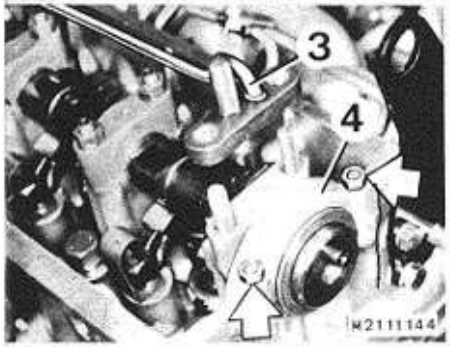
Burner retrusion "distance B"*.

* See Specifications

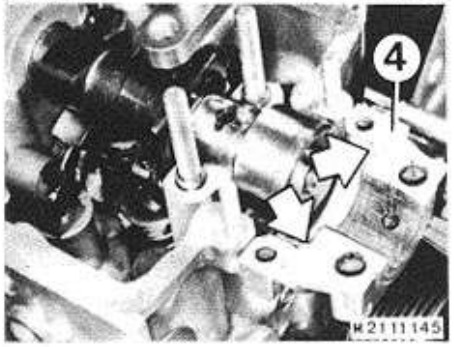
11 12 240 REPLACING RADIAL OIL SEAL IN END COVER



Remove drive belt 11 31 110.
Unscrew the drive belt sprocket (1).
Installation:
Slide slot of sprocket and bore of washer (2) over the pin of the camshaft.

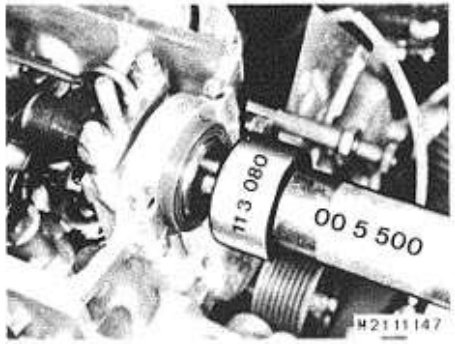


Unscrew the oil line (3) and bearing cap (4).
Pull off the radial oil seal.



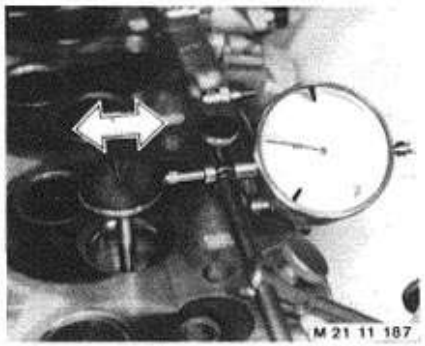
Coat the sealing surface with a brush-on universal sealing compound / Three Bond Silicone 1207** and mount the bearing cap (4) again.
Tightening torque*.

Slide on the radial oil seal over Special Tool 11 2 212.
Lubricate the sealing lip with oil.



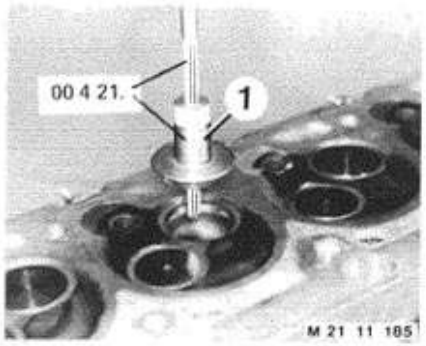
Press in the radial oil seal with Special Tools 11 3 080 and 00 5 500.
Press in the new radial oil seal against the stop, in contradiction to the standard seal which had been pressed in flush.

* See Specifications
** Source: HWB



11 12 595 CHECKING VALVE GUIDE FOR WEAR
– Valve Removed –

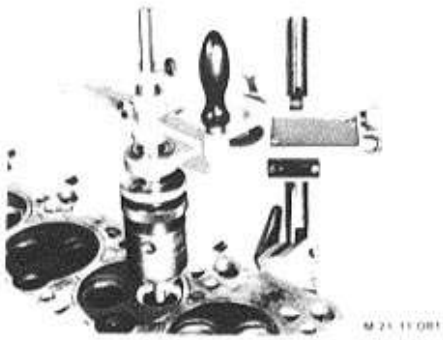
To measure, install a new valve that its stem end is flush with the valve guide.
Apply the dial gage and measure the tilt clearance.
Max. permissible tilt clearance*.

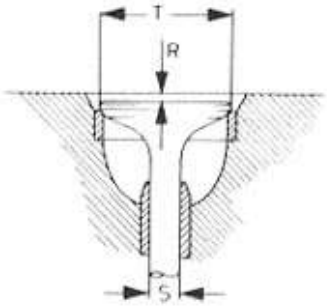


11 12 600 REAMING OUT VALVE GUIDE
– Valve Removed –

If there is excessive play between the valve guide and valve stem, see 11 12 595, ream out the valve guide and install a valve with a larger stem diameter "S"*.
The valve seat must also be machined in conjunction with this step, see 11 12 607.
Press guide mushroom (1) on to the valve seat and ream out the valve guide from the combustion chamber end – turning down the reamer once.

* See Specifications

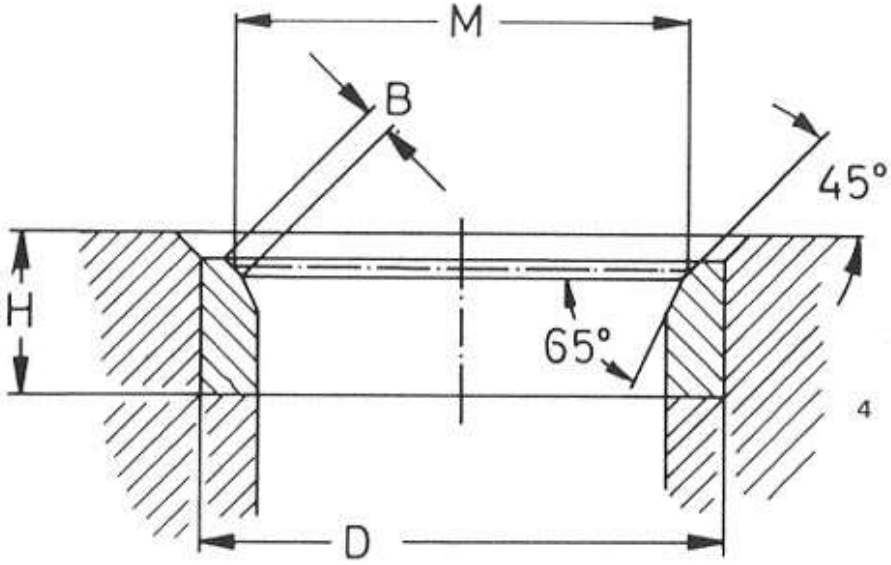




11 12 607 MACHINING VALVE SEAT
– Cylinder Head Disassembled

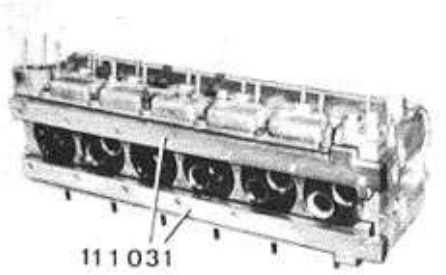
The valve seat machine from "Hunger" and the five-edged cutting tool from "New Way" are approved for the machining of valve seat insert rings.
An oversized valve must be installed after machining a valve seat.
Machine the valve seat insert rings until the specified valve retrusion "R" is reached.

Valve retrusion R*.
Produce the valve seat diameter M* and valve seat width B* by grinding the correction angles* after machining the valve seat angle*.
The valves must not be ground in.
Check the valves for leaks 11 34 509.



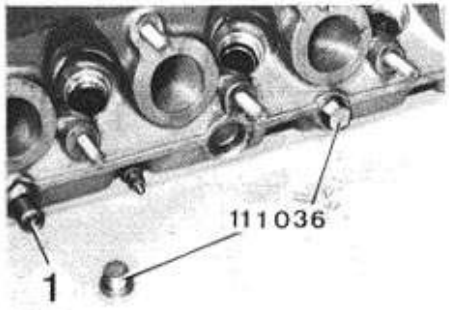
* See Specifications

11 12 729 CHECKING CYLINDER HEAD FOR CRACKS IN WATER TEST
– Cylinder Head Disassembled –



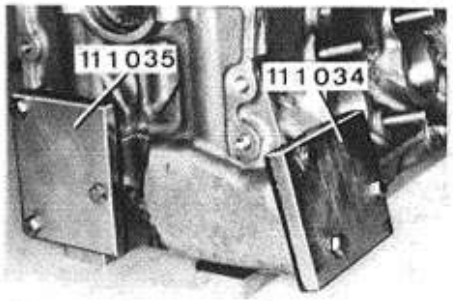
M 2111083

Mount Special Tools 11 1 031 on the cylinder head (using cylinder head bolts).



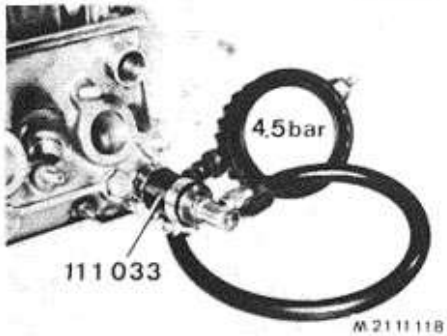
M 2111100

Unscrew adapter (1) and plug holes with Special Tools 11 1 036.
Use seals.
Note:
Screw in the adapter with a bolt cement**.



M 2111117

Install Special Tools 11 1 034 and 11 1 035.

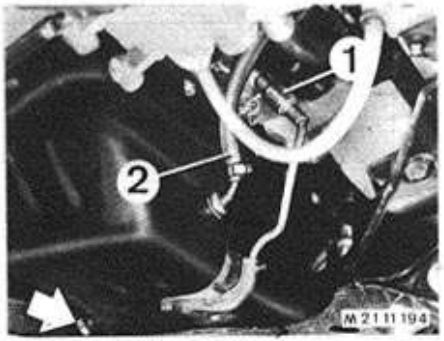


M 2111118

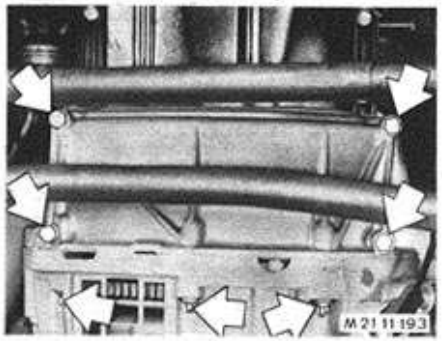
Install Special Tool 11 1 033.
Apply 4.5 bar (64 psi) air pressure on cylinder head and check for leaks (cracks) by placing the head in a water bath.
Note:
Relax the water bath with a detergent.

** Source: HWB

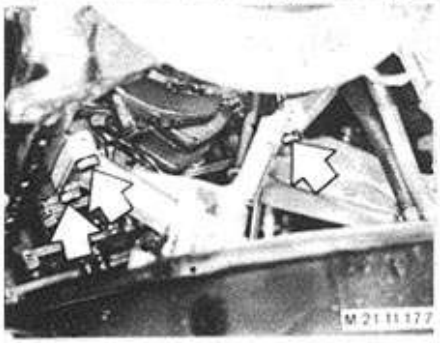
11 13 000 REMOVING AND INSTALLING OIL PAN



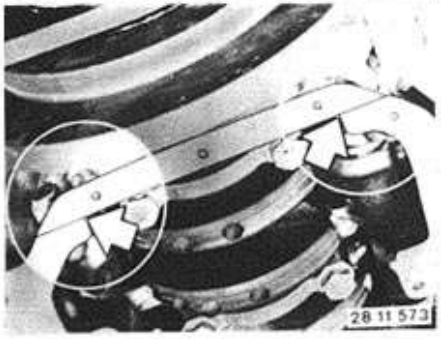
Drain engine oil.
Lift out and disconnect plug (1).
Disconnect hose (2).
Installation:
Pour in engine oil***.



Unscrew reinforcement plate.

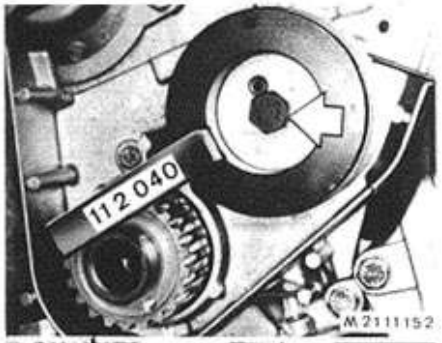


Unscrew oil pan.
Unscrew oil pump and remove oil pan.
Installation:
Insert drive shaft for oil pump, see 11 41 000.
Replace gasket.



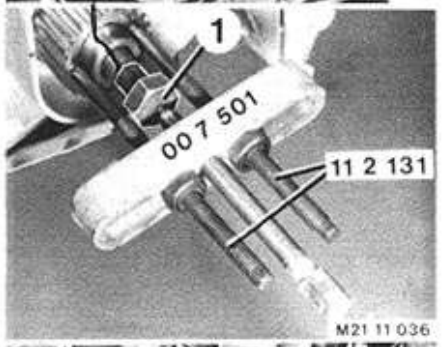
Installation:
Clean sealing surfaces.
Coat mating surfaces on timing case cover and end cover with universal sealing compound**.

** Source: HWB
*** See Service Information of Gr. 00

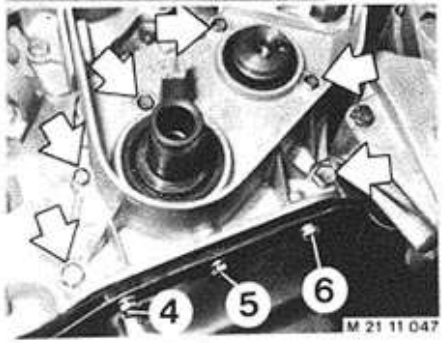


11 14 175 REMOVING AND INSTALLING FRONT END COVER

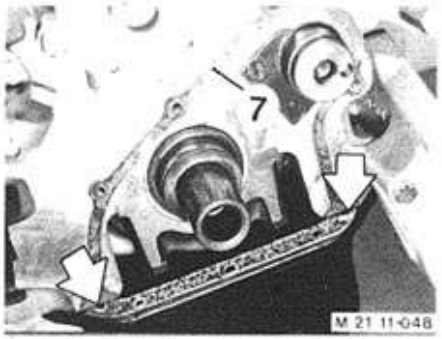
Remove hub for vibration damper – see 11 23 031.
Remove the drive belt, see 11 31 110.
Hold the intermediate shaft sprocket with Special Tool 11 2 040.
Unscrew the bolt.
Take off the washer and sprocket.
Installation:
Guide the centering pin into the bore.



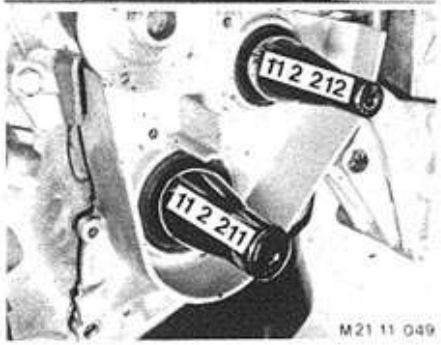
Screw in bolt (1).
Pull the sprocket off of the crankshaft with Special Tools 00 7 501 and 11 2 131.
Important!
Woodruff key.
Installation:
Mount the sprocket that the stepped side faces forward.



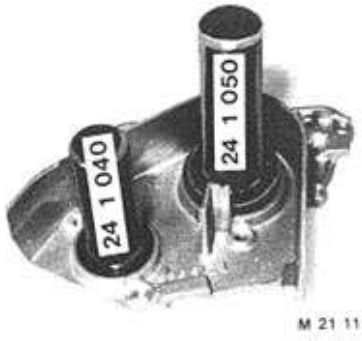
Unscrew bolts (4 ... 6).
Only loosen the other oil pan bolts.
Loosen the oil pan gasket on the end cover carefully with a knife.
Remove the cover.



Installation:
If the oil pan gasket was damaged, remove the oil pan and replace the gasket 11 13 000.
Coat the bores of the oil pan gasket with a brush-on universal sealing compound / Three Bond Silicone 1207**.
Replace gasket (7).



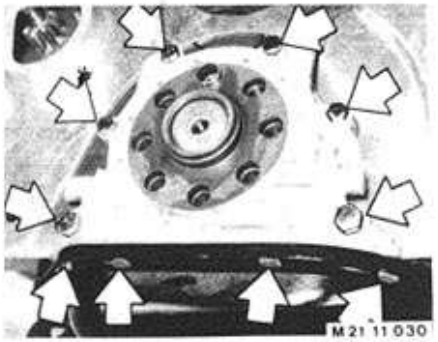
Check the radial oil seals, replacing if necessary.
Install the end cover with Special Tools 11 2 211 (crankshaft) and 11 2 212 (intermediate shaft).



11 14 180 REPLACING RADIAL OIL SEAL IN END COVER

Remove the end cover, see 11 14 175.
Press radial oil seals out of the cover.
Press in the radial oil seals with Special Tools 24 1 050 / 24 1 040.
Press in the new radial oil seals 1 to 2 mm (0.039 to 0.079") deep, in contradiction to the standard seals which had been installed flush.
Lubricate the sealing lips with oil.

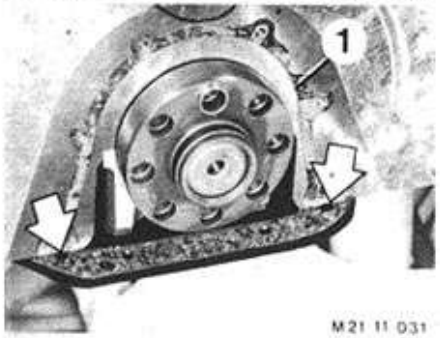
** Source: HWB



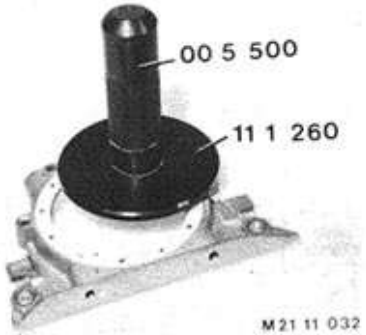
11 14 605 REPLACING RADIAL OIL SEAL IN CLUTCH END COVER

– Transmission Removed –

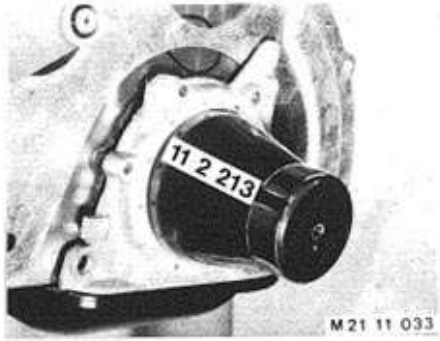
Remove the flywheel, see 11 22 000.
Unscrew the oil pan/end cover bolts.
Only loosen the other oil pan bolts.
Loosen the oil pan gasket on the end cover carefully with a knife.
If the oil pan gasket is damaged, remove the oil pan and replace the gasket, see 11 13 000.
Remove the end cover.



Installation:
Replace gasket (1).
Coat the bores of the oil pan gasket with a brush-on universal sealing compound / Three Bond Silicone 1207**.

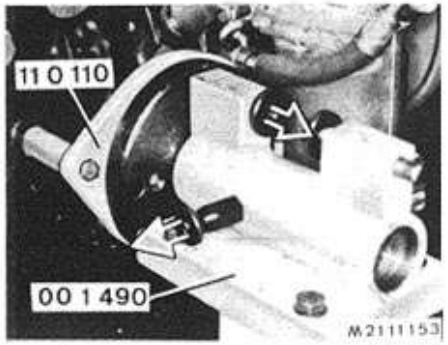


Press in the radial oil seal with Special Tools 11 1 260 and 00 5 500.
Press in the new radial oil seal 1 to 2 mm (0.039 to 0.079") deep, in contradiction to the standard seal which had been pressed in flush.
Lubricate the sealing lip with oil.



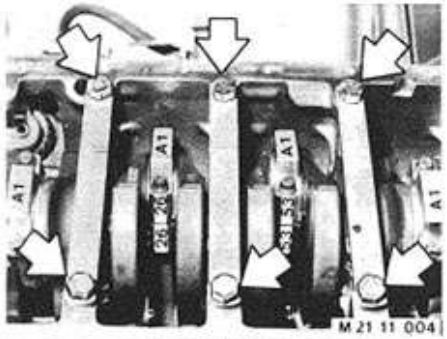
Installation:
Install the end cover with Special Tool 11 2 213.

** Source: HWB

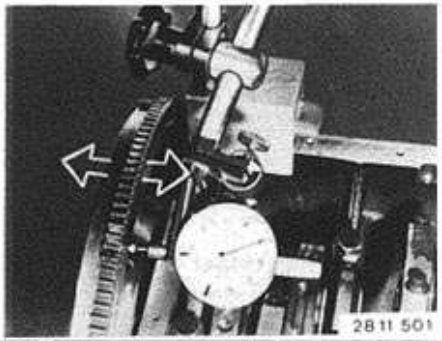


11 21 000 REMOVING AND INSTALLING CRANKSHAFT

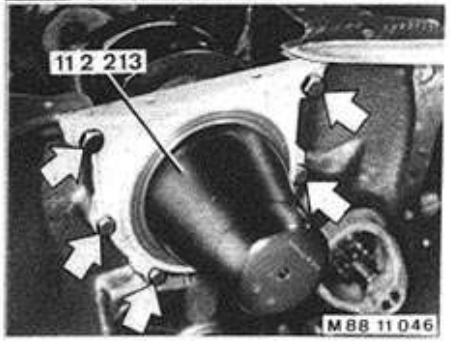
Remove the engine, see 11 00 050.
Mount the engine block on Special Tool 11 0 110 in Special Tool 00 1 490.



Remove the clutch, see 21 21 000.
Remove the cylinder head, see 11 12 100.
Remove the front end cover, see 11 14 175.
Remove the oil pump, see 11 41 000.
Unscrew the struts.

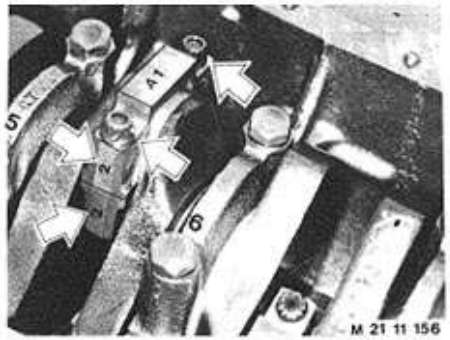


Measure the axial play* before removing the crankshaft.
Check / replace the thrust bearing, if the maximum permissible play is exceeded.

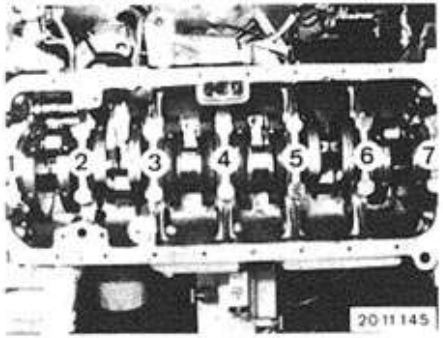


Remove the flywheel, see 11 22 000.
Remove the end cover.
Installation:
Replace the gasket.
Use Special Tool 11 2 213 to avoid damage on the radial oil seal.
Cut off the gasket on the oil pan sealing surface.

* See Specifications



Unscrew the connecting rod bearing caps.
Installation:
Replace the conrod bearing shells and measure the conrod bearing play, see 11 24 571.
The pairing code (0 to 99) must be the same on the connecting rods and bearing caps.



Remove the crankshaft bearing caps and lift out the crankshaft.
Installation:
Do not mix up the bearing caps.
Bearing cap no. 1 is on the drive belt end.
Bearing no. 6 is the thrust bearing.
Install the bearing shells and check the bearing play, see 11 21 531.

Installation:
Measure the axial play with the crankshaft installed – loosen thrust bearing 6.
Center the thrust bearing by applying knocks from a plastic hammer on the front and rear ends of the crankshaft.
Tighten the thrust bearing to specifications.
Measure the axial play*.

Clean the oil and water bores thoroughly to remove the casting sand, if the crankcase is replaced.

* See Specifications

28 11 301

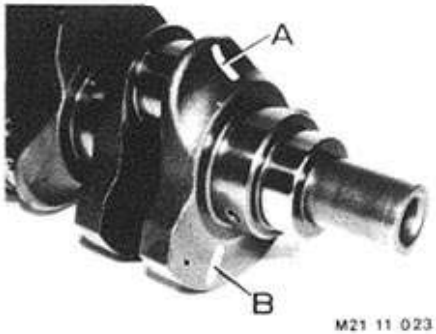
11 21 501 REPLACING CRANKSHAFT
– Crankshaft Removed –

Crankshaft Identification:

Engine	Stroke	Code
M 21 D	81 mm (3.189")	C

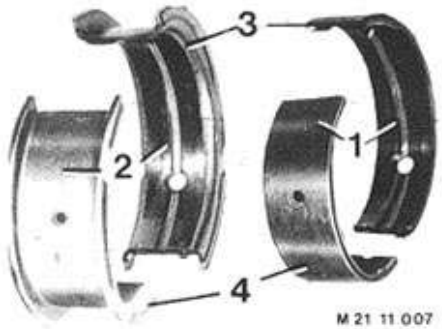
28 11 308

Reground crankshafts are marked with stripes of paint.
Check the machined sizes!
Conrod Bearing Journal (A)
1 paint stripe = size 1*
2 paint stripes = size 2*
Main Bearing Journal (B)
1 paint stripe = size 1*
2 paint stripes = size 2*
Important!
Crankshafts are surface treated and may only be reground in the plant.
Crankshafts are supplied with the corresponding bearing shells.
Install bearing shells and check the bearing play, see 11 21 531.
Install the pilot bearing for cars with a manual transmission, see 11 21 571.



M21 11 023

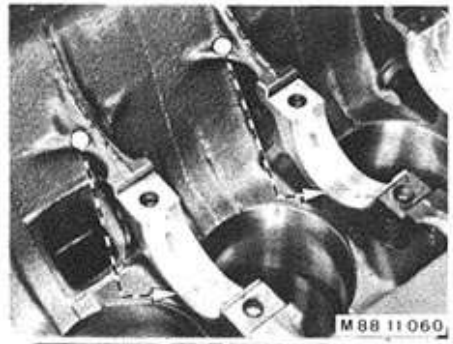
* See Specifications



M 21 11 007

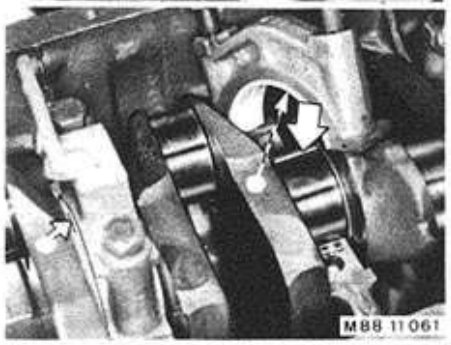
11 21 531 REPLACING CRANKSHAFT MAIN BEARING SHELLS
– Engine Disassembled –

The bearing shells are marked with yellow, green or white paint.
1 = Bearing shell 1 2 3 4 5 7
2 = Bearing shell 6 (thrust bearing)
3 = Bearing shell with lubricating groove installed in crankcase
4 = Bearing shell without lubricating groove installed in bearing cap
Check the machined size (main bearing dia.).



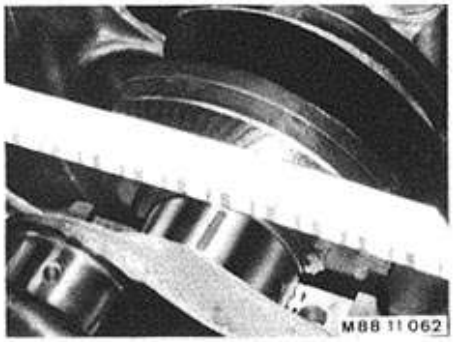
M88 11 060

Install bearing shells in the crankcase according to the color code of the crankcase.
If the mark has been washed off in the crankcase, install both shells to the crankshaft color code.
Install the crankshaft.



M88 11 061

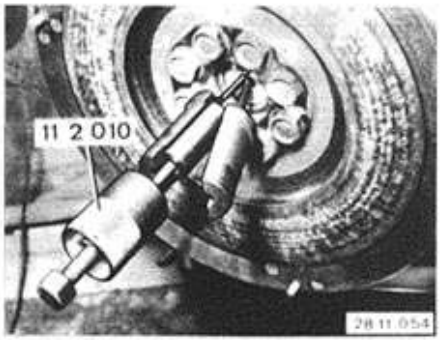
Install bearing shells in the bearing caps to the color codes of the shaft.



M88 11 062

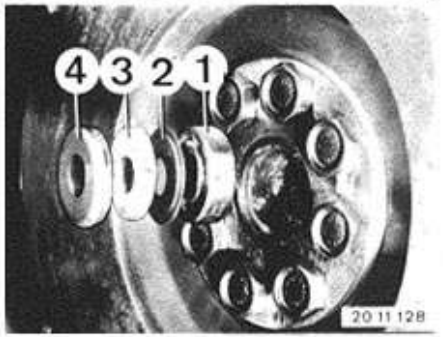
Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten bearing caps to the correct torque*.
Do not turn the crankshaft.
Source for Plastigage:
Cartool
Alfred-Brehm-Str. 5
D-8070 Ingolstadt / West Germany
Remove the bearing caps.
Read the bearing play* from the width of the flattened Plastigage with help of the scale.
Correct the bearing play by installing new bearing shells, bearing shells with different machined size or different color code.

* See Specifications

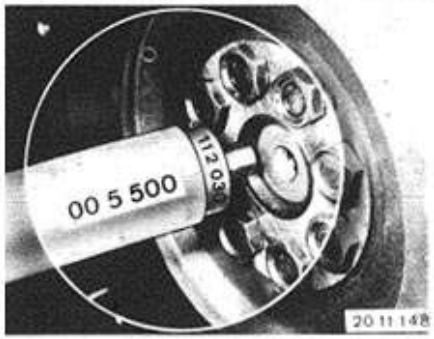


11 21 571 REPLACING PILOT BEARING IN CRANKSHAFT

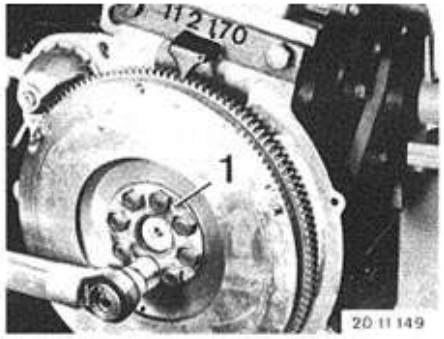
Remove the clutch, see 21 21 000.
Pull out the ball bearing with Special Tool 11 2 010.



Installed Order:
Ball bearing (1), cover (2), felt ring (3) and capsule (4).
Install the cover (2) with the embossment facing out.

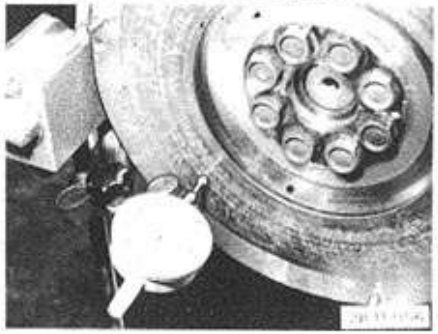


Pack bore in the crankshaft with approx. 1 gr. of lubricating grease.
Drive in the pilot bearing with Special Tools 11 2 030 and 00 5 500.

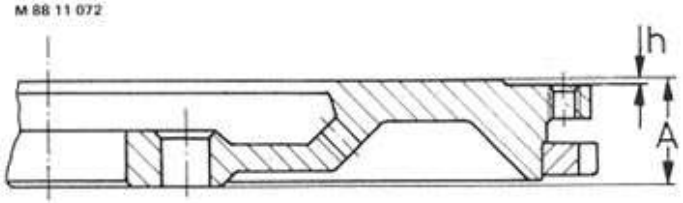


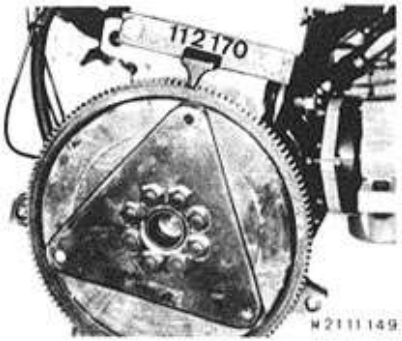
11 22 000 REMOVING AND INSTALLING FLYWHEEL

Remove the clutch, see 21 21 000.
Hold the flywheel with Special Tool 11 2 170.
Unscrew the bolt and take off the flywheel.
Installation:
Clean the tapped bores.
Insert ring (1).
Replace and install the new expansion bolts with a bolt cement**.
Tightening torque*.



Check the axial runout* of the flywheel.
The friction surface may be machined to minimum thickness A*.
If machining the friction surface reduces distance "h" to zero, the flange surface (distance "h") has to be machined.

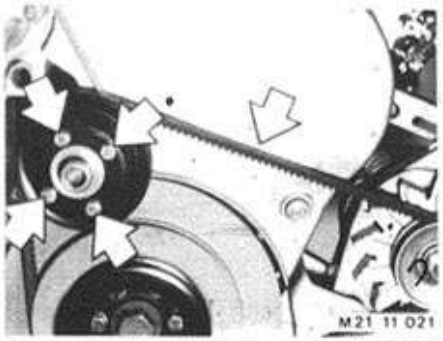


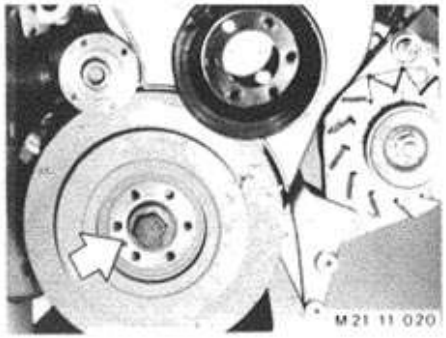


11 22 051 REPLACING DRIVE PLATE FOR TORQUE CONVERTER

Remove the transmission, see Group 24.
Hold the flywheel with Special Tool 11 2 170.
Unscrew the bolts and remove the flywheel.
Installation:
Clean the tapped bores.
Replace and install the new expansion bolts with a bolt cement**.
Tightening torque*.

* See Specifications
** Source: HWB

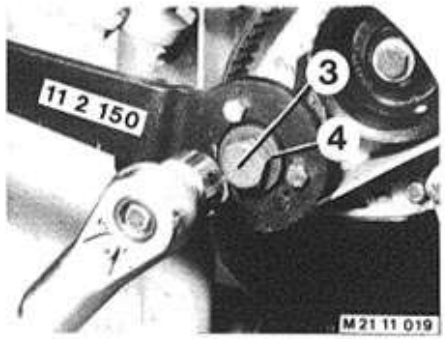


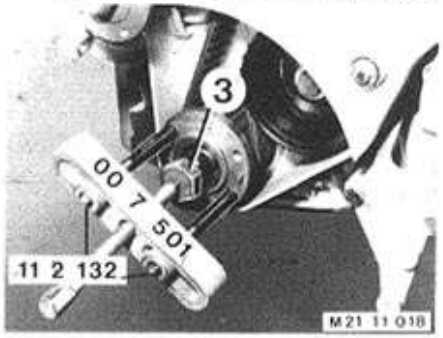


11 23 010 REPLACING VIBRATION DAMPER

Remove the fan, see 11 52 000.
Take the drive belt off of the alternator, power steering pump and, if applicable, air conditioner compressor.
Unscrew the pulley.
Installation:
Tighten the drive belt and check tightness with Special Tool 11 5 020.

Take pulley and vibration damper off of the hub.
Installation:
The centering pin must fit in the bore of the vibration damper.



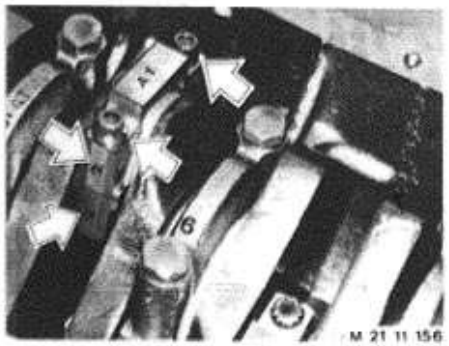


11 23 031 REPLACING HUB FOR VIBRATION DAMPER

Remove the radiator, see 17 11 000.
Remove the vibration damper, see 11 23 010.
Hold the hub with Special Tool 11 2 150.
Unscrew bolt (3).
Take off the collar washer (4).
Installation:
Tightening torque*.

Screw in bolt (3) about three turns.
Pull the hub off of the crankshaft with Special Tools 00 7 501 and 11 2 132.
Remove bolt (3).

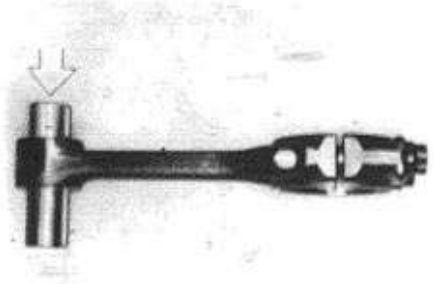
* See Specifications

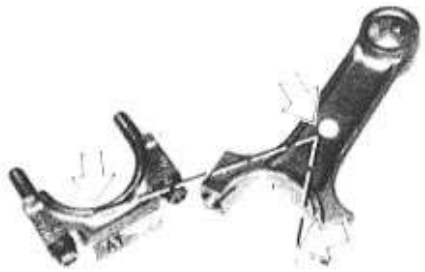


11 24 521 REPLACING CONNECTING RODS
– Pistons Removed –

Important!
Only install connecting rods of same weight class in one engine.
Weight class is stamped in machined conrod cap surface.
Connecting rods may not be machined.

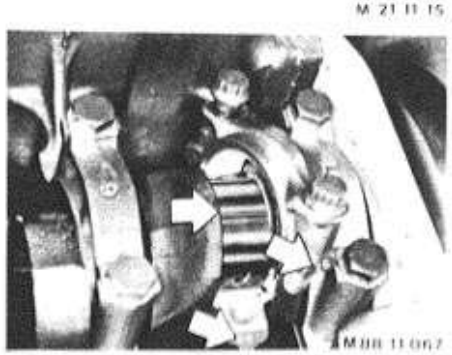
Piston pin must slide through conrod bush under light pressure.



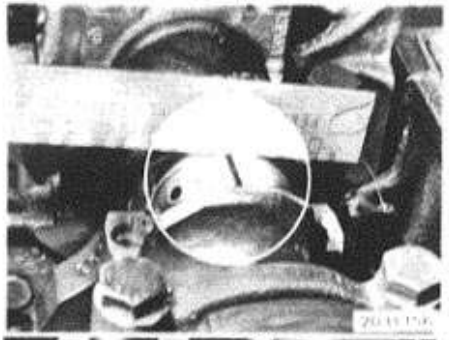


11 24 571 REPLACING CONROD BEARING SHELLS
– Engine Disassembled –

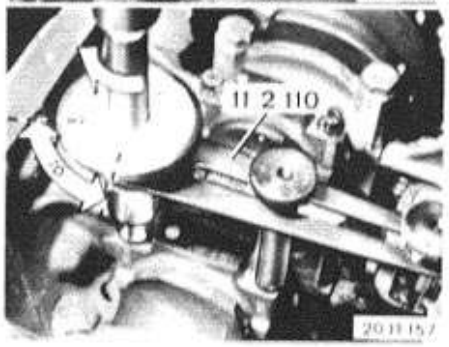
Install red or blue conrod bearing shells according to color code on connecting rod.
Important!
Check machined size (conrod bearing dia.).



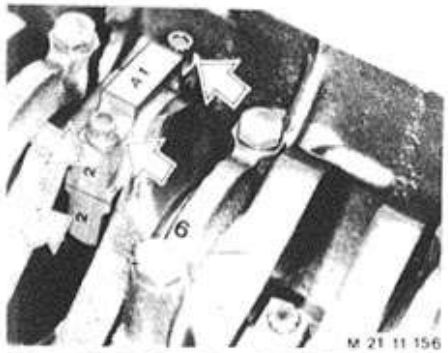
In BDC position place Plastigage Type PG 1 on crankshaft wiped clean of oil and install conrod bearing caps that grooves are on one side.
Pairing code (0 ... 99) must be the same on cap and connecting rod.
Source for Plastigage:
Cartool
Alfred-Brehm-Str. 5
D-8070 Ingolstadt



Tighten bolts in two steps (using old conrod bolts):
Step 1 - 20 Nm (14. ft. lbs.)
Step 2 - 70° torque angle
Important!
Do not turn the connecting rod or crankshaft.
Remove bearing caps.
Read bearing play* from width of flattened Plastigage with help of supplied scale.
Correct bearing play by installing new bearing shells, bearing shells with different machined size or different color code.
For final installation, use new conrod bolts and tighten conrod cap bolts in two steps (see above).



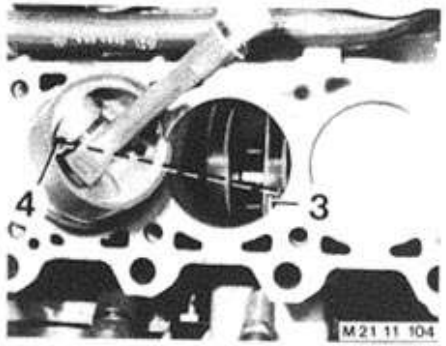
* See Specifications



M 21 11 156

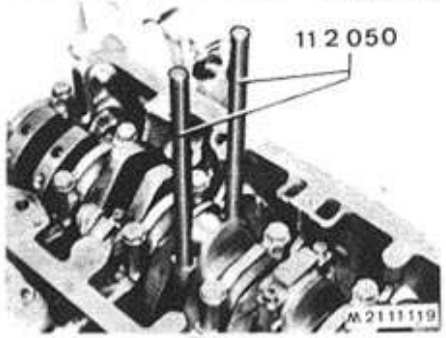
11 25 000 REMOVING AND INSTALLING PISTON

Remove the engine
Take off the cylinder head, oil pan and oil pump.
Remove the conrod bearing cap.
Important!
Mark the installed position of the connecting rod to the crankshaft, if the conrod bearing shells do not have to be replaced.



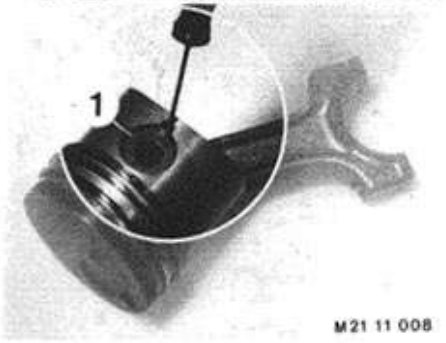
M21 11 104

Important!
Engine oil is injected through the oil spray jet (3) into the annular port (4) to cool the pistons.
Even slight damage on the oil spray jet (3) could mean that the oil stream would not align with bore (4) for the annular port, which would result in an immediate engine defect.



M 21 11 119

To avoid damage on the oil spray jet (3), bolt Special Tool 11 2 050 on the connecting rod.
Press out the piston upwards.



M21 11 008

Lift out circlip (1).
Press out the piston pin.
Installation:
The piston pin is matched with the piston and must not be mixed up.

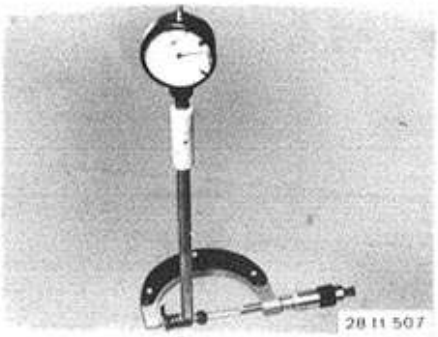

M21 11 009

Only install a piston of the same make and same weight group.
The weight group is stamped in the piston crown with a "+" or "–" sign.
Important!
Check the machined size* (piston diameter).

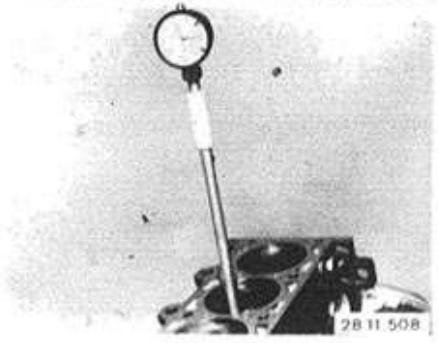
28 11 064

Check the piston installed clearance*.

Engine	Make	Checkpoint A
M 21 D	Alcan	15.00 mm (0.591")
	KS	18.00 mm (0.709")
	Mahle/ König	12.00 mm (0.472")


28 11 507

Set the internal calipers on the micrometer to zero with the measured piston diameter.

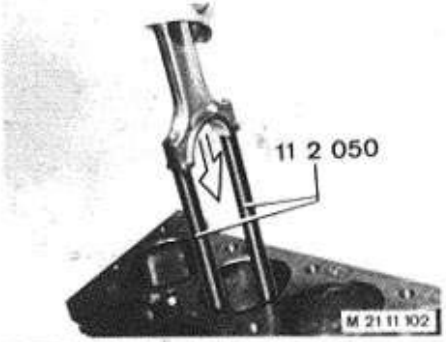

28 11 508

Measure the cylinder bore at the bottom, middle and top with the internal calipers in forward and rotating directions.
Measure the piston installed clearance*.

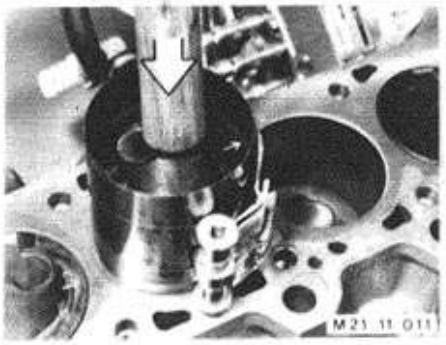
* See Specifications

M 21 11 010

Lubricate piston and piston rings with oil. Offset piston ring end gaps by 120°. Compress piston rings with Special Tool 11 2 260.



Screw Special Tool 11 2 050 on connecting rod to avoid damaging oil spray jet (3).

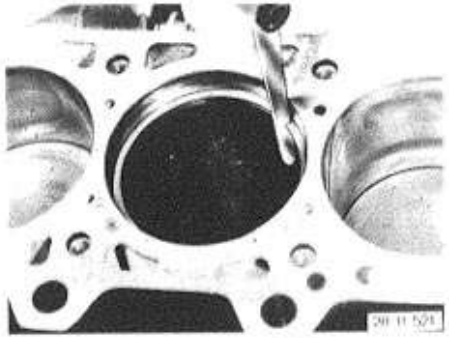


Install piston that arrow faces toothed belt. Install connecting rod, see 11 24 521.

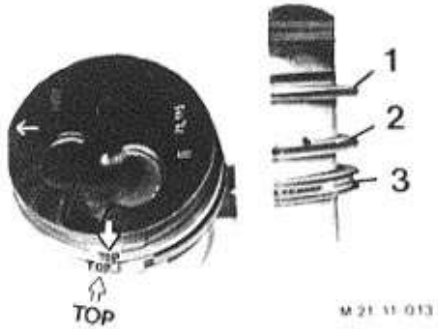
M 21 11 012

11 25 651 REPLACING PISTON RINGS OF ONE PISTON
– Piston Removed –

Check side clearance* of piston rings (only possible on rings 2/3).



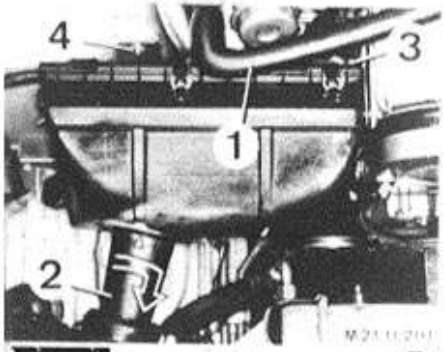
Remove piston rings and check end clearance*.



M 21 11 013

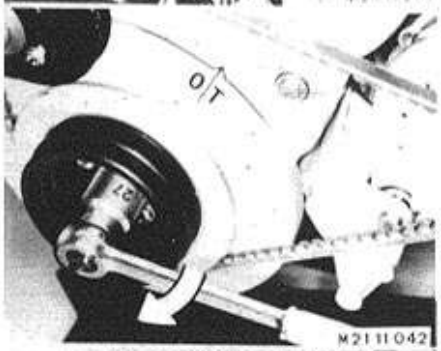
Installation:
Install piston rings that word "TOP" faces piston crown.
1 Keystone ring
2 Taper face ring
3 Bevelled ring with rubber lined spring

* See Specifications

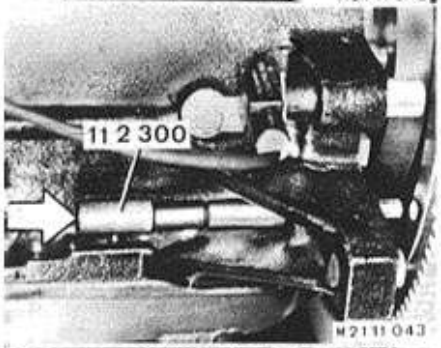


11 31 000 REMOVING AND INSTALLING CAMSHAFT

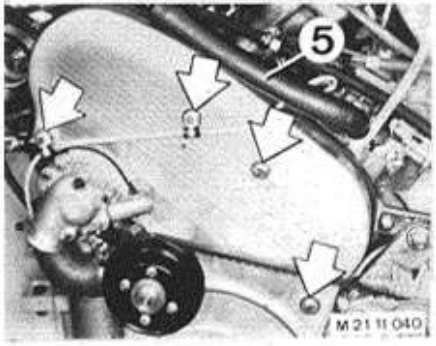
Detach hose (1).
Unscrew hose (2).
Loosen clamp (3).
Unscrew nut (4) and remove air cleaner.
Remove fan 11 52 000.
Remove vacuum pump 11 66 000.
Installation:
Turn arrow up.



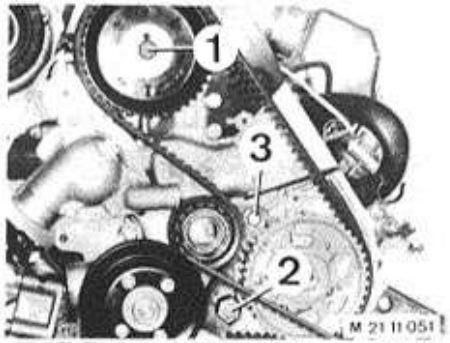
Remove rocker arm of cylinder no. 2/exhaust and rocker arm of cylinder no. 3/intake, see 11 33 031, to remove tension on camshaft.
Turn cylinder no. 1 to TDC – cylinder no. 6 overlaps.



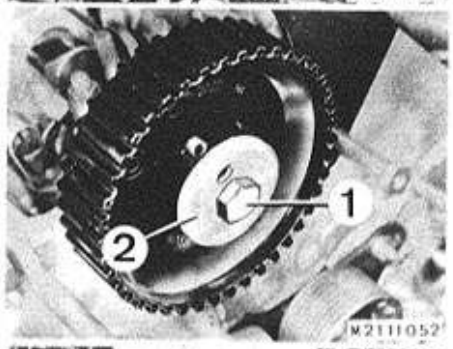
Hold crankshaft with Special Tool 11 2 300.



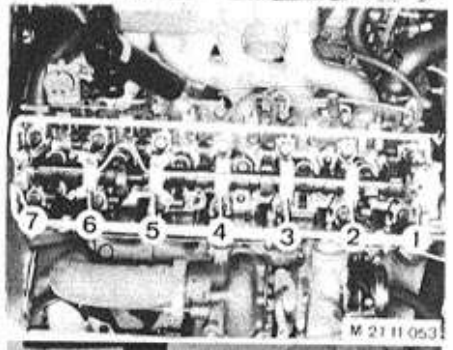
Detach hose (5) and unscrew protective cover.



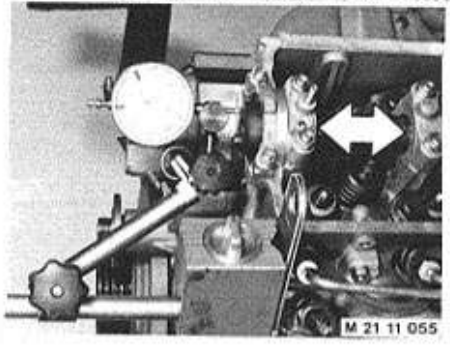
Loosen bolts (1 and 2) and nut (3).
Loosen toothed belt and take off of camshaft sprocket.
Unscrew bolt (1) and take off camshaft sprocket.
Installation:
Tightening torque*.



Installation:
Slide slot of sprocket and bore of washer (2) over pin in camshaft.

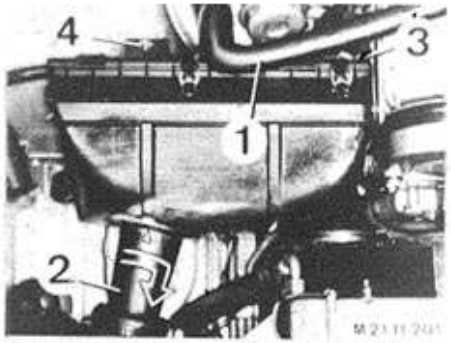


Unscrew camshaft.
Installation:
Replace rocker arms, if replacing camshaft because of worn cams!
Slide steel ring on to cam for vacuum pump.
Bearings are marked.
Bearing no. 1 is at front end.
Install radial oil seal together with bearing no. 1, see 11 12 240.
Mount oil line.



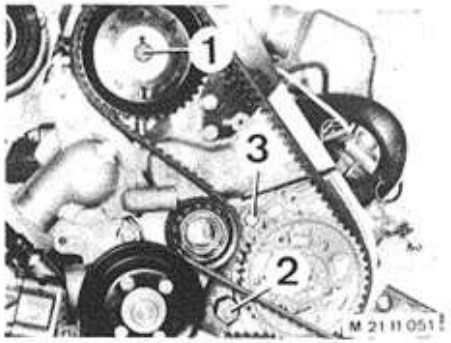
Installation:
Check camshaft axial play*.
Install and tighten toothed belt, see 11 31 110.

* See Specifications

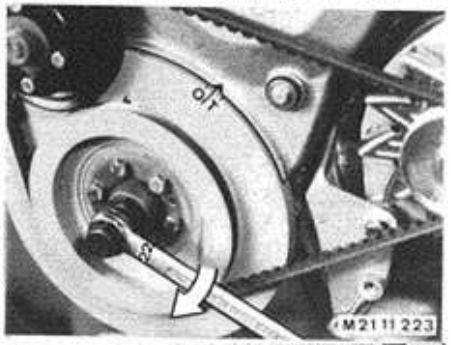


11 31 100 TIGHTENING DRIVE BELT

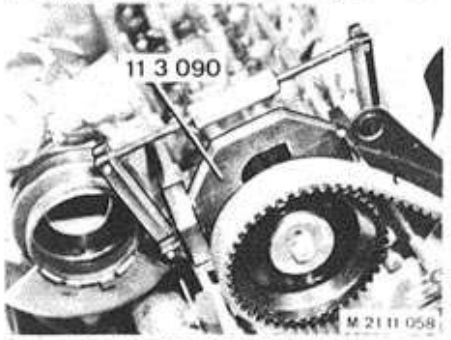
Disconnect hose (1).
Turn out hose (2).
Loosen clamp (3).
Unscrew nut (4) and remove the air cleaner.
Remove the fan, see 11 52 000.
Installation:
Turn the arrow to face up.



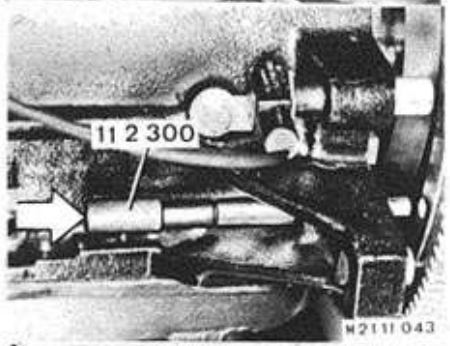
Loosen bolts (1 and 2) and nut (3).



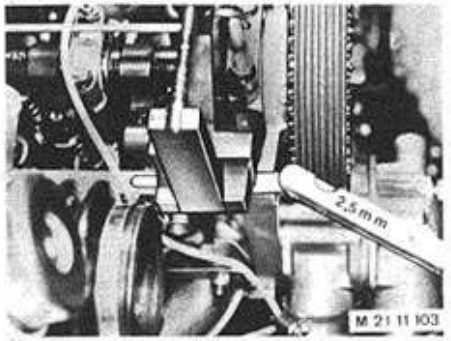
Turn crankshaft to have TDC in cylinder no. 1 and overlapping in cylinder no. 6.



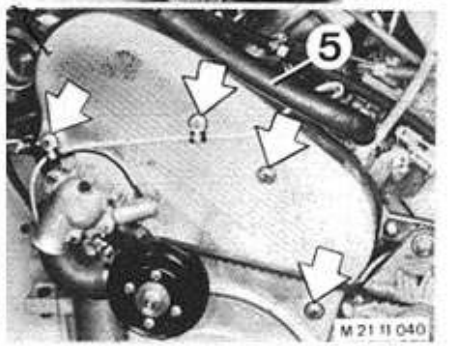
Hold the camshaft with Special Tool 11 3 090.
Turn the crankshaft to have TDC in cylinder no. 1 and overlapping in cylinder no. 6.



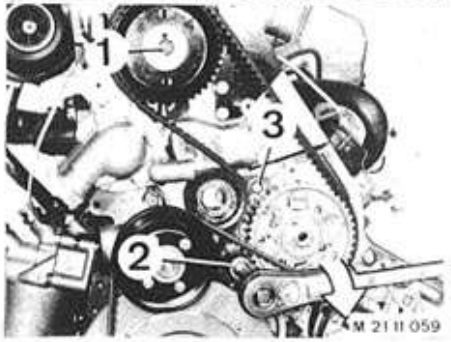
Hold the crankshaft with Special Tool 11 2 300.



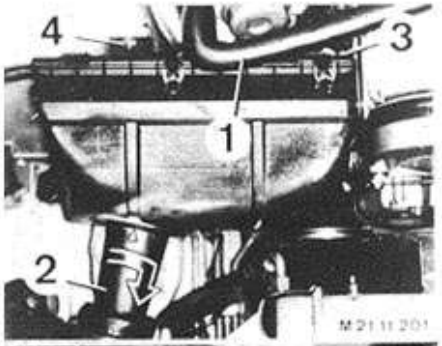
Important!
Tighten the drive belt at a coolant temperature of 15 to 35° C (60 to 95° F).
Place a 2.5 mm thick feeler gage blade on the exhaust end for new drive belts or drive belts used less than 15,000 km (10,000 miles).



Remove hose (5) and protective cover.
Remove the cylinder head cover, see 11 12 000.

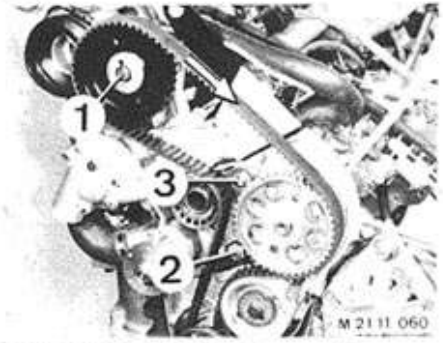


Press tensioning roller toward outside with a torque wrench (analog display).
Tightening torque for toothed belts
up to 15,000 km (10.000 miles)
42 + 3 Nm (30.5 + 2 ft. lbs.)
from 15,000 km (10,000 miles) on
30 to 35 Nm (22 to 25 ft. lbs.).
Tighten nut (3).
Tighten bolts (1 and 2).
Check tightening torque of bolt (1).
Crank engine once in turning direction and recheck timing.
Adjust injection pump statically – see 13 51 005.

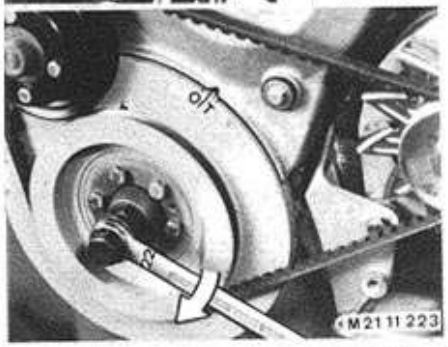


11 31 110 REMOVING AND INSTALLING DRIVE BELT

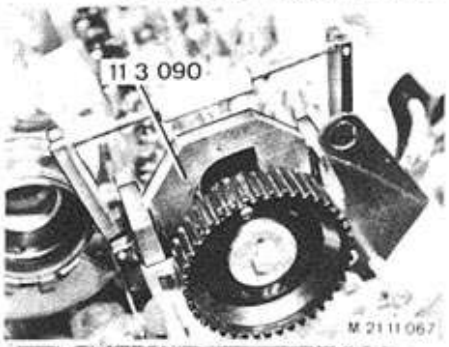
Disconnect hose (1).
Turn out hose (2).
Loosen clamp (3).
Unscrew nut (4) and remove air cleaner.
Remove fan 11 52 000.
Installation:
Turn the arrow to face up.



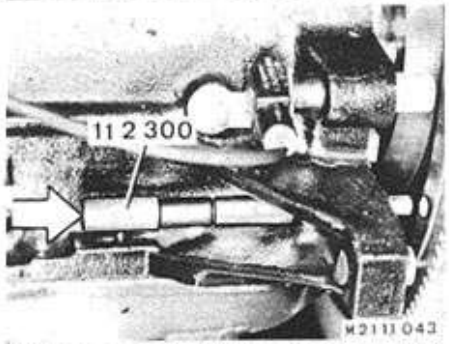
Loosen bolts (1 and 2) and nut (3).
Mark the running direction of the drive belt and take off the belt.



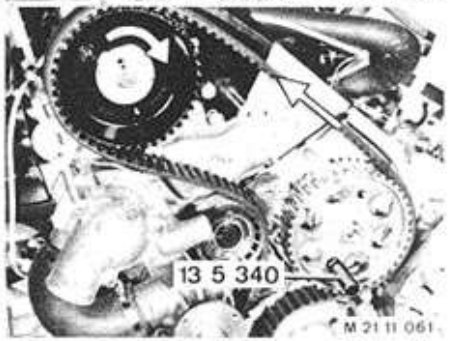
Cylinder no. 1 at TDC – cylinder no. 6 overlapping.



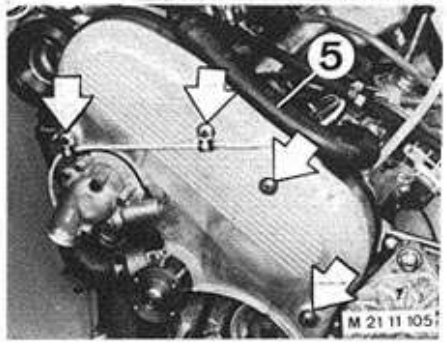
Installation:
Hold the camshaft with Special Tool 11 3 090.
Cyl. 1 at TDC – cyl. 6 overlapping.



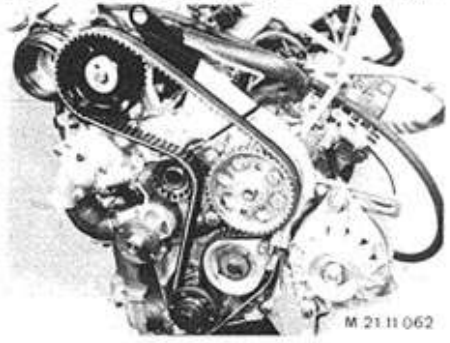
Hold the crankshaft with Special Tool 11 2 300.



Hold the injection pump gear with Special Tool 13 5 340 for a rough adjustment of the injection pump.
Install drive belt in opposite direction of the engine's running direction – turning the loose camshaft sprocket against the drive belt.
Remove Special Tool 13 5 340.
Tighten the drive belt, see 11 31 100.

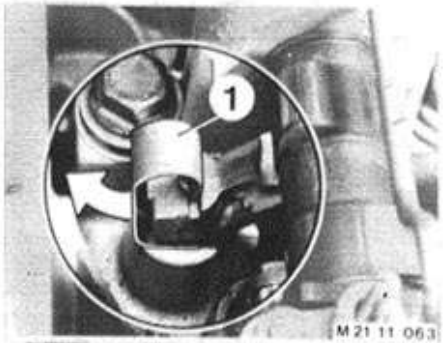


Remove hose (5) and protective cover.
Remove vibration damper, see 11 23 010.
Remove cylinder head cover, see 11 12 000.



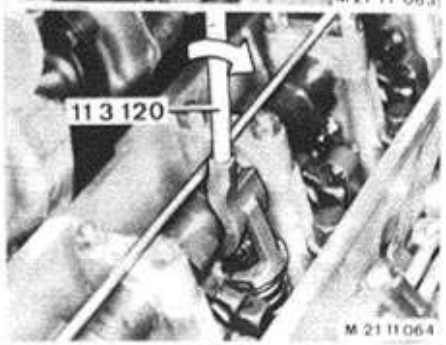
Drive Belt Layout

Adjust injection pump statically – see 13 51 005.

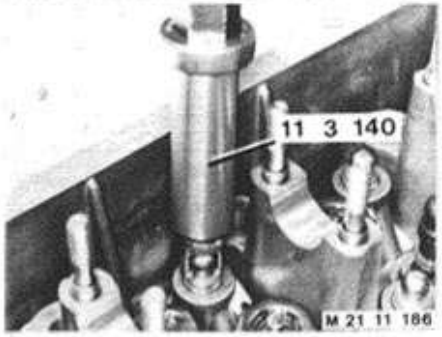


11 33 050 REPLACING ROCKER ARM

Remove vacuum pump 11 66 000.
Pull off spring clip (1).
Pertinent cams of camshaft must be turned up for removal of rocker arms.



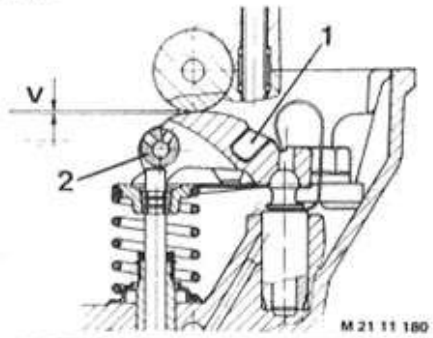
Press down valve springs with Special Tool 11 3 120 and remove rocker arm – watching out for valve collets.
Important!
Install rocker arm with same ball-headed bolt.
When replacing rocker arms, it is always necessary to also replace the ball-headed bolts.



Pull out ball-headed bolt with Special Tool 11 3 140.
Installation:
Install ball-headed bolt with a bolt cement** and press in against stop.

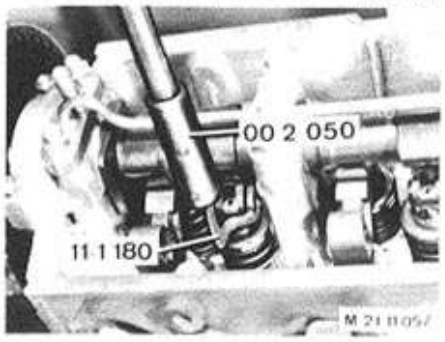
Installation:
Press spring clip into groove of ball-headed bolt.
Adjust valve clearance 11 34 004.

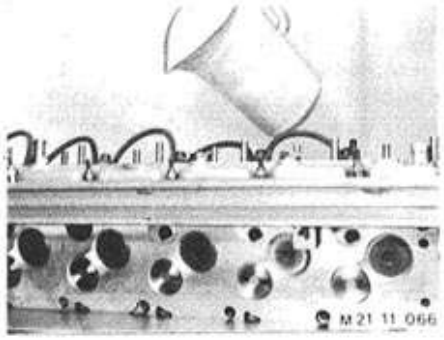
** Source: HWB



11 34 004 ADJUSTING VALVE CLEARANCE

Remove cylinder head cover 11 12 000.
Turn engine to TDC with a wrench socket used on crankshaft (vibration damper).
Apply a 12 mm open-end wrench on nut (1) for counterholding and unscrew nut on adjusting eccentric (2).
Adjust valve clearance "V" – eccentric always turned toward outside.
Make adjustments in firing order (1-5-3-6-2-4) and in compression TDC.
Tighten nut with Special Tools 11 1 180 and 00 2 050.
Tightening torque*.

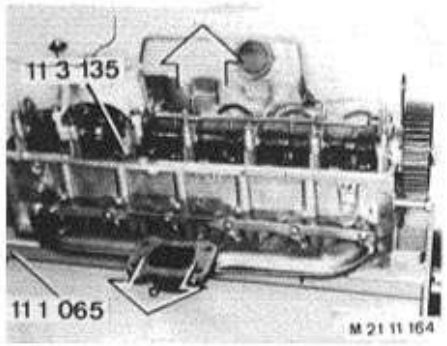




11 34 509 CHECKING VALVES FOR LEAKS – Camshaft Removed –

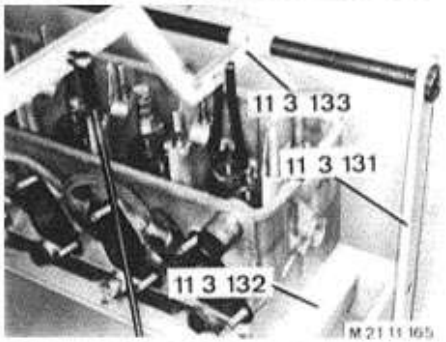
Fill intake and exhaust ports with gasoline outdoors or indoors with strict conformance of fire prevention regulations.
Valves and valve seats must be inspected if the gasoline runs past the valve heads.
Remove and install valves 11 34 550.
Machine valve seats 11 12 607.

* See Specifications

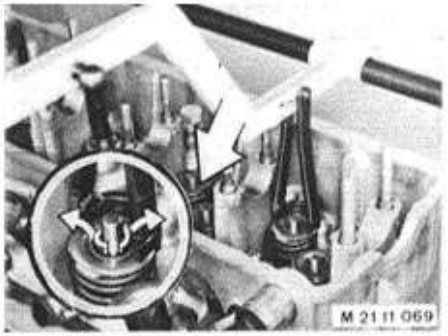


11 34 550 REMOVING AND INSTALLING VALVES

Remove cylinder head, see 11 12 000.
Unscrew the thermostat housing and mount the cylinder head on Special Tool 11 1 065 with Special Tool 11 3 135.
Unscrew the intake manifold and exhaust manifold.
Installation:
Replace the gaskets.



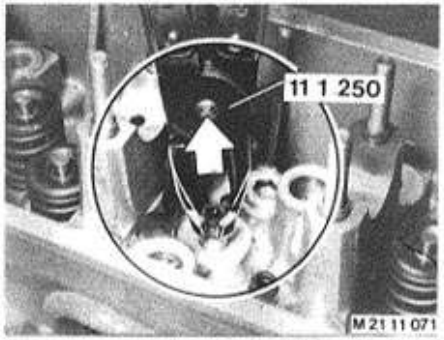
Remove the camshaft, see 11 31 000.
Install Special Tool 11 3 131 / 133 and place tray 11 3 132 in the assembly stand.
Remove the drag lever.



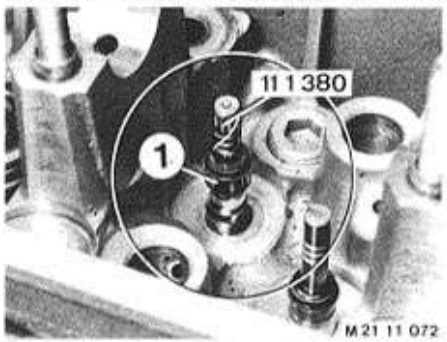
Press down valve springs and remove the valve keepers.

Take off the upper spring retainer, valve springs and lower spring retainer.
Take tray out of the assembly stand and pull out the valve.
Installation:
Only install valve springs with same color code, wire gage size and length.
Lubricate the valve guide and valve stem with oil.
Measure the valve retrusion R*, see 11 12 607.

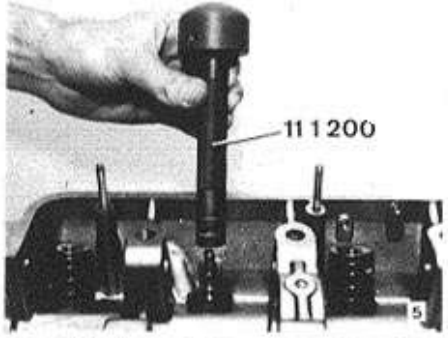
* See Specifications



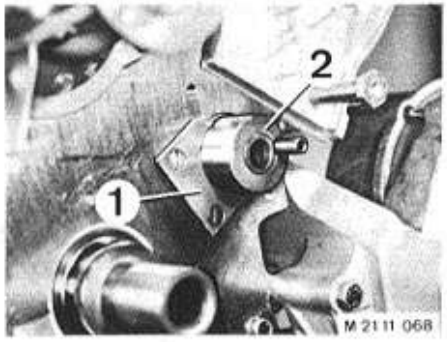
Pull off the valve stem seal with Special Tool 11 1 250.



Install the valve.
Use assembly sleeves to avoid damage on the valve stem seal.
Lubricate the valve stem seal with oil and install seal (1).
Source for Assembly Sleeves:
Cartool
Alfred-Brehm-Str. 5
D--8070 Ingolstadt / West Germany

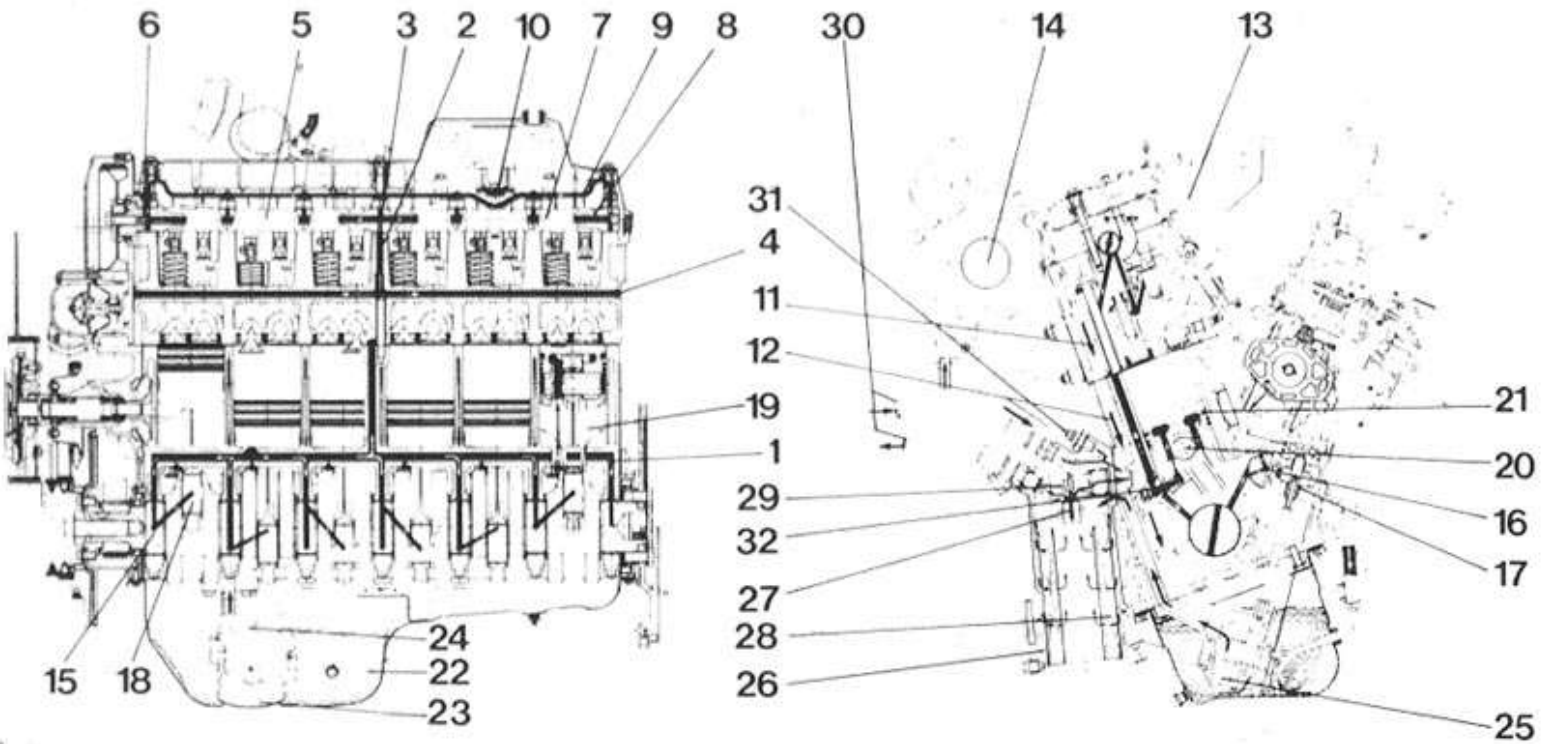


Press on the valve stem seal against the stop with Special Tool 11 1 170.
The new, improved valve stem seal (internal grooving) is pressed on by hand with Special Tool 11 1 200.
Special Tool 11 1 200 has two diameters – for 7/8 mm (0.276/0.315") valve stem seals.

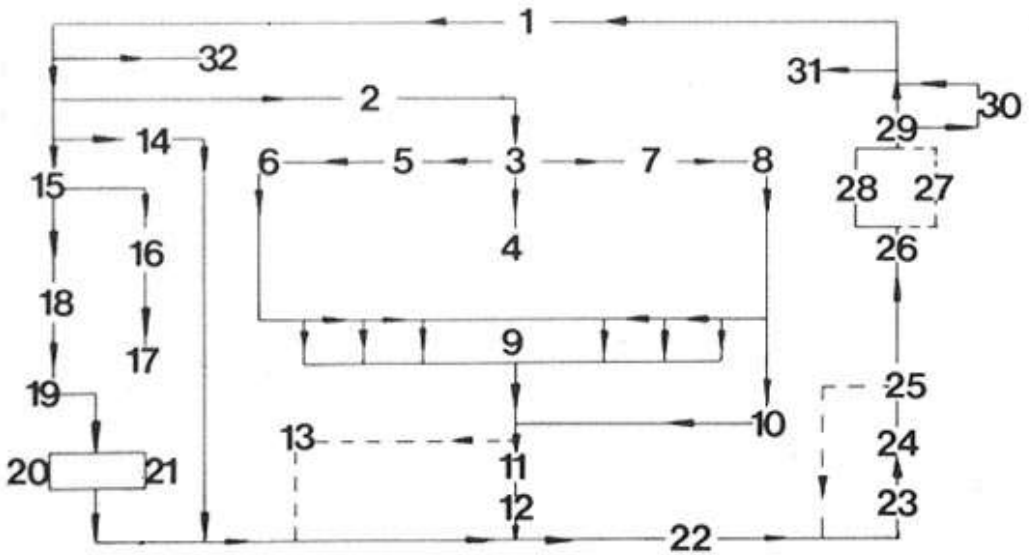


11 35 020 REMOVING AND INSTALLING INTERMEDIATE SHAFT

Remove the front end cover, see 11 14 175.
Unscrew guide plate (1).
Pull out intermediate shaft (2) and, if necessary, turn the crankshaft.
Installation:
Check the gear, replacing the intermediate shaft if necessary.
Bearings in the crankcase cannot be replaced.



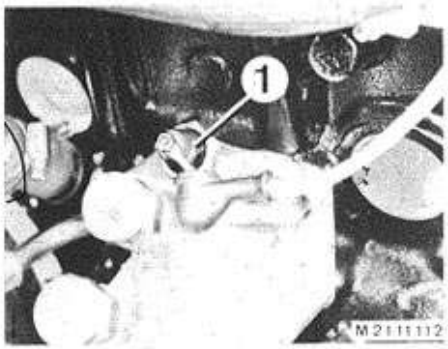
M21 11 086



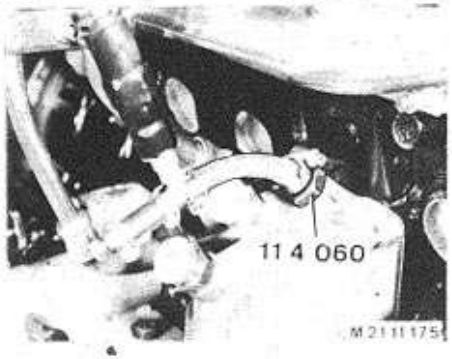
ENGINE OIL CIRCUIT

1 Main distribution bore in crankcase
2 Oil riser bore in cylinder head
3 Camshaft bearing, center
4 Distributor bore in cylinder head
5 Hollow camshaft
6 Camshaft bearing, front
7 Hollow camshaft
8 Camshaft bearing, rear
9 Oil line with open jets for supply to cams from outside, valve guide and ball pin for drag lever
10 Eccentric for vacuum pump
11 Overflow from cylinder head
12 Drain into oil pan
13 Oil trap (crankcase vent)
14 Turbocharger
15 Crankshaft bearing
16 Bearing of intermediate shaft and guide plate
17 Spray oil for gears (oil pump drive)
18 Connecting rod bearing
19 Spray oil
20 Piston pin
21 Cylinder wall
22 Oil pan
23 Intake with filter screen
24 Oil pump
25 Overload valve (oil pump) with cold oil (opens at 5.5 to 6.5 bar pressure)
26 Oil filter, 1.2 ltr. volume
27 Safety valve (opens at 2.5 bar pressure/ oil supply guaranteed when filter is clogged)
28 Filter cartridge
29 Thermostat
30 Oil cooler
31 Conn. for oil pressure transmitter of indicator lamp
32 Oil spray jet (piston cooling) (opens at 1.5 to 2.0 bar pressure)

11 40 000 CHECKING ENGINE OIL PRESSURE

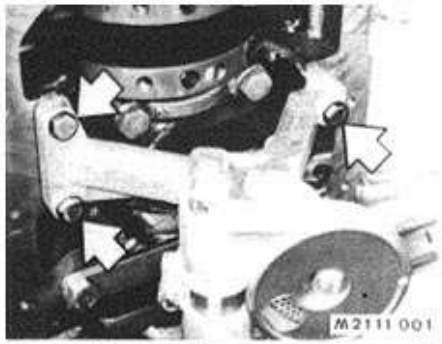


Disconnect wires on oil pressure switch.
Unscrew oil pressure switch (1).
Installation:
Check gasket, replacing if necessary.



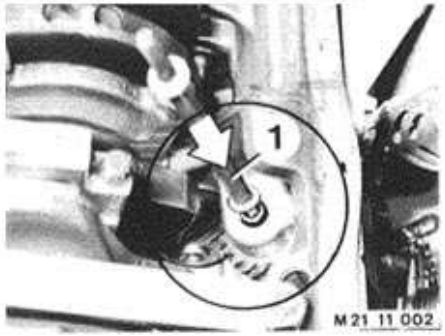
Screw in Special Tool 11 4 060.
Connect 10 bar (142 psi) pressure tester of BMW service test unit.
Check oil pressure*.

* See Specifications

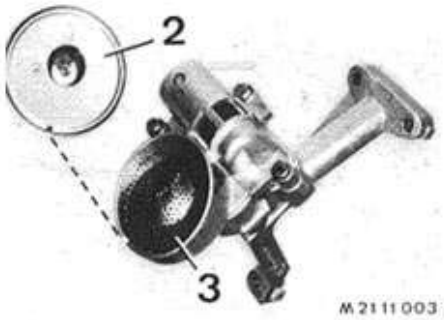


11 41 000 REMOVING AND INSTALLING OIL PUMP

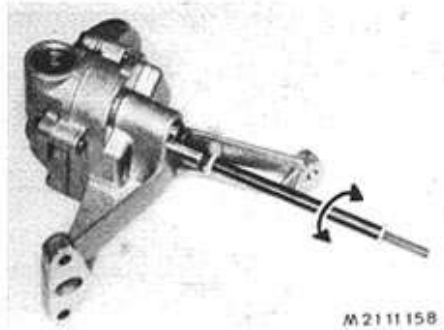
Remove the oil pan, see 11 13 000.
Remove the oil pump.



Installation:
Guide drive shaft (1) into the bearing.
Replace the bearing, see 11 11 160.

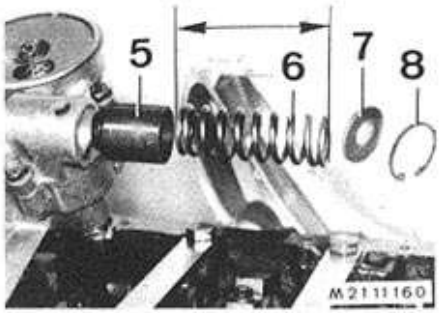


Checking and Servicing:
Unscrew cap (2) and clean oil filter screen (3).

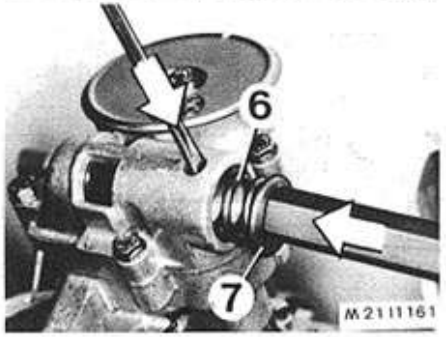


Check whether the gears run easily by turning the drive shaft.

Unscrew the oil pump cover and inspect the oil pump for wear.
– Scoring in body/cover
– Wear of gears

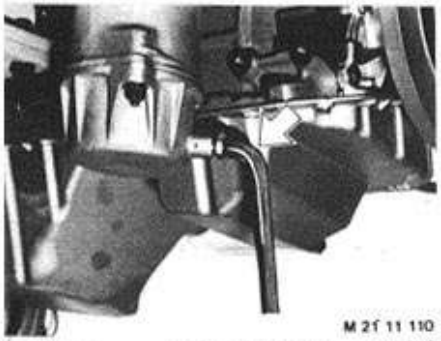


The engine oil control valve regulates the engine oil pressure*.
Check movement of piston (5).
Check length of spring (6) = 71.6 mm (2.819").



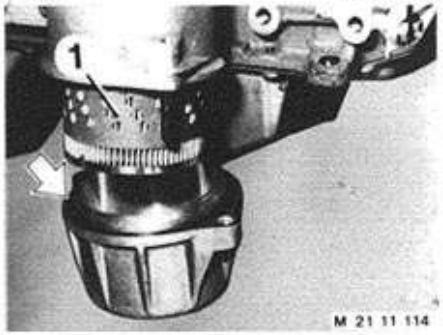
Installation:
Press in and hold spring (6) and washer (7) with a screwdriver.
Install circlip (8).

* See Specifications



11 42 020 REPLACING OIL FILTER

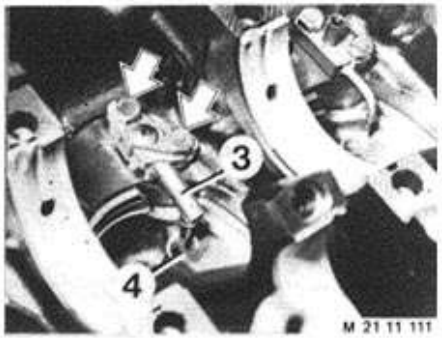
Unscrew oil drain plug in oil filter and drain oil.
Installation:
Tightening torque*.



Unscrew cover and pull out oil filter (1).
Installation:
Check seal, replacing if necessary.
Add oil* and ***.
Tightening torque*.

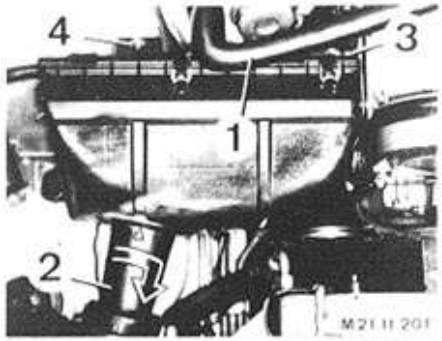
11 42 650 REMOVING AND INSTALLING/ REPLACING OIL SPRAY JET
– Crankshaft Removed –

Engine oil is injected into annular bore (4) of piston via oil spray jet (3) for piston cooling. A guarantee that oil stream meets bore (4) could not be given were oil spray jet (3) even slightly damaged.
Follow-up damage would be immediate engine failure.



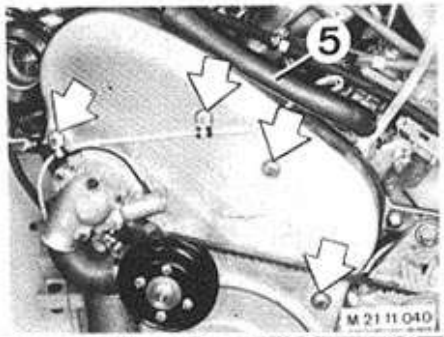
Unscrew screws and take out oil spray jet (3).

* See Specifications
*** See Service Information of Gr. 00

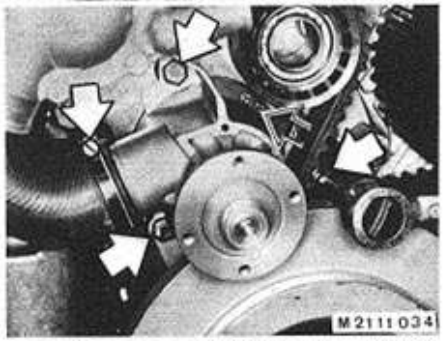


11 51 000 REMOVING AND INSTALLING WATER PUMP

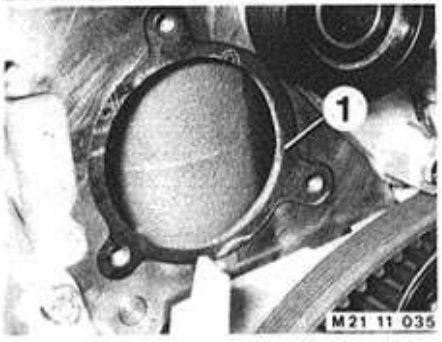
Detach hose (1).
Unscrew hose (2).
Loosen clamp (3).
Unscrew nut (4) and remove air cleaner.
Installation:
Turn arrow up.



Remove fan 11 52 000.
Remove water hose (5).
Take off drive belt and unscrew pulley.
Unscrew screws and remove protective cover.
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.

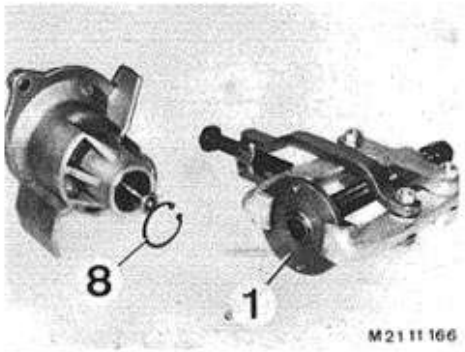


Detach water hose.
Unscrew water pump.
Note:
Only push toothed belt to one side.



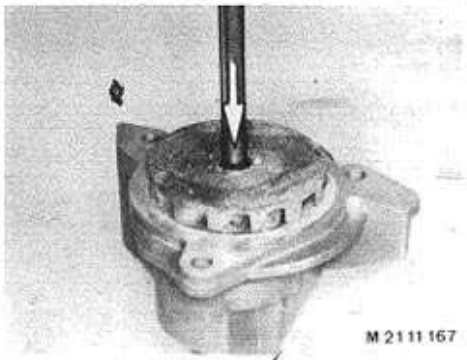
Installation:
Replace gasket (1).

11 51 502 OVERHAULING WATER PUMP
– Water Pump Removed –

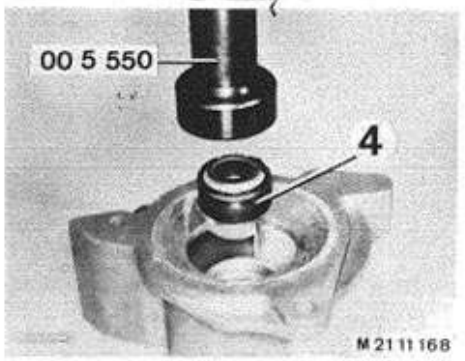


M 21 11 166

Pull off hub (1) with Special Tool 00 8 500.
Lift out circlip (8).

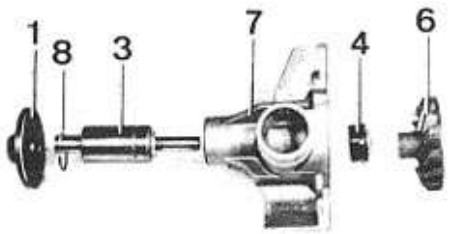

M 21 11 167

Press out water pump bearing.



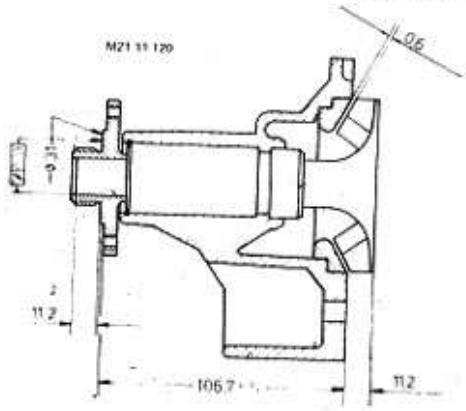
M 21 11 168

Drive out seal (4).
Installation:
Lubricate seal (4) with oil and press in with Special Tool 00 5 550.

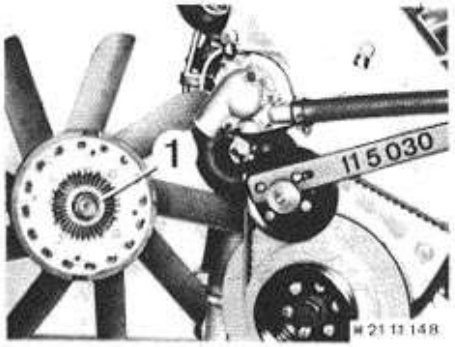


Replace bearing (3) and seal (4).
Check impeller (6), replacing if necessary.
(1) = Hub
(7) = Water pump body
Installation:
Press in bearing (3) against stop.
Press on impeller (6).

M 21 11 169

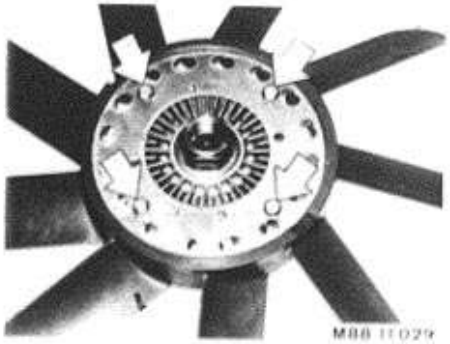


Check assembled distances.



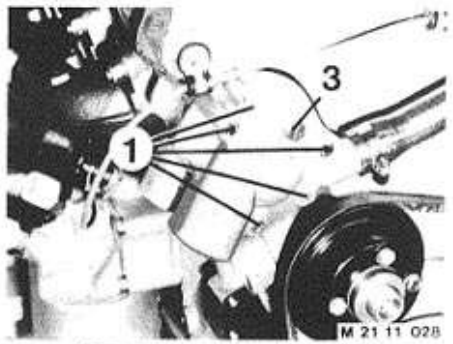
11 52 000 REMOVING AND INSTALLING FAN

Remove fan cowl.
Hold pulley with Special Tool 11 5 030 and unscrew coupling nut (1).
Important!
Left-hand threads – nut turned clockwise to unscrew.
Installation:
Tightening torque*.



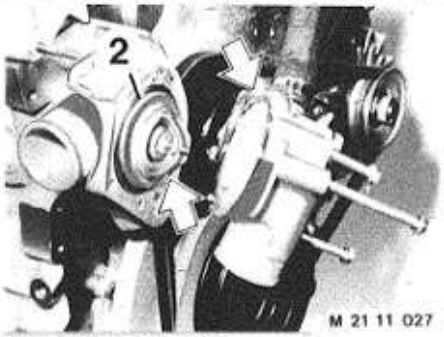
11 52 020 REPLACING FAN CLUTCH

Remove fan 11 52 000.
Replace fan clutch, if
a) hub has seized – fan of stopped engine cannot be turned or is hard to turn,
b) fan clutch has axial/radial play or is losing oil.
Check the switching points* with a Vibrocard ***
Unscrew fan mounting bolts and take off the fan clutch.

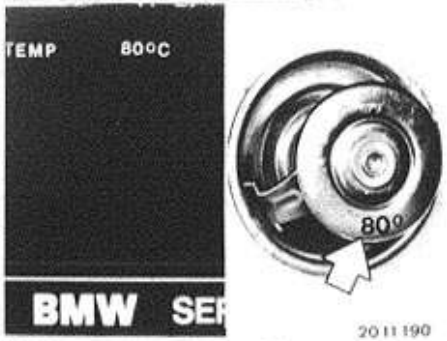


11 53 000 REMOVING AND INSTALLING COOLANT THERMOSTAT

Remove fan, see 11 52 000.
Drain coolant partially.
Remove covers (1).
Remove thermostat.



Installation:
Clamp on thermostat faces out.
Replace rubber ring (2) and gasket.
Loosen bleeder screw (3) with engine at operating temperature, heater set to "warm" and engine running at fast idle speed, and tighten bleeder screw again when escaping coolant is without air bubbles.



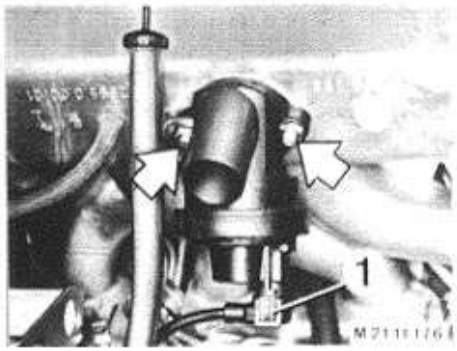
Checking Thermostat:
Does the thermostat begin to open at the temperature quoted in the Specifications?
Check opening temperature in hot water and compare with the stamped value.

11 53 080 REPLACING TEMPERATURE TRANSMITTER

Pull off plug.
Unscrew transmitter.
Installation:
Replace seal.
Tightening torque*.
Testing see Group 12.

* See Specifications
*** See Workshop Equipment Catalog

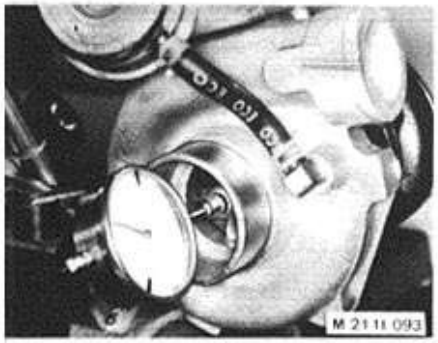
* See Specifications

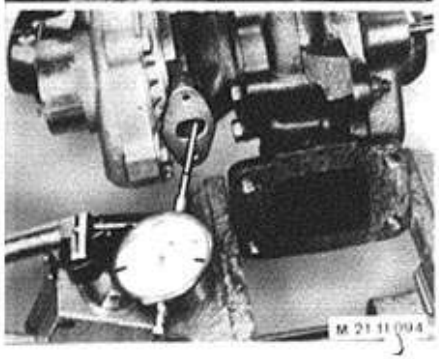


11 61 450 REMOVING AND INSTALLING CHARGING AIR PRESSURE BLOWOFF VALVE

The control valve limits charging air pressure. If this system fails, the blowoff valve protects the engine against overcharging – the oil indicator lamp comes on.
Opening pressure*.
Pull off wire (1).
Unscrew bolts.

* See Specifications

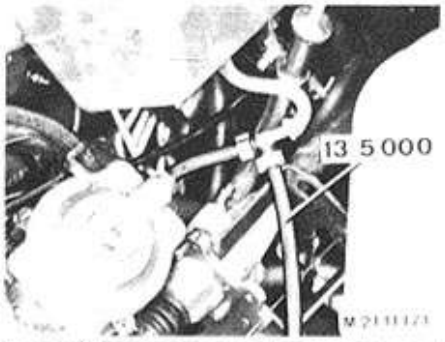


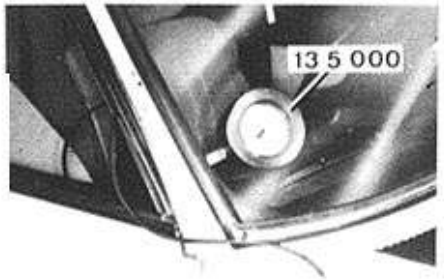


11 65 015 CHECKING BEARING PLAY OF TURBOCHARGER

Excessive bearing play could be causing excessive oil in the turbocharger (which is also noticed by blue smoke) or noise.
Axial Play*:
Apply dial gage on turbocharger shaft and press from stop to stop without turning the shaft.
Turn turbocharger shaft and repeat check.

Radial Play*:
Apply dial gage on turbocharger shaft.
Press turbocharger shaft on both ends uniformly from stop to stop, while turning it.





11 65 018 CHECKING CHARGING AIR PRESSURE OF TURBOCHARGER

Connect pressure tester 13 5 000 between collector and hose for injection pump.

Place pressure tester 13 5 000 in passenger compartment.
Be careful not to clamp the hose.
Measure charging air pressure by driving car in load range (braking) or on a dynamometer.
The system is okay, if the charging air pressure* stabilizes.
If charging air pressure is not correct, check control valve – see 11 65 060.
If charging air pressure is too low, check hose connections (leak spray) and movement of turbocharger shaft.

* See Specifications

* See Specifications

11 65 020 REMOVING AND INSTALLING TURBOCHARGER

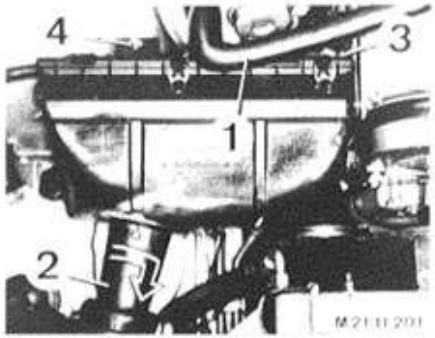
The turbocharger receives oil from the engine oil circuit.
Conformance with the following points is important to guarantee sufficient lubrication of the high speed turbocharger.

- Perfect engine oil circuit (specified engine oil, oil level, crankcase vent, etc.).
- Engine speed not too high before engine oil pressure has been built up (indicator lamp) – engine running at high speed also not stopped (turbocharger runs on).
- Engine not started immediately after an oil change. Instead first build up oil pressure by cranking the engine with the starter (disconnect wire for fuel shutoff, see 11 00 039).
- Excessively old engine oil will cause carbon deposits in the turbocharger. Carbon can be seen on the turbocharger shaft after taking off the oil line. In this case it would be necessary to replace the engine oil and oil filter.

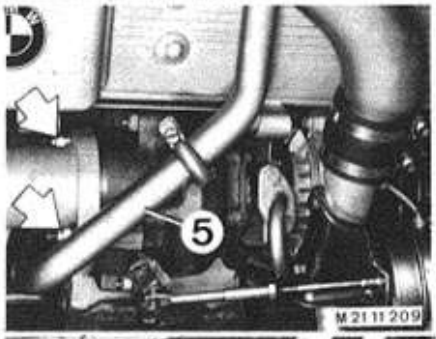
Important When Working on Turbochargers:

- Even the most minute particles of dirt could lead to destruction of the turbocharger – consequently never run the engine without its air cleaner.
- If the hose is pulled off of the control valve, this could lead to overcharging and destruction of the engine when operating with the throttle wide open.

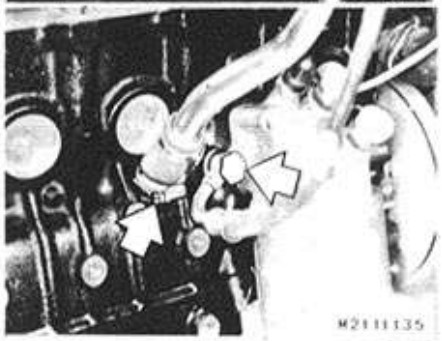
No repairs may be performed on turbochargers.



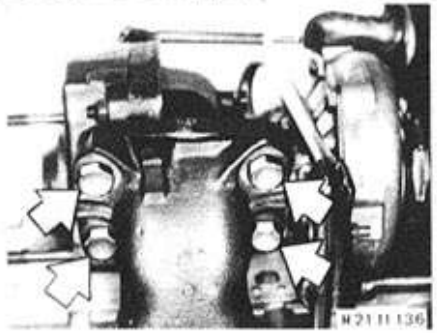
Disconnect hose (1).
Turn out hose (2).
Loosen clamp (3).
Unscrew nut (4) and remove air cleaner.
Installation:
Turn arrow to face up.



Remove pipe (5).
Unscrew exhaust pipe on turbocharger.
Remove EGR valve, see 11 71 501.
Installation:
Check gaskets, replacing if necessary.
Coat studs with copper paste "CRC"**.
Replace self-locking nut.
Tightening torque*.



Unscrew oil lines.
Installation:
Replace seals.
Tightening torque*.
Check engine oil level.

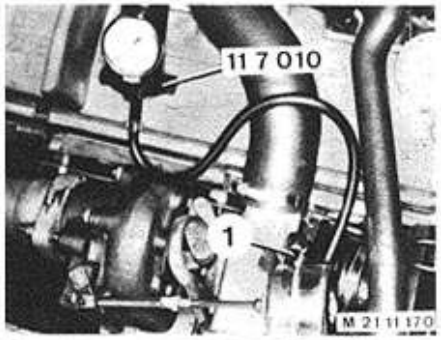


Unscrew bolts and remove turbocharger.
Installation:
Check levelness of sealing surface.
Tightening torque*.

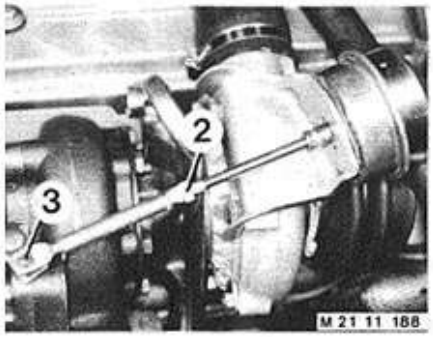
* See Specifications
** Source: HWB

11 65 059 CHECKING AND ADJUSTING CONTROL VALVE

The control valve limits charging air pressure – see 11 65 018 for testing procedures.
A control valve opening too early will be noticed by a drop in power and richening of the mixture (soot in exhaust).
If the bypass valve opens too late, this will cause excessive charging air pressure – see 11 65 018.



Pull off hose (1) and connect pump 11 7 010.
The control valve begins to open with a pressure of 0.840 ± 0.035 bar – the regulating rod of a closed control valve must rest on pin (3) without tension.

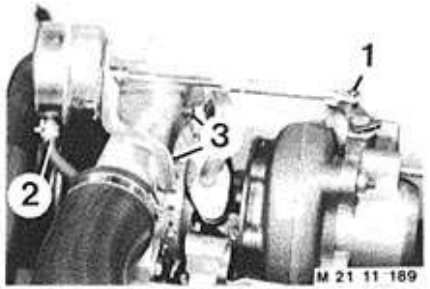


Unscrew lock nut (2).
Remove circlip on pin (3).
Adjust control valve opening time as described
Note:
One turn of the linkage is equal to 0.05 bar.
Installation:
Lock nut (2) with clear lacquer**.

The regulating linkage is locked on a standard installed turbocharger and therefore cannot be turned.
Such control valves with locked regulating rods must be replaced when the beginning of opening is not correct, see 11 65 060.

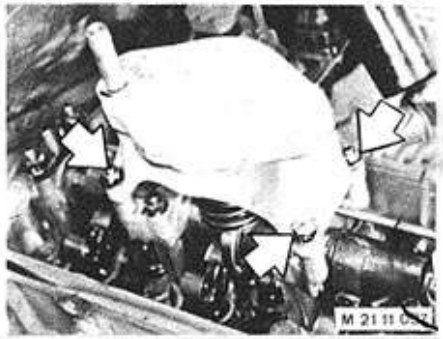
** Source: HWB, No. 81 229 407 404

11 65 060 REMOVING AND INSTALLING CONTROL VALVE

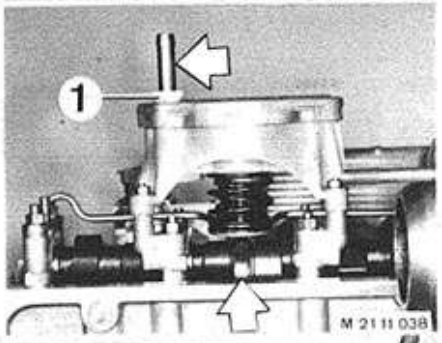


Remove circlip (1) and disconnect linkage.
Pull off hose (2).
Unscrew screws (3).
Installation:
Replace screws (3).
Adjust control valve, see 11 65 059.

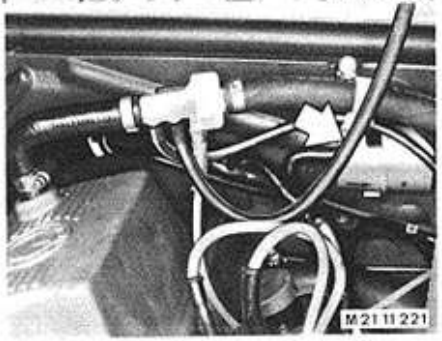
11 66 000 REMOVING AND INSTALLING VACUUM PUMP



Remove cylinder head cover 11 12 000.
Turn cams for vacuum pump to face down (with socket applied on crankshaft).
Unscrew nuts and take off vacuum pump.

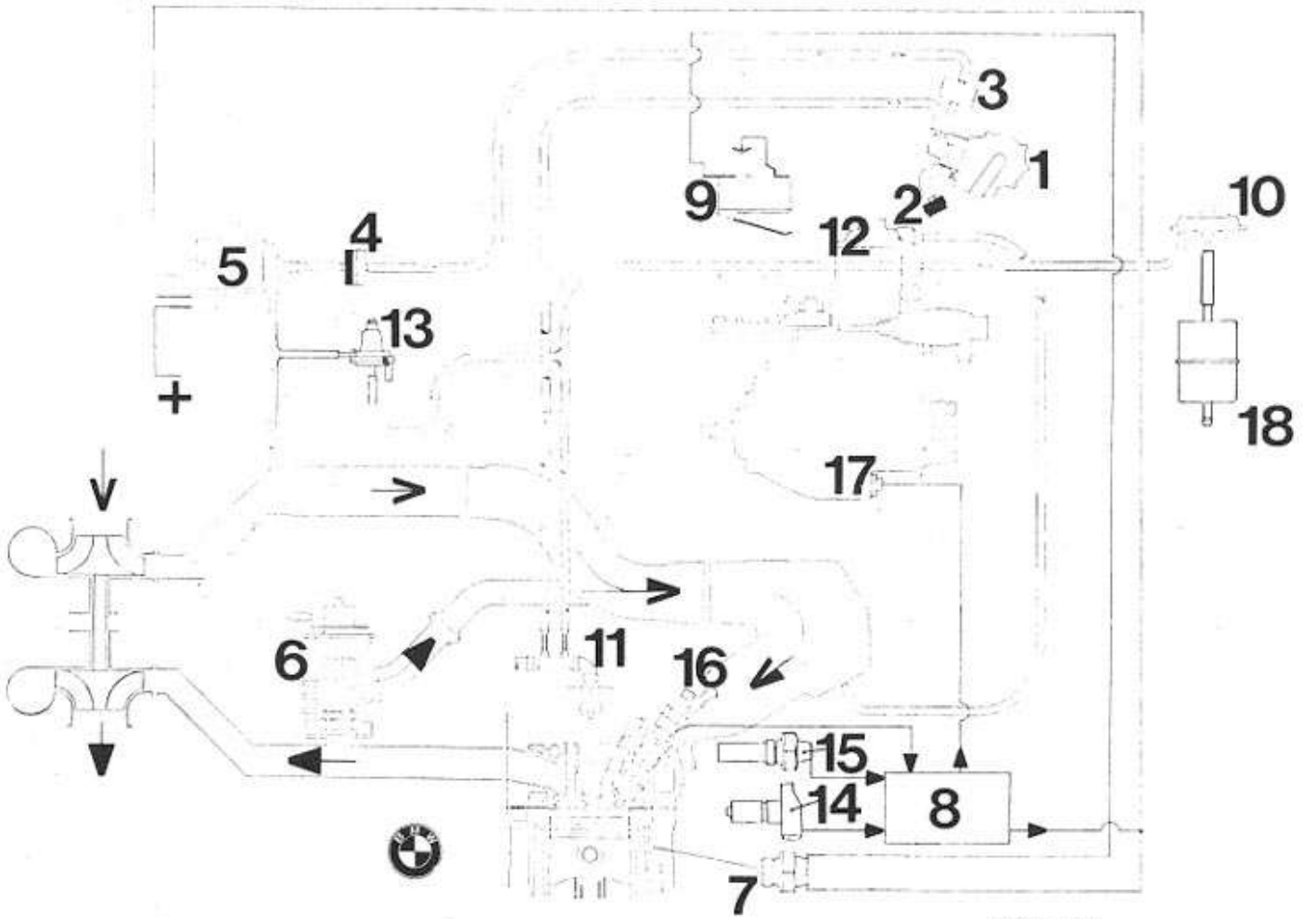


Installation:
Install vacuum pump that pipe adapter is at rear and cam runs in opening of plunger.
Insert seal (1).
Caution!
Never run engine without attached vacuum pump – loose cam ring.



Checking Vacuum Pump Pressure* and Throttle:
Connect BMW service test unit on throttle and check with engine running.

* See Specifications



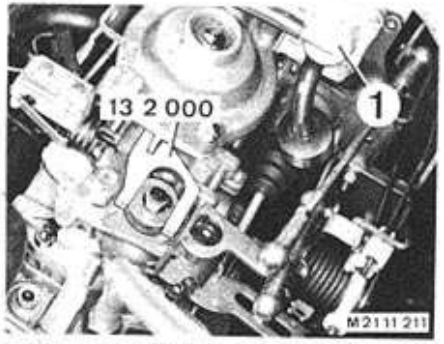
M21 11 192

EMISSION CONTROL LAYOUT DRAWING – 524 td

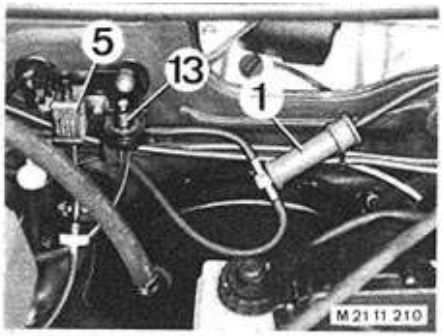
1 Pressure converter (7.20.680.12)
2 Filter
3 Damping container
4 Throttle (black side faces electric switching valve)
5 Electric switching valve (black - 7.20.939.13)
6 EGR valve (7.20.905.00)
7 Temperature switch (1 288 474) - open above + 78° C (172° F)
8 Control unit for VP-20 (0 281 001 018)
9 Idle switch
10 Altitude transmitter for ALDA (0 460 997 002) see Gr. 13
11 Vacuum pump
12 Atmospheric and charging pressure dependent control box for full load stop (ALDA) see Gr. 13
13 Venting valve (ALDA venting with EGR operation)
14 Speed/reference mark sensor – see Gr. 12
15 Coolant temperature sensor (0 280 130 037) see Gr. 12/13
16 Needle travel sensor in fuel injector – see Gr. 13
17 Valve for injection timing control – see Gr. 13
18 Air cleaner – see Gr. 13

11 70 009 CHECKING EMISSION CONTROL

Exhaust gas recirculation (EGR) is working at idle speed and partial load.

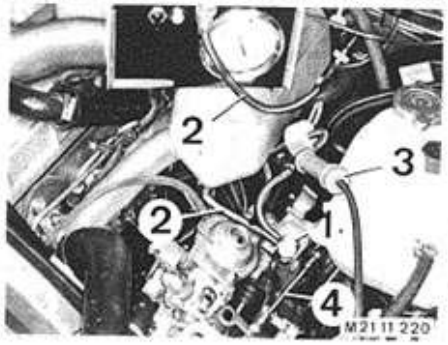


Pressure Converter (1)
Apply Special Tool 13 2 000.



Perform following test with a coolant temperature > 78° C (172° F) and the engine running.

– Vacuum on EGR Valve (6) –
Connect hose (1) of the BMW service tester.

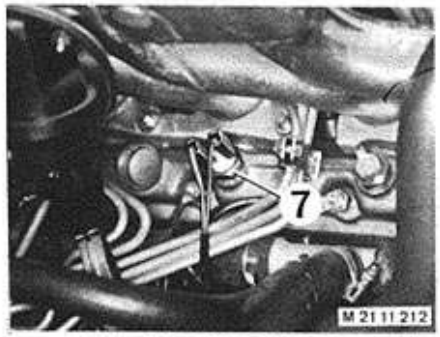


Provide – 600 ± 10 mbar inlet pressure (2) with an external vacuum pump.
Measure outlet pressure (3) with the BMW service tester.
Testing value: – 360 ±25 mbar.
If necessary, adjust the outlet pressure with linkage (4).
Adjusting value: – 360 ± 5 mbar.

Measure the vacuum at idle speed and speeds of 1,000 to 2,800 rpm.
Min.: – 320 mbar
Max.: – 430 ± 10 mbar

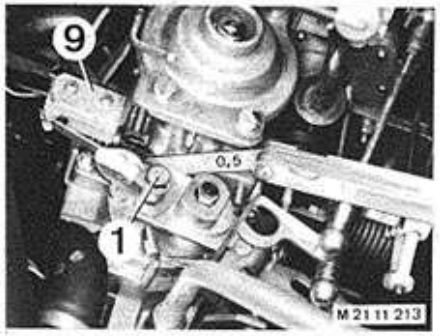
Defective:
- Check the vacuum pump pressure* and throttle, see 11 66 000.
- Check EGR at idle speed.
- Check EGR at partial load.

* See Specifications

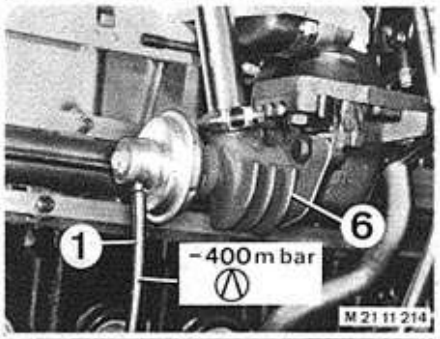


A.) EGR at Idle Speed:

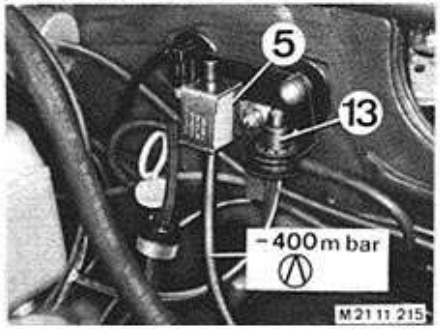
EGR is working at idle speed and with a coolant temperature of > 78° C (172° F).
– Temperature Switch (7) –
Switching-on temp.: 78 ± 3° C (172 ± 5° F)
Switching-off temp.: 60 ± 3° C (140 ± 5° F)
Check with BMW service test unit (ohmmeter).



– Idle Switch (9) –
Switching-off point: 0.5 mm (0.020") after idle stop.
Check with BMW service test unit (ohmmeter).
Loosen screw (1) to adjust.



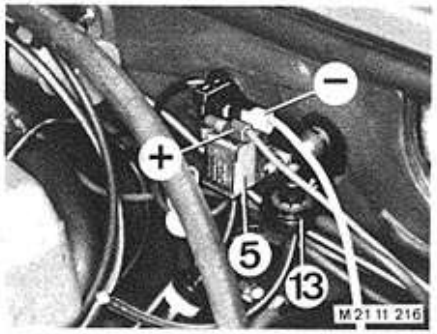
– EGR Valve (6) –
Apply about – 400 mbar pressure (BMW service test unit) on EGR valve (6).
Pull off and reconnect hose (1) – closing and opening clicks will be heard.
Also refer to 11 71 501.



– Electric Switching Valve (5) –
Check with ignition on and a coolant temperature of > 78° C (172° F) or a bridged temperature switch (7).
Apply about – 400 mbar pressure (BMW service test unit) on electric switching valve (5).
The operation of the electric switching valve (5) and EGR valve (6) will be heard when operating the idle switch (9).

B.) EGR at Partial Load:

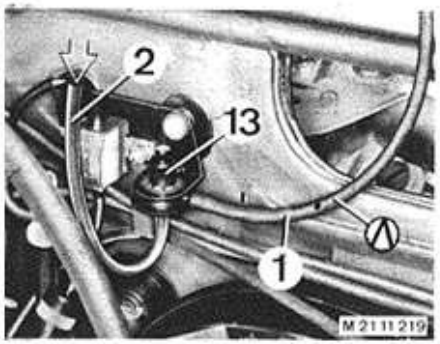
EGR is working at speeds of 1000 to 2800 rpm and a coolant temperature of > 78° C (172° F) (coolant temperature sensor 15).



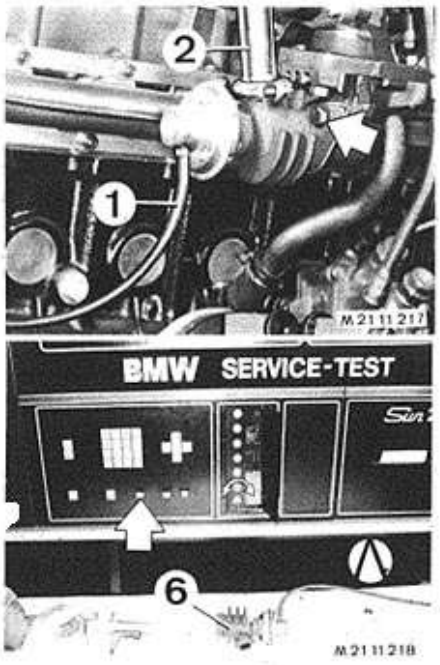
– Control Unit (8) –
Check with a coolant temperature of > 78° C (172° F) and engine running.
Connect BMW service test unit and check signal output on control unit (8).
There should be battery voltage at speeds of 1000 to 2800 rpm.

Defect:
Check control unit and wire harness with an universal adapter, see Group 13.

– Venting Valve (13) –
The ALDA regulation will be vented, i.e. altitude compensation will be stopped, with EGR operation.



Apply vacuum (1) from BMW service test unit.
Pull off hose (2) and blow in air.
Venting valve (13) is open completely with a pressure of – 290 ± 34 mbar.



11 71 501 REPLACING EGR VALVE

Pull off vacuum hose (1).
Loosen pipe clamp (2).
Unscrew EGR valve.
Installation:
Replace gasket.
Coat studs with copper paste "CRC"**.

Checking Valve Travel:

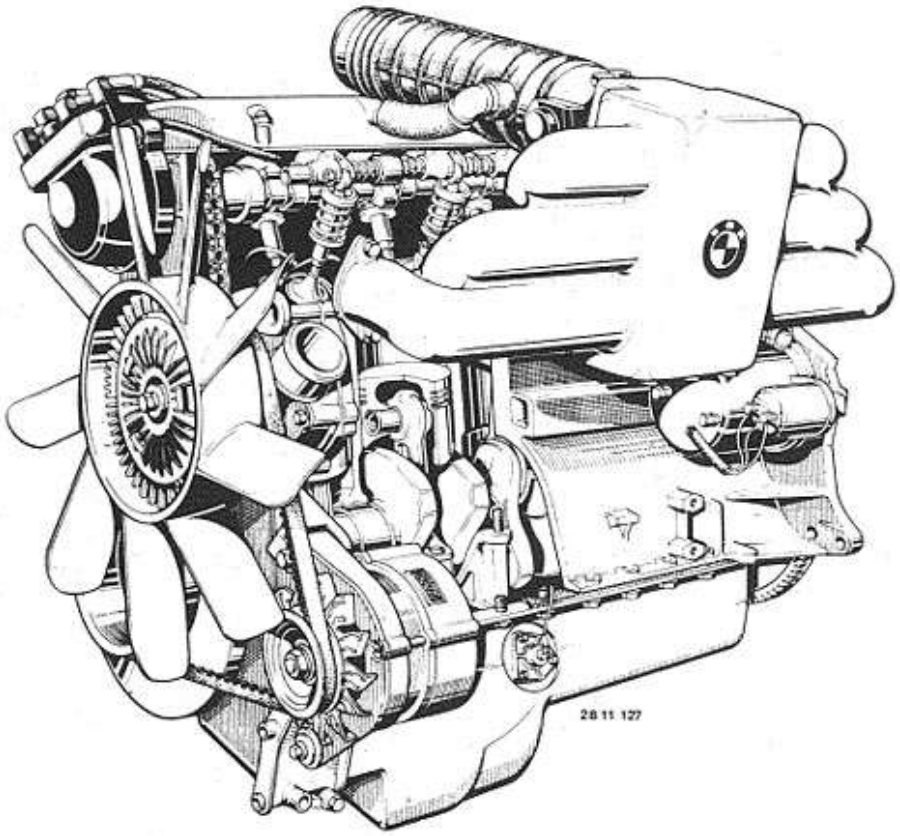
Test Step	Pressure mbar	Travel mm (inch)
1	– 340 ± 3	1 (0.040)
2	– 400 ± 3	4 ± 0.5 (0.157 ± 0.020)
3	– 470 + 20	–
4	– 300 + 20	0

Note:
The EGR valve is open in case of acceleration smoke and acceleration hesitation.
Check installed position of throttle (4) in case of excessive smoke.
EGR valve must not squeak while opening and closing!

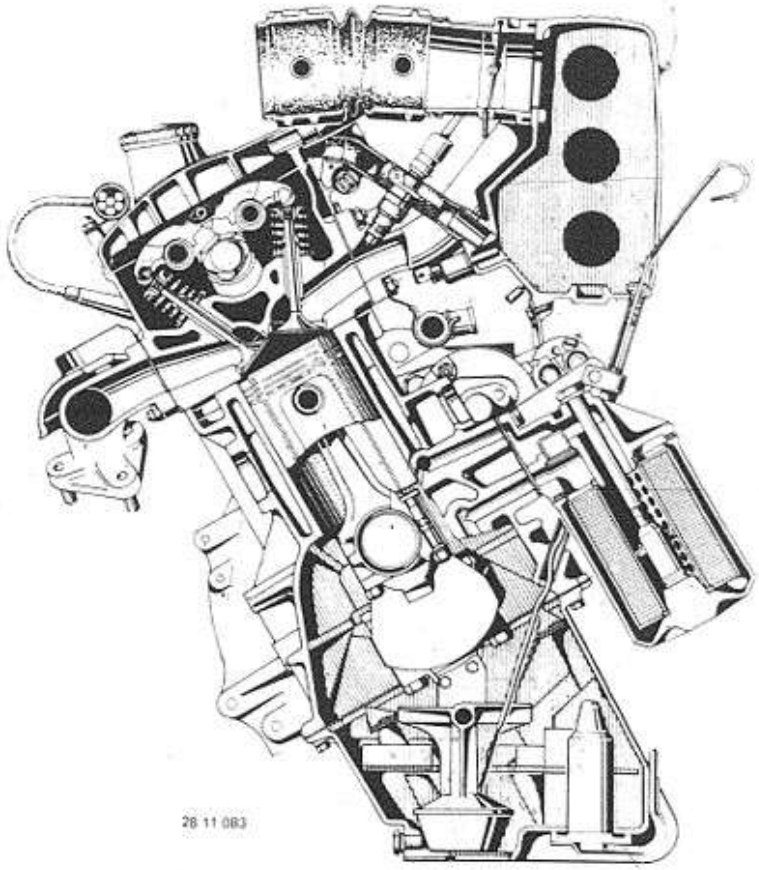
** Source: HWB

11 Engine

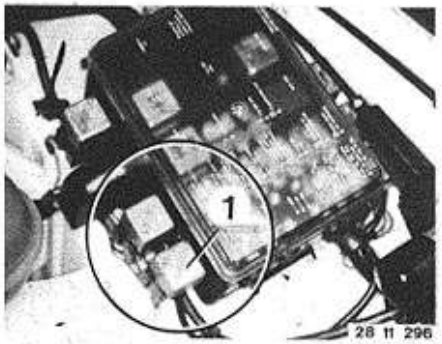
BMW 533i, BMW 535i



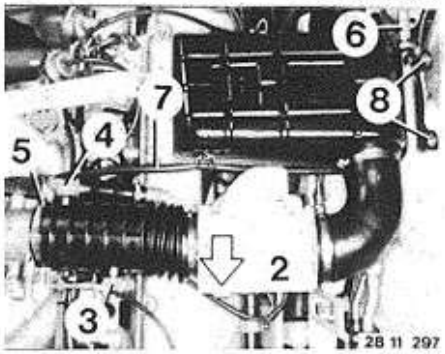
M 30 B 32 = BMW 533 i
M 30 B 34 = BMW 535 i



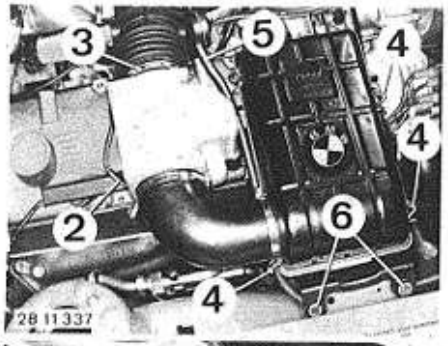
11 00 039 CHECKING COMPRESSION OF ALL CYLINDERS



Pull off relay (1).



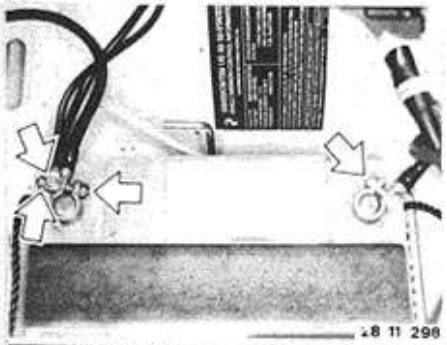
M 30 B 32:
Pull off plug (2) and lift out wires.
Pull out hoses (3 and 4).
Unscrew hose clamp (5).
Unscrew pipe (6).
Disconnect vent hose (7).
Unscrew nuts (8) and remove air cleaner with air flow sensor.



M 30 B 34:
Pull off plug (2) and lift out wires.
Loosen hose clamp (3).
Open clips (4).
Pull off hose (5).
Unscrew nuts (6) and remove air cleaner with air flow sensor.

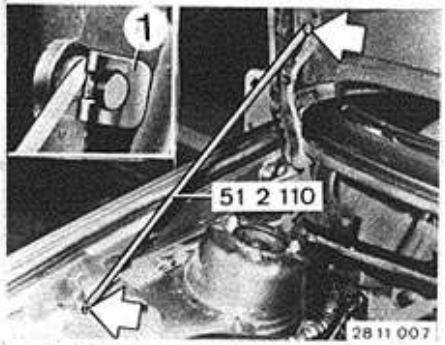
Unscrew spark plugs.
Check compression*
Installation:
Check tightening torque***.

* See Specifications
*** See Specifications of Gr. 12

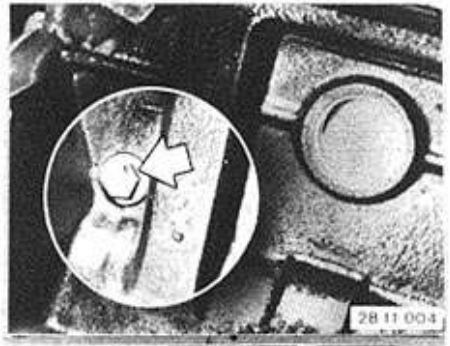


11 00 050 REMOVING AND INSTALLING ENGINE

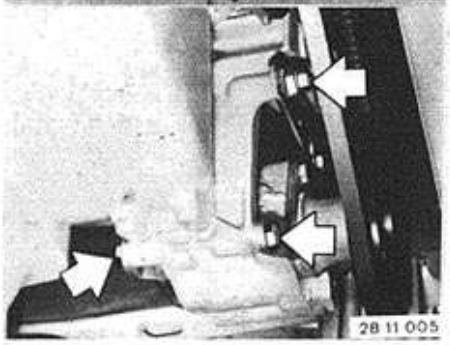
Disconnect negative and positive leads on battery.
Unscrew lead on positive terminal.



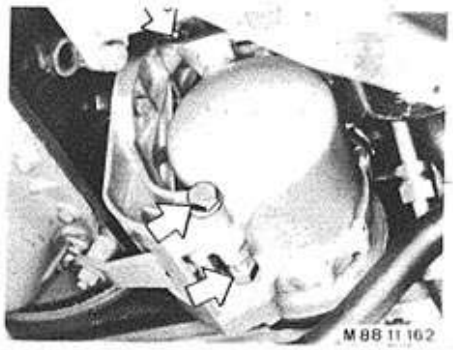
Unscrew ground strap for hood.
Disconnect or remove gas pressure props and insert Special Tool 51 2 110 to prop up the engine hood.
Caution!
Use locks (1).



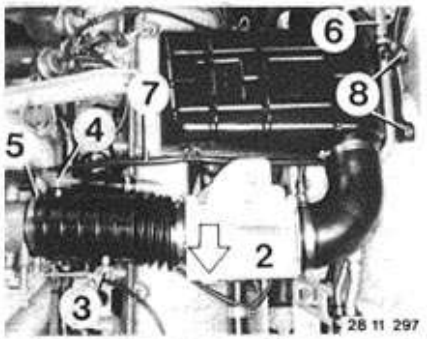
Remove transmission – see Gr. 23 or 24.
Unscrew plug and drain coolant.
Remove fan 11 52 000.
Remove radiator 17 11 000.



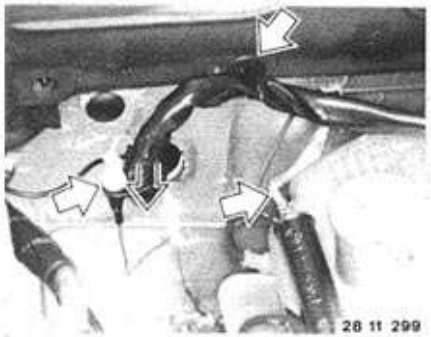
Unscrew power steering pump.
Pressure hoses remain connected.
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.



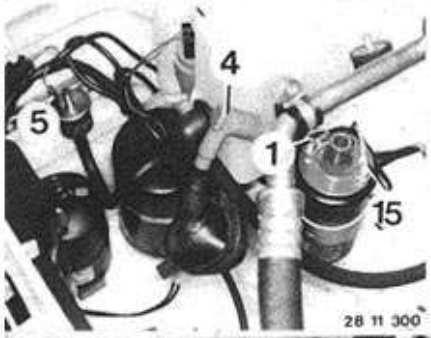
Unscrew compressor – see Group 64.
Refrigerant hoses remain connected.
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.



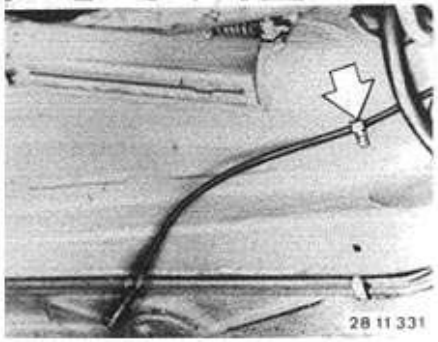
M 30 B 32:
Pull off plug (2) and lift out wires.
Pull out hoses (3 and 4).
Unscrew hose clamp (5).
Unscrew pipe (6).
Disconnect vent hose (7).
Unscrew nuts (8) and remove air cleaner with air flow sensor.



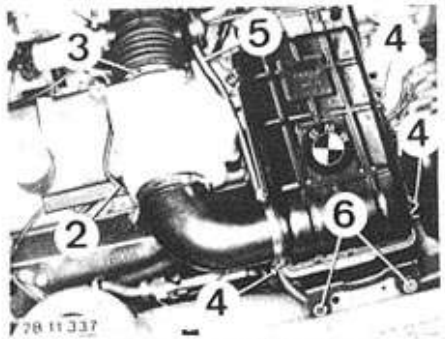
Pull off plugs on idle control unit and DME control unit in glove box and pull wires into engine compartment.
Disconnect ground wire.
Disconnect plug for oxygen sensor.
Disconnect wire harness on firewall.



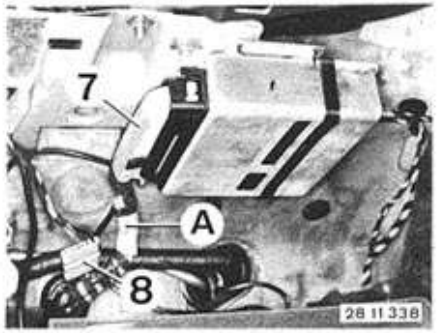
Pull off wire (4).
Disconnect wires (1 and 15).
Pull off wire (5) on solenoid.
Disconnect wire harness.



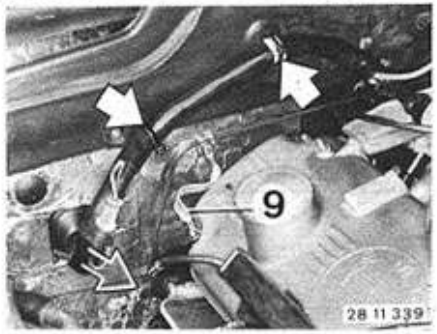
M 30 B 34:
Disconnect wire harness for oxygen sensor on floor plate.



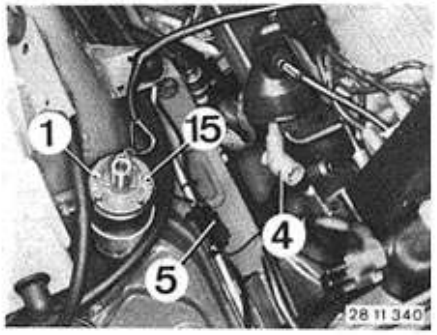
Pull off plug (2) and lift out wires.
Loosen hose clamp (3).
Open clips (4).
Pull off hose (5).
Unscrew nuts (6) and remove air cleaner with air flow sensor.



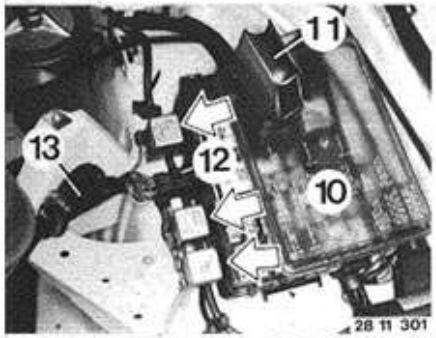
Pull off plug (7) on DME control unit in glove box.
Disconnect plug (8) and run wire harness into engine compartment.
Note:
Refer to 13 61 000 or a wiring diagram for the meaning of plug connection (A).



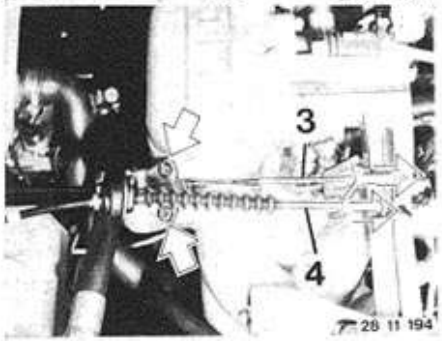
Unscrew ground wire (9).
Disconnect wire harness.



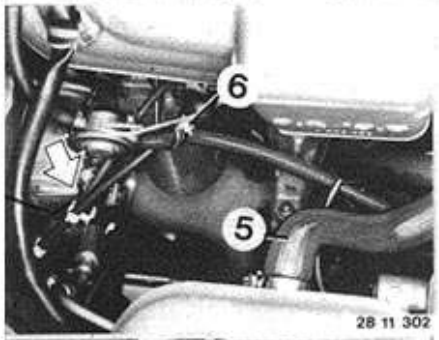
Pull off wire (4).
Unscrew wires (1 and 15).
Disconnect plugs (5).



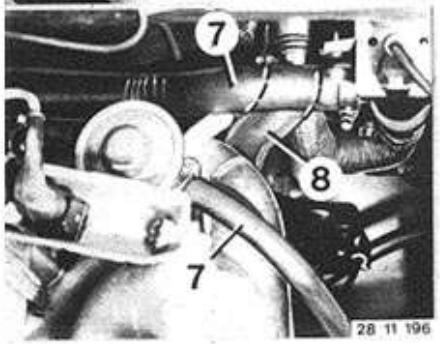
All Models:
Remove cover (10) and cap (11).
Pull off plug (12) and lift out relay.
Disconnect wire harness (13).



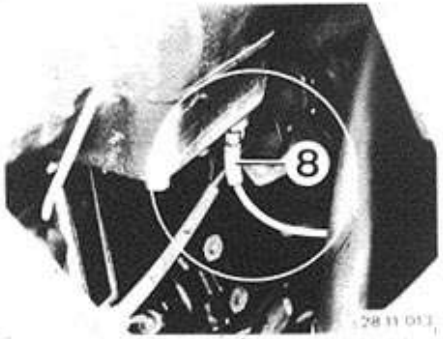
Disconnect accelerator cable (3) and cruise control cable (4).
Installation:
Adjust accelerator cable, see 35 41 421.
Adjust cruise control cable, see Group 65.



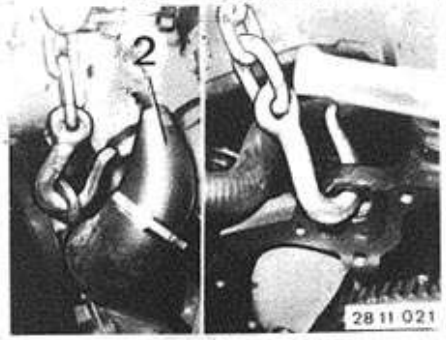
Unscrew water hose (5) for expansion tank.
Disconnect fuel return line (6).
Take wires out of clips.



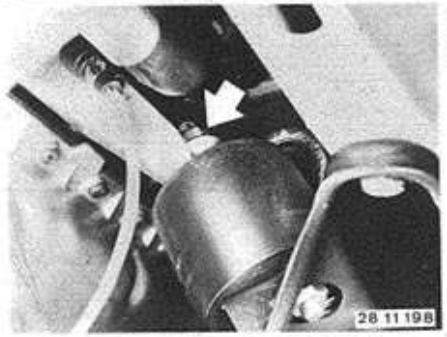
Disconnect fuel feed line (7) and heater hoses (8 and 9).



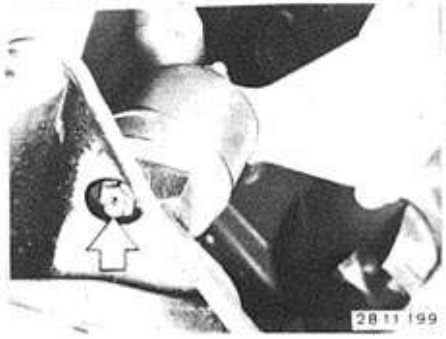
Pull off vacuum hose (8).



Disconnect water hose (2) and apply Special Tool 11 0 020.

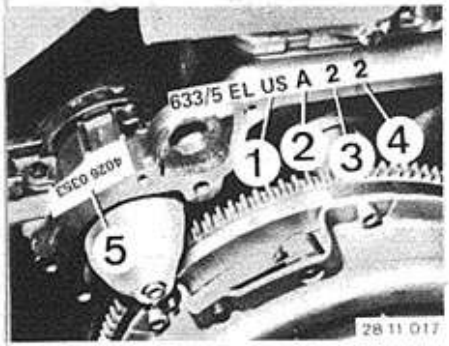


Unscrew left engine mount.
Installation:
Tightening torque*.



Disconnect ground strap.
Unscrew right engine mount.
Lift out engine.
Installation:
Tightening torque*
Only M 30 B 32:
Adjust engine idle speed/CO 13 00 054.

* See Specifications



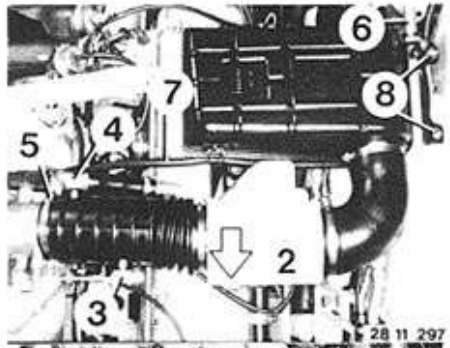
11 00 091 INSTALLING EXCHANGE ENGINE

Remove engine 11 00 050.
Exchange Engine Identification on Crankcase:
1 = Type designation
2 = "A" for exchange or "N" for new part
3 = Month of manufacture
4 = Year of manufacture (1982)

Stamp the engine number (5).

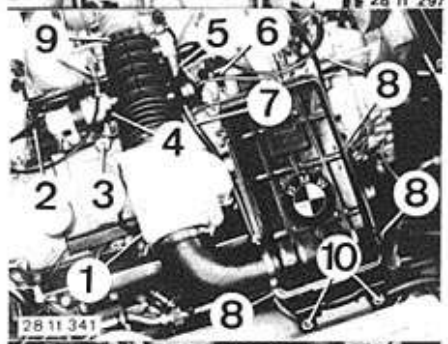
Drive in the supplied oil dipstick guide tube (see 11 43 101) and transfer parts from the old to the exchange engine.
Add engine oil***.
Important!
Remove the pilot bearing in the crankshaft (see 11 21 571), if the car has an automatic transmission.
Install engine.
Only M 30 B 32:
Adjust the engine idle speed and CO level, see Group 13.

*** See Service Information of Gr. 00

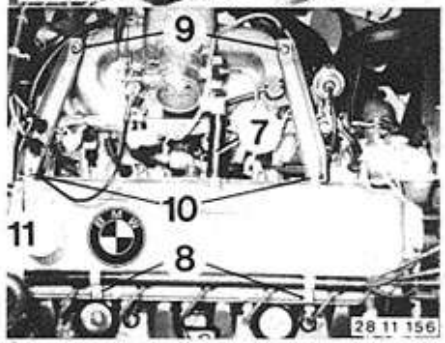


11 12 000 REMOVING AND INSTALLING CYLINDER HEAD COVER

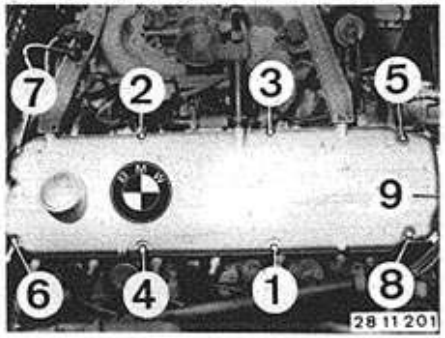
M 30 B 32:
Pull off plug (2) and lift out wires.
Pull out hoses (3 and 4).
Unscrew hose clamp (5).
Unscrew pipe (6).
Disconnect vent hose (7).
Unscrew nuts (8) and remove the air cleaner with the air flow sensor.



M 30 B 34:
Pull off plug (1) and lift out the wires.
Pull off plug (2) and unscrew nut (3).
Pull off hoses (4 ... 7).
Open clips (8).
Loosen hose clamp (9).
Unscrew nuts (10) and remove the air cleaner with the air flow sensor.



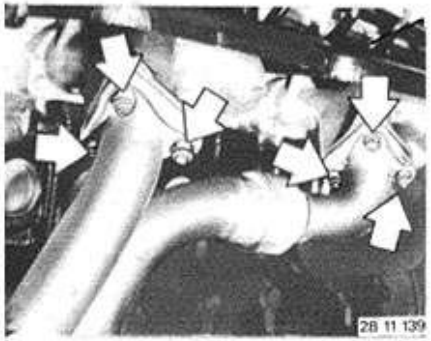
Pull off hose (7).
Unscrew ignition lead tube (8).
Loosen nuts (9).
Unscrew and remove nuts (10).
Unscrew clamp (11).
Installation:
First tighten nuts (10) and then (9).



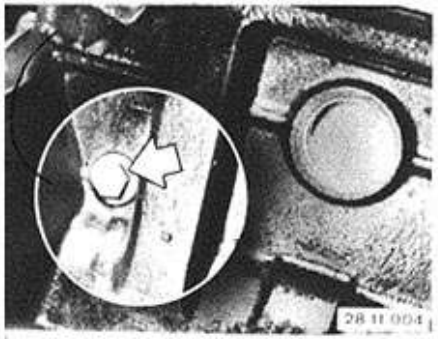
Unscrew the cylinder head cover.
Installation:
Check gasket, replacing if necessary.
Make sure that the gasket is positioned correctly and tighten the bolts in order o 1 through 9.
Mount the clamp with bolt (9).
Tightening torque*.

* See Specifications

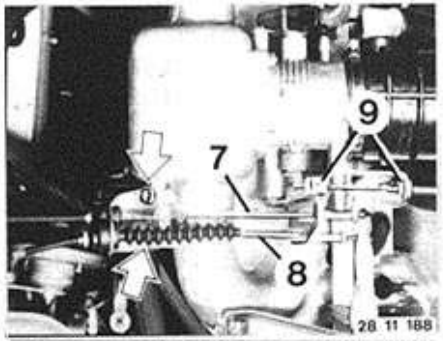
11 12 160 REMOVING AND INSTALLING CYLINDER HEAD



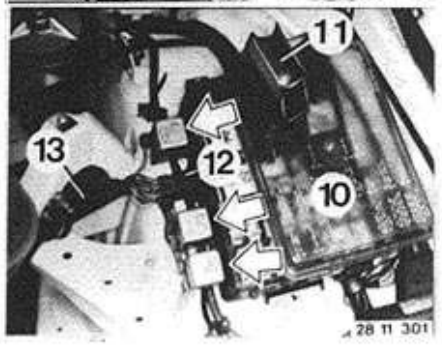
Unscrew exhaust pipes on exhaust manifolds and pipe clamp on transmission.
Installation:
Check gaskets, replacing if necessary.
Coat studs with copper paste "CRC"***
Replace self-locking nuts.
Tightening torque*.



Unscrew plug and drain coolant.
Disconnect battery ground lead.
Installation:
Fill cooling system with coolant*** and bleed 17 00 039.
Replace engine oil***.

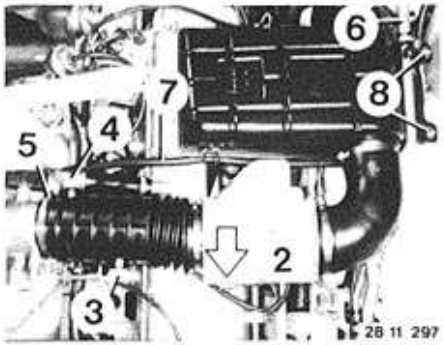


Disconnect accelerator cable (7), cruise control cable (8) and throttle cable (9).
Installation:
Adjust accelerator cable, see 35 41 421.
Adjust cruise control cable, see Group 65.
Adjust throttle cable, see Group 24.

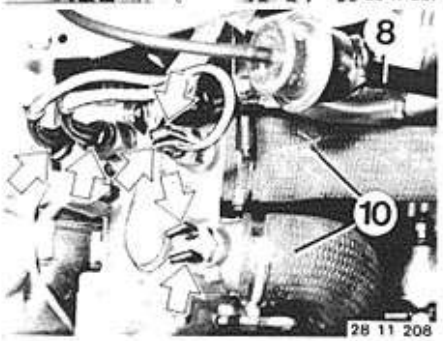


Remove cover (10) and cap (11).
Pull off plug (12) and lift out relay.
Disconnect wire harness (13).

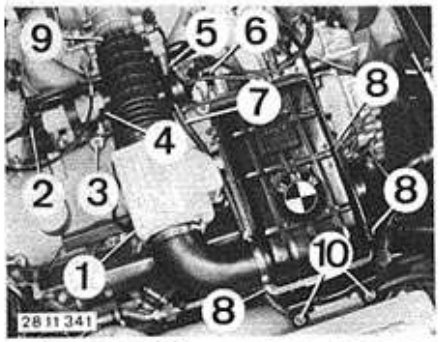
* See Specifications
** Source: HWB
*** See Service Information of Gr. 00



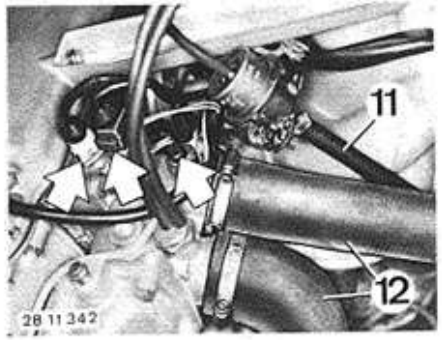
M 30 B 32:
Pull off plug (2) and lift out wires.
Pull out hoses (3 and 4).
Unscrew hose clamp (5).
Unscrew pipe (6).
Disconnect vent hose (7).
Unscrew nuts (8) and remove air cleaner with air flow sensor.



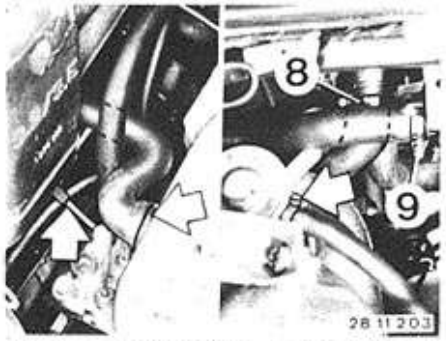
Pull off plug.
Disconnect fuel return line (8) and water hoses (10).



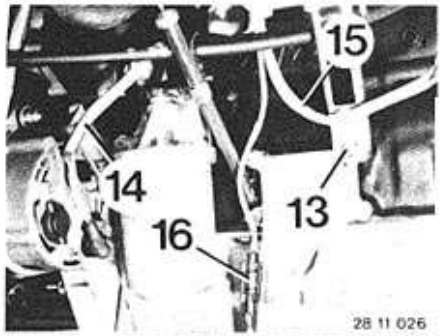
M 30 B 34:
Pull off plug (1) and lift out wires.
Pull off plug (2) and unscrew nut (3).
Pull off hoses (4 ... 7).
Open clips (8).
Loosen hose clamp (9).
Unscrew nuts (10) and remove air cleaner with air flow sensor.



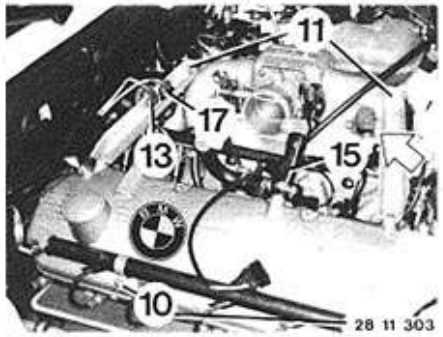
Pull off plug.
Disconnect fuel return line (11) and coolant hose (12).



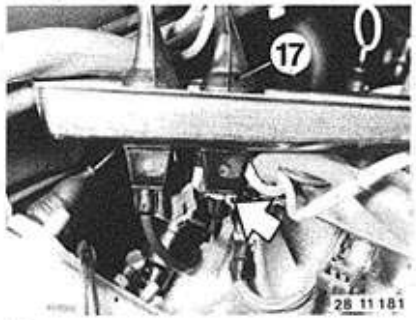
All Models:
Disconnect fuel feed line and heater hoses (8 and 9).
Disconnect water hose for expansion tank.
Pull off vacuum hose.



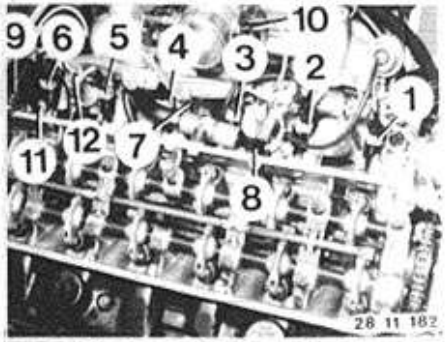
Remove bolt (13).
Disconnect wires (14 and 15) on alternator and starter.
Lift out and disconnect plugs (16).



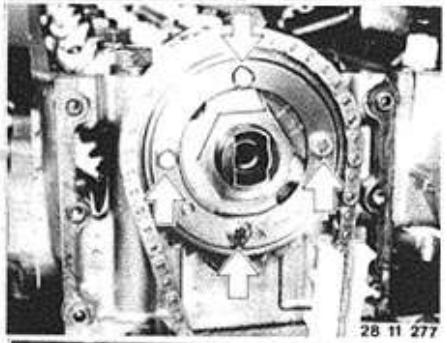
Unscrew ignition lead tube (10) and distributor cap.
Unscrew diagnosis socket.
Remove bolts (11).
Disconnect DME plugs (13 and 17).
Pull off hose (15).
Take off cylinder head cover.
Installation:
Check that gasket seats correctly.



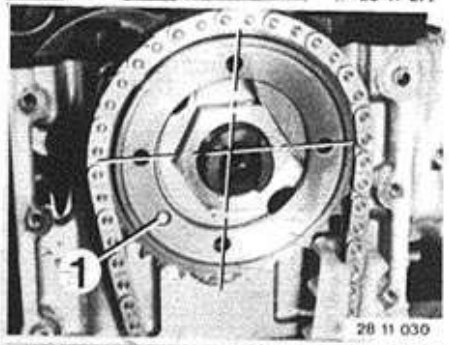
Connect DME plugs for reference mark and speed signals in such a manner, that gray plug (17) is connected with the plug marked with a ring.



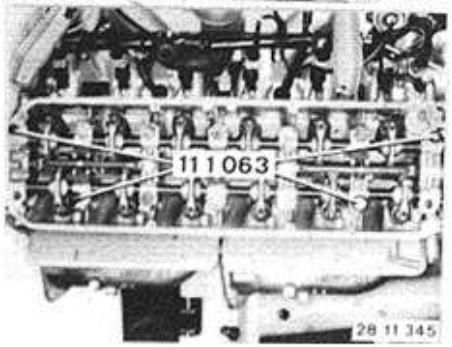
Pull off plugs on fuel injectors (1 ... 6), cold start valve (7), idle positioner (8), oil pressure switch (9) and throttle (10).
Unscrew clamp (11) and ground lead (12).
Disconnect engine wire harness and place aside to the right.



Remove upper timing case cover 11 14 100.
Remove chain tensioner piston 11 31 000.
Open lockplates.
Unscrew sprocket.
Note:
Lockplates are not used again.
Tightening torque*.

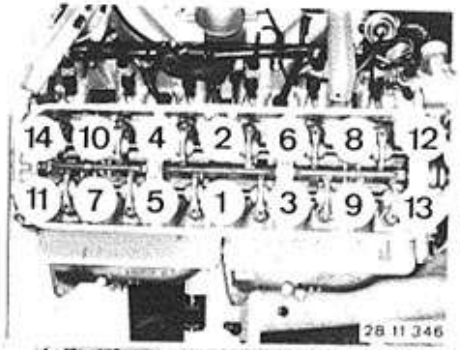


Installation:
Install timing chain that dowel pin (1) is at bottom left when tapped bores are perpendicular to the engine.

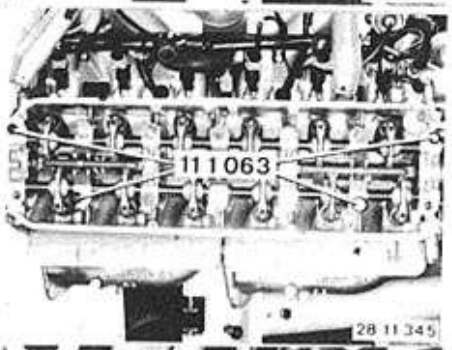


Unscrew cylinder head bolts in order of 14 through 1.
Insert Special Tools 11 1 063 as shown in picture, to prevent moving or turning of rocker arm shafts.
Lift off cylinder head.

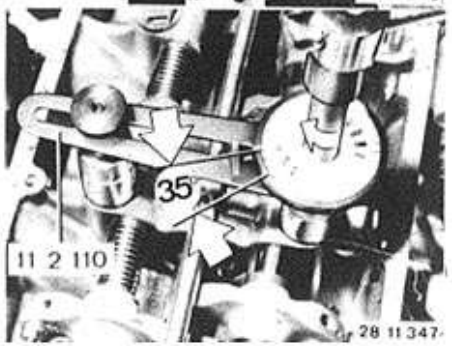
* See Specifications



Installation:
Keep oil out of cavities, since otherwise bolts would not exert sufficient pressure on the cylinder head even though they are tightened to correct torque.
Engine block could also be cracked.
Clean cylinder head bolts.
Lubricate threads and bearing surfaces of bolt heads with a light coat of oil.
Replace cylinder head gasket – see 11 12 101.

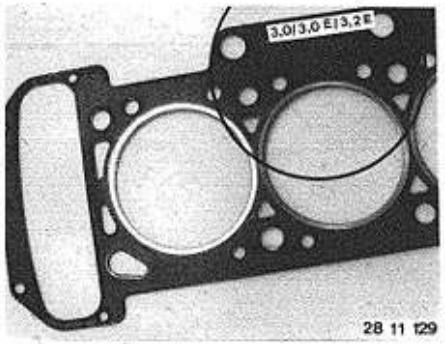


Tighten bolts in order of 1 through 14 to correct torque* in three steps.
Important!
New cylinder head bolts without collar (better quality):
First tighten bolts 1 ... 6 with 60 ± 2 Nm (43.4 ± 1.4 ft. lbs.) – remove Special Tools 11 1 063 – then tighen bolts 7 ... 14 in first step.



Adjust valve clearance – see 11 34 004.
Only M 30 B 32:
Adjust engine idle speed/CO – see Group 13.
Tighten cylinder head bolts to torque angle* with Special Tool 11 2 110 regardless of engine temperature in the third step (cylinder head cover removed again after engine was run warm).

* See Specifications

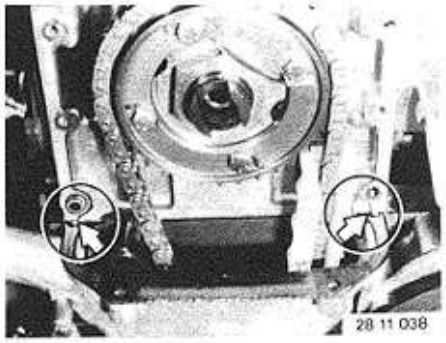


11 12 101 REPLACING CYLINDER HEAD GASKET

Remove cylinder head 11 12 100.
Clean sealing surfaces on cylinder head and crankcase with a sealant remover** and hard wood scraper..
Check levelness with a standard steel ruler, grinding cylinder head sealing surface if necessary – see 11 12 719.
Installation:
Only use original cylinder head gaskets, of which openings for coolant match precisely.

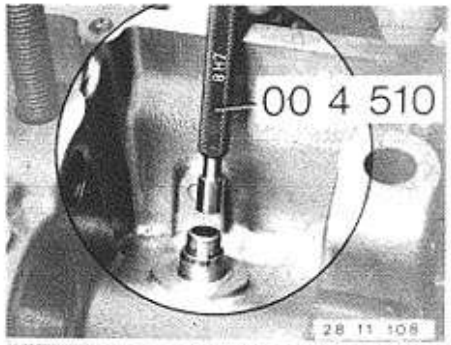
Stamped Identification:

Engine	Code	Bore Dia.
M 30 B 32	3.0/3.0E/3.2E	89 mm (3.504")
M 30 B 34	3.4	92 mm (3.622")



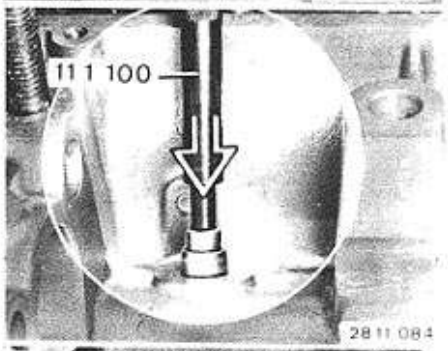
Important!
A 0.3 mm (0.012") thicker gasket can be used on a ground cylinder head, to avoid reducing the specified combustion chamber size.
This gasket may also be used, if poor fuel grade is causing engine knock.
Important!
Coat bores with a brush-on universal sealant / Three Bond Silicon 1207** prior to installation of the timing case cover.

** Source: HWB

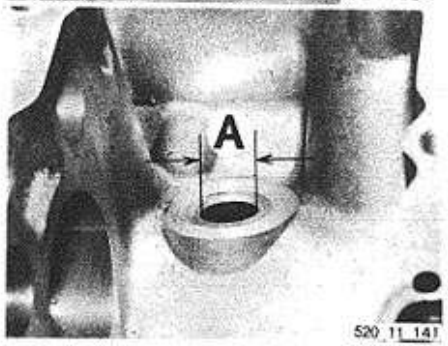


11 12 561 REPLACING VALVE GUIDE – Valve Removed –

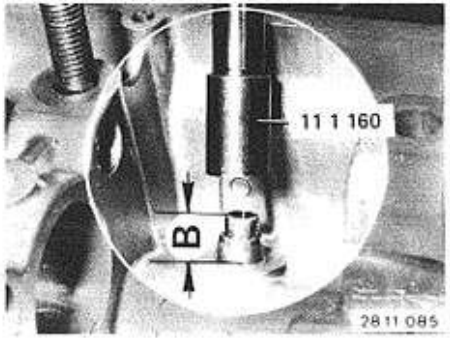
Check valve guide wear* with Special Tool 00 4 510.



Drive out valve guide (cold) with Special Tool 11 1 000.

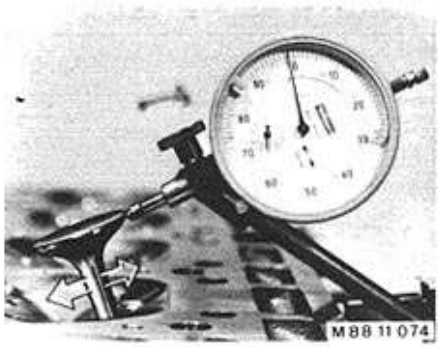


Check bore in cylinder head with Special Tool 00 4 520.
Ream out bore with a standard reamer and install an oversize* valve guide, if permissible diameter (A) is exceeded.



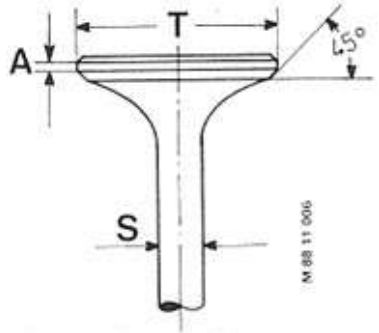
Heat cylinder head*
Drive valve guide into cylinder head from the camshaft side with Special Tool 11 1 160.
Stepped end of valve guide faces camshaft.
Important!
Bore in special tool determines protrusion B* of valve guide.
Ream out valve guide to specified inside diameter* with Special Tool 00 4 500.
Machine valve seats – see 11 12 607.

* See Specifications



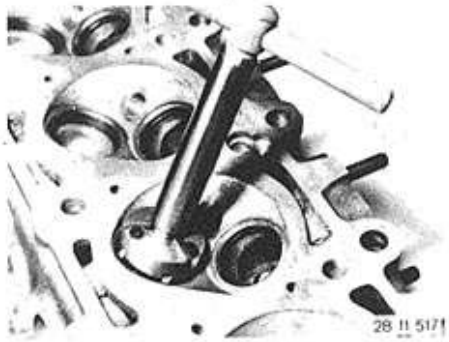
11 12 595 CHECKING VALVE GUIDE FOR WEAR
– Valve Removed –

Check by inserting a new valve, that the end of the valve stem is flush with the valve guide. Attach dial gage and measure tilt play. Max. permissible tilt play*.

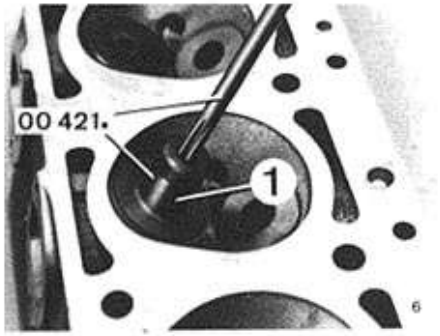


11 12 607 MACHINING VALVE SEATS AND VALVES
– Valves Removed –

Replace valve, if edge thickness A* is less than specified.

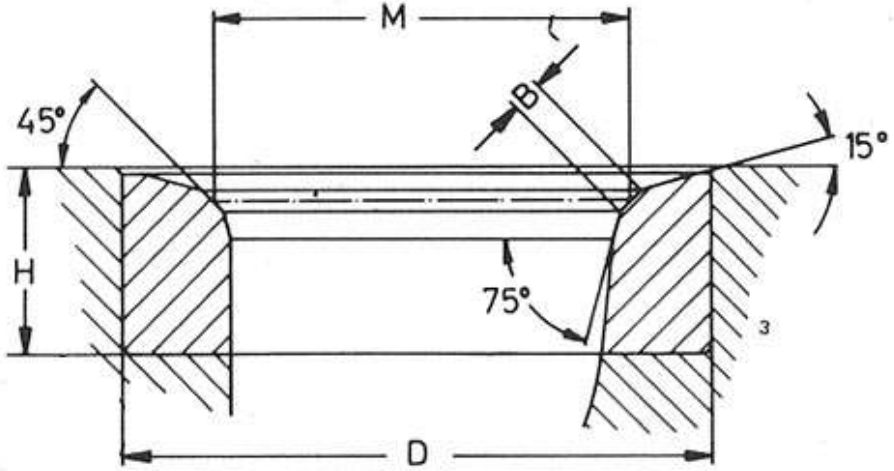


Produce valve seat diameter M* and valve seat width B* by machining correction angles* after machining the valve seat angle*.
Grind in valves with grinding paste and check for leaks – see 11 34 509.



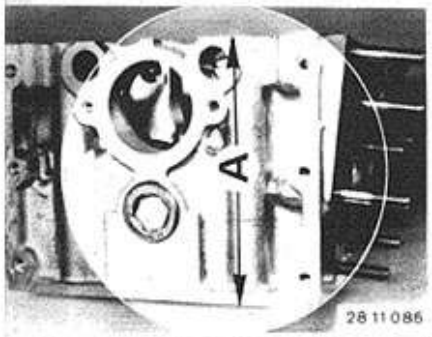
11 12 600 REAMING OUT VALVE GUIDE
– Valve Removed –

Ream out valve guide and install a valve with a larger stem diameter "S"*, if there is excessive play between the valve guide and valve stem – see 11 12 595.
The valve seat must also be machined in conjunction with this step – see 11 12 607.
Press guide pad (1) on to valve seat and ream out valve guide beginning from the combustion end – turn down reamer once.

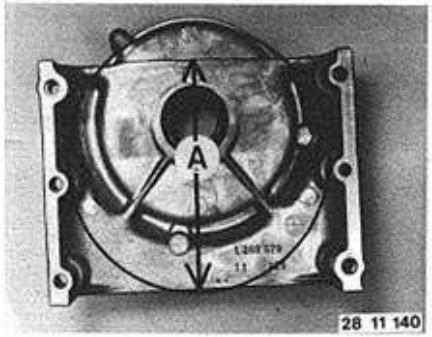


* See Specifications

* See Specifications



28 11 086

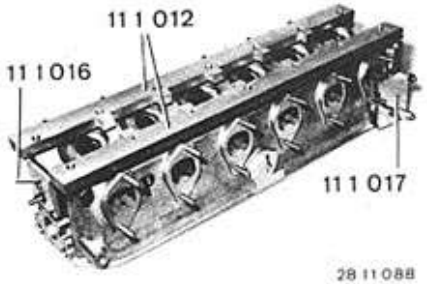


28 11 140

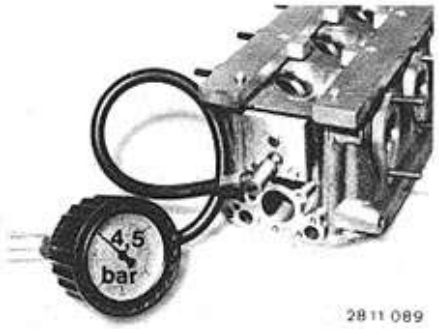
11 12 719 GRINDING CYLINDER HEAD SEALING SURFACES –CYL. HEAD DISASSEMBLED–

Not more than 0.3 mm (0.012") may be ground off of cylinder head's original total thickness (A) = 129 ± 0.1 mm (5.079 ± 0.004").
Install a 0.3 mm (0.012") thicker gasket on a reground cylinder head (also refer to 11 12 101).

Machine upper timing case cover accordingly when grinding the cylinder head.



28 11 088

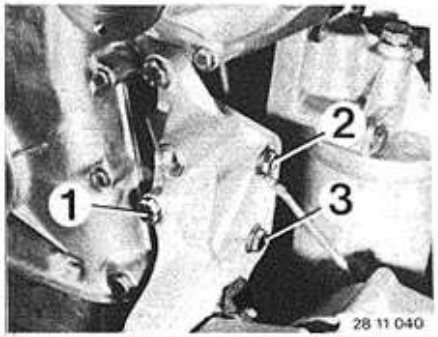


28 11 089

11 12 729 CHECKING CYLINDER HEAD FOR CRACKS IN WATER TEST –CYL. HEAD DISASSEMBLED–

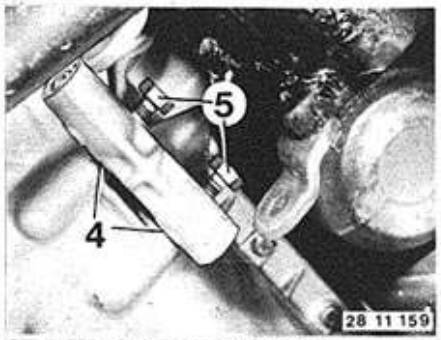
Mount Special Tools 11 1 012 on cylinder head.
Plug water circuit on cylinder head with Special Tools 11 1 016 and 11 1 017.

Fill cylinder head with compressed air.
Testing pressure: 4.5 bar (64 psi).
Place cylinder head in water bath and check for cracks.
Note:
Relax water bath with a detergent if necessary.

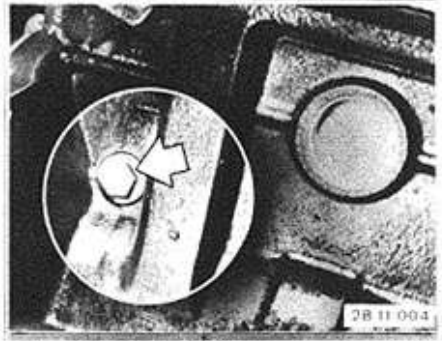


11 13 000 REMOVING AND INSTALLING OIL PAN

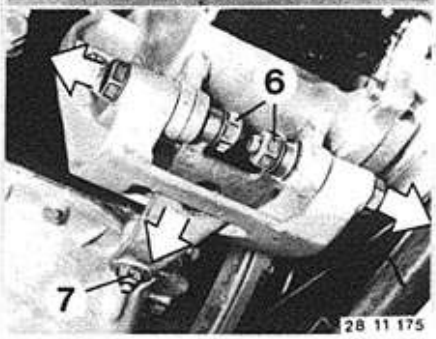
Take off drive belt for alternator.
Unscrew alternator and swing aside.
Unscrew bolt (1).
Loosen bolts (2 and 3).
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.



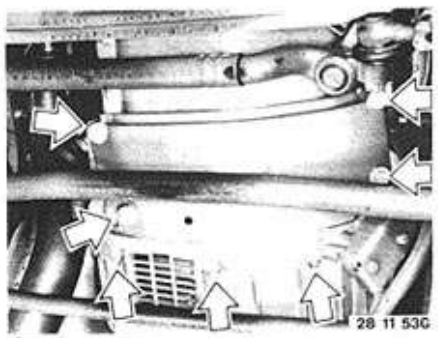
Take off drive belt for power steering pump.
Unscrew power steering pump and remove bolts (5).
Installation:
Do not tension console when installing – use spacers (4), see 32 41 131.
Tighten drive belt and check tightness with Special Tool 11 5 020.



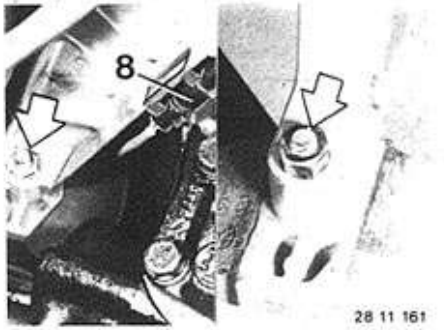
Unscrew plug and drain coolant partially.
Drain engine oil.
Installation:
Add coolant**.
Add engine oil**.



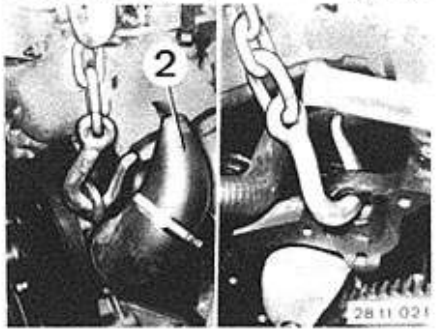
Unscrew bolts (6) and nut (7).
Remove holder toward inside.



Unscrew cover / reinforcement plate.
Unscrew and remove oil pan bolts.



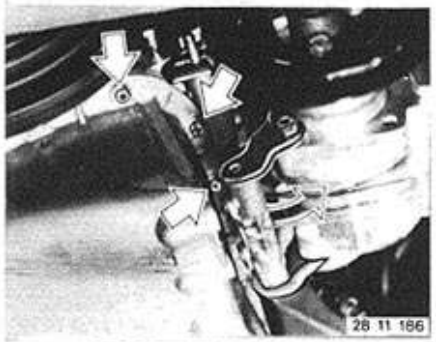
Unscrew both engine mounts.
Disconnect wire (8).
Installation:
Tightening torque*.



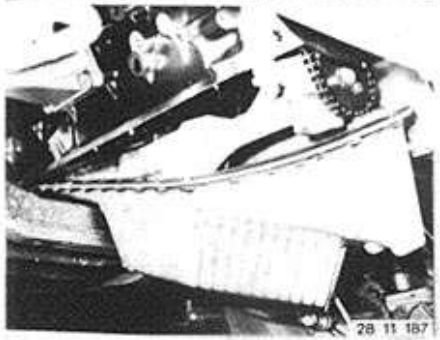
Disconnect water hose (2) and apply Special Tool 11 0 020.
Lift engine.

** See Service Information of Gr. 00

* See Specifications

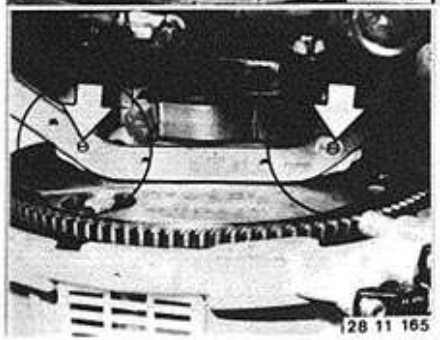


Swing out the console and tie down.
Unscrew remaining oil pan bolts.



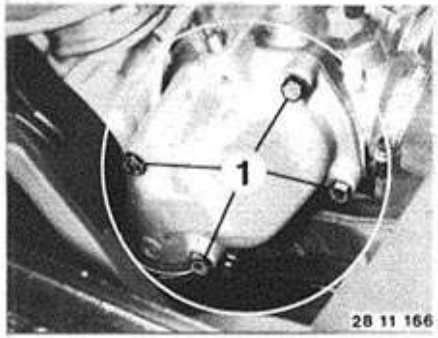
Turn connecting rods of cylinders 5 and 6 to the highest position and remove oil pan.

Installation:
Clean sealing surfaces.
Replace oil pan gasket.
Coat joint surfaces on timing case cover and



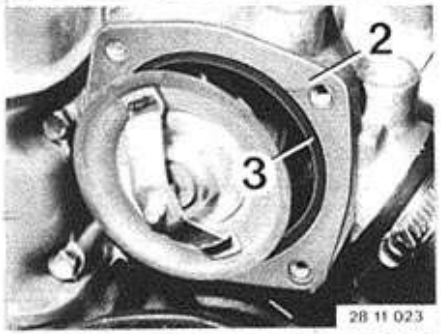
end cover with a brush-on universal sealing compound**

** Source: HWB

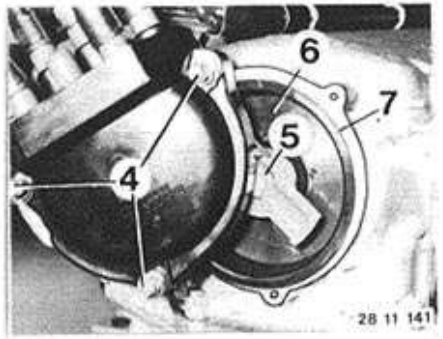


11 14 100 REMOVING AND INSTALLING/ SEALING UPPER TIMING CASE COVER

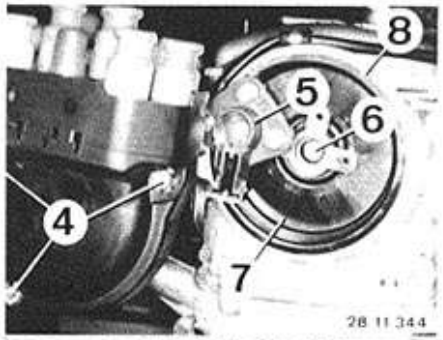
Remove cylinder head cover 11 12 000.
Drain coolant partially.
Installation:
Bleed cooling system 17 00 039.
Unscrew cover (1) on thermostat housing.



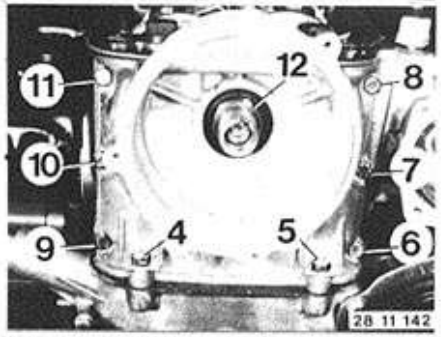
Installation:
Replace gasket (2) and seal (3).
Clamp on thermostat faces out.
From model '86 on:
new Thermostat, with gasket on cover, see 11 53 000.



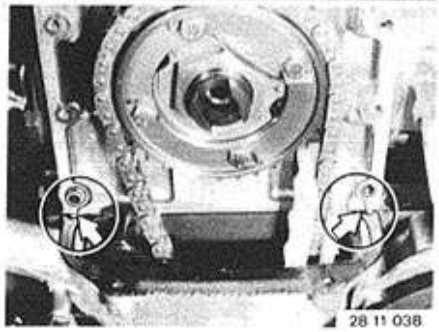
For DME with Inserted Distributor Arm:
Take off distributor cap (4).
Pull off distributor arm (5) and remove cover (6).
Installation:
Check rubber ring (7).



For DME with Screwed Distributor Arm:
Take off distributor cap (4).
Unscrew distributor arm (5).
Unscrew adapter (6) and remove cover (7).
Installation:
Check rubber ring (8).
Place seal on screw (6) and install screw with a bolt cement**
Tightening torque*

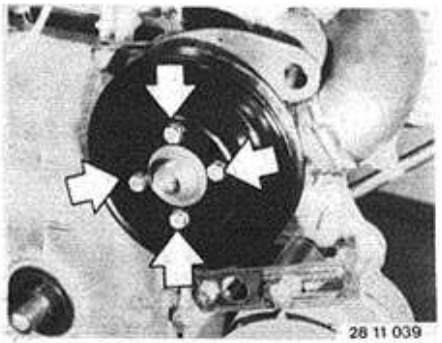


Unscrew timing case cover.
Installation:
Tighten screws (4 and 5) finger tight.
Now tighten screws (6 ... 11) (8 and 9 are longer).
If applicable, replace damaged cylinder head gasket – see 11 12 000.
Check that radial oil seal fits correctly on the distributor rotor adapter (12).



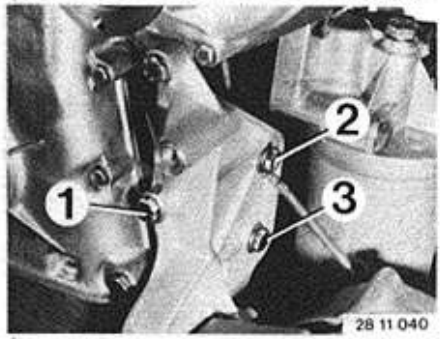
Important!
Coat bores with a brush-on universal sealing compound/Three Bond Silicone 1207** prior to installation of the timing case cover.

* See Specifications
** Source: HWB

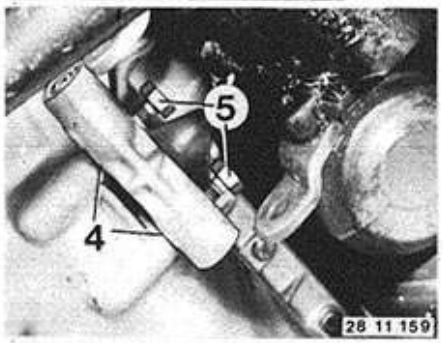


11 14 120 REMOVING AND INSTALLING/ SEALING LOWER TIMING CASE COVER

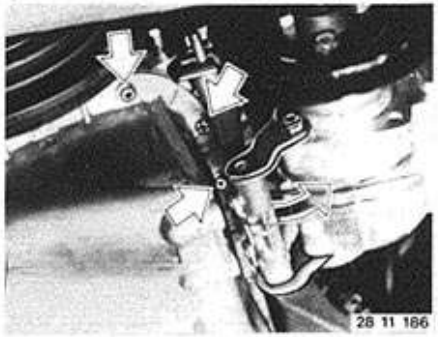
Remove fan 11 52 000.
Remove vibration damper with hub 11 23 000.
Remove upper timing case cover 11 14 100.
Remove chain tensioner piston 11 31 090.
Unscrew water pump pulley.



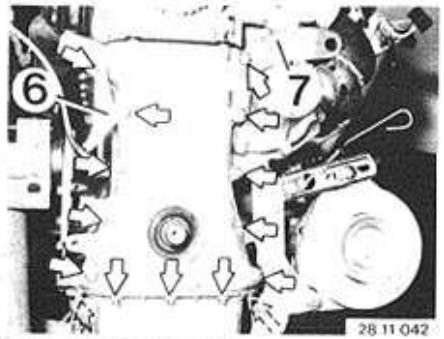
Unscrew and swing alternator aside.
Unscrew bolt (1).
Loosen bolts (2 and 3).



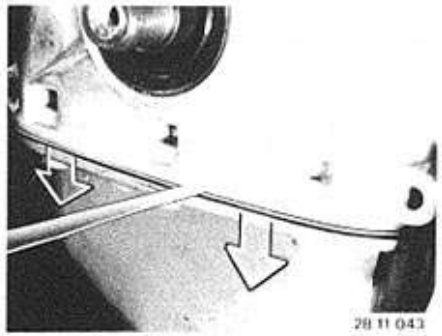
Unscrew power steering pump and remove bolts (5).
Installation:
Do not tension console while installing – use spacers (4), see 32 41 131.



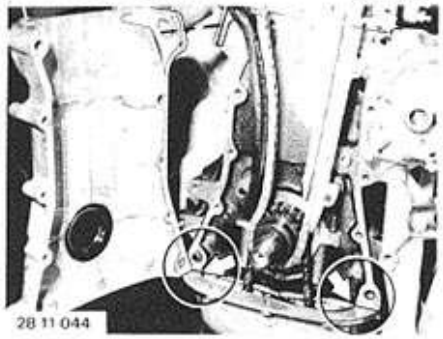
Swing away and tie down console.
Unscrew oil pan bolts.



Unscrew bolts on timing case cover and oil pan.
Only loosen other oil pan bolts.
Installation:
Mount TDC transmitter (6) and suspension eye (7).
Check length of bolts.

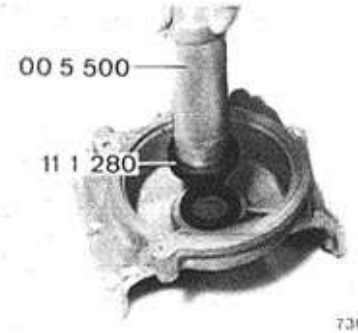


Pry oil pan gasket off of timing case cover carefully with a knife.
If oil pan gasket is damaged, remove oil pan 11 13 000.



Take off timing case cover.
Installation:
Coat mating surfaces between oil pan and crankcase with a brush-on universal sealing compound/Three Bond Silicone 1207**.
Important!
Take-up for tensioner piston must be in oil pocket.

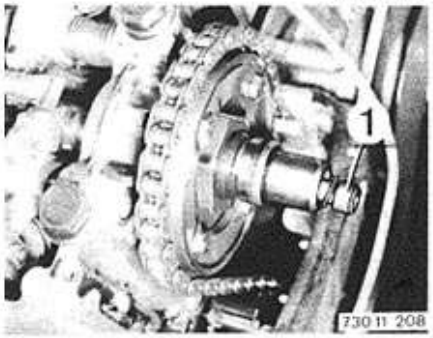
** Source: HWB



730 11 207

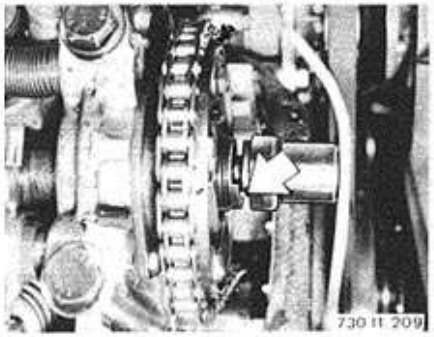
11 14 131 REPLACING RADIAL OIL SEAL IN UPPER TIMING CASE COVER

Remove upper timing case cover 11 14 100.
Lift out radial oil seal.
Drive in new radial oil seal with Special Tools 11 1 280 and 00 5 500.
Lubricate sealing lip with oil.

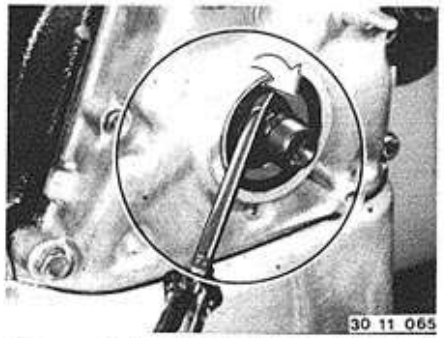


730 11 208

If distributor rotor adapter is scored, unscrew bolt (1) and replace adapter.
Installation:
Fit bolt (1) with a seal and install bolt with a bolt cement**.
Tightening torque*.

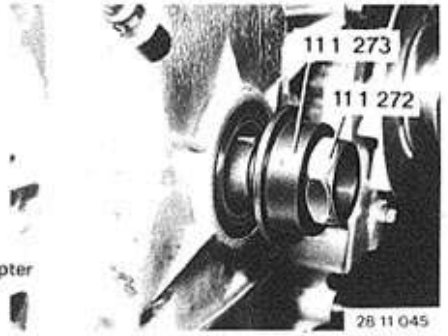

730 11 209

Installation:
When installing the distributor rotor adapter, make sure that machined surfaces mesh with each other.


30 11 065

11 14 141 REPLACING RADIAL OIL SEAL IN LOWER TIMING CASE COVER

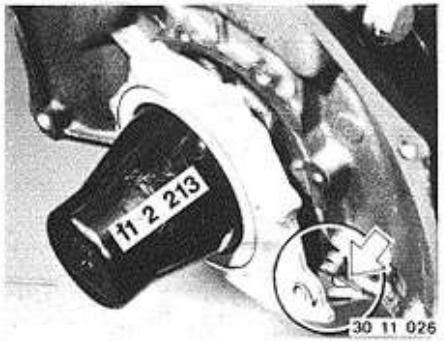
Remove vibration damper with hub 11 23 000.
Lift out radial oil seal with a screwdriver.



28 11 045

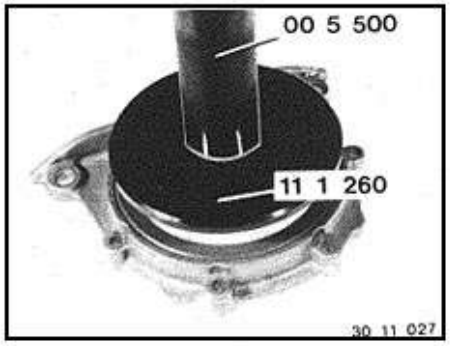
Lubricate sealing lip of radial oil seal with oil.
Press in radial oil seal with Special Tools 11 1 273 and 11 1 272.

* See Specifications
** Source: HWB



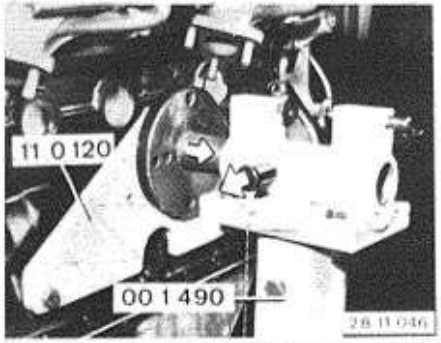
11 14 605 REPLACING RADIAL OIL SEAL IN CLUTCH END COVER
– Transmission Removed –

Remove flywheel 11 22 000.
Drain engine oil.
Loosen oil pan.
Pry off gasket carefully with a knife in area of end cover/oil pan joint.
Take off end cover.
Replace gasket.
If oil pan gasket was damaged, remove oil pan 11 13 000.
Installation:
Coat end cover/oil pan joint with a brush-on universal sealing compound/Three Bond Silicone 1207**.
Use Special Tool 11 2 213 to avoid damaging the radial oil seal.



Press in radial oil seal with Special Tools 11 1 260 and 00 5 500.
Press in new radial oil seal approx. 1 to 2 mm (0.039 to 0.079"), in contradiction to the standard radial oil seal which had been pressed in flush.
Lubricate sealing lip with oil.

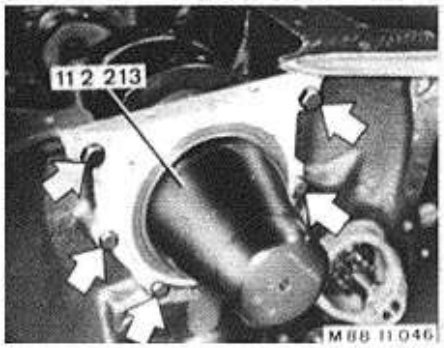
** Source: HWB



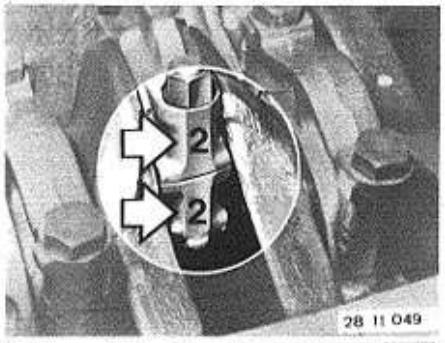
11 21 000 REMOVING AND INSTALLING CRANKSHAFT

Remove engine 11 00 050.
Unscrew right engine mount console.
Mount crankcase on Special Tool 00 1 490 with help of Special Tool 11 0 120.

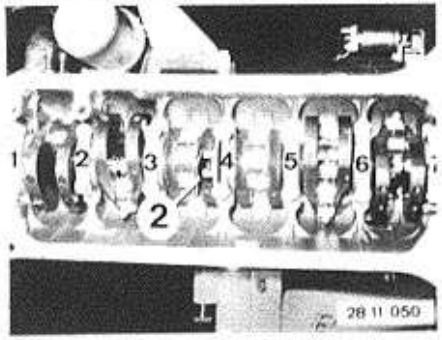
Remove clutch 21 21 000.
Remove cylinder head 11 12 100.
Remove timing chain 11 31 051.
Remove oil pump 11 41 000.
Check axial play* before removing the crankshaft.
Check or replace thrust bearing, if max. permissible play is exceeded.



Remove flywheel 11 22 000.
Unscrew end cover.
Installation:
Replace gasket.
Use Special Tool 11 2 213 to avoid damaging the radial oil seal.
Cut off gasket on oil pan sealing surface.



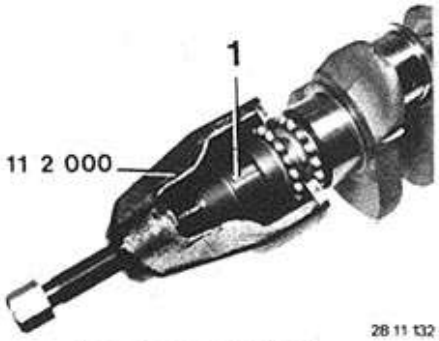
Mark position of conrod bearing caps to connecting rods and unscrew.
Installation:
Replace conrod bearings and measure conrod bearing play – see 11 24 571.



Remove crankshaft bearing caps and lift out crankshaft.
Installation:
Bearing cap no. 1 is on sprocket end.
Also mount oil pump console (2) with thrust bearing cap (4).
Install bearing shells and check bearing play – see 11 21 531.
Installation:
Measure axial play with crankshaft installed – unscrew thrust bearing cap no. 4 again.
Center thrust bearing by applying knocks from a plastic hammer on the rear and front ends of the crankshaft.
Tighten thrust bearing cap to specifications.
Measure axial play*.
If crankcase is replaced, clean oil and water bores thoroughly to remove casting sand.

* See Specifications

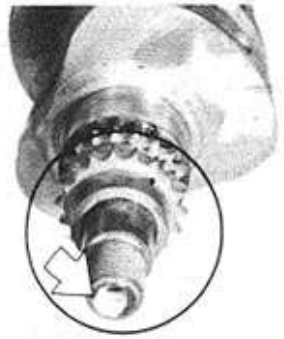
* See Specifications



28 11 132

11 21 501 REPLACING CRANKSHAFT
– Crankshaft Removed –

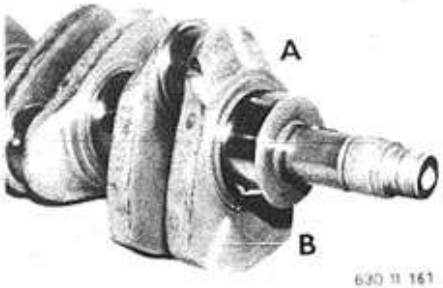
Take out woodruff key (1).
Pull off sprocket with Special Tool 11 2 000.
Installation:
Heat sprocket to max. 200° C (390° F) for installation.



28 11 133

Identification of Crankshafts:

Engine	Throw (mm)	Paint Dot or Code in Center	
M 30 B 32	86.0	blue	K
M 30 B 34	86.0	blue	K



630 11 161

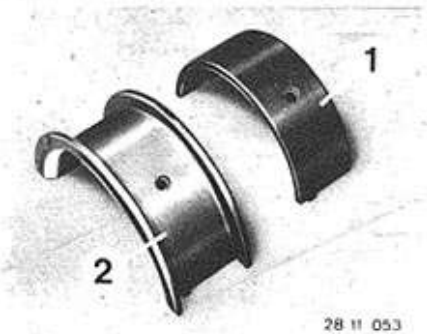
Reground crankshafts are marked with stripes of paint.
Check machined sizes!

Connecting Rod Bearing Journal (A):
1 paint stripe size 1*
2 paint stripes size 2*
3 paint stripes size 3*

Main Bearing Journal (B):
1 paint stripe size 1*
2 paint stripes size 2*
3 paint stripes size 3*

Important!
Crankshafts are surface treated and may only be reground in the plant.
Crankshafts are supplied with corresponding bearing shells.
Install bearing shells and check bearing play, see 11 21 531.
Install pilot bearing for cars with manual transmission, see 11 21 571.

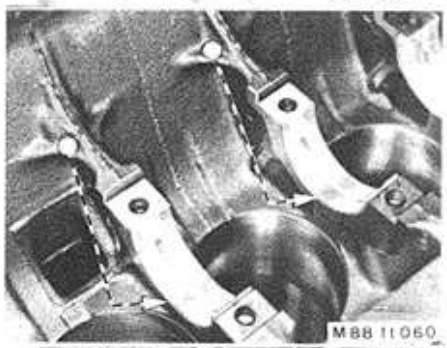
* See Specifications



28 11 053

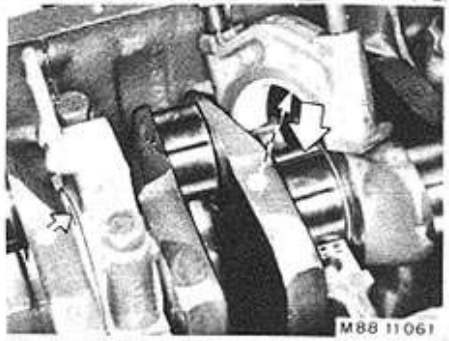
11 21 531 REPLACING CRANKSHAFT MAIN BEARING SHELLS
– Engine Disassembled –

Bearing shells are marked with color codes.
Double classification: red / blue.
Triple classification: yellow / green / white.
1 = Bearing shell 1 2 3 5 6 7
2 = Bearing shell 4 (thrust bearing)
Check machined size (main bearing diameter).



M88 11 060

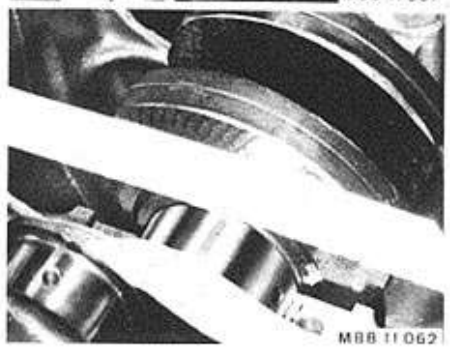
Bearing shells are installed in crankcase according to color code of crankcase.
If color code has been washed off of the crankcase, both shells are installed according to the crankshaft color code.
Install crankshaft.



M88 11 061

Bearing shells are installed in bearing caps according to color code of the crankshaft.
Only Double Classification:
If red and blue bearing shells are required on one bearing journal, bearing shells must be installed that all shells of same color on all bearing journals are in one plane (down or up).
Place Plastigage (Type PG-1) on crankshaft wiped clean of oil and bolt down bearing caps to specified torque*.
Don't turn the crankshaft.

Source for Plastigage:
Cartool
Alfred-Brehm-Str. 5
D–8070 Ingolstadt

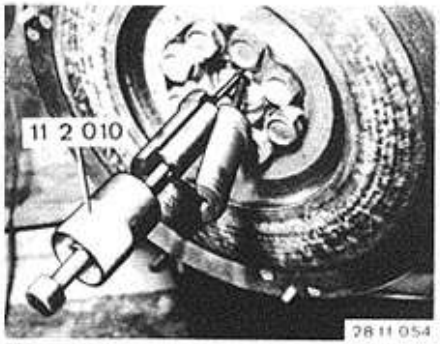


M88 11 062

Take off bearing caps.
Read bearing play* from width of flattened Plastigage with help of supplied scale.
Correct bearing play by installing new bearing shells, bearing shells of different machined size or with different color codes.

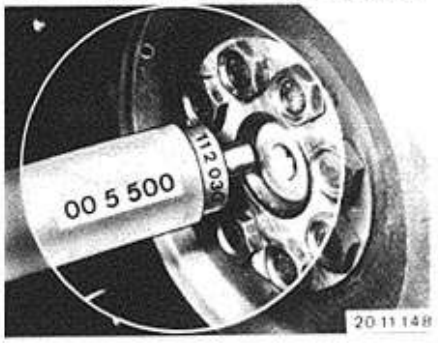
* See Specifications

11 21 571 REPLACING PILOT BEARING IN CRANKSHAFT

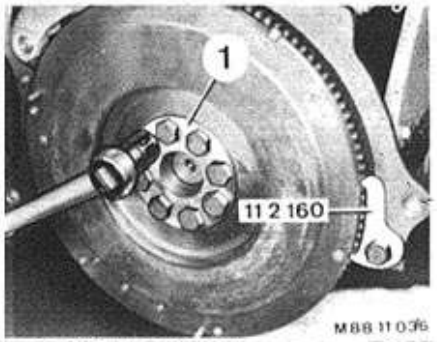


Remove clutch disc 21 21 000.
Pull out ball bearing with Special Tool 11 2 010.
Cars with Automatic Transmission:
Pull out adapter sleeve with Special Tool 11 2 020.

Installed Order:
Ball bearing (1), cover (2), felt ring (3) and capsule (4).
Insert cover (2) with embossment facing out.

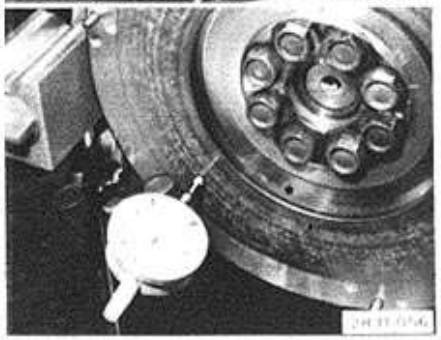


Pack bore in crankshaft with appröx. 1 gram of lubricating grease.
Drive in pilot bearing with Special Tools 11 2 030 and 00 5 500.



11 22 000 REMOVING AND INSTALLING FLYWHEEL

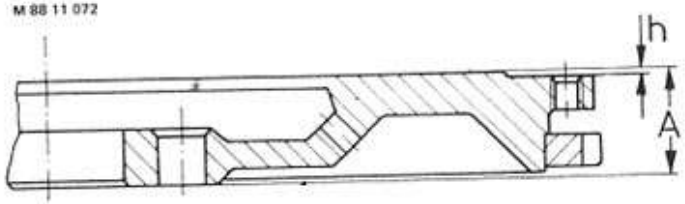
Remove clutch disc 21 21 000.
Hold flywheel with Special Tool 11 2 160.
Unscrew bolts and take off flywheel.
Installation:
Clean tapped bores.
Insert ring (1).
Replace and install expansion bolts with Loctite No. 270**
Tightening torque*



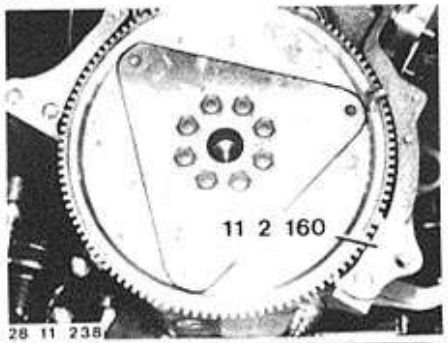
Check axial runout* of flywheel.

Friction surface may be machined to minimum thickness A*.
If machining the friction surface reduces distance "h" to zero, the flange surface distance "h" has to be machined.

M 88 11 072



* See Specifications
** Source: HWB

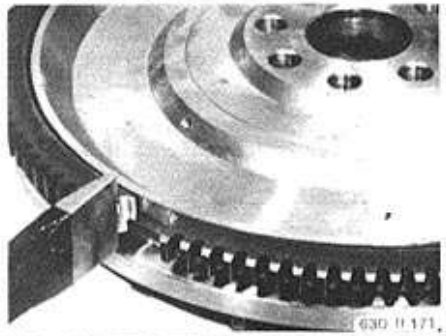


11 22 051 REPLACING TORQUE CONVERTER DRIVE PLATE

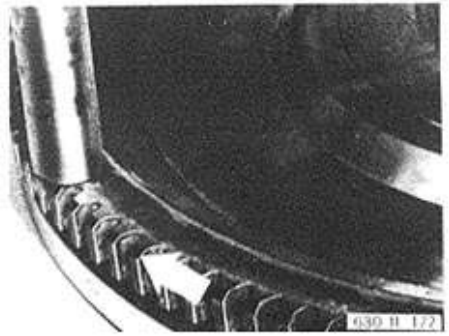
Remove transmission – see Group 24.
Hold flywheel with Special Tool 11 2 160.
Unscrew bolts and take off flywheel.
Installation:
Clean tapped bores.
Replace and install expansion bolts with Loctite No. 270**
Tightening torque*.

11 22 541 REPLACING STARTER GEAR RING

Drill a 6 mm (0.236") dia. hole about 8 mm (0.315") deep below a tooth gap, to make breaking the gear ring easier.

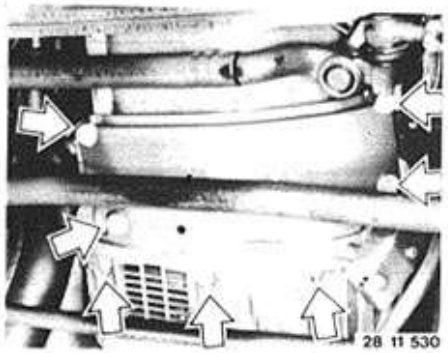


Break gear ring at drilled point with a chisel.



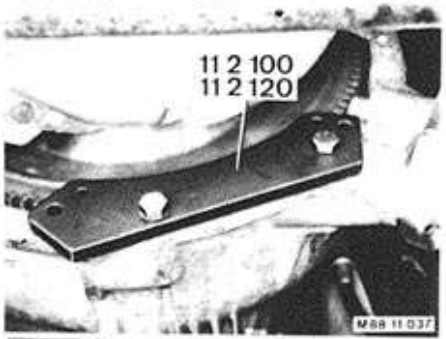
Installation:
Heat new gear ring to 200 ... 230° C (390 ... 445° F).
Check temperature with a thermochrome pencil.
Tooth bevelled surface faces engine end.
Install starter gear ring to fit snugly with a brass mandrel.

* See Specifications
** Source: HWB

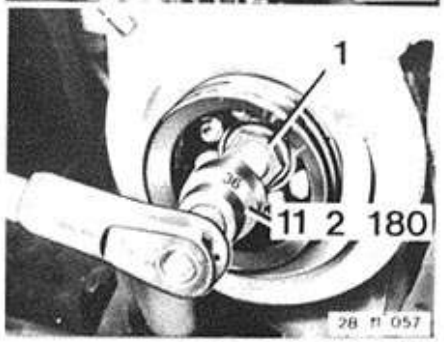


11 23 000 REMOVING AND INSTALLING VIBRATION DAMPER WITH HUB

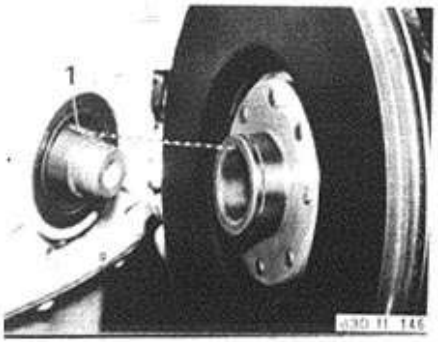
Unscrew reinforcement plate.



Hold flywheel with Special Tool 11 2 100/ 11 2 120.
Remove fan 11 52 000.

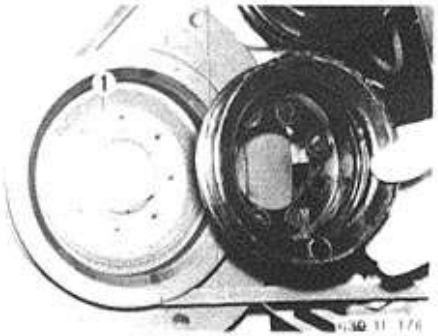


Take off drive belts on alternator, power steering pump and, if applicable, compressor for air conditioner.
Unscrew nut (1) with Special Tool 11 2 180.
Installation:
Tightening torque*.
Tighten drive belts and check tightness with Special Tool 11 5 020.



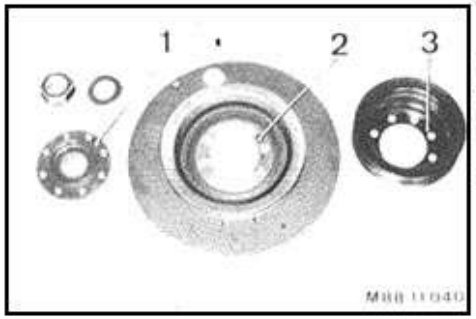
Pull off vibration damper with hub.
Important!
Make sure key (1) is installed in correct position.
Check seal, replacing if necessary.
Installation:
If hub is scored seriously, install seal that its lip makes contact in front of or behind the scored groove.

* See Specifications



11 23 010 REPLACING VIBRATION DAMPER

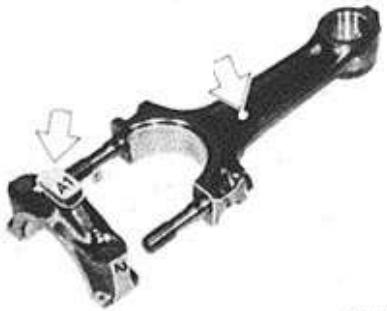
Take off drive belts on alternator, power steering pump and, if applicable, compressor for air conditioner.
Unscrew pulley and take off vibration damper.
Installation:
Centering pin (1) must be in bore of vibration damper.
Tightening torque*.
Tighten drive belts and check tightness with Special Tool 11 5 020.



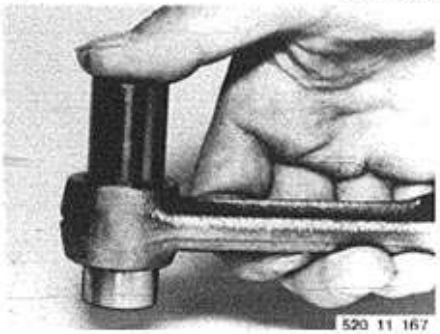
11 23 031 REPLACING HUB FOR VIBRATION DAMPER

Remove vibration damper with hub 11 23 000.
Unscrew pulley and take off vibration damper.
Installation / Arrangement:
– Dowel pin (1) with bore (2).
– Bore (3) with bore (2).
Tightening torque*.

* See Specifications



28 11 275

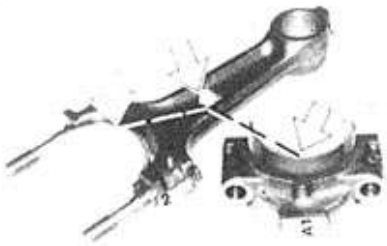


520 11 167

11 24 521 REPLACING CONNECTING RODS – PISTONS REMOVED –

Important!
Only install connecting rods of same weight class in one engine.
Weight class is stamped in the machined conrod bearing cap surface or indicated by a color code.
Machining of connecting rods is not approved.

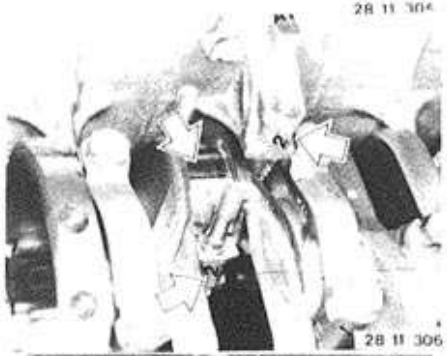
Piston pin must slide through connecting rod bushing under light pressure.
Install connecting rod bearing shells, see 11 24 571.



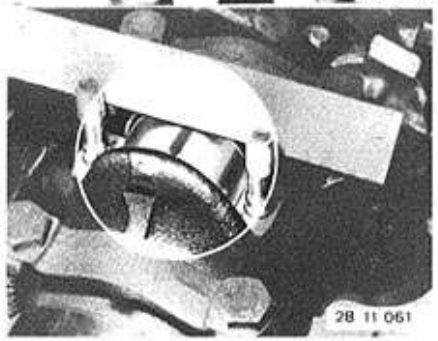
11 24 571 REPLACING CONNECTING ROD BEARING SHELLS – ENGINE DISASSEMBLED –

Install bearing shells in connecting rods and bearing caps.
Double Classification:
Install red or blue conrod bearing shells according to color code on connecting rod.
Important!
Check machined size (connecting rod bearing diameter).

28 11 304



28 11 306

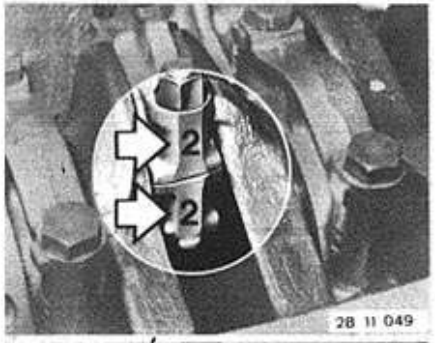


28 11 061

In BDC position place Plastigage Type PG 1 on crankshaft wiped clean of oil.
Connecting rods and bearing caps are marked with the same pair number (0 — 99).
All pair number codes must be on the same side in one engine.
Mount connecting rod bearing caps.
Tightening torque*.
Source for Plastigage:
Cartool
Alfred-Brehm-Str. 5
D–8070 Ingolstadt/West Germany

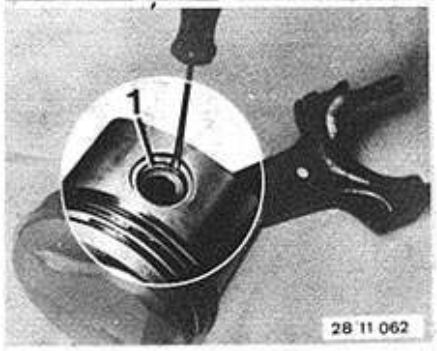
Important!
Don't turn connecting rods or crankshaft.
Remove bearing caps.
Check bearing play* by measuring width of flattened Plastigage with the supplied scale.
Correct bearing play by installing new bearing shells, bearing shells of different machined size or with different color codes.
Use new conrod bolts for final installation and mount conrod bearing caps.
Tightening torque*.

* See Specifications



11 25 000 REMOVING AND INSTALLING PISTON

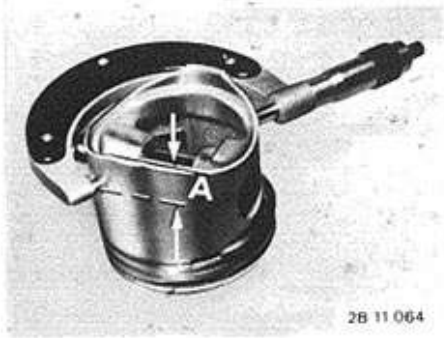
Remove engine.
Take off cylinder head, oil pan and oil pump.
Remove connecting rod bearing cap and press out piston with connecting rod upwards.
Important!
Mark installed position of connecting rod to crankshaft, if conrod bearing shells do not have to be replaced.



Remove circlip (1).
Press out piston pin.
Installation:
Piston pins and pistons are matched and must not be mixed up.
Install connecting rod, see 11 24 521.
Only install pistons of same make and same weight class.
Weight class is stamped with "+" or "–" in piston crown.

Important!
Check machined size (piston diameter)*
Identification:

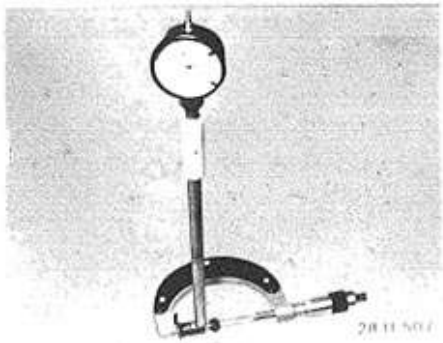
Engine	E*	Piston Cup (mm)	Dia. (mm)
M 30 B 32	8.8	0 (flat piston)	89
M 30 B 34	8.0	5.3	92



Check piston installed clearance*.

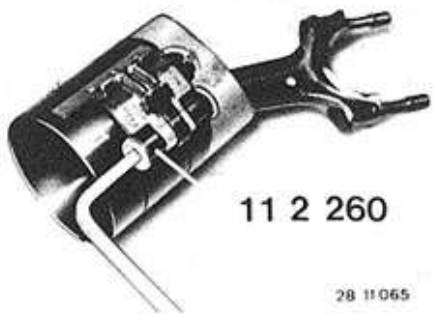
Engine	Make	Checkpoint A mm (in.)
M 30 B 32	Mahle	26.00 (1.024)
	KS	33.95 (1.337)
M 30 B 34	Mahle	14.00 (0.551)

* See Specifications
*** AUS/CH/S

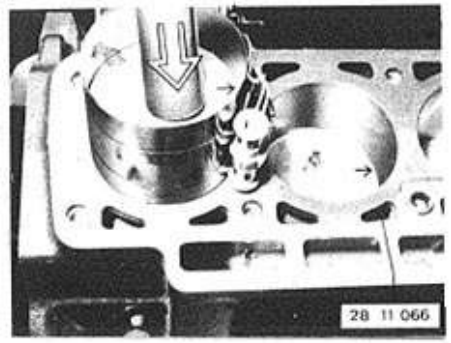


Set internal calipers to zero on micrometer with the measured piston diameter.

Measure cylinder bore with internal calipers at bottom, center and top in forward and rotational directions.
Check piston installed clearance*.



Lubricate piston and piston rings with oil.
Offset piston ring end gaps by 120°.
Compress piston rings with Special Tool 11 2 260.



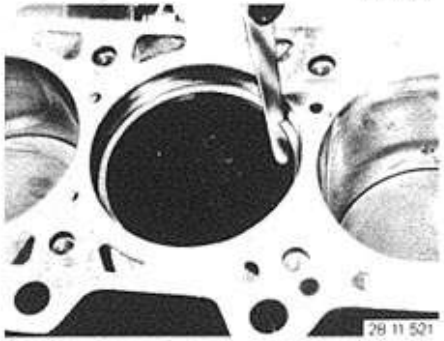
Install piston that arrow faces timing chain.

* See Specifications

11 25 651 REPLACING PISTON RINGS OF ONE PISTON – PISTON REMOVED –

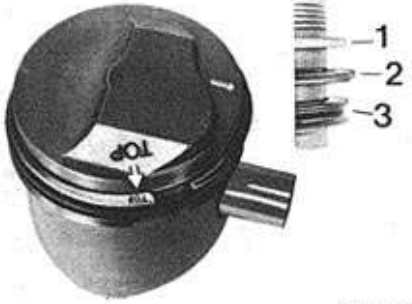
28 11 135

Measure side clearance* of piston rings.



28 11 521

Remove piston rings and measure end clearance*.

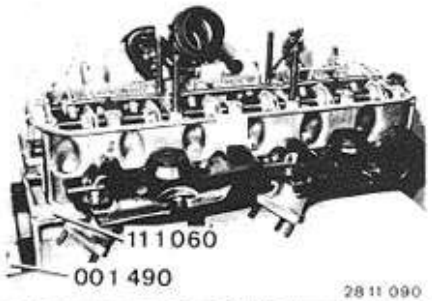


28 11 068

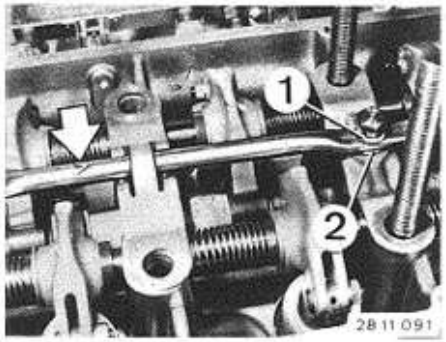
Installation:
Install piston rings that word "TOP" faces piston crown.
1 Plain compression ring
2 Tapered face ring
3 Oil scraper ring

* See Specifications

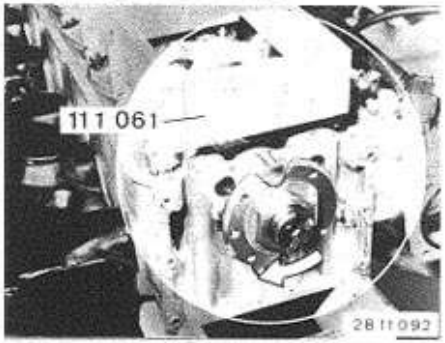
11 31 000 REMOVING AND INSTALLING CAMSHAFT –CYL. HEAD REMOVED–



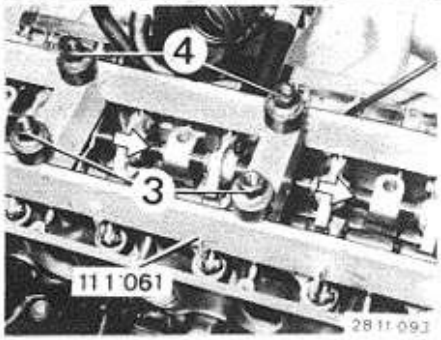
Mount Special Tool 11 1 060 on Special Tool 00 1 490.
Mount cylinder head on special tool assembly.



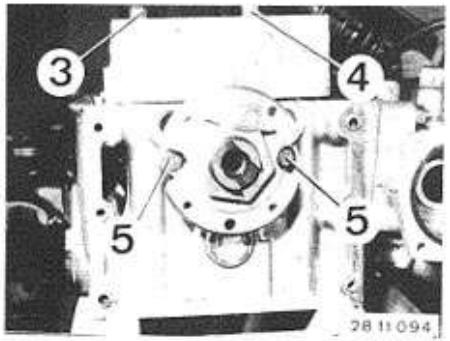
Unscrew oil line.
Installation:
Replace seals (1 and 2).
Mount oil line that arrow faces forward.
Tightening torque*.



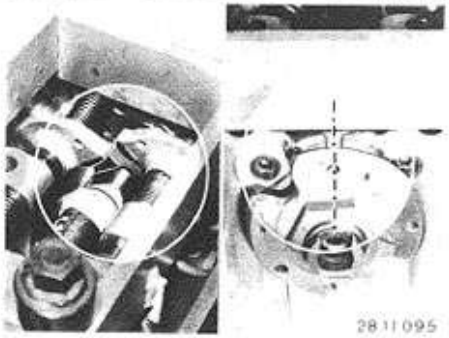
Adjust valve clearance of all valves to the greatest value.
Turn camshaft approx. 15° and mount Special Tool 11 1 061.



Push rocker arms of cylinders 2 and 4 (intake) forward and align special tool in such a manner that tabs rest on eccentrics of rocker arms.
Important!
To avoid contact between valve heads, first tighten nuts (3) on exhaust side to stop and then tighten nuts (4) on intake side slightly. Procedures are inversed when taking off the special tool.



Unscrew bolts (5).
Pull out camshaft.
Important!
If nuts (4) on the intake side have to be retightened, make sure that contact between valve heads is avoided.

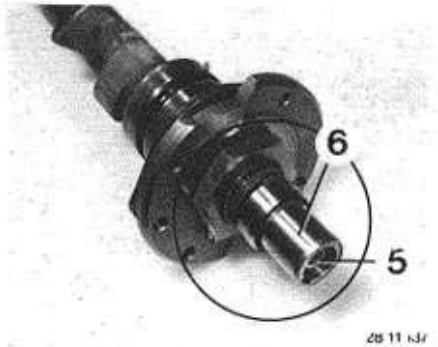


Installation:
It must be possible to turn the camshaft easily after installation of the guide plate.
Set valves of cylinder no. 6 to overlap before releasing the special tool.
Tapped bore in flange must be aligned with the cast boss.
Installation:
Adjust valve clearance 11 34 004.

Important!
Install a hexagon nut with a drive pin** as a service sector solution for a camshaft with a damaged drive pin.

* See Specifications

** See Service Information of Gr. 11



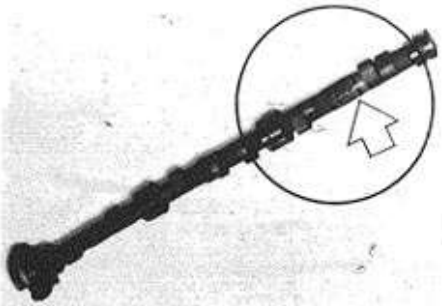
28 11 137

11 31 001 REPLACING CAMSHAFT
– Camshaft Removed –

Cars with Plugged Distributor Rotor:
Unscrew bolt (5) and take off adapter (6).
Installation:
Make sure milled surfaces engage with each other when installing adapter.
Place seal on bolt (5) and screw in bolt with Loctite No. 270**.
Tightening torque*.

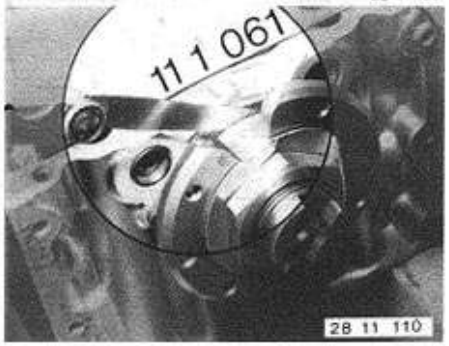
28 11 143

Transfer flange for sprocket.
Guide plate (1)
Flange (2)
Lockplate (3)
Nut (4)
Tightening torque*.


28 11 138

Camshaft Identification:

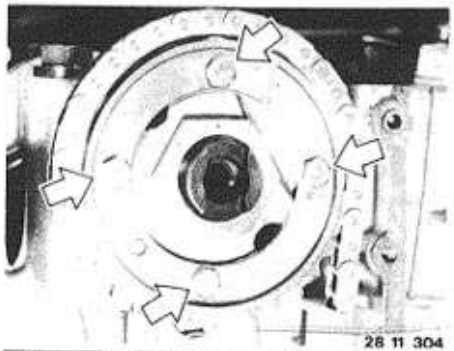
Engine	Degrees		Code
M 30 B 32	260		H
		since 5.83:	L
M 30 B 34	260		M



28 11 110

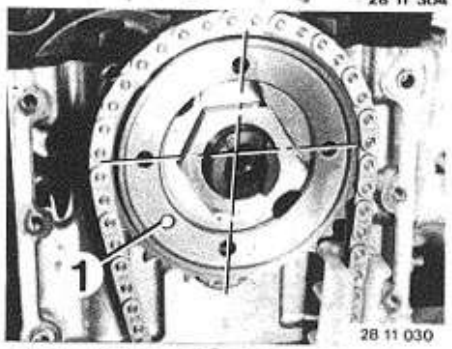
Installation:
Check axial play* of camshaft, replacing guide plate if necessary.

* See Specifications
** Source: HWB


28 11 304

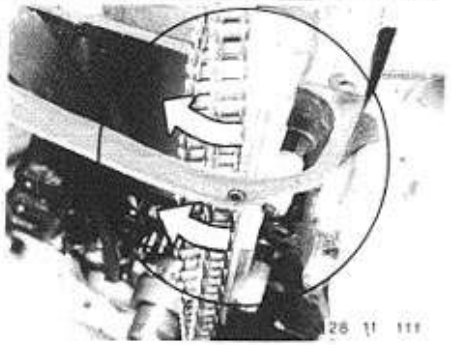
11 31 051 REPLACING TIMING CHAIN

Remove upper timing case cover 11 14 100.
Remove lower timing case cover 11 14 120.
Set cylinder no. 1 to TDC.
Take off sprocket.
Caution!
Don't run engine after removing timing chain.
Lockplates can be omitted.



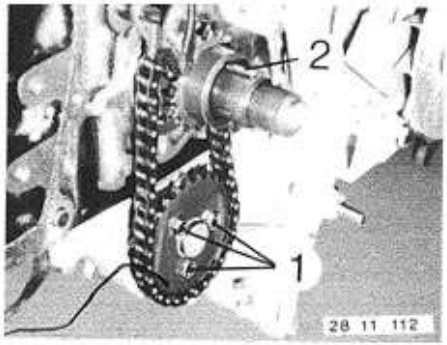
28 11 030

Installation:
Install chain that dowel pin (1) is at bottom left when tapped bores are perpendicular to the engine.
Cylinder no. 1 must be at TDC.
Tightening torque*.


28 11 111

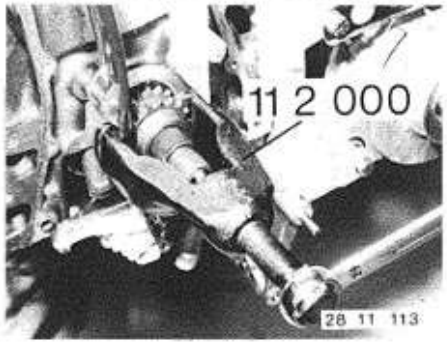
Remove timing chain from bottom sprocket and guide it out of guiding rail carefully.
Note:
Timing chains are pre-stretched.

* See Specifications

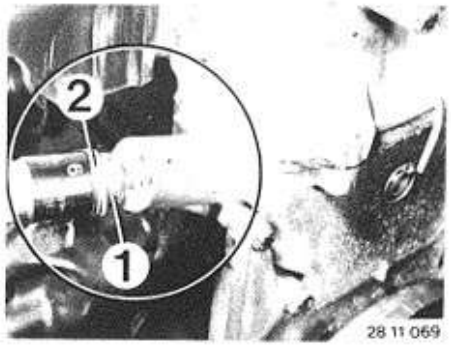


11 31 061 REPLACING SPROCKET SET
–TIMING CHAIN REMOVED–

Remove oil pan 11 13 000.
Unscrew sprocket (1) on oil pump.
Take off chain.
Lift out woodruff key (2).



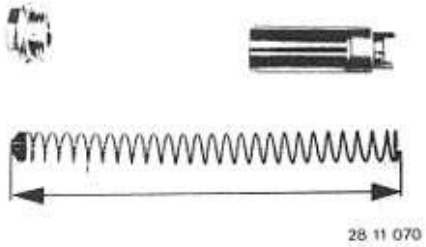
Pull off sprocket with Special Tool 11 2 000.
Installation:
Heat sprocket to max. 200° C (392° F) for installation.
Tighten oil pump chain, see 11 41 000.

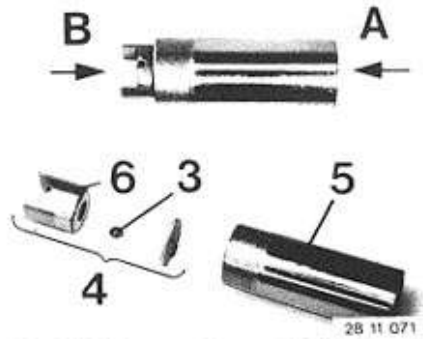


11 31 090 REMOVING AND INSTALLING
CHAIN TENSIONER PISTON

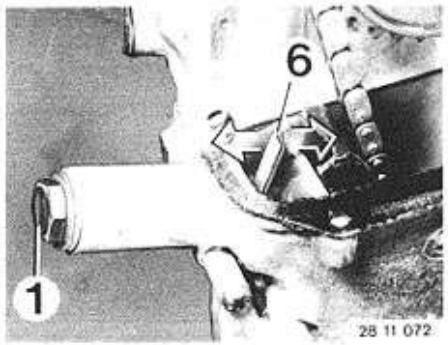
Unscrew plug (1).
Caution!
Strong spring force.
Remove spring and piston.
Installation:
Replace seal (2).

Installation:
Check spring length*.
Tapered end of spring faces plug.



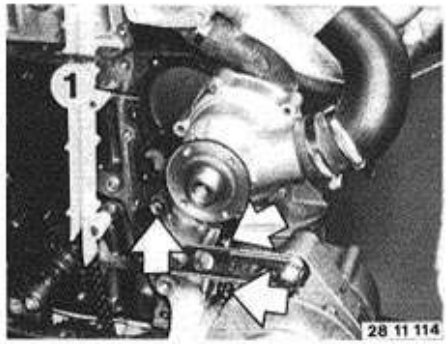


Checking Piston:
Shake to check whether ball (3) moves easily.
Check operation of valve by blowing in air.
– in direction A = closed
– in direction B = open
If necessary, drive out and clean valve (4) in sleeve (5).
Are vent slots (6) clogged?



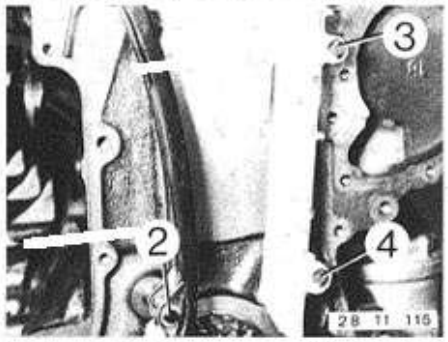
Remove cylinder head cover (see 11 12 000) to bleed the piston.
Loosen plug (1) and move tensioning rail (6) back and forth until oil escapes past plug (1) and resistance is noticed.
Causes for Unusual Chain Noise:
a) Piston bled insufficiently
b) Piston seized
c) Vent slots clogged
d) Ball valve in piston not working
e) Spring force excessive or insufficient

* See Specifications

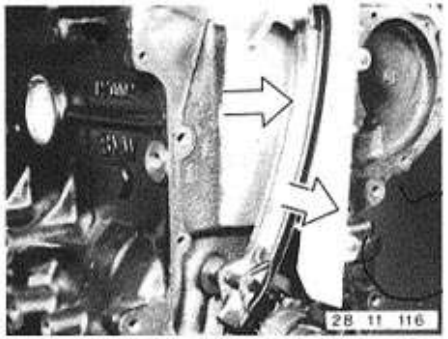


11 31 601 REPLACING TENSIONING RAIL/GUIDE RAIL
–TIMING CHAIN REMOVED–

Unscrew water pump and console.
Installation:
Replace gasket (1).

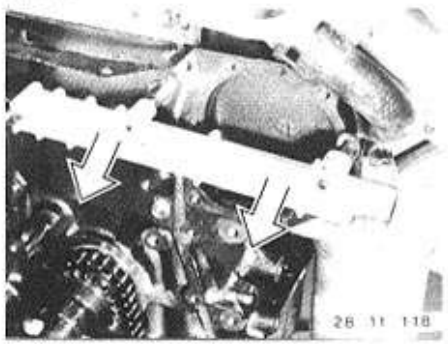


Remove lock washers (2 — 4).

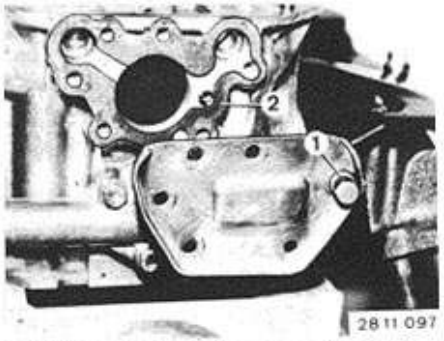


Swing in and remove tensioning rail.

Unscrew bottom bearing bolt (5) and swing the guide rail aside.

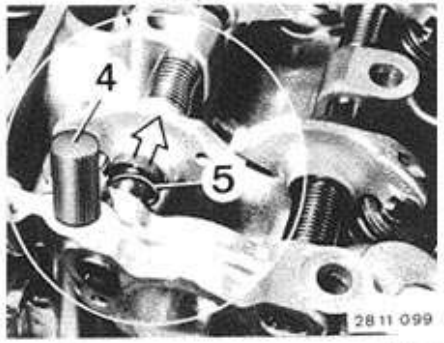


Pull off guide rail.

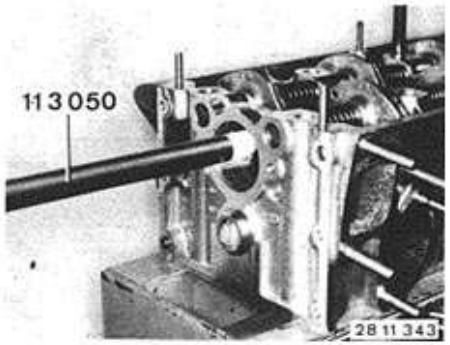


11 33 020 REMOVING AND INSTALLING ROCKER ARM SHAFTS

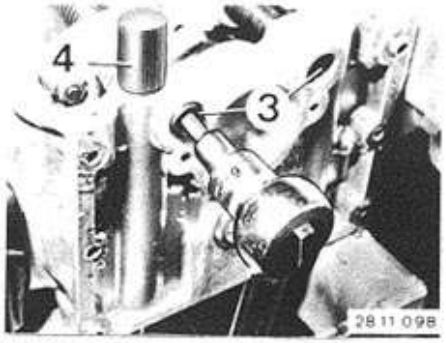
Remove camshaft 11 31 000.
Unscrew end cover.
Installation:
Replace seal (1) and gasket (2).



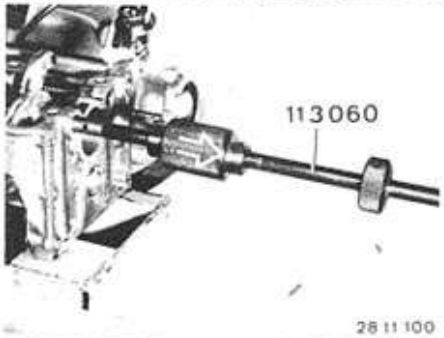
Push back rocker arms and thrust rings.
Lift out circlips (5).
Remove locating pin (4).



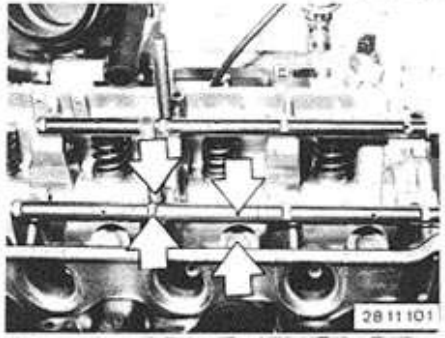
Rocker Arm Shafts with Welded Plugs:
Drive out rocker arm shafts with Special Tool 11 3 050.
Caution!
Springs pop out!



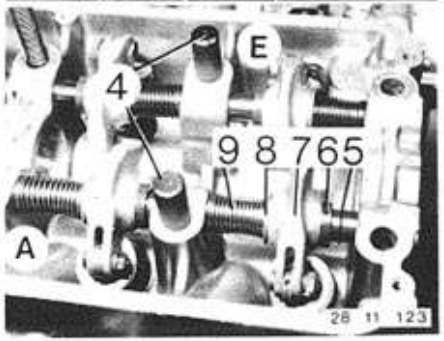
Rocker Arm Shafts with Screw-in Plugs:
Unscrew plugs (3).
If applicable, hold turning rocker arm shafts with locating pin (4).
Installation:
Screw in plugs (3) with Loctite 270**.



Screw Special Tool 11 3 060 in rocker arm shaft.
Drive out rocker arm shafts with the impact sleeve.
Caution!
Springs pop out!



Installation:
The longer rocker arm shafts belong on the sprocket end.
The openings face bores for cylinder head bolts.
Oil bores face valves.
Plug threads face out.



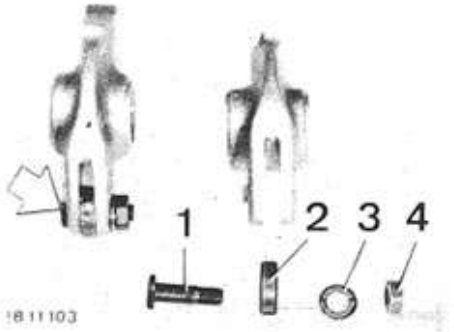
Installed Order:
spring (9), washer (8), rocker arm (7), thrust ring (6) and circlip (5).
A = Exhaust side
E = Intake side
Align rocker arm shafts that cylinder head bolts fit in openings.
Insert locating pins (4).
Important!
The new, shorter springs (9) could be installed mixed with the conventional long springs (9).

** Source: HWB

28 11 102

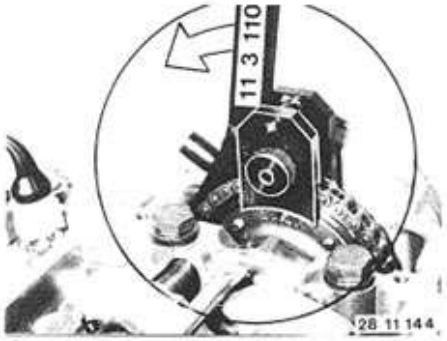
11 33 031 REPLACING ROCKER ARMS

Remove rocker arms 11 33 020.
Replace worn rocker arms or rocker arms with loose guides.
Loose guides will be noticed as excessively loud valve noise.



28 11 103

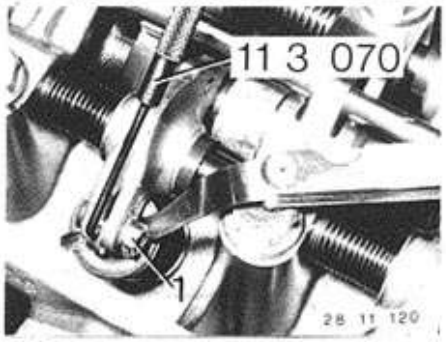
Transfer screw (1), eccentric (2), washer (3) and nut (4) to new rocker arm.
Replace worn eccentrics.
Important!
Screw and nut have M 6 x 0.75 fine threads.
Bore faces out and thick side down.
Bevelled surface of screw faces boss on the rocker arm.



28 11 144

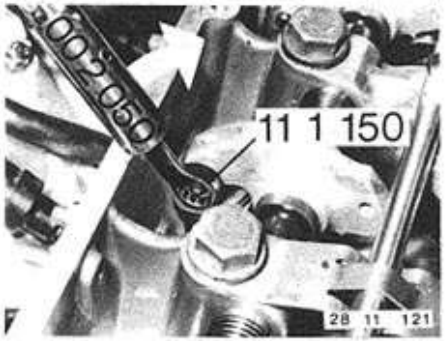
11 34 004 ADJUSTING VALVE CLEARANCE

Remove cylinder head cover 11 12 000.
Crank engine with Special Tool 11 3 110.



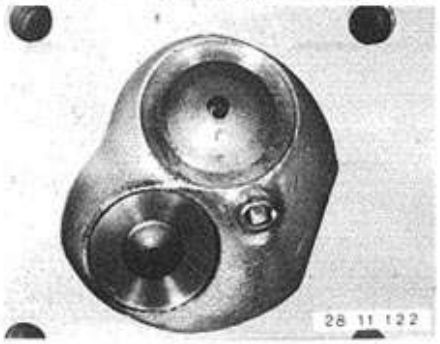
28 11 120

Adjusting order is same as the firing order (1 5 3 6 2 4) in compression top dead center (TDC).
Adjust valve clearance* between valve and eccentric after loosening nut (1).



28 11 121

Tighten nut (1) with Special Tools 11 1 150 and 00 2 050.
Tightening torque*.

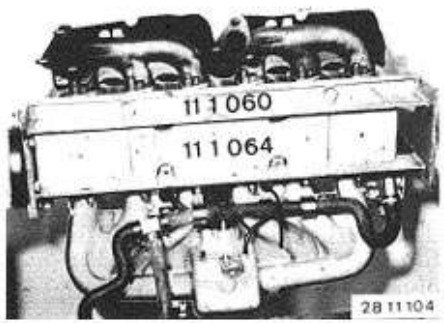


28 11 122

11 34 509 CHECKING ALL VALVES FOR LEAKS – CAMSHAFT REMOVED –

Spark plugs remain installed.
Fill combustion chamber with gasoline outdoors or indoors in compliance with safety regulations.
Check valve seats and valves, if gasoline runs past the valve heads.
Remove and install valves 11 34 550.
Machine valve seats 11 12 607.

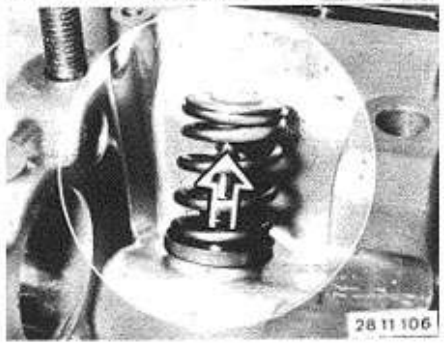
* See Specifications



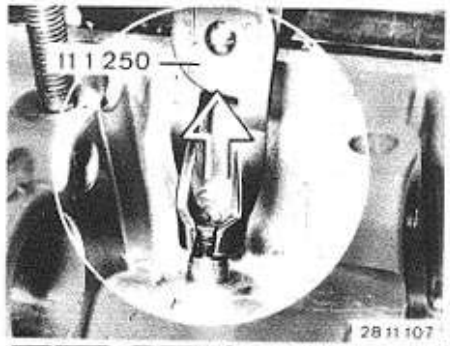
11 34 550 REMOVING AND INSTALLING VALVES
– Rocker Arm Shafts Removed –

Place Special Tool 11 1 064 (tray) in Special Tool 11 1 060.

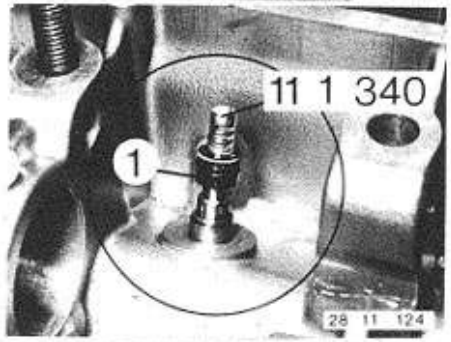
Press down valve springs with Special Tool 11 1 060 and remove valve collets.



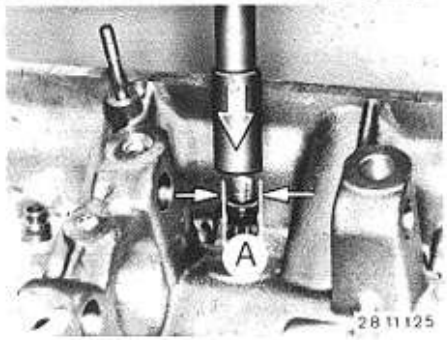
Take off upper spring retainer, valve springs and lower spring retainer.
Take tray out of special tool and pull out valve.
Installation:
Only install valve springs with same color code, wire gage size and length.
Lubricate valve guide and valve stem with oil.



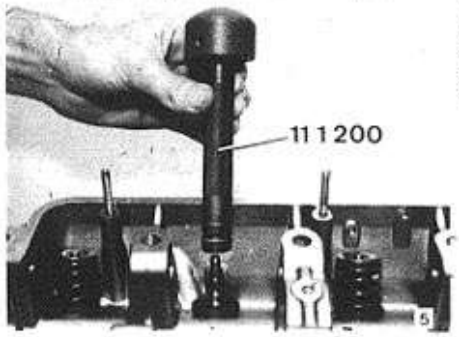
Pull off valve stem seal with Special Tool 11 1 250.



Insert valve.
Use Special Tool 11 1 340 to avoid damaging the valve stem seal.
Lubricate valve stem seal (1) with oil and install.
Source for Special Tool Sleeves:
Cartool
Alfred-Brehm-Str. 5
D–8070 Ingolstadt



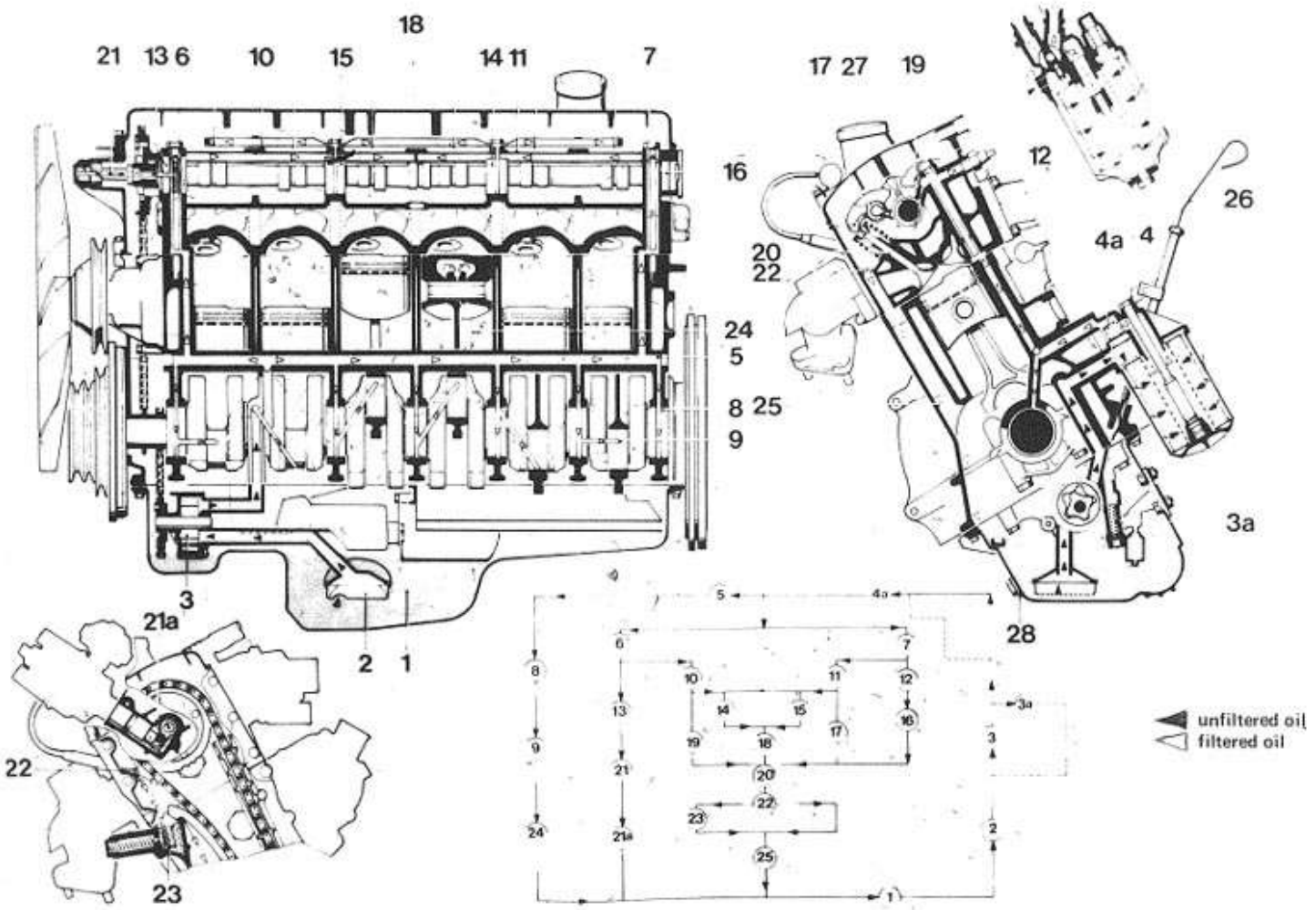
Press on valve stem seal against stop with Special Tool 11 1 090 for diameter A = 14 ± 0.2 mm (0.551 ± 0.008") or Special Tool 11 1 070 for diameter A = 14.3 ± 0.2 mm (0.563 ± 0.008").



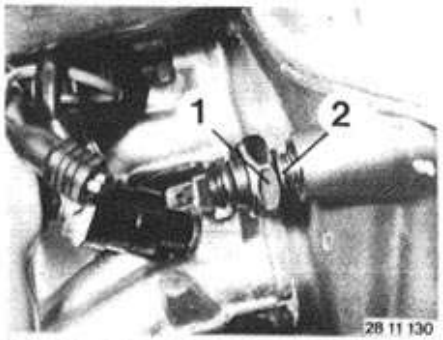
The new, improved valve stem seals (internal grooves) are pressed on by hand with help of Special Tool 11 1 200.
Special Tool 11 1 200 has two diameters for 7 mm (0.276")/8 mm (0.315") valve stem seals.

11-333

ENGINE OIL CIRCUIT

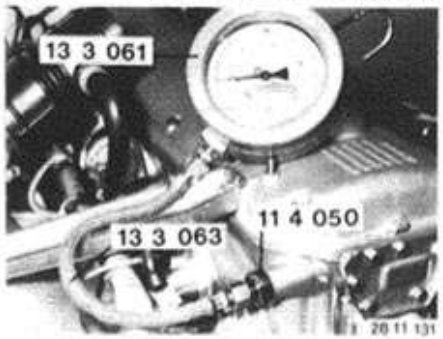


1 Oil pan
2 Intake with filter screen
3 Oil pump
3 a Pressure relief valve
4 Oil filter
4 a Safety valve (oil filter)
5 Main distribution bore
6 Oil bore in cylinder head, front
7 Oil bore in cylinder head, rear
8 Crankshaft bearing
9 Connecting rod bearing
10 Hollow rocker arm shaft, front
11 Hollow rocker arm shaft, rear
12 Transmitter for oil pressure indicator lamp
13 Front camshaft bearing
14 Camshaft bearing
15 Camshaft bearing
16 Rear camshaft bearing
17 Rocker arm bearing (exhaust)
18 Spray jets for cam lubrication
19 Rocker arm bearing (intake)
20 Valve guide
21 Bore in distributor drive
21 a Spray oil for distributor drive
22 Overflow from cylinder head
23 Oil pocket for chain lubrication
24 Spray oil for piston pin
25 Oil drain bore
26 Oil dipstick
27 Oil filler neck
28 Oil drain plug



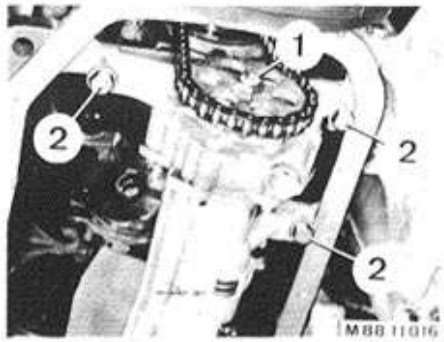
11 40 000 CHECKING ENGINE OIL PRESSURE

Pull off wires on oil pressure switch.
Unscrew oil pressure switch (1).
Installation:
Check gasket (2), replacing if necessary.



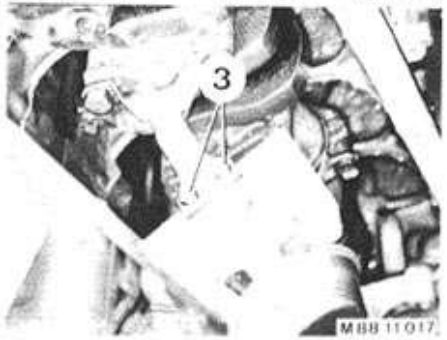
Screw in Special Tool 11 4 050.
Connect hose 13 3 063 in conjunction with pressure tester 13 3 061.
Check oil pressure*.

* See Specifications

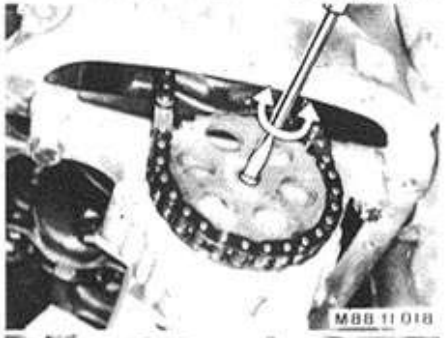


11 41 000 REMOVING AND INSTALLING OIL PUMP

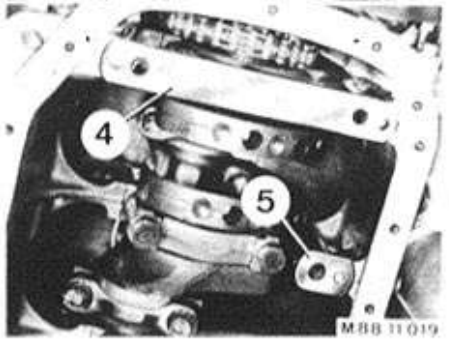
Pull out oil dipstick.
Remove oil pan 11 13 000.
Unscrew nut (1) and take off sprocket.
Unscrew bolts (2).



Unscrew holder (3) and remove oil pump.
Installation:
Mount holder without tension.

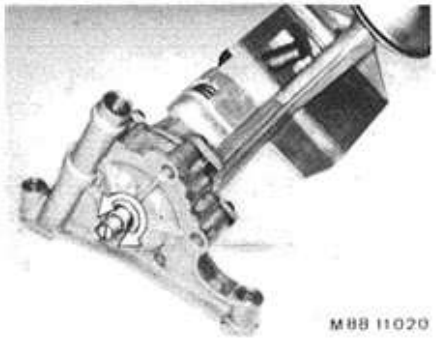


Installation:
Push on sprocket after mounting oil pump.
Tightening torque* for nut.

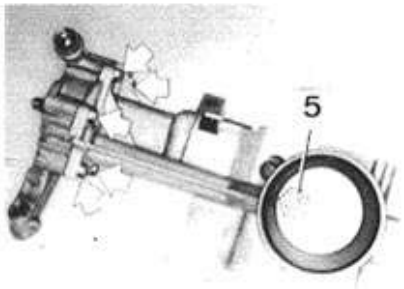


Installation / Chain Tightness:
Adjust chain tightness with shims (4 and 5) that chain will give at center under light thumb pressure.
Shims (4 and 5) must have the same thickness.

* See Specifications


M88 11020

Testing and Servicing:
Check whether oil pump runs easily by turning the drive shaft.

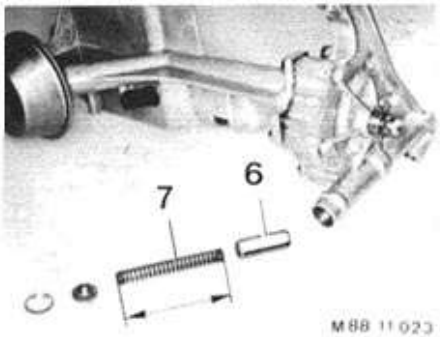


M88 11021

Disassemble oil pump and clean the oil filter screen (5).


M88 11022

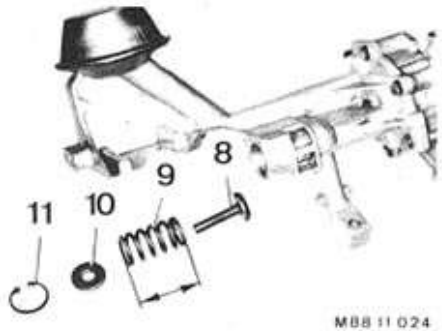
Check oil pump for wear.
– Scoring in body
– Wear on rotors



M88 11023

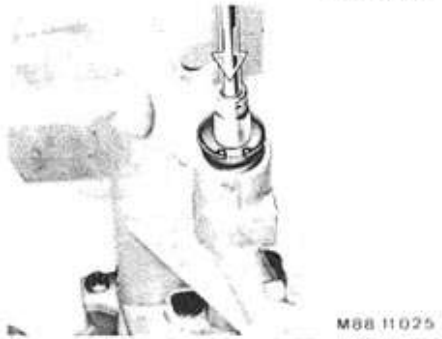
The pressure relief valve is installed in the main bore and regulates the engine oil pressure*, see 11 40 000.
Check whether piston (6) moves easily.
Check length of spring (7) = 68 mm (2.677").

* See Specifications

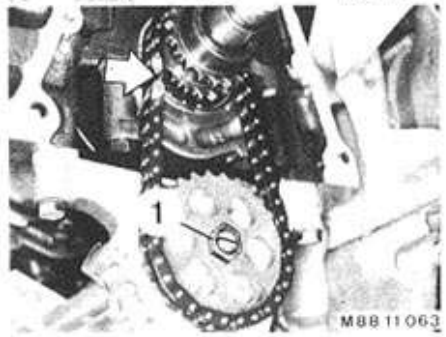


M88 11024

The 8 bar (112 psi) pressure relief valve regulates the oil pressure in front of the oil filter and prevents oil filter leakage.
Check piston seat (8).
Check length of spring (9) = 44 ± 0.4 mm (1.732 ± 0.016").


M88 11025

Installation:
Press in spring (9) and washer (10) with a wrench socket and install circlip (11).

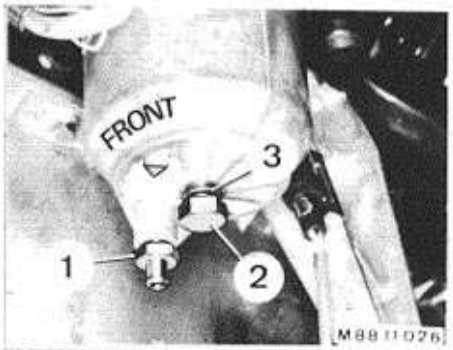


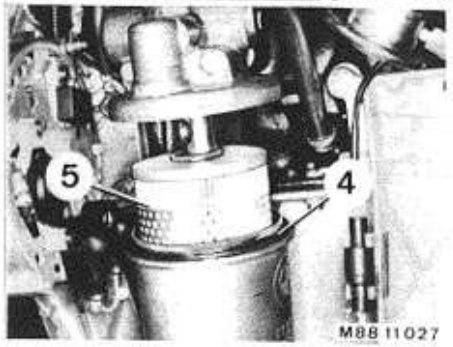
M88 11063

11 41 151 REPLACING OIL PUMP DRIVE CHAIN

Remove oil pan 11 13 000.
Remove timing chain 11 31 051.
Unscrew nut (1) and take off sprocket.
Installation:
Adjust chain tightness, see 11 41 000.
Chain with a green color code is longer than chains with a red color code.
Tightening torque*.

* See Specifications

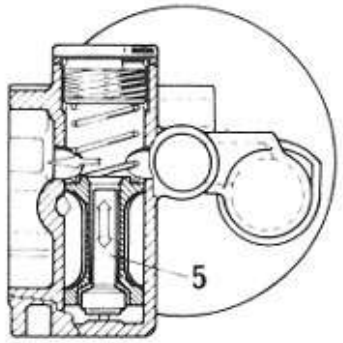


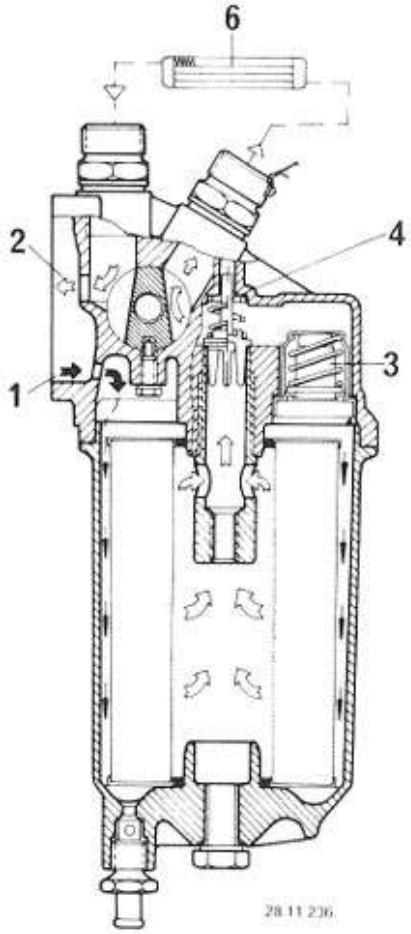


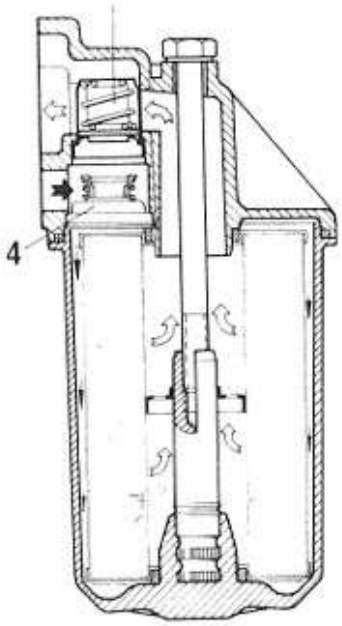
11 42 021 REPLACING FULL FLOW OIL FILTER

Unscrew oil drain plug (1) and drain oil.
Unscrew bolt (2).
Replace oil filter (5).

Installation:
Check seals (3 and 4), replacing if necessary.
Mount oil filter housing that arrow faces forward (FRONT).
Tightening torque*.
Add engine oil***.



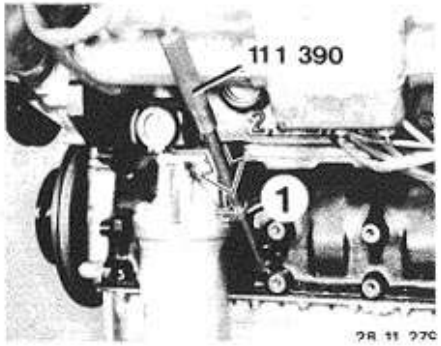




1 Feed from oil pump
2 Return to main oil bore
3 Bypass valve
– opening pressure = 2.5 ±0.25 bar (35 ±3 psi)
4 Return flow inhibiting valve
– opening pressure = 0.1 ±0.05 bar (1.4 ±0.7 psi)
5 Thermostatic activator for switching oil cooler
6 Oil cooler

➡ Unfiltered oil
⇨ Filtered oil

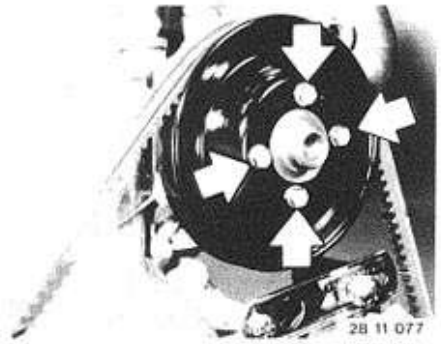
* See Specifications
*** See Service Information of Gr. 11



28 11 270

11 43 101 REPLACING GUIDE TUBE FOR OIL DIPSTICK

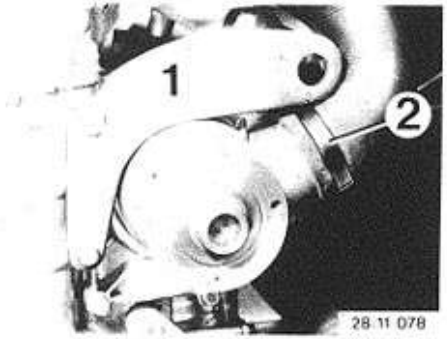
Transfer clamp (1).
Install guide tube with Loctite No. 270** and drive in against stop.
Important!
Eyelet grip of oil dipstick must always face left when looking forward in car to check the oil level.
Non-conformance could cause incorrect readings, i.e. engine oil volume would not be as specified*.



28 11 077

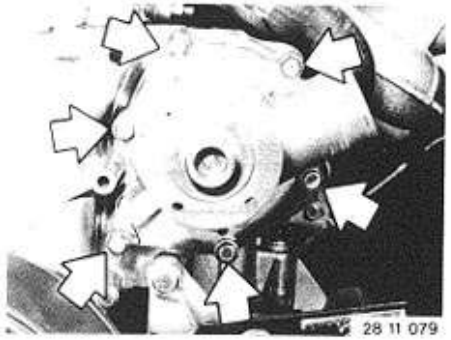
11 51 000 REMOVING AND INSTALLING WATER PUMP

Remove fan 11 52 000.
Take off drive belt and unscrew pulley.
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.



28 11 078

Unscrew suspension eye (1) and disconnect water hose (2).



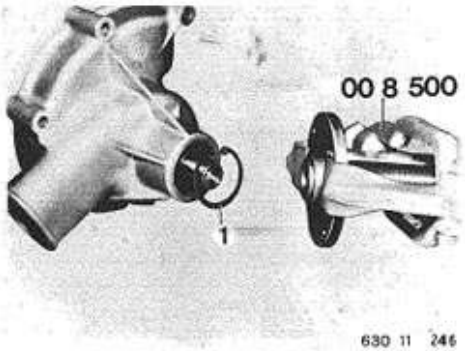
28 11 079

Unscrew water pump.
Installation:
Replace gasket.

* See Specifications
** Source: HWB

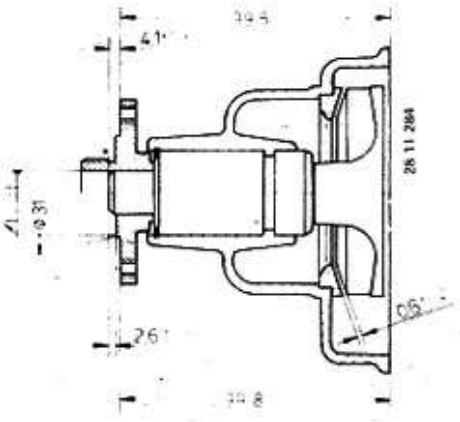
11 51 502 OVERHAULING WATER PUMP

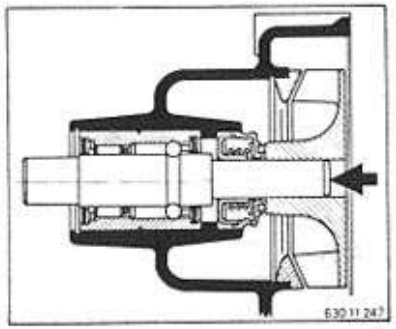
Check dimensions after assembling!



630 11 246

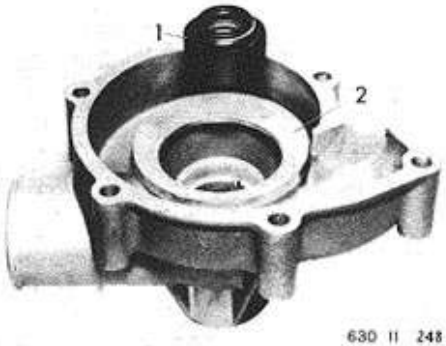
Pull off hub with Special Tool 00 8 500.
Lift out circlip (1).





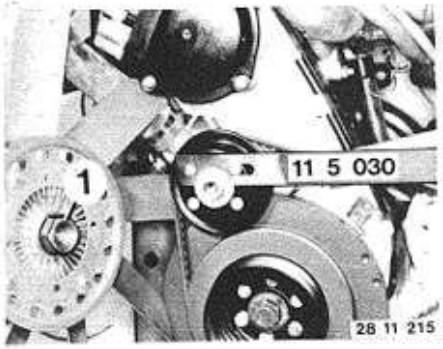
630 11 247

Press out water pump bearing.
Installation:
Press in water pump bearing against stop.
Press on impeller.



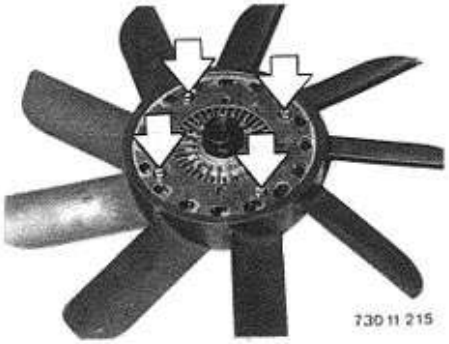
630 11 248

Drive out seal (1).
Installation:
Press in seal (1) with Special Tool 00 5 500.



11 52 000 REMOVING AND INSTALLING FAN

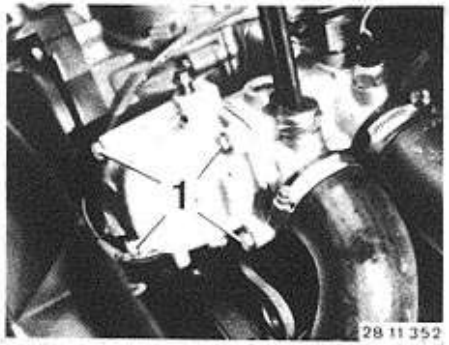
Hold pulley with Special Tool 11 5 030 and unscrew coupling nut (1).
Important!
Left-hand threads – nut turned clockwise to unscrew.
Tightening torque*.



11 52 020 REPLACING FAN CLUTCH

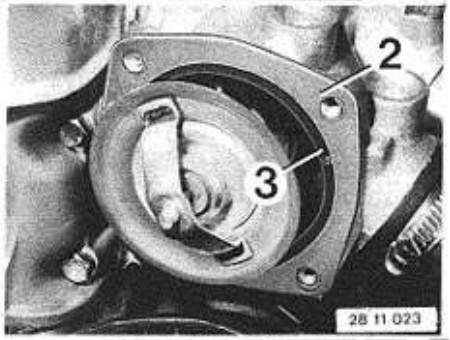
Remove fan 11 52 000.
Replace fan clutch, if
a) hub has seized (fan of stopped engine cannot be turned or difficult to turn),
b) fan clutch has axial and radial play or is losing oil.
Check switching points* with a Vibrocard***.
Unscrew fan mounting bolts and take off fan clutch.

* See Specifications
*** See Workshop Equipment Catalog

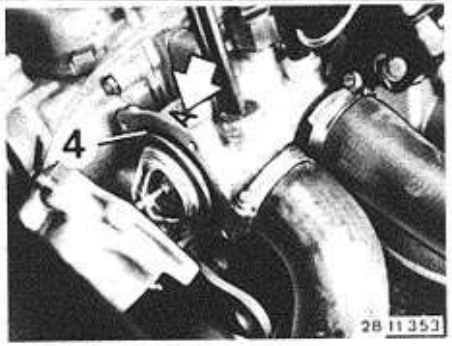


11 53 000 REMOVING AND INSTALLING COOLANT THERMOSTAT

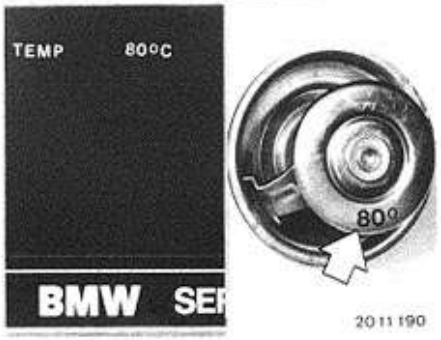
Drain coolant partially.
Unscrew cover (1).
Installation:
Bleed cooling system 17 00 039.



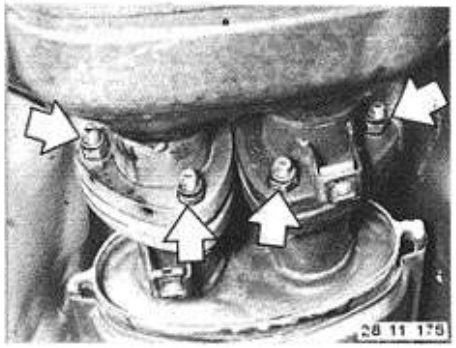
Remove thermostat.
Replace gasket (2) and seal (3).
Installation:
Clamp on thermostat faces out.



From model '86 on – Letter "A" cast in housing:
Fit new thermostat, no. 1 713 040 with gasket (4) on cover.

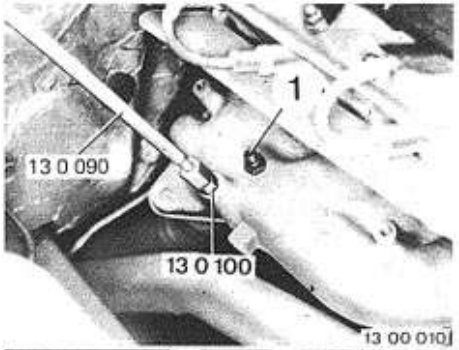


Check Thermostat:
Check whether opening temperature agress with specifications.
Check opening temperature by placing thermostat in hot water and compare with stamped opening temperature.



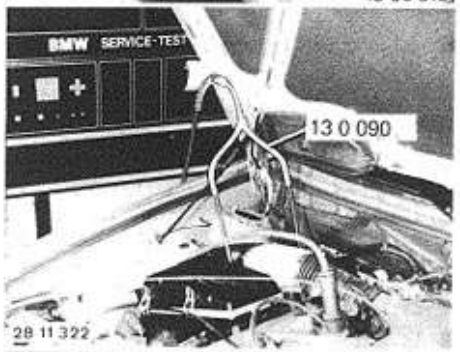
11 76 010 REMOVING AND INSTALLING CATALYTIC CONVERTER

Remove the exhaust assembly, see 18 00 020.
Unscrew the triangular flanges.
Pull off the catalytic converter.
Installation:
Replace the gasket.
Inspect the catalytic converter for damage or cracks on the outside and loose parts on the inside.
Important!
Replace the oxygen sensor and catalytic converter, if the car had been operated with leaded gasoline.

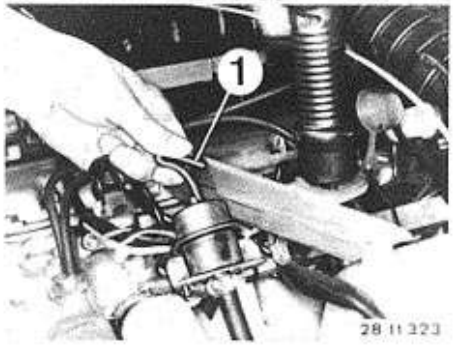


11 78 010 CHECKING FUNCTION OF OXYGEN SENSOR

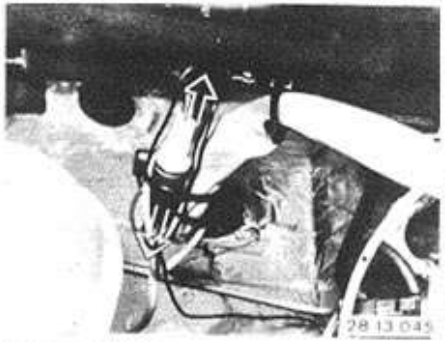
Unscrew plug (1).
Screw in Special Tool 13 0 100 and attach the Special Tool 13 0 090.
Connect the BMW service tester.



Measure the CO level.
Specifications: 0.2 to 1.2 % by volume.
Refer to 13 00 054 for other information.



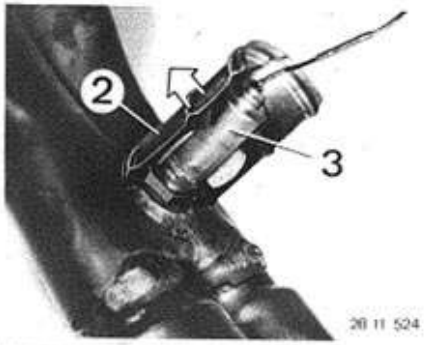
Pull off vacuum hose (1) on the pressure regulator and plug.
The CO level will rise briefly and is immediately regulated back to the original value = the oxygen sensor is working.
If Not:
Check the power supply to the oxygen sensor from the relay according to the wiring diagram.
See Group 13 for additional information.



11 78 510 REPLACING OXYGEN SENSOR

– Do not clean oxygen sensors or let them come in contact with lubricants.
– Only coat the threads with "Anti-Seize"**.
– Cover oxygen sensors when undercoating the car.

M 30 B 32:
The oxygen sensor has to be replaced at intervals of 30,000 miles.
However, the "O_2 SENSOR" sign will only light up after the first 30,000 miles.
Disconnect plugs.

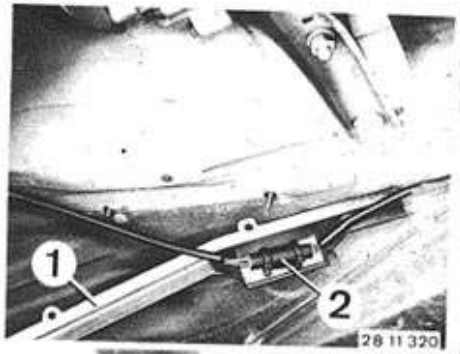


Pull off plate (2).
Unscrew oxygen sensor (3).
Installation:
Coat the threads with "Anti-Seize"**.

Lift out the check control.

Remove the lamp for the "O_2 SENSOR" sign.

** Source: HWB, No. 81 22 9 400 088



M 30 B 34:
The heated oxygen sensor has to be replaced at intervals of 50,000 miles – there is no sign or indicator lamp.
Unscrew plate (1) and disconnect plug (2).

Unscrew oxygen sensor (3).
Installation:
Coat the threads with "Anti-Seize"**.

** Source: HWB, No. 81 22 9 400 088

12 Engine electrical equipment

12-0

INSTRUCTIONS FOR WORKING ON TRANSISTORIZED COIL-TYPE IGNITION (TCI) AND DIGITAL MOTOR ELECTRONICS (DME)

- Always disconnect battery or interrupt power supply to ignition control unit and ignition coil when working on the electrical system (charging battery or welding, etc.) – dangerous primary and secondary voltage as well as danger of destroying the ignition system.

- Never start the engine after removal of distributor cap and/or disconnection of wire on ignition coil term. 4 – pull off plug on ignition control unit.

- Never disconnect the battery or leads on the alternator and starter while engine is running.

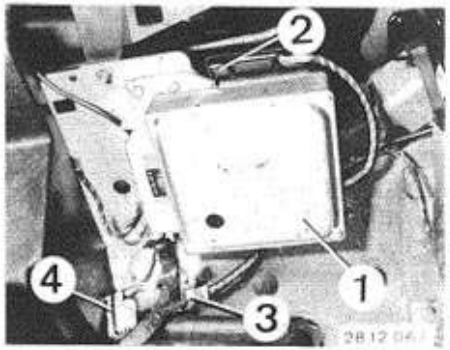
- Only install specified original BMW parts.

- Never connect a shielded capacitor or test lamp on term. 1 of the ignition coil.

- Never connect wire of ignition coil term. 1 on ground or B +. Consequently the ignition coil term. 1 wire must not be used to prevent engine starting when service installing a burglar alarm system. In this case, for example, the wire on term. 50 of the starter could be used.

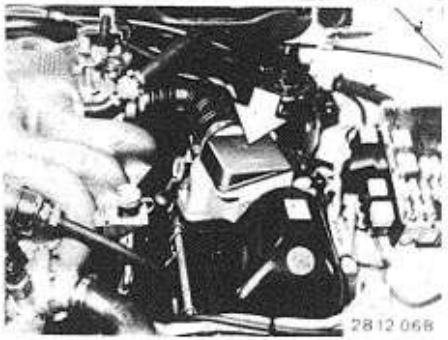
- When checking the compression, pull off plug on control unit for TCI or master relay for fuel injection (relay no. 2) for DME.

- The secondary side (high voltage side) of the ignition system must be shielded with at least 4 k-ohms, whereby the original distributor rotor with 1 k-ohm shielded resistor must be installed. Do not use a 5 k-ohm distributor rotor for the shielding of radio and/or communication equipment!

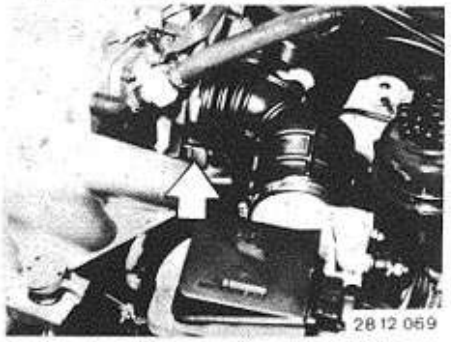


SURVEY OF ENGINE ELECTRICAL EQUIPMENT FOR BMW 528 e

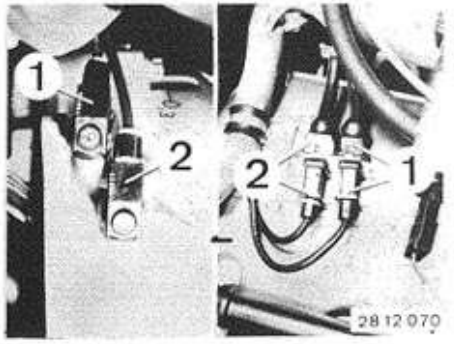
1 DME control unit
2 Idle control unit (in glove box)
3 Plug for transmission – disconnected for cars with automatic transm. (mixture leaned)
4 Plug for car electrical system



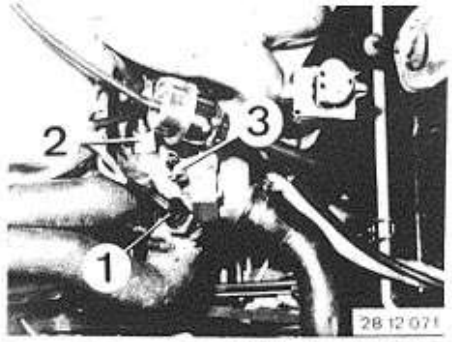
Air flow sensor
(air temperature sensor is integrated in air flow sensor)



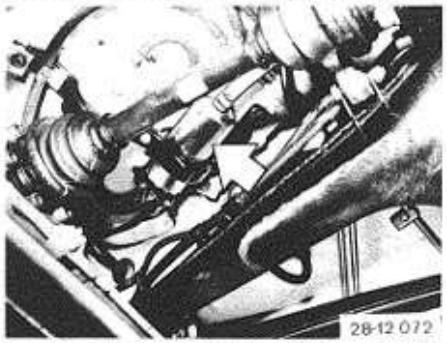
Throttle switch



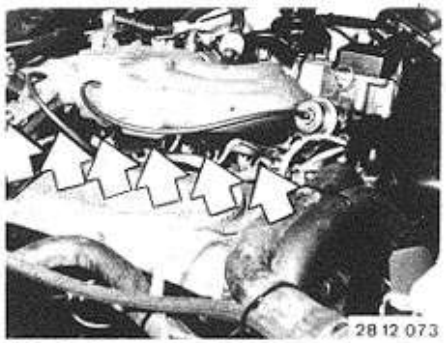
Speed transmitter (1) and reference mark transmitter (2)



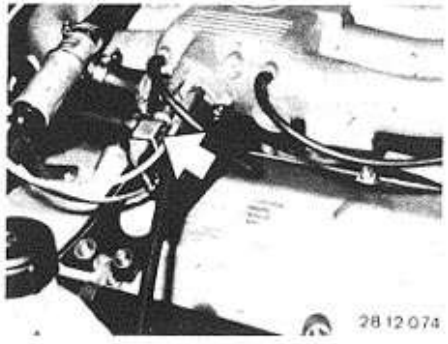
Temperature time switch (1)
Coolant temperature sensor (2)
Temperature switch (3)



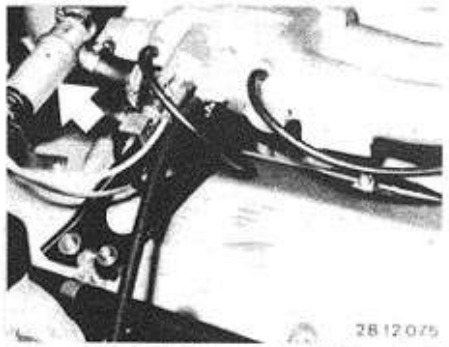
Electric fuel pump



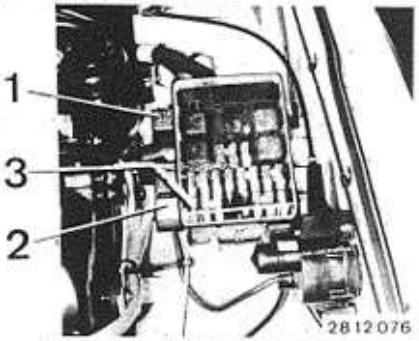
Fuel injectors



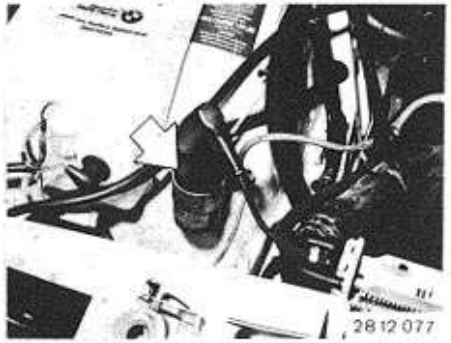
Cold start valve



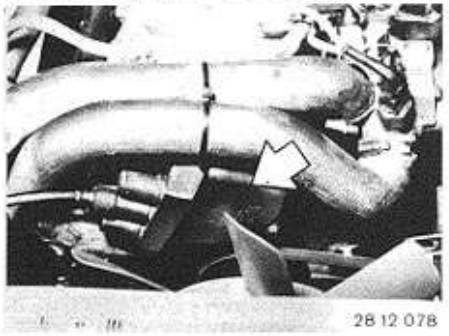
Idle valve
(control element)



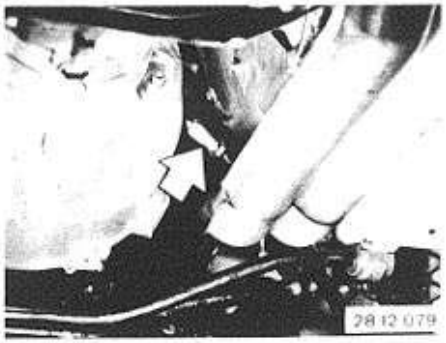
Relays and fuses
1 Fuel pump relay
2 Injection system relay
3 Fuse for fuel pump



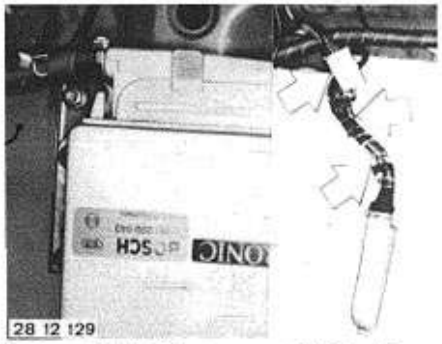
Ignition coil



High voltage distributor

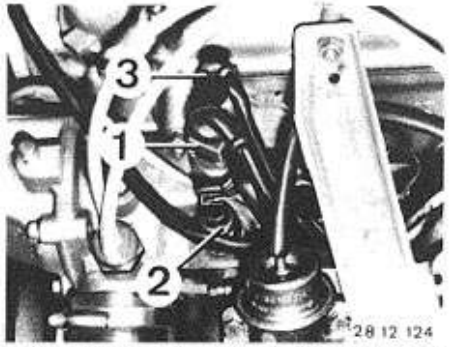


Oxygen sensor

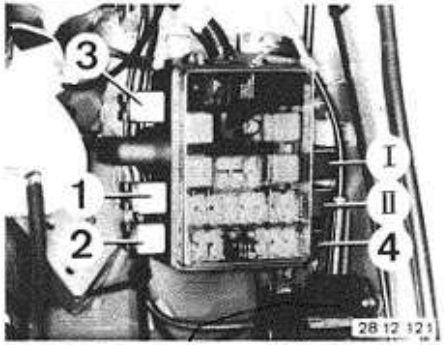


SURVEY OF ENGINE ELECTRICAL EQUIPMENT FOR BMW 535 i

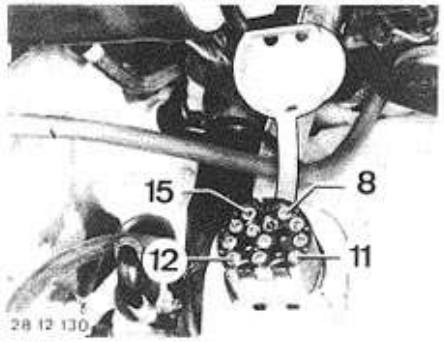
DME control unit in glove box
Plug Connections:
6-pin – car electric system
2-pin – transmission
(not used for automatics)
1-pin – fuel injection
(not used for automatics)



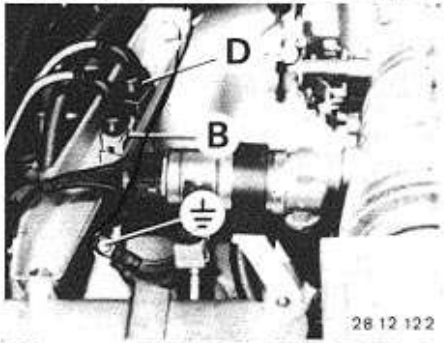
Temperature time switch (1), temperature gage (2), coolant temperature sensor (3)



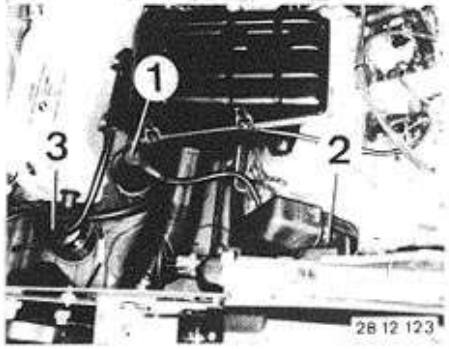
Master relay for DME (relay 2), fuel pump relay (relay 1).
Oxygen sensor relay (3).
Extra fan relay – stage I / stage II.
Check control relay (4) for low beams.



Diagnosis plug

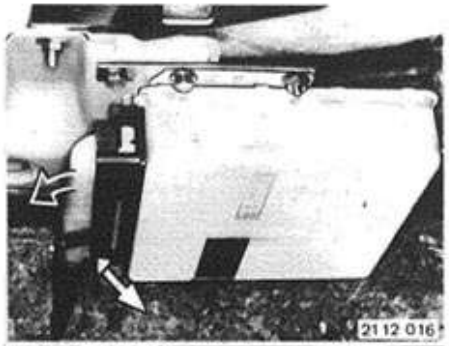


Plug connections for reference mark sensor (B) and speed sensor (D).
Ground point for DME.

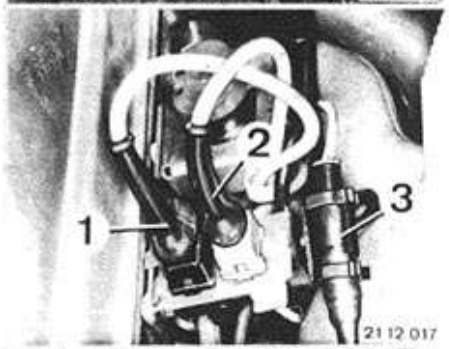


Ignition coil (1).
High voltage distributor (2).
Charcoal canister (3).

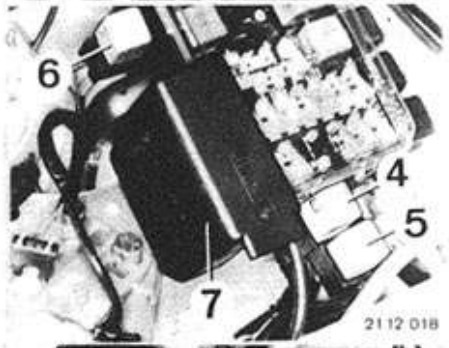
SURVEY OF ENGINE ELECTRICAL EQUIPMENT FOR BMW 524 td



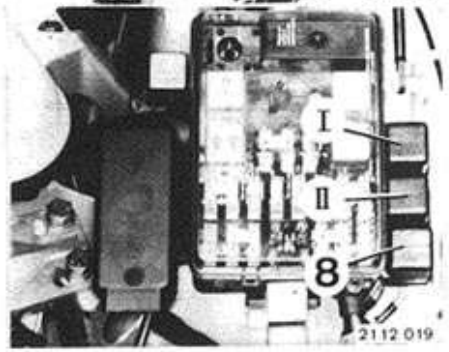
Control unit for VP-20 fuel injection in glove box



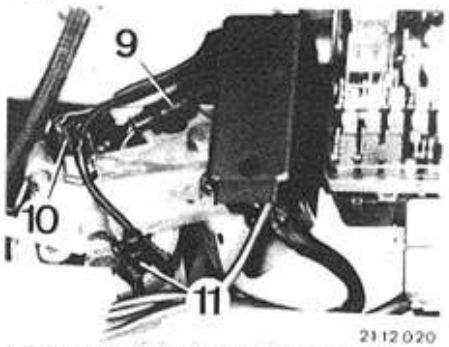
Plug connections for timing valve (3), initial injection jet (2) and speed sensor (1)



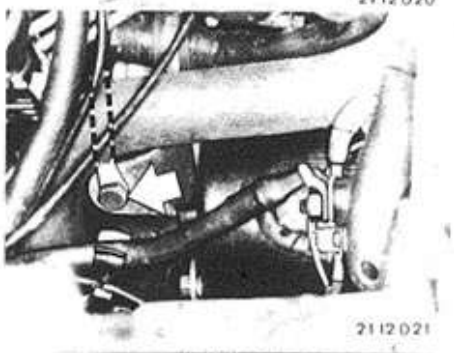
Relay for fuel transfer pump (4), VP-20 injection control (5), fuel heating (6) and heating time control (7)



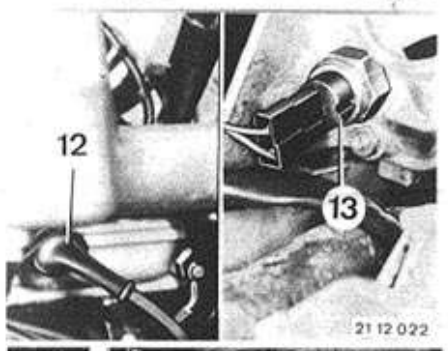
Relay for extra fan (stage I), extra fan (stage II) and low beam check control (8)



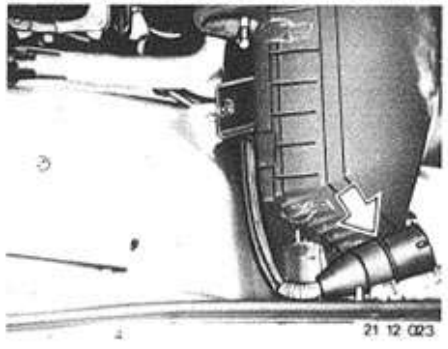
Plug connection for coolant level sensor (9), temperature switch for fuel heating (10), connection for heating adapter (11)



Ground point for engine electrical system

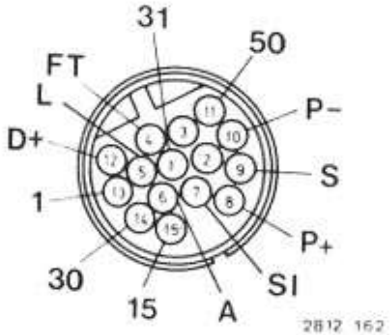


VP-20 coolant temperature sensor (12), temperature gage/heating time sensor (13)

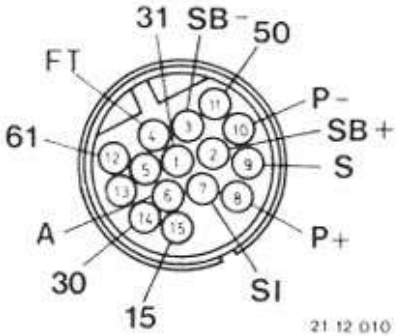


Plug for coolant heater

DIAGNOSIS PLUG CONNECTIONS
BMW 528 e / 533 i / 535 i



2812 162

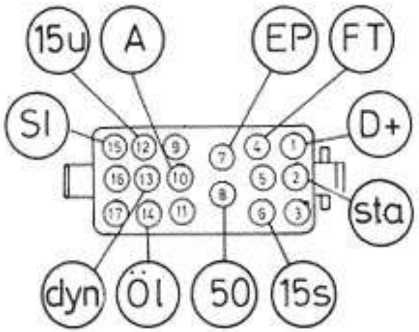


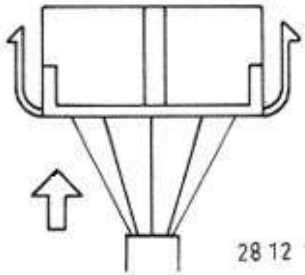
21 12 010

No.	Term.	Application
1	31	Ground
2	–	–
3	–	–
4	FT	Temperature gage
5	L	Oxygen sensor signal
6	A	Airbag
7	SI	Service indicator
8	P+	Position transmitter
9	S	Shielding
10	P–	Position transmitter
11	50	Starter
12	61	Alternator
13	1	Ignition signal
14	30	Battery +
15	15	Ignition supply

Connection Deviations for BMW 524 td, as Compared with Above Models

2	SB+	Fuel injector – initial injection sensor
3	SB–	Fuel injector – initial injection sensor
13	TD	Speed signal

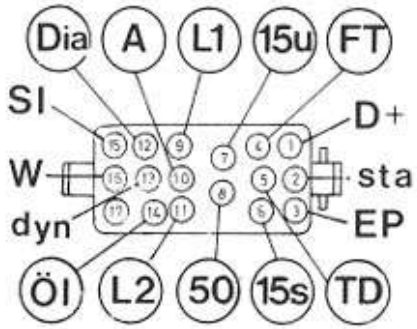


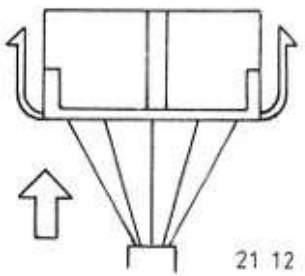


CONNECTION PLAN FOR ENGINE WIRE HARNESS PLUG

BMW 528 e, 533 i, 535 i

No.	Term.	Description
1	D+	Alternator charge indicator
2	sta	Oil level-static
3	–	–
4	FT	Coolant temperature gage
5	–	–
6	15s	Power supply with ignition turned on - fuse protected
7	EP	Electric fuel pump
8	50	Voltage while starting
9	–	–
10	A	Diagnosis lead for airbag
11	–	–
12	15u	Power supply with ignition turned on - no fuse protection
13	dyn	Oil level dynamic
14	Öl	Oil pressure
15	SI	Service indicator
16	–	–
17	–	–

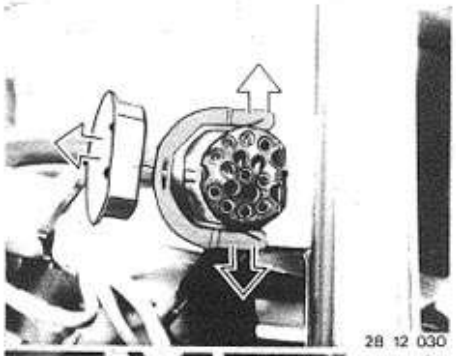




BMW 524 td

No.	Term.	Description
1	D+	Alternator charge indicator
2	sta	Oil level-static
3	EP	Electric fuel pump
4	FT	Coolant temperature gage
5	TD	Speed signal
6	15s	Power supply with ignition turned on - fuse protected
7	15u	Power supply with ignition turned on - no fuse protection
8	50	Voltage while starting
9	L1	Heating time indicator
10	A	Diagnosis lead for airbag
11	L2	Readiness to start after heating
12	Dia	Diagnosis lead for injection-system
13	dyn	Oil level - dynamic
14	Öl	Oil pressure
15	SI	Service indicator
16	W	Water - In - Fuel indicator
17	–	–

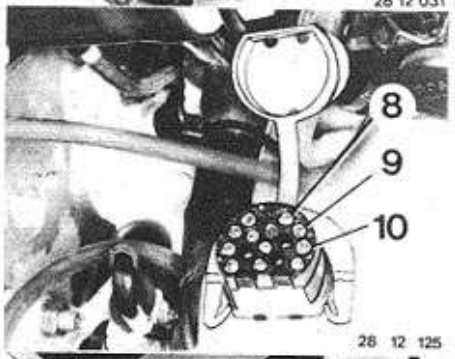
12 11 031 REPLACING / CHECKING TDC POSITION TRANSMITTER


28 12 030

BMW 528 e / 533 i / 535 i:
Unlock clips and pull diagnosis plug out of holder.
Remove protective hose.


28 12 031

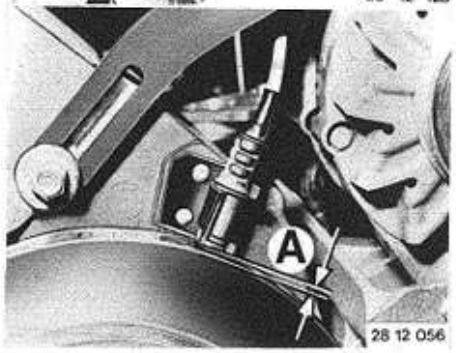
Press plug receptacles out of chambers 8, 9 and 10 with special tool**.



28 12 125

Installation:
Connect new position transmitter as shown.

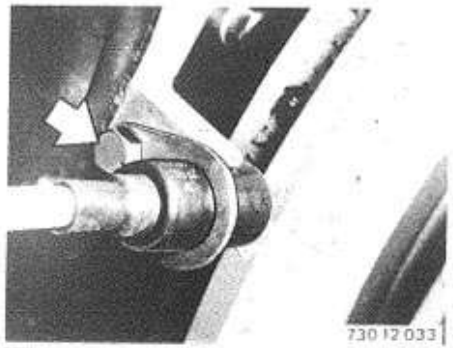
Number	Wire Color
8 (P+)	yellow
9 (S)	shielding
10 (P–)	black



28 12 056

BMW 528 e:
Press position transmitter out of holder.
Installation:
Mount wire.
Provide spacing (A) of 0.2 to 2.0 mm (0.008 to 0.079").

** Source: HWB (= Division of BMW)

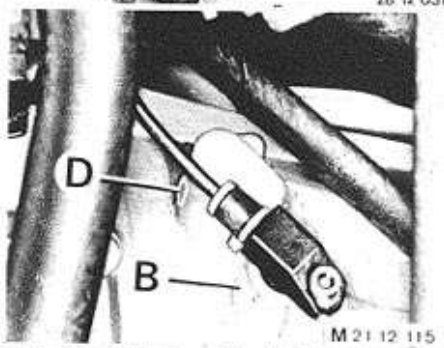

730 12 033

BMW 533 i / 535 i:
Unscrew position transmitter.
Installation:
Mount wire.
Provide distance of 0.2 to 2.0 mm (0.008 to 0.079") to vibration damper.


28 12 031

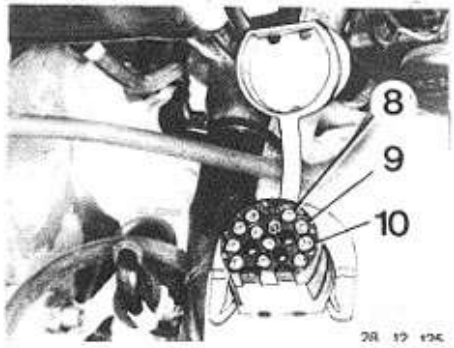
BMW 524 td:
Take diagnosis socket out of holder.
Press out plug receptacles 8, 9 and 10 with special tool**.

Number	Wire Color
8	yellow
9	shielding
10	black



M 21 12 115

Unscrew and pull out position transmitter.
Installation:
Mount wire.
Coat seal with Molykote paste.
Keep grease off of face!

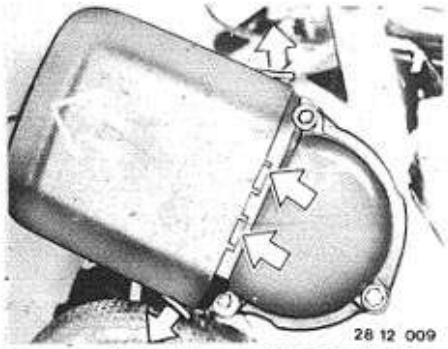


28 12 125

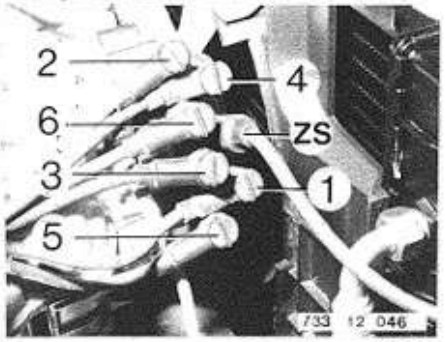
Checking:
Measure resistance* of transmitter on disgnosis socket terminals 8 and 10.

* See Specifications
** Source: HWB (= Division of BMW)

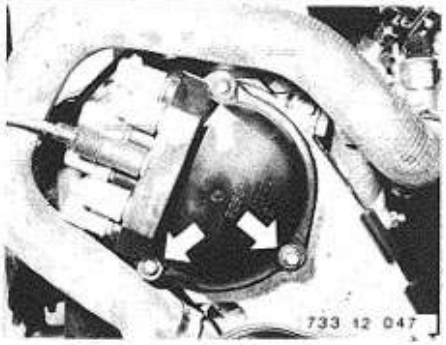
12 11 091 REPLACING / CHECKING DISTRIBUTOR CAP



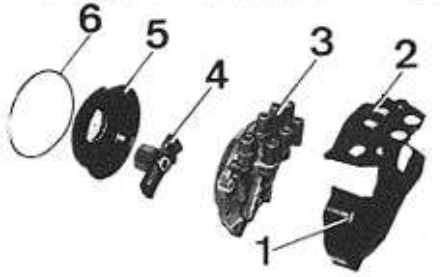
Important!
Refer to working instructions on page 12-0.
BMW 528 e:
Take off protective cap.
Installation:
Engage protective cap in holder correctly.



Pull out shielded connectors.
Installation:
Check firing order.

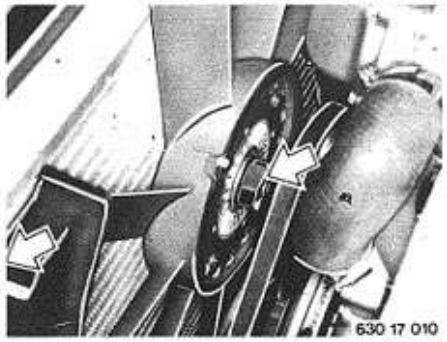


Unscrew screws and take off distributor cap.
Caution!
Protect hands – danger of injury on sharp cooling fins.

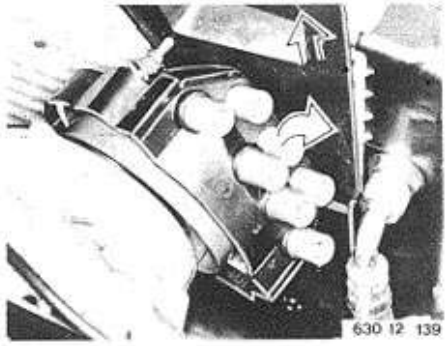


730 12 023

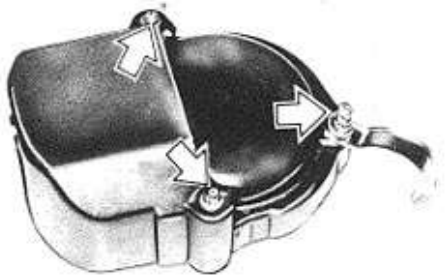
Installation:
Check seal (6), replacing if necessary.
Transfer protective caps (1 and 2).
Arrangement:
1 Protective cap
2 Protective cap
3 Distributor cap
4 Distributor rotor
5 Protective cap (inside)
6 Seal



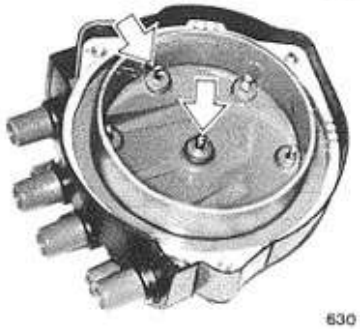
BMW 533 i / 535 i:
Unscrew fan – left-hand threads.
Unscrew and lift out fan cowl.



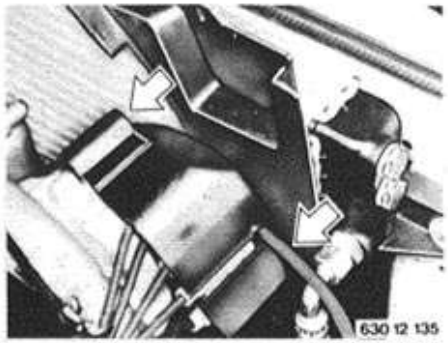
Take off or unscrew protective cap.
Unscrew distributor cap screws.



Installation:
Screw in all screws finger tight and then attach holder for water hose.

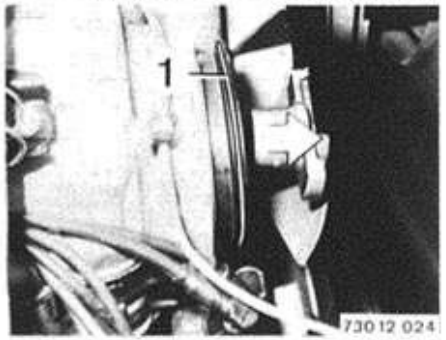


Checking:
Check inside and connection cover for hairline cracks and traces of burning.

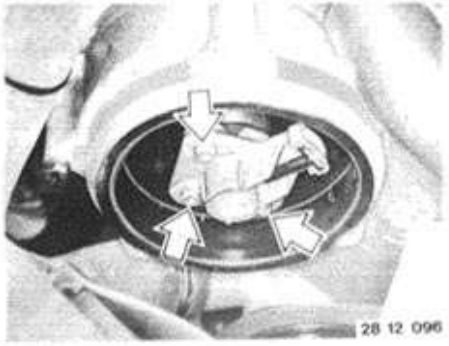


12 11 111 REPLACING DISTRIBUTOR ROTOR

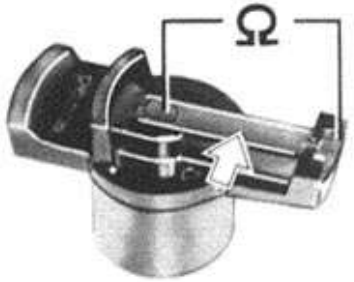
Caution!
Refer to page 12 - 0 for instructions for working on ignition system.
Remove distributor cap 12 11 091.



Loosen distributor rotor by pressing in both directions (radial) and pull off.
Installation:
Check seal (1), replacing if necessary.



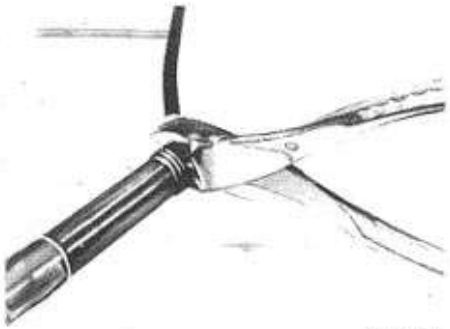
Since 1984 Models:
The distributor rotor of these models is bolted.



Checking:
Measure the resistance*.
Check casting compound (brittleness, burnt).

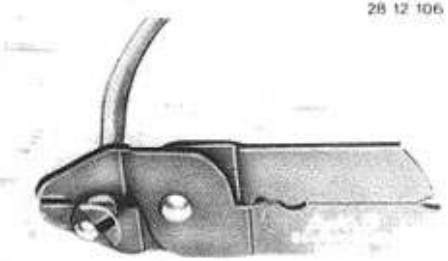
* See Specifications

12 12 072 REPLACING ONE SPARK PLUG CONNECTOR



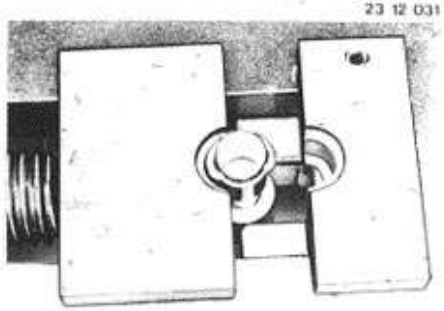
28 12 106

(non-disconnectable version – 30 kV system)
Cut off ignition lead as shown.



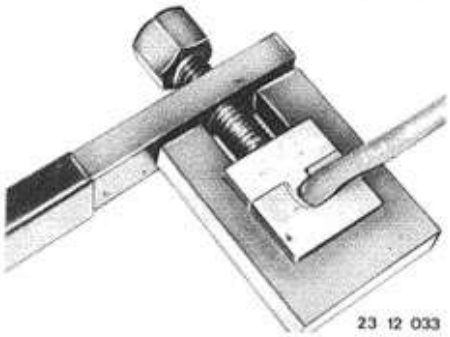
23 12 031

Strip ignition lead end by 6 mm with a stripping pliers (1.5 mm wire cross section size).



23 12 032

Place connector on ignition lead and insert in Special Tool 12 1 091 as shown.
Move clamping jaws together by turning screw against stop.

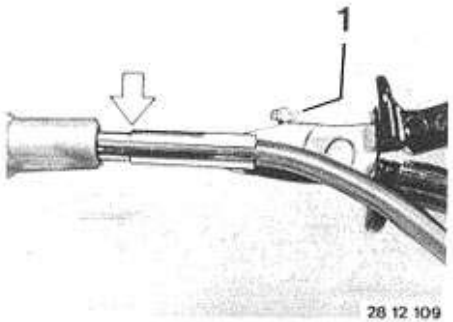


23 12 033

After squeezing, release jaws and take out the ignition lead.
Perform tear-out test by hand (tearing-out force: ≥ 200 N / 44 lbs.).

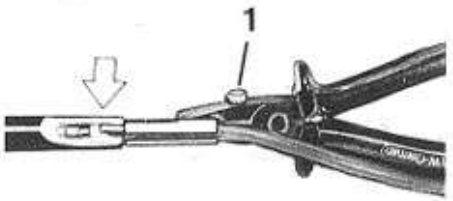
23 12 034

Spray a thin coat of lubricant 12 1 098 on guiding sleeve of Special Tool 12 1 092.



28 12 109

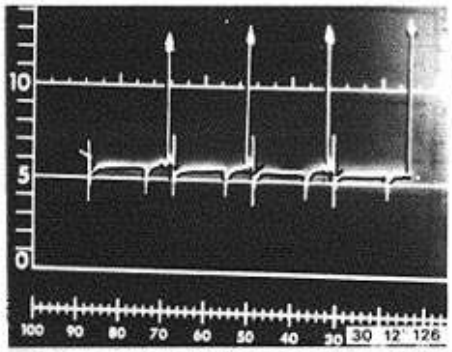
Unscrew screw (1).
Slide in ignition lead against stop (see picture), follow with pliers and slide in ignition lead further until connector is heard to engage.



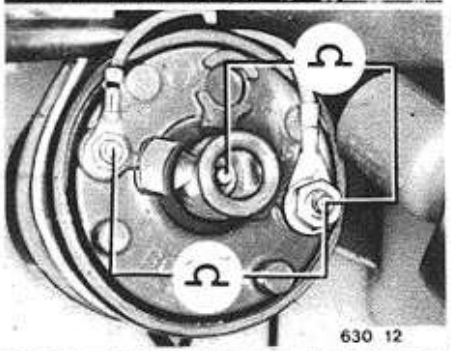
28 12 110

Tighten screw (1) enough, that the pliers can be pulled back.
Caution!
Opening the pliers too much could cause the plug receptacle to break.
The plug receptacle is shown cut open for better illustration.
Note:
The required special tools 12 1 091/092/098 are also available as a complete set 12 1 090.

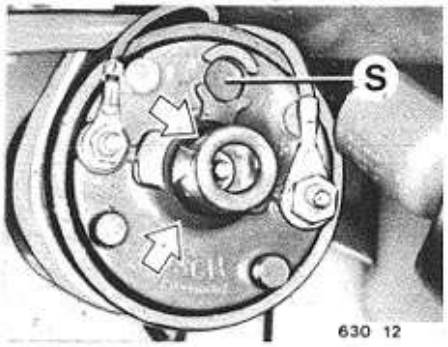
12 13 009 CHECKING IGNITION COIL



Connect BMW service test unit.
Carry out engine test step 09.
Observe oscillograph — ignition voltage and ignition voltage deviation must agree with nominal values**.



Multimeter Test (M 06):
Measure resistance* of primary coil (term. 1/15) and secondary coil (term. 15/4).

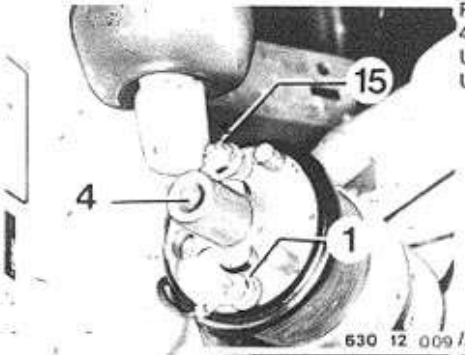


Check for hairline cracks and signs of burning.
Check plug (S) for tight fit — if pressed out, replace ignition coil.

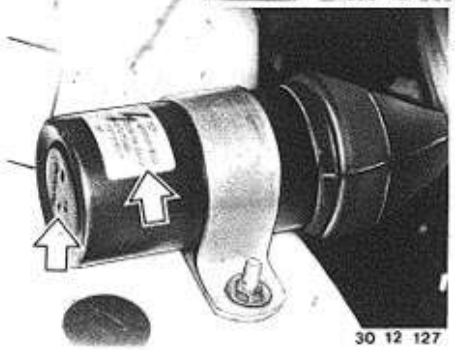
* See Specifications
** See nominal value microfiche

12 13 011 REPLACING IGNITION COIL

Caution!
Always turn off ignition before working on the ignition system — dangerous high voltage!
Refer to page 12 - 0 for instructions for working on ignition system.

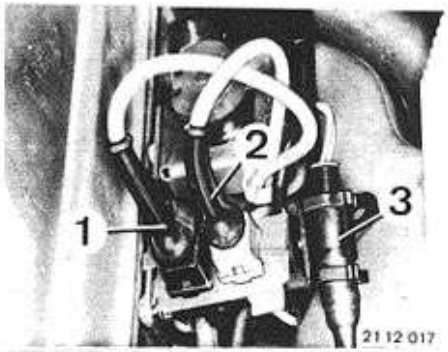


Pull off protective cap and ignition lead (term. 4).
Unscrew connections (term. 1 and 15).
Unscrew holder and take off ignition coil.



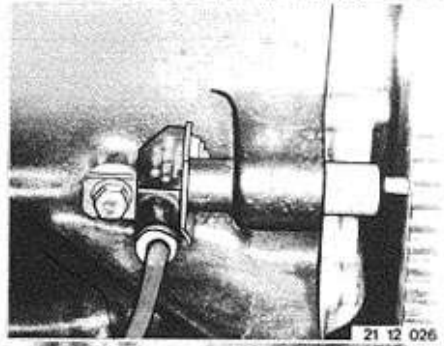
Installation:
Check new ignition coil for correct code number* and color label*.

* See Specifications

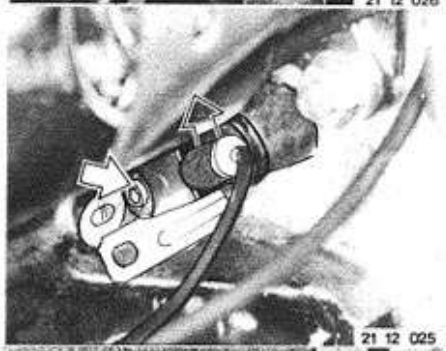


12 14 160 REPLACING/CHECKING SPEED SENSOR

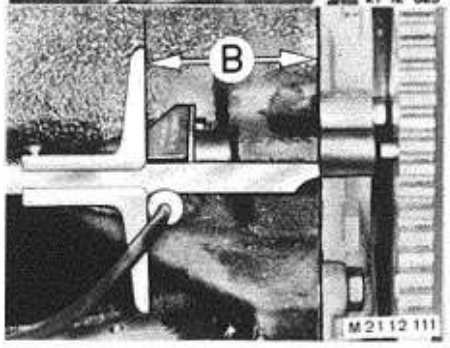
BMW 524 td:
Disconnect plug (1).



Unscrew holder from below.

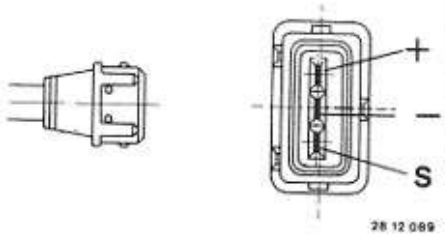


Turn speed sensor up, unscrew socket head screw and pull out speed sensor.

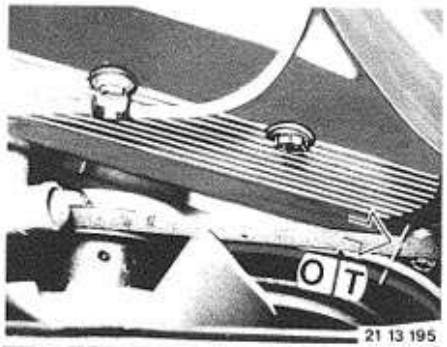


Installation:
Coat seal with Molykote paste – keep grease off of face!
Adjust speed sensor distance *).

*) See Specifications

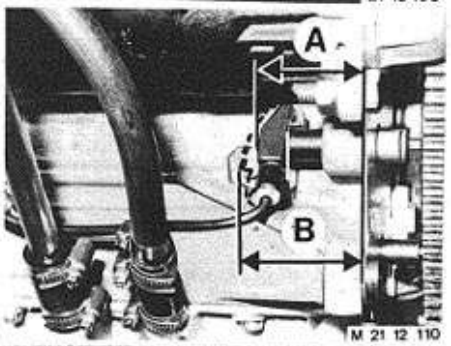


Checking:
Measure coil resistance* and insulation resistance*.
See engine electrical equipment wiring diagram for wire routing and connection.
+ and – = coil.
S = shielding.
Check alternating current voltage* (M 02) with plug disconnected and engine running at idle speed, adjusting speed sensor distance* if necessary.

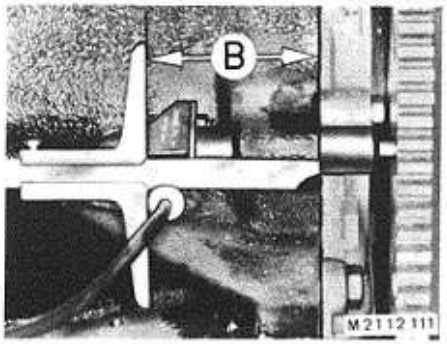


12 14 . . . ADJUSTING SPEED SENSOR

Unscrew fan cowl and fan (left-hand threads) – see 11 52 000.
Turn crankshaft up to 40 mm (1.575") after TDC – measured on vibration damper.

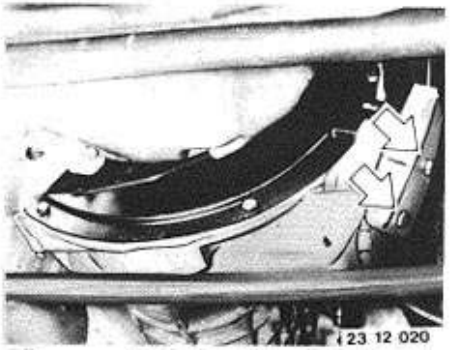


Unscrew brake fluid tank – hoses remain connected.
Loosen speed sensor and check whether pin is exactly in front of the speed sensor, correcting the flywheel position if necessary.
The sensor may be pushed in by about 2 mm (0.079").



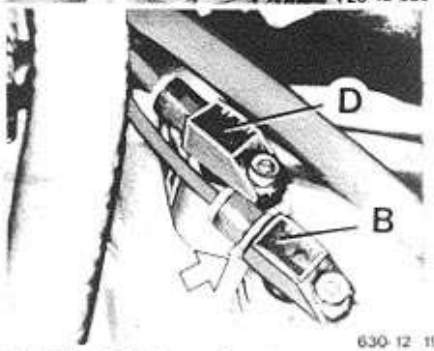
Push in speed sensor against stop and measure distance (A).
Pull out speed sensor until distance (B) is reached.
A = Speed sensor rests on pin
B = Distance A + speed sensor distance*

* See Specifications

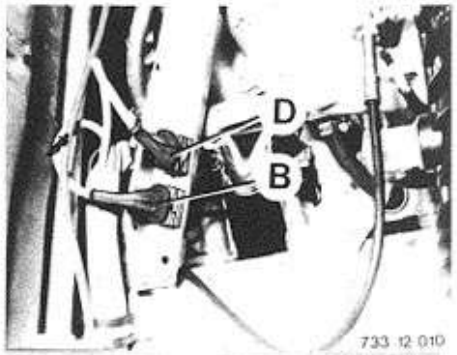


12 14 510/ 515 REPLACING/CHECKING SPEED AND REFERENCE MARK SENSORS

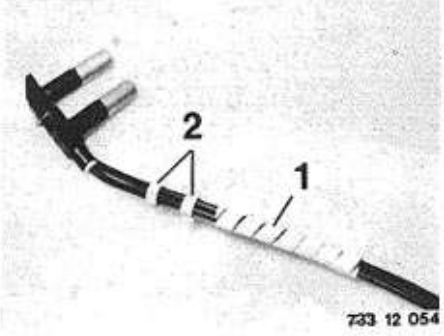
BMW 528 e / 533 i / 535 i
Unscrew shield.



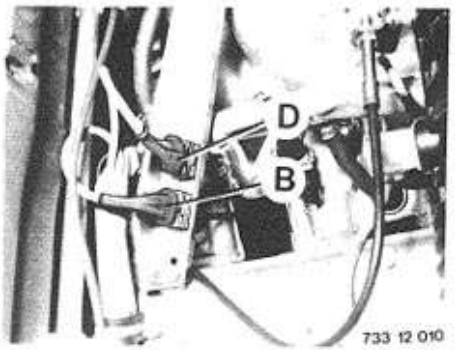
Unscrew screws of speed and reference mark sensors (D and B) and pull out sensors.
Installation:
Mark new reference mark sensor (B) with a piece of tape.



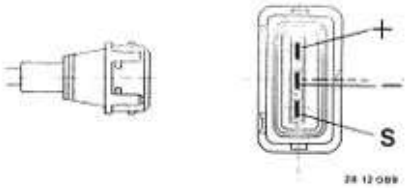
Pull off plugs on speed sensor (D) and reference mark sensor (B).
Press plug of sensor lead out of holder.
Installation:
Plug marked with tape belongs to gray plug.



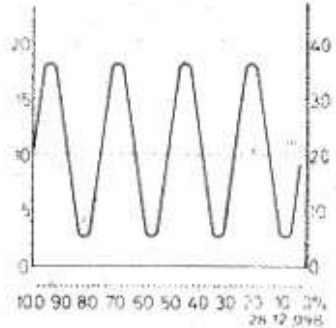
Pull off protective sleeve (1).
Lift out clip (2).
Installation:
Coat seals with Molykote paste.
Keep grease and dirt off of face surface on sensors.



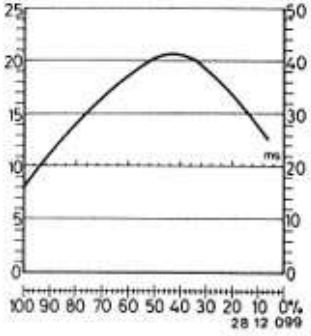
Testing:
Disconnect plug.
Connect BMW service test unit to operating instructions (M 06/22/23).
Use universal test leads.
B = Reference mark sensor
D = Speed sensor



Measure resistance* of sensor coil (M 06) on + and – of plug.



Connect oscilloscope (M 22/23) on + and connections of speed sensor.
Turn engine with the starter.
Signal shown in the figure should be displayed.
Only the shape is important when evaluating the signal – not the amplitude height.



Check reference mark sensor in same manner.
If oscillograph deviates, remove sensor and check for dirt (grease, burrs, dust), cleaning if necessary.
Check reference mark, replacing pin for flywheel if necessary.

* See Specifications

1) Cold engine will not start (oil temp. ∠ 20° C / 68° F)
2) Engine starts, but stops again
3) Cold engine hard to start (oil temp. ∠ 20° C / 68° F)
4) Warm engine will not start
5) Warm engine hard to start
6) Erratic idling during warm-up phase
7) Idle speed not correct
8) Splashing in intake
9) Hesitation when accelerating
10) Knock when accelerating
11) Hesitation when coasting
12) Misfiring at constant speed
13) Poor acceleration/final output
14) Fuel consumption too high
15) CO/HC not correct

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		TEST POSITION	REFERENCE
X			X								X									1	Speed sensor/reference mark sensor	
X		X	X	X			X				X									2	Ignition coil	
		X		X	X	X	X	X	X		X	X		X						3	Spark plugs	
		X		X	X		X	X			X									4	High voltage distributor	
		X		X	X		X	X			X									5	Ignition lead connectors and leads	
X	X	X	X	X					X	X		X	X							6	DME control unit / Ignition timing	
																				7		
																				8		
																				9		
													X	X						10	Oxy. sensor/emission control and EGR	Group 11
														X						11	Active carbon filter/purge valve	Group 13/16
																				12		
	X			X				X				X								13	Tank vent system	Group 16
																				14		
X		X			X	X						X								15	Fuel supply	Group 16
		X		X	X	X		X		X	X	X		X						16	Intake system	Group 13
														X						17	Catalytic converter	Group 11
														X						18	Exhaust system	Group 18
		X		X	X	X						X		X						19	Crankcase vent / air hoses	Group 13
					X	X														20	Cooling system	Group 17
																				21		
																				22		
																				23		
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SURVEY FOR TROUBLESHOOTING DIGITAL MOTOR ELECTRONICS

– See application information on next page.

Testing Requirements:
Engine in perfect running condition (timing, compression, oil carbon deposits, etc.).
Starting system in perfect condition (battery voltage, starter, ignition lock, etc.).
Correct fuel in tank (octane rating, leaded/unleaded, dirt, etc.).
Connections, plugs and ground points according to wiring diagram.
Refer to "Troubleshooting Fuel Injection" in Group 13 for other test positions.

TEST POSITIONS TO TROUBLESHOOT DIGITAL MOTOR ELECTRONICS

Application Information:

This survey can be applied for troubleshooting and consequently finding sources of defect more quickly.
The checked causes of malfunction might not always be sufficient to eliminate a defect, so that under certain circumstances additional tests could be necessary.

Testing instructions refer to the BMW SERVICE TEST, e.g. engine test/test step 05 (P 05) or a multimeter function (M). See operating instructions for connections.

Test 1 – SPEED AND REFERENCE MARK SENSORS

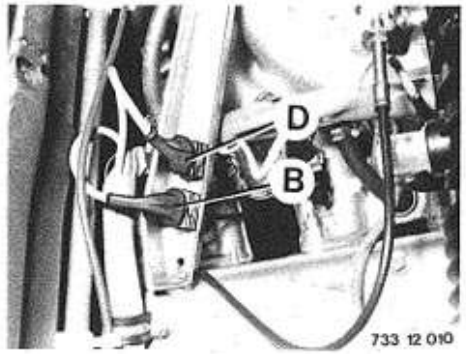
Check wires for tight fit and damage.
Check connections and arrangement of plug connections.
Reference mark sensor (B) is marked with a ring – see 12 14 510 / 515.

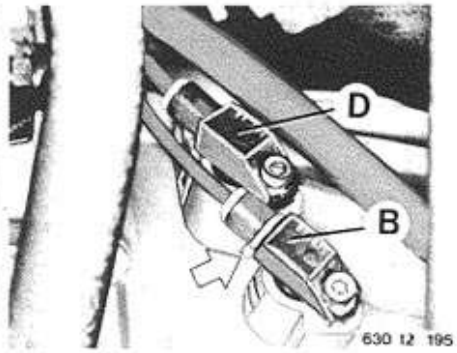
↓

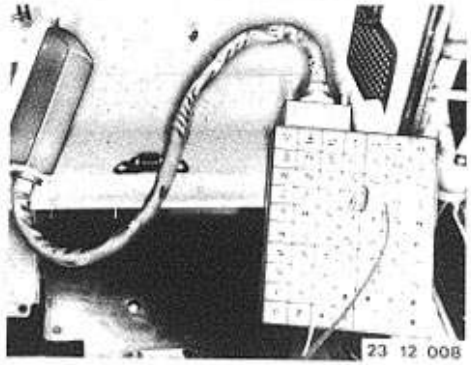
Turn engine with the starter. Check resistance (M 06) and oscillograph (M 22/23) on disconnected pulse sensor plug with BMW service test unit, see 12 14 510.

↓

Check wires leading to DME control unit:
Take off trim panel.
Pull off plug on control unit and connect on universal adapter** with (35-pin) test lead – see illustration.
Check power flow (M 06) in wires on specified pins***.







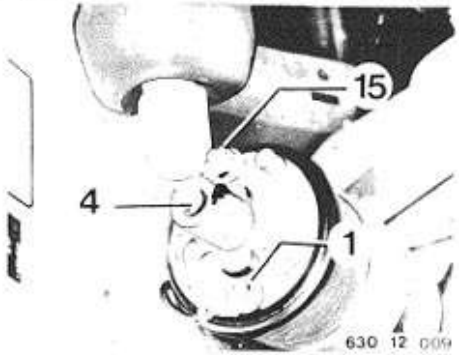
* See Specifications
** Source: HWB
*** See engine wiring diagram

Test 2 – IGNITION COIL

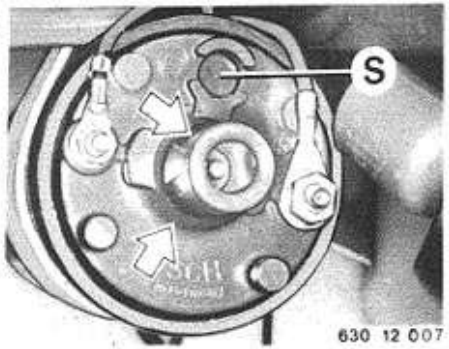
Check wires for tight fit.
Check connection plate and ignition lead contacts for traces of burning, cracks and oxidation.
Check code number* of ignition coil – see 12 13 009.

↓

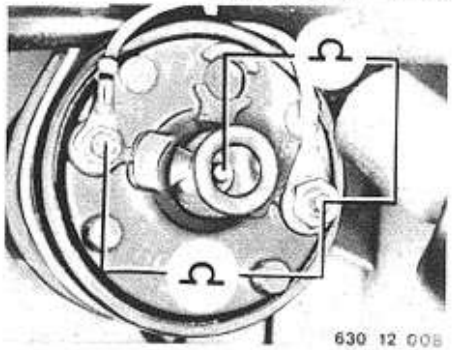
Check resistance* (M 06) and inductivity* (M 07) of primary and secondary coils – see 12 13 009.



630 12 009



630 12 007



630 12 008

Test 3 – SPARK PLUGS

Check spark plugs for tight fit and leaks.
Check insulator for signs of leakage current.

↓

Check spark plug type* and electrode gap*.
Check resistance *.

30 12 232

* See Specifications

Test 4 – HIGH VOLTAGE DISTRIBUTOR

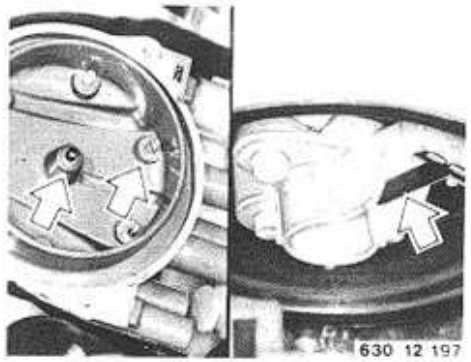
Check distributor cap and rotor for correct fit, damage and hairline cracks as well as signs of burning.
Check wire connections for oxidation and good contact – see 12 11 091 / 111.

↓

Check resistance* (M 06) from distributor peak to corresponding contact in distributor cap.
Resistance must be approximately 0 ohm.

↓

Check resistance* (M 06) of distributor rotor.



Test 5 – IGNITION LEADS AND LEAD CONNECTORS

Check spark plug connectors and shielded connectors for damage, tightness and good contact.
Bend ignition leads in a tight radius and check for cracks.

↓

Check resistance* (M 06) of spark plug connectors and ignition leads.

* See Specifications

Test 6 – DME CONTROL UNIT AND POWER SUPPLY

Check code number* and manufacturing date* of DME control unit – see Group 13.

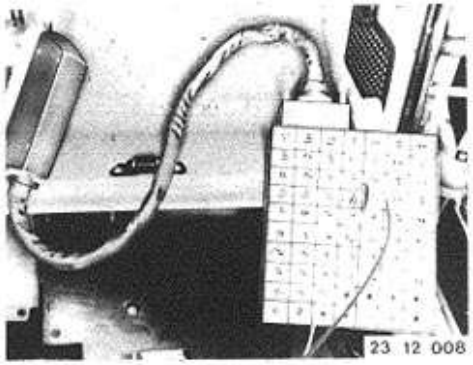
↓

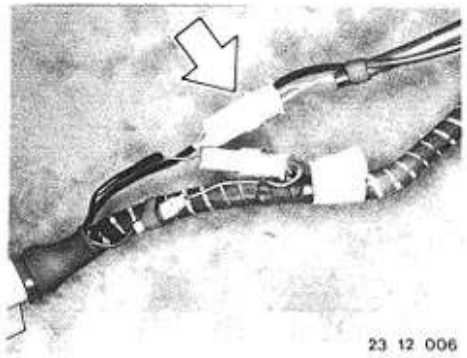
Check power supply**:
Pull off plug on control unit and connect universal adapter*** with (35-pin) test lead.
Car wire harness plugs remain connected.
Turn on ignition.
Check voltage on pins**, e.g. on connections 17 (–) and 35 (+).

→ Pull off relay 2 and bridge terminals 87 and 30 with a piece of wire.
This supplies power to the control unit.
Check activation** for relay 2:
Turn on ignition.
Terminals 85 (–) and 86 (+) should have voltage (approx. 12 V).
If necessary, check ground point and plug connection (near DME control unit) – see figure.

↓

If test results indicate the necessity to replace the control unit, first make the periphery test with an universal adapter***.





Test 6a – IGNITION TIMING

Check ignition - timing [1] (P 06) → no → Check code number * and manufacturing date – see Group 13

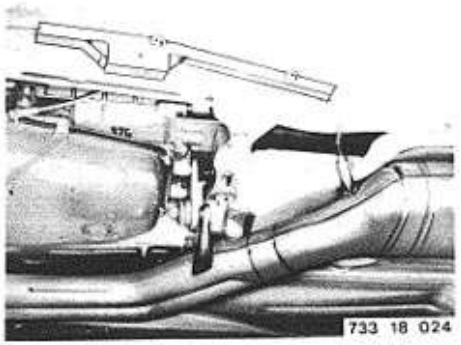
↓

Replace DME control-unit.

* See Specifications
** See engine wiring diagram
*** Source: HWB (= Division of BMW)
[1] See nominal value microfiche

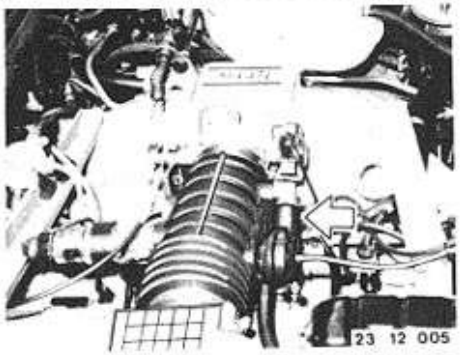
Test 17/18 – EXHAUST SYSTEM / CATALYTIC CONVERTER

Check exhaust system and catalytic converter for damage, tight fit and leaks – see Group 18.



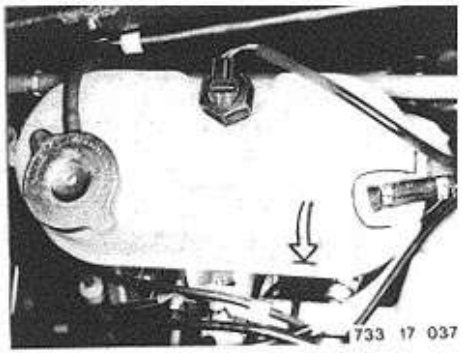
Test 19 – CRANKCASE VENT/AIR HOSES

Check hoses for crankcase vent and oil dipstick for tight fit and leaks.



Test 20 – COOLING SYSTEM

Check coolant level and concentration**.
If necessary, fill and bleed cooling system – see Group 17.



** See Service Information of Gr. 00

TROUBLESHOOTING HEATING SYSTEM

Testing Requirements:
- Charged battery.
- Connections and wires on indicator lamps, heating time control unit and heater plugs correct.

Ignition key turned to "DRIVE" before each test.

Yellow and green indicator lamps do not come on

Check fuse (S) on heating time control unit.

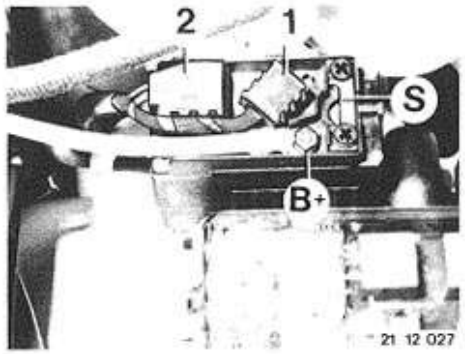
Check light bulb(s) in instrument carrier, replacing if necessary – see 62 99 . . ..

Pull off plug (1) on heating time control unit.
Connect plug receptacle LA 1 (for yellow lamp) and LA 2 (for green lamp) with ground – indicator lamps must come on. If necessary, check power supply for indicator lamps.

Yellow indicator lamp does not come on – coolant temp. <60° C (140° F)

Check coolant temperature sensor, replacing if necessary – see 12 62 . . ..

Check light bulb(s) in instrument carrier, replacing if necessary – see 62 99 . . ..



Green indicator lamp does not come on

Cold engine hard to start.
One or more heater plugs defective.

Pull off plug on control unit (2).
Connect BMW service test unit (M 03) and supply battery voltage to connections G 1 through G 6 5 seconds each and measure power consumption* of heater plugs.
Replace defective heater plugs – see 12 23 . . ..

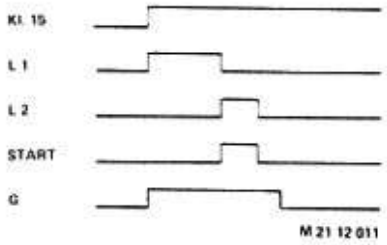
Yellow indicator lamp flashes

Pull off plug on heating time control unit (2).

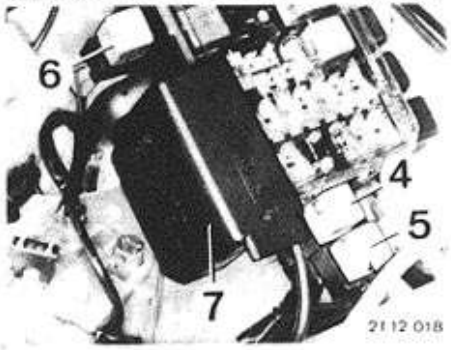
Check heater plugs, replacing if necessary – see 12 23 . . ..
Replace control unit.

* See Specifications

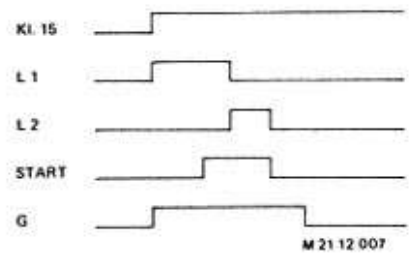
12 21 . . . CHECKING FUNCTION OF HEATING SYSTEM



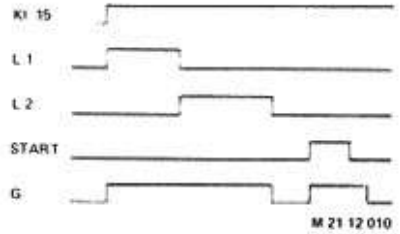
Normal Operation:
With the ignition key in "DRIVE" (term. 15) heating (G) begins and yellow lamp (L 1) in instrument panel comes on.
Green lamp (L 2) comes on when engine is ready to be started.
Heating continues during the engine starting phase and stops shortly after.
Green lamp (L 2) comes on immediately with a coolant temperature of > 60° C (140° F).



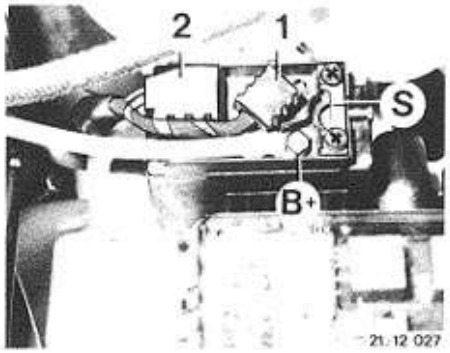
Heating without Start:
Heating is stopped by the safety circuit in control unit (7) after 8 to 13 seconds.



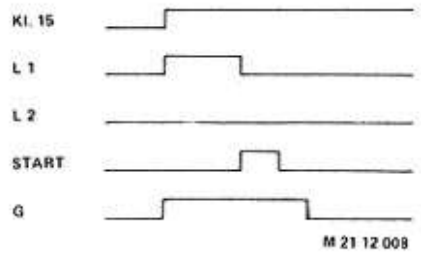
Heating when Engine is Started Too Early:
If the engine is started before lamp (L 2) comes on, this will only mean longer starting time.



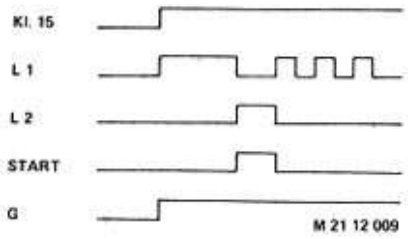
Heating for Subsequental Start:
If the engine is started after lamp (L 2) has gone out (cancelled by the safety circuit), heating continues during the starting phase and stops after a brief delay.



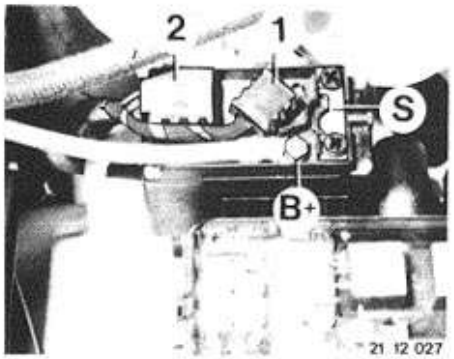
The yellow indicator lamp does not come on when the 80 ampere fuse (S) blows or the control unit is defective (below 60° C/140° F coolant temperature).



Green indicator lamp (L 2) no longer comes on when one or more heater plugs are defective.

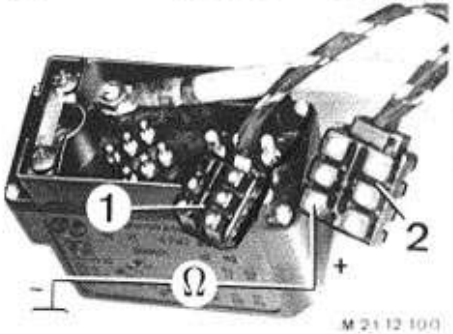


A flashing yellow indicator lamp (L 1) indicates the continued heating of the heater plugs replace control unit and check heater plugs.

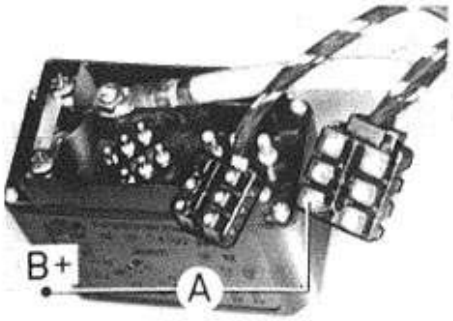


12 23 000 CHECKING HEATER PLUGS – Installed in Car –

Lift cover off of heating time control unit.
Pull off plugs (1 and 2).



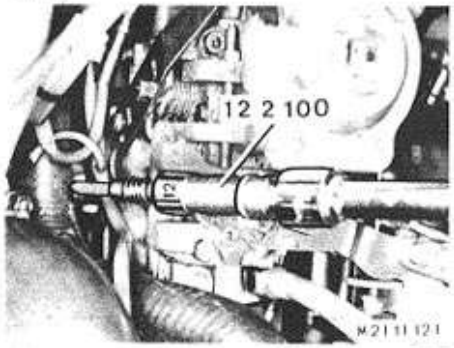
Measuring Resistance:
Measure resistance* of heater plugs with leads with BMW service test unit (M 06) or an ohmmeter.
Apply test lead tips on plug receptacles of plug (2) G1 through G6 and ground (battery –) separately.



Measuring Current:
Hold test leads on battery + and plug receptacles G1 through G6 five seconds each.
Connect BMW service test unit (M 03) or an ammeter and measure current input

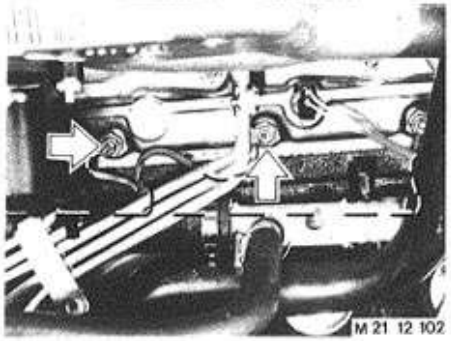
Important!
Do not measure current after removal of heater plugs – danger of injury and burns!
See diagram for temperature curve of heater plugs during operation.

* See Specifications

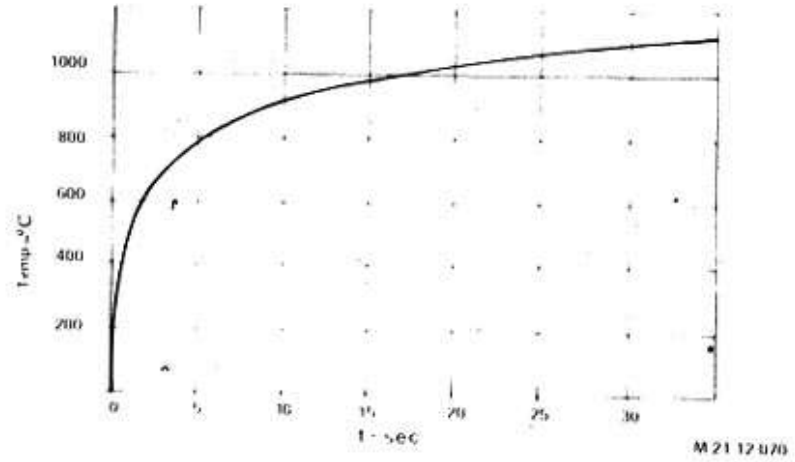


12 23 505 REPLACING ALL HEATER PLUGS

Unscrew connections.
Unscrew heater plugs with Special Tool 12 2 100.



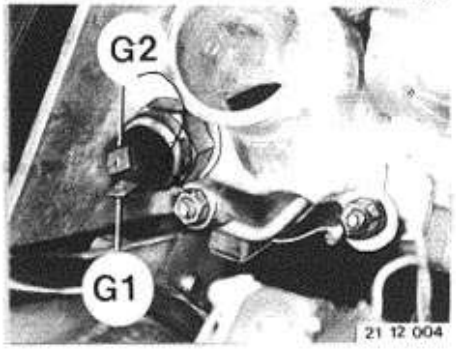
Installation:
Coat threads with copper paste "CRC"**.
Don't twist leads when tightening plugs.
Check tightening torque* of heater plugs and connections.



* See Specifications
** Source: HWB

12 62 . . . CHECKING TEMPERATURE SENSOR FOR COOLANT (Heating Time/Temperature Gage)

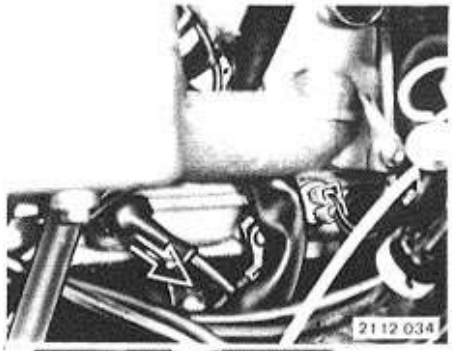
Remove temperature sensor only when coolant temperature is below 40° C (104° F)
danger of scalding!
Installation:
Use new seal.
Tightening torque*.



Connections:
G 1 = for coolant temp. indicator (temperature gage)
G 2 = for heating time control (to heating time control unit)

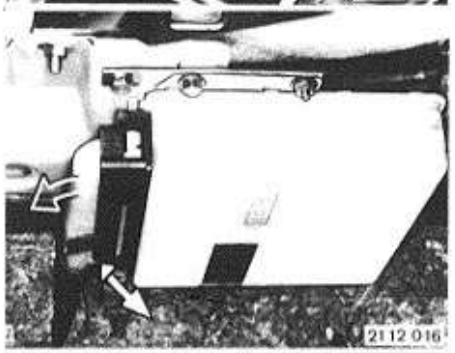
Dip removed temperature sensor in heated coolant up to hexagon and measure resistance* on G 1 / G 2 and ground at specified temperature*.

* See Specifications

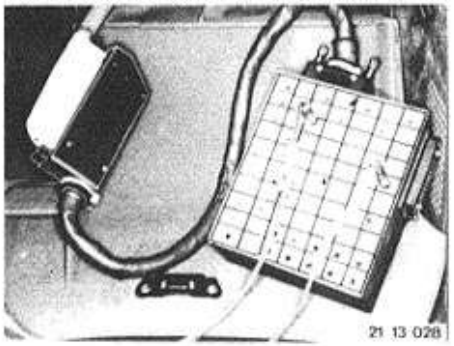


12 62 . . . CHECKING TEMPERATURE SENSOR FOR COOLANT (VP-20)

Pull off plug.
Measure resistance* at testing temperature*.



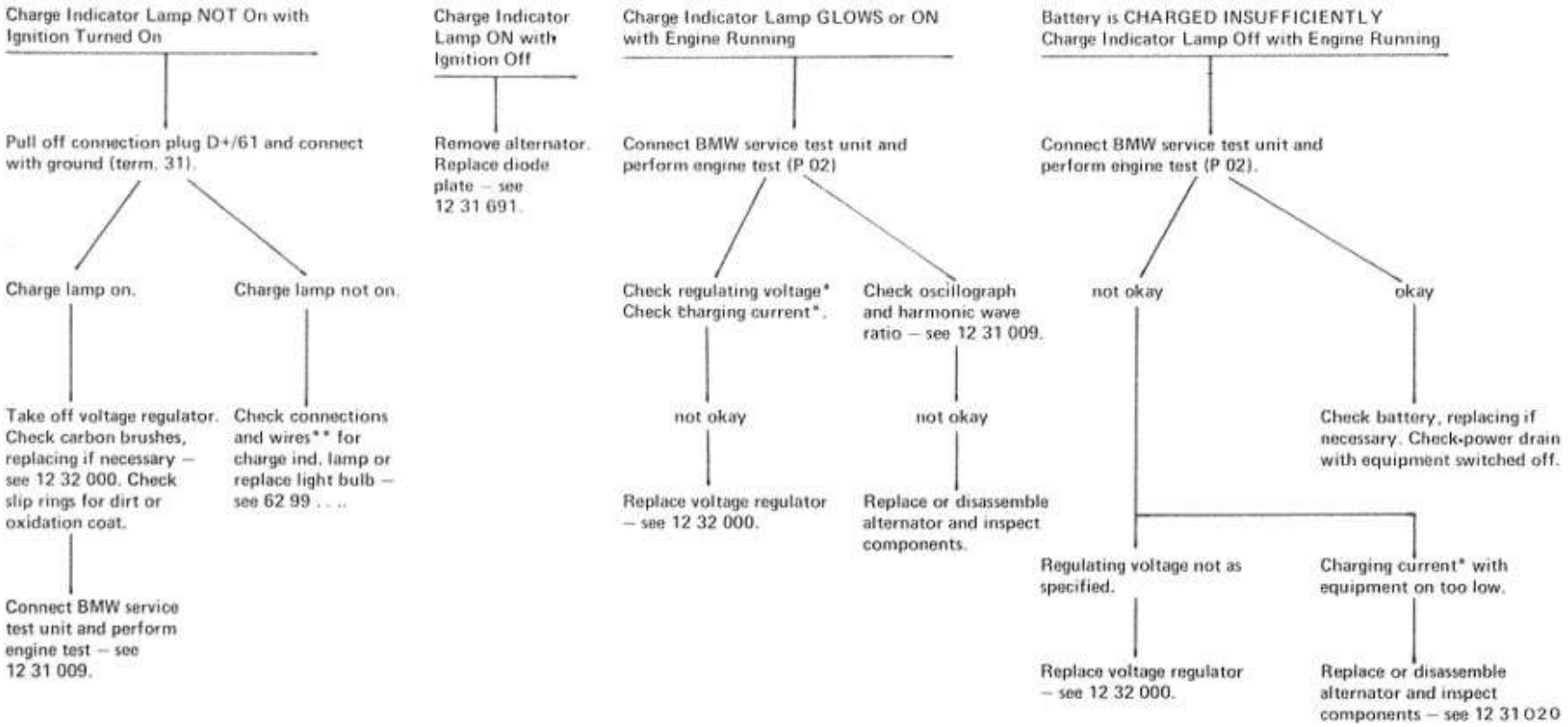
To check sensor with wire, pull off plug on control unit and connect universal adapter**
Measure resistance* on terminal 6/13 also refer to Group 13.
Troubleshooting injection system.



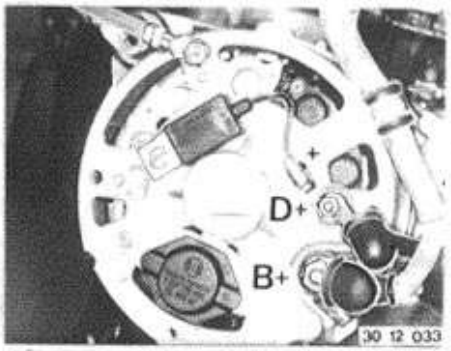
* See Specifications
** Source: HJWB

TROUBLESHOOTING ALTERNATOR

Test Requirements: – Correct connections on battery, starter and alternator.
– Good ground connection between engine and body.
– Tight drive belt.

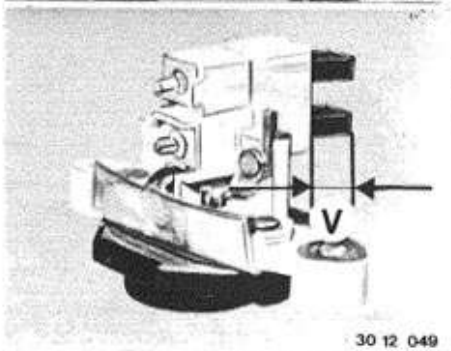


* See nominal value microfiche
** See wiring diagram

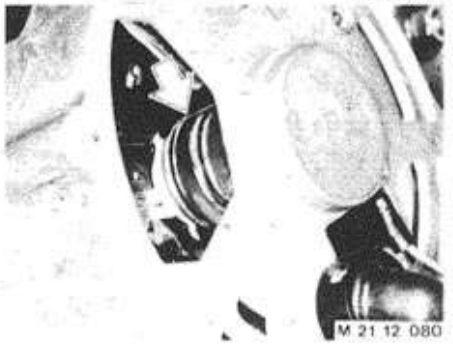


12 31 009 CHECKING ALTERNATOR AND VOLTAGE REGULATOR

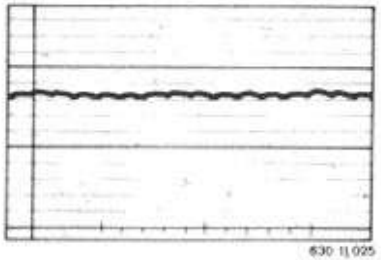
Testing Requirements:
- Correct connections on charged battery
- Correct connections on alternator and starter
- Good ground connection between engine and body.
- Tight drive belt



Indicator Lamp On Continuously:
Remove voltage regulator and check carbon brushes, replacing if necessary – 12 31 200.
Distance "V" for new condition = approx. 12 mm (0.472").

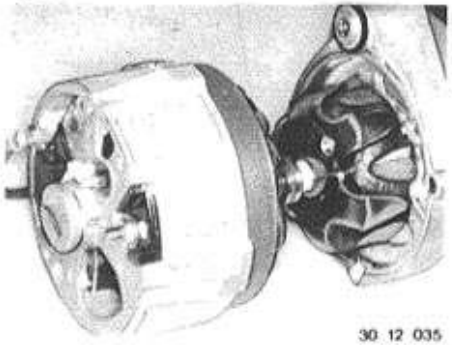


Installation:
Check slip rings for wear, fine grinding and polishing if necessary.
Connect BMW service test unit.
Start engine and compare test values with nominal values*.



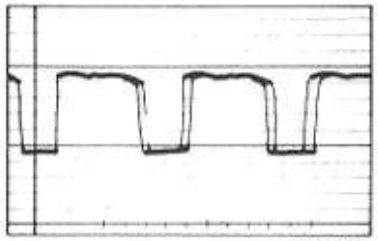
If the battery charge indicator lamp goes out while engine is running and the regulating voltage* is not reached – harmonic wave ratio and oscillograph okay (as shown) – the voltage regulator has to be replaced, see 12 32 000.

* See nominal value microfiche

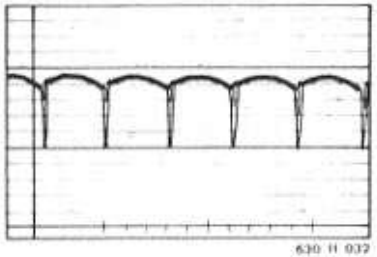


Repeat test.
If the specified charging current is not reached, remove and disassemble alternator, and inspect components – 12 31 020 / 513.

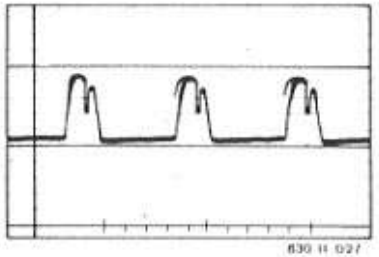
Oscillographs of Defective Alternator:
Defective power or exciter diode.

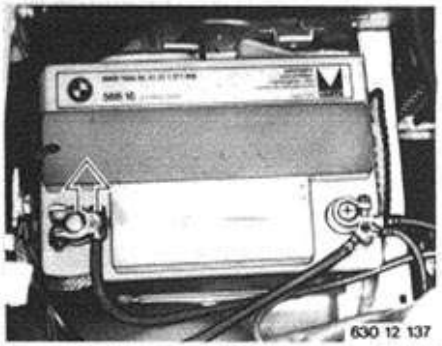


Shorted turn of stator coil.



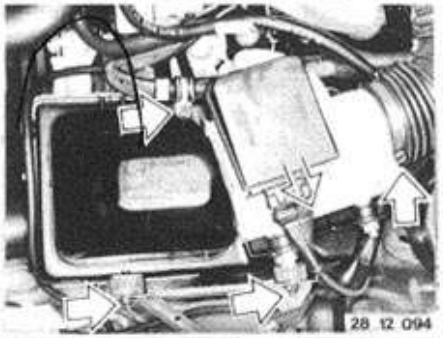
Break in one exciter diode.



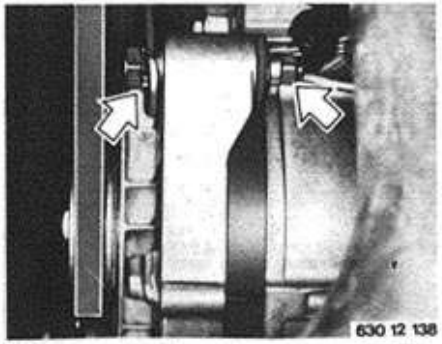

630 12 137

12 31 020 REMOVING AND INSTALLING/ REPLACING ALTERNATOR

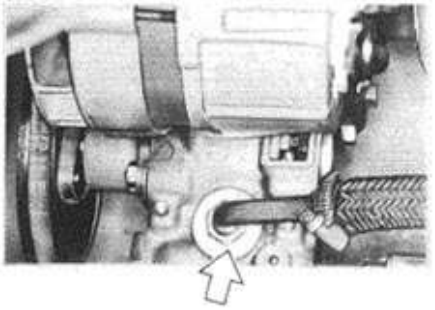
Model 528e/533i/535i
Disconnect battery.
Caution!
Always stop engine before disconnecting wires on battery, alternator and starter.
Also disconnect negative and positive leads when charging battery with a charger.


28 12 094

Remove air cleaner and air flow sensor. (528e only)

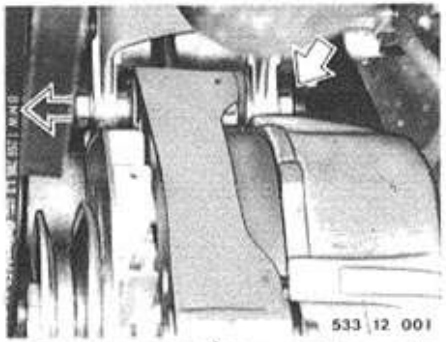

630 12 138

Unscrew nut and remove bolt with tensioning wheel.
Remove drive belt.

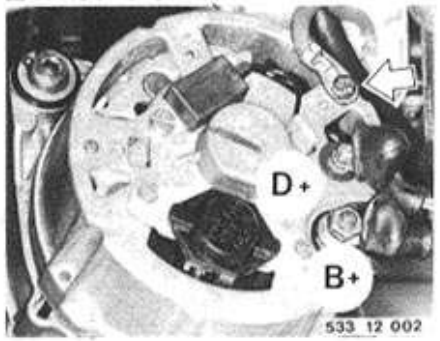

533 12 003

Loosen line on power steering pump, if necessary.
Installation:
Install line, that it cannot rub on engine carrier.
Tightening torque*.

* See Specifications

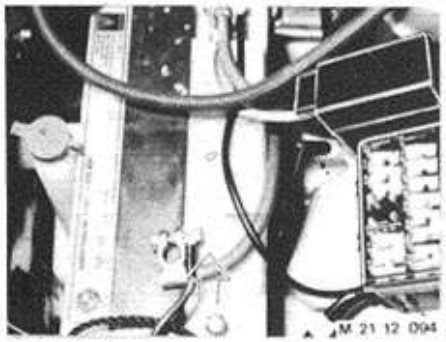

533 12 001

Unscrew nut and pull out bolt.
Remove alternator.
Installation:
Tighten drive belt – 12 31 299.



533 12 002

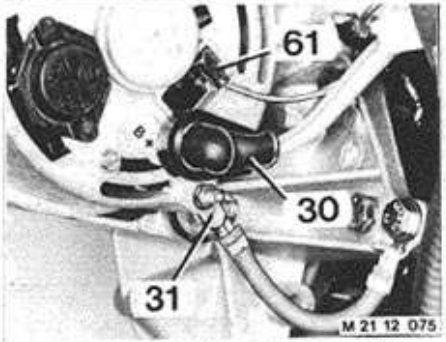
Unscrew wires on connection B + (term. 30) and D + (term. 61).
Unscrew ground wire.



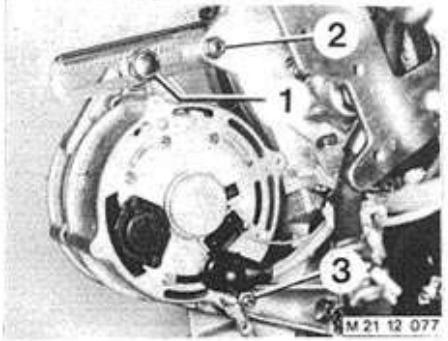
12 31 020 REMOVING AND INSTALLING/ REPLACING ALTERNATOR

BMW 524 td:
Disconnect battery.
Caution!
Always stop engine before disconnecting leads on battery, alternator and starter.
Also disconnect positive and negative leads when charging battery with a charger.

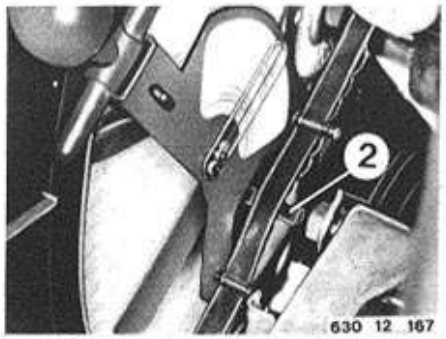
Unscrew and swing away fuel filter.



Disconnect wires on connection B + (term. 30) and D + (term. 61).
Unscrew ground wire (term. 31).

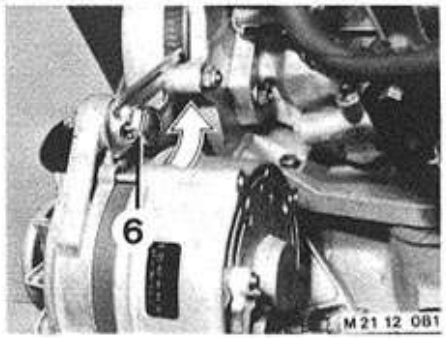


Unscrew bolts (1 and 3).
Remove alternator.
Installation:
Tighten drive belt – see 12 31 299.

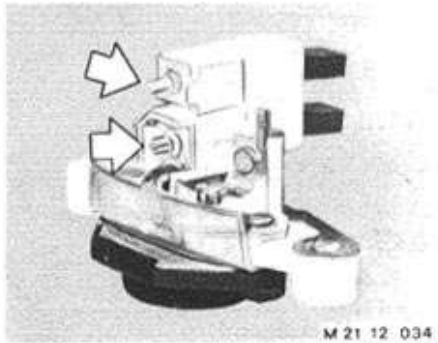


12 31 299 CHECKING AND TIGHTENING ALTERNATOR DRIVE BELT

Check belt tightness with Special Tool 11 5 020, tightening belt if necessary.
Pulling hook (2) must be in middle of teeth.
Gage needle must be above green or yellow field of scale.



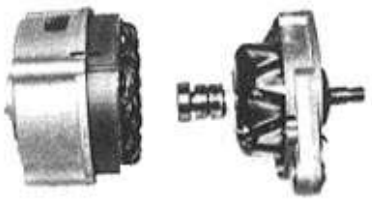
Tightening Belt:
Unscrew nut (1) and turn tensioning wheel (2) with a torque of approx. 7 Nm (5 ft. lbs.).
Tighten nut (1).
Recheck tightness with a tester, correcting if necessary.



M 21 12 034

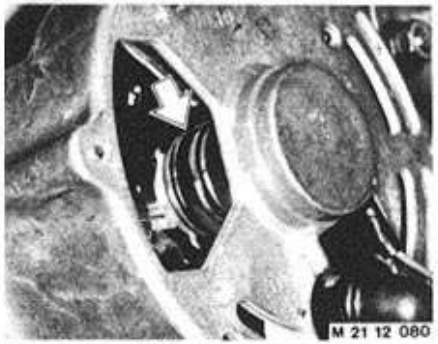
12 31 201 REPLACING CARBON BRUSHES

Remove voltage regulator 12 32 000.
Unsolder leads on carbon brush holder.
Note:
Only use a small amount of solder for soldering to prevent hardening of leads.



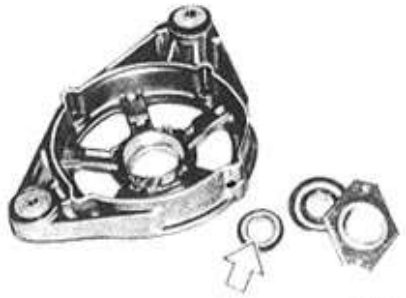
M 21 12 093

Mark housing sections to each other.
Unscrew bolts.
Pull housing sections apart.



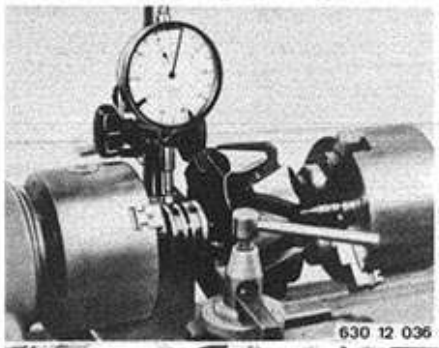
M 21 12 080

Installation:
Check slip rings for wear.
If necessary, remove the rotor and fine grind as well as polish the slip rings – see 12 31 201.



M 21 12 091

Unscrew bearing cap bolts.
Take off the end plate.

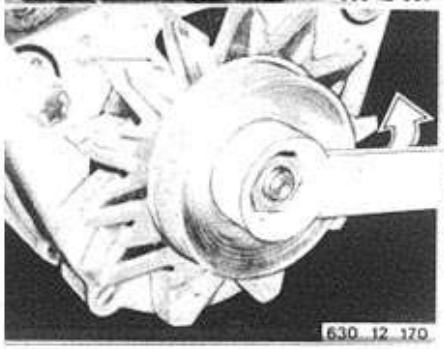


630 12 036

Avoid excessive out-of-true.
Max. slip ring out-of-true = 0.03 mm (0.0012").

M 21 12 031

Unscrew the shielded capacitor.
Unscrew nuts on B + and D/+ terminals.
Take off the diode plate with stator coil.
Installation:
Check condition of insulating sleeves and washers, replacing if necessary.

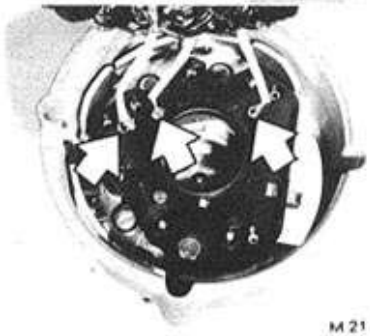


630 12 170

12 31 513 DISASSEMBLING AND ASSEMBLING ALTERNATOR – Alternator Removed –

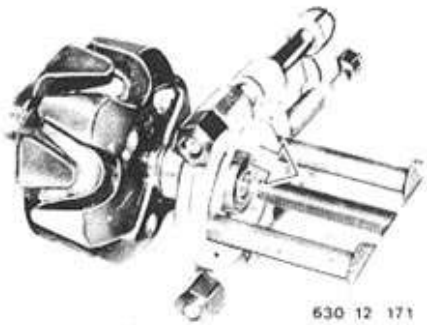
Remove voltage regulator 12 32 000.
Take off the fan.
Remove the pulley, using Special Tool 12 3 000.
Since 1986 Models:
Hold the rotor shaft with a socket wrench.
Installation:
Tightening torque*.

* See Specifications



M 21 12 030

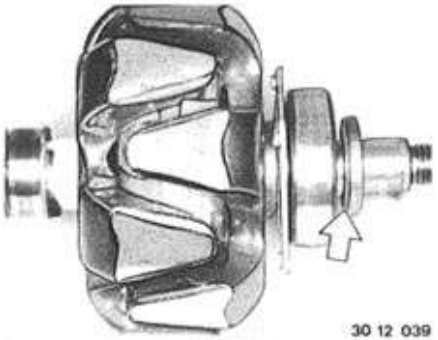
Unsolder stator coil on the diode plate.
Caution!
Excessive heat from soldering iron would destroy the diodes.
Inspect components of the alternator.



630 12 171

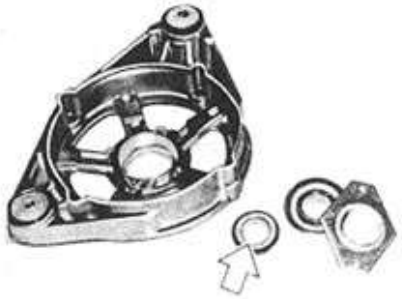
12 31 581* REPLACING BALL BEARING
– Alternator Removed and Disassembled –

Alternator – 65 A:
Pull off bearing with Special Tool 00 7 500.



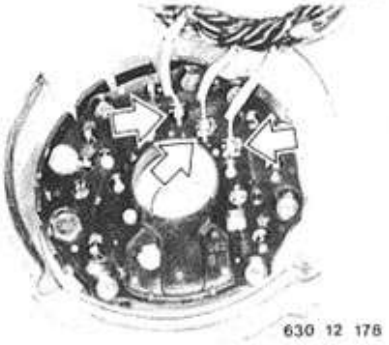
30 12 039

Installation:
Check installed position of washer – collar faces bearing.



M 21 12 091

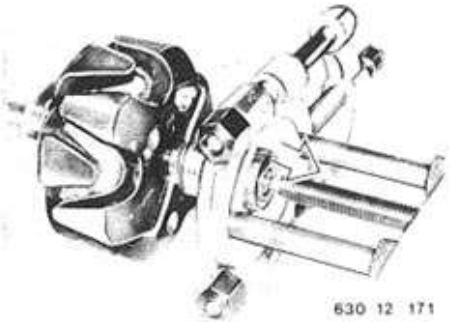
Unscrew bearing cap and press out bearing.
Installation:
Check installed position of washer – collar faces bearing.



630 12 176

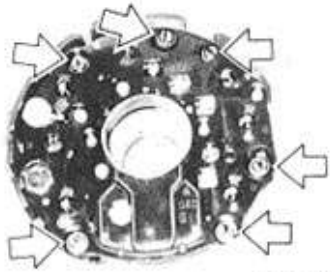
12 31 691 REPLACING DIODE PLATE
– Alternator Removed and Disassembled –

Unsolder stator coil on diode plate.
Caution!
Excessive heat from soldering iron would destroy the diodes.



630 12 171

Alternator – 80 A:
Pull off bearing with Special Tool 00 7 500.

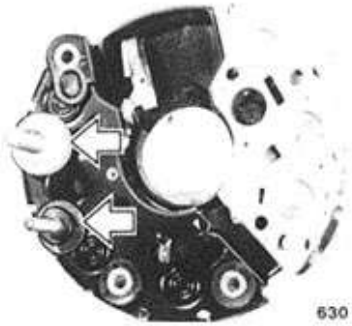


630 12 173

Unscrew bolts.
Remove diode plate.

630 12 172

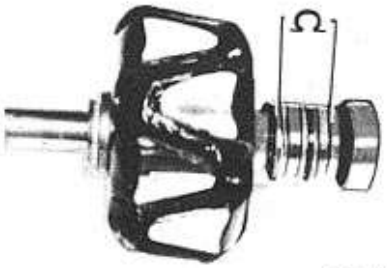
Installation:
Replace cover for bearing, if it had been damaged through application of special tool.



630 12 179

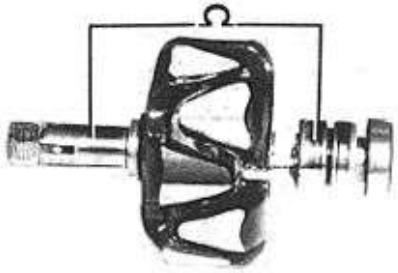
Installation:
Check condition of insulating sleeves and insulators.

12 31 . . . INSPECTING COMPONENTS OF ALTERNATOR



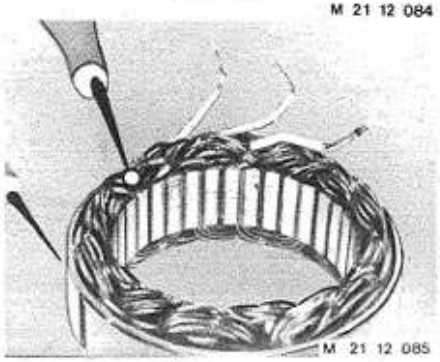
M 21 12 083

Perform tests with the BMW service test unit.
Checking Rotor Coil for Breaks and Shorted Turns:
Connect test leads for resistance test on slip rings.
For 80 A alternator: 2.8 to 3.0 ohms.



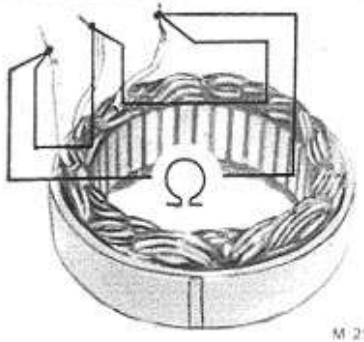
M 21 12 084

Checking Rotor Coil for Ground Contact:
Connect test leads for resistance test on slip ring and rotor shaft.
Nominal value: ∞ = 999 k-ohm display.
Check slip rings, fine grinding if necessary – see 12 31 200.



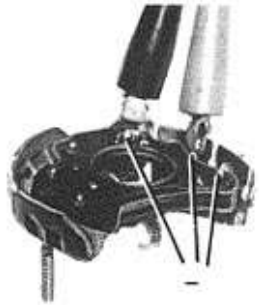
M 21 12 085

Checking Stator Coil for Ground Contact:
Connect test leads for resistance test on solder point and stator (coil carrier).
Nominal value: ∞ = 999 k-ohm display.



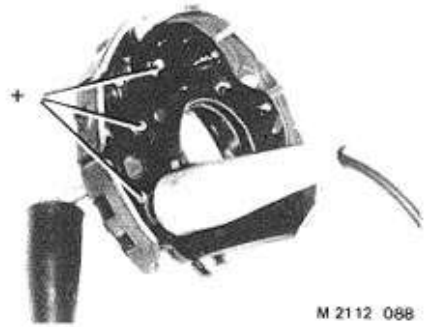
M 21 12 086

Checking Stator Coil for Breaks:
Compare resistance values of wires 1/2, 1/3 and 2/3 with an ohmmeter – they should be identical.
The shorted turn test can be performed with a standard tester.



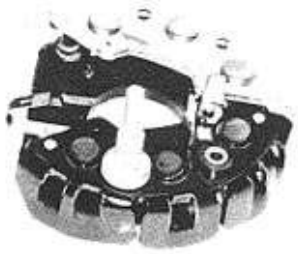
M 21 12 087

Checking Negative Diodes:
Connect test leads for diode test.
Negative lead on cooler and positive lead on one of the negative diode connections.
Display with perfect condition diodes: polarity "–".



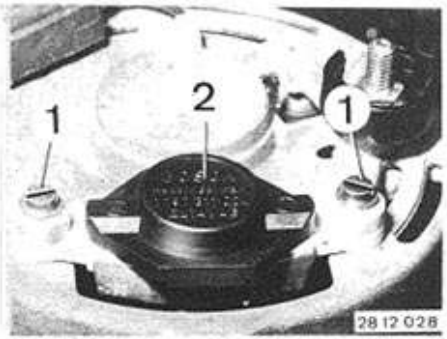
M 2112 088

Checking Positive Diodes:
Connect negative lead on B + connection pin and positive lead on one of the positive diode connections.
Display with perfect condition diodes: polarity "+".



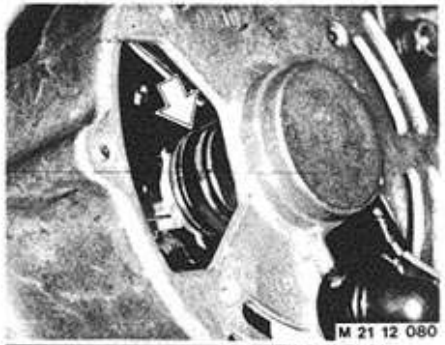
M 21 12 089

If a diode is defective, replace entire diode plate – 12 31 691.

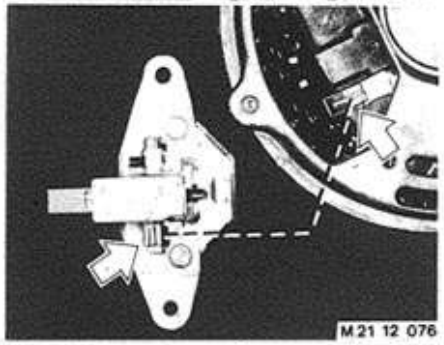


13 32 000 REMOVING AND INSTALLING/ REPLACING VOLTAGE REGULATOR

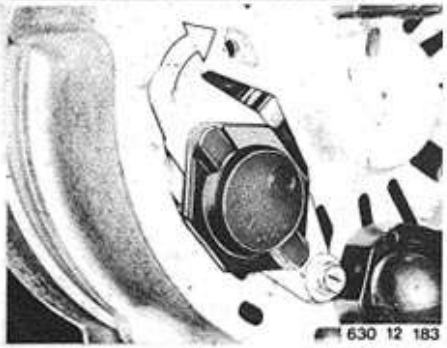
Unscrew bolts (1) and take off regulator (2) carefully.



Check slip rings for wear, fine grinding if necessary.



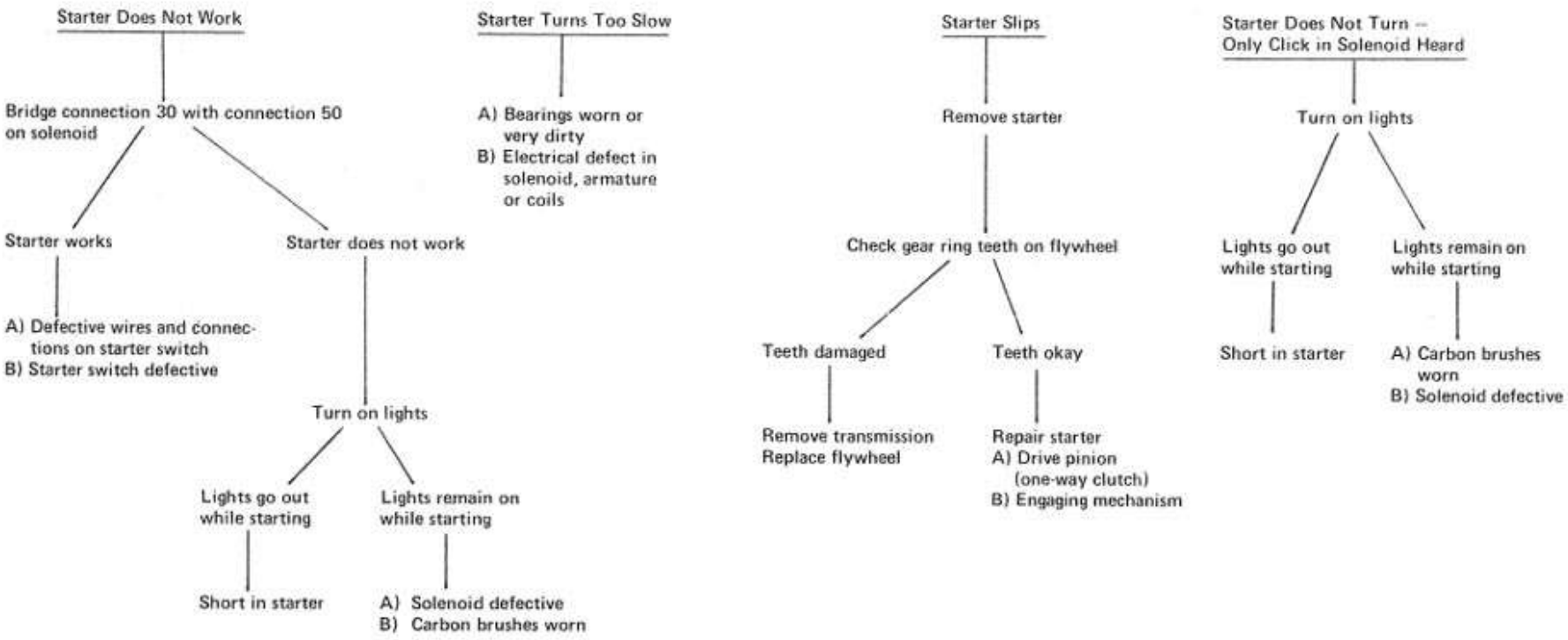
Clean contact surfaces and check tension of spring contacts, correcting if necessary.

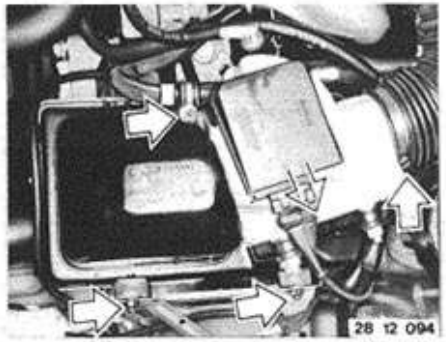


Installation:
Mount regulator at first with one bolt screwed in finger tight, then press alternator to final installed position carefully, install and tighten all bolts.

TROUBLESHOOTING STARTER

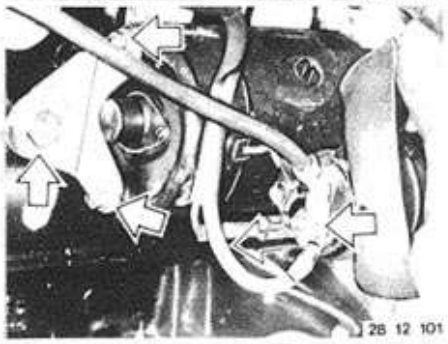
Testing Requirements: – Correct connections on battery and starter
– Good ground connection between engine and body
– Charged battery



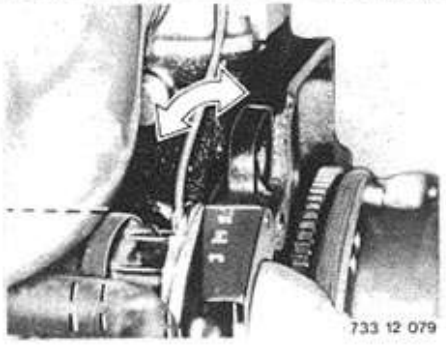


12 41 020 REMOVING AND INSTALLING STARTER

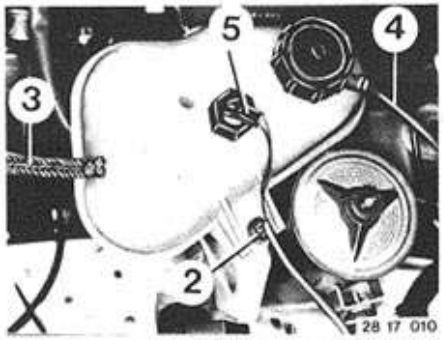
BMW 528 e:
Disconnect battery.
Remove air cleaner with air flow sensor



Disconnect leads (term. 30 and 50).
Unscrew support.

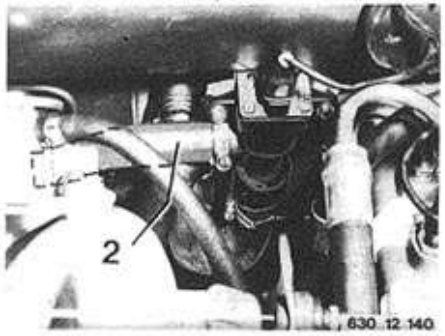


Unscrew nuts.
A ring wrench can be bent subsequently to improve accessablility – see figure.
Unscrew 2nd starter bolt from below.
Take off starter from below.

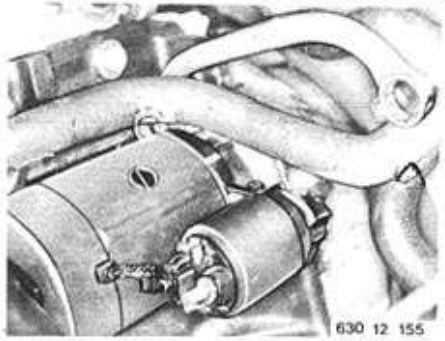


BMW 533 i / 535 i:
Disconnect battery ground lead.
Drain coolant and take off expansion tank.

Installation:
Add coolant * and bleed cooling system – see 17 00 039.

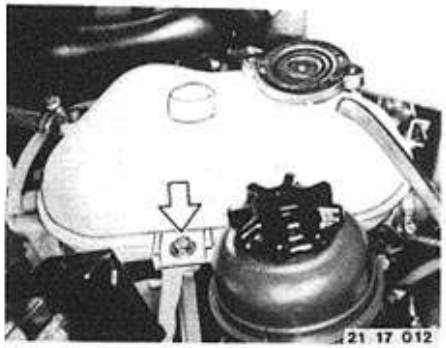


Detach heater hose.



Disconnect leads (term 30 and 50).
Remove mounting bolts.
Unscrew top bolt with the bent ring wrench and take off starter.

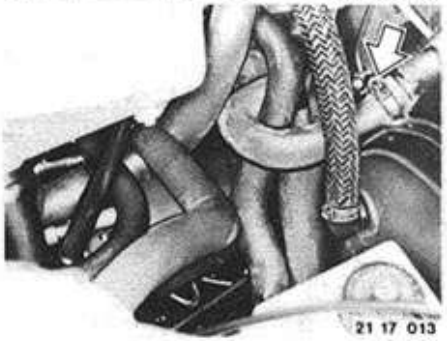
* See Service Information of Gr. 00



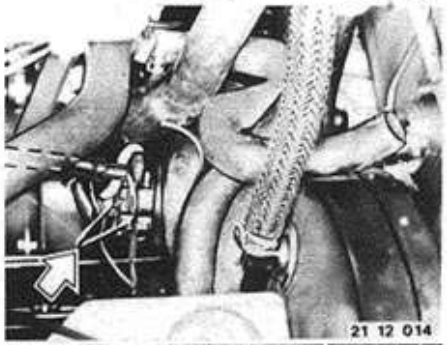
12 41 020 REMOVING AND INSTALLING STARTER

BMW 524 td:
Disconnect battery ground lead.
Take off expansion tank and drain coolant.

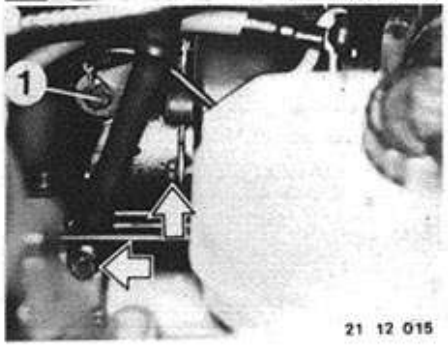
Installation:
Add coolant* and bleed cooling system – see 17 00 039.



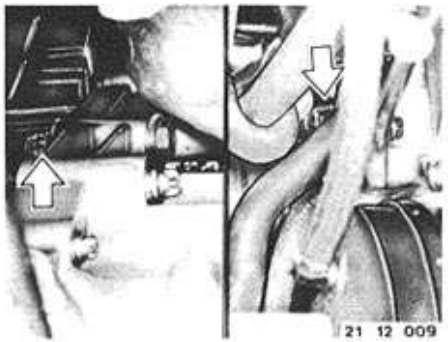
Detach heater hose.



Uscrew wires (B +/Term. 30 and Term. 50).



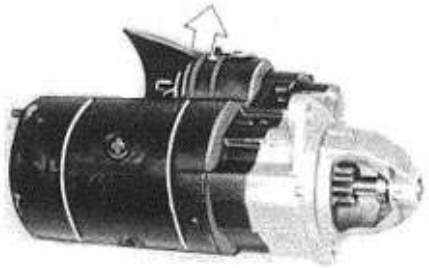
Unscrew support for air collector and support plate.
Note ground wire on bolt (1).



Unscrew bolts and remove starter from above.

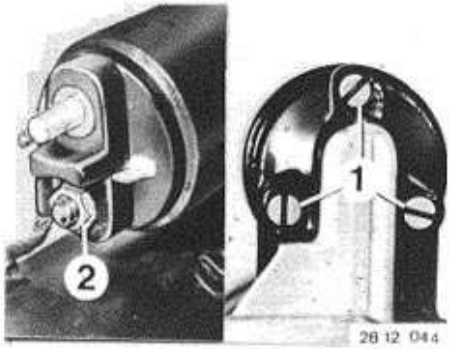
* See Service Information of Gr. 00.

12 41 041 REPLACING SOLENOID SWITCH



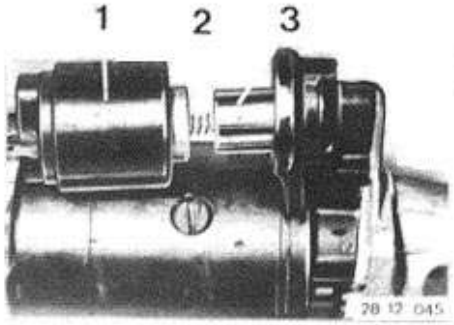
M 21 12 095

Remove starter – 12 41 020
Take off cover.



28 12 044

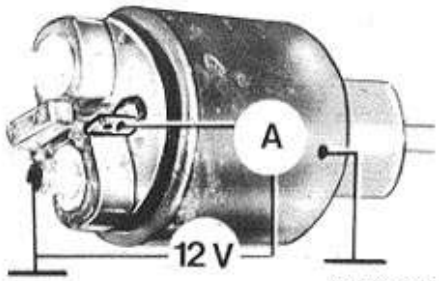
Unscrew solenoid switch (1 and 2).
Installation:
Don't bend wire connector while tightening switch – danger of short circuit.



28 12 045

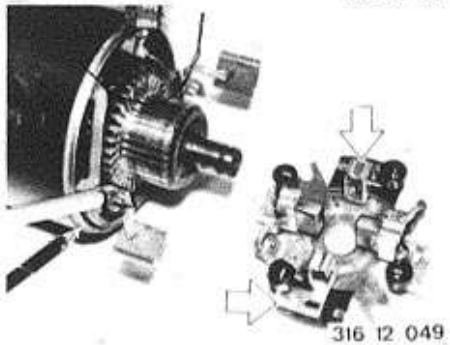
Take off solenoid switch (1) and spring (2).
Disconnect pin (3).
Installation:
Check pin (3) for wear and lubricate with grease.

12 41 . . . INSPECTING COMPONENTS OF STARTER (Electric Test)



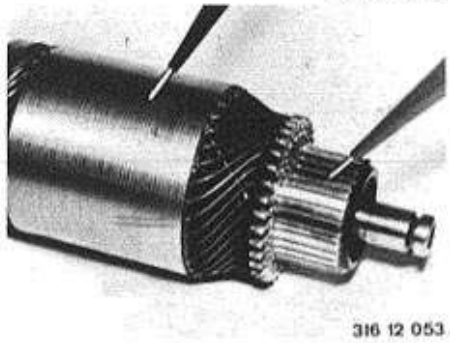
630 12 186

Check power input* of activating and holding coils in solenoid switch.



316 12 049

Check exciter coil, carbon brush holder and armature coil for ground connection.
Check armature for coil short – use conventional tester.



316 12 053

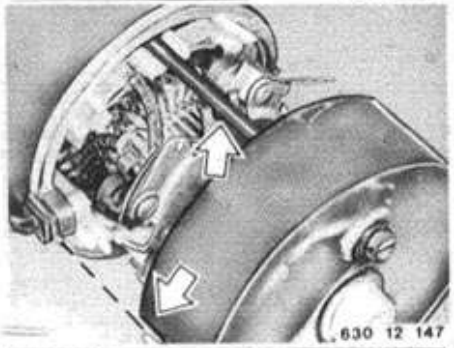
* See Specifications

630 12 052

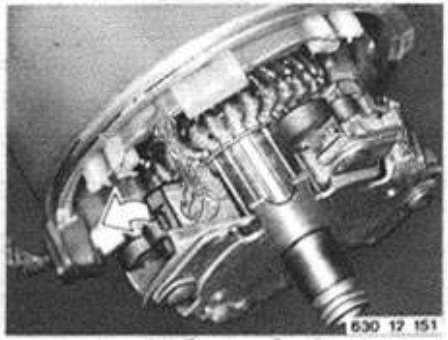
12 41 103 DISASSEMBLING/ASSEMBLING STARTER

Model 528 e / 533 i / 535 i

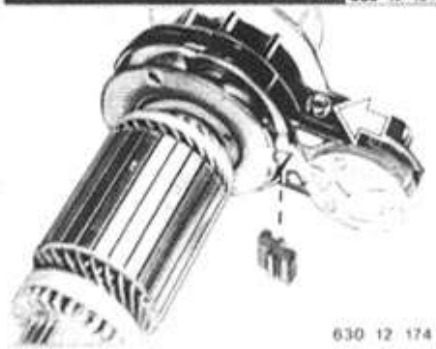
Remove starter – see 12 41 020.
Remove solenoid switch – see 12 41 041.
Unscrew dust cap (2).
Take off circlip (3), shims (4) and seal (5).
Installation:
Check axial play of armature, correcting with shims if necessary.


630 12 147

Unscrew housing bolts and take off cover.
Installation:
Align openings for housing bolts and insulator to each other.
Check bearing sleeve, lubricating with oil before installing.

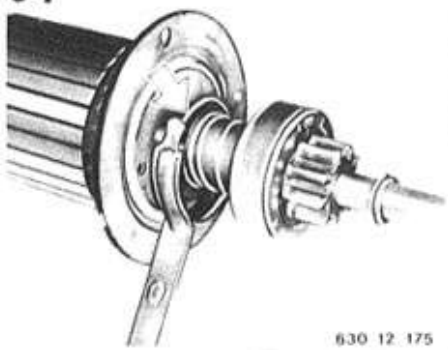

630 12 151

Lift springs and pull out carbon brushes.
Remove holder.
Installation:
Check carbon brushes and commutator for wear, repairing if necessary – see 12 41 551.

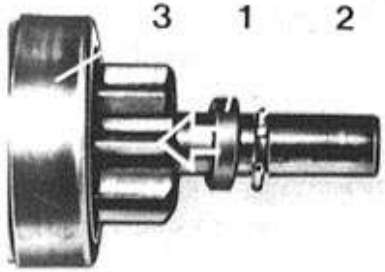

630 12 174

Remove pole housing.
Unscrew engaging lever bolt and remove rubber seal.

* See Specifications


630 12 175

Lift out armature with drive pinion and engaging fork.
Installation:
Lubricate guide for engaging fork with grease.
Check bearing sleeve in drive bearing bracket, lubricating with oil before installing.

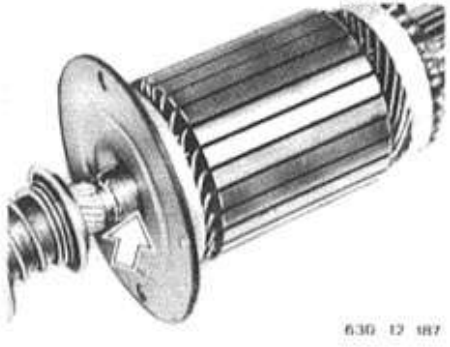


28 12 049

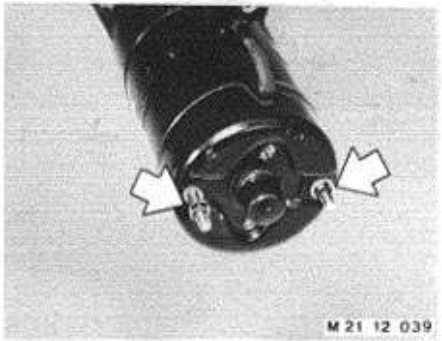
Push back bearing race (1) with a piece of suitable pipe.
Pry circlip (2) apart and pull it off of the shaft.
Remove burrs with a file.
Take off drive pinion (3).
Installation:
Use new circlip (2).
Lubricate bearing surface for drive pinion with grease.


630 12 144

Installation:
Check pinion for wear (on teeth, bearings, one way clutch), replacing if necessary.

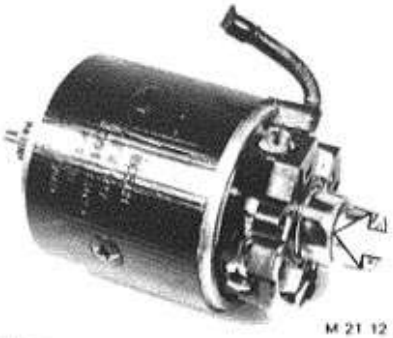

630 12 187

Check sleeve in intermediate bearing, replacing if necessary.

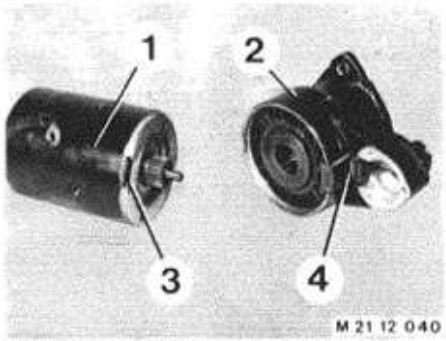

M 21 12 039

12 41 403 DISASSEMBLING/ASSEMBLING STARTER

Model 524td:
Remove starter 12 41 020.
Remove solenoid 12 41 041.
Unscrew both bolts.
Installation:
Clean all parts thoroughly before assembling.


M 21 12 045

Insert a size 22 mm wrench socket or piece of pipe with approx. 30 mm (1.181") outside diameter to prevent carbon brushes from springing out.

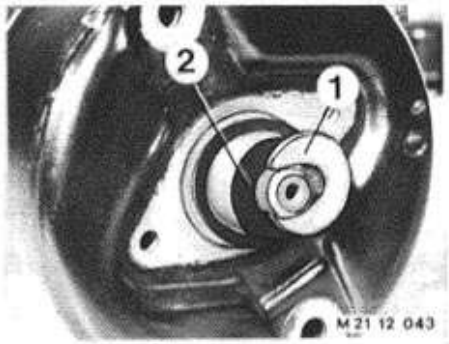


M 21 12 040

Disconnect motor (1) on gearbox (2).
Installation:
Groove (3) must be aligned with rubber part (4).

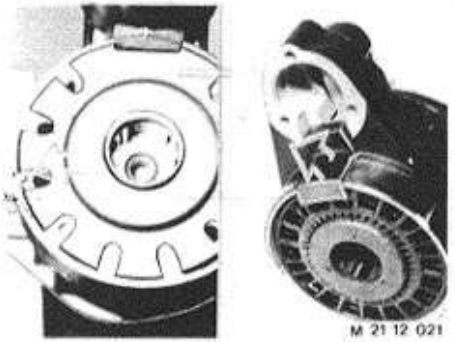

M 21 12 046

Installation:
Use wrench socket or pipe again to make installation easier.
Place entire unit on transmission case and then tighten wire connector.

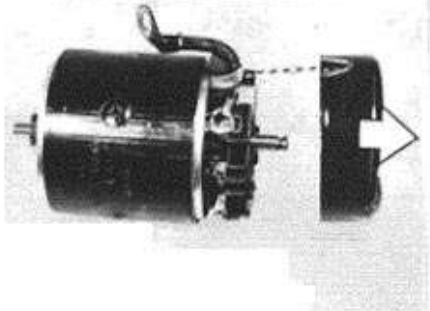


M 21 12 043

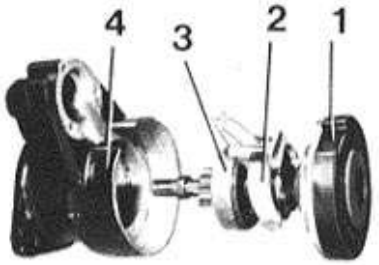
Take off protective cap.
Remove retainer (1) and shims (2).
Installation:
Check axial play*, correcting if necessary.


M 21 12 021

Remove cover and rubber pad.


M 21 12 044

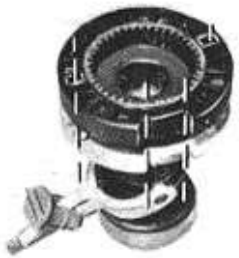
Check armature shaft, removing burrs if necessary.
Take off cover.



M 21 12 054

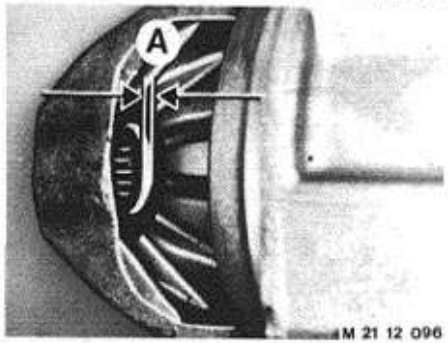
Pull out transmission assembly.
Take off toothed ring on planet gear and release.
1 Planet gear
2 Release
3 Pinion
4 Transmission case

* See Specifications



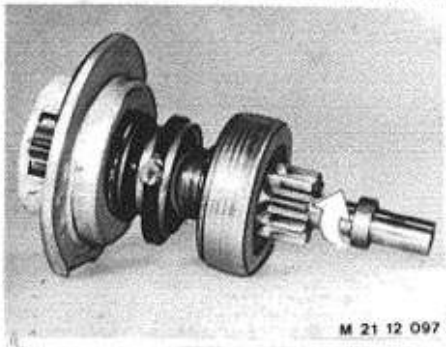
Installation:
Openings and bores must be aligned.

M 21 12 057



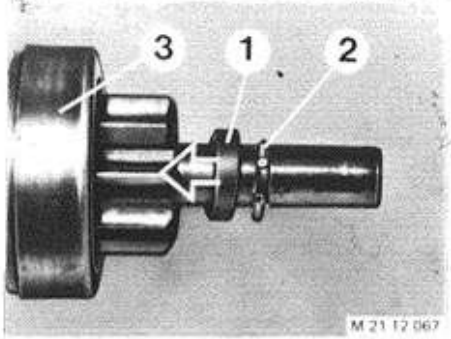
M 21 12 096

Check bearings, driving out with a suitable mandrel if necessary.
Installation:
Lubricate new bearing with grease and press in.
Distance A = approx. 1 mm (0.039").



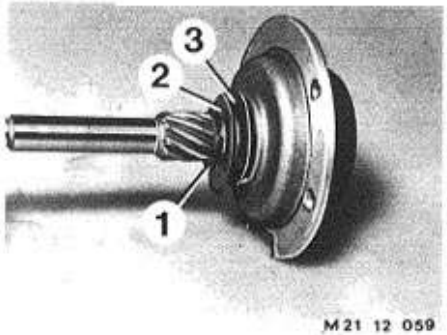
M 21 12 097

Turn drive pinion against stop.
Pinion can be turned very easily when one-way clutch is worn.
Check bearing sleeve and teeth of pinion for wear.



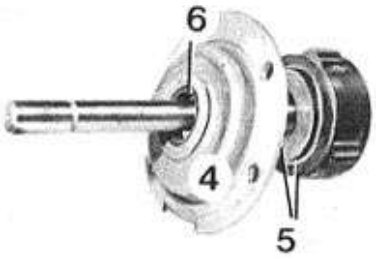
M 21 12 067

Knock back thrust ring (1) and pull off circlip (2) toward front.
If applicable, remove burrs and then take off drive pinion.
Installation:
Clean pinion bearing surface thoroughly and lubricate with grease.



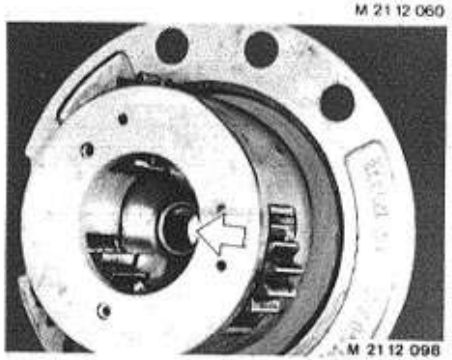
M 21 12 059

Pull off circlip (1) and remove washers.
2 Metal washer
3 Plastic washer



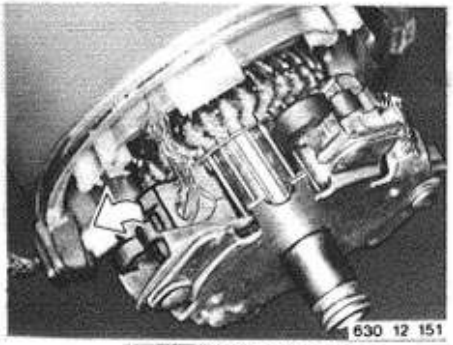
Remove bearing cap (4) and washers (5).
Check bearing sleeve (6), replacing if necessary.
Installation:
Lubricate sleeve with oil after pressing in.

M 21 12 060



M 21 12 098

Check bearing sleeve, removing with a suitable puller if necessary.
Check planet gears for wear.
Installation:
Lubricate sleeve with oil after pressing in.


630 12 151

12 41 551 REPLACING CARBON BRUSHES
– Starter disassembled –

Model 528e/533i/535i:
Lift springs and pull out carbon brushes.


630 12 060

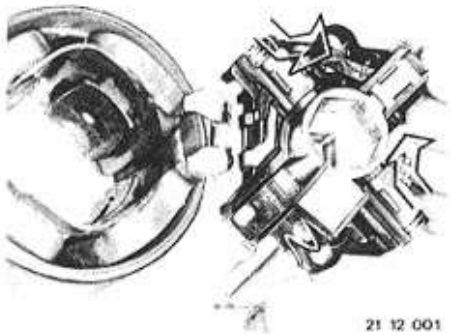
Remove holder and pole housing.
Unsolder or cut off all carbon brushes.
When soldering in new carbon brushes, make sure that copper leads are not hardened with flowing solder.


630 12 065

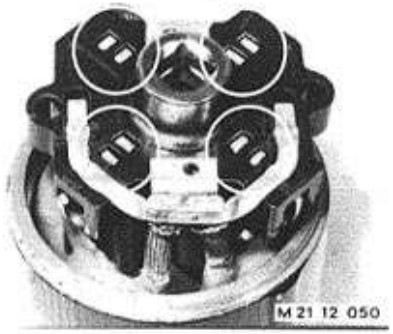
Check commutator for wear, fine grinding if necessary.
Diameter must be at least 33.5 mm (1.319").
Machine insulation between plates approx. 0.5 to 0.7 mm (0.020 to 0.028") deep.

Check armature for shorted turns after repairing.

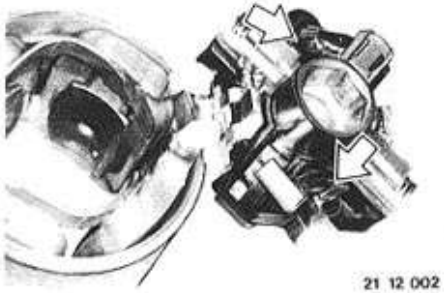
Model 524td:
Fine grind and polish commutator on armature.
File or machine insulation between commutator plates 0.5 to 0.7 mm (0.020 to 0.028") deep.
Check for shorted turns after repairing.


21 12 001

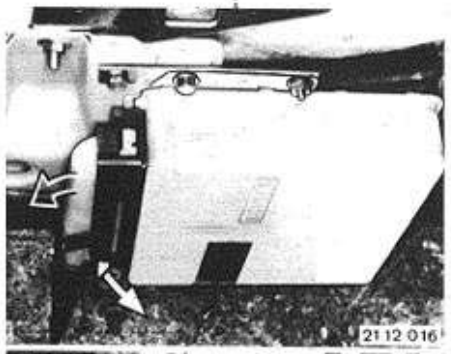
Push carbon brush holder to middle and lift off.


M 21 12 050

Installation:
Engage hooks of carbon brush holder fully.

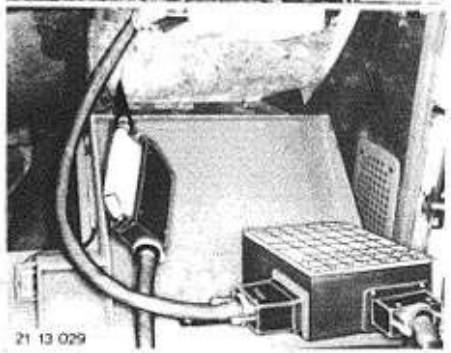

21 12 002

Two carbon brushes have to be cut off on the leads.
Solder in new carbon brushes.

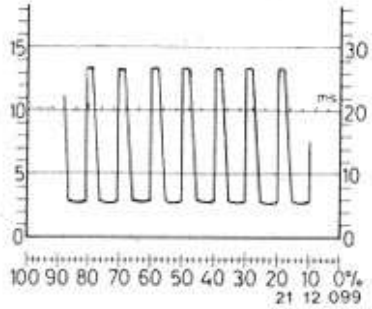


12 63 . . . CHECKING SPEED SIGNAL FOR TACHOMETER

Remove cover in glove box.
Pull off plug on control unit VP-20.



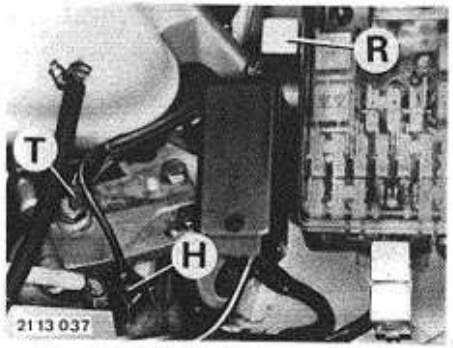
Connect universal adapter**.
Connect test leads for control unit and periphery.



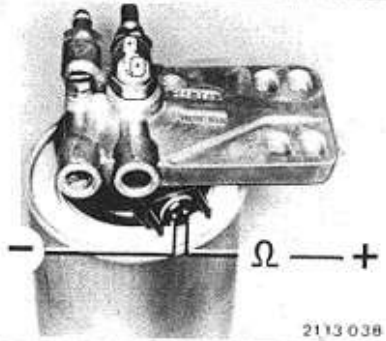
Connect oscilloscope on terminals 17 (–) and 21 (+).
Start and run engine at idle speed.
The illustrated oscillograph must appear on the screen.
If necessary, check speed sensor – see 12 14 160.

** Source: HWB

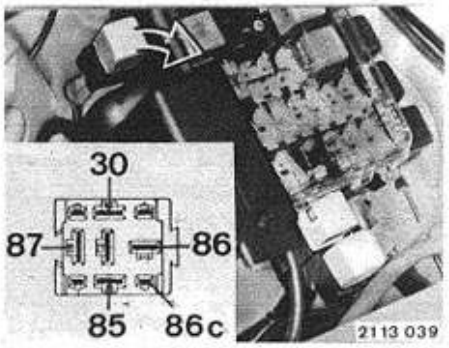
12 64 . . . CHECKING FUEL HEATING



Fuel is heated when its temperature is less than + 5° C (41° F) in ignition key position "DRIVE".
Temperature switch (T) activates relay (R), which supplies current to heating element (H) – see engine electrical equipment wiring diagram.



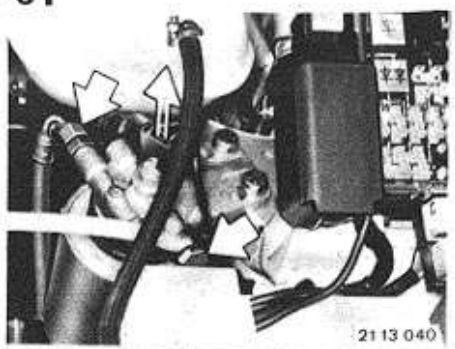
Measure coil resistance* with an ohmmeter replacing heating element if necessary.
Check switching temperature* of temperature switch.



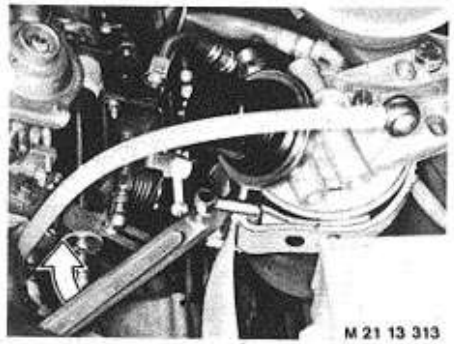
Pull off relay and apply battery voltage on terminal 87 (black wire) approx. 10 seconds.
Measure power input* – must drop as temperature of heating element rises.

* See Specifications

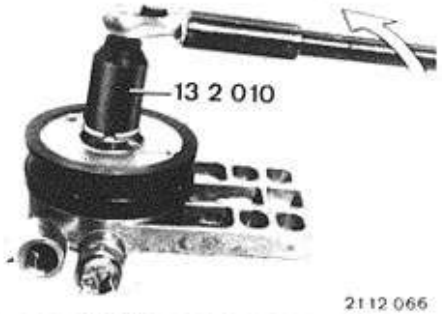
12 64 005 REPLACING FUEL HEATING ELEMENT



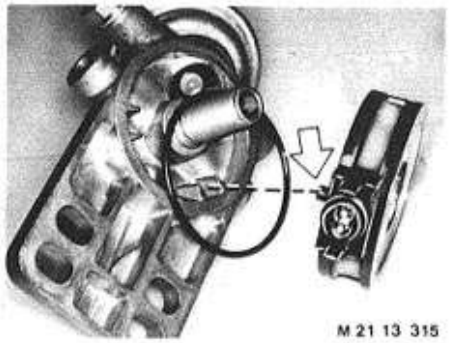
Unscrew fuel lines.
Pull off plugs for temperature switch, water level sensor and heating element.



Unscrew filter cartridge with a standard filter strap.
Unscrew filter head and take off unit.

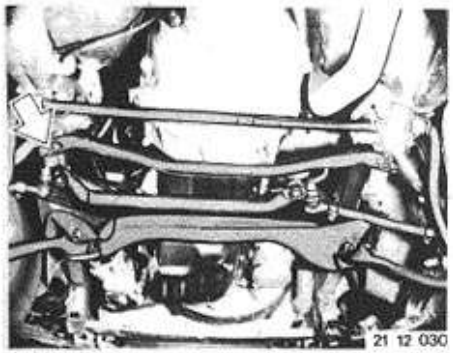


Unscrew filter cartridge.
Unscrew heating element with Special Tool 13 2 010.



Installation:
Insert heating element seal correctly – note dowel pin.
Tighten nut to correct torque*.
Tighten filter cartridge to instructions on filter.
Bleed fuel filter, see 13 32 051.

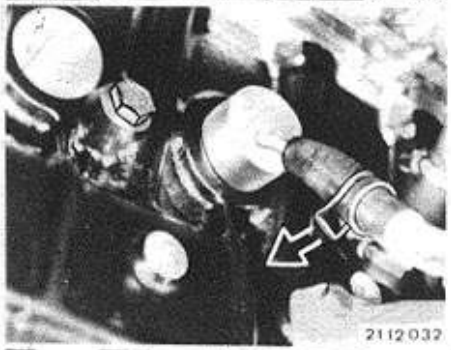
* See Specifications


21 12 030

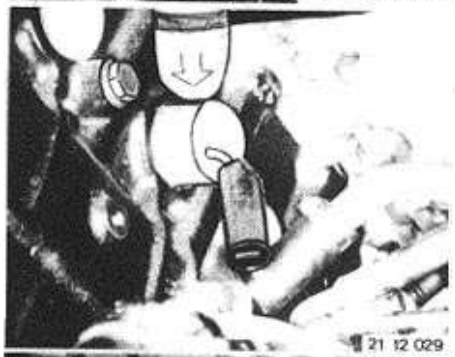
12 81 . . . REPLACING / CHECKING COOLANT HEATER

Caution!
Heater is operated with 120 AC voltage – never work on a connected heater.

Remove rod.

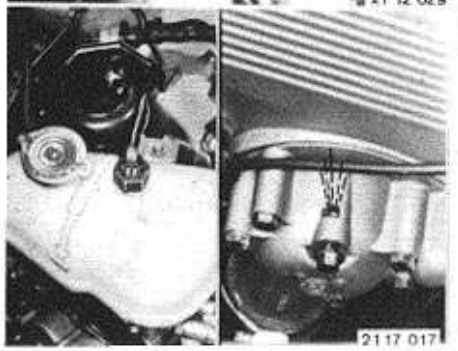

21 12 032

Remove retainer and pull off plug.
Drain coolant from engine.

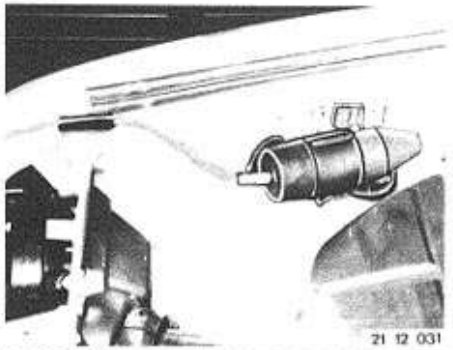

21 12 029

Loosen heater on engine block by applying knocks from the side with a plastic hammer.
Clean sealing surface.

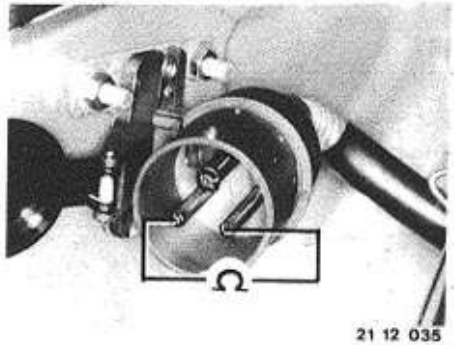
Installation:
Coat sealing surface with Loctite No. 573.
Knock in heater uniformly until seated well, not necessarely against stop.


21 17 017

Fill cooling system with specified coolant** and bleed cooling system – see 17 00 039.


21 12 031

Caution!
Never operate heater before filling the cooling system – danger of destruction.



21 12 035

Checking:
Open socket and check resistance * and insulation of heater, replacing cable or heater if necessary.

Never repair single components (connecting lead and cable, as well as socket and heater); always replace only a complete part.

** See Service Information of Gr. 00

* See Specifications

13 Fuel system

BMW 524 td

BMW 528 e/A

BMW 533 i/A, 535 i/A

WORKING INSTRUCTIONS

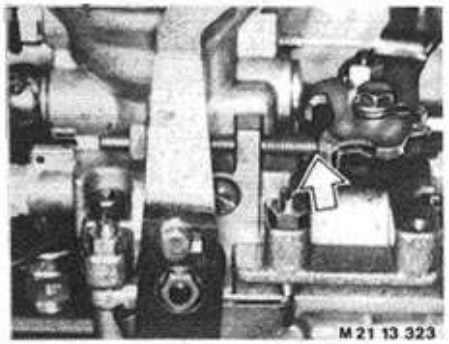
These instructions concern cleanliness when working on fuel supply and control systems.

- Clean area around repair point thoroughly – e.g. before disconnecting lines, switches, etc..
- Place removed parts only on clean surfaces and cover with plastic sheet – never use cloths losing lint.
- Cover or inert plugs in open lines and openings in parts immediately – do not work with compressed air.
- Only install cleaned parts.
  Take new replacement parts out of their packaging only shortly before installing.
- Keep diesel fuel off of coolant hoses – or wash off immediately with water if applicable.

EXPLANATIONS OF ABBREVIATIONS

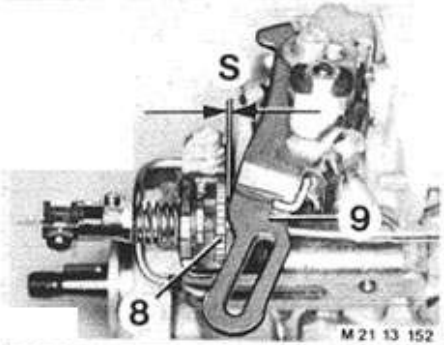
Injection Pump Attachments:

TLA	– Temperature dependent idle speed boost
ALDA	– Atmospheric and charging air pressure dependent full load stop
AGR	– Exhaust gas recirculation (EGR)

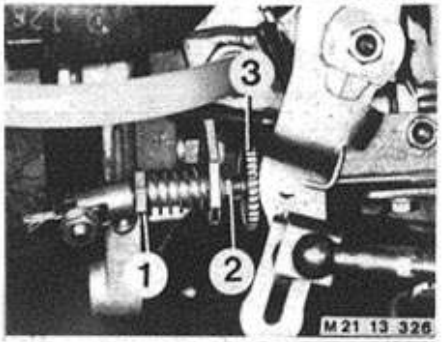


13 00 050 CHECKING / ADJUSTING ENGINE IDLE SPEED

Requirements:
- Engine at operating temperature (oil temperature > 60° C / 140° F).
- Valve clearance okay
- All electric equipment switched off
- Speed lever resting on adjusting screw



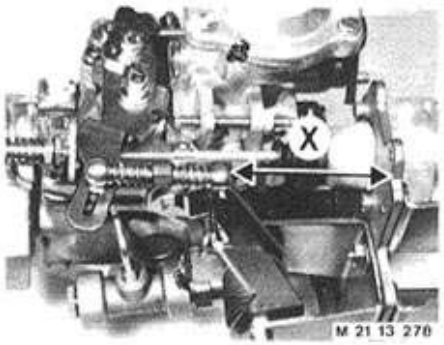
Check or correct play "S" of 0.5 ± 0.3 mm (0.020 ± 0.012") between knurled head screw (8) and speed lever (9).



Hold on hexagon (1) and unscrew nut (2).
Turn knurled head screw (3) until play "S" is reached.

Start the engine.
Check the idle speed* and, if necessary, loosen nut (1) and turn adjusting screw (2) until the correct idle speed* is reached.
Tighten nut (1) again.
Recheck play "S", correcting if necessary.

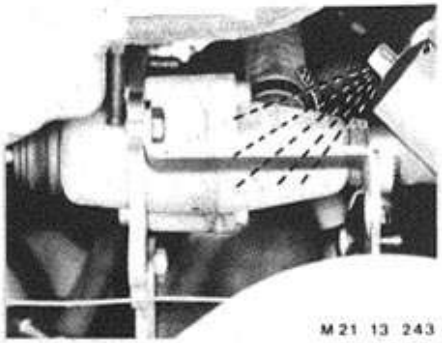
* See Specifications



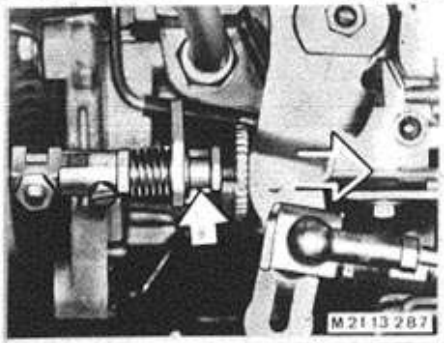
Cars with Automatic Transmission:
Check distance "X" in idle position, correcting if necessary – linkage basic adjustment – see 13 51 340.

13 00 550 CHECKING / ADJUSTING COLD IDLE DEVICE (TEMPERATURE DEPENDENT IDLE SPEED BOOST)

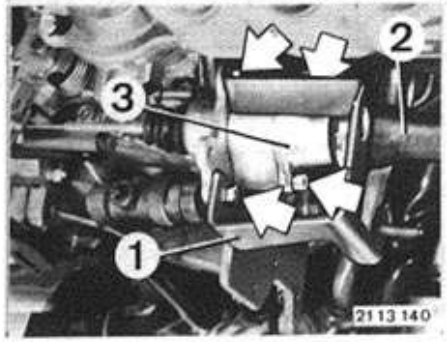
Requirements:
Coolant temperature: < 20° C (68° F).
Idle speed (warm) okay.



Checking Expansion Element:
Spray housing for expansion element with a refrigerating spray** about one minute.



Pull back the speed lever by hand slightly.
The piston with knurled head screw should be pulled back by 2 to 3 mm (0.079 to 0.118") by the action of the expansion element.
Replace the expansion element, if necessary.



Checking Adjustment:
Unscrew holder (1) for the cable.
Pinch hoses (2) with clamps and unscrew housing (3).

** Source: HWB

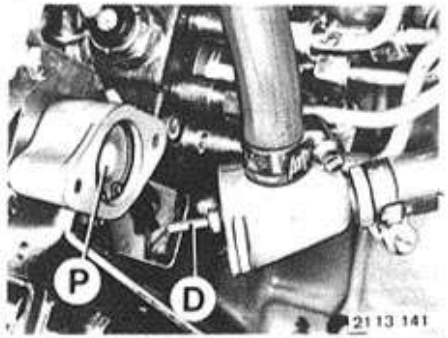
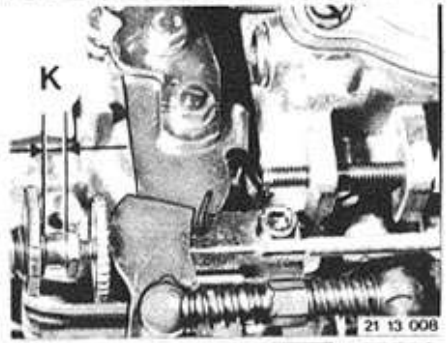
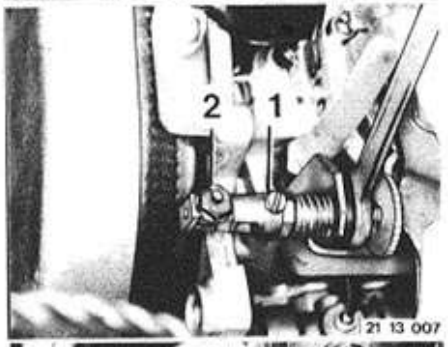


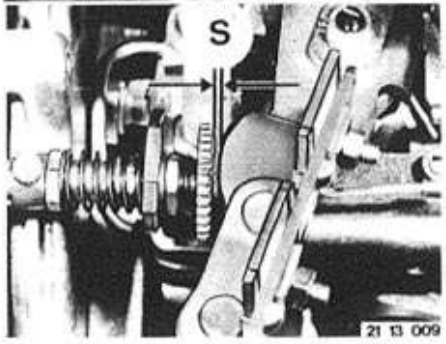
Plate (P) must rest on the circlip by spring pressure.
Installation:
Make sure that expansion element (D) is seated correctly.



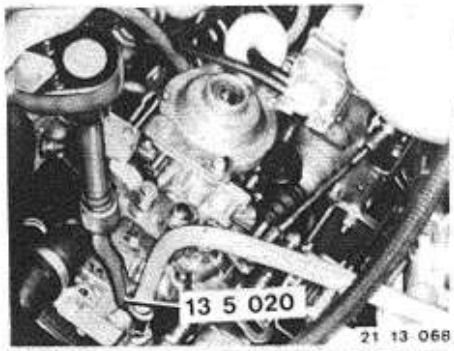
The adjusting device should now be pulled out.
Distance "K" = 5.5 ± 0.4 mm (0.216 ± 0.016").



Correction:
Loosen clamps (1 and 2) and turn until the distance "K" is reached.
Apply a 10 mm fork wrench to help making adjustments.
Tighten clamp (2) first and then (1).

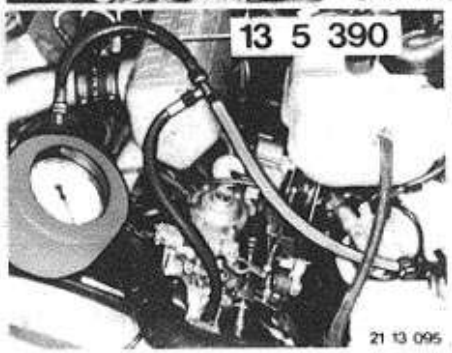


Check/correct play "S" = 0.5 ± 0.3 mm (0.020 ± 0.012") after making adjustments.
Check / correct the engine idle speed – see 13 00 050.



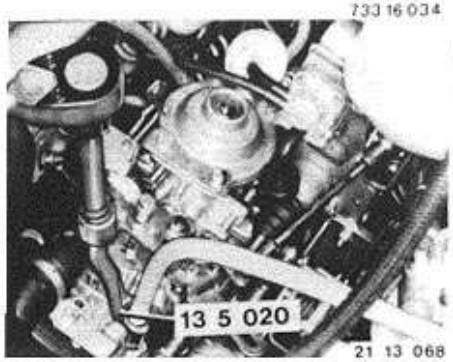
13 31 028 CHECKING FUEL FEED PRESSURE

Unscrew coupling nut with Special Tool 13 5 020.
Counterhold adapter with a fork wrench.



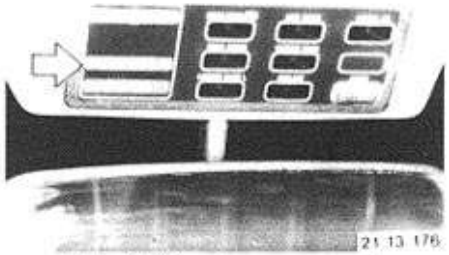
Connect pressure meter 13 5 390 with adapter. Turn start key to "DRIVE" position before tightening adapter on the injection pump, so the line can discharge itself.

Start engine and read feed pressure * at test speed *.
If specified value is not reached, check
– filter screen in tank,
– fuel transfer pump,
– fuel lines and
– fuel filter.



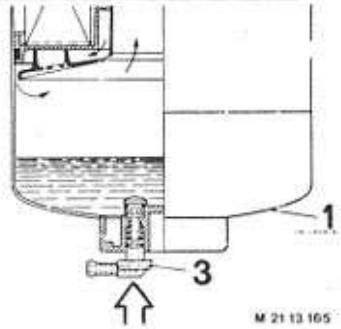
Bleed feed line again after testing.

* See Specifications

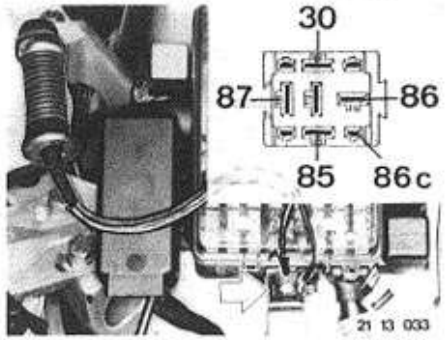


13 32 . . . DRAINING WATER IN AND BLEEDING FUEL FILTER

Water in the fuel filter is detected by a water sensor and reported to check control where it is displayed.

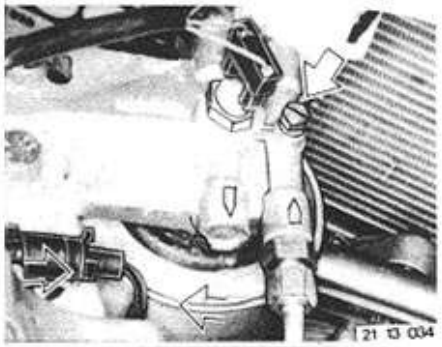


Loosen bleeder screw.
Hold an approx. 0.2 liter (0.4 pint) container underneath drain adapter (3), using a short hose if necessary.
Press drain adapter (3) and drain fluid until pure fuel runs out.

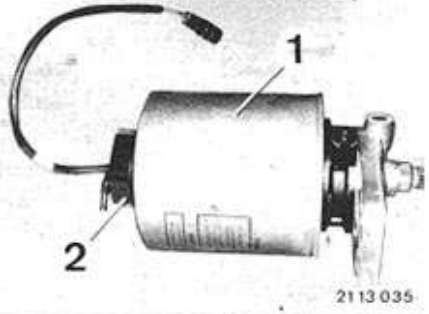


Pull off relay for fuel transfer pump and connect tester 61 3 050 on terminals 30 and 87, and operate pump until fuel runs out of bleeder screw opening.

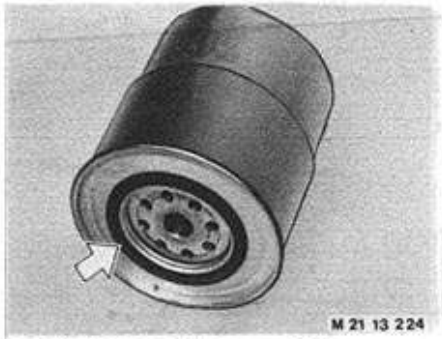
13 32 051 REMOVING AND INSTALLING/ REPLACING FUEL FILTER



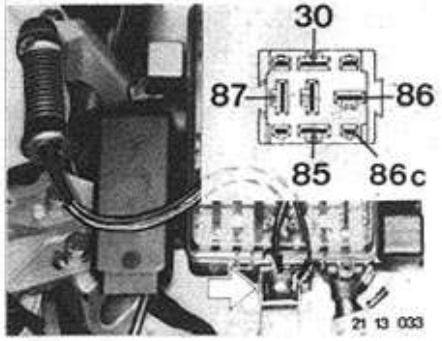
Loosen bleeder screw and drain a little fuel through water drain connection – see draining water in fuel filter, 13 32 . . ..
Disconnect plug on water level sensor.
Unscrew filter with a standard tool, if necessary.
Installation:
Replace seal.



Unscrew bolt with water level sensor (2) and install on new filter.

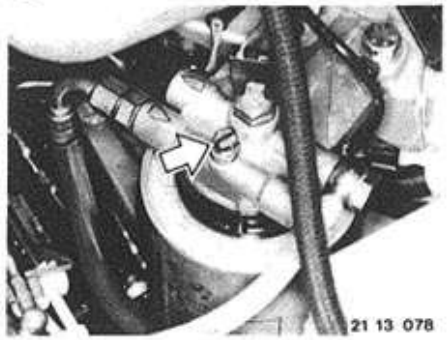


Coat seal with fuel and screw on filter against surface, and then tighten by hand with one half turn – see installing instructions on filter.



Pull off relay for fuel transfer pump and bridge terminals 30 and 87 with Special Tool 61 3 050.

* See Specifications



Operate fuel transfer pump until fuel runs out of bleeder screw opening and then tighten screw again.
Start engine and check filter for leaks, tightening filter if necessary.

TROUBLESHOOTING SURVEY FOR ENGINE ELECTRICAL, FUEL AND INJECTION SYSTEMS

Requirements:
- Starting system (battery voltage, starter, ignition lock, etc.) in perfect condition
- Engine in perfect running condition (timing, compression, charging air pressure)
- Specified fuel in tank (no contamination, winter-proof)
- Connections, plugs and ground points according to wiring diagram

2.) Engine does not start or hard to start (coolant temp. < 35° C/95° F)
3.) Engine hard to start (coolant temp. > 35° C/95° F)
5.) "Injection" warning lamp on (check control)
7.) Insufficient power/smoke (no warning lamp)
9.) Insufficient power in cold running phase
10.) Unsatisfactory idling
12.) Erratic engine running/black smoke
13.) Foggy type smoke
15.) Engine power output not reached

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		Test Position	Reference
	X																			1	Heating system	12 21 . . .
	X	X						X	X					X						2	Fuel feed/filter/shutoff valve	13 31 . . ./13 51 . .
	X	X							X											3	Air in fuel system	13 51 ...
								X						X						4	Accel. pedal/linkage/cable adjustments	Gr. 35/13 51 ...
																				5		
																				6		
	X	X		X							X			X						7	Injection begin - static/dynamic	13 51 ...
	X			X																8	Injection pump internal pressure	13 51 ...
														X						9	Fuel return / OUT bolt	13 51 ...
	X					X			X		X									10	Injection pump	13 51 ...
	X	X				X		X	X			X		X						11	Pressure valves/injection nozzles	13 51 .../13 51 ...
																				12		
						X					X	X								13	Power supply to control unit/relay VP-20	Eng. wiring diagram
				X							X									14	Speed sensor	12 14 ...
				X							X									15	Injection duration nozzle	13 53 ...
				X				X	X		X									16	Coolant temperature sensor VP-20	12 62 ...
				X							X									17	Timing valve in injection pump	13 51 ...
	X	X				X					X	X								18	Control unit	13 61 . . .
																				19		
						X								X						20	ALDA/altitude compensator	13 51 ...
						X		X												21	EGR control/EGR valve	Group 11
																				22		
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TESTING INSTRUCTIONS FOR VP-20 FUEL INJECTION

These instructions show a sequence of tests for time saving diagnosis and repairs.
The listed test points only describe such jobs which are not contained in the troubleshooting survey.

Testing Equipment:
- BMW service test unit, e.g. engine test step 05 (P 05) or multimeter 02 (M 02).
- Test adapter to measure beginning of injection, in conjunction with BMW service test unit.
- Universal adapter* for periphery test and diagnosis in conjunction with check control

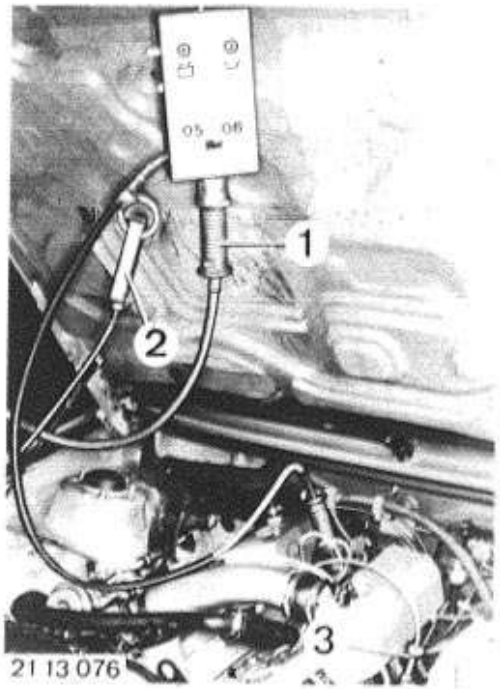
Testing Requirements:
- Charged battery
- Starting system in perfect condition
- Specified fuel in tank
- Engine in perfect running condition (timing, toothed belt, compression etc.)
- Connections, plugs and ground points according to wiring diagram

Turn ignition on.
"INJECTION" lamp in check control on. — no → Check lamp. Check power supply – see Group 62.

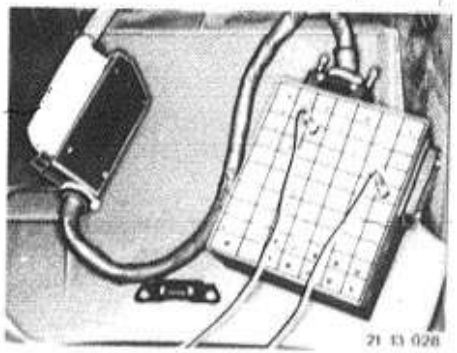
↓

Start engine (coolant temp. < 35°C/95°F) — runs poorly → Check heating system – see 12 21 . . .

does not run → Check fuel feed pressure – see 13 31 . . .
Check electric shutoff – see 13 51 . . .
Bleed fuel system – see 13 51 . . .



21 13 076

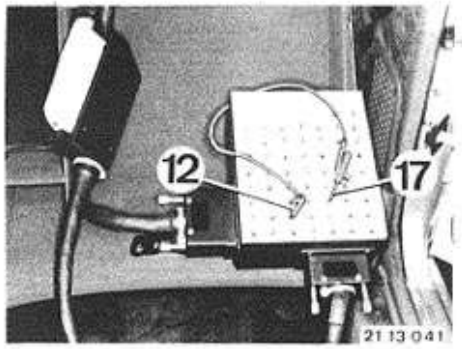

21 13 028

* Source: HWB

Engine running, increase speed to approx. 2,000 rpm.
"INJECTION" lamp goes out.

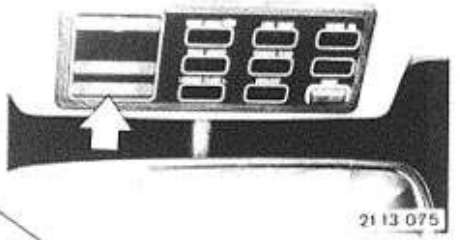
no

Connect universal adapter with test lead for periphery and control unit as shown.
Start engine and activate defekt check control:
Bridge term. 12 and 17 briefly (1 to 2 sec.) with test lead.
Observe and count flash pulses of INJECTION lamp.
Lamp remains on continuously after flashing.
If INJECTION lamp is only on continuously at high speed, there must also be a defect check control at this speed.



Check dynamic injection begin*, correcting static adjustment of injection pump if necessary – see 13 51 006 / 506.

0 – 2 – 4 – 6 – 8 flash pulses



VP-20 control unit defective.

Initial injection nozzle not working.

Check resistance * of initial injection nozzle (term. 4/5) and insulation resistance (term. 4/17 and 5/17), replacing nozzle if necessary – see 12 53 . . .

Speed sensor not working.

Check resistance * of speed sensor (term. 8/27) and insulation resistance (term. 8/17 and 27/17) adjusting or replacing speed sensor if necessary – see 12 14 ...

Start engine and reactivate defect check control.

* See Specifications

6 Flash Pulses

Timing valve in injection pump not working or injection begin deviating from specifications by more than 4° on crankshaft.

Measure resistance * of timing valve (term. 14/18) and insulation resistance (term. 14/17 and 18/17) replacing if necessary – see 13 51 ...

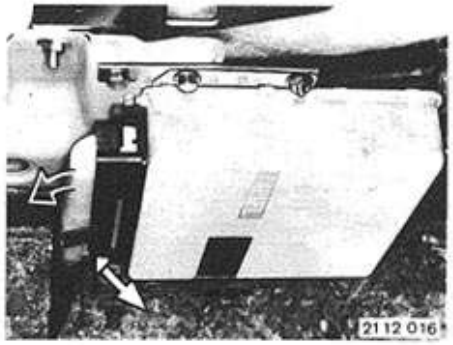
Check dynamic injection begin, correcting static adjustment if necessary – see 13 51 006 / 506.

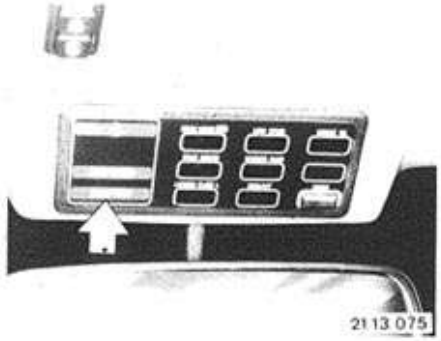
8 Flash Pulses

Coolant temperature sensor not working.

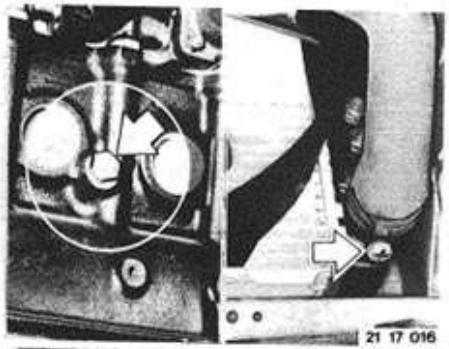
Measure resistance * of temperature sensor (term. 6/13) and insulation resistance (term. 6/17 and 13/17) replacing if necessary – see 12 62 ...

Start engine and reactivate defect check control.





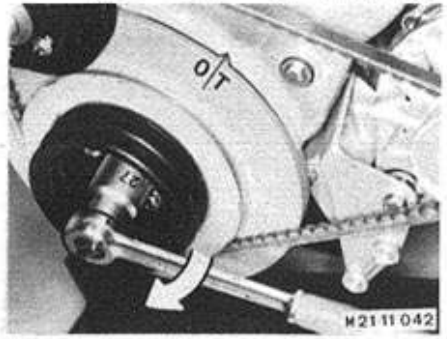
* See Specifications



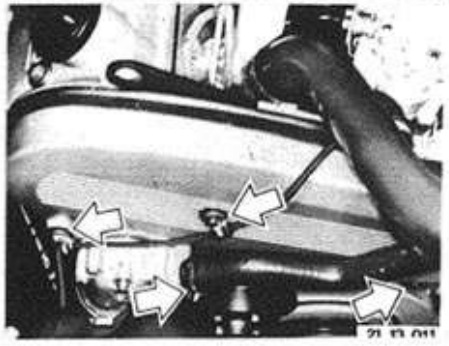
13 51 000 REMOVING AND INSTALLING INJECTION PUMP

Removing:
Unscrew drain plugs on engine and radiator, and drain coolant.
Unscrew and swing away expansion tank.
Installation:
Add coolant* and bleed cooling system – see 17 00 039.

Unscrew fan cowl.
Unscrew fan (left-hand threads).
Hold with Spezial Tool 11 5 030 – see 11 52 000.

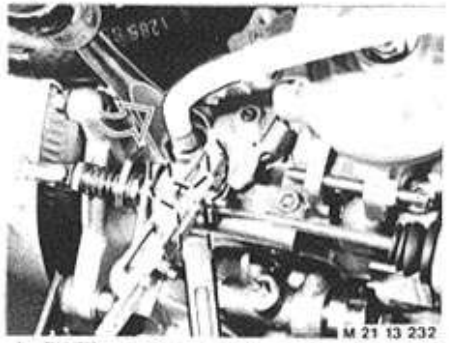


Turn crankshaft up to TDC mark (ignition position in cylinder no. 1).

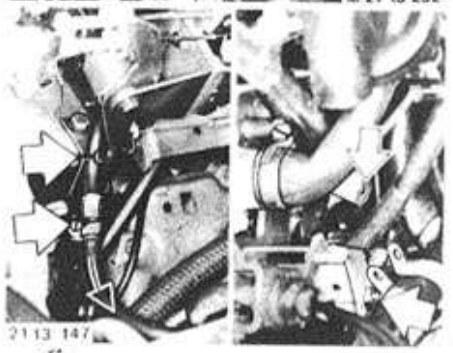


Disconnect water hoses.
Loosen alternator drive belt and take off toothed belt cover.

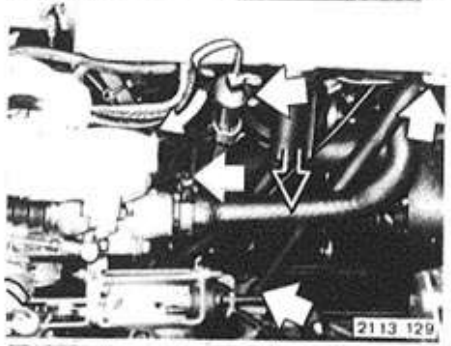
* See Service Information of Gr. 00



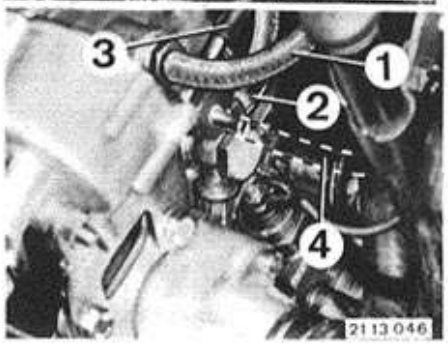
Hold adapter and unscrew line with Special Tool 13 5 020.
Plug opening with cap.



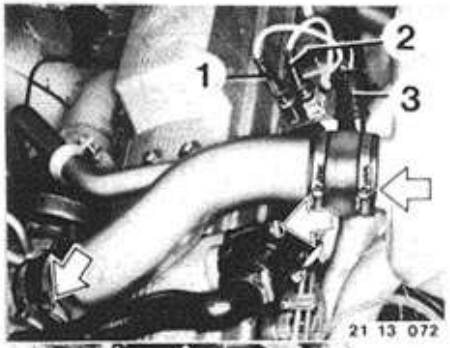
Disconnect connection and unscrew return line.
Loosen clamp for wire harness.



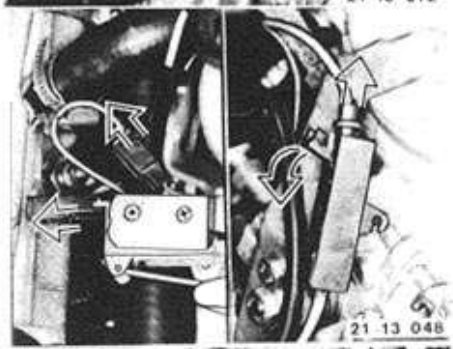
Unscrew holder for oil pipe.
Disconnect hoses on TLA.
Unscrew support for air collector.
Pull off plug on blowoff valve.



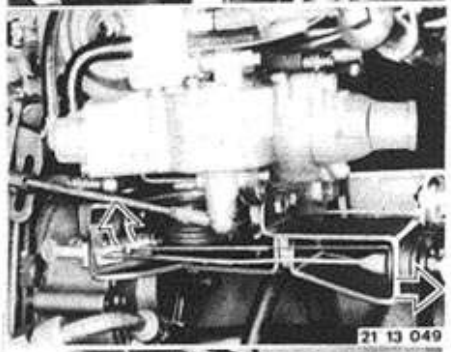
Pull off hoses for
charging air pressure (1),
leak oil (2),
vacuum (3) and
altitude compensator (4).



Unscrew charging air pressure pipe and oil trap.
Pull off plugs for
speed sensor (1),
initial injection nozzle (2) and
timing valve (3).

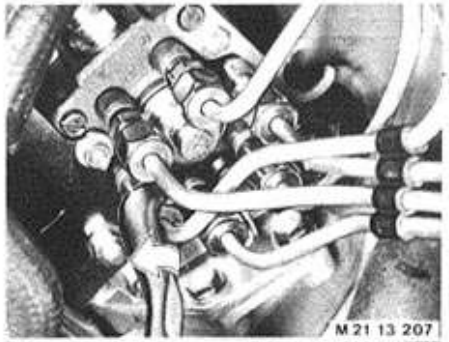


Disconnect plug for fuel shutoff.
Pull off connections for idle switch (EGR).

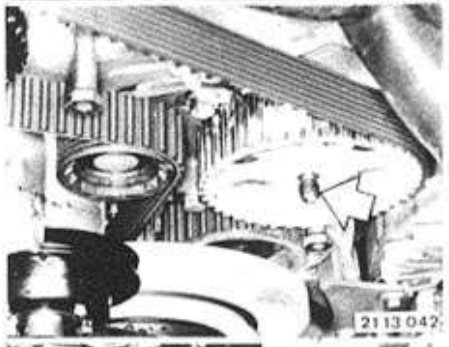


Disconnect cables and take out of holders.

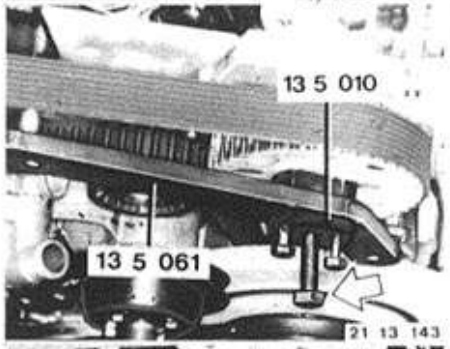
Unscrew all coupling nuts on injection nozzles.
Plug openings in injection nozzles with caps.
Important!
Reposition special tool in good time to avoid bending injection lines.



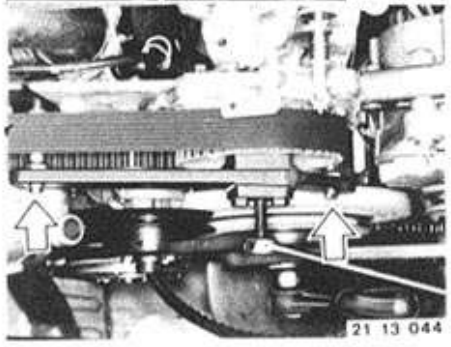
Unscrew coupling nuts on injection pump and pull back lines.
Plug openings with caps.



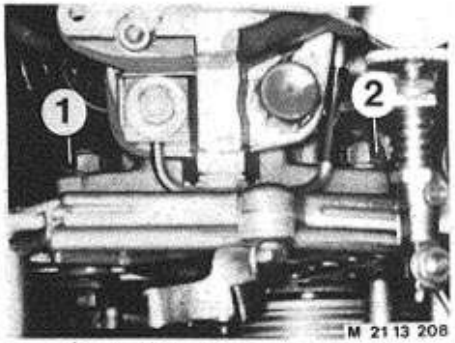
Unscrew nut on toothed belt sprocket.



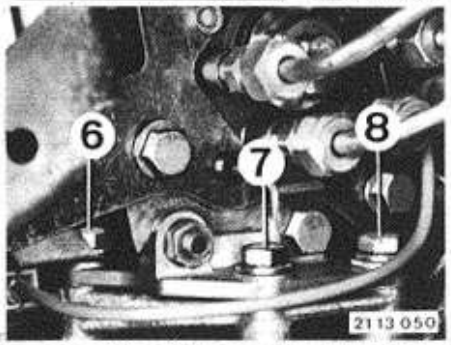
Bolt Special Tool 13 5 061 with Tool 13 5 010 on toothed belt sprocket.



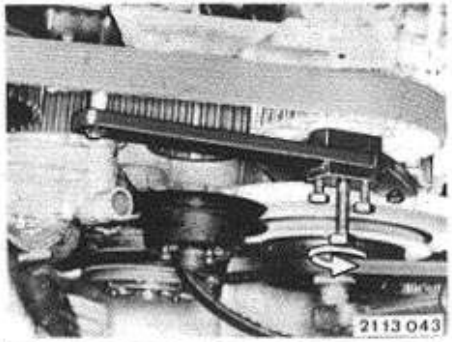
Turn crankshaft until special tool can be bolted at top and bottom.
Use M 6 x 20 mm screws.



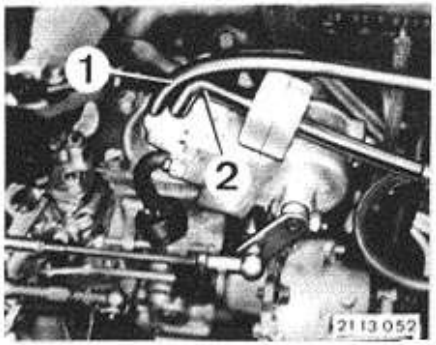
Unscrew nuts (1 and 2).



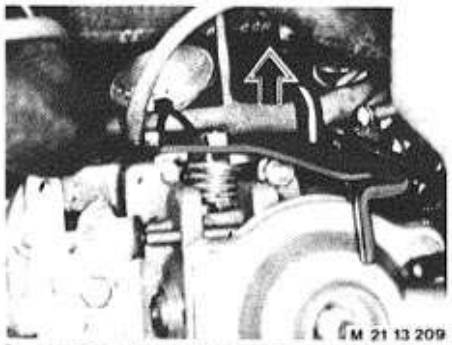
Unscrew bolts (6 ... 8)



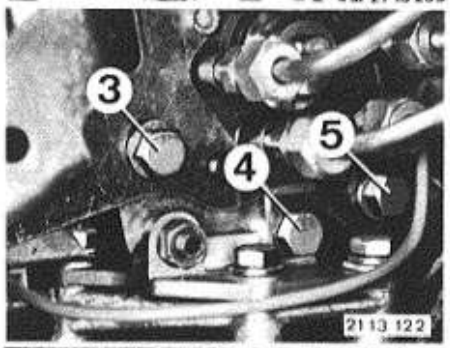
Press out injection pump toward rear with bolt.



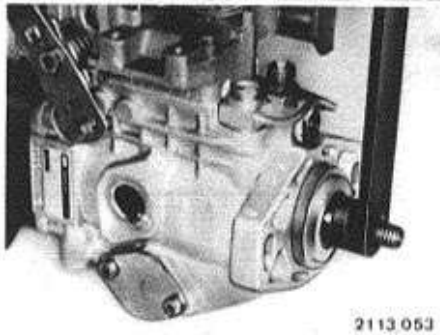
Pull off hoses on pressure converter (EGR).
1 Vacuum supply
2 To solenoid valve



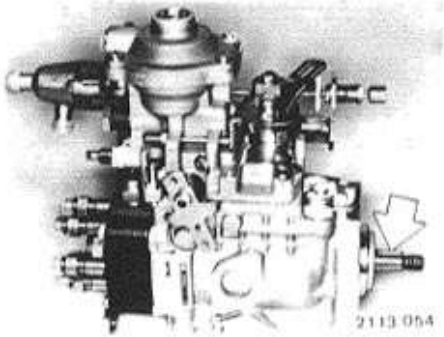
Take wire harness out of holders.
Remove injection pump.



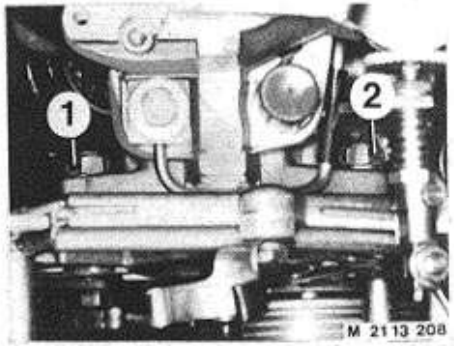
Installing:
Loosen bolts (3 ... 5) before installing.



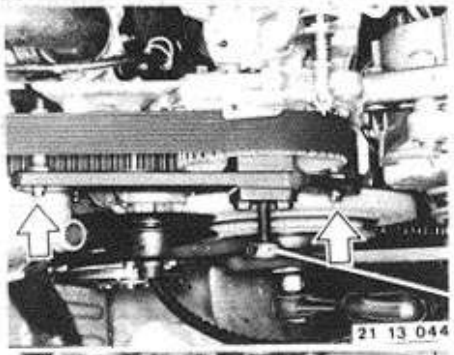
Check position of injection pump shaft, correcting as shown in picture with Special Tool 13 5 062 if necessary.
Turning lever must be vertical.



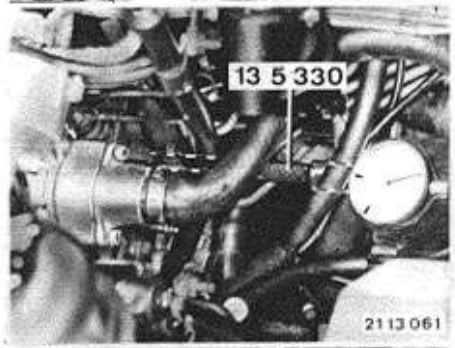
Insert injection pump, being careful that the woodruff key does not fall out.



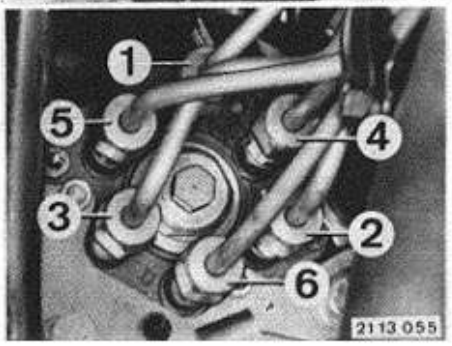
Tighten nuts (1 and 2) until injection pump rests firmly on holder.



Remove Special Tool 13 5 010 and 13 5 061, mount toothed belt sprocket.
Tightening torque*.

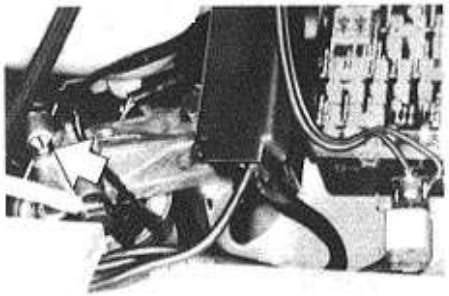


Adjust injection pump statically – see 13 51 005.

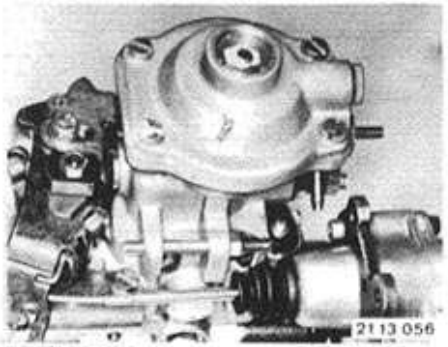


Begin with connection (4) when tightening injection lines.

* See Specifications

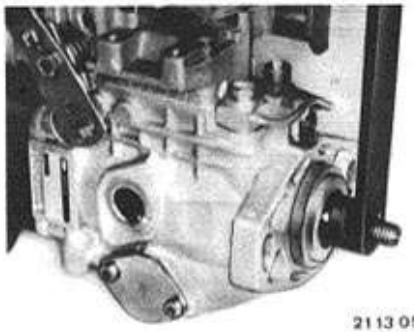


After assembling, bleed fuel system – see 13 51 320.
Check idle speed – see 13 00 050.
Check dynamic injection begin – see 13 51 006

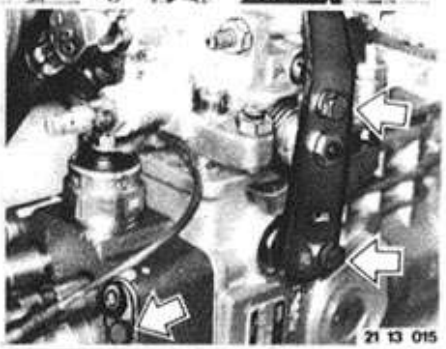


13 51 001 REPLACING INJECTION PUMP

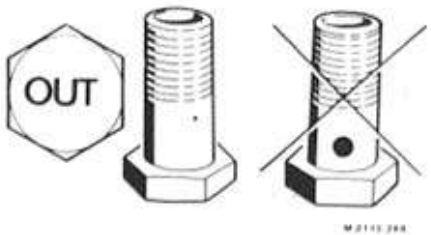
Remove injection pump – see 13 51 000.
Transfer following parts to new injection pump.



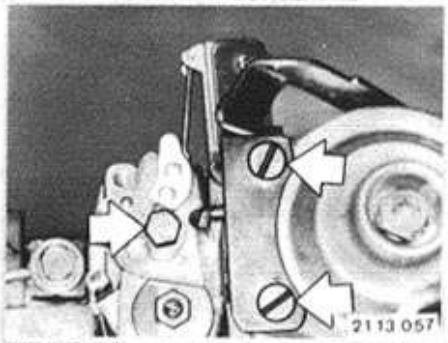
Turn injection pump shaft with Special Tool 13 5 062 as shown.
Lever of special tool must be vertical.



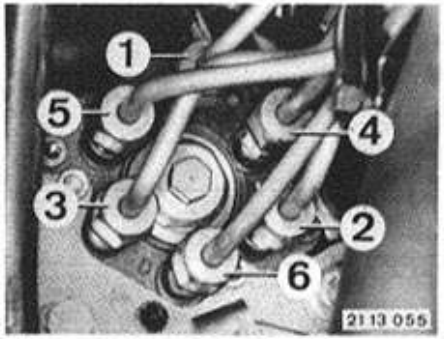
– Stopping lever and holder for wire harness



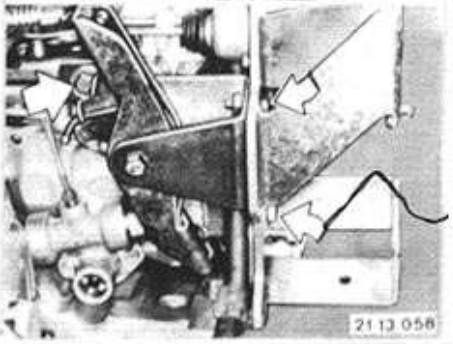
Install and mount injection pump.
The hollow union bolt "OUT" (fuel return orifice) is matched with an injection pump. Consequently it must not be mixed up or used with a different injection pump.



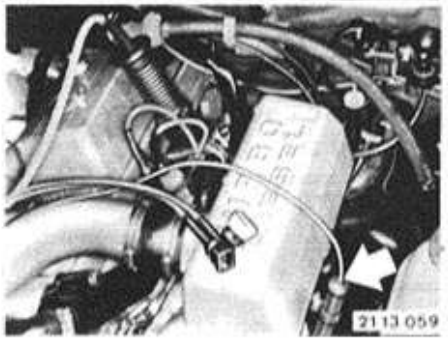
– Holder and switching contact for idle switch (EGR).
Pressure converter with linkage holder.
After installation, make adjustments on EGR – see Group 11.



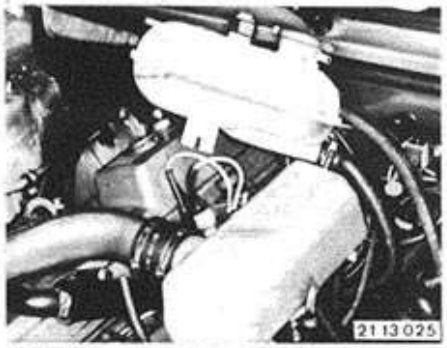
Adjust injection pump statically – see 13 51 005.
Start at connection (4) when tightening injection lines.



– Holders and reversing lever for cables.
Tests and adjustments after installation:
– On pull rod – see 13 51 340.
– On throttle cable – see Group 35.
– On transmission cable – see Group 24.

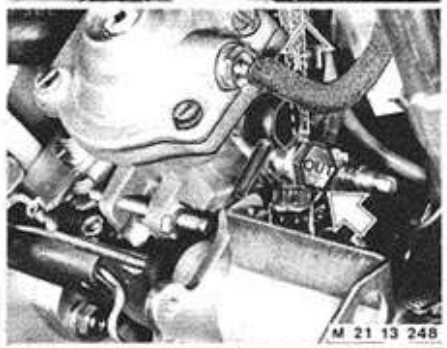


After Assembling:
Bleed fuel system – see 13 51 320.
Check idle speed – see 13 00 050.
Check dynamic injection begin – see 13 51 006.

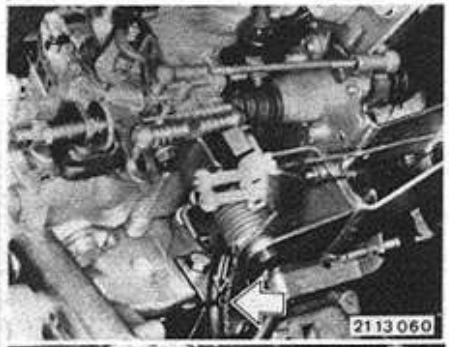


13 51 002 CHECKING INJECTION PUMP INTERNAL PRESSURE

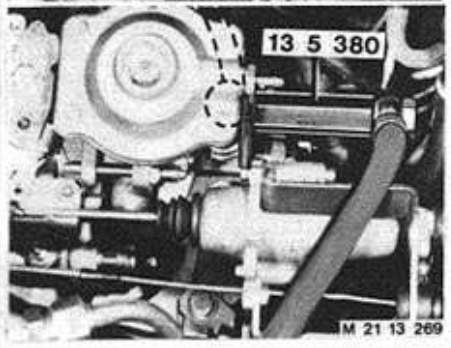
Unscrew and swing away expansion tank.
Plug overflow hose.



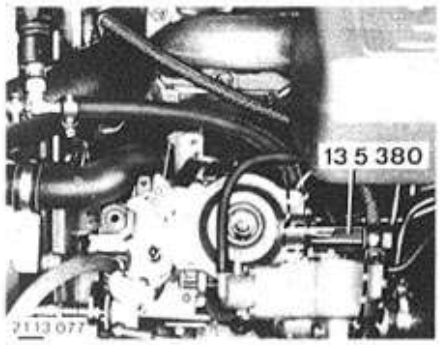
Pull off plug on blowoff valve.
Pull off leak oil hose on injection nozzle.
Unscrew hollow union bolt (OUT).



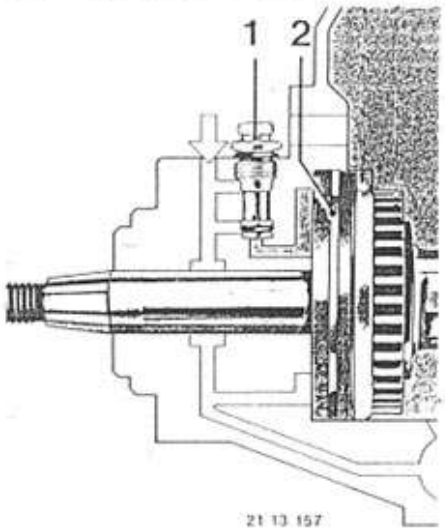
Disconnect return hose on holder and pull out downward.



Install test hose (1) with adapter 13 5 380 and seals.
Mount return hose on adapter with hollow union bolt (OUT).



Connect BMW service test unit (M 19).
Use hose for pressure test.
Start engine and read pump internal pressure* at test speed*.
If specifications are not reached, check fuel feed pressure – see 13 31 028.
If okay, replace injection pump.

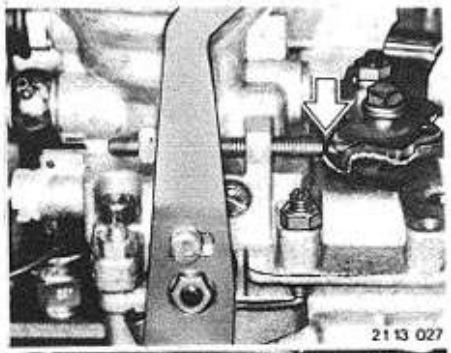


Diagnosing Information:
Internal Pressure Too Low
– Pressure control valve (1) faulty.
– Fuel delivery pump (2) performance insufficient.

Remedy:
Replace injection pump.

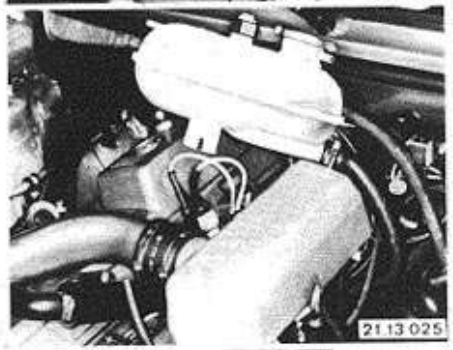
Internal Pressure Too High
– Hollow union bolt (OUT) for return hose plugged – clean, if necessary.
– Pressure control valve faulty, replace injection pump if necessary.

Incorrect internal pressure will cause displacement of the injection timing.
This will be noticed on insufficient pressure due to inadequate power or on excessive pressure with hard engine running.

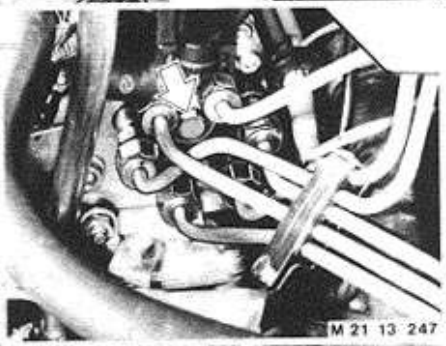


13 51 506 CHECKING / CORRECTING STATIC ADJUSTMENT OF INJECTION PUMP

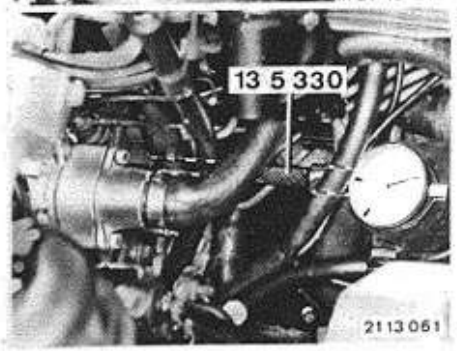
Requirements:
Coolant temperature > 20° C (68° F) or speed lever not in cold running position — must rest on idle stop.



Unscrew and swing away expansion tank.
Plug overflow hose.
Unscrew support for air collector.

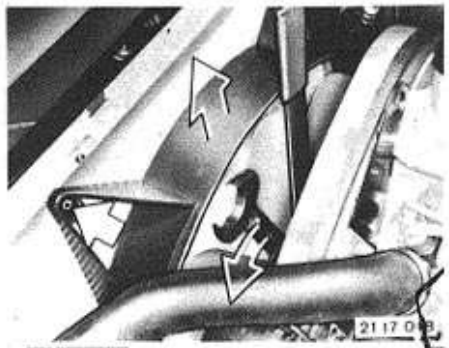


Unscrew plug.
Installation:
Use a new seal.
Tightening torque*.



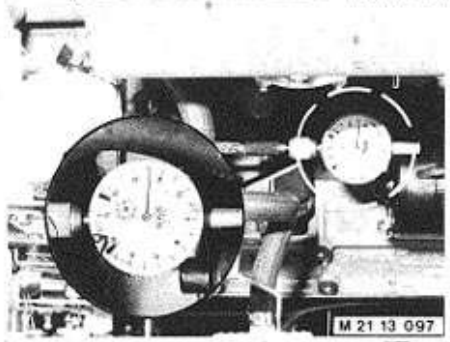
Screw in Special Tool 13 5 330 and tighten by hand.
Clamp dial gage with pre-load.

* See Specifications

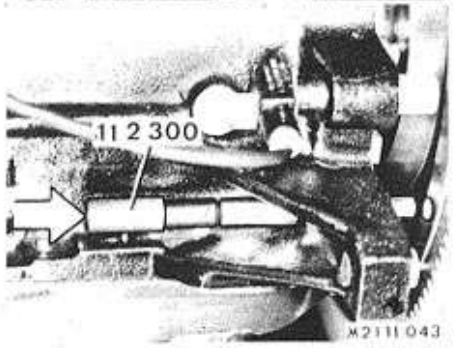


Unscrew fan cowl and fan (left-hand threads) — see 11 52 000.

Turn crankshaft in TDC direction (ignition control of cylinder no. 1) until dial gage needle has reached the highest value.

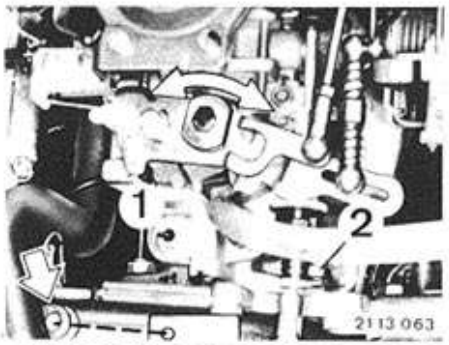


Set scale of dial gage to zero.
Continue turning crankshaft up to TDC position and press Special Tool 11 2 300 into bore at same time until it engages.
The displayed value should correspond with the static test value*, correct static adjustment if necessary.
Important!
Test must only be made with ignition control in cylinder no. 1 — check through open oil filler cap.
Only turn engine clockwise for testing.

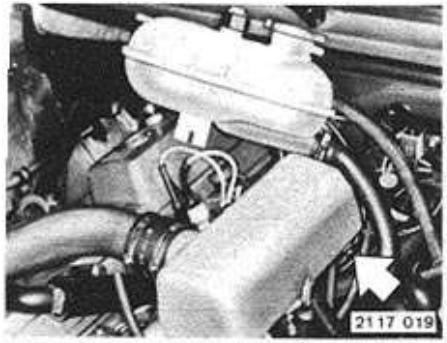


* See Specifications

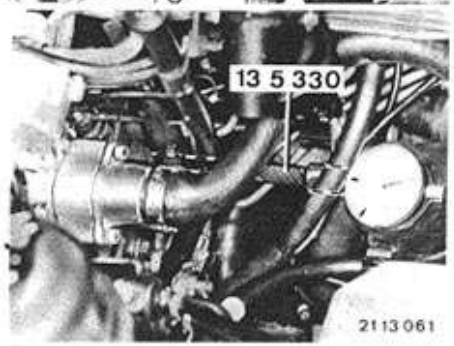
Correcting Static Adjustment:
Corrections will be necessary as soon as the test value is not within tolerances* or the test value* is not reached in the dynamic test.



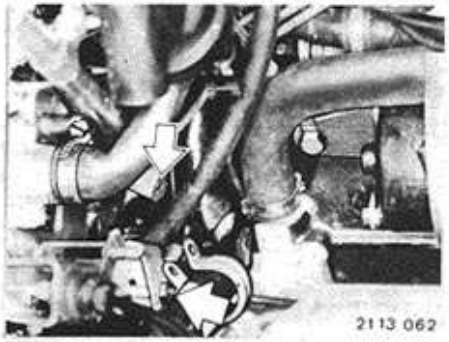
Loosen hose clamp.
Only loosen nuts (1 and 2) enough that the injection pump can be moved.



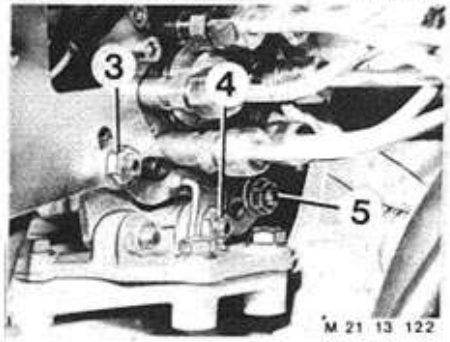
Unscrew and swing away expansion tank.
Plug overflow hose.
Unscrew support for air collector.



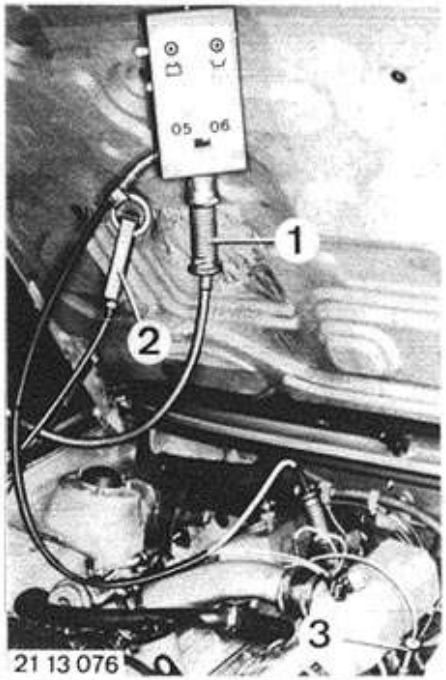
Mount dial gage (see testing) and turn injection pump accordingly.
The beginning of injection will be advanced by turning toward the engine.
After adjusting the injection pump, tighten in order of 1 through 5 and recheck adjustment.
After Adjusting:
Check dynamic injection begin – see 13 51 006



Take wire harness out of holders.

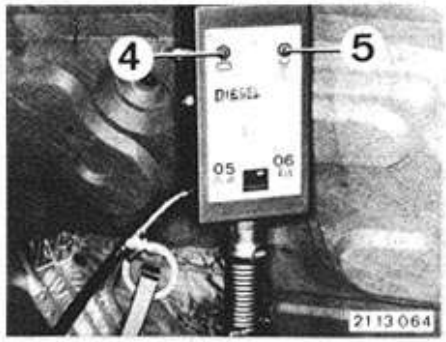


Unscrew bolts (3 ... 5).
Use a 3/8" joint ratchet with 120 mm long extension, joint and 13 mm socket.



13 51 006 CHECKING INJECTION BEGIN (DYNAMIC)

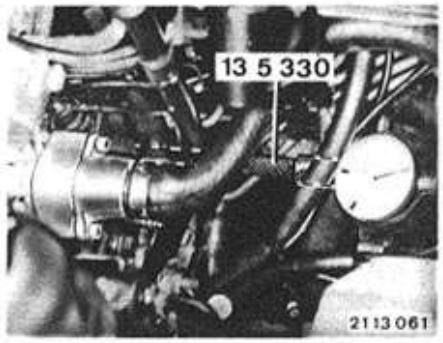
Connect diesel test adapter on diagnosis socket.
Connect BMW service test plug (1) and trigger clips (2) to adapter.
Use engine test – teststep 06.
Insert number of cylinders.
Guide in oil temperature sensor (3).
Set selector switch on diesel test adapter to 06 (injection begin).
The switch position must conform with the engine test step on the service test unit.



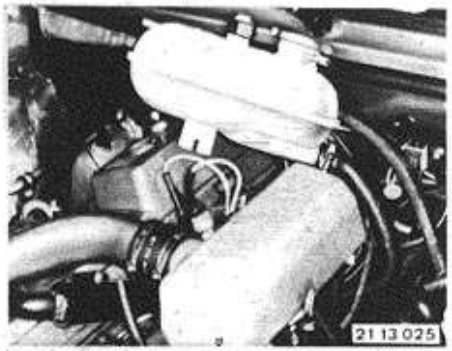
Lamp (4) comes on when power is supplied.
Lamp (5) flashes in time with initial injection nozzle.

Start and run engine to operating temperature (oil temperature > 70° C / 158° F).
Rise speed slowly up to test speed * , read injection begin * (in crankshaft degrees before TDC).
Right values only appear at constant revolutions.

*) See Specifications

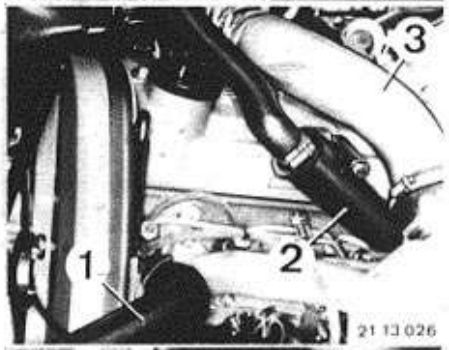


In case of wrong injection begin, make static adjustment – see 13 51 506



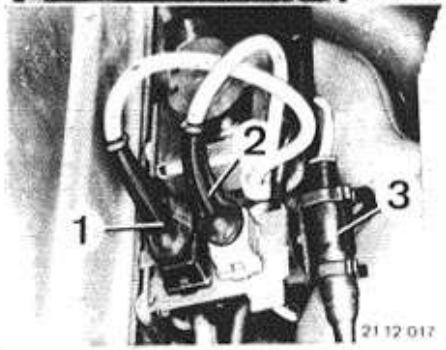
13 51 290 REPLACING PRESSURE VALVES

Disconnect battery.
Loosen reservoir and turn aside.

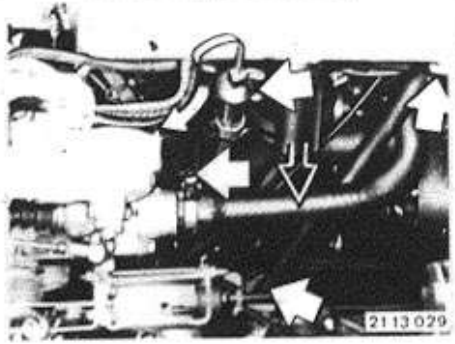


Drain coolant, remove hose (1).
Remove oil seperator (2) and charger air pipe (3).

Installation:
Fill up with correct coolant **)
bleed cooling system - see 17 00 039

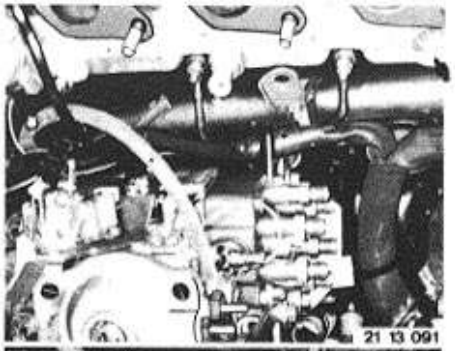


Disconnect plugs and remove bracket.
1 Speed transmitter
2 Injection begin jet
3 Pulse valve.



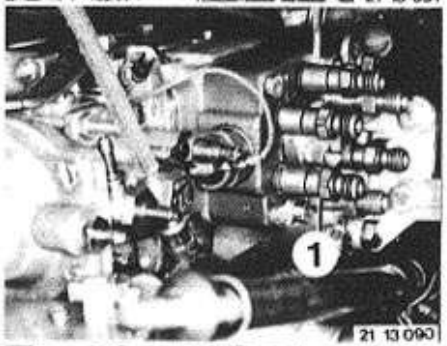
Remove receptacle for oil dip stick and air collector bracket.
Pull off charger pressure hose and plug of check valve.

**) See service Information Group 00.



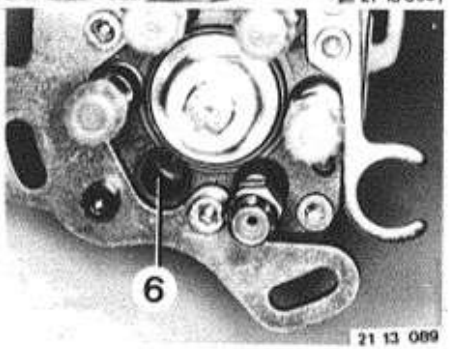
Remove air collector.
Disconnect injection lines on injection pump and injectors with special tool 13 5 020.

Installation:
Note tightening torque *).



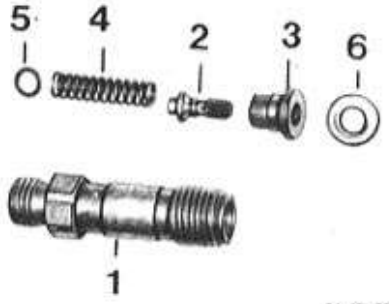
Remove pressure valve bracket.

Attention!
Parts come loose.
Parts 1 to 5 are matched – don't mix.

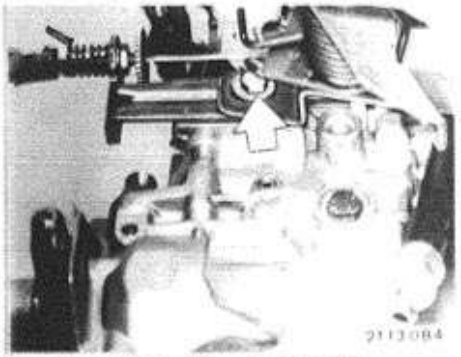


Lift out washer (6) with a pin etc.

Installation:
Note job descriptions on page 13 - 1.
Use new washers (6) – note installed position.
Note tightening torque *).
Bleed injection system after installation - see 13 51 320.
1 pressure valve holder
2 pressure valve
3 pressure valve body
4 pressure spring
5 shim
6 washer

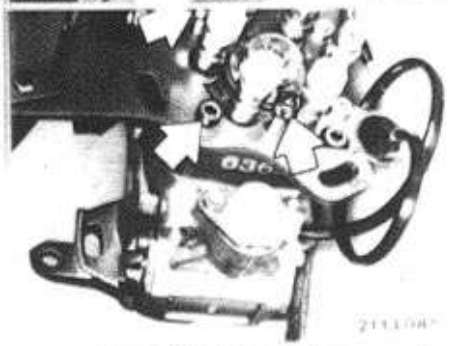


*) See technical data

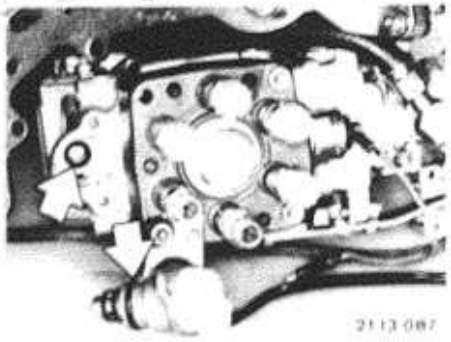


13 51 . . . REPLACING PULSE VALVE FROM INJECTION PUMP

Remove injection pump - 13 51 000.
Remove mounting plate.

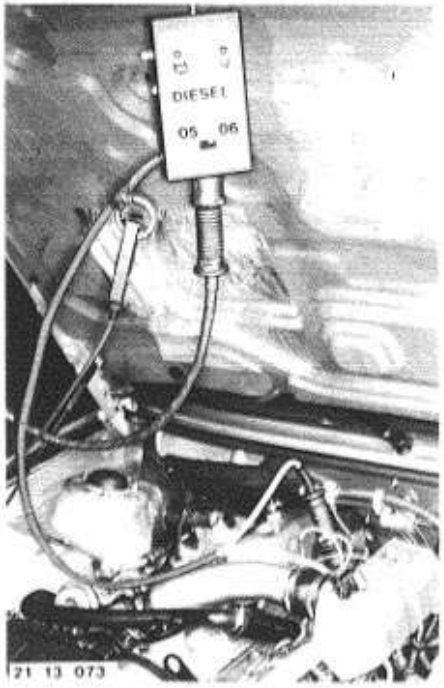


Unscrew and pull out pulse valve.
Lift out small O-ring from injection pump.
Attention, place oil pan underneath
Diesel fuel runs out of injection pump.
See job information page 13 - 1

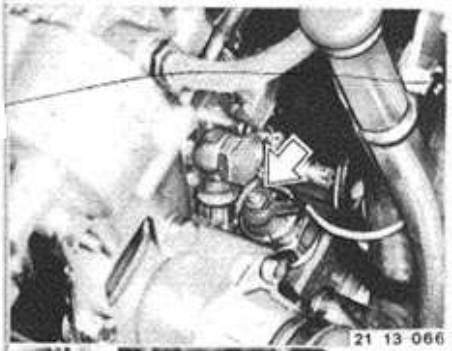


Installation
Fit new O-rings.
Note tightening torque *).

*) see technical data

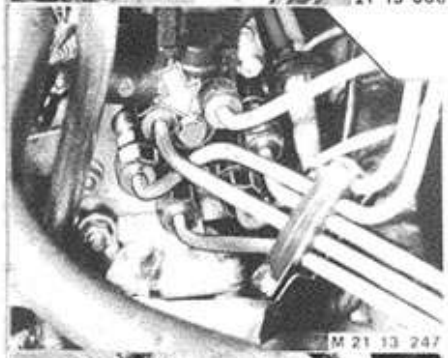


After installation of injection pump make static adjustment and dynamic test see 13 51 506



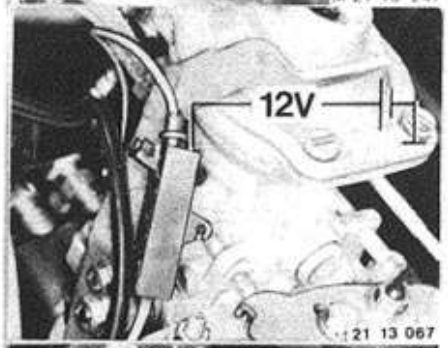
13 51 300 CHECKING ELECTRIC FUEL SHUTOFF

The fuel shutoff receives electric power from the ignition lock (key turned to "DRIVE"). A click is heard when shutoff switches on.

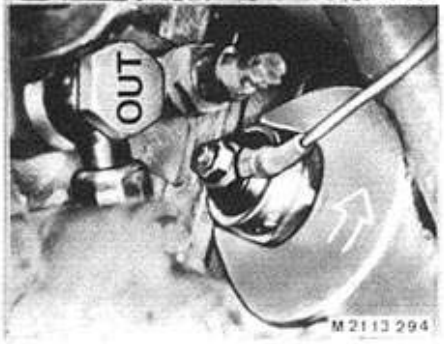


Testing Requirements:
- Fuel in tank
- Fuel filter in perfect condition
- Fuel line bled up to injection pump

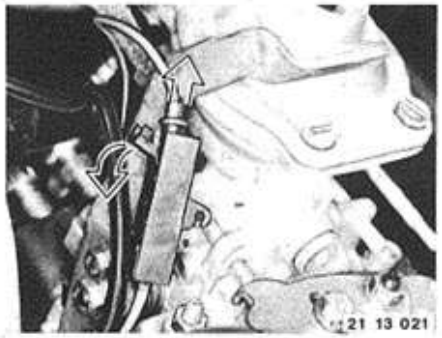
Loosen plug two turns.



Turn ignition key to "DRIVE" or apply 12 V on fuel shutoff.

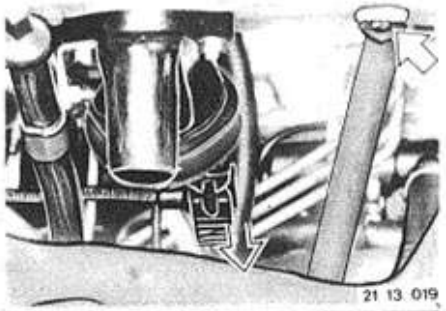


Crank engine with the starter.
Fuel must run out of the plug bore.
If not, replace fuel shutoff.

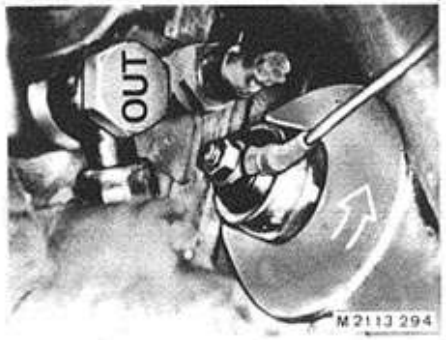


13 51 301 REPLACING ELECTRIC FUEL SHUTOFF

Open plug receptacle and pull off wire.
Installation:
Mount plug receptacle on wire harness.

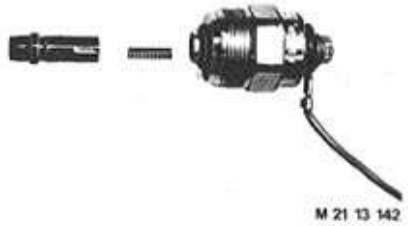


Unscrew support for air collector.
Pull off plug for blowoff valve.

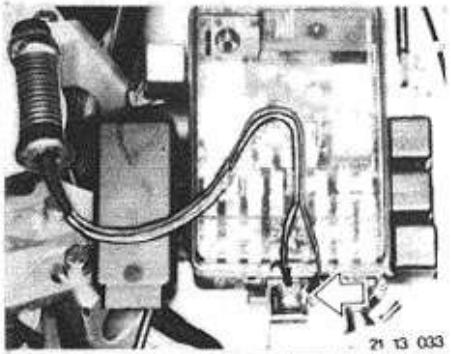


Unscrew fuel shutoff with a 24 mm open-end wrench.
Caution!
Be careful that piston and spring do not fall out.

The spring will run the piston out when in no current condition – fuel feed stopped.
Installation:
Check that O-ring fits correctly.
Tightening torque*.

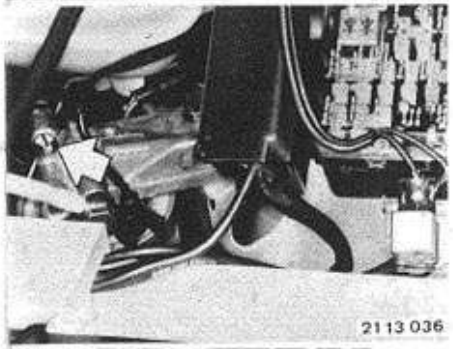


* See Specifications

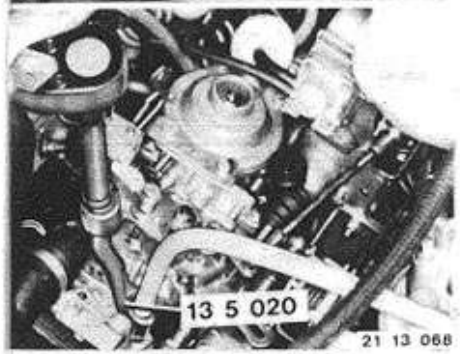


13 51 320 BLEEDING FUEL SYSTEM

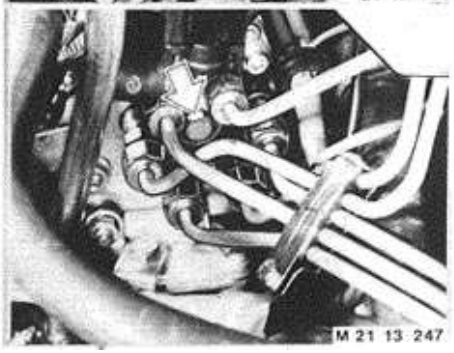
Pull off relay for fuel transfer pump.
Bridge terminals 30 and 87 with Special Tool 61 3 050.



Loosen bleeder screw.
Operate fuel transfer pump with the special tool until fuel runs out.
Tighten bleeder screw.

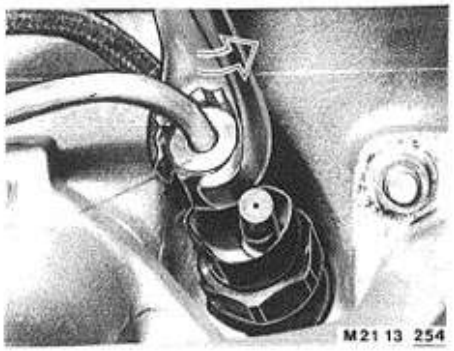


Bleed feed line by loosening coupling nut with Special Tool 13 5 020.
Installation:
Tighten coupling nut with correct torque*.
Operate fuel transfer pump with Special Tool 61 3 050 to bleed the fuel line.



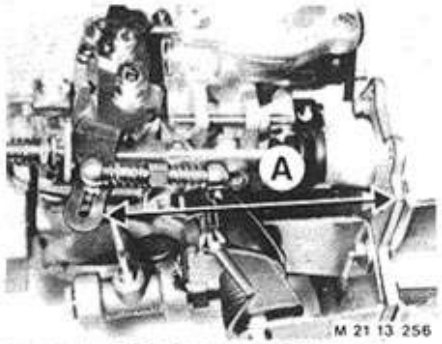
Bleeding Injection Pump:
Loosen plug two turns.
Crank engine with starter until fuel runs out.
Tighten plug with correct torque*.

* See Specifications



Bleeding Injection Lines:
Loosen all coupling nuts on fuel injectors with Special Tool 13 5 020.
Crank engine with starter until fuel runs out of lines.
Tighten coupling nuts with correct torque*.

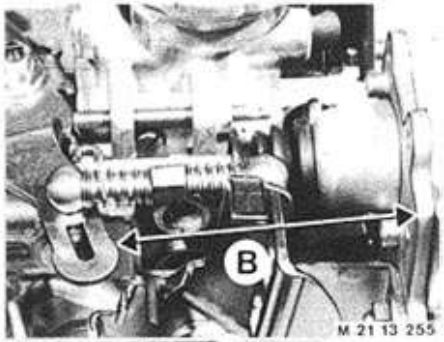
* See Specifications



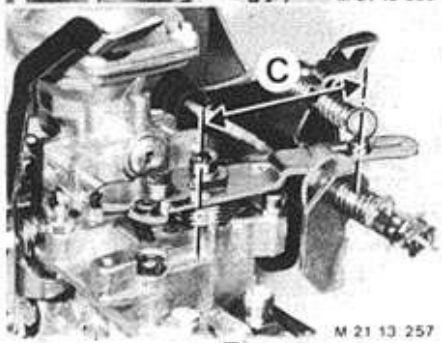
13 51 340 CHECKING / ADJUSTING OPERATING LEVER OF INJECTION PUMP

Requirements:
- Coolant temp. > 20° C (68° F)
- Correct idle speed

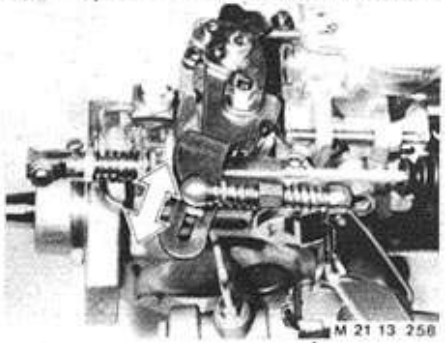
Unscrew and swing away expansion tank.
Measure and note distance "A".



Press speed lever against full load stop.
Measure distance "B" and subtract it from distance "A" to produce distance "Y".



Adjusting distance "C" can be found in the table with help of distance "Y".



Unscrew ball head and adjust accordingly to correct distance "C".

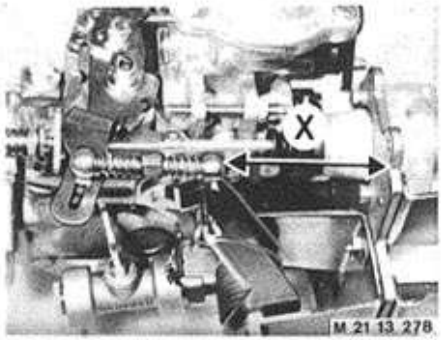
ADJUSTING TABLE
All dimensions in millimeters

Y	41	41.5	42	42.5	43	43.5	44	44.5	45	45.5	46	46.5
C	78.1	77.0	76.0	74.9	73.9	73.0	72.0	71.1	70.3	69.4	68.6	67.8
Y	47	47.5	48	48.5	49	49.5	50	50.5	51	51.5	52	52.5
C	67.0	66.3	65.6	64.9	64.2	63.5	62.9	62.3	61,6	61.0	60.5	59.9
Y	53	53.5	54	54.5	55	55.5	56					
C	59.4	58.8	58.3	57.8	57.3	56.8	56.4					

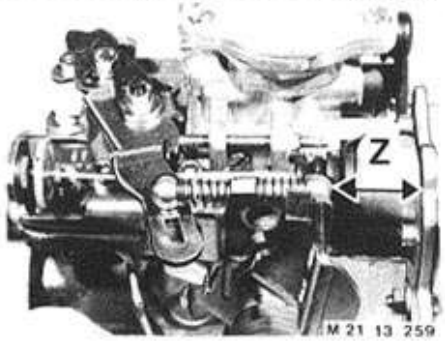
Example:

	A	129.0 mm (5.079")
−	B	83.2 mm (3.276")
	Y	45.8 mm (1.803")

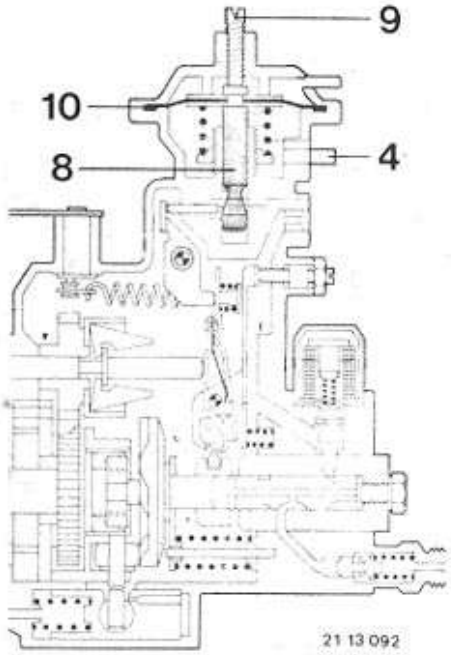
Consequently distance "C", measured from pivot point of speed lever to ball socket, is 69 mm (2.716").



In idle position distance "X" should be 68 ±0.5 mm (2.677 ±0.020").
If necessary, correct by changing length of pull rod.



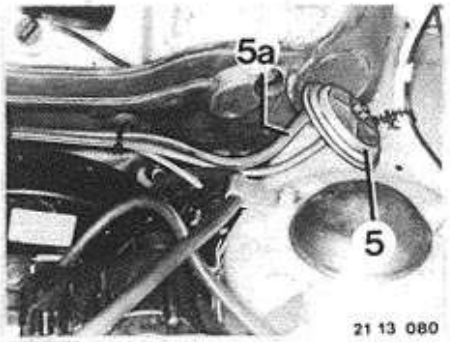
In full load position distance "Z" must be 29.1 ±0.5 mm (1.146 ±0.020").
After adjusting check throttle cable adjustment for automatic transmission – see 24 00 004.



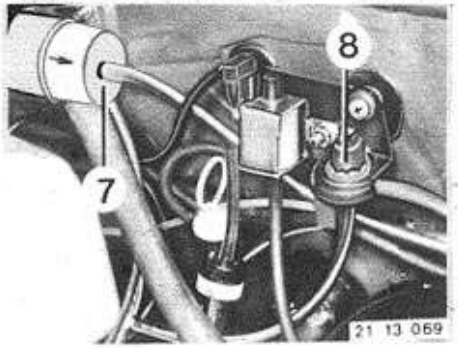
13 51 . . . CHECKING ATMOSPHERIC AND CHARGING AIR PRESSURE DEPENDENT REGULATION (ALDA)

Connect vacuum pump on connection (4) and produce at least – 300 mbar.
This will pull diaphragm (10) down.
The pushrod (8) will be heard knocking against adjusting screw (9) when pulling off the hose.
If necessary, check connector and seals.
Replace injection pump, if diaphragm leaks.

The vacuum pump (A) supplies vacuum to the chamber below the diaphragm (10).



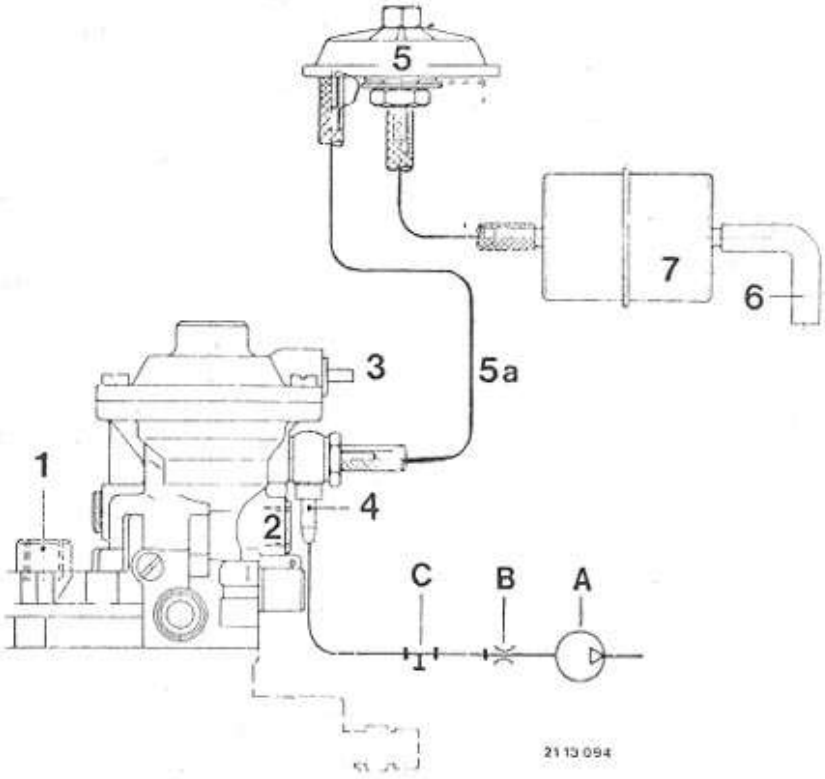
The altitude compensator (5) bleeds the vacuum underneath the diaphragm in relation to atmospheric pressure.
Check vacuum in hose 5 a - see example.



This regulation is switched off by a vent valve (8) during EGR operation – see EGR layout in Group 11.
The altitude compensator is discharged via air cleaner (7).
Check installed position, elbow hose must face down.

Example:
Hose 6 –
atmospheric pressure 1000 mbar (absolute)
Hose 5 a –
vacuum – 230 mbar

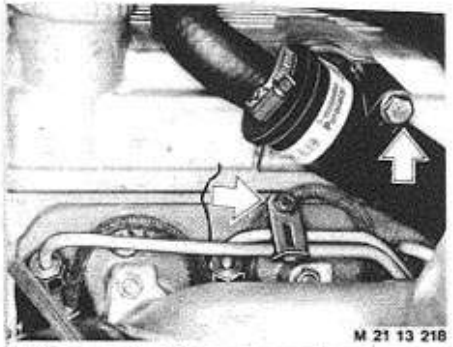
Constant reference pressure
below the diaphram 770 mbar (absolute)



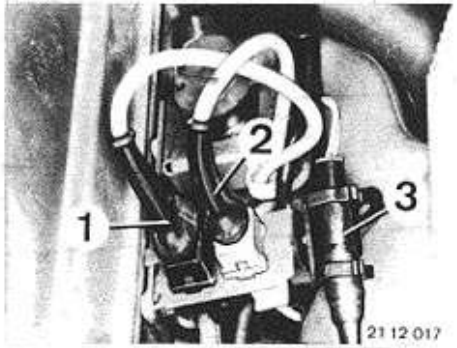
1 Fuel feed
2 Fuel return
3 Charging air pressure connection
4 Vacuum supply
5 Altitude compensator
6 Discharge
7 Air cleaner

A Vacuum pump
B Throttle
C Distributor

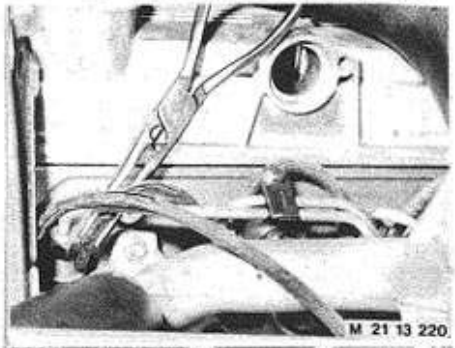
13 53 320 REMOVING AND INSTALLING/ REPLACING ALL COMBINATION FUEL INJECTORS



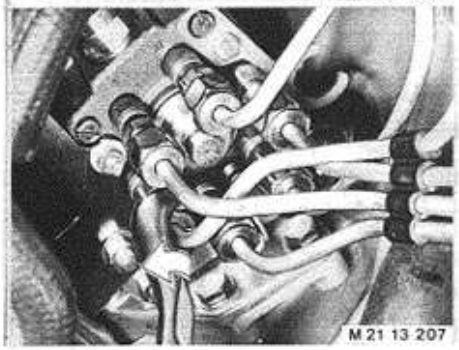
Remove oil trap.
Loosen clamps.



Pull off plug 1 and 2.
Unscrew holder for diagnosis plug.

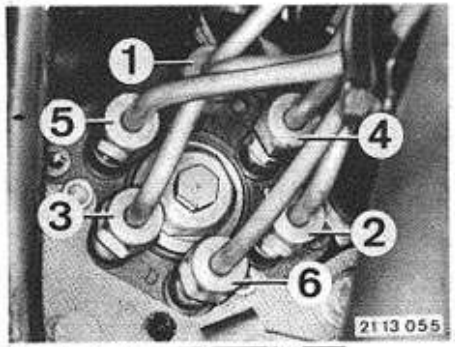


Pull off leak oil hoses with a pliers.
Unscrew coupling nuts on injection lines with Special Tool 13 5 020.
Plug openings with caps.



Unscrew lines on injection pump.
Reposition Special Tool 13 5 020 in good time to avoid bending the injection lines.

* See Specifications



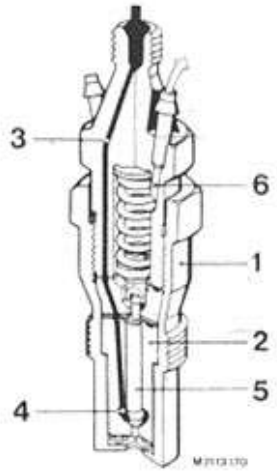
Installation:
First tighten injection line (4).
Tightening torque*.

Unscrew combination fuel injector with Special Tool 13 5 320 and plug with cap.
Run wire plug through special tool in case of the initial injection jet.
Important!
Wire should come out of opening as close as possible to the middle to avoid clamping or tearing off.

Installation:
Coat threads with copper paste "CRC".
Tightening torque*.
Bleed fuel system – see 13 51 320.
Replacing:
Combination fuel injectors can only be replaced complete – never disassembly or make adjustments.

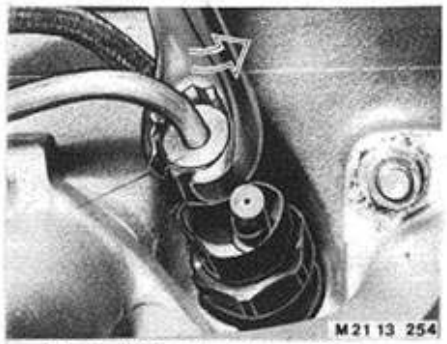
* See Specifications

13 53 . . . FLUSHING INJECTION NOZZLE
– Installed in Car –

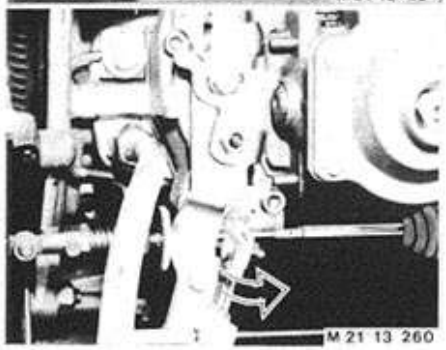


Engines producing loud knocking noise indicate nozzle needle (5) not closing completely because of combustion residue.

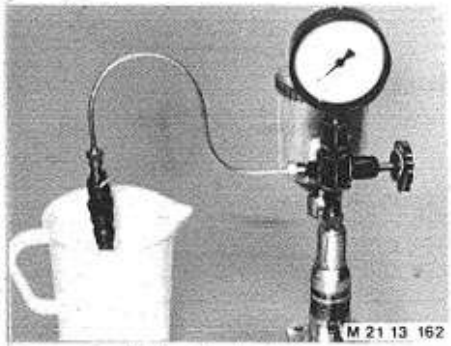
Components of Combination Fuel Injector:
1 Nozzle holder
2 Nozzle body
3 Feed bore
4 Pressure chamber
5 Nozzle needle
6 Leak oil line

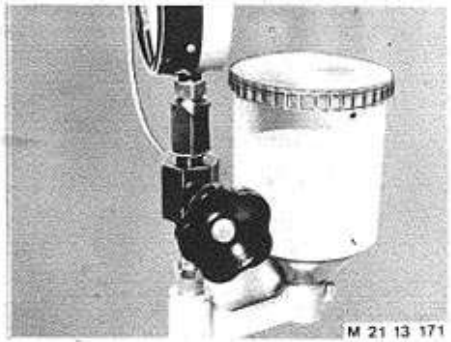


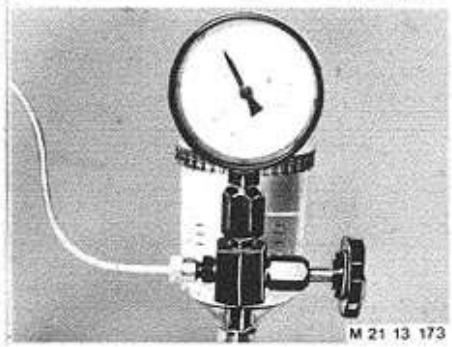
Finding Defective Injection Nozzle:
Start engine and unscrew a coupling nut on one injection line after the other with Special Tool 13 5 020.
Knocking noise will stop, when coupling nut of defective nozzle is loosened.



Run engine to operating temperature.
Operate speed lever from idle speed to higher speeds (approx. 4,000 rpm) several times to flush the nozzle.
If necessary, remove and replace defective combination fuel injector – see 13 53 320.


M 21 13 162


M 21 13 171


M 21 13 173

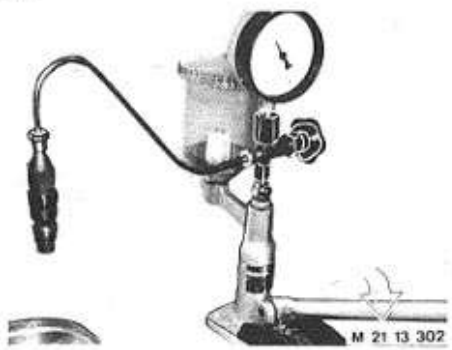
13 53 800 CHECKING INJECTION NOZZLE
– Combination Fuel Injector Removed–

Set up tester 00 2 540 on steady place.
Clean combination fuel injector with gasoline and mount on pressure line.
Loosen handwheel for pressure gage – see operating instructions.

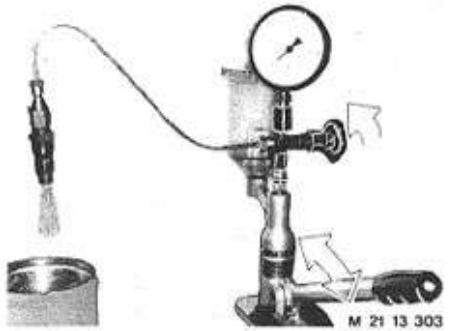
Fill tank with diesel fuel or test oil*.
Caution!
Never use gasoline – danger of explosion.

a) Opening Pressure Test:
Caution!
Keep hands and fingers away from nozzle ejection – danger of injury!
Press manual lever down slowly until injection nozzle ejects fuel.
Read ejection pressure* on pressure gage.
Value must not be less than the minimum ejection pressure.
The difference in opening pressure among the six injection nozzles may be max. 15 bar (213 psi).

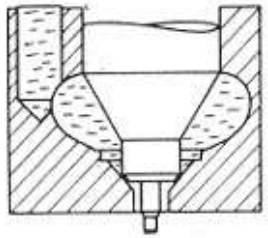
Important!
Press and release the manual lever slowly when working with a pressure gage, to avoid damaging the pressure gage.


M 21 13 302

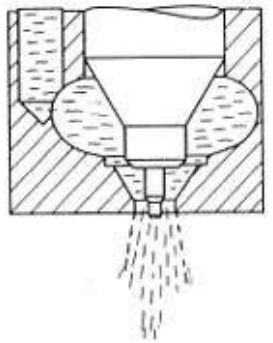
b) Injection Nozzle Leak Test:
Press down manual lever slowly and hold at point 20 bar (284 psi) below opening pressure.
No drop of fuel shoulddrip from nozzle within 10 seconds.


M 21 13 303

c) Vibration Humming Test:
Tighten handwheel for pressure gage in tests c) and d).
Operate lever 1 to 2 times per second.
A perfect condition injection nozzle will hum (vibrate) while ejecting fuel.

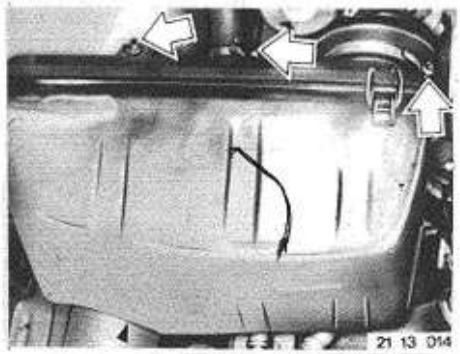


d) Spray Pattern Test:
Operate lever with short, fast strokes.
Fuel must have an as tight as possible tapered spray pattern.
Ejection must stop abruptly at end of each stroke.


M21 13 174

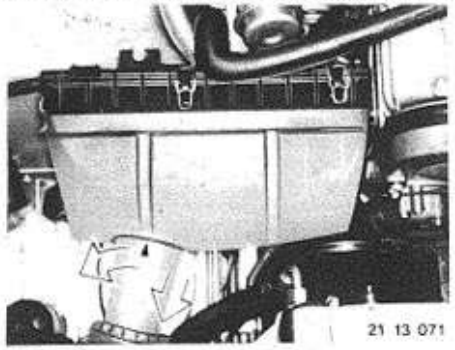
If the results of one of the tests a) through c) are negative, the combination fuel injector has to be replaced.
If only the results of test d) are negative, the combination fuel injector does NOT have to be replaced.

* See Specifications

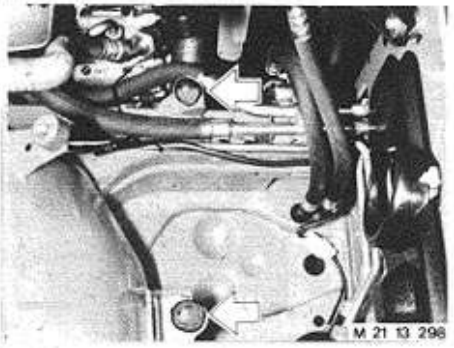


13 71 000 REMOVING AND INSTALLING AIR CLEANER

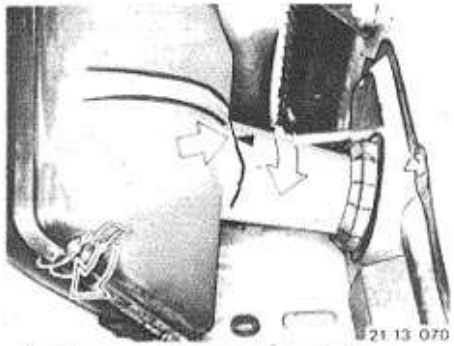
Unscrew hose clamps and nuts.



Turn intake neck 90° and pull off toward front – note arrow.

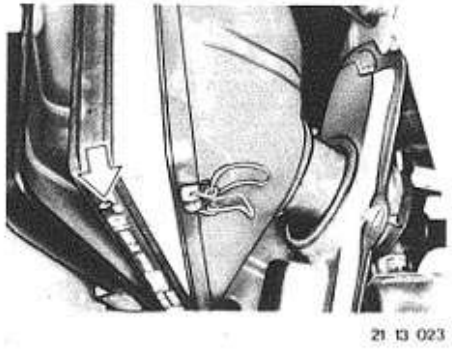


Lift out filter housing.
Installation:
Place housing exactly on rubber mounts.



13 72 001 REPLACING AIR FILTER CARTRIDGE

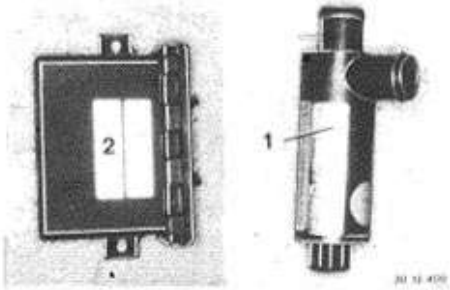
Turn intake neck 90° and pull off toward front.
Open clamps and take out filter cartridge.



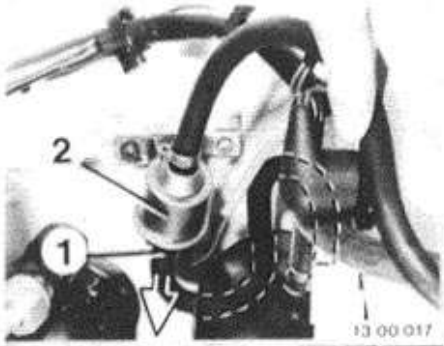
With the cover open insert filter cartridge in the middle (see note on housing) so that arrow points in direction of air flow.
Close and secure cover.

13 00 054 ADJUSTING ENGINE IDLE SPEED / CO TEST

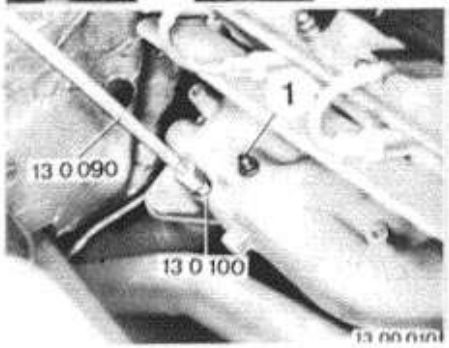
Requirements for All Adjustments:
Engine at operating temperature, i.e. oil temperature at least 60° C (140° F).
Ignition timing and valve clearance correct.
All electric equipment switched off.
BMW service test unit connected according to operating instructions.



1) Checking Engine Idle Speed**
If nominal value is not reached, check idle control valve (1) and idle regulation control unit (2), replacing if necessary.
Note:
There is no adjusting screw for idle speed regulation.

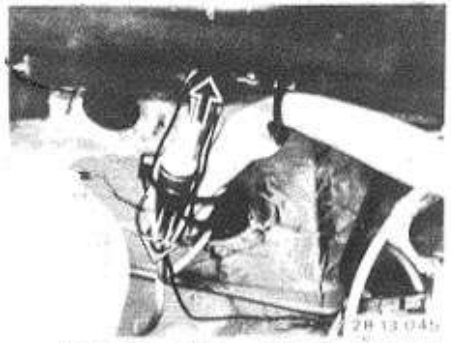


2) CO Test:
Pull off hose (1) on throttle housing.
Plugs are not inserted in open connections.

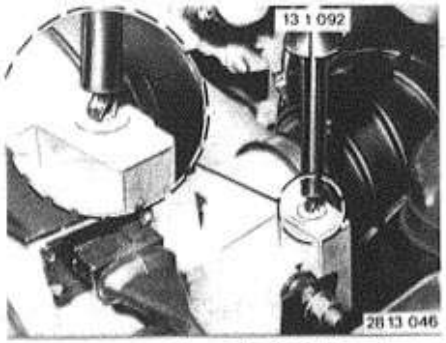


Unscrew screws (1).
Connect Special Tools 13 0 070 and 13 0 100 on exhaust manifold.
Check idle speed CO level*.

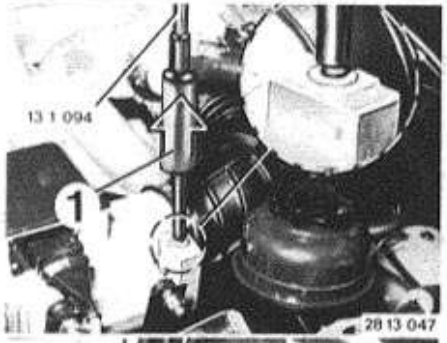
** See Nominal Value Microfiche



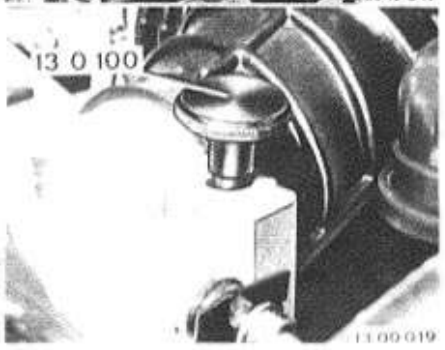
Disconnect oxygen sensor plug.



Drill hole in anti-tamper lock (1) with Special Tool 13 1 092.

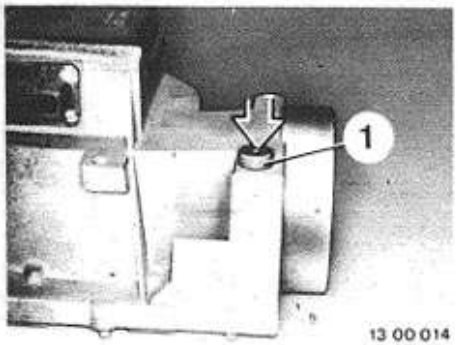


Screw Special Tool 13 1 094 in anti-tamper lock. Drive special tool and anti-tamper lock out of air flow sensor with impact (1).

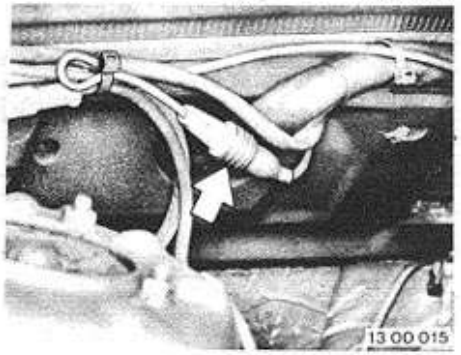


Adjust idle speed CO level* with Special Tool 13 1 100.

* See Nominal Value Microfiche

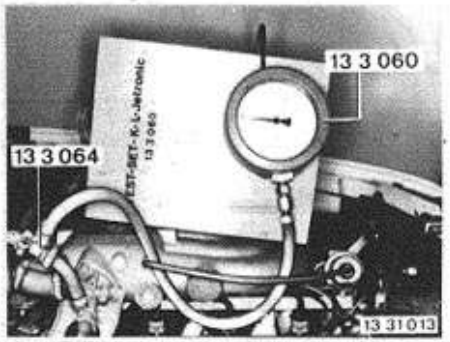


Install new anti-tamper lock (1) in air flow sensor.

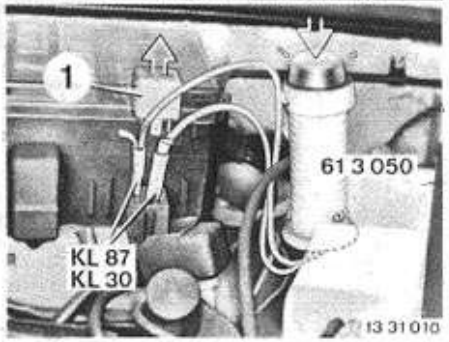


Connect plug for oxygen sensor.

13 31 029 CHECKING FUEL DELIVERY PRESSURE



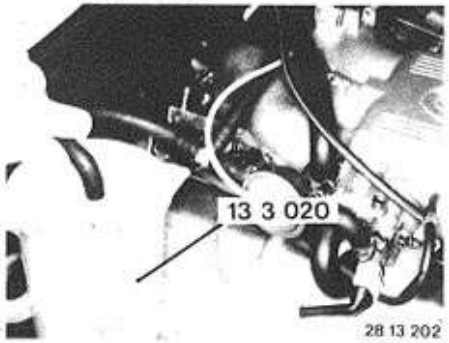
Install pressure gage 13 3 061 with connecting line and T-adapter 13 3 064 in the fuel feed line, in front of fuel pressure regulator.
Plug fuel return line with Special Tool 13 3 010.



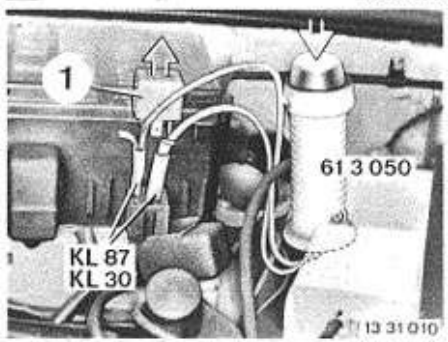
Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Check delivery pressure*.

* See Specifications of Gr. 16

13 31 . . . CHECKING FUEL DELIVERY RATE



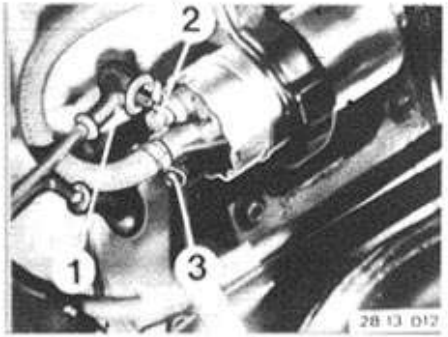
Unscrew fuel return line and hold loose end in measuring glass 13 3 020.



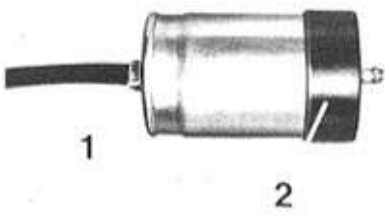
Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Check delivery rate*.

* See Specifications of Gr. 16

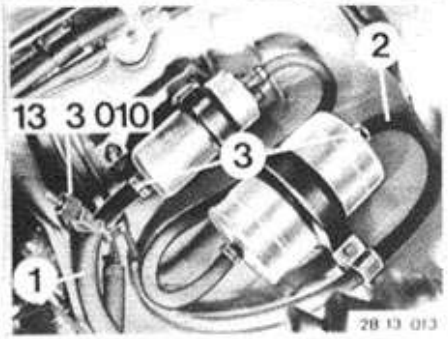
13 31 030 REMOVING AND INSTALLING FUEL PUMP



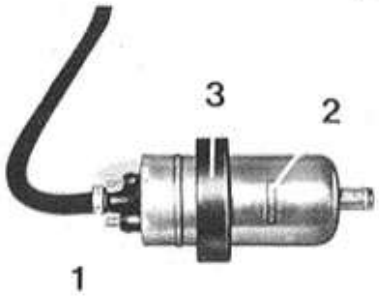
Turn back protective caps (1).
Loosen nuts (2 and 3) and take off cable.



Loosen hose clamp (1) on fuel filter and pull off fuel hose.
Remove rubber ring (2).
Installation:
Check direction of flow – IN and OUT are marked on filter.

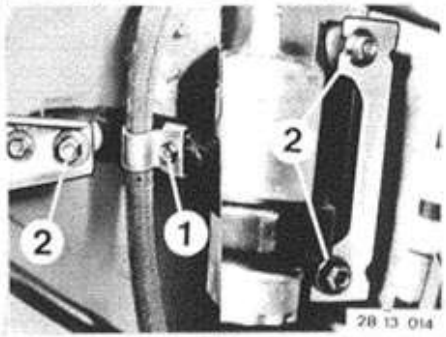


Pinch suction hose (1) and pressure hose (2) with Special Tool 13 3 010.
Cut open squeeze-hose clamp (3) and pull off hoses.

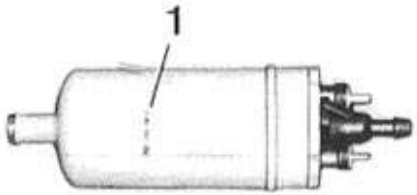


Loosen hose clamp (1) on fuel pump and pull off fuel hose.
Pull off rubber ring (3).

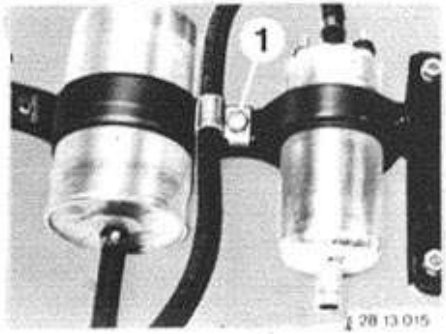
2 = Code number*



Unscrew bolt (1) and nuts (2).
Remove fuel pump with filter.



Installation:
Check code number (2)*.

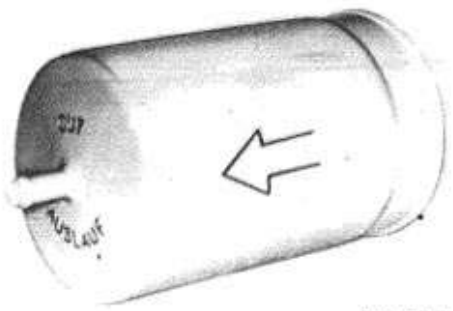


Unscrew bolt (1) and take off clamp.

* See Specifications

13 32 052 REMOVING AND INSTALLING FUEL FILTER

See "Removing and Installing Fuel Pump" – 13 31 030.



20 13 321

Installation:
Check direction of flow (arrow).

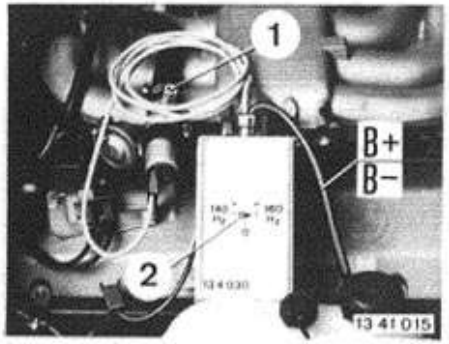
13 41 ... MAKING BASIC ADJUSTMENT OF VDO IDLE CONTROL SYSTEM

Requirements:
- Engine at operating temperature, i.e. oil temperature at least 60° C (140° F).
- Ignition timing and valve clearance correct.
- Air filter cartridge in perfect condition.
- All electric equipment switched off.
- Idle CO level correct.

Note:
Basic adjustments are not made at certain intervals.

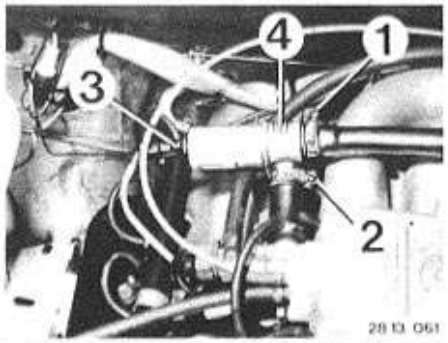
13 41 013

Basic adjustments can only be made with application of the illustrated metal valve.
This metal valve can be installed retroactively on a general basis.
1 = Basic adjustment screw



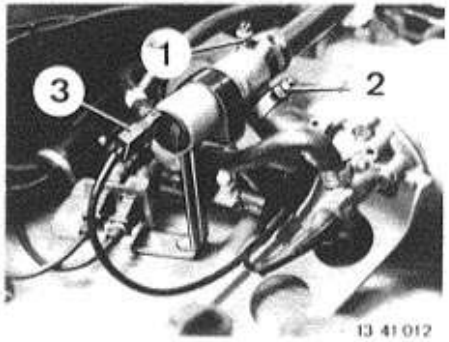
Connect tester 13 4 030 on car battery (B+/B–) and idle control valve.
Set switch (2) to 140 Hz.
Run engine at idle speed.
Adjust idle speed to 700 ± 50 rpm with basic adjustment screw (1).

Remove tester 13 4 030.
Connect plug from engine wire harness on idle control valve again.



13 41 000 REMOVING AND INSTALLING IDLE CONTROL VALVE

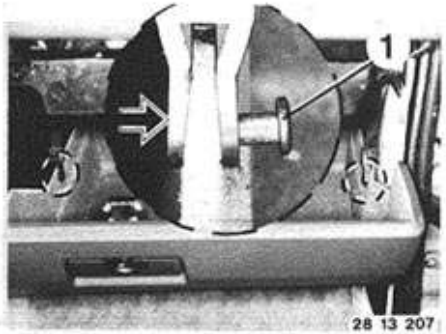
Loosen hose straps (1 and 2).
Pull off plug (3).
Remove idle control valve.
Installation:
Check code number (4)*.
Check idle speed*.



Idle Control Valve with Adjusting Screw:
Disconnect retaining strap.
Loosen hose straps (1 and 2).
Pull off plug (3).
Remove idle control valve.
Installation:
Make basic adjustment.

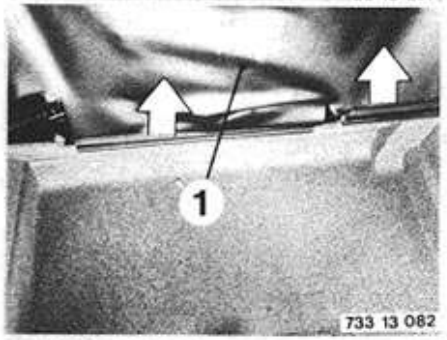
Checking Idle Control Valve:
Apply battery voltage on idle control valve.
Idle control valve must close and be tight.
Idle control valve should be open when without voltage.

* See Specifications and Nominal Values

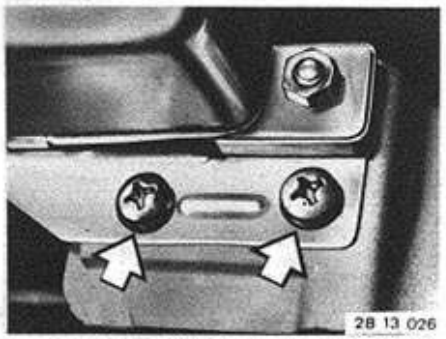


13 41 010 REMOVING AND INSTALLING CONTROL UNIT FOR IDLE CONTROL VALVE

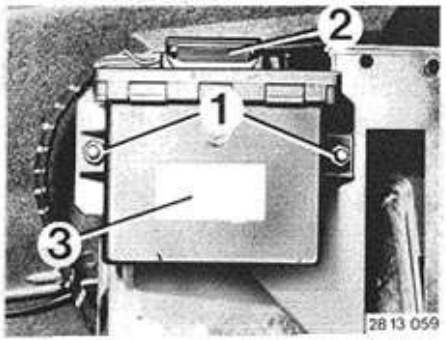
Open glove box.
Pull out pins (1) of both retaining straps.



Disconnect cover (1).

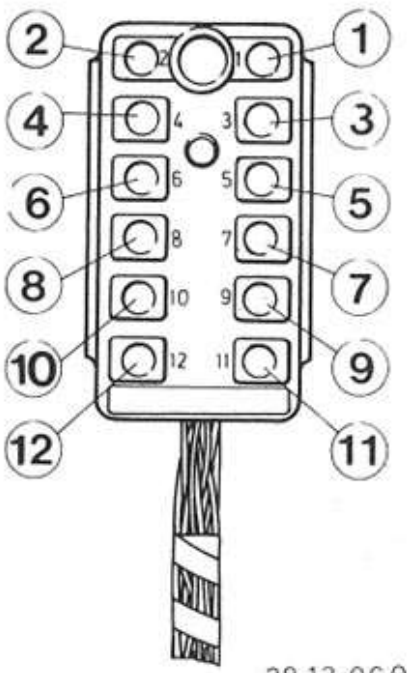


Unscrew both screws on left and right sides of control unit.



Unscrew nuts (1).
Pull off multiple pin plug (2).
Remove control unit.
Installation:
Check code number (3)*.
Check idle speed*.

* See Specifications and Nominal Value Microfiche

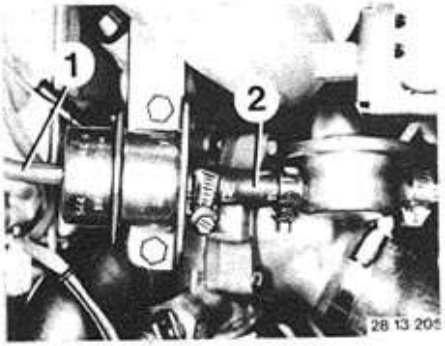


Multiple Pin Plug Connections:

No.	mm^2	Color	Connection To
1	0.5	BLRT	Idle control valve A
2	0.5	GNGE	Terminal 15
3	1.0	GN	DME contr. unit (pin 8)
4	0.5	BR	Terminal 31
5	0.5	BLSW	Idle control valve B
6	0.5	WS	Temp.switch 45°C/113°F
7	0.5	BLBR	Conn. transm. P
8	0.5	BLGE	Conn. transm. N
9	0.5	BLWS	Air conditioner
10	0.5	BLGN	Air temp. switch
11	0.5	BRRT	DME contr. unit (pin 13)
12	0.5	BRBL	DME contr. unit (pin 2)

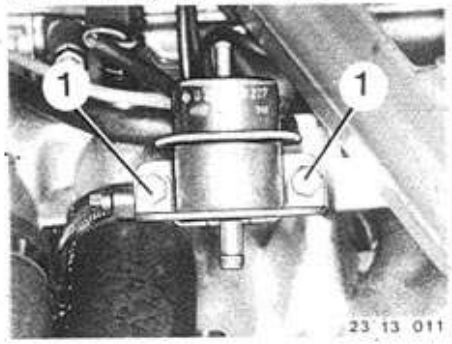
Wire Colors:

BL = Blue
BR = Brown
GE = Yellow
GN = Green
RT = Red
SW = Black
WS = White

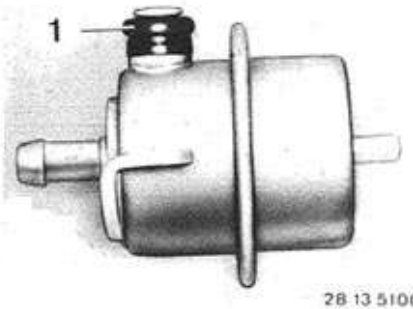


13 51 200 REMOVING AND INSTALLING FUEL PRESSURE REGULATOR

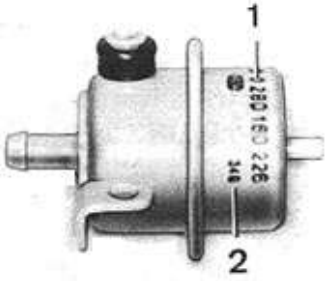
Disconnect air hose (1) and fuel hose (2).



Unscrew bolts (1).
Take off fuel pressure regulator.

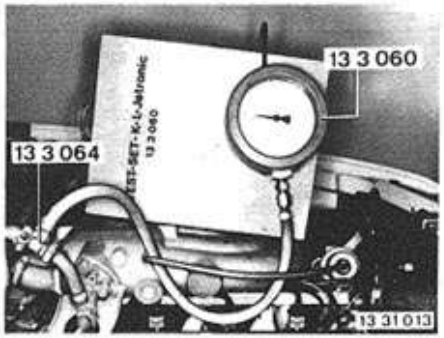


Installation:
Check seal (1), replacing if necessary.

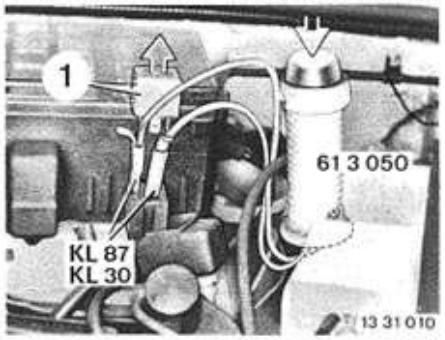


Installation:
Check code number (1)*
(2) = Manufacturing date

* See Specification



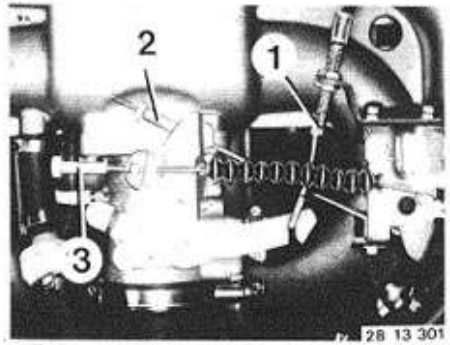
Checking:
Install pressure gage 13 3 060 with connecting line and T-adapter 13 3 064 in fuel feed line, in front of fuel pressure regulator.



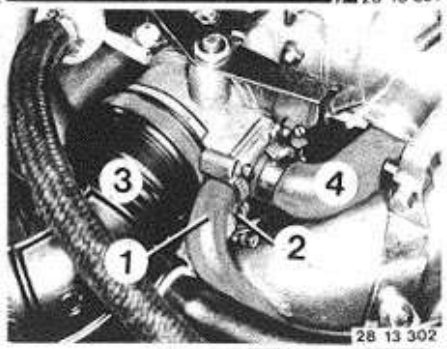
Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Fuel injection pressure*.

* See Specifications/Nom. Value Microfiche

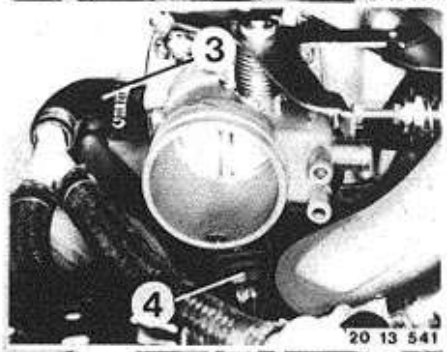
13 54 030 REMOVING AND INSTALLING THROTTLE HOUSING



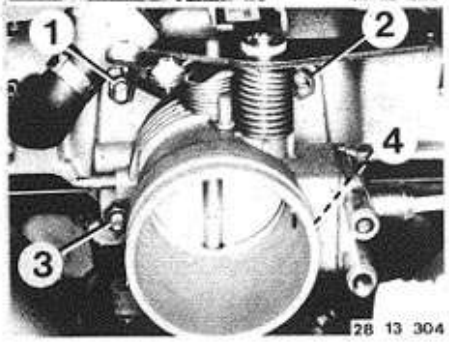
Disconnect cables (1 ... 3).
1 = Automatic transmission
2 = Accelerator pedal
3 = Cruise control
Installation:
Adjust cables, see Groups 23, 35 and 65.



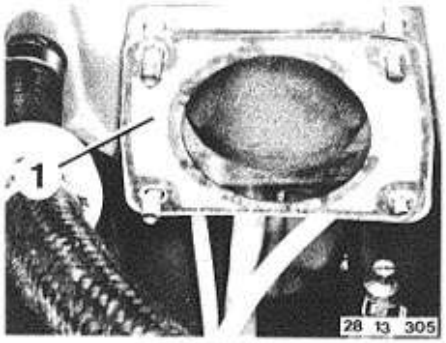
Disconnect water hoses (1 and 2).
Disconnect air hoses (3 and 4).
Installation:
Filling and bleeding cooling system.



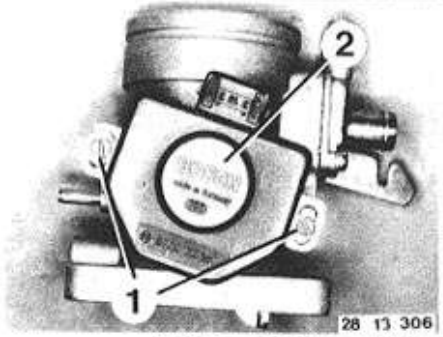
Disconnect hose (3).
Pull off multiple pin plug (4) on throttle switch.



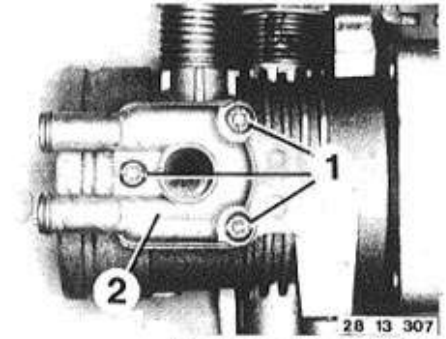
Unscrew nuts (1 ... 4) and take off throttle housing.



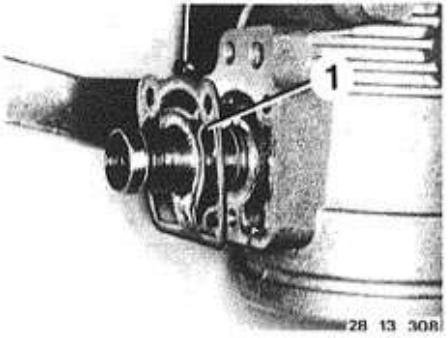
Installation:
Replace gasket (1).



Unscrew bolts (1).
Remove throttle switch (2).
Installation:
Adjust throttle switch 13 63 544.



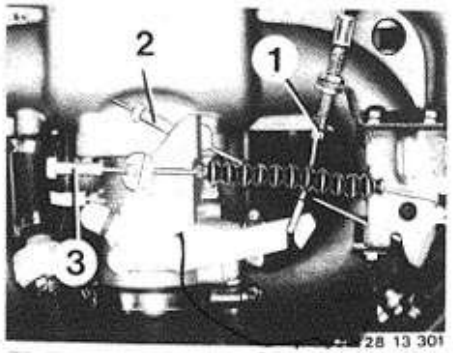
Unscrew bolts (1) and take off cover (2).



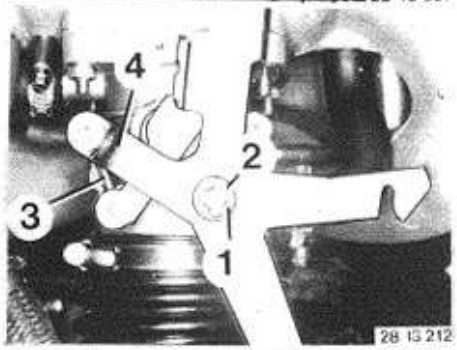
Installation:
Replace gasket.
Check engine idle speed* and CO*.

* See nominal value microfilm

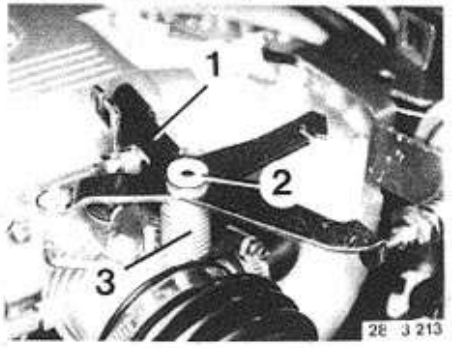
13 54 051 REPLACING RETURN SPRINGS OF THROTTLE SHAFT



Disconnect cables (1 — 3).
1 = Automatic transmission
2 = Accelerator pedal
3 = Cruise control
Installation:
Adjust cables – see Groups 24, 35 and 65.

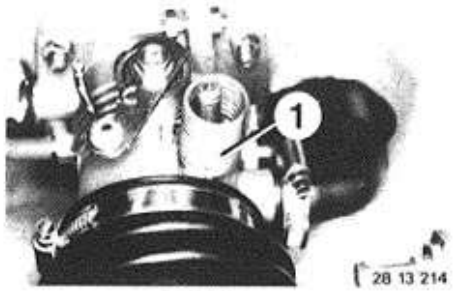


Remove retainer (1).
Remove washer (2).
Disconnect linkage (3) on lever (4).



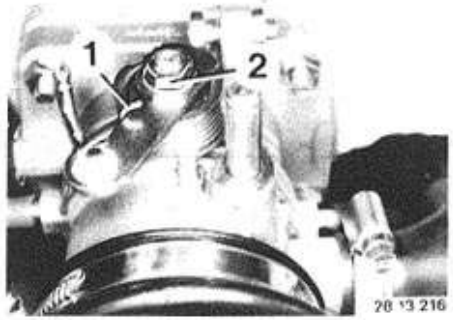
Lift and turn lever (1) to relax spring (3).
Take off lever (1).
Installation:
Check bearing sleeves (2), replacing if necessary.

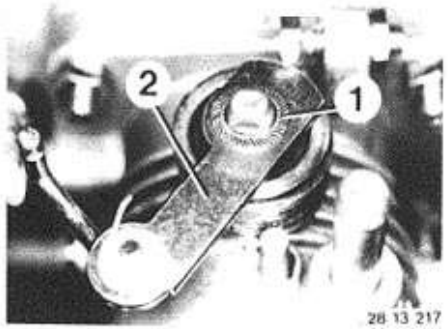
Remove spring (1).



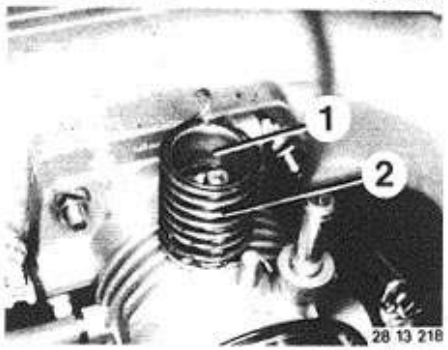
Note:
Check spring washer (1).

Disconnect spring (1).
Unscrew nut (2).

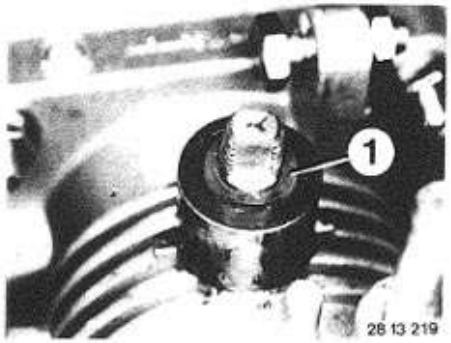




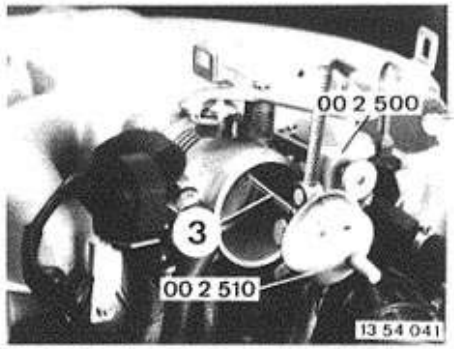
Take off washer (1) and lever (2).



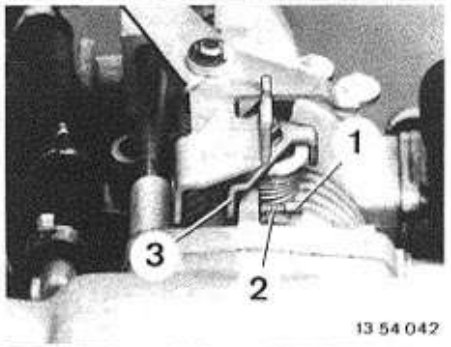
Remove bushing (1) and spring (2).



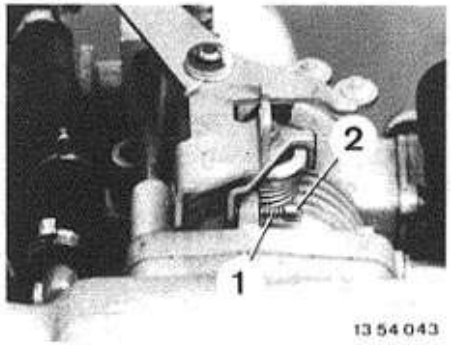
Check corrugated washer (1) and plain washer (2).



Throttle Valve Basic Adjustment:
Disconnect air hose on throttle housing.
Mount dial gage 00 2 510 with extension (3) and holder 00 2 500 on throttle housing.
Place dial gage tip on edge of throttle valve with pre-load.



Pull off anti-tamper lock (1) and loosen screw (2) until lever (3) no longer rests on screw (2).
Screw in screw (2) until throttle valve starts to move.

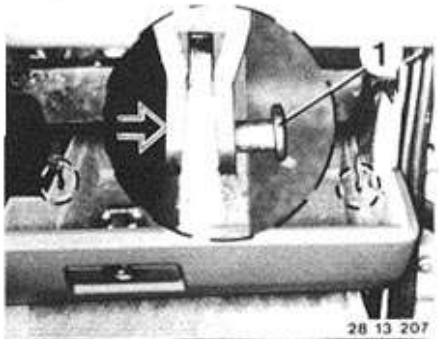


Open throttle valve 0.2 mm (0.008") further with screw (1).
Lock screw with clear lacquer.
Install anti-tamper lock (2).
Open and close throttle valve several times after finishing adjustment.
Throttle valve must not hesitate.

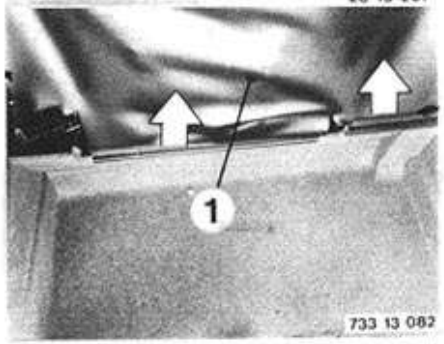
Check adjustment of throttle switch.
Check engine idle speed* and CO level*.

* See Nominal Value Microfiche

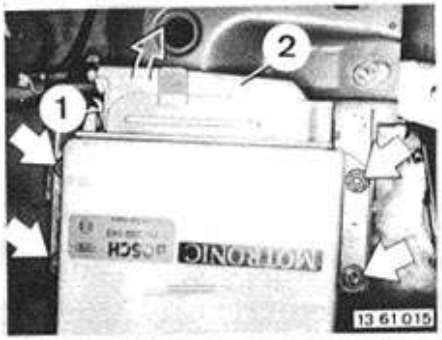
13 61 000 REMOVING AND INSTALLING CONTROL UNIT



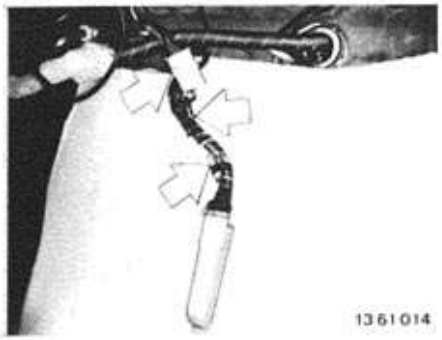
Open glove box.
Pull out pins (1) of both retaining straps.



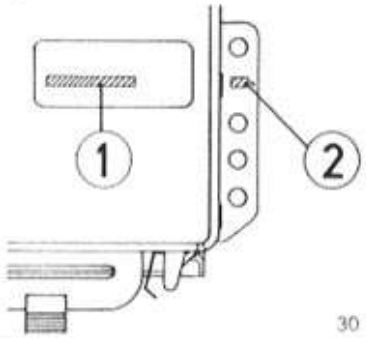
Unscrew trim panel.

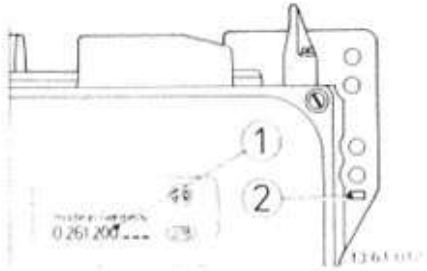


Press back retainer (1) and pull off plug (2).
Unscrew four mounting screws and take off control unit.



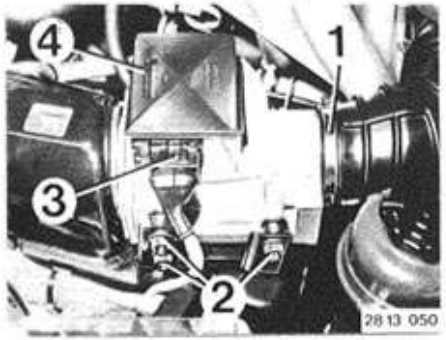
Connect plugs according to wiring diagram.





Installation:
Check code number (1)* and manufacturing date (2)*.

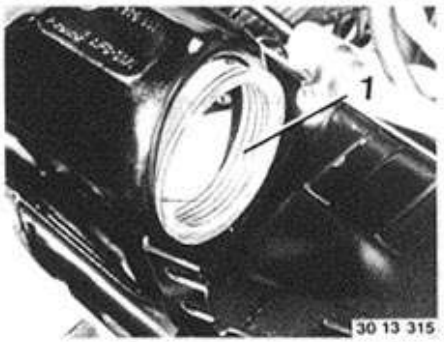
* See Specifications + Nom. Value Microfiche



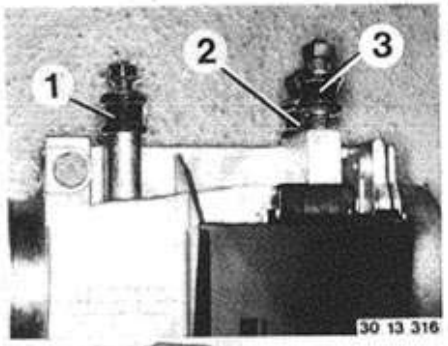
13 62 000 REMOVING AND INSTALLING AIR FLOW SENSOR

Until Model '85:

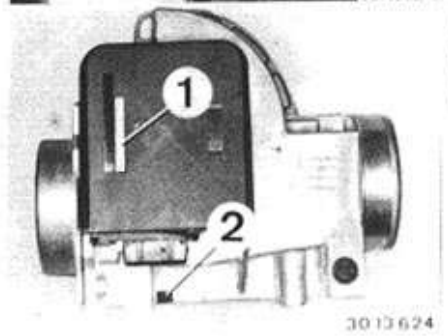
Loosen hose clamp (1).
Unscrew nuts (2).
Pull off plug (3).
Pull air flow sensor out of air cleaner housing and remove.
4 = Code number*



Installation:
Check seal (1), replacing if necessary.

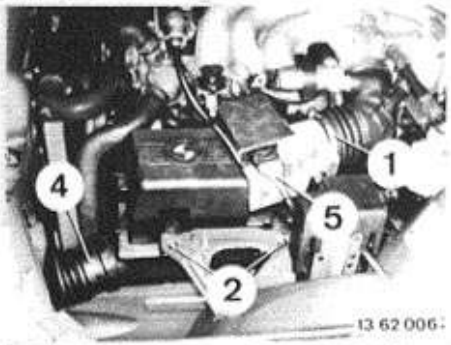


Unscrew silent mounts (1 — 3) on air flow sensor.
Check silent mounts, replacing if necessary.



Installation:
Check code number (1)* and manufacturing date (2)*.
Check engine idle speed* and idle speed CO*.
Check air flow sensor*.

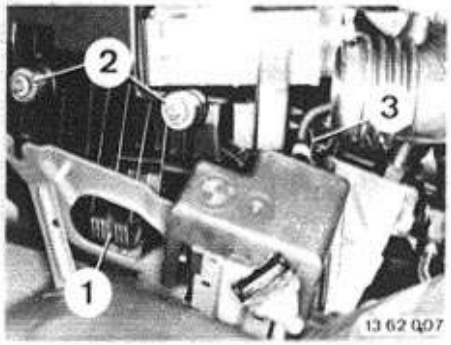
* See Specifications and nominal value microfilm



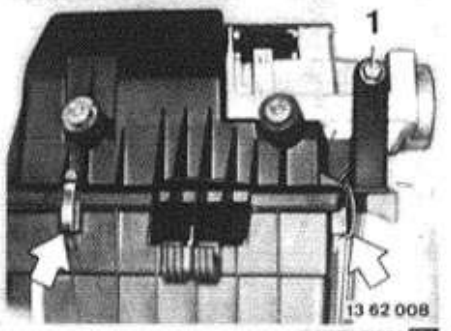
13 62 000 REMOVING AND INSTALLING AIR FLOW SENSOR

From Model '86:

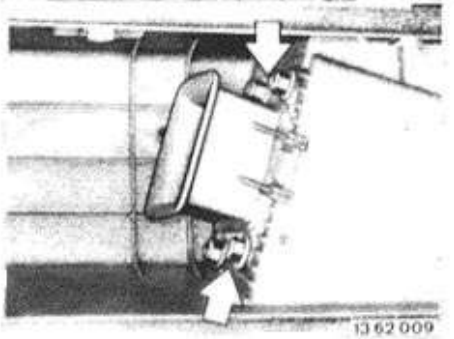
Loosen hose strap (1).
Loosen nuts (2).
Pull off hose (4).
Pull off plug (5).



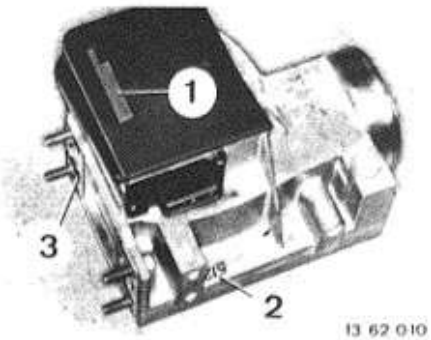
Cut off hose strap (3).
Take off complete air cleaner.
Installation:
Check rubber mount (1) and cushions (2), and check for correct seating.



Open four clamps.
Unscrew bolt (1).
Separate housing sections.

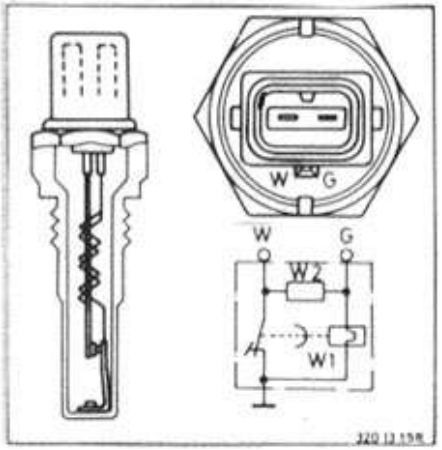


Unscrew nuts.



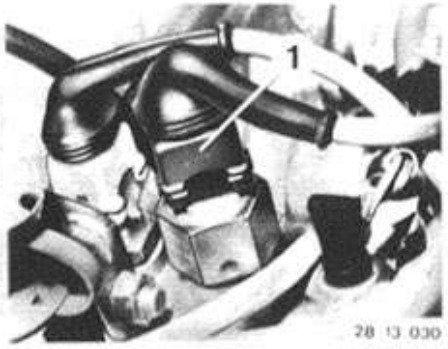
Installation
Check code number (1)* and manufacturing date (2)*.
Check engine idle speed* and idle speed CO level*.
Check gasket (3).
Check air flow sensor*.

* See Specifications and Nominal Values

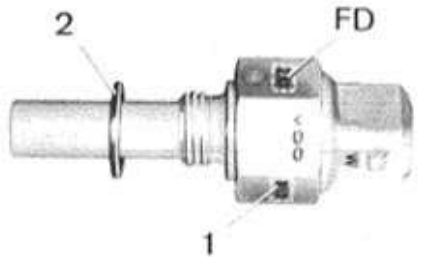


13 62 050 REMOVING AND INSTALLING/ CHECKING TEMPERATURE TIME SWITCH

The temperature time switch regulates the open time of the cold start valve in accordance with the coolant temperature.
Open time (e.g. 8 seconds) and switching off temperature (e.g. 35° C/95° F) are stamped in the hexagon.



Removing and Installing:
Pull off plug (1).
Unscrew temperature time switch.
Installation:
Tightening torque*.



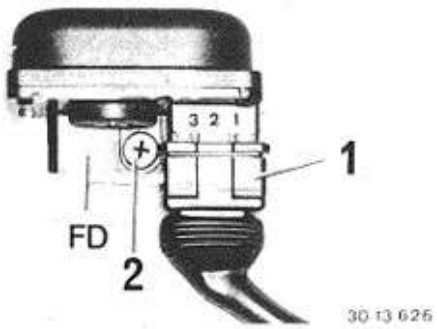
Installation:
Check code number (1)*.
Replace seal (2).
FD = Manufacturing date
Fill and bleed cooling system (Group 17).

Checking:
Connect Jetronic test lead 61 1 440.
Check nominal value* with an ohmmeter.
To check the entire temperature range, remove temperature sensor and place it in a water bath heated to testing temperature.
Check resistance* with an ohmmeter.

* See Specifications

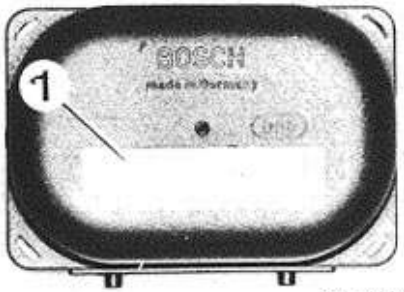
* See Specifications

13 62 080 REMOVING AND INSTALLING/ CHECKING PRESSURE SENSOR



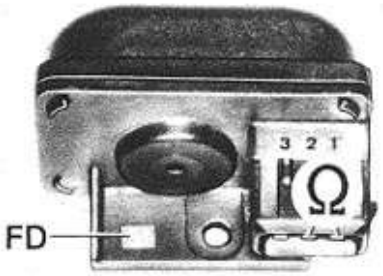
30 13 626

Pull off plug (1).
Unscrew screw (2) and take off pressure sensor.
FD = Manufacturing date



30 13 627

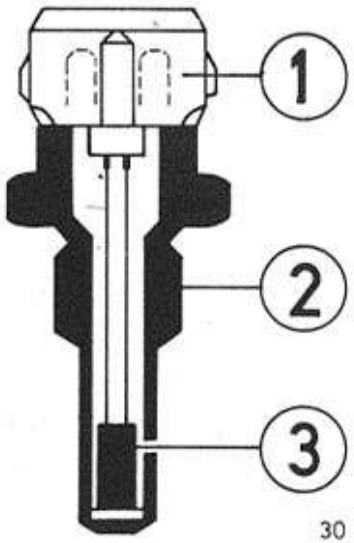
Installation:
Check code number (1)*.



30 13 628

Checking:
There should be approx. 0 ohm between plug connections (1 and 2) with atmospheric pressure of ◿ 880 mbar.
There should be approx. ∞ ohms between plug connections (1 and 2) with atmospheric pressure of ◺ 930 mbar.

* See Specifications

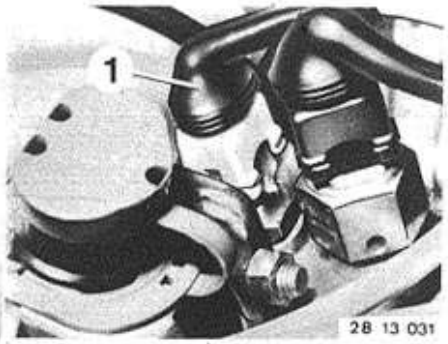


30 13 625

13 62 531 REMOVING AND INSTALLING/ CHECKING TEMPERATURE SENSOR FOR COOLANT

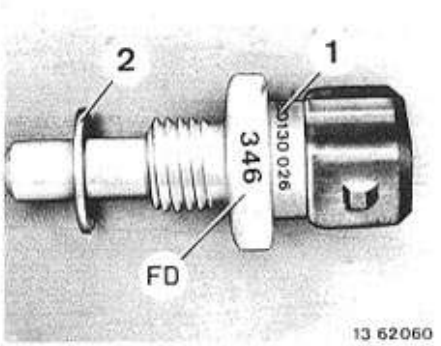
The temperature sensor measures the engine temperature and sends this information to the control unit in form of a resistance value.
The resistance value drops as temperature rises (NTC).

1 Plug connection
2 Housing
3 NTC resistor



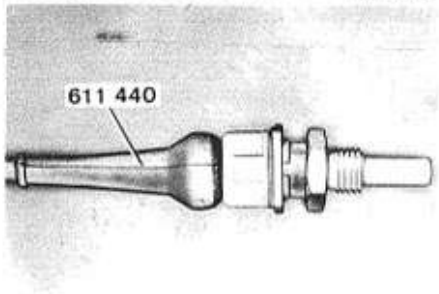
28 13 031

Removing and Installing:
Pull off plug (1).
Unscrew temperature sensor.
Installation:
Tightening torque*.



13 62060

Installation:
Check code number (1)*.
Replace seal (2).
FD = Manufacturing date
Fill and bleed cooling system (Group 17).

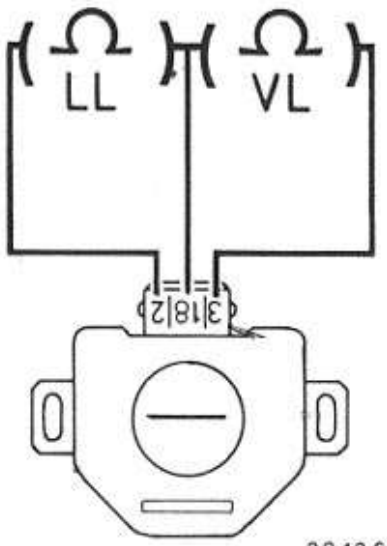


13 62061

Checking:
Connect Jetronic test lead 61 1 440.
Check nominal value* with an ohmmeter.
To check the entire temperature range, remove temperature sensor and place it in a water bath heated to testing temperature.
Check resistance* with an ohmmeter.

* See Specifications

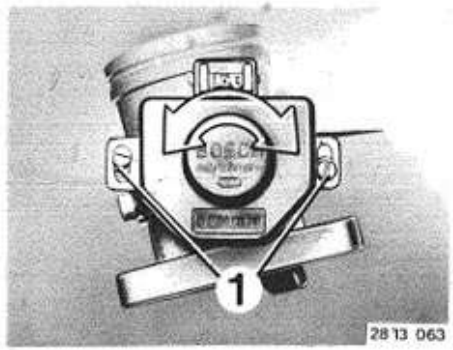
* See Specifications



30 13 631

13 63 544 ADJUSTING THROTTLE SWITCH

Check throttle switch.
There should be approximately 0 ohm betw. connections 2 and 18 when throttle is closed.
With the throttle wide open there must be approximately 0 ohm between connections 3 and 18.
LL = Idle
VL = Full throttle

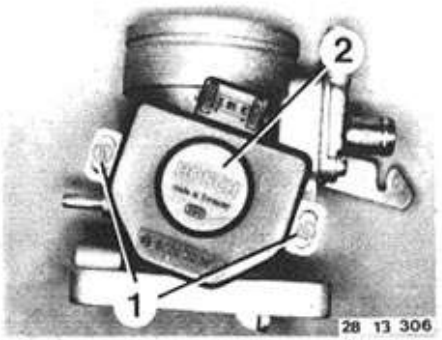


28 13 063

Adjusting:

– Throttle Housing Removed –
There should be approximately 0 ohm betw. connections 2 and 18 when throttle is closed.
Adjust by loosening screws (1) and turning the throttle switch.
Open throttle after finishing adjustments – resistance should rise immediately to ∞ ohms.
When releasing the throttle, the resistance must drop again to approximately 0 ohm.

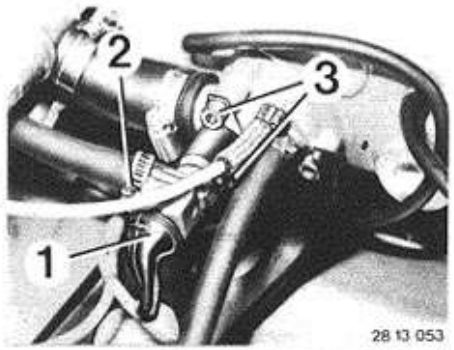
13 63 551 REMOVING AND INSTALLING THROTTLE SWITCH



Remove throttle switch 13 54 030.
Unscrew screws (1).
Take off throttle switch (2).

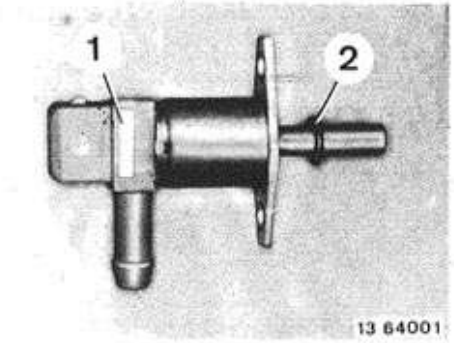
Installation:
Check code number (1)*.
Adjust throttle switch 13 63 544.

* See Specifications



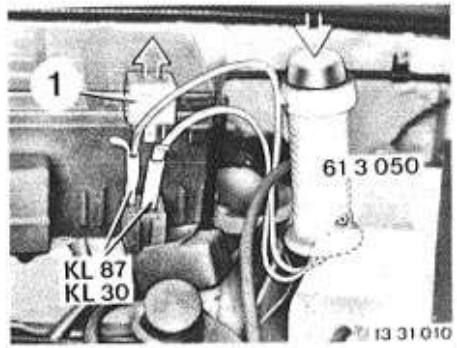
13 64 030 REMOVING AND INSTALLING COLD START VALVE

Removing and Installing:
Pull off plug (1).
Unscrew fuel line (2).
Unscrew bolts.
Take off cold start valve.

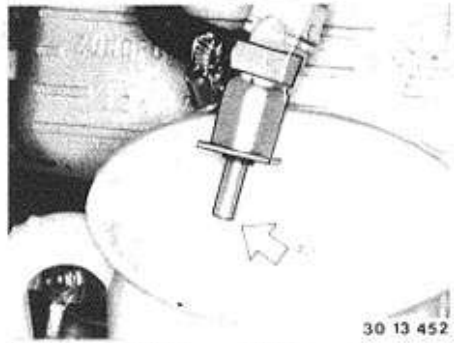


Installation:
Check code number (1)*.
Replace seal (2).

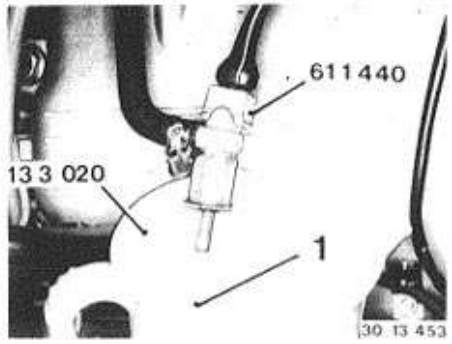
Checking:
Unscrew cold start valve on intake housing.
Fuel line remains connected.



Checking – DME / E 28 /
Unscrew cold start valve on intake housing.
Fuel line remains connected.
Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Fuel pump runs.



Leak Test:
Check permissible leak rate*.

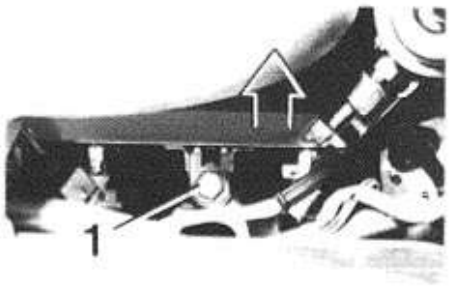


Chekcing Fuel Flow Rate and Spray Angle:
Hold cold start valve in measuring glass 13 3 020.
Plug Jetronic test lead 61 1 440 on cold start valve and connect with B + and B –.
Check fuel flow rate* and spray angle (1)*.

* See Specifications

* See Specifications

13 64 501 REPLACING FUEL INJECTOR



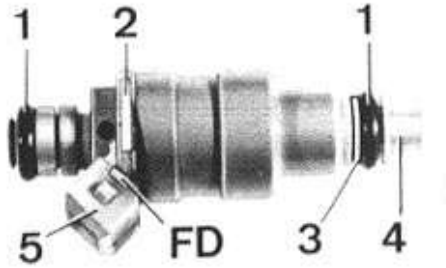
28 13 055

Unscrew four mounting bolts (1) of injection pipe.
Push up injection pipe until fuel injectors have cleared the guide on the intake manifold.

28 13 054

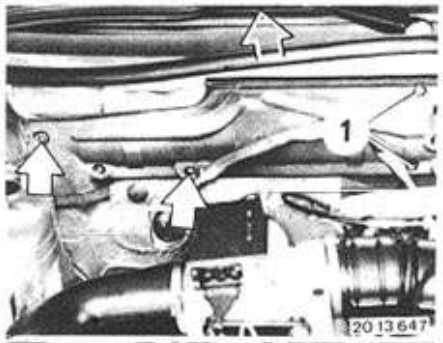
Pull off plug (1) on fuel injector.
Lift out retainer (2) and pull fuel injector out of injection pipe.

Installation:
Check O-rings (1), replacing if necessary.
Check code number (2)*.
FD = Manufacturing date.
Check position of plastic washer (3).
Check color* of plug receptacle (5) or injector guard (4).
Only coat O-rings for installation with vaseline or SAE 90/SAE 80 gear lube.



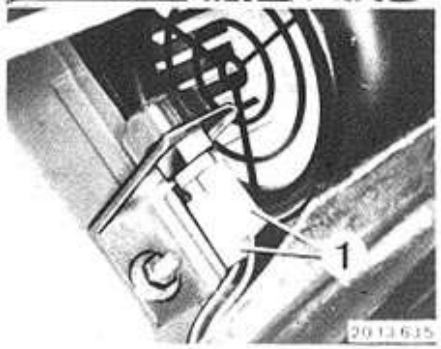
30 13 122

* See Specifications

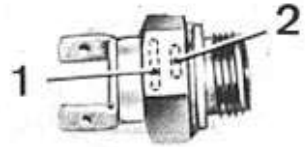


12 63 051 REMOVING AND INSTALLING 0° C (32° F) TEMPERATURE SWITCH

E 28
Unscrew screws (1).
Unscrew screws (2) on left and right sides.
Pull off rubber guard.
Fold cover forward.

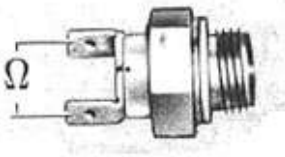


Pull off plug (1).
Unscrew temperature switch.
Installation:
Torque: max. 30 Nm (22 ft. lbs.).



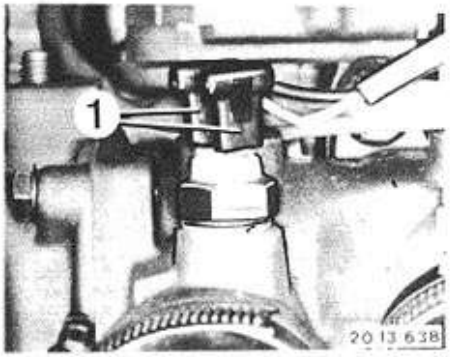
Installation:
Check code number (1)* and switching point (2)*.

20 13 633



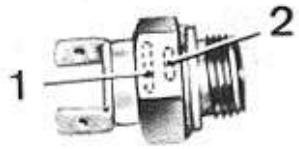
Checking:
Connect ohmmeter (M 06) on temperature switch.
Ohmmeter should display about 0 ohm with temperature < – 8° C (+ 18° F).
Ohmmeter should display about ∞ ohms with temperature > 4° C (39° F).

20 13 634 * See Specifications

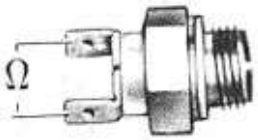


12 63 060 REMOVING AND INSTALLING 45° C (113° F) TEMPERATURE SWITCH

Pull off plug (1).
Remove temperature switch.
Installation:
Tightening torque: max. 30 Nm (22 ft. lbs.).
Fill and bleed cooling system (Group 17).



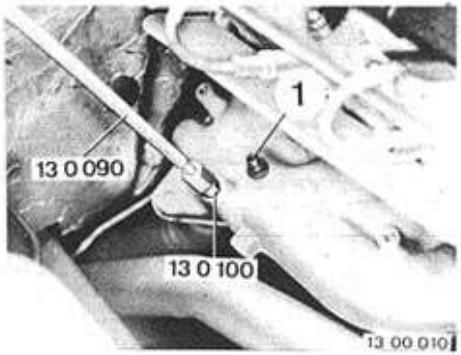
Installation:
Check code number (1)* and switching point (2)*.



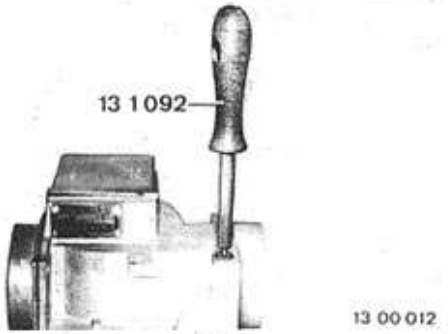
Checking:
Connect ohmmeter (M 06) on temperature switch.
Ohmmeter should display approximately 0 ohm for temperature $< 30^{\circ}$ C (86° F).
Ohmmeter should display approximately ∞ ohms for temperature $> 48^{\circ}$ C (118° F).

* See Specifications

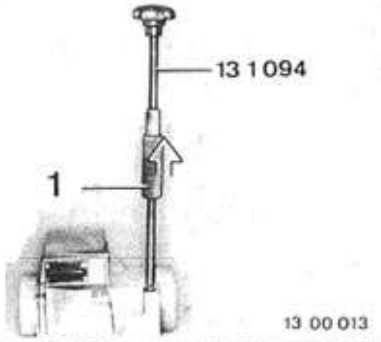
13 00 020 CHECKING ADAPTIVE PILOT CONTROL
(Integrated in DME Control Unit Since 1985 Models)



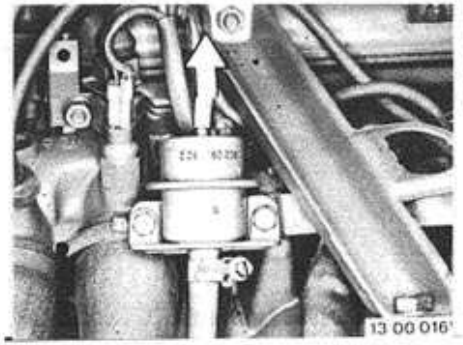
Testing Requirements:
Engine, oxygen sensor and catalytic converter have operating temperature.
Oxygen sensor is heated electrically.
Unscrew screws (1).
Mount exhaust tester 13 0 090 on exhaust manifold with adapter 13 0 100.
Connect BMW service test unit.



Remove anti-tamper lock.
Remove air cleaner with air flow sensor.
Drill hole in anti-tamper lock with Special Tool 13 1 092.

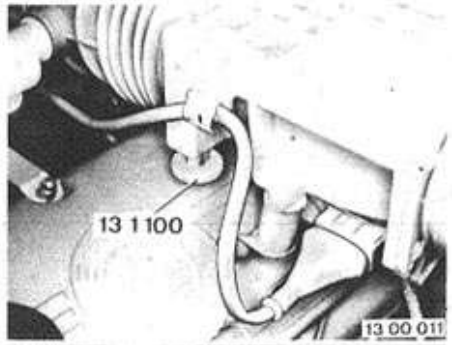


Screw Special Tool 13 1 094 in anti-tamper lock.
Knock special tool with anti-tamper lock out of air flow sensor with impact (1).
Install air cleaner with air flow sensor.
Run engine at idle speed.

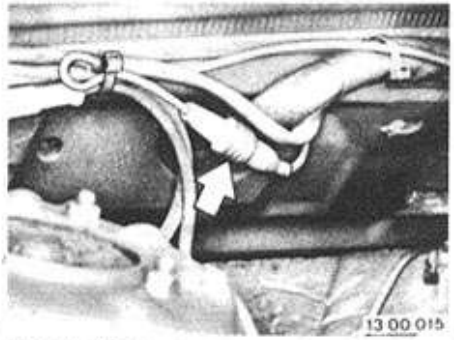


Pull off and plug vacuum hose on fuel pressure regulator.
Oxygen sensor must regulate the CO level back to nominal value* after a brief rise.
Oxygen sensor is okay.

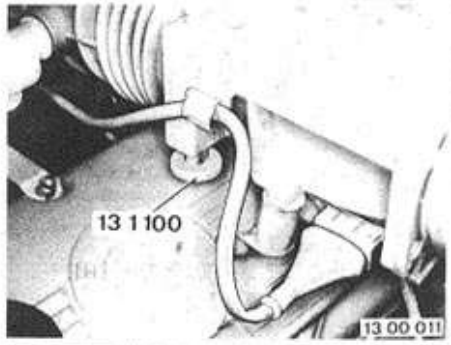
* See nominal value microfiche



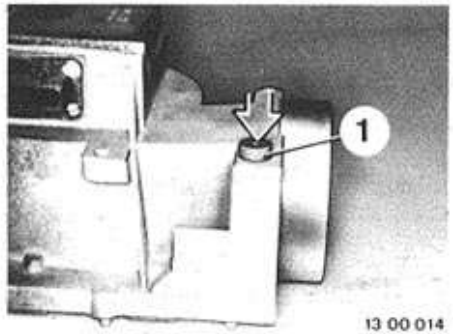
Tighten air control screw in air flow sensor completely with Special Tool 13 1 100 richer mixture.
Run engine at idle speed – CO level will be regulated back to nominal value*.



Disconnect oxygen sensor plug.
CO level rises to approx. 2.0 % by volume.
Note instantaneous actual value.
Stop engine.
Disconnect battery ground lead briefly.
This will cancel the value stored in memory of DME control unit.



Start engine.
If actual CO level value is considerably higher, adaptive pilot control is working.
Connect vacuum hose again.
Adjust CO level to nominal value* with Special Tool 13 1 100.
Connect oxygen sensor.
Remove exhaust tester.



Remove and install air cleaner with air flow sensor.
Insert new anti-tamper lock (1) in air flow sensor.

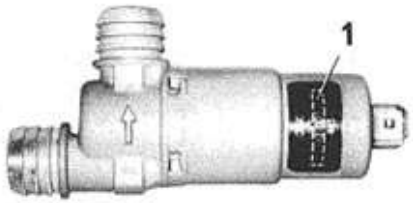
* See nominal value microfiche

13 00 050 CHECKING / ADJUSTING ENGINE PERFORMANCE (9.84 ... 9.85)

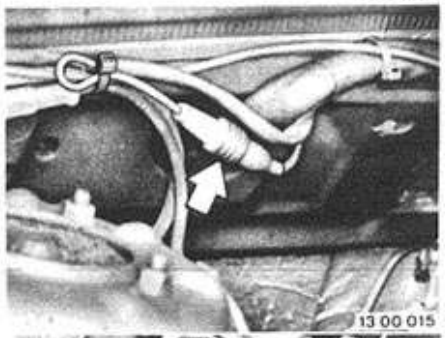
Requirements for All Adjustments:
Engine at operating temperature, which means oil temperature at least 60° C (140° F).
Ignition timing and valve clearance okay.
All electric equipment switched off.
BMW service tester connected to instructions.
Routine checking and adjusting is not neces sary -- adaptive initial control.
Following adjustments are only necessary for problem cases (troubleshooting).

1) Engine Idle Speed

Check engine idle speed**
Check idle speed control valve, if nominal value is not reached.
Check intake system for leaks.
Note:
There is no control screw for idle speed adjustments.

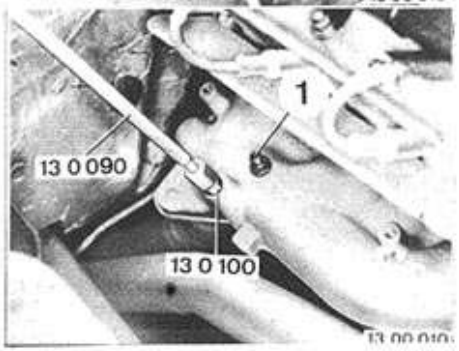


13 41 002



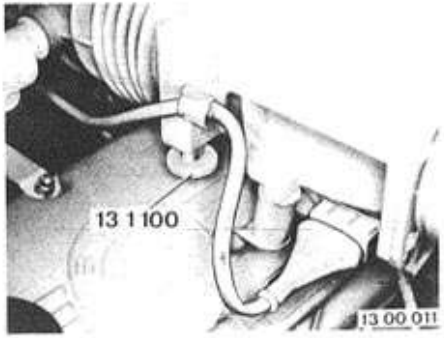
2) CO Level Test (Basic Adjustment)

Disconnect oxygen sensor plug.
Stop control unit power supply briefly (this stops operation of the adaptive initial control system).



Unscrew plugs (1).
Connect Special Tools 13 0 090 and 13 0 100 on the exhaust manifold.
Check CO level at idle speed.
Remove anti-tamper lock -- see 13 - 010.

** See Nominal Value Microfiche



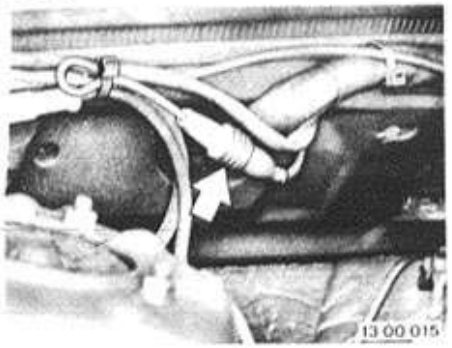
Switch off extraction system for time of measuring.
Make sure that there are no faults on the engine, ignition or fuel injection systems (see trouble shooting) before correcting the CO level.
Remove end cap -- see 13 00 054.
Adjust CO level* with Special Tool 13 1 100 applied on control screw in air flow sensor.

Check adaptive initial control see 13 00 020.

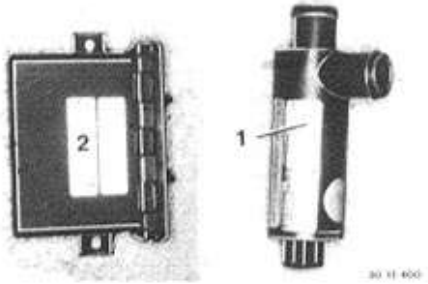
* See Nominal Value Microfiche

13 00 054 ADJUSTING ENGINE IDLE SPEED / CO TEST

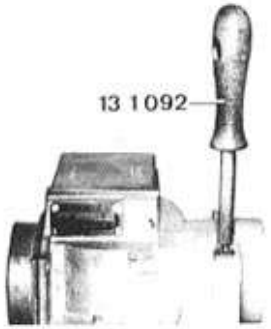
Requirements for All Adjustments:
Engine at operating temperature, i.e. oil temperature at least 60° C (140° F).
Ignition timing and valve clearance correct.
All electric equipment switched off.
BMW service test unit connected to operating instructions.



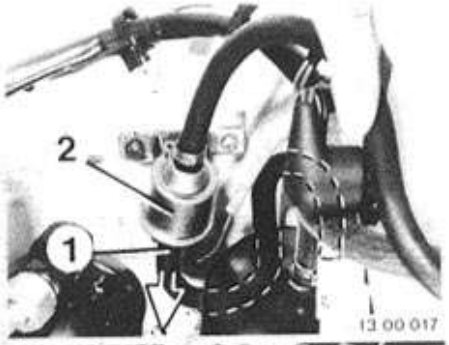
Pull off oxygen sensor plug.



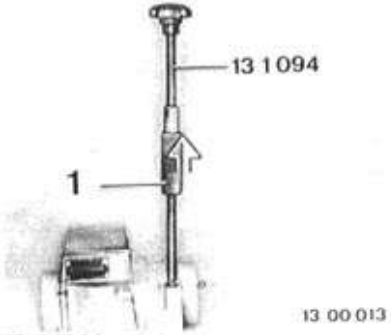
1) Engine Idle Speed:
Check engine idle speed**.
If specified value is not reached, check idle control valve (1) and idle speed regulation control unit (2), replacing if necessary.
Note:
There is no adjustment screw for idle speed regulation.



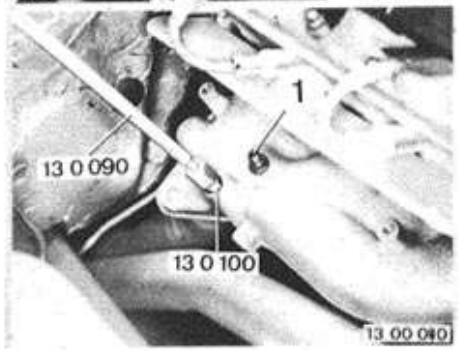
Remove air cleaner with air flow sensor.
Drill hole in anti-tamper lock with Special Tool 13 1 092.



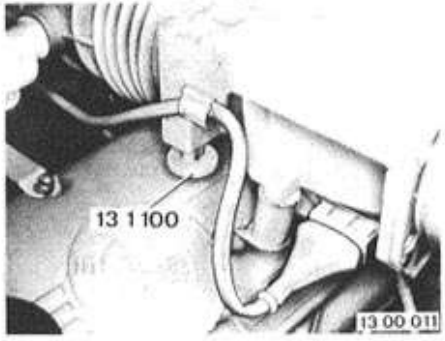
2) CO Test:
Pull off hose (1) on solenoid (2).
Do not insert plugs in open connections.



Screw Special Tool 13 1 094 in anti-tamper lock.
Knock special tool and anti-tamper lock out of air flow sensor with impact (1).
Install air cleaner with air flow sensor.
Run engine at idle speed.



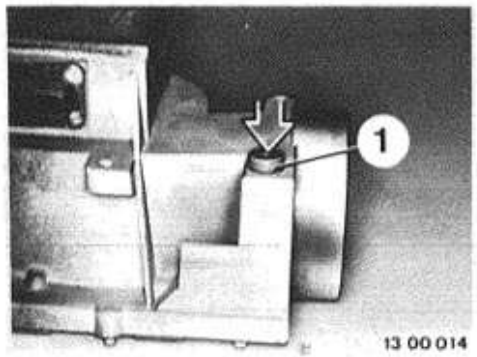
Unscrew bolts (1).
Connect Special Tool 13 0 070 on exhaust manifold with adapter 13 0 100.
Check idle speed CO level**.



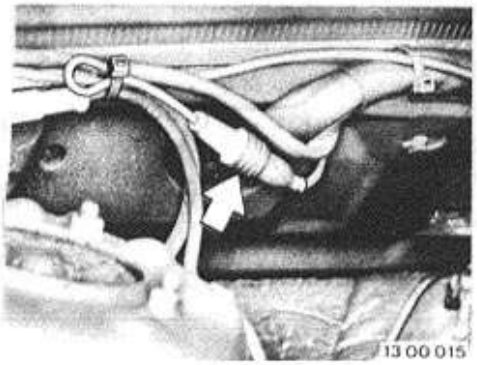
Adjust CO to specified value** with Special Tool 13 1 100.
Connect oxygen sensor.
Remove CO tester.

** See Nominal Value Microfilm

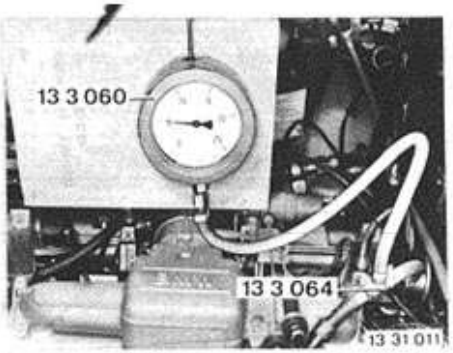
** See Nominal Value Microfilm



Remove air cleaner with air flow sensor.
Insert new anti-tamper lock (1) in air flow sensor.
Install air cleaner with air flow sensor.

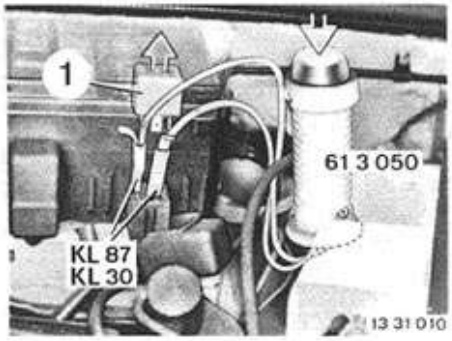


Connect oxygen sensor plug.

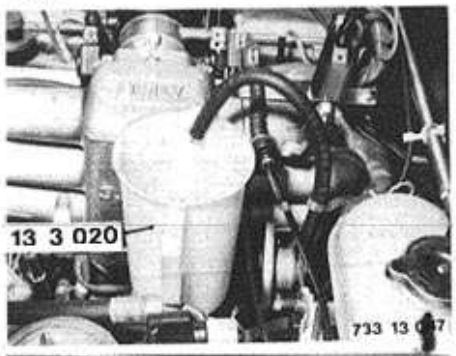


13 31 029 CHECKING FUEL DELIVERY PRESSURE

Install pressure tester 13 3 060 with connecting hose and t-adapter 13 3 064 in fuel feed line – in front of fuel pressure regulator.
Plug fuel return hose with Special Tool 13 3 010.

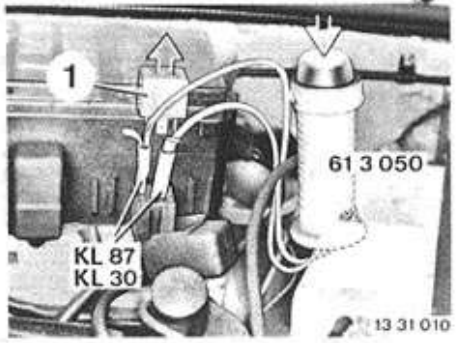


Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Check delivery pressure*.



13 31 . . . CHECKING FUEL DELIVERY RATE

Disconnect fuel return hose and hold loose end in measuring glass 13 3 020.

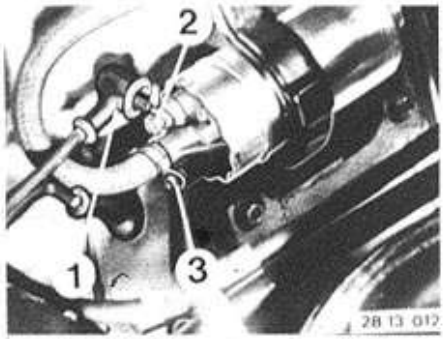


Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Check delivery rate*.

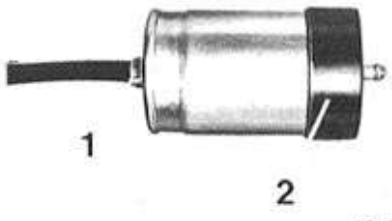
* See Specifications of Group 16

* See Specifications of Group 16

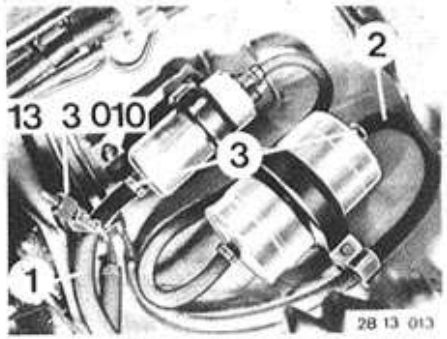
13 31 030 REMOVING AND INSTALLING FUEL PUMP



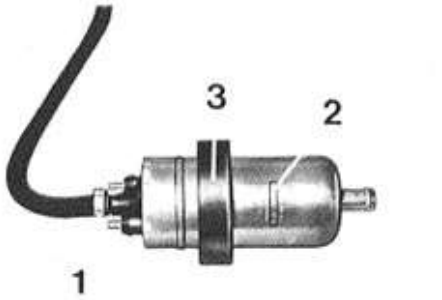
Push back protective caps (1).
Unscrew nuts (2 and 3) and take off wires.



Loosen hose clamp (1) on fuel filter and pull off fuel hose.
Remove rubber ring (2).
Installation:
Check direction of flow – IN and OUT are marked on filter.
Do not use a squeeze-hose clamp.

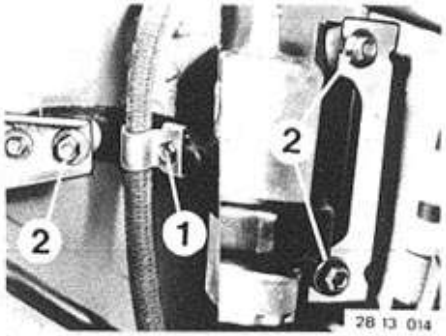


Pinch suction hose (1) and pressure hose (2) with Special Tool 13 3 010.
Loosen hose clamps (3) and pull off hoses.
Note:
Do not use squeeze-hose clamps on pressure hose.

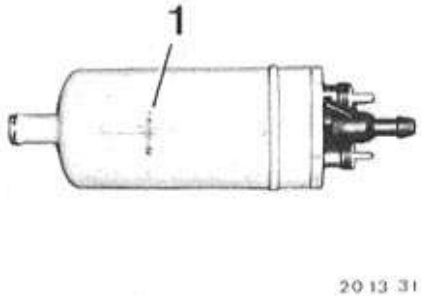


Loosen hose clamp (1) on fuel pump and pull off fuel hose.
Pull off rubber ring (3).

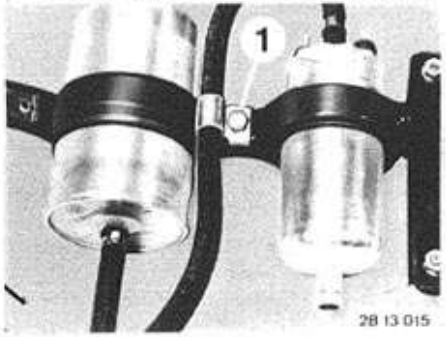
2 = Code number*



Unscrew bolt (1) and nuts (2).
Take off fuel pump with filter.



Installation:
Check code number (1)*.

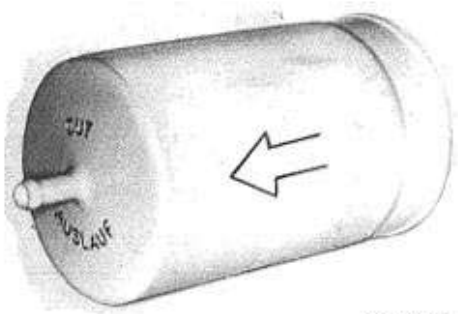


Unscrew bolt (1) and take off clamp.

* See Specifications

13 32 052 REMOVING AND INSTALLING FUEL FILTER

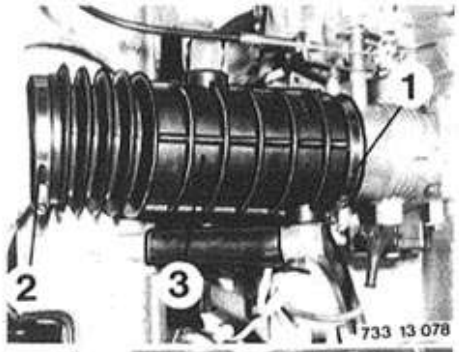
See "Removing and Installing Fuel Pump" – 13 31 030.



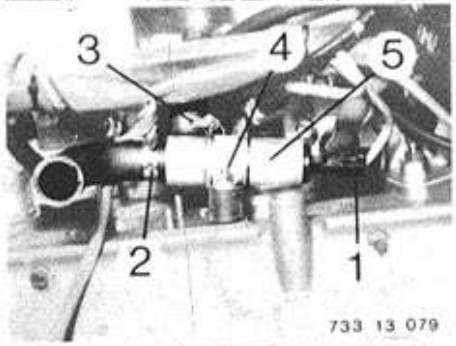
20 13 321

Installation:
Check direction of flow (arrow).

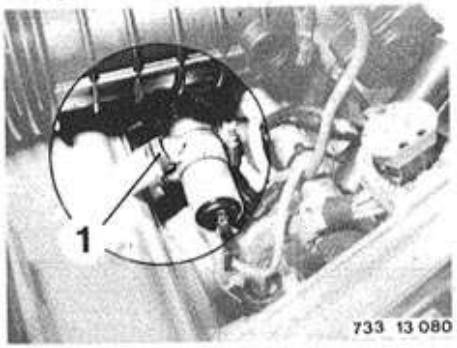
13 41 000 REMOVING AND INSTALLING IDLE CONTROL VALVE



Loosen hose clamps (1 and 2).
Remove air hose (3).



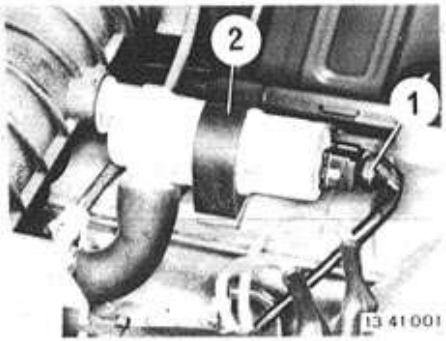
Pull off plug (1).
Loosen hose clamps (2 and 3) and pull off hoses.
Unscrew nut (4) and take off idle control valve (5).



Installation:
Check code number*.
Check rubber mount (1) for cracks or damage, replacing if necessary.
Check idle speed*.

Checking Idle Control Valve:
Apply battery voltage* on idle control valve.
Idle control valve should close and be tight.
Idle control valve should be open without voltage supply.

* See Specifications and Nominal Value Microfiche

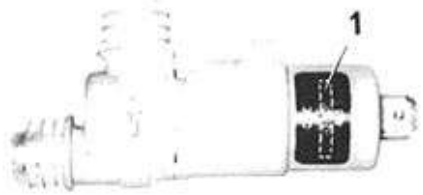


13 41 001

13 41 000 REMOVING AND INSTALLING IDLE CONTROL VALVE (Since 1985 Models)

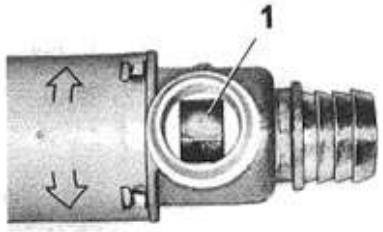
Pull off plug (1).
Disconnect retaining strap (2).
Pull off idle control valve on hoses and remove.

Installation:
Check code number (1)*.
Check idle speed*.



13 41 002

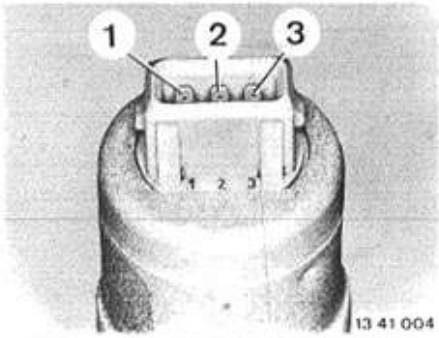
Note:
Whether or not the idle control valve is running can be felt by taking hold of valve with a hand (cycled power supply).



13 41 003

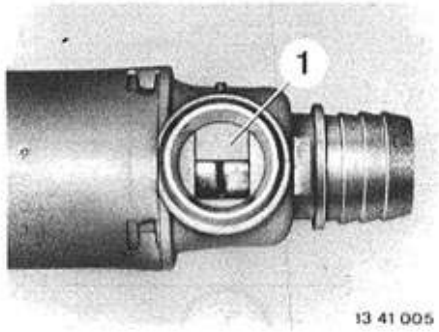
Mechanical Test:
The rotating piston (1) in the idle control vlave must move when turning the idle control valve suddenly.

* See Specifications and Nominal Value Microfiche



13 41 004

Electric Test:
Measure resistance between terminals (1 and 3).
Nominal value: approx. 40 ohms.
Measure resistance between terminals (2 and 1) or (2 and 3).
Nominal value: each approx. 20 ohms.



13 41 005

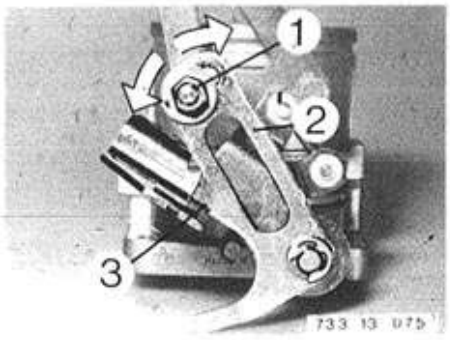
Dynamic Test:
Remove idle control valve.
Plug remains connected.
Open rotating piston (1) completely, or close.
Turn on ignition.
Rotating piston must take on a position of approx. 50 % the cross section opening and stay there.

Testing Procedures for Idle Speed Surging and Idle Speed of ≤ 750 rpm, But Perfect (Checked) Idle Control Valve:

Requirements:

Engine at operating temperature.
No leak in intake system.
Idle speed CO level* correct.
All equipment (lights, air conditioner, etc.) switched off.
BMW service test unit or digital tester connected.
There is no oil dilution,

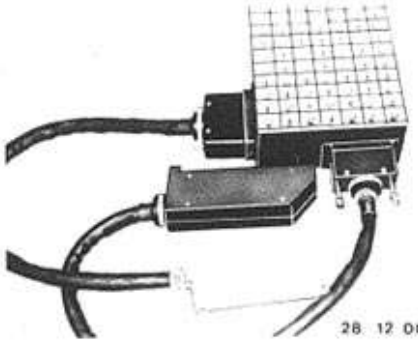
Oil dilution = gasoline in engine oil; possible in cold season of year and when car operated chiefly in stop-and-go traffic.



If the idle speed is ≤ 750 rpm, the throttle valve basic setting must be changed.
Loosen nut (1).
Adjust connecting plate (2) with stop (3) (engine running) until the idle speed is 800 50 rpm.

Note:

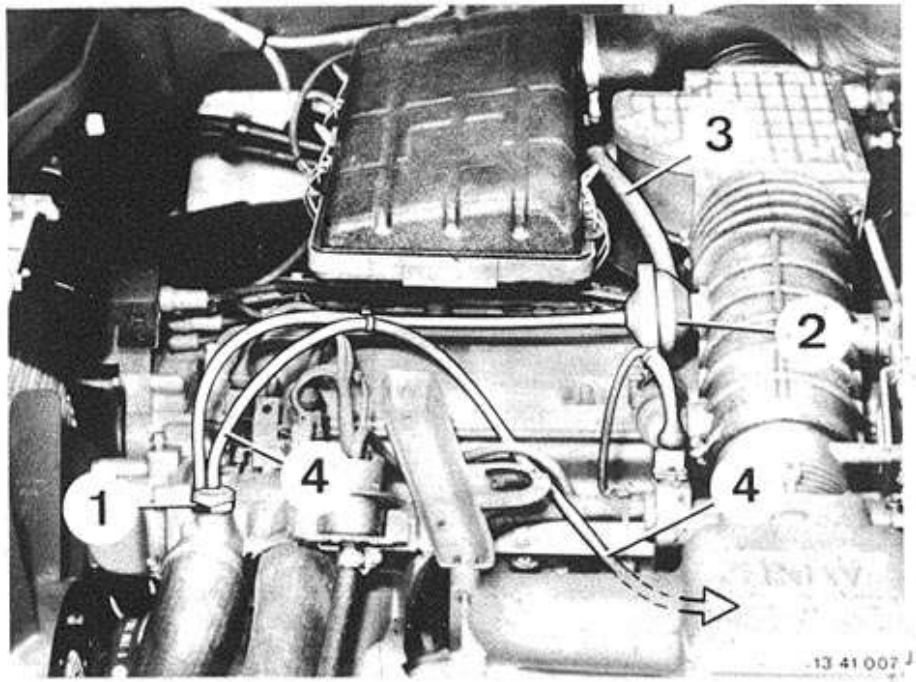
If the fault is not eliminated after adjusting the throttle valve, the throttle valve must be returned back to its original setting.
Cars with Active Carbon Filter Venting (US / J):
There must not be vacuum in hose (4) at idle speed in spite of possible adjusted throttle valve – check.

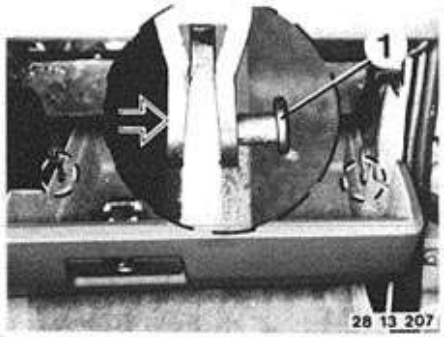


Connect universal adapter between DME control unit and engine wire harness.
Connect plug chambers (2/3/5) with each other (idle and full load contacts closed).
Run engine at idle speed.

Proceed with troubleshooting, if idle speed is ≥ 750 rpm (fault is not within the idle regulation system).

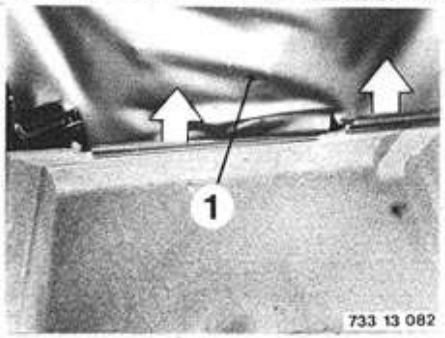
* See Nominal Value Microfilm



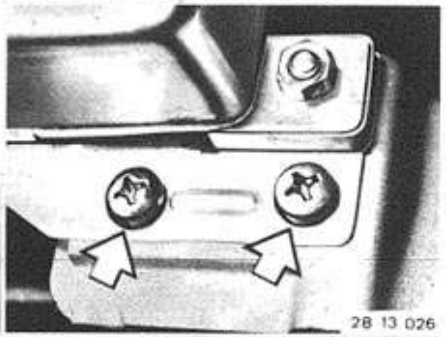


13 41 010 REMOVING AND INSTALLING CONTROL UNIT FOR IDLE CONTROL VALVE

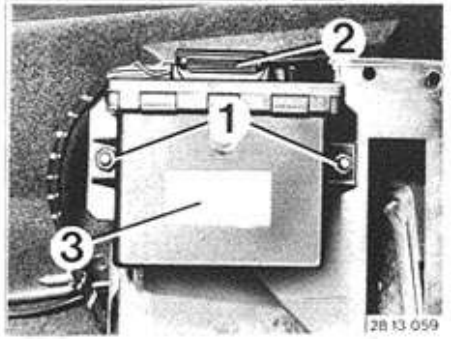
Open glove box.
Pull out pins (1) of both retaining straps.



Disconnect cover (1).

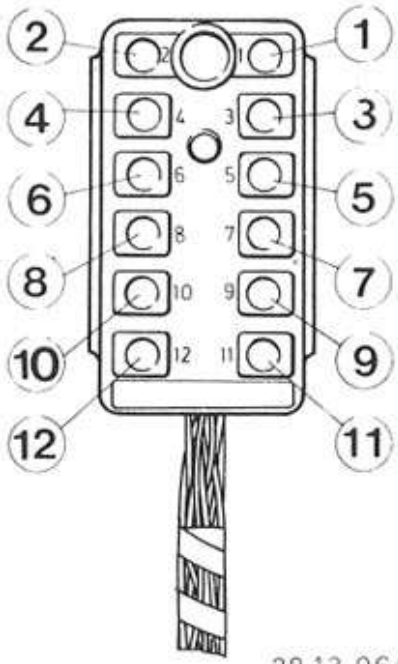


Unscrew both screws on left and right sides of control unit.



Unscrew nuts (1).
Pull off multiple pin plug (2).
Remove control unit.
Installation:
Check code number (3)*.
Check idle speed*.

* See Specifications and Nominal Value Microfiche

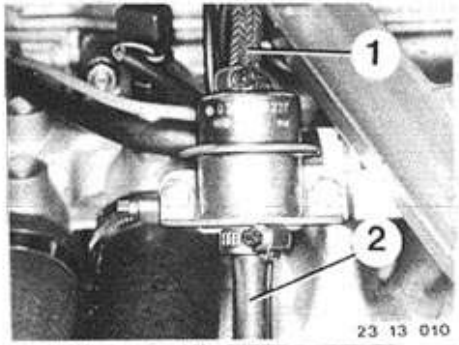


Multiple Pin Plug Connections:

No.	mm^2	Color	Connection To
1	0.5	BLRT	Idle control valve A
2	0.5	GNGE	Terminal 15
3	1.0	GN	DME contr. unit (pin 8)
4	0.5	BR	Terminal 31
5	0.5	BLSW	Idle control valve B
6	0.5	WS	Temp.switch 45°C/113°F
7	0.5	BLBR	Conn. transm. P
8	0.5	BLGE	Conn. transm. N
9	0.5	BLWS	Air conditioner
10	0.5	BLGN	Air temp. switch
11	0.5	BRRT	DME contr. unit (pin 13)
12	0.5	BRBL	DME contr. unit (pin 2)

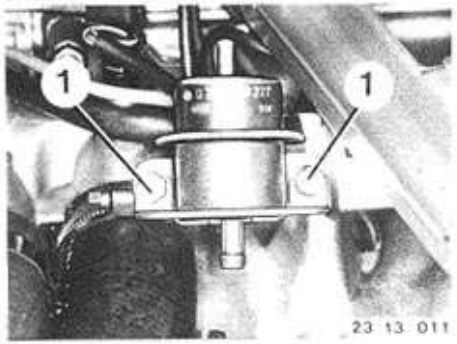
Wire Colors:

BL = Blue
BR = Brown
GE = Yellow
GN = Green
RT = Red
SW = Black
WS = White

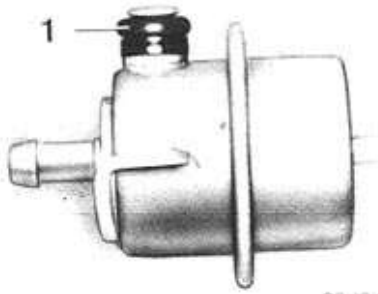


13 51 200 REMOVING AND INSTALLING FUEL PRESSURE REGULATOR

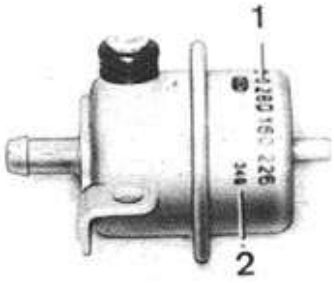
Disconnect air hose (1) and fuel hose (2).



Unscrew bolts (1).
Remove fuel pressure regulator.

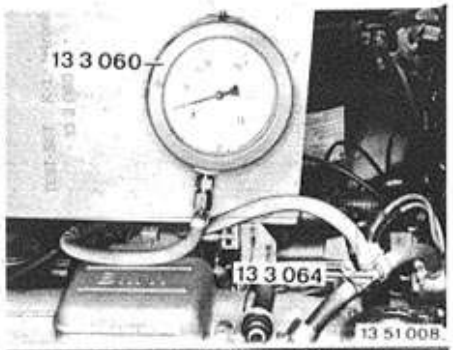


Installation:
Check seal (1), replacing if necessary.

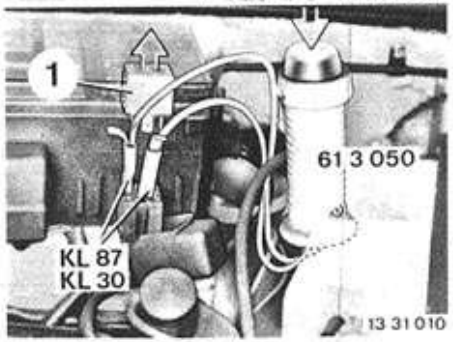


Installation:
Check code number (1)*.
(2) = Manufacturing date

* See Specifications

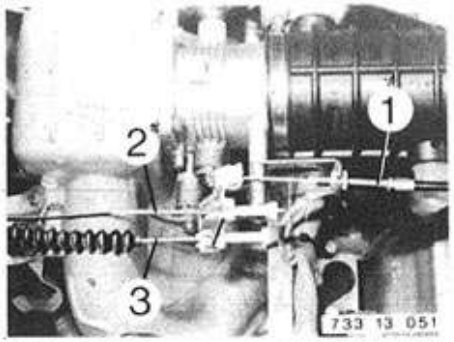


Checking:
Install pressure tester 13 3 060 with connecting hose and t-adapter 13 3 064 in the fuel feed line – in front of fuel pressure regulator.



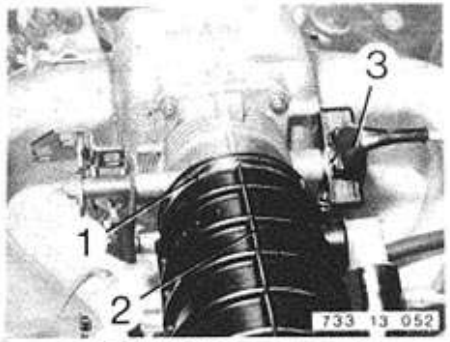
Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Check fuel injection pressure*.

* See Specifications and Nominal Value Microfiche

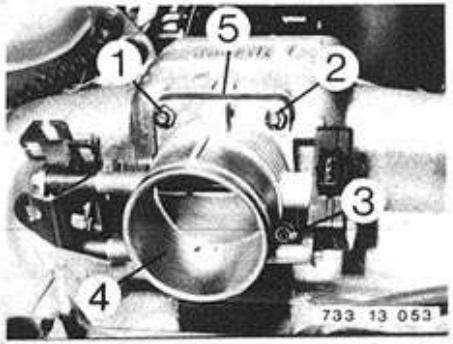


13 54 030 REMOVING AND INSTALLING THROTTLE HOUSING

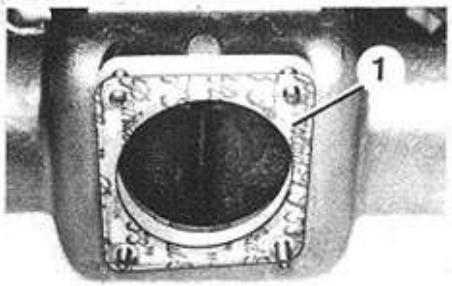
Disconnect cables (1 ... 3).
1 = Automatic transmission
2 = Accelerator pedal
3 = Cruise control motor
Installation:
Adjust cables – see Groups 24/35/65.



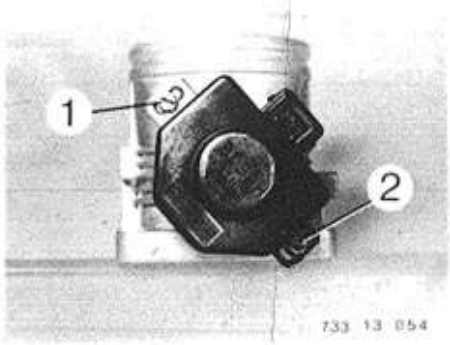
Loosen hose clamp (1) and push back hose (2).
Pull off plug (3) on throttle switch.



Unscrew screws (1 ... 4).
Take off throttle housing.
5 = Gasket

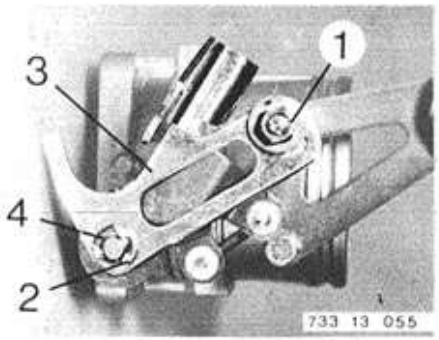


Installation:
Replace gasket (1).



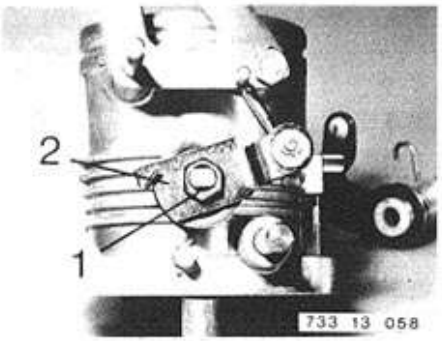
Unscrew screws (1 and 2).
Take off throttle switch.
Installation:
Adjust throttle switch 13 63 544.
Connect vacuum hoses again.
Check engine idle speed* and CO*.

* See Nominal Value Microfiche

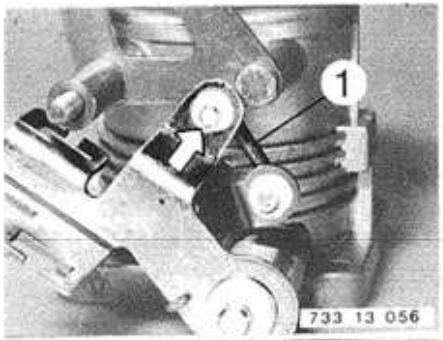


13 54 051 REPLACING THROTTLE SHAFT RETURN SPRINGS
– Throttle Housing Removed –

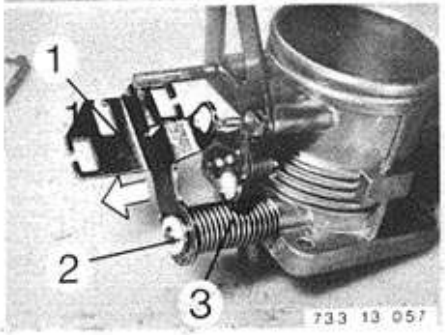
Unscrew nut (1).
Remove retainer (2).
Take off connector (3).
Important!
Watch out for shims (4) on both sides of the connector.



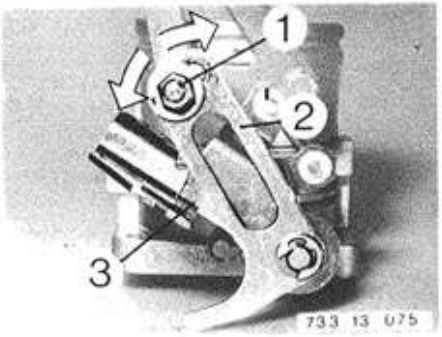
Unscrew nut (1).
Pull off lever (2) with shim and spring.
Important!
Be careful not to turn the attached throttle switch beyond the permissible gap angle when unscrewing the nut.
Installation:
Use spacer between lever (2) and housing.
Preload return spring with approx. 1/2 turn.



Disconnect connecting rod (1).

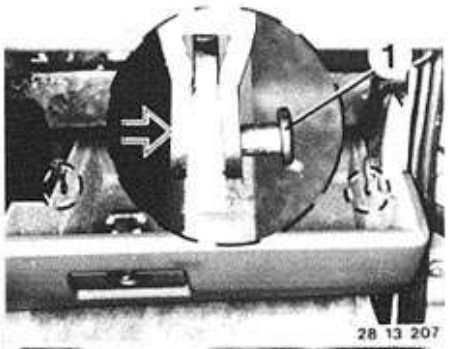


Remove lever (1) with plastic sleeve (2) and spring (3).
Caution!
Strong spring force.
Installation:
Preload spring with about 1/2 turn.

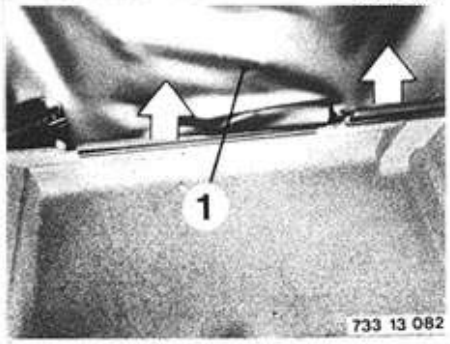


Basic Throttle Valve Adjustment:
Adjustments are only necessary after repairing.
Loosen screw (1).
Adjust connector (2) with stop (3) until there is slight clearance between housing and throttle valve.

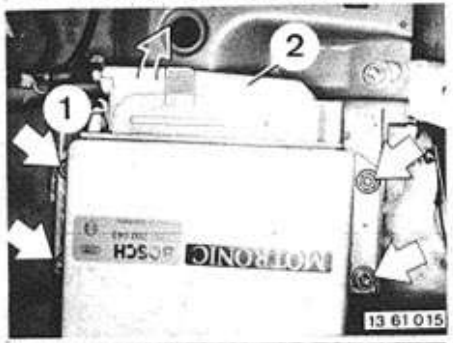
13 61 000 REMOVING AND INSTALLING CONTROL UNIT



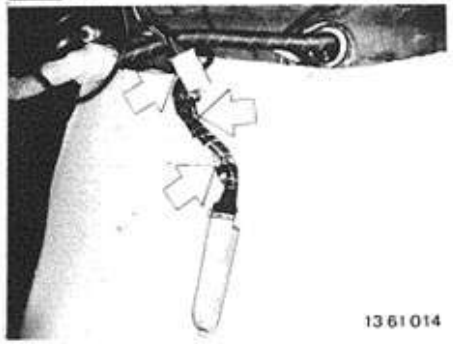
Open glove box.
Pull out pins (1) of both retaining straps.



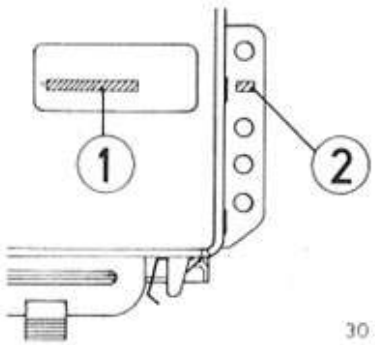
Unscrew trim panel.

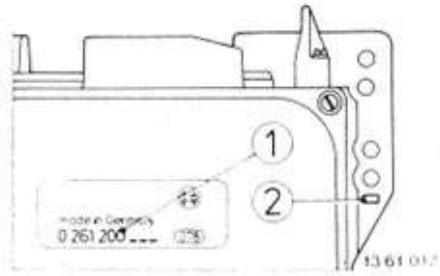


Press back retainer (1) and pull off plug (2).
Unscrew four mounting screws and take off control unit.



Connect plugs according to wiring diagram.



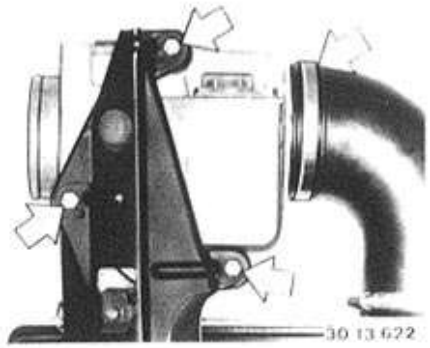


Installation:
Check code number (1)* and manufacturing date (2)*.

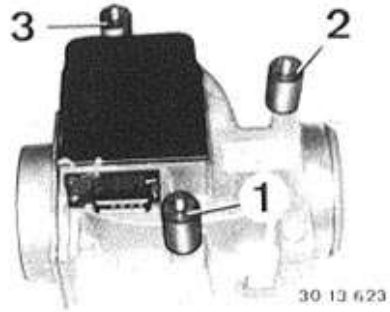
* See Specifications + Nom. Value Microfiche

13 62 000 REMOVING AND INSTALLING AIR FLOW SENSOR

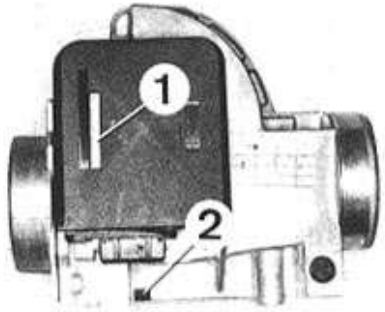
Remove and install air cleaner
Take air flow sensor off of air cleaner.


30 13 622

Unscrew silent mounts (1 — 3) on air flow sensor.
Check silent mounts, replacing if necessary.



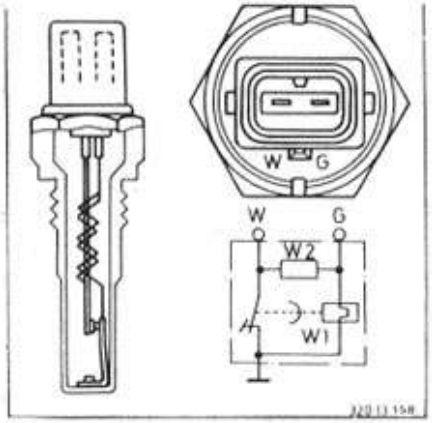
30 13 623



30 13 624

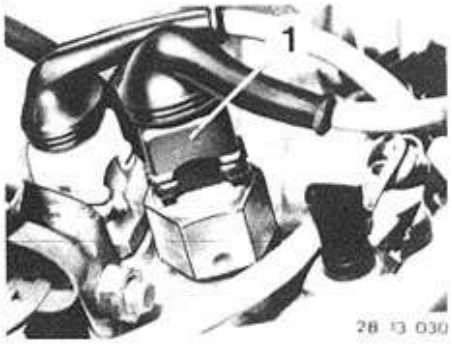
Installation:
Check code number (1)* and manufacturing date (2)*.
Check engine idle speed* and idle speed CO*.
Check air flow sensor*.

* See Specifications and nominal value microfilm



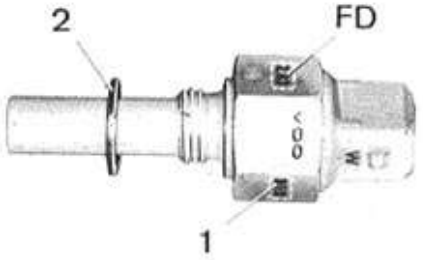
13 62 050 REMOVING AND INSTALLING/ CHECKING TEMPERATURE TIME SWITCH

The temperature time switch regulates the open time of the cold start valve, depending on the coolant temperature.
The open time (e.g. 8 sec.) and switching-off temperature (e.g. + 35° C / 95° F) are stamped on the hexagon.



28 13 030

Removing and Installing:
Pull off plug (1).
Unscrew temperature time switch.
Installation:
Tightening torque*.



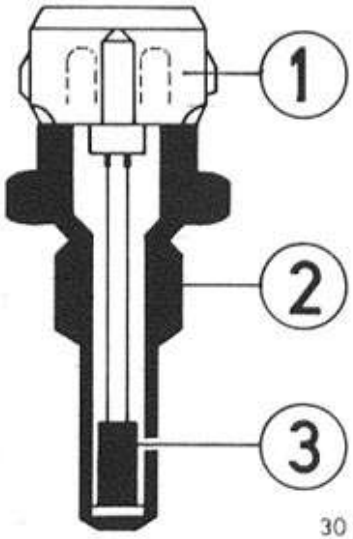
13 62 042

Installation:
Check code number (1)*.
Replace seal (2).
FD = Manufacturing date
Fill and bleed cooling system (Group 17).

Checking:
Connect Jetronic test lead 61 1 440.
Check nominal value* with ohmmeter.
To check the entire temperature range, remove and place temperature sensor in a water bath heated to testing temperature.
Check resistance* with an ohmmeter.

* See Specifications

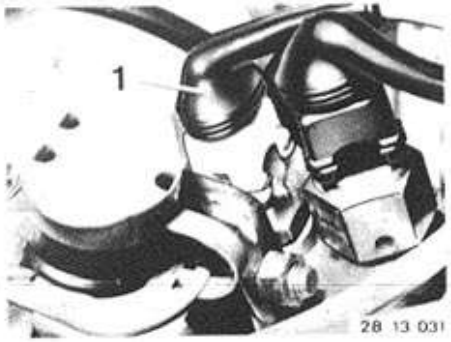
13 62 043 * See Specifications



30 13 625

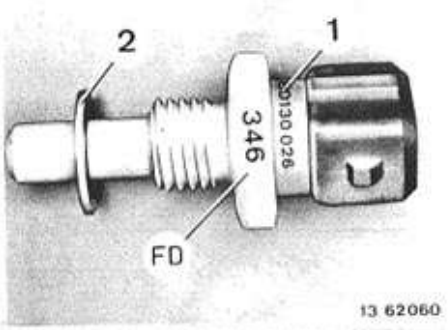
13 62 531 REMOVING AND INSTALLING/ CHECKING COOLANT TEMPERATURE SENSOR

The temperature sensor measures engine temperature and sends this information to the control unit in the form of a resistance value. The resistance value drops as temperature rises (NTC).
1 = Plug connection
2 = Housing
3 = NTC resistor



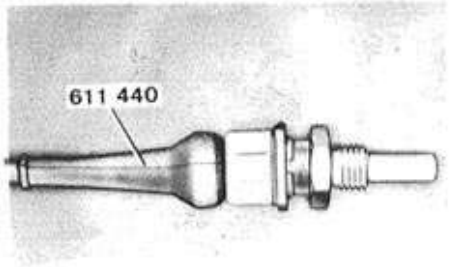
28 13 031

Removing and Installing:
Pull off plug (1).
Unscrew temperature sensor.
Installation:
Tightening torque*.



13 62060

Installation:
Check code number (1)*.
Replace seal (2).
FD = Manufacturing date
Fill and bleed cooling system (Group 17).

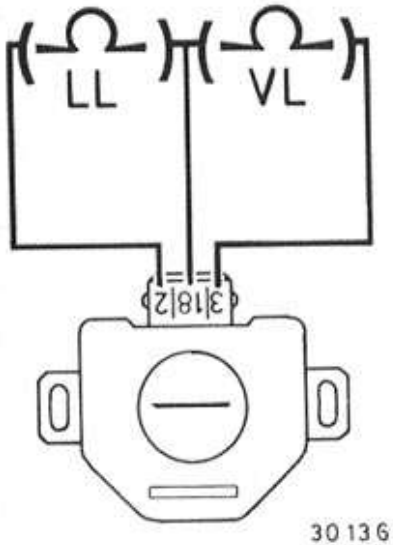


13 62062

Checking:
Connect Jetronic test lead 61 1 440.
Check nominal value* with ohmmeter.
To check the entire temperature range, remove and place temperature sensor in a water bath heated to testing temperature.
Check resistance with an ohmmeter*.

* See Specifications

* See Specifications

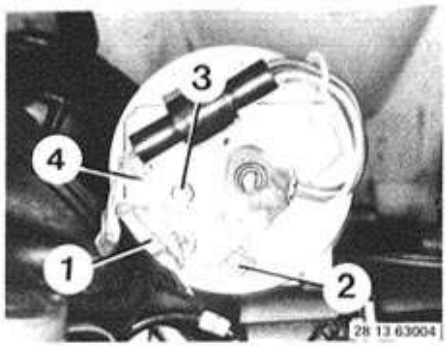


30 13 631

13 63 544 ADJUSTING THROTTLE SWITCH

Check throttle switch.
There should be approximately 0 ohm between connections 2 and 18 with a closed throttle valve.
There should be approximately 0 ohm between connections 3 and 18 with the throttle valve wide open.

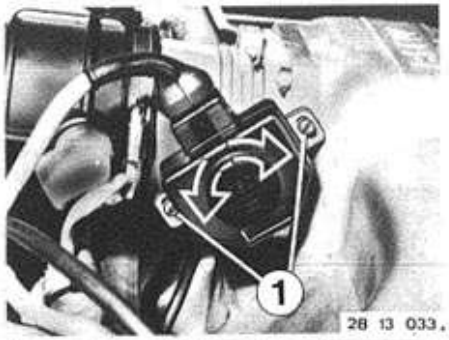
LL = Idle speed
VL = Full load



28 13 63004

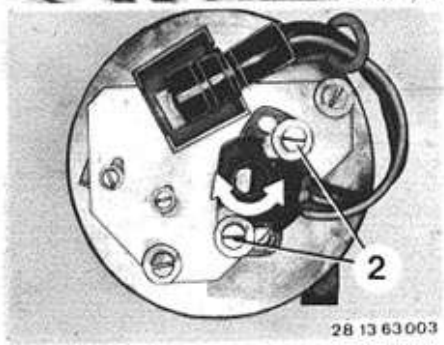
Checking/Adjusting Throttle Potentiometer:
Pull off multiple-pin plug on transmission control unit.
Connect test adapter with test lead between control unit and wire harness.
Turn on ignition.
Accelerator pedal in full load position as well as kickdown.

Transmission Control Unit:
Measure and note power supply value between terminals 9 (+) and 6 (–).
Measure and note power supply value between terminals 7 (+) and 6 (–).
The adjusting voltage should be 0.22 ± 0.04 V less than the power supply voltage value.



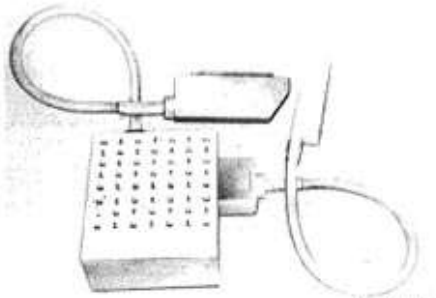
28 13 033

Adjusting:
There should be approximately 0 ohm between connections 2 and 18 with a closed throttle valve.
Adjust by loosening screws (1) and turning the throttle switch.
Open throttle valve after finishing the adjustment – resistance must rise immediately to ∞ ohms.
The resistance should drop back to approx. 0 ohm after releasing the throttle valve.



28 13 63003

Adjusting Idle Speed Switch:
Pull off rubber protective cap.
Pull off plugs (1 and 2).
Connect ohmmeter on plug connections.
Loosen screws (4 and 3).
Move switch until ohmmeter displays approx. 0 ohm.
Tighten screws (4 and 3).
Operating the throttle valve must cause the idle speed switch to switch immediately and have a resistance of approx. ∞ ohms.

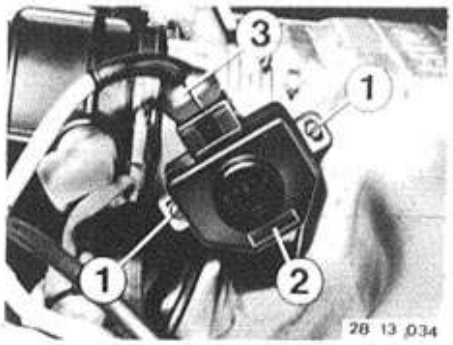


13 63 007

Adjusting:
Correct by loosening screws (2) of throttle potentiometer and turning the throttle potentiometer.

– Checking Potentiometer:
The voltage on the test point of the potentiometer must rise linear up to the adjusting value when opening the throttle valve from the idle stop to the full load stop.

– The throttle valve lever must bear on the full load stop when the accelerator pedal is floored (including kickdown).

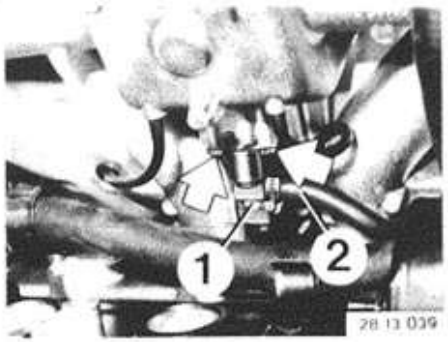


13 63 551 REMOVING AND INSTALLING THROTTLE SWITCH

Pull off multiple pin plug (3).
Unscrew screws.
Remove throttle switch (2).

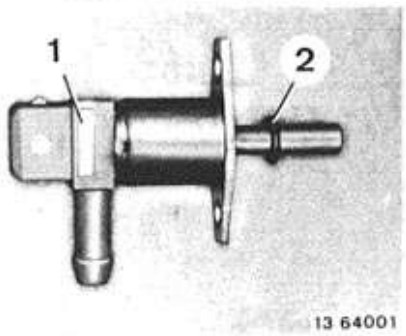
Installation:
Check code number (1)*.
Adjust throttle switch 13 63 544.

* See Specifications



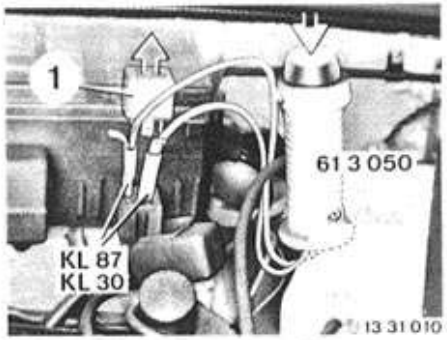
13 64 030 REMOVING AND INSTALLING COLD START VALVE

Removing and Installing:
Pull off plug (1).
Unscrew fuel line (2).
Unscrew bolts.
Take off cold start valve.

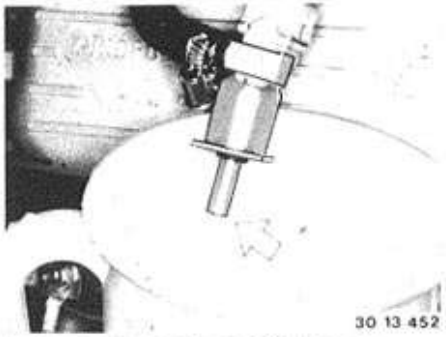


Installation:
Check code number (1)*.
Replace seal (2).

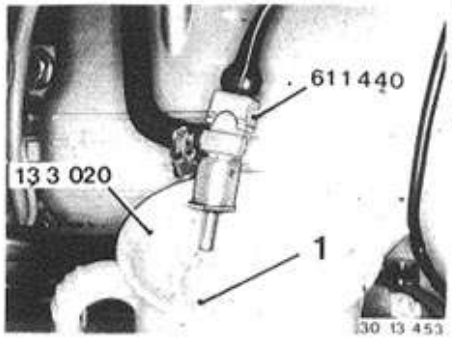
Checking:
Unscrew cold start valve on intake housing.
Fuel line remains connected.



Checking – DME / E 28 /
Unscrew cold start valve on intake housing.
Fuel line remains connected.
Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Fuel pump runs.



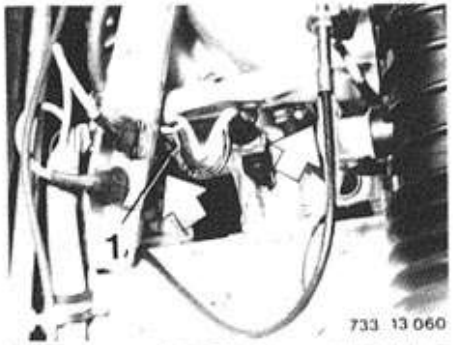
Leak Test:
Check permissible leak rate*.



Chekcing Fuel Flow Rate and Spray Angle:
Hold cold start valve in measuring glass 13 3 020.
Plug Jetronic test lead 61 1 440 on cold start valve and connect with B + and B
Check fuel flow rate* and spray angle (1)*.

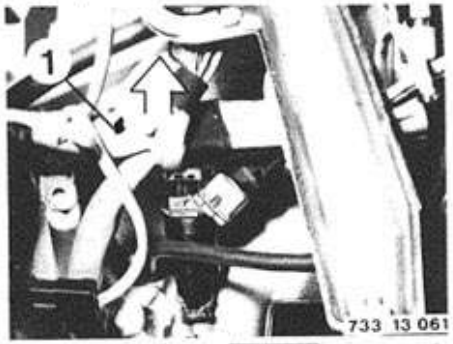
* See Specifications

* See Specifications

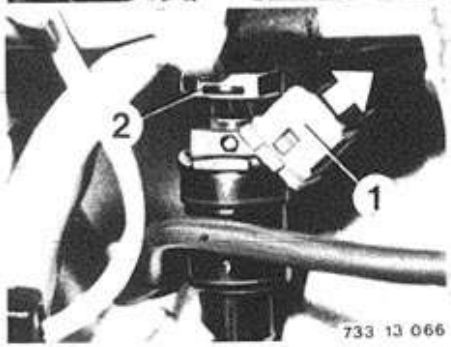


13 64 501 REPLACING ONE FUEL INJECTOR

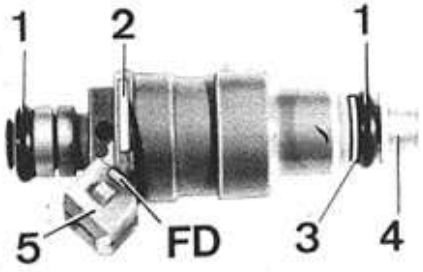
Unscrew four screws on injection tube.
Installation:
Mount ground wire with screw (1).



Push up injection tube (1) until fuel injectors have cleared the guide in the intake manifold.

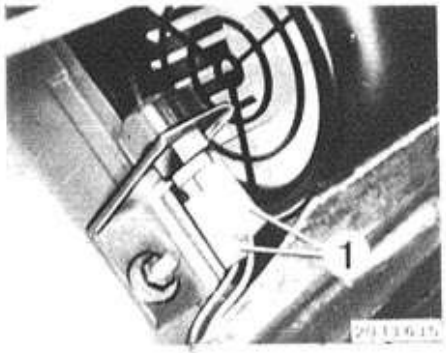


Pull off plug (1).
Lift out retainer (2) and remove fuel injector.



Installation:
Check O-rings (1), replacing if necessary.
Check code number (2)*.
FD = Manufacturing date.
Check position of plastic washer (3).
Check color* of plug receptacle (5) or injector guard (4).
Only coat O-rings for installation with vaseline or SAE 90/SAE 80 gear lube.

* See Specifications

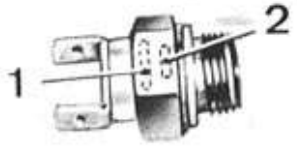


2013615

12 63 051 REMOVING AND INSTALLING 0° C (32° F) TEMPERATURE SWITCH

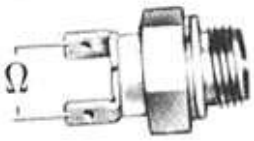
Pull off plug (1).
Unscrew temperature switch.
Installation:
Tightening torque: max. 30 Nm (22 ft. lbs.).

Installation:
Check code number (1)* and switching point (2)*.



2013613

Checking:
Connect ohmmeter (M 06) on temperature switch.
Ohmmeter should display approximately 0 ohm for temperature $< -8^{\circ}$ C ($+18^{\circ}$ F).
Ohmmeter should display approximately ∞ ohms for temperature $> 4^{\circ}$ C (39° F).



2013634

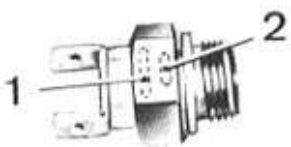
* See Specifications

2013614

12 63 060 REMOVING AND INSTALLING 45° C (113° F) TEMPERATURE SWITCH

Pull off plug (1).
Remove temperature switch.
Installation:
Tightening torque: max. 30 Nm (22 ft. lbs.).
Fill and bleed cooling system (Group 17).

Installation:
Check code number (1)* and switching point (2)*.

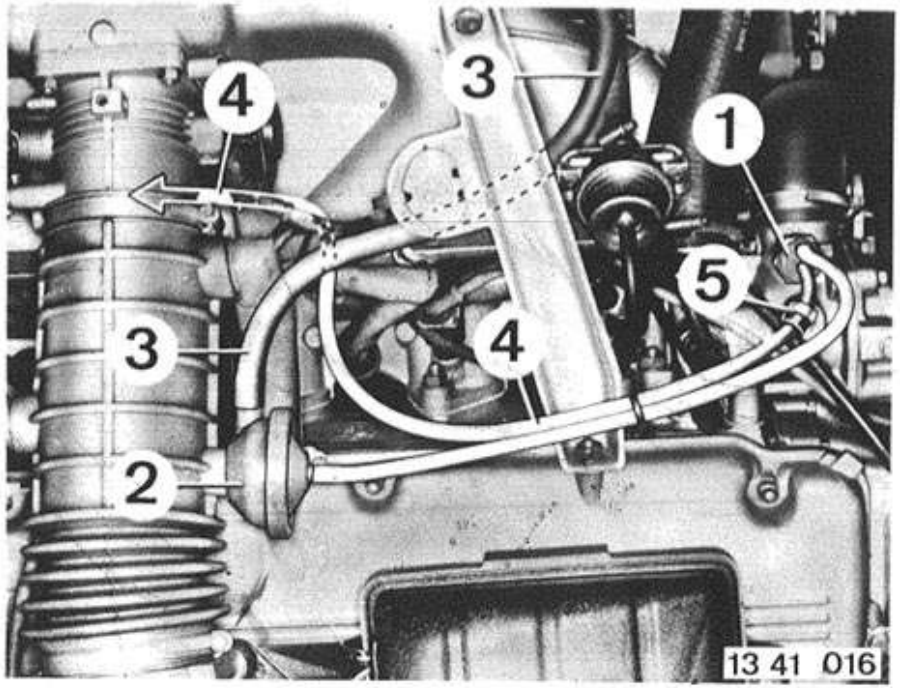


2013613

Checking:
Connect ohmmeter (M 06) on temperature switch.
Ohmmeter should display approximately 0 ohm for temperature $< 30^{\circ}$ C (86° F).
Ohmmeter should display approximately ∞ ohms for temperature $> 48^{\circ}$ C (118° F).

2013634

* See Specifications



DESCRIPTION:

There will be vacuum in hose (4) from partial load on (not at idle speed).
A thermo valve switches the vacuum through to the flushing air control valve as from a coolant temperature of ≥ 46° C (115° F).
With vacuum supply the flushing air control valve switches and the active carbon filter is flushed with fresh air depending on speed and temperature.

ACTIVE CARBON FILTER VENT – HOSE ROUTING AND COMPONENTS

1 = Thermo valve; tightening torque max. 15 Nm (11 ft. lbs.)
switching temperature opens ≥ 43 · 3° C (109 · 5° F) – opens with rising temperature
closes ≤ 33 · 3° C (91 · 5° F)

2 = Flushing air control valve

3 = Hose to active carbon filter

4 = Hose to throttle housing

5 = Check valve

Connections on thermo valve must not be mixed up
– center connection for throttle housing.

TROUBLESHOOTING ELECTRONIC IDLE CONTROL (VDO)

Testing Requirements:

Battery charged – battery voltage at least 11.5 volts.
Components must have ambient temperature (23 ± 5° C / 73 ± 9° F).
Specified multimeter functions (for example, M 01) refer to the BMW SERVICE TEST.
Testing is performed on the disconnected control unit plug for electronic idle control.
The following test procedures do not consider outside effects on the electronic idle control system.

1.) Checking Power Supply and Ground of Idle Control Unit:

Connect voltmeter (M 01) between term. 2 and car ground point.
Turn on ignition.
Voltmeter displaying at least 9 volts?

no → Check green/yellow wire for breaks with ohmmeter (M 06) – see wiring diagram.
Eliminate breaks.

yes ↓

Connect voltmeter (M 01) between term. 2 and term. 4.
Turn on ignition.
Voltmeter displaying at least 9 volts?

no → Check brown wire for breaks with ohmmeter (M 06) – see wiring diagram.
Eliminate breaks.

yes ↓

Power supply and ground of idle control unit are okay!

2. Checking Speed Signal and Idle Speed Signal for Idle Speed Control Unit

a) Speed Signal

Terminal 3 must have "terminal 1 signal"
with the engine running.

b) Idle Speed Signal

Connect ohmmeter (M 06) between terminals 4 and 12.
Is voltmeter displaying at least 9 volts?
Nominal value: 0 ohm.

no → Adjust or replace throttle switch.
Adjust cable.

yes

Depress accelerator pedal several centimeters.
Is voltmeter displaying approximately "0" volt?

no → Adjust or replace throttle switch.
Adjust cable.

yes

Idle speed signal for idle speed control unit is okay!

3.) Checking Idle Valve

Pull off plug on idle valve.
Connect Jetronic test leads 61 1 440 on idle valve and ohmmeter (M 06).
Ohmmeter displaying 9 to 10 ohms with component temperature of 23 ± 5° C (73 ± 9° F)?

— no → Replace idle valve.
Check code number* and color code*.

yes

Connect Jetronic test leads 61 1 440 between idle valve, wire plug and ammeter (M 03).
Run engine having operating temperature** at idle speed.
Ammeter displaying a value between 400 and 500 mA?

— no → Check flow in both wires (from control unit to idle valve) with ohmmeter (M 06) according to wiring diagram.
Eliminate any breaks.
Replace control unit, if there are no breaks.
Check code number* and color code*.

yes

Run engine having operating temperature** at idle speed.
Pull off wire plug on idle valve.
Engine idle speed should rise to approx. 2,000 rpm.
Does speed rise?

— no → Replace idle valve.
Check code number* and color code*.

yes

Connect wire plug on idle valve.
Does engine speed drop to nominal value?

— no → Replace idle valve.
Check code number* and color code*

yes

Idle valve is okay!

* See Specifications
** Engine oil temperature at least 60° C (140° F)

4.) Checking Periphery for Air Conditioner Speed

Connect voltmeter (M 01) between term. 4 and term. 9.
Turn on ignition.
Turn op air conditioner.
Voltmeter displaying at least 9 volts?

no → Check blue/white wire for breaks with ohmmeter (M 06).
Eliminate breaks.

Important!
After selecting a driving range (cars with automatic transmission) there will always only be regulation of the nominal idle speed = 700 ± 50 rpm (priority circuit).

5.) Checking Periphery for Warm-up Speed

a) Coolant Temperature Switch

Connect voltmeter (M 01) between term. 2 and term. 6.
Turn on ignition.
Voltmeter displaying at least 0 volts for a coolant temperature of $\leq 30^{\circ}$ C (86° F)?

— no → Connect ohmmeter (M 06) on "white wire" plug connection on temperature switch 45° C (113° F) and car ground point.
Ohmmeter displaying at least 100 k-ohms for a coolant temperature of $\leq 30^{\circ}$ C (86° F)?

— no → Replace temperature switch 45° C (113° F).
Check code number*.

yes ↓

yes ↓

Connect voltmeter (M 01) between term. 2 and term. 6.
Turn on ignition.
Voltmeter displaying at least 9 volts for a coolant temperature of $\geq 48^{\circ}$ C (118° F)?

— no → Check white wire to temperature switch 45° C (113° F) for breaks and eliminate.
Check tightness and contact of plug contacts on temperature switch 45° C (113° F).
Wire and plug contacts okay?

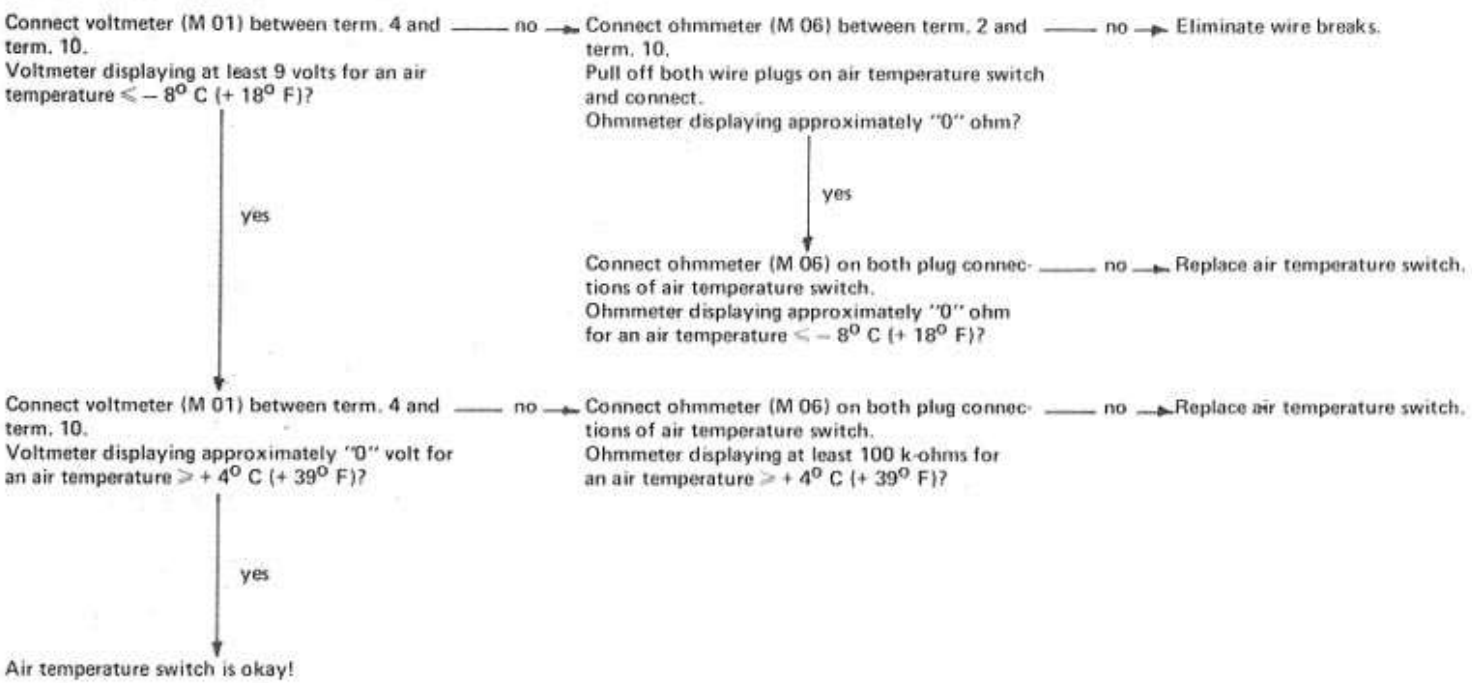
yes ↓

Connect ohmmeter (M 06) on "white wire" plug connection on temperature switch 45° C (113° F) and car ground point.
Ohmmeter displaying approximately "0" ohm for coolant temperature $\geq 48^{\circ}$ C (118° F)?

— no → Replace temperature switch 45° C (113° F).
Check code number*.

* See Specifications

b) Air Temperature Switch



6.) Priority Circuit

(Car with automatic transmission)
Connect voltmeter (M 01) between term. 4 and term. 8.
Turn on ignition.
Move selector lever on automatic transmission to "P".
Voltmeter displaying at least 9 volts?

—— no → Check blue/brown wire for breaks with ohmmeter (M 06) and eliminate breaks.
Check selector lever switch, replacing if necessary.

(Car with manual transmission)
Connect voltmeter (M 01) between term. 4 and term. 7.
Turn on ignition.
Voltmeter displaying at least 9 volts?

—— no → Eliminate breaks in blue/yellow wires (from terminal 7 to terminal 2).

Important!
After selecting a driving range (cars with automatic transmission) there will always only be regulation of the nominal idle speed = 700 ± 50 rpm.

TROUBLESHOOTING FUEL INJECTION

– See application information on next page.

Testing Requirements:
Engine in perfect running condition (timing, compression, oil carbon deposits, etc.).
Starting system in perfect condition (battery voltage, starter, ignition lock, etc.).
Correct fuel in tank (octane rating, leaded/unleaded, dirt, etc.).
Connections and plugs correct according to the wiring diagram.
See engine electronics troubleshooting in Group 12 for other test points.

1) Cold engine does not start (oil temp. ∠ 20° C / 68° F)
2) Engine starts, but stops again
3) Cold engine hard to start (oil temp. ∠ 20° C / 68° F)
4) Warm engine does not start (oil temp. ∠ 60° C / 140° F)
5) Warm engine hard to start (oil temp. ∠ 60° C / 140° F)
6) Erratic idling during warm-up phase
7) Idle speed not correct
8) Splashing in intake
9) Hesitation while accelerating
10) Knock while accelerating
11) Hesitation while coasting
12) Misfiring at constant engine speed
13) Poor acceleration/final power output
14) Fuel consumption too high
15) CO/HC values not correct

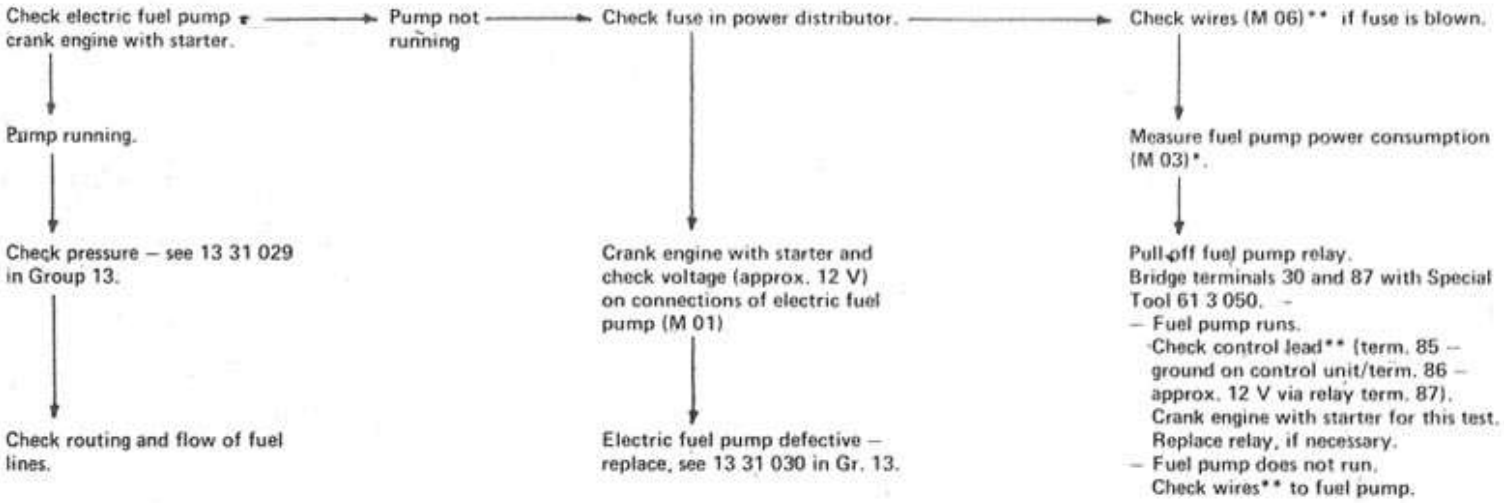
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		Test Position	Job No.	Page
X			X	X				X				X	X	X						1	Fuel pressure (injection pressure)	13 51 200	
		X		X				X				X								2	Fuel pressure (pump pressure)	13 31 029	
		X		X								X		X						3	Fuel pressure regulator	13 51 200	
																				4			
																				5			
X	X		X	X			X	X		X	X	X	X	X						6	Fuel injector	13 64 501	
X		X											X	X						7	Cold start valve	13 64 030	
																				8			
		X											X							9	Temperature time switch	13 62 050	
					X							X	X							10	Coolant temperature sensor	13 62 531	
																				11			
													X							12	Throttle switch	13 63 544	
																				13			
					X	X				X										14	Throttle housing	13 54 051	
		X		X																15	Throttle positioner	13 54 130	
X	X		X						X	X		X	X							16	Control unit (DME or L-Jetronic)	13 61 000	
X			X									X	X							17	Air flow sensor	13 62 000	
																				18			
																				19			
						X														20	Temperature switch (idle control)		
																				21			
						X														22	Electric idle control valve	13 41 000	
						X														23	Control unit (idle control)	13 41 010	
																				24			
																				25			
																				26			
																				27			
X			X																	28	Fuel pump relay/master relay		
								X				X		X						29	Oxygen sensor	Group 11	
																				30			

TEST POSITIONS FOR FUEL INJECTION TROUBLESHOOTING CHART

Note:
These points have been compiled in view of the greatest probability, so that it is quite possible to have to perform additional tests depending on circumstances.

The testing instructions refer to the "BMW service tester", e.g. engine test, test step 05 (P 05) or multimeter functions (M).
See operating instructions of the BMW service tester for connections.

Test Positions 1, 2 and 3 – FUEL PRESSURE
a) No Pressure



* See Specifications
** See Wiring Diagram

b) Fuel Pressure Too High

Vacuum hose to or on pressure regulator leaking or bent. → Check fuel return line – routing, flow. → Pressure regulator defective – replace, see 13 51 200 in Group 13.

c) Fuel Pressure Too Low

Check fuel feed line – routing and flow. → Check flow in fuel filter. → Check filter screen on fuel intake, cleaning if necessary – see 16 12 000 in Group 16.

↓

Check pressure regulator, replacing if necessary – see 13 51 200 in Group 13.

* See Specifications
** See Wiring Diagram

Test Position 6 – FUEL INJECTORS

Start engine.
Feel lifting movement of needle valves on fuel injectors with fingers. → Check wire harness** and relay 2 or fuel pump relay.
Power supply is via relay 2 or fuel pump relay term. 87 (general system voltage).
Ground from term. 12, 14, 15 and 24 differs depending on control unit.

↓

Check code number* and color code*. → Replace fuel injector(s) – see 13 64 501.

↓

Check resistance* of fuel injectors with BMW service tester (M 06).
(L-Jetronic Test Step 05) → Replace fuel injector(s) – see 13 64 501.

↓

Leakage*. → Replace fuel injector(s) – see 13 64 501.

* See Specifications
** See Wiring Dia gram

Test Position 7 – COLD START VALVE

Check code number*. → Replace cold start valve.
Check resistance*.

↓

Power supply** via term. 50 (greater than 9 volts while starting).
Ground supply** via temperature time switch (and 0° C / 32° F temp. switch).

↓

Remove cold start valve (fuel line remains connected). → Replace cold start valve.
Plug Jetronic test lead 61 1 440 on cold start valve and connect with B + or B –
Hold cold start valve in measuring glass 13 3 020.
Operate electric fuel pump.
Cold start valve ejecting fuel?
Spray angle* and flow rate* okay?

↓

Pull off Jetronic test lead 61 1 440 on cold start valve while electric fuel pump is still running. → Replace cold start valve.
Cold start valve must stop fuel flow.
Does cold start valve stop fuel flow?

↓

Leak Test: → Replace cold start valve.
A leak rate* of max. 0.3 cc per minute is permissible with electric fuel pump running and Jetronic test lead 61 1 440 disconnected.

* See Specifications
** See Wiring Diagram

Test Position 9 – TEMPERATURE TIME SWITCH

Check code number*.
Check plugs for tight fit and good contact.
Check/correct coolant level – see Gr. 17
(air bubbles)

→ Replace temperature time switch.
Repair plug contacts.

↓

Check resistance values*.
See nominal value table.
If necessary, heat water bath to testing temperature.

→ Replace temperature time switch.

↓

Check wires**.

NOMINAL VALUE TABLE			
Version	Temperature Below °C / Above °C	Resistance Measured in Ohms Between Term. G and Ground (Housing)	Resistance Measured in Ohms Between Term. W and Ground (Housing)
15° C 8 s	+ 10	50 ... 70	0
	+ 20	50 ... 70	∞
35° C 8 s	+ 30	25 ... 40	0
	+ 40	50 ... 80	100 ... 200
35° C 12 s	+ 30	25 ... 80	0
	+ 40	50 ... 100	200 ... 400

* See Specifications
** See Wiring Diagram

Test Position 10 – COOLANT TEMPERATURE SENSOR

Check code number*. → Replace coolant temperature sensor.
Check for tight fit, good contact of plug connections and correct level of coolant – see Gr. 17 (air bubbles). → Repair plug contact.

↓

Check resistance values* → Replace coolant temperature sensor.
(if necessary, heat to testing temperature in a water bath).

↓

Check wires**.

* See Specifications
** See Wiring Diagram

Test Position 12 – THROTTLE VALVE SWITCH

Check code number*.
Check switching points – see 13 63 544.
Check connections and wires**.
→ Replace throttle valve switch.
Adjust throttle valve switch.

Test Position 13 – THROTTLE VALVE POTENTIOMETER

Check tightness of throttle valve potentiometer.
Check contacts of plug.
Check wires to wiring diagram.

Check adjustment of throttle valve potentiometer – see 13 63 544.

* See Specifications
** See Wiring Diagram

Test Position 14 – THROTTLE HOUSING

Check throttle cable adjustment. ——→ See Groups 24 / 35 / 65.
Check full load position.
Eliminate leaks if applicable.
Check movement of throttle.
Check basic setting of throttle. ——→ See 13 54 051.

Test Position 16 – CONTROL UNIT

Check code number* and manufacturing date*. → Replace control unit, if necessary.

Check control unit plug for tight fit.
Check contacts of plug pins.

↓

Check tied back plug connections on wire harness close to the control unit plug to the wiring diagram.

↓

Check power supply** and ground** (with L-Jetronic check control unit test program; not with DME)

* See Specifications
** See Wiring Diagram

Test Step 17 – AIR FLOW SENSOR

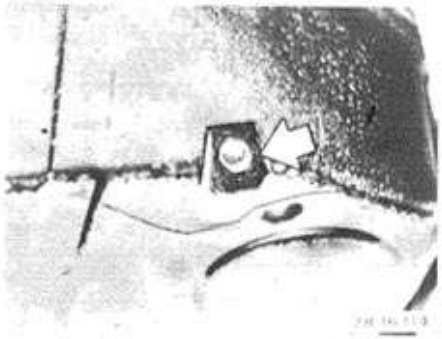
Check code number* and manufacturing date* ——→ Replace air flow sensor.
Check tightness of plug contacts.
Check movement and swinging range of sensor plate.

↓

Electric Test:
Check air flow sensor with universal test adapter and wire harness connection (35 pins). ——→ Replace air flow sensor.
Test values*.

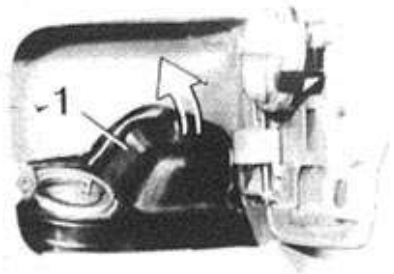
* See Specifications
** See Wiring Diagram

16 Fuel tank and lines

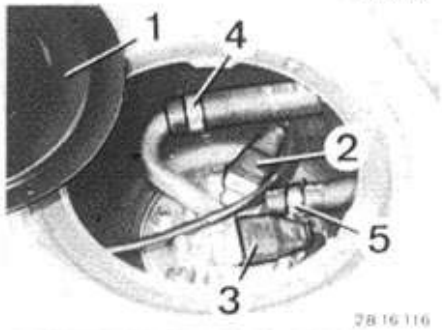


16 11 030 REMOVING AND INSTALLING FUEL TANK

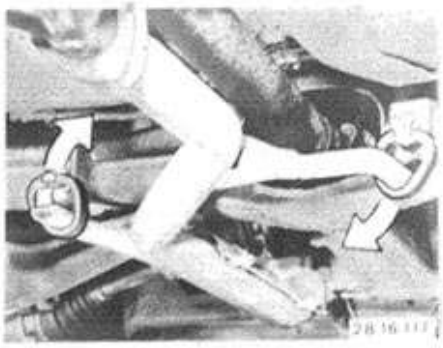
Empty fuel tank with a scavenging pump** or unscrew drain plug if necessary.
Caution!
Conform with safety regulations when draining and filling fuel tank.
Installation:
Tightening torque*.



Pull off cover (1).
Loosen hose clamps and pull off vent lines.

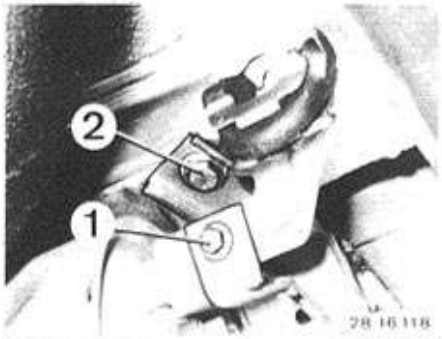


Remove trunk mat.
Unscrew cover (1).
Pull off plugs (2 and 3).
Loosen hose clamps (4 and 5) and pull off fuel lines.
Installation:
Use new hose clamps.

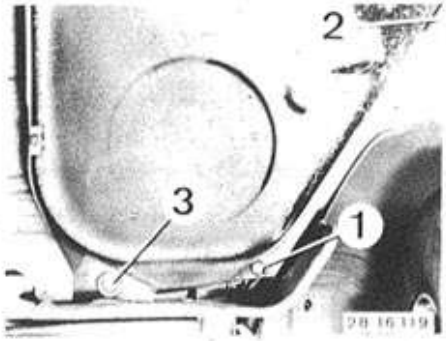


Disconnect rubber suspension ring of muffler assembly.

* See Specifications
** Source: HWB



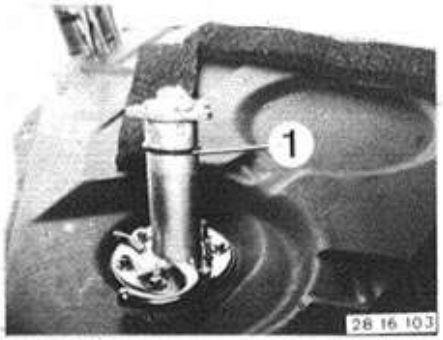
Prevent final muffler from falling down (wire).
Unscrew bolt (1).
Unscrew tank mounting bolt (2).
Installation:
Tightening torque*.



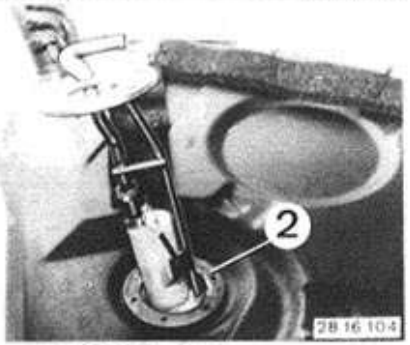
Prevent fuel tank from falling down.
Cut straps (1).
Unscrew bolts (2 and 3).
Remove fuel tank.
Installation:
Tightening torque*.

* See Specifications

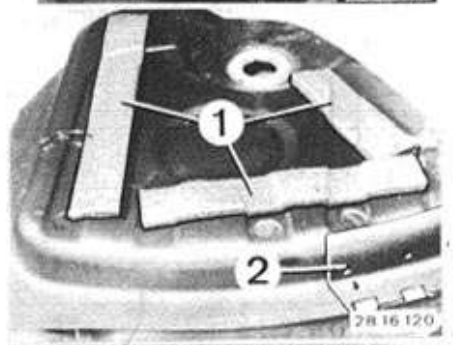
16 11 031 REPLACING FUEL TANK



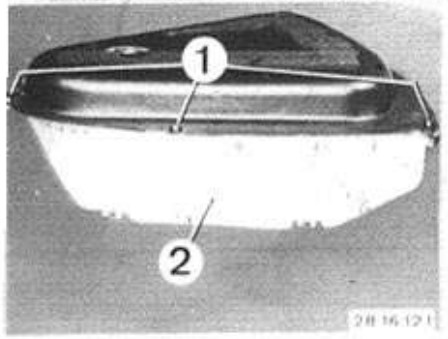
Removing and installing fuel tank 16 11 030.
Unscrew nuts and pull out fuel level transmitter.
Installation:
Replace gasket (1).



Unscrew bolts.
Pull out fuel intake.
Installation:
Replace gasket (2) if necessary.



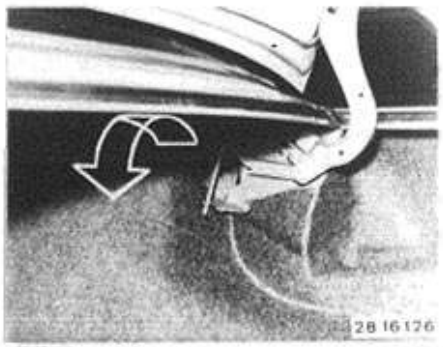
Install liners (1).
Screw on guard (2).



Unscrew and transfer bolts (1) for heat shield (2).

16 11 120 REMOVING AND INSTALLING EXPANSION TANK

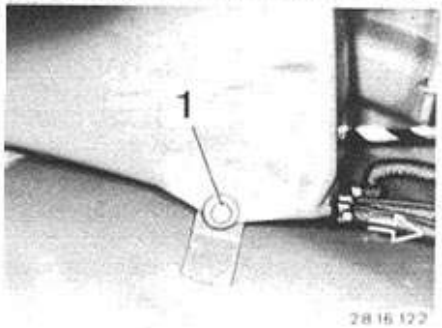
Remove trim panels in trunk.

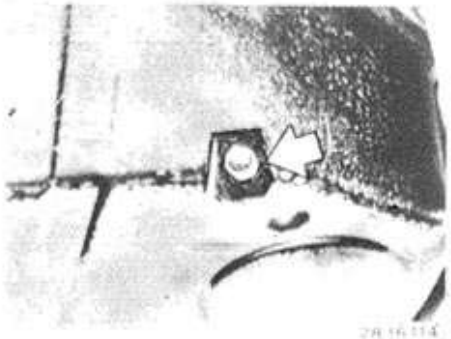


Unscrew bolts (1) and pull off lines.

Installation:

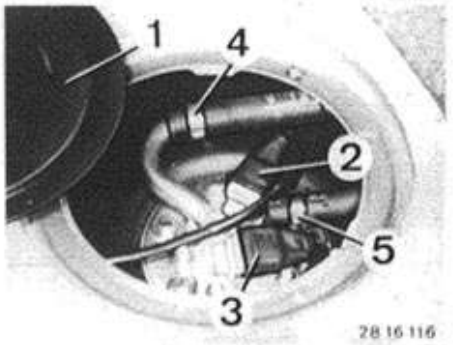
Use new hose clamps.





16 12 002 REMOVING AND INSTALLING/ REPLACING FUEL INTAKE (LEVEL TRANSMITTER)

If fuel tank is full, drain some of gasoline with a scavenging pump** or through drain plug opening, if necessary.
Caution!
Conform with safety regulations.

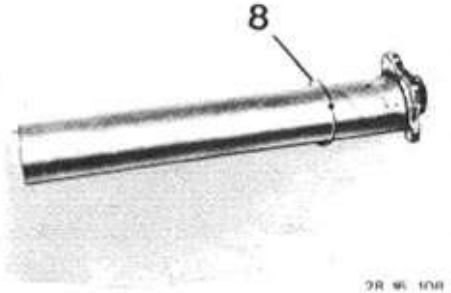


28 16 116

Remove trunk mat.
Unscrew cover (1).
Pull off plugs (2 and 3).
Loosen hose clamps (4 and 5) and pull off fuel lines.
Installation:
Use new hose clamps.

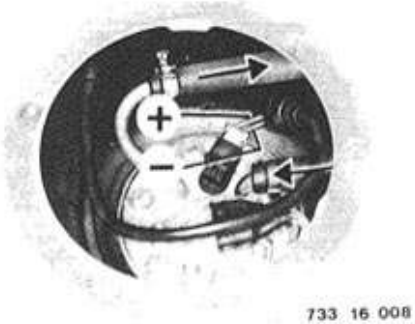
21 16 002

Unscrew nuts and pull out level transmitter.
Installation:
Replace gasket



If replacing fuel level transmitter, remove transportation guard (8).

** Source: HWB



733 16 008

Unscrew screws
Pull out fuel intake.

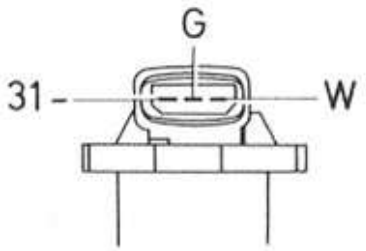
28 16 110

Installation:
Clean filter screen if necessary.
Replace gasket (9).

28 16 125

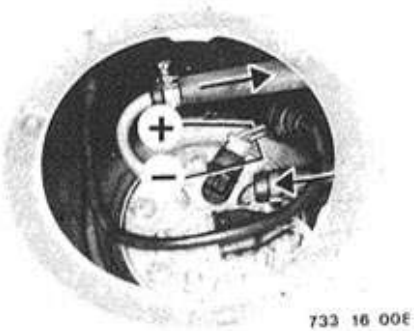
16 12 010 REPLACING CHARCOAL CANISTER

Loosen hose clamp (1) and pull off lines.
Unscrew bolt (2)
Pull out canister.
Installation:
Use new hose clamp.



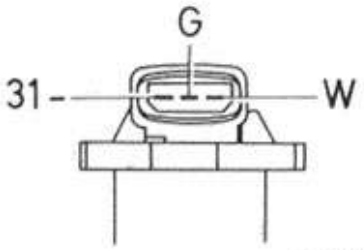
28 16 131

There must be connection between W and 31 in float position EMPTY.



733 16 00E

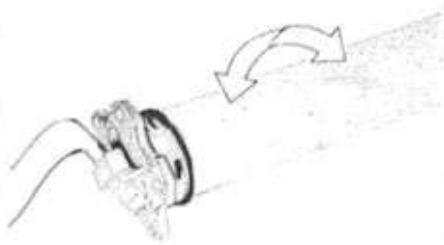
Electric power is supplied to the fuel transfer pump via the fuel pump relay (relay 1) – see engine electrical equipment wiring diagram.
Check by measuring power input* and delivery pressure*.



28 16 131

16 12 . . . CHECKING FUEL LEVEL TRANSMITTER AND FUEL TRANSFER PUMP

Connect ohmmeter (M 06) of BMW service test unit on terminals G and 31.


733 16 010

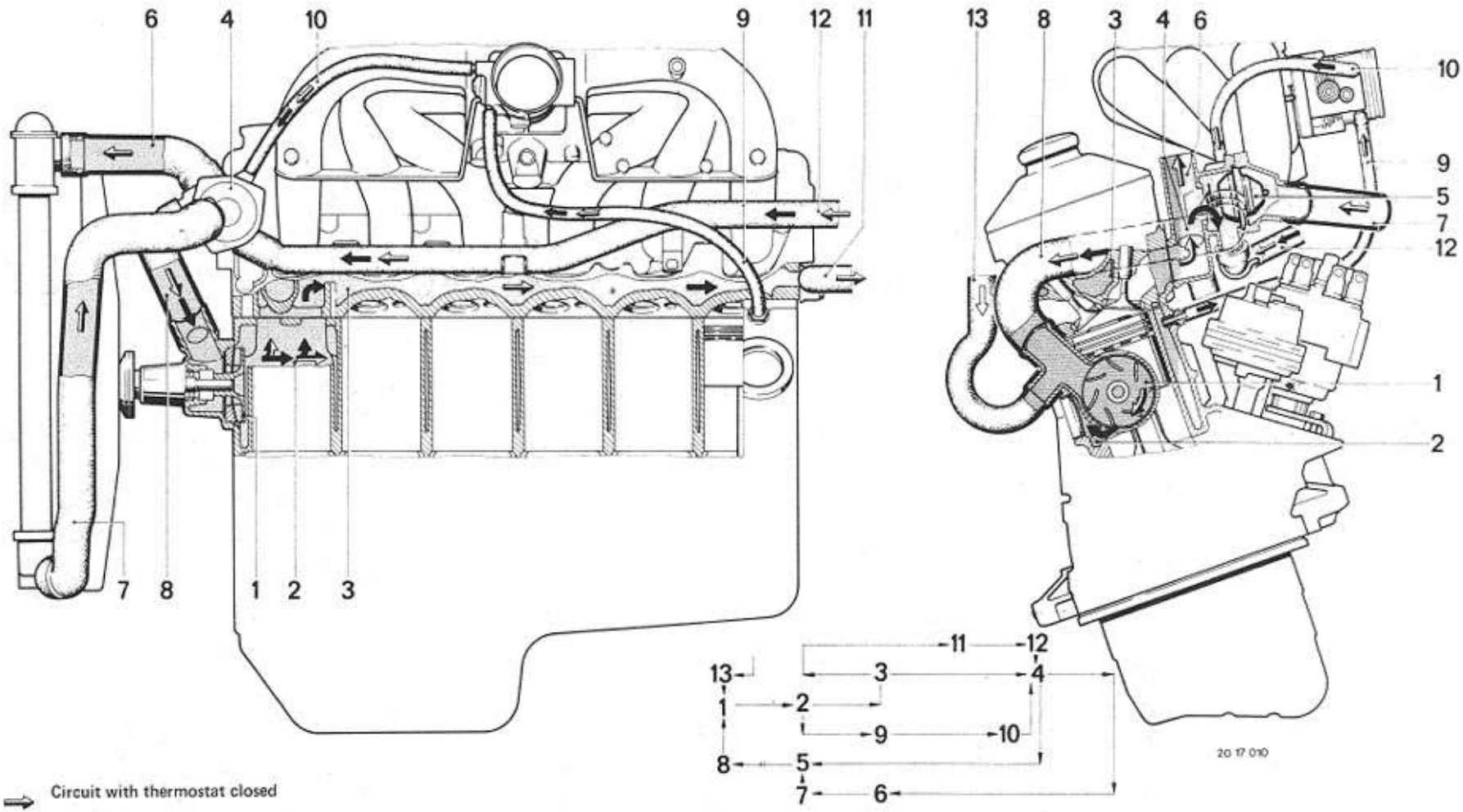
Swing fuel level transmitter slowly.
Measure resistance with float positioned at EMPTY and FULL.
Resistance value must change continuously while moving the float.

* See Specifications

* See Specifications

17 Radiator

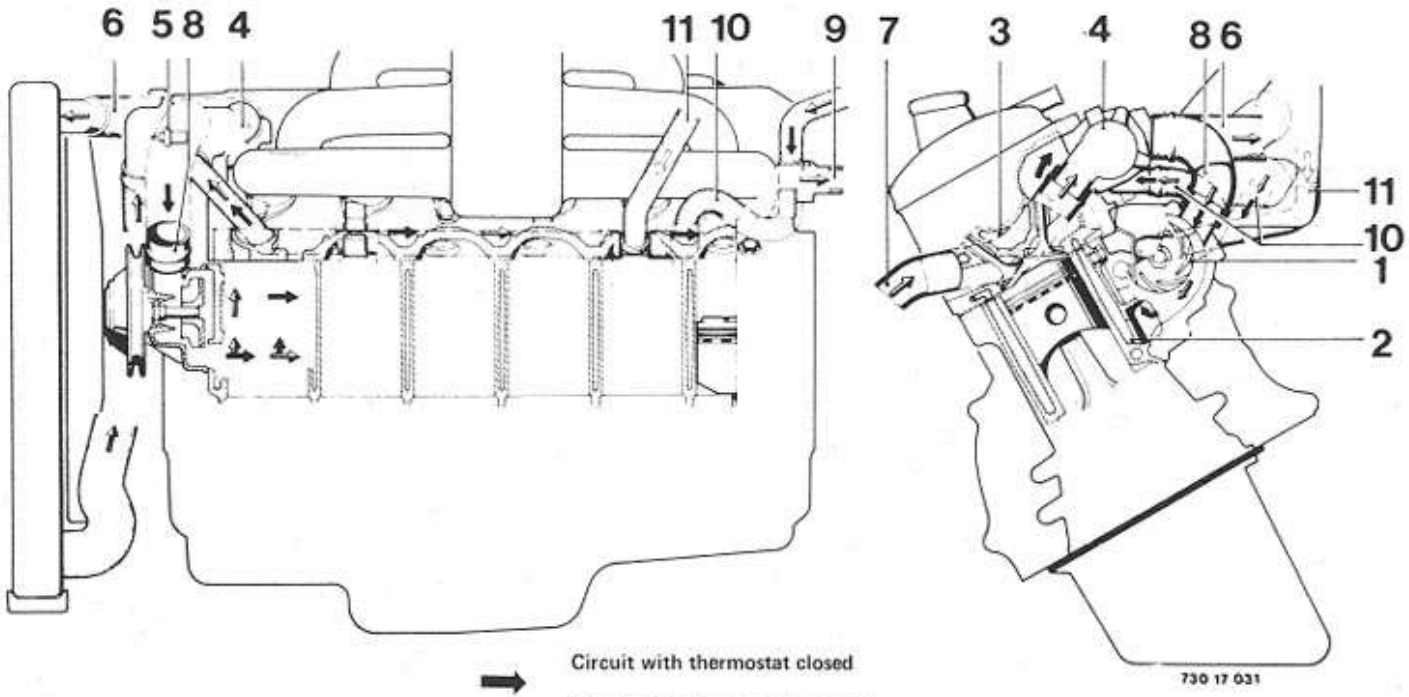
COOLANT CIRCUIT – BMW 528 e

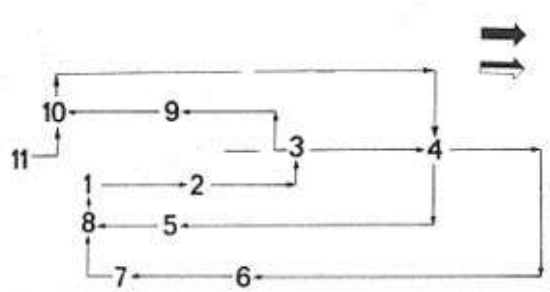


Circuit with thermostat closed

Circuit with thermostat opened

1 Water pump
2 Crankcase
3 Cylinder head
4 Thermostat housing
5 Thermostat closed
6 Radiator inlet – thermostat open
7 Radiator outlet
8 To water pump
9 Throttle feed
10 Throttle return
11 To heat exchanger (car heating)
12 Heat exchanger return
13 To expansion tank



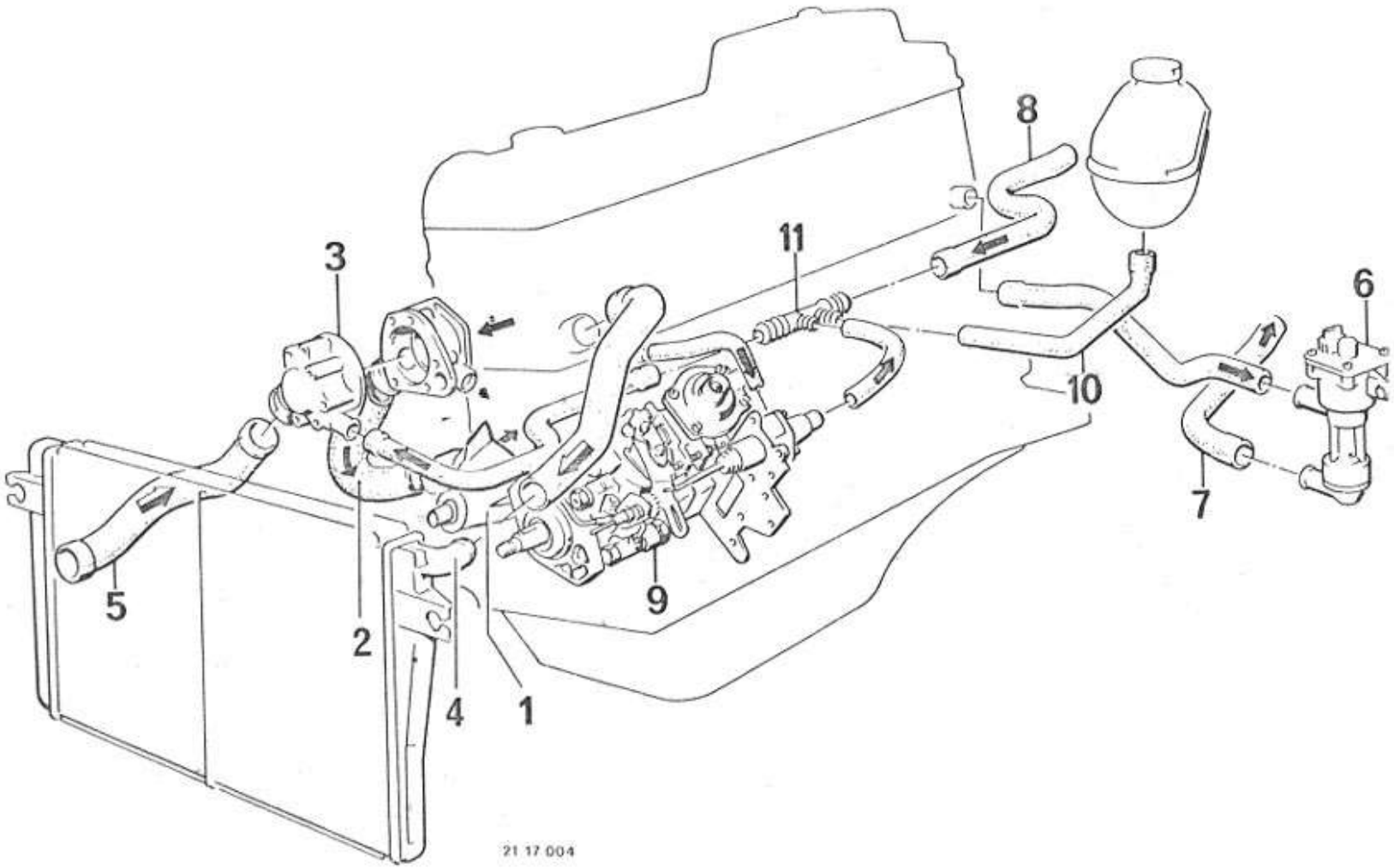


Circuit with thermostat closed

Circuit with thermostat opened

1 Water pump
2 Crankcase
3 Cylinder head
4 Thermostat housing
5 Thermostat
6 To radiator – thermostat open
7 Radiator outlet
8 To water pump
9 To heat exchanger (car heating)
10 From heat exchanger
11 From expansion tank

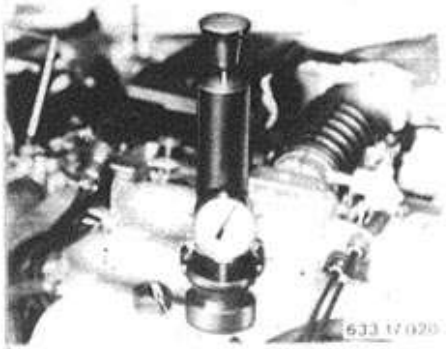
COOLANT CIRCUIT – BMW 524 td



Circuit with opened thermostat

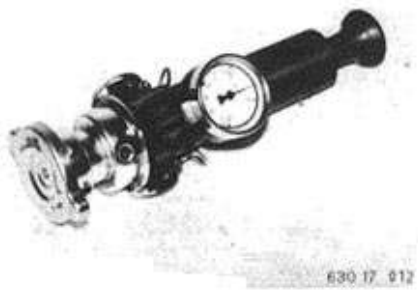
Circuit with closed thermostat

1 Water pump
2 Cylinder head
3 Thermostat housing
4 Radiator inlet - with opened thermostat
5 Radiator outlet
6 Heater valve
7 To heater excnanger (car heater)
8 Heat exchanger return
9 Housing for TLA
(temp. dependent idle boost)
10 To expansion tank
11 Connector

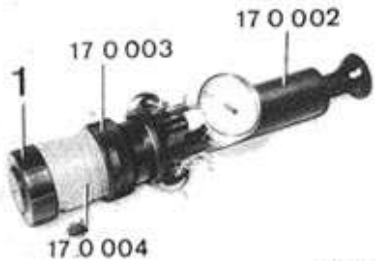


17 00 009 CHECKING COOLING SYSTEM FOR LEAKS

Apply Special Tool 17 0 002 (with adapter 17 0 003 for screw-on cap) and produce 1 bar (14 psi) pressure.
Cooling system does not leak, if there is no considerable pressure drop (approx. 0.1 bar or 0.7 psi) after waiting about 2 minutes.



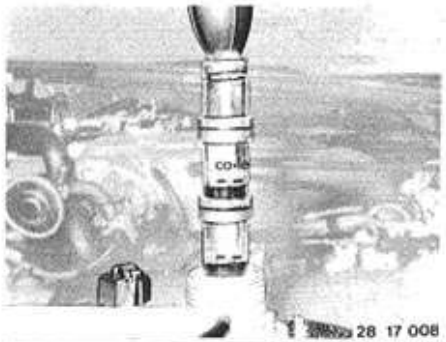
Checking Cooling System Bayonet Cap:
Assemble adapter 17 0 001, cap and tester 17 0 002.
Check opening pressure* of safety valve.



Checking Cooling System Screw-On Cap:
Assemble adapter 17 0 003, connector 17 0 004, cap (1) and tester 17 0 002.
Check opening pressure* of safety valve.

Lift vacuum valve slightly and check for correct fit.
Check gasket, replacing if necessary.

See Specifications

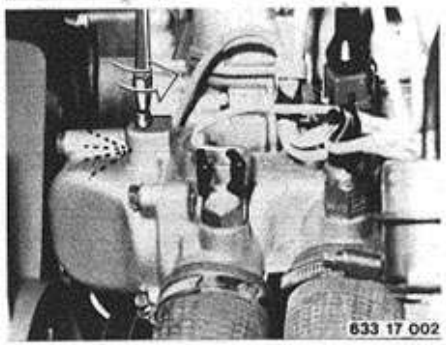


17 00 010 CHECKING FOR LEAKS BETWEEN COOLING SYSTEM AND COMBUSTION CHAMBER

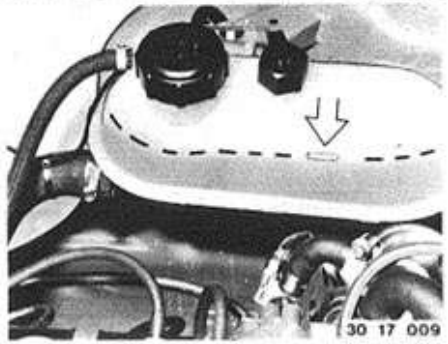
Run engine to operating temperature.
Fill "tester for cylinder head gasket"** and perform test (see intructions supplied with equipment).

17 00 039 BLEEDING COOLING SYSTEM

Requirements:
Engine at operating temperature.
Heater set to "WARM".
Engine running at fast idle speed.

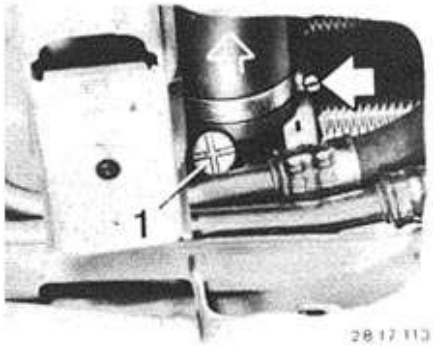


Loosen bleeder screw and tighten again when escaping coolant is without air bubbles.
Keep expansion tank full while bleeding.
See Service Information of Group 00 for coolant specifications.



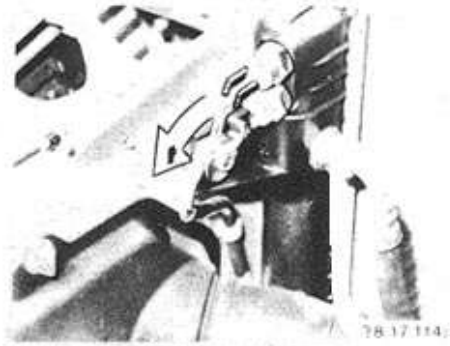
Mark on expansion tank shows the full level for cold coolant (approx. 20° C / 68° F).

** Source: HWB

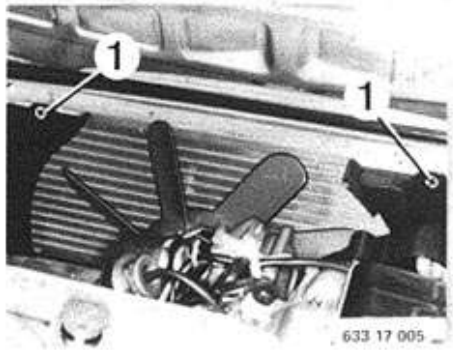


17 11 000 REMOVING AND INSTALLING RADIATOR

Unscrew cap on expansion tank.
Unscrew drain plug (1) and drain coolant.
Loosen hose clamp and pull off hose.
Caution!
Danger of scalding when engine is hot.
Installation:
Drain plug tightening torque*.
Use new hose clamp.
Fill cooling system with coolant** and bleed 17 00 039.



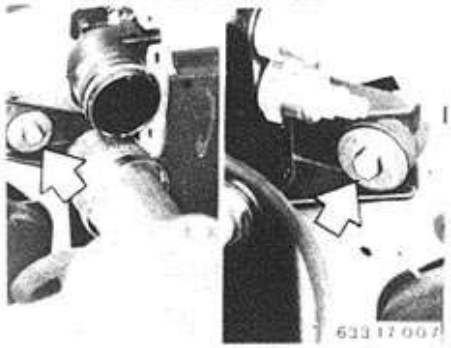
Pull off plugs on temperature switches.



Unscrew fan cowl mounting screws (1).
Loosen hose clamps and pull off hoses.

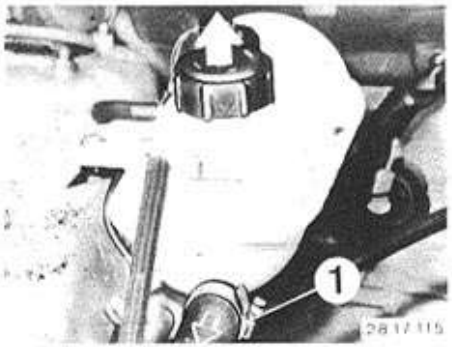
* See Specifications
** See Service Information of Gr. 00

Cars with Automatic Transmission:
Unscrew oil lines on radiator.
Installation:
Tightening torque*.
Check ATF level, see 24 00 009.



Unscrew mounting bolts on right and left sides.
Disconnect cable.
Lift out radiator.
Installation:
Check rubber mounts for correct installation.

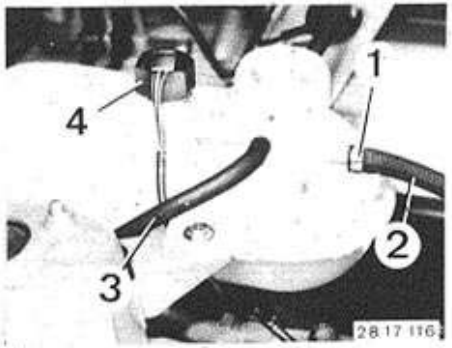
* See Specifications



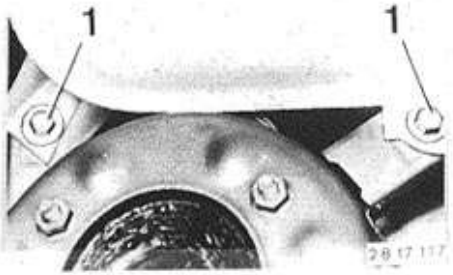
17 11 100 REMOVING AND INSTALLING COOLANT EXPANSION TANK

Unscrew cap on expansion tank.
Loosen hose clamp (1).
Pull off hose (2) and drain coolant in tank.
Caution!
Danger of scalding when engine is hot.

Installation:
Fill cooling system with coolant* and bleed, see 17 00 039.



Loosen hose clamp (1).
Pull off hoses (2 and 3).
Unscrew and remove full level transmitter (4).



Unscrew bolts (1).
Remove tank.

* See Service Information of Gr. 00

17 11 509 FLUSHING RADIATOR

If oil has penetrated into the coolant circuit, flush the radiator and expansion tank with solvethane*.
Cleaning and Flushing Procedures:
1. Remove radiator and expansion tank.
2. Pour in 2 to 3 liters (2 to 3 quarts) of
3. Shake radiator and tank thoroughly and drain when oil has been dissolved (after 2 to 3 minutes).
4. Install cleaned radiator and expansion tank in car and connect on cooling circuit.
5. Fill entire cooling circuit with hot water and flush thoroughly by replacing hot water several times as necessary, to make sure that all solvethane is removed.
6. Check drained coolant for traces of oil and, if necessary, repeat step 5. Fill and bleed cooling system as normally the case after completion of cleaning and flushing procedures.

Caution!
Solvethane attacks rubber seals, hoses etc. and consequently must not be permitted to enter or remain in cooling system.
Always conform with safety measures for handling solvethane (printed on cans).
Also refer to Service Information 11 03 80 (660)

* Source: HWB, No. 81 22 9 400 702