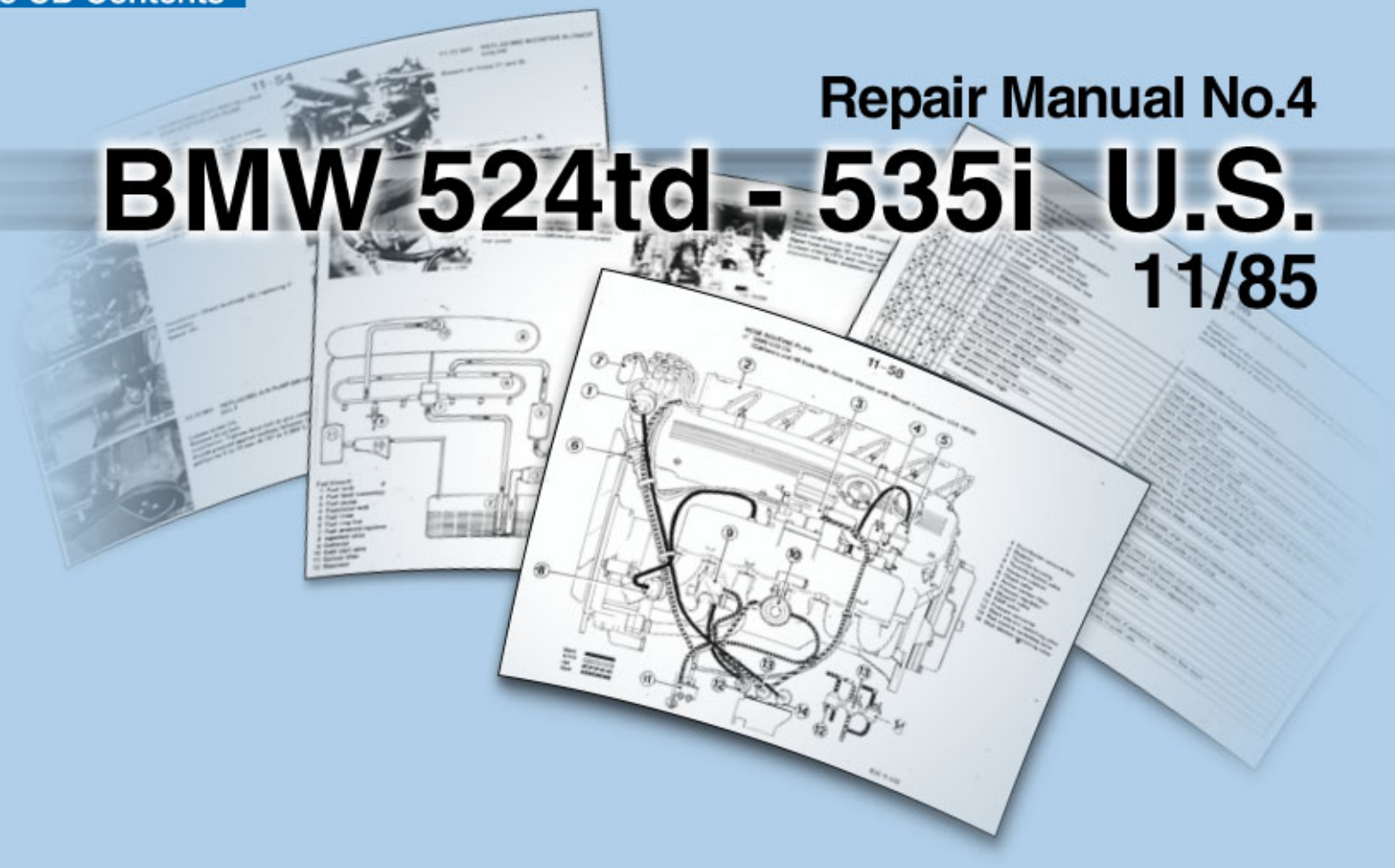
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Repair Manual No.4

BMW 524td - 535i U.S.

11/85



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00 Maintenance and general data

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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.

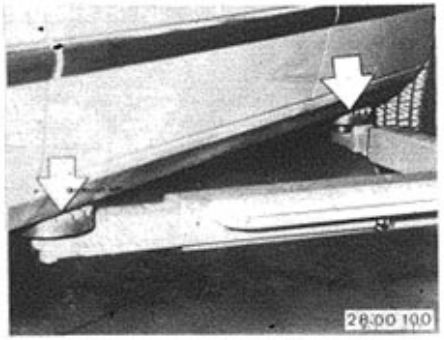
BAYERISCHE MOTOREN WERKE AG
SERVICE DEPARTMENT

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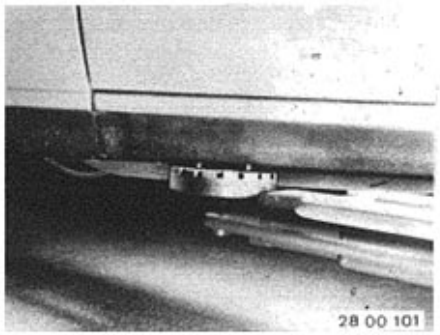
GENERAL INFORMATION

LIFTING VEHICLE ON A LIFTING PLATFORM

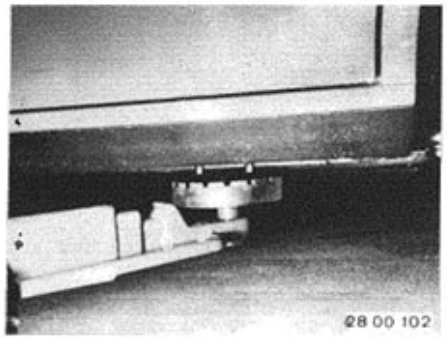
Before driving a car on the platform, make sure that there is sufficient space (clearance) between the lifting platform and vehicle (if applicable spoiler, splash guard, etc.).



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.

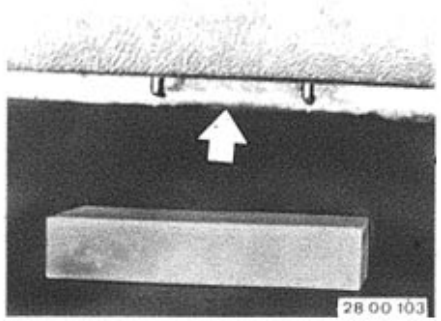


Rear: Apply rubber block of lifting arm on the rear perpendicular reinforcement of the frame member, which is also provided for application of the car's jack.

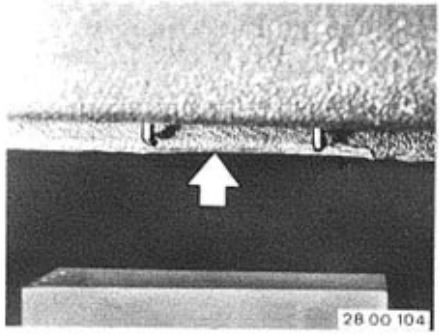
LIFTING VEHICLE ON A WORKSHOP TROLLEY JACK

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.

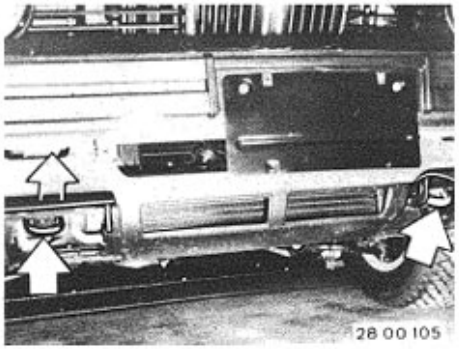
Cars with Automatic Transmission:

Selector lever in "N".

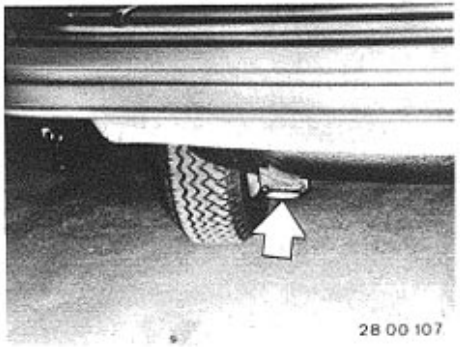
Max. towing speed: 50 km/h (30 mph).

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

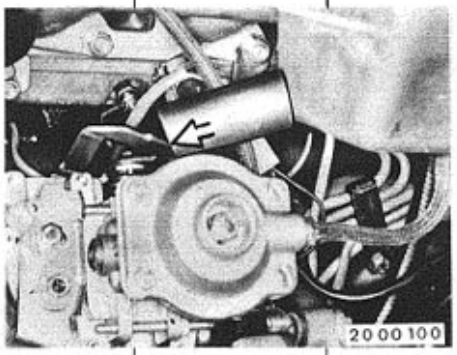
If the car has to be towed further than 50 km (30 miles) add an extra liter (2 pints) of ATF than the specified oil volume for automatics or remove the propeller shaft.
After repairing the car it is absolutely essential to correct the ATF volume to the specified amount.



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						

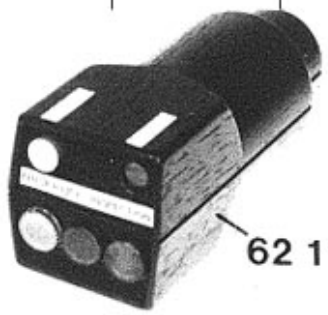
00 00 009 Pre-Delivery Inspection	General Information					Important Instructions!
	Repair Manuel	Specifications	Nominal Values	Service Information	Owner's Manual	
Check instument and sign lights, and brightness control					+	
Check indicator and warning lamps, clock, buzzer and check control: alternator, 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						

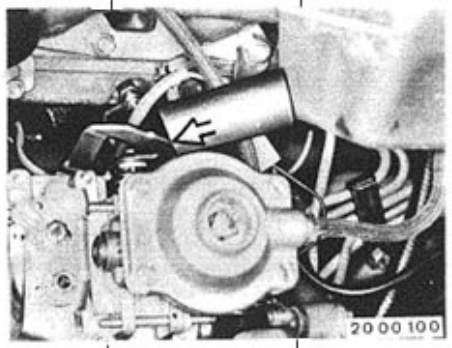
00 00 009 Pre-Delivery Inspection	General Information					Important Instructions!
	Repair Manuel	Specifications	Nominal Values	Service Information	Owner's Manual	
Test drive: check acceleration, coasting, brake system (before and during road test)						Caution: On systems with Po-litex brake linings, 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

00 00 009 Pre-Delivery Inspection	General Information: 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.						

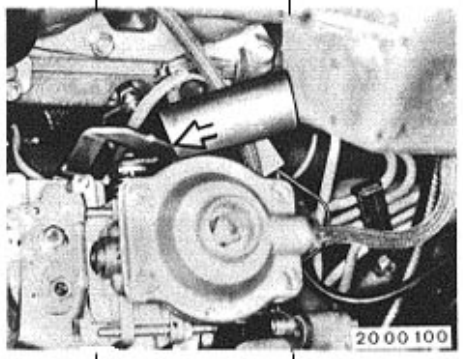


20 00 005

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 corrosion 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 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 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.	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.
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						



2E00 006

BMW MAINTENANCE SYSTEM	General Information					
00 00 230 BMW Inspection II = Inspection I + Additional Jobs	Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	Important Remarks!
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

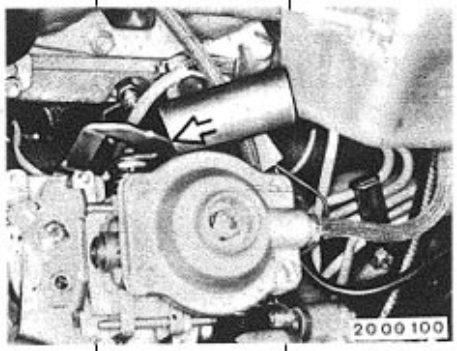
General Information					
Repair Manual	Technical Data	Nominal Values	Service Information	Owner's Manual	Important Remarks!

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.



20 00 006

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

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

BMW 528e .....

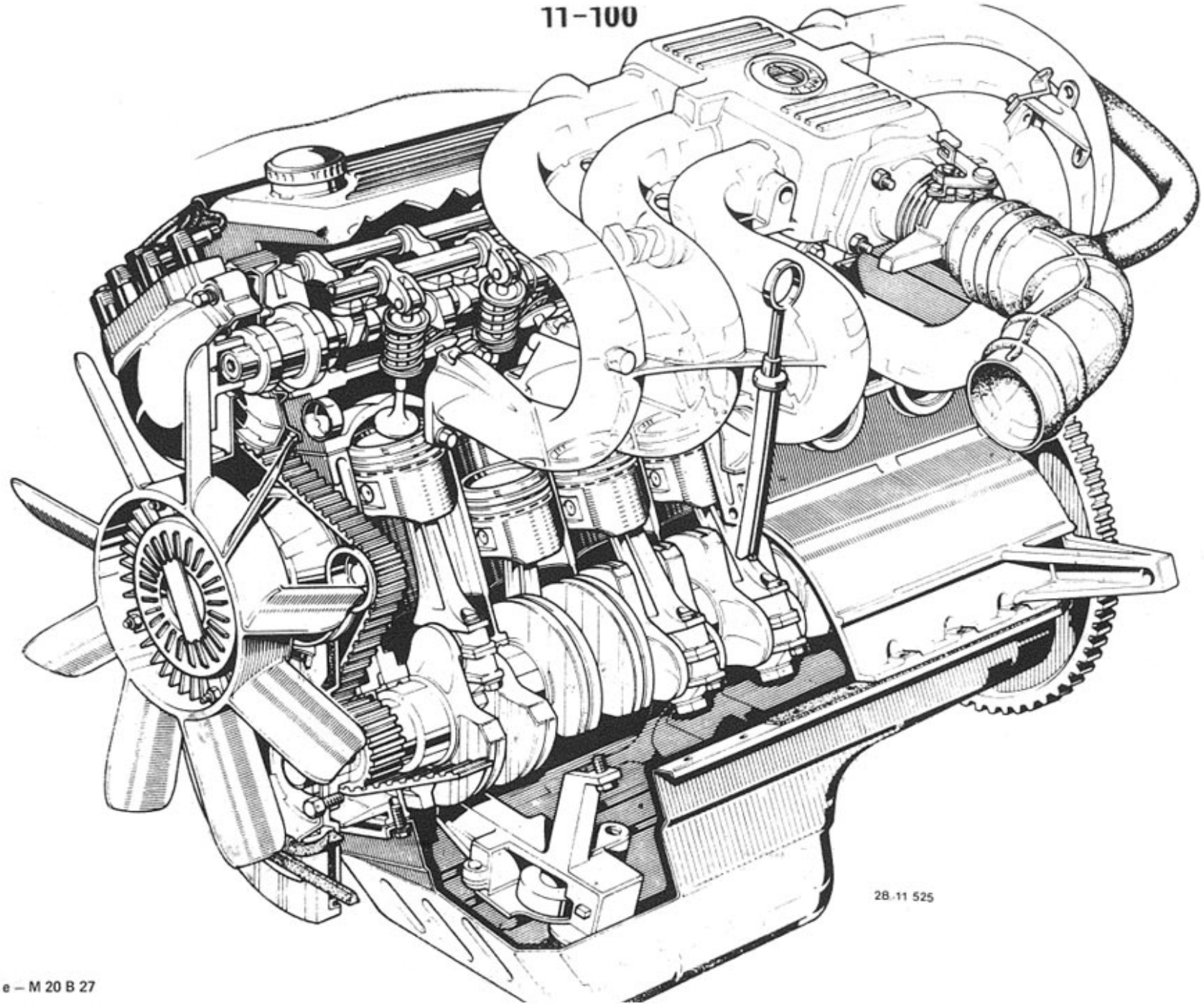
BMW 524td .....

BMW 533i, BMW 535i .....

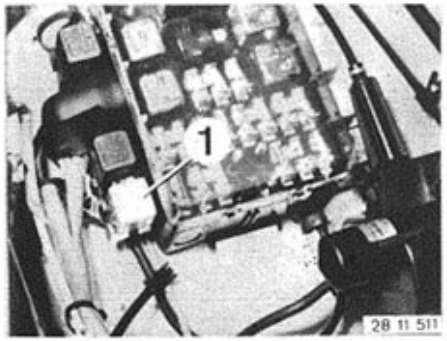
11 Engine

BMW 528e

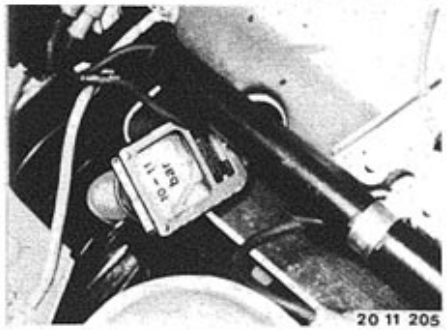
11 00 006	Diagnosis with BMW service tester	see nominal value microfiche
039	Compression of all cylinders – check	11- 101
050	Engine – remove and install	11- 102
091	Exchange engine – install	11- 104
11 11 160	Bearing for oil pump drive shaft – replace	11- 105
11 12 000	Cylinder head cover – remove and install	11- 105
100	Cylinder head – remove and install	11- 106
101	Cylinder head gasket – replace	11- 109
240	Radial oil seal in end cover – replace	11- 109
561	Valve guide – replace (valve removed)	11- 110
595	Valve guide – check for wear	11- 110
600	Valve guide – ream out	11- 110
607	Valve seats and valves – machine (cylinder head disassembled)	11- 111
719	Cylinder head sealing surface – grind (cylinder head disassembled)	11- 111
729	Cylinder head – check for cracks in water test (cylinder head disassembled)	11- 111
11 13 000	Oil pan – remove and install	11- 112
11 14 175	Front end cover – remove and install	11- 112
180	Radial oil seals in front end cover – replace	11- 113
605	Radial oil seal in clutch end cover – replace	11- 113
11 21 000	Crankshaft – remove and install	11- 114
501	Crankshaft – replace (crankshaft removed)	11- 115
531	Crankshaft main bearing shells – replace (engine disassembled)	11- 115
571	Pilot bearing in crankshaft – replace	11- 116
11 22 000	Flywheel – remove and install	11- 117
051	Drive plate for torque converter – replace	11- 117
541	Starter gear ring – replace	11- 117
11 23 010	Vibration damper – replace	11- 118
031	Vibration damper hub – replace	11- 118
11 24 521	Connecting rods – replace (pistons removed)	11- 119
571	Connecting rod bearing shells – replace (engine disassembled)	11- 119
11 25 000	Piston – remove and install	11- 120
651	Piston rings of one piston – replace (piston removed)	11- 121
11 31 000	Camshaft – remove and install	11- 122
100	Toothed belt – tighten	11- 122
110	Toothed belt – remove and install	11- 123
11 33 020	Rocker arm shafts – remove and install	11- 124
031	Rocker arms – replace	11- 125
11 34 004	Valve clearance – adjust	11- 125
509	Valves – check for leaks (camshaft removed)	11- 125
550	Valves – remove and install	11- 126
11 35 020	Intermediate shaft – remove and install	11- 126
	Engine oil circuit	11- 127
11 40 000	Engine oil pressure – check	11- 128
11 41 000	Oil pump – remove and install	11- 129
110	Pressure relief valve – remove and install	11- 130
11 42 020	Full flow oil filter – replace	11- 130
11 43 101	Oil dipstick guide tube – replace	11- 130
11 51 000	Water pump – remove and install	11- 130
502	Water pump – overhaul (water pump removed)	11- 131
11 52 000	Fan – remove and install	11- 132
020	Fan coupling – replace	11- 132
11 53 000	Coolant thermostat – remove and install	11- 132
080	Temperature transmitter – replace	11- 132
11 76 010	Catalytic converter – remove and install	11- 133
11 78 010	Oxygen sensor – check	11- 133
510	Oxygen sensor – replace	11- 134


28.11 525

11 00 039 CHECKING COMPRESSION OF ALL CYLINDERS



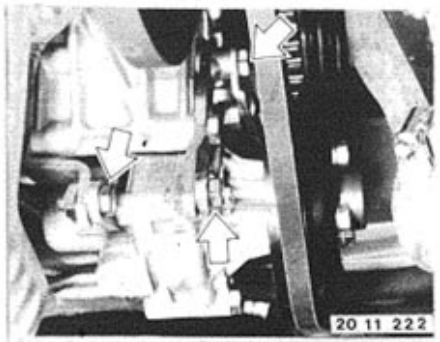
Pull off main relay (1).



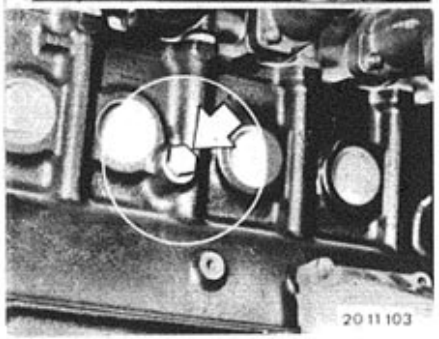
Unscrew spark plugs.
Test compression*.
Installation:
Tightening torque**.

* See Specifications
** See Specifications of Gr. 12

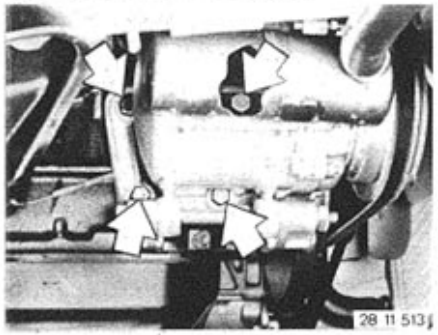
11 00 050 REMOVING AND INSTALLING ENGINE



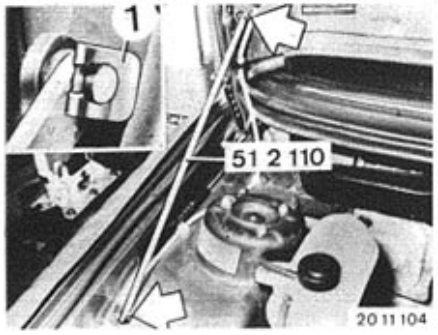
Remove transmission – see Group 23 or 24.
Unscrew power steering pump.
Pressure hoses remain connected.
Installation:
Tighten drive belt, see 32 41 060.



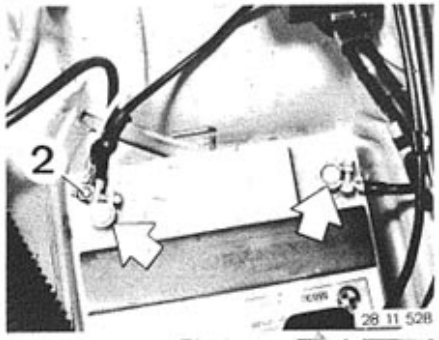
Unscrew plug and drain coolant.
Remove radiator 17 11 000.



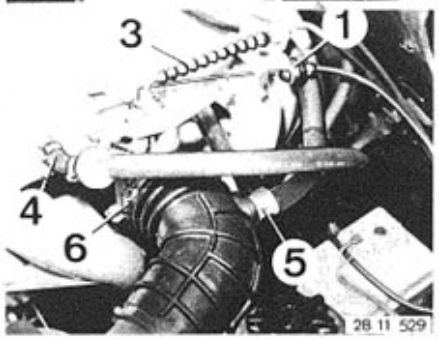
Unscrew compressor.
Refrigerant hoses remain connected.
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.



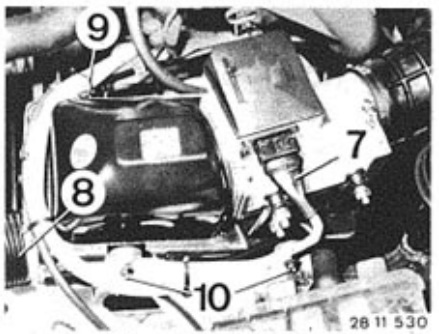
Unscrew ground wire for hood.
Disconnect or remove gas pressure props and prop engine hood with Special Tool 51 2 110.
Caution!
Use locks (1).



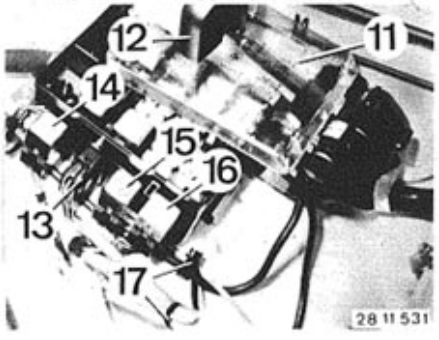
Disconnect negative and positive leads on battery.
Unscrew wire (2).



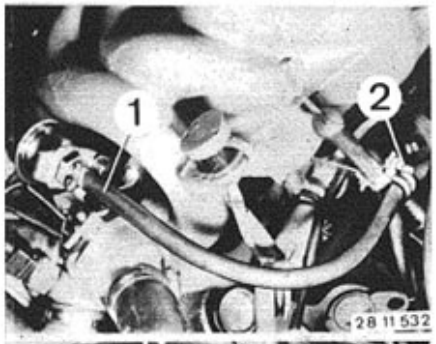
Disconnect accelerator cable (1) and cruise control cable (3).
Pull off vacuum hose (4) and hoses (5).
Loosen clamp (6).
Installation:
Adjust accelerator cable – see 35 41 421.
Adjust cruise control cable – see Group 65.



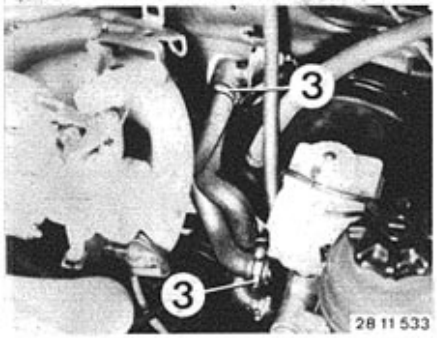
Pull off plug (7).
Pull out hose (8) and loosen strap (9).
Unscrew nuts (10) and remove air cleaner with air flow sensor.



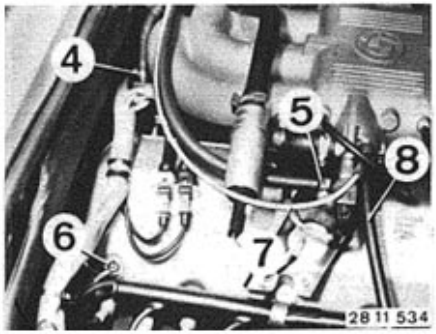
Take off cover (11) and lift off cap (12).
Pull off plug (13).
Lift out relays (14 ... 16).
Loosen straps (17).



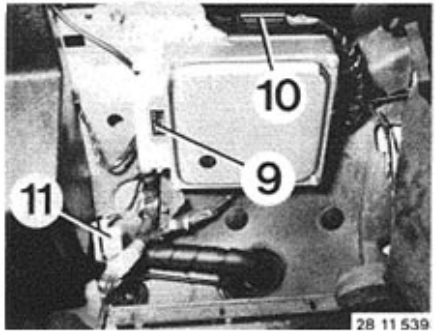
Unscrew fuel line (1) and holder (2).



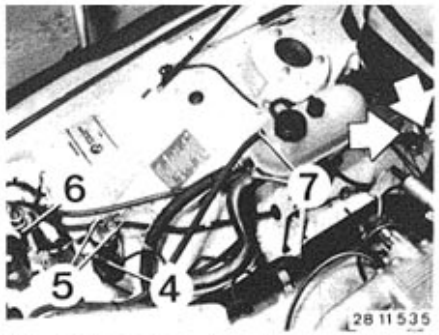
Disconnect heater water hoses (3).



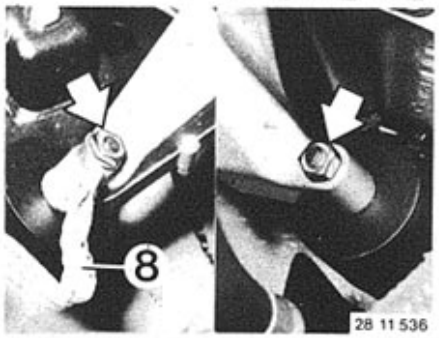
Unscrew fuel lines (4 and 5).
Unscrew ground strap (6).
Pull off hoses (7 and 8).



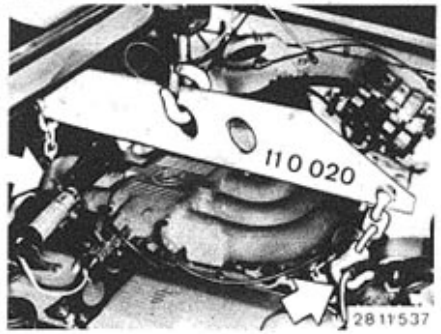
Pull off plugs (9 and 10) on control units in glove box.
Disconnect lead (11).



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.

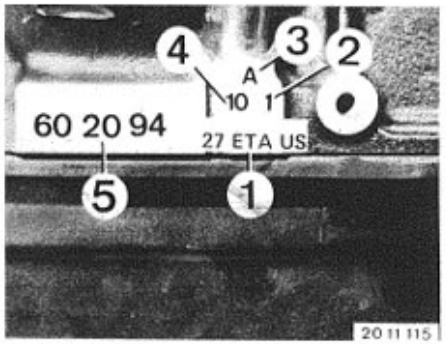


Unscrew ground strap (8) and both engine mounts.
Installation:
Tightening torque*.



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).

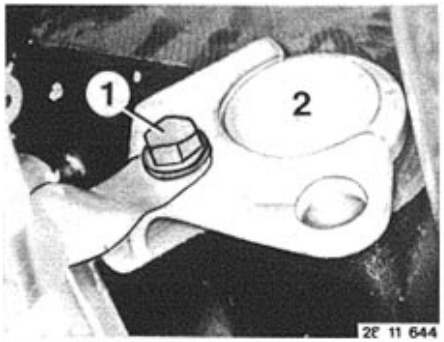
Drive in supplied oil dipstick guide tube (see 11 43 101) and transfer parts from the old engine to the exchange engine.
Fill exchange engine with oil**.
Important!
Remove pilot bearing in crankshaft, see 11 21 571, if the car has an automatic transmission.

Install engine.

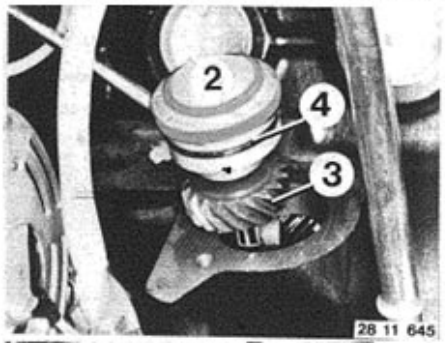
Adjust engine idle speed/CO 13 00 054.

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

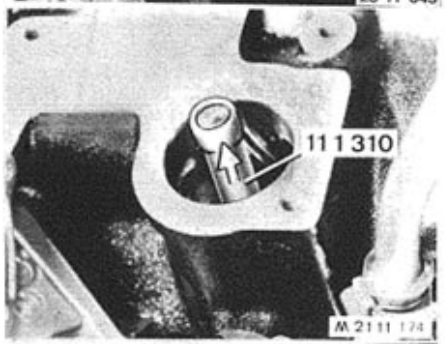
11 11 160 REPLACING BEARING FOR OIL PUMP DRIVE SHAFT



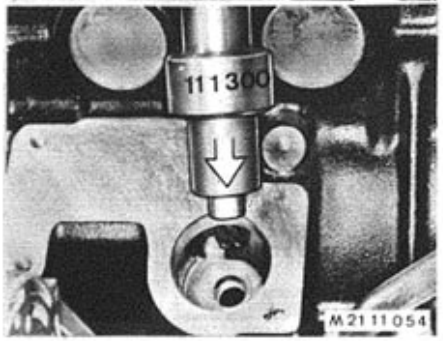
Remove oil pump 11 41 000.
Unscrew bolt (1) and take off cover (2).



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

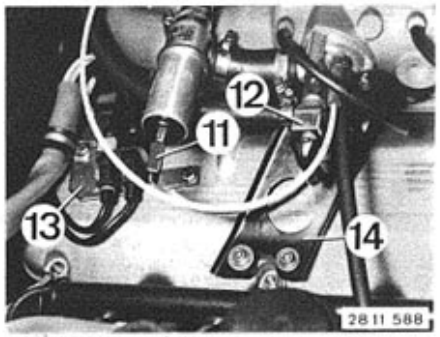


Drive out needle bearing from bottom upwards with Special Tool 11 1 310.

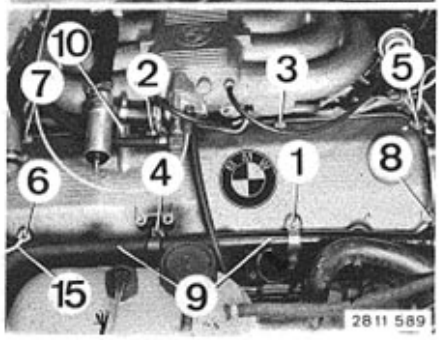


Installation:
Lubricate needle bearing with grease.
Drive in needle bearing against stop with Special Tool 11 1 300.

11 12 000 REMOVING AND INSTALLING CYLINDER HEAD COVER



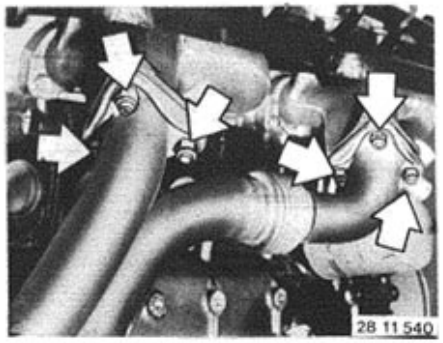
Pull off plugs (11 and 12) and unscrew holder (13).
Unscrew support (14).



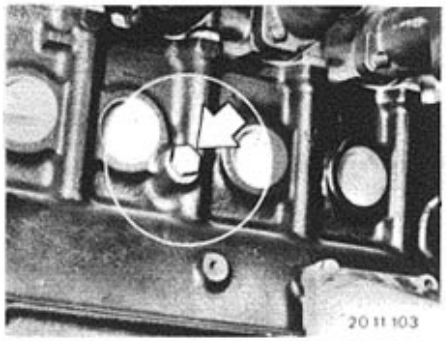
Disconnect ignition lead tube (9) and vent hose (10).
Take off cylinder head cover.
Installation:
Check gasket, replacing if necessary.
Tighten nuts in order of 1 through 8.
Mount ground strap (15).

* See Specifications

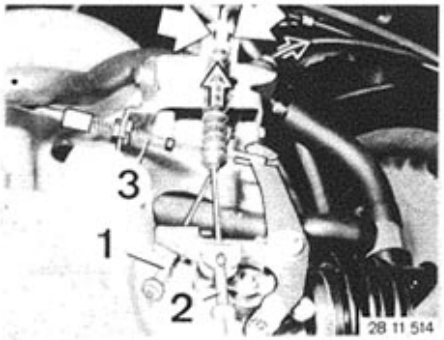
11 12 100 REMOVING AND INSTALLING CYLINDER HEAD



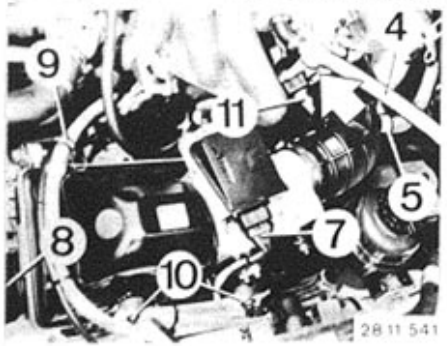
Unscrew exhaust pipes on exhaust manifolds and pipe clamp on transmission.
Installation:
Check gaskets, replacing if necessary.
Coat studs with copper paste "CRC"***.
Replace self-locking nuts.
Tightening torque*.



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

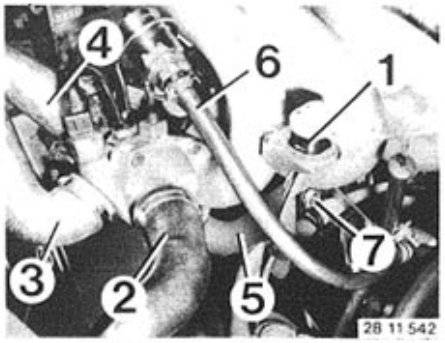


Disconnect throttle cable (1) and cruise control cable (2).
Installation:
Adjust throttle cable – see 35 41 421.
Adjust cruise control cable – see Group 65.
Disconnect accelerator cable (3).
Installation:
Adjust accelerator cable s. Gr. 24 .

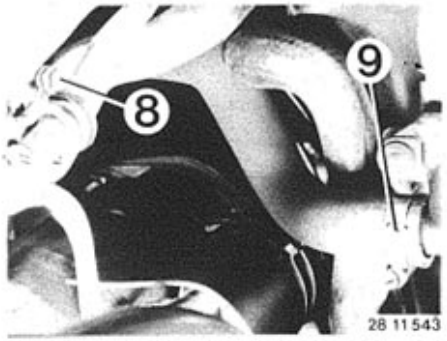


Pull off vacuum hose (4) and hoses (5).
Pull off plugs (7 and 11).
Pull out hose (8) and loosen strap (9).
Unscrew nuts (10) and remove air cleaner with air flow sensor.

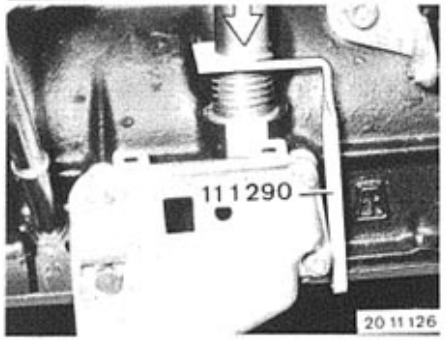
* See Specifications
*** Source: HWB
*** See Service Information of Gr. 00



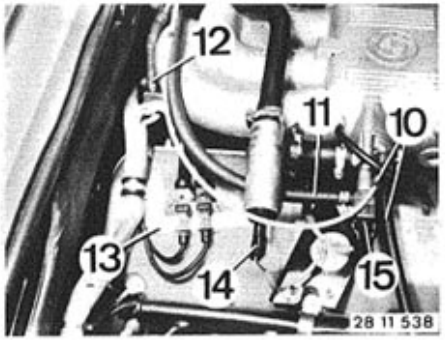
Disconnect diagnosis plug (1).
Disconnect radiator hoses (2 ... 5).
Pull off fuel line (6).
Unscrew holder (7).



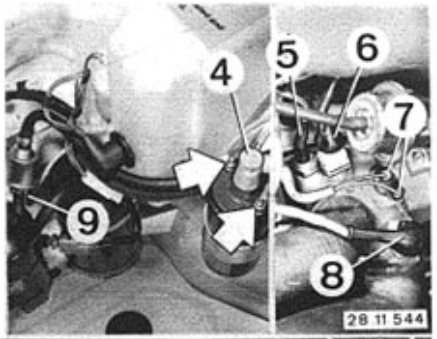
Unscrew holder (8).
Disconnect hose (9).



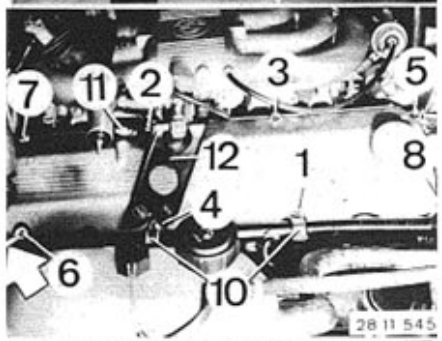
Press vent tube down and hold down with Special Tool 11 1 290.
Installation:
Check seal, replacing if necessary.
Check vent tube for correct fit after removing Special Tool 11 1 290.



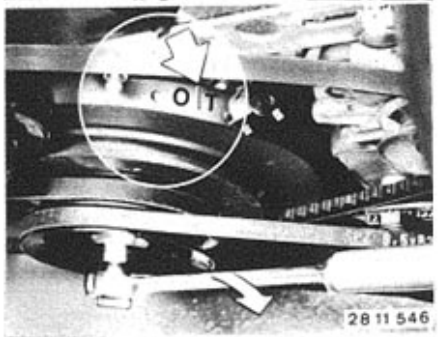
Pull off hoses (10).
Unscrew fuel lines (11 and 12).
Unscrew holder (13).
Pull off plugs on fuel injectors 4, 5 and 6.
Pull off plugs (14 and 15).
Installation:
Use new squeeze hose clamps.



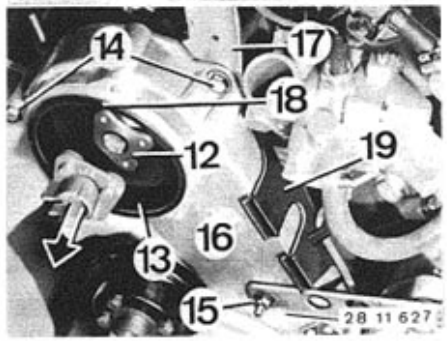
Pull off plugs on fuel injectors 1, 2 and 3.
Pull off plugs (5 ... 8).
Pull off wire (4) and disconnect ignition coil.
Pull off wire (9) on solenoid and wires on oil pressure switch.
Disconnect wire harness and pull out to the left side.



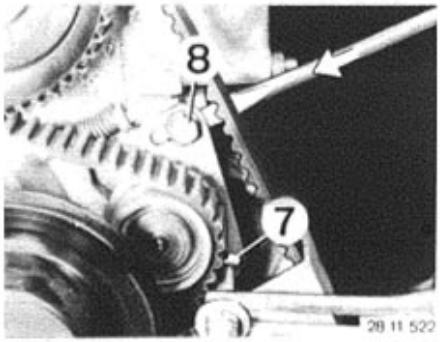
Pull off spark plug end caps and unscrew ignition lead tube (10).
Disconnect vent hose (11).
Unscrew holder (12).
Unscrew nuts (1 ... 8) and take off cylinder head cover.
Installation:
Check gasket, replacing if necessary.
Tighten nuts in order of 1 through 8.



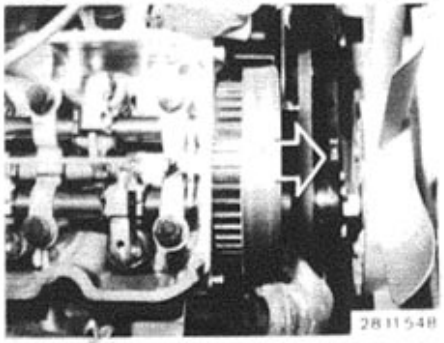
Turn crankshaft to set cylinder no. 1 to TDC; valves of cylinder no. 6 overlap.
Remove distributor cap.



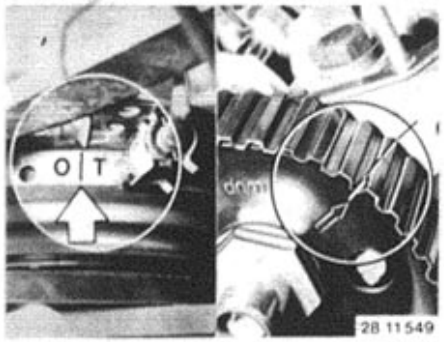
Remove distributor rotor.
Unscrew adapter (12).
Remove cover (13).
Unscrew bolts (14).
Unscrew nut (15).
Remove guard (16).
Installation:
Screw on holder (17).
Check rubber ring (18).
Insert rubber cover (19).



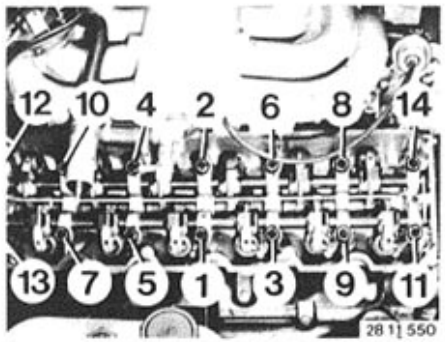
Loosen bolts (7 and 8).
Press in tensioning roller.
Tighten bolt (6).



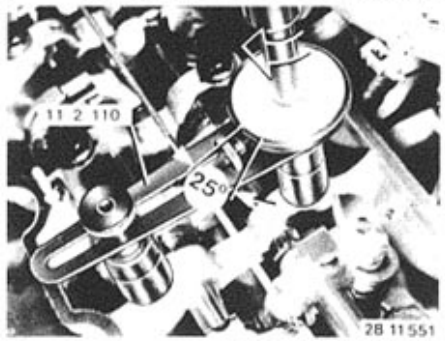
Take off drive belt on camshaft sprocket.
Caution!
Never crank engine after removing drive belt.
Installation:
Check/tighten drive belt 11 31 100.



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.

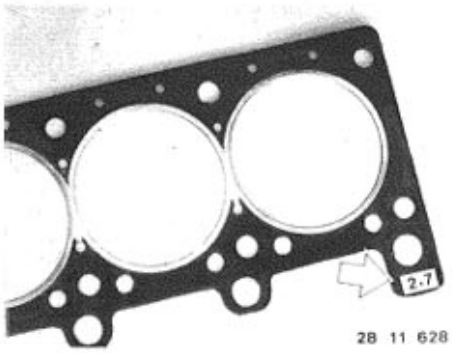


Unscrew bolts in order of 14 through 1 and remove cylinder head.
Installation:
Keep oil out of cavities, since otherwise bolts tightened to specified torque would not exert sufficient pressure on the cylinder head and, in addition, the crankcase could be cracked.
Clean cylinder head bolts.
Apply a light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

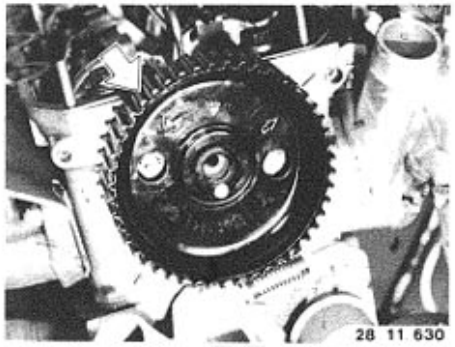
* See Specifications



28 11 628

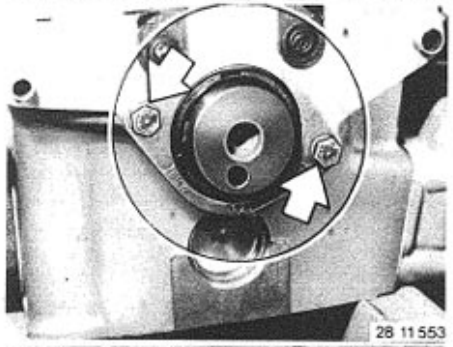
11 12 101 REPLACING CYLINDER HEAD GASKET

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.

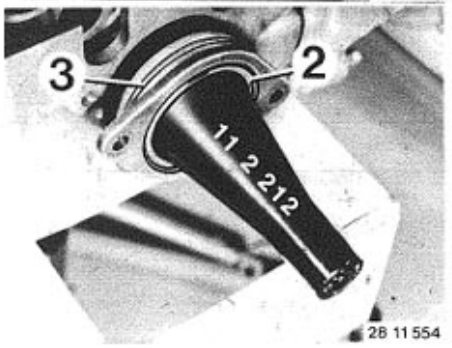

28 11 630

11 12 240 REPLACING RADIAL OIL SEAL IN END COVER

Remove drive belt 11 31 110.
Take off sprocket.

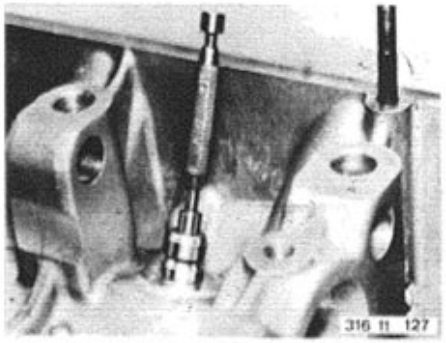

28 11 553

Unscrew cover.



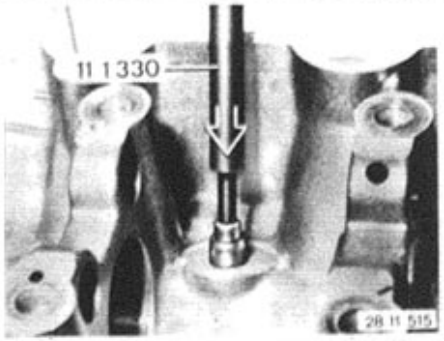
28 11 554

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

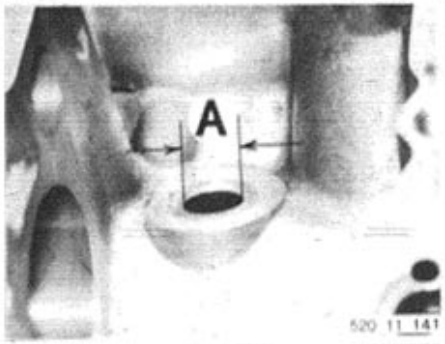


11 12 561 REPLACING VALVE GUIDE
– Valve Removed –

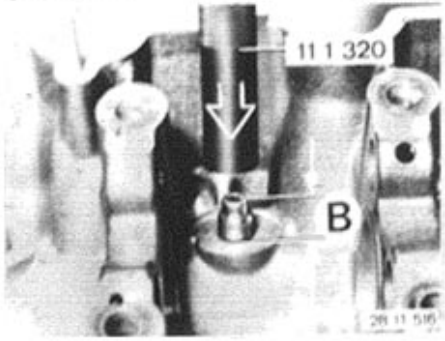
Check wear* of valve guide with Special Tool 00 4 300.



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

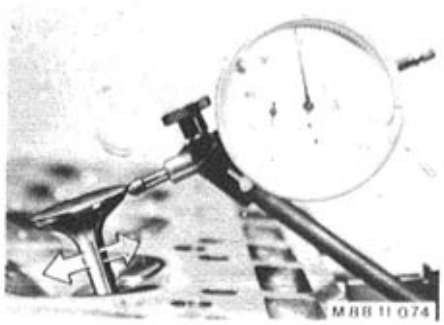


Inspect bore in cylinder head with Special Tool 00 4 530.
If permissible diameter A is exceeded, ream out the bore with a standard reamer and install an oversize* valve guide.



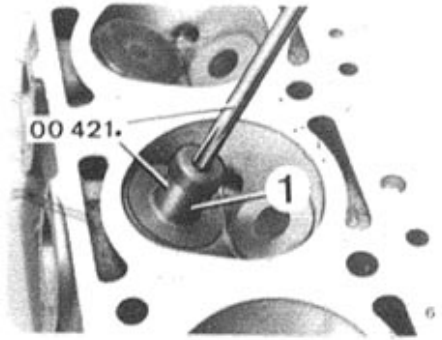
Heat* cylinder head.
Drive valve guide into the combustion chamber from the camshaft side with Special Tool 11 1 320.
Stepped end of valve guide faces the camshaft.
Important!
The bore in the special tool determines the installed depth B = 14.5 ± 0.5 mm (0.571 ± 0.020").
Ream out valve guide to 7 mm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

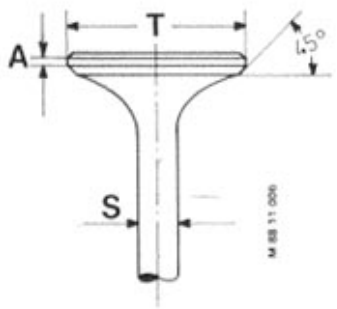
To measure, insert a new valve that its stem end is flush with the valve guide.
Apply dial gage and measure the tilt clearance.
Max. permissible tilt clearance*.



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.

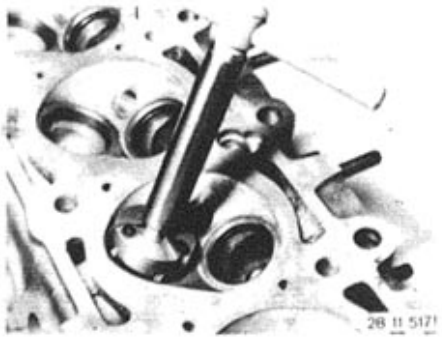
* See Specifications



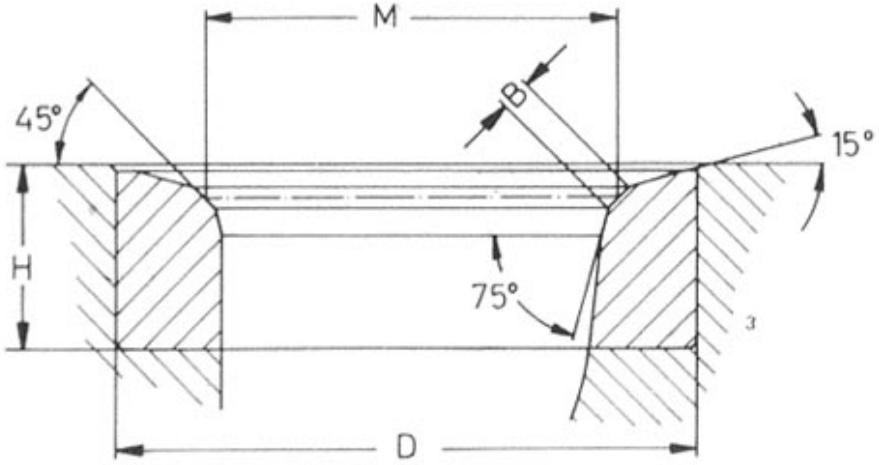
11 12 607 MACHINING VALVE SEATS AND VALVES

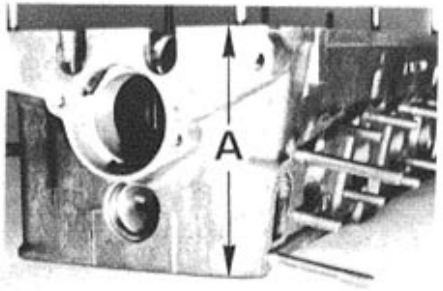
– Valves Removed –

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.



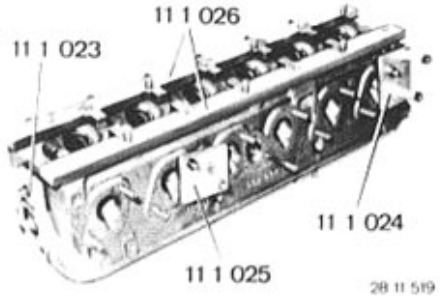


28 11 518

11 12 719 GRINDING CYLINDER HEAD SEALING SURFACE

– Cylinder Head Disassembled –

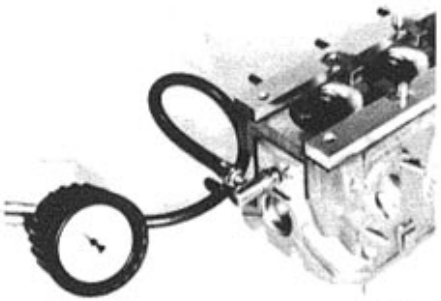
The original total thickness (A) of the cylinder head is 125.1 ± 0.1 mm (4.925 ± 0.004") and not more than 0.3 mm (0.012") may be ground off.
Use a 0.3 mm (0.012") thicker gasket on a reground cylinder head (also refer to 11 12



28 11 519

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.

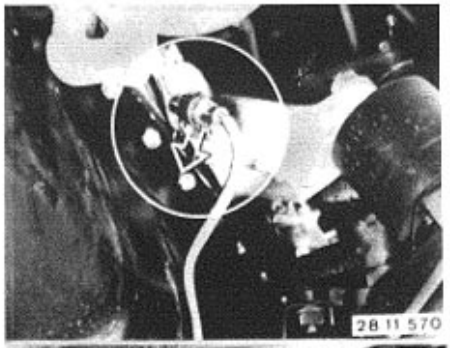


28 11 520

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.

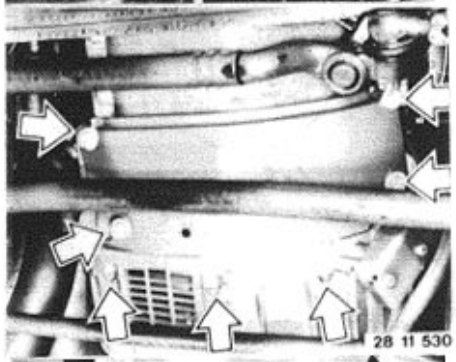
* See Specifications

* See Specifications

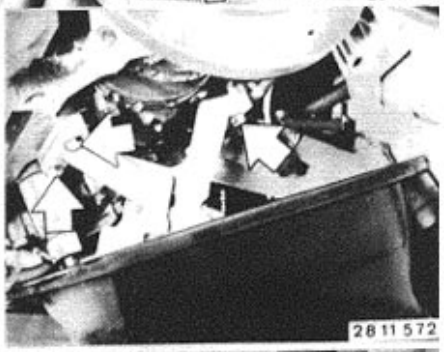


11 13 000 REMOVING AND INSTALLING OIL PAN

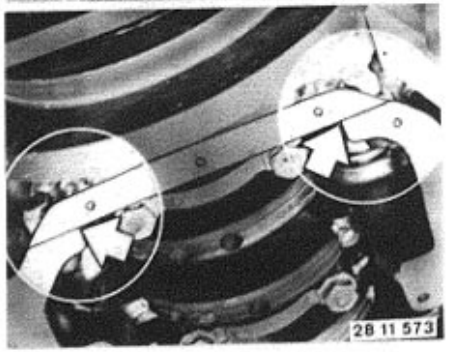
Lift out and disconnect plug.
Drain oil.
Installation:
Add engine oil***.



Unscrew cover/reinforcement plate.

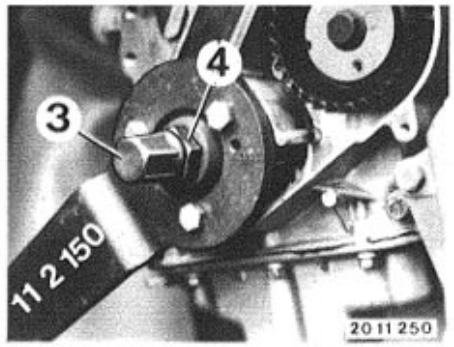


Unscrew oil pan.
Unscrew oil pump and remove oil pan.
Installation:
Insert oil pump drive shaft, see 11 41 000.
Replace gasket.



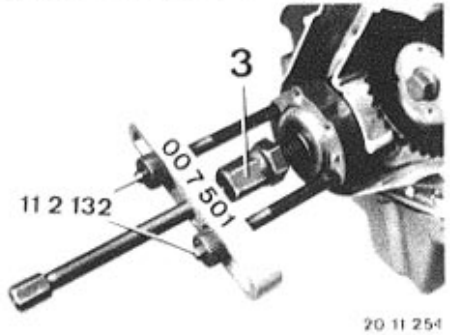
Installation:
Clean sealing surfaces.
Coat joint surfaces on timing case covers and end cover with a brush-on universal sealing compound**.

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

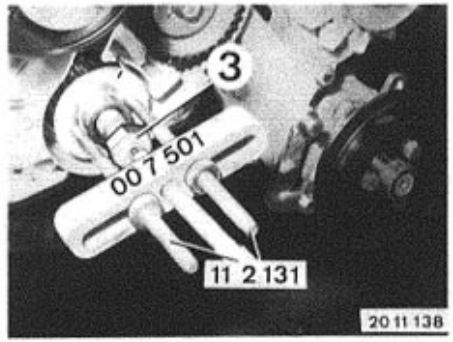


11 14 175 REMOVING AND INSTALLING FRONT END COVER

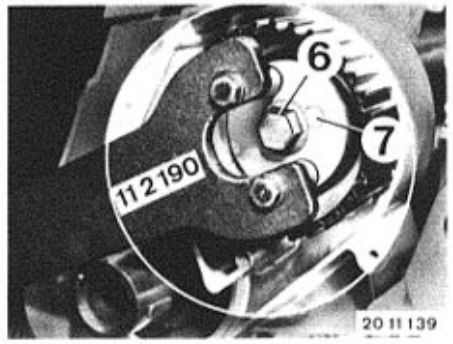
Remove radiator, see Group 17.
Remove toothed drive belt 11 31 110.
Single piece Hub/Drive Belt Sprocket:
Hold drive belt sprocket with Special Tool 11 2 150.
Unscrew bolt (3).
Take off collar washer (4).
Installation:
Tightening torque*.



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.

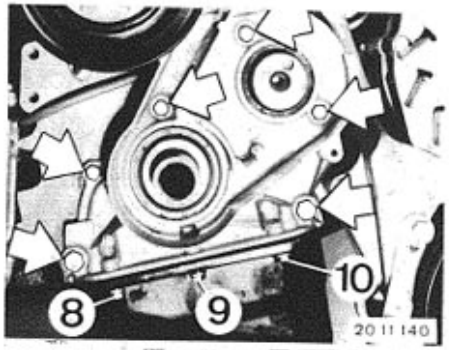


Two-piece Hub/Drive Belt Sprocket:
Screw in bolt (3).
Pull sprocket off of the crankshaft with Special Tools 00 7 501 and 11 2 131.
Important!
Woodruff key.
Installation:
Mount sprocket that lettering faces forward.

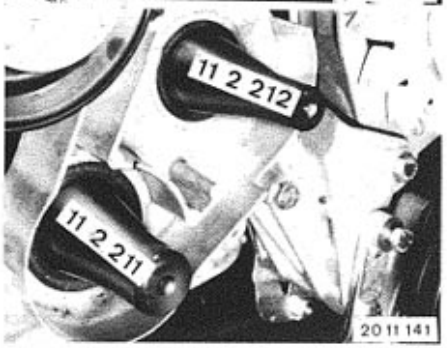


Hold sprocket of the intermediate shaft with Special Tool 11 2 190.
Unscrew bolt (6).
Take off washer and sprocket.
Installation:
Guide centering pin (7) into bore.

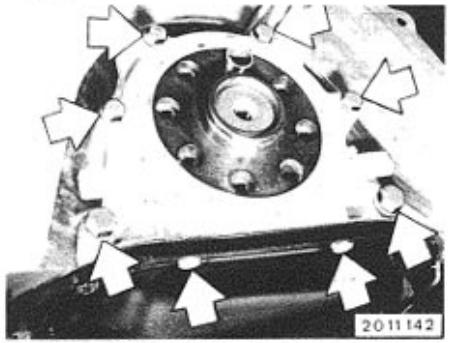
* See Specifications



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.

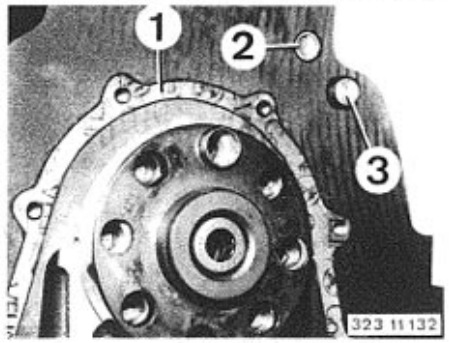


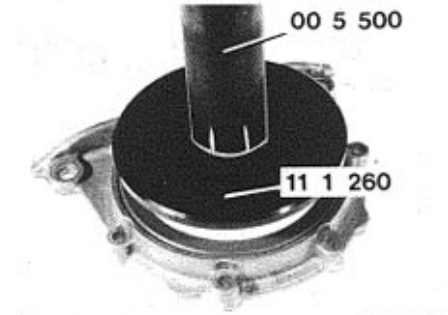
Check radial oil seals, replacing if necessary.
Important!
Always use Special Tools 11 2 211 (crankshaft) and 11 2 212 (intermediate shaft) for installation of the end cover.



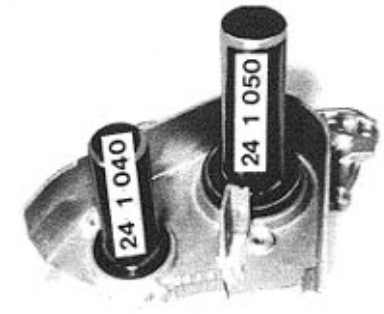
11 14 605 REPLACING RADIAL OIL SEAL IN CLUTCH END COVER
– Transmission Removed –

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**.



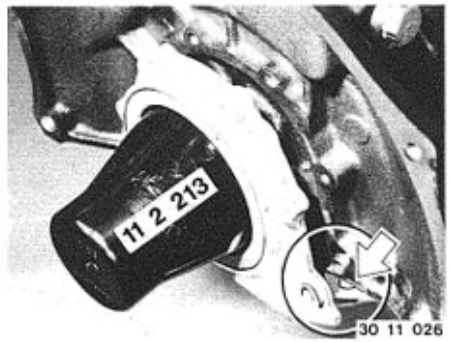


Press in the radial oil seal with Special Tools 11 1 260 and 00 5 500.
Press in the new radial oil seal approx. 1 to 2 mm (0.039 to 0.079") deeper, in contradiction to the standard seal which had been installed flush.
Lubricate sealing lip with oil.



11 14 180 REPLACING RADIAL OIL SEAL IN END COVER

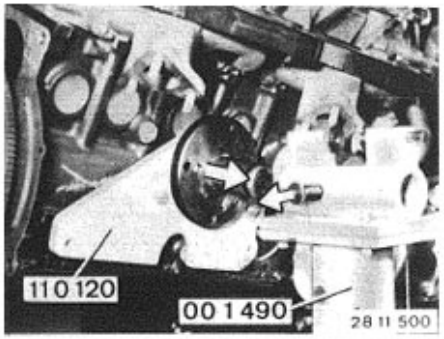
Remove end cover 11 14 175.
Press radial oil seals out of the cover.
Press in radial oil seals with Special Tools 24 1 050 and 24 1 040.
Press in the new radial oil seals approx. 1 to 2 mm (0.039 to 0.079") deeper, in contradiction to the standard seal which had been installed flush.
Lubricate sealing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



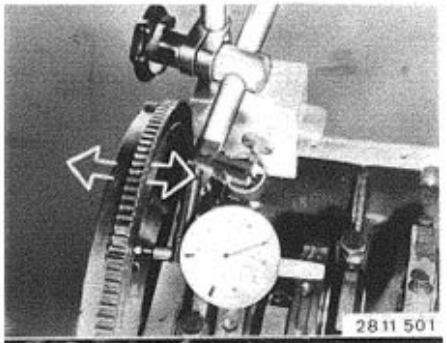
Coat end cover/oil pan joint with a brush-on universal sealing compound / Three Bond Silicone 1207**.
Use Special Tool 11 2 213 to avoid damage on the radial oil seal.

** Source: HWB

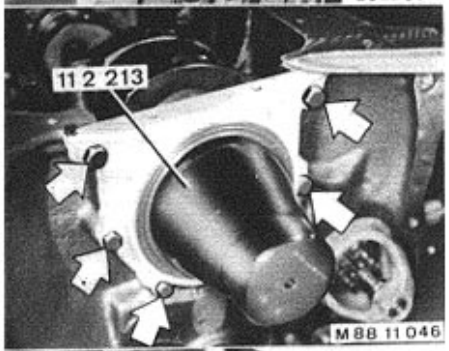
11 21 000 REMOVING AND INSTALLING CRANKSHAFT



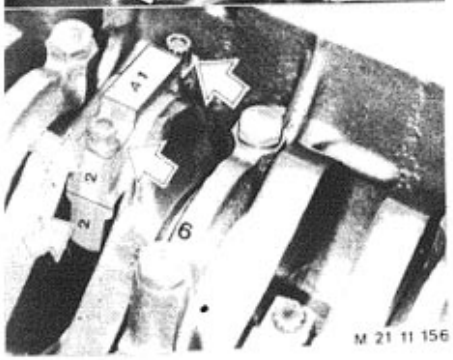
Remove the engine 11 00 050.
Mount engine block in assembly stand 00 1 490 with Special Tool 11 0 120.



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.

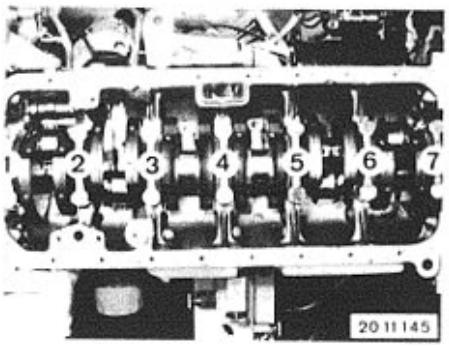


Remove flywheel 11 22 000.
Take off the end cover.
Installation:
Replace the gasket.
Use Special Tool 11 2 213 to avoid damage on the radial oil seal.
Cut off gasket on the oil pan sealing surface.



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

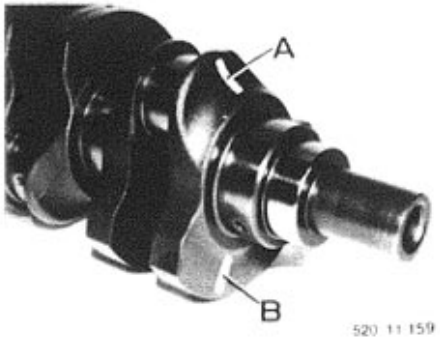


28 11 301

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:

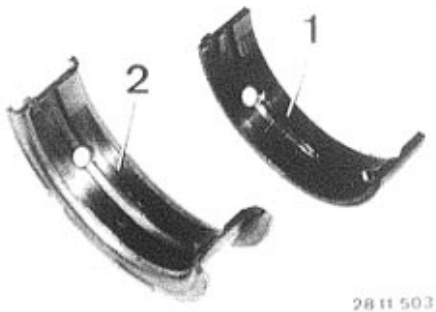
Type	Throw (cast on cheek 6)	Code
M 20 B 27	H 81 mm (3.189")	W



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.

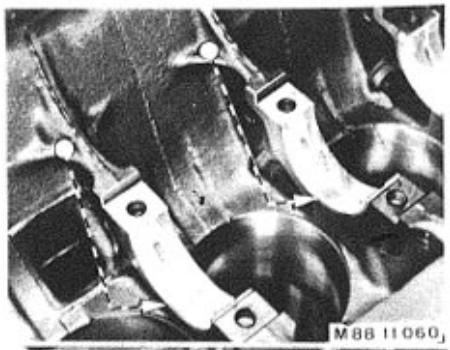
* See Specifications



28 11 503

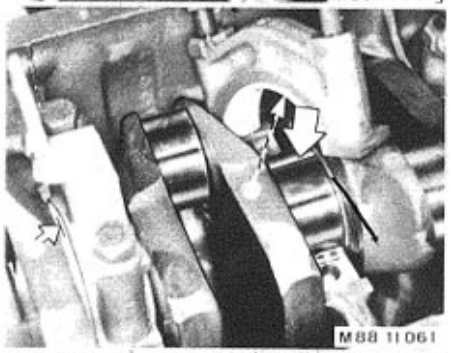
11 21 531 REPLACING CRANKSHAFT MAIN BEARING SHELLS
– Engine Disassembled –

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

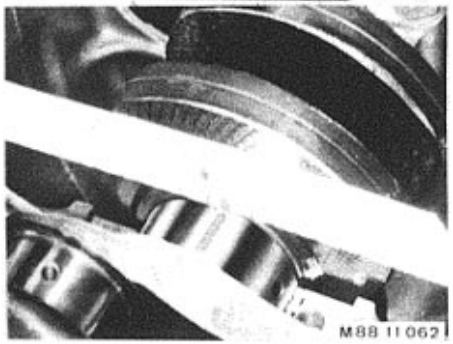
Bearing shells are installed in the crankcase according to color code of the crankcase.
If color code has been washed off of the crankcase, both shells are installed according to the crankshaft color code.
Install the crankshaft.



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

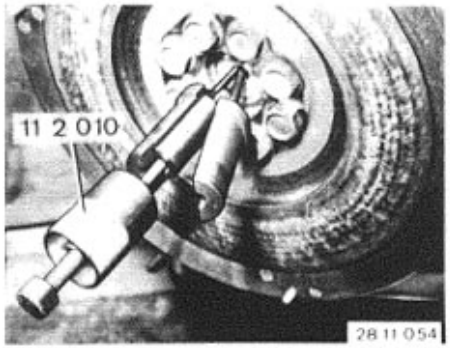


M88 11 062

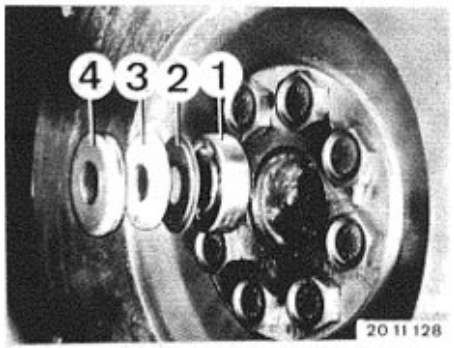
Take off the bearing caps.
Read bearing play* from width of flattened Plastigage with help of supplied scale.
Correct bearing play by installing new bearing shells, bearing shells of different machined size or with different color codes.

* See Specifications

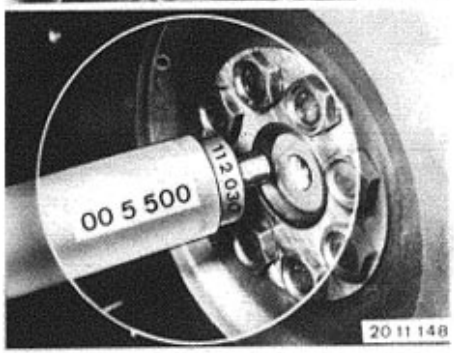
11 21 571 REPLACING PILOT BEARING IN CRANKSHAFT



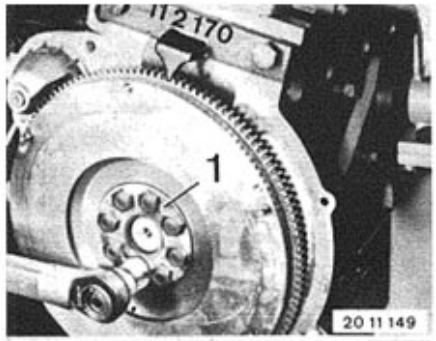
Remove clutch disc 21 21 000.
Pull out ball bearing with Special Tool 11 2 010.

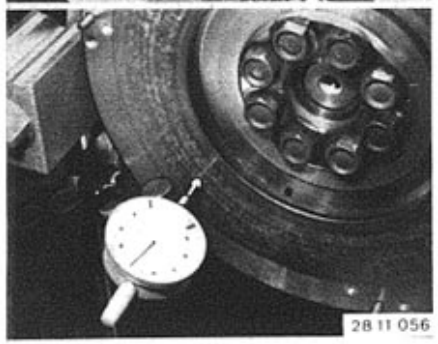


Installed Order:
Ball bearing (1), cover (2), felt ring (3) and capsule (4).
Install cover (2) with embossment facing out.



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.





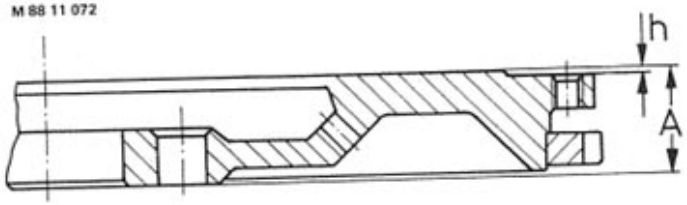
11 22 000 REMOVING AND INSTALLING FLYWHEEL

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*.

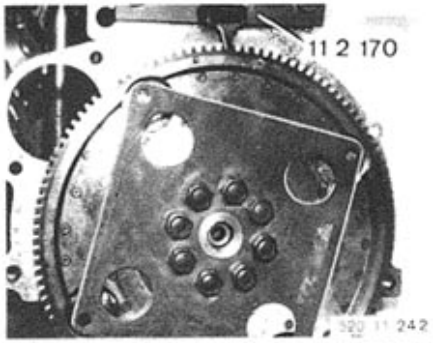
Check flywheel for axial runout*.

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.

M 88 11 072

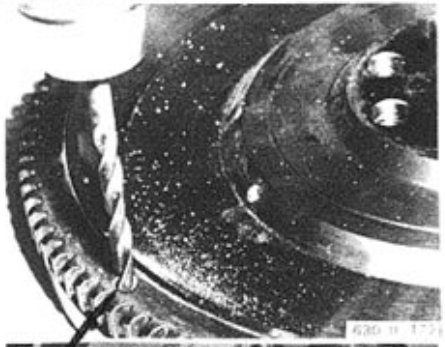


* See Specifications
** Source: HWB



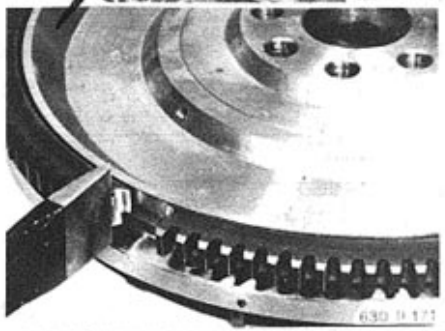
11 22 051 REPLACING DRIVE PLATE FOR TORQUE CONVERTER

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*.

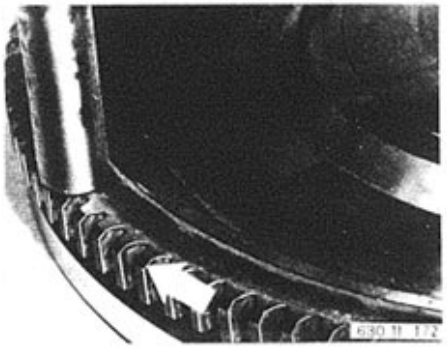


11 22 541 REPLACING STARTER GEAR RING

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.

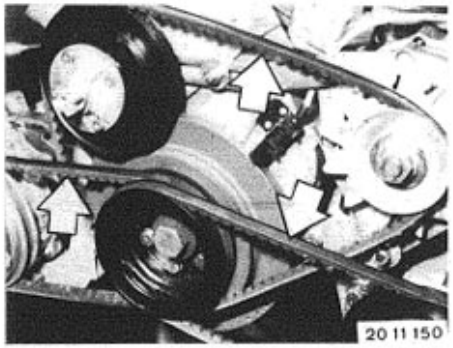


Break starter gear ring a drilled point with a chisel.



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

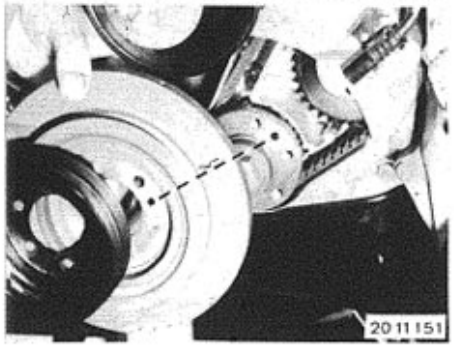


11 23 010 REPLACING VIBRATION DAMPER

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

Installation:

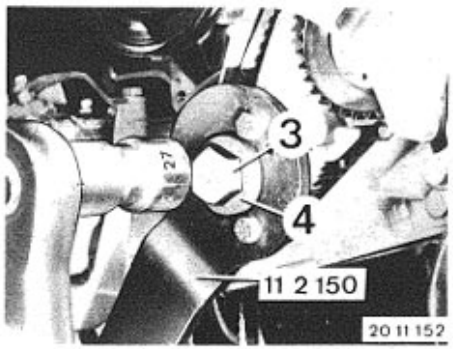
Tighten drive belt and check tightness with Special Tool 11 5 020.



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.

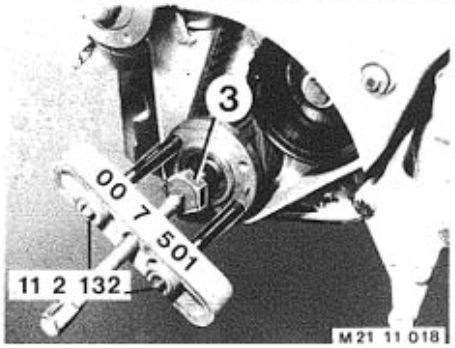
Hold hub with Special Tool 11 2 150.

Unscrew bolt (3).

Take off collar washer (4).

Installation:

Tightening torque*.

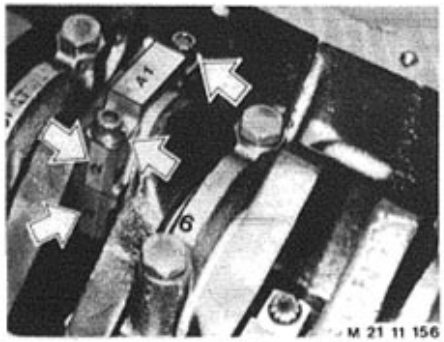


Screw in bolt (3) about three turns.

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

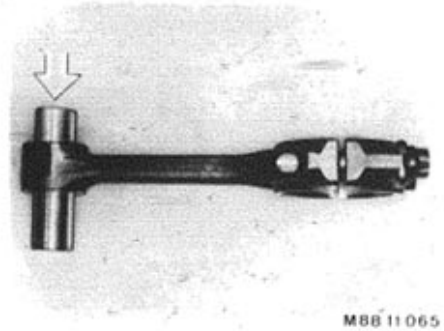
Remove bolt (3).

* See Specifications

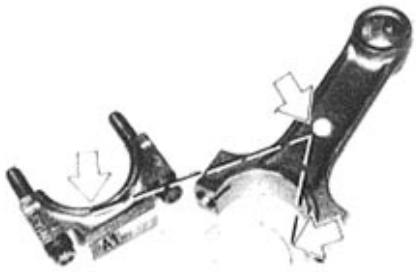


11 24 521 REPLACING CONNECTING RODS
– Pistons Removed –

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!

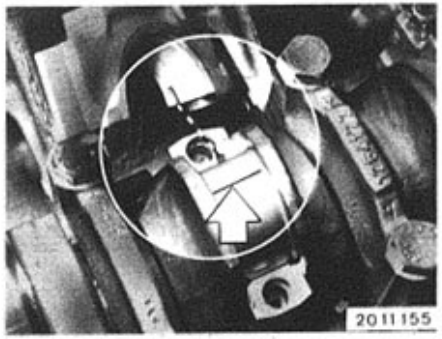


The piston pin must slide through the conrod bushing under light pressure.



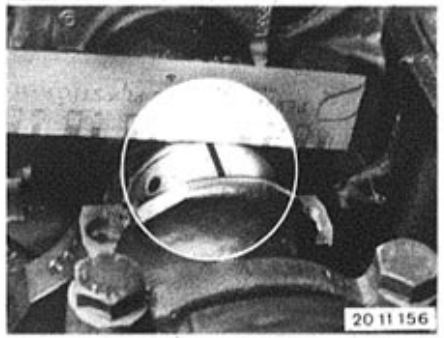
11 24 571 REPLACING CONNECTING ROD BEARING SHELLS
– Engine Disassembled –

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).

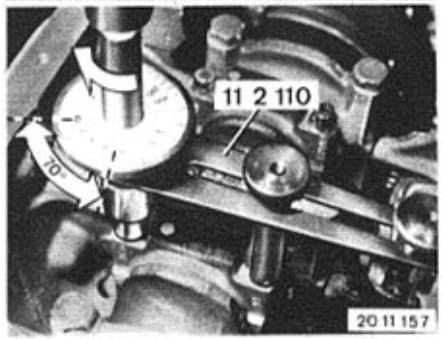


Turn to BDC, place Type PG-1 Plastigage on crankshaft wiped clean of oil and mount conrod bearing caps that grooves are on one side.
The pairing code (0 to 99) must be the same on the connecting rod and cap.

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).

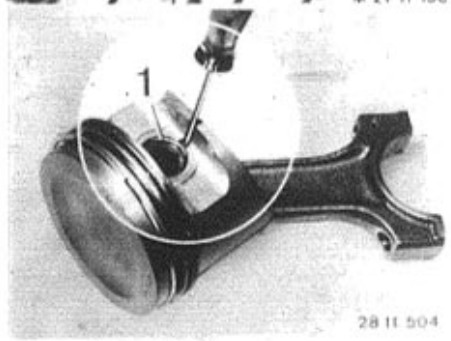


* See Specifications


M 21 11 156

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.



28 11 504

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.


28 11 505

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")

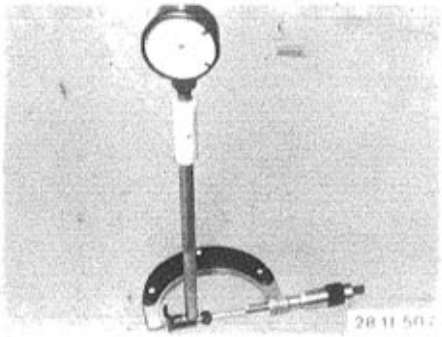


28 11 506

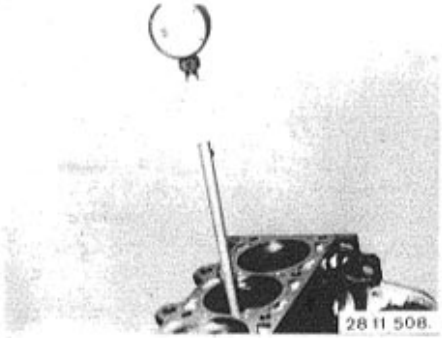
Check piston installed clearance*.

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")

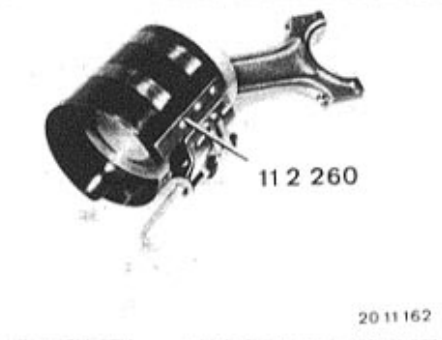
* See Specifications


28 11 507

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

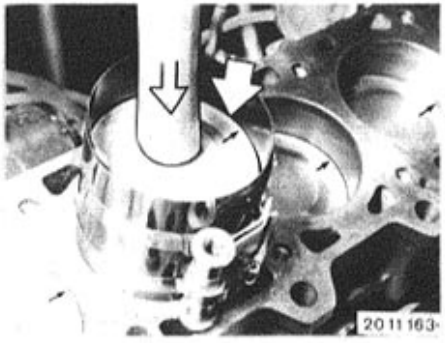

28 11 508

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



20 11 162

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.


20 11 163

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

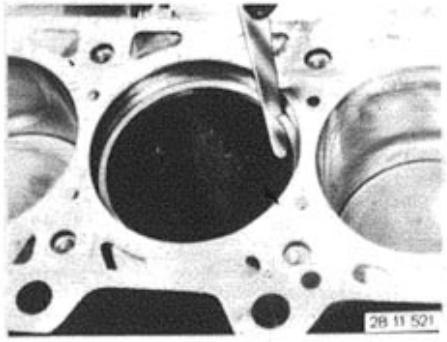
* See Specifications

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



28 11 509

Measure side clearance* of piston rings.



28 11 521

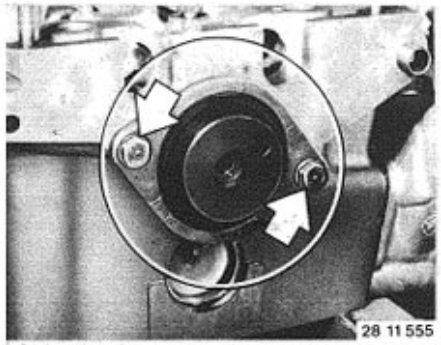
Remove piston rings and measure end clearance*.



28 11 510

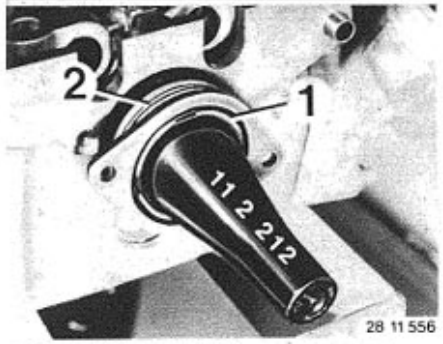
Installation:
Install piston rings that word "TOP" faces piston crown.
1 Plain compression ring
2 Taper face ring
3 Oil scraper ring

* See Specifications

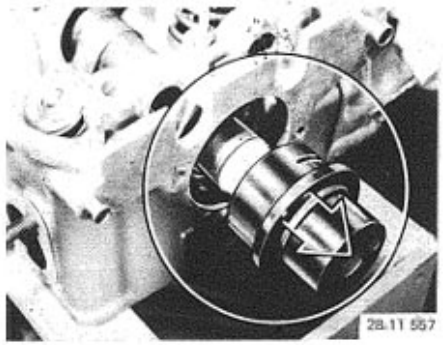


11 31 000 REMOVING AND INSTALLING CAMSHAFT

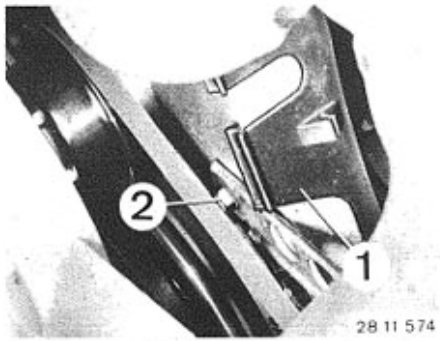
Remove rocker arm shafts 11 33 020.
Unscrew end cover.



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*.

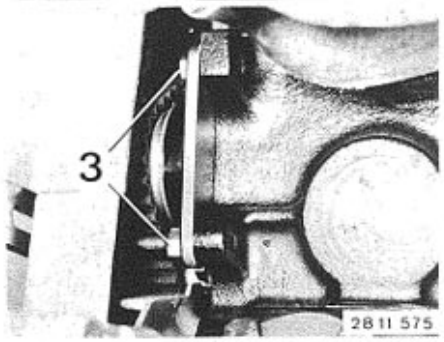


Pull out the camshaft.

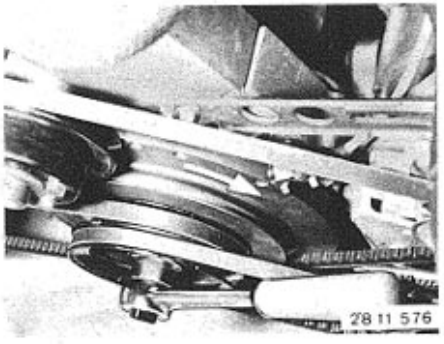


11 31 100 TIGHTENING DRIVE BELT

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*.



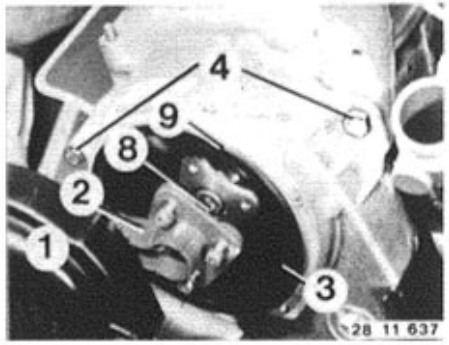
Unscrew bolts (3).



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

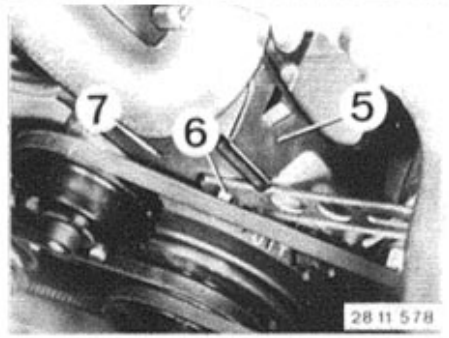
* See Specifications

* See Specifications

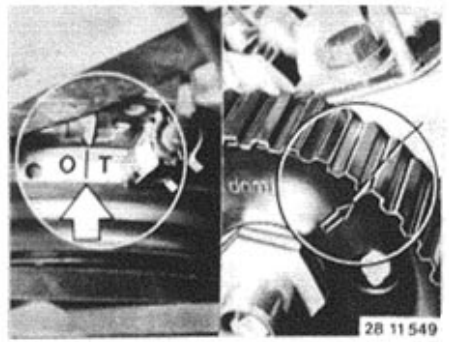


11 31 110 REMOVING AND INSTALLING DRIVE BELT

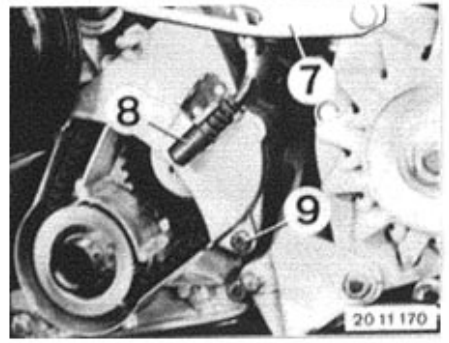
Remove distributor cap (1).
Remove distributor rotor (2).
Old Version:
Unscrew adapter (8).
Remove cover (3).
Unscrew bolts (4).
Installation:
Check seal (9), replacing if necessary.
Tightening torque*.



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

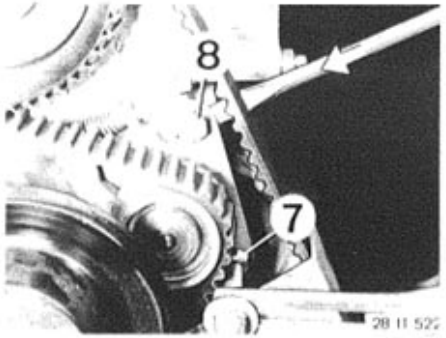


Turn the crankshaft to set cylinder no. 1 to TDC – arrow on camshaft sprocket faces the mark on the cylinder head.
Remove the vibration damper 11 23 010.

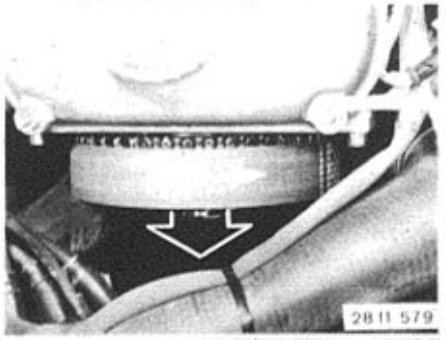


Two-piece Hub/Drive Belt Sprocket:
Remove hub for the vibration damper – see 11 23 031.
Swing away the tensioning bar (7).
Lift out TDC transmitter (8).
Unscrew bolt (9) and take off the cover.

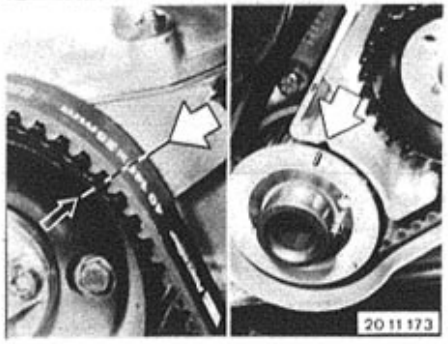
* See Specifications



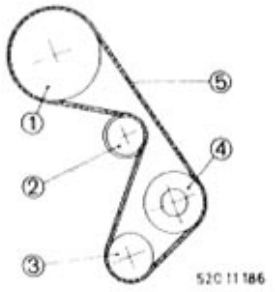
Loosen bolts (7 and 8).
Press in the tensioning roller.
Tighten bolt (8).
Installation:
Tighten drive belt 11 31 100.



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.

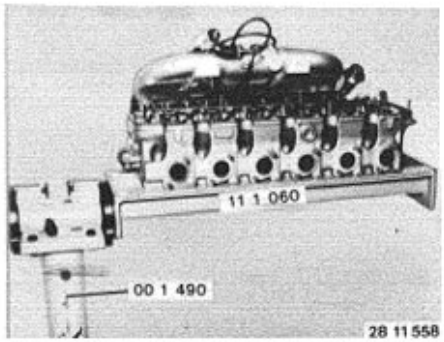


Installation:
Turn engine again in turning direction and recheck timing after installation of the drive belt.
Adjust ignition timing 12 11 004.

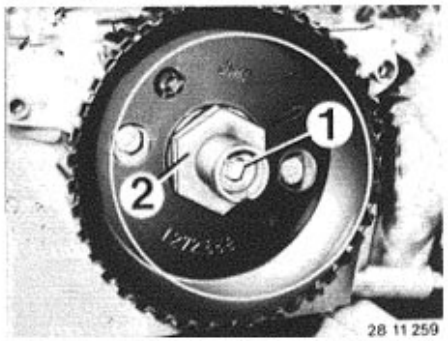


Drive Belt Layout:
1 Camshaft sprocket
2 Tensioning roller
3 Crankshaft sprocket
4 Intermediate shaft sprocket
5 Drive belt

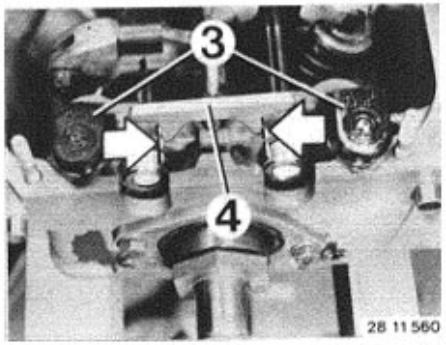
11 33 020 REMOVING AND INSTALLING ROCKER ARM SHAFTS – PLUGGED DISTRIBUTOR ROTOR –



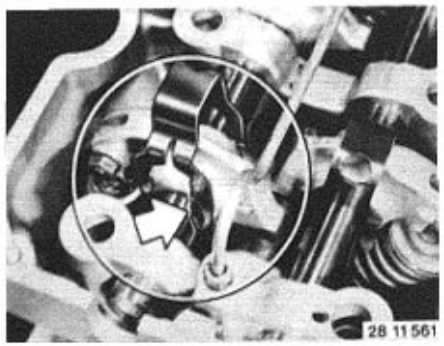
Remove cylinder head 11 12 100.
Set up Special Tool 11 1 060 on Special Tool 00 1 490 and mount cylinder head with one cylinder head bolt.



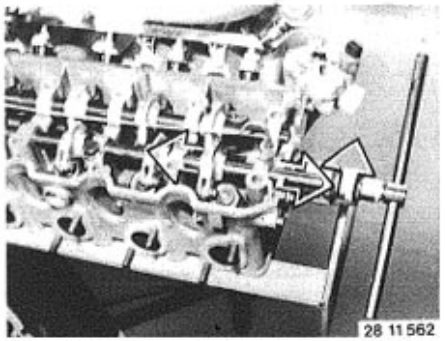
Unscrew bolt (1) and take off sprocket.
Press adapter (2) out of sprocket and install sprocket again.
Adjust valve clearance of all valves to greatest value.



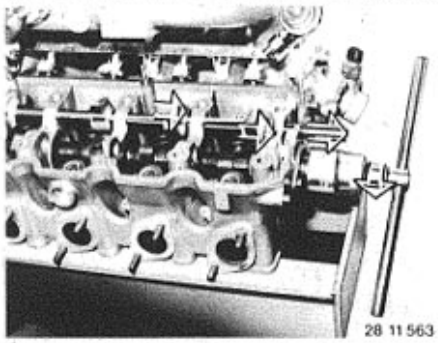
Remove front and rear plugs (3).
Remove guide plate (4).
Installation:
Guide plate (4) must fit in grooves of rocker arm shafts.



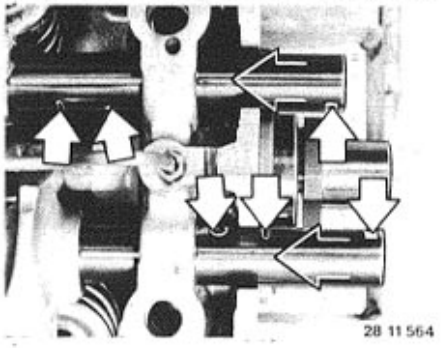
Remove spring clamps.
Installation:
Straight surfaces of spring clamps must fit in grooves of rocker arm shafts.



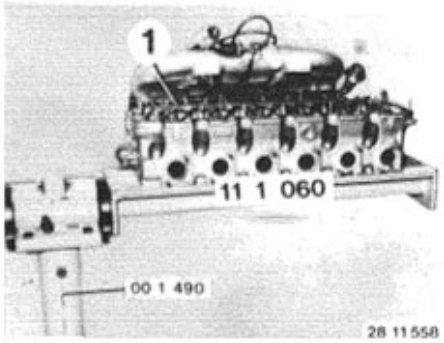
Remove rocker arm shafts.
1) Exhaust Side:
Cylinder no. 6 must overlap.
Push in rocker arms of cylinder no. 1 and turn camshaft on adapter to intake side until rocker arms (all) are relaxed.
Pull out rocker arm shaft.



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.

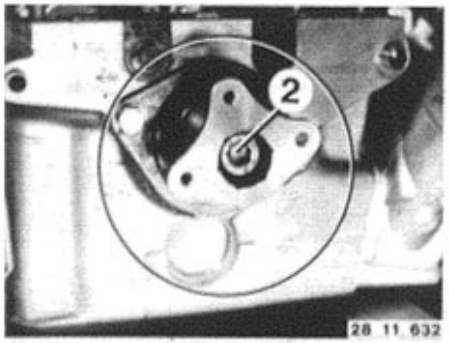


Installation:
Install rocker arm shafts that large oil bores face down to valve guides and small oil bores as well as grooves for guide plate face in.

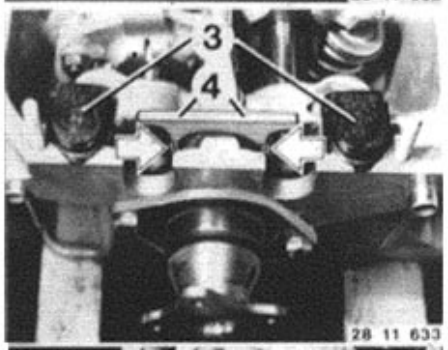


11 33 020 REMOVING AND INSTALLING ROCKER ARM SHAFTS – BOLTED DISTRIBUTOR ROTOR –

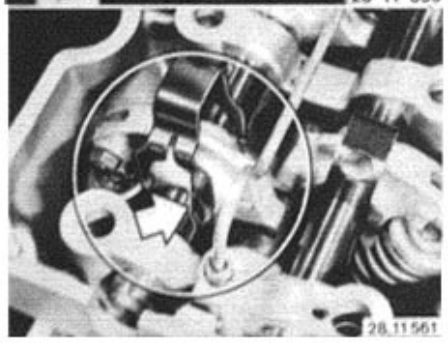
Remove cylinder head 11 12 100.
Set up Special Tool 11 1 060 on Special Tool 00 1 490 and mount cylinder head with one cylinder head bolt.



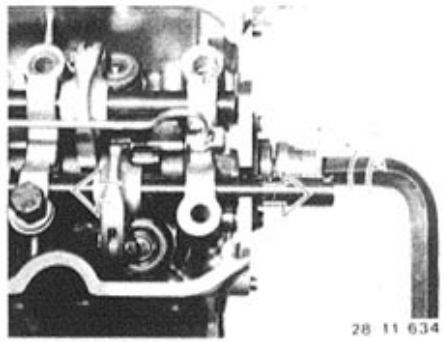
Mount adapter (2) again.
Adjust valve clearance of all valves to greatest value.



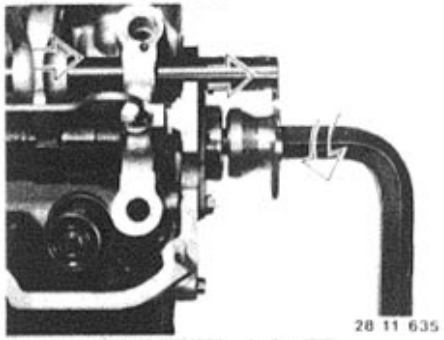
Remove front and rear plugs (3).
Remove guide plate (4).
Installation:
Guide plate (4) must fit in grooves of rocker arm shafts.



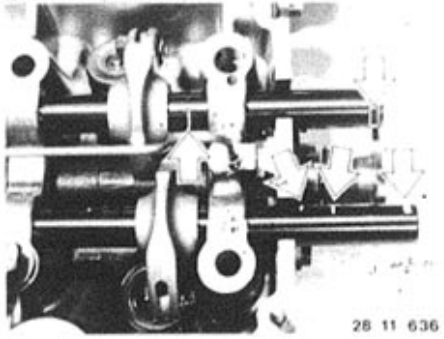
Remove spring clamps.
Installation:
Straight surfaces of spring clamps must fit in grooves of rocker arm shafts.



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.

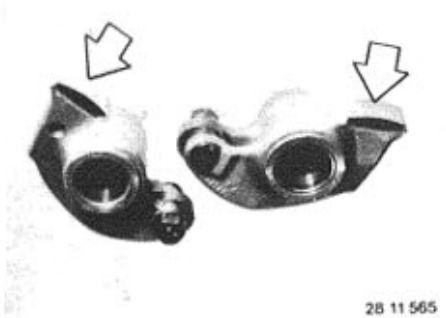


2) Intake Side:
Turn camshaft on the adapter to exhaust side and move rocker arms until all rocker arms are relaxed.
Pull out rocker arm shaft.
Replace worn (scored) rocker arm shafts and rocker arms.



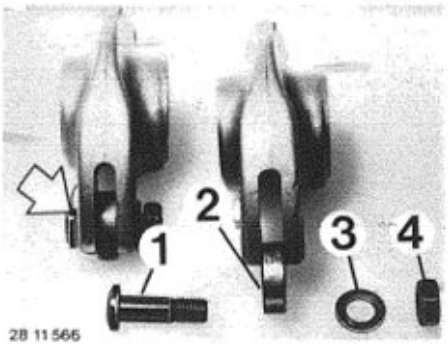
Installation:
Install rocker arm shafts that large oil bores face down to valve guides and small oil bores as well as grooves for guide plate face in.

11 33 031 REPLACING ROCKER ARMS



28 11 565

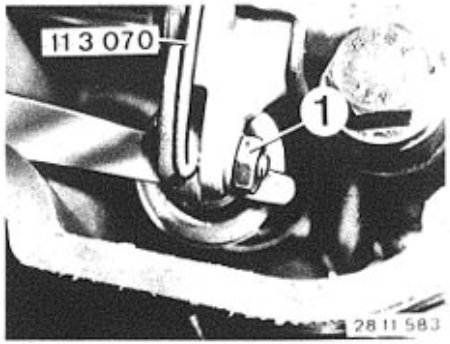
Remove rocker arm shafts 11 33 020.
Replace worn rocker arms or rocker arms with loose guides.
Loose guides will be noticed as excessively loud valve noise.



28 11 566

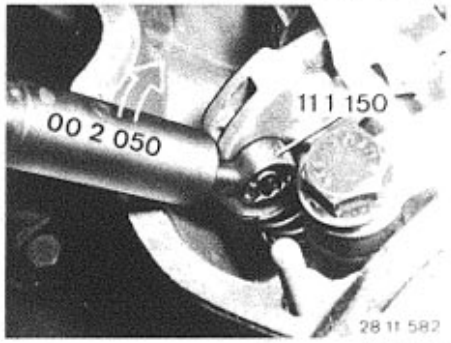
Transfer screw (1), eccentric (2), washer (3) and nut (4) to new rocker arm.
Replace a worn eccentric.
Important!
Screw and nut have M 6 x 0.75 fine threads.
Bore faces out and thick side down.
Bevelled surface of screw faces tab on rocker arm.

11 34 004 ADJUSTING VALVE PLAY



28 11 583

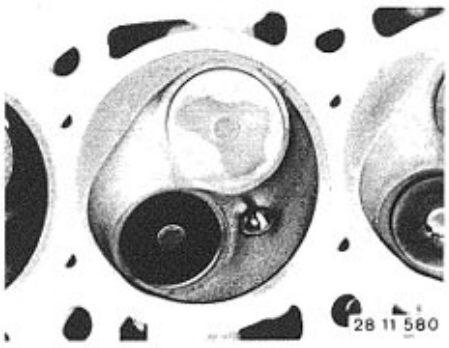
Remove cylinder head cover 11 12 000.
Crank engine with a wrench socket on the crankshaft (vibration damper).
Adjusting order is same as the firing order (1 5 3 6 2 4) in compression top dead center (TDC).
Adjust valve clearance* between valve and eccentric after loosening nut (1).



28 11 582

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

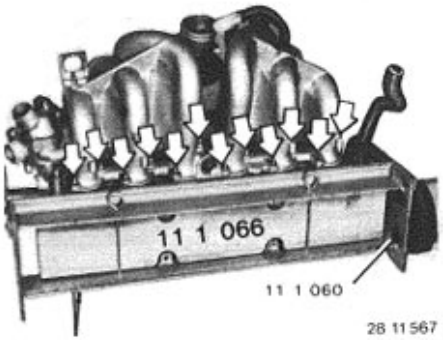
11 34 509 CHECKING ALL VALVES FOR LEAKS – CAMSHAFT REMOVED –



28 11 580

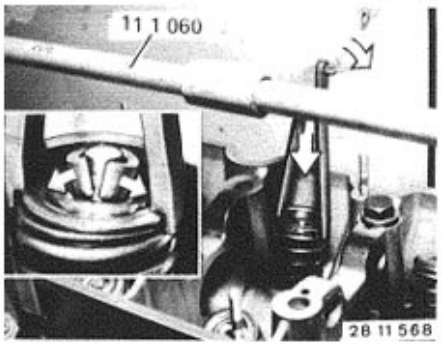
Spark plugs remain installed.
Fill combustion chamber with gasoline outdoors or indoors with strict conformance with fire prevention regulations.
If the gasoline runs past the valve heads, check valves and valve seats.
Remove and install valves 11 34 550.
Machine valve seats 11 12 607.

* See Specifications

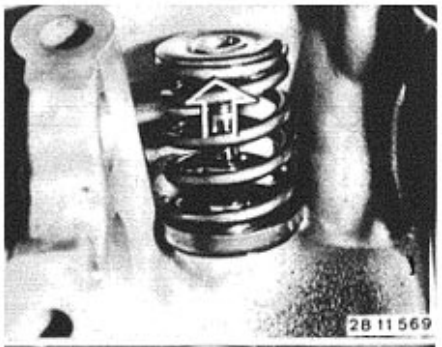


11 34 550 REMOVING AND INSTALLING VALVES

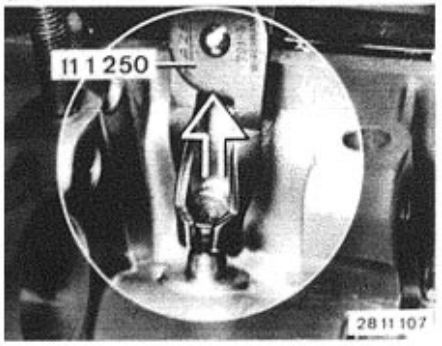
Remove rocker arm shafts 11 33 020.
Place tray 11 1 066 in assembly stand 11 1 060.
Unscrew intake.
Installation:
Replace gaskets.



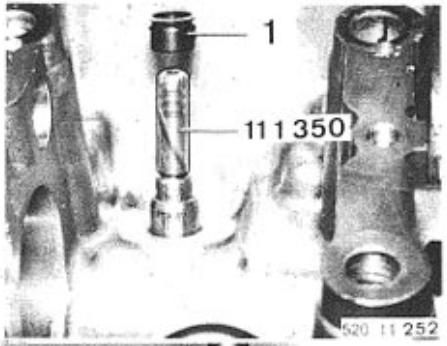
Press down the valve springs with Special Tool 11 1 060 and remove the valve collets.



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.

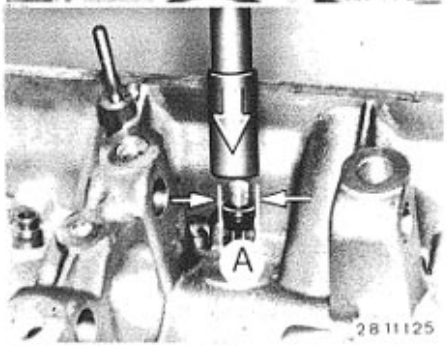


Pull off valve stem seal with Special Tool 11 1 250.

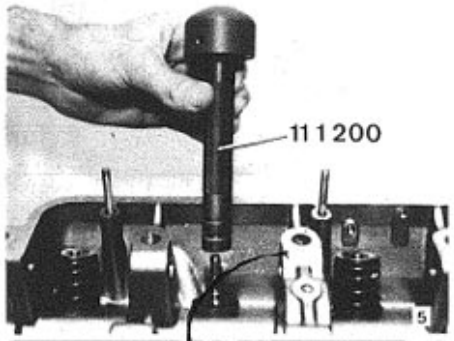


Install valve.
Always use Special Tool 11 1 350 to avoid damage on the valve stem seal.
Lubricate valve stem seal (1) with oil and install.

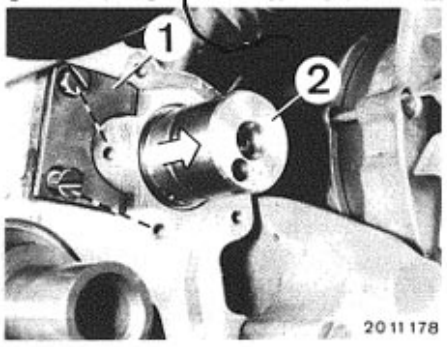
Source for Special Special Tool Sleeves:
Cartool
Alfred-Brehm-Str. 5
D–8070 Ingolstadt / West Germany



"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").

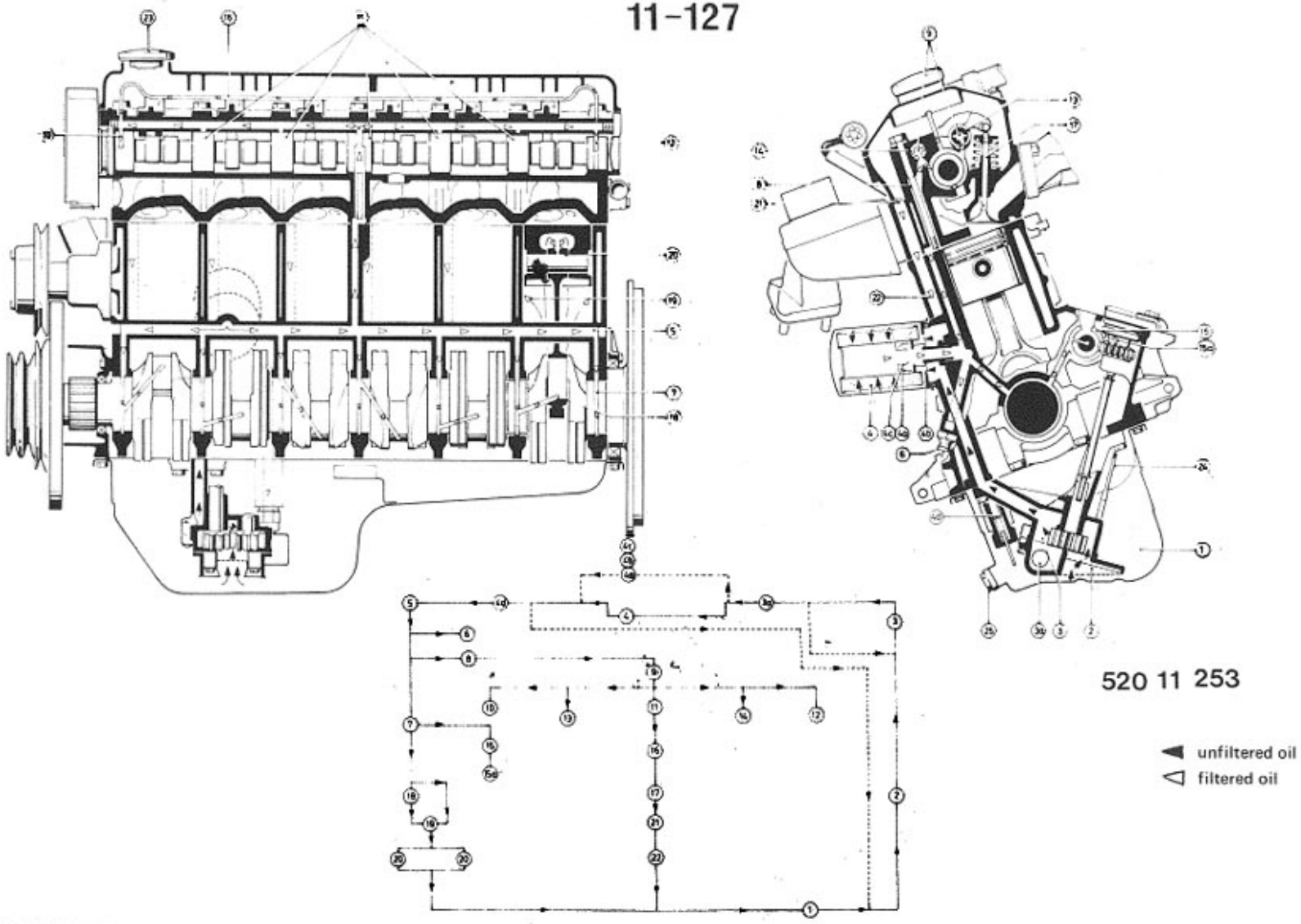


The new, improved valve stem seals (internal grooving) are pressed on by hand with Special Tool 11 1 200.
Special Tool 11 1 200 has two diameters – for 7/8 mm (0.276/0.315") valve stem seals.



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.

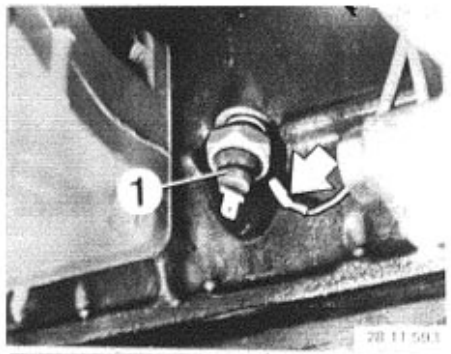


520 11 253

◀ unfiltered oil
◁ filtered oil

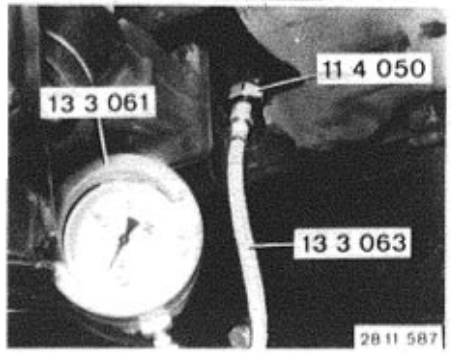
ENGINE OIL CIRCUIT

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



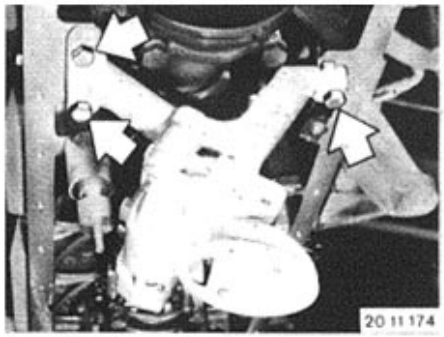
11 40 000 CHECKING ENGINE OIL PRESSURE

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



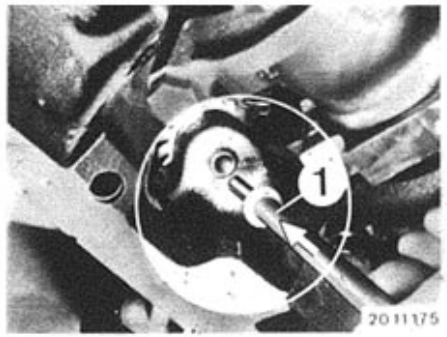
Screw in Special Tool 11 4 050 (adapter).
Connect Special Tools 13 3 063 (hose) and 13 3 061 (pressure tester).
Check oil pressure*.

* See Specifications

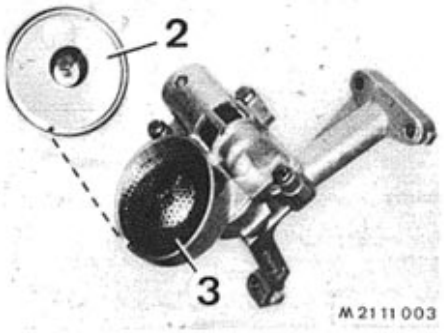


11 41 000 REMOVING AND INSTALLING OIL PUMP

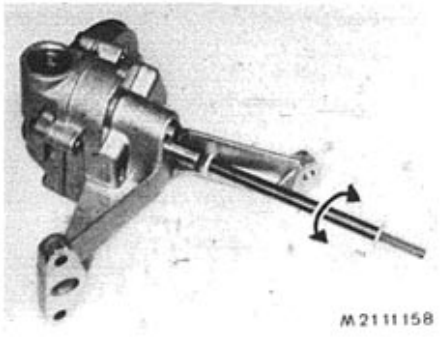
Remove oil pan 11 03 000
Unscrew oil pump.



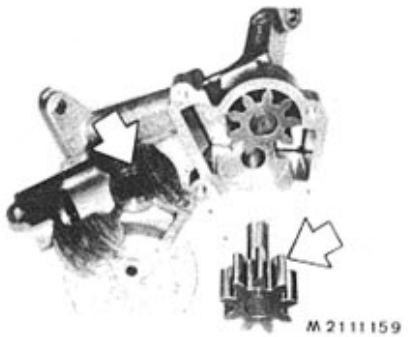
Installation:
Guide in drive shaft (1).
Replace bearing, see 11 11 160.



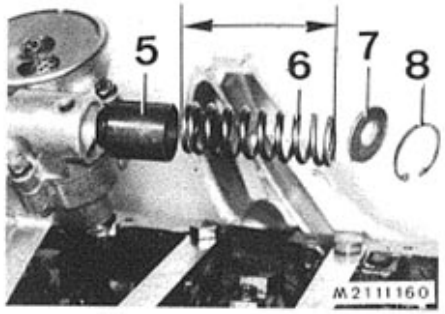
Testing and Servicing:
Unscrew cover (2) and clean oil filter screen (3).



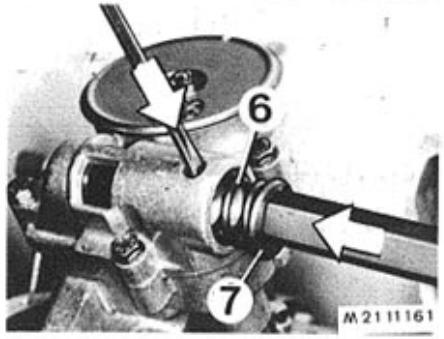
Check whether gears turn easily by turning the drive shaft.



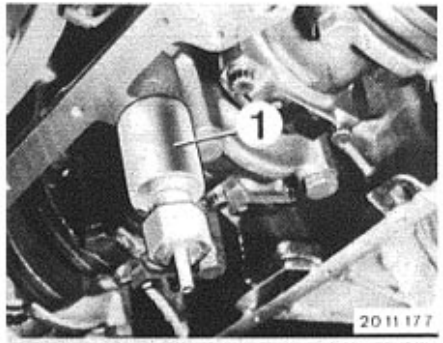
Unscrew oil pump cover and check oil pump for wear.
– Scoring in body/cover
– Wear on gears



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").

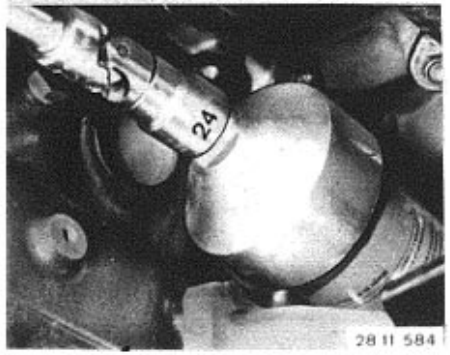


Installation:
Press in and hold spring (6) and washer (7) with a screwdriver.
Install circlip (8).



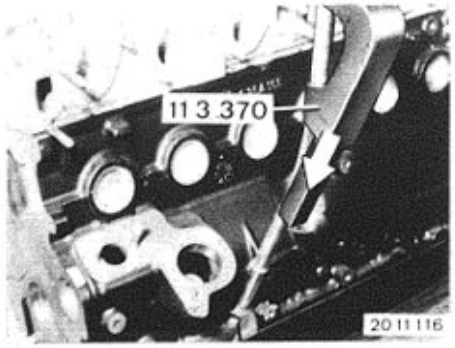
11 41 110 REMOVING AND INSTALLING PRESSURE RELIEF VALVE

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

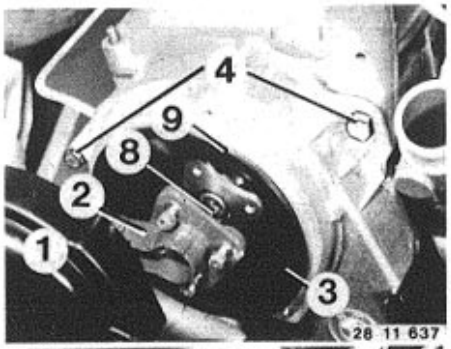
Unscrew filter with Special Tools 11 4 020/ 11 4 650.
Installation:
Give gasket a light coat of oil.
Screw on the oil filter by hand until the gasket touches – then tighten by hand with one half turn.
Add oil, start engine and check oil level and for leaks.
If the engine no longer builds up oil pressure 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

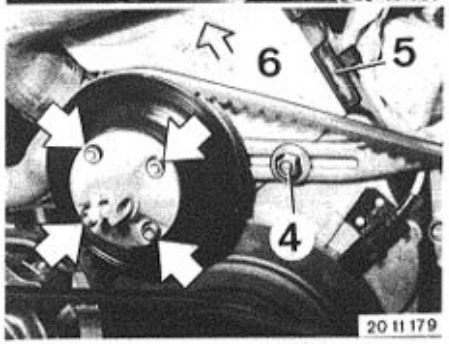
Install the guide tube with Loctite No. 270** and drive it in against the stop.

* See Specifications
** Source: HWB

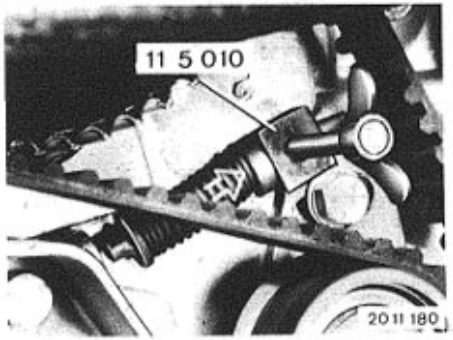


11 51 000 REMOVING AND INSTALLING WATER PUMP

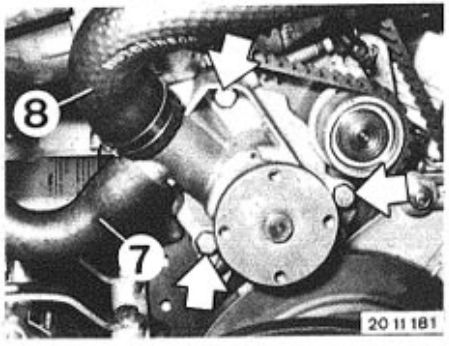
Drain coolant.
Remove distributor cap (1).
Remove distributor rotor (2).
Unscrew adapter (8).
Remove cover (3).
Unscrew bolts (4).
Remove fan 11 52 000.
Installation:
Pour in coolant and bleed the cooling system 17 00 039.
Check seal (9), replacing if necessary.



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.

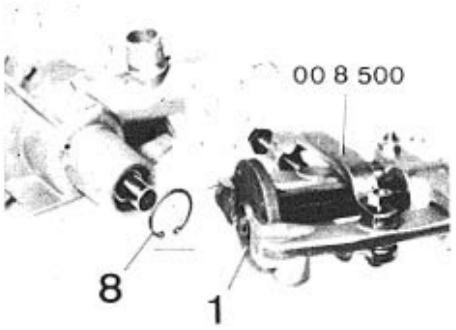


Compress the spring and clamp the pin with Special Tool 11 5 010.
Installation:
Check installed position of the pin to the water pump.



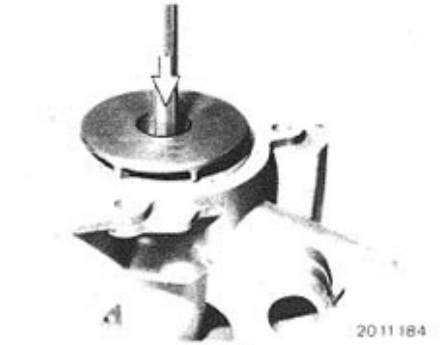
Disconnect coolant hoses (7 and 8).
Remove the water pump.
Installation:
Replace the gasket.

11 51 502 OVERHAULING WATER PUMP
– WATER PUMP REMOVED –



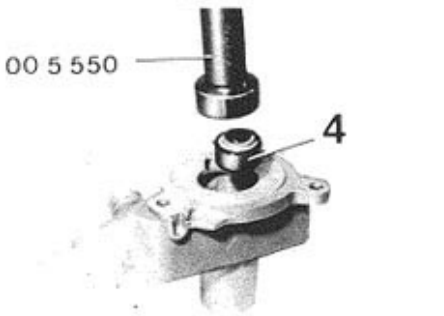
20 11 182

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



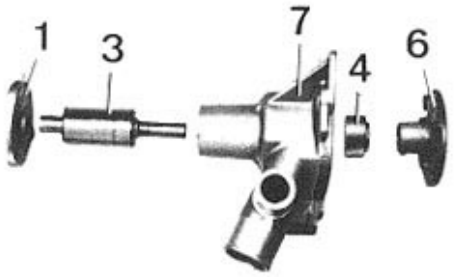
20 11 184

Press out water pump bearing.



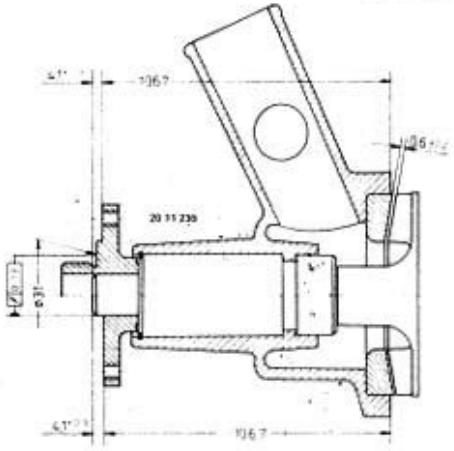
20 11 185

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

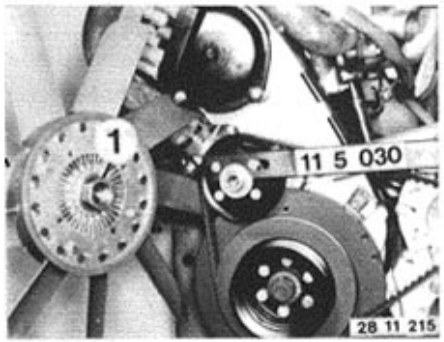


20 11 186

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).

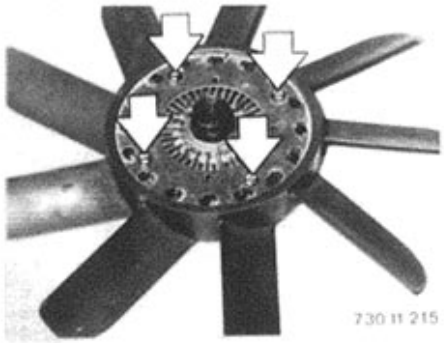


Check dimensions after assembling.



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*.

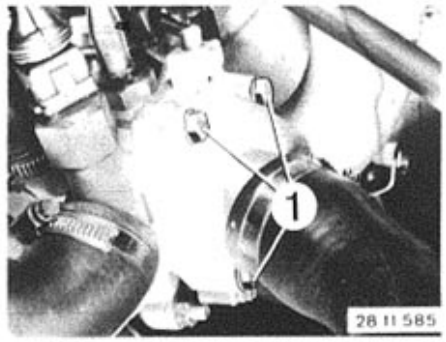


11 52 020 REPLACING FAN CLUTCH

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.

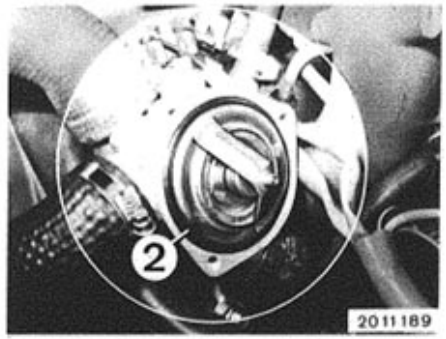
Check the switching points* with a Vibrocard***.
Unscrew the fan mounting bolts and take off the fan clutch.

* See Specifications
*** See Workshop Equipment Catalog

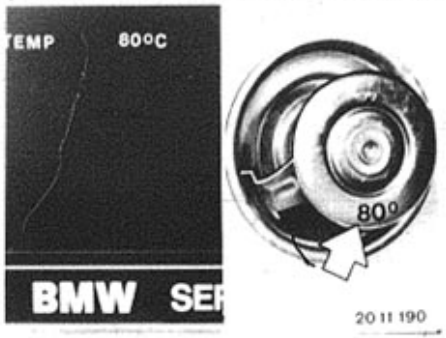


11 53 000 REMOVING AND INSTALLING COOLANT THERMOSTAT

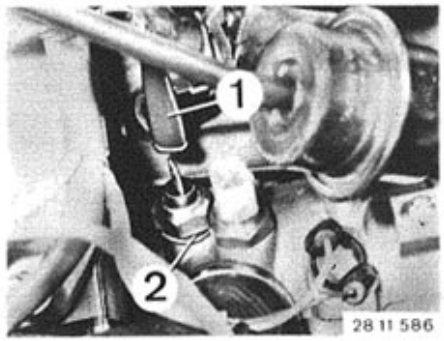
Drain some of the coolant.
Unscrew cover (1).
Installation:
Bleed the cooling system 17 00 039.



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).

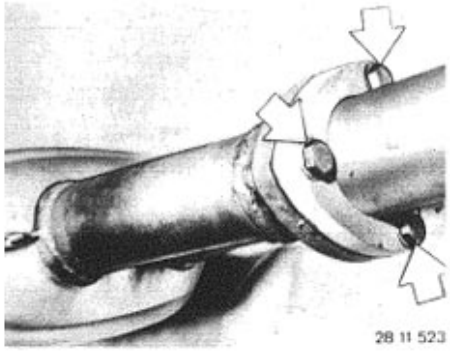


Checking Thermostat:
Check whether opening temperature agrees with the value in the Specifications.
Check opening temperature in a hot water bath and compare value with the stamped opening temperature value.



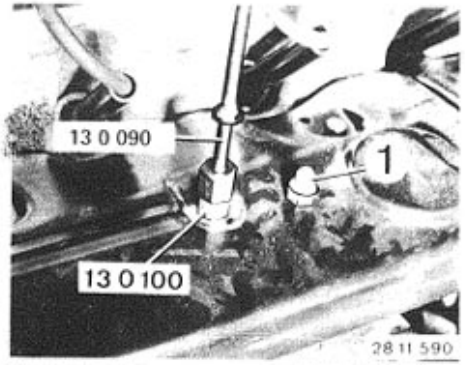
11 53 080 REPLACING TEMPERATURE TRANSMITTER

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

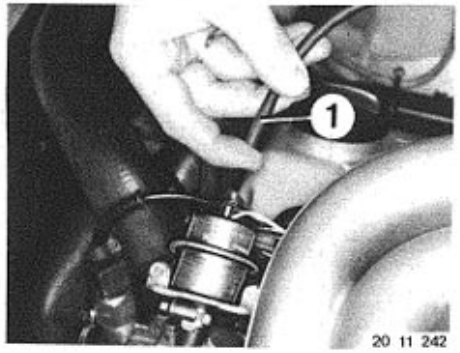

28 11 523

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

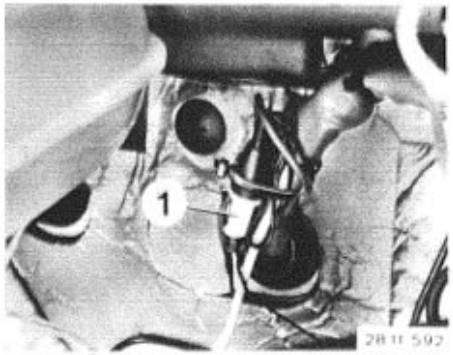


20 11 242

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.

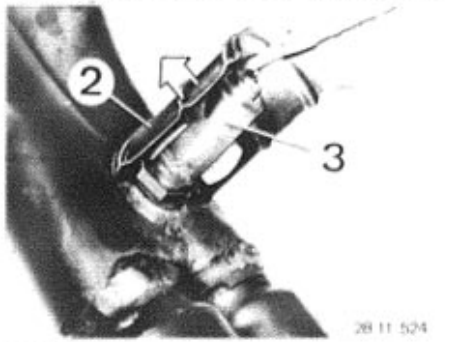


11 78 510 REPLACING OXYGEN SENSOR

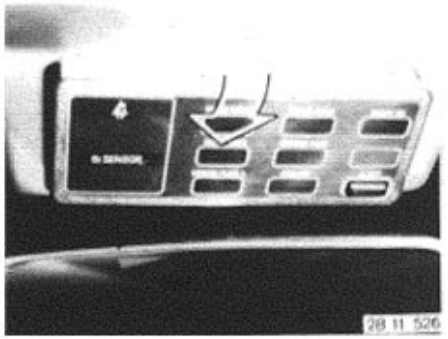
Oxygen sensors have to be replaced at intervals of 30,000 miles – see "O_2 SENSOR" lamp in check control.

- 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.

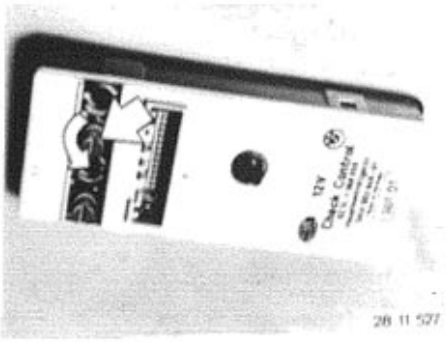
Disconnect plugs (1).
Lift wires out of clips.



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

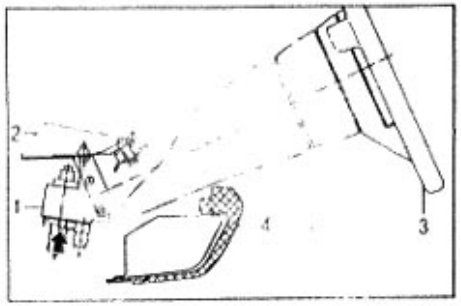


Until 1984 Models:
However, the "O_2 SENSOR" sign will light up only after the first 30,000 miles.
Lift out the check control.



Remove lamp for the "O_2 SENSOR" sign.

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



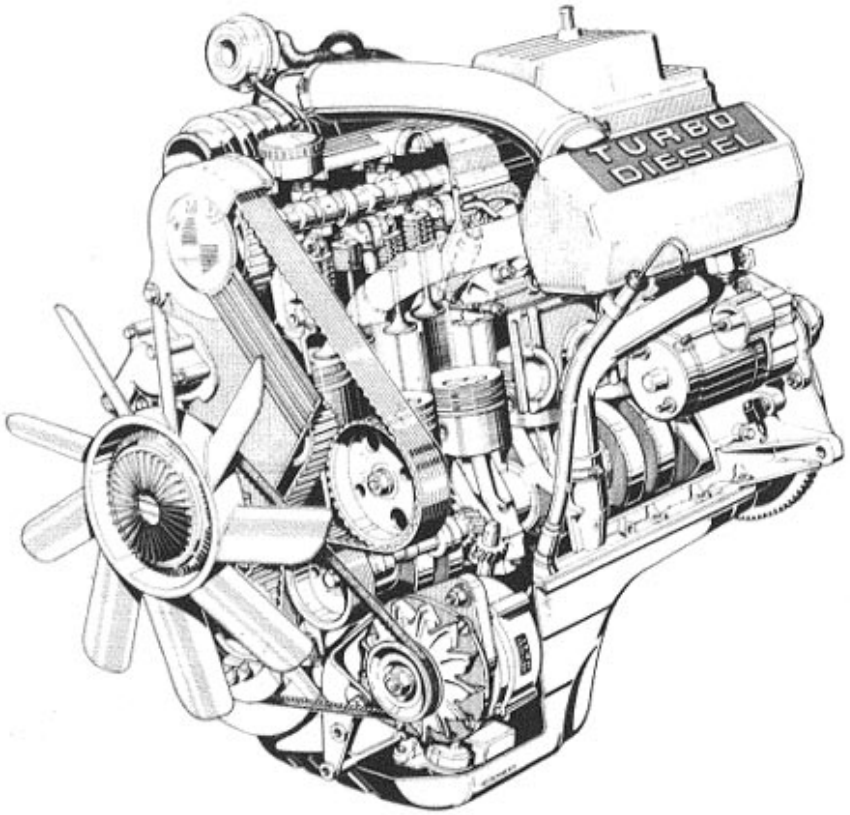
Since 1985 Models:
Reset the oxygen sensor indicator by pressing the resetter (arrow) – the "O_2 SENSOR" lamp goes out.

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

11 Engine

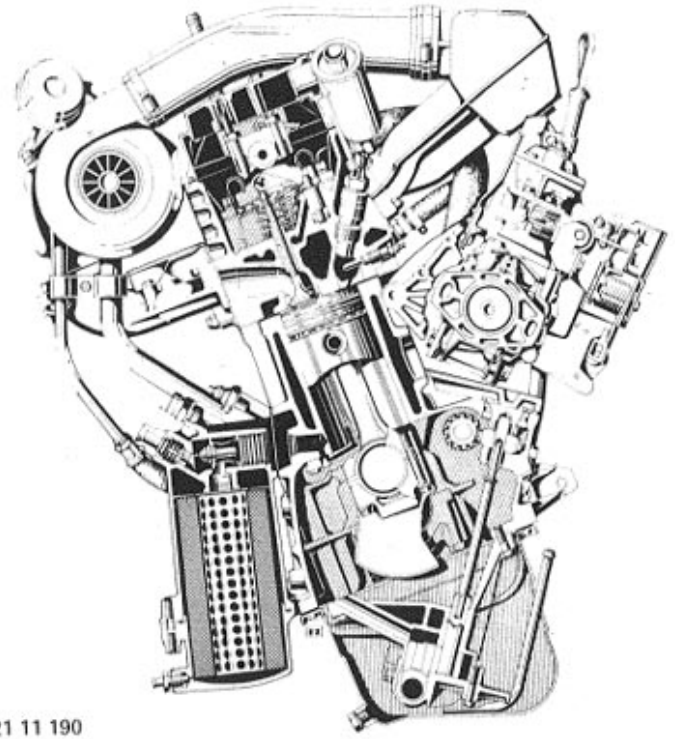
BMW 524td

	Special working instructions	11- 200a
11 00 039	Compression – check	11- 201
050	Engine – remove and install	11- 202
091	Engine – exchange	11- 204
11 11 160	Bearing for oil pump drive shaft – replace	11- 205
11 12 000	Cylinder head cover – remove and install	11- 205
100	Cylinder head – remove and install	11- 206
101	Cylinder head gasket – replace	11- 209
240	Radial oil seal in end cover – replace	11- 210
595	Valve guide – check for wear (valve removed)	11- 211
600	Valve guide – ream out (valve removed)	11- 211
607	Valve seat – machine (cylinder head disassembled)	11- 211
729	Cylinder head – check for cracks in water test (cylinder head disassembled)	11- 212
11 13 000	Oil pan – remove and install	11- 213
11 41 175	Front end cover – remove and install	11- 214
180	Radial oil seal in front end cover – replace	11- 214
605	Radial oil seal in clutch end cover – replace	11- 215
11 21 000	Crankshaft – remove and install	11- 216
501	Crankshaft – replace (crankshaft removed)	11- 217
531	Crankshaft main bearing shells - replace (engine disassembled)	11- 217
571	Pilot bearing in crankshaft – replace	11- 218
11 22 000	Flywheel – remove and install	11- 218
051	Drive plate for torque converter – replace	11- 218
11 23 010	Vibration damper – replace	11- 219
031	Vibration damper hub – replace	11- 219
11 24 521	Connecting rods – replace (pistons removed)	11- 220
571	Connecting rod bearing shells – replace (engine disassembled)	11- 220
11 25 000	Piston – remove and install	11- 221
651	Piston rings of one piston – replace (piston removed)	11- 222
11 31 000	Camshaft – remove and install	11- 223
100	Toothed belt – tighten	11- 224
110	Toothed belt – remove and install	11- 225
11 33 050	Rocker arm – replace	11- 226
11 34 004	Valve clearance – adjust	11- 226
509	Valves – check for leaks (camshaft removed)	11- 226
550	Valves – remove and install	11- 227
11 35 020	Intermediate shaft – remove and install	11- 227
	Engine oil circuit	11- 228
11 40 000	Engine oil pressure – check	11- 229
11 41 000	Oil pump – remove and install	11- 230
11 42 020	Oil filter – replace	11- 231
650	Oil spray jet – remove and install/replace (crankshaft removed)	11- 231
11 51 000	Water pump – remove and install	11- 231
502	Water pump – overhaul (water pump removed)	11- 232
11 52 000	Fan – remove and install	11- 233
020	Fan coupling – replace	11- 233
11 53 000	Coolant thermostat – remove and install	11- 233
080	Temperature transmitter – replace	11- 233
11 61 450	Charging air pressure blow-off valve – remove and install	11- 234
11 65 015	Bearing play of turbocharger – check (turbocharger removed)	11- 235
018	Charging air pressure of turbocharger – check	11- 235
020	Turbocharger – remove and install	11- 236
059	Control valve – check and adjust	11- 237
060	Control valve – remove and install	11- 237
11 66 000	Vacuum pump – remove and install	11- 237
	Emission control layout – 524 td	11- 238
11 70 009	Emission control – check	11- 239
11 71 501	EGR valve – replace	11- 241



M21 11 191

M 21 D 24 = BMW 524 td



M21 11 190

WORKING INSTRUCTIONS

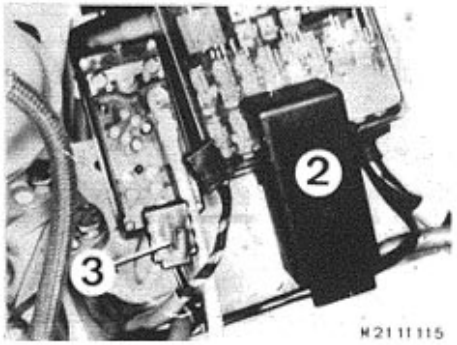
These instructions concern cleanliness when working on fuel supply and control systems.

- 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

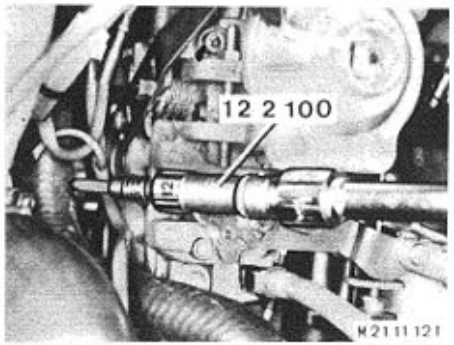
Injection Pump Attachments:

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

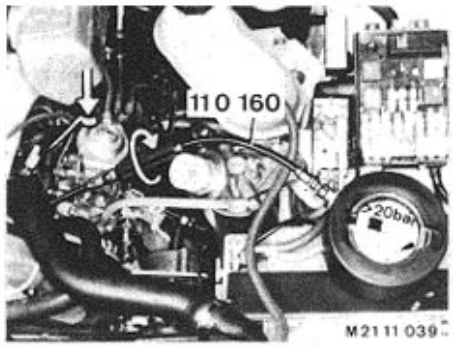


11 00 039 CHECKING COMPRESSION

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.



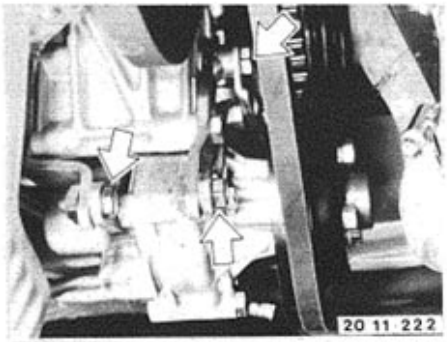
Unscrew the glow plugs with Special Tool 11 2 100 – see Group 12.
Installation:
Screw in the glow plugs with copper paste "CRC"**.
Tightening torque***.



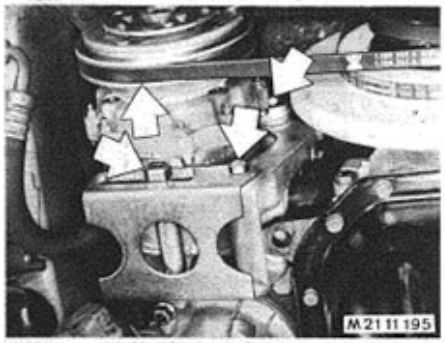
Screw in compression tester 11 0 160 together with an adapter completely and tighten slightly by hand.
Press the manual stopping lever forward and measure the compression pressure*.
Operate the starter so long, until the pressure stops rising – the compression tester has completed the test.

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

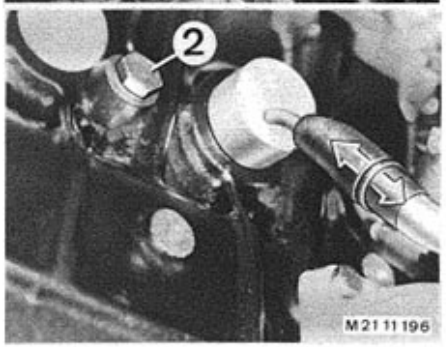
11 00 050 REMOVING AND INSTALLING ENGINE



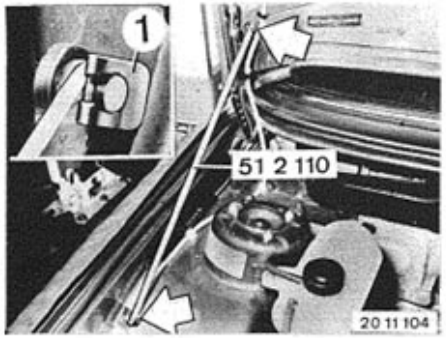
Remove transmission – see Group 23 or 24.
Unscrew power steering pump.
Pressure hoses remain connected.
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.



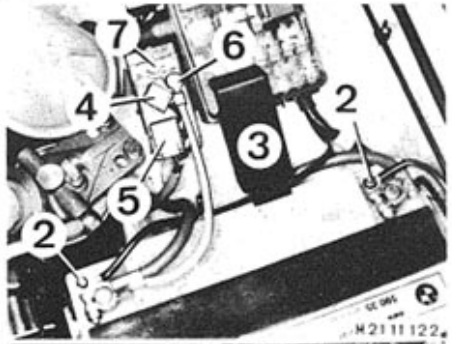
Unscrew compressor.
Refrigerant hoses remain connected.
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.



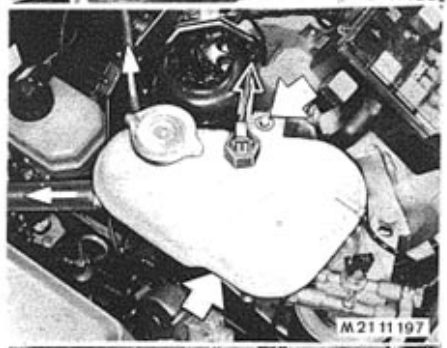
Unscrew plug (2) and drain coolant.
Remove radiator 17 11 000.
Remove circlip and disconnect power lead.



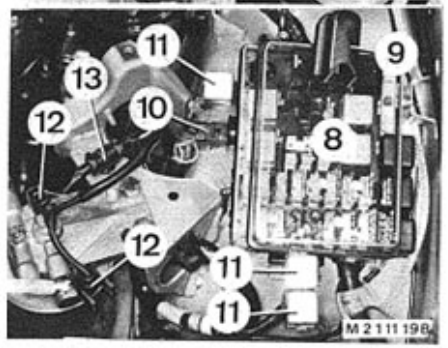
Unscrew ground wire for hood.
Disconnect or remove gas pressure props and prop up engine hood with Special Tool 51 2 110.
Caution!
Use locks (1).



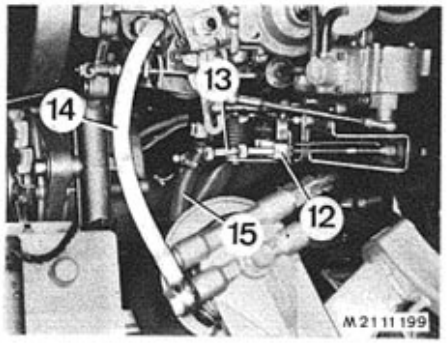
Disconnect negative and positive leads on battery.
Unscrew wire (2).
Lift off cover (3) and pull off plugs (4 and 5).
Unscrew wire (6).
Remove preheating time control unit (7).



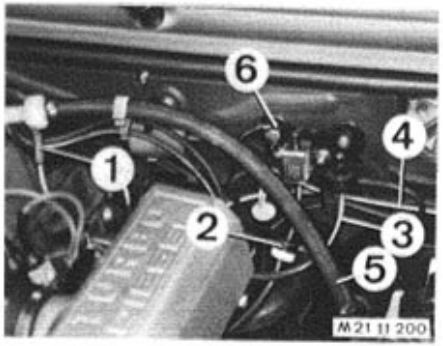
Remove tank.



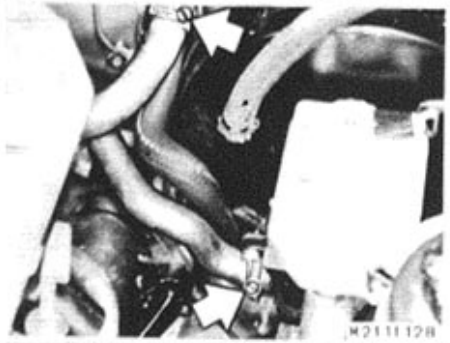
Take off cover (8) and lift off cap (9).
Pull off plug (10) and lift out relay (11).
Pull off plug (12).
Disconnect plug (13).
Unscrew wire harness on body.



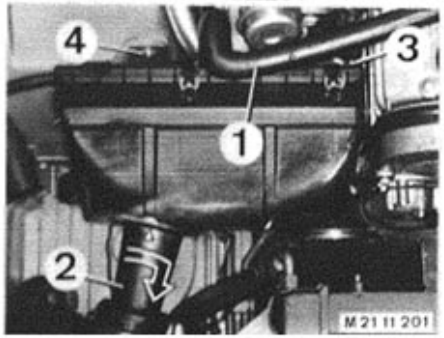
Disconnect accelerator cable (12) and cruise control cable (13).
Disconnect fuel hoses (14 and 15).
Installation:
Adjust accelerator cable, see 35 41 421.
Adjust cruise control cable, see Group 65.



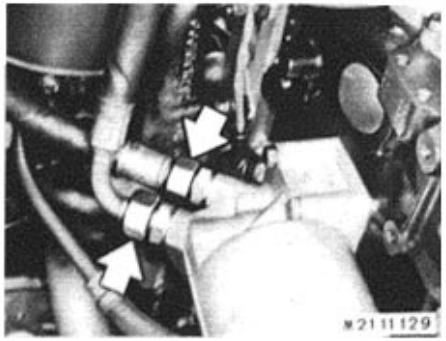
Disconnect hoses (1 ... 5).
Pull off plug (6) and disconnect wire.



Disconnect water hoses for heater.

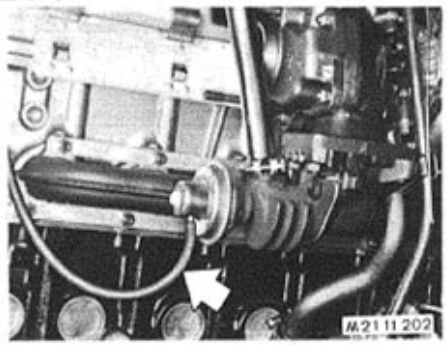


Disconnect hose (1).
Turn out hose (2).
Loosen clamp (3).
Unscrew nut (4) and remove air cleaner.
Installation:
Turn arrow to face up.

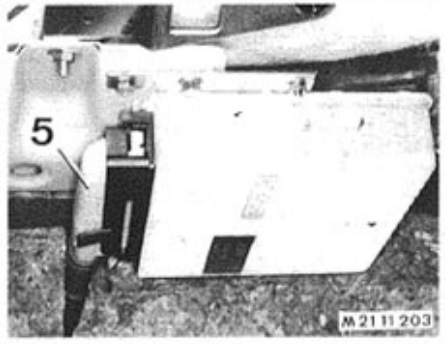


Unscrew oil lines on oil cooler.
Installation:
Pour in engine oil***.

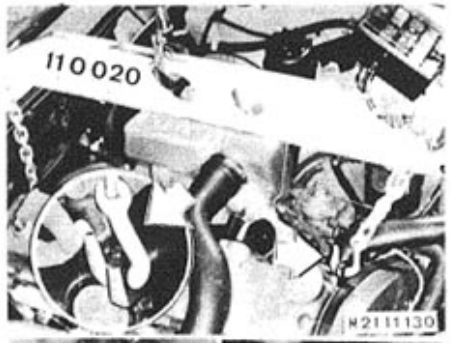
*** See Service Information of Gr. 00



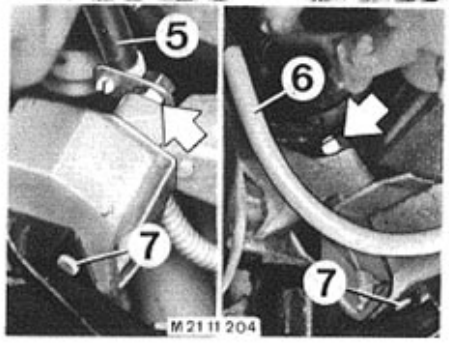
Pull off hose.



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

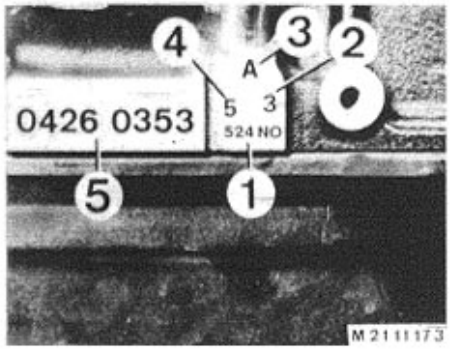


Attach Special Tool 11 0 020 on engine.



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



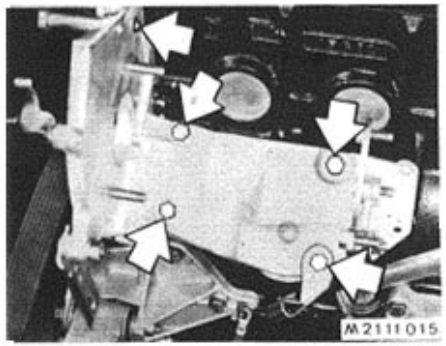
11 00 091 INSTALLING EXCHANGE ENGINE

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.

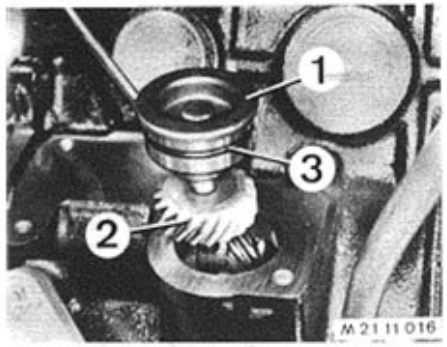
Install engine.
Check static adjustment of injection pump, see 13 51 005.
Check engine performance, see 13 00 050.

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

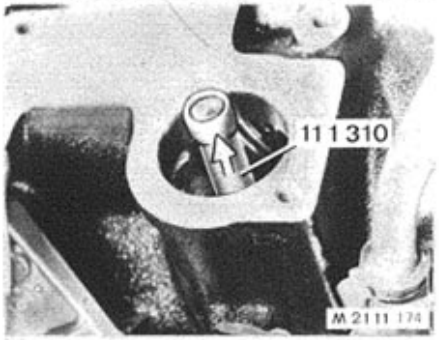


11 11 160 REPLACING BEARING FOR OIL PUMP DRIVE SHAFT

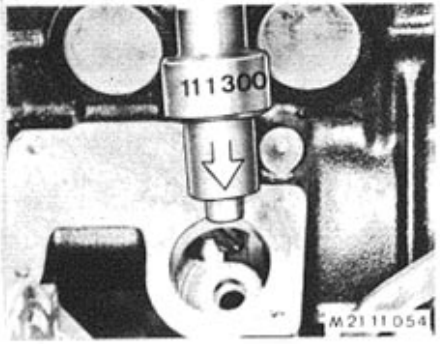
Remove oil pump 11 41 000.
Remove injection pump, see Group 13.
Unscrew the console.



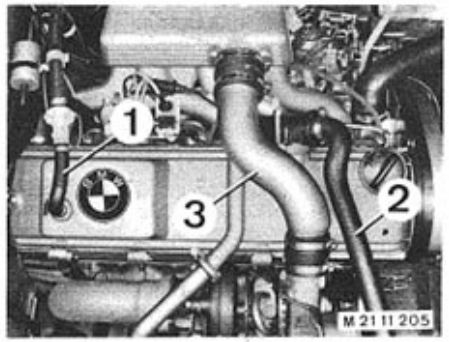
Lift out cover (1).
Remove gear (2).
Installation:
The open end of the gear shaft faces down.
Check bearing in cover (1) and seal (3), replacing if necessary.



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

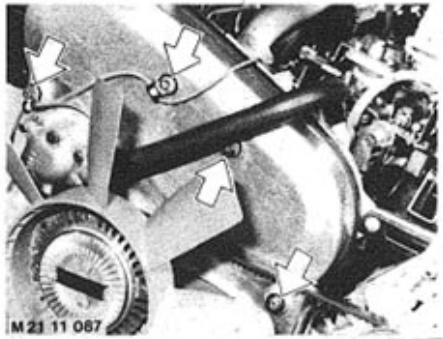


Installation:
Lubricate the needle bearings.
Drive in needle bearing against the stop with Special Tool 11 1 300.

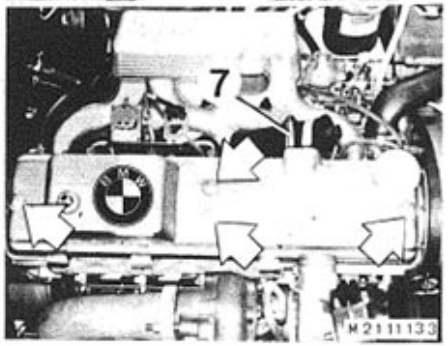


11 12 000 REMOVING AND INSTALLING CYLINDER HEAD COVER

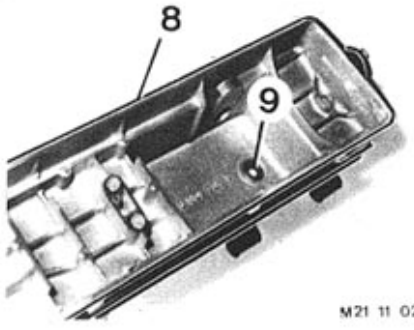
Disconnect hoses (1 and 2).
Remove pipe (3).



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

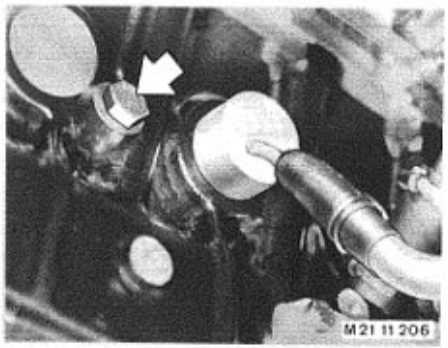


Unscrew oil trap (7).
Unscrew threaded sleeves and take off the cylinder head cover.
Installation:
Install the threaded sleeves with seals.
Check seal on the oil trap, replacing if necessary.



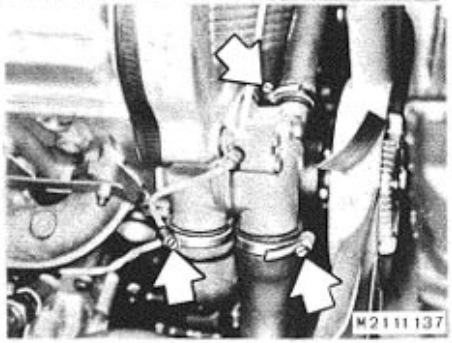
Installation:
Check cylinder head cover gasket (8) and rubber ring (9), replacing if necessary.
Insert rubber ring (9) in cover and lubricate with oil.
Tightening torque*.

* See Specifications

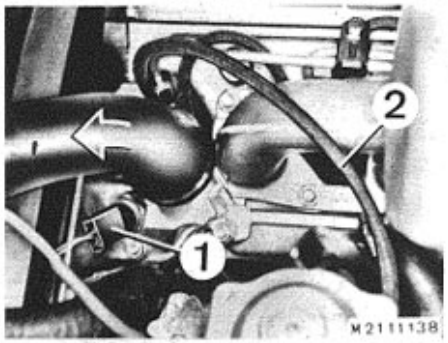


11 12 100 REMOVING AND INSTALLING CYLINDER HEAD

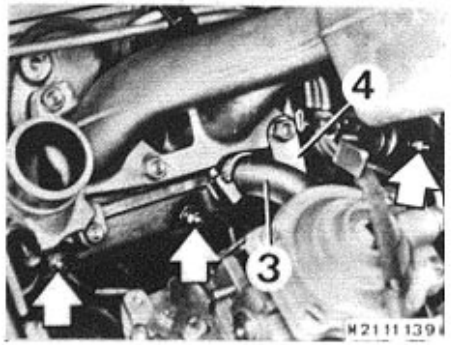
Remove turbocharger, see 11 65 020.
Unscrew plug and drain coolant.
Disconnect battery ground lead.
Installation:
Pour in coolant*** and bleed cooling system 17 00 039.
Replace engine oil***.



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

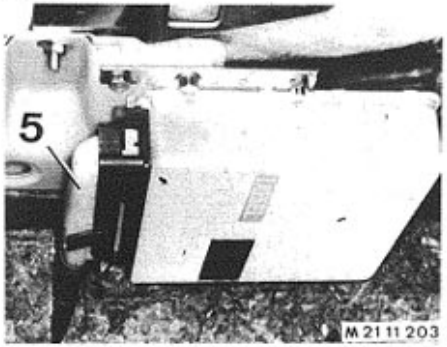


Disconnect coolant hose.
Pull off plug (1).
Pull off leak oil line (2).

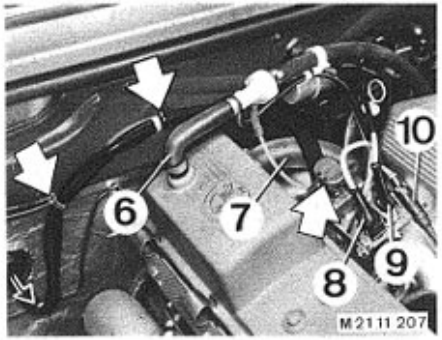


Disconnect coolant hose (3).
Unscrew holder (4).
Unscrew wires on heater plugs.

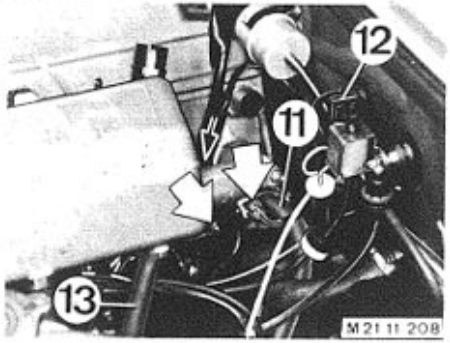
*** See Service Information of Gr. 00



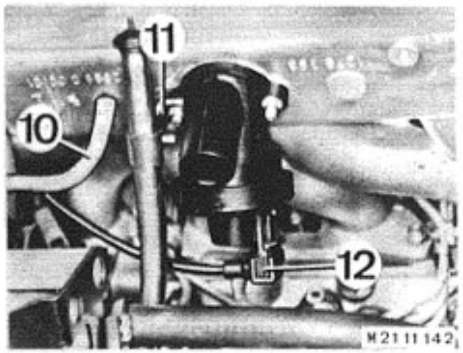
Pull off plug (5) on control unit in glove box.



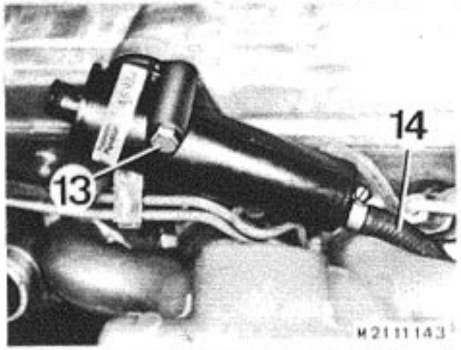
Disconnect engine wire harness and pull into engine compartment.
Pull off hoses (6 and 7).
Disconnect plugs (8 ... 10).
Disconnect diagnosis plug.
Installation:
Always connect two gray plugs (9) together.



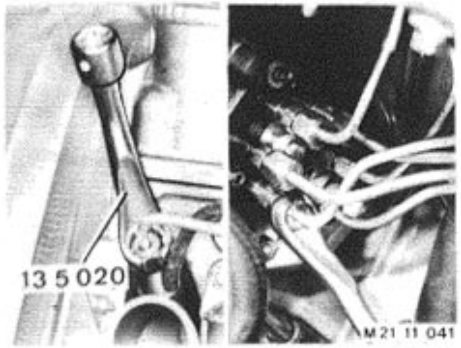
Disconnect coolant hose (11).
Unscrew wires on heater plugs.
Pull off plugs on temperature sensors.
Pull off plug (12).
Unscrew support (13).
Disconnect wire harness and lead it down.



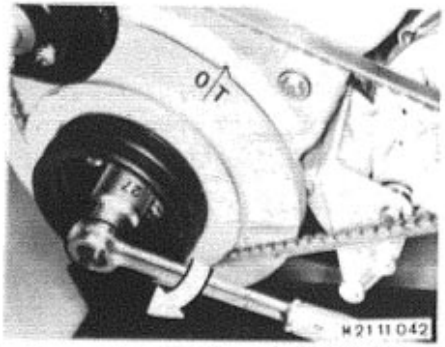
Pull off hose (10).
Unscrew holder (11).
Pull off plug (12).



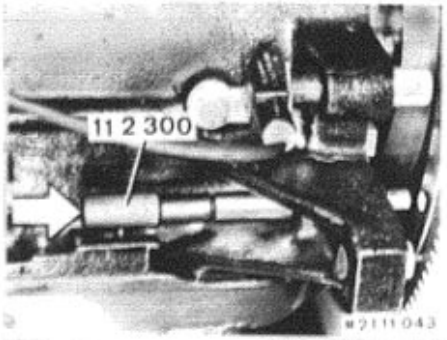
Unscrew oil trap (13).
Pull off hose (14).
Installation:
Check seal, replacing if necessary.



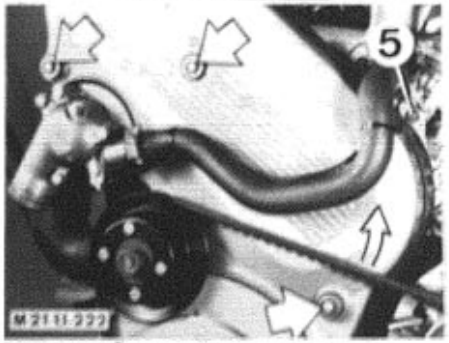
Unscrew injection lines on fuel injectors and injection pump with Special Tool 13 5 020.
Install protective caps.
Remove cylinder head cover, see 11 12 000.
Installation:
Tightening torque: 20 to 25 Nm (14 to 18 ft. lbs.).
Screw on injection lines and bleed fuel system, see 13 51 . . ..



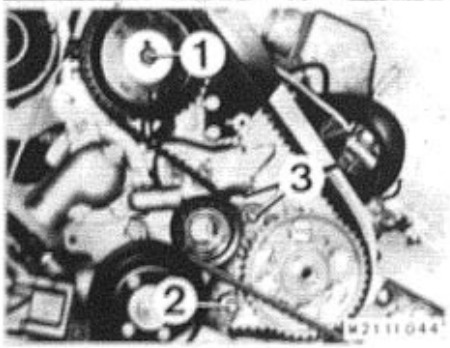
Turn cylinder no. 1 to TDC – cyl. no. 6 overlaps.



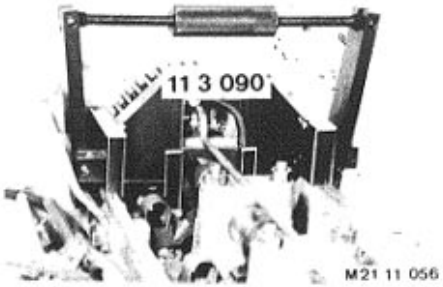
Hold the crankshaft with Special Tool 11 2 300.



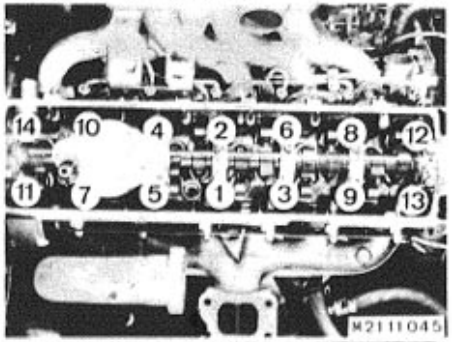
Remove hose (5) and the protective cover.
Installation:
First tighten the cylinder head cover and then the protective cover.



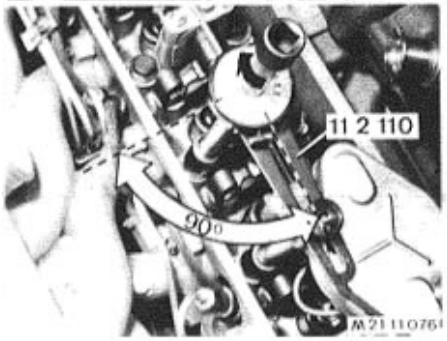
Loosen screws (1 and 2) and nut (3).
Loosen the drive belt and take it off of the camshaft sprocket.



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.



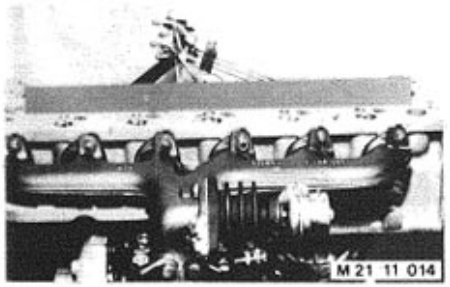
Unscrew the bolts in order of 14 to 1 and take off the cylinder head.
Installation:
Keep oil out of the cavities, since otherwise the bolts tightened with the correct torque will not exert sufficient force on the cylinder head and, in addition, the crankcase might be cracked.
Clean the cylinder head 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.



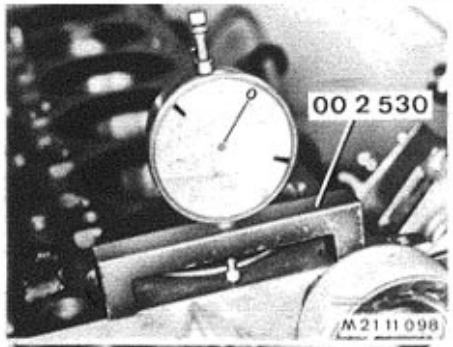
Tighten the bolts in three steps in order of 1 to 14.
Tightening torque*.
Adjust the valve clearance 11 34 004.
Check the static adjustment of the injection pump 13 51 005.
In the third step (cylinder head cover removed again after running the engine warm) the cylinder head bolts are tightening to the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

* See Specifications

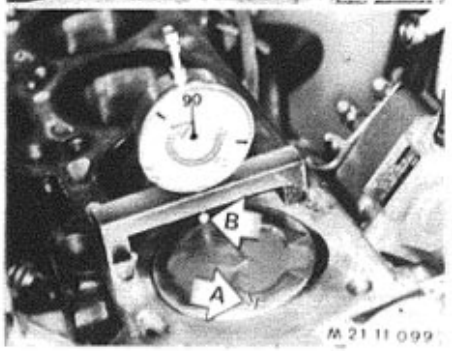
11 12 101 REPLACING CYLINDER HEAD GASKET



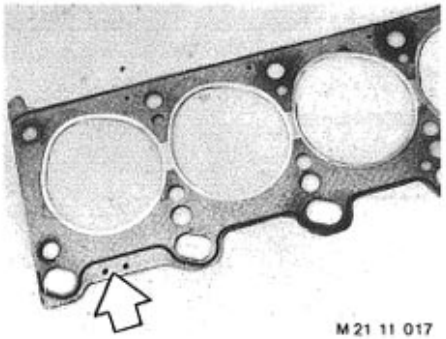
Remove the cylinder head 11 12 100.
Clean the sealing surfaces on the cylinder head and crankcase thoroughly with a sealant remover** and hard wood scraper carefully (even slight scoring would render the engine to leak due to the high compression).
Check the levelness with a standard steel ruler*.
The 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.



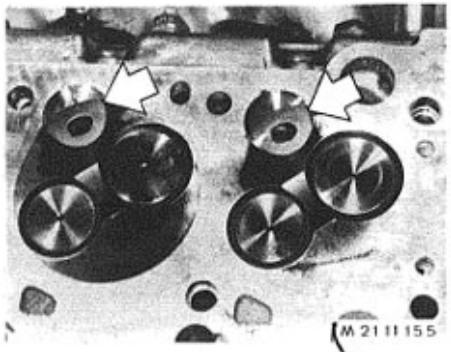
Place the dial gage on checkpoint "A" of the cleaned piston and find the highest point by turning the crankshaft.
Note the displayed value = "piston protrusion A".
Set up the dial gage on checkpoint "B" and note "piston protrusion B".
The mean value of "A" + "B" is the "piston protrusion" of a piston.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



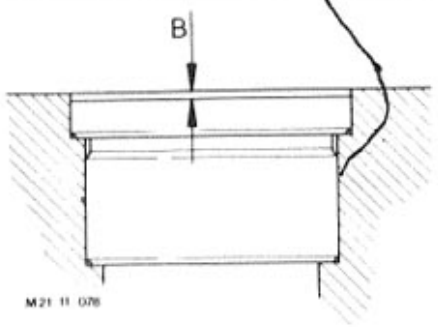
The piston with the highest "piston protrusion" determines the thickness of the cylinder head gasket.

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.

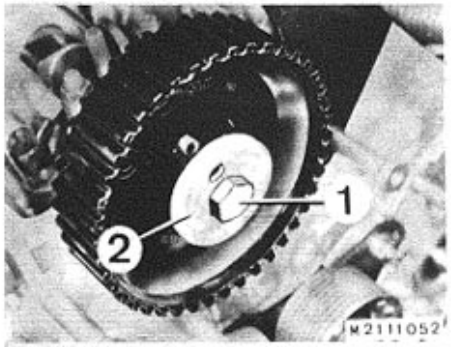


Burner retrusion "distance B"*.

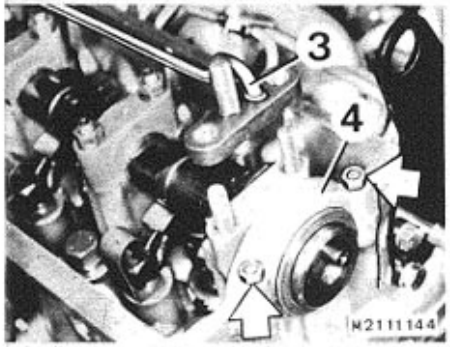
* See Specifications
** Source: HWB

* See Specifications

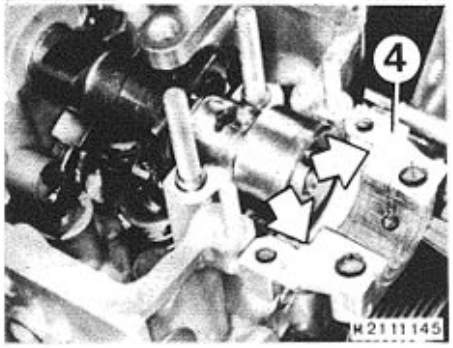
11 12 240 REPLACING RADIAL OIL SEAL IN END COVER



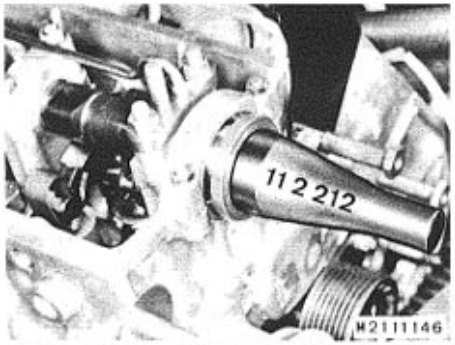
Remove drive belt 11 31 110.
Unscrew the drive belt sprocket (1).
Installation:
Slide slot of sprocket and bore of washer (2) over the pin of the camshaft.



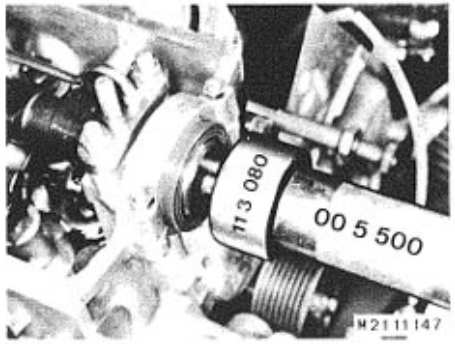
Unscrew the oil line (3) and bearing cap (4).
Pull off the radial oil seal.



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

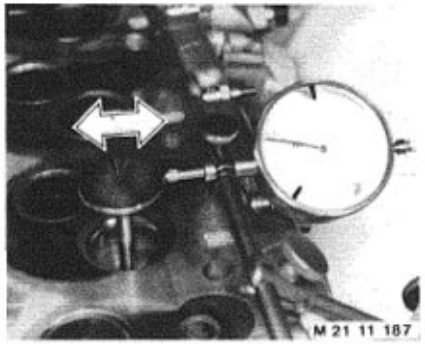


Slide on the radial oil seal over Special Tool 11 2 212.
Lubricate the sealing lip with oil.



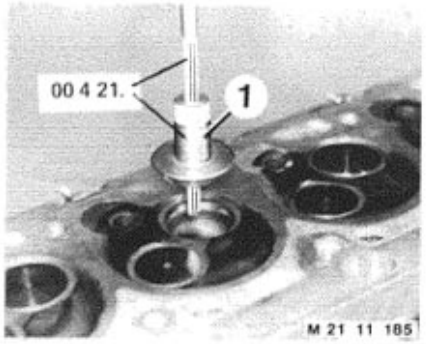
Press in the radial oil seal with Special Tools 11 3 080 and 00 5 500.
Press in the new radial oil seal against the stop, in contradiction to the standard seal which had been pressed in flush.

* See Specifications
** Source: HWB



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

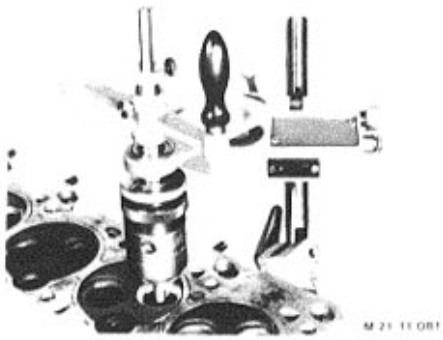
To measure, install a new valve that its stem end is flush with the valve guide.
Apply the dial gage and measure the tilt clearance.
Max. permissible tilt clearance*.



11 12 600 REAMING OUT VALVE GUIDE
– Valve Removed –

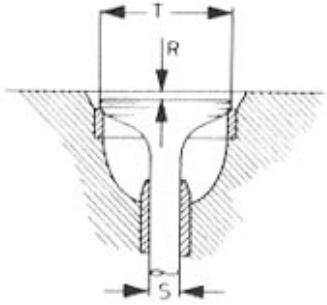
If there is excessive play between the valve guide and valve stem, see 11 12 595, ream out the valve guide and install a valve with a larger stem diameter "S"*.
The valve seat must also be machined in conjunction with this step, see 11 12 607.
Press guide mushroom (1) on to the valve seat and ream out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

* See Specifications

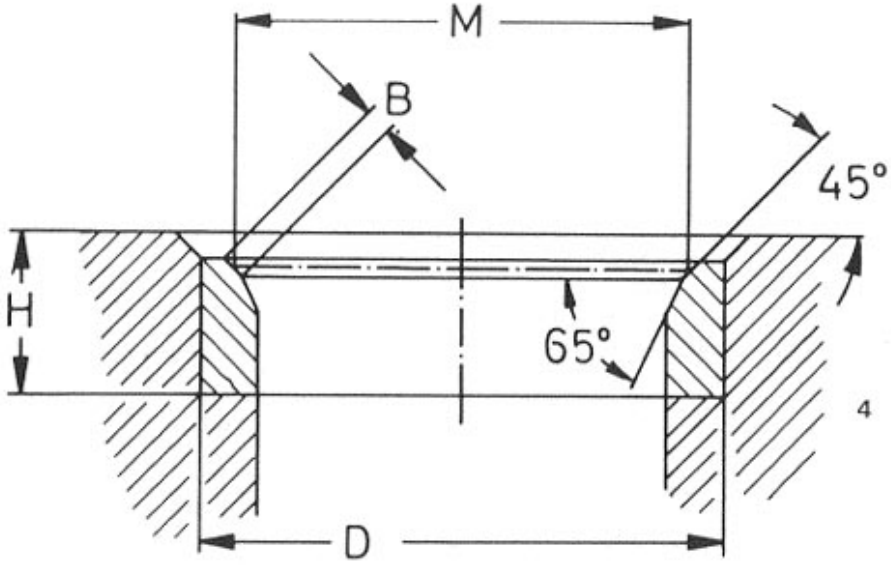


11 12 607 MACHINING VALVE SEAT
– Cylinder Head Disassembled

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.

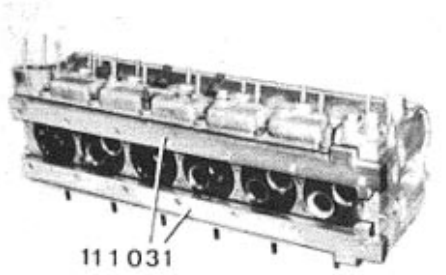


Valve retrusion R*.
Produce the valve seat diameter M* and valve seat width B* by grinding the correction angles* after machining the valve seat angle*.
The valves must not be ground in.
Check the valves for leaks 11 34 509.



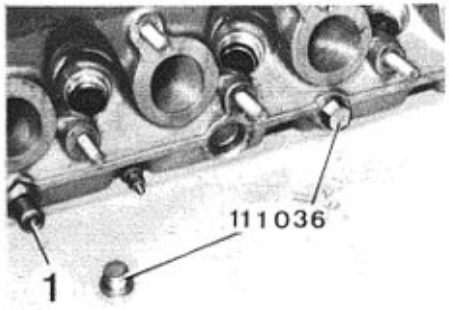
* See Specifications

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



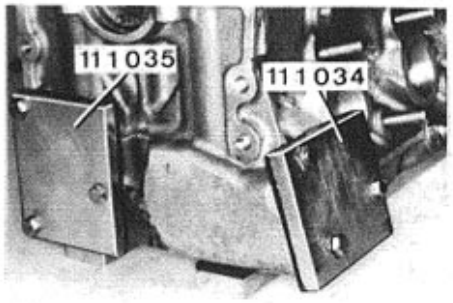
M 2111083

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



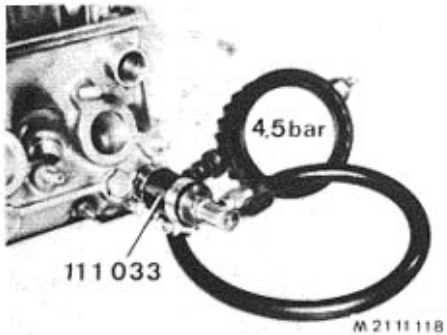
M 2111100

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

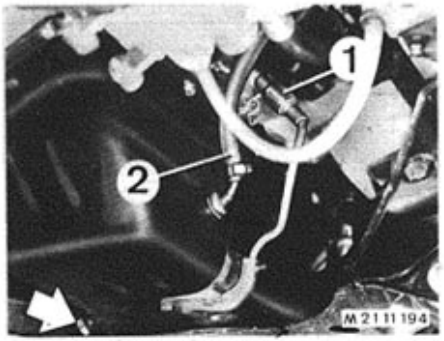
Install Special Tools 11 1 034 and 11 1 035.



M 2111118

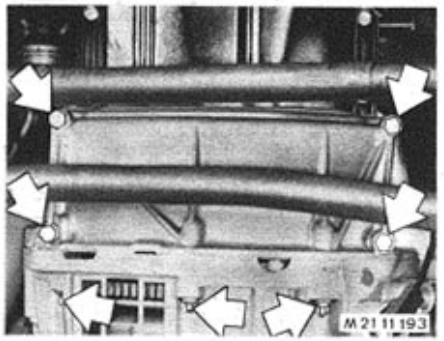
Install Special Tool 11 1 033.
Apply 4.5 bar (64 psi) air pressure on cylinder head and check for leaks (cracks) by placing the head in a water bath.
Note:
Relax the water bath with a detergent.

** Source: HWB

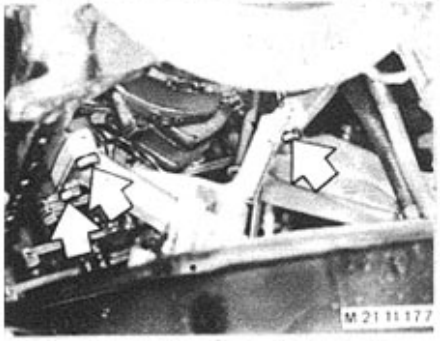


11 13 000 REMOVING AND INSTALLING OIL PAN

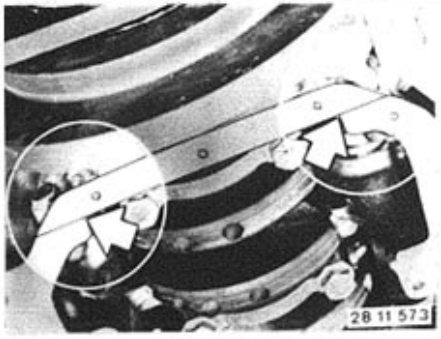
Drain engine oil.
Lift out and disconnect plug (1).
Disconnect hose (2).
Installation:
Pour in engine oil***.



Unscrew reinforcement plate.

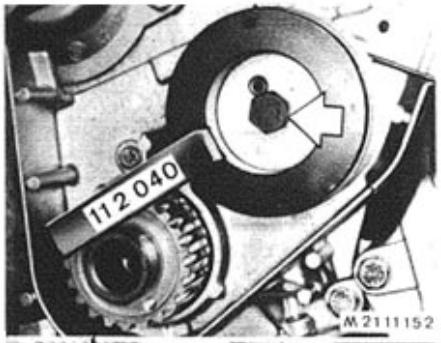


Unscrew oil pan.
Unscrew oil pump and remove oil pan.
Installation:
Insert drive shaft for oil pump, see 11 41 000.
Replace gasket.



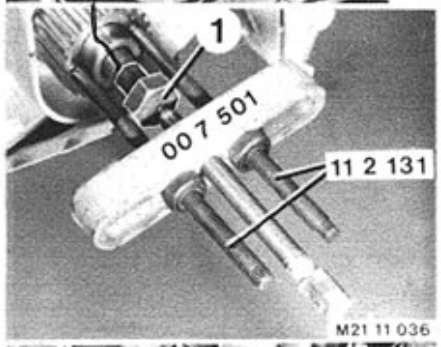
Installation:
Clean sealing surfaces.
Coat mating surfaces on timing case cover and end cover with universal sealing compound**.

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

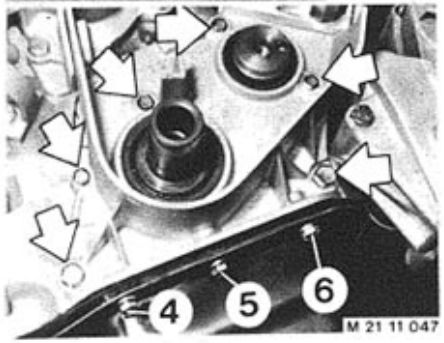


11 14 175 REMOVING AND INSTALLING FRONT END COVER

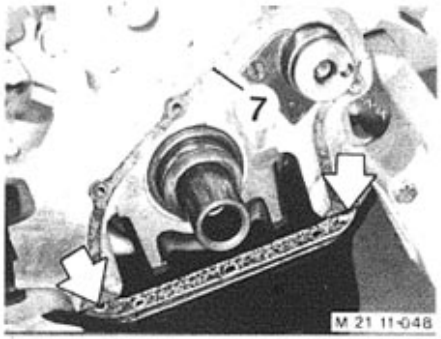
Remove hub for vibration damper – see 11 23 031.
Remove the drive belt, see 11 31 110.
Hold the intermediate shaft sprocket with Special Tool 11 2 040.
Unscrew the bolt.
Take off the washer and sprocket.
Installation:
Guide the centering pin into the bore.



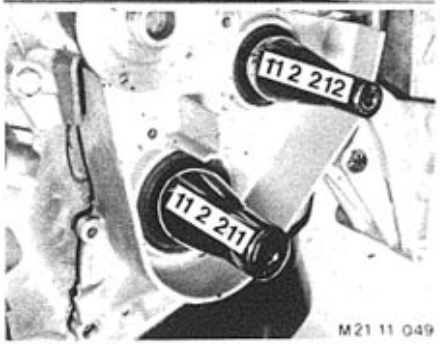
Screw in bolt (1).
Pull the sprocket off of the crankshaft with Special Tools 00 7 501 and 11 2 131.
Important!
Woodruff key.
Installation:
Mount the sprocket that the stepped side faces forward.



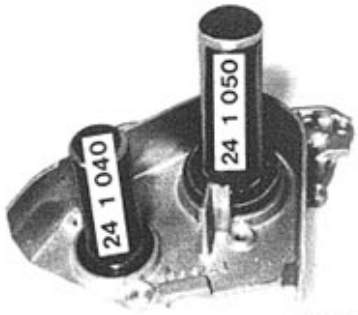
Unscrew bolts (4 ... 6).
Only loosen the other oil pan bolts.
Loosen the oil pan gasket on the end cover carefully with a knife.
Remove the cover.



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).



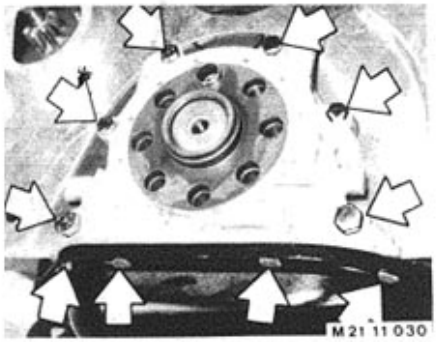
Check the radial oil seals, replacing if necessary.
Install the end cover with Special Tools 11 2 211 (crankshaft) and 11 2 212 (intermediate shaft).



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.

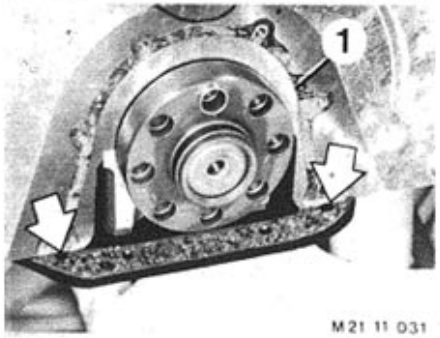
** Source: HWB



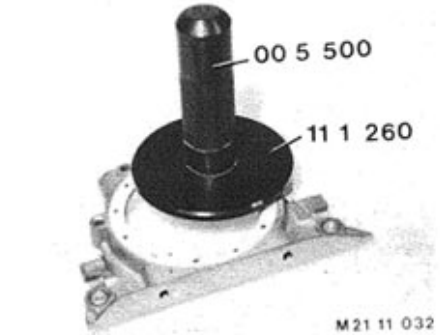
11 14 605 REPLACING RADIAL OIL SEAL IN CLUTCH END COVER

– Transmission Removed –

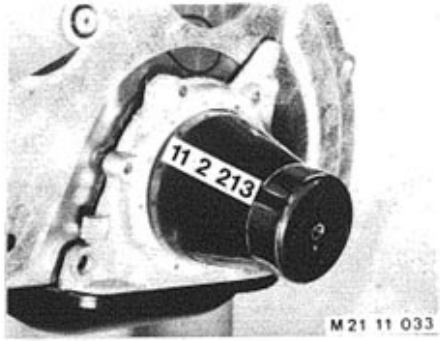
Remove the flywheel, see 11 22 000.
Unscrew the oil pan/end cover bolts.
Only loosen the other oil pan bolts.
Loosen the oil pan gasket on the end cover carefully with a knife.
If the oil pan gasket is damaged, remove the oil pan and replace the gasket, see 11 13 000.
Remove the end cover.



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

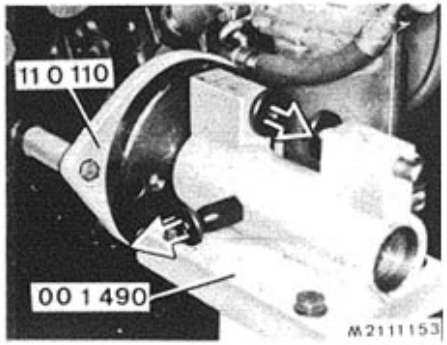


Press in the radial oil seal with Special Tools 11 1 260 and 00 5 500.
Press in the new radial oil seal 1 to 2 mm (0.039 to 0.079") deep, in contradiction to the standard seal which had been pressed in flush.
Lubricate the sealing lip with oil.



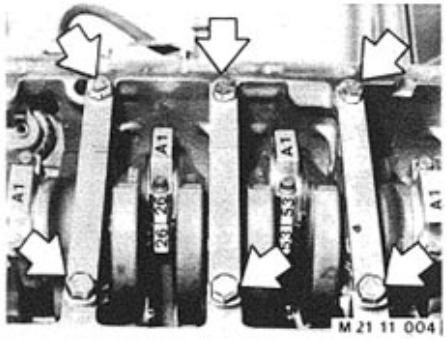
Installation:
Install the end cover with Special Tool 11 2 213.

** Source: HWB

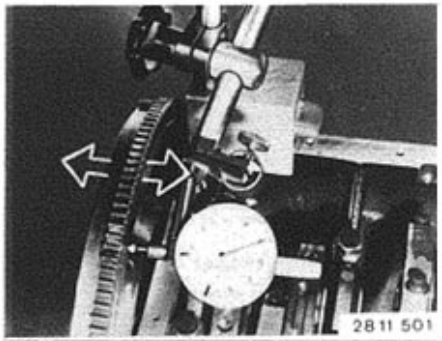


11 21 000 REMOVING AND INSTALLING CRANKSHAFT

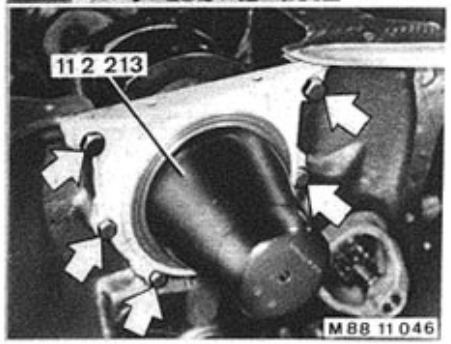
Remove the engine, see 11 00 050.
Mount the engine block on Special Tool 11 0 110 in Special Tool 00 1 490.



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.

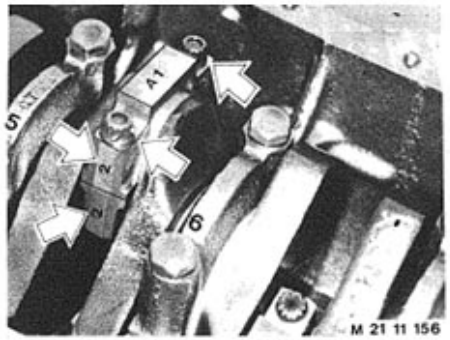


Measure the axial play* before removing the crankshaft.
Check / replace the thrust bearing, if the maximum permissible play is exceeded.

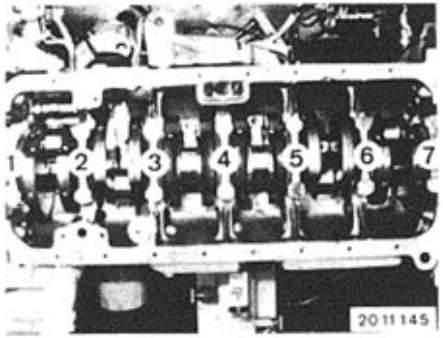


Remove the flywheel, see 11 22 000.
Remove the end cover.
Installation:
Replace the gasket.
Use Special Tool 11 2 213 to avoid damage on the radial oil seal.
Cut off the gasket on the oil pan sealing surface.

* 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

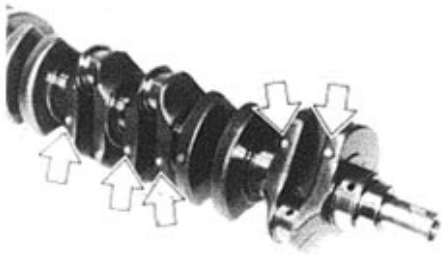


28 11 307

11 21 501 REPLACING CRANKSHAFT
– Crankshaft Removed –

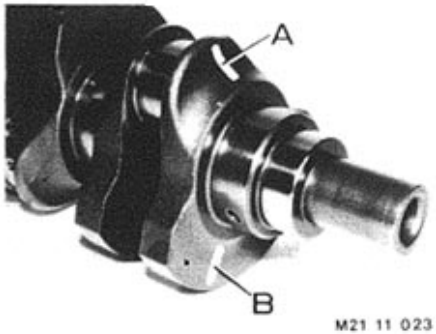
Crankshaft Identification:

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



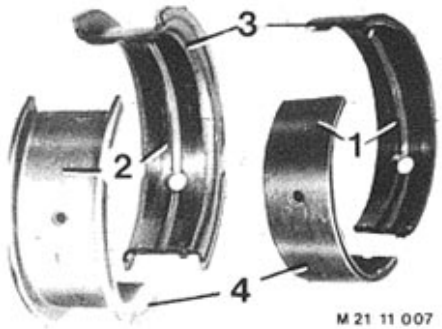
28 11 308

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

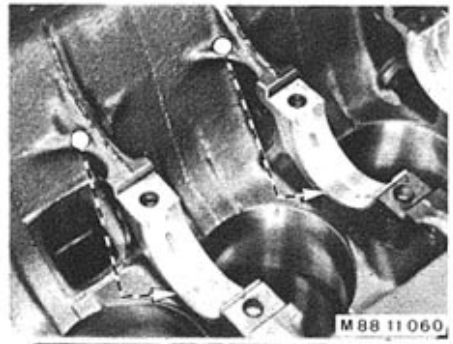
* See Specifications



M 21 11 007

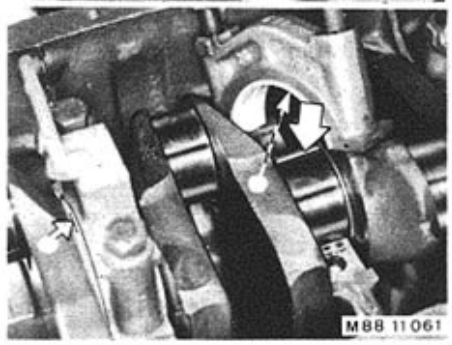
11 21 531 REPLACING CRANKSHAFT MAIN BEARING SHELLS
– Engine Disassembled –

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.).



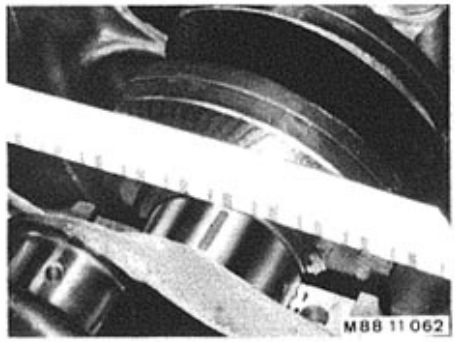
M88 11 060

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

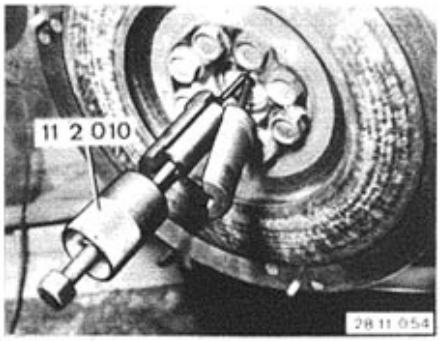
Install bearing shells in the bearing caps to the color codes of the shaft.



M88 11 062

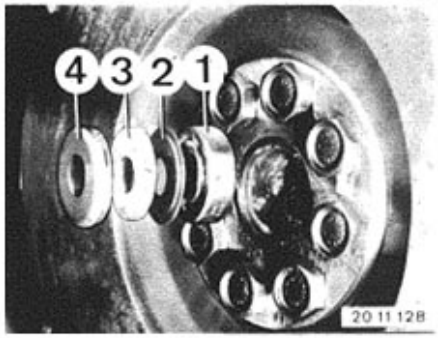
Place Type PG-1 Plastigage on crankshaft wiped clean of oil and tighten bearing caps to the correct torque*.
Do not turn the crankshaft.
Source for Plastigage:
Cartool
Alfred-Brehm-Str. 5
D-8070 Ingolstadt / West Germany
Remove the bearing caps.
Read the bearing play* from the width of the flattened 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

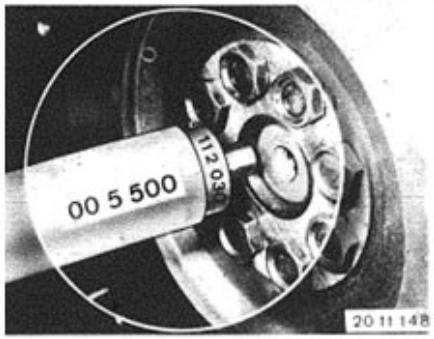


11 21 571 REPLACING PILOT BEARING IN CRANKSHAFT

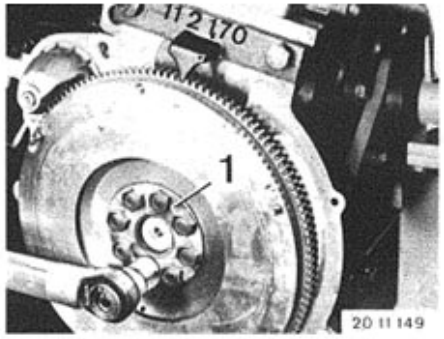
Remove the clutch, see 21 21 000.
Pull out the ball bearing with Special Tool 11 2 010.



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

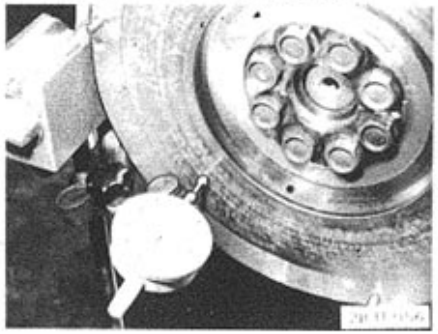


Pack bore in the crankshaft with approx. 1 gr. of lubricating grease.
Drive in the pilot bearing with Special Tools 11 2 030 and 00 5 500.



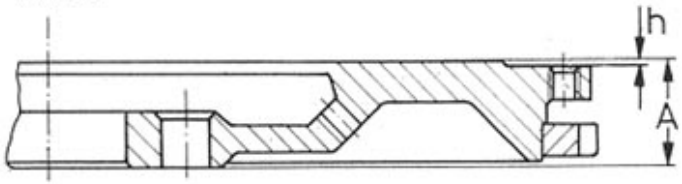
11 22 000 REMOVING AND INSTALLING FLYWHEEL

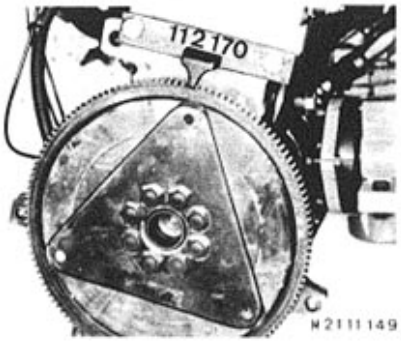
Remove the clutch, see 21 21 000.
Hold the flywheel with Special Tool 11 2 170.
Unscrew the bolt and take off the flywheel.
Installation:
Clean the tapped bores.
Insert ring (1).
Replace and install the new expansion bolts with a bolt cement**.
Tightening torque*.



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.

M 88 11 072

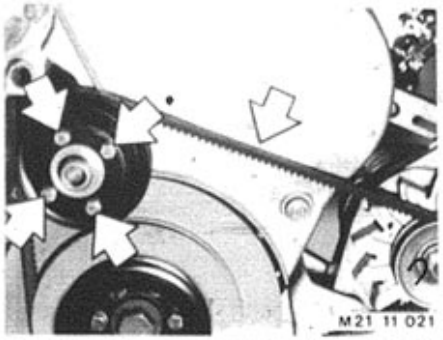


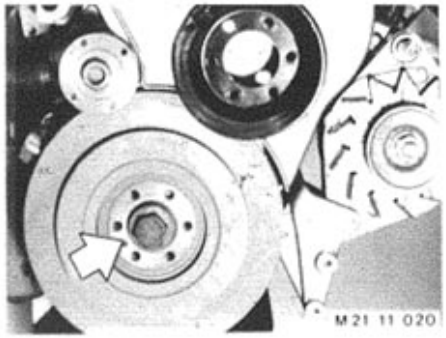


11 22 051 REPLACING DRIVE PLATE FOR TORQUE CONVERTER

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

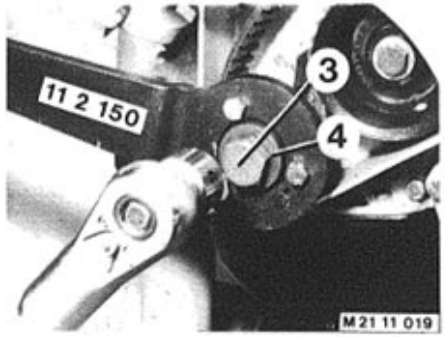


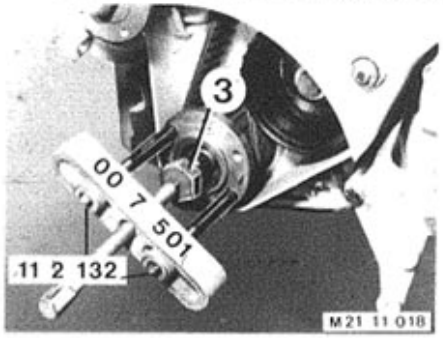


11 23 010 REPLACING VIBRATION DAMPER

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.



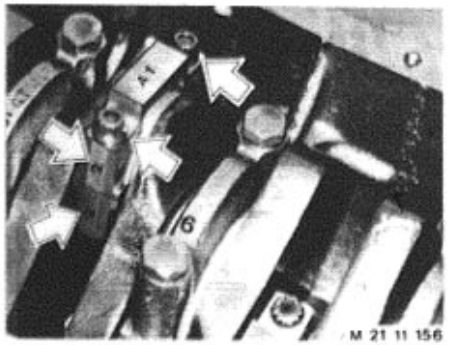


11 23 031 REPLACING HUB FOR VIBRATION DAMPER

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).

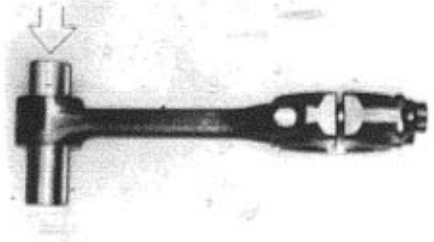
* See Specifications

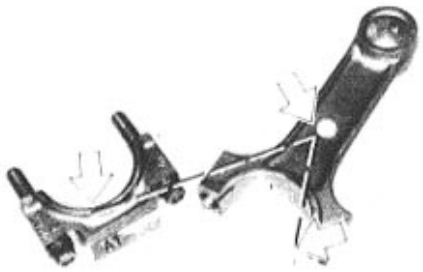


11 24 521 REPLACING CONNECTING RODS
– Pistons Removed –

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.

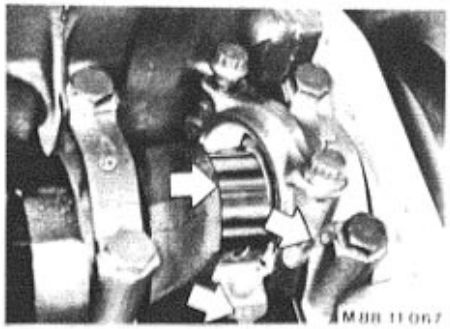


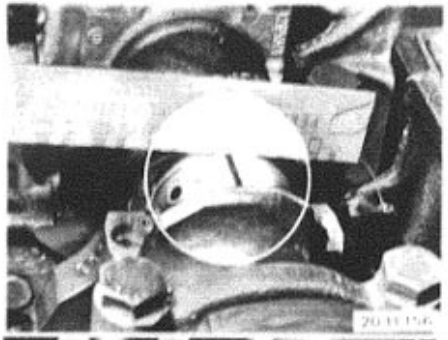


11 24 571 REPLACING CONROD BEARING SHELLS
– Engine Disassembled –

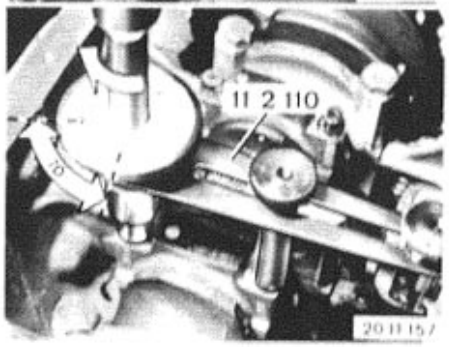
Install red or blue conrod bearing shells according to color code on connecting rod.
Important!
Check machined size (conrod bearing dia.).

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

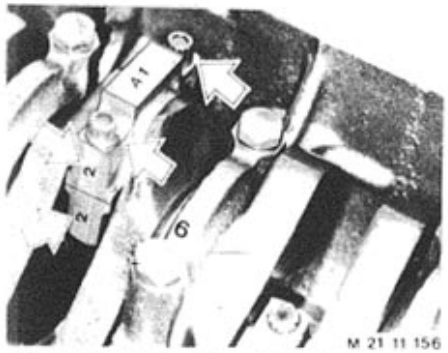




Tighten bolts in two steps (using old conrod bolts):
Step 1 – 20 Nm (14. ft. lbs.)
Step 2 – 70° torque angle
Important!
Do not turn the connecting rod or crankshaft.
Remove bearing caps.
Read bearing play* from width of flattened Plastigage with help of supplied scale.
Correct bearing play by installing 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).



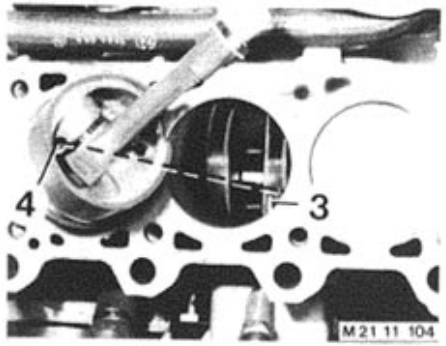
* See Specifications



M 21 11 156

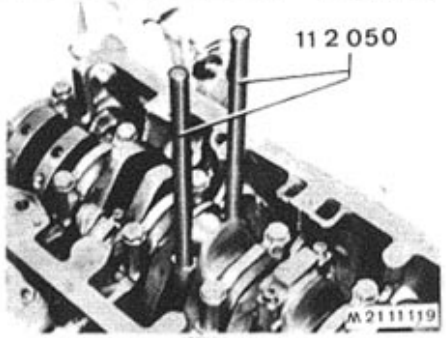
11 25 000 REMOVING AND INSTALLING PISTON

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.



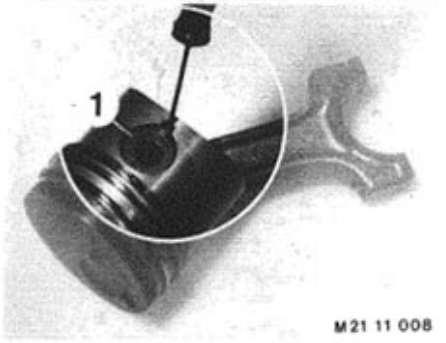
M21 11 104

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

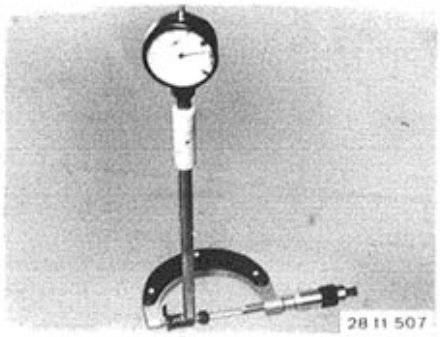
Only install a piston of the same make and same weight group.
The weight group is stamped in the piston crown with a "+" or "–" sign.
Important!
Check the machined size* (piston diameter).



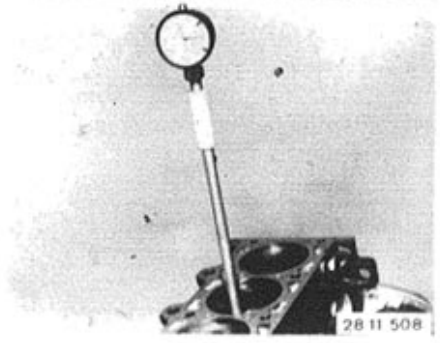
28 11 064

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")

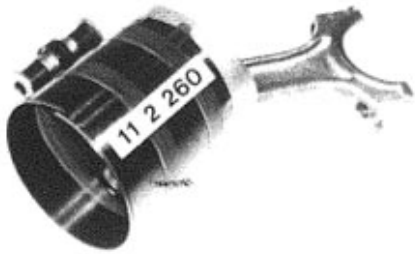

28 11 507

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


28 11 508

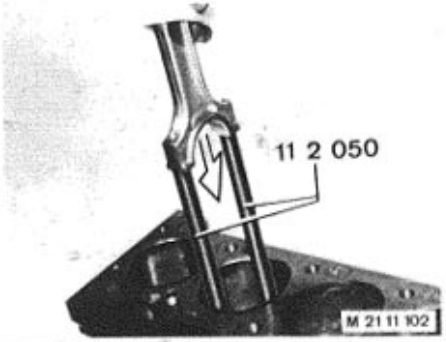
Measure the cylinder bore at the bottom, middle and top with the internal calipers in forward and rotating directions.
Measure the piston installed clearance*.

* See Specifications

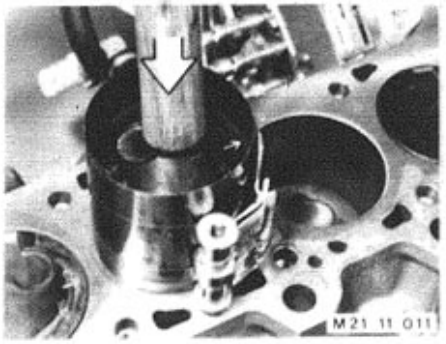


M 21 11 010

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).



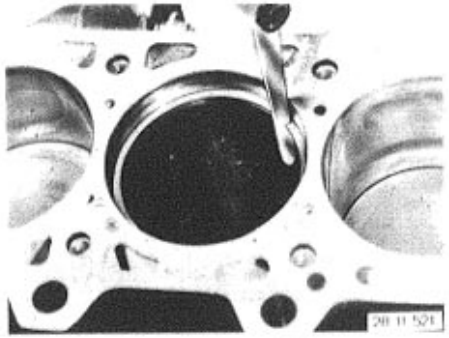
Install piston that arrow faces toothed belt. Install connecting rod, see 11 24 521.



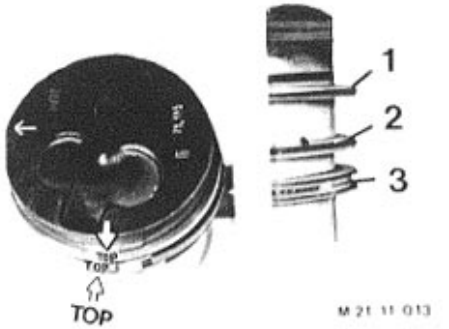
M 21 11 012

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

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



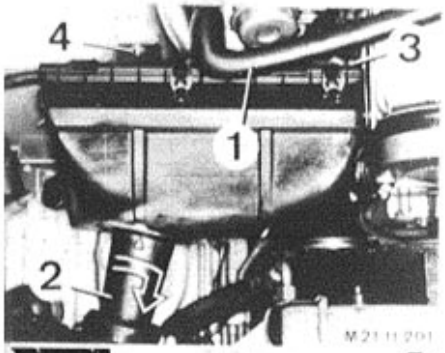
Remove piston rings and check end clearance*.



M 21 11 013

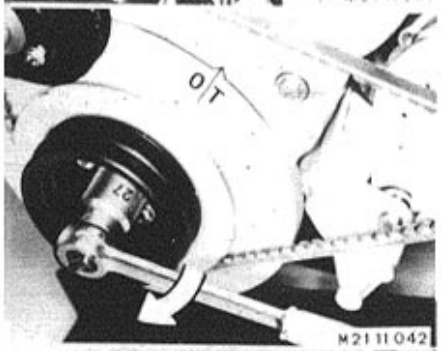
Installation:
Install piston rings that word "TOP" faces piston crown.
1 Keystone ring
2 Taper face ring
3 Bevelled ring with rubber lined spring

* See Specifications

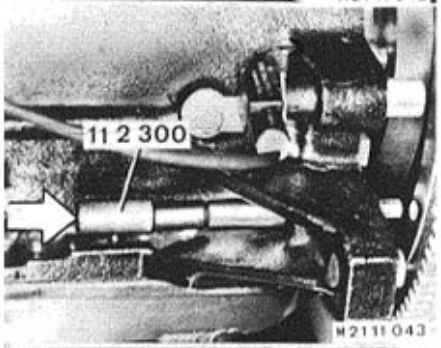


11 31 000 REMOVING AND INSTALLING CAMSHAFT

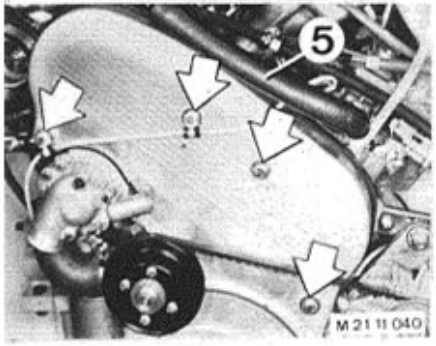
Detach hose (1).
Unscrew hose (2).
Loosen clamp (3).
Unscrew nut (4) and remove air cleaner.
Remove fan 11 52 000.
Remove vacuum pump 11 66 000.
Installation:
Turn arrow up.



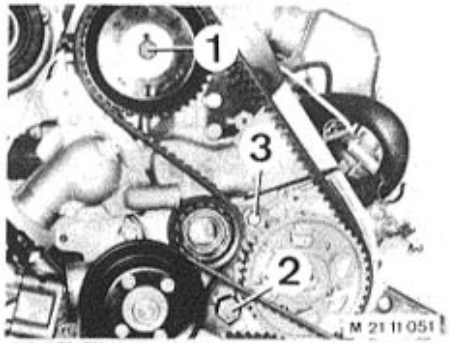
Remove rocker arm of cylinder no. 2/exhaust and rocker arm of cylinder no. 3/intake, see 11 33 031, to remove tension on camshaft.
Turn cylinder no. 1 to TDC – cylinder no. 6 overlaps.



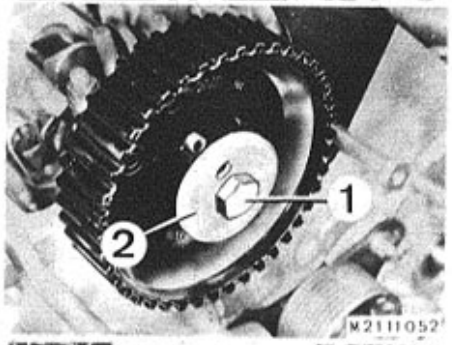
Hold crankshaft with Special Tool 11 2 300.



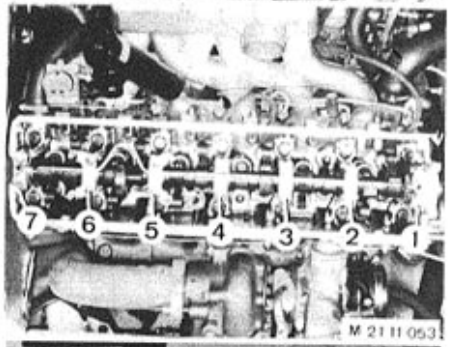
Detach hose (5) and unscrew protective cover.



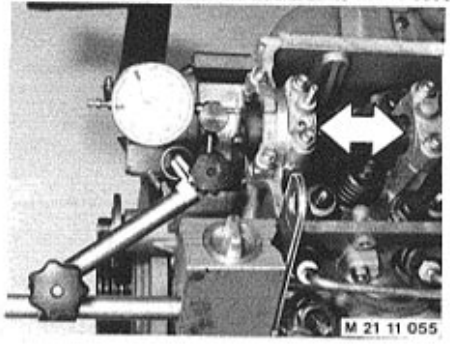
Loosen bolts (1 and 2) and nut (3).
Loosen toothed belt and take off of camshaft sprocket.
Unscrew bolt (1) and take off camshaft sprocket.
Installation:
Tightening torque*.



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

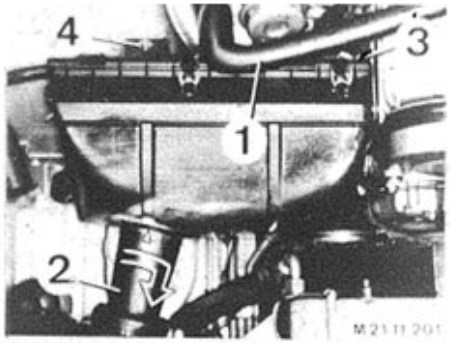


Unscrew camshaft.
Installation:
Replace rocker arms, if replacing camshaft because of worn cams!
Slide steel ring on to cam for vacuum pump.
Bearings are marked.
Bearing no. 1 is at front end.
Install radial oil seal together with bearing no. 1, see 11 12 240.
Mount oil line.



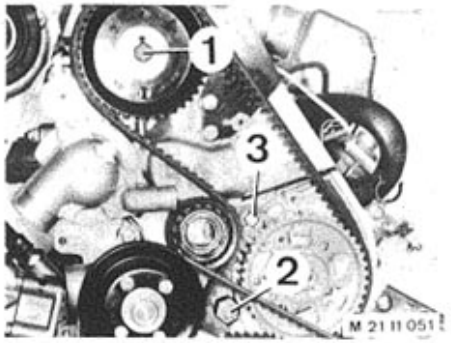
Installation:
Check camshaft axial play*.
Install and tighten toothed belt, see 11 31 110.

* See Specifications

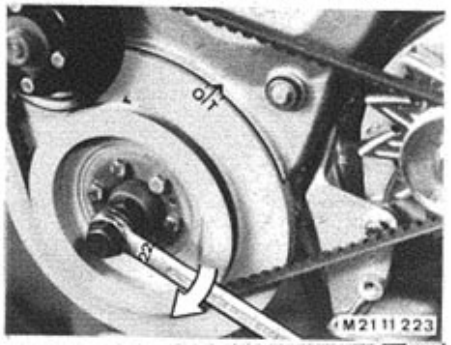


11 31 100 TIGHTENING DRIVE BELT

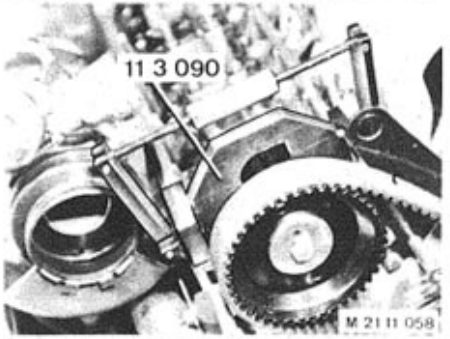
Disconnect hose (1).
Turn out hose (2).
Loosen clamp (3).
Unscrew nut (4) and remove the air cleaner.
Remove the fan, see 11 52 000.
Installation:
Turn the arrow to face up.



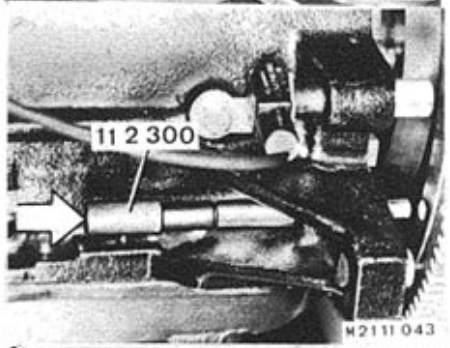
Loosen bolts (1 and 2) and nut (3).



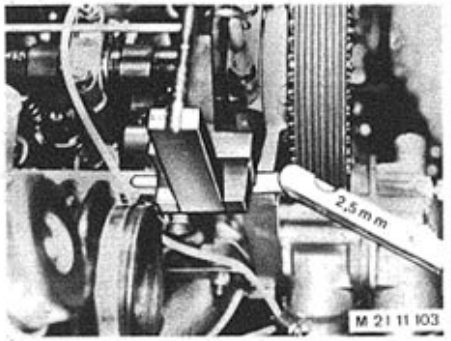
Turn crankshaft to have TDC in cylinder no. 1 and overlapping in cylinder no. 6.



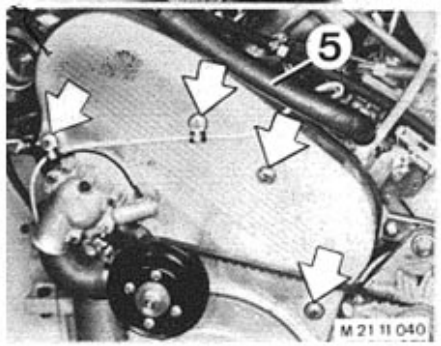
Hold the camshaft with Special Tool 11 3 090.
Turn the crankshaft to have TDC in cylinder no. 1 and overlapping in cylinder no. 6.



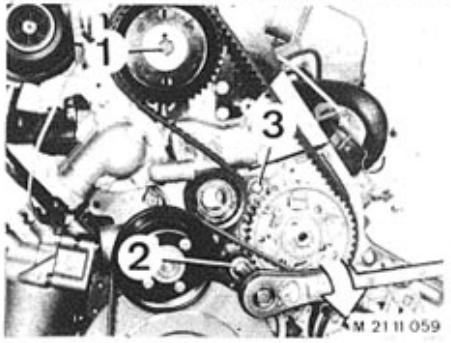
Hold the crankshaft with Special Tool 11 2 300.



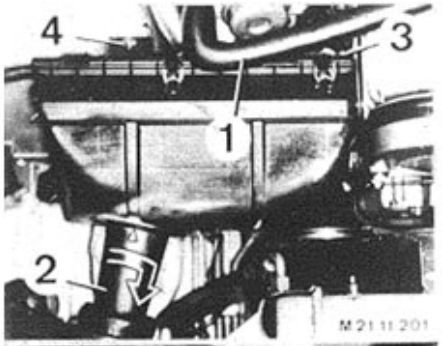
Important!
Tighten the drive belt at a coolant temperature of 15 to 35° C (60 to 95° F).
Place a 2.5 mm thick feeler gage blade on the exhaust end for new drive belts or drive belts used less than 15,000 km (10,000 miles).



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

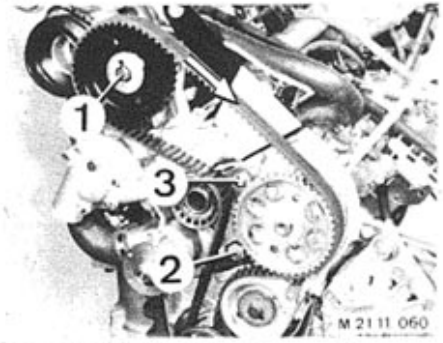


Press tensioning roller toward outside with a torque wrench (analog display).
Tightening torque for toothed belts
up to 15,000 km (10.000 miles)
42 + 3 Nm (30.5 + 2 ft. lbs.)
from 15,000 km (10,000 miles) on
30 to 35 Nm (22 to 25 ft. lbs.).
Tighten nut (3).
Tighten bolts (1 and 2).
Check tightening torque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

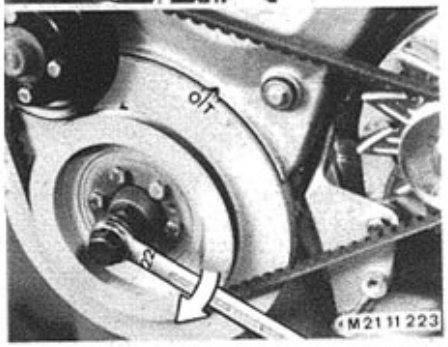


11 31 110 REMOVING AND INSTALLING DRIVE BELT

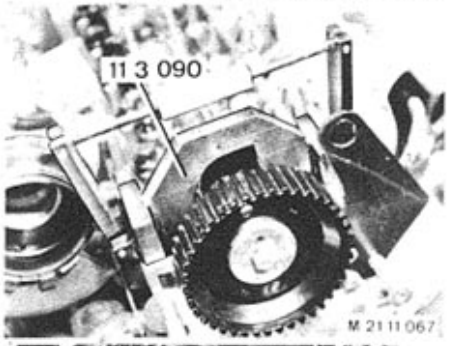
Disconnect hose (1).
Turn out hose (2).
Loosen clamp (3).
Unscrew nut (4) and remove air cleaner.
Remove fan 11 52 000.
Installation:
Turn the arrow to face up.



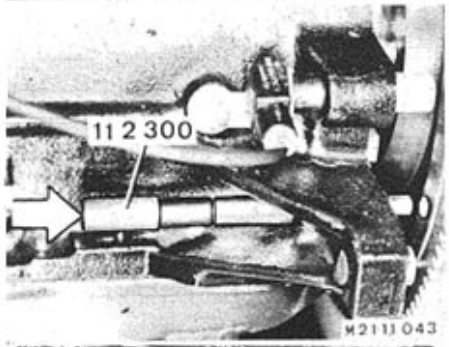
Loosen bolts (1 and 2) and nut (3).
Mark the running direction of the drive belt and take off the belt.



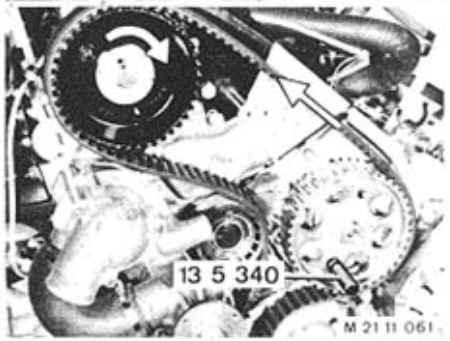
Cylinder no. 1 at TDC – cylinder no. 6 overlapping.



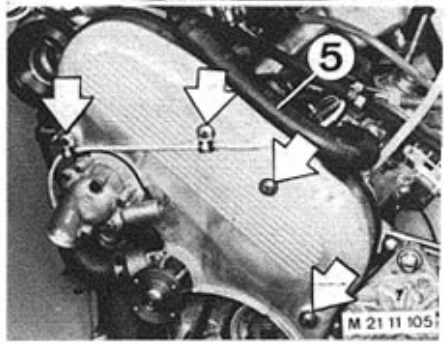
Installation:
Hold the camshaft with Special Tool 11 3 090.
Cyl. 1 at TDC – cyl. 6 overlapping.



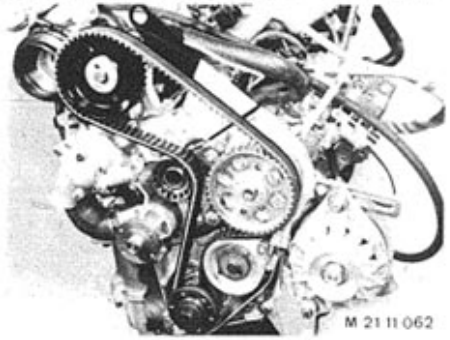
Hold the crankshaft with Special Tool 11 2 300.



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.

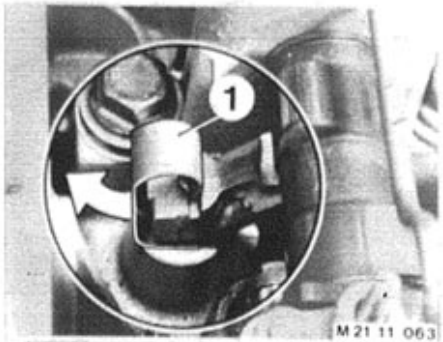


Remove hose (5) and protective cover.
Remove vibration damper, see 11 23 010.
Remove cylinder head cover, see 11 12 000.



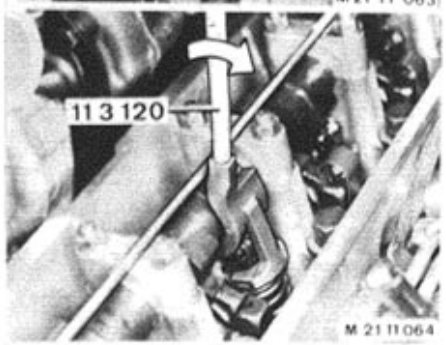
Drive Belt Layout

Adjust injection pump statically – see 13 51 005.

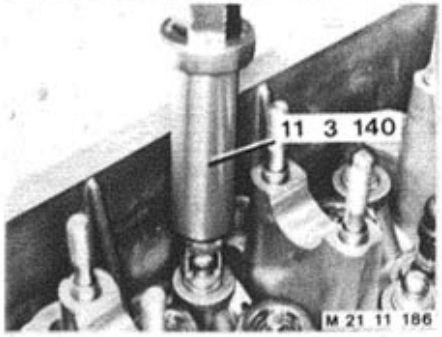


11 33 050 REPLACING ROCKER ARM

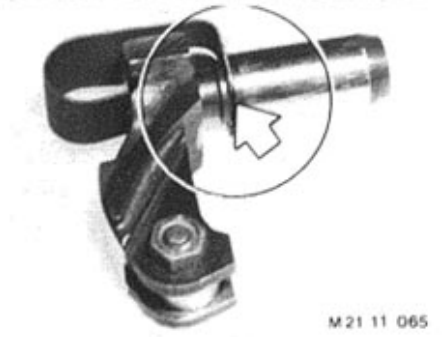
Remove vacuum pump 11 66 000.
Pull off spring clip (1).
Pertinent cams of camshaft must be turned up for removal of rocker arms.



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.

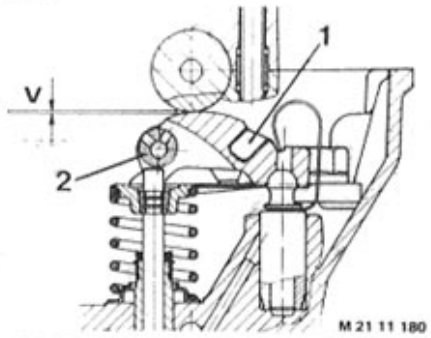


Pull out ball-headed bolt with Special Tool 11 3 140.
Installation:
Install ball-headed bolt with a bolt cement** and press in against stop.



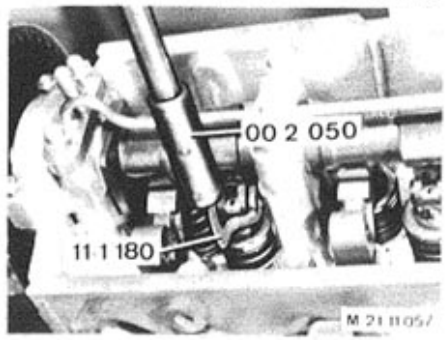
Installation:
Press spring clip into groove of ball-headed bolt.
Adjust valve clearance 11 34 004.

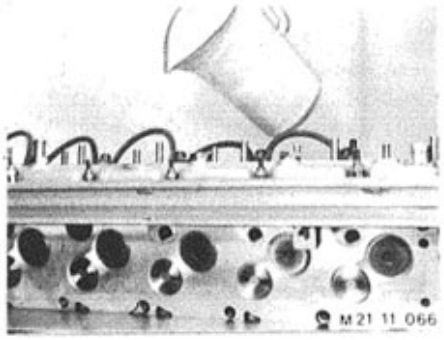
** Source: HWB



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*.

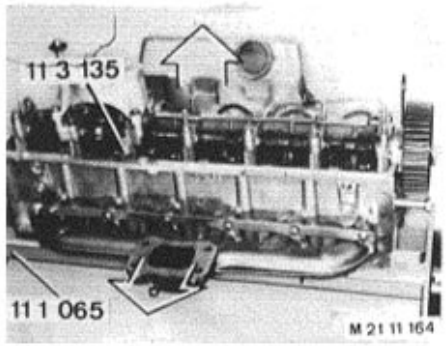




11 34 509 CHECKING VALVES FOR LEAKS – Camshaft Removed –

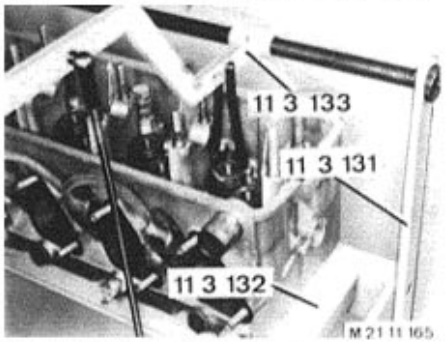
Fill intake and exhaust ports with gasoline outdoors or indoors with strict conformance of fire prevention regulations.
Valves and valve seats must be inspected if the gasoline runs past the valve heads.
Remove and install valves 11 34 550.
Machine valve seats 11 12 607.

* See Specifications

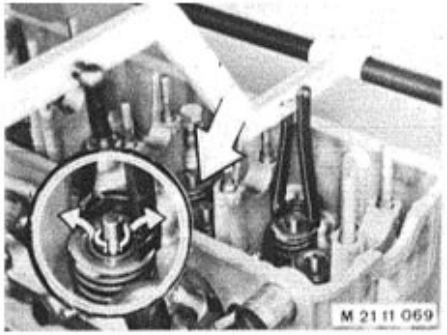


11 34 550 REMOVING AND INSTALLING VALVES

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.

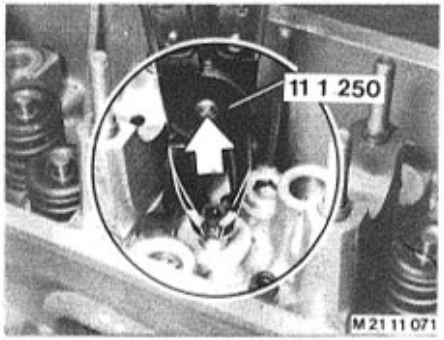


Press down valve springs and remove the valve keepers.

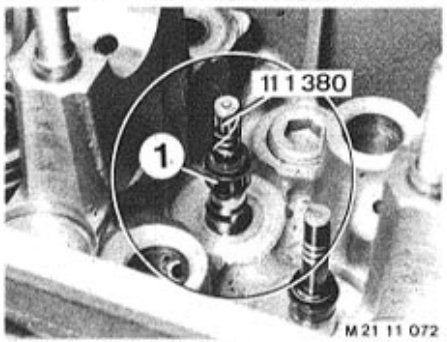


Take off the upper spring retainer, valve springs and lower spring retainer.
Take tray out of the assembly stand and pull out the valve.
Installation:
Only install valve springs with same color code, wire gage size and length.
Lubricate the valve guide and valve stem with oil.
Measure the valve retrusion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

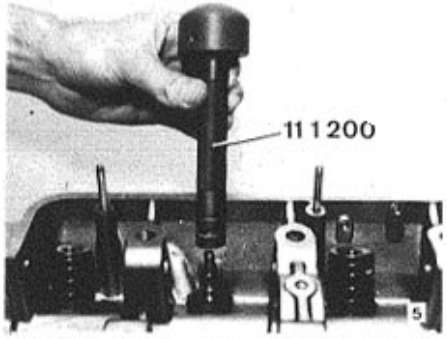
* See Specifications



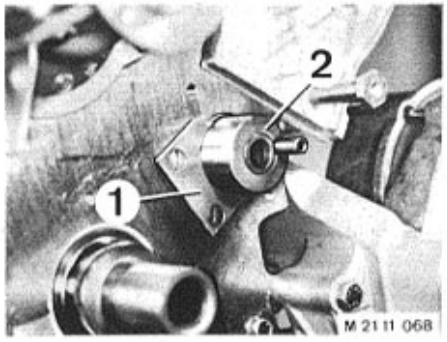
Pull off the valve stem seal with Special Tool 11 1 250.



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

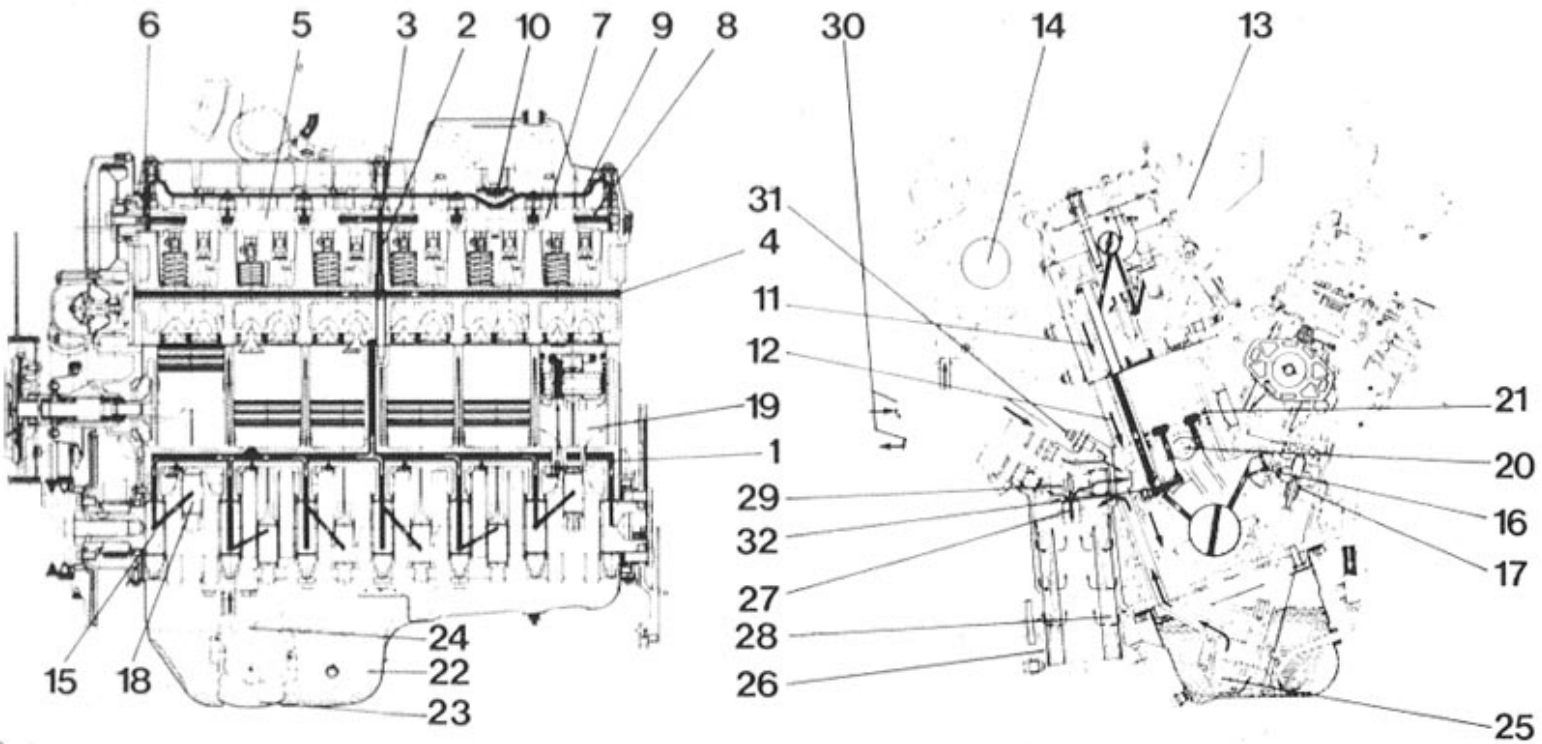


Press on the valve stem seal against the stop with Special Tool 11 1 170.
The new, improved valve stem seal (internal grooving) is pressed on by hand with Special Tool 11 1 200.
Special Tool 11 1 200 has two diameters – for 7/8 mm (0.276/0.315") valve stem seals.

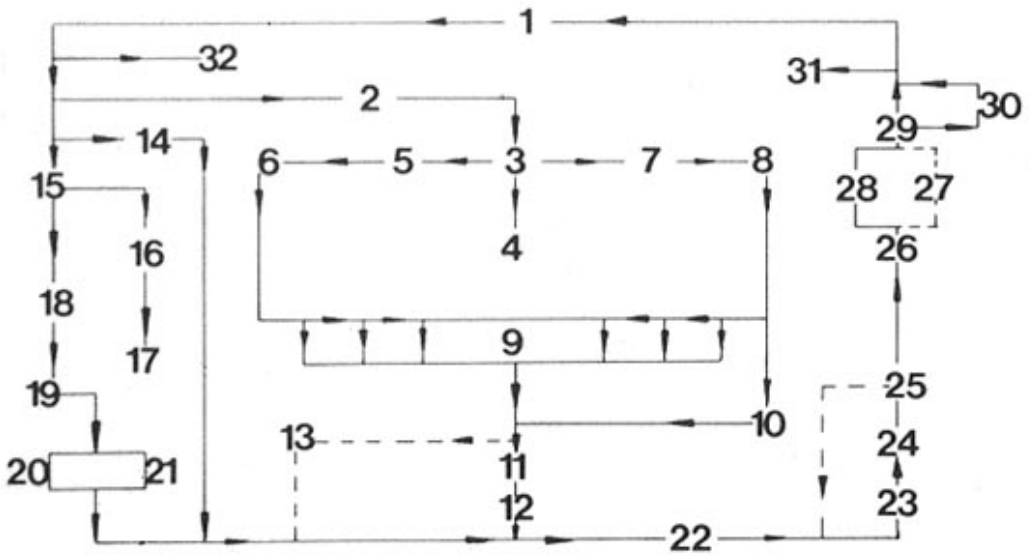


11 35 020 REMOVING AND INSTALLING INTERMEDIATE SHAFT

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.



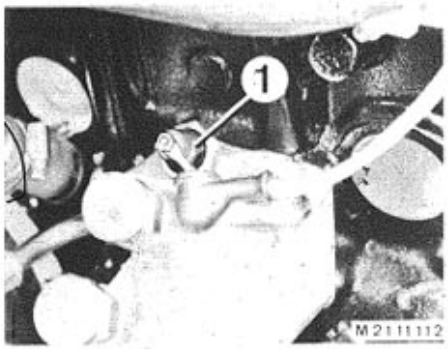
M21 11 086



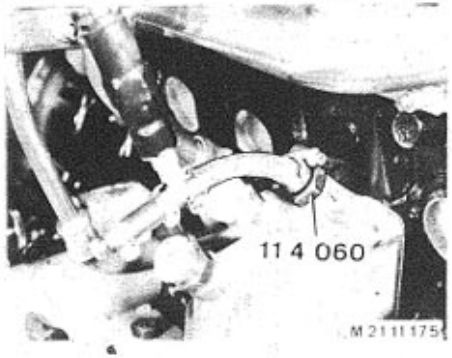
ENGINE OIL CIRCUIT

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

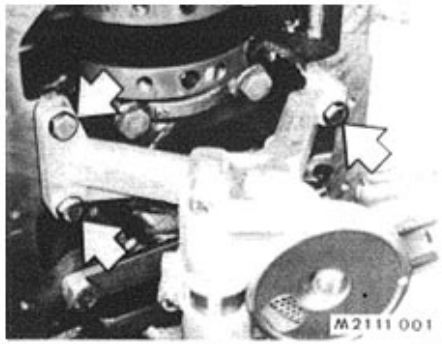


Disconnect wires on oil pressure switch.
Unscrew oil pressure switch (1).
Installation:
Check gasket, replacing if necessary.



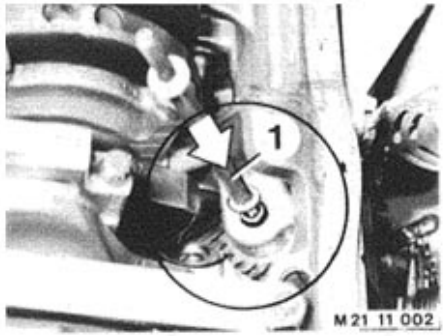
Screw in Special Tool 11 4 060.
Connect 10 bar (142 psi) pressure tester of BMW service test unit.
Check oil pressure*.

* See Specifications

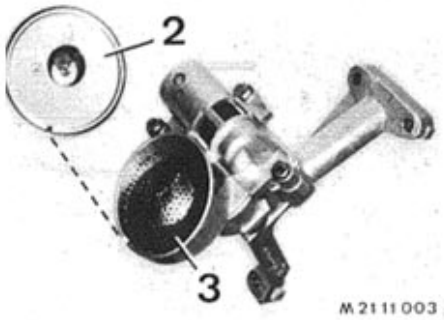


11 41 000 REMOVING AND INSTALLING OIL PUMP

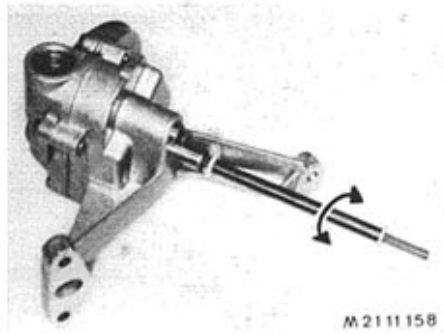
Remove the oil pan, see 11 13 000.
Remove the oil pump.



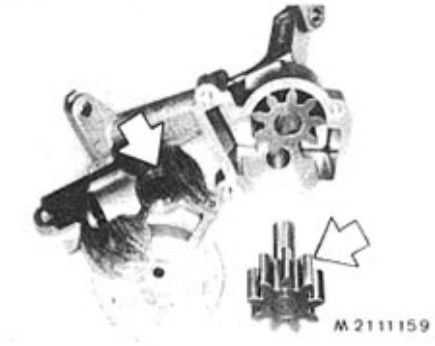
Installation:
Guide drive shaft (1) into the bearing.
Replace the bearing, see 11 11 160.



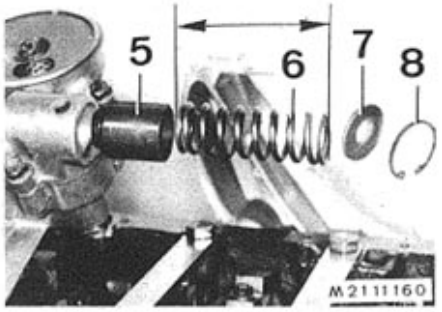
Checking and Servicing:
Unscrew cap (2) and clean oil filter screen (3).



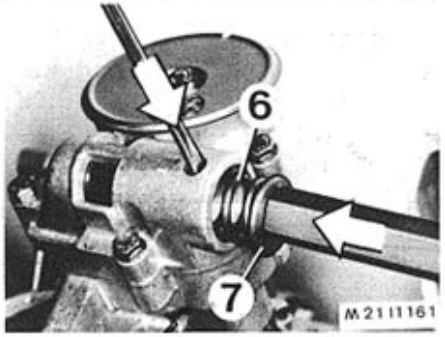
Check whether the gears run easily by turning the drive shaft.



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

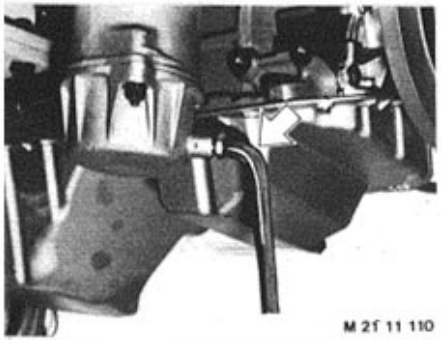


The engine oil control valve regulates the engine oil pressure*.
Check movement of piston (5).
Check length of spring (6) = 71.6 mm (2.819").



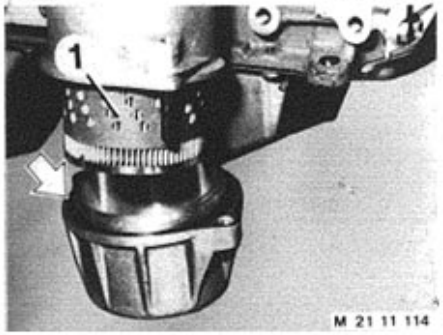
Installation:
Press in and hold spring (6) and washer (7) with a screwdriver.
Install circlip (8).

* See Specifications



11 42 020 REPLACING OIL FILTER

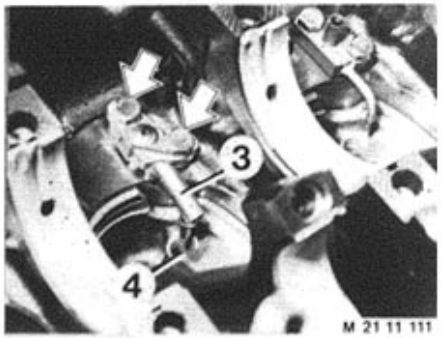
Unscrew oil drain plug in oil filter and drain oil.
Installation:
Tightening torque*.



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

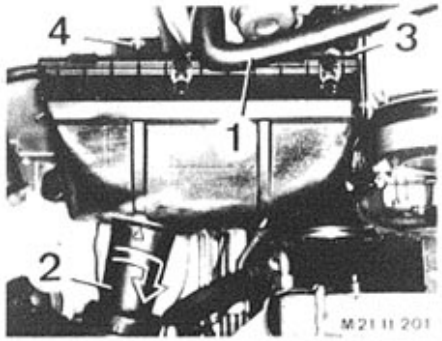
11 42 650 REMOVING AND INSTALLING/ REPLACING OIL SPRAY JET
– Crankshaft Removed –

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.



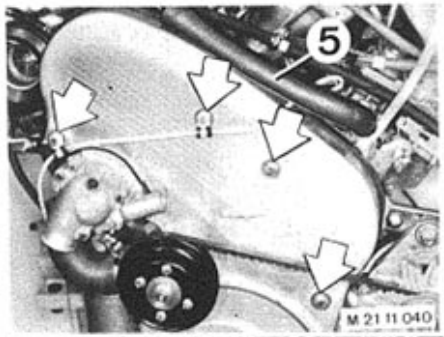
Unscrew screws and take out oil spray jet (3).

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

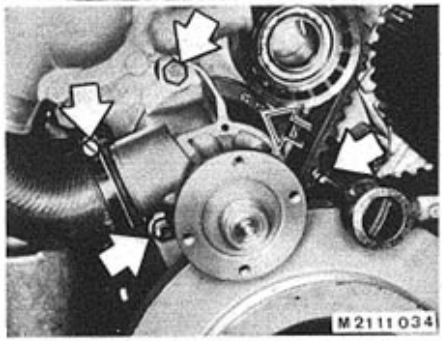


11 51 000 REMOVING AND INSTALLING WATER PUMP

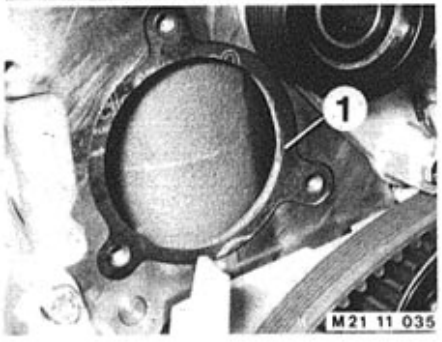
Detach hose (1).
Unscrew hose (2).
Loosen clamp (3).
Unscrew nut (4) and remove air cleaner.
Installation:
Turn arrow up.



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.

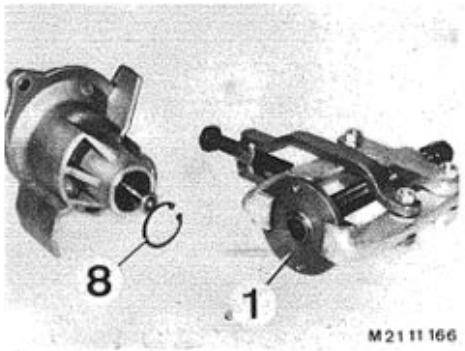


Detach water hose.
Unscrew water pump.
Note:
Only push toothed belt to one side.



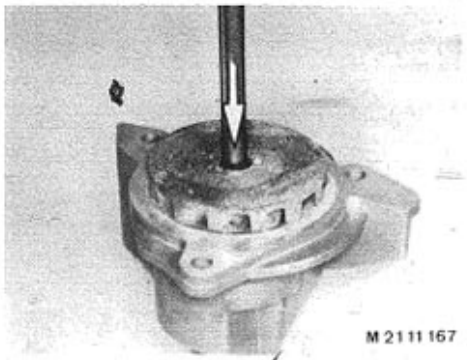
Installation:
Replace gasket (1).

11 51 502 OVERHAULING WATER PUMP
– Water Pump Removed –

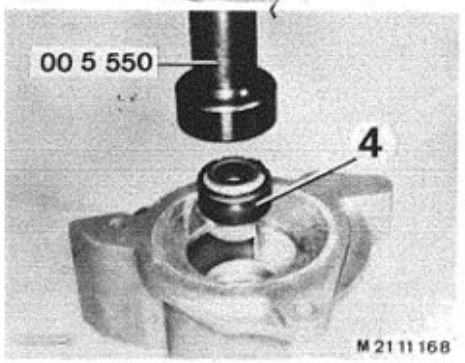


M 21 11 166

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

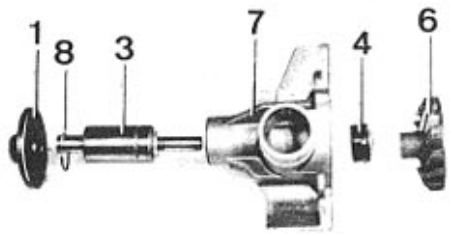

M 21 11 167

Press out water pump bearing.



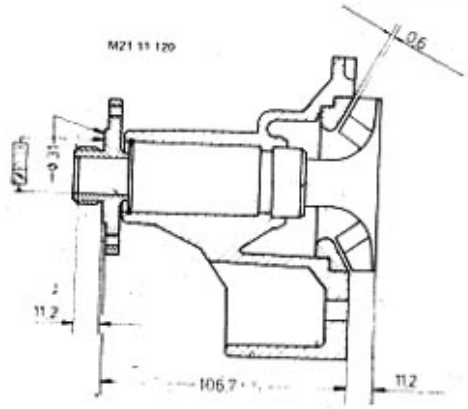
M 21 11 168

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

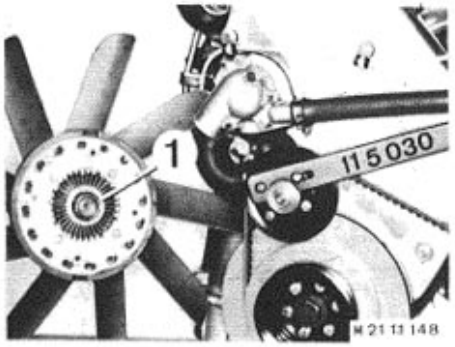


Replace bearing (3) and seal (4).
Check impeller (6), replacing if necessary.
(1) = Hub
(7) = Water pump body
Installation:
Press in bearing (3) against stop.
Press on impeller (6).

M 21 11 169

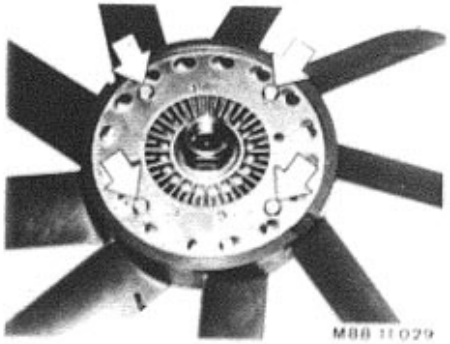


Check assembled distances.



11 52 000 REMOVING AND INSTALLING FAN

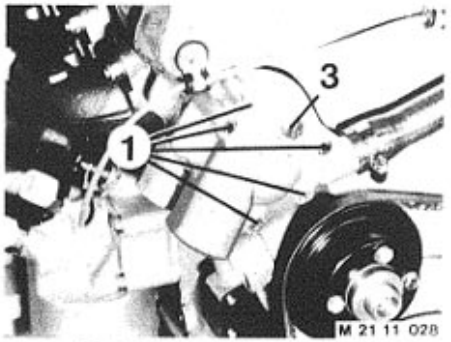
Remove fan cowl.
Hold pulley with Special Tool 11 5 030 and unscrew coupling nut (1).
Important!
Left-hand threads – nut turned clockwise to unscrew.
Installation:
Tightening torque*.



11 52 020 REPLACING FAN CLUTCH

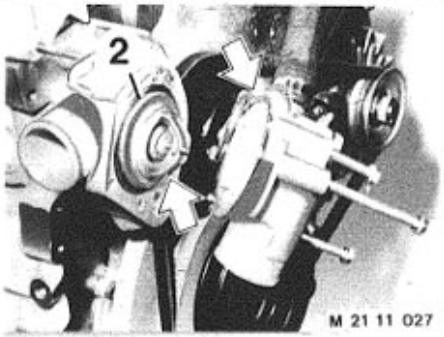
Remove fan 11 52 000.
Replace fan clutch, if
a) hub has seized – fan of stopped engine cannot be turned or is hard to turn,
b) fan clutch has axial/radial play or is losing oil.
Check the switching points* with a Vibrocard ***.
Unscrew fan mounting bolts and take off the fan clutch.

* See Specifications
*** See Workshop Equipment Catalog

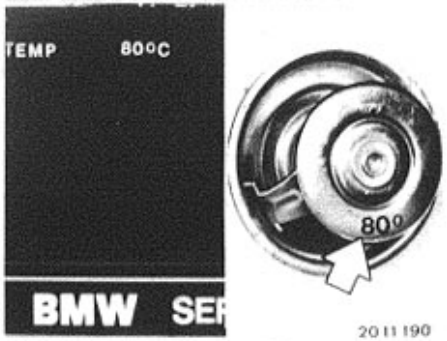


11 53 000 REMOVING AND INSTALLING COOLANT THERMOSTAT

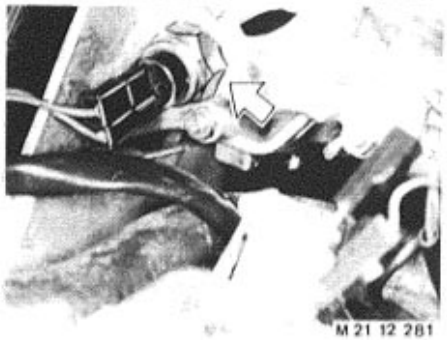
Remove fan, see 11 52 000.
Drain coolant partially.
Remove covers (1).
Remove thermostat.



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.



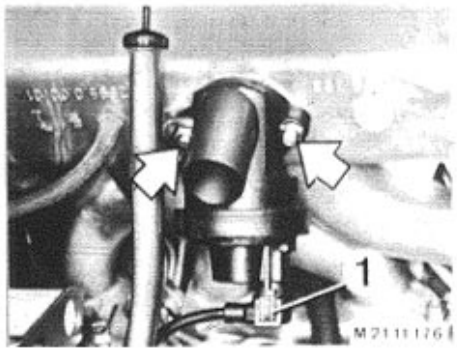
Checking Thermostat:
Does the thermostat begin to open at the temperature quoted in the Specifications?
Check opening temperature in hot water and compare with the stamped value.



11 53 080 REPLACING TEMPERATURE TRANSMITTER

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

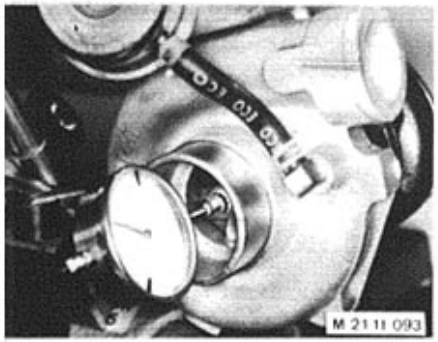
* See Specifications

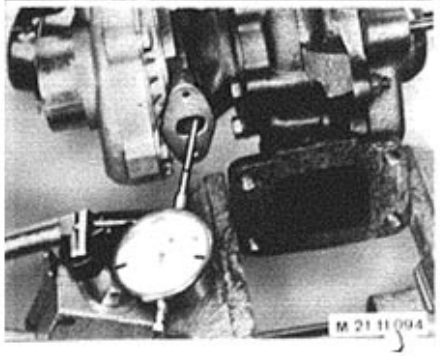


11 61 450 REMOVING AND INSTALLING CHARGING AIR PRESSURE BLOWOFF VALVE

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

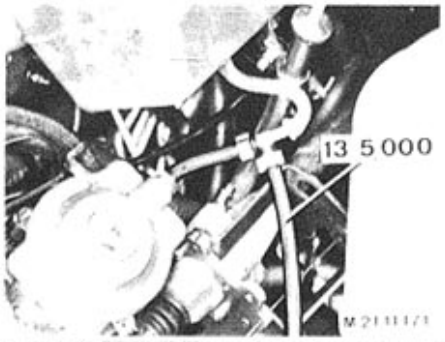


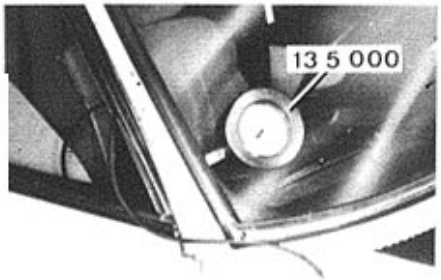


11 65 015 CHECKING BEARING PLAY OF TURBOCHARGER

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

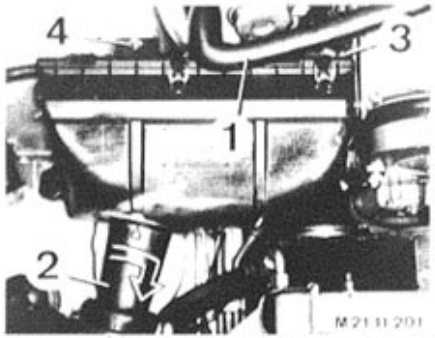
The turbocharger receives oil from the engine oil circuit.
Conformance with the following points is important to guarantee sufficient lubrication of the high speed turbocharger.

- 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.

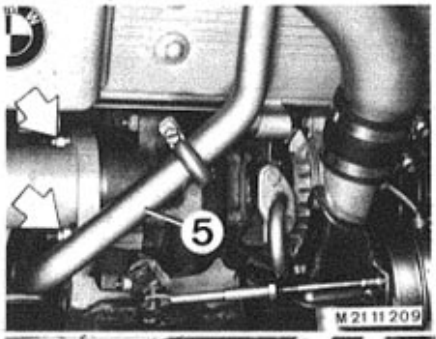
Important When Working on Turbochargers:

- 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.

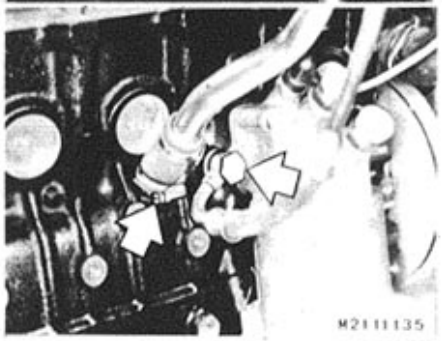
No repairs may be performed on turbochargers.



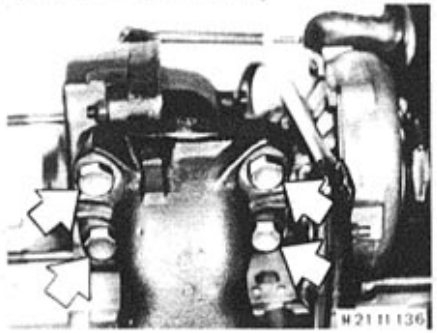
Disconnect hose (1).
Turn out hose (2).
Loosen clamp (3).
Unscrew nut (4) and remove air cleaner.
Installation:
Turn arrow to face up.



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.

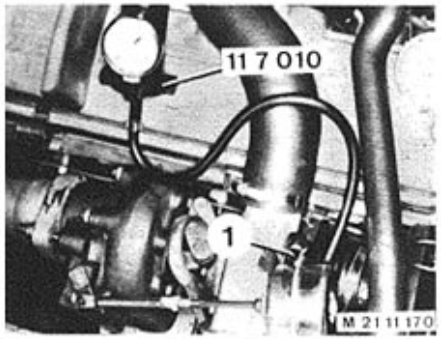


Unscrew bolts and remove turbocharger.
Installation:
Check levelness of sealing surface.
Tightening torque*.

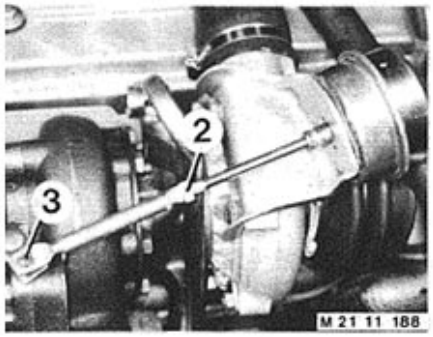
* See Specifications
** Source: HWB

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.

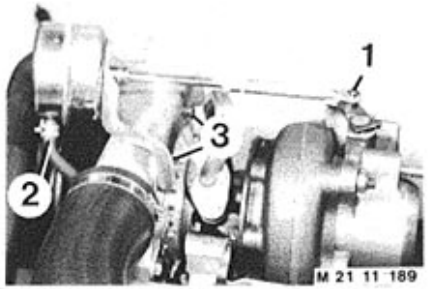


Unscrew lock nut (2).
Remove circlip on pin (3).
Adjust control valve opening time as described
Note:
One turn of the linkage is equal to 0.05 bar.
Installation:
Lock nut (2) with clear lacquer**.

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.

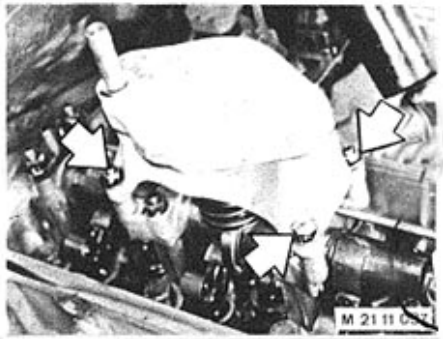
** Source: HWB, No. 81 229 407 404

11 65 060 REMOVING AND INSTALLING CONTROL VALVE

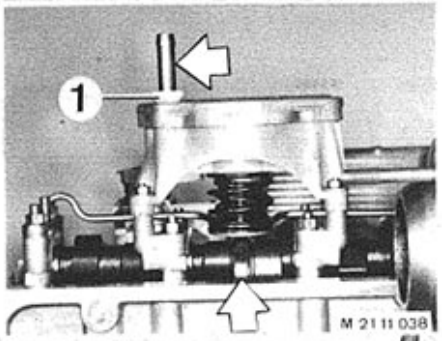


Remove circlip (1) and disconnect linkage.
Pull off hose (2).
Unscrew screws (3).
Installation:
Replace screws (3).
Adjust control valve, see 11 65 059.

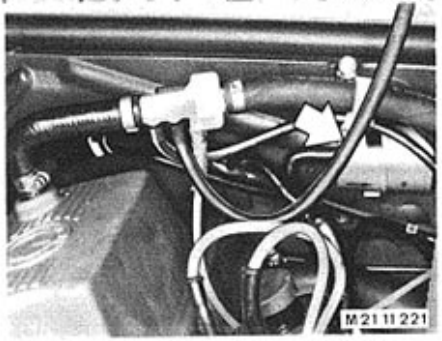
11 66 000 REMOVING AND INSTALLING VACUUM PUMP



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.

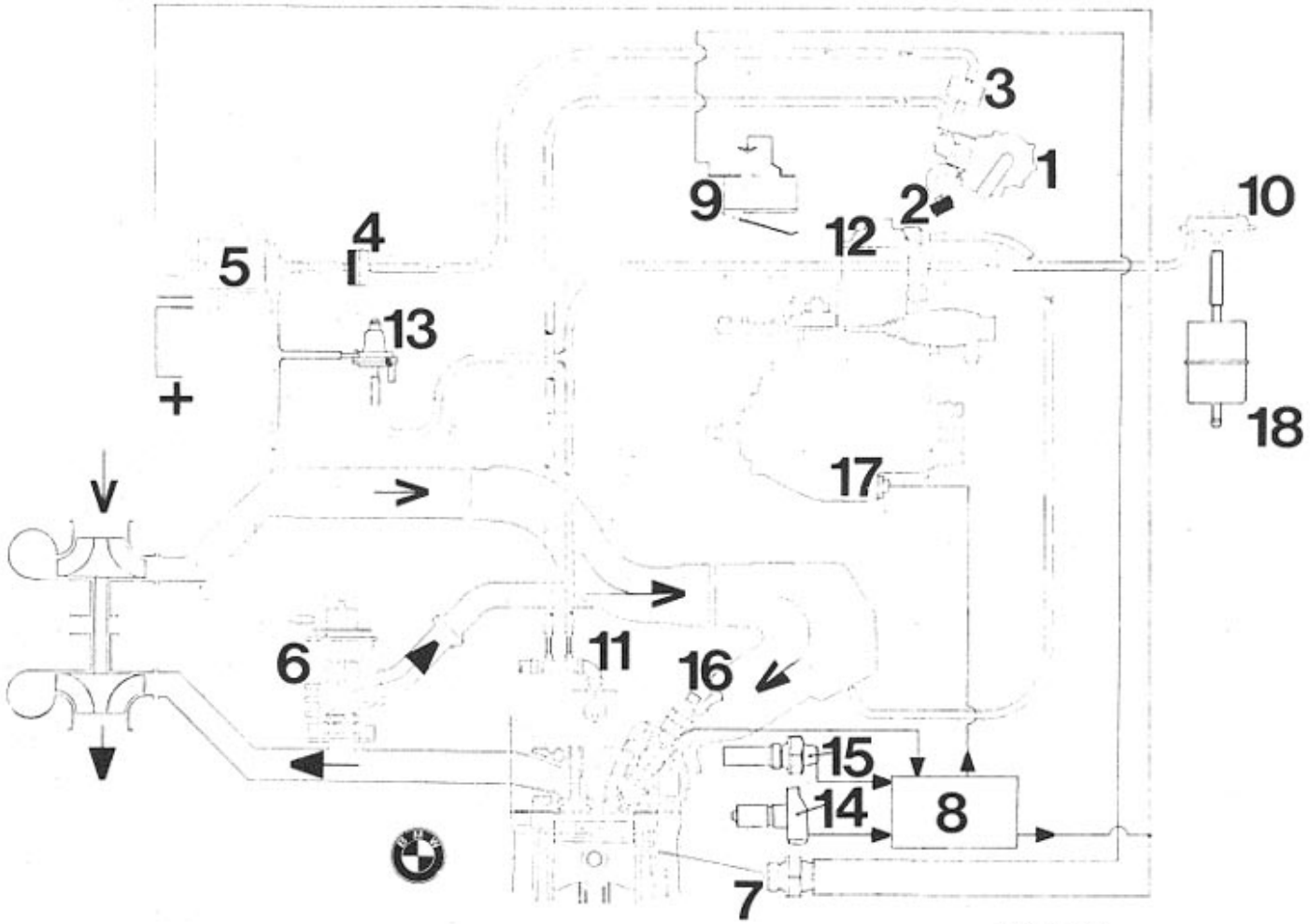


Installation:
Install vacuum pump that pipe adapter is at rear and cam runs in opening of plunger.
Insert seal (1).
Caution!
Never run engine without attached vacuum pump – loose cam ring.



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

* See Specifications



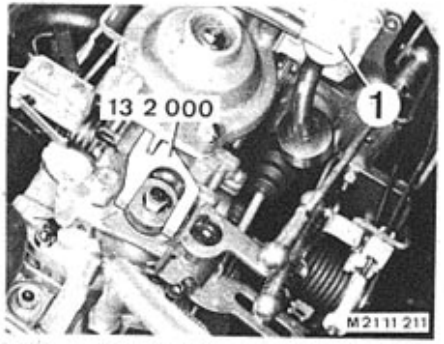
M21 11 192

EMISSION CONTROL LAYOUT DRAWING – 524 td

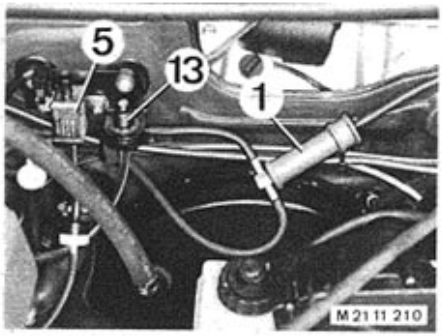
1 Pressure converter (7.20.680.12)
2 Filter
3 Damping container
4 Throttle (black side faces electric switching valve)
5 Electric switching valve (black - 7.20.939.13)
6 EGR valve (7.20.905.00)
7 Temperature switch (1 288 474) - open above + 78° C (172° F)
8 Control unit for VP-20 (0 281 001 018)
9 Idle 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.

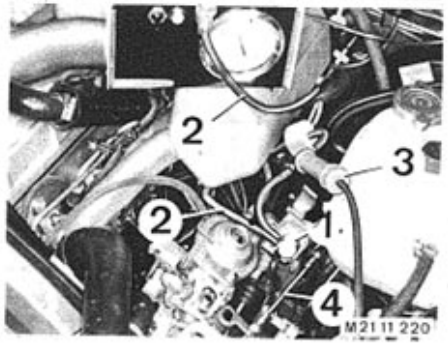


Pressure Converter (1) -
Apply Special Tool 13 2 000.



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.

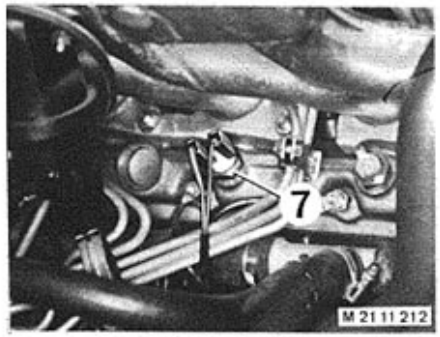


Provide – 600 ± 10 mbar inlet pressure (2) with an external vacuum pump.
Measure outlet pressure (3) with the BMW service tester.
Testing value: – 360 ±25 mbar.
If necessary, adjust the outlet pressure with linkage (4).
Adjusting value: – 360 ± 5 mbar.

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

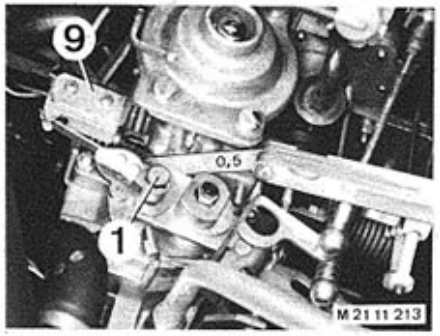
Defective:
- Check the vacuum pump pressure* and throttle, see 11 66 000.
- Check EGR at idle speed.
- Check EGR at partial load.

* See Specifications

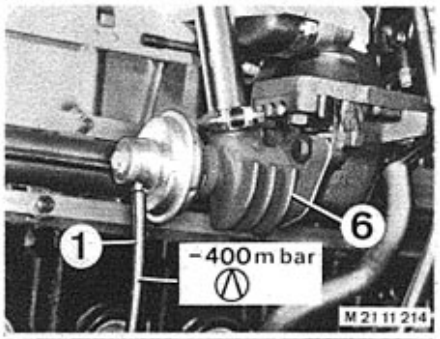


A.) EGR at Idle Speed:

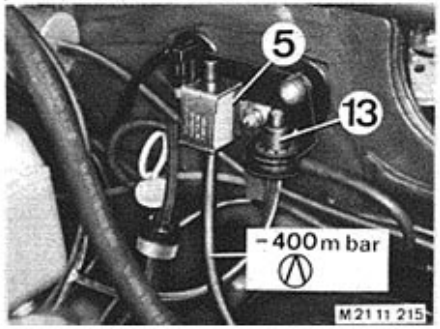
EGR is working at idle speed and with a coolant temperature of > 78° C (172° F).
– Temperature Switch (7) –
Switching-on temp.: 78 ± 3° C (172 ± 5° F)
Switching-off temp.: 60 ± 3° C (140 ± 5° F)
Check with BMW service test unit (ohmmeter).



– 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.



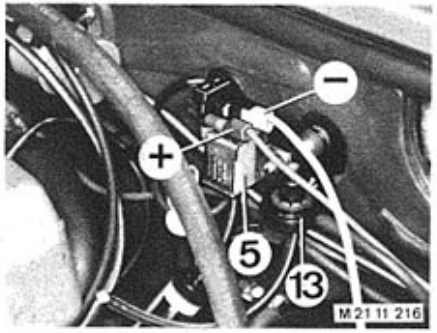
– EGR Valve (6) –
Apply about – 400 mbar pressure (BMW service test unit) on EGR valve (6).
Pull off and reconnect hose (1) – closing and opening clicks will be heard.
Also refer to 11 71 501.



– 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:

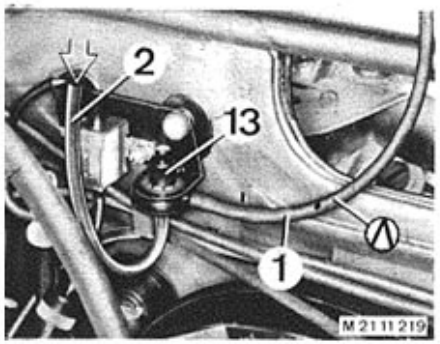
EGR is working at speeds of 1000 to 2800 rpm and a coolant temperature of > 78° C (172° F) (coolant temperature sensor 15).



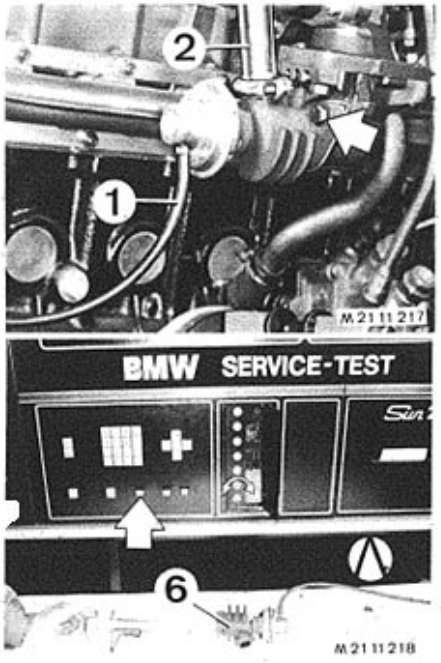
– Control Unit (8) –
Check with a coolant temperature of > 78° C (172° F) and engine running.
Connect BMW service test unit and check signal output on control unit (8).
There should be battery voltage at speeds of 1000 to 2800 rpm.

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

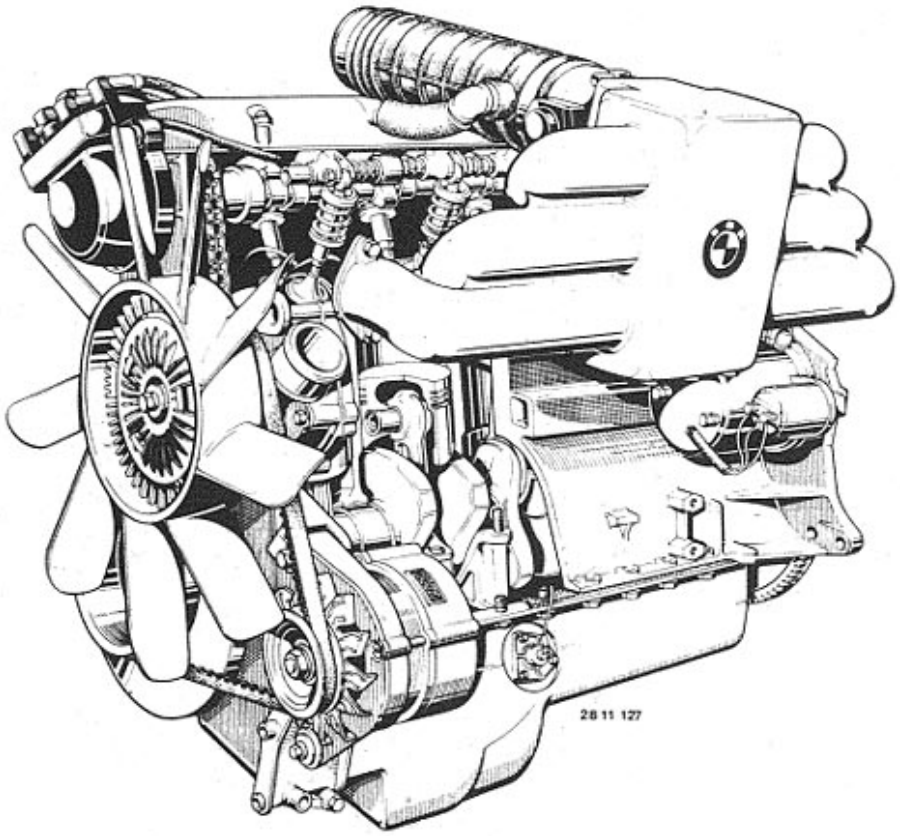
Note:
The EGR valve is open in case of acceleration smoke and acceleration hesitation.
Check installed position of throttle (4) in case of excessive smoke.
EGR valve must not squeak while opening and closing!

** Source: HWB

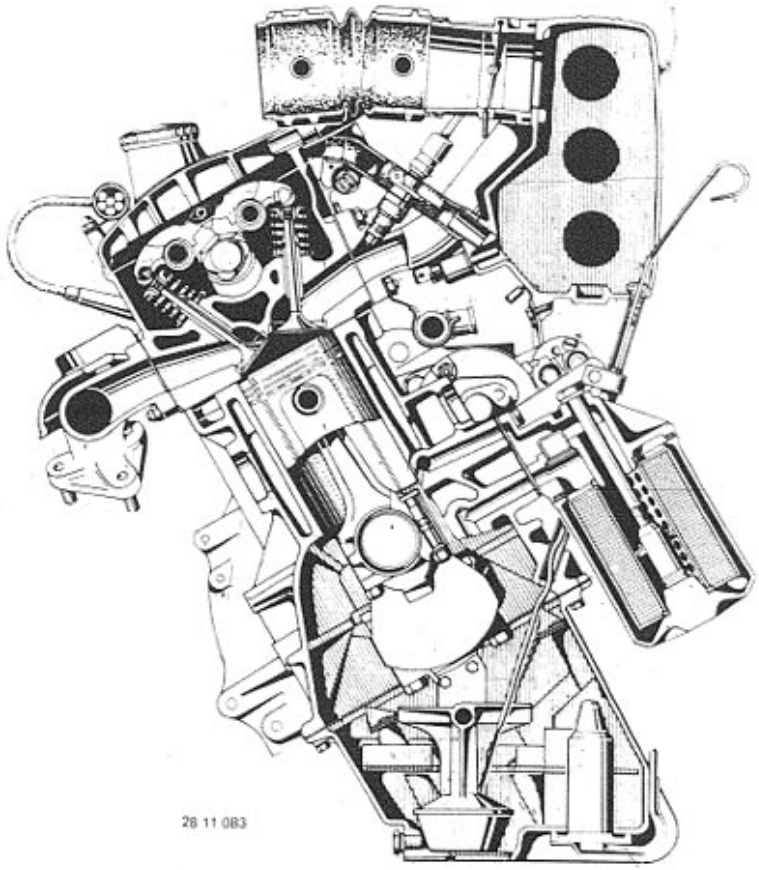
11 Engine

BMW 533i, BMW 535i

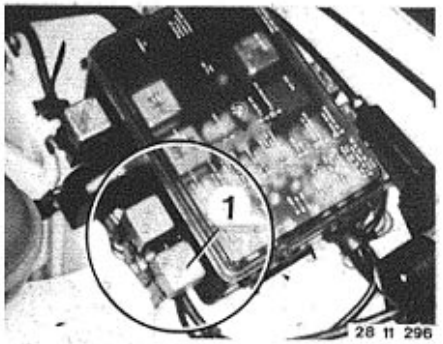
11 00 006	Diagnosis with BMW service tester	see nominal value microfiche
039	Compression of all cylinders – check	11- 302
050	Engine – remove and install	11- 303
091	Exchange engine – replace	11- 306
11 12 000	Cylinder head cover – remove and install	11- 306
100	Cylinder head – remove and install	11- 307
101	Cylinder head gasket – replace	11- 310
561	Valve guide – replace (valve removed)	11- 310
595	Valve guide – check for wear	11- 311
600	Valve guide – ream out	11- 311
607	Valve seats and valves – machine (cylinder head disassembled)	11- 311
719	Cylinder head sealing surface – grind (cylinder head disassembled)	11- 312
729	Cylinder head – check for cracks in water test (cylinder head disassembled)	11- 312
11 13 000	Oil pan – remove and install	11- 313
11 14 100	Timing case cover, upper – remove and install/seal	11- 314
120	Timing case cover, lower – remove and install/seal	11- 315
131	Radial oil seal in upper timing case cover – replace	11- 316
141	Radial oil seal in lower timing case cover – replace	11- 316
605	Radial oil seal in clutch end cover – replace	11- 317
11 21 000	Crankshaft – remove and install	11- 318
501	Crankshaft – replace (crankshaft removed)	11- 319
531	Crankshaft main bearing shells – replace (engine disassembled)	11- 319
571	Pilot bearing in crankshaft – replace	11- 320
11 22 000	Flywheel – remove and install	11- 321
051	Drive plate for torque converter – replace	11- 321
541	Starter gear ring – replace	11- 321
11 23 000	Vibration damper with hub – remove and install	11- 322
010	Vibration damper – replace	11- 322
031	Vibration damper hub – replace	11- 322
11 24 521	Connecting rod – replace (piston removed)	11- 323
571	Connecting rod bearing shells – replace (engine disassembled)	11- 323
11 25 000	Piston – remove and install	11- 324
651	Piston rings of one piston – replace (piston removed)	11- 325
11 31 000	Camshaft – remove and install (cylinder head removed)	11- 326
001	Camshaft – replace (camshaft removed)	11- 327
051	Timing chain – replace	11- 327
061	Sprocket set – replace (timing chain removed)	11- 328
090	Chain tensioner piston – remove and install	11- 328
601	Tensioning rail / guide rail – replace (timing chain removed)	11- 329
11 33 020	Rocker arm shafts – remove and install	11- 330
031	Rocker arms – replace	11- 331
11 34 004	Valve clearance – adjust	11- 331
509	Valves – check for leaks (camshaft removed)	11- 331
550	Valves – remove and install (rocker arm shafts removed)	11- 332
	Engine oil circuit	11- 333
11 40 000	Engine oil pressure – check	11- 334
11 41 000	Oil pump – remove and install	11- 334
151	Oil pump drive chain – replace	11- 335
11 42 021	Full flow oil filter – replace	11- 336
11 43 101	Oil dipstick guide tube – replace	11- 337
11 51 000	Water pump – remove and install	11- 337
502	Water pump – overhaul (water pump removed)	11- 338
11 52 000	Fan – remove and install	11- 339
020	Fun clutch – replace	11- 339
11 53 000	Coolant thermostat – remove and install	11- 339
11 76 010	Catalytic converter – remove and install	11- 340
11 78 010	Oxygen sensor – check	11- 340
510	Oxygen sensor – replace	11- 341



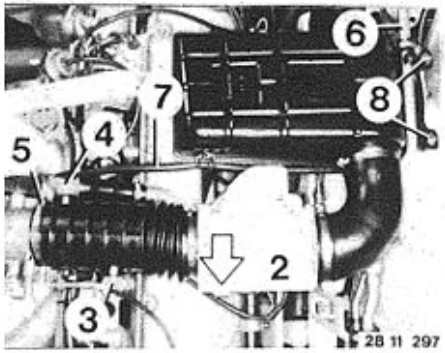
M 30 B 32 = BMW 533 i
M 30 B 34 = BMW 535 i



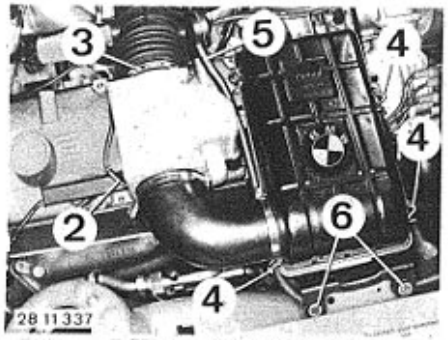
11 00 039 CHECKING COMPRESSION OF ALL CYLINDERS



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.

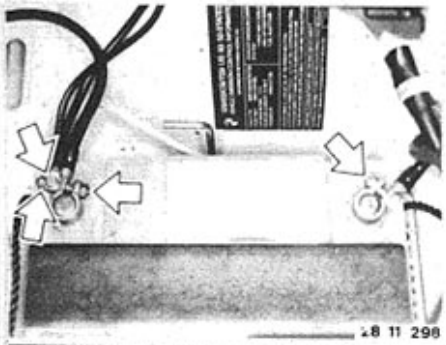


M 30 B 34:
Pull off plug (2) and lift out wires.
Loosen hose clamp (3).
Open clips (4).
Pull off hose (5).
Unscrew nuts (6) and remove air cleaner with air flow sensor.



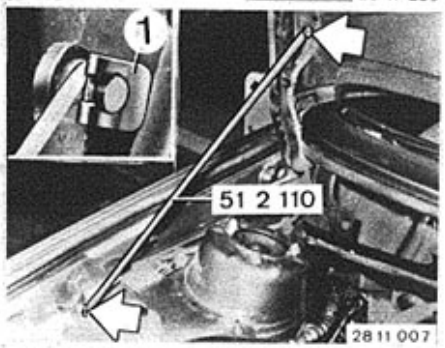
Unscrew spark plugs.
Check compression*
Installation:
Check tightening torque***.

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

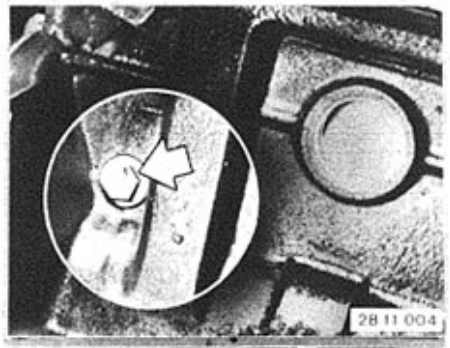


11 00 050 REMOVING AND INSTALLING ENGINE

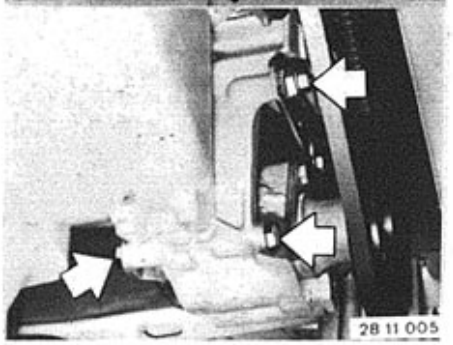
Disconnect negative and positive leads on battery.
Unscrew lead on positive terminal.



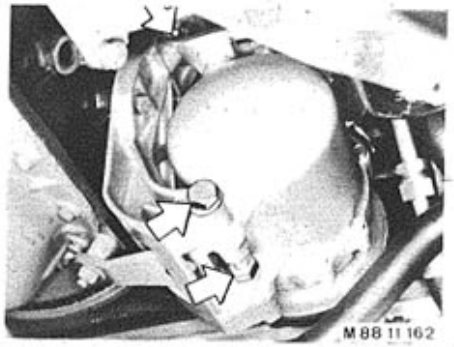
Unscrew ground strap for hood.
Disconnect or remove gas pressure props and insert Special Tool 51 2 110 to prop up the engine hood.
Caution!
Use locks (1).



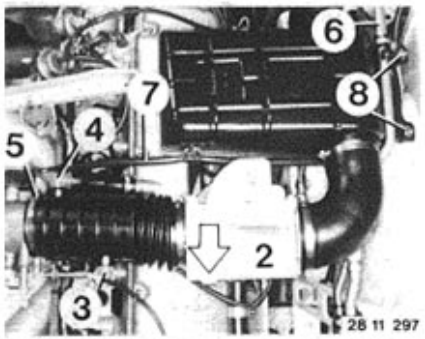
Remove transmission – see Gr. 23 or 24.
Unscrew plug and drain coolant.
Remove fan 11 52 000.
Remove radiator 17 11 000.



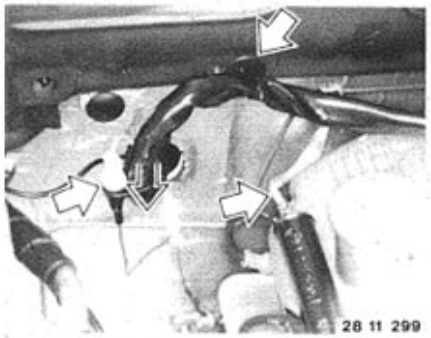
Unscrew power steering pump.
Pressure hoses remain connected.
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.



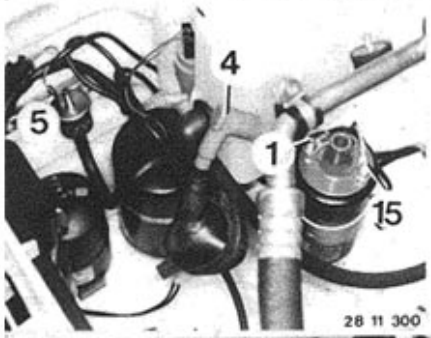
Unscrew compressor – see Group 64.
Refrigerant hoses remain connected.
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.



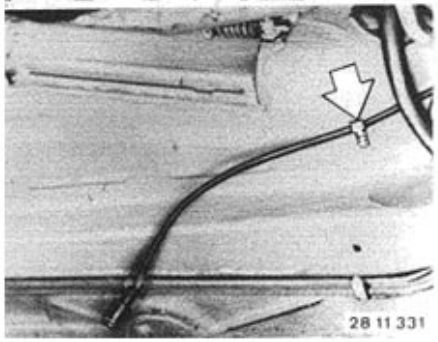
M 30 B 32:
Pull off plug (2) and lift out wires.
Pull out hoses (3 and 4).
Unscrew hose clamp (5).
Unscrew pipe (6).
Disconnect vent hose (7).
Unscrew nuts (8) and remove air cleaner with air flow sensor.



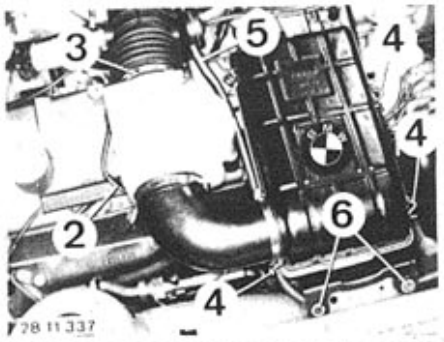
Pull off plugs on idle control unit and DME control unit in glove box and pull wires into engine compartment.
Disconnect ground wire.
Disconnect plug for oxygen sensor.
Disconnect wire harness on firewall.



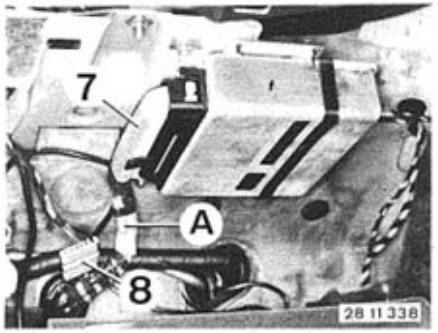
Pull off wire (4).
Disconnect wires (1 and 15).
Pull off wire (5) on solenoid.
Disconnect wire harness.



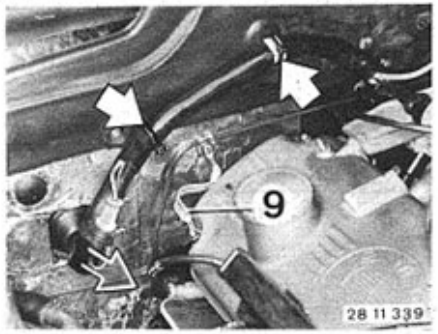
M 30 B 34:
Disconnect wire harness for oxygen sensor on floor plate.



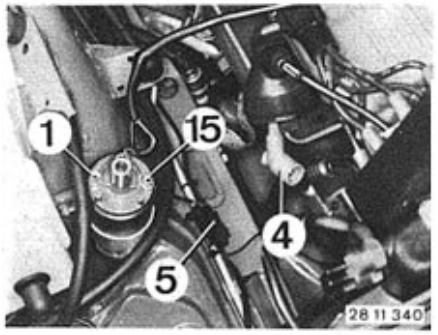
Pull off plug (2) and lift out wires.
Loosen hose clamp (3).
Open clips (4).
Pull off hose (5).
Unscrew nuts (6) and remove air cleaner with air flow sensor.



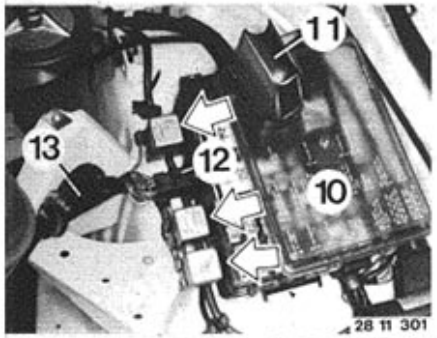
Pull off plug (7) on DME control unit in glove box.
Disconnect plug (8) and run wire harness into engine compartment.
Note:
Refer to 13 61 000 or a wiring diagram for the meaning of plug connection (A).



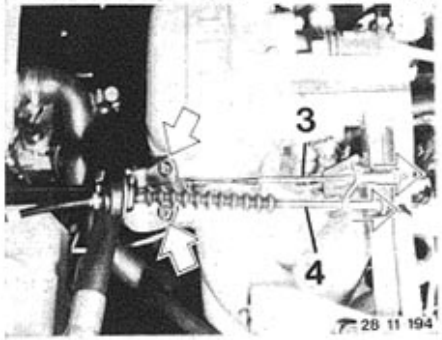
Unscrew ground wire (9).
Disconnect wire harness.



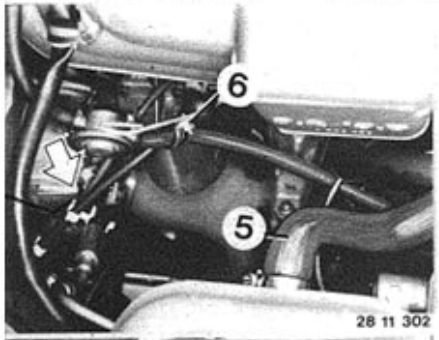
Pull off wire (4).
Unscrew wires (1 and 15).
Disconnect plugs (5).



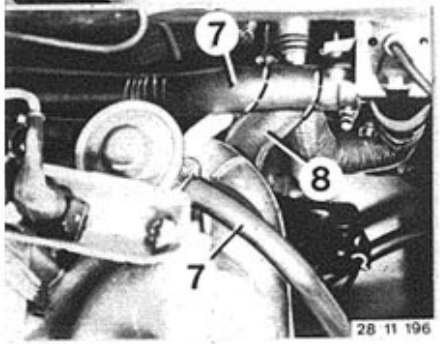
All Models:
Remove cover (10) and cap (11).
Pull off plug (12) and lift out relay.
Disconnect wire harness (13).



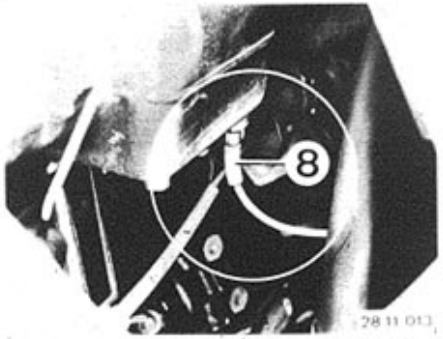
Disconnect accelerator cable (3) and cruise control cable (4).
Installation:
Adjust accelerator cable, see 35 41 421.
Adjust cruise control cable, see Group 65.



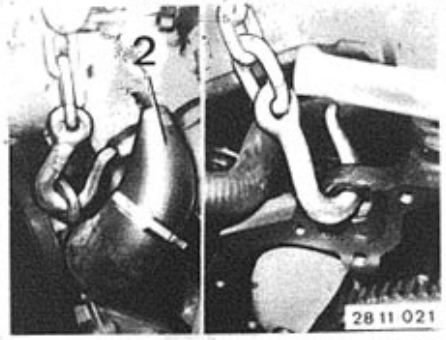
Unscrew water hose (5) for expansion tank.
Disconnect fuel return line (6).
Take wires out of clips.



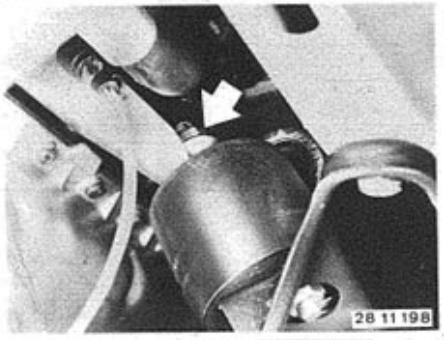
Disconnect fuel feed line (7) and heater hoses (8 and 9).



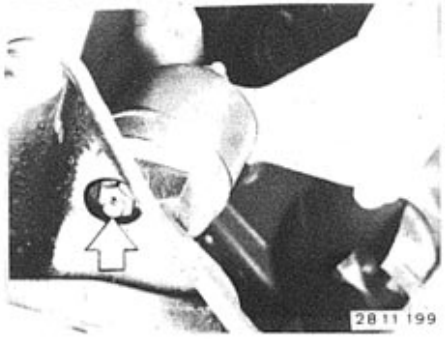
Pull off vacuum hose (8).



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

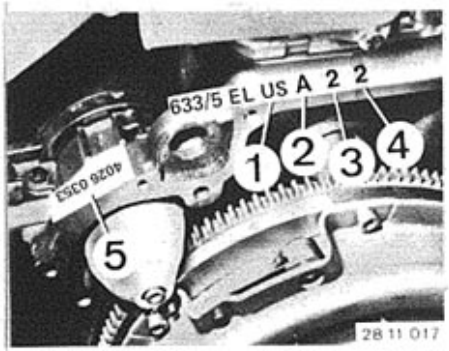


Unscrew left engine mount.
Installation:
Tightening torque*.



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



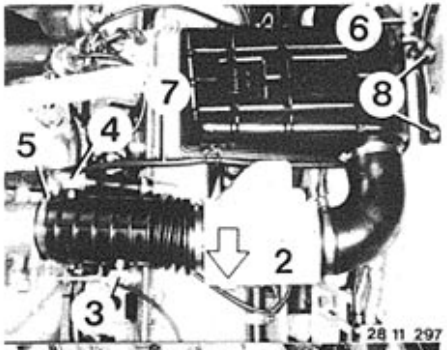
11 00 091 INSTALLING EXCHANGE ENGINE

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).

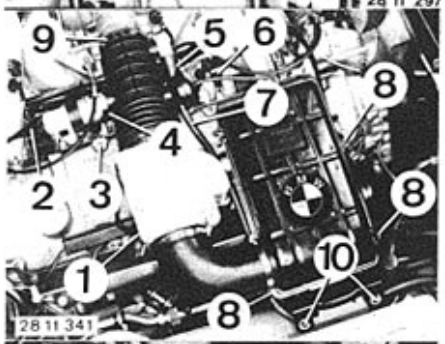
Drive in the supplied oil dipstick guide tube (see 11 43 101) and transfer parts from the old to the exchange engine.
Add engine oil***.
Important!
Remove the pilot bearing in the crankshaft (see 11 21 571), if the car has an automatic transmission.
Install engine.
Only M 30 B 32:
Adjust the engine idle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

*** See Service Information of Gr. 00

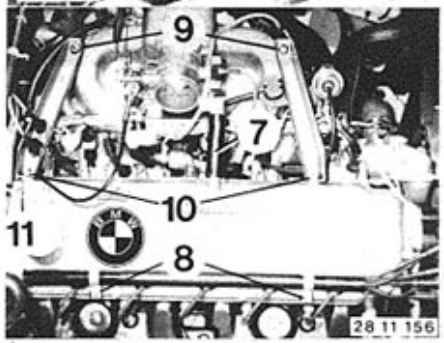


11 12 000 REMOVING AND INSTALLING CYLINDER HEAD COVER

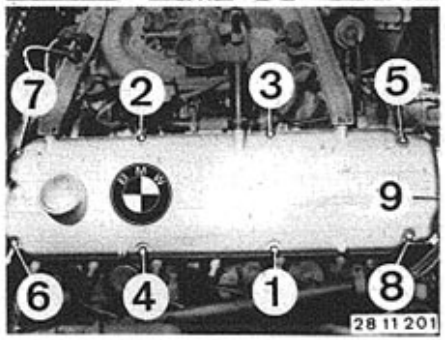
M 30 B 32:
Pull off plug (2) and lift out wires.
Pull out hoses (3 and 4).
Unscrew hose clamp (5).
Unscrew pipe (6).
Disconnect vent hose (7).
Unscrew nuts (8) and remove the air cleaner with the air flow sensor.



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.



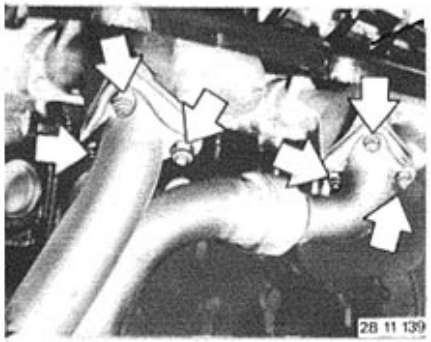
Pull off hose (7).
Unscrew ignition lead tube (8).
Loosen nuts (9).
Unscrew and remove nuts (10).
Unscrew clamp (11).
Installation.
First tighten nuts (10) and then (9).



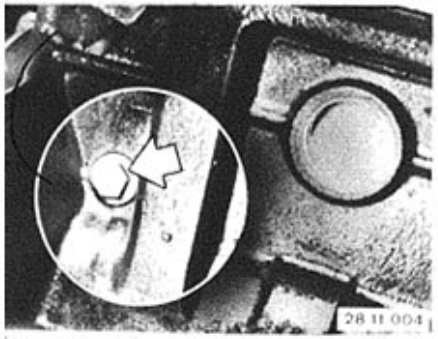
Unscrew the cylinder head cover.
Installation:
Check gasket, replacing if necessary.
Make sure that the gasket is positioned correctly and tighten the bolts in order o 1 through 9.
Mount the clamp with bolt (9).
Tightening torque*.

* See Specifications

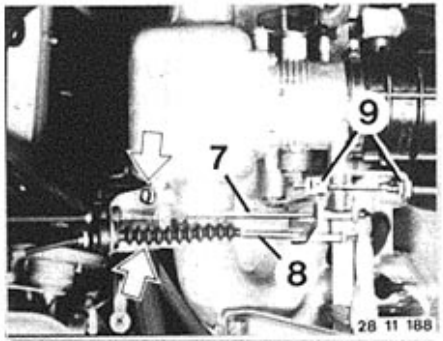
11 12 100 REMOVING AND INSTALLING CYLINDER HEAD



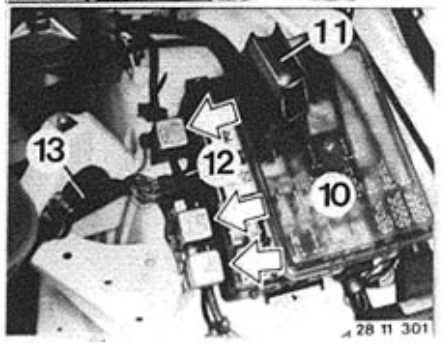
Unscrew exhaust pipes on exhaust manifolds and pipe clamp on transmission.
Installation:
Check gaskets, replacing if necessary.
Coat studs with copper paste "CRC"***
Replace self-locking nuts.
Tightening torque*.



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

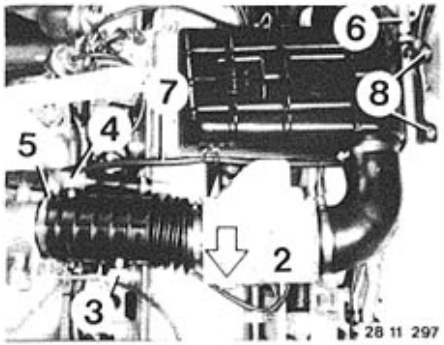


Disconnect accelerator cable (7), cruise control cable (8) and throttle cable (9).
Installation:
Adjust accelerator cable, see 35 41 421.
Adjust cruise control cable, see Group 65.
Adjust throttle cable, see Group 24.

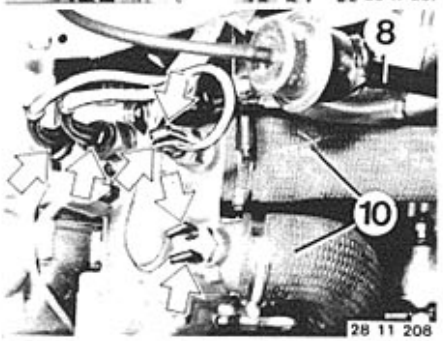


Remove cover (10) and cap (11).
Pull off plug (12) and lift out relay.
Disconnect wire harness (13).

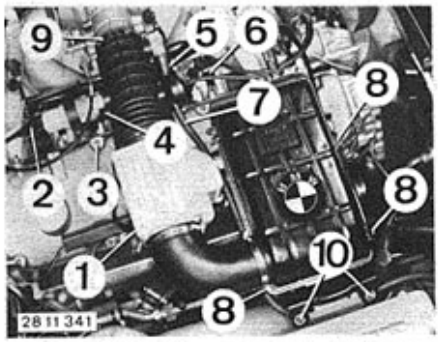
* See Specifications
** Source: HWB
*** See Service Information of Gr. 00



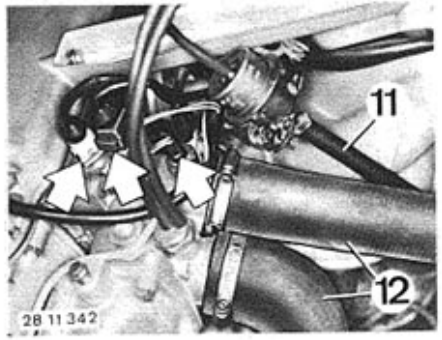
M 30 B 32:
Pull off plug (2) and lift out wires.
Pull out hoses (3 and 4).
Unscrew hose clamp (5).
Unscrew pipe (6).
Disconnect vent hose (7).
Unscrew nuts (8) and remove air cleaner with air flow sensor.



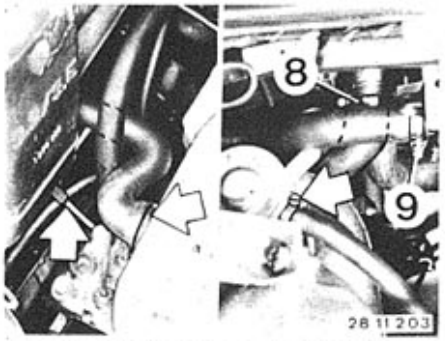
Pull off plug.
Disconnect fuel return line (8) and water hoses (10).



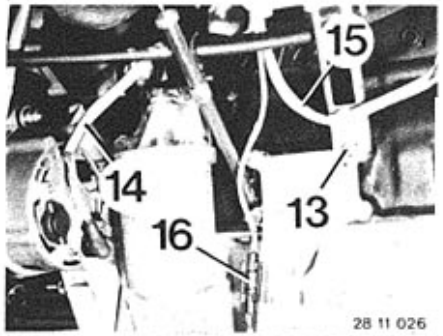
M 30 B 34:
Pull off plug (1) and lift out wires.
Pull off plug (2) and unscrew nut (3).
Pull off hoses (4 ... 7).
Open clips (8).
Loosen hose clamp (9).
Unscrew nuts (10) and remove air cleaner with air flow sensor.



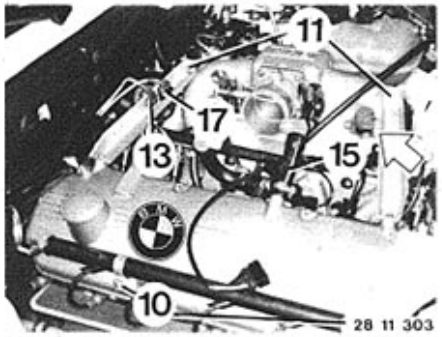
Pull off plug.
Disconnect fuel return line (11) and coolant hose (12).



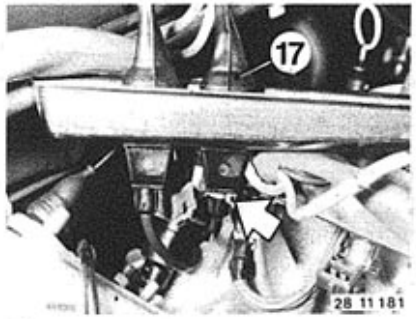
All Models:
Disconnect fuel feed line and heater hoses (8 and 9).
Disconnect water hose for expansion tank.
Pull off vacuum hose.



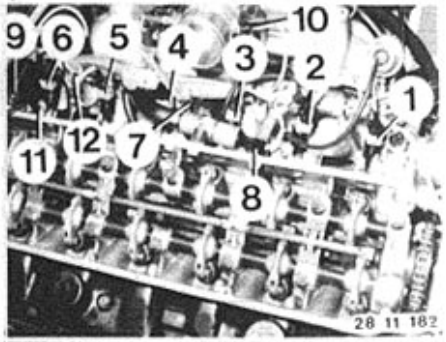
Remove bolt (13).
Disconnect wires (14 and 15) on alternator and starter.
Lift out and disconnect plugs (16).



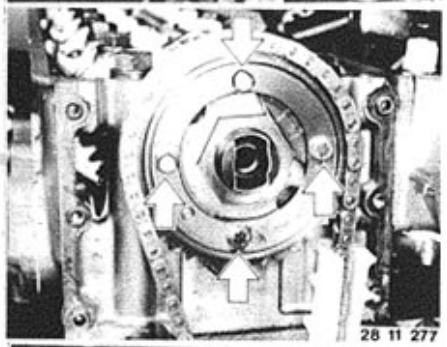
Unscrew ignition lead tube (10) and distributor cap.
Unscrew diagnosis socket.
Remove bolts (11).
Disconnect DME plugs (13 and 17).
Pull off hose (15).
Take off cylinder head cover.
Installation:
Check that gasket seats correctly.



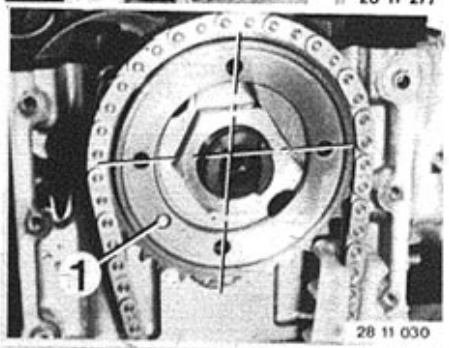
Connect DME plugs for reference mark and speed signals in such a manner, that gray plug (17) is connected with the plug marked with a ring.



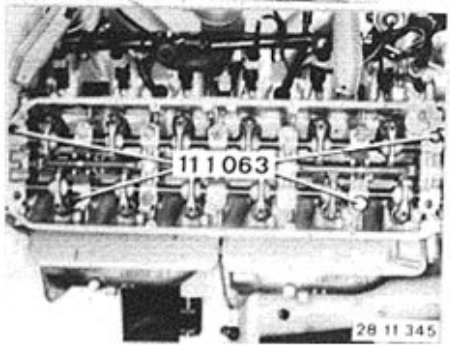
Pull off plugs on fuel injectors (1 ... 6), cold start valve (7), idle positioner (8), oil pressure switch (9) and throttle (10).
Unscrew clamp (11) and ground lead (12).
Disconnect engine wire harness and place aside to the right.



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*.

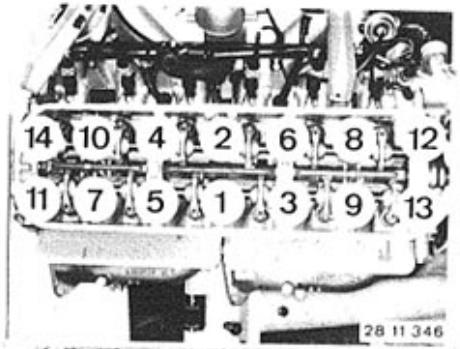


Installation:
Install timing chain that dowel pin (1) is at bottom left when tapped bores are perpendicilar to the engine.

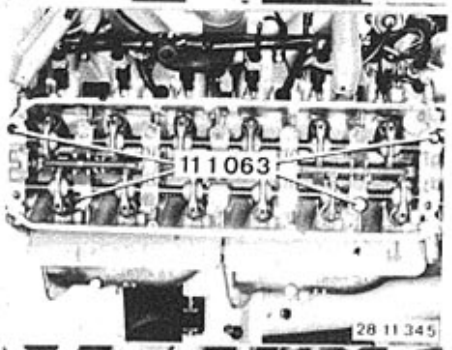


Unscrew cylinder head bolts in order of 14 through 1.
Insert Special Tools 11 1 063 as shown in picture, to prevent moving or turning of rocker arm shafts.
Lift off cylinder head.

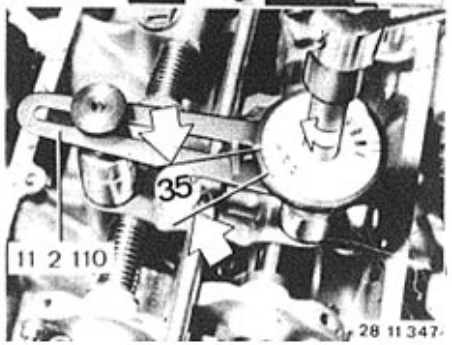
* See Specifications



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.

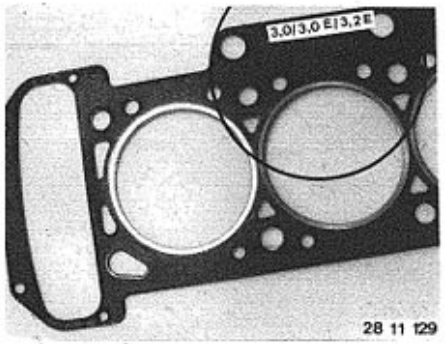


Tighten bolts in order of 1 through 14 to correct torque* in three steps.
Important!
New cylinder head bolts without collar (better quality):
First tighten bolts 1 ... 6 with 60 ± 2 Nm (43.4 ± 1.4 ft. lbs.) – remove Special Tools 11 1 063 – then tighen bolts 7 ... 14 in first step.



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

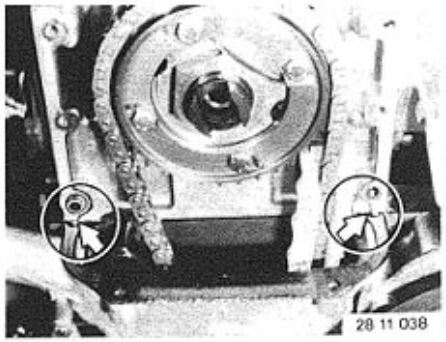


11 12 101 REPLACING CYLINDER HEAD GASKET

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.

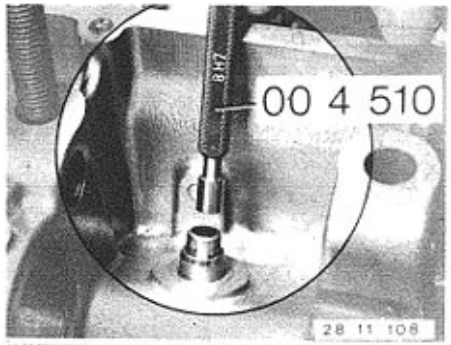
Stamped Identification:

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")



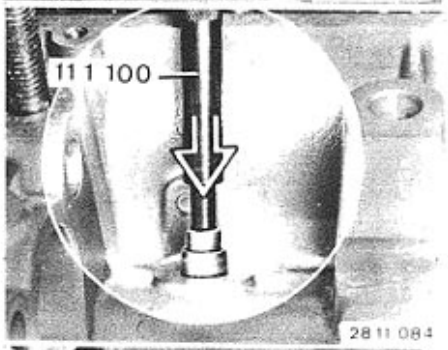
Important!
A 0.3 mm (0.012") thicker gasket can be used on a ground cylinder head, to avoid reducing the specified combustion chamber size.
This gasket may also be used, if poor fuel grade is causing engine knock.
Important!
Coat bores with a brush-on universal sealant / Three Bond Silicon 1207** prior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

** Source: HWB

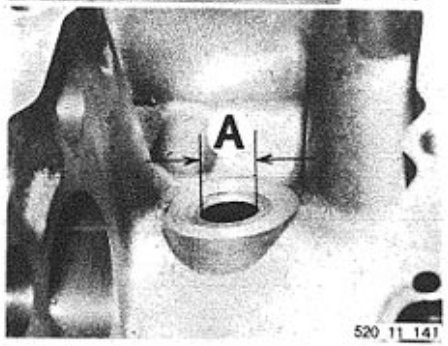


11 12 561 REPLACING VALVE GUIDE – Valve Removed –

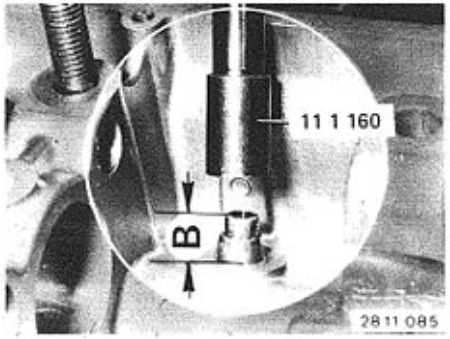
Check valve guide wear* with Special Tool 00 4 510.



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

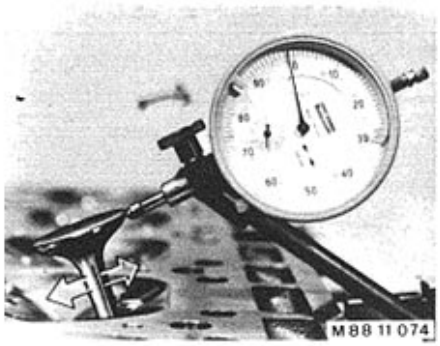


Check bore in cylinder head with Special Tool 00 4 520.
Ream out bore with a standard reamer and install an oversize* valve guide, if permissible diameter (A) is exceeded.



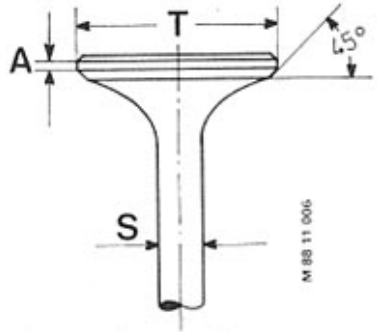
Heat cylinder head*
Drive valve guide into cylinder head from the camshaft side with Special Tool 11 1 160.
Stepped end of valve guide faces camshaft.
Important!
Bore in special tool determines protrusion B* of valve guide.
Ream out valve guide to specified inside diameter* with Special Tool 00 4 500.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

* See Specifications



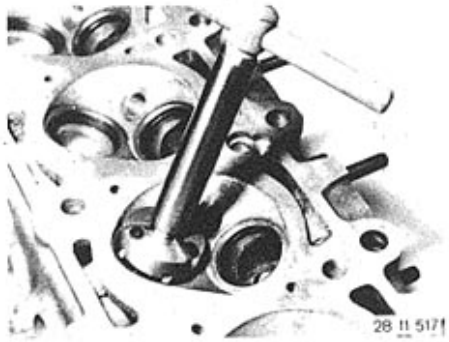
11 12 595 CHECKING VALVE GUIDE FOR WEAR
– Valve Removed –

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*.

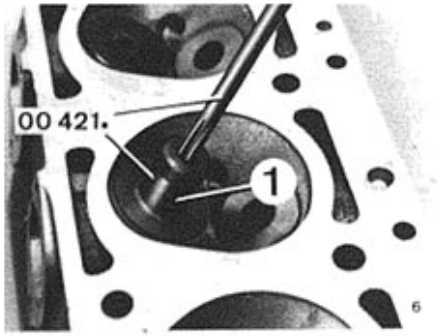


11 12 607 MACHINING VALVE SEATS AND VALVES
– Valves Removed –

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

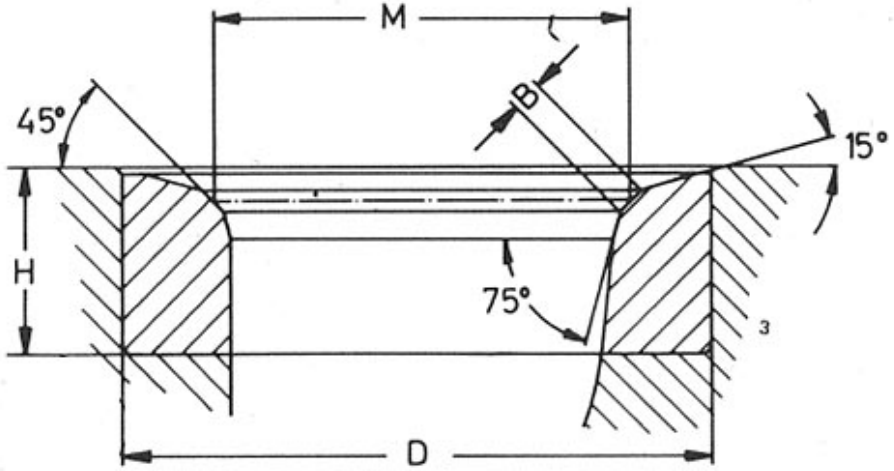


Produce valve seat diameter M* and valve seat width B* by machining correction angles* after machining the valve seat angle*.
Grind in valves with grinding paste and check for leaks – see 11 34 509.



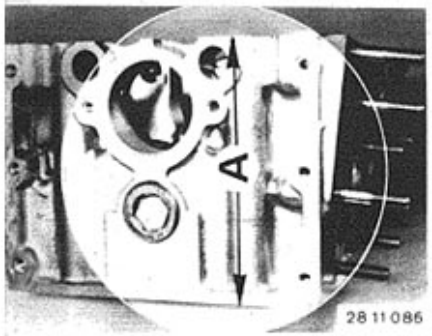
11 12 600 REAMING OUT VALVE GUIDE
– Valve Removed –

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.

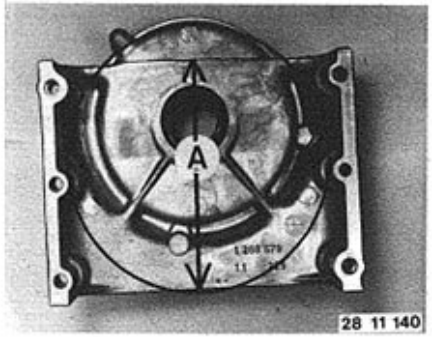


* See Specifications

* See Specifications



28 11 086

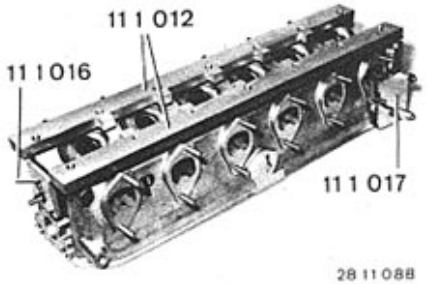


28 11 140

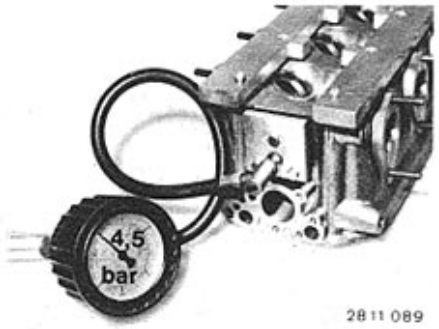
11 12 719 GRINDING CYLINDER HEAD SEALING SURFACES –CYL. HEAD DISASSEMBLED–

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

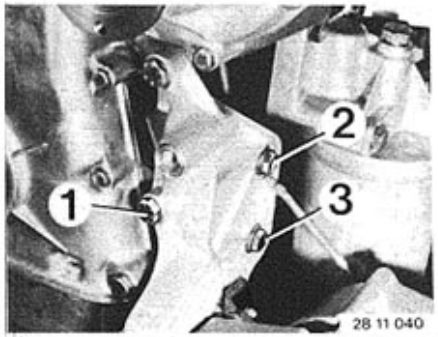


28 11 089

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

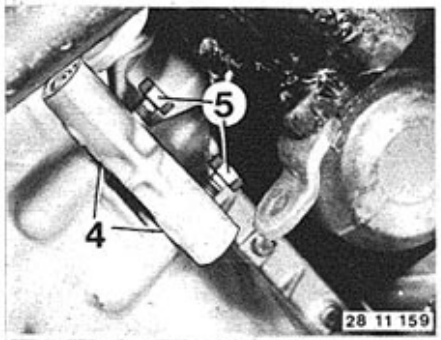
Mount Special Tools 11 1 012 on cylinder head.
Plug water circuit on cylinder head with Special Tools 11 1 016 and 11 1 017.

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.

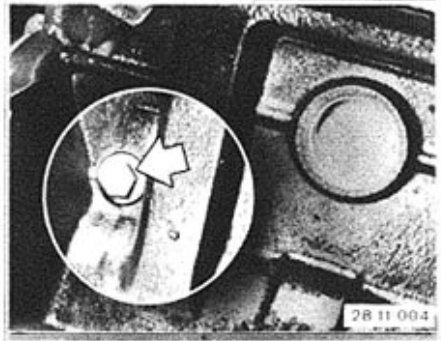


11 13 000 REMOVING AND INSTALLING OIL PAN

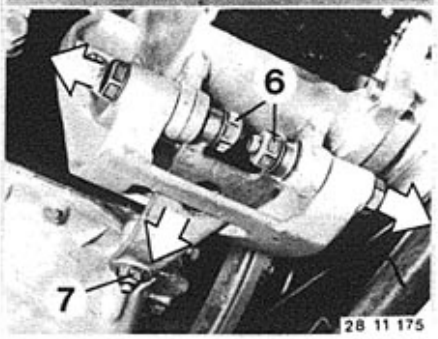
Take off drive belt for alternator.
Unscrew alternator and swing aside.
Unscrew bolt (1).
Loosen bolts (2 and 3).
Installation:
Tighten drive belt and check tightness with Special Tool 11 5 020.



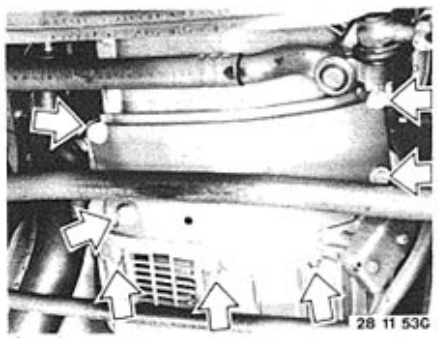
Take off drive belt for power steering pump.
Unscrew power steering pump and remove bolts (5).
Installation:
Do not tension console when installing – use spacers (4), see 32 41 131.
Tighten drive belt and check tightness with Special Tool 11 5 020.



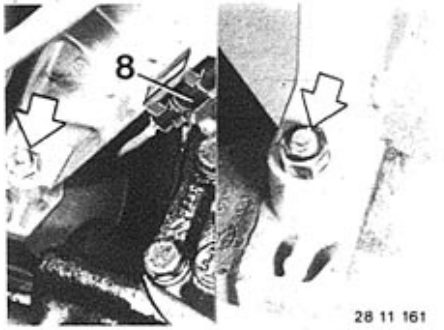
Unscrew plug and drain coolant partially.
Drain engine oil.
Installation:
Add coolant**.
Add engine oil**.



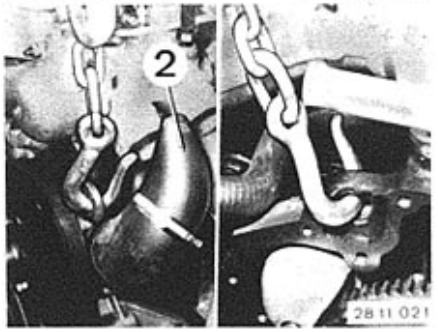
Unscrew bolts (6) and nut (7).
Remove holder toward inside.



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



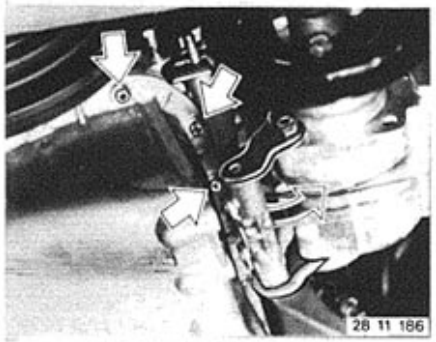
Unscrew both engine mounts.
Disconnect wire (8).
Installation:
Tightening torque*.



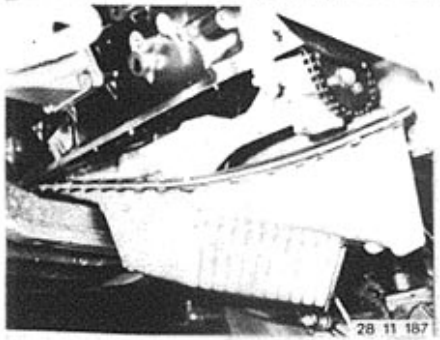
Disconnect water hose (2) and apply Special Tool 11 0 020.
Lift engine.

** See Service Information of Gr. 00

* See Specifications



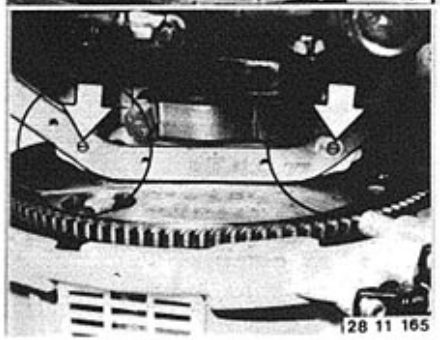
Swing out the console and tie down.
Unscrew remaining oil pan bolts.



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

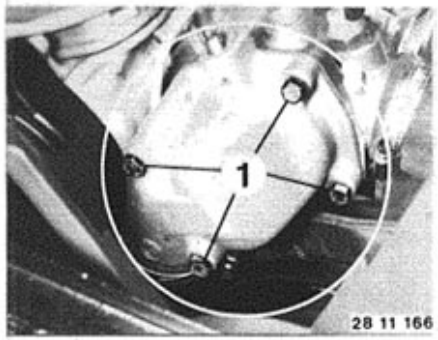


Installation:
Clean sealing surfaces.
Replace oil pan gasket.
Coat joint surfaces on timing case cover and



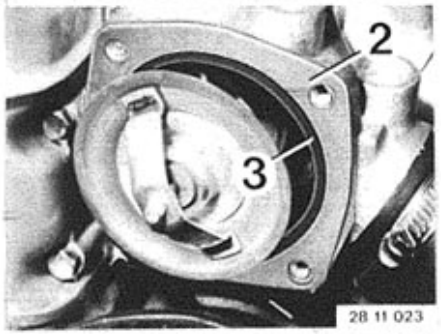
end cover with a brush-on universal sealing compound**

** Source: HWB

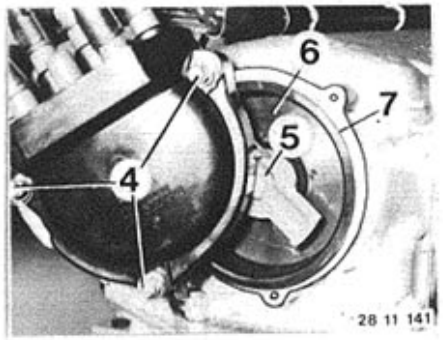


11 14 100 REMOVING AND INSTALLING/ SEALING UPPER TIMING CASE COVER

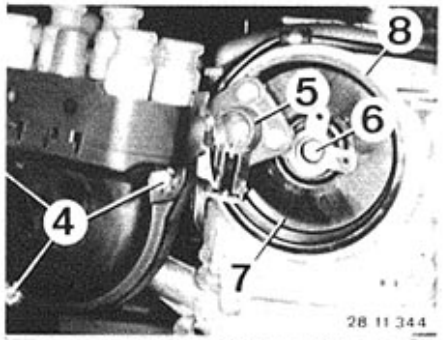
Remove cylinder head cover 11 12 000.
Drain coolant partially.
Installation:
Bleed cooling system 17 00 039.
Unscrew cover (1) on thermostat housing.



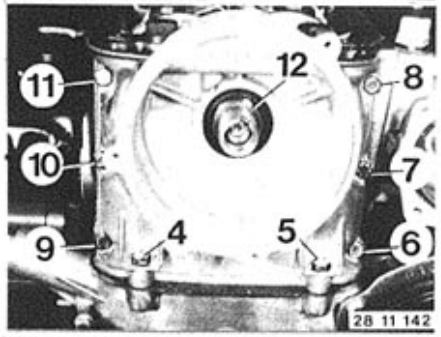
Installation:
Replace gasket (2) and seal (3).
Clamp on thermostat faces out.
From model '86 on:
new Thermostat, with gasket on cover, see 11 53 000.



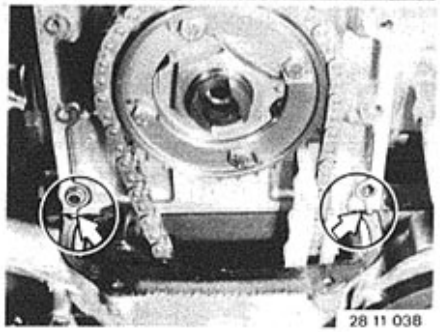
For DME with Inserted Distributor Arm:
Take off distributor cap (4).
Pull off distributor arm (5) and remove cover (6).
Installation:
Check rubber ring (7).



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*

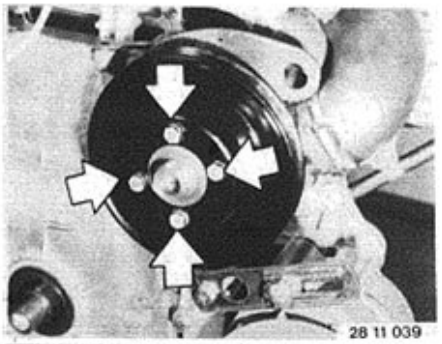


Unscrew timing case cover.
Installation:
Tighten screws (4 and 5) finger tight.
Now tighten screws (6 ... 11) (8 and 9 are longer).
If applicable, replace damaged cylinder head gasket – see 11 12 000.
Check that radial oil seal fits correctly on the distributor rotor adapter (12).



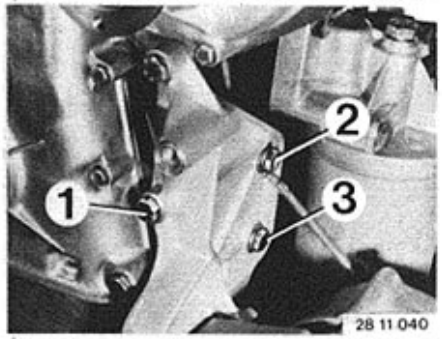
Important!
Coat bores with a brush-on universal sealing compound/Three Bond Silicone 1207** prior to installation of the timing case cover.

* See Specifications
** Source: HWB

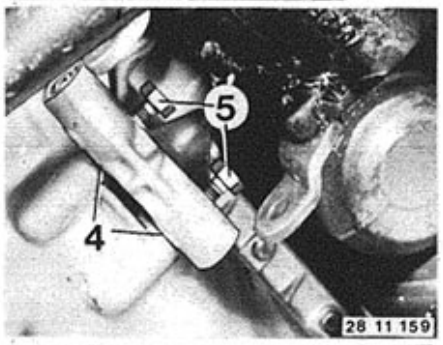


11 14 120 REMOVING AND INSTALLING/ SEALING LOWER TIMING CASE COVER

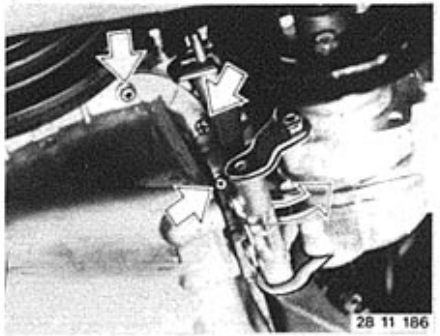
Remove fan 11 52 000.
Remove vibration damper with hub 11 23 000.
Remove upper timing case cover 11 14 100.
Remove chain tensioner piston 11 31 090.
Unscrew water pump pulley.



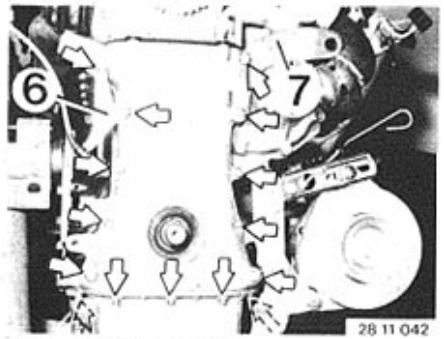
Unscrew and swing alternator aside.
Unscrew bolt (1).
Loosen bolts (2 and 3).



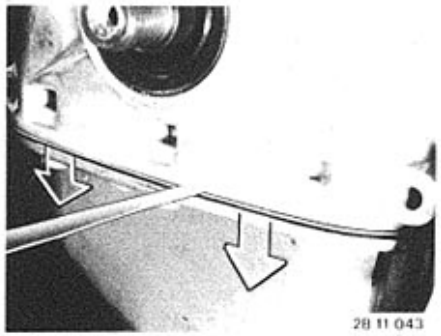
Unscrew power steering pump and remove bolts (5).
Installation:
Do not tension console while installing – use spacers (4), see 32 41 131.



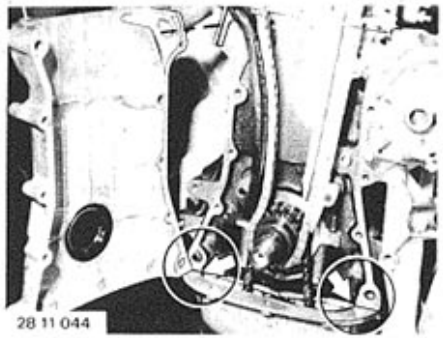
Swing away and tie down console.
Unscrew oil pan bolts.



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.

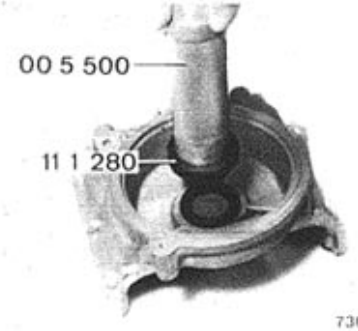


Pry oil pan gasket off of timing case cover carefully with a knife.
If oil pan gasket is damaged, remove oil pan 11 13 000.



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.

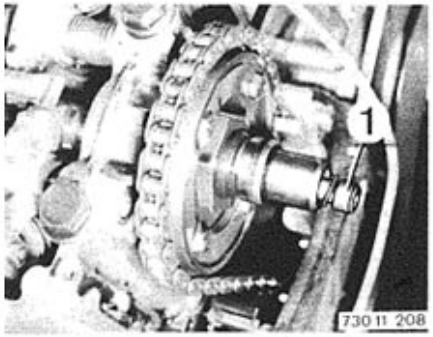
** Source: HWB



730 11 207

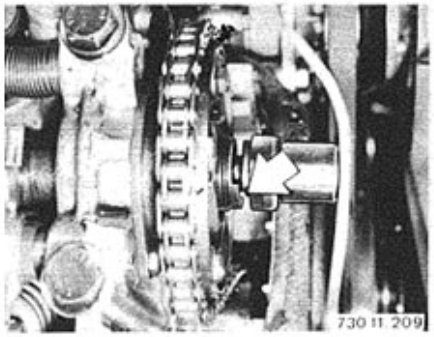
11 14 131 REPLACING RADIAL OIL SEAL IN UPPER TIMING CASE COVER

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.

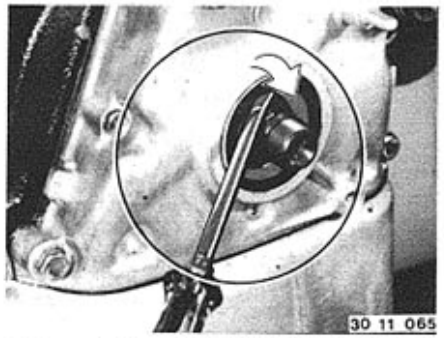


730 11 208

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*.

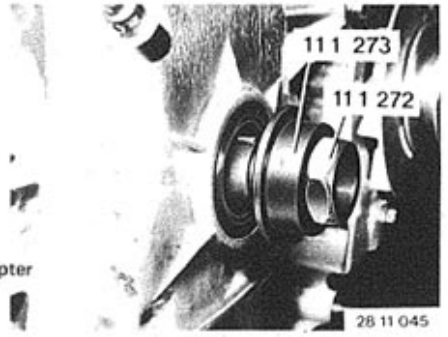

730 11 209

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

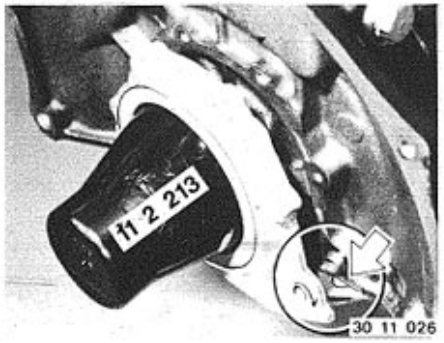
Remove vibration damper with hub 11 23 000.
Lift out radial oil seal with a screwdriver.



28 11 045

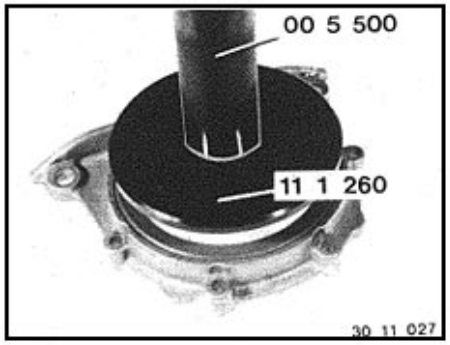
Lubricate sealing lip of radial oil seal with oil.
Press in radial oil seal with Special Tools 11 1 273 and 11 1 272.

* See Specifications
** Source: HWB



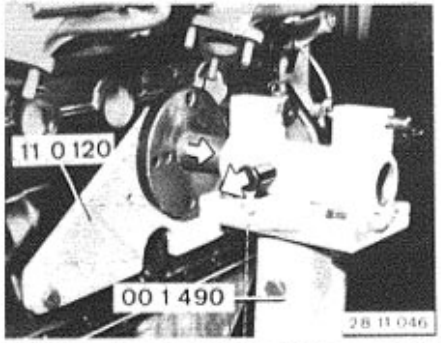
11 14 605 REPLACING RADIAL OIL SEAL IN CLUTCH END COVER
– Transmission Removed –

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

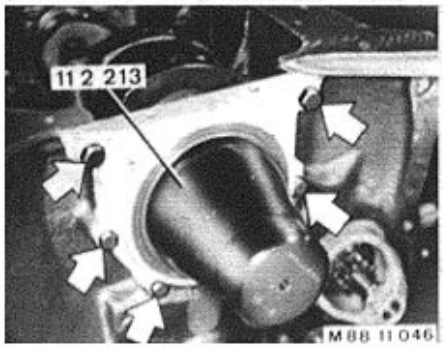


11 21 000 REMOVING AND INSTALLING CRANKSHAFT

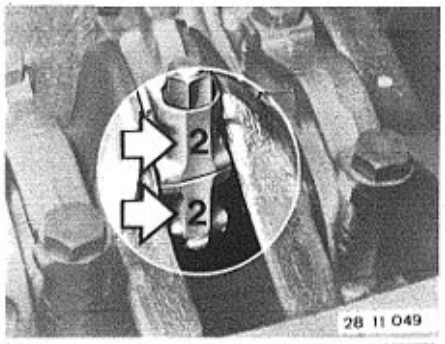
Remove engine 11 00 050.
Unscrew right engine mount console.
Mount crankcase on Special Tool 00 1 490 with help of Special Tool 11 0 120.



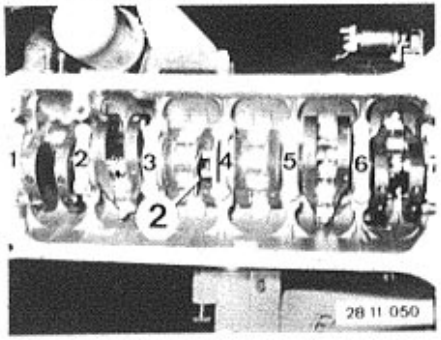
Remove clutch 21 21 000.
Remove cylinder head 11 12 100.
Remove timing chain 11 31 051.
Remove oil pump 11 41 000.
Check axial play* before removing the crankshaft.
Check or replace thrust bearing, if max. permissible play is exceeded.



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.



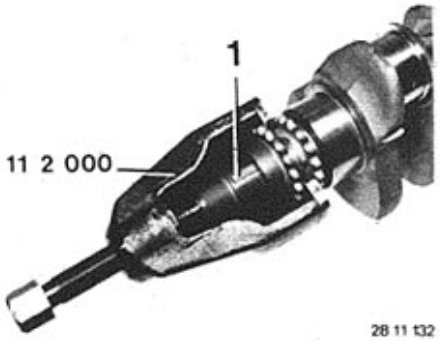
Mark position of conrod bearing caps to connecting rods and unscrew.
Installation:
Replace conrod bearings and measure conrod bearing play – see 11 24 571.



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

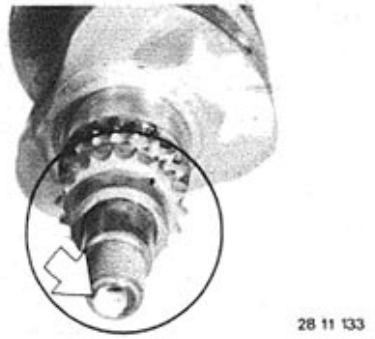
* See Specifications



28 11 132

11 21 501 REPLACING CRANKSHAFT
– Crankshaft Removed –

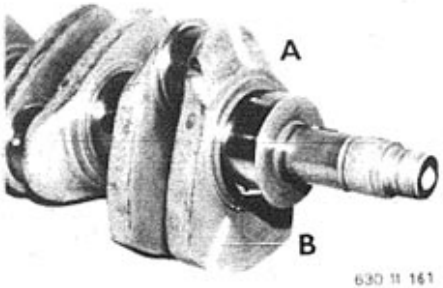
Take out woodruff key (1).
Pull off sprocket with Special Tool 11 2 000.
Installation:
Heat sprocket to max. 200° C (390° F) for installation.



28 11 133

Identification of Crankshafts:

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



630 11 161

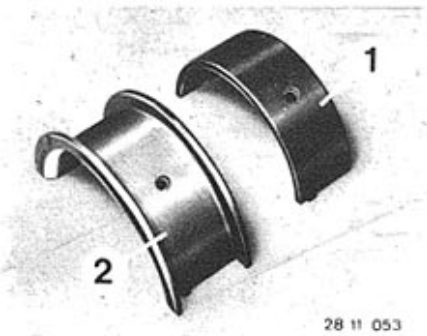
Reground crankshafts are marked with stripes of paint.
Check machined sizes!

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.

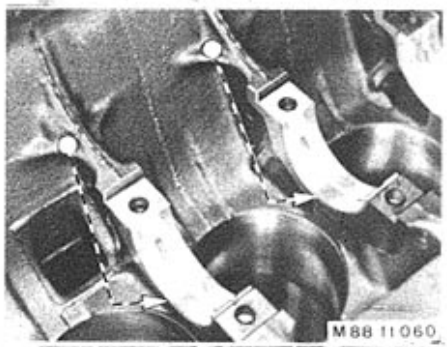
* See Specifications



28 11 053

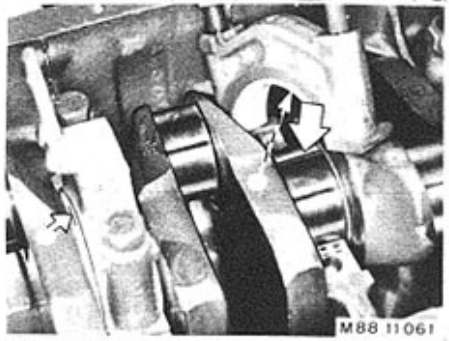
11 21 531 REPLACING CRANKSHAFT MAIN BEARING SHELLS
– Engine Disassembled –

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

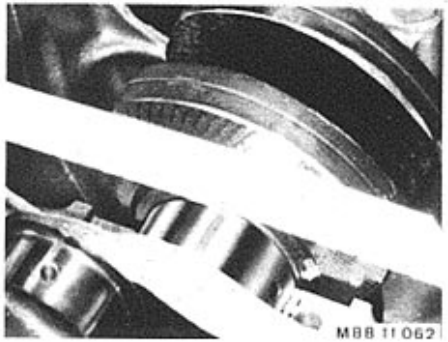
Bearing shells are installed in crankcase according to color code of crankcase.
If color code has been washed off of the crankcase, both shells are installed according to the crankshaft color code.
Install crankshaft.



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

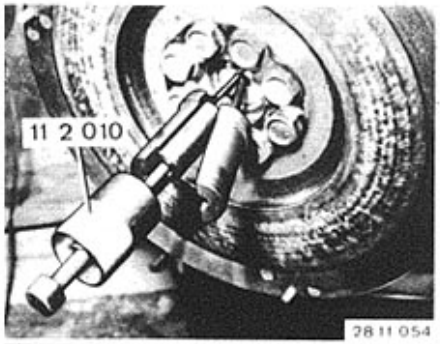


M88 11 062

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

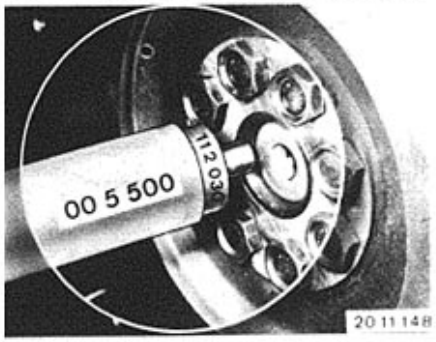
11 21 571 REPLACING PILOT BEARING IN CRANKSHAFT



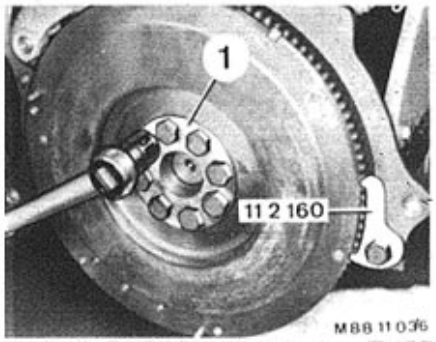
Remove clutch disc 21 21 000.
Pull out ball bearing with Special Tool 11 2 010.
Cars with Automatic Transmission:
Pull out adapter sleeve with Special Tool 11 2 020.



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

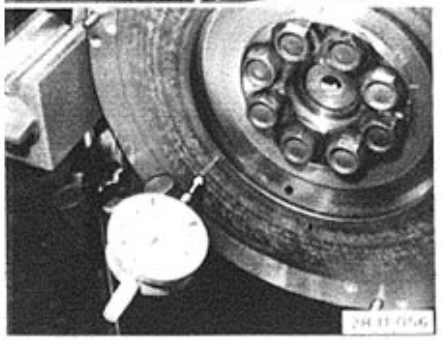


Pack bore in crankshaft with appròx. 1 gram of lubricating grease.
Drive in pilot bearing with Special Tools 11 2 030 and 00 5 500.



11 22 000 REMOVING AND INSTALLING FLYWHEEL

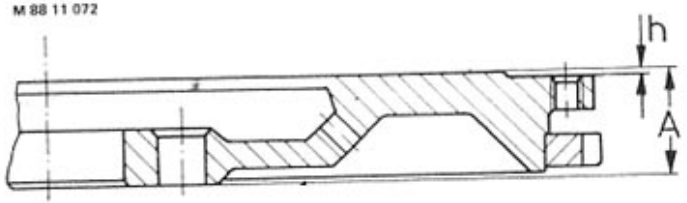
Remove clutch disc 21 21 000.
Hold flywheel with Special Tool 11 2 160.
Unscrew bolts and take off flywheel.
Installation:
Clean tapped bores.
Insert ring (1).
Replace and install expansion bolts with Loctite No. 270**
Tightening torque*



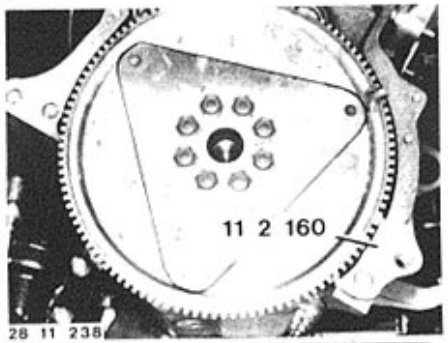
Check axial runout* of flywheel.

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

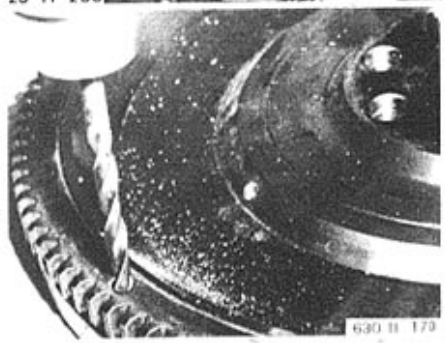


* See Specifications
** Source: HWB



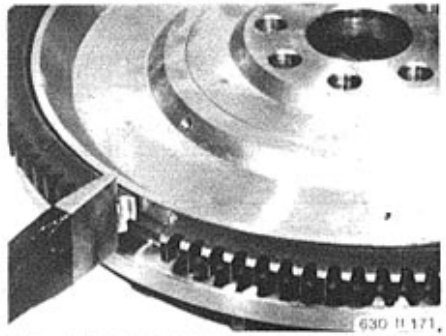
11 22 051 REPLACING TORQUE CONVERTER DRIVE PLATE

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*.

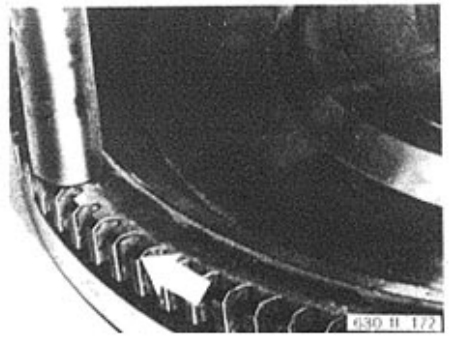


11 22 541 REPLACING STARTER GEAR RING

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.

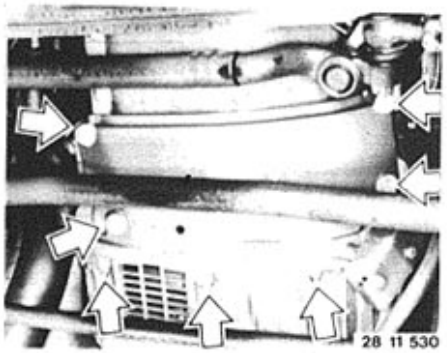


Break gear ring at drilled point with a chisel.



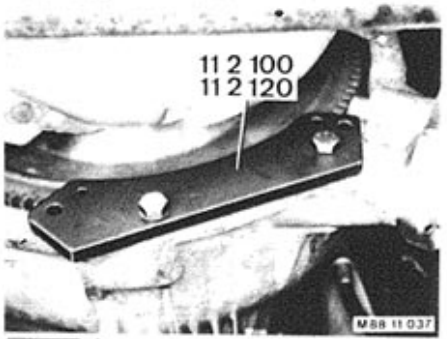
Installation:
Heat new gear ring to 200 ... 230° C (390 ... 445° F).
Check temperature with a thermochrome pencil.
Tooth bevelled surface faces engine end.
Install starter gear ring to fit snugly with a brass mandrel.

* See Specifications
** Source: HWB

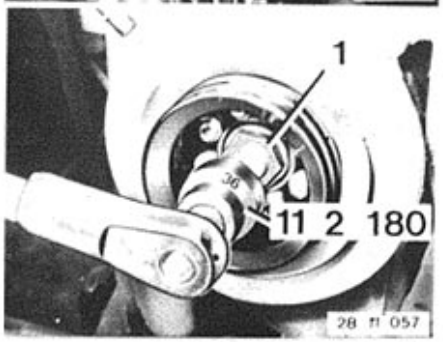


11 23 000 REMOVING AND INSTALLING VIBRATION DAMPER WITH HUB

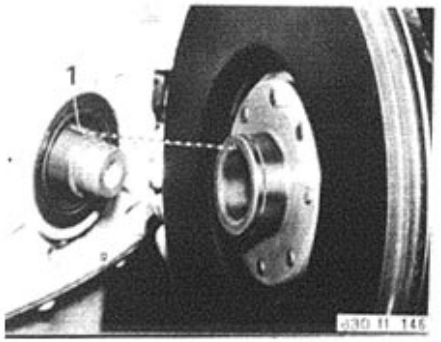
Unscrew reinforcement plate.



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

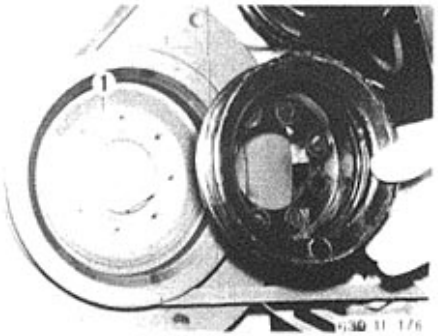


Take off drive belts on alternator, power steering pump and, if applicable, compressor for air conditioner.
Unscrew nut (1) with Special Tool 11 2 180.
Installation:
Tightening torque*.
Tighten drive belts and check tightness with Special Tool 11 5 020.



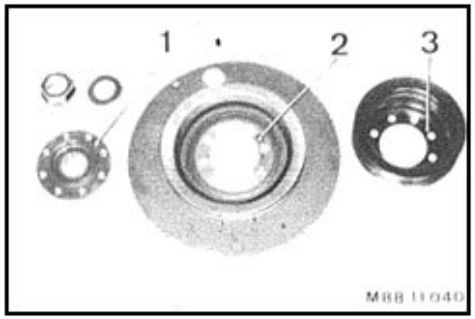
Pull off vibration damper with hub.
Important!
Make sure key (1) is installed in correct position.
Check seal, replacing if necessary.
Installation:
If hub is scored seriously, install seal that its lip makes contact in front of or behind the scored groove .

* See Specifications



11 23 010 REPLACING VIBRATION DAMPER

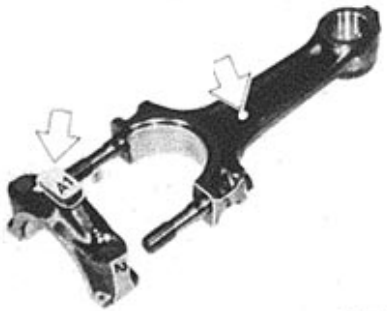
Take off drive belts on alternator, power steering pump and, if applicable, compressor for air conditioner.
Unscrew pulley and take off vibration damper.
Installation:
Centering pin (1) must be in bore of vibration damper.
Tightening torque*.
Tighten drive belts and check tightness with Special Tool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



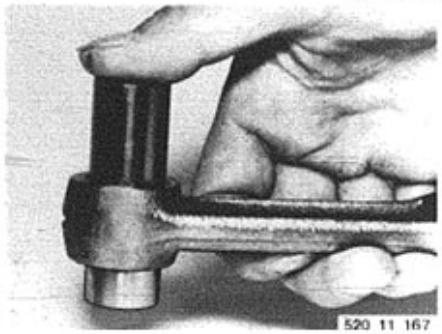
11 23 031 REPLACING HUB FOR VIBRATION DAMPER

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



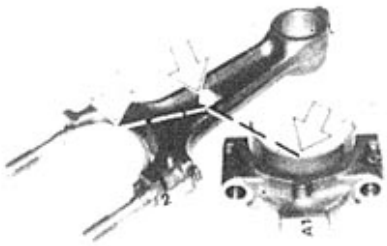
28 11 275



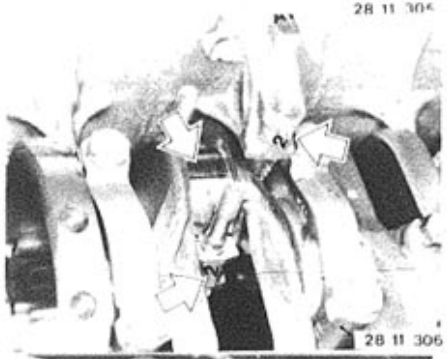
11 24 521 REPLACING CONNECTING RODS – PISTONS REMOVED –

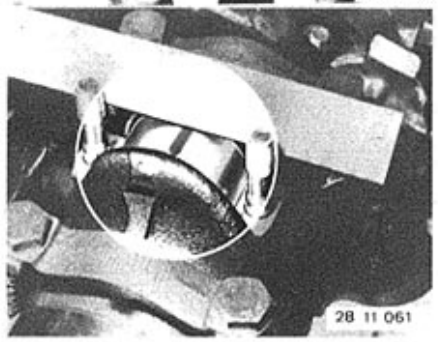
Important!
Only install connecting rods of same weight class in one engine.
Weight class is stamped in the machined conrod bearing cap surface or indicated by a color code.
Machining of connecting rods is not approved.

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



28 11 306





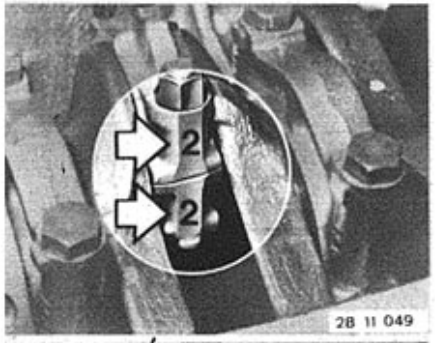
11 24 571 REPLACING CONNECTING ROD BEARING SHELLS – ENGINE DISASSEMBLED –

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).

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

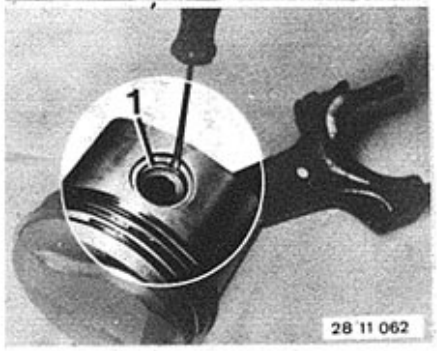
Important!
Don't turn connecting rods or crankshaft.
Remove bearing caps.
Check bearing play* by measuring width of flattened Plastigage with the supplied scale.
Correct bearing play by installing new bearing shells, bearing shells of different machined size or with different color codes.
Use new conrod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

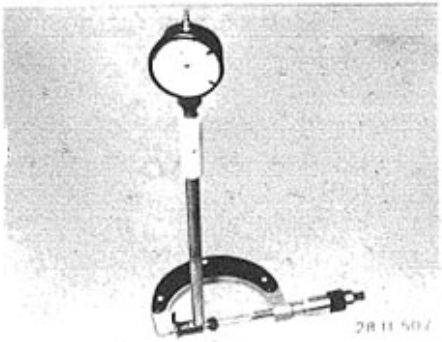
Engine	E*	Piston Cup (mm)	Dia. (mm)
M 30 B 32	8.8	0 (flat piston)	89
M 30 B 34	8.0	5.3	92



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)

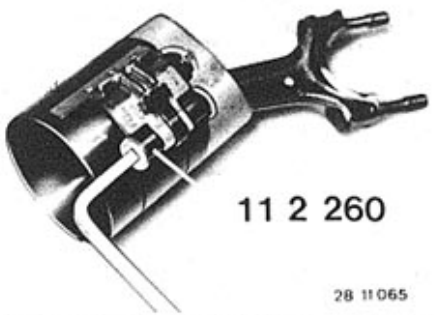
* See Specifications
*** AUS/CH/S



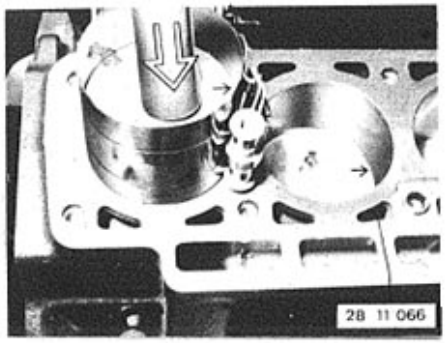
Set internal calipers to zero on micrometer with the measured piston diameter.



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.

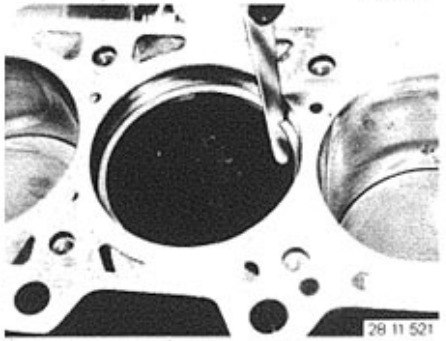
* See Specifications

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



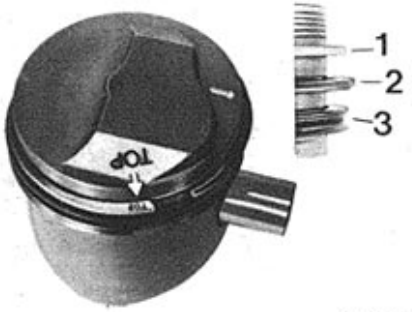
28 11 135

Measure side clearance* of piston rings.



28 11 521

Remove piston rings and measure end clearance*.

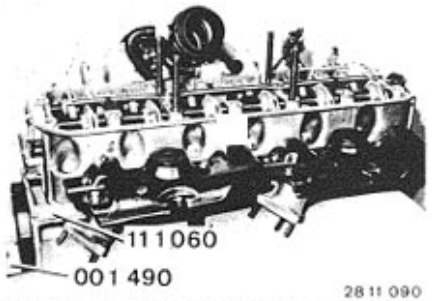


28 11 068

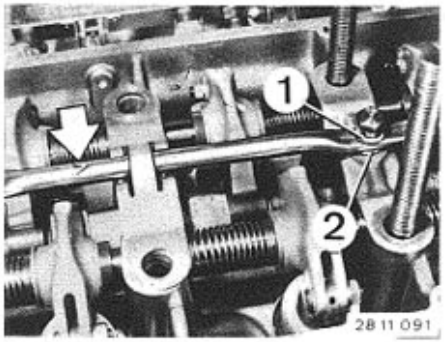
Installation:
Install piston rings that word "TOP" faces piston crown.
1 Plain compression ring
2 Tapered face ring
3 Oil scraper ring

* See Specifications

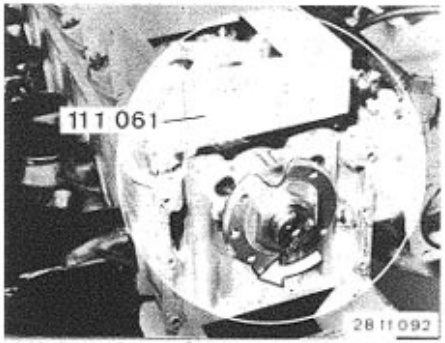
11 31 000 REMOVING AND INSTALLING CAMSHAFT –CYL. HEAD REMOVED–



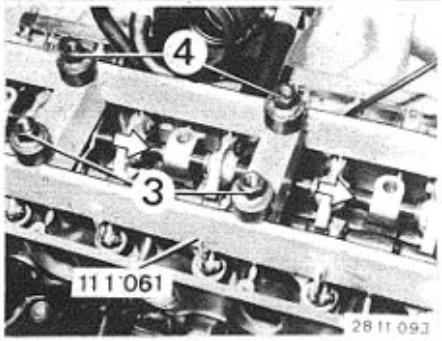
Mount Special Tool 11 1 060 on Special Tool 00 1 490.
Mount cylinder head on special tool assembly.



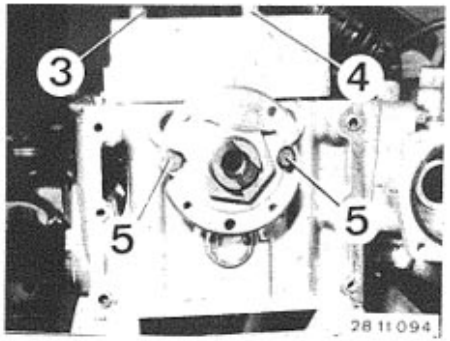
Unscrew oil line.
Installation:
Replace seals (1 and 2).
Mount oil line that arrow faces forward.
Tightening torque*.



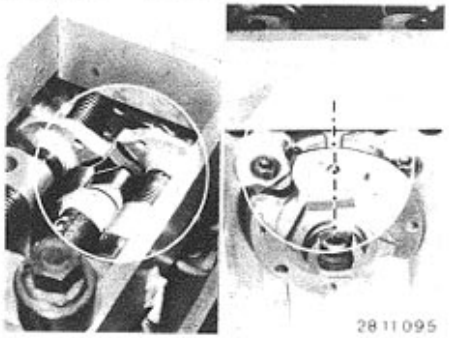
Adjust valve clearance of all valves to the greatest value.
Turn camshaft approx. 15° and mount Special Tool 11 1 061.



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.

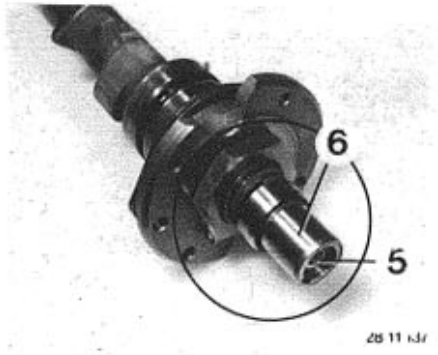


Installation:
It must be possible to turn the camshaft easily after installation of the guide plate.
Set valves of cylinder no. 6 to overlap before releasing the special tool.
Tapped bore in flange must be aligned with the cast boss.
Installation:
Adjust valve clearance 11 34 004.

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

* See Specifications

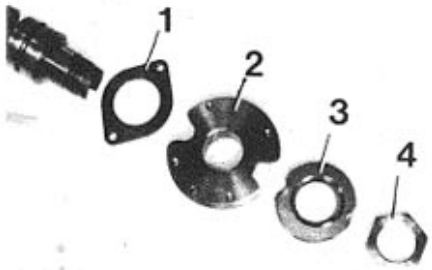
** See Service Information of Gr. 11



28 11 137

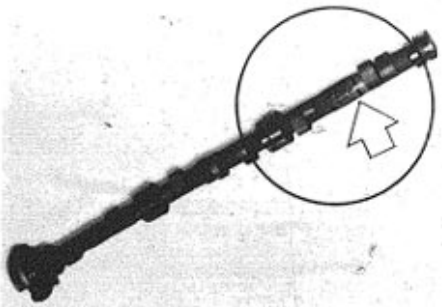
11 31 001 REPLACING CAMSHAFT
– Camshaft Removed –

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

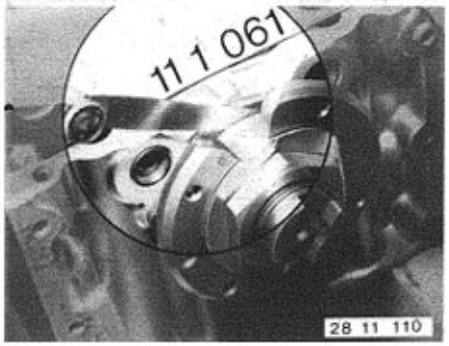
Transfer flange for sprocket.
Guide plate (1)
Flange (2)
Lockplate (3)
Nut (4)
Tightening torque*.



28 11 138

Camshaft Identification:

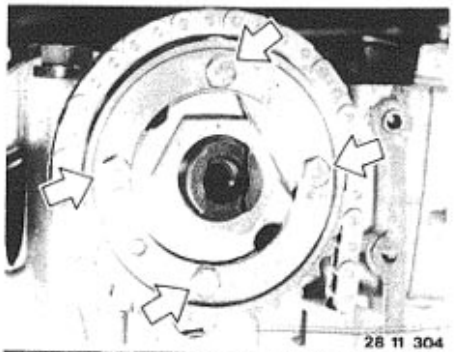
Engine	Degrees		Code
M 30 B 32	260		H
		since 5.83:	L
M 30 B 34	260		M



28 11 110

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

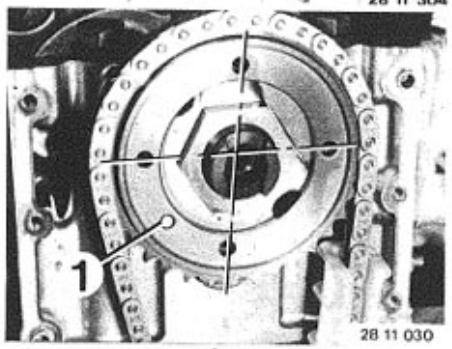
* See Specifications
** Source: HWB



28 11 304

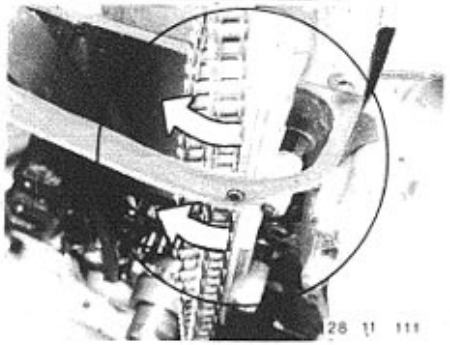
11 31 051 REPLACING TIMING CHAIN

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

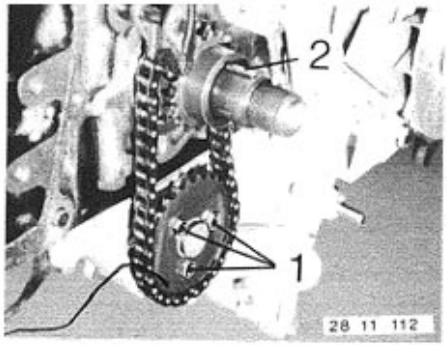
Installation:
Install chain that dowel pin (1) is at bottom left when tapped bores are perpendicular to the engine.
Cylinder no. 1 must be at TDC.
Tightening torque*.



28 11 111

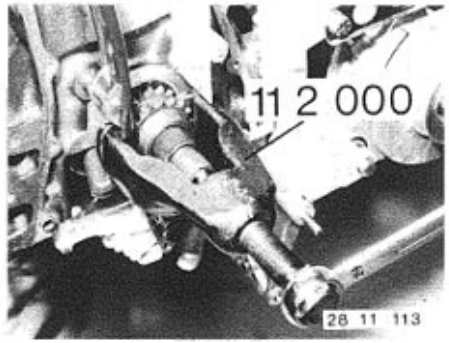
Remove timing chain from bottom sprocket and guide it out of guiding rail carefully.
Note:
Timing chains are pre-stretched.

* See Specifications

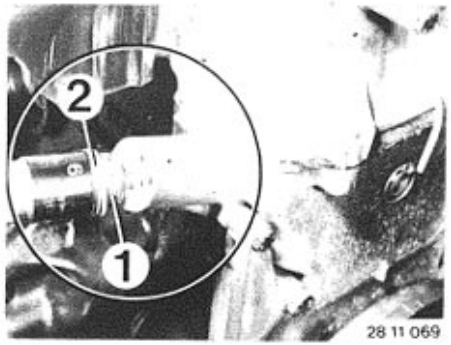


11 31 061 REPLACING SPROCKET SET
–TIMING CHAIN REMOVED–

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



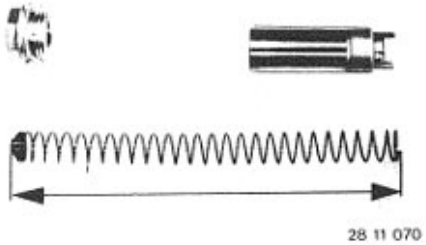
Pull off sprocket with Special Tool 11 2 000.
Installation:
Heat sprocket to max. 200° C (392° F) for installation.
Tighten oil pump chain, see 11 41 000.

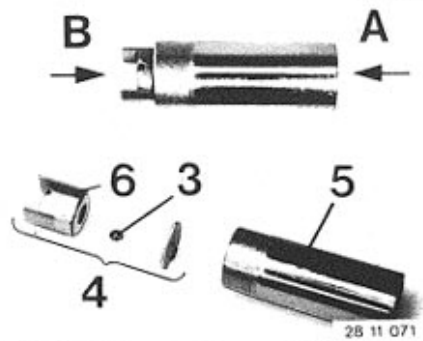


11 31 090 REMOVING AND INSTALLING
CHAIN TENSIONER PISTON

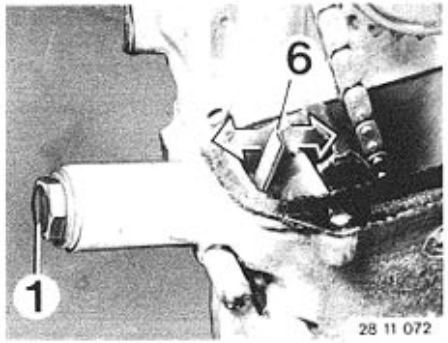
Unscrew plug (1).
Caution!
Strong spring force.
Remove spring and piston.
Installation:
Replace seal (2).

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



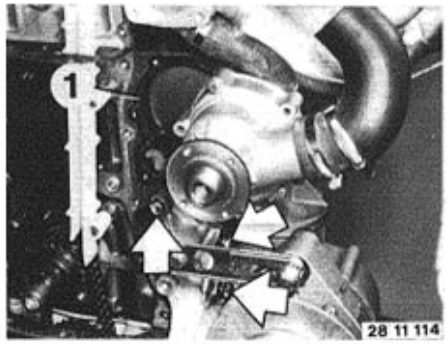


Checking Piston:
Shake to check whether ball (3) moves easily.
Check operation of valve by blowing in air.
– in direction A = closed
– in direction B = open
If necessary, drive out and clean valve (4) in sleeve (5).
Are vent slots (6) clogged?



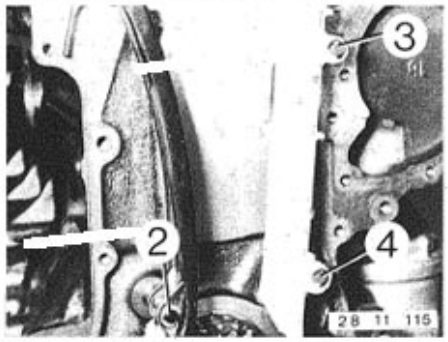
Remove cylinder head cover (see 11 12 000) to bleed the piston.
Loosen plug (1) and move tensioning rail (6) back and forth until oil escapes past plug (1) and resistance is noticed.
Causes for Unusual Chain Noise:
a) Piston bled insufficiently
b) Piston seized
c) Vent slots clogged
d) Ball valve in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

* See Specifications

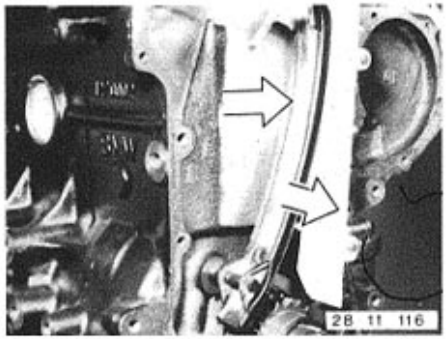


11 31 601 REPLACING TENSIONING RAIL/GUIDE RAIL
–TIMING CHAIN REMOVED–

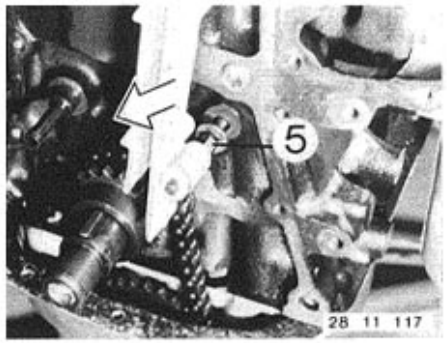
Unscrew water pump and console.
Installation:
Replace gasket (1).



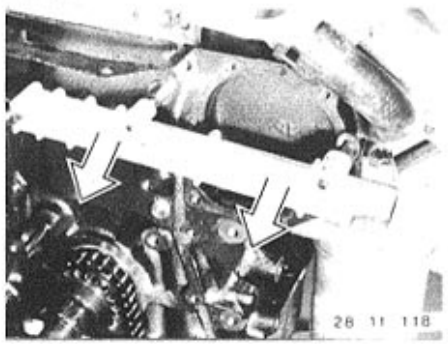
Remove lock washers (2 --- 4).



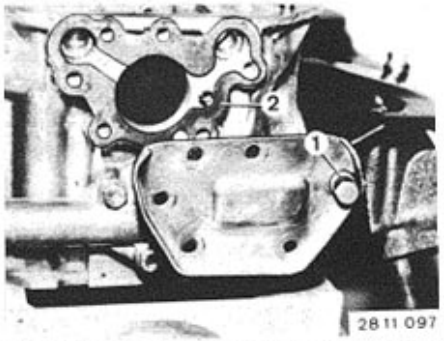
Swing in and remove tensioning rail.



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

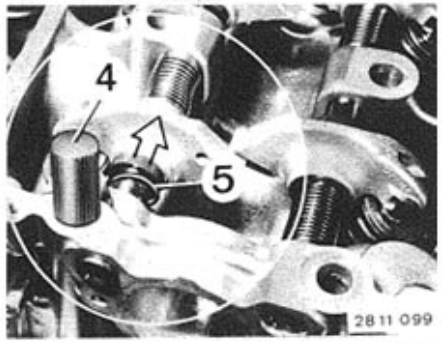


Pull off guide rail.

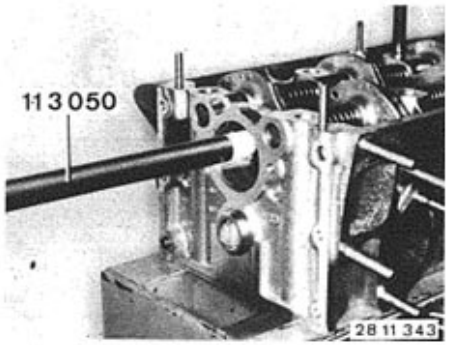


11 33 020 REMOVING AND INSTALLING ROCKER ARM SHAFTS

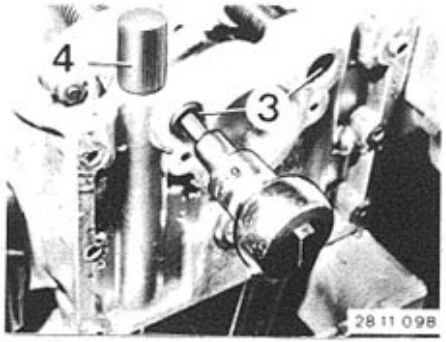
Remove camshaft 11 31 000.
Unscrew end cover.
Installation:
Replace seal (1) and gasket (2).



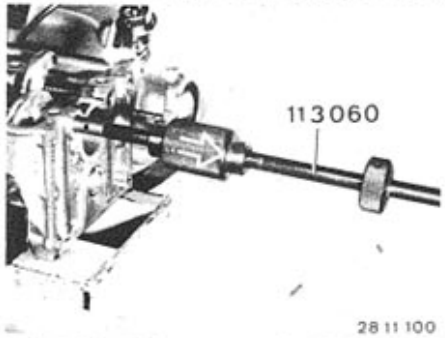
Push back rocker arms and thrust rings.
Lift out circlips (5).
Remove locating pin (4).



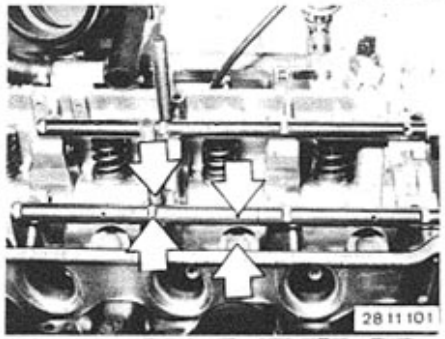
Rocker Arm Shafts with Welded Plugs:
Drive out rocker arm shafts with Special Tool 11 3 050.
Caution!
Springs pop out!



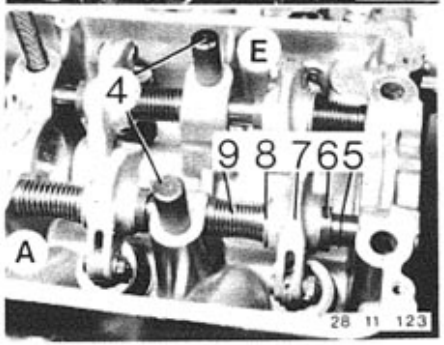
Rocker Arm Shafts with Screw-in Plugs:
Unscrew plugs (3).
If applicable, hold turning rocker arm shafts with locating pin (4).
Installation:
Screw in plugs (3) with Loctite 270**.



Screw Special Tool 13 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).

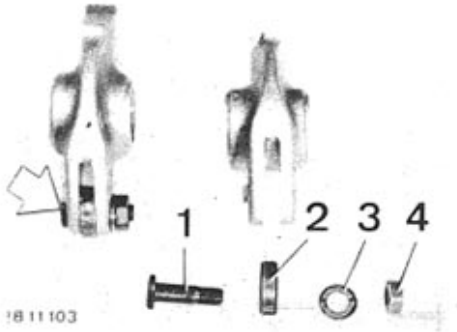
** Source: HWB



28 11 102

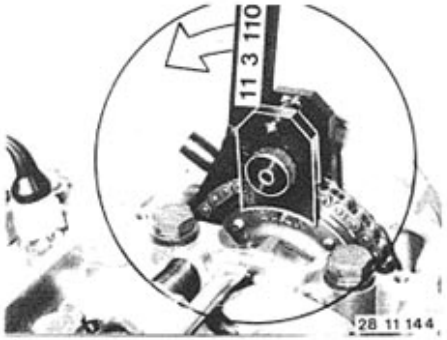
11 33 031 REPLACING ROCKER ARMS

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

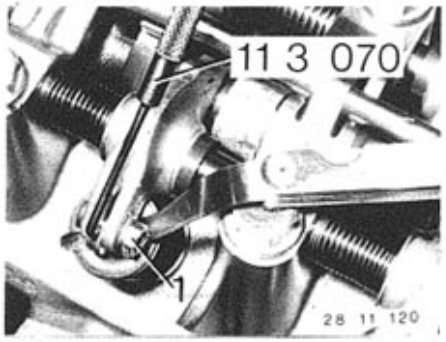
Transfer screw (1), eccentric (2), washer (3) and nut (4) to new rocker arm.
Replace worn eccentrics.
Important!
Screw and nut have M 6 x 0.75 fine threads.
Bore faces out and thick side down.
Bevelled surface of screw faces boss on the rocker arm.



28 11 144

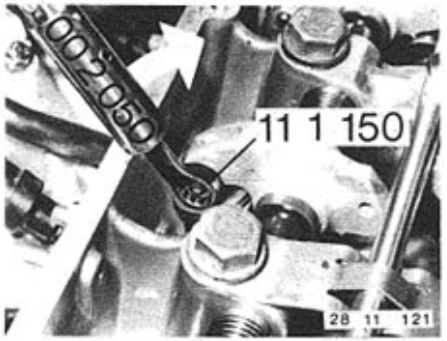
11 34 004 ADJUSTING VALVE CLEARANCE

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



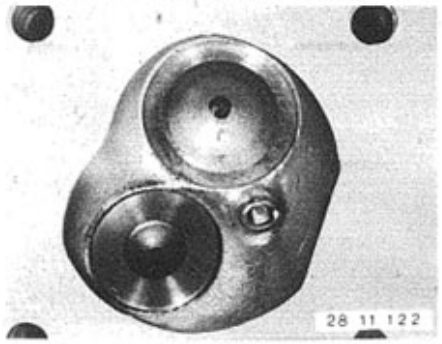
28 11 120

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*.

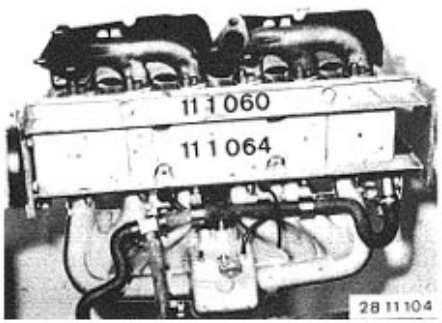


28 11 122

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

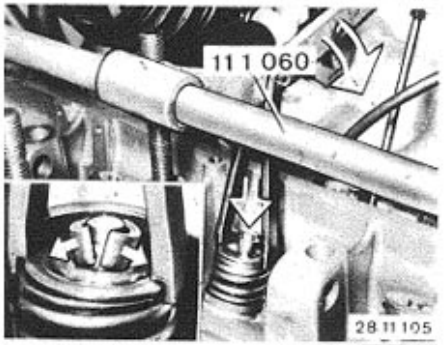
Spark plugs remain installed.
Fill combustion chamber with gasoline outdoors or indoors in compliance with safety regulations.
Check valve seats and valves, if gasoline runs past the valve heads.
Remove and install valves 11 34 550.
Machine valve seats 11 12 607.

* See Specifications

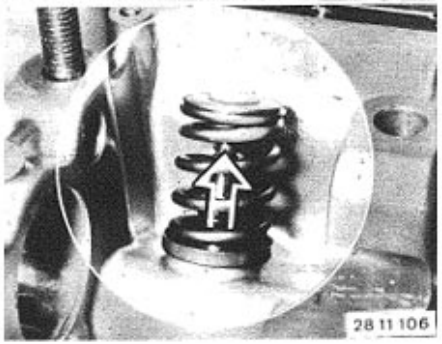


11 34 550 REMOVING AND INSTALLING VALVES
– Rocker Arm Shafts Removed –

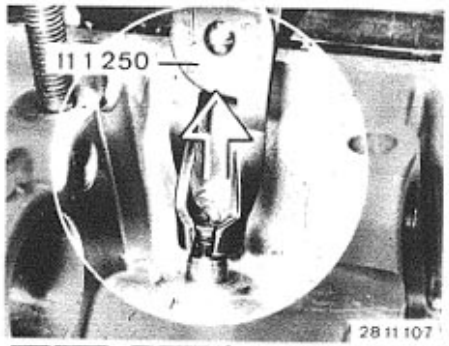
Place Special Tool 11 1 064 (tray) in Special Tool 11 1 060.



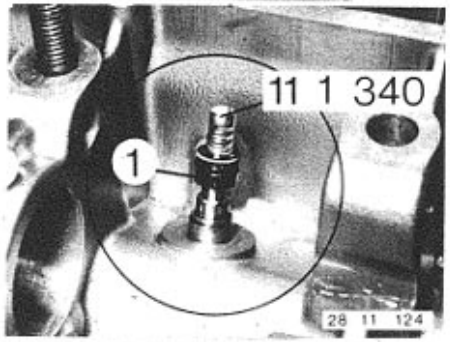
Press down valve springs with Special Tool 11 1 060 and remove valve collets.



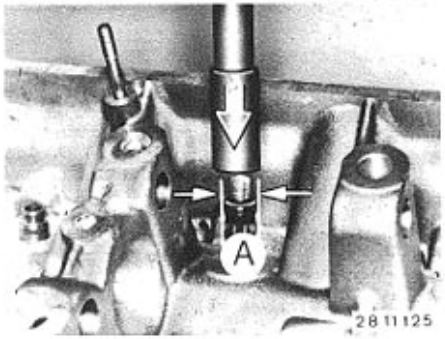
Take off upper spring retainer, valve springs and lower spring retainer.
Take tray out of special tool and pull out valve.
Installation:
Only install valve springs with same color code, wire gage size and length.
Lubricate valve guide and valve stem with oil.



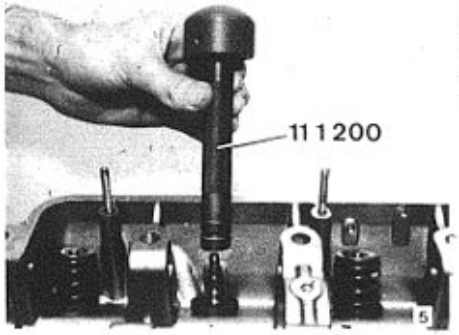
Pull off valve stem seal with Special Tool 11 1 250.



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



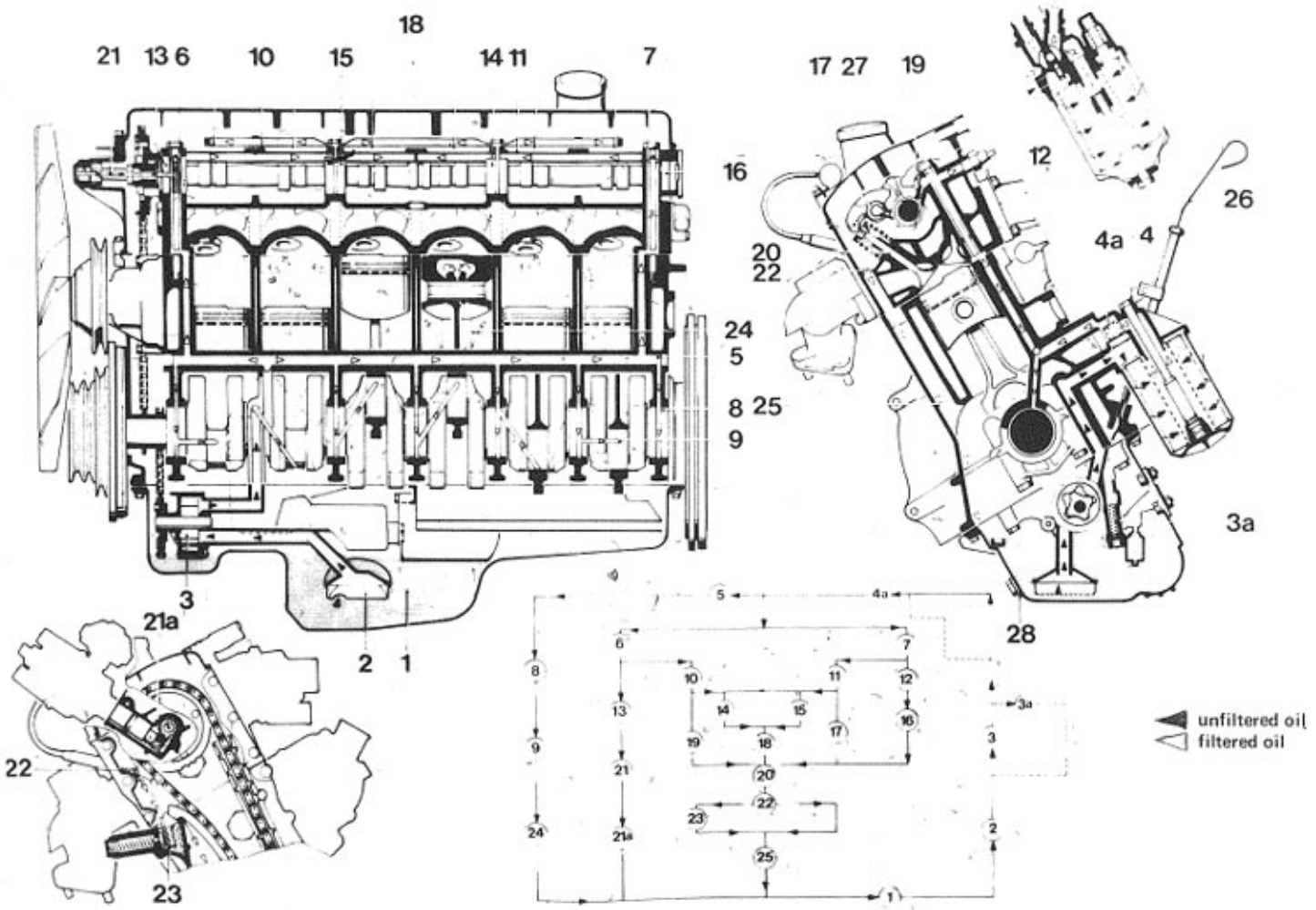
Press on valve stem seal against stop with Special Tool 11 1 090 for diameter A = 14 ± 0.2 mm (0.551 ± 0.008") or
Special Tool 11 1 070 for diameter A = 14.3 ± 0.2 mm (0.563 ± 0.008").



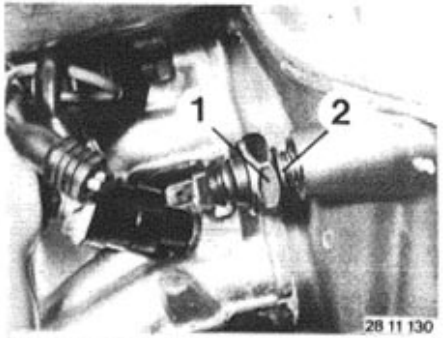
The new, improved valve stem seals (internal grooves) are pressed on by hand with help of Special Tool 11 1 200.
Special Tool 11 1 200 has two diameters for 7 mm (0.276")/8 mm (0.315") valve stem seals.

11-333

ENGINE OIL CIRCUIT

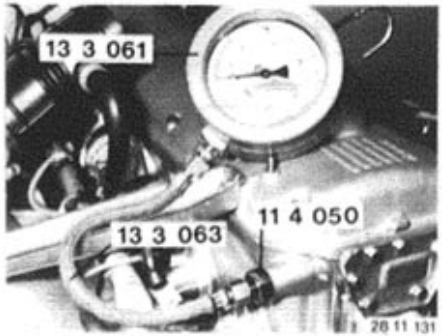


1 Oil pan
2 Intake with filter screen
3 Oil pump
3 a Pressure relief valve
4 Oil filter
4 a Safety valve (oil filter)
5 Main distribution bore
6 Oil bore in cylinder head, front
7 Oil bore in cylinder head, rear
8 Crankshaft bearing
9 Connecting rod bearing
10 Hollow rocker arm shaft, front
11 Hollow 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



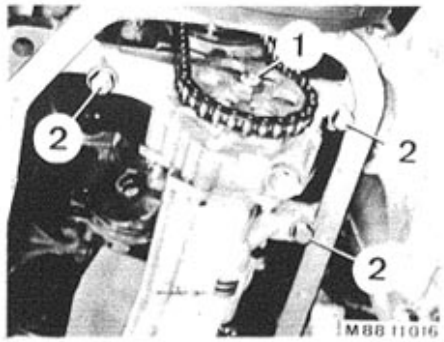
11 40 000 CHECKING ENGINE OIL PRESSURE

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



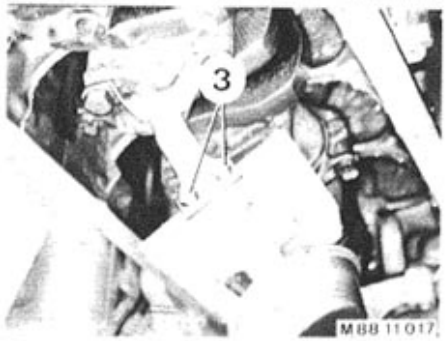
Screw in Special Tool 11 4 050.
Connect hose 13 3 063 in conjunction with pressure tester 13 3 061.
Check oil pressure*.

* See Specifications



11 41 000 REMOVING AND INSTALLING OIL PUMP

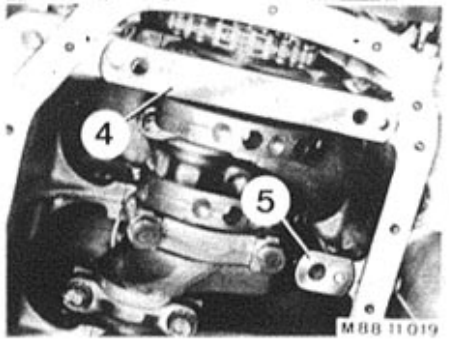
Pull out oil dipstick.
Remove oil pan 11 13 000.
Unscrew nut (1) and take off sprocket.
Unscrew bolts (2).



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

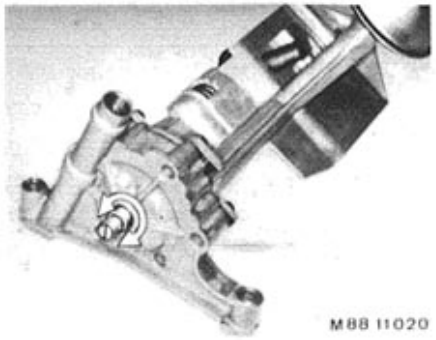


Installation:
Push on sprocket after mounting oil pump.
Tightening torque* for nut.

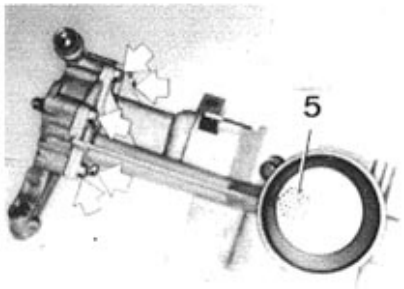


Installation / Chain Tightness:
Adjust chain tightness with shims (4 and 5) that chain will give at center under light thumb pressure.
Shims (4 and 5) must have the same thickness.

* See Specifications

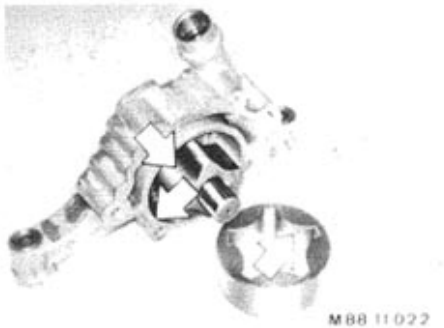

M88 11020

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

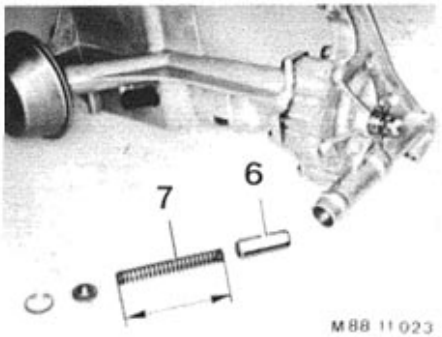


M88 11021

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


M88 11022

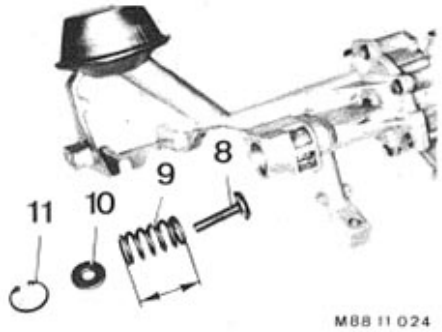
Check oil pump for wear.
– Scoring in body
– Wear on rotors



M88 11023

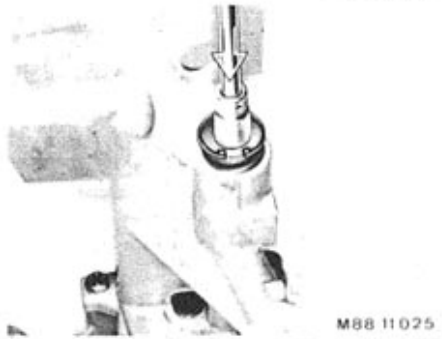
The pressure relief valve is installed in the main bore and regulates the engine oil pressure*, see 11 40 000.
Check whether piston (6) moves easily.
Check length of spring (7) = 68 mm (2.677").

* See Specifications

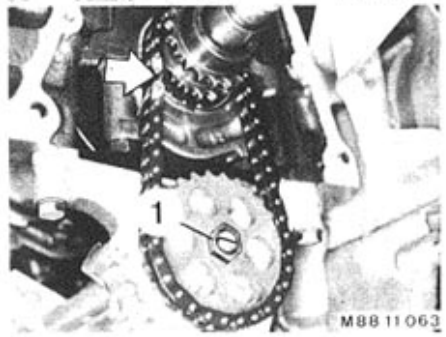


M88 11 024

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 11 025

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

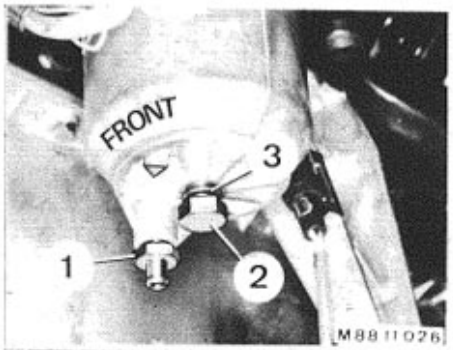


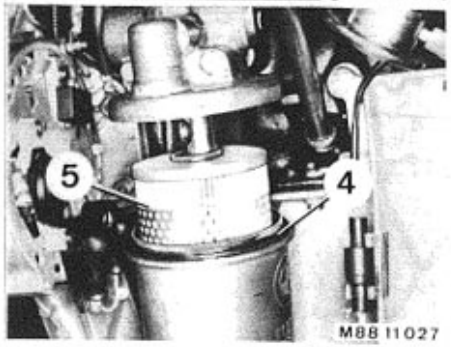
M88 11 063

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

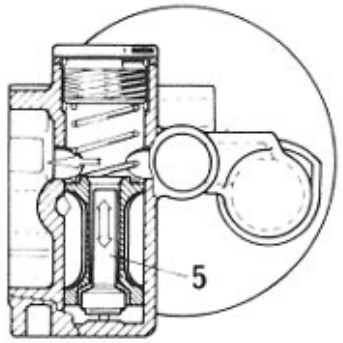


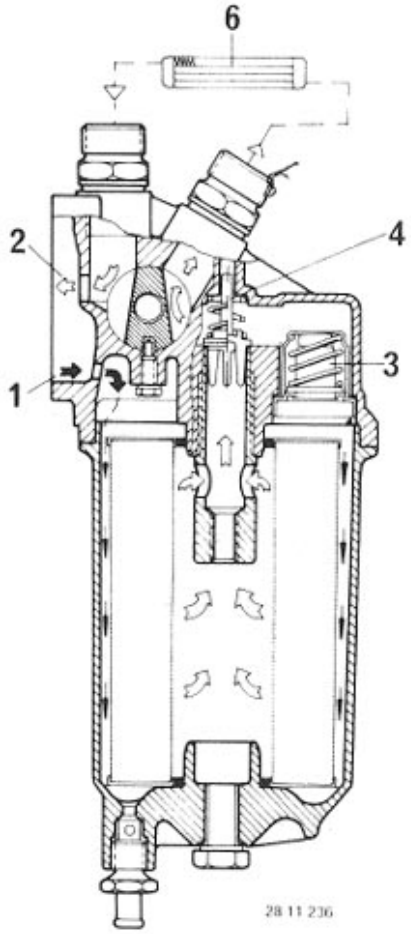


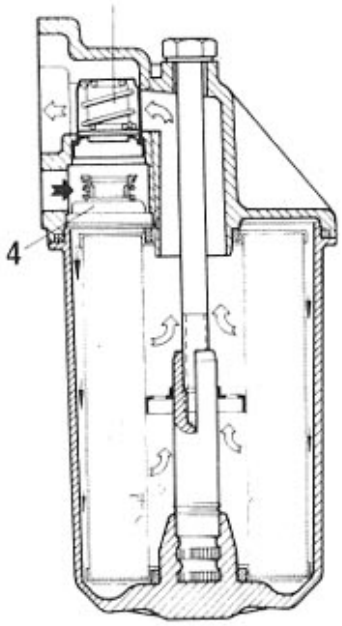
11 42 021 REPLACING FULL FLOW OIL FILTER

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***.



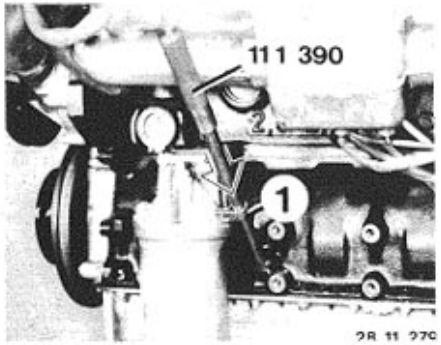




1 Feed from oil pump
2 Return to main oil bore
3 Bypass valve
– opening pressure = 2.5 ±0.25 bar (35 ±3 psi)
4 Return flow inhibiting valve
– opening pressure = 0.1 ±0.05 bar (1.4 ±0.7 psi)
5 Thermostatic activator for switching oil cooler
6 Oil cooler

➡ Unfiltered oil
⇨ Filtered oil

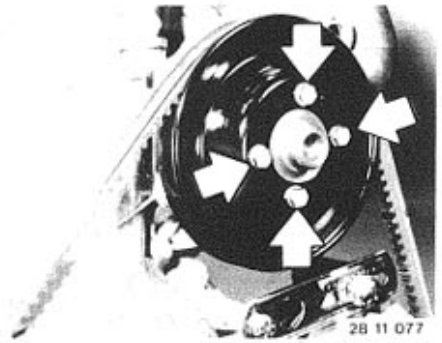
* See Specifications
*** See Service Information of Gr. 11



28 11 270

11 43 101 REPLACING GUIDE TUBE FOR OIL DIPSTICK

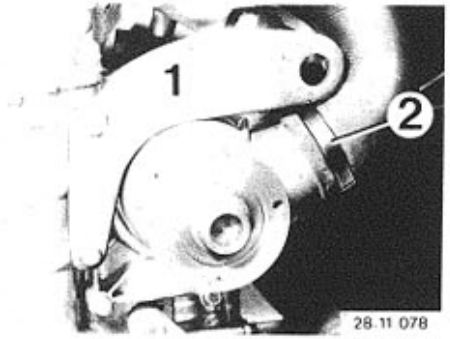
Transfer clamp (1).
Install guide tube with Loctite No. 270** and drive in against stop.
Important!
Eyelet grip of oil dipstick must always face left when looking forward in car to check the oil level.
Non-conformance could cause incorrect readings, i.e. engine oil volume would not be as specified*.



28 11 077

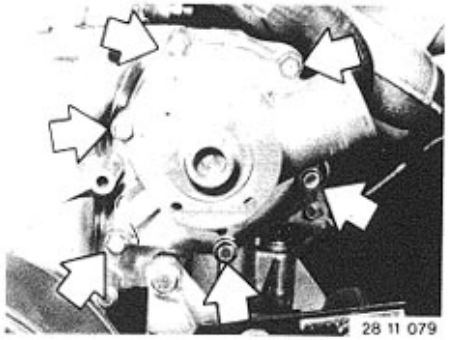
11 51 000 REMOVING AND INSTALLING WATER PUMP

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).



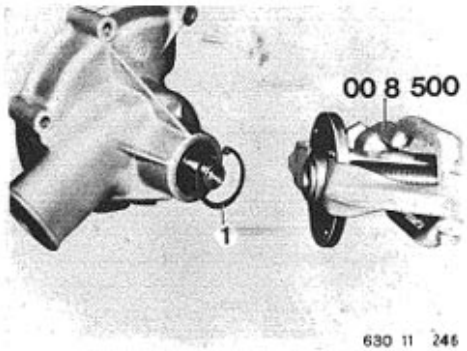
28 11 079

Unscrew water pump.
Installation:
Replace gasket.

* See Specifications
** Source: HWB

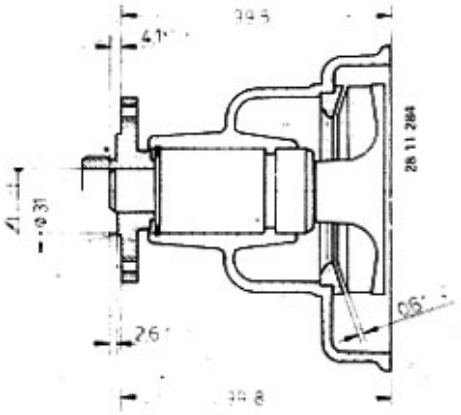
11 51 502 OVERHAULING WATER PUMP

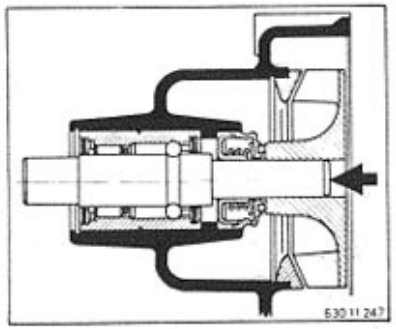
Check dimensions after assembling!



630 11 246

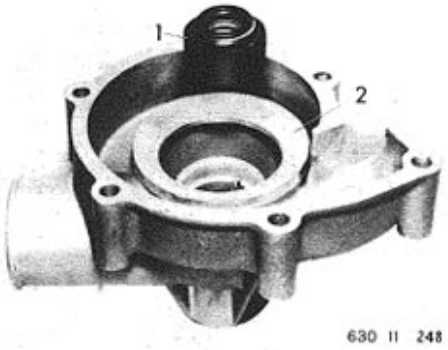
Pull off hub with Special Tool 00 8 500.
Lift out circlip (1).





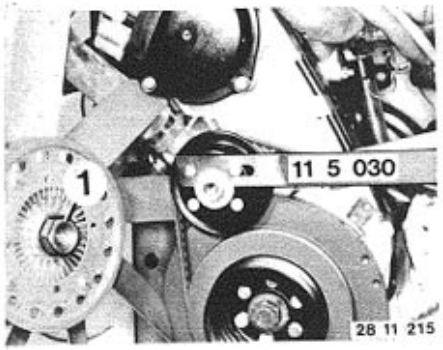
630 11 247

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



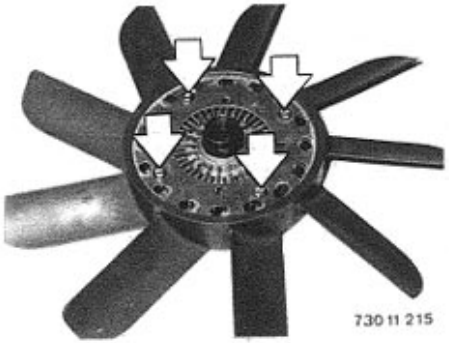
630 11 248

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



11 52 000 REMOVING AND INSTALLING FAN

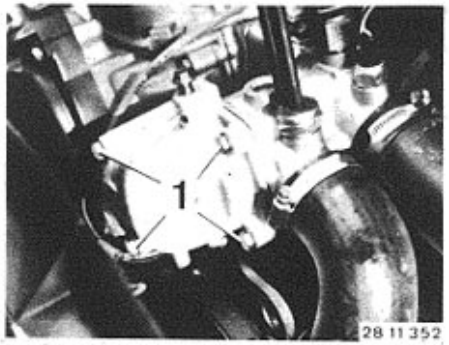
Hold pulley with Special Tool 11 5 030 and unscrew coupling nut (1).
Important!
Left-hand threads – nut turned clockwise to unscrew.
Tightening torque*.



11 52 020 REPLACING FAN CLUTCH

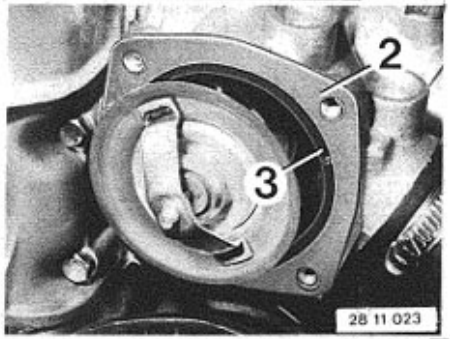
Remove fan 11 52 000.
Replace fan clutch, if
a) hub has seized (fan of stopped engine cannot be turned or difficult to turn),
b) fan clutch has axial and radial play or is losing oil.
Check switching points* with a Vibrocard***.
Unscrew fan mounting bolts and take off fan clutch.

* See Specifications
*** See Workshop Equipment Catalog

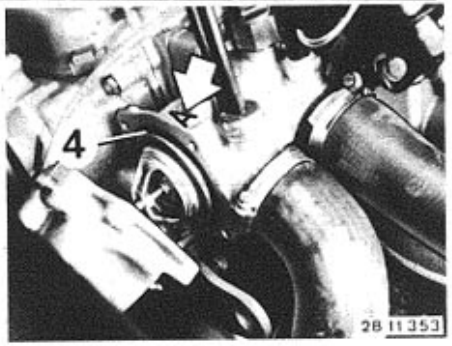


11 53 000 REMOVING AND INSTALLING COOLANT THERMOSTAT

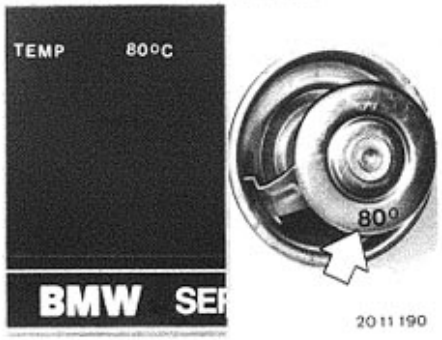
Drain coolant partially.
Unscrew cover (1).
Installation:
Bleed cooling system 17 00 039.



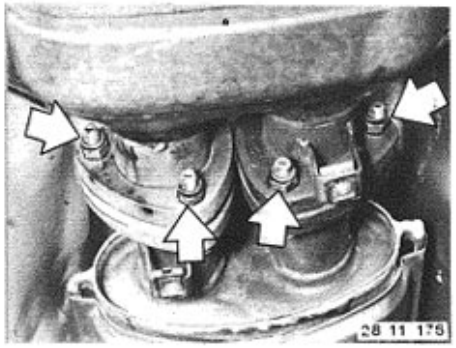
Remove thermostat.
Replace gasket (2) and seal (3).
Installation:
Clamp on thermostat faces out.



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

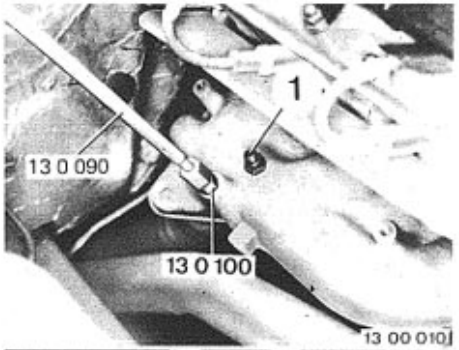


Check Thermostat:
Check whether opening temperature agress with specifications.
Check opening temperature by placing thermostat in hot water and compare with stamped opening temperature.



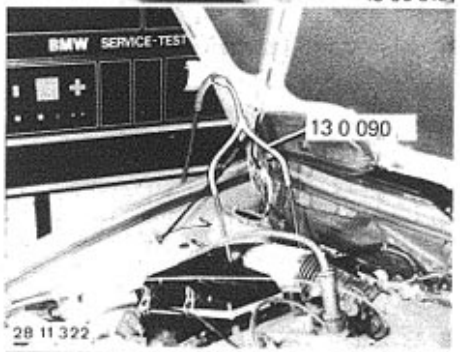
11 76 010 REMOVING AND INSTALLING CATALYTIC CONVERTER

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.

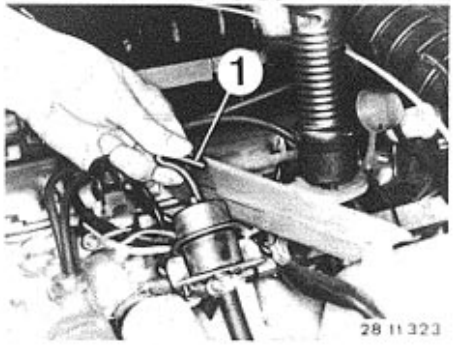


11 78 010 CHECKING FUNCTION OF OXYGEN SENSOR

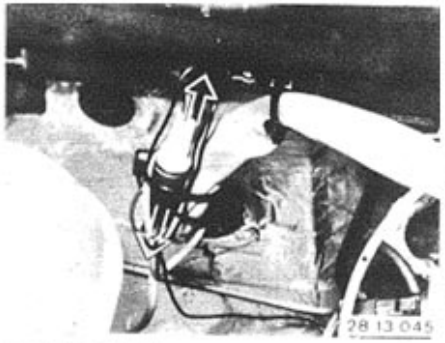
Unscrew plug (1).
Screw in Special Tool 13 0 100 and attach the Special Tool 13 0 090.
Connect the BMW service tester.



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



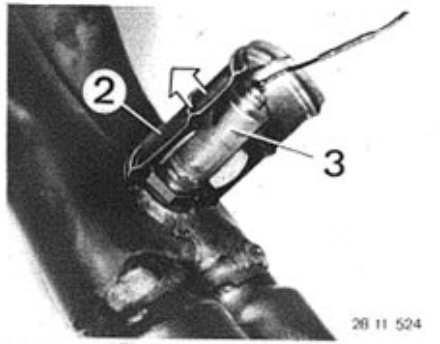
Pull off vacuum hose (1) on the pressure regulator and plug.
The CO level will rise briefly and is immediately regulated back to the original value = the oxygen sensor is working.
If Not:
Check the power supply to the oxygen sensor from the relay according to the wiring diagram.
See Group 13 for additional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



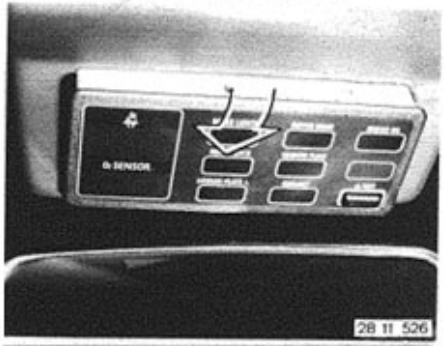
11 78 510 REPLACING OXYGEN SENSOR

– 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"**.

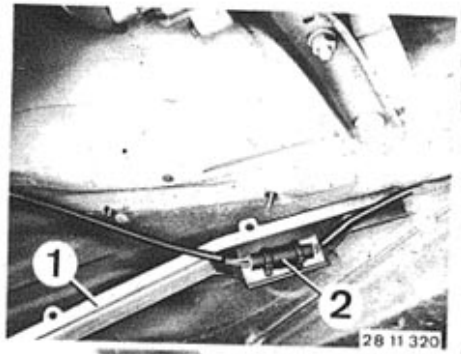


Lift out the check control.

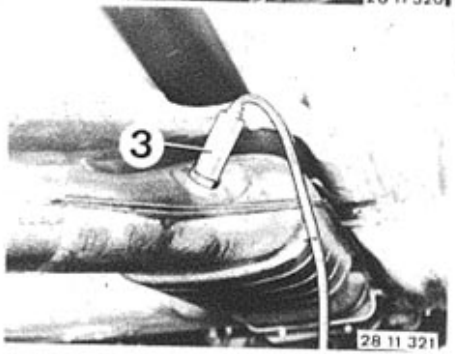


Remove the lamp for the "O_2 SENSOR" sign.

** 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

	Information for working on ignition systems	12- 0
	Survey of engine electrical equipment – 528 e	12- 1
	Survey of engine electrical equipment – 535 i	12- 3
	Survey of engine electrical equipment – 524 td	12- 5
	Diagnosis plug connections	12- 7
	Engine wire harness plug connections	12- 8
12 11 031	TDC position sensor – replace/check	12- 9
091	Distributor cap – replace/check	12- 10
111	Distributor rotor – replace	12- 11
12 12 072	Spark plug connector – replace	12- 12
12 13 009	Ignition coil – check	12- 13
011	Ignition coil – replace	12- 13
12 14 160	Speed sensor – replace/check (524 td)	12- 14
510	Reference mark and speed sensors – replace/check	12- 15
515	Reference mark and speed sensors – replace/check	12- 15
	DME troubleshooting	12- 20
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12 23 000	Heater plugs – check	12- 32
505	Heater plugs – replace	12- 32
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. . .	Temperature sensor – coolant (VP-20) – check	12- 33
12 31 . . .	Alternator – troubleshoot	12- 40
009	Alternator and voltage regulator – check	12- 41
020	Alternator – remove and install (BMW 528 e / 533 i / 535 i)	12- 42
020	Alternator – remove and install (BMW 524 td)	12- 43
299	Alternator drive belt – check and tighten	12- 43
201	Carbon brushes – replace / slip rings – grind	12- 44
513	Alternator – disassemble and assemble	12- 44
581	Ball bearing – replace	12- 45
691	Diode plate – replace	12- 45
. . .	Alternator components – inspect	12- 46
12 32 000	Voltage regulator – remove and install/replace	12- 47
12 41 . . .	Starter – troubleshoot	12- 50
020	Starter – remove and install	12- 51
041	Solenoid switch – replace	12- 53
. . .	Starter components – inspect	12- 53
103	Starter – disassemble and assemble	12- 54
551	Carbon brushes – replace	12- 57
12 63 . . .	Speed signal – check	12- 60
12 64 . . .	Fuel heating – check	12- 61
12 64 005	Fuel heating element – replace	12- 61
12 81 . . .	Coolant heater – replace/check	12- 62

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.

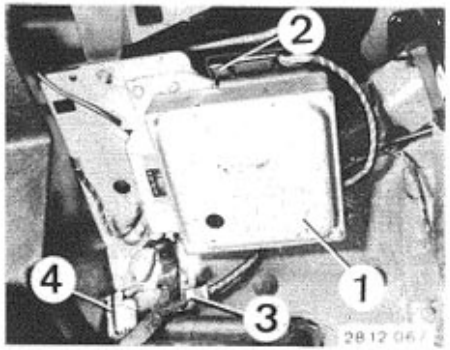
- Only install specified original BMW parts.

- 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.

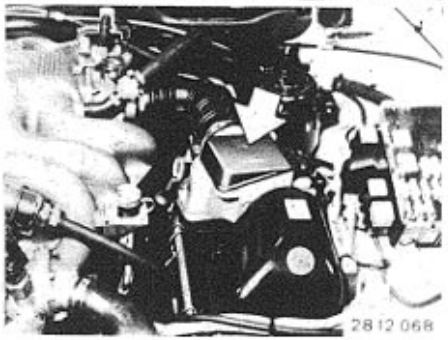
- When checking the compression, pull off plug on control unit for TCI or master relay for fuel injection (relay no. 2) for DME.

- 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!

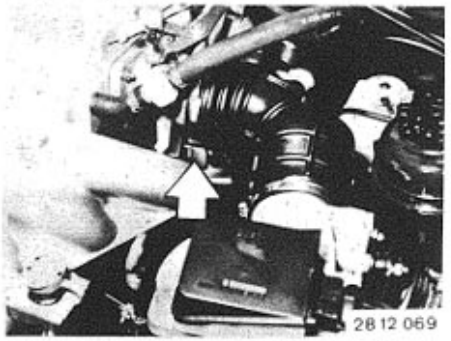


SURVEY OF ENGINE ELECTRICAL EQUIPMENT FOR BMW 528 e

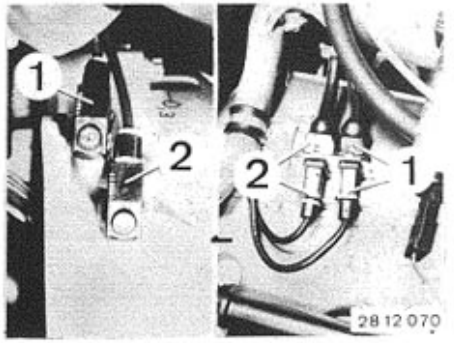
1 DME control unit
2 Idle control unit (in glove box)
3 Plug for transmission – disconnected for cars with automatic transm. (mixture leaned)
4 Plug for car electrical system



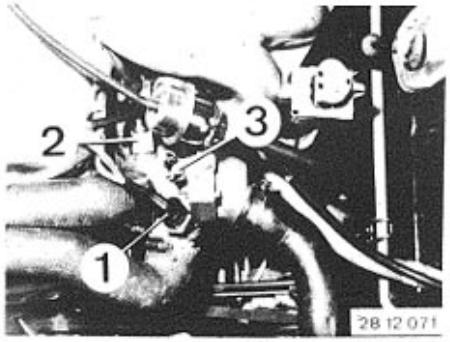
Air flow sensor
(air temperature sensor is integrated in air flow sensor)



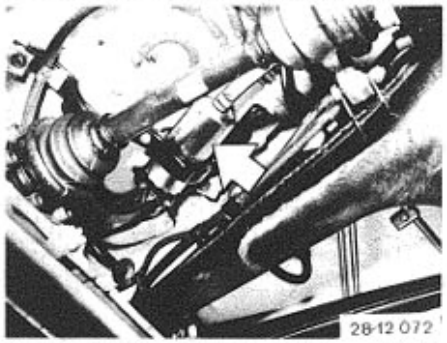
Throttle switch



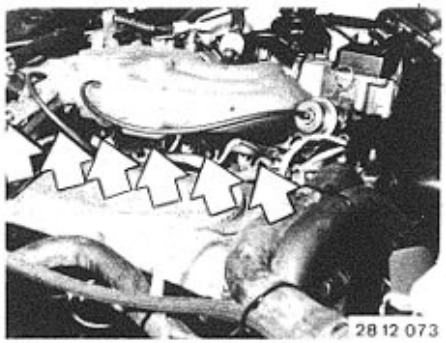
Speed transmitter (1) and reference mark transmitter (2)



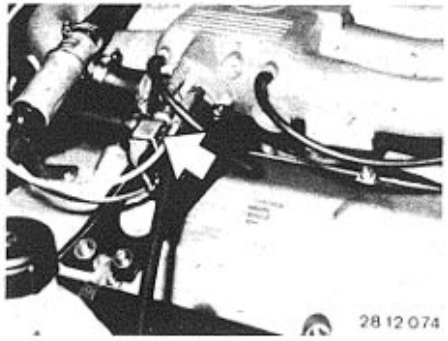
Temperature time switch (1)
Coolant temperature sensor (2)
Temperature switch (3)



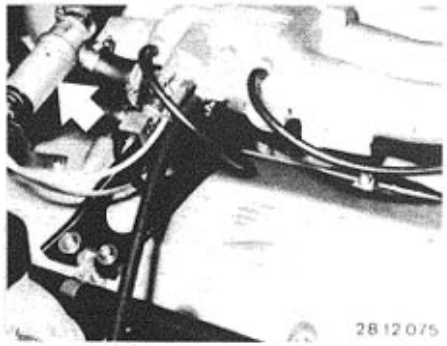
Electric fuel pump



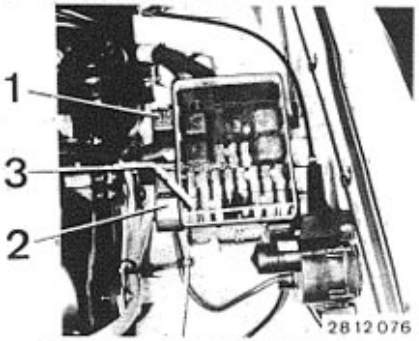
Fuel injectors



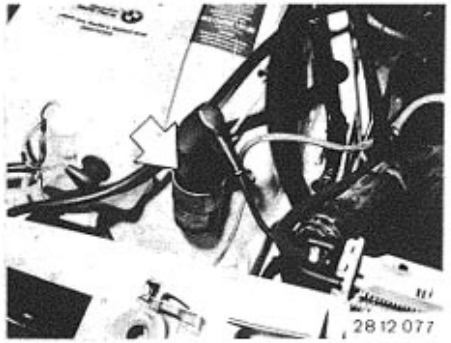
Cold start valve



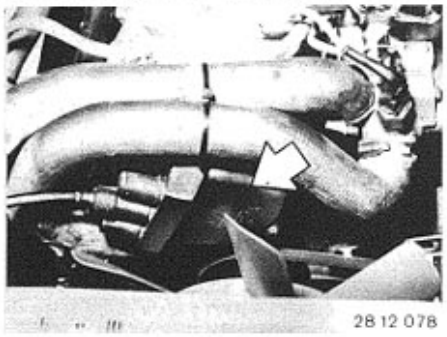
Idle valve
(control element)



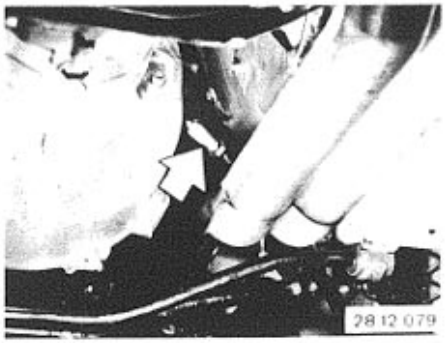
Relays and fuses
1 Fuel pump relay
2 Injection system relay
3 Fuse for fuel pump



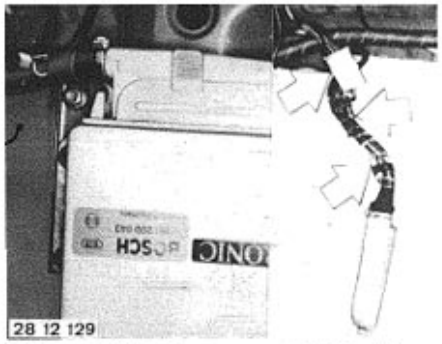
Ignition coil



High voltage distributor

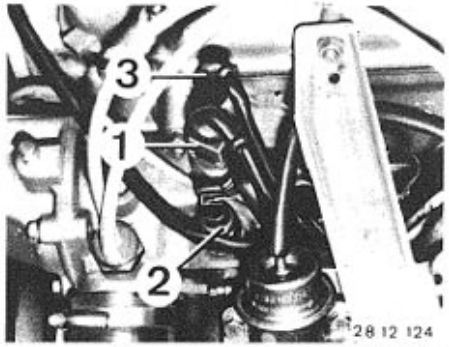


Oxygen sensor

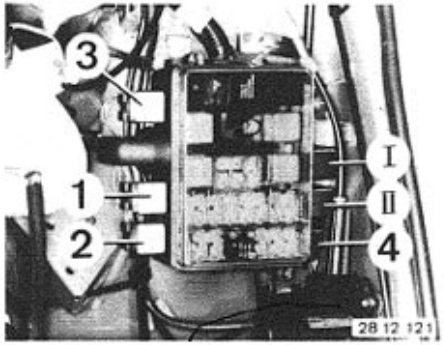


SURVEY OF ENGINE ELECTRICAL EQUIPMENT FOR BMW 535 i

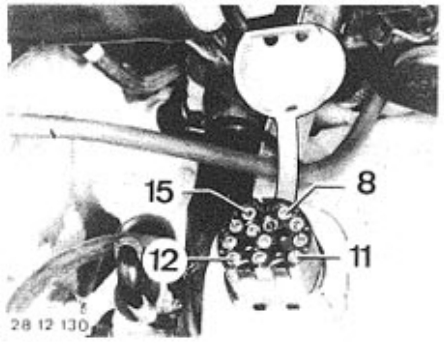
DME control unit in glove box
Plug Connections:
6-pin – car electric system
2-pin – transmission
(not used for automatics)
1-pin – fuel injection
(not used for automatics)



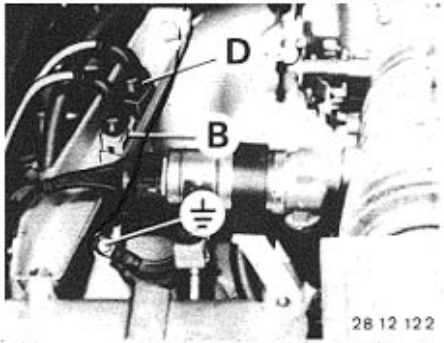
Temperature time switch (1), temperature gage (2), coolant temperature sensor (3)



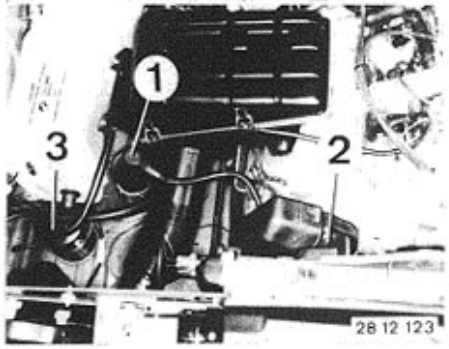
Master relay for DME (relay 2), fuel pump relay (relay 1).
Oxygen sensor relay (3).
Extra fan relay – stage I / stage II.
Check control relay (4) for low beams.



Diagnosis plug

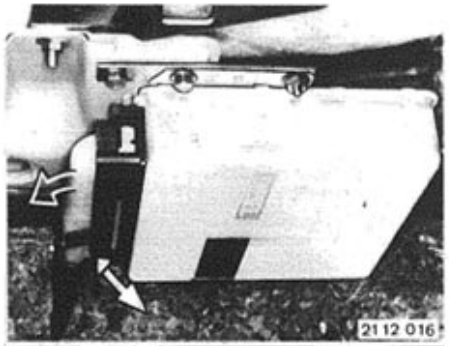


Plug connections for reference mark sensor (B) and speed sensor (D).
Ground point for DME.

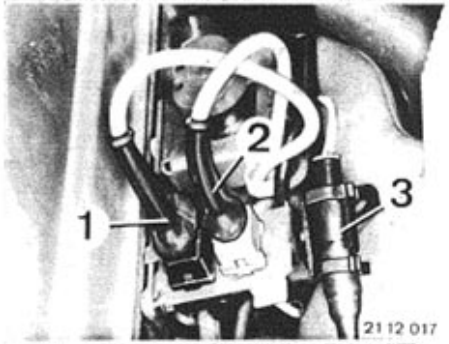


Ignition coil (1).
High voltage distributor (2).
Charcoal canister (3).

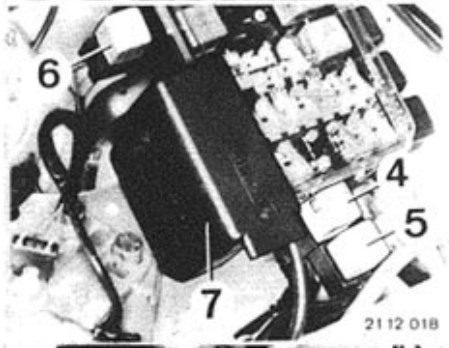
SURVEY OF ENGINE ELECTRICAL EQUIPMENT FOR BMW 524 td



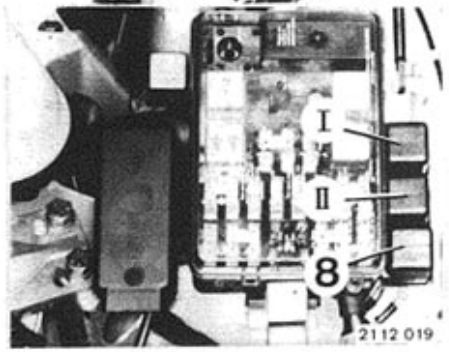
Control unit for VP-20 fuel injection in glove box



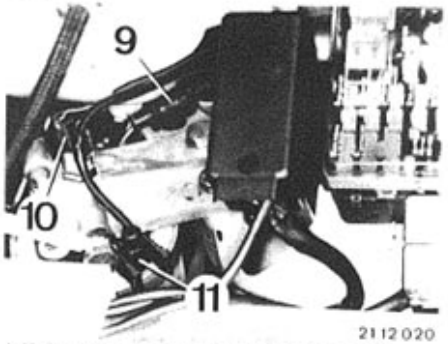
Plug connections for timing valve (3), initial injection jet (2) and speed sensor (1)



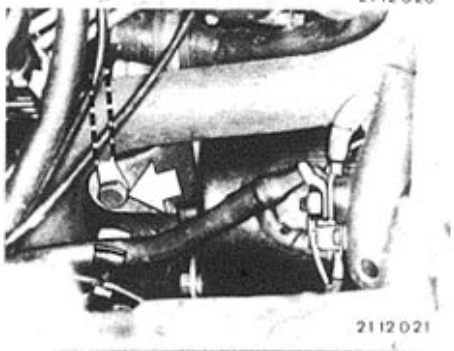
Relay for fuel transfer pump (4), VP-20 injection control (5), fuel heating (6) and heating time control (7)



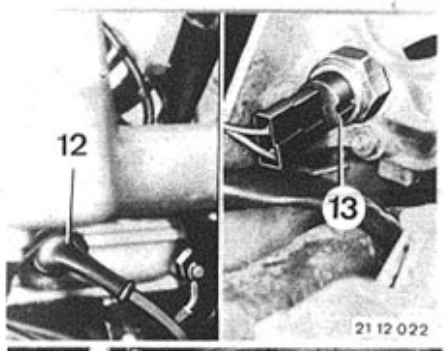
Relay for extra fan (stage I), extra fan (stage II) and low beam check control (8)



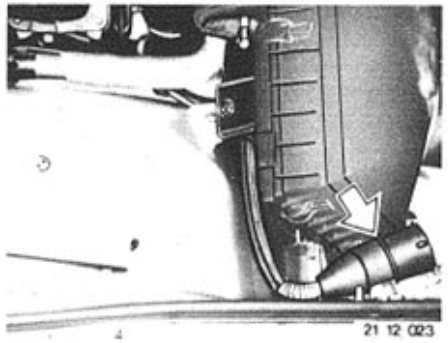
Plug connection for coolant level sensor (9), temperature switch for fuel heating (10), connection for heating adapter (11)



Ground point for engine electrical system

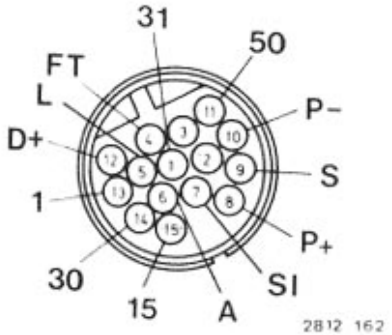


VP-20 coolant temperature sensor (12), temperature gage/heating time sensor (13)

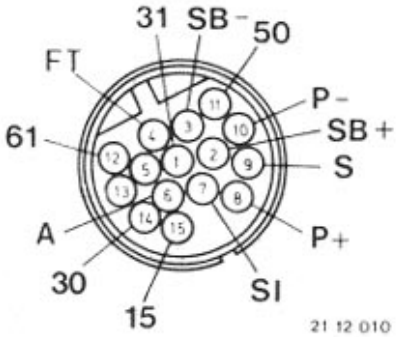


Plug for coolant heater

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



2812 162

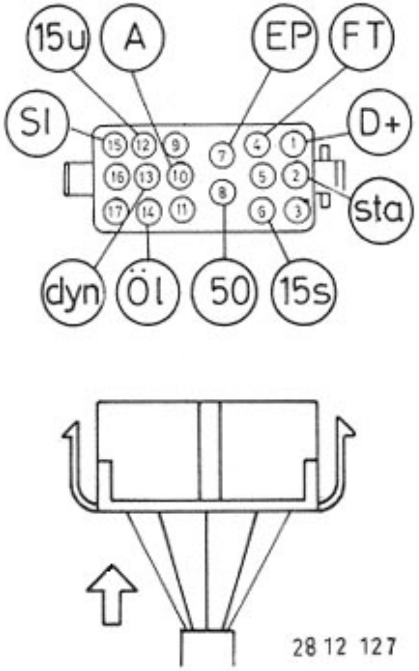


21 12 010

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

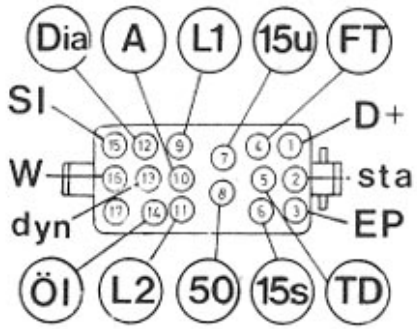
2	SB+	Fuel injector – initial injection sensor
3	SB–	Fuel injector – initial injection sensor
13	TD	Speed signal

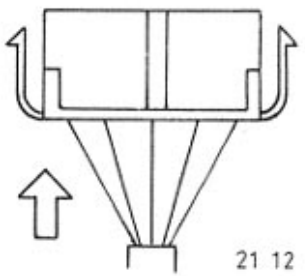


CONNECTION PLAN FOR ENGINE WIRE HARNESS PLUG

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	–	–

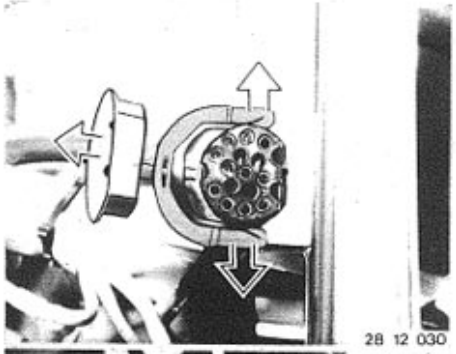




BMW 524 td

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	–	–

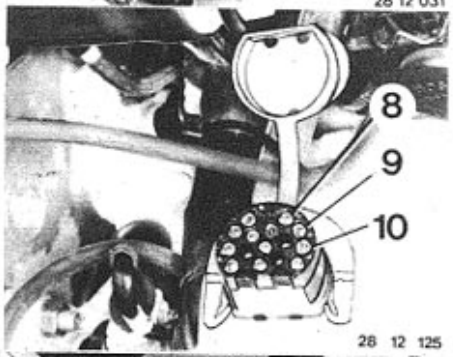
12 11 031 REPLACING / CHECKING TDC POSITION TRANSMITTER



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

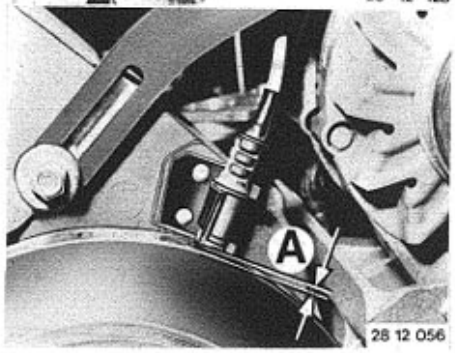


Press plug receptacles out of chambers 8, 9 and 10 with special tool**.



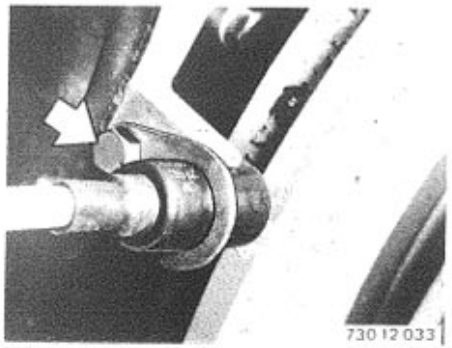
Installation:
Connect new position transmitter as shown.

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



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)

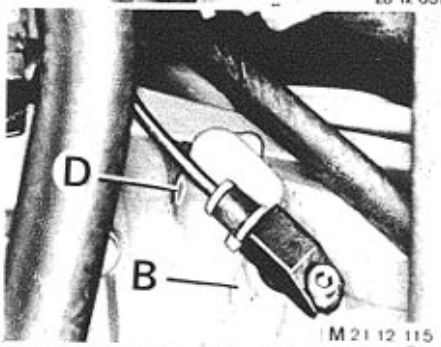


BMW 533 i / 535 i:
Unscrew position transmitter.
Installation:
Mount wire.
Provide distance of 0.2 to 2.0 mm (0.008 to 0.079") to vibration damper.

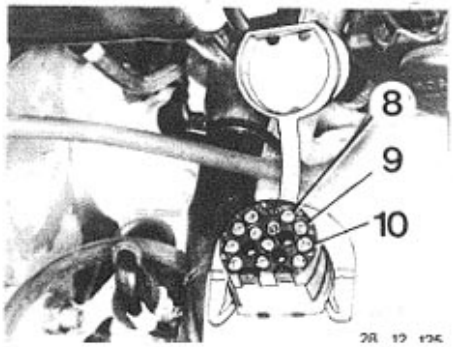


BMW 524 td:
Take diagnosis socket out of holder.
Press out plug receptacles 8, 9 and 10 with special tool**.

Number	Wire Color
8	yellow
9	shielding
10	black



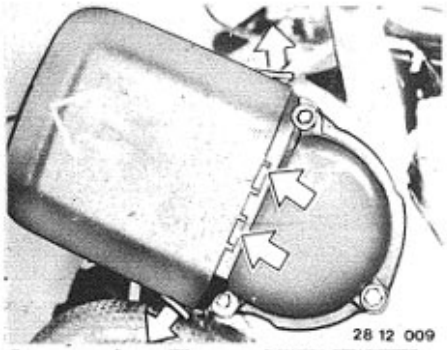
Unscrew and pull out position transmitter.
Installation:
Mount wire.
Coat seal with Molykote paste.
Keep grease off of face!



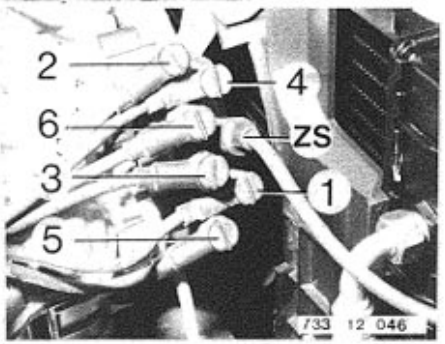
Checking:
Measure resistance* of transmitter on disgnosis socket terminals 8 and 10.

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

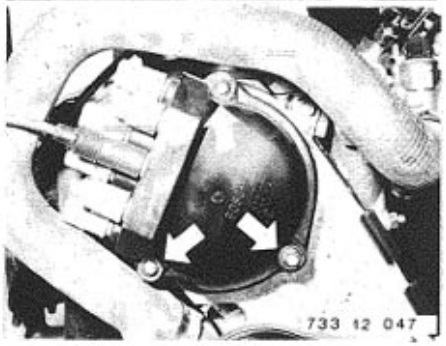
12 11 091 REPLACING / CHECKING DISTRIBUTOR CAP



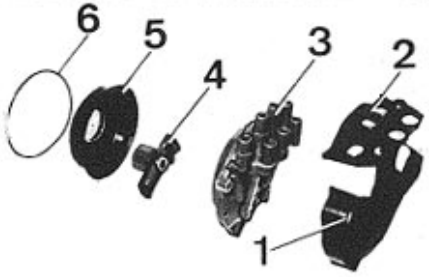
Important!
Refer to working instructions on page 12-0.
BMW 528 e:
Take off protective cap.
Installation:
Engage protective cap in holder correctly.



Pull out shielded connectors.
Installation:
Check firing order.

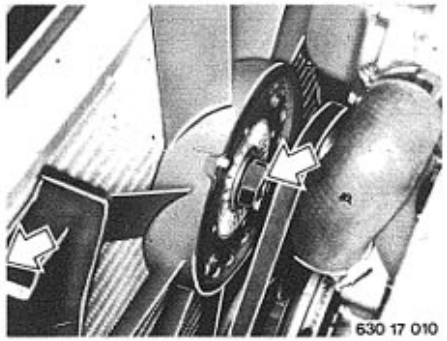


Unscrew screws and take off distributor cap.
Caution!
Protect hands – danger of injury on sharp cooling fins.

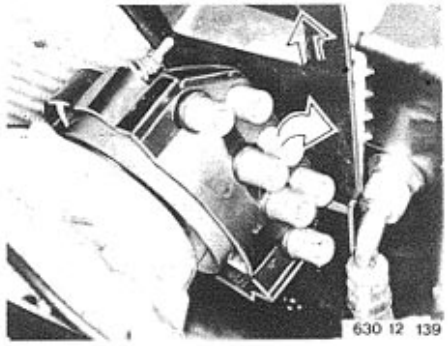


730 12 023

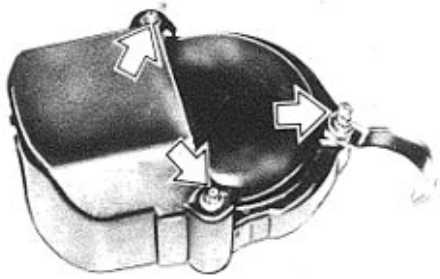
Installation:
Check seal (6), replacing if necessary.
Transfer protective caps (1 and 2).
Arrangement:
1 Protective cap
2 Protective cap
3 Distributor cap
4 Distributor rotor
5 Protective cap (inside)
6 Seal



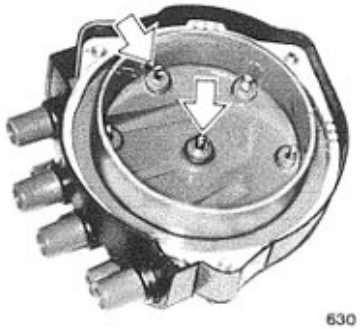
BMW 533 i / 535 i:
Unscrew fan – left-hand threads.
Unscrew and lift out fan cowl.



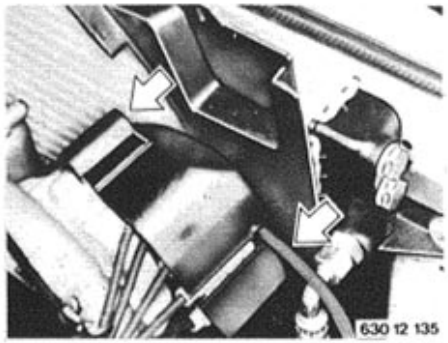
Take off or unscrew protective cap.
Unscrew distributor cap screws.



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

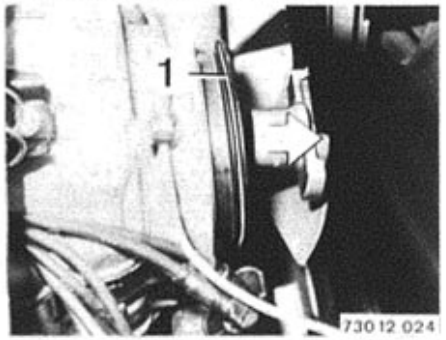


Checking:
Check inside and connection cover for hairline cracks and traces of burning.

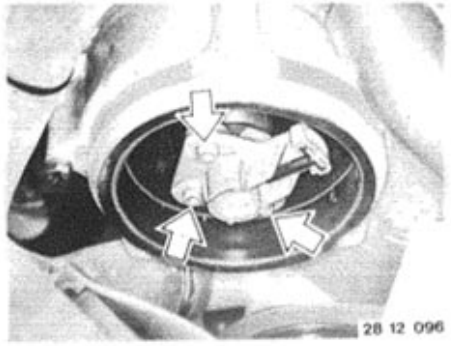


12 11 111 REPLACING DISTRIBUTOR ROTOR

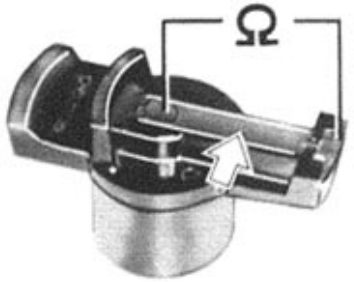
Caution!
Refer to page 12 - 0 for instructions for working on ignition system.
Remove distributor cap 12 11 091.



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



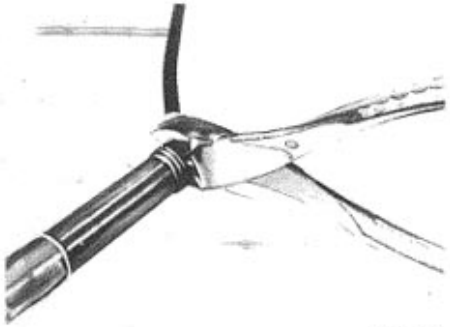
Since 1984 Models:
The distributor rotor of these models is bolted.



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

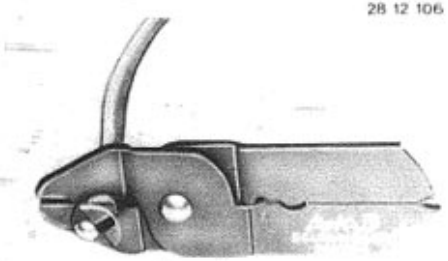
* See Specifications

12 12 072 REPLACING ONE SPARK PLUG CONNECTOR



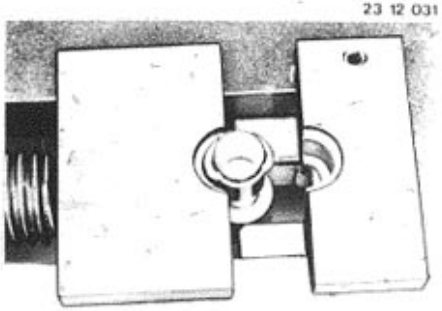
28 12 106

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



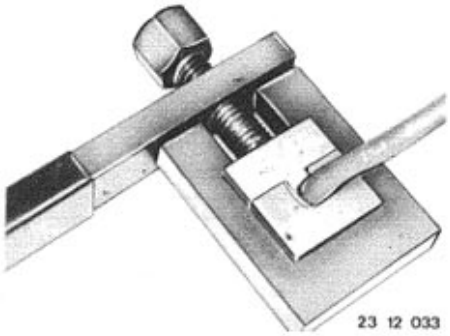
23 12 031

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



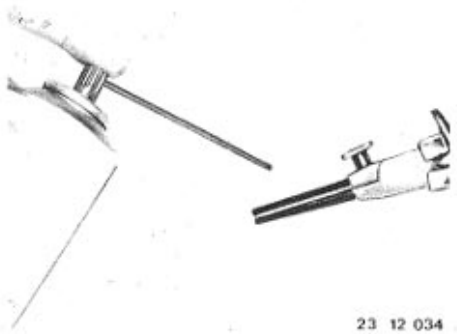
23 12 032

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



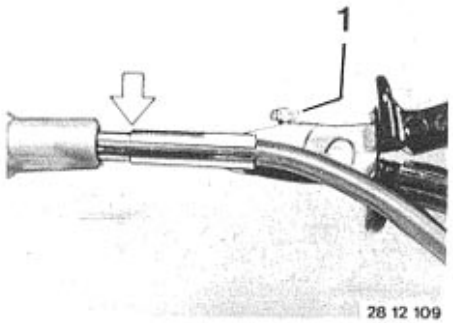
23 12 033

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



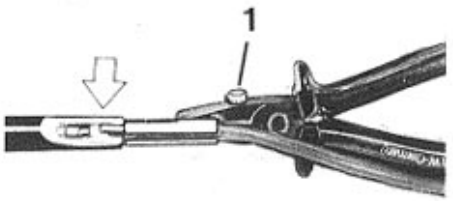
23 12 034

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



28 12 109

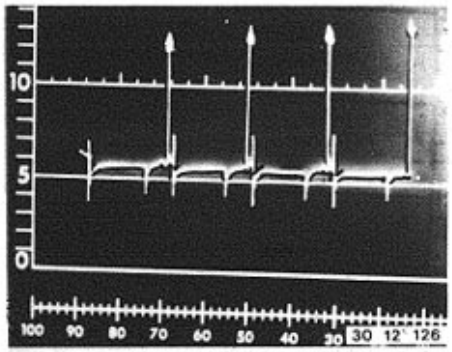
Unscrew screw (1).
Slide in ignition lead against stop (see picture), follow with pliers and slide in ignition lead further until connector is heard to engage.



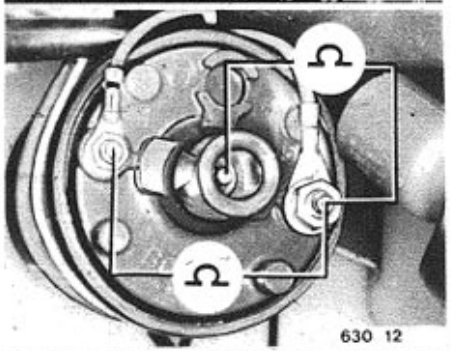
28 12 110

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.

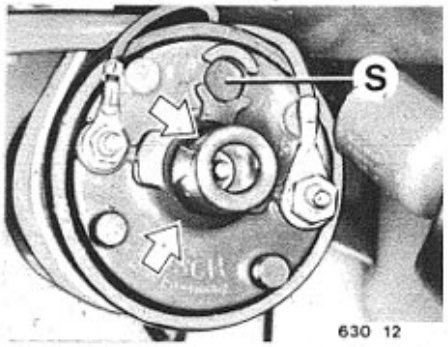
12 13 009 CHECKING IGNITION COIL



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).

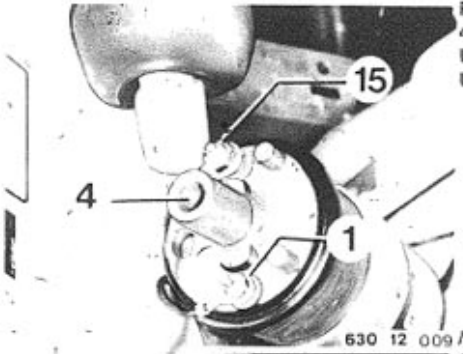


Check for hairline cracks and signs of burning.
Check plug (S) for tight fit — if pressed out, replace ignition coil.

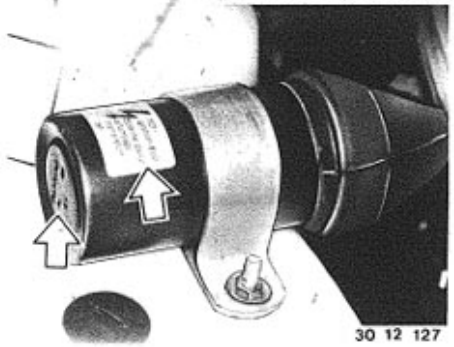
* See Specifications
** See nominal value microfiche

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.

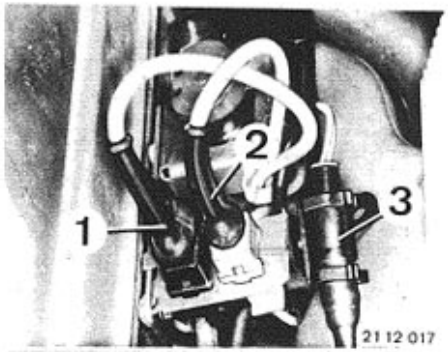


Pull off protective cap and ignition lead (term. 4).
Unscrew connections (term. 1 and 15).
Unscrew holder and take off ignition coil.



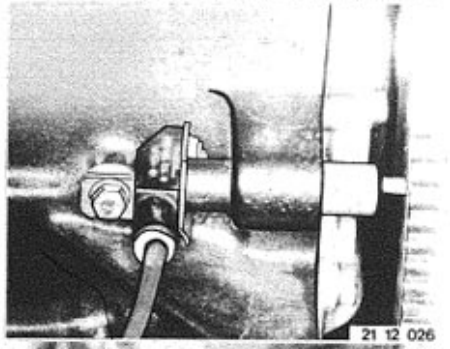
Installation:
Check new ignition coil for correct code number* and color label*.

* See Specifications

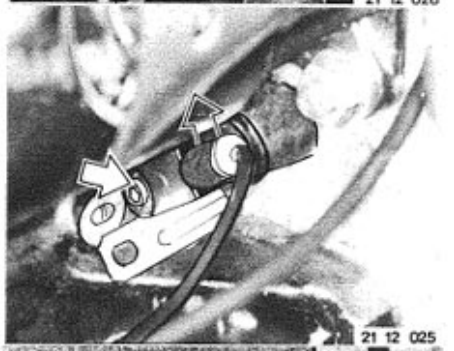


12 14 160 REPLACING/CHECKING SPEED SENSOR

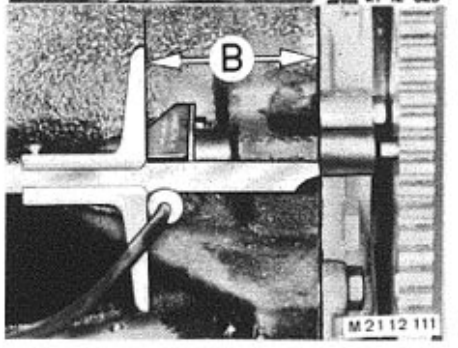
BMW 524 td:
Disconnect plug (1).



Unscrew holder from below.

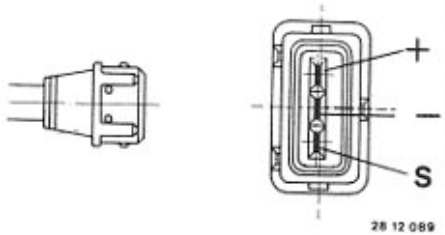


Turn speed sensor up, unscrew socket head screw and pull out speed sensor.

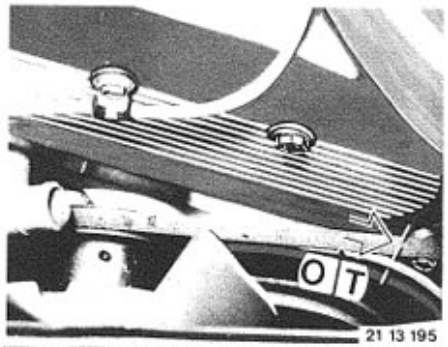


Installation:
Coat seal with Molykote paste – keep grease off of face!
Adjust speed sensor distance *).

*) See Specifications

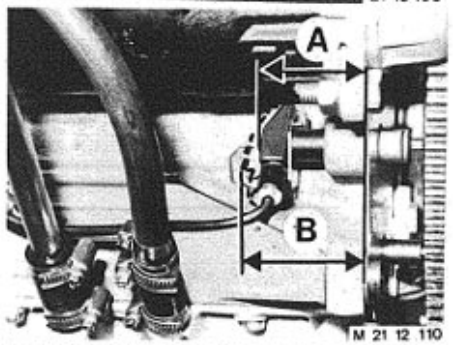


Checking:
Measure coil resistance* and insulation resistance*.
See engine electrical equipment wiring diagram for wire routing and connection.
+ and – = coil.
S = shielding.
Check alternating current voltage* (M 02) with plug disconnected and engine running at idle speed, adjusting speed sensor distance*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

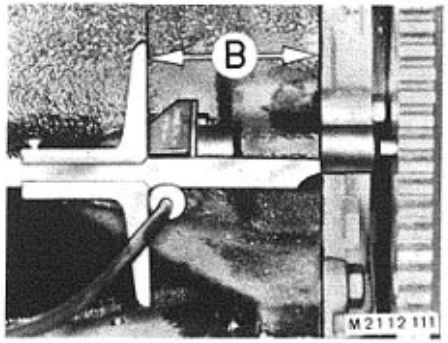


12 14 . . . ADJUSTING SPEED SENSOR

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.

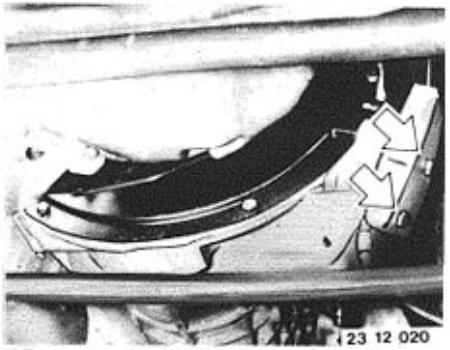


Unscrew brake fluid tank – hoses remain connected.
Loosen speed sensor and check whether pin is exactly in front of the speed sensor, correcting the flywheel position if necessary.
The sensor may be pushed in by about 2 mm (0.079").



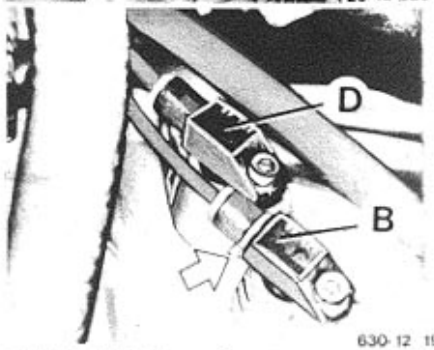
Push in speed sensor against stop and measure distance (A).
Pull out speed sensor until distance (B) is reached.
A = Speed sensor rests on pin
B = Distance A + speed sensor distance*

* See Specifications

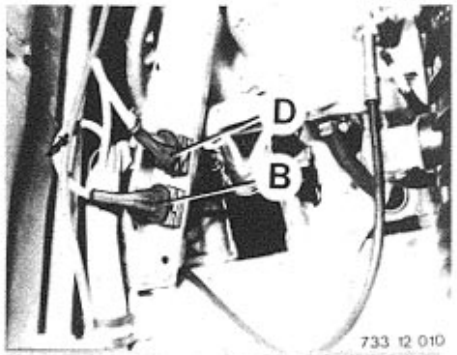


12 14 510/ 515 REPLACING/CHECKING SPEED AND REFERENCE MARK SENSORS

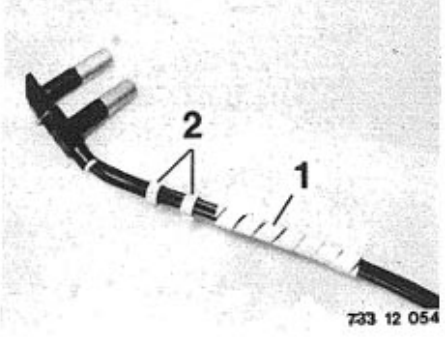
BMW 528 e / 533 i / 535 i
Unscrew shield.



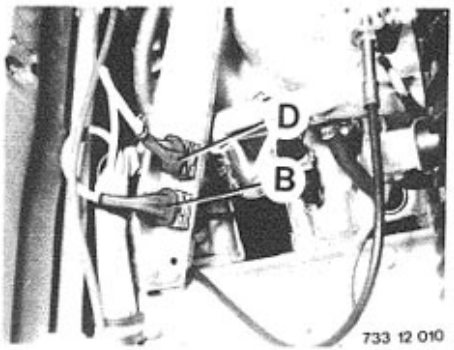
Unscrew screws of speed and reference mark sensors (D and B) and pull out sensors.
Installation:
Mark new reference mark sensor (B) with a piece of tape.



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.

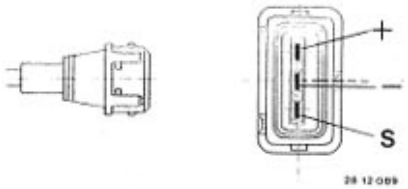


Pull off protective sleeve (1).
Lift out clip (2).
Installation:
Coat seals with Molykote paste.
Keep grease and dirt off of face surface on sensors.

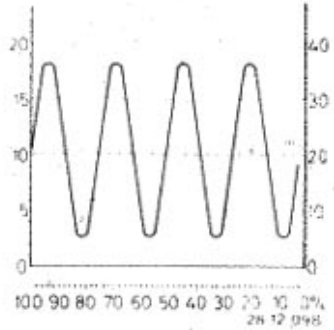


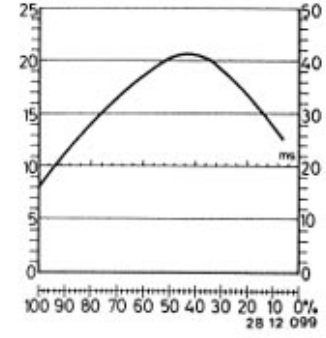
Testing:
Disconnect plug.
Connect BMW service test unit to operating instructions (M 06/22/23).
Use universal test leads.
B = Reference mark sensor
D = Speed sensor

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

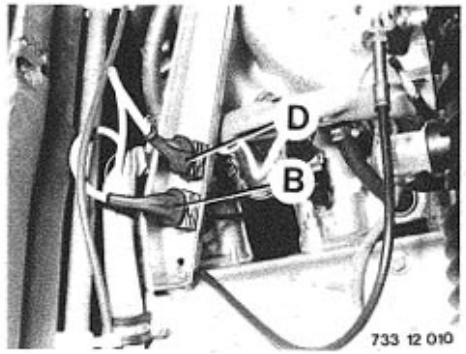
Check wires for tight fit and damage.
Check connections and arrangement of plug connections.
Reference mark sensor (B) is marked with a ring – see 12 14 510 / 515.

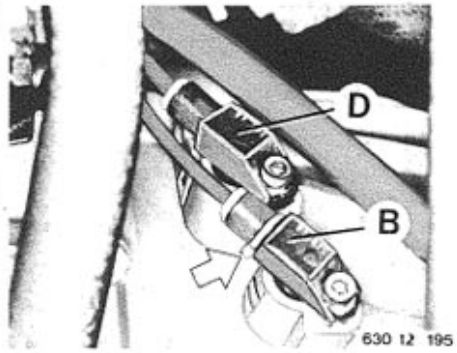
↓

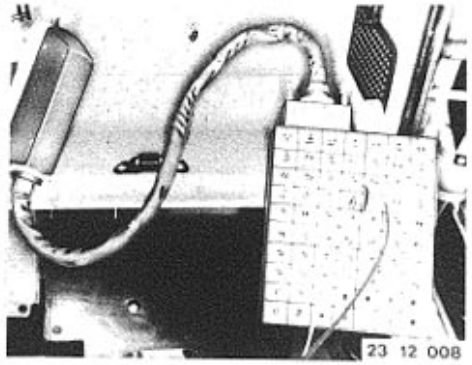
Turn engine with the starter. Check resistance (M 06) and oscillograph (M 22/23) on disconnected pulse sensor plug with BMW service test unit, see 12 14 510.

↓

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***.







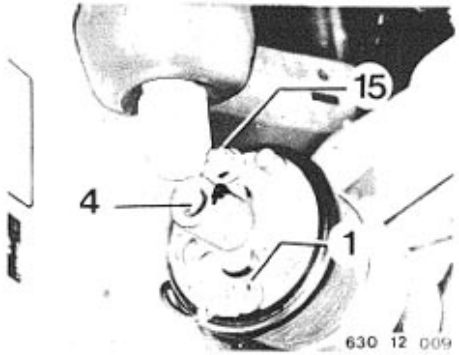
* See Specifications
** Source: HWB
*** See engine wiring diagram

Test 2 – IGNITION COIL

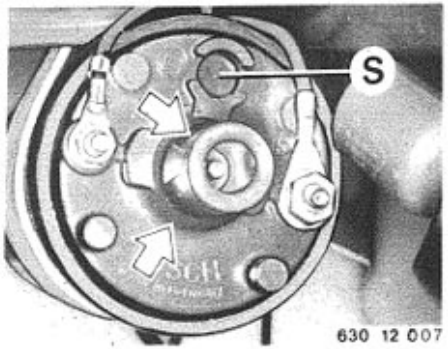
Check wires for tight fit.
Check connection plate and ignition lead contacts for traces of burning, cracks and oxidation.
Check code number* of ignition coil – see 12 13 009.

↓

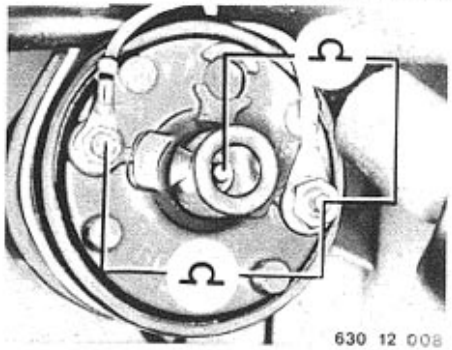
Check resistance* (M 06) and inductivity* (M 07) of primary and secondary coils – see 12 13 009.



630 12 009



630 12 007



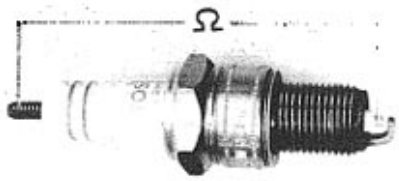
630 12 008

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

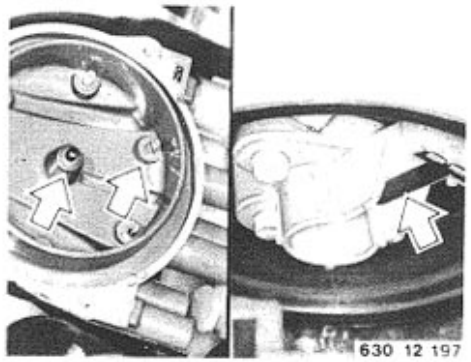
Check distributor cap and rotor for correct fit, damage and hairline cracks as well as signs of burning.
Check wire connections for oxidation and good contact – see 12 11 091 / 111.

↓

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.

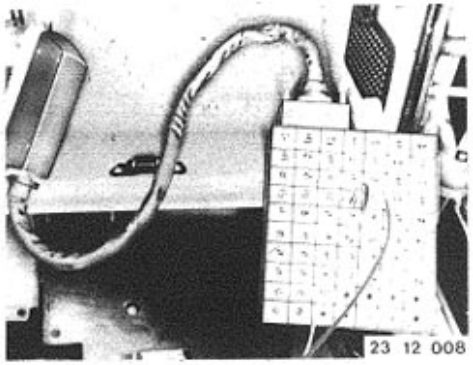
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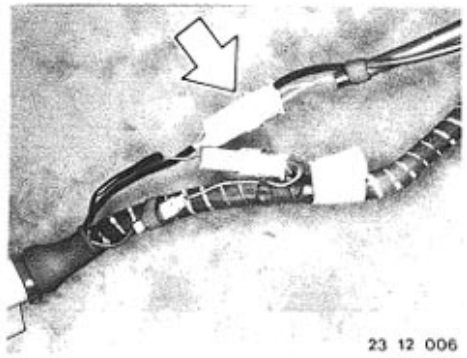
Check power supply**:
Pull off plug on control unit and connect universal adapter*** with (35-pin) test lead.
Car wire harness plugs remain connected.
Turn on ignition.
Check voltage on pins**, e.g. on connections 17 (–) and 35 (+).

→ 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

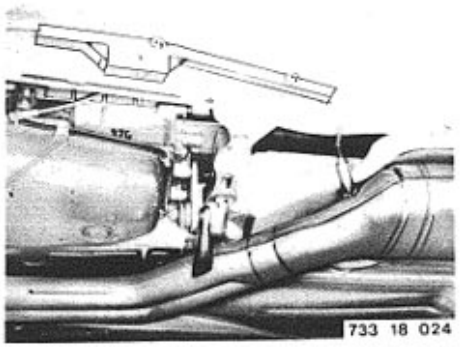
↓

Replace DME control-unit.

* See Specifications
** See engine wiring diagram
*** Source: HWB (= Division of BMW)
[1] See nominal value microfiche

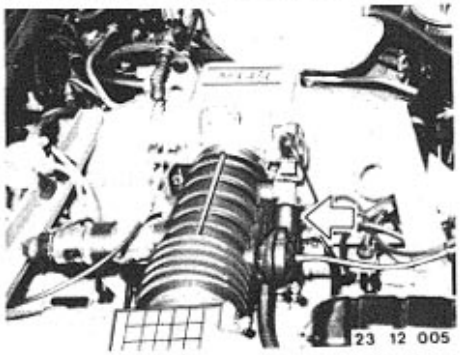
Test 17/18 – EXHAUST SYSTEM / CATALYTIC CONVERTER

Check exhaust system and catalytic converter for damage, tight fit and leaks – see Group 18.



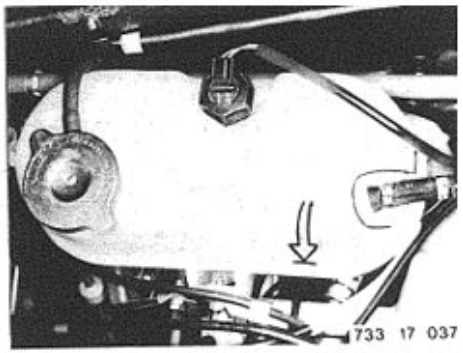
Test 19 – CRANKCASE VENT/AIR HOSES

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.

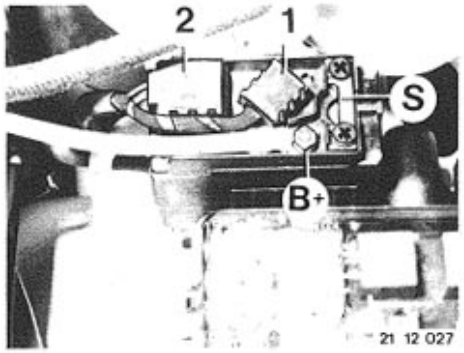
Check light bulb(s) in instrument carrier, replacing if necessary – see 62 99 . . ..

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 . . ..

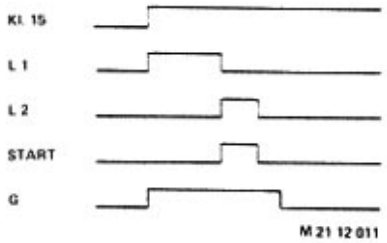
Yellow indicator lamp flashes

Pull off plug on heating time control unit (2).

Check heater plugs, replacing if necessary – see 12 23 . . ..
Replace control unit.

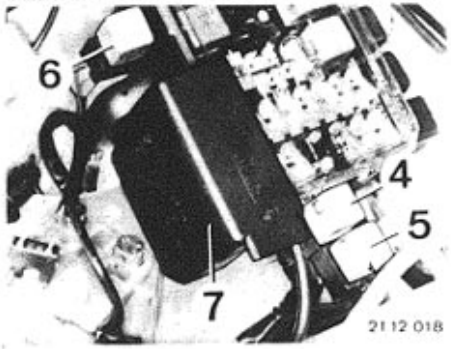
* See Specifications

12 21 . . . CHECKING FUNCTION OF HEATING SYSTEM

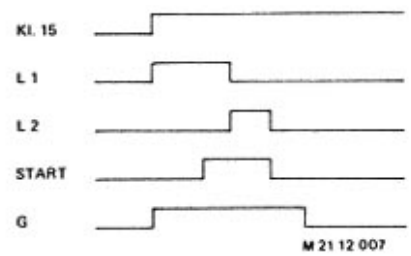


Normal Operation:
With the ignition key in "DRIVE" (term. 15) heating (G) begins and yellow lamp (L 1) in instrument panel comes on.
Green lamp (L 2) comes on when engine is ready to be started.
Heating continues during the engine starting phase and stops shortly after.
Green lamp (L 2) comes on immediately with a coolant temperature of > 60° C (140° F).

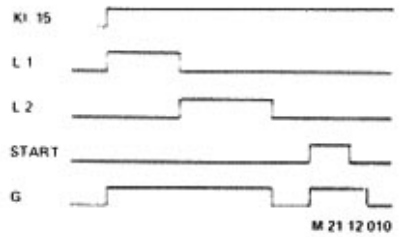




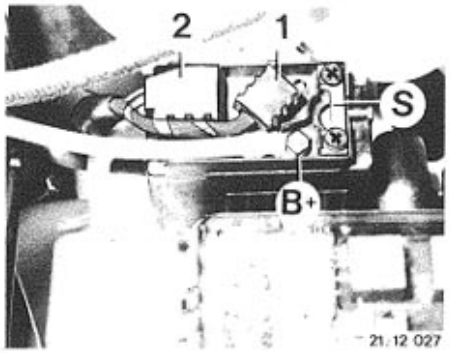
Heating without Start:
Heating is stopped by the safety circuit in control unit (7) after 8 to 13 seconds.



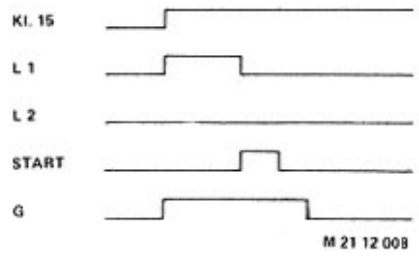
Heating when Engine is Started Too Early:
If the engine is started before lamp (L 2) comes on, this will only mean longer starting time.



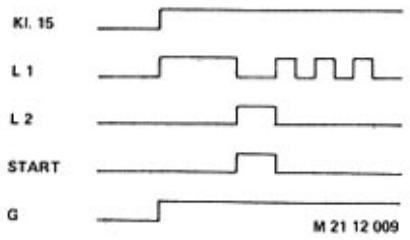
Heating for Subsequental Start:
If the engine is started after lamp (L 2) has gone out (cancelled by the safety circuit), heating continues during the starting phase and stops after a brief delay.



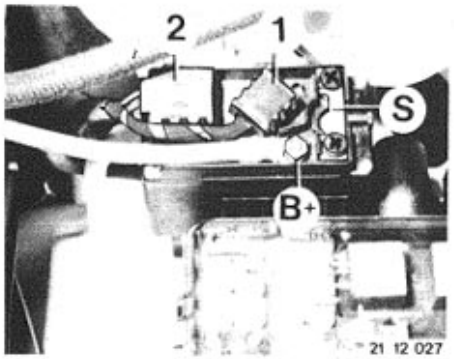
The yellow indicator lamp does not come on when the 80 ampere fuse (S) blows or the control unit is defective (below 60° C/140° F coolant temperature).



Green indicator lamp (L 2) no longer comes on when one or more heater plugs are defective.

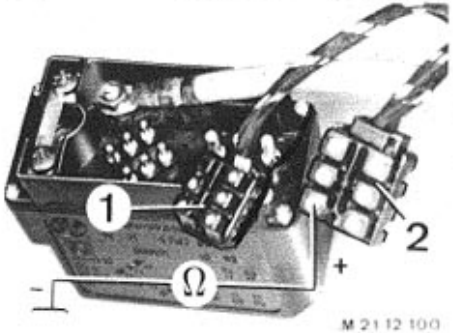


A flashing yellow indicator lamp (L 1) indicates the continued heating of the heater plugs replace control unit and check heater plugs.

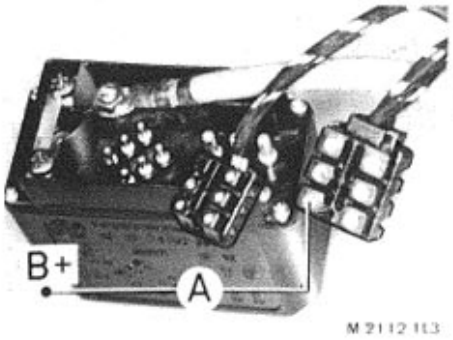


12 23 000 CHECKING HEATER PLUGS
– Installed in Car –

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.

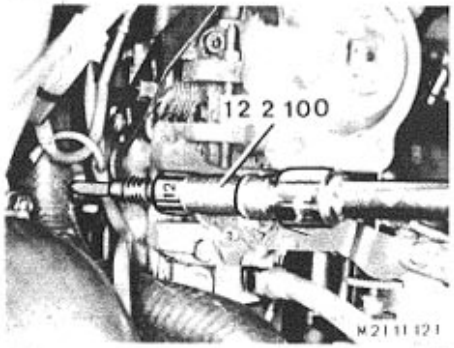


Measuring Current:
Hold test leads on battery + and plug receptacles G1 through G6 five seconds each.
Connect BMW service test unit (M 03) or an ammeter and measure current input

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.

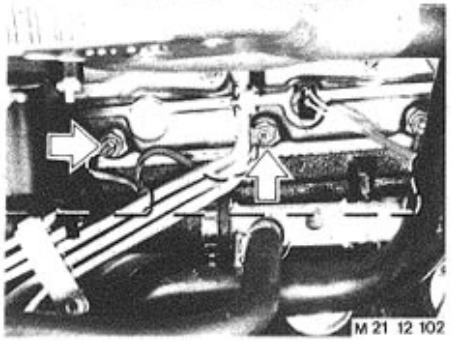


* See Specifications

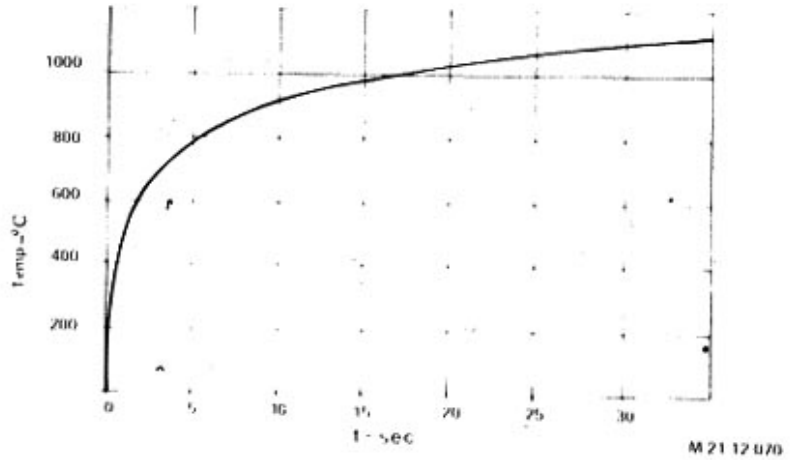


12 23 505 REPLACING ALL HEATER PLUGS

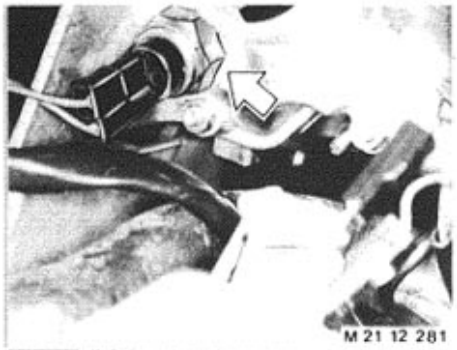
Unscrew connections.
Unscrew heater plugs with Special Tool 12 2 100.

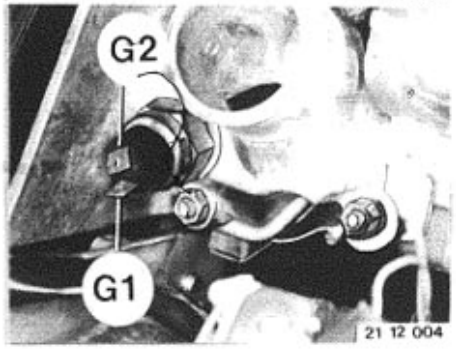


Installation:
Coat threads with copper paste "CRC"**.
Don't twist leads when tightening plugs.
Check tightening torque* of heater plugs and connections.



* See Specifications
** Source: HWB





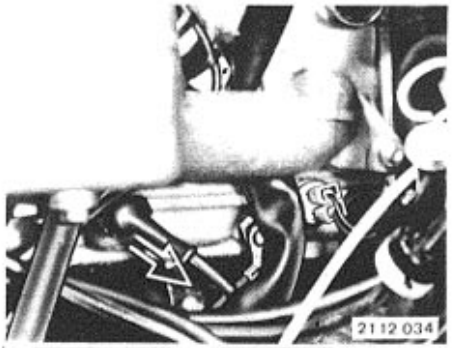
12 62 . . . CHECKING TEMPERATURE SENSOR FOR COOLANT (Heating Time/Temperature Gage)

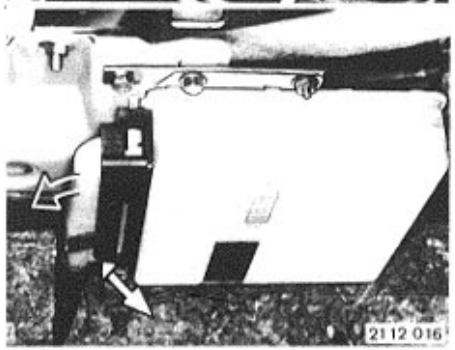
Remove temperature sensor only when coolant temperature is below 40° C (104° F)
danger of scalding!
Installation:
Use new seal.
Tightening torque*.

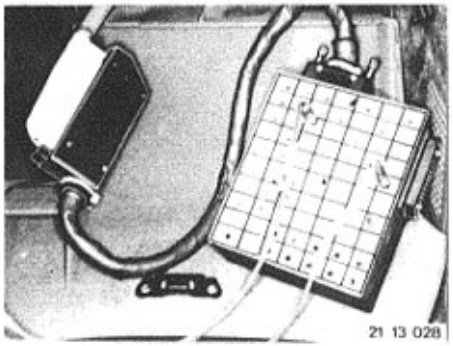
Connections:
G 1 = for coolant temp. indicator (temperature gage)
G 2 = for heating time control (to heating time control unit)

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)

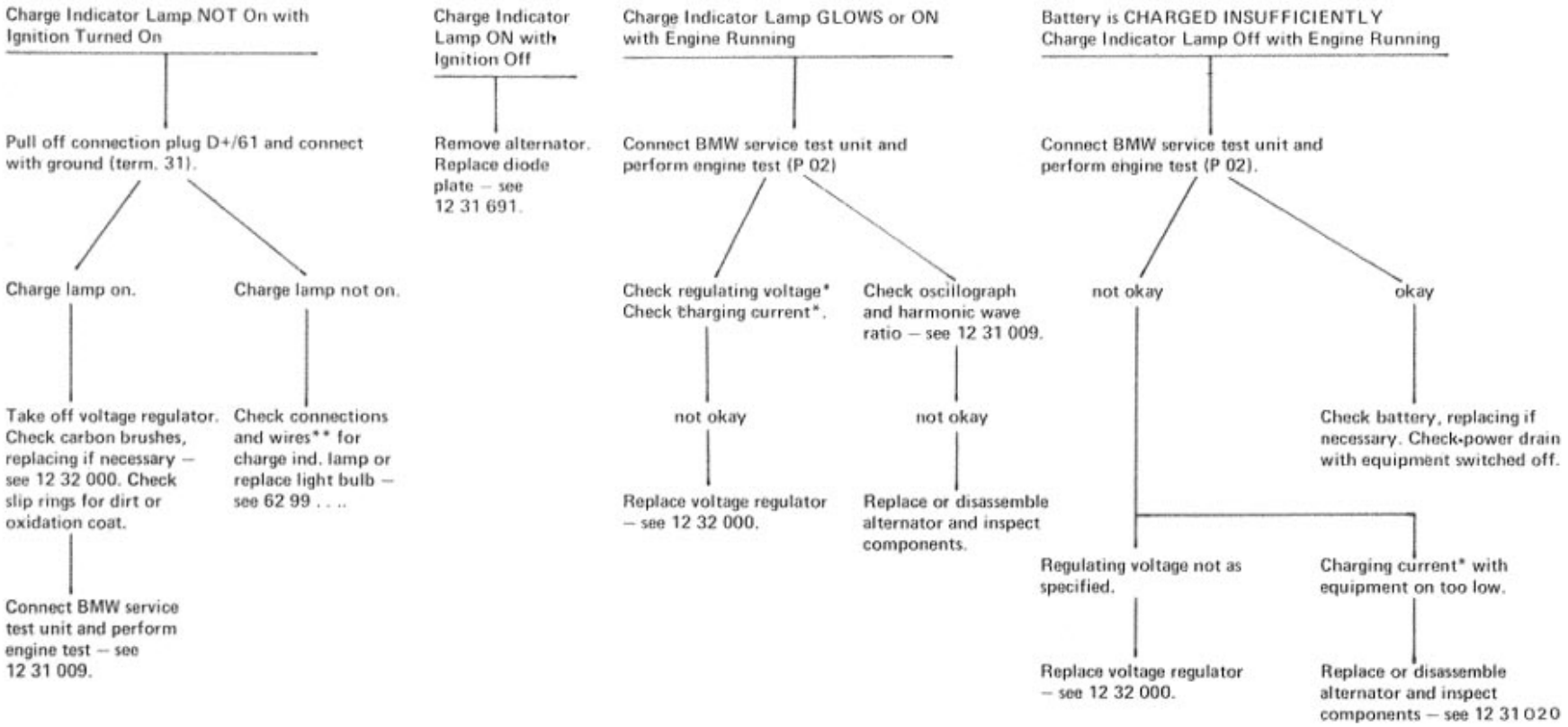
Pull off plug.
Measure resistance* at testing temperature*.

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.

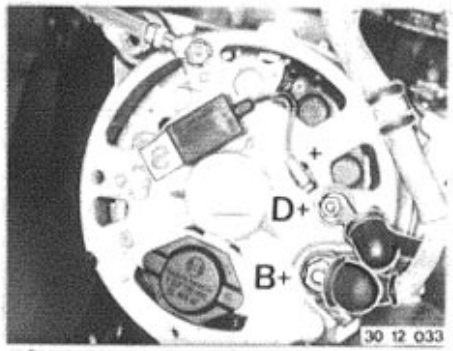
* See Specifications
** Source: HJWB

TROUBLESHOOTING ALTERNATOR

Test Requirements: – Correct connections on battery, starter and alternator.
– Good ground connection between engine and body.
– Tight drive belt.



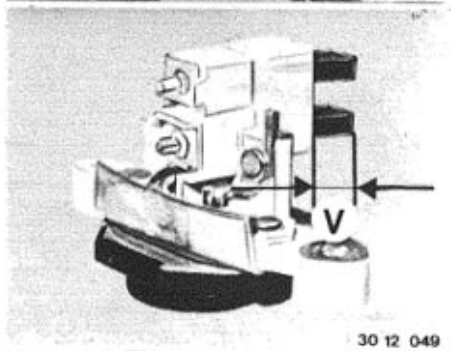
* See nominal value microfiche
** See wiring diagram



30 12 033

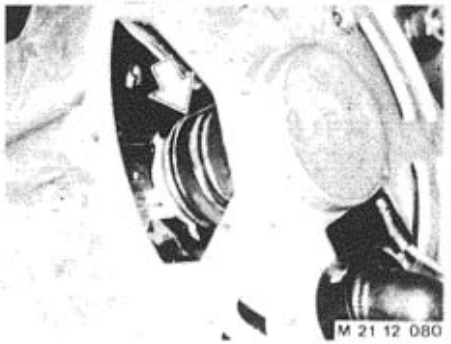
12 31 009 CHECKING ALTERNATOR AND VOLTAGE REGULATOR

Testing Requirements:
- Correct connections on charged battery
- Correct connections on alternator and starter
- Good ground connection between engine and body.
- Tight drive belt

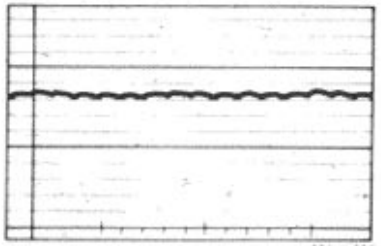


30 12 049

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").

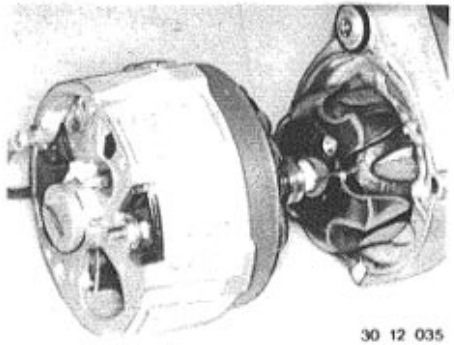

M 21 12 080

...stallation:
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*.

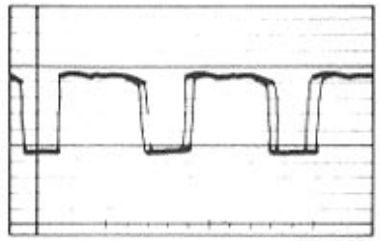

630 11 025

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.

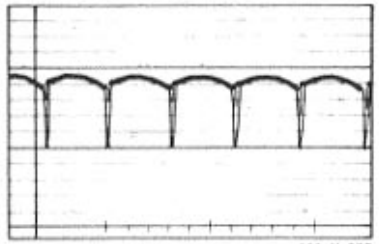
* See nominal value microfiche


30 12 035

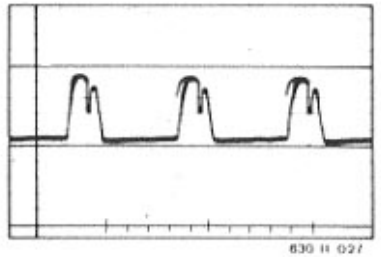
Repeat test.
If the specified charging current is not reached, remove and disassemble alternator, and inspect components – 12 31 020 / 513.


630 11 031

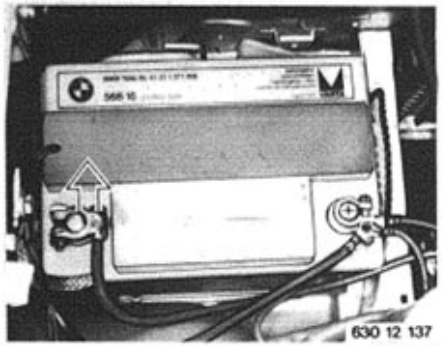
Oscillographs of Defective Alternator:
Defective power or exciter diode.


630 11 032

Shorted turn of stator coil.

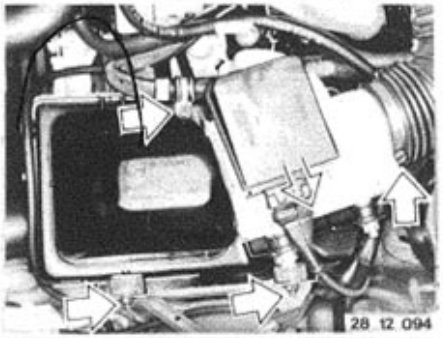

630 11 027

Break in one exciter diode.

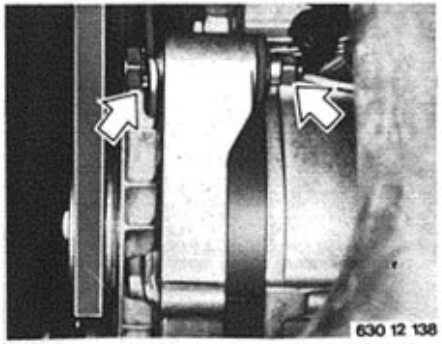

630 12 137

12 31 020 REMOVING AND INSTALLING/ REPLACING ALTERNATOR

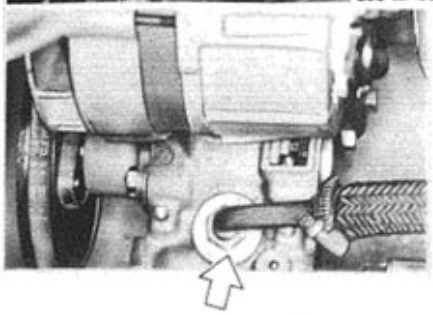
Model 528e/533i/535i
Disconnect battery.
Caution!
Always stop engine before disconnecting wires on battery, alternator and starter.
Also disconnect negative and positive leads when charging battery with a charger.


28 12 094

Remove air cleaner and air flow sensor. (528e only)

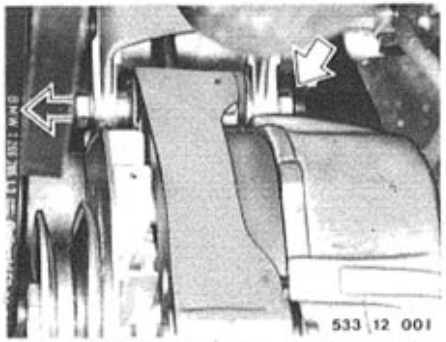

630 12 138

Unscrew nut and remove bolt with tensioning wheel.
Remove drive belt.

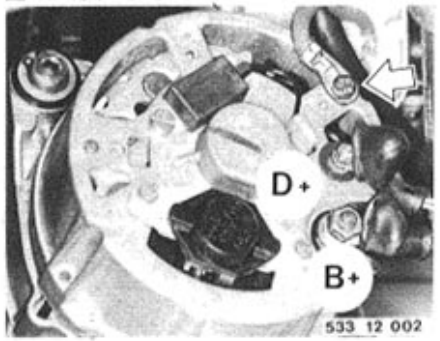

533 12 003

Loosen line on power steering pump, if necessary.
Installation:
Install line, that it cannot rub on engine carrier.
Tightening torque*.

* See Specifications

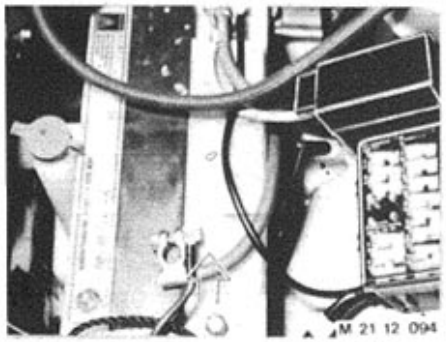

533 12 001

Unscrew nut and pull out bolt.
Remove alternator.
Installation:
Tighten drive belt – 12 31 299.



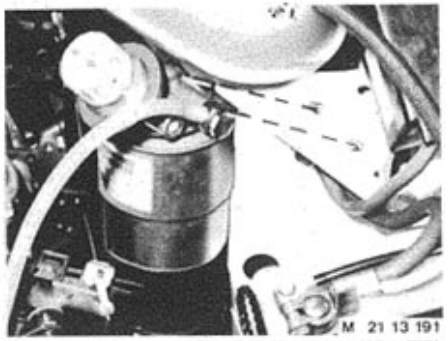
533 12 002

Unscrew wires on connection B + (term. 30) and D + (term. 61).
Unscrew ground wire.

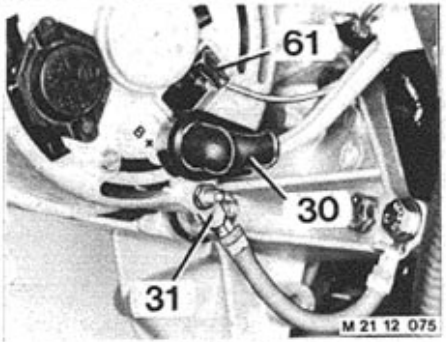


12 31 020 REMOVING AND INSTALLING/ REPLACING ALTERNATOR

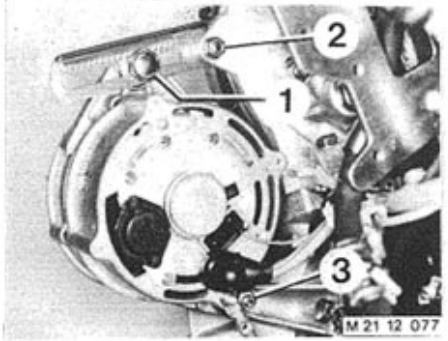
BMW 524 td:
Disconnect battery.
Caution!
Always stop engine before disconnecting leads on battery, alternator and starter.
Also disconnect positive and negative leads when charging battery with a charger.



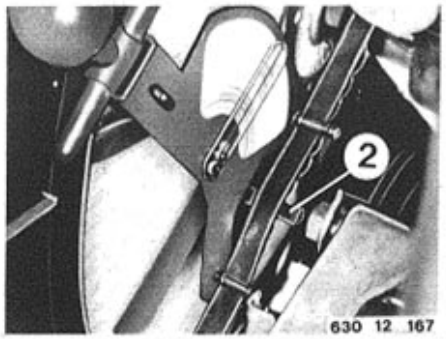
Unscrew and swing away fuel filter.



Disconnect wires on connection B + (term. 30) and D + (term. 61).
Unscrew ground wire (term. 31).

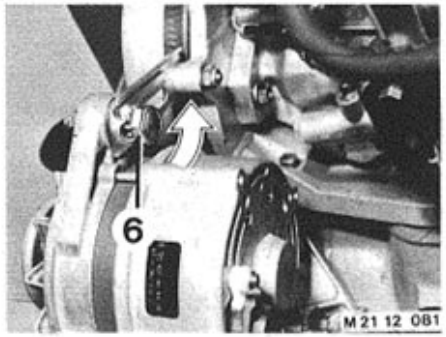


Unscrew bolts (1 and 3).
Remove alternator.
Installation:
Tighten drive belt – see 12 31 299.

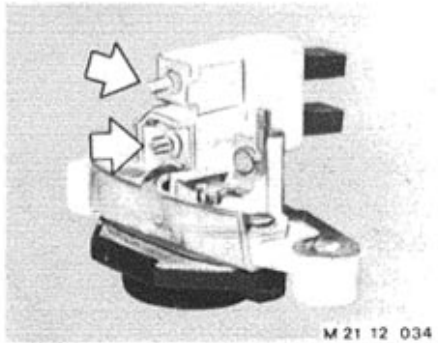


12 31 299 CHECKING AND TIGHTENING ALTERNATOR DRIVE BELT

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.

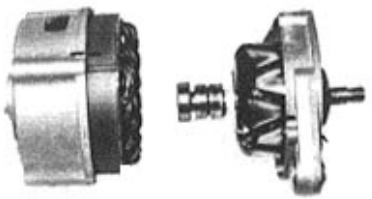


Tightening Belt:
Unscrew nut (1) and turn tensioning wheel (2) with a torque of approx. 7 Nm (5 ft. lbs.).
Tighten nut (1).
Recheck tightness with a tester, correcting if necessary.

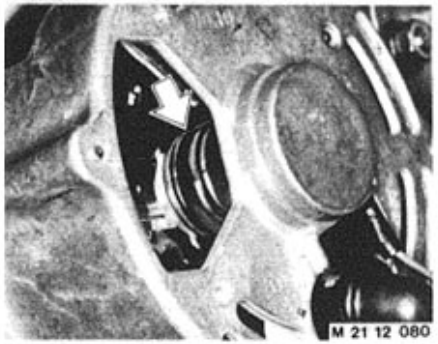

M 21 12 034

12 31 201 REPLACING CARBON BRUSHES

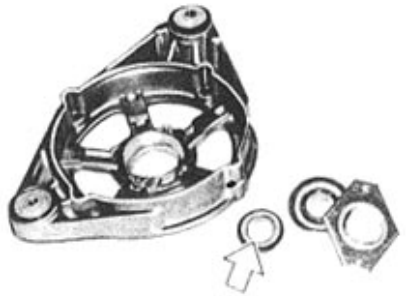
Remove voltage regulator 12 32 000.
Unsolder leads on carbon brush holder.
Note:
Only use a small amount of solder for soldering to prevent hardening of leads.


M 21 12 093

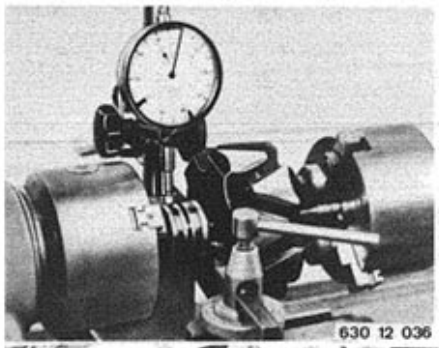
Mark housing sections to each other.
Unscrew bolts.
Pull housing sections apart.


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

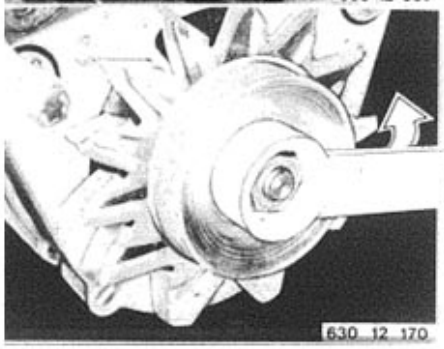
Unscrew bearing cap bolts.
Take off the end plate.


630 12 036

Avoid excessive out-of-true.
Max. slip ring out-of-true = 0.03 mm (0.0012").


M 21 12 031

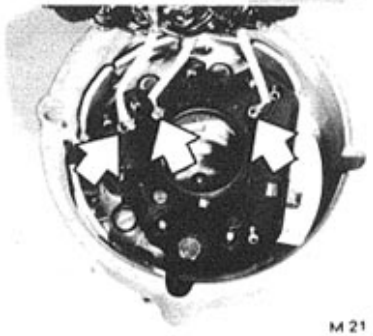
Unscrew the shielded capacitor.
Unscrew nuts on B + and D/+ terminals.
Take off the diode plate with stator coil.
Installation:
Check condition of insulating sleeves and washers, replacing if necessary.


630 12 170

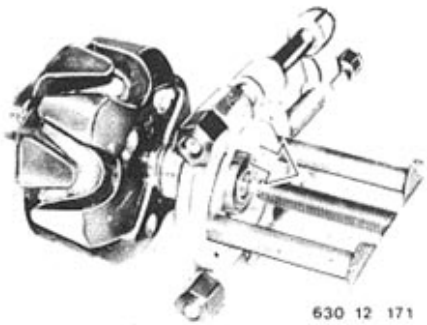
12 31 513 DISASSEMBLING AND ASSEMBLING ALTERNATOR
– Alternator Removed –

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

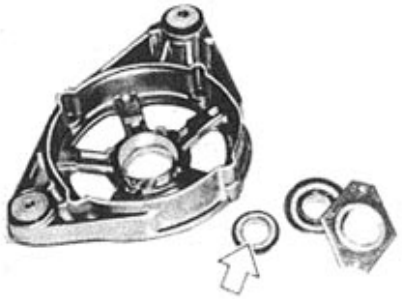
Unsolder stator coil on the diode plate.
Caution!
Excessive heat from soldering iron would destroy the diodes.
Inspect components of the alternator.



630 12 171

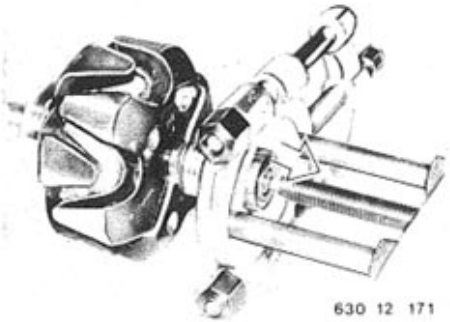
12 31 581* REPLACING BALL BEARING
– Alternator Removed and Disassembled –

Alternator – 65 A:
Pull off bearing with Special Tool 00 7 500.



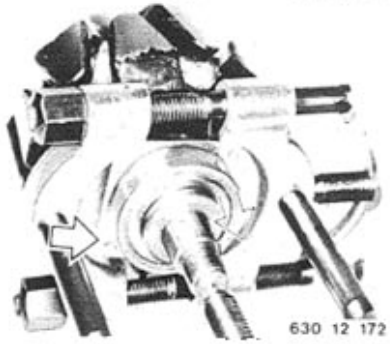
M 21 12 091

Unscrew bearing cap and press out bearing.
Installation:
Check installed position of washer – collar faces bearing.



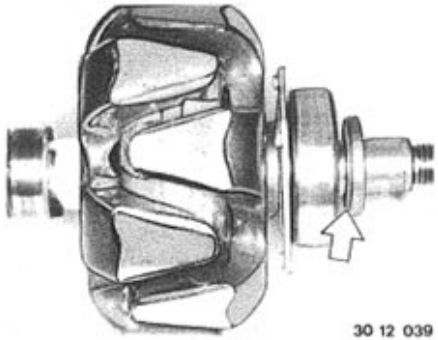
630 12 171

Alternator – 80 A:
Pull off bearing with Special Tool 00 7 500.



630 12 172

Installation:
Replace cover for bearing, if it had been damaged through application of special tool.



30 12 039

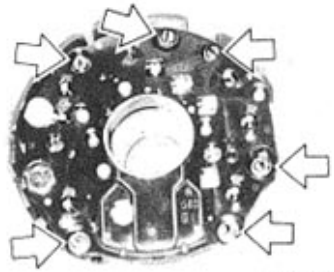
Installation:
Check installed position of washer – collar faces bearing.



630 12 178

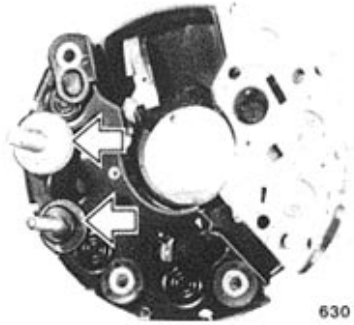
12 31 691 REPLACING DIODE PLATE
– Alternator Removed and Disassembled –

Unsolder stator coil on diode plate.
Caution!
Excessive heat from soldering iron would destroy the diodes.



630 12 173

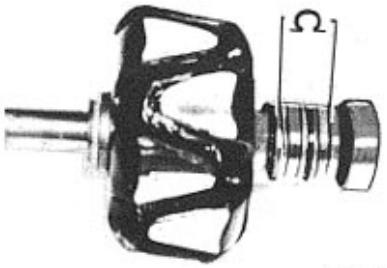
Unscrew bolts.
Remove diode plate.



630 12 179

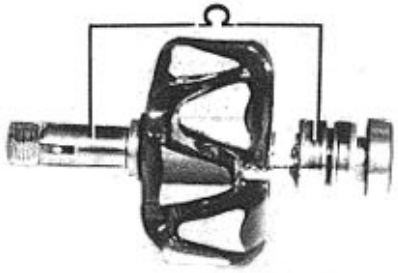
Installation:
Check condition of insulating sleeves and insulators.

12 31 . . . INSPECTING COMPONENTS OF ALTERNATOR



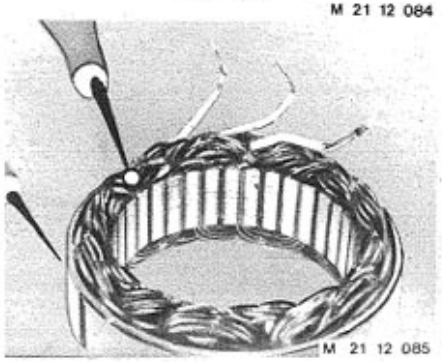
M 21 12 083

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.



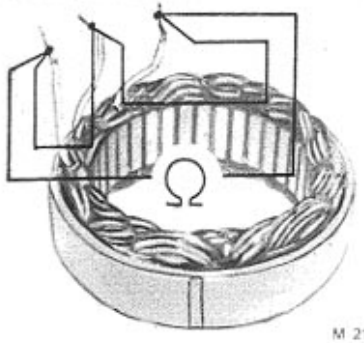
M 21 12 084

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.



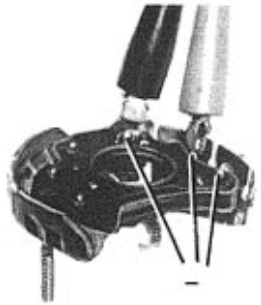
M 21 12 085

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.



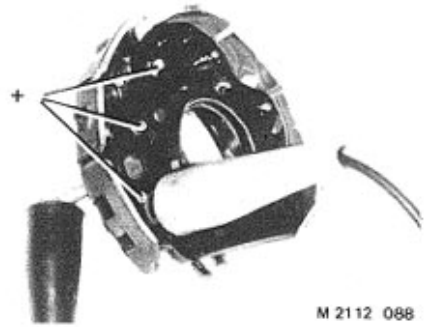
M 21 12 086

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.



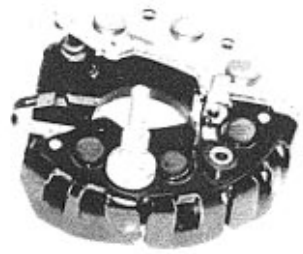
M 21 12 087

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 "–".



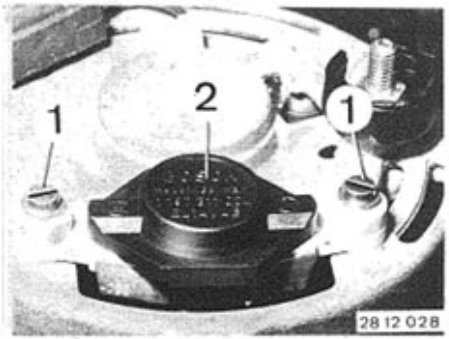
M 2112 088

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 "+".



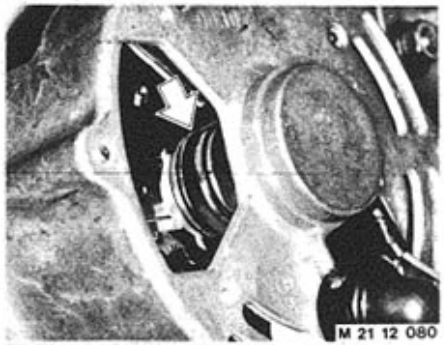
M 21 12 089

If a diode is defective, replace entire diode plate – 12 31 691.

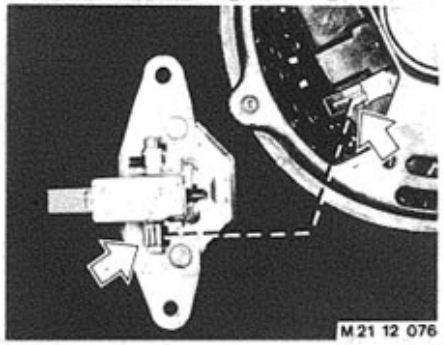


13 32 000 REMOVING AND INSTALLING/ REPLACING VOLTAGE REGULATOR

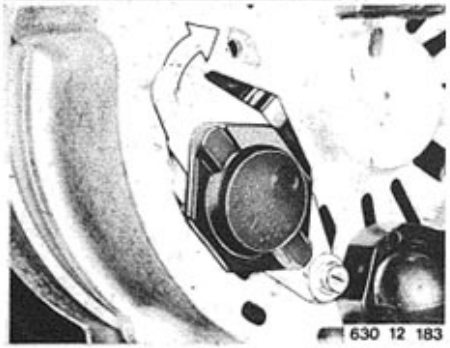
Unscrew bolts (1) and take off regulator (2) carefully.



Check slip rings for wear, fine grinding if necessary.



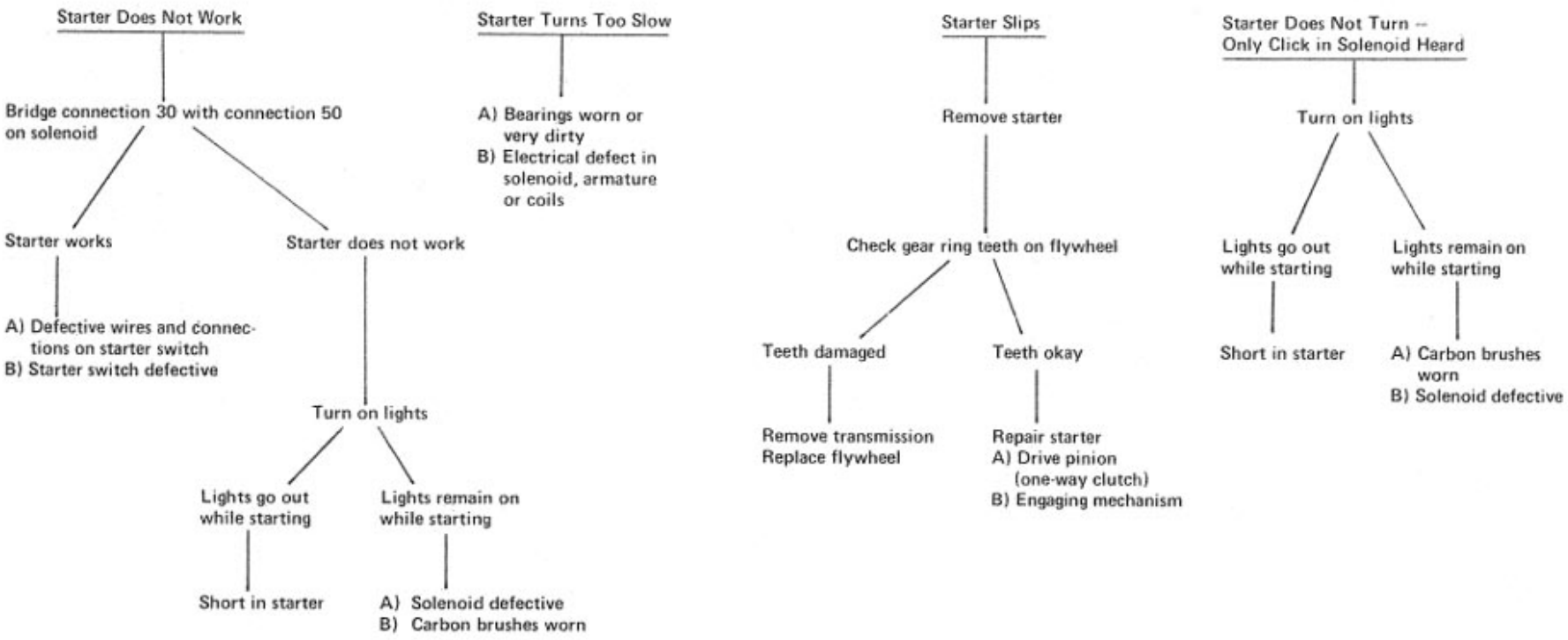
Clean contact surfaces and check tension of spring contacts, correcting if necessary.

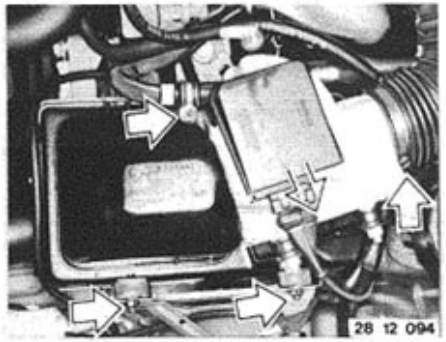


Installation:
Mount regulator at first with one bolt screwed in finger tight, then press alternator to final installed position carefully, install and tighten all bolts.

TROUBLESHOOTING STARTER

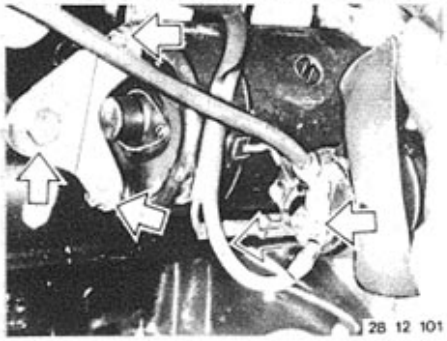
Testing Requirements: – Correct connections on battery and starter
– Good ground connection between engine and body
– Charged battery



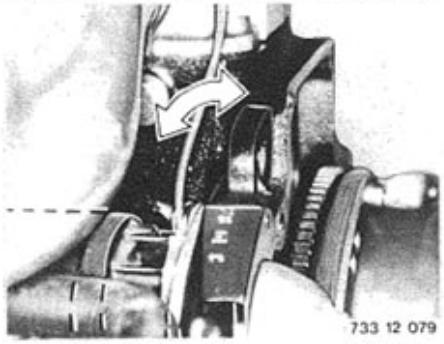


12 41 020 REMOVING AND INSTALLING STARTER

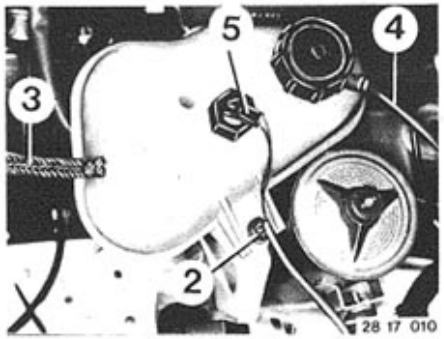
BMW 528 e:
Disconnect battery.
Remove air cleaner with air flow sensor



Disconnect leads (term. 30 and 50).
Unscrew support.

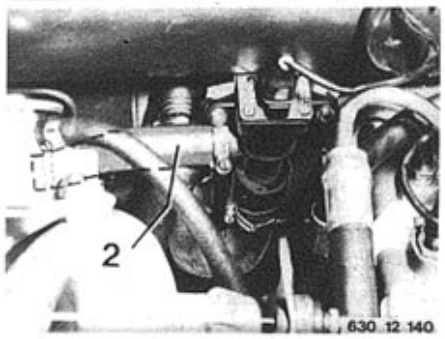


Unscrew nuts.
A ring wrench can be bent subsequently to improve accessablility – see figure.
Unscrew 2nd starter bolt from below.
Take off starter from below.

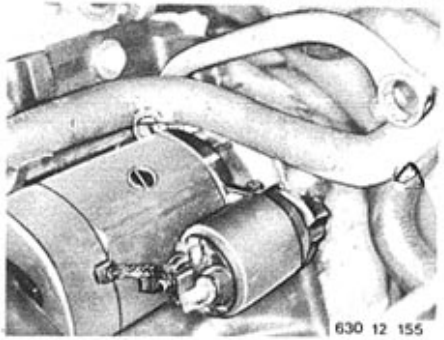


BMW 533 i / 535 i:
Disconnect battery ground lead.
Drain coolant and take off expansion tank.

Installation:
Add coolant * and bleed cooling system – see 17 00 039.

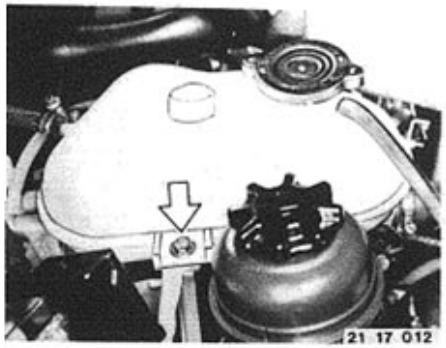


Detach heater hose.



Disconnect leads (term 30 and 50).
Remove mounting bolts.
Unscrew top bolt with the bent ring wrench and take off starter.

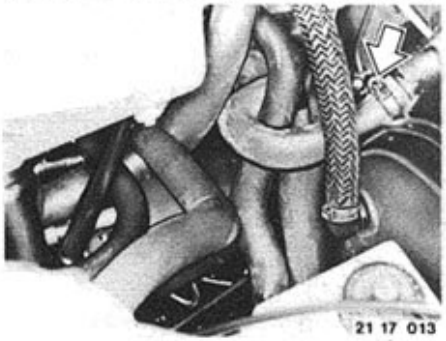
* See Service Information of Gr. 00



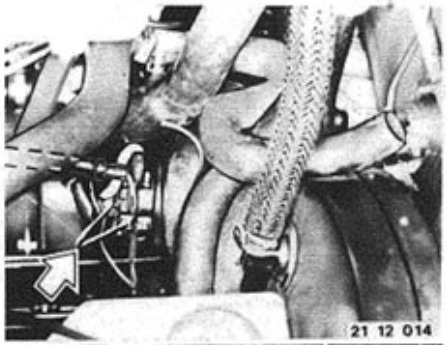
12 41 020 REMOVING AND INSTALLING STARTER

BMW 524 td:
Disconnect battery ground lead.
Take off expansion tank and drain coolant.

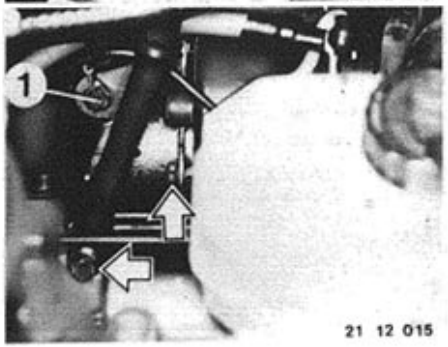
Installation:
Add coolant* and bleed cooling system – see 17 00 039.



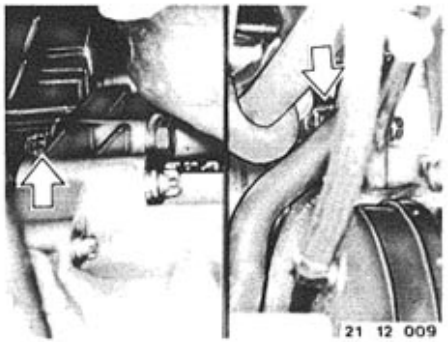
Detach heater hose.



Uscrew wires (B +/Term. 30 and Term. 50).



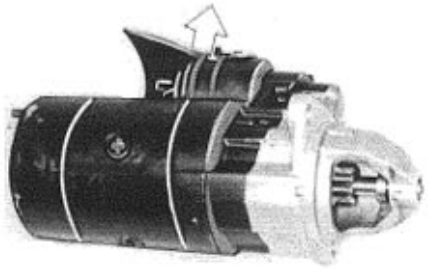
Unscrew support for air collector and support plate.
Note ground wire on bolt (1).



Unscrew bolts and remove starter from above.

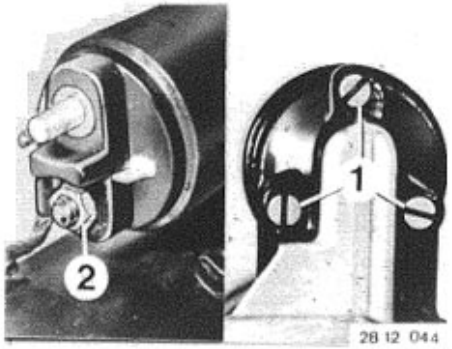
* See Service Information of Gr. 00.

12 41 041 REPLACING SOLENOID SWITCH



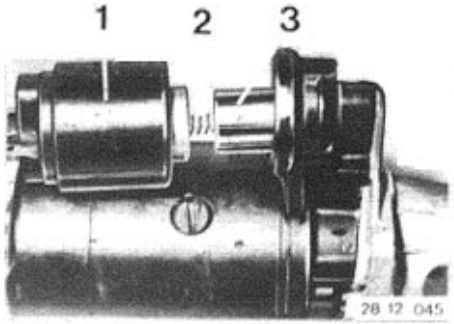
M 21 12 095

Remove starter – 12 41 020
Take off cover.



28 12 044

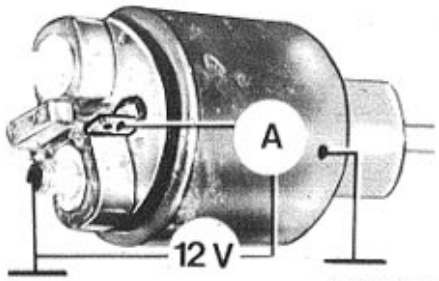
Unscrew solenoid switch (1 and 2).
Installation:
Don't bend wire connector while tightening switch – danger of short circuit.



28 12 045

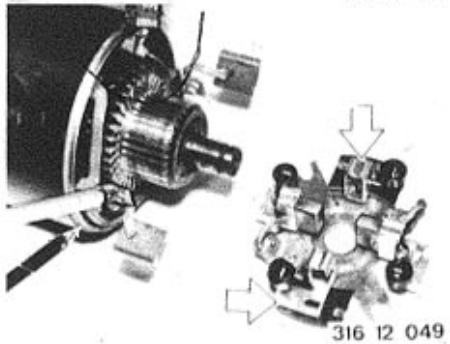
Take off solenoid switch (1) and spring (2).
Disconnect pin (3).
Installation:
Check pin (3) for wear and lubricate with grease.

12 41 . . . INSPECTING COMPONENTS OF STARTER (Electric Test)



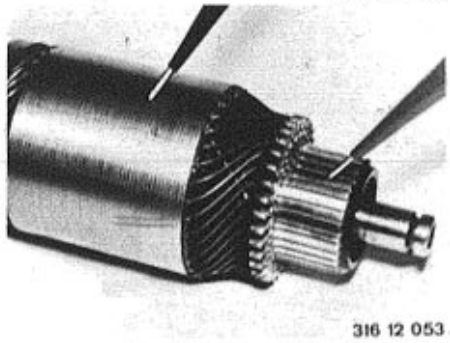
630 12 186

Check power input* of activating and holding coils in solenoid switch.



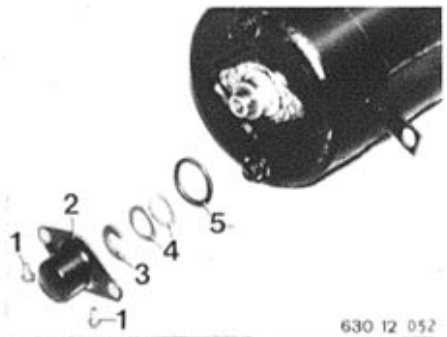
316 12 049

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

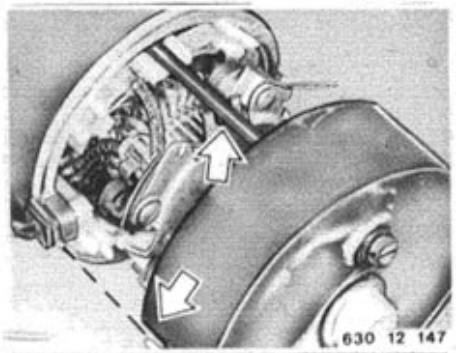


630 12 052

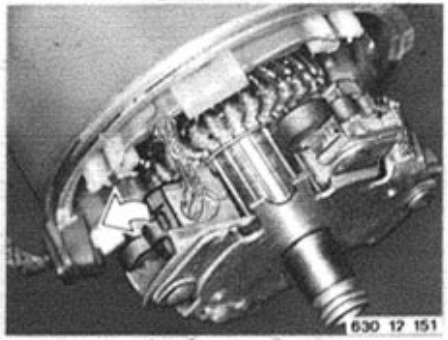
12 41 103 DISASSEMBLING/ASSEMBLING STARTER

Model 528 e / 533 i / 535 i

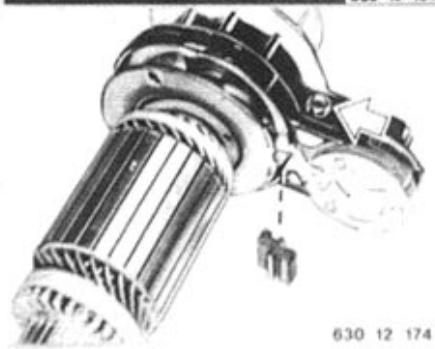
Remove starter – see 12 41 020.
Remove solenoid switch – see 12 41 041.
Unscrew dust cap (2).
Take off circlip (3), shims (4) and seal (5).
Installation:
Check axial play of armature, correcting with shims if necessary.


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.

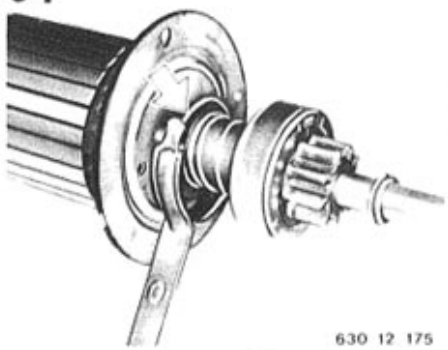

630 12 151

Lift springs and pull out carbon brushes.
Remove holder.
Installation:
Check carbon brushes and commutator for wear, repairing if necessary – see 12 41 551.

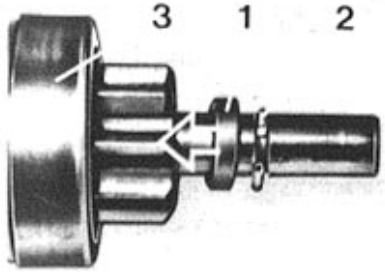

630 12 174

Remove pole housing.
Unscrew engaging lever bolt and remove rubber seal.

* See Specifications

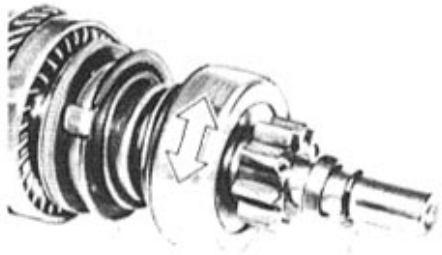

630 12 175

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.

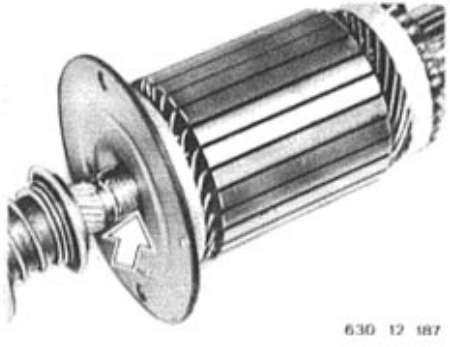


28 12 049

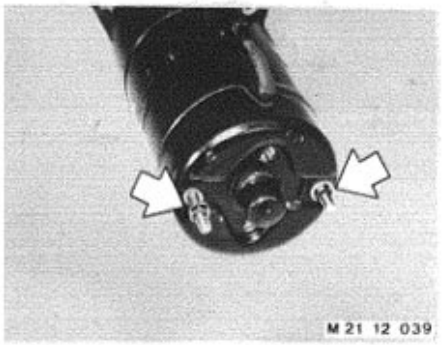
Push back bearing race (1) with a piece of suitable pipe.
Pry circlip (2) apart and pull it off of the shaft.
Remove burrs with a file.
Take off drive pinion (3).
Installation:
Use new circlip (2).
Lubricate bearing surface for drive pinion with grease.


630 12 144

Installation:
Check pinion for wear (on teeth, bearings, one way clutch), replacing if necessary.

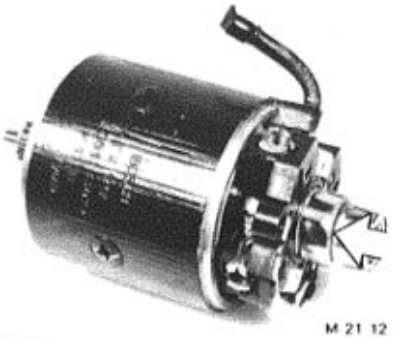

630 12 187

Check sleeve in intermediate bearing, replacing if necessary.

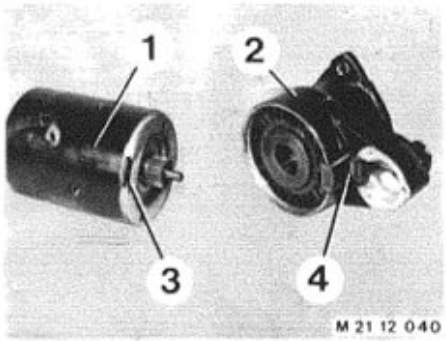

M 21 12 039

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.

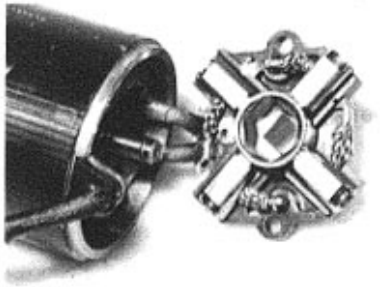

M 21 12 045

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.

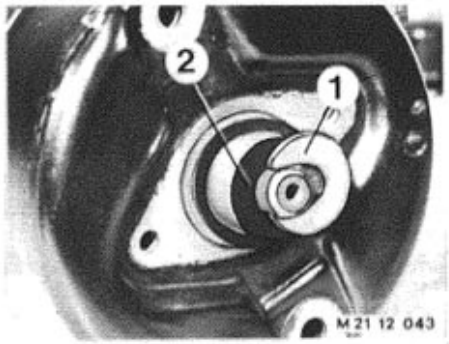


M 21 12 040

Disconnect motor (1) on gearbox (2).
Installation:
Groove (3) must be aligned with rubber part (4).

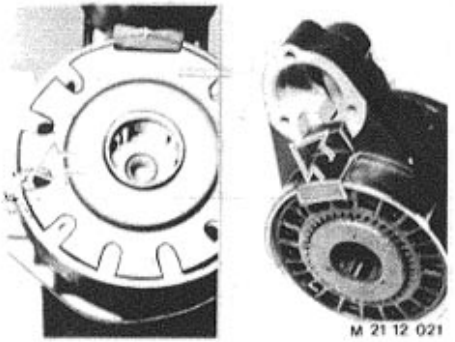

M 21 12 046

Installation:
Use wrench socket or pipe again to make installation easier.
Place entire unit on transmission case and then tighten wire connector.

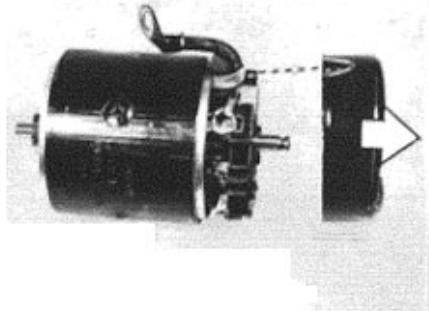


M 21 12 043

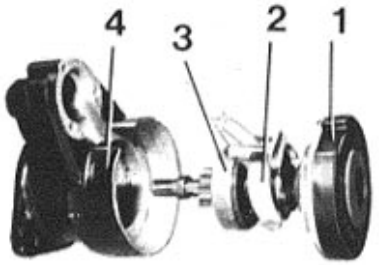
Take off protective cap.
Remove retainer (1) and shims (2).
Installation:
Check axial play*, correcting if necessary.


M 21 12 021

Remove cover and rubber pad.


M 21 12 044

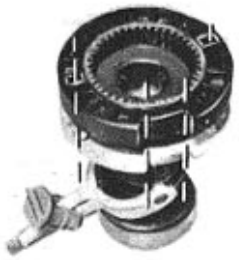
Check armature shaft, removing burrs if necessary.
Take off cover.



M 21 12 054

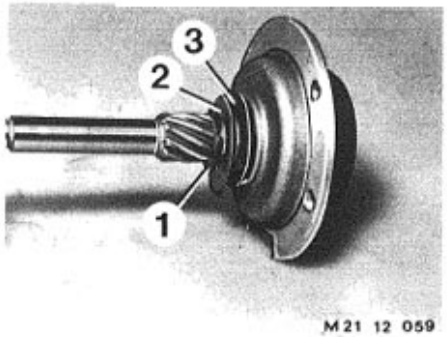
Pull out transmission assembly.
Take off toothed ring on planet gear and release.
1 Planet gear
2 Release
3 Pinion
4 Transmission case

* See Specifications



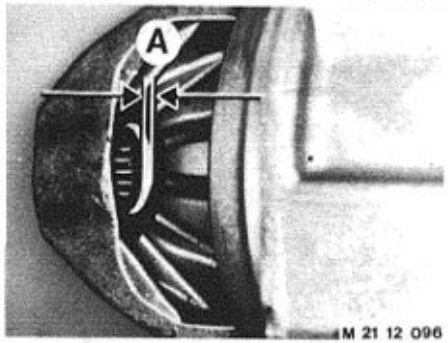
M 21 12 057

Installation:
Openings and bores must be aligned.



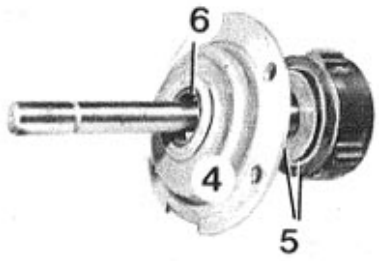
M 21 12 059

Pull off circlip (1) and remove washers.
2 Metal washer
3 Plastic washer

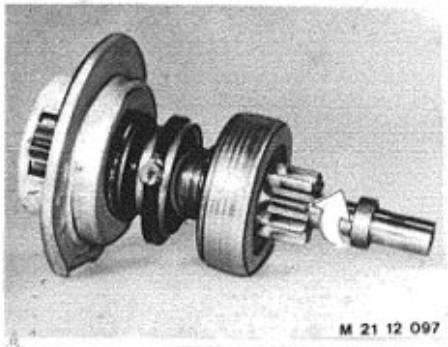


M 21 12 096

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").



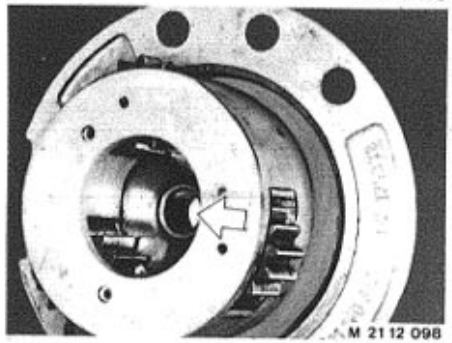
Remove bearing cap (4) and washers (5).
Check bearing sleeve (6), replacing if necessary.
Installation:
Lubricate sleeve with oil after pressing in.



M 21 12 097

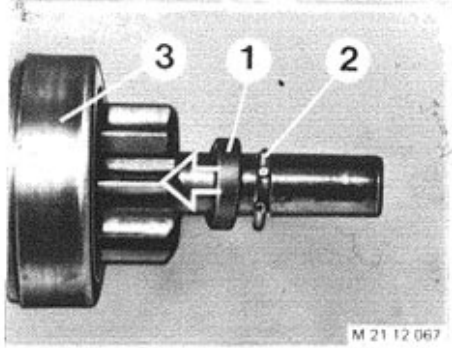
Turn drive pinion against stop.
Pinion can be turned very easily when one-way clutch is worn.
Check bearing sleeve and teeth of pinion for wear.

M 21 12 060



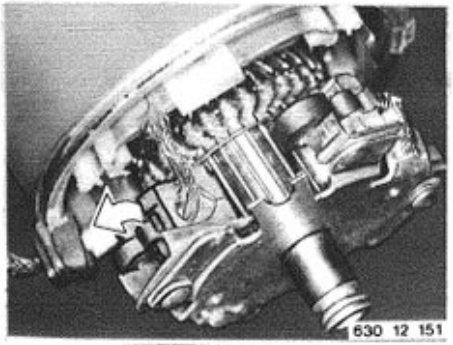
M 21 12 098

Check bearing sleeve, removing with a suitable puller if necessary.
Check planet gears for wear.
Installation:
Lubricate sleeve with oil after pressing in.



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.


630 12 151

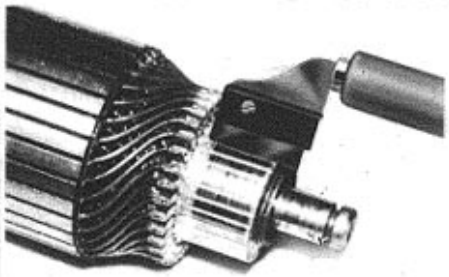
12 41 551 REPLACING CARBON BRUSHES
– Starter disassembled –

Model 528e/533i/535i:
Lift springs and pull out carbon brushes.



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.

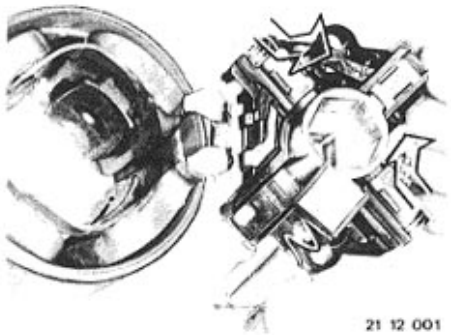

630 12 060


630 12 065

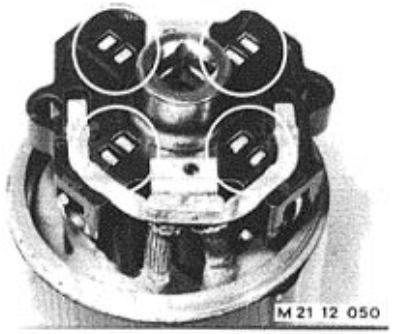
Check commutator for wear, fine grinding if necessary.
Diameter must be at least 33.5 mm (1.319").
Machine insulation between plates approx. 0.5 to 0.7 mm (0.020 to 0.028") deep.

Check armature for shorted turns after repairing.

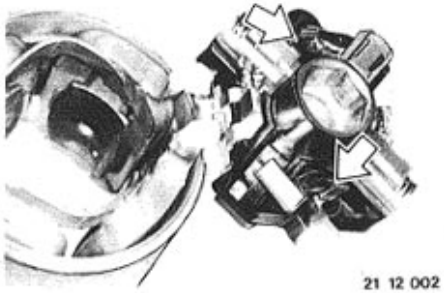
Model 524td:
Fine grind and polish commutator on armature.
File or machine insulation between commutator plates 0.5 to 0.7 mm (0.020 to 0.028") deep.
Check for shorted turns after repairing.


21 12 001

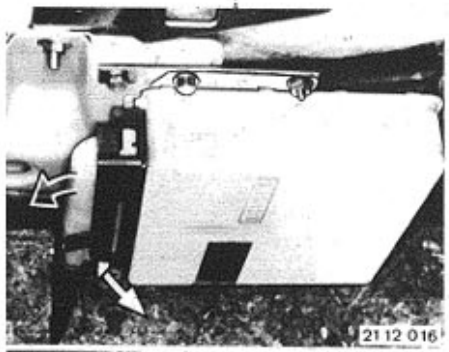
Push carbon brush holder to middle and lift off.


M 21 12 050

Installation:
Engage hooks of carbon brush holder fully.

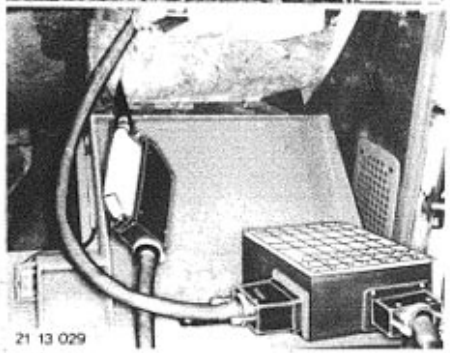

21 12 002

Two carbon brushes have to be cut off on the leads.
Solder in new carbon brushes.

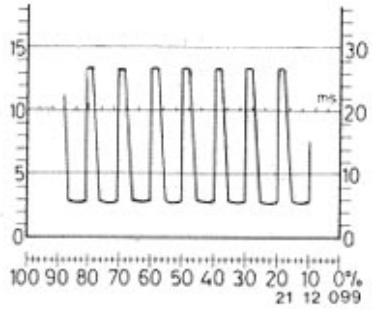


12 63 . . . CHECKING SPEED SIGNAL FOR TACHOMETER

Remove cover in glove box.
Pull off plug on control unit VP-20.



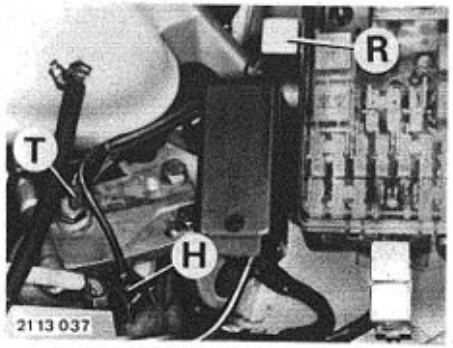
Connect universal adapter**.
Connect test leads for control unit and periphery.



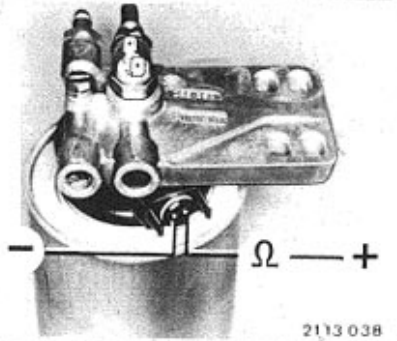
Connect oscilloscope on terminals 17 (–) and 21 (+).
Start and run engine at idle speed.
The illustrated oscillograph must appear on the screen.
If necessary, check speed sensor – see 12 14 160.

** Source: HWB

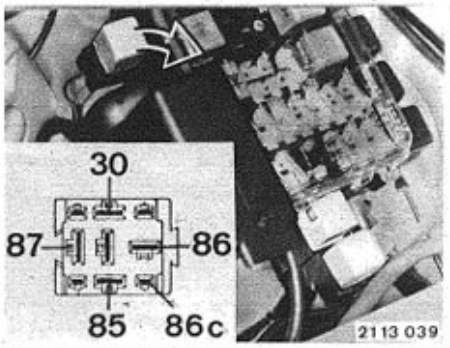
12 64 . . . CHECKING FUEL HEATING



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.



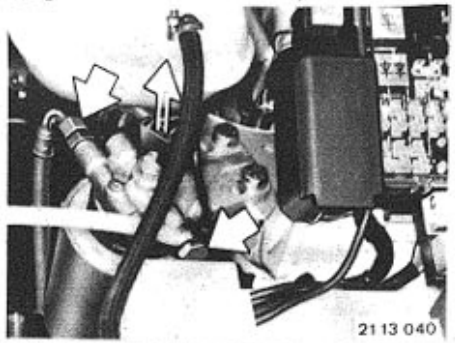
Measure coil resistance* with an ohmmeter replacing heating element if necessary.
Check switching temperature* of temperature switch.



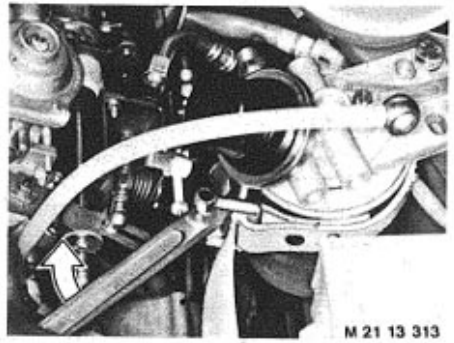
Pull off relay and apply battery voltage on terminal 87 (black wire) approx. 10 seconds.
Measure power input* – must drop as temperature of heating element rises.

* See Specifications

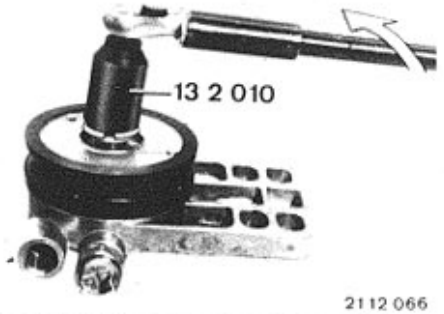
12 64 005 REPLACING FUEL HEATING ELEMENT



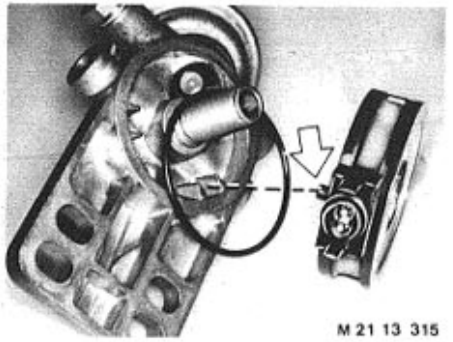
Unscrew fuel lines.
Pull off plugs for temperature switch, water level sensor and heating element.



Unscrew filter cartridge with a standard filter strap.
Unscrew filter head and take off unit.

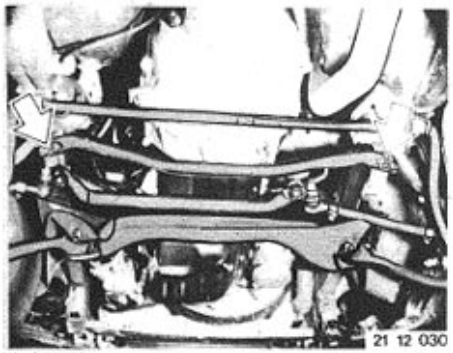


Unscrew filter cartridge.
Unscrew heating element with Special Tool 13 2 010.



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.

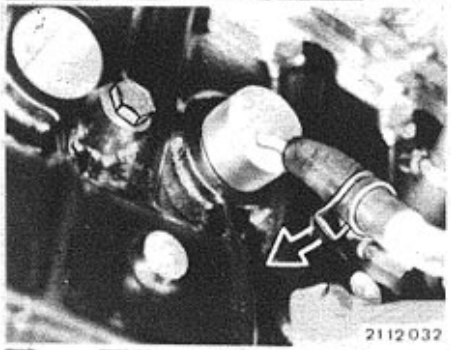
* See Specifications


21 12 030

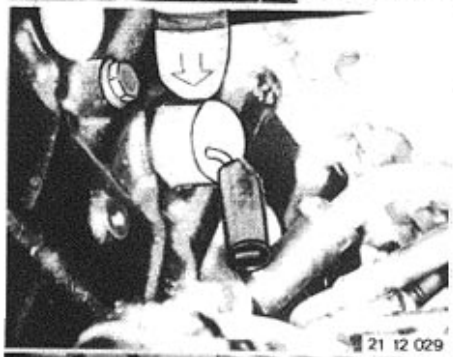
12 81 . . . REPLACING / CHECKING COOLANT HEATER

Caution!
Heater is operated with 120 AC voltage – never work on a connected heater.

Remove rod.

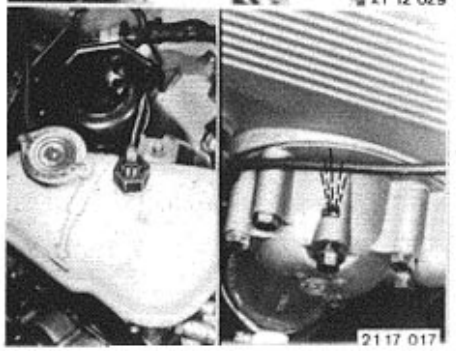

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Remove retainer and pull off plug.
Drain coolant from engine.


21 12 029

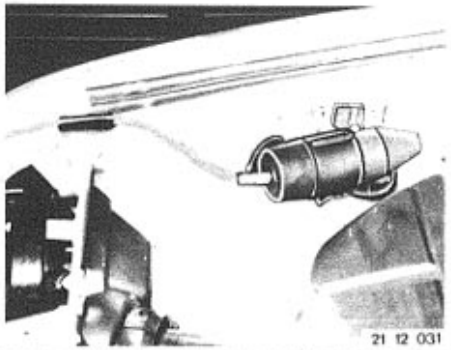
Loosen heater on engine block by applying knocks from the side with a plastic hammer.
Clean sealing surface.

Installation:
Coat sealing surface with Loctite No. 573.
Knock in heater uniformly until seated well, not necessarely against stop.

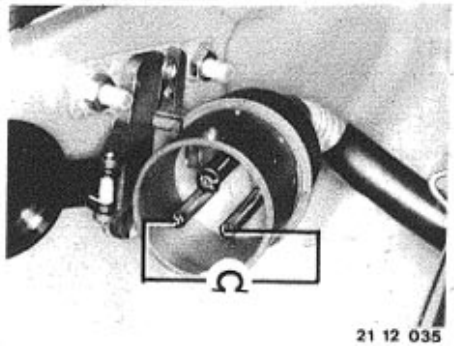

2117017

Fill cooling system with specified coolant** and bleed cooling system – see 17 00 039.

** See Service Information of Gr. 00


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 Specifications

13 Fuel system

BMW 524 td

	Working instructions / explanations of abbreviations	13- 1
13 00 050	Engine idle speed – check/adjust	13- 2
550	Cold running device (temperature dependent idle speed boost) – check/adjust	13- 3
13 31 028	Fuel feed pressure – check	13- 4
13 32 . . .	Fuel filter – draining water	13- 4
051	Fuel filter – remove and install/replace	13- 5
	Troubleshooting survey for engine electrical, fuel and injection systems	13- 10
	Testing instruction for VP-20 fuel injection	13- 11
13 51 000	Injection pump – remove and install	13- 15
001	Injection pump – replace	13- 19
002	Injection pump internal pressure – check	13- 20
506	Injection pump static adjustment – check/correct	13- 21
006	Injection begin (dynamic) – check	13- 23
290	Pressure valve – replace	13- 24
. . .	Timing valve in injection pump – replace	13- 25
13 51 300	Electric fuel shut off – check	13- 26
301	Electric fuel shut off – replace	13- 26
320	Fuel system – bleed	13- 27
340	Operating lever of injection pump – check /adjust	13- 28
13 51 . . .	Atmospheric and charging air pressure dependent regulation (ALDA) – check	13- 29
13 53 320	Fuel injectors – remove/install/replace	13- 30
13 53 . . .	Injection nozzle – flush	13- 31
800	Injection nozzle – check	13- 32
13 71 000	Air cleaner – remove/install	13- 33

BMW 528 e/A

13 00 054	Engine idle speed / CO level – adjust	13- 008
13 31 029	Fuel delivery pressure – check	13- 312
. . .	Fuel delivery rate – check	13- 312
030	Fuel pump – remove and install	13- 319
13 32 051	Fuel filter – remove and install	13- 324
13 41 000	Idle speed control valve – remove and install	13- 411
010	Control unit for idle speed control valve – remove and install	13- 418
13 51 200	Fuel pressure regulator – remove and install	13- 512
. . .	Fuel pressure regulator (fuel injection pressure) – check	13- 512
13 54 030	Throttle housing – remove and install	13- 521
051	Throttle shaft return springs – remove and install	13- 532
13 61 000	Control unit – remove and install	13- 613
13 62 000	Air flow sensor – remove and install	13- 621
050	Temperature time switch – remove and install/check	13- 626
080	Pressure sensor – remove and install	13- 627
531	Coolant temperature sensor – remove and install/check	13- 629
13 63 544	Throttle switch – adjust	13- 631
551	Throttle switch – remove and install	13- 634
13 64 030	Cold start valve – remove and install/check	13- 642
501	Fuel injector – remove and install	13- 643
12 63 051	Temperature switch 0° C (32° F) – remove and install	13- 701
060	Temperature switch 45° C (113° F) – remove and install	13- 704

BMW 533 i/A, 535 i/A

13 00 020	Adaptive initial control – check	13- 01
050	Engine performance – check/adjust	13- 05
054	Engine idle speed / CO level – adjust	13- 010
13 31 029	Fuel delivery pressure – check	13- 313
. . .	Fuel delivery rate – check	13- 313
030	Fuel pump – remove and install	13- 319
13 32 051	Fuel filter – remove and install	13- 324
13 41 000	Idle speed control valve – remove and install	13- 412
010	Idle speed control valve control unit – remove and install	13- 418
13 51 200	Fuel pressure regulator – remove and install	13- 512
. . .	Fuel pressure regulator (fuel injection pressure) – check	13- 512
13 54 030	Throttle housing – remove and install	13- 524
051	Throttle shaft return springs – remove and install	13- 534
13 61 000	Control unit – remove and install	13- 613
13 62 000	Air flow sensor – remove and install	13- 623
050	Temperature time switch – remove and install/check	13- 626
531	Coolant temperature sensor – remove and install/check	13- 629
13 63 544	Throttle switch – adjust	13- 632
551	Throttle switch – remove and install	13- 633
13 64 030	Cold start valve – remove and install	13- 644
501	Fuel injector – remove and install	13- 645
12 63 051	Temperature switch 0° C (32° F) – remove and install	13- 701
060	Temperature switch 45° C (113° F) – remove and install	13- 701
	Hose routing plan	13- 750

Testing instructions for electronic idle regulation	13- 810
Troubleshooting fuel injection	13- 900
Troubleshooting engine electronics	see group 12

WORKING INSTRUCTIONS

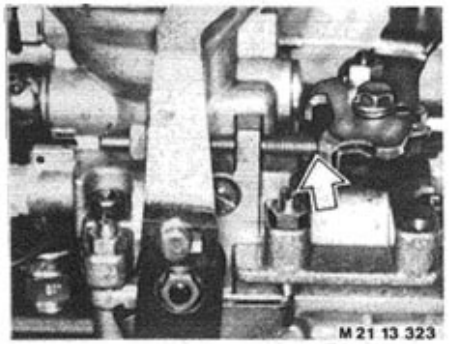
These instructions concern cleanliness when working on fuel supply and control systems.

- 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

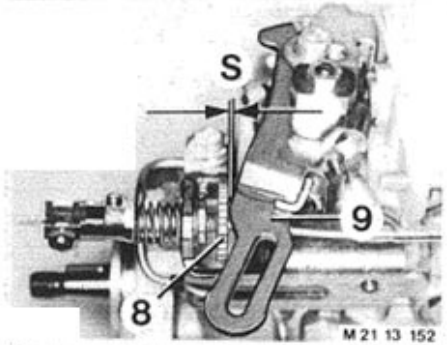
Injection Pump Attachments:

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

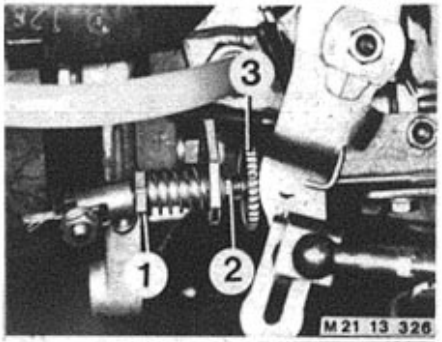


13 00 050 CHECKING / ADJUSTING ENGINE IDLE SPEED

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).

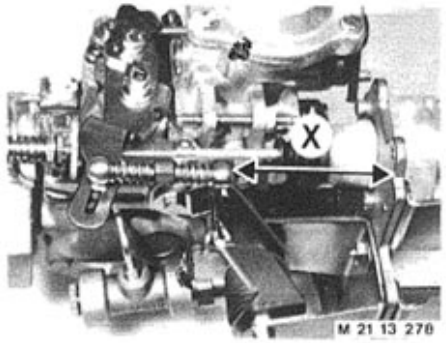


Hold on hexagon (1) and unscrew nut (2).
Turn knurled head screw (3) until play "S" is reached.



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.

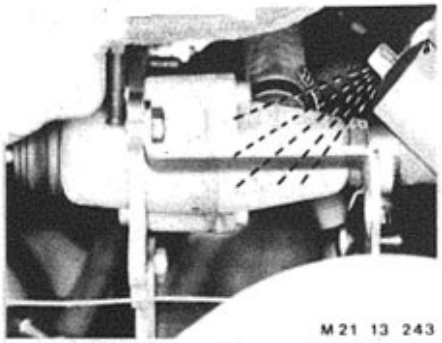
* See Specifications



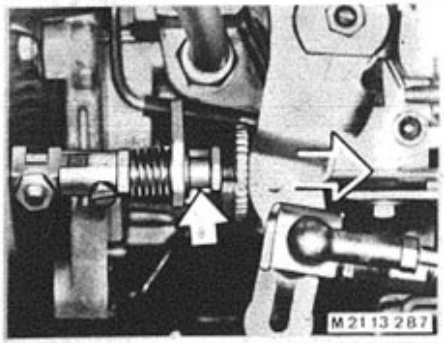
Cars with Automatic Transmission:
Check distance "X" in idle position, correcting if necessary – linkage basic adjustment – see 13 51 340.

13 00 550 CHECKING / ADJUSTING COLD IDLE DEVICE (TEMPERATURE DEPENDENT IDLE SPEED BOOST)

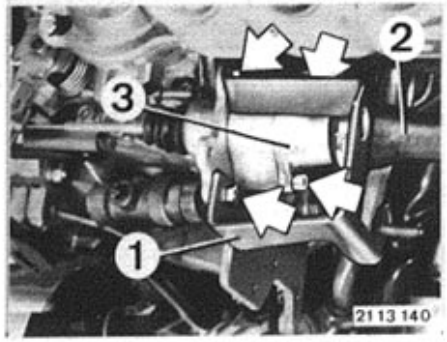
Requirements:
Coolant temperature: < 20° C (68° F).
Idle speed (warm) okay.



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

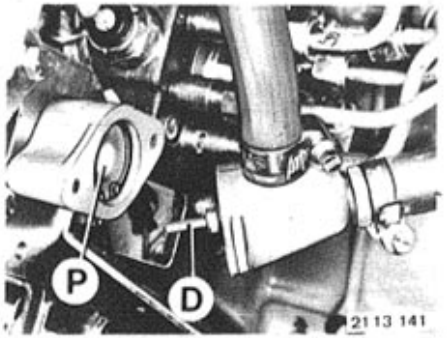
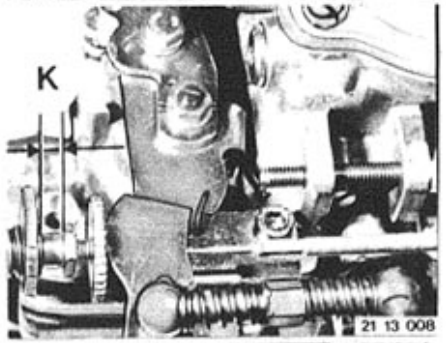
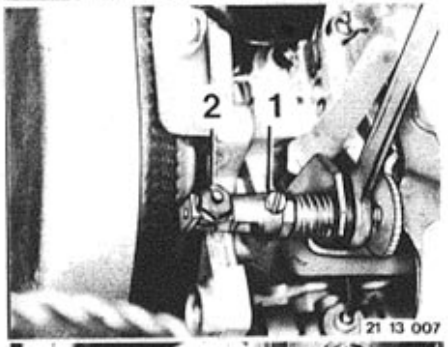


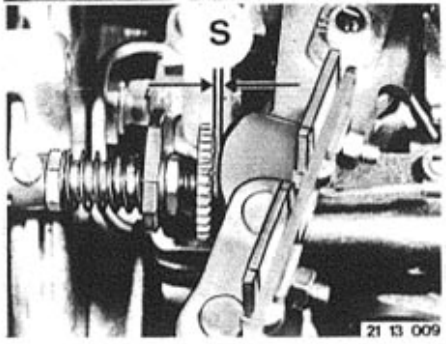
Plate (P) must rest on the circlip by spring pressure.
Installation:
Make sure that expansion element (D) is seated correctly.



The adjusting device should now be pulled out.
Distance "K" = 5.5 ± 0.4 mm (0.216 ± 0.016").

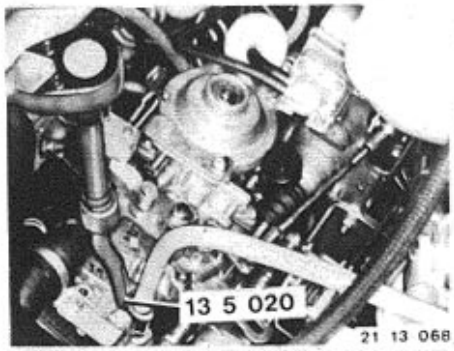


Correction:
Loosen clamps (1 and 2) and turn until the distance "K" is reached.
Apply a 10 mm fork wrench to help making adjustments.
Tighten clamp (2) first and then (1).

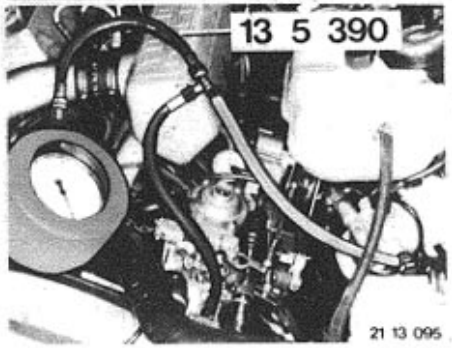


Check/correct play "S" = 0.5 ± 0.3 mm (0.020 ± 0.012") after making adjustments.
Check / correct the engine idle speed – see 13 00 050.

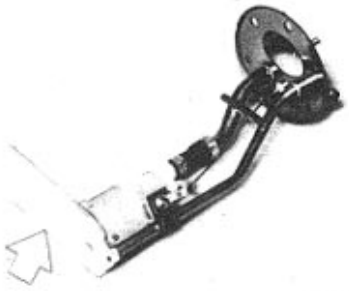
13 31 028 CHECKING FUEL FEED PRESSURE



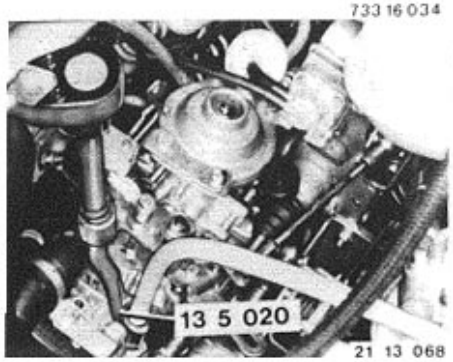
Unscrew coupling nut with Special Tool 13 5 020.
Counterhold adapter with a fork wrench.



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.



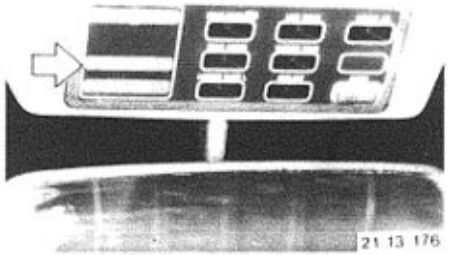
Start engine and read feed pressure * at test speed *.
If specified value is not reached, check
– filter screen in tank,
– fuel transfer pump,
– fuel lines and
– fuel filter.



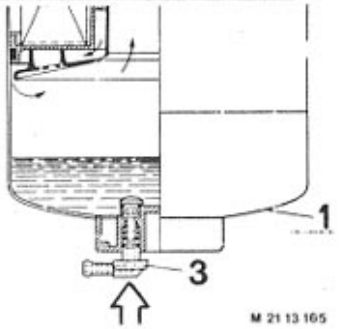
Bleed feed line again after testing.

* See Specifications

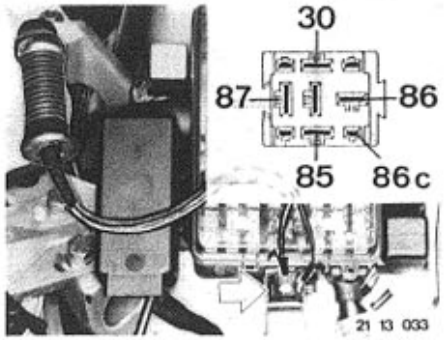
13 32 . . . DRAINING WATER IN AND BLEEDING FUEL FILTER



Water in the fuel filter is detected by a water sensor and reported to check control where it is displayed.

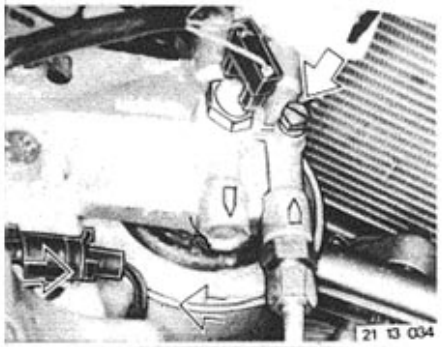


Loosen bleeder screw.
Hold an approx. 0.2 liter (0.4 pint) container underneath drain adapter (3), using a short hose if necessary.
Press drain adapter (3) and drain fluid until pure fuel runs out.

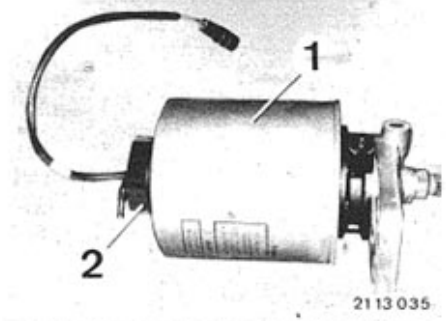


Pull off relay for fuel transfer pump and connect tester 61 3 050 on terminals 30 and 87, and operate pump until fuel runs out of bleeder screw opening.

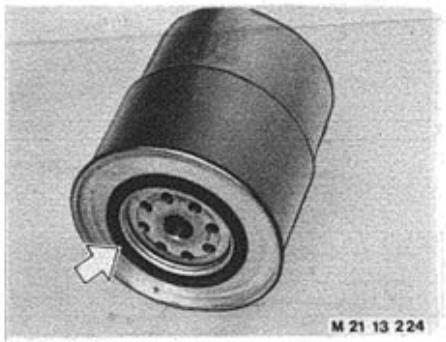
13 32 051 REMOVING AND INSTALLING/ REPLACING FUEL FILTER



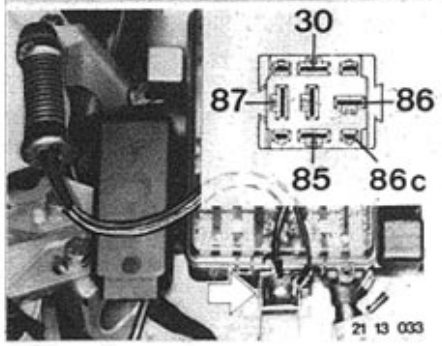
Loosen bleeder screw and drain a little fuel through water drain connection – see draining water in fuel filter, 13 32 . . ..
Disconnect plug on water level sensor.
Unscrew filter with a standard tool, if necessary.
Installation:
Replace seal.



Unscrew bolt with water level sensor (2) and install on new filter.

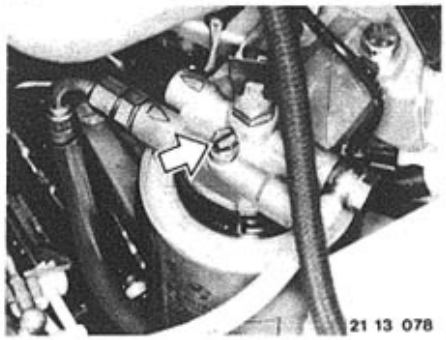


Coat seal with fuel and screw on filter against surface, and then tighten by hand with one half turn – see installing instructions on filter.



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	13 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.

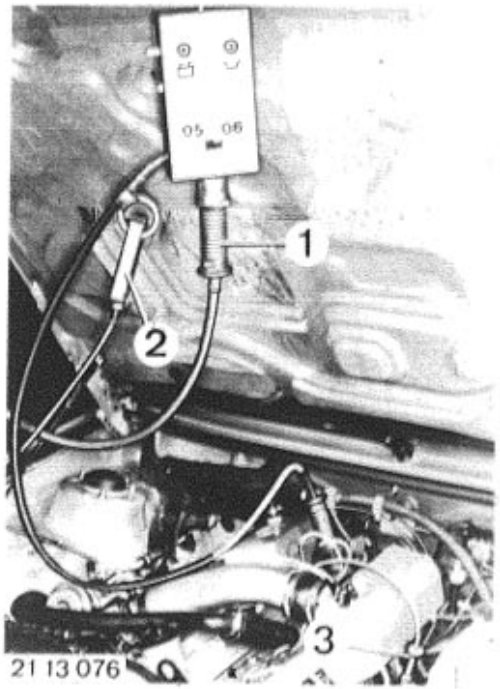
Testing Equipment:
- BMW service test unit, e.g. engine test step 05 (P 05) or multimeter 02 (M 02).
- Test adapter to measure beginning of injection, in conjunction with BMW service test unit.
- Universal adapter* for periphery test and diagnosis in conjunction with check control

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

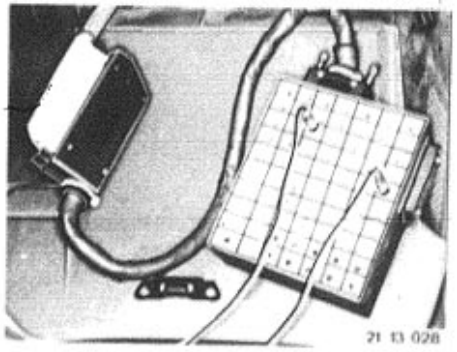
Turn ignition on.
"INJECTION" lamp in check control on.
— no → Check lamp.
Check power supply – see Group 62.

↓

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

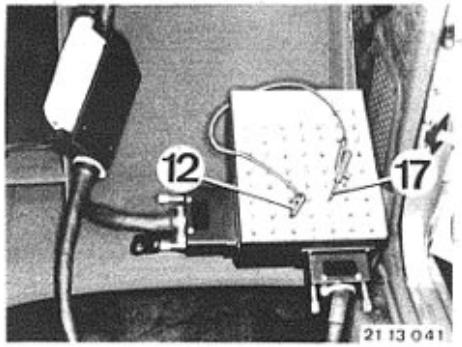

21 13 028

* Source: HWB

Engine running, increase speed to approx. 2,000 rpm.
"INJECTION" lamp goes out.

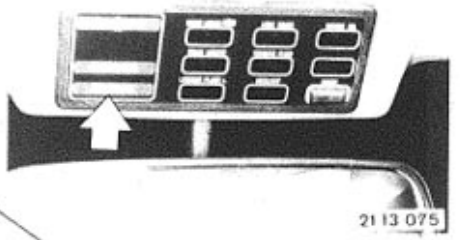
no

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 ...

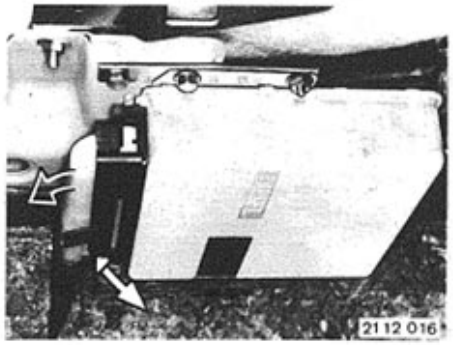
Check dynamic injection begin, correcting static adjustment if necessary – see 13 51 006 / 506.

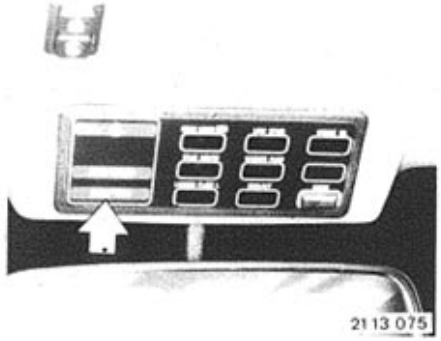
8 Flash Pulses

Coolant temperature sensor not working.

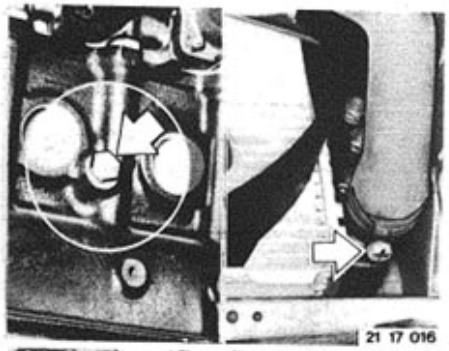
Measure resistance * of temperature sensor (term. 6/13) and insulation resistance (term. 6/17 and 13/17) replacing if necessary – see 12 62 ...

Start engine and reactivate defect check control.





* See Specifications

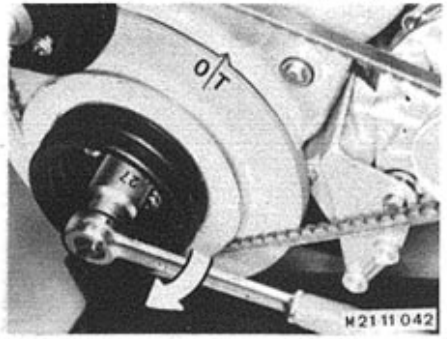


13 51 000 REMOVING AND INSTALLING INJECTION PUMP

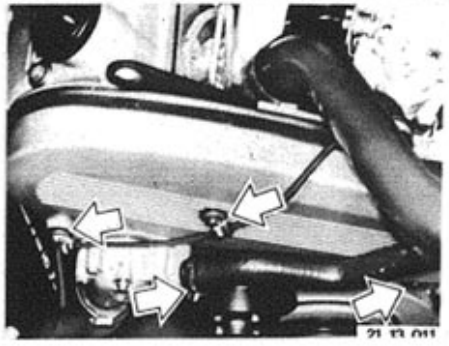
Removing:
Unscrew drain plugs on engine and radiator, and drain coolant.
Unscrew and swing away expansion tank.
Installation:
Add coolant* and bleed cooling system – see 17 00 039.



Unscrew fan cowl.
Unscrew fan (left-hand threads).
Hold with Spezial Tool 11 5 030 – see 11 52 000.

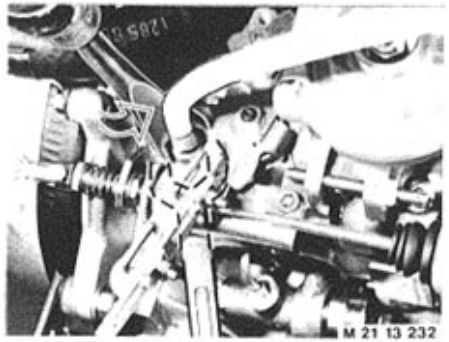


Turn crankshaft up to TDC mark (ignition position in cylinder no. 1).

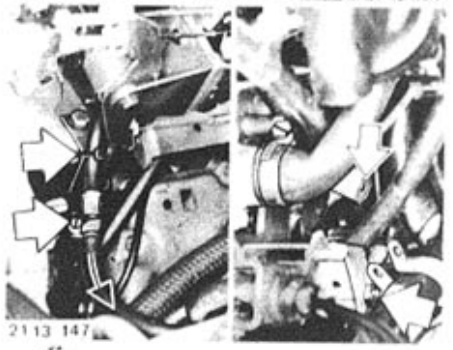


Disconnect water hoses.
Loosen alternator drive belt and take off toothed belt cover.

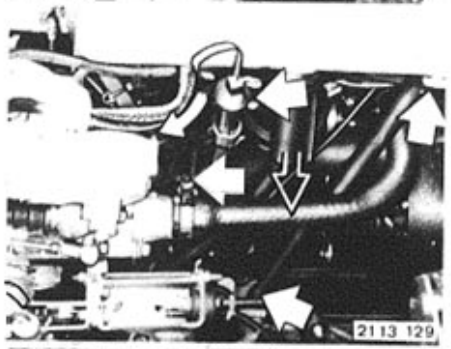
* See Service Information of Gr. 00



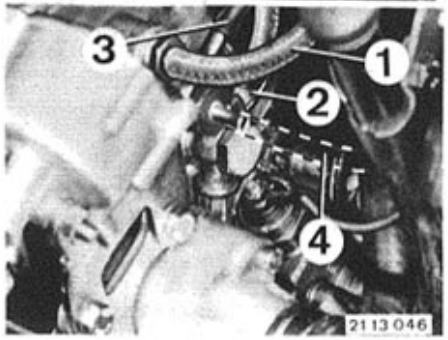
Hold adapter and unscrew line with Special Tool 13 5 020.
Plug opening with cap.



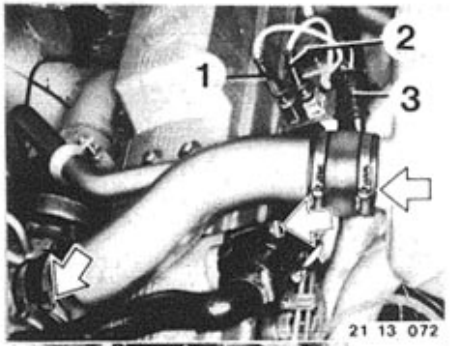
Disconnect connection and unscrew return line.
Loosen clamp for wire harness.



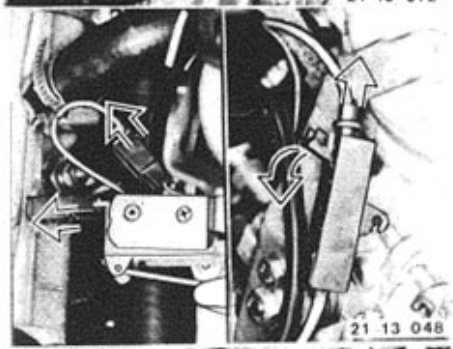
Unscrew holder for oil pipe.
Disconnect hoses on TLA.
Unscrew support for air collector.
Pull off plug on blowoff valve.



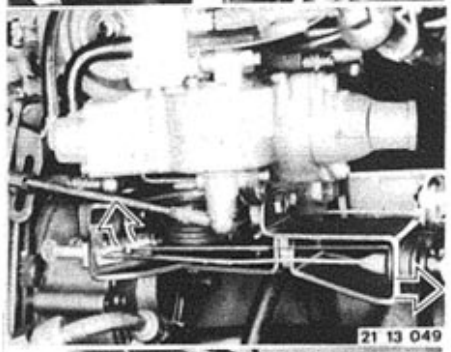
Pull off hoses for
charging air pressure (1),
leak oil (2),
vacuum (3) and
altitude compensator (4).



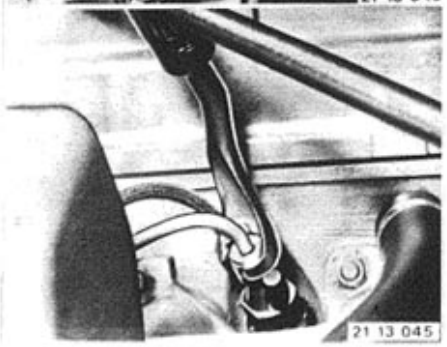
Unscrew charging air pressure pipe and oil trap.
Pull off plugs for
speed sensor (1),
initial injection nozzle (2) and
timing valve (3).



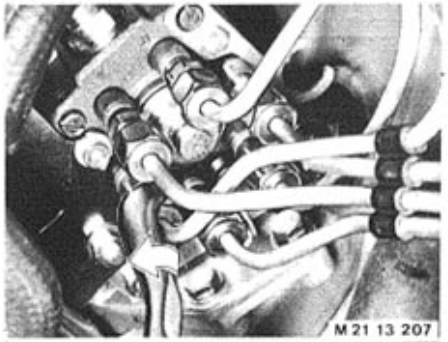
Disconnect plug for fuel shutoff.
Pull off connections for idle switch (EGR).



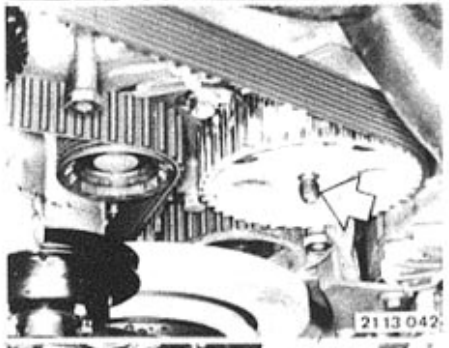
Disconnect cables and take out of holders.



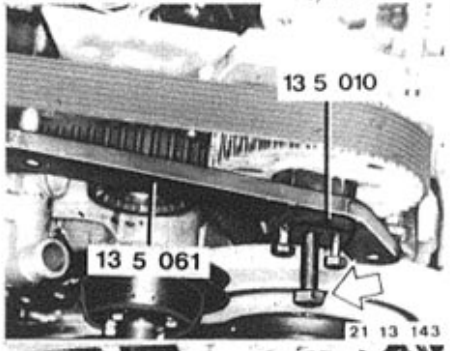
Unscrew all coupling nuts on injection nozzles.
Plug openings in injection nozzles with caps.
Important!
Reposition special tool in good time to avoid bending injection lines.



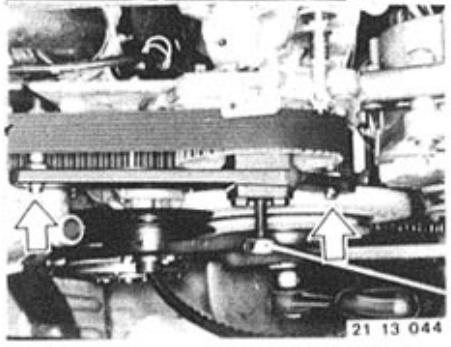
Unscrew coupling nuts on injection pump and pull back lines.
Plug openings with caps.



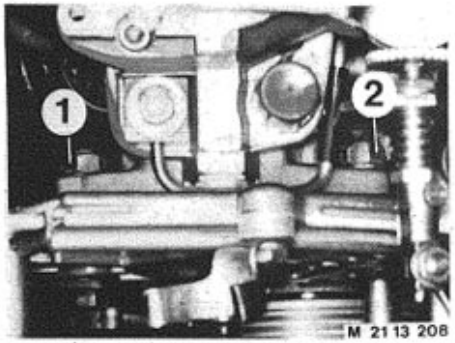
Unscrew nut on toothed belt sprocket.



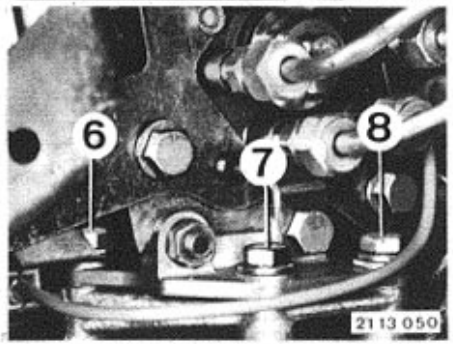
Bolt Special Tool 13 5 061 with Tool 13 5 010 on toothed belt sprocket.



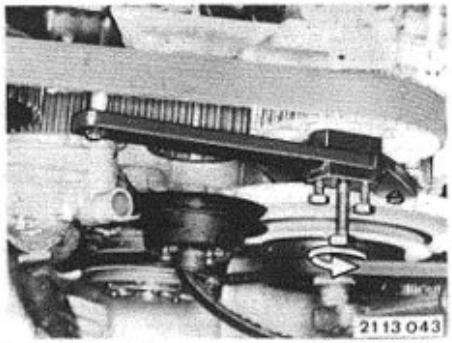
Turn crankshaft until special tool can be bolted at top and bottom.
Use M 6 x 20 mm screws.



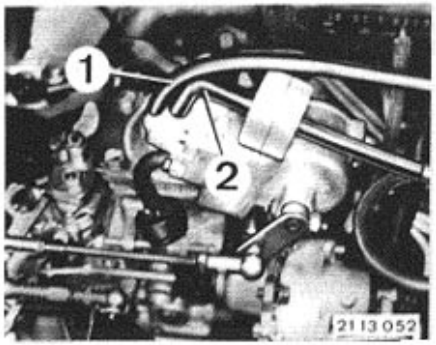
Unscrew nuts (1 and 2).



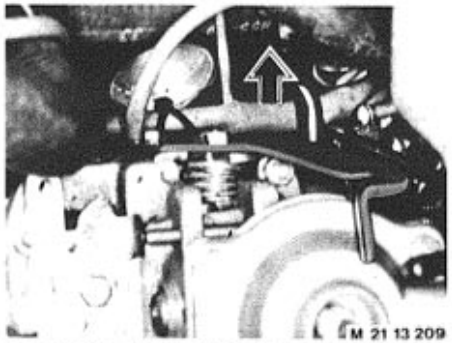
Unscrew bolts (6 ... 8)



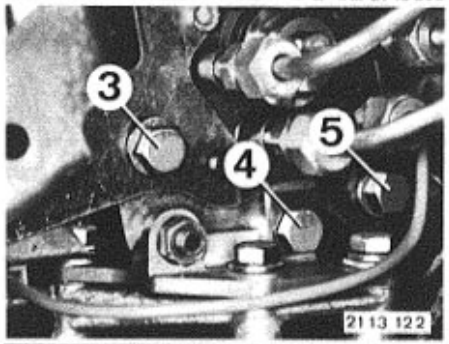
Press out injection pump toward rear with bolt.



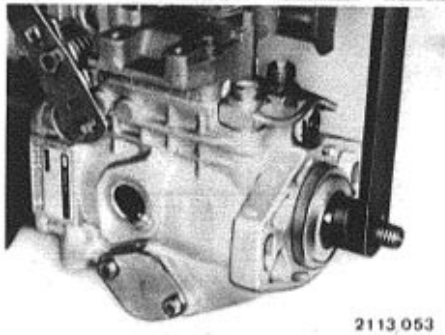
Pull off hoses on pressure converter (EGR).
1 Vacuum supply
2 To solenoid valve



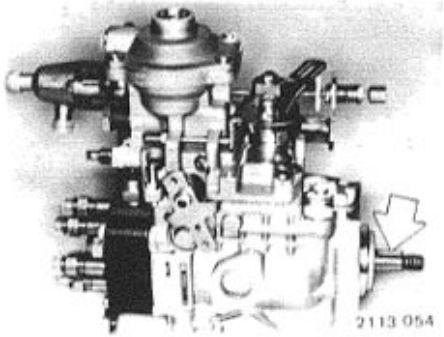
Take wire harness out of holders.
Remove injection pump.



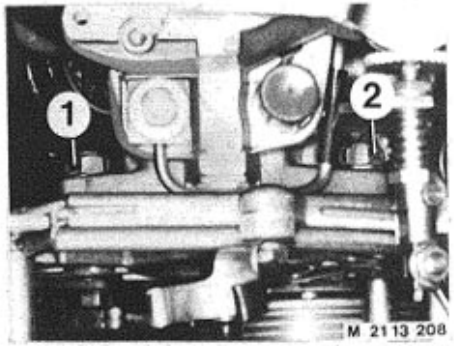
Installing:
Loosen bolts (3 ... 5) before installing.



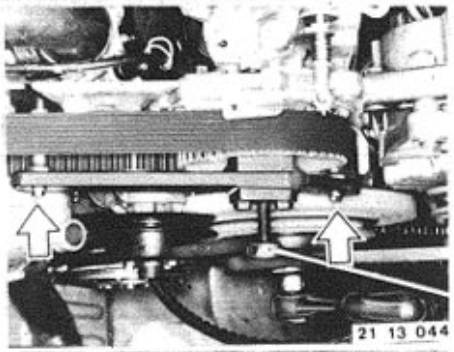
Check position of injection pump shaft, correcting as shown in picture with Special Tool 13 5 062 if necessary.
Turning lever must be vertical.



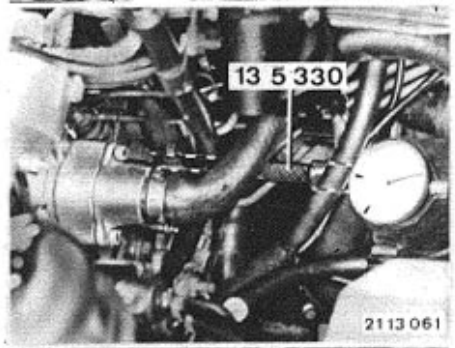
Insert injection pump, being careful that the woodruff key does not fall out.



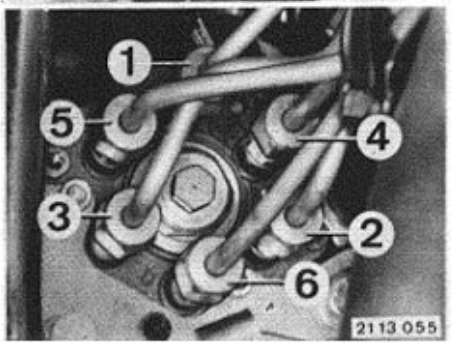
Tighten nuts (1 and 2) until injection pump rests firmly on holder.



Remove Special Tool 13 5 010 and 13 5 061, mount toothed belt sprocket.
Tightening torque*.

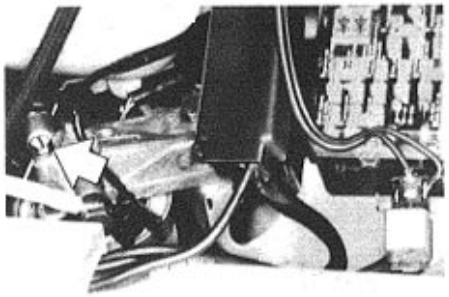


Adjust injection pump statically – see 13 51 005.

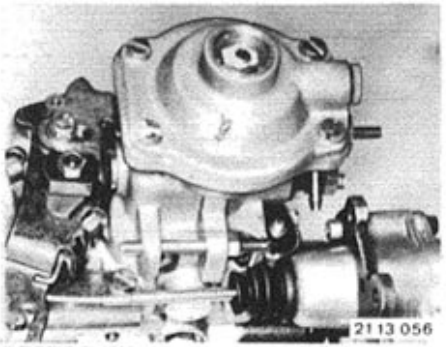


Begin with connection (4) when tightening injection lines.

* See Specifications

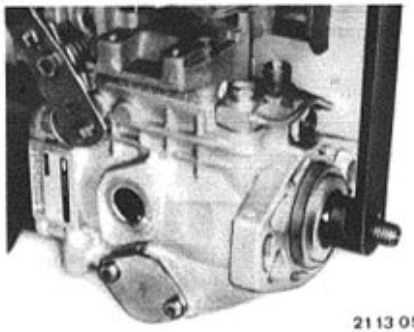


After assembling, bleed fuel system – see 13 51 320.
Check idle speed – see 13 00 050.
Check dynamic injection begin – see 13 51 006

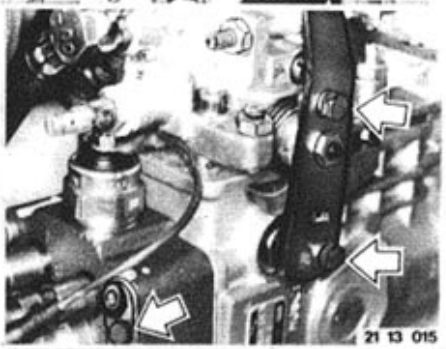


13 51 001 REPLACING INJECTION PUMP

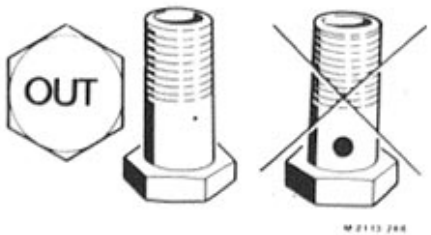
Remove injection pump – see 13 51 000.
Transfer following parts to new injection pump.



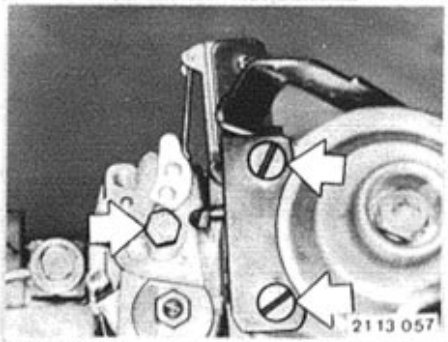
Turn injection pump shaft with Special Tool 13 5 062 as shown.
Lever of special tool must be vertical.



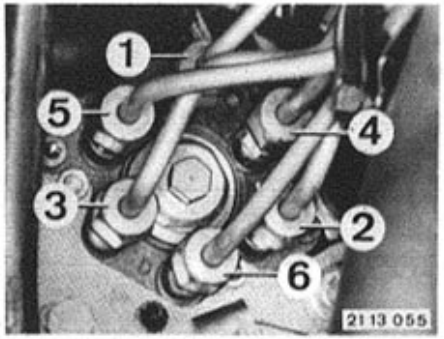
– Stopping lever and holder for wire harness



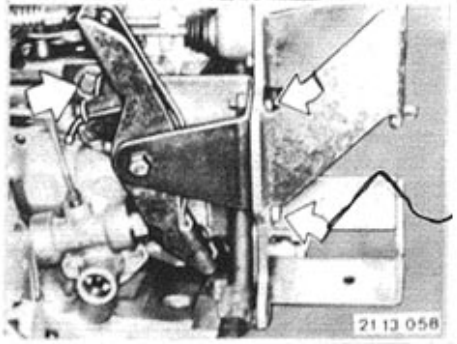
Install and mount injection pump.
The hollow union bolt "OUT" (fuel return orifice) is matched with an injection pump.
Consequently it must not be mixed up or used with a different injection pump.



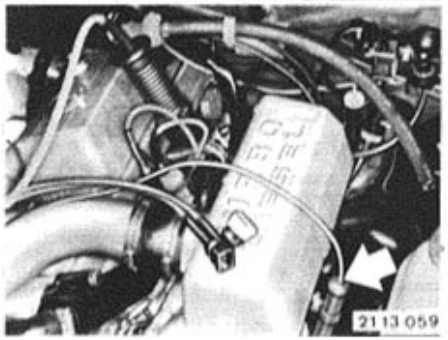
– Holder and switching contact for idle switch (EGR).
Pressure converter with linkage holder.
After installation, make adjustments on EGR – see Group 11.



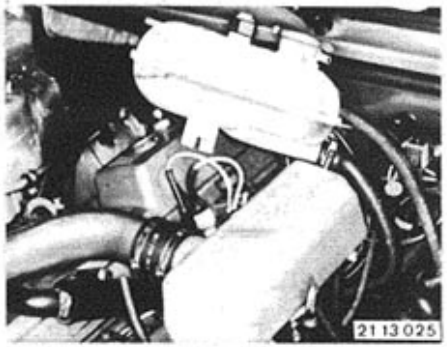
Adjust injection pump statically – see 13 51 005.
Start at connection (4) when tightening injection lines.



– 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.

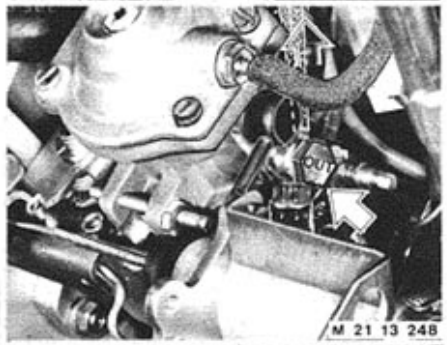


After Assembling:
Bleed fuel system – see 13 51 320.
Check idle speed – see 13 00 050.
Check dynamic injection begin – see 13 51 006.

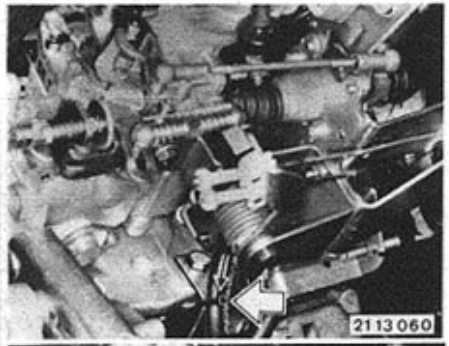


13 51 002 CHECKING INJECTION PUMP INTERNAL PRESSURE

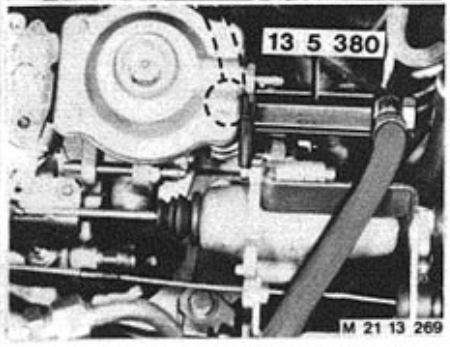
Unscrew and swing away expansion tank.
Plug overflow hose.



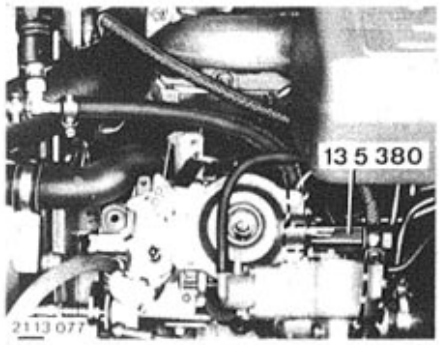
Pull off plug on blowoff valve.
Pull off leak oil hose on injection nozzle.
Unscrew hollow union bolt (OUT).



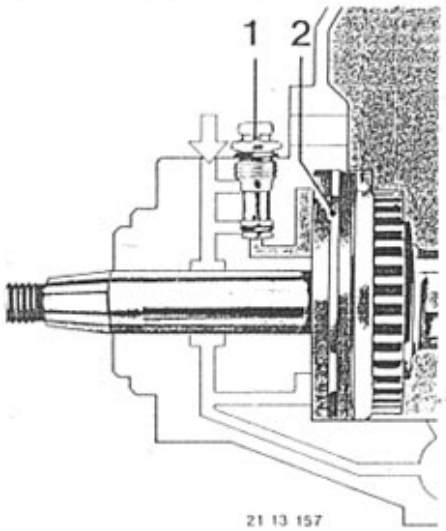
Disconnect return hose on holder and pull out downward.



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.

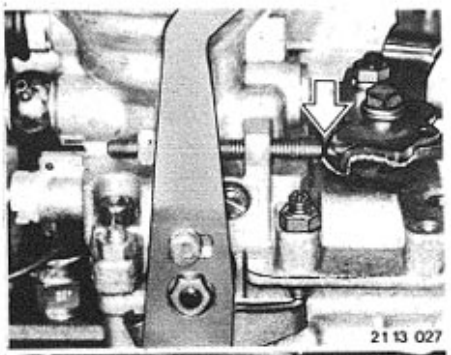


Diagnosing Information:
Internal Pressure Too Low
– Pressure control valve (1) faulty.
– Fuel delivery pump (2) performance insufficient.

Remedy:
Replace injection pump.

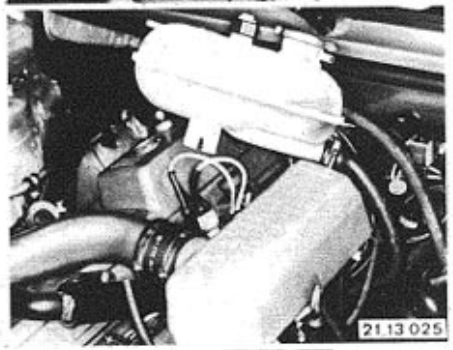
Internal Pressure Too High
– Hollow union bolt (OUT) for return hose plugged – clean, if necessary.
– Pressure control valve faulty, replace injection pump if necessary.

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.

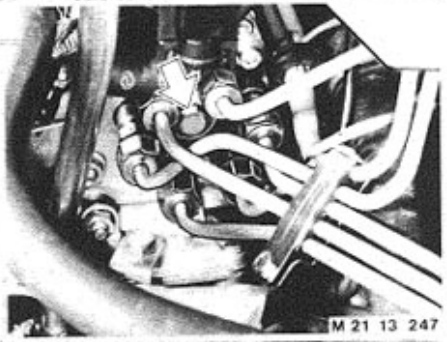


13 51 506 CHECKING / CORRECTING STATIC ADJUSTMENT OF INJECTION PUMP

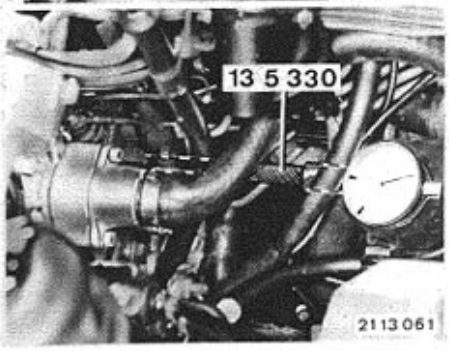
Requirements:
Coolant temperature > 20° C (68° F) or speed lever not in cold running position — must rest on idle stop.



Unscrew and swing away expansion tank.
Plug overflow hose.
Unscrew support for air collector.

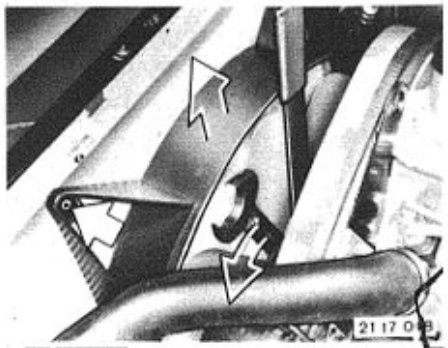


Unscrew plug.
Installation:
Use a new seal.
Tightening torque*.

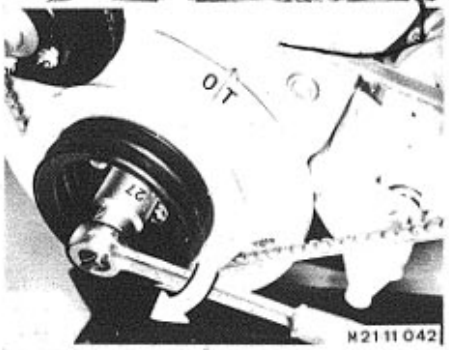


Screw in Special Tool 13 5 330 and tighten by hand.
Clamp dial gage with pre-load.

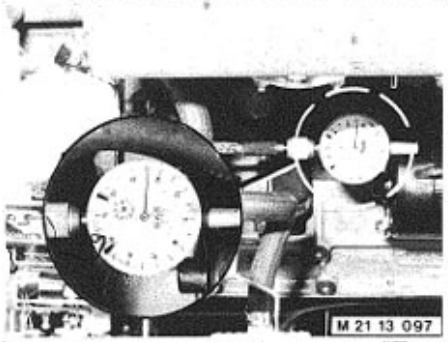
* See Specifications



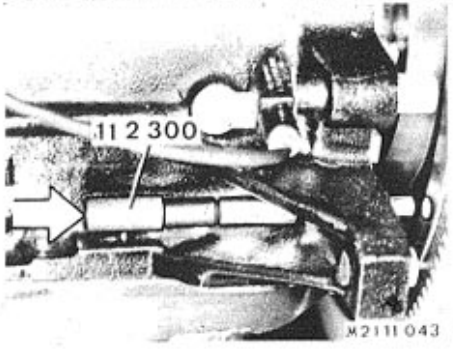
Unscrew fan cowl and fan (left-hand threads) — see 11 52 000.



Turn crankshaft in TDC direction (ignition control of cylinder no. 1) until dial gage needle has reached the highest value.

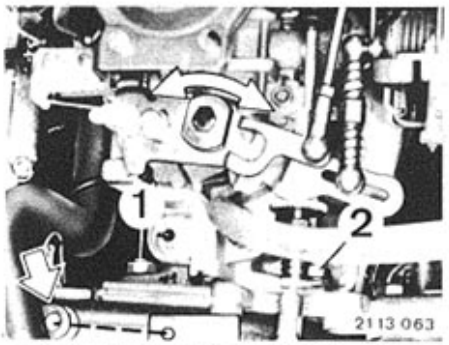


Set scale of dial gage to zero.
Continue turning crankshaft up to TDC position and press Special Tool 11 2 300 into bore at same time until it engages.
The displayed value should correspond with the static test value*, correct static adjustment if necessary.
Important!
Test must only be made with ignition control in cylinder no. 1 — check through open oil filler cap.
Only turn engine clockwise for testing.

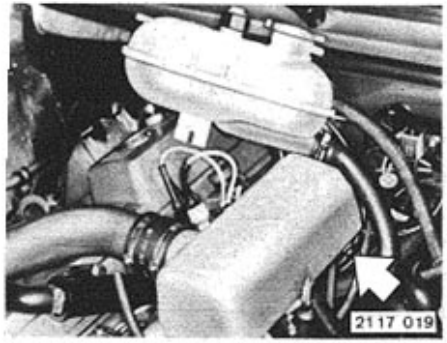


* See Specifications

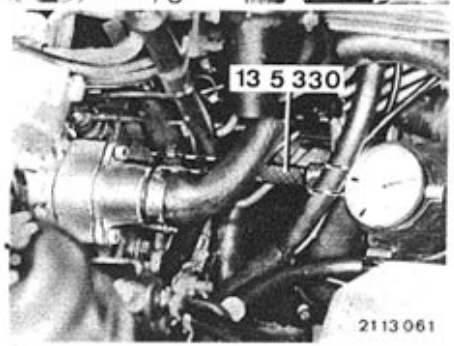
Correcting Static Adjustment:
Corrections will be necessary as soon as the test value is not within tolerances* or the test value* is not reached in the dynamic test.



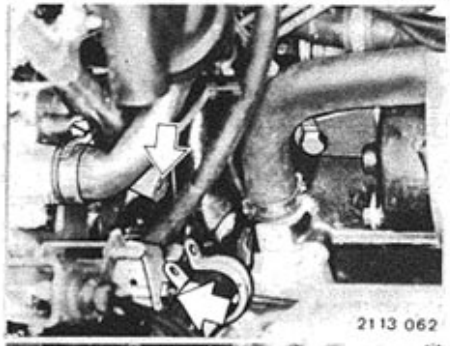
Loosen hose clamp.
Only loosen nuts (1 and 2) enough that the injection pump can be moved.



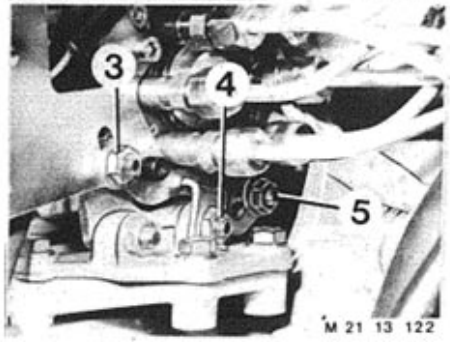
Unscrew and swing away expansion tank.
Plug overflow hose.
Unscrew support for air collector.



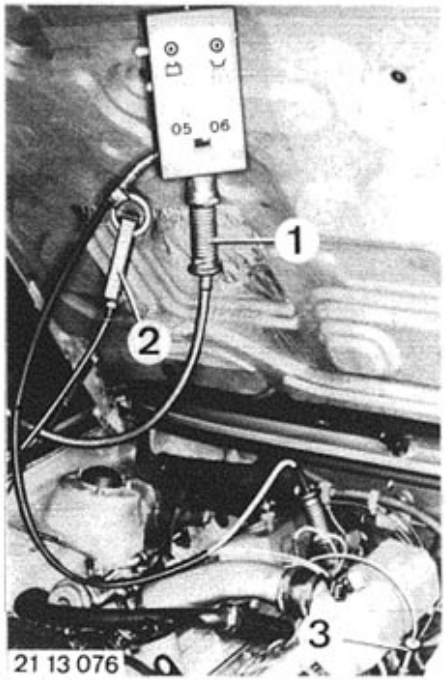
Mount dial gage (see testing) and turn injection pump accordingly.
The beginning of injection will be advanced by turning toward the engine.
After adjusting the injection pump, tighten in order of 1 through 5 and recheck adjustment.
After Adjusting:
Check dynamic injection begin – see 13 51 006



Take wire harness out of holders.

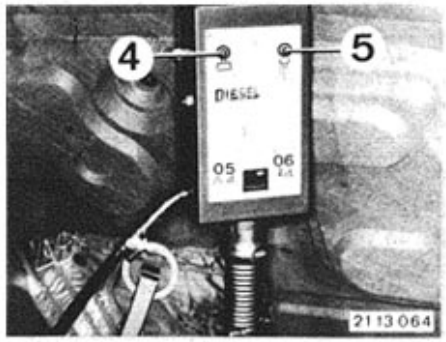


Unscrew bolts (3 ... 5).
Use a 3/8" joint ratchet with 120 mm long extension, joint and 13 mm socket.



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.

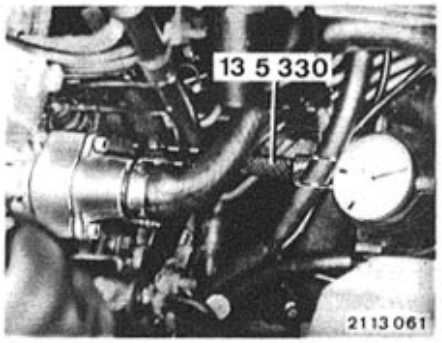


Lamp (4) comes on when power is supplied.
Lamp (5) flashes in time with initial injection nozzle.

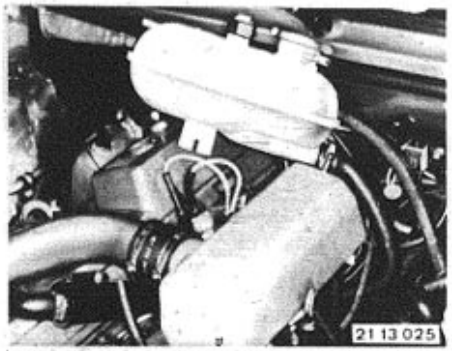


Start and run engine to operating temperature (oil temperature > 70° C / 158° F).
Rise speed slowly up to test speed * , read injection begin * (in crankshaft degrees before TDC).
Right values only appear at constant revolutions.

*) See Specifications

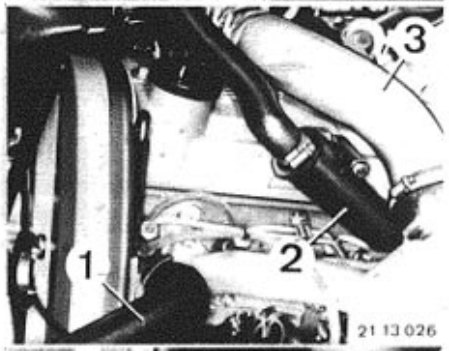


In case of wrong injection begin, make static adjustment – see 13 51 506



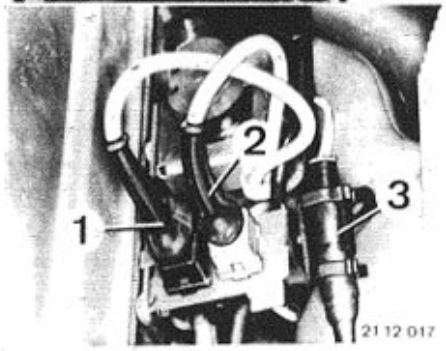
13 51 290 REPLACING PRESSURE VALVES

Disconnect battery.
Loosen reservoir and turn aside.

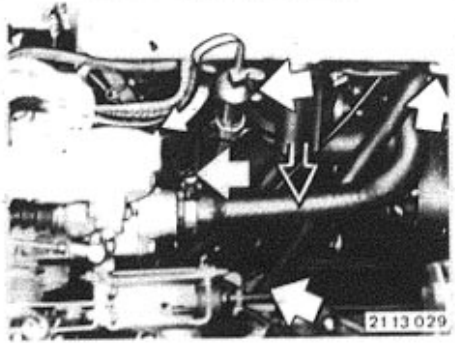


Drain coolant, remove hose (1).
Remove oil seperator (2) and charger air pipe (3).

Installation:
Fill up with correct coolant **)
bleed cooling system - see 17 00 039

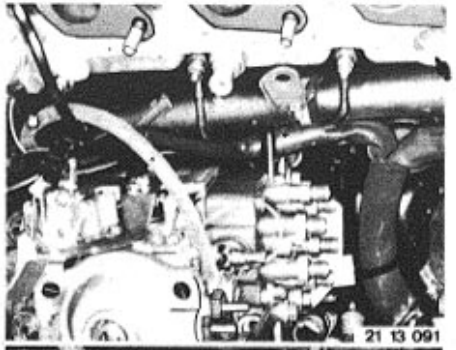


Disconnect plugs and remove bracket.
1 Speed transmitter
2 Injection begin jet
3 Pulse valve.



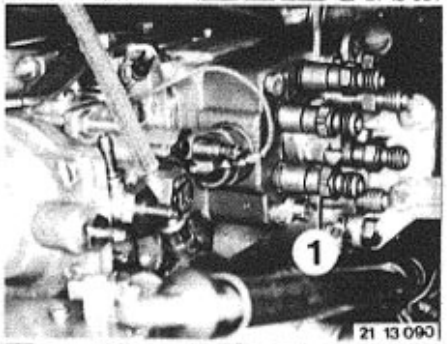
Remove receptacle for oil dip stick and air collector bracket.
Pull off charger pressure hose and plug of check valve.

**) See service Information Group 00.



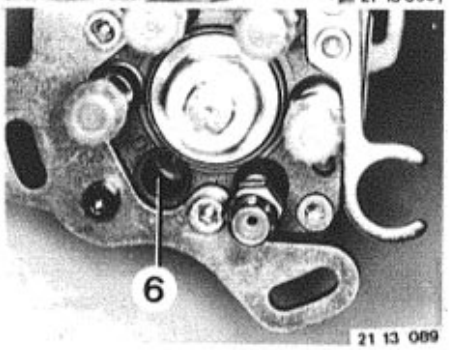
Remove air collector.
Disconnect injection lines on injection pump and injectors with special tool 13 5 020.

Installation:
Note tightening torque *).



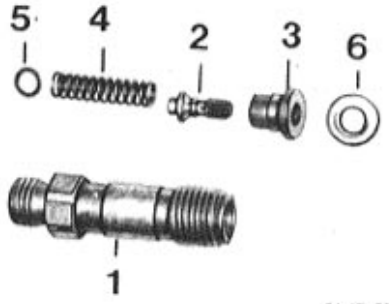
Remove pressure valve bracket.

Attention!
Parts come loose.
Parts 1 to 5 are matched – don't mix.

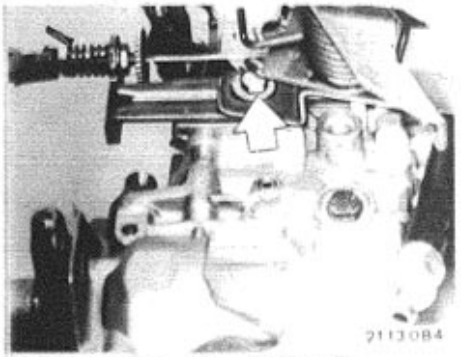


Lift out washer (6) with a pin etc.

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

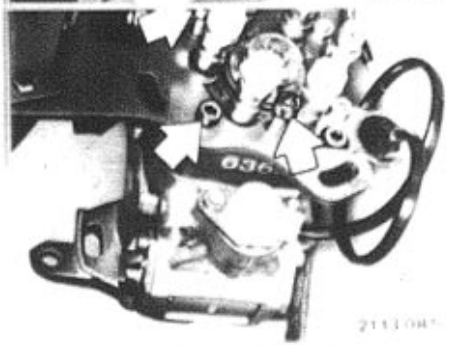


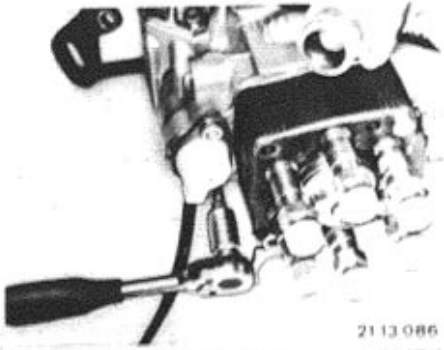
*) See technical data



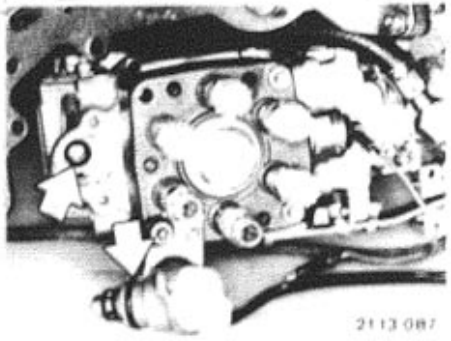
13 51 . . . REPLACING PULSE VALVE FROM INJECTION PUMP

Remove injection pump - 13 51 000.
Remove mounting plate.



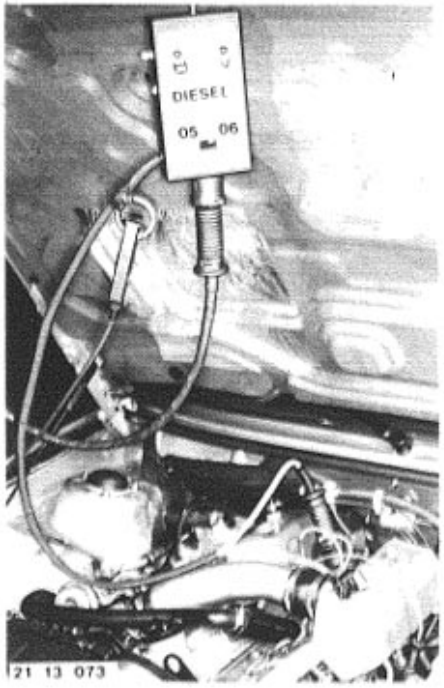


Unscrew and pull out pulse valve.
Lift out small O-ring from injection pump.
Attention, place oil pan underneath
Diesel fuel runs out of injection pump.
See job information page 13 - 1

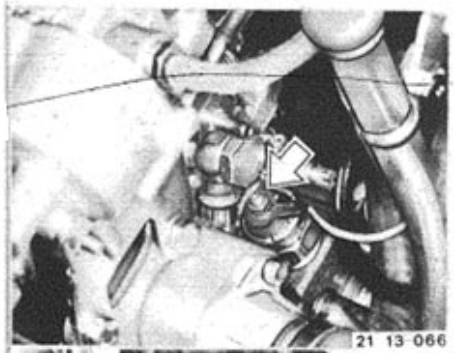


Installation.
Fit new O-rings.
Note tightening torque *).

*) see technical data

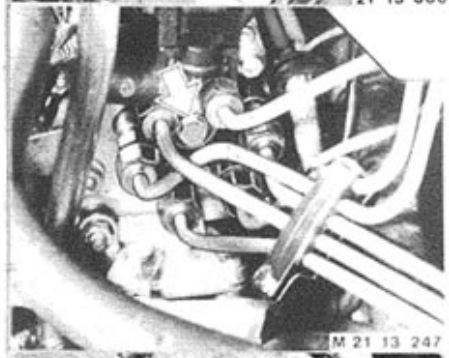


After installation of injection pump make static adjustment and dynamic test see 13 51 506



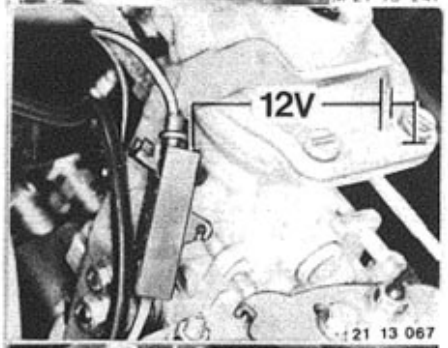
13 51 300 CHECKING ELECTRIC FUEL SHUTOFF

The fuel shutoff receives electric power from the ignition lock (key turned to "DRIVE"). A click is heard when shutoff switches on.

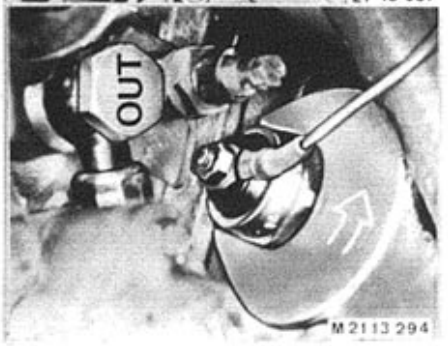


Testing Requirements:
- Fuel in tank
- Fuel filter in perfect condition
- Fuel line bled up to injection pump

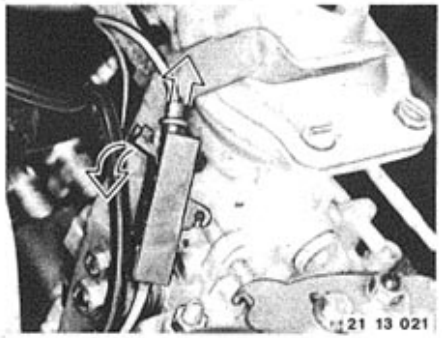
Loosen plug two turns.



Turn ignition key to "DRIVE" or apply 12 V on fuel shutoff.

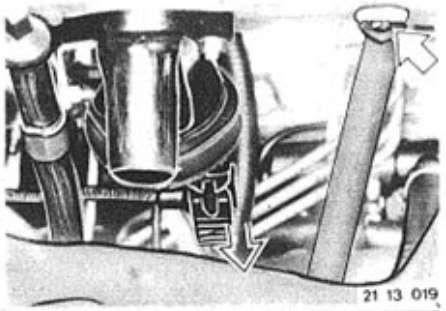


Crank engine with the starter.
Fuel must run out of the plug bore.
If not, replace fuel shutoff.

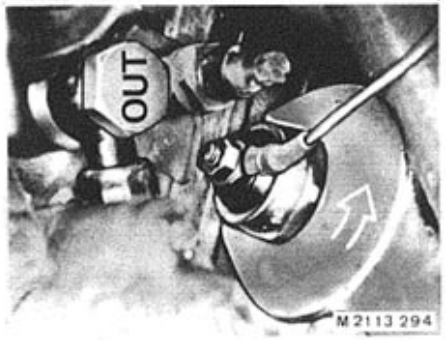


13 51 301 REPLACING ELECTRIC FUEL SHUTOFF

Open plug receptacle and pull off wire.
Installation:
Mount plug receptacle on wire harness.

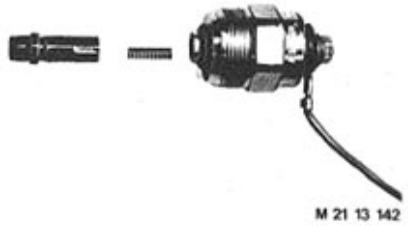


Unscrew support for air collector.
Pull off plug for blowoff valve.

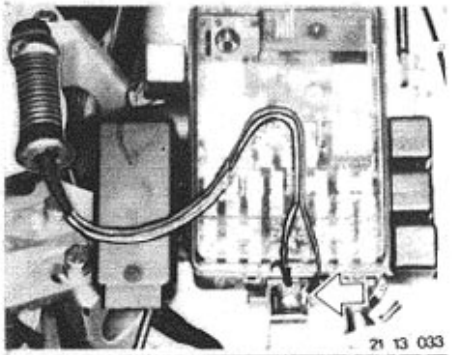


Unscrew fuel shutoff with a 24 mm open-end wrench.
Caution!
Be careful that piston and spring do not fall out.

The spring will run the piston out when in no current condition -- fuel feed stopped.
Installation:
Check that O-ring fits correctly.
Tightening torque*.

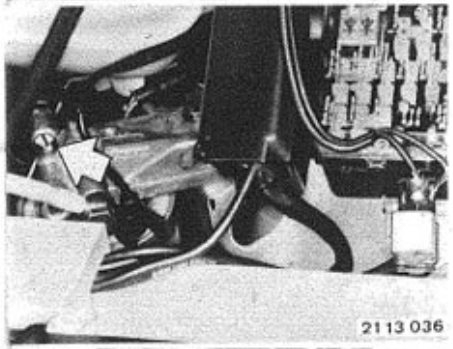


* See Specifications

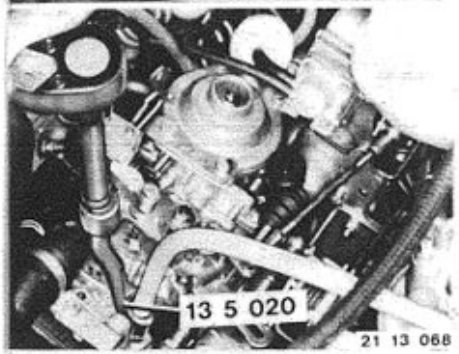


13 51 320 BLEEDING FUEL SYSTEM

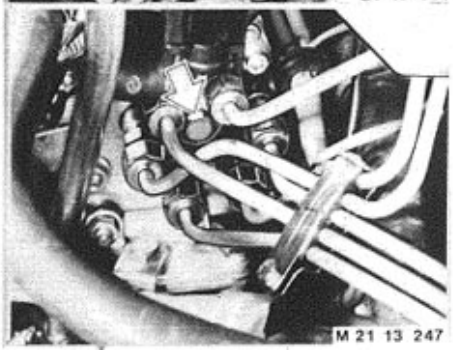
Pull off relay for fuel transfer pump.
Bridge terminals 30 and 87 with Special Tool 61 3 050.



Loosen bleeder screw.
Operate fuel transfer pump with the special tool until fuel runs out.
Tighten bleeder screw.

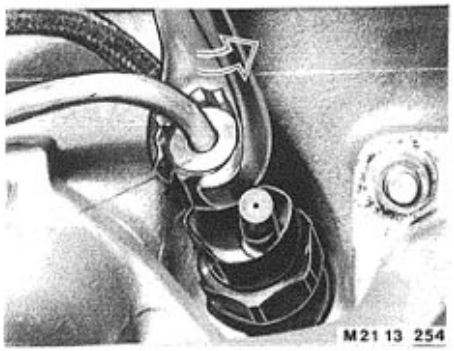


Bleed feed line by loosening coupling nut with Special Tool 13 5 020.
Installation:
Tighten coupling nut with correct torque*.
Operate fuel transfer pump with Special Tool 61 3 050 to bleed the fuel line.



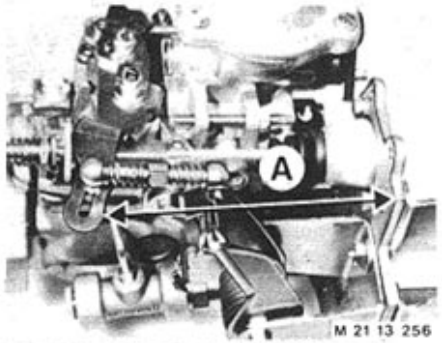
Bleeding Injection Pump:
Loosen plug two turns.
Crank engine with starter until fuel runs out.
Tighten plug with correct torque*.

* 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*,

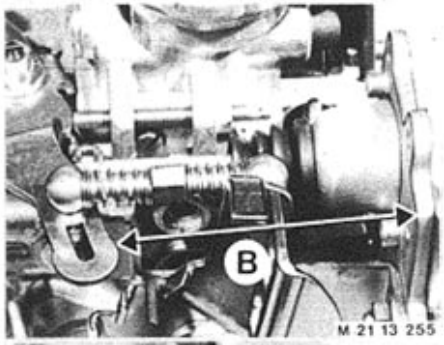
* See Specifications



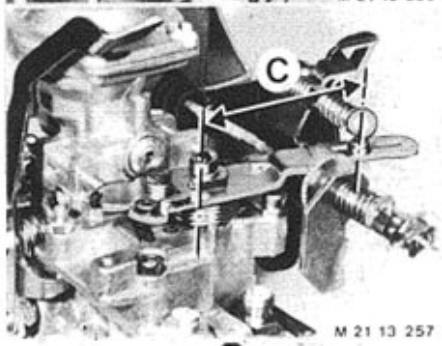
13 51 340 CHECKING / ADJUSTING OPERATING LEVER OF INJECTION PUMP

Requirements:
– Coolant temp. > 20° C (68° F)
– Correct idle speed

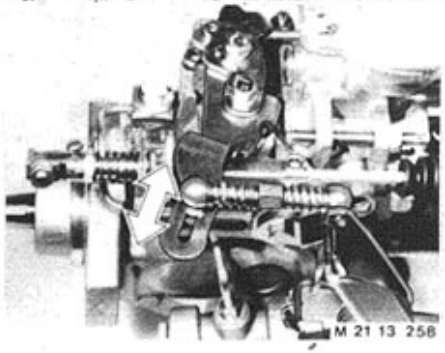
Unscrew and swing away expansion tank.
Measure and note distance "A".



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".

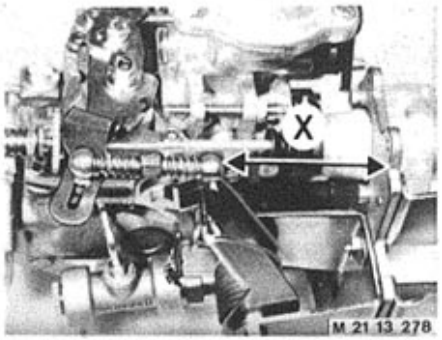
ADJUSTING TABLE
All dimensions in millimeters

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					

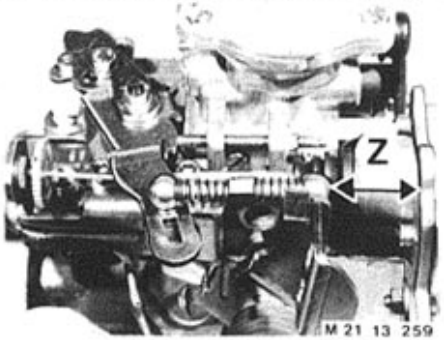
Example:

	A	129.0 mm (5.079")
–	B	83.2 mm (3.276")
	Y	45.8 mm (1.803")

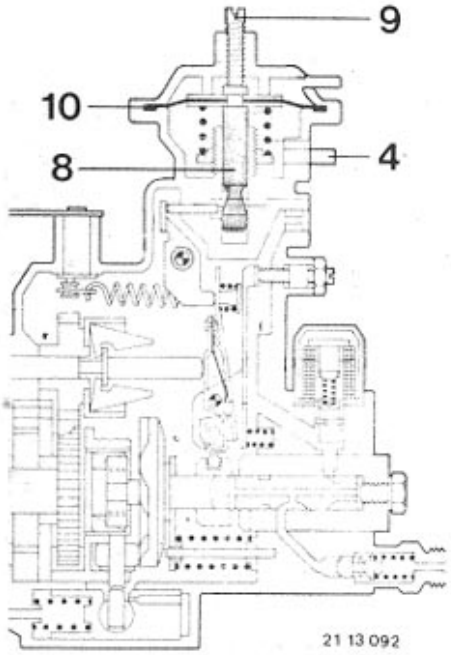
Consequently distance "C", measured from pivot point of speed lever to ball socket, is 69 mm (2.716").



In idle position distance "X" should be 68 ±0.5 mm (2.677 ±0.020").
If necessary, correct by changing length of pull rod.



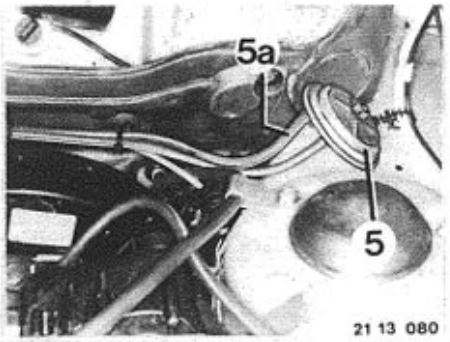
In full load position distance "Z" must be 29.1 ±0.5 mm (1.146 ±0.020").
After adjusting check throttle cable adjustment for automatic transmission – see 24 00 004.



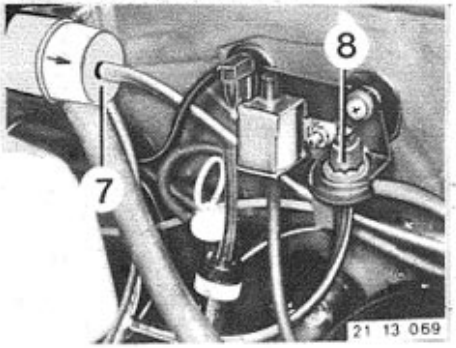
13 51 . . . CHECKING ATMOSPHERIC AND CHARGING AIR PRESSURE DEPENDENT REGULATION (ALDA)

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).



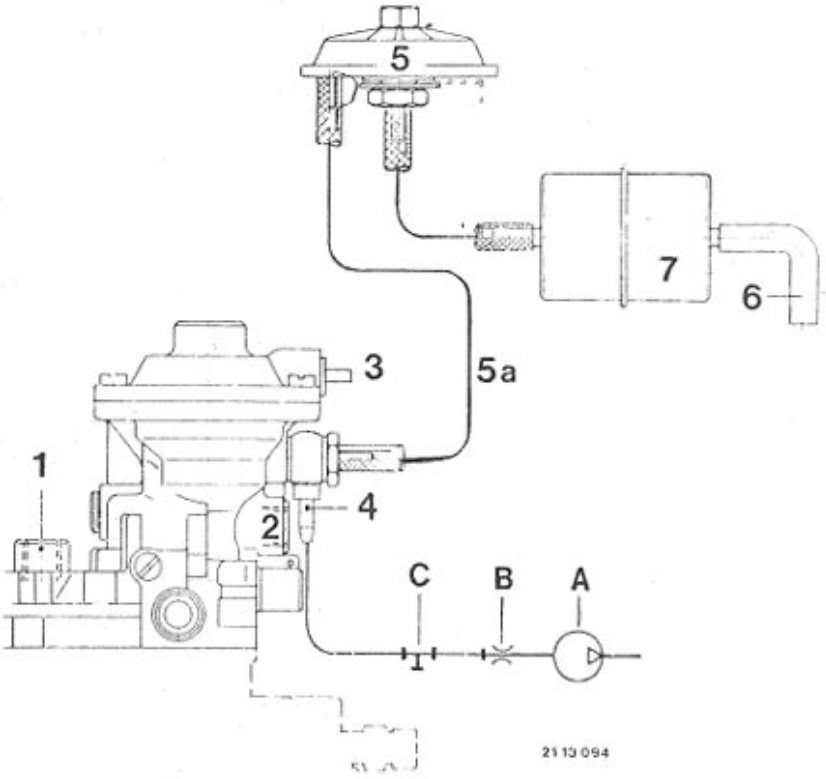
The altitude compensator (5) bleeds the vacuum underneath the diaphragm in relation to atmospheric pressure.
Check vacuum in hose 5 a - see example.



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

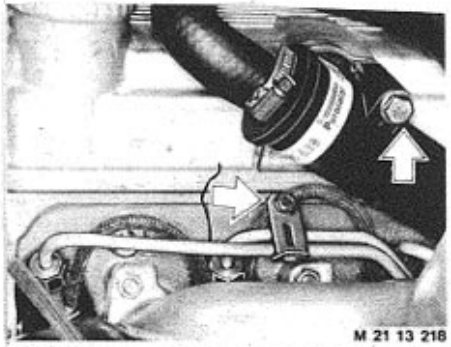
Constant reference pressure
below the diaphram 770 mbar (absolute)



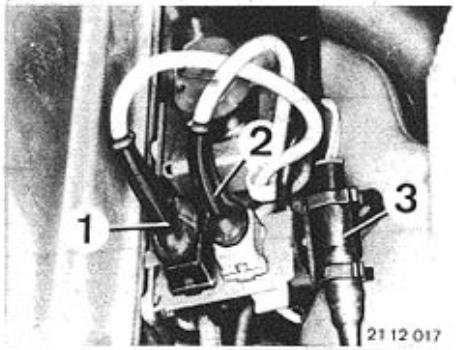
1 Fuel feed
2 Fuel return
3 Charging air pressure connection
4 Vacuum supply
5 Altitude compensator
6 Discharge
7 Air cleaner

A Vacuum pump
B Throttle
C Distributor

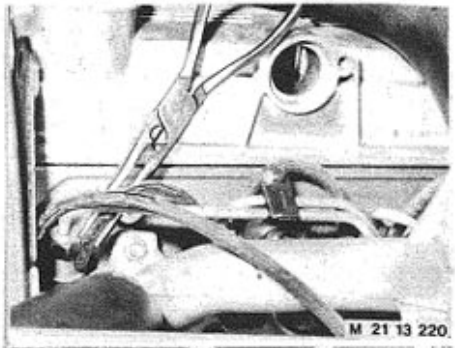
13 53 320 REMOVING AND INSTALLING/ REPLACING ALL COMBINATION FUEL INJECTORS



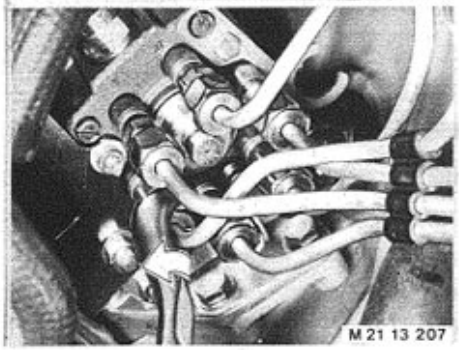
Remove oil trap.
Loosen clamps.



Pull off plug 1 and 2.
Unscrew holder for diagnosis plug.

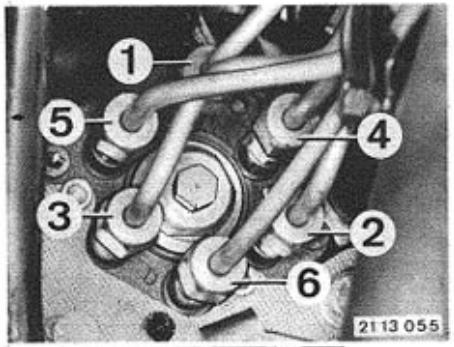


Pull off leak oil hoses with a pliers.
Unscrew coupling nuts on injection lines with Special Tool 13 5 020.
Plug openings with caps.



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*.



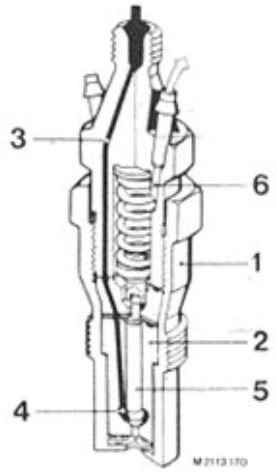
Unscrew combination fuel injector with Special Tool 13 5 320 and plug with cap.
Run wire plug through special tool in case of the initial injection jet.
Important!
Wire should come out of opening as close as possible to the middle to avoid clamping or tearing off.



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.

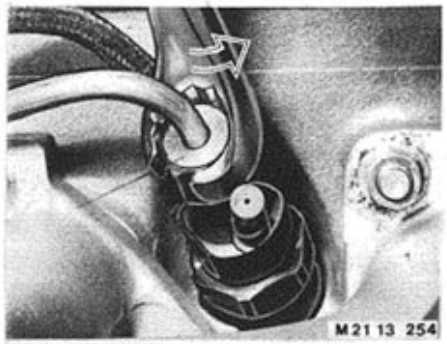
* See Specifications

13 53 . . . FLUSHING INJECTION NOZZLE
– Installed in Car –

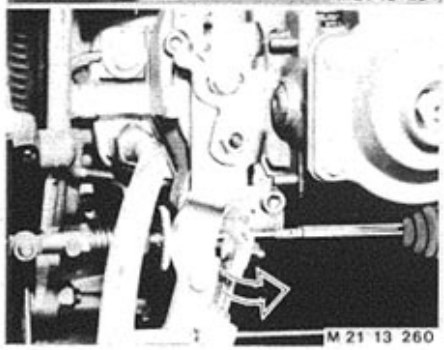


Engines producing loud knocking noise indicate nozzle needle (5) not closing completely because of combustion residue.

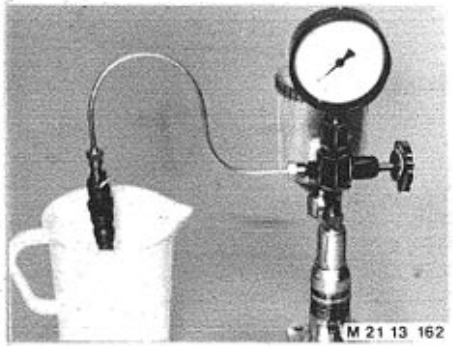
Components of Combination Fuel Injector:
1 Nozzle holder
2 Nozzle body
3 Feed bore
4 Pressure chamber
5 Nozzle needle
6 Leak oil line

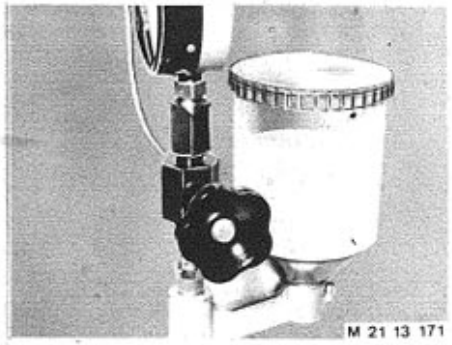


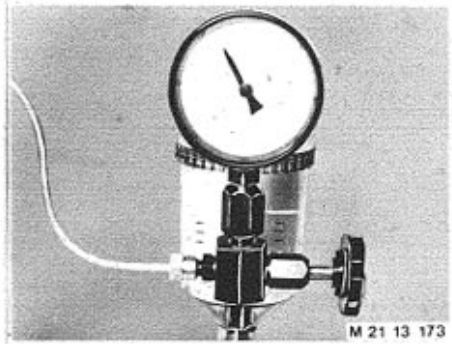
Finding Defective Injection Nozzle:
Start engine and unscrew a coupling nut on one injection line after the other with Special Tool 13 5 020.
Knocking noise will stop, when coupling nut of defective nozzle is loosened.



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

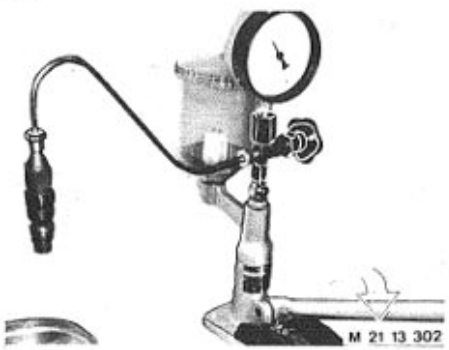
13 53 800 CHECKING INJECTION NOZZLE
– Combination Fuel Injector Removed–

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.

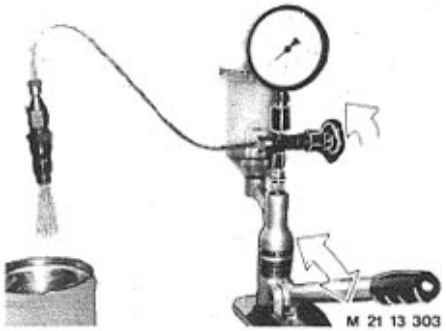
Fill tank with diesel fuel or test oil*.
Caution!
Never use gasoline – danger of explosion.

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).

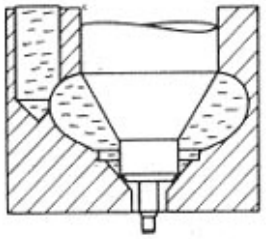
Important!
Press and release the manual lever slowly when working with a pressure gage, to avoid damaging the pressure gage.


M 21 13 302

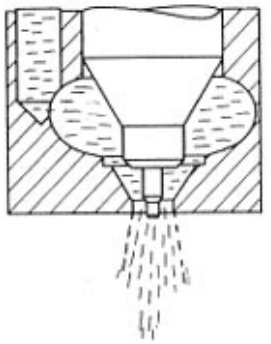
b) Injection Nozzle Leak Test:
Press down manual lever slowly and hold at point 20 bar (284 psi) below opening pressure.
No drop of fuel shoulddrip from nozzle within 10 seconds.


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.

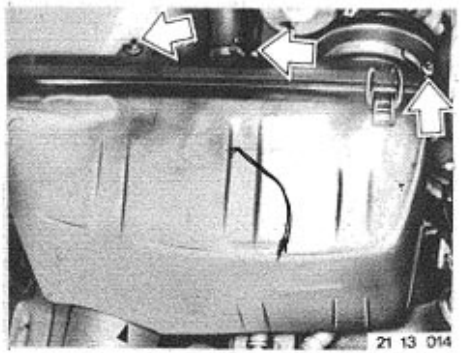


d) Spray Pattern Test:
Operate lever with short, fast strokes.
Fuel must have an as tight as possible tapered spray pattern.
Ejection must stop abruptly at end of each stroke.


M21 13 174

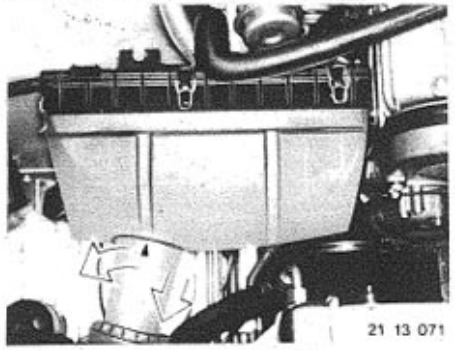
If the results of one of the tests a) through c) are negative, the combination fuel injector has to be replaced.
If only the results of test d) are negative, the combination fuel injector does NOT have to be replaced.

* See Specifications

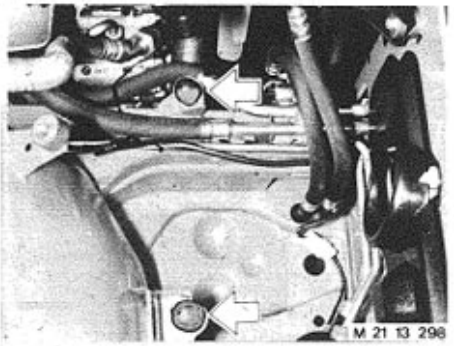


13 71 000 REMOVING AND INSTALLING AIR CLEANER

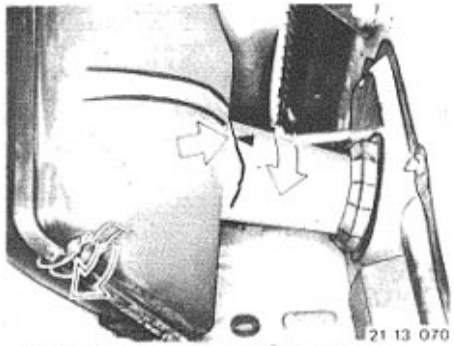
Unscrew hose clamps and nuts.



Turn intake neck 90° and pull off toward front – note arrow.

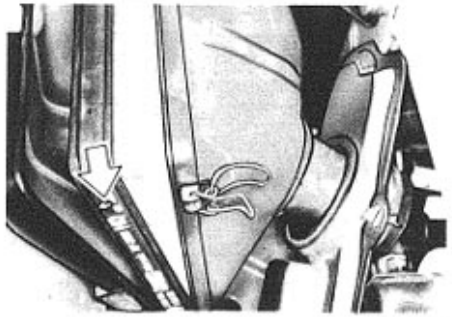


Lift out filter housing.
Installation:
Place housing exactly on rubber mounts.



13 72 001 REPLACING AIR FILTER CARTRIDGE

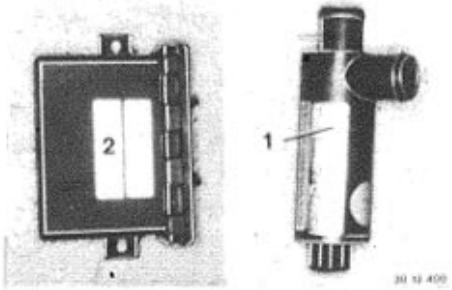
Turn intake neck 90° and pull off toward front.
Open clamps and take out filter cartridge.



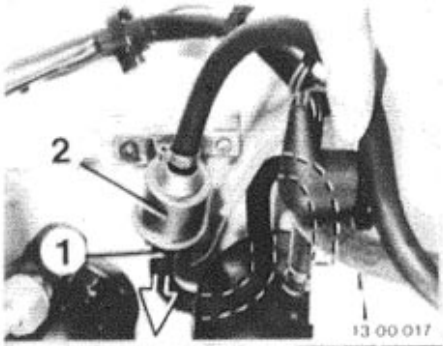
With the cover open insert filter cartridge in the middle (see note on housing) so that arrow points in direction of air flow.
Close and secure cover.

13 00 054 ADJUSTING ENGINE IDLE SPEED / CO TEST

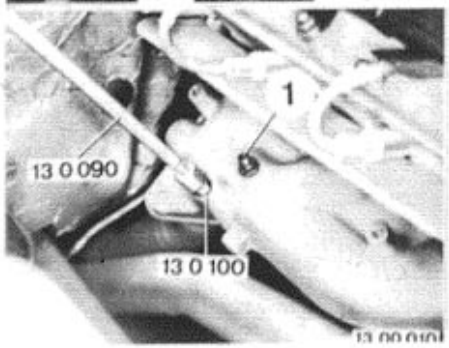
Requirements for All Adjustments:
Engine at operating temperature, i.e. oil temperature at least 60° C (140° F).
Ignition timing and valve clearance correct.
All electric equipment switched off.
BMW service test unit connected according to operating instructions.



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 adjustment screw for idle speed regulation.

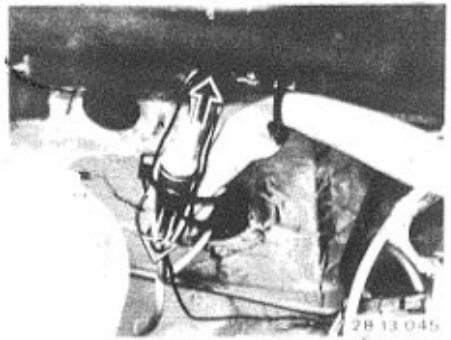


2) CO Test:
Pull off hose (1) on throttle housing.
Plugs are not inserted in open connections.

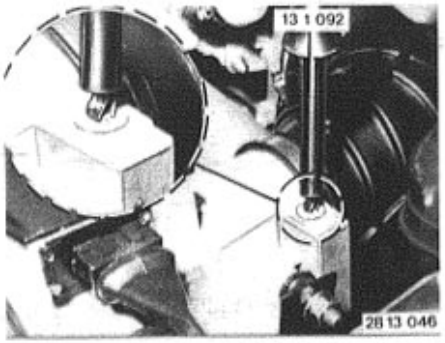


Unscrew screws (1).
Connect Special Tools 13 0 070 and 13 0 100 on exhaust manifold.
Check idle speed CO level*.

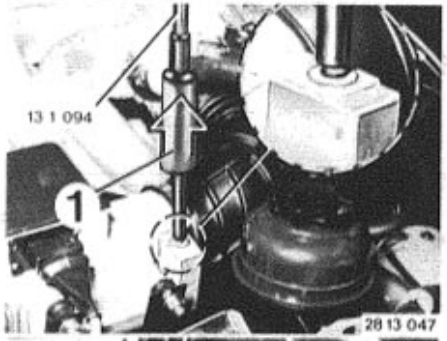
** See Nominal Value Microfiche



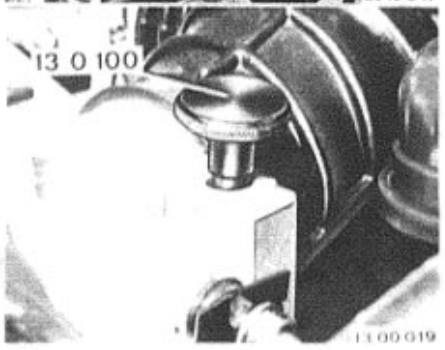
Disconnect oxygen sensor plug.



Drill hole in anti-tamper lock (1) with Special Tool 13 1 092.

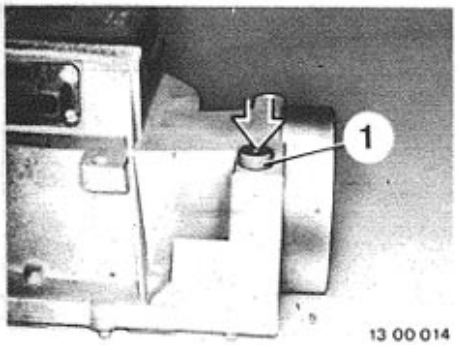


Screw Special Tool 13 1 094 in anti-tamper lock. Drive special tool and anti-tamper lock out of air flow sensor with impact (1).

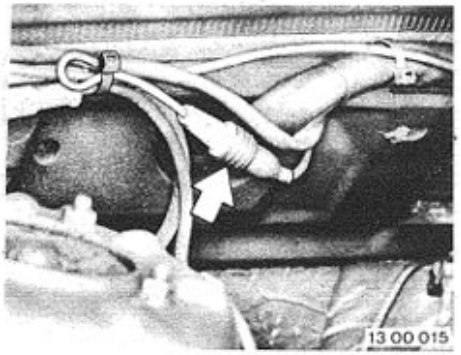


Adjust idle speed CO level* with Special Tool 13 1 100.

* See Nominal Value Microfiche

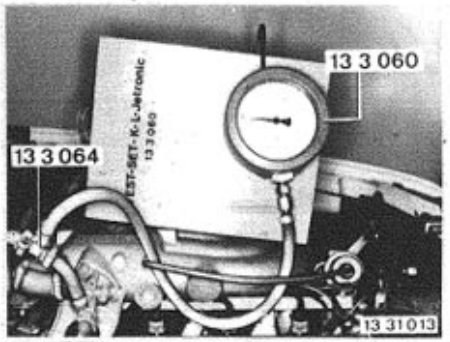


Install new anti-tamper lock (1) in air flow sensor.

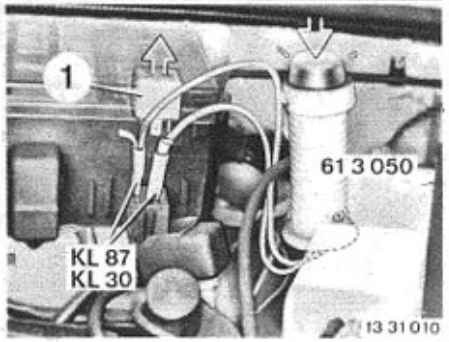


Connect plug for oxygen sensor.

13 31 029 CHECKING FUEL DELIVERY PRESSURE



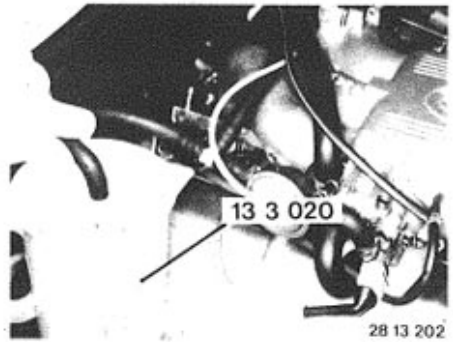
Install pressure gage 13 3 061 with connecting line and T-adapter 13 3 064 in the fuel feed line, in front of fuel pressure regulator.
Plug fuel return line with Special Tool 13 3 010.



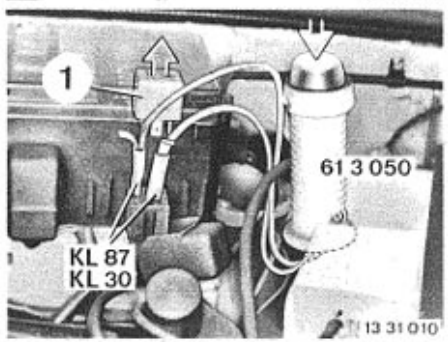
Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Check delivery pressure*.

* See Specifications of Gr. 16

13 31 . . . CHECKING FUEL DELIVERY RATE



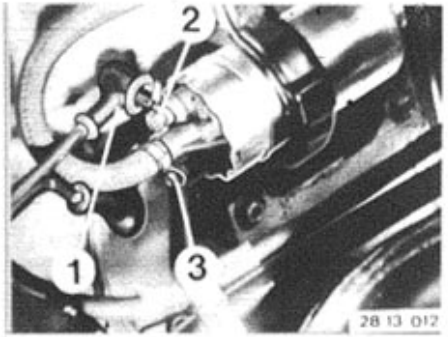
Unscrew fuel return line and hold loose end in measuring glass 13 3 020.



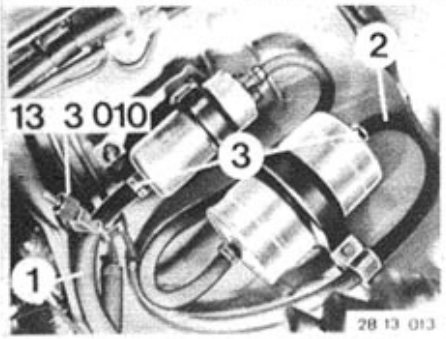
Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Check delivery rate*.

* See Specifications of Gr. 16

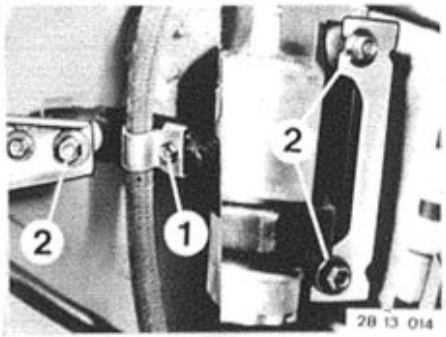
13 31 030 REMOVING AND INSTALLING FUEL PUMP



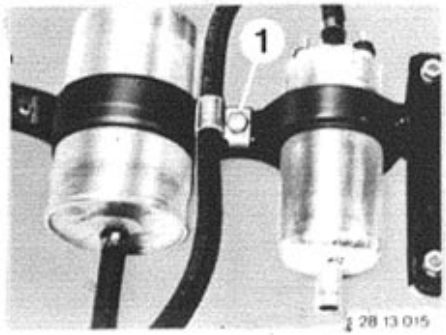
Turn back protective caps (1).
Loosen nuts (2 and 3) and take off cable.



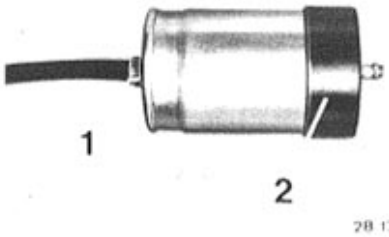
Pinch suction hose (1) and pressure hose (2) with Special Tool 13 3 010.
Cut open squeeze-hose clamp (3) and pull off hoses.



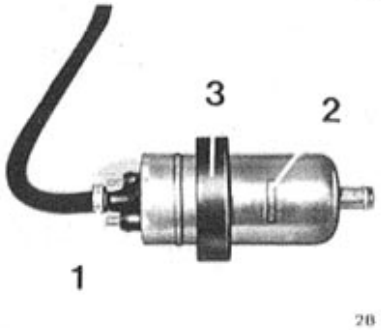
Unscrew bolt (1) and nuts (2).
Remove fuel pump with filter.



Unscrew bolt (1) and take off clamp.

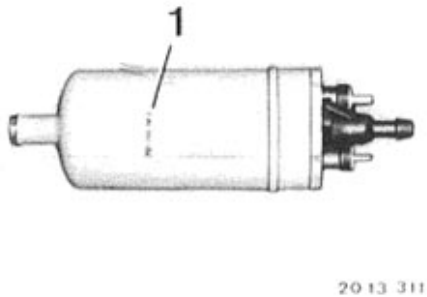


Loosen hose clamp (1) on fuel filter and pull off fuel hose.
Remove rubber ring (2).
Installation:
Check direction of flow – IN and OUT are marked on filter.



Loosen hose clamp (1) on fuel pump and pull off fuel hose.
Pull off rubber ring (3).

2 = Code number*

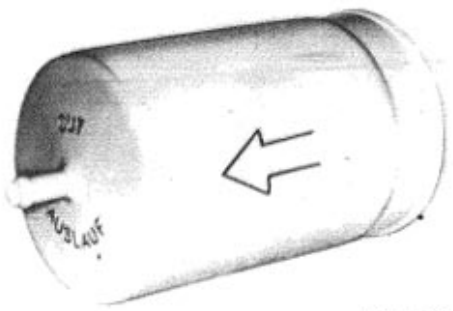


Installation:
Check code number (2)*.

* 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

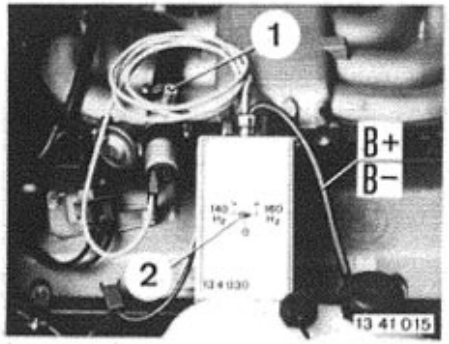
Requirements:
- Engine at operating temperature, i.e. oil temperature at least 60° C (140° F).
- Ignition timing and valve clearance correct.
- Air filter cartridge in perfect condition.
- All electric equipment switched off.
- Idle CO level correct.

Note:
Basic adjustments are not made at certain intervals.



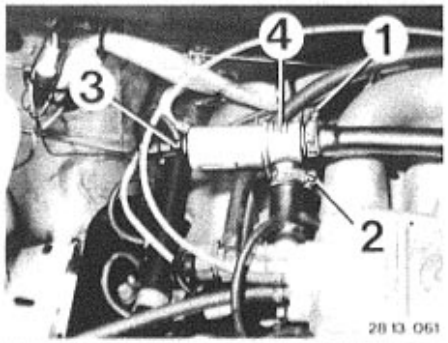
13 41 013

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



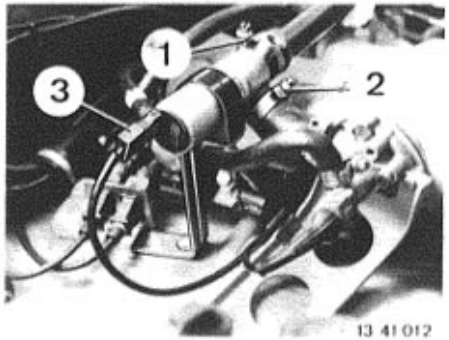
Connect tester 13 4 030 on car battery (B+/B–) and idle control valve.
Set switch (2) to 140 Hz.
Run engine at idle speed.
Adjust idle speed to 700 ± 50 rpm with basic adjustment screw (1).

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

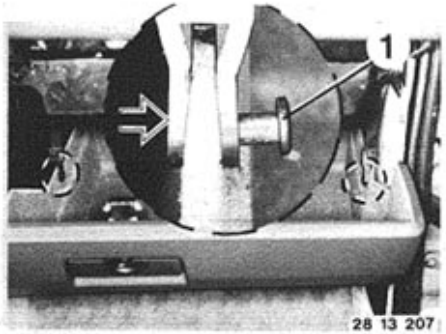
Loosen hose straps (1 and 2).
Pull off plug (3).
Remove idle control valve.
Installation:
Check code number (4)*.
Check idle speed*.



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.

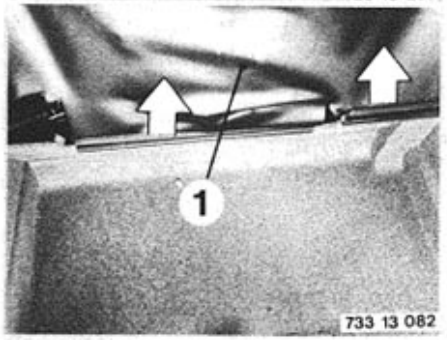
Checking Idle Control Valve:
Apply battery voltage on idle control valve.
Idle control valve must close and be tight.
Idle control valve should be open when without voltage.

* See Specifications and Nominal Values

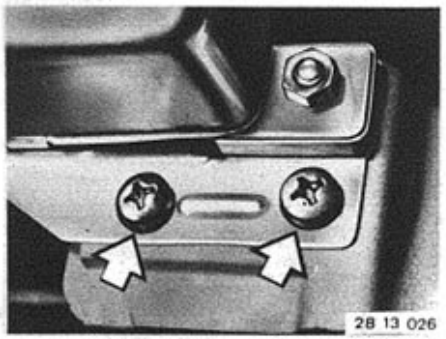


13 41 010 REMOVING AND INSTALLING CONTROL UNIT FOR IDLE CONTROL VALVE

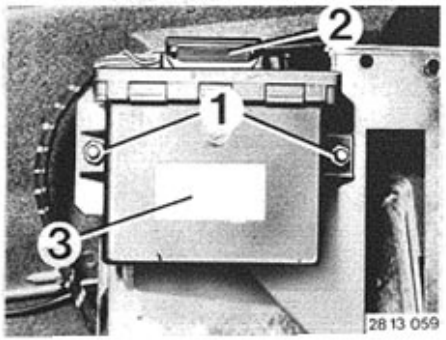
Open glove box.
Pull out pins (1) of both retaining straps.



Disconnect cover (1).

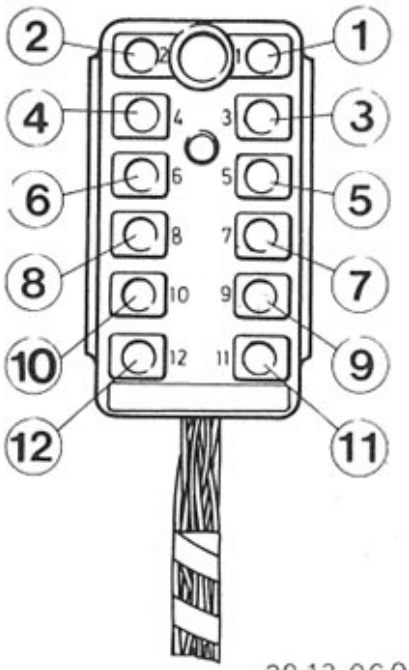


Unscrew both screws on left and right sides of control unit.



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

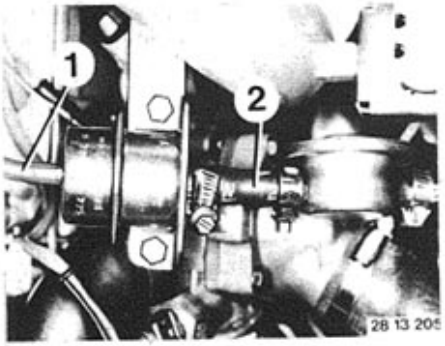


Multiple Pin Plug Connections:

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)

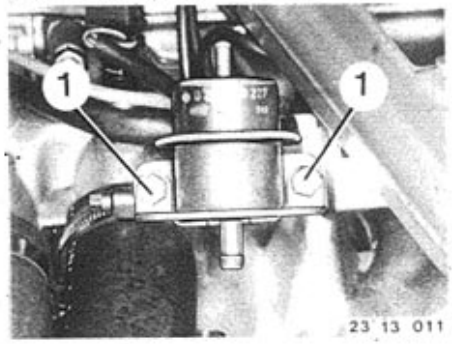
Wire Colors:

BL = Blue
BR = Brown
GE = Yellow
GN = Green
RT = Red
SW = Black
WS = White

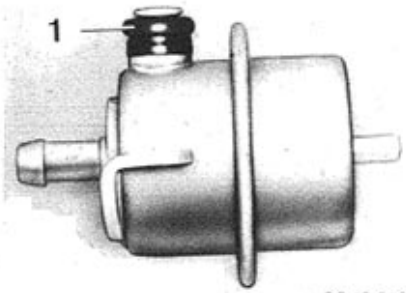


13 51 200 REMOVING AND INSTALLING FUEL PRESSURE REGULATOR

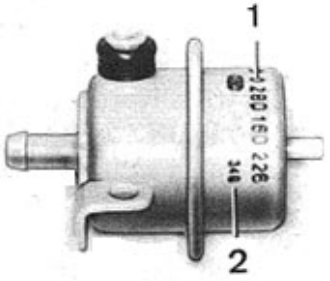
Disconnect air hose (1) and fuel hose (2).



Unscrew bolts (1).
Take off fuel pressure regulator.

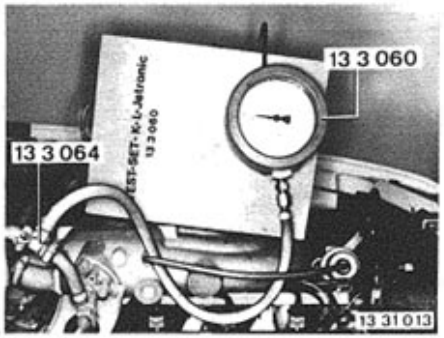


Installation:
Check seal (1), replacing if necessary.

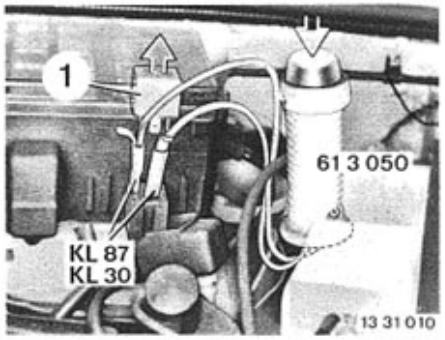


Installation:
Check code number (1)*
(2) = Manufacturing date

* See Specification



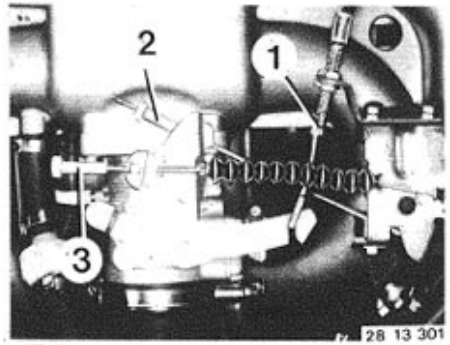
Checking:
Install pressure gage 13 3 060 with connecting line and T-adapter 13 3 064 in fuel feed line, in front of fuel pressure regulator.



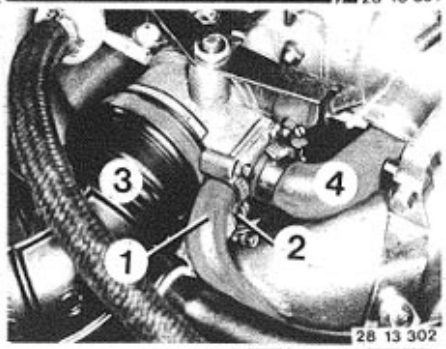
Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Fuel injection pressure*.

* See Specifications/Nom. Value Microfiche

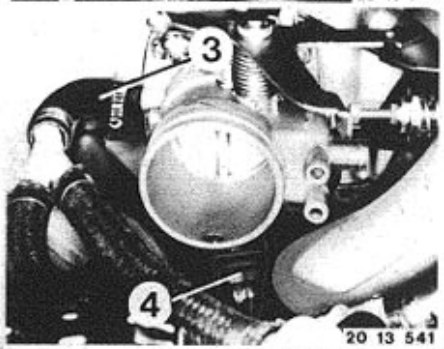
13 54 030 REMOVING AND INSTALLING THROTTLE HOUSING



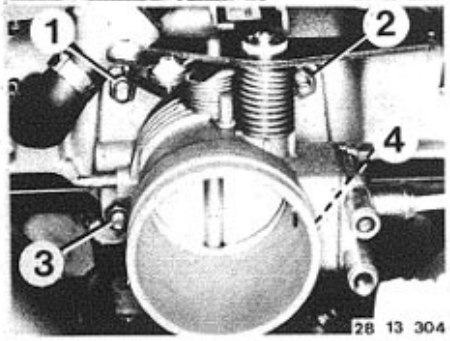
Disconnect cables (1 ... 3).
1 = Automatic transmission
2 = Accelerator pedal
3 = Cruise control
Installation:
Adjust cables, see Groups 23, 35 and 65.



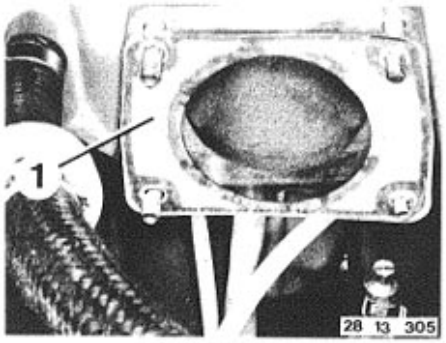
Disconnect water hoses (1 and 2).
Disconnect air hoses (3 and 4).
Installation:
Filling and bleeding cooling system.



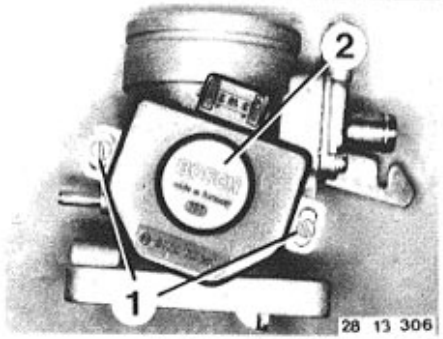
Disconnect hose (3).
Pull off multiple pin plug (4) on throttle switch.



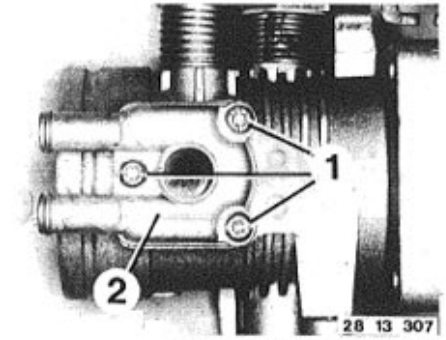
Unscrew nuts (1 ... 4) and take off throttle housing.



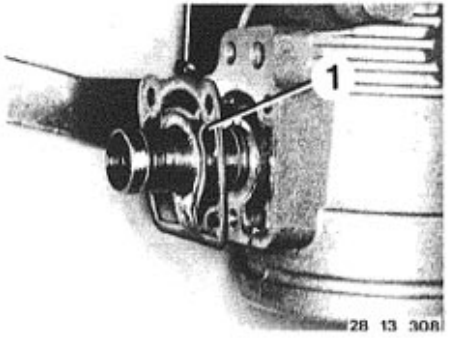
Installation:
Replace gasket (1).



Unscrew bolts (1).
Remove throttle switch (2).
Installation:
Adjust throttle switch 13 63 544.



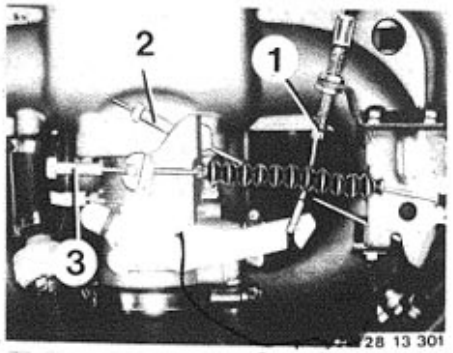
Unscrew bolts (1) and take off cover (2).



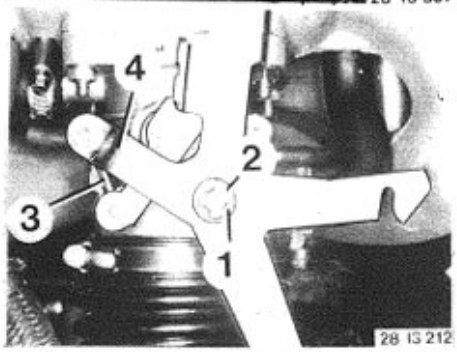
Installation:
Replace gasket.
Check engine idle speed* and CO*.

* See nominal value microfilm

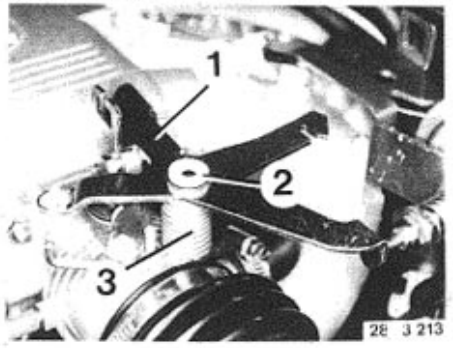
13 54 051 REPLACING RETURN SPRINGS OF THROTTLE SHAFT



Disconnect cables (1 — 3).
1 = Automatic transmission
2 = Accelerator pedal
3 = Cruise control
Installation:
Adjust cables – see Groups 24, 35 and 65.

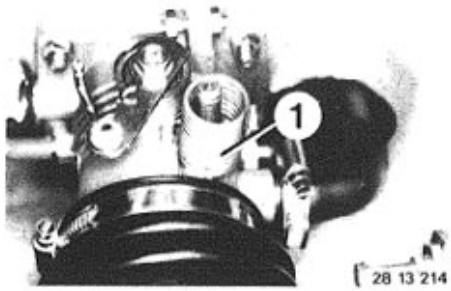


Remove retainer (1).
Remove washer (2).
Disconnect linkage (3) on lever (4).

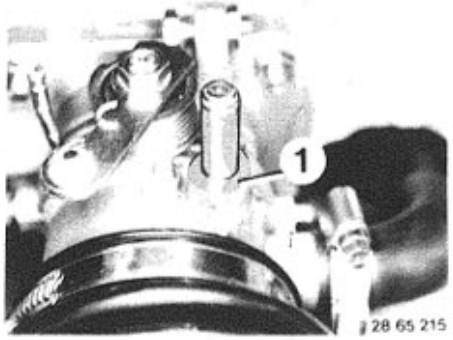


Lift and turn lever (1) to relax spring (3).
Take off lever (1).
Installation:
Check bearing sleeves (2), replacing if necessary.

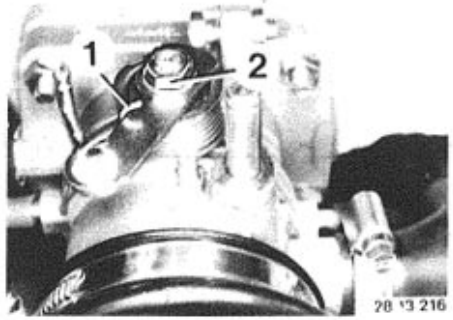
Remove spring (1).

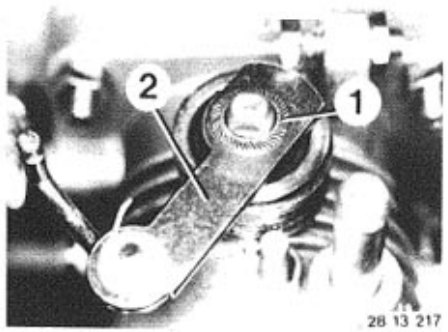


Note:
Check spring washer (1).

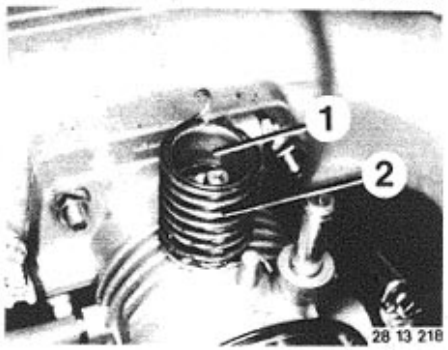


Disconnect spring (1).
Unscrew nut (2).

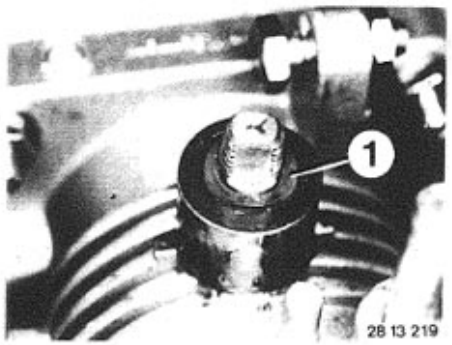




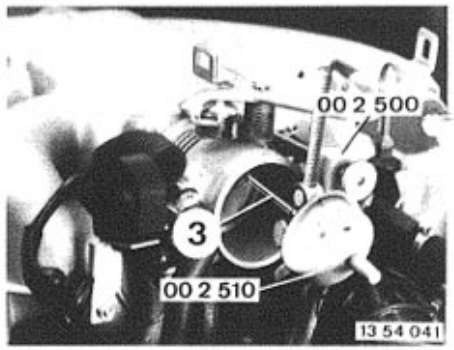
Take off washer (1) and lever (2).



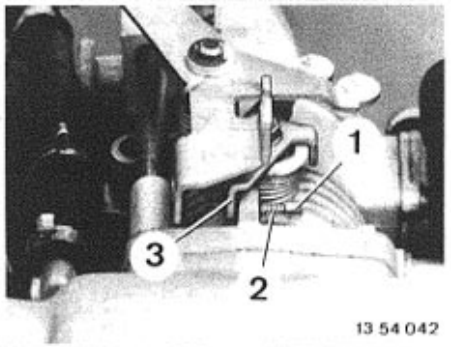
Remove bushing (1) and spring (2).



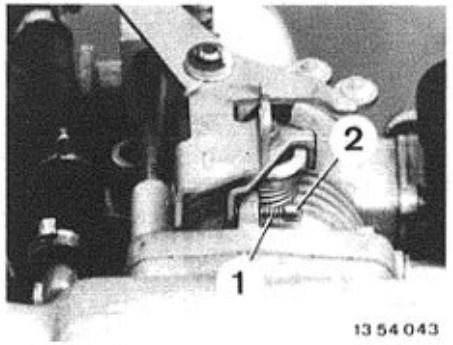
Check corrugated washer (1) and plain washer (2).



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.



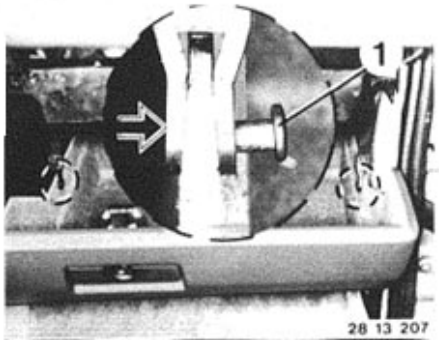
Pull off anti-tamper lock (1) and loosen screw (2) until lever (3) no longer rests on screw (2).
Screw in screw (2) until throttle valve starts to move.



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.

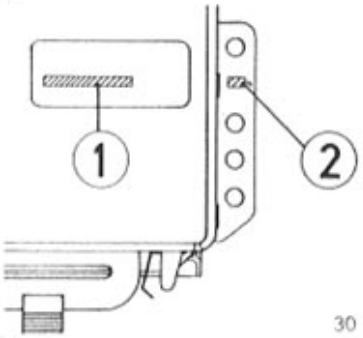
Check adjustment of throttle switch.
Check engine idle speed* and CO level*.

* See Nominal Value Microfiche

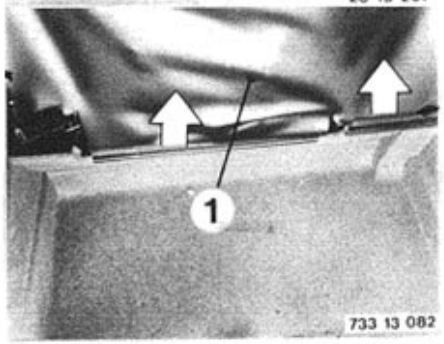


13 61 000 REMOVING AND INSTALLING CONTROL UNIT

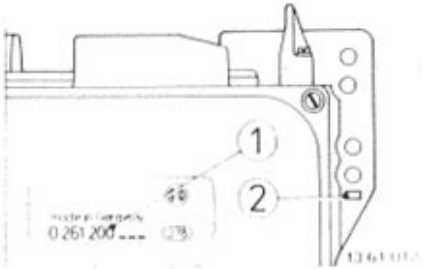
Open glove box.
Pull out pins (1) of both retaining straps.

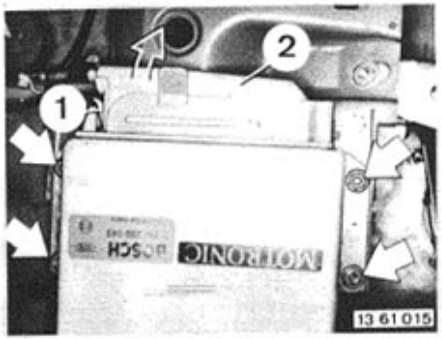


Installation:
Check code number (1)* and manufacturing date (2)*.

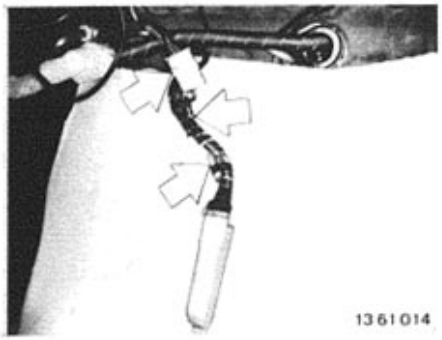


Unscrew trim panel.



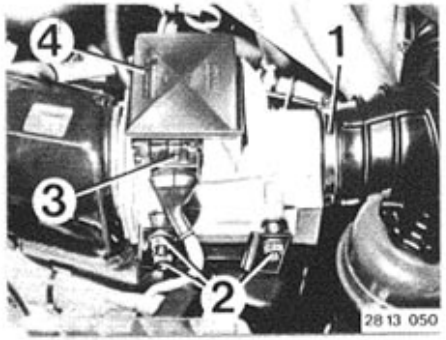


Press back retainer (1) and pull off plug (2).
Unscrew four mounting screws and take off control unit.



Connect plugs according to wiring diagram.

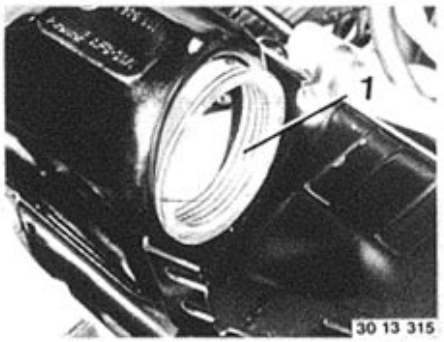
* See Specifications + Nom. Value Microfiche



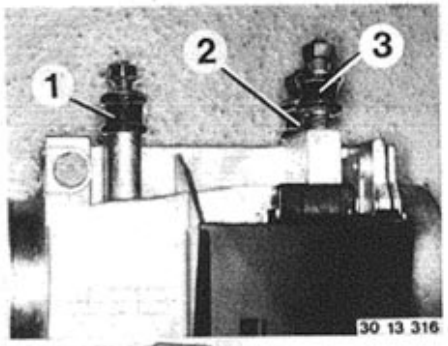
13 62 000 REMOVING AND INSTALLING AIR FLOW SENSOR

Until Model '85:

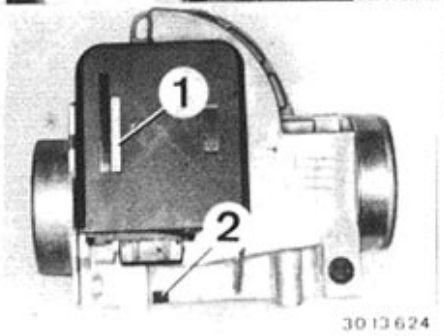
Loosen hose clamp (1).
Unscrew nuts (2).
Pull off plug (3).
Pull air flow sensor out of air cleaner housing and remove.
4 = Code number*



Installation:
Check seal (1), replacing if necessary.

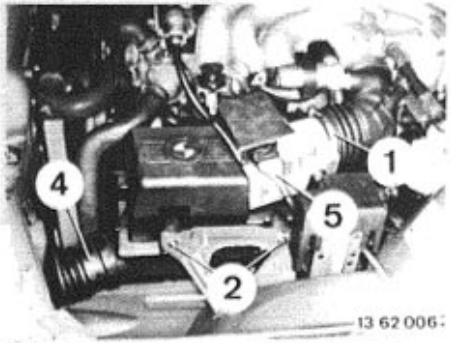


Unscrew silent mounts (1 — 3) on air flow sensor.
Check silent mounts, replacing if necessary.



Installation:
Check code number (1)* and manufacturing date (2)*.
Check engine idle speed* and idle speed CO*.
Check air flow sensor*.

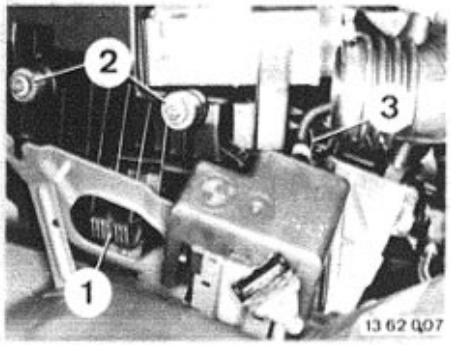
* See Specifications and nominal value microfilm



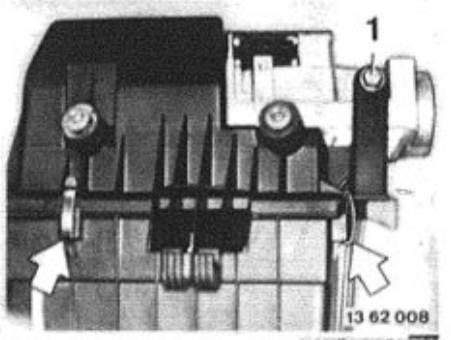
13 62 000 REMOVING AND INSTALLING AIR FLOW SENSOR

From Model '86:

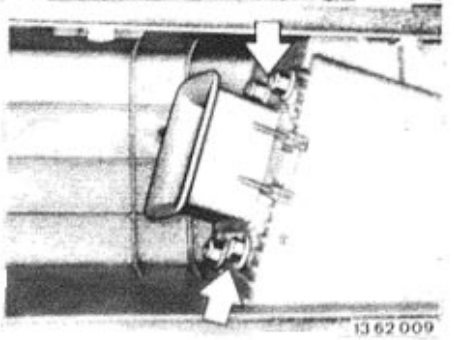
Loosen hose strap (1).
Loosen nuts (2).
Pull off hose (4).
Pull off plug (5).



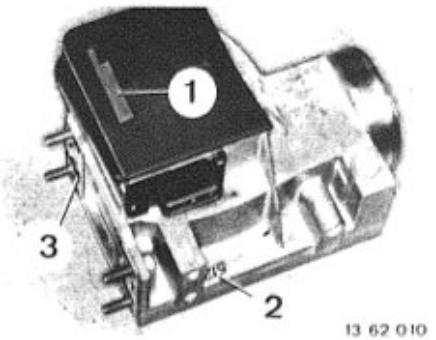
Cut off hose strap (3).
Take off complete air cleaner.
Installation:
Check rubber mount (1) and cushions (2), and check for correct seating.



Open four clamps.
Unscrew bolt (1).
Separate housing sections.

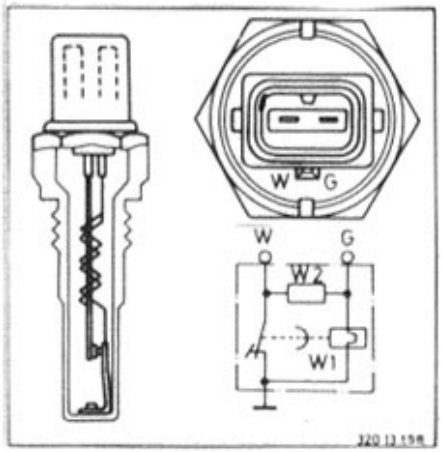


Unscrew nuts.



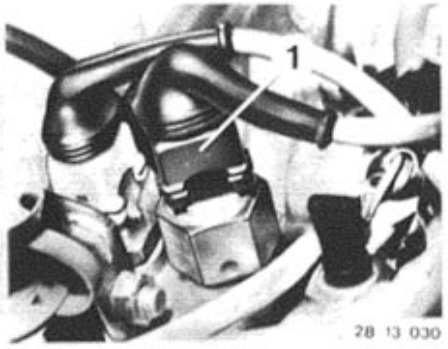
Installation:
Check code number (1)* and manufacturing date (2)*.
Check engine idle speed* and idle speed CO level*.
Check gasket (3).
Check air flow sensor*.

* See Specifications and Nominal Values

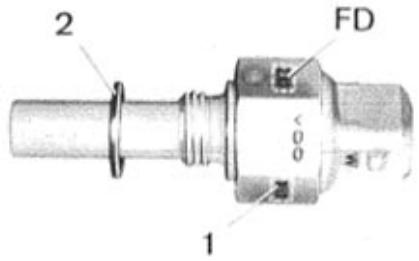


13 62 050 REMOVING AND INSTALLING/ CHECKING TEMPERATURE TIME SWITCH

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).

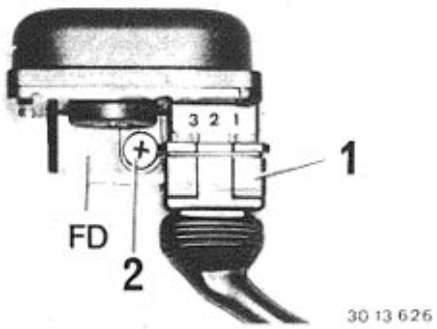


Checking:
Connect Jetronic test lead 61 1 440.
Check nominal value* with an ohmmeter.
To check the entire temperature range, remove temperature sensor and place it in a water bath heated to testing temperature.
Check resistance* with an ohmmeter.

* See Specifications

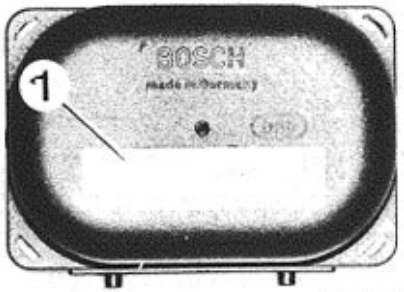
* See Specifications

13 62 080 REMOVING AND INSTALLING/ CHECKING PRESSURE SENSOR



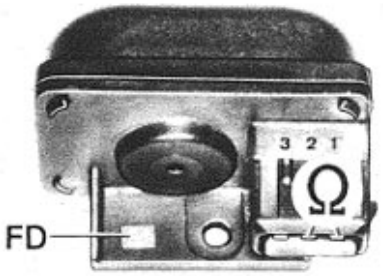
30 13 626

Pull off plug (1).
Unscrew screw (2) and take off pressure sensor.
FD = Manufacturing date



30 13 627

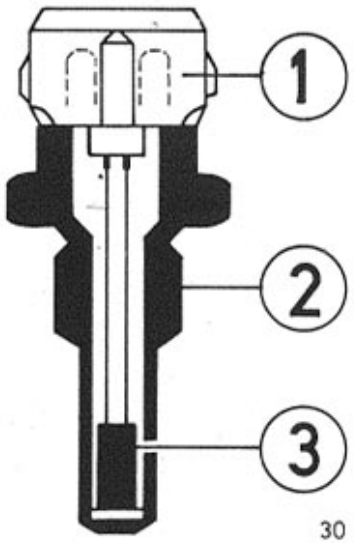
Installation:
Check code number (1)*.



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

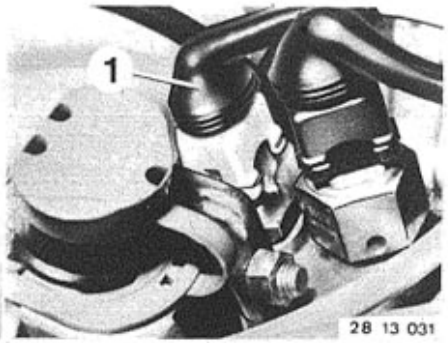


30 13 625

13 62 531 REMOVING AND INSTALLING/ CHECKING TEMPERATURE SENSOR FOR COOLANT

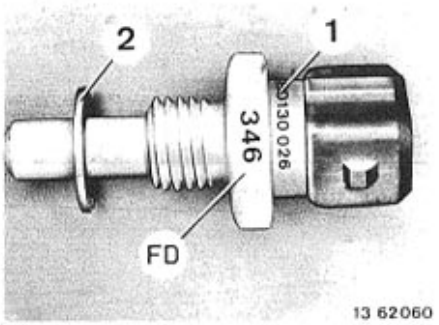
The temperature sensor measures the engine temperature and sends this information to the control unit in form of a resistance value.
The resistance value drops as temperature rises (NTC).

1 Plug connection
2 Housing
3 NTC resistor



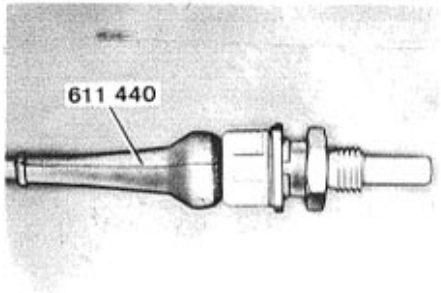
28 13 031

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).

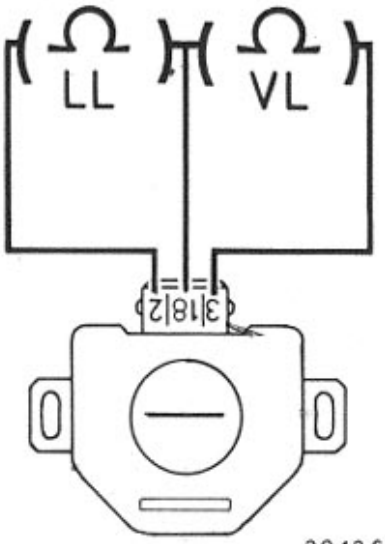


13 62061

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

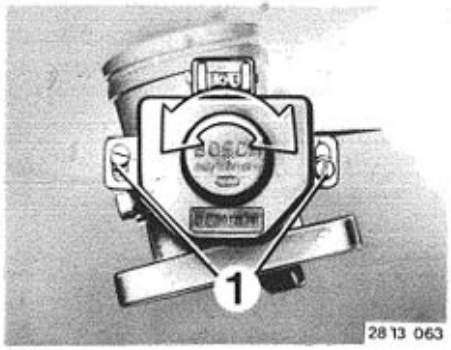
* See Specifications



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

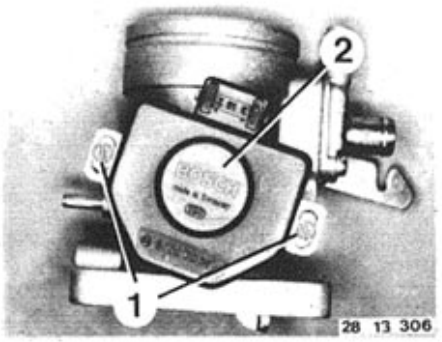


28 13 063

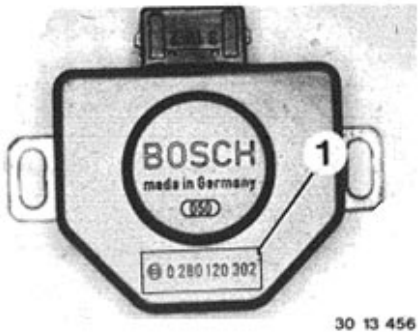
Adjusting:

– 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

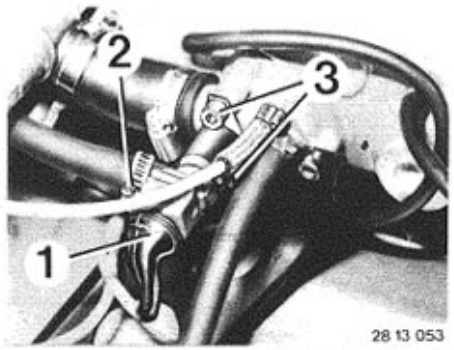


Remove throttle switch 13 54 030.
Unscrew screws (1).
Take off throttle switch (2).



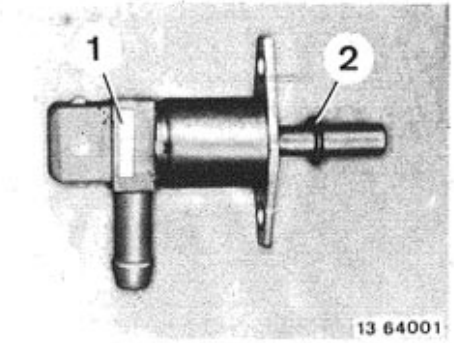
Installation:
Check code number (1)*.
Adjust throttle switch 13 63 544.

* See Specifications



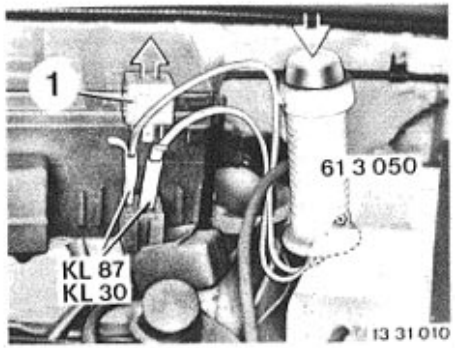
13 64 030 REMOVING AND INSTALLING COLD START VALVE

Removing and Installing:
Pull off plug (1).
Unscrew fuel line (2).
Unscrew bolts.
Take off cold start valve.

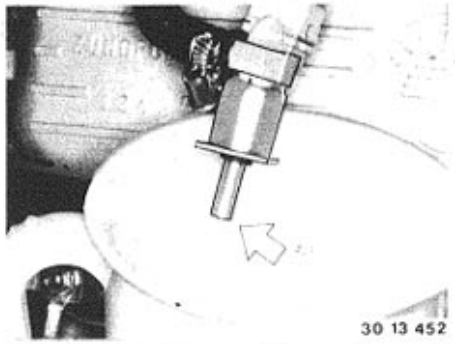


Installation:
Check code number (1)*.
Replace seal (2).

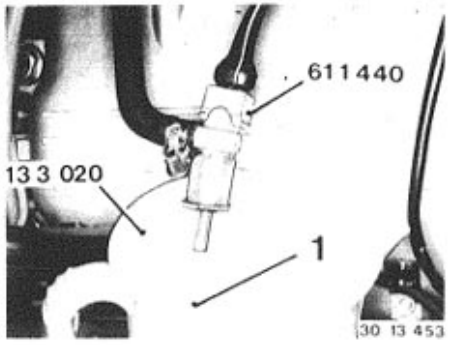
Checking:
Unscrew cold start valve on intake housing.
Fuel line remains connected.



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*.

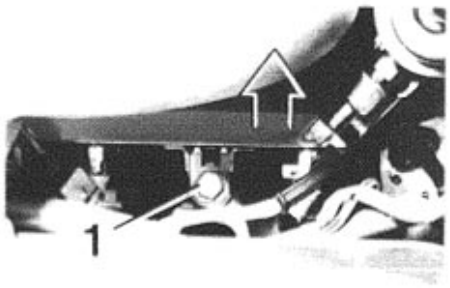


Chekcing Fuel Flow Rate and Spray Angle:
Hold cold start valve in measuring glass 13 3 020.
Plug Jetronic test lead 61 1 440 on cold start valve and connect with B + and B –.
Check fuel flow rate* and spray angle (1)*.

* See Specifications

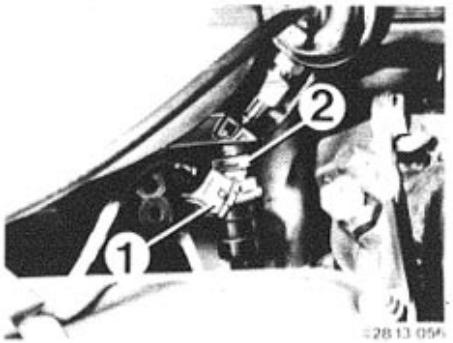
* See Specifications

13 64 501 REPLACING FUEL INJECTOR



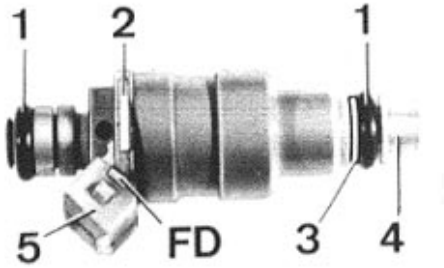
28 13 055

Unscrew four mounting bolts (1) of injection pipe.
Push up injection pipe until fuel injectors have cleared the guide on the intake manifold.



28 13 056

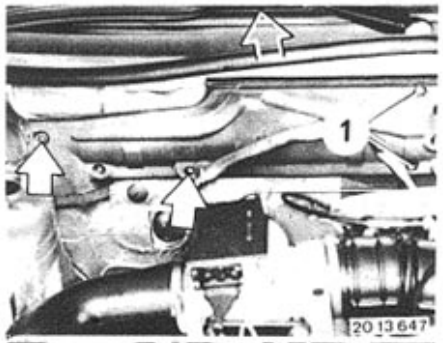
Pull off plug (1) on fuel injector.
Lift out retainer (2) and pull fuel injector out of injection pipe.



30 13 122

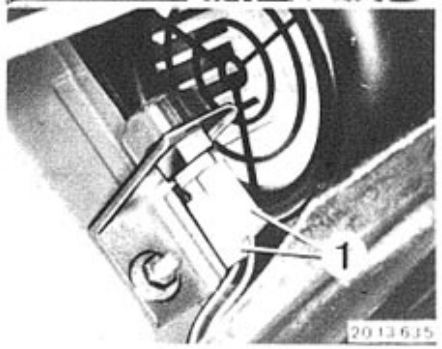
Installation:
Check O-rings (1), replacing if necessary.
Check code number (2)*.
FD = Manufacturing date.
Check position of plastic washer (3).
Check color* of plug receptacle (5) or injector guard (4).
Only coat O-rings for installation with vaseline or SAE 90/SAE 80 gear lube.

* See Specifications

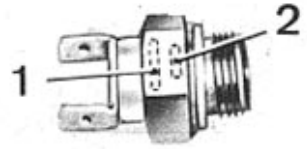


12 63 051 REMOVING AND INSTALLING 0° C (32° F) TEMPERATURE SWITCH

E 28
Unscrew screws (1).
Unscrew screws (2) on left and right sides.
Pull off rubber guard.
Fold cover forward.

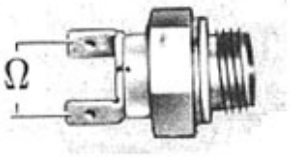


Pull off plug (1).
Unscrew temperature switch.
Installation:
Torque: max. 30 Nm (22 ft. lbs.).



Installation:
Check code number (1)* and switching point (2)*.

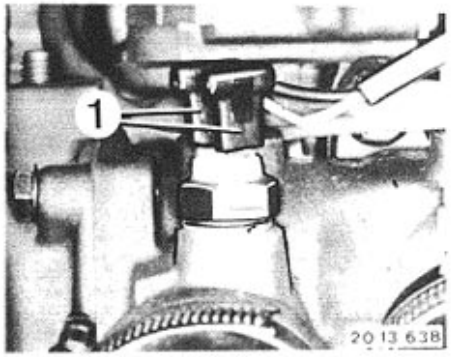
20 13 633



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).

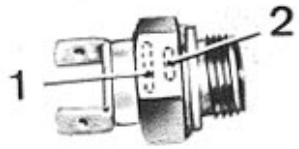
20 13 634

* See Specifications

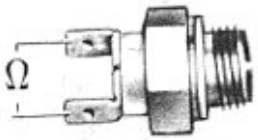


12 63 060 REMOVING AND INSTALLING 45° C (113° F) TEMPERATURE SWITCH

Pull off plug (1).
Remove temperature switch.
Installation:
Tightening torque: max. 30 Nm (22 ft. lbs.).
Fill and bleed cooling system (Group 17).

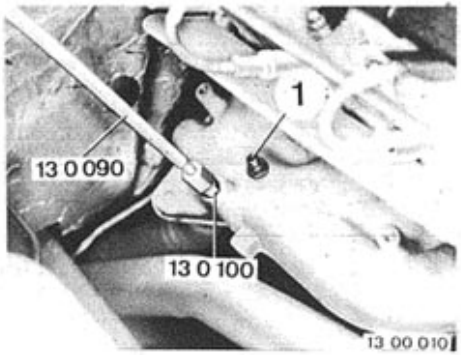


Installation:
Check code number (1)* and switching point (2)*.



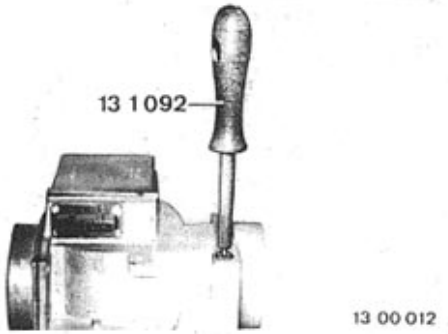
Checking:
Connect ohmmeter (M 06) on temperature switch.
Ohmmeter should display approximately 0 ohm for temperature < 30° C (86° F).
Ohmmeter should display approximately ∞ ohms for temperature > 48° C (118° F).

* See Specifications

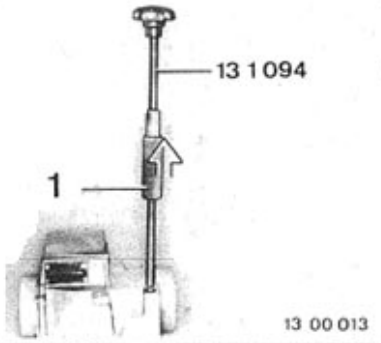


13 00 020 CHECKING ADAPTIVE PILOT CONTROL
(Integrated in DME Control Unit Since 1985 Models)

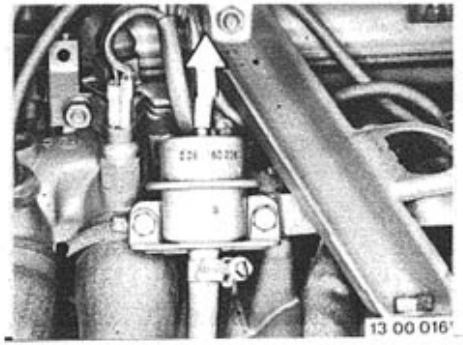
Testing Requirements:
Engine, oxygen sensor and catalytic converter have operating temperature.
Oxygen sensor is heated electrically.
Unscrew screws (1).
Mount exhaust tester 13 0 090 on exhaust manifold with adapter 13 0 100.
Connect BMW service test unit.



Remove anti-tamper lock.
Remove air cleaner with air flow sensor.
Drill hole in anti-tamper lock with Special Tool 13 1 092.

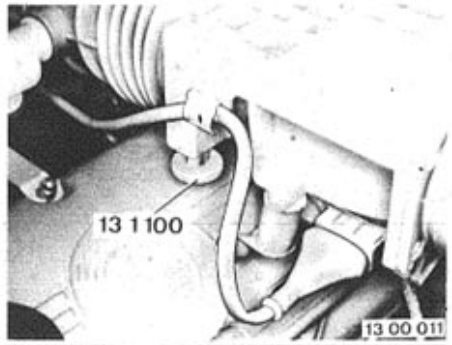


Screw Special Tool 13 1 094 in anti-tamper lock.
Knock special tool with anti-tamper lock out of air flow sensor with impact (1).
Install air cleaner with air flow sensor.
Run engine at idle speed.

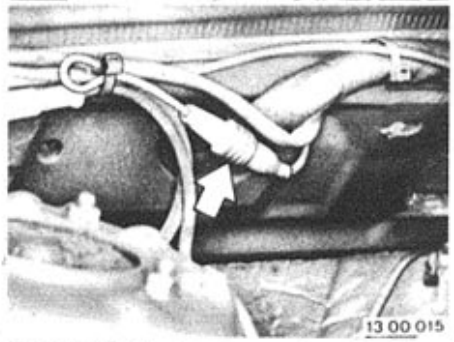


Pull off and plug vacuum hose on fuel pressure regulator.
Oxygen sensor must regulate the CO level back to nominal value* after a brief rise.
Oxygen sensor is okay.

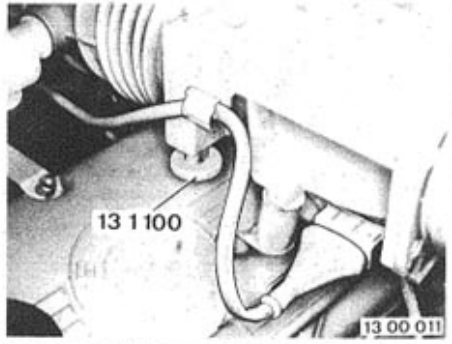
* See nominal value microfiche



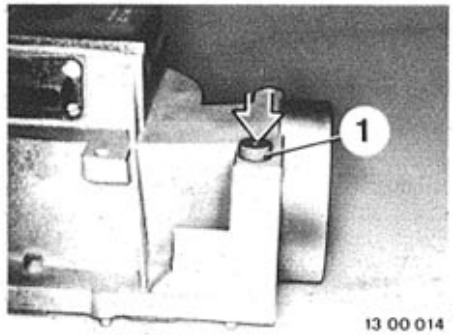
Tighten air control screw in air flow sensor completely with Special Tool 13 1 100 richer mixture.
Run engine at idle speed – CO level will be regulated back to nominal value*.



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.

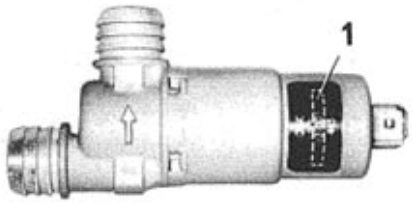
* See nominal value microfiche

13 00 050 CHECKING / ADJUSTING ENGINE PERFORMANCE (9.84 ... 9.85)

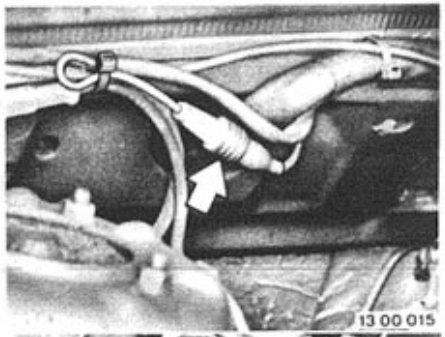
Requirements for All Adjustments:
Engine at operating temperature, which means oil temperature at least 60° C (140° F).
Ignition timing and valve clearance okay.
All electric equipment switched off.
BMW service tester connected to instructions.
Routine checking and adjusting is not neces sary -- adaptive 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.

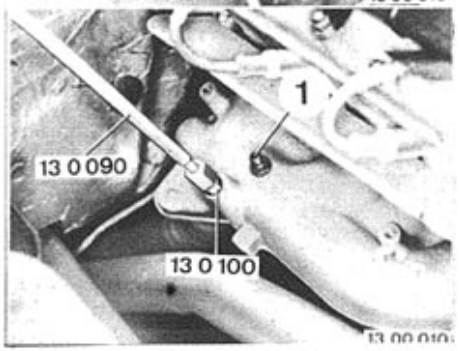


13 41 002



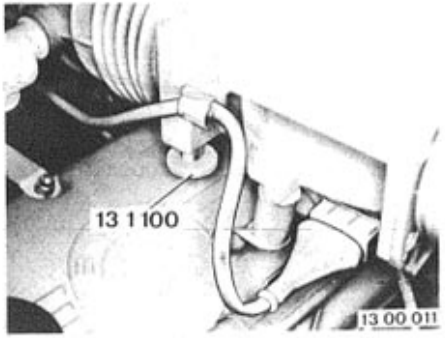
2) CO Level Test (Basic Adjustment)

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



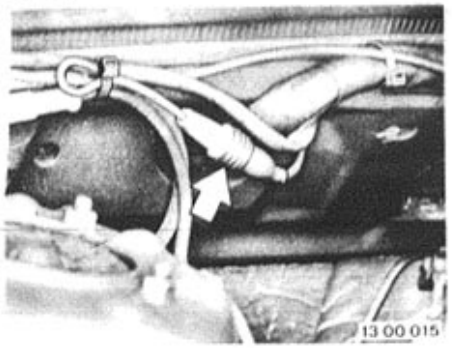
Switch off extraction system for time of measuring.
Make sure that there are no faults on the engine, ignition or fuel injection systems (see trouble shooting) before correcting the CO level.
Remove end cap -- see 13 00 054.
Adjust CO level* with Special Tool 13 1 100 applied on control screw in air flow sensor.

Check adaptive initial control see 13 00 020.

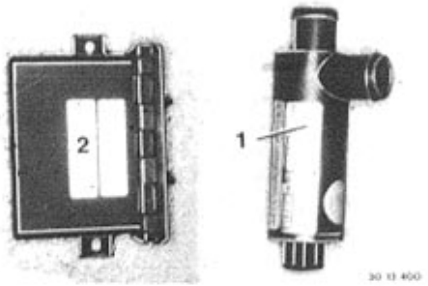
* See Nominal Value Microfiche

13 00 054 ADJUSTING ENGINE IDLE SPEED / CO TEST

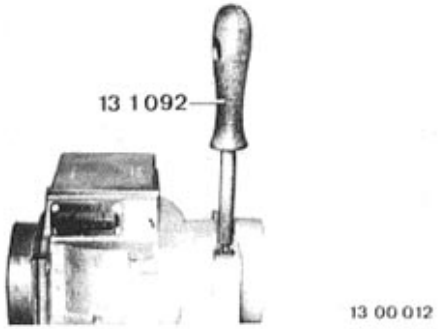
Requirements for All Adjustments:
Engine at operating temperature, i.e. oil temperature at least 60° C (140° F).
Ignition timing and valve clearance correct.
All electric equipment switched off.
BMW service test unit connected to operating instructions.



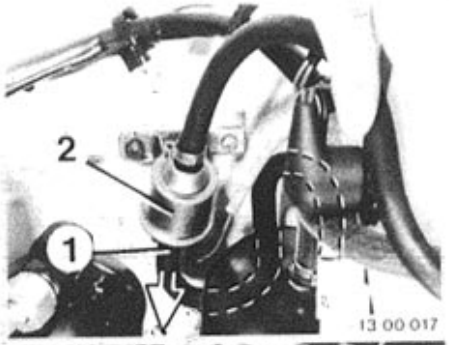
Pull off oxygen sensor plug.



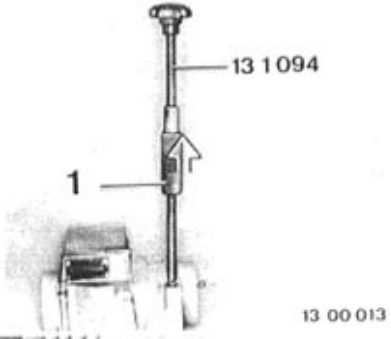
1) Engine Idle Speed:
Check engine idle speed**.
If specified value is not reached, check idle control valve (1) and idle speed regulation control unit (2), replacing if necessary.
Note:
There is no adjusting screw for idle speed regulation.



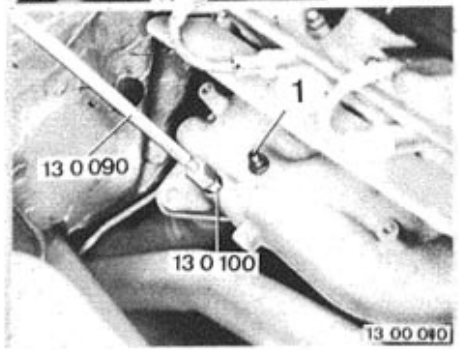
Remove air cleaner with air flow sensor.
Drill hole in anti-tamper lock with Special Tool 13 1 092.



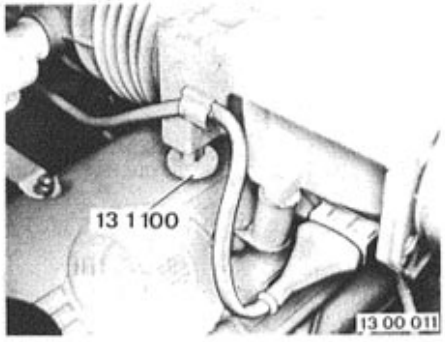
2) CO Test:
Pull off hose (1) on solenoid (2).
Do not insert plugs in open connections.



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.



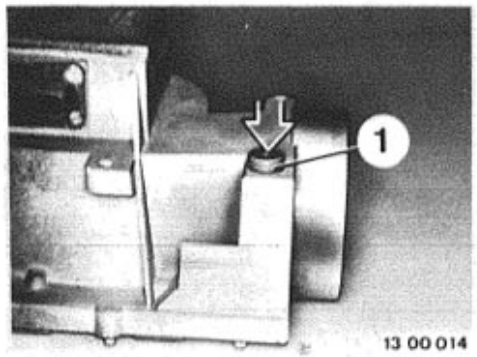
Unscrew bolts (1).
Connect Special Tool 13 0 070 on exhaust manifold with adapter 13 0 100.
Check idle speed CO level**.



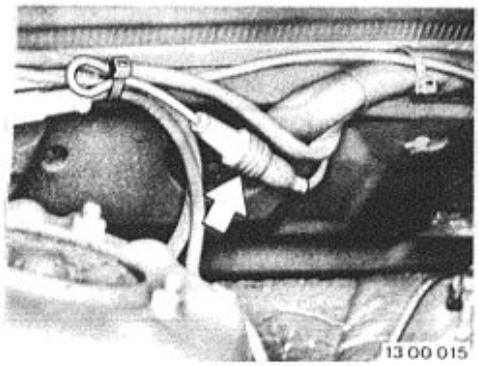
Adjust CO to specified value** with Special Tool 13 1 100.
Connect oxygen sensor.
Remove CO tester.

** See Nominal Value Microfilm

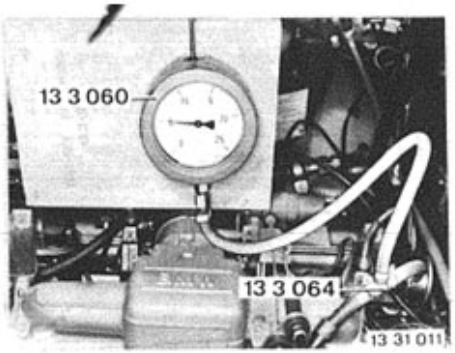
** See Nominal Value Microfilm



Remove air cleaner with air flow sensor.
Insert new anti-tamper lock (1) in air flow sensor.
Install air cleaner with air flow sensor.

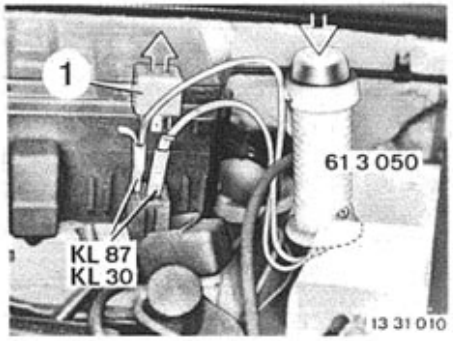


Connect oxygen sensor plug.

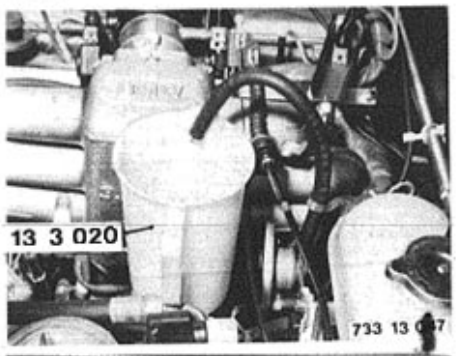


13 31 029 CHECKING FUEL DELIVERY PRESSURE

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.

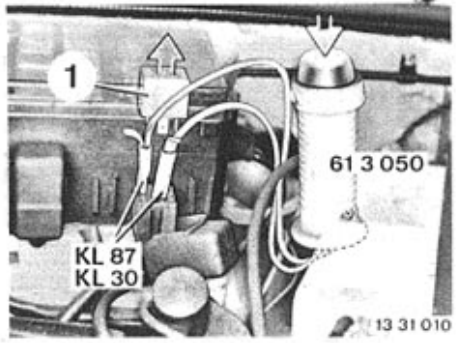


Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Check delivery pressure*.



13 31 . . . CHECKING FUEL DELIVERY RATE

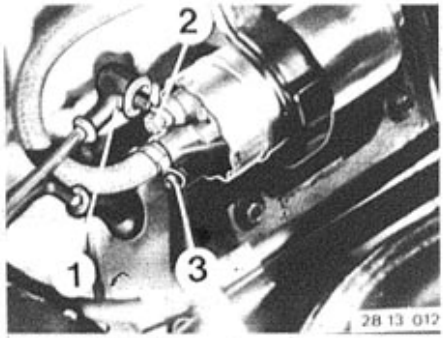
Disconnect fuel return hose and hold loose end in measuring glass 13 3 020.



Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Check delivery rate*.

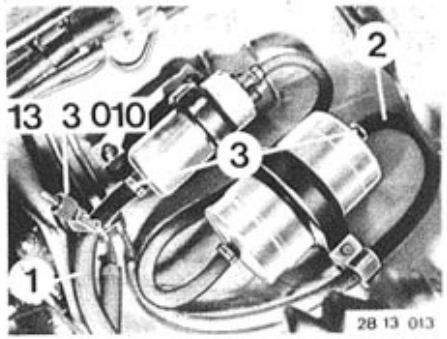
* See Specifications of Group 16

* See Specifications of Group 16

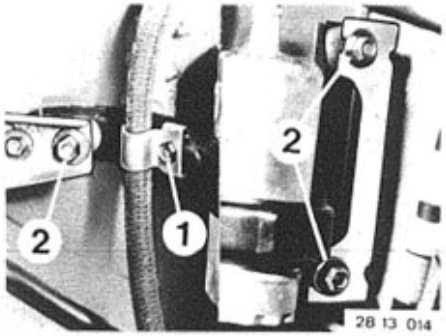


13 31 030 REMOVING AND INSTALLING FUEL PUMP

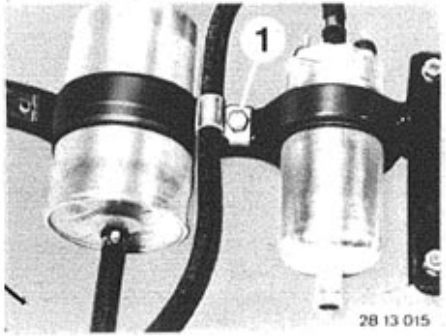
Push back protective caps (1).
Unscrew nuts (2 and 3) and take off wires.



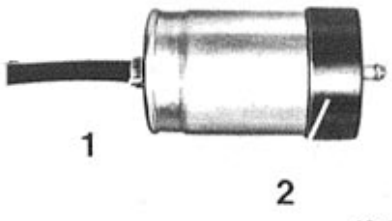
Pinch suction hose (1) and pressure hose (2) with Special Tool 13 3 010.
Loosen hose clamps (3) and pull off hoses.
Note:
Do not use squeeze-hose clamps on pressure hose.



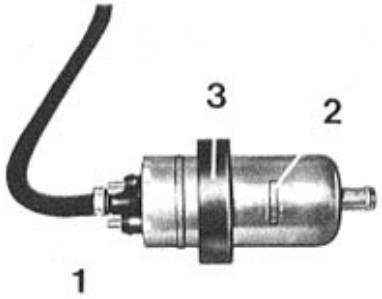
Unscrew bolt (1) and nuts (2).
Take off fuel pump with filter.



Unscrew bolt (1) and take off clamp.



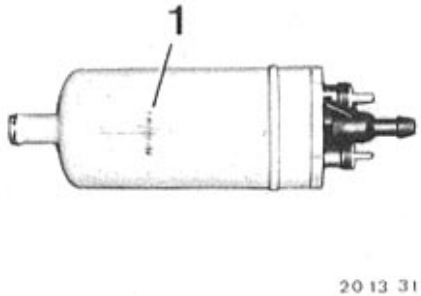
Loosen hose clamp (1) on fuel filter and pull off fuel hose.
Remove rubber ring (2).
Installation:
Check direction of flow – IN and OUT are marked on filter.
Do not use a squeeze-hose clamp.



Loosen hose clamp (1) on fuel pump and pull off fuel hose.
Pull off rubber ring (3).

2 = Code number*

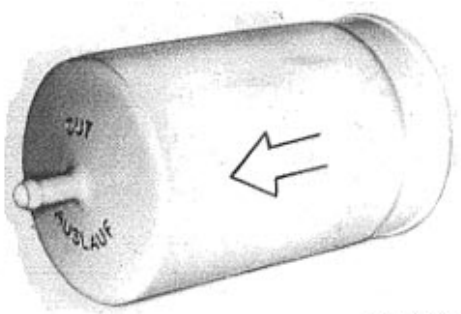
Installation:
Check code number (1)*.



* See Specifications

13 32 052 REMOVING AND INSTALLING FUEL FILTER

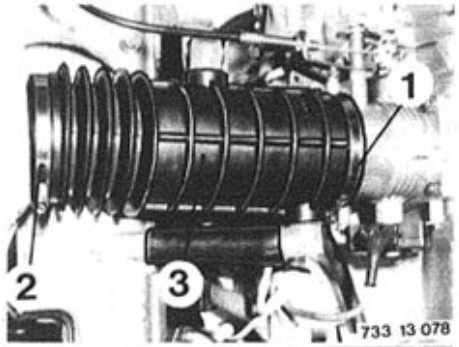
See "Removing and Installing Fuel Pump" – 13 31 030.



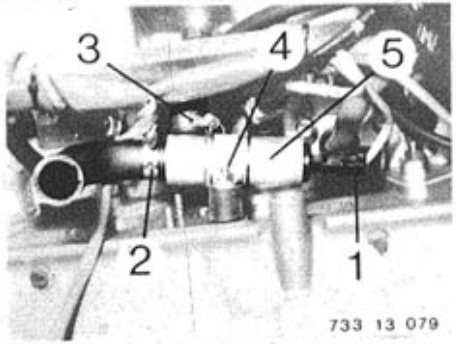
20 13 321

Installation:
Check direction of flow (arrow).

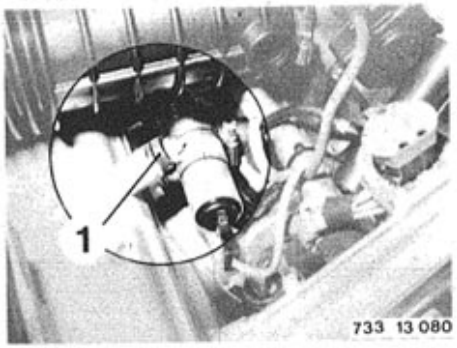
13 41 000 REMOVING AND INSTALLING IDLE CONTROL VALVE



Loosen hose clamps (1 and 2).
Remove air hose (3).



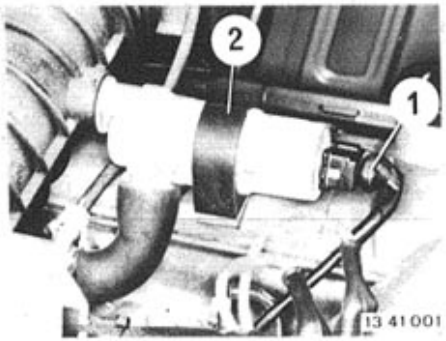
Pull off plug (1).
Loosen hose clamps (2 and 3) and pull off hoses.
Unscrew nut (4) and take off idle control valve (5).



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



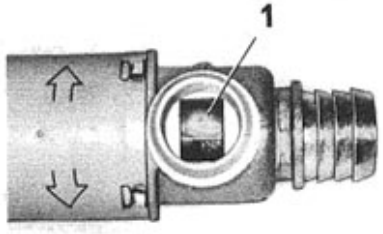
13 41 002

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*.

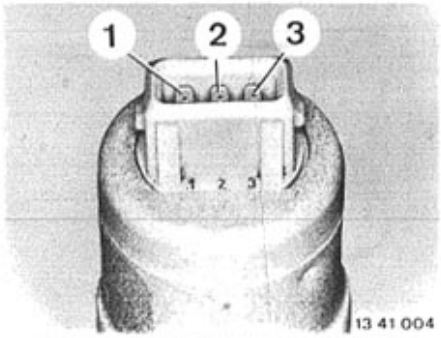
Note:
Whether or not the idle control valve is running can be felt by taking hold of valve with a hand (cycled power supply).



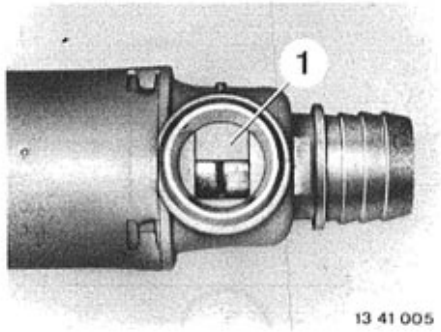
13 41 003

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



13 41 005

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.

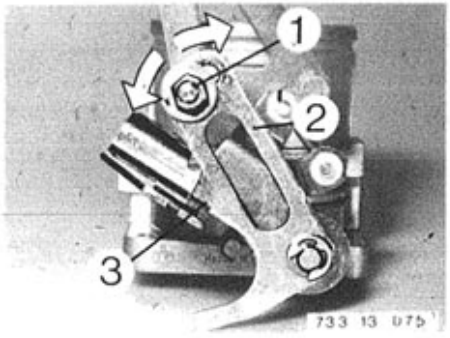
Dynamic Test:
Remove idle control valve.
Plug remains connected.
Open rotating piston (1) completely, or close.
Turn on ignition.
Rotating piston must take on a position of approx. 50 % the cross section opening and stay there.

Testing Procedures for Idle Speed Surging and Idle Speed of ≤ 750 rpm, But Perfect (Checked) Idle Control Valve:

Requirements:

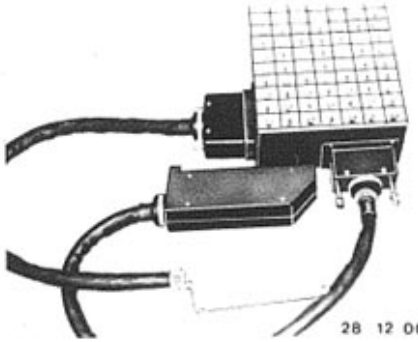
Engine at operating temperature.
No leak in intake system.
Idle speed CO level* correct.
All equipment (lights, air conditioner, etc.) switched off.
BMW service test unit or digital tester connected.
There is no oil dilution,

Oil dilution = gasoline in engine oil; possible in cold season of year and when car operated chiefly in stop-and-go traffic.



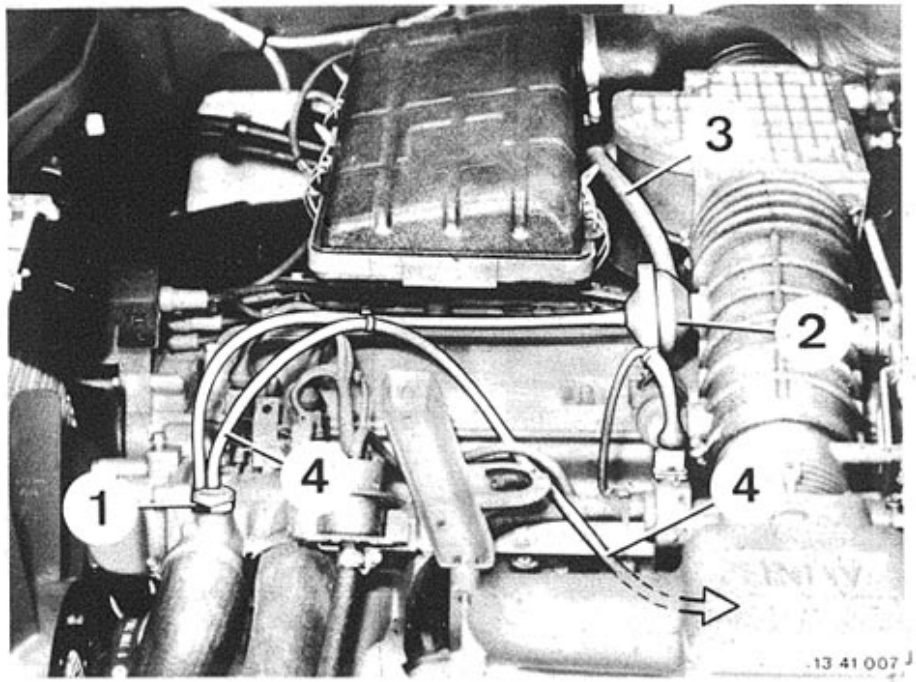
If the idle speed is ≤ 750 rpm, the throttle valve basic setting must be changed.
Loosen nut (1).
Adjust connecting plate (2) with stop (3) (engine running) until the idle speed is 800 50 rpm.

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.

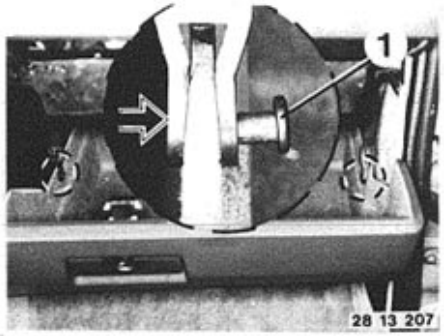


Connect universal adapter between DME control unit and engine wire harness.
Connect plug chambers (2/3/5) with each other (idle and full load contacts closed).
Run engine at idle speed.

Proceed with troubleshooting, if idle speed is ≥ 750 rpm (fault is not within the idle regulation system).

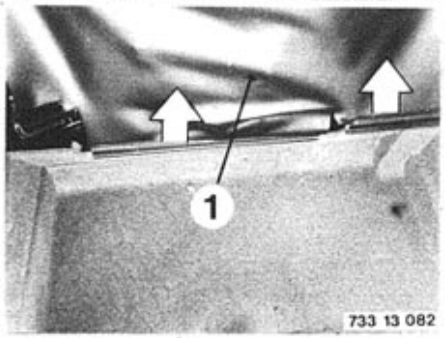


* See Nominal Value Microfilm

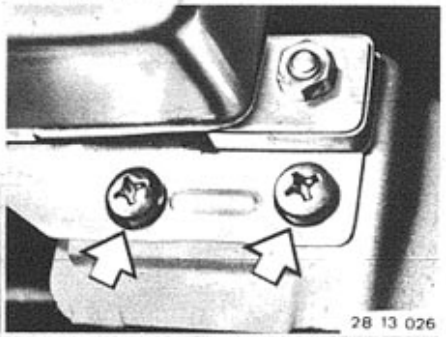


13 41 010 REMOVING AND INSTALLING CONTROL UNIT FOR IDLE CONTROL VALVE

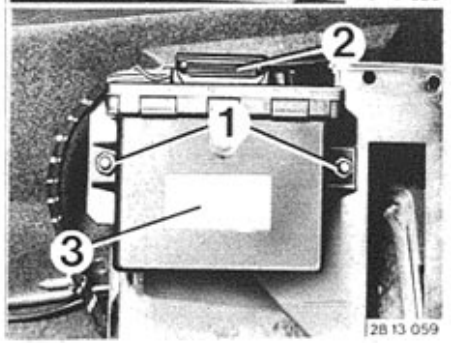
Open glove box.
Pull out pins (1) of both retaining straps.



Disconnect cover (1).

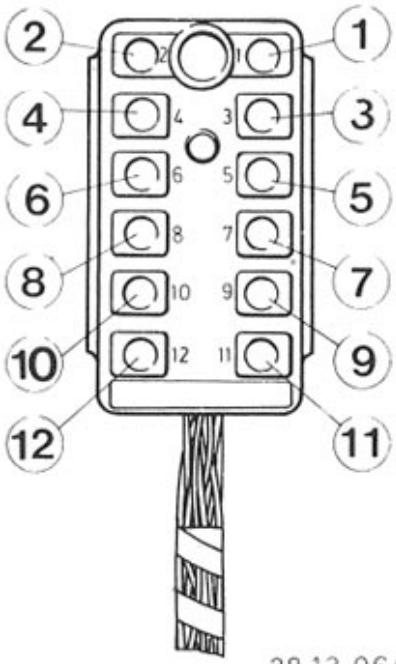


Unscrew both screws on left and right sides of control unit.



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

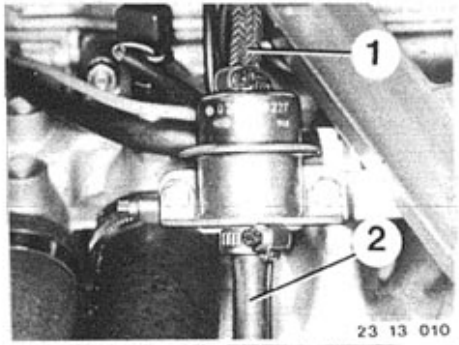


Multiple Pin Plug Connections:

No.	mm²	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)

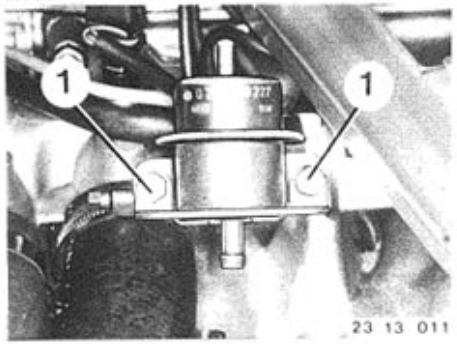
Wire Colors:

BL = Blue
BR = Brown
GE = Yellow
GN = Green
RT = Red
SW = Black
WS = White

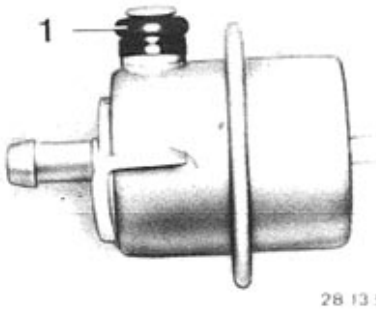


13 51 200 REMOVING AND INSTALLING FUEL PRESSURE REGULATOR

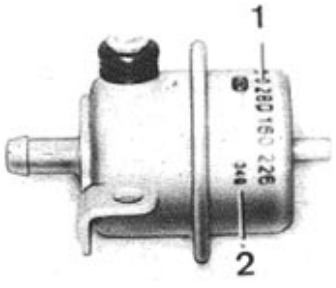
Disconnect air hose (1) and fuel hose (2).



Unscrew bolts (1).
Remove fuel pressure regulator.

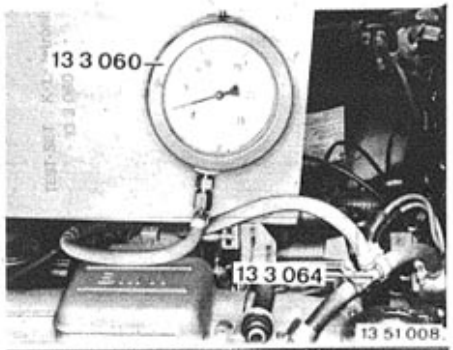


Installation:
Check seal (1), replacing if necessary.

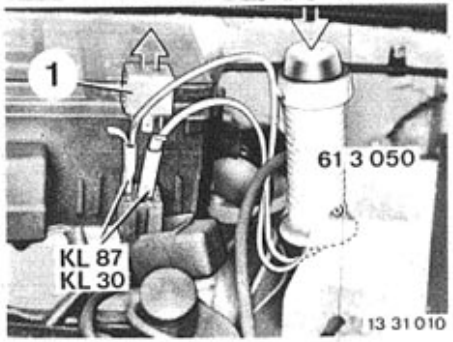


Installation:
Check code number (1)*.
(2) = Manufacturing date

* See Specifications

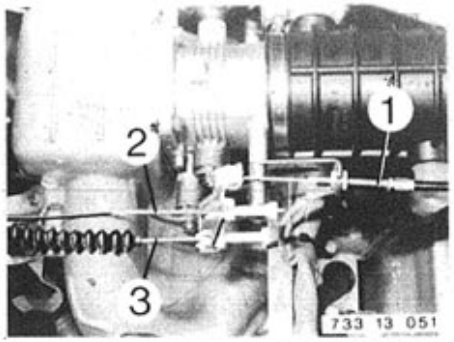


Checking:
Install pressure tester 13 3 060 with connecting hose and t-adapter 13 3 064 in the fuel feed line – in front of fuel pressure regulator.



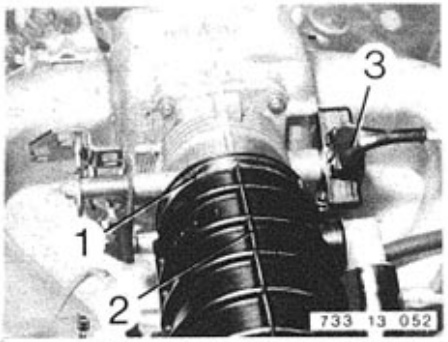
Pull off fuel pump relay (1).
Bridge terminals 87 and 30 with Special Tool 61 3 050.
Check fuel injection pressure*.

* See Specifications and Nominal Value Microfiche

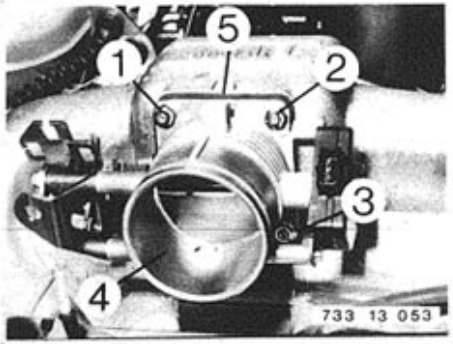


13 54 030 REMOVING AND INSTALLING THROTTLE HOUSING

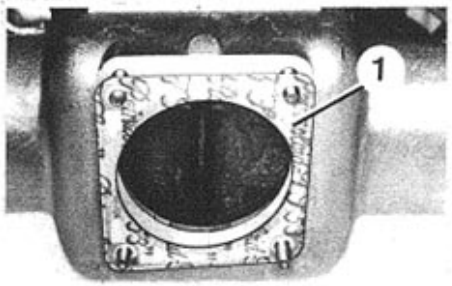
Disconnect cables (1 ... 3).
1 = Automatic transmission
2 = Accelerator pedal
3 = Cruise control motor
Installation:
Adjust cables – see Groups 24/35/65.



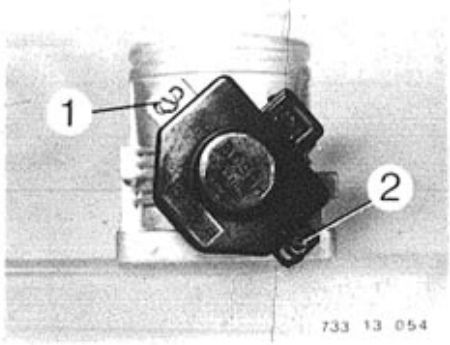
Loosen hose clamp (1) and push back hose (2).
Pull off plug (3) on throttle switch.



Unscrew screws (1 ... 4).
Take off throttle housing.
5 = Gasket

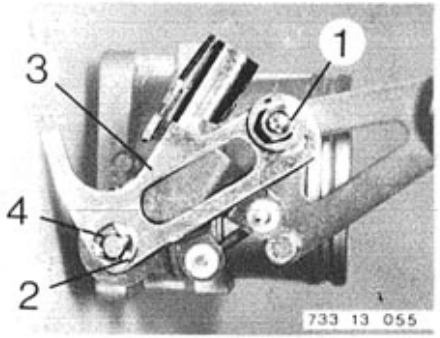


Installation:
Replace gasket (1).



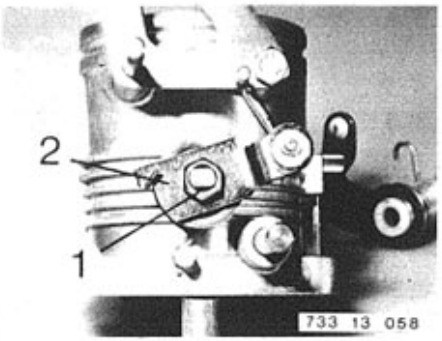
Unscrew screws (1 and 2).
Take off throttle switch.
Installation:
Adjust throttle switch 13 63 544.
Connect vacuum hoses again.
Check engine idle speed* and CO*.

* See Nominal Value Microfiche

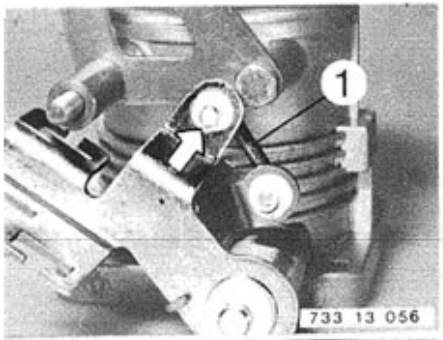


13 54 051 REPLACING THROTTLE SHAFT RETURN SPRINGS
– Throttle Housing Removed –

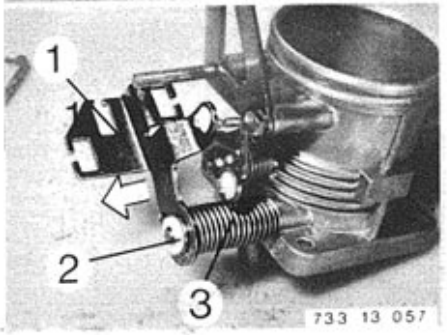
Unscrew nut (1).
Remove retainer (2).
Take off connector (3).
Important!
Watch out for shims (4) on both sides of the connector.



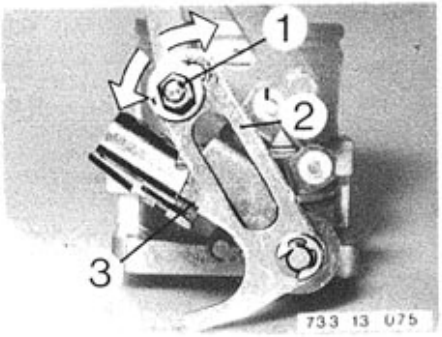
Unscrew nut (1).
Pull off lever (2) with shim and spring.
Important!
Be careful not to turn the attached throttle switch beyond the permissible gap angle when unscrewing the nut.
Installation:
Use spacer between lever (2) and housing.
Preload return spring with approx. 1/2 turn.



Disconnect connecting rod (1).

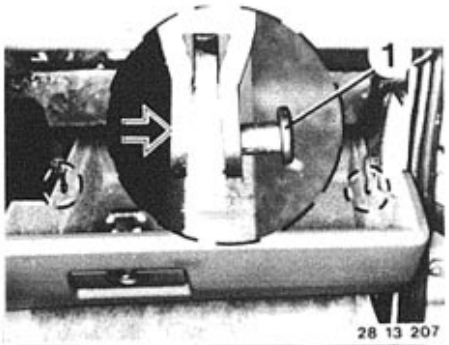


Remove lever (1) with plastic sleeve (2) and spring (3).
Caution!
Strong spring force.
Installation:
Preload spring with about 1/2 turn.

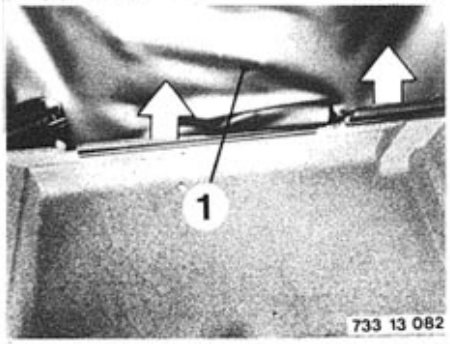


Basic Throttle Valve Adjustment:
Adjustments are only necessary after repairing.
Loosen screw (1).
Adjust connector (2) with stop (3) until there is slight clearance between housing and throttle valve.

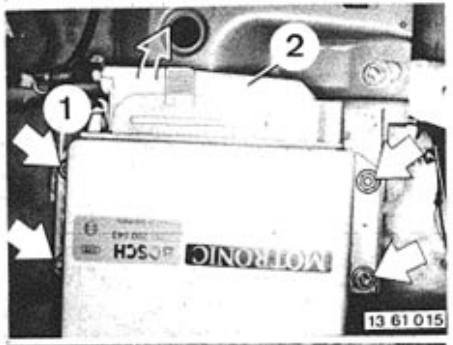
13 61 000 REMOVING AND INSTALLING CONTROL UNIT



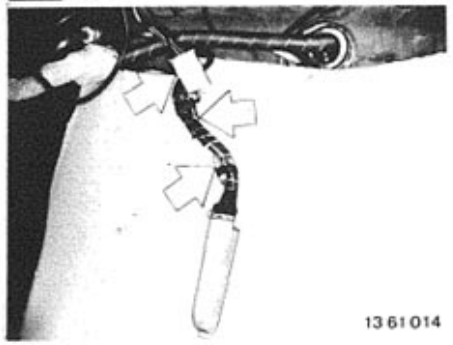
Open glove box.
Pull out pins (1) of both retaining straps.



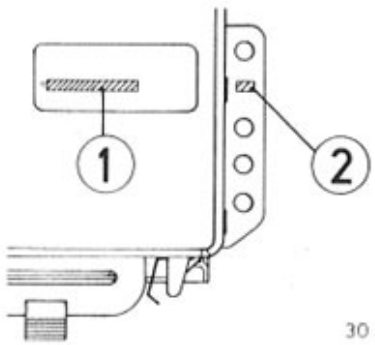
Unscrew trim panel.

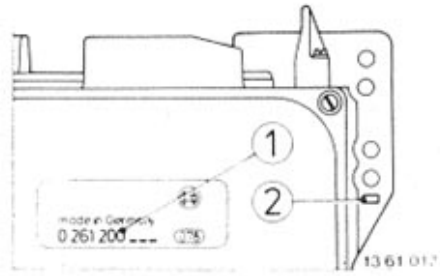


Press back retainer (1) and pull off plug (2).
Unscrew four mounting screws and take off control unit.



Connect plugs according to wiring diagram.



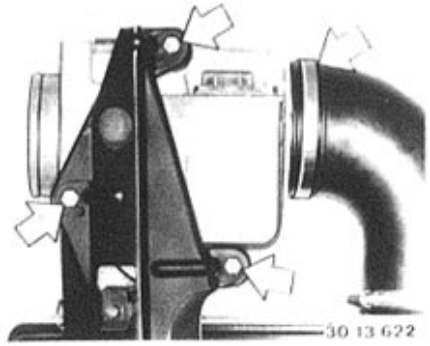


Installation:
Check code number (1)* and manufacturing date (2)*.

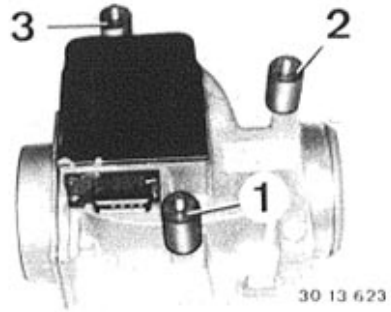
* See Specifications + Nom. Value Microfiche

13 62 000 REMOVING AND INSTALLING AIR FLOW SENSOR

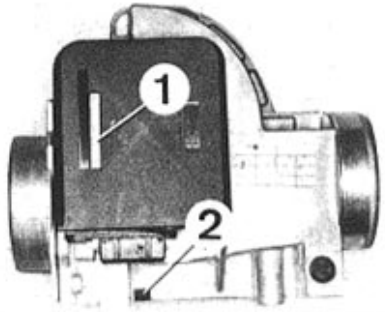
Remove and install air cleaner
Take air flow sensor off of air cleaner.


30 13 622

Unscrew silent mounts (1 — 3) on air flow sensor.
Check silent mounts, replacing if necessary.



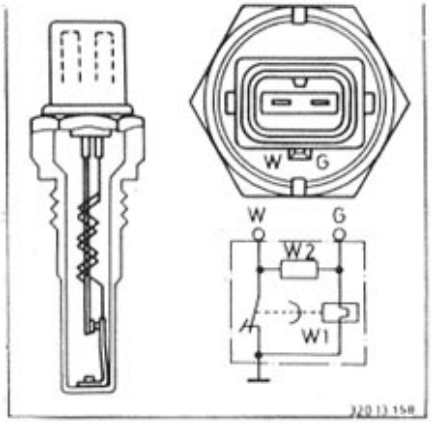
30 13 623



30 13 624

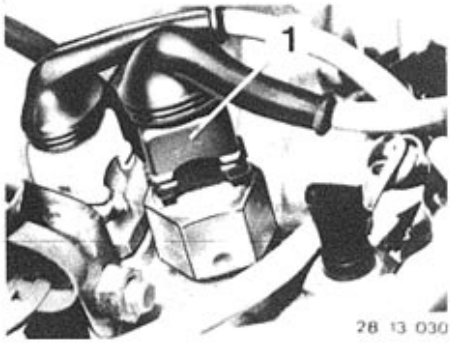
Installation:
Check code number (1)* and manufacturing date (2)*.
Check engine idle speed* and idle speed CO*.
Check air flow sensor*.

* See Specifications and nominal value microfilm

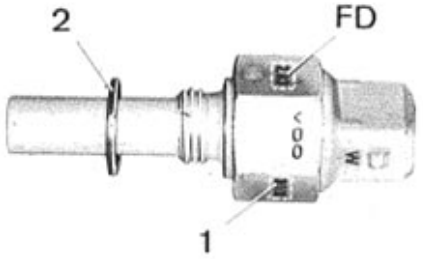


13 62 050 REMOVING AND INSTALLING/ CHECKING TEMPERATURE TIME SWITCH

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.



Removing and Installing:
Pull off plug (1).
Unscrew temperature time switch.
Installation:
Tightening torque*.



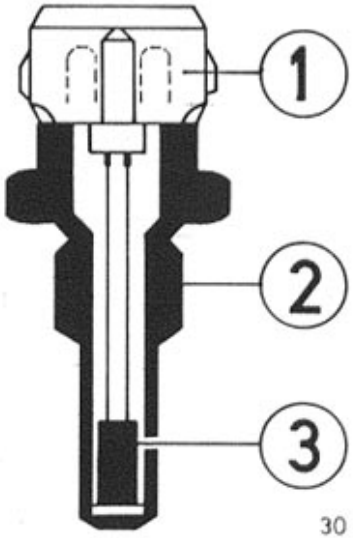
Installation:
Check code number (1)*.
Replace seal (2).
FD = Manufacturing date
Fill and bleed cooling system (Group 17).



Checking:
Connect Jetronic test lead 61 1 440.
Check nominal value* with 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

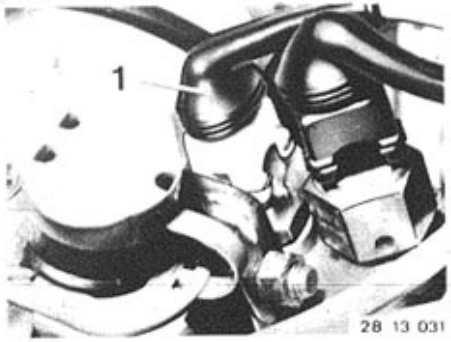
* See Specifications



30 13 625

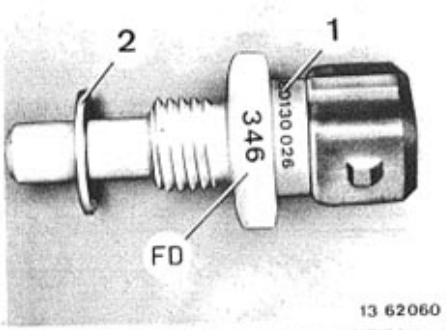
13 62 531 REMOVING AND INSTALLING/ CHECKING COOLANT TEMPERATURE SENSOR

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



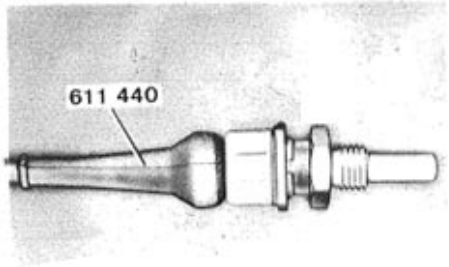
28 13 031

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).

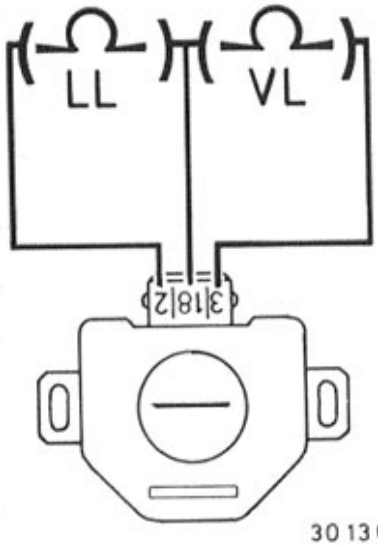


13 62062

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

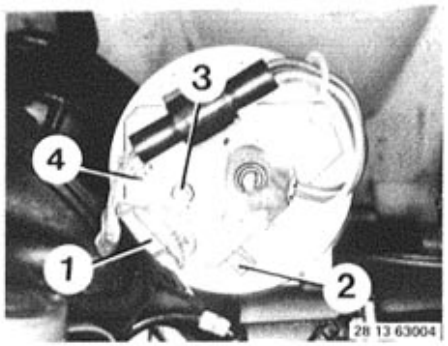


30 13 631

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.

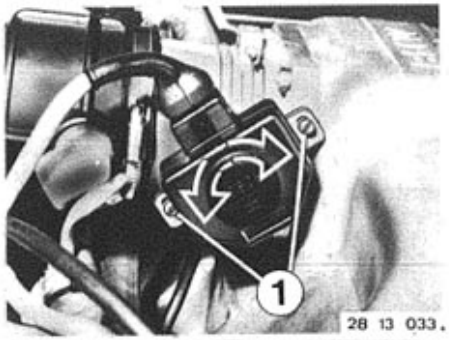
LL = Idle speed
VL = Full load



28 13 63004

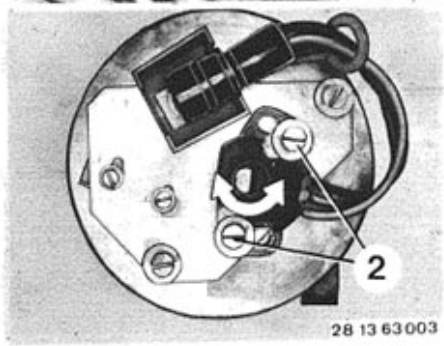
Checking/Adjusting Throttle Potentiometer:
Pull off multiple-pin plug on transmission control unit.
Connect test adapter with test lead between control unit and wire harness.
Turn on ignition.
Accelerator pedal in full load position as well as kickdown.

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.



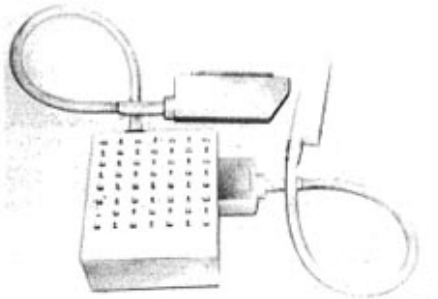
28 13 033

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

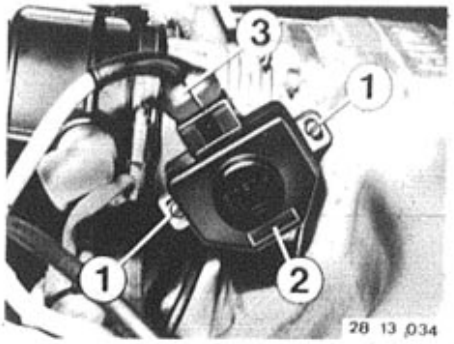
Adjusting Idle Speed Switch:
Pull off rubber protective cap.
Pull off plugs (1 and 2).
Connect ohmmeter on plug connections.
Loosen screws (4 and 3).
Move switch until ohmmeter displays approx. 0 ohm.
Tighten screws (4 and 3).
Operating the throttle valve must cause the idle speed switch to switch immediately 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).



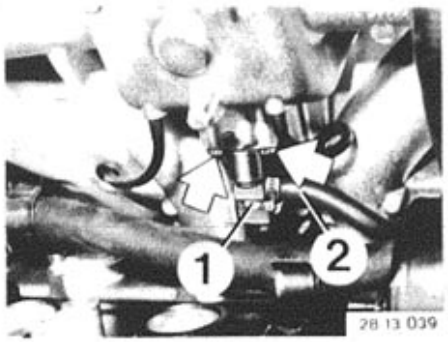
13 63 551 REMOVING AND INSTALLING THROTTLE SWITCH

Pull off multiple pin plug (3).
Unscrew screws.
Remove throttle switch (2).



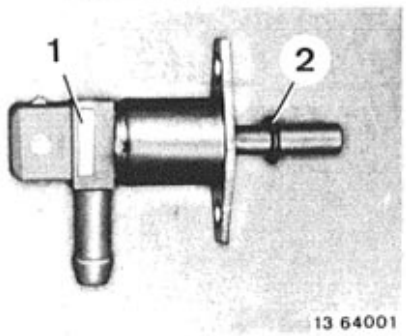
Installation:
Check code number (1)*.
Adjust throttle switch 13 63 544.

* See Specifications



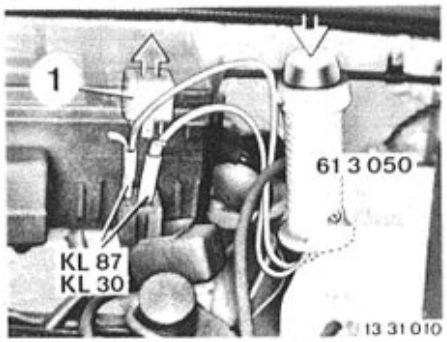
13 64 030 REMOVING AND INSTALLING COLD START VALVE

Removing and Installing:
Pull off plug (1).
Unscrew fuel line (2).
Unscrew bolts.
Take off cold start valve.

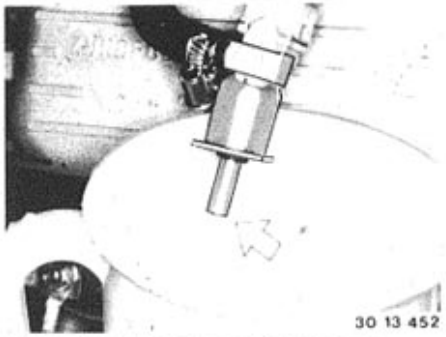


Installation:
Check code number (1)*.
Replace seal (2).

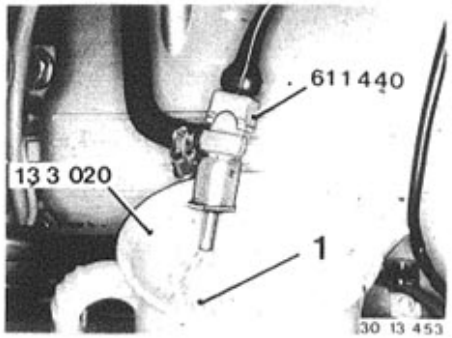
Checking:
Unscrew cold start valve on intake housing.
Fuel line remains connected.



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.



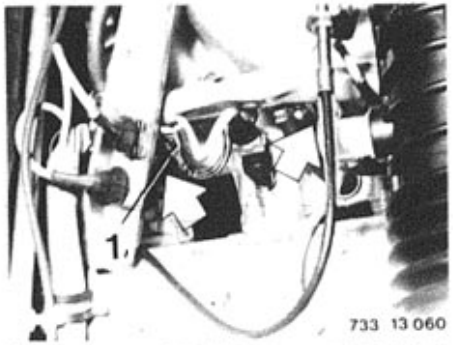
Leak Test:
Check permissible leak rate*.



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)*.

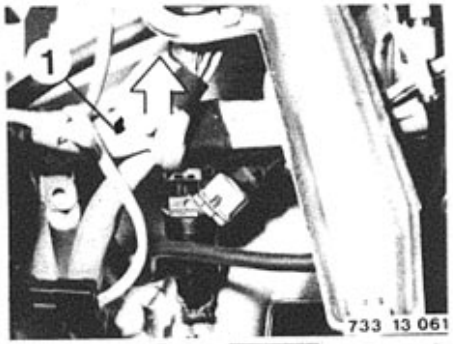
* See Specifications

* See Specifications

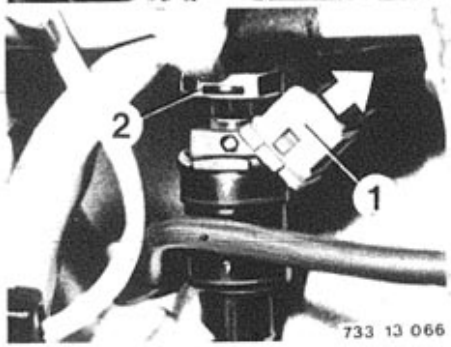


13 64 501 REPLACING ONE FUEL INJECTOR

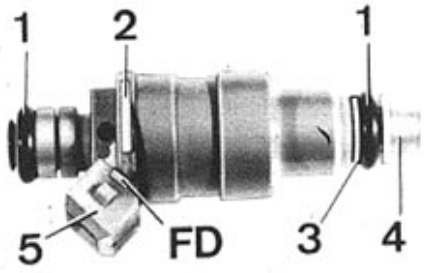
Unscrew four screws on injection tube.
Installation:
Mount ground wire with screw (1).



Push up injection tube (1) until fuel injectors have cleared the guide in the intake manifold.

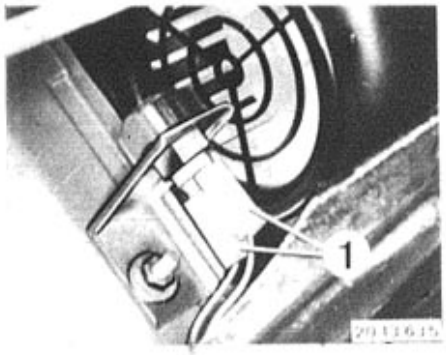


Pull off plug (1).
Lift out retainer (2) and remove fuel injector.



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

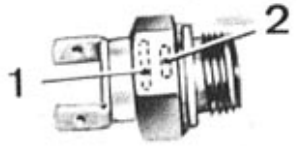


2013615

12 63 051 REMOVING AND INSTALLING 0° C (32° F) TEMPERATURE SWITCH

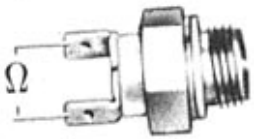
Pull off plug (1).
Unscrew temperature switch.
Installation:
Tightening torque: max. 30 Nm (22 ft. lbs.).

Installation:
Check code number (1)* and switching point (2)*.



2013633

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

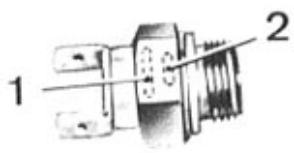


2013619

12 63 060 REMOVING AND INSTALLING 45° C (113° F) TEMPERATURE SWITCH

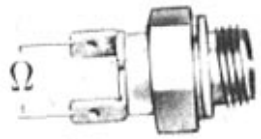
Pull off plug (1).
Remove temperature switch.
Installation:
Tightening torque: max. 30 Nm (22 ft. lbs.).
Fill and bleed cooling system (Group 17).

Installation:
Check code number (1)* and switching point (2)*.



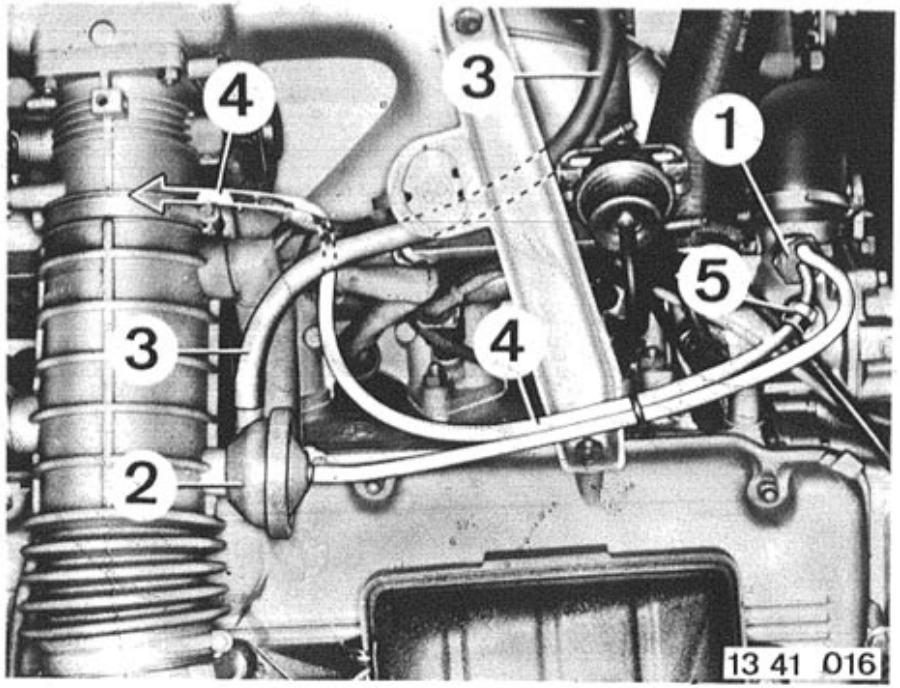
2013613

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 ≤ 30° 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 ≤ 30° 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 ≥ 48° 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?

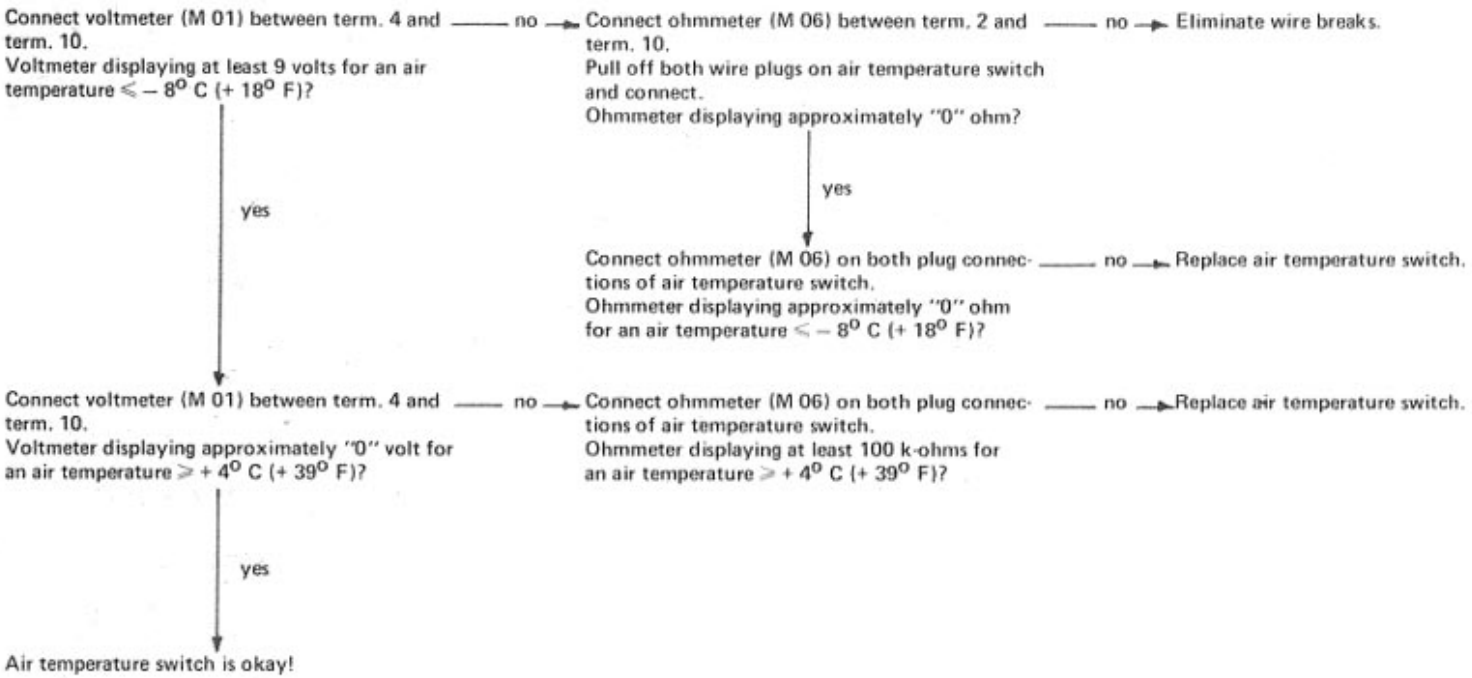
yes ↓

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 ≥ 48° 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

Check electric fuel pump – crank engine with starter. → Pump not running → Check fuse in power distributor. → Check wires (M 06)** if fuse is blown.

Check electric fuel pump – crank engine with starter.
↓
Pump running.
↓
Check pressure – see 13 31 029 in Group 13.
↓
Check routing and flow of fuel lines.

Pump not running
↓
Crank engine with starter and check voltage (approx. 12 V) on connections of electric fuel pump (M 01)
↓
Electric fuel pump defective – replace, see 13 31 030 in Gr. 13.

Check fuse in power distributor.
↓
Measure fuel pump power consumption (M 03)*.
↓
Pull off fuel pump relay.
Bridge terminals 30 and 87 with Special Tool 61 3 050.
– Fuel pump runs.
Check control lead** (term. 85 – ground on control unit/term. 86 – approx. 12 V via relay term. 87).
Crank engine with starter for this test.
Replace relay, if necessary.
– Fuel pump does not run.
Check wires** to fuel pump.

Check wires (M 06)** if fuse is blown.
↓
Measure fuel pump power consumption (M 03)*.
↓
Pull off fuel pump relay.
Bridge terminals 30 and 87 with Special Tool 61 3 050.
– Fuel pump runs.
Check control lead** (term. 85 – ground on control unit/term. 86 – approx. 12 V via relay term. 87).
Crank engine with starter for this test.
Replace relay, if necessary.
– Fuel pump does not run.
Check wires** to fuel pump.

* 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)	Term. W and Ground (Housing)
15° C 8 s	+ 10	+ 20	50 ... 70 50 ... 70	0 ∞
35° C 8 s	+ 30	+ 40	25 ... 40 50 ... 80	0 100 ... 200
35° C 12 s	+ 30	+ 40	25 ... 80 50 ... 100	0 200 ... 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.

↓

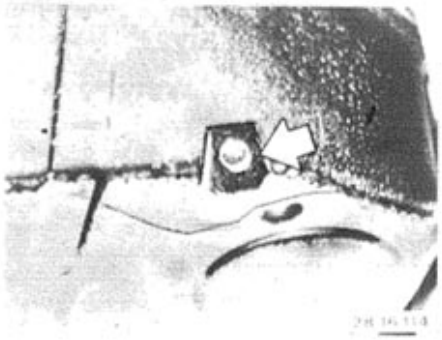
Electric Test:
Check air flow sensor with universal test adapter and wire harness connection (35 pins). → Replace air flow sensor.
Test values*.

* See Specifications
** See Wiring Diagram

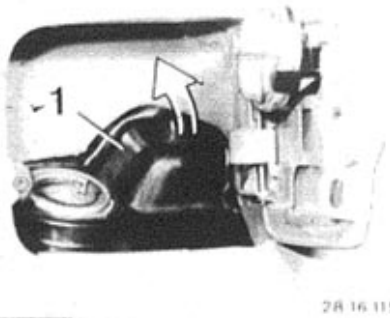
16 Fuel tank and lines

16 11 030	Fuel tank – remove and install	16- 1
031	Fuel tank – replace	16- 2
120	Expansion tank – remove and install	16- 3
16 12 002	Fuel intake (level transmitter) – remove and install or replace	16- 4
010	Charcoal canister – replace	16- 5
16 12 . . .	Fuel intake / level transmitter – checking	16- 5

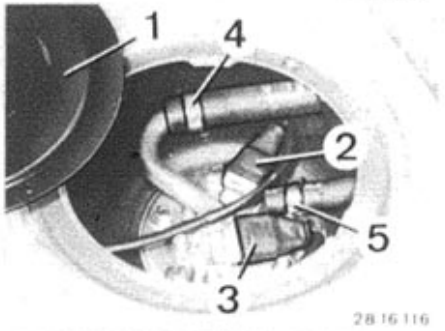
16 11 030 REMOVING AND INSTALLING FUEL TANK



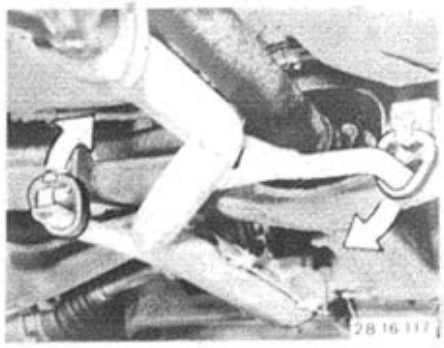
Empty fuel tank with a scavenging pump** or unscrew drain plug if necessary.
Caution!
Conform with safety regulations when draining and filling fuel tank.
Installation:
Tightening torque*.



Pull off cover (1).
Loosen hose clamps and pull off vent lines.

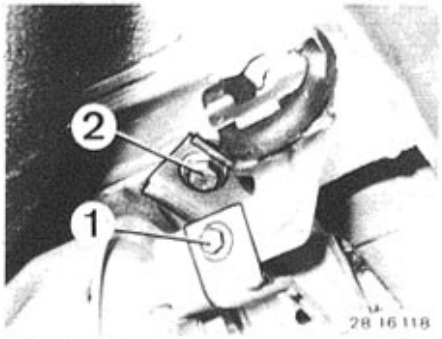


Remove trunk mat.
Unscrew cover (1).
Pull off plugs (2 and 3).
Loosen hose clamps (4 and 5) and pull off fuel lines.
Installation:
Use new hose clamps.

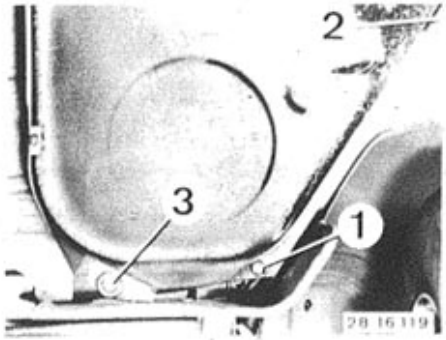


Disconnect rubber suspension ring of muffler assembly.

* See Specifications
** Source: HWB



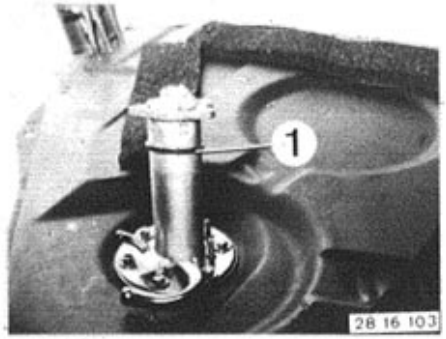
Prevent final muffler from falling down (wire).
Unscrew bolt (1).
Unscrew tank mounting bolt (2).
Installation:
Tightening torque*.



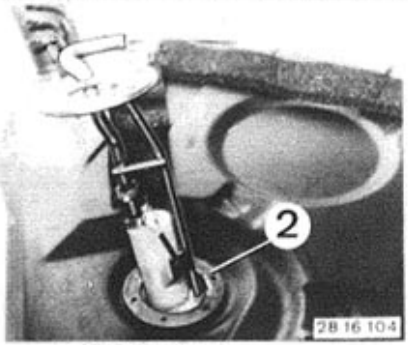
Prevent fuel tank from falling down.
Cut straps (1).
Unscrew bolts (2 and 3).
Remove fuel tank.
Installation:
Tightening torque*.

* See Specifications

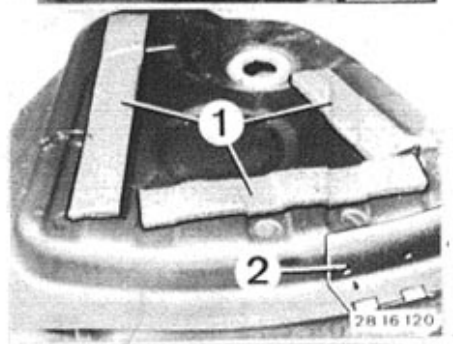
16 11 031 REPLACING FUEL TANK



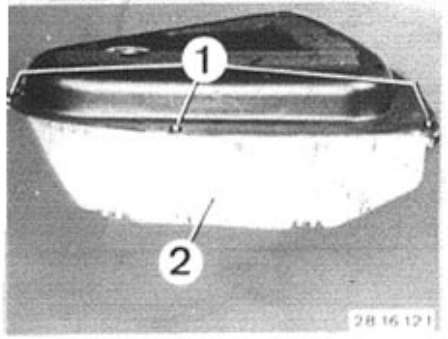
Removing and installing fuel tank 16 11 030.
Unscrew nuts and pull out fuel level transmitter.
Installation:
Replace gasket (1).



Unscrew bolts.
Pull out fuel intake.
Installation:
Replace gasket (2) if necessary.



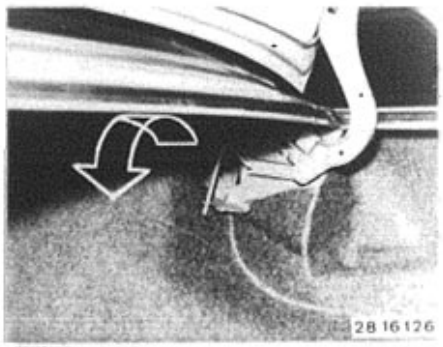
Install liners (1).
Screw on guard (2).



Unscrew and transfer bolts (1) for heat shield (2).

16 11 120 REMOVING AND INSTALLING EXPANSION TANK

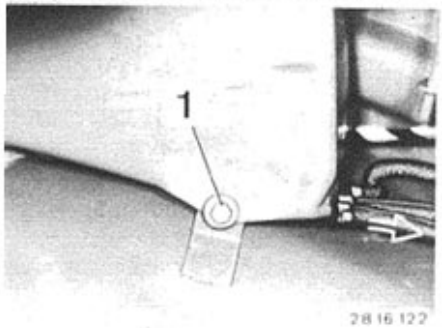
Remove trim panels in trunk.



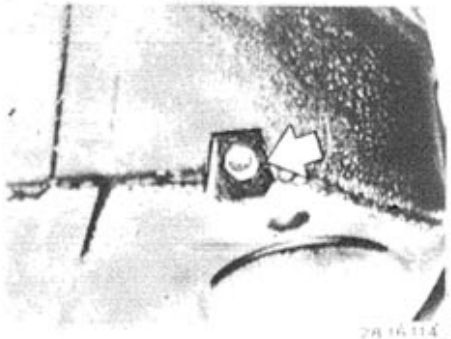
Unscrew bolts (1) and pull off lines.

Installation:

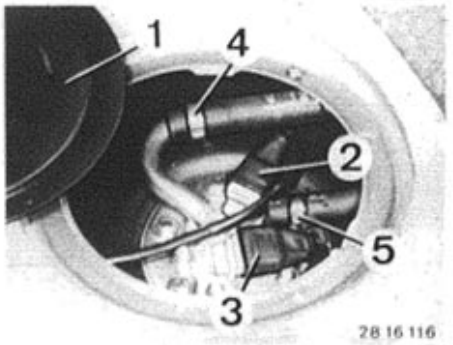
Use new hose clamps.



16 12 002 REMOVING AND INSTALLING/ REPLACING FUEL INTAKE (LEVEL TRANSMITTER)

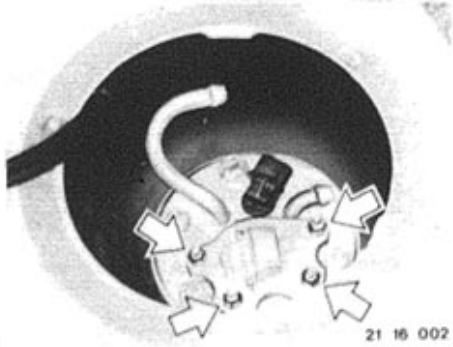


If fuel tank is full, drain some of gasoline with a scavenging pump** or through drain plug opening, if necessary.
Caution!
Conform with safety regulations.

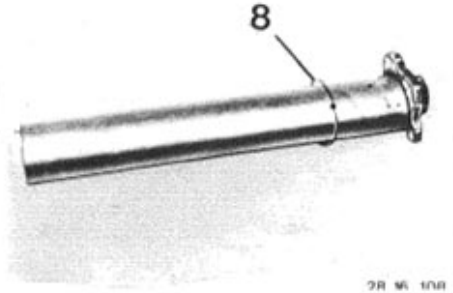


28 16 116

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.

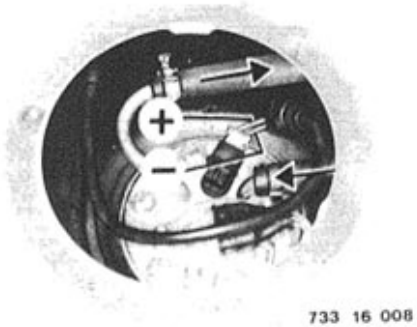

21 16 002

Unscrew nuts and pull out level transmitter.
Installation:
Replace gasket



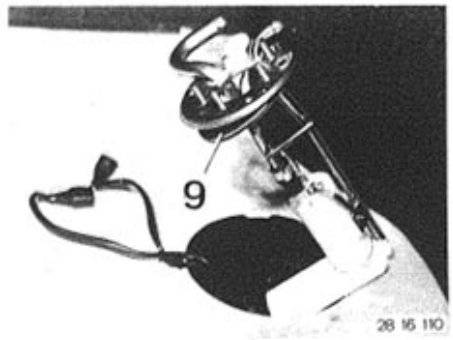
If replacing fuel level transmitter, remove transportation guard (8).

** Source: HWB



733 16 008

Unscrew screws
Pull out fuel intake.



28 16 110

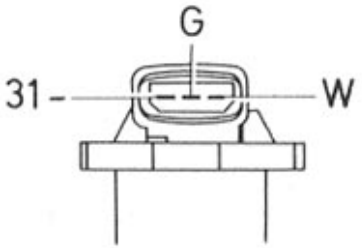
Installation:
Clean filter screen if necessary.
Replace gasket (9).



28 16 125

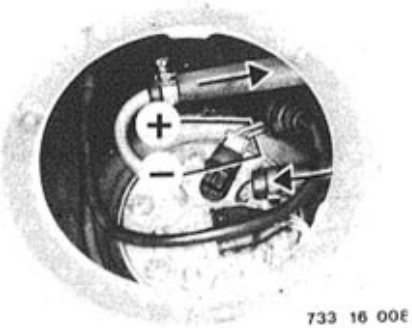
16 12 010 REPLACING CHARCOAL CANISTER

Loosen hose clamp (1) and pull off lines.
Unscrew bolt (2)
Pull out canister.
Installation:
Use new hose clamp.



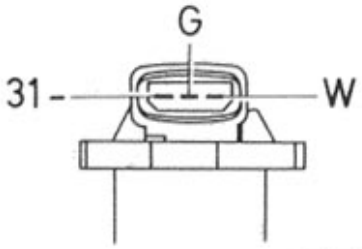
28 16 131

There must be connection between W and 31 in float position EMPTY.



733 16 008

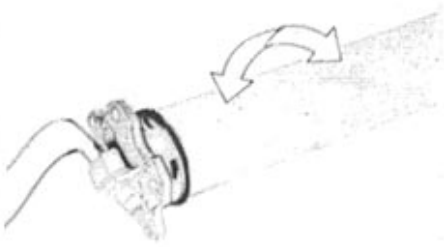
Electric power is supplied to the fuel transfer pump via the fuel pump relay (relay 1) – see engine electrical equipment wiring diagram. Check by measuring power input* and delivery pressure*.



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.

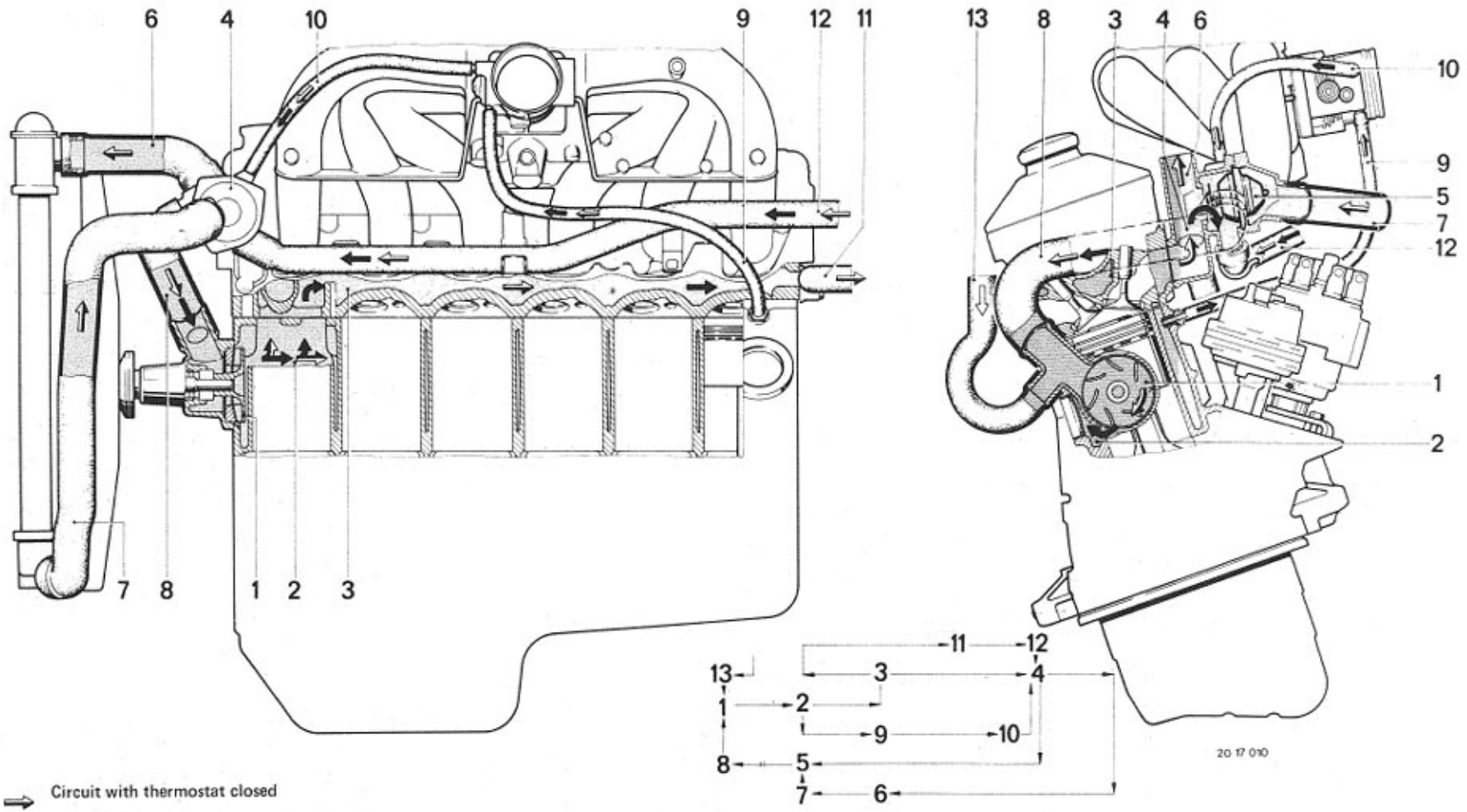
* See Specifications

* See Specifications

17 Radiator

	Coolant circuit – 528 e	17- 1
	Coolant circuit – 533 i / 535 i	17- 2
	Coolant circuit – 524 td	17- 3
17 00 009	Cooling system – check for leaks (with tester)	17- 4
010	Leakage between cooling system and combustion chamber – check	17- 4
039	Cooling system – bleed	17- 4
17 11 000	Radiator – remove and install	17- 5
100	Coolant expansion tank – remove and install	17- 6
509	Radiator – flush	17- 6
17 40 000	Extra fan assembly – remove and install	17- 7
17 11 150	Oil cooler – remove and install	17- 8

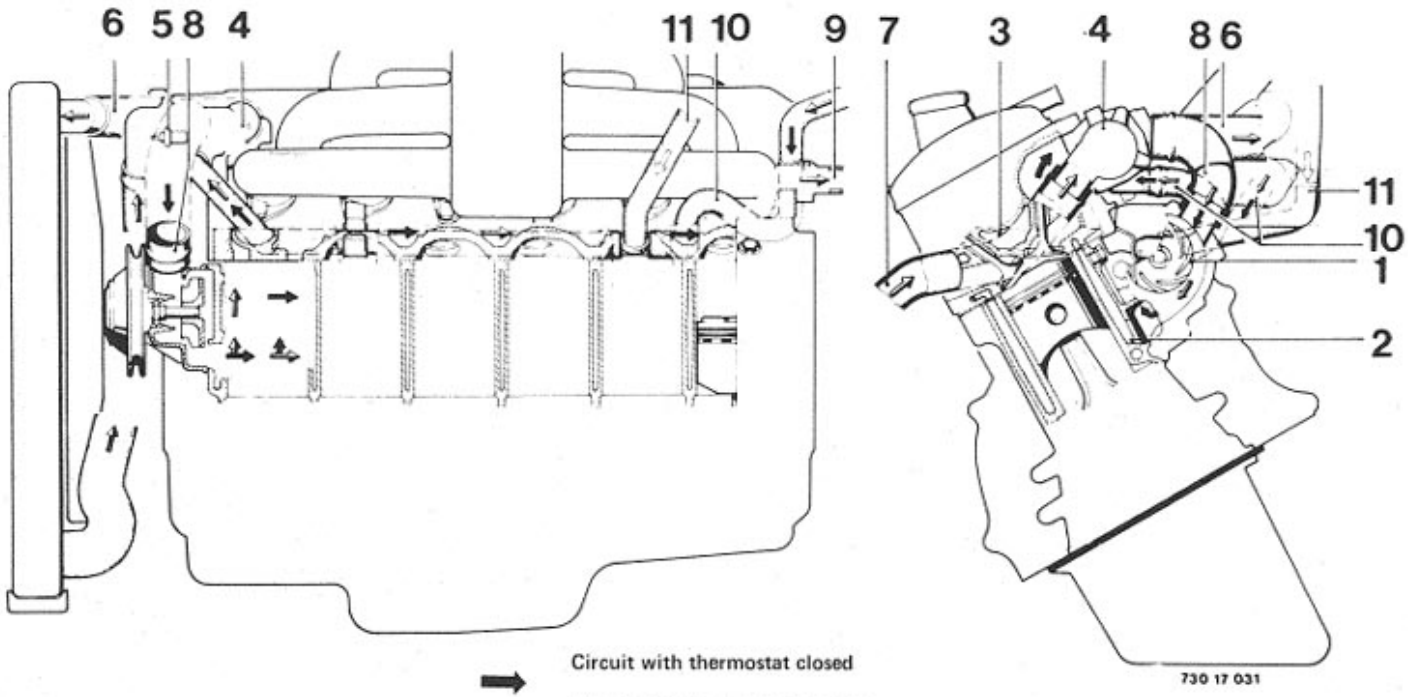
COOLANT CIRCUIT – BMW 528 e



Circuit with thermostat closed

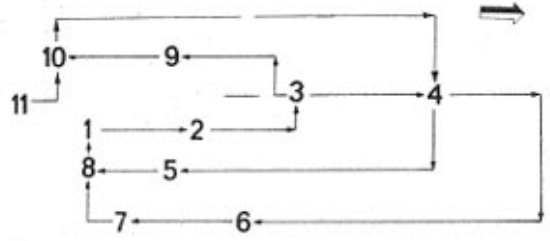
Circuit with thermostat opened

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



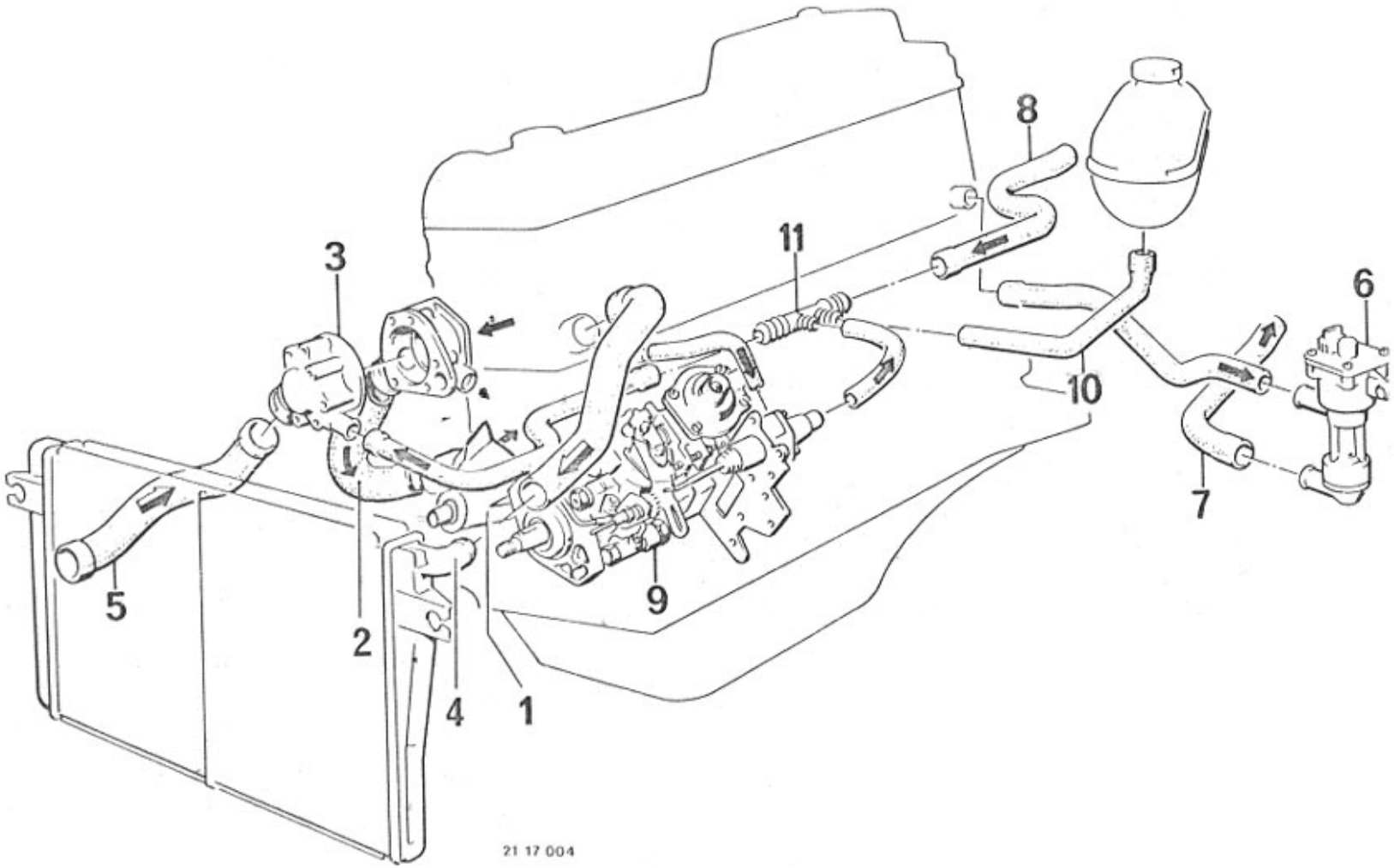
Circuit with thermostat closed

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

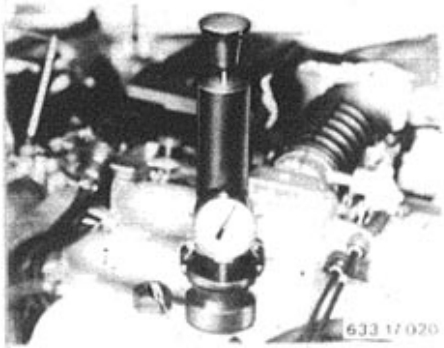
COOLANT CIRCUIT – BMW 524 td



Circuit with opened thermostat

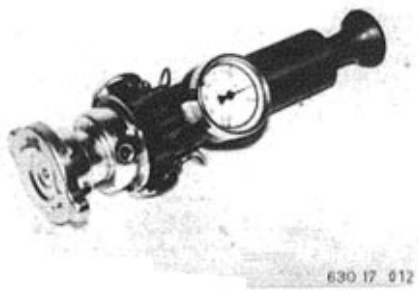
Circuit with closed thermostat

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

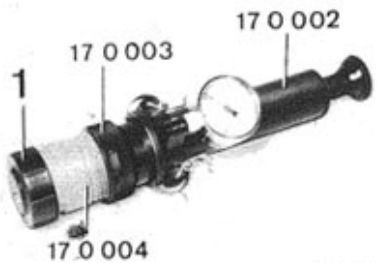


17 00 009 CHECKING COOLING SYSTEM FOR LEAKS

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.

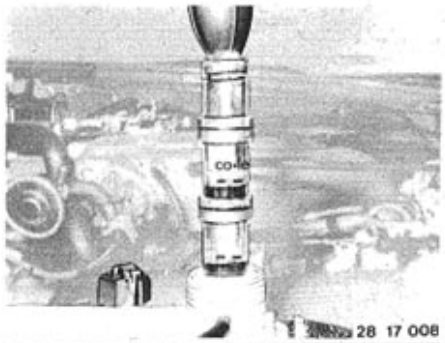


Checking Cooling System Screw-On Cap:
Assemble adapter 17 0 003, connector 17 0 004, cap (1) and tester 17 0 002.
Check opening pressure* of safety valve.



Lift vacuum valve slightly and check for correct fit.
Check gasket, replacing if necessary.

See Specifications



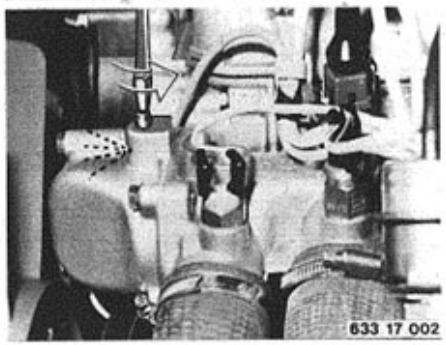
17 00 010 CHECKING FOR LEAKS BETWEEN COOLING SYSTEM AND COMBUSTION CHAMBER

Run engine to operating temperature.
Fill "tester for cylinder head gasket"** and perform test (see intructions supplied with equipment).

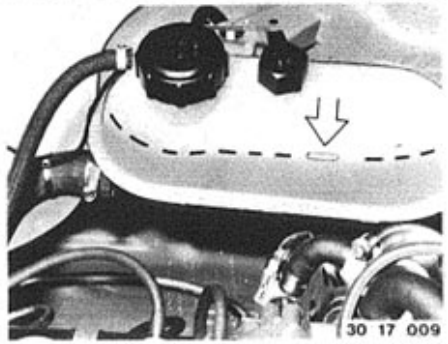


17 00 039 BLEEDING COOLING SYSTEM

Requirements:
Engine at operating temperature.
Heater set to "WARM".
Engine running at fast idle speed.



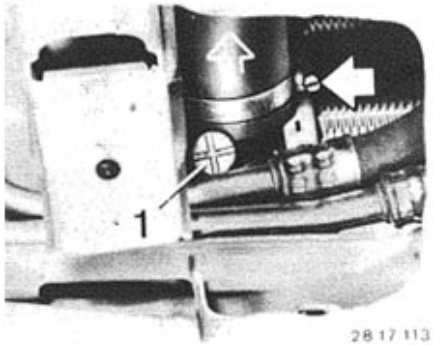
Loosen bleeder screw and tighten again when escaping coolant is without air bubbles.
Keep expansion tank full while bleeding.
See Service Information of Group 00 for coolant specifications.



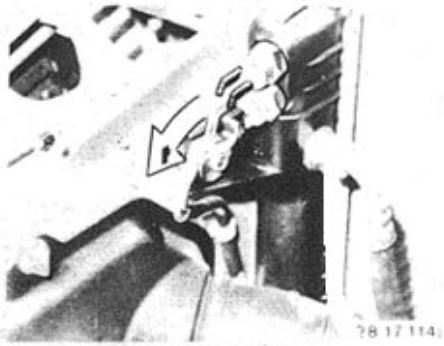
Mark on expansion tank shows the full level for cold coolant (approx. 20° C / 68° F).

** Source: HWB

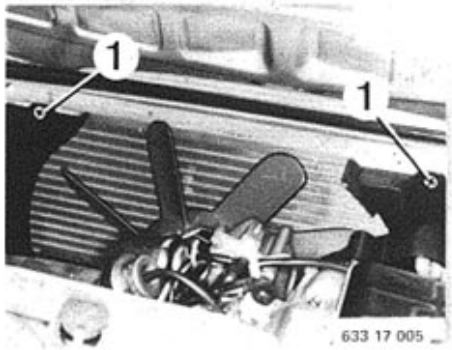
17 11 000 REMOVING AND INSTALLING RADIATOR



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.

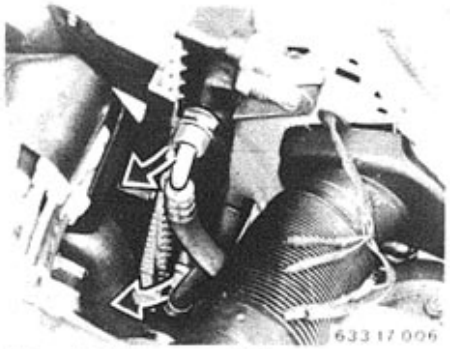


Pull off plugs on temperature switches.

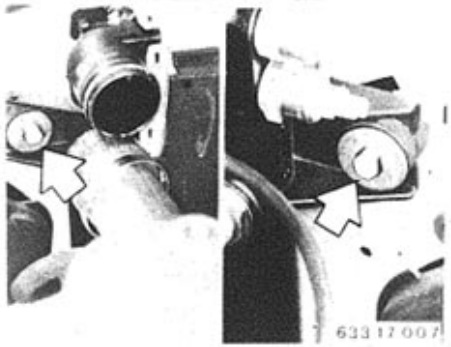


Unscrew fan cowl mounting screws (1).
Loosen hose clamps and pull off hoses.

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

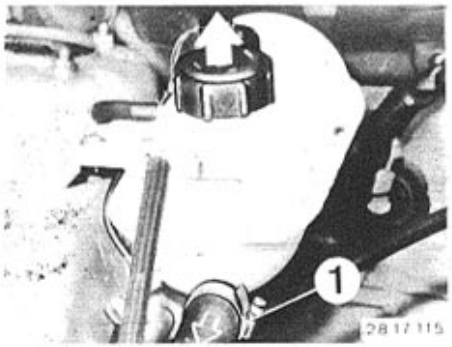


Cars with Automatic Transmission:
Unscrew oil lines on radiator.
Installation:
Tightening torque*.
Check ATF level, see 24 00 009.



Unscrew mounting bolts on right and left sides.
Disconnect cable.
Lift out radiator.
Installation:
Check rubber mounts for correct installation.

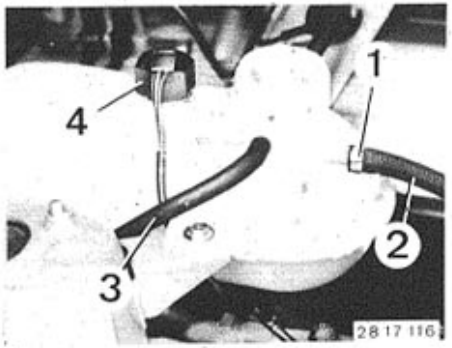
* See Specifications



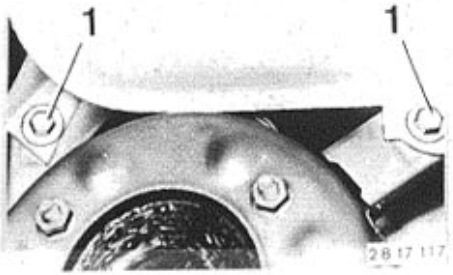
17 11 100 REMOVING AND INSTALLING COOLANT EXPANSION TANK

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

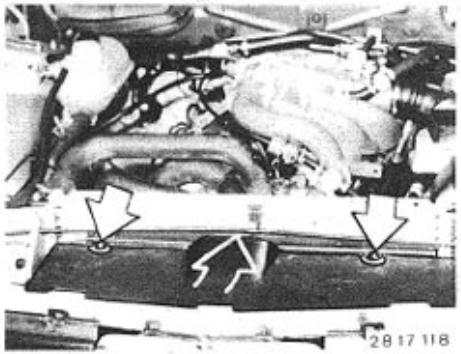
17 11 509 FLUSHING RADIATOR

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.

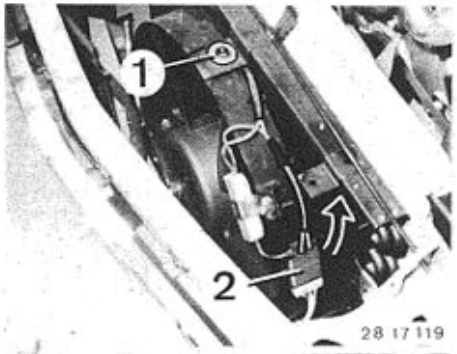
Caution!
Solvethane attacks rubber seals, hoses etc. and consequently must not be permitted to enter or remain in cooling system.
Always conform with safety measures for handling solvethane (printed on cans).
Also refer to Service Information 11 03 80 (660)

* Source: HWB, No. 81 22 9 400 702

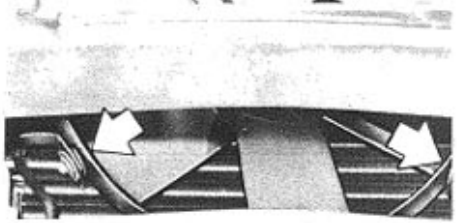
17 40 000 REMOVING AND INSTALLING EXTRA FAN ASSEMBLY



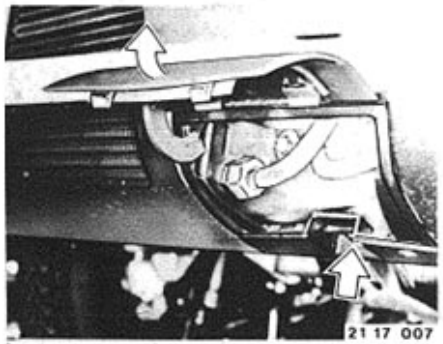
Pull out retainers from above and remove trim panel.



Unscrew nut (1).
Disconnect plug (2).

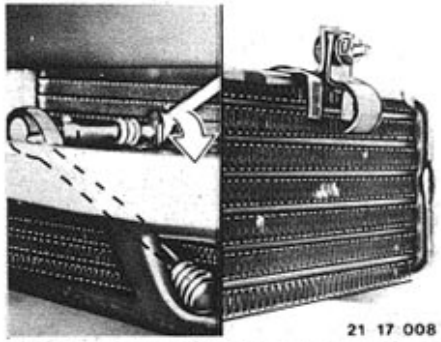


Unscrew nuts.
Remove extra fan from above.

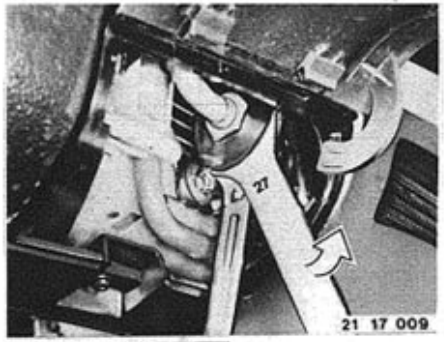

21 17 007

17 11 150 REMOVING AND INSTALLING ENGINE OIL COOLER

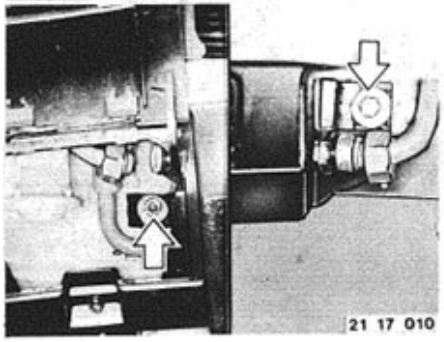
BMW 524 td
Fold open both covers.
Unscrew trim panel on left side.


21 17 008

Unscrew line holder.

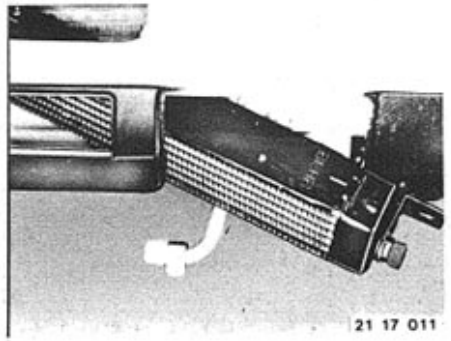

21 17 009

Unscrew coupling nuts (size 27 mm wrench).
Hold on hexagon of oil cooler with a 22 mm open-ended wrench.
Catch escaping oil (approx. 0.5 ltr./1 pint).
Installation:
Tightening torque*.
Only add same amount of oil which had run out during removal.


21 17 010

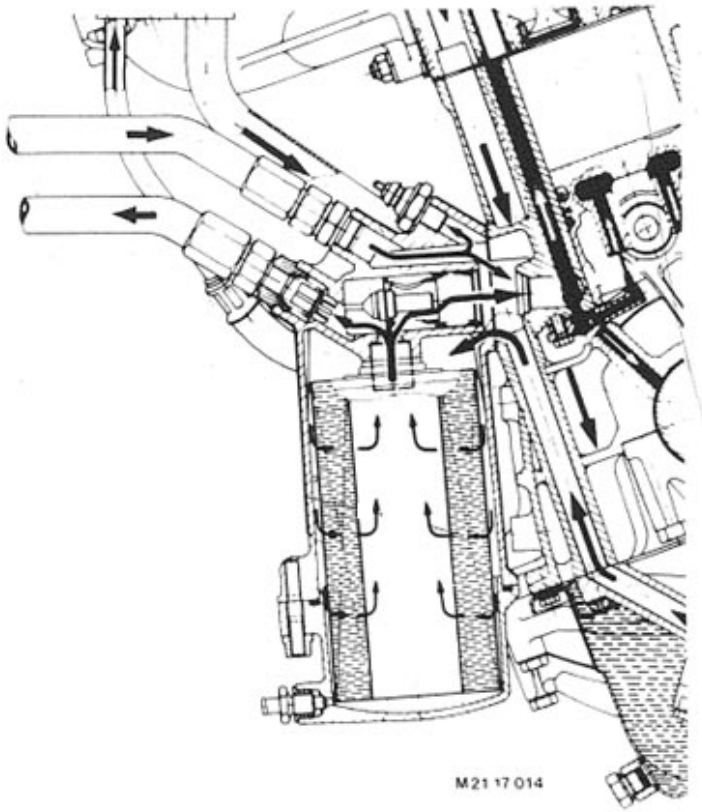
Unscrew bolts (1 and 2).
Installation:
Tightening torque*.

* See Specifications


21 17 011

Lift out oil cooler.

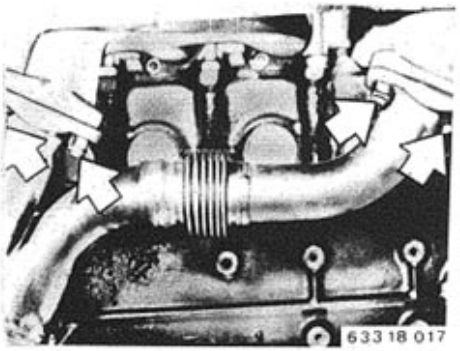
The system is bled automatically.
The oil cooler is switched into the engine oil circuit at oil temperature of approx. 95° C (203° F). Volume of engine oil cooler incl. hoses is approx. 0.75 ltr. (1.5 pints).


M21 17 014

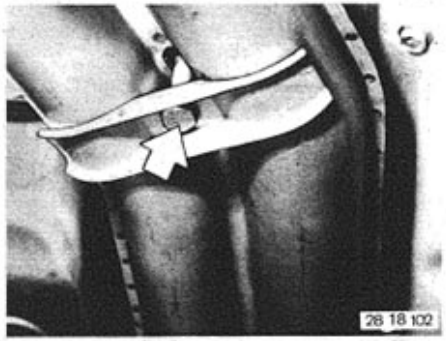
18 Exhaust system

18 00 020	Exhaust assembly – remove and install	18- 1
18 12 011	Muffler assembly (intermediate and final mufflers) – replace	18- 3
031	Final muffler – replace	18- 4

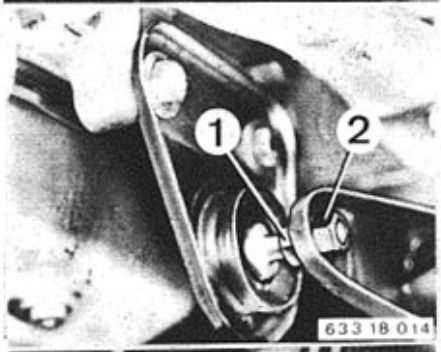
18 00 020 REMOVING AND INSTALLING EXHAUST ASSEMBLY



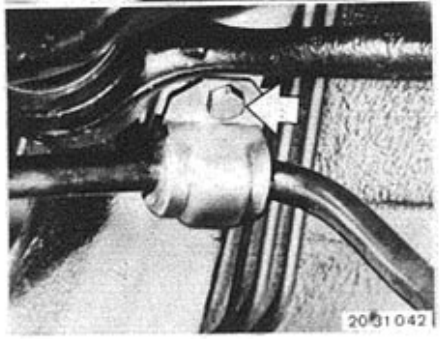
Remove oxygen sensor (see 11 78 510) to avoid damage on same.
Unscrew front exhaust pipes on exhaust manifolds.
Installation:
Check gaskets, replacing if necessary.
Coat studs with CRC** copper paste.
Replace self-locking nuts.
Tightening torque*.



Unscrew pipe clamp.

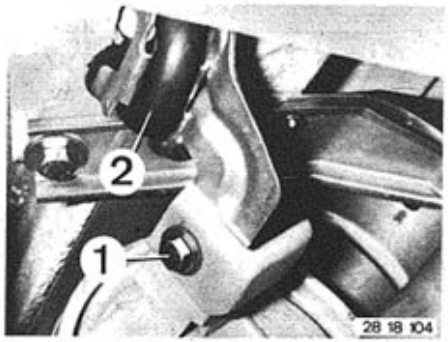


Since 1984 Models:
Unscrew nut (2).
Installation:
Mount exhaust assembly without tension by adjusting nut (1).
Tighten nut (2).

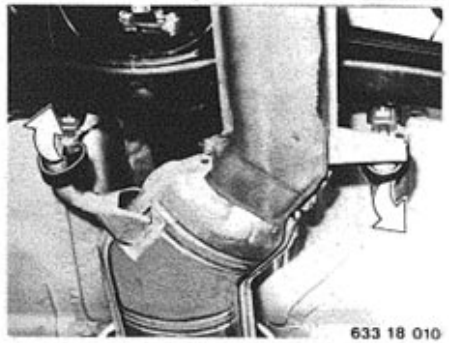


Since 1984 Models with Automatic Transm.:
Unscrew stabilizer on body at left and right sides.
Installation:
Tightening torque*.

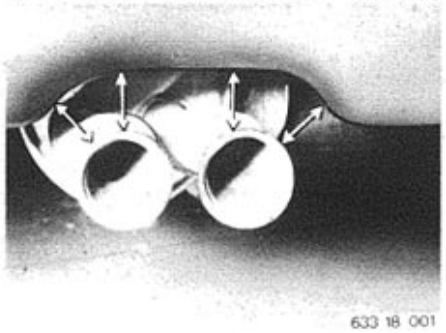
* See Specifications
** Source: HWB



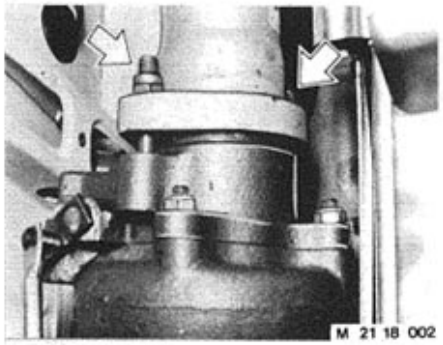
Unscrew bolt (1).
Remove exhaust assembly.
Installation:
Check rubber ring (2), replacing if necessary.



Disconnect rubber rings.
Take off exhaust assembly.
Installation:
Replace rubber rings if necessary.

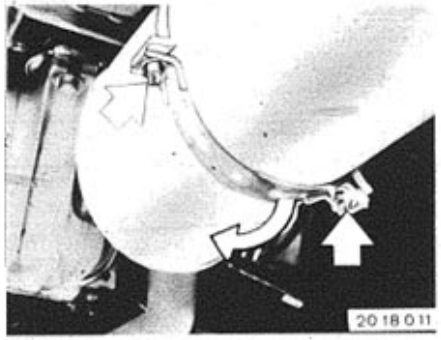


If necessary, correct distance between tailpipes and body by adjusting holders.

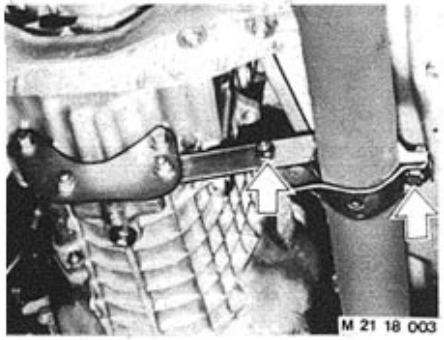


18 00 020 REMOVING AND INSTALLING EXHAUST ASSEMBLY

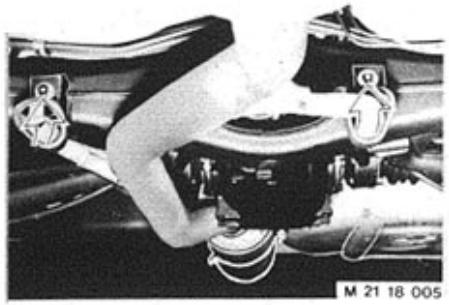
BMW 524 td:
Unscrew exhaust pipe on turbocharger.
Installation:
Coat threads with copper paste "CRC"**.
Tightening torque*.



Unscrew and swing away clamp on muffler.
Installation:
Check rubber ring, replacing if necessary.
Tightening torque*.

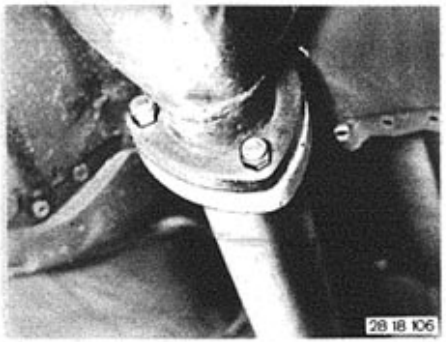


Unscrew holder for exhaust pipe.



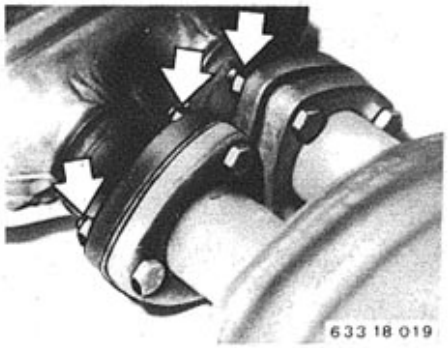
Disconnect rubber rings.
Take off exhaust assembly.
Installation:
Check rubber rings, replacing if necessary.
Keep distance to rear axle and body, correcting if necessary.

* See Specifications

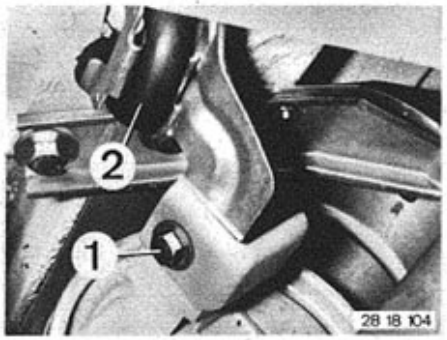


18 12 011 REPLACING MUFFLER ASSY (INTERMEDIATE AND FINAL MUFFLERS)

BMW 528 e:
Unscrew bolts on triangular flange.
Installation:
Replace self-locking nuts.
Check gasket, replacing if necessary.
Tightening torque*.

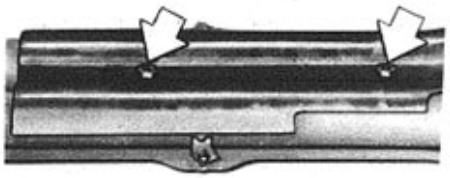


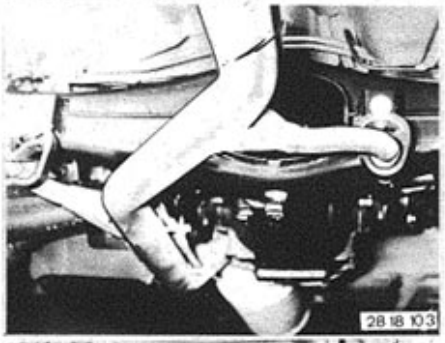
Unscrew nuts.
Installation:
Replace seals.
Replace self-locking nuts.
Tightening torque*.



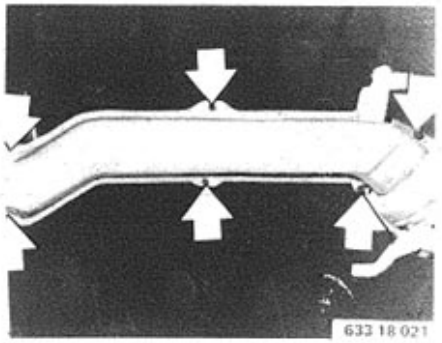
Unscrew bolt (1).
Installation:
Check rubber ring (2), replacing if necessary.

Transfer upper heat shield.

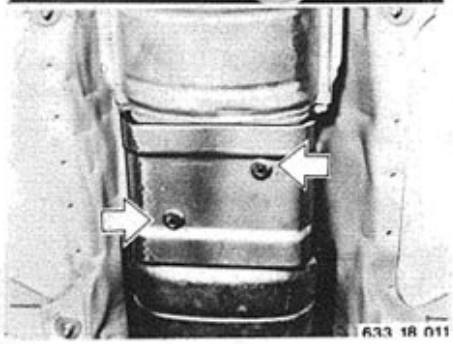




Disconnect rubber rings.
Remove exhaust assembly.
Transfer heat shield.
Installation:
Replace rubber rings if necessary.
Correct distance between tailpipe and body by adjusting holders.



Transfer lower heat shield.

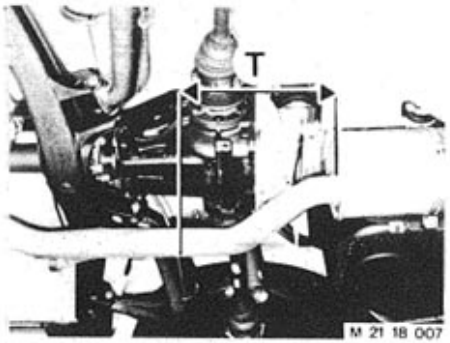


BMW 533 i:
Remove and install exhaust assembly 18 00 020.
Unscrew bolts.

* See Specifications

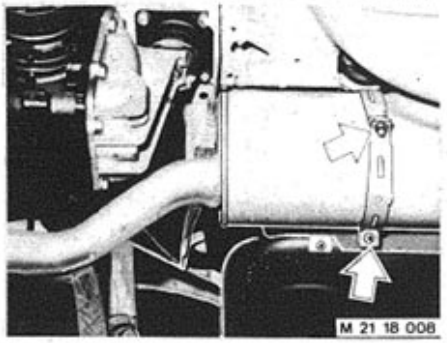
* See Specifications

18 12 031 REPLACING FINAL MUFFLER



BMW 524 td:
Mark cutting point "T" and cut exhaust pipe with Special Tool 00 2 200.
Deburr cut edges.

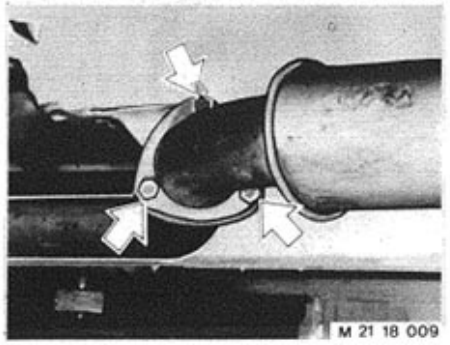
T = 400 mm (15.748")



Unscrew clamp and take off muffler.
Installation:
Check rubber ring, replacing if necessary.
Tightening torque*.

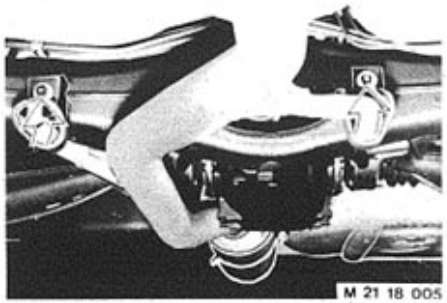


Install new final muffler and move to correct installed position.
Slide on sleeve and tack weld on both ends.

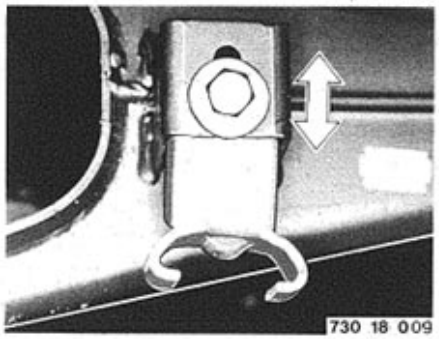


Remove muffler assembly again.
Installation:
Replace self-locking nuts.
Check seal, replacing if necessary.
Tightening torque*.

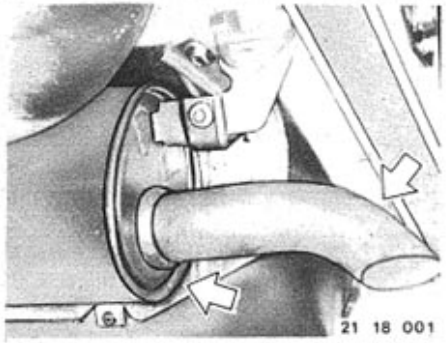
* See Specifications



Disconnect and remove muffler assembly.
Weld sleeve all around.
Installation:
Check rubber rings, replacing if necessary.

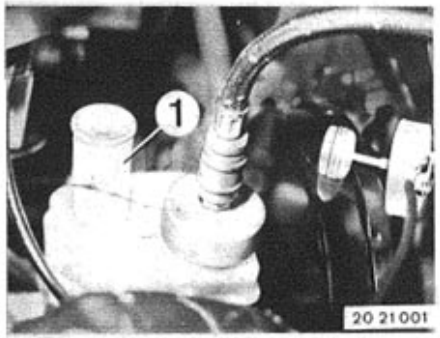


Installation:
Check installed position and distance to rear axle and body, correcting on holder if necessary.



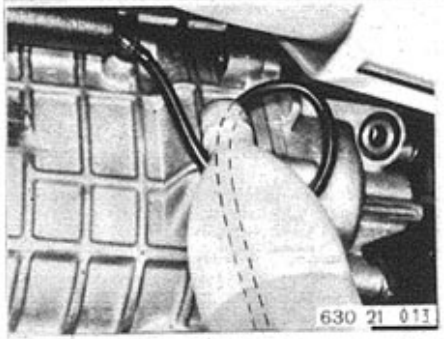
21 Clutch

21 00 006	Clutch – bleed	21- 1
21 11 000	Clutch housing – remove and install	21- 1
21 21 000	Clutch disc – remove and install	21- 2
565	Drive plate – check for lateral runout	21- 3
21 51 000	Clutch release – remove and install/replace	21- 4
21 52 000	Clutch master cylinder – remove and install	21- 5
010	Clutch slave cylinder – remove and install	21- 5
502	Clutch master cylinder – overhaul	21- 6
512	Clutch slave cylinder – overhaul	21- 6
	Clutch – troubleshoot	21- 7

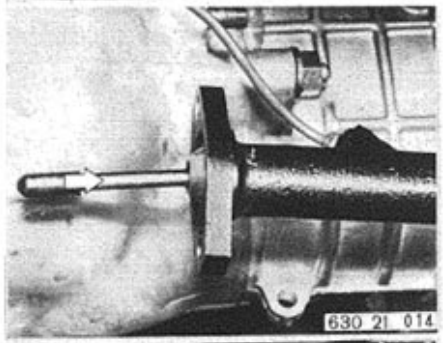


21 00 006 BLEEDING HYDRAULIC CLUTCH SYSTEM

A) With Bleeder
Unscrew cap on expansion tank.
Remove float container (1).
Connect bleeder.



Open bleeder screw on clutch slave cylinder so long until escaping fluid is without air bubbles.
Operate clutch pedal several times during this step.

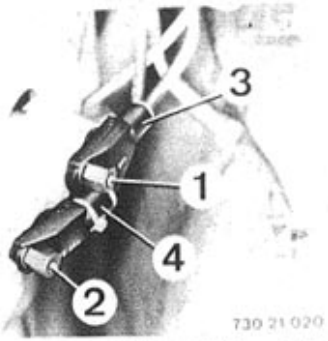


If there is still air in hydraulic system after repeating bleeding procedures several times, unscrew slave cylinder on transmission.
Press push rod into slave cylinder against stop and release slowly.
This will force back residual air into supply tank and guarantee maximum release travel.

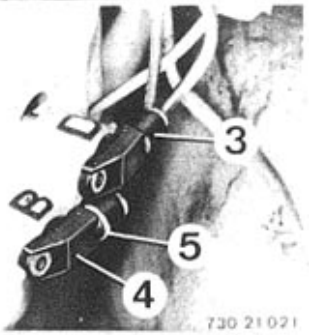


21 11 000 REMOVING AND INSTALLING CLUTCH HOUSING

Remove and install transmission 23 00 022.
Cars with Cover:
Remove cover.



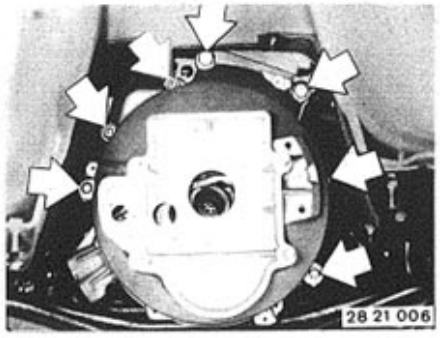
Cars with DME:
Unscrew heat shield.
Unscrew bolts (1 and 2).
Pull out speed sensor (3) and reference mark sensor (4).



Important!
Installation:
Check installed position.
Don't mix up plugs.
Install speed sensor (3) in bore (D) and reference mark sensor (4) with ring (5) in bore (B).
Engine cannot be started if mixed up.

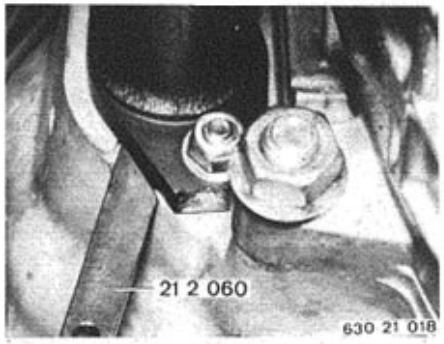


Installation:
Check O-rings.
Install sensors with Molykote Longterm 2.
Important!
Keep grease and dirt off of face of sensors for DME.



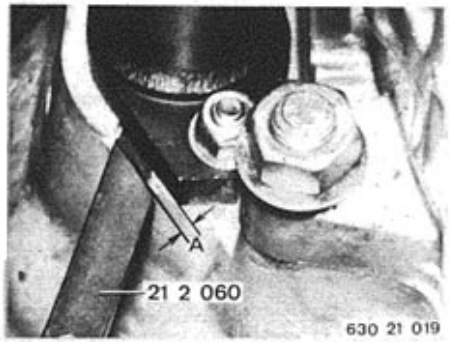
Unscrew clutch housing.
Unscrew Torx bolts with a Torx socket**
Important!
Installation:
Washers must be used for version with Torx bolts to avoid an increase in breaking loose torque.
Tightening torque*.

* See Specifications
** Source: HWB

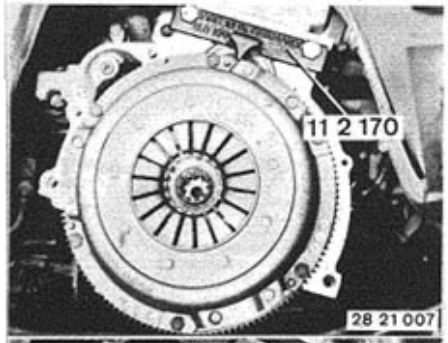


21 21 000 REMOVING AND INSTALLING CLUTCH DISC

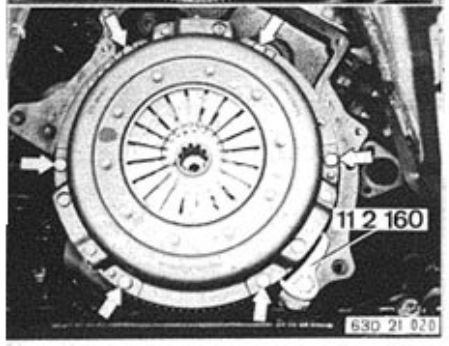
Check clutch for wear without removing from the car.
If Special Tool 21 2 060 can be inserted in opening of slave cylinder against stop liners are still good.



With a gap (A) of 5 mm (0.197") between gage 21 2 060 and the slave cylinder, the drive plate is worn and must be replaced.

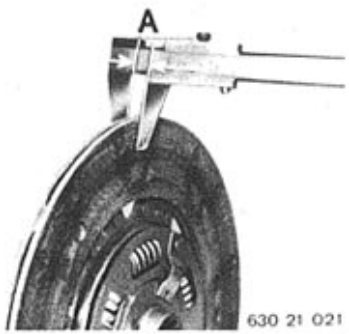


Remove the transmission – see 23 00 022.
Cars with 265/6 Transmission:
Remove the clutch housing – see 21 11 000.
Check the diaphragm spring tip deviation*.
BMW 528 e/524 td:
Hold the flywheel with Special Tool 11 2 170.
Loosen the mounting nuts one after the other by 1 to 1 1/2 turns until the clutch is relaxed.
Remove the mounting bolts, clutch disc and drive plate.
Important!
Don't throw or let the clutch fall.
Improper handling could cause the tangential leaf springs, holding the clutch in direction of turning, to be bent off.
The diaphragm spring will still initiate lift off, but because of the weak leaf springs the pressure ring would not lift off far enough and the drive plate will not be cleared.

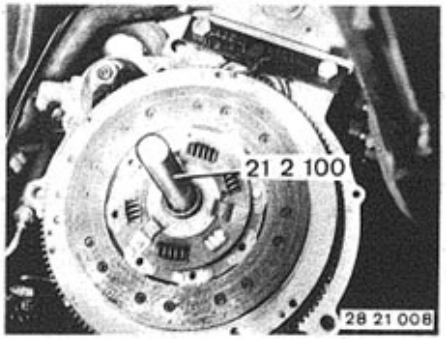


BMW 533 i / 535 i:
Hold the flywheel with Special Tool 11 2 160.

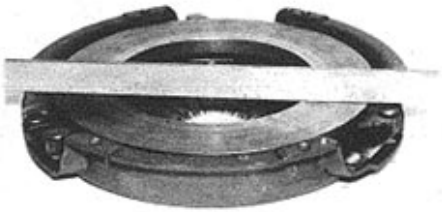
* See Specifications



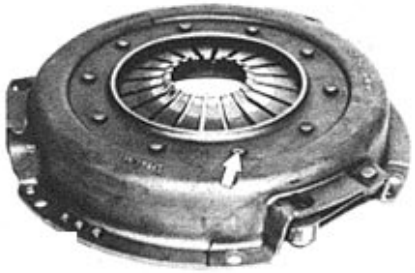
Check the drive plate for wear (A)*, cracks and the torsional damper for tight fit of the spring elements.
Installation:
Note clutch side.
Important! – Installation:
Note the transmission end mark on the drive plate.
Version with Double Mass Flywheel:
The drive plate is designed rigid with a damper.
The torsional damper is integrated in the flywheel.



Installation:
Check the grooved ball bearing in the crankshaft for easy movement, replacing if necessary.
Check the flywheel for scoring.
Center the drive plate in the flywheel with Special Tool 21 2 100.

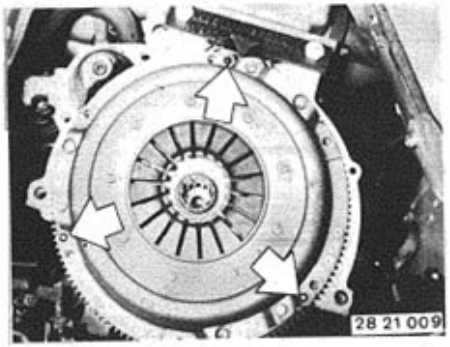


Visually inspect the clutch for cracks, wear and burnt spots.
The pressure contact surface must be level.



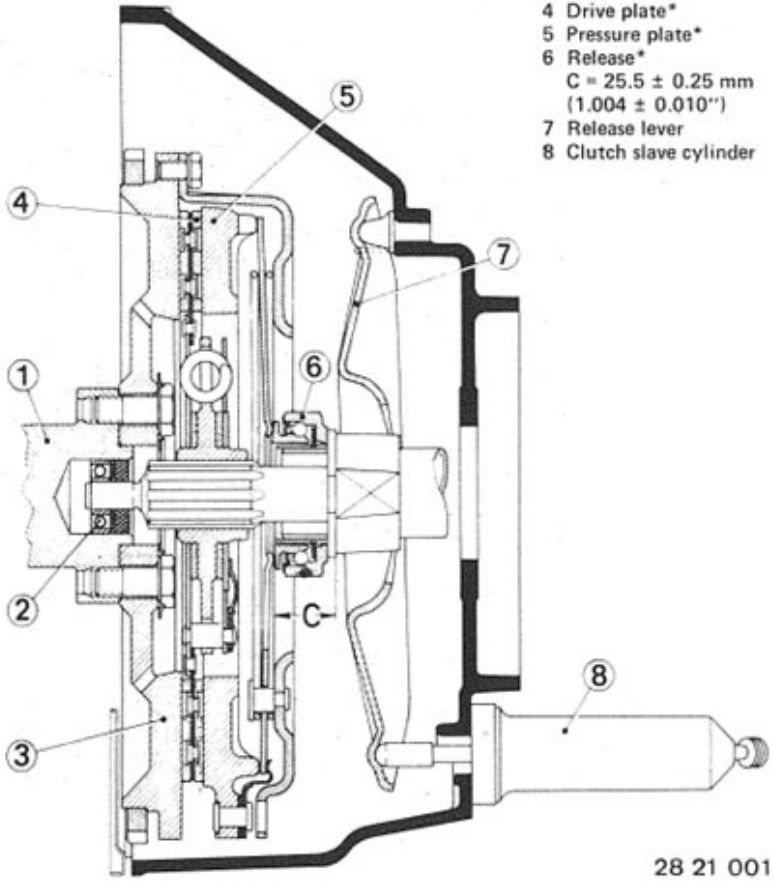
Check rivets for wear and tight fit visually.
Replace a clutch with loose or worn rivet heads.
Important!
Remove all corrosion inhibiting compound when installing a new clutch disc.
Version with Double Mass Flywheel:
The clutch is lower in height.

* See Specifications



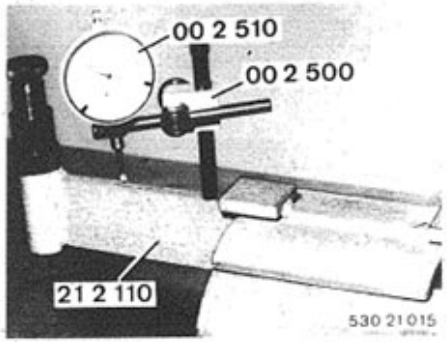
Install the clutch on the dowel pins.
Tighten the mounting bolts uniformly in specified order and torque*.
Installation:
Give keyways of the transmission input shaft a light coat of Molykote Longterm 2.
Important!
Version with Double Mass Flywheel:
Lubricate the keyways lightly with Microlube 261**.

Clutch Assembly:
1 Crankshaft
2 Grooved ball bearing
3 Flywheel
4 Drive plate*
5 Pressure plate*
6 Release*
C = 25.5 ± 0.25 mm
(1.004 ± 0.010")
7 Release lever
8 Clutch slave cylinder



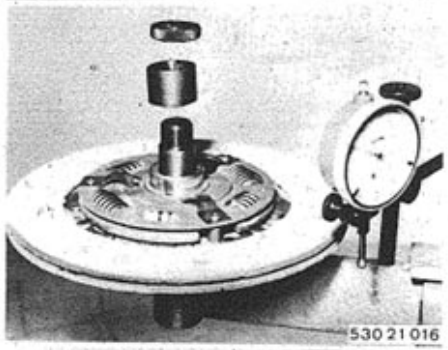
28 21 001

* See Specifications
** Source: HWB

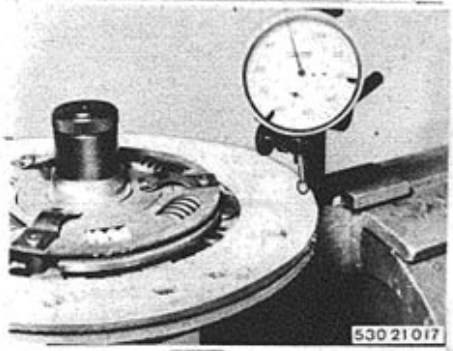


21 21 565 CHECKING LATERAL RUNOUT OF DRIVE PLATE
– Drive Plate Removed –

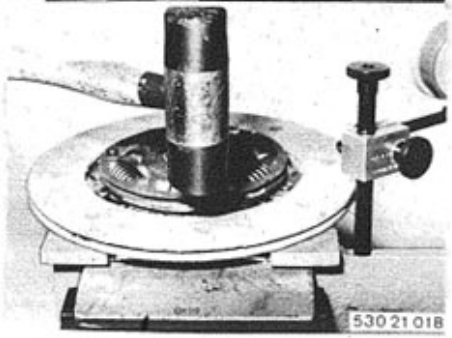
Clamp Special Tool 21 2 110 in a vise.
Mount Special Tools 00 2 510 and 00 2 500.



Clamp the drive plate on the fixture and clean the liners with emery cloth.

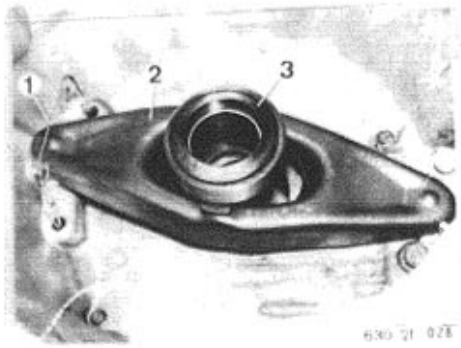


Apply the dial gage about 3 mm (0.118") from the outer edge.
Turn the drive plate and read the lateral runout*.



Straighten the drive plate with a plastic hammer applied on the take-up points of the fixture.
Repeat the test.

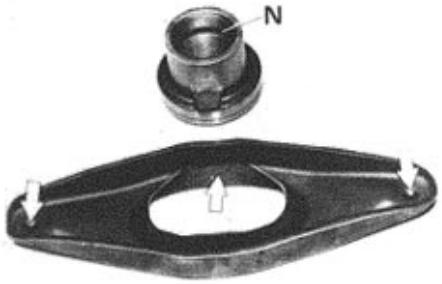
* See Specifications



630 21 028

21 51 000 REMOVING AND INSTALLING OR REPLACING CLUTCH RELEASE

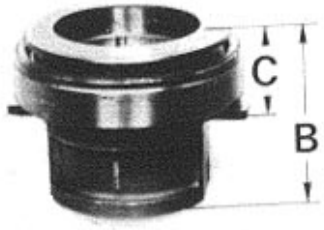
Remove the clutch housing – 21 11 000.
Remove spring (1) and release lever (2) with release (3).



630 21 029

Installation:
Pack lubricating groove (N) with Molykote Longterm 2.
Give the guides and bearings a light coat of Molykote Longterm 2.
Important!
Version with Double Mass Flywheel:
Use Microlube 261**.
Non-conformance could cause the bearings to seize on the guide sleeve.

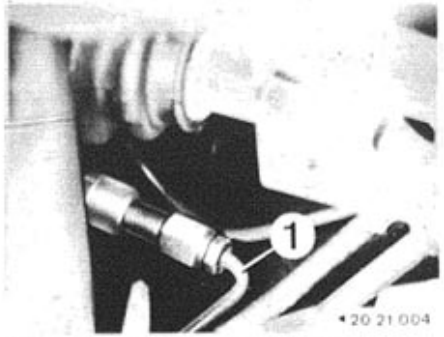
Check the specified height of release B and C*.



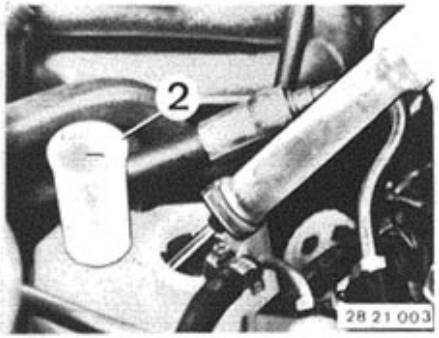
28 21 011

* See Specifications
** Source: HWB

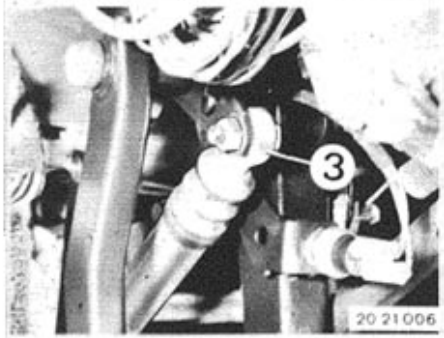
21 52 000 REMOVING AND INSTALLING CLUTCH MASTER CYLINDER



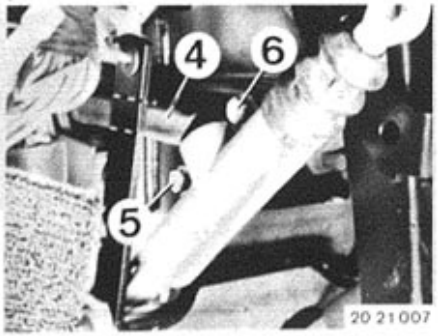
Disconnect line (1) to slave cylinder.



Unscrew cap on expansion tank.
Remove float container (2).
Draw off brake fluid in tank to lower level to connection for filling line.

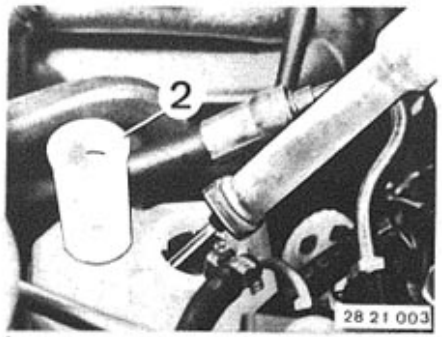


Detach instrument panel trim at bottom left.
Detach piston rod (3) on clutch pedal.
Installation:
Adjust clutch pedal with eccentricbolt (see 35 11 000).

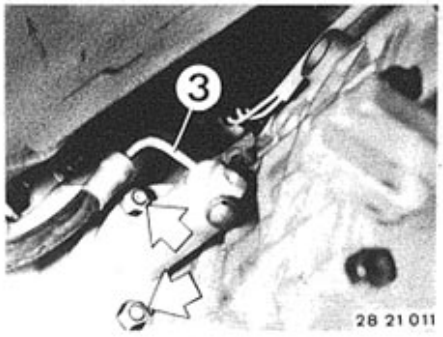


Pull out filling line (4).
Unscrew bolts (5 and 6).
Remove master cylinder.
Installation:
Bleed clutch 21 00 006.

21 52 010 REMOVING AND INSTALLING CLUTCH SLAVE CYLINDER



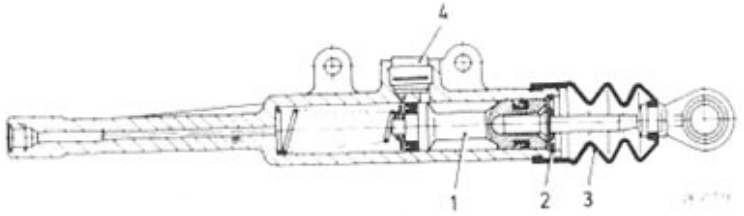
Unscrew cap on expansion tank.
Remove float container (2).
Draw off brake fluid in tank to lower level to connection for filling line.



Detach slave cylinder at transmission.
Remove slave cylinder.
Disconnect line (3).
Installation:
Bleeder screw faces down.
Install front push rod with Molykote Longterm 2.
Bleed clutch 21 00 006.

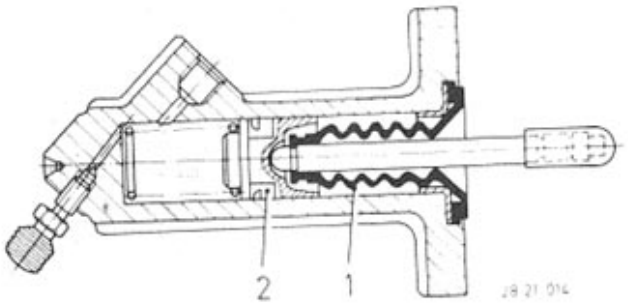
21 52 502 OVERHAULING CLUTCH MASTER CYLINDER (REMOVED)

Clean master cylinder and inside parts with alcohol.
Replace entire master cylinder, if cylinder bore has scoring or corrosion.
Install repair kit, consisting of:
1 Piston assy.
2 Circlip
3 Protective cap
4 Sealing plug
Apply a light coat of ATE* brake cylinder paste on cylinder bore walls and slotted rings.



21 52 512 OVERHAULING CLUTCH SLAVE CYLINDER (REMOVED)

Clean slave cylinder and inside parts with alcohol.
Replace entire slave cylinder, if cylinder bore has scoring or corrosion.
Install repair kit, consisting of:
1 Protective cap
2 Slotted dust cover
Apply a light coat of ATE* brake cylinder paste on cylinder bore wall and slotted dust cover.



* Source: HWB

TROUBLESHOOTING CLUTCH

Condition	Cause	Correction
Clutch slips	a) Clutch contact pressure[1] insufficient b) Liner[1] seriously worn c) Liner splattered with oil -- transmission or crankshaft seal defective d) Clutch was overheated e) Clutch not an original BMW part	a) Replace clutch 21 21 000 b) Replace drive plate 21 21 000 c) Replace defective seal and drive plate d) Replace clutch 21 21 000 e) Install original BMW parts
Clutch grabs	a) Liner[1] not as specified b) Liner splattered with oil c) Release pressure one-sided d) Pressure plate pressing crooked e) Crankshaft not aligned with transmission input shaft f) Engine and transmission suspension defective g) Drive plate not an original BMW part	a) Replace drive plate 21 21 000 b) Replace drive plate 21 21 000 c) Check release lever d) Replace pressure plate 21 21 000 e) Check centering surfaces of engine and transmission f) Replace engine and transmission suspension g) Install original BMW parts
Clutch does not release	a) Drive plate wrenched excessively or liner broken b) Drive plate has excessive lateral runout[1] c) Liner rusted on flywheel d) Drive plate seized on transmission input shaft e) Bearing in crankshaft for transmission input shaft defective f) Air in clutch hydraulic system g) Tangential leaf springs of clutch bent off	a) Replace drive plate 21 21 000 b) Straighten or replace drive plate 21 21 565 c) Clean flywheel, roughen liner surface with emery cloth d) Service drive plate on transmission input shaft, replacing damaged parts if necessary e) Replace bearing in crankshaft 11 21 571 f) Bleed clutch 21 00 006 g) Replace clutch 21 21 000
Clutch noise	a) Unbalance[1] of clutch and drive plate excessive b) Torsional damper defective c) Clutch release defective d) Bearing in crankshaft for transmission input shaft defective e) Clutch rivets loose	a) Replace clutch and/or drive plate 21 21 000 b) Replace drive plate 21 21 000 c) Replace clutch release d) Replace bearing in crankshaft 11 21 571 e) Replace clutch 21 21 000

[1] See Specifications

23 Manual transmission

Getrag 265/6 five speed manual transmission (overdrive)

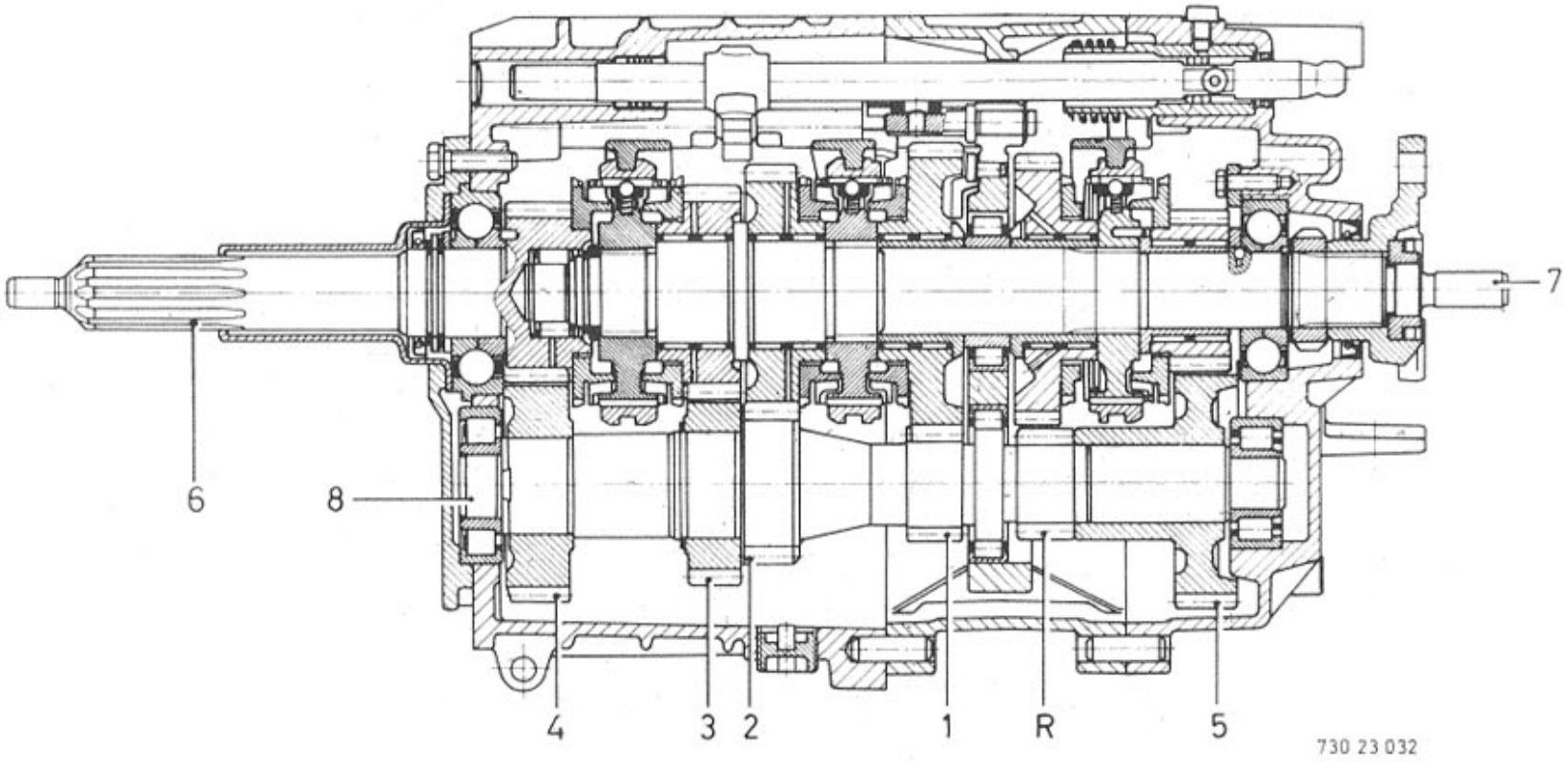
	Layout drawing – transmission	23- 1
	Layout drawing – shift mechanism	23- 2
23 00 022	Transmission – remove and install	23- 3
23 11 013	Transmission case front section – remove and install/seal	23- 5
022	Transmission case rear section – remove and install/seal	23- 7
610	Clutch release guide tube – replace	23- 10
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23 12 053	Radial oil seal for output flange – replace	23- 11
083	Radial oil seal for selector shaft – replace	23- 11
503	Radial oil seal for input shaft – replace	23- 12
23 21 503	Input and output shaft assembly – remove and install	23- 13
554	Output shaft – replace	23- 19
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23 23 505	Synchronization – disassemble and assemble	23- 24
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Getrag 260 five speed manual transmission with overdrive

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503	Radial oil seal for input shaft – replace	23- 173
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23 23 505	Synchronization – disassemble and assemble	23- 186

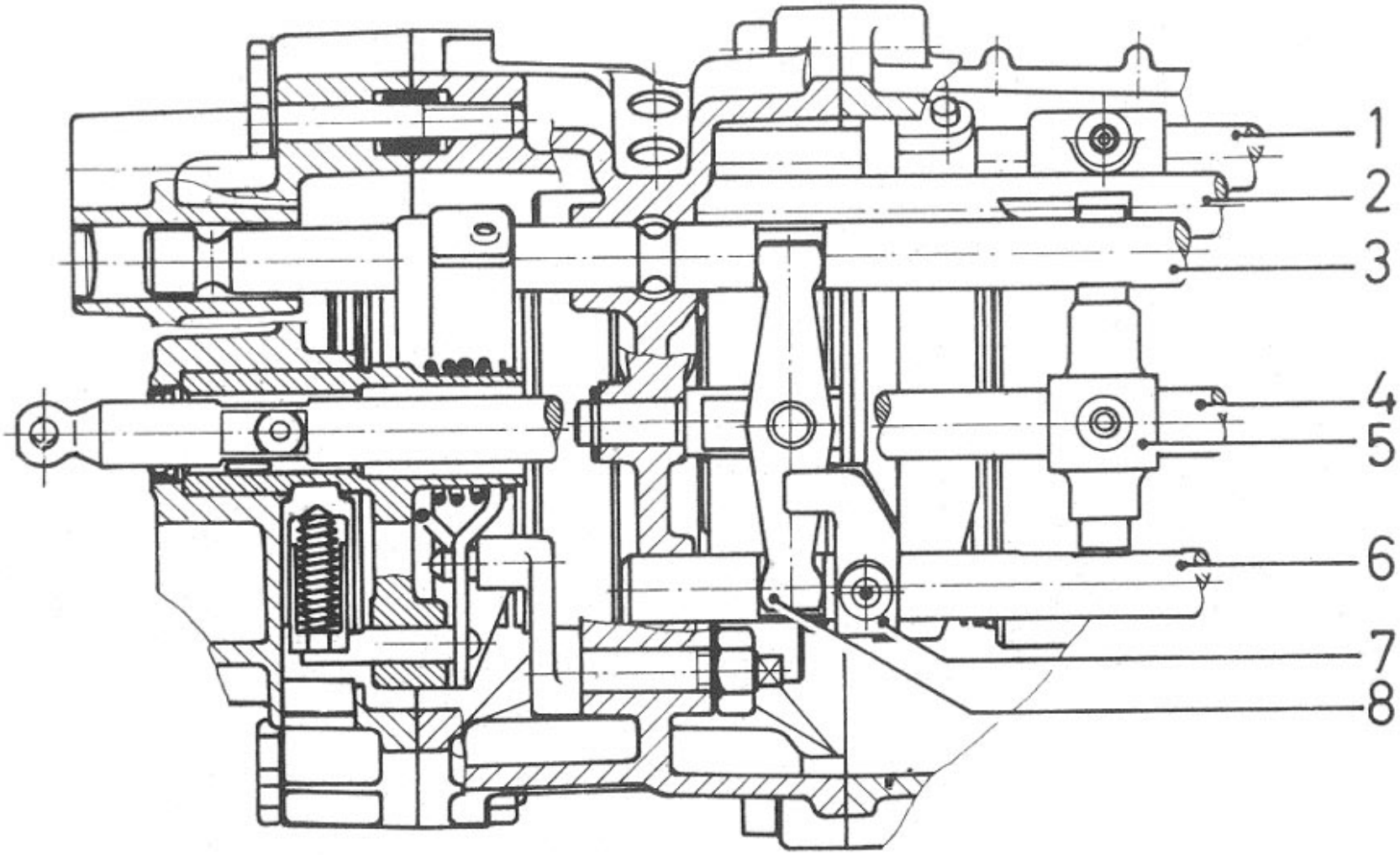
23 – 1

LAYOUT DRAWING OF GETRAG 265/6 OVERDRIVE TRANSMISSION



1 1st gear
2 2nd gear
3 3rd gear
4 4th gear
5 5th gear
R Reverse gear
6 Input shaft
7 Output shaft
8 Layshaft

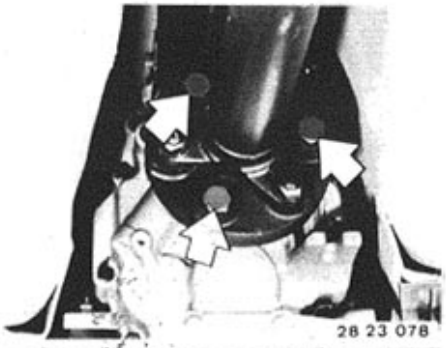
LAYOUT DRAWING OF SHIFT PARTS FOR GETRAG 265/6 OVERDRIVE TRANSMISSION



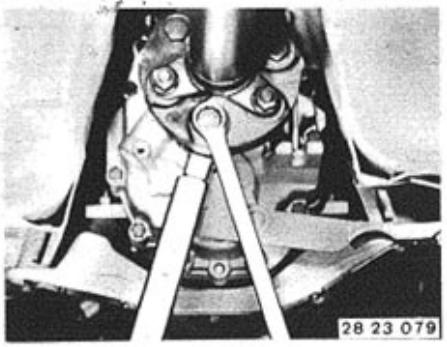
730 23 033

1 Selector rod, 1st/2nd gear
2 Selector rod, 3rd/4th gear
3 Selector rod, 5th/reverse gear
4 Selector shaft
5 Selector arm
6 Selector rail
7 Dog
8 Reversing lever

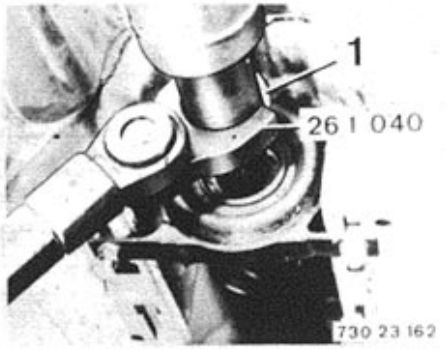
23 00 022 REMOVING AND INSTALLING TRANSMISSION



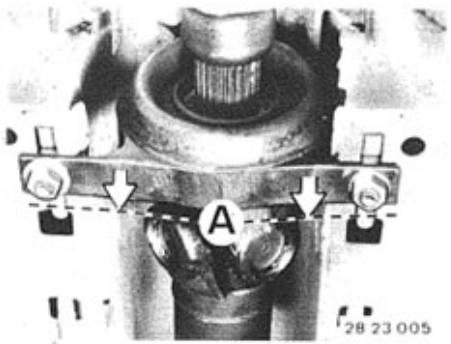
Remove exhaust assembly 18 00 020.
Unscrew heat shield.
Unscrew joint disc on transmission.



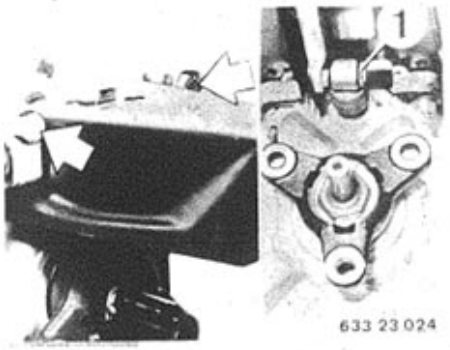
Installation:
Always replace stop nuts.
Tighten nuts with a standard 12 mm socket and torque wrench.
Tightening torque*.
Important!
Only tighten nuts (never bolts) to avoid stress in joint disc.



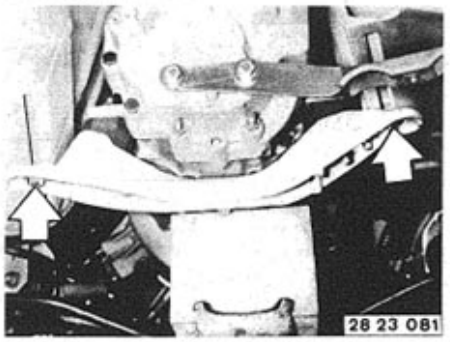
Loosen threaded ring (1) several turns.
Installation:
After finishing installation, tighten threaded ring (1) with Special Tool 26 1 040.
Tightening torque*.



Unscrew center mount.
Installation:
Preload center mount forward by distance (A) = 2 to 4 mm (0.079 to 0.157").
Tightening torque*.
Bend propeller shaft down and pull off of centering pin.
Important!
Suspend propeller shaft from car on a piece of wire.



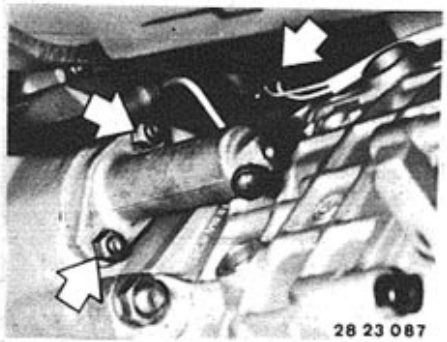
Unscrew console on transmission.
Lift out retainer (1).
Take off washer.
Pull out shift rod.
Installation:
Tightening torque*



Support transmission.
Unscrew cross member on body.
Lower transmission.
Installation:
Tightening torque*

* See Specifications

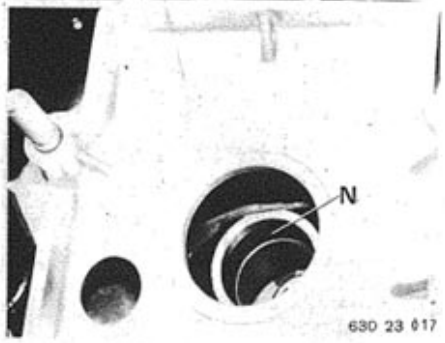
* See Specifications



Unscrew clutch slave cylinder.
Line remains connected.
Installation:
Pull off wires on reverse gear switch.
Lift wire harness out of holders.

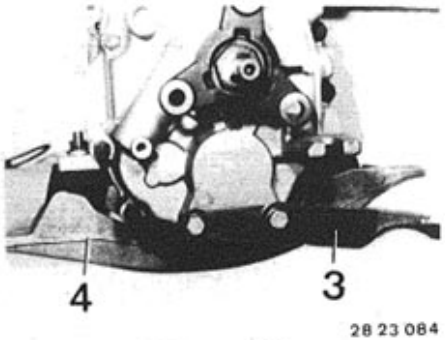


Unscrew transmission on clutch housing and remove toward rear.
Use special ring wrench** to loosen and tighten nuts at top left.



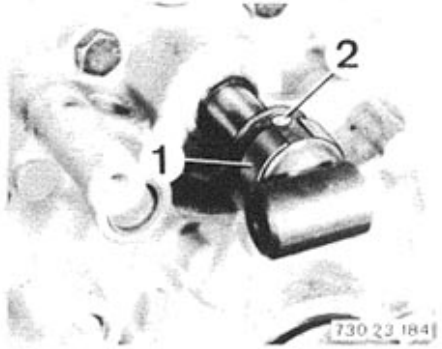
Installation:
Position release lever with the clutch slave cylinder.
Align clutch release bearing.
Pack groove (N) with Molykote Longterm 2.
Non-conformance could cause bearing to seize on guide sleeve.
Engage gear before connecting transmission.
Insert guide sleeve of transmission in bearing carefully.
Turn output flange until input shaft slides into drive plate.
Remove clutch slave cylinder again.
Mount transmission.

** Source: HWB

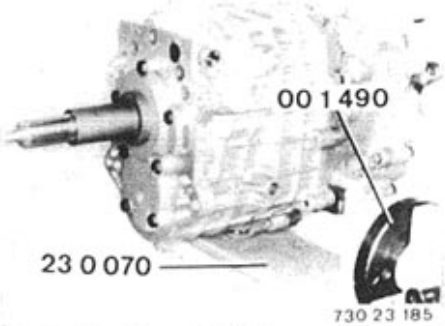


23 11 013 REMOVING AND INSTALLING/ SEALING TRANSMISSION CASE FRONT SECTION

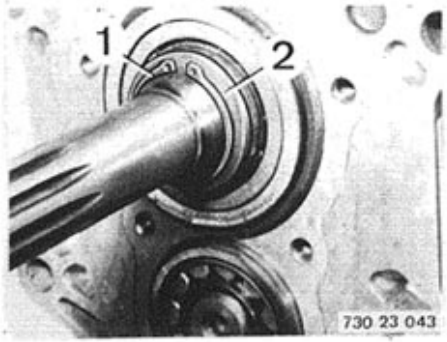
Remove transmission 23 00 022.
Unscrew exhaust bracket (3) and cross member (4) with rubber mount.



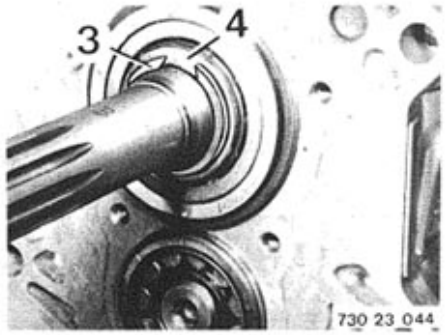
Engage 3rd gear.
Push back spring sleeve (1).
Drive out cylindrical pin (2).
Pull off selector rod.
Pull off selector rod joint.
Note:
Mount selector rod joint with offset side on left when locking in forward direction.



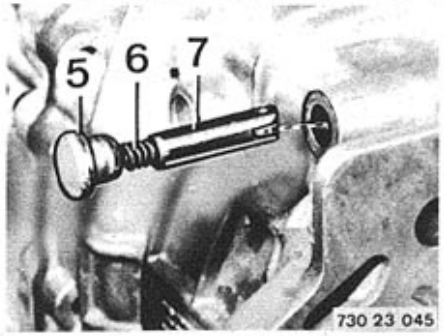
Mount transmission on Special Tool 23 0 070 in conjunction with Special Tool 00 1 490.
Drain oil.



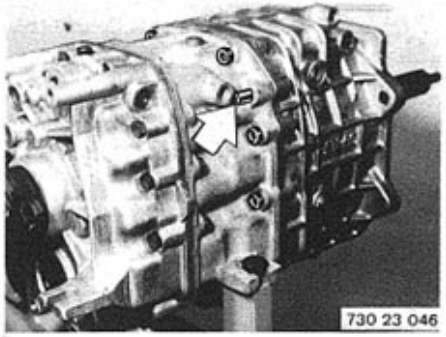
Remove guide flange 23 11 623.
Lift out circlip (1).
Take off grooved washer (2).
Installation:
Position grooved washer that groove faces the circlip.



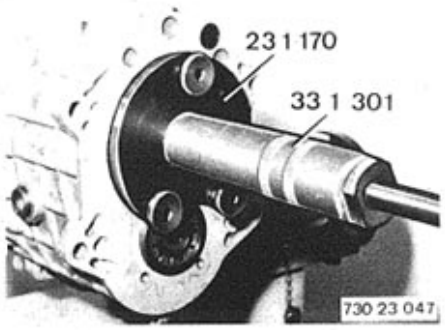
Lift out circlip (3).
Remove washer (4).
Installation:
Always replace circlip.



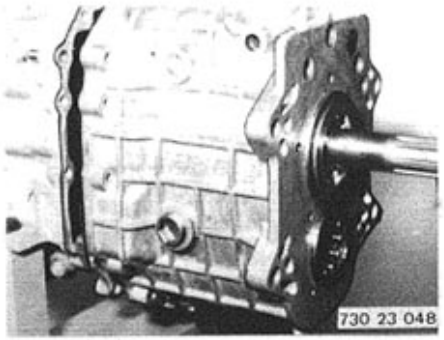
Lift out end cap (5).
Remove spring (6) and lockpin (7).
Installation:
Check installed position.
Remove backup light switch.



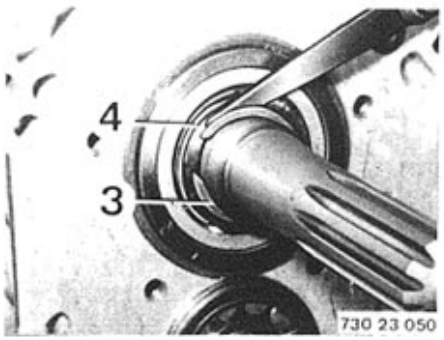
Drive out cylindrical pin.
Unscrew bolts.



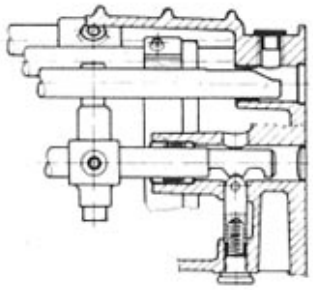
Pull off transmission case front section with Special Tools 23 1 170 and 33 1 301.



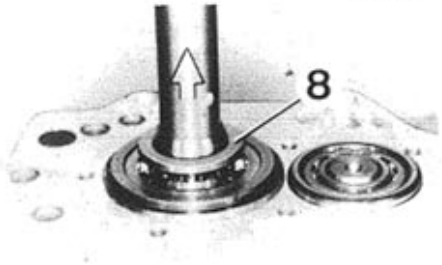
Coat sealing surfaces with Loctite No. 573.
Sealing surfaces must be cleaned thoroughly and dried of oil.
Mount transmission case front section.
Tightening torque*.



Adjust play between washer (4) and circlip (3) to 0 ... 0.09 mm (0 to 0.0035").
Circlips (3) are available from Parts in various thicknesses.
Install grooved washer and circlip.



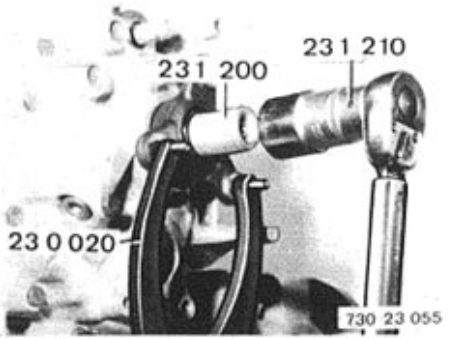
Install lockpin and backup light switch.
Note arrangement of lockpin.



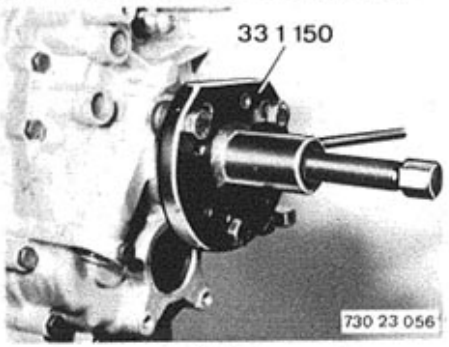
Heat ball bearing inner race (8) to about 80° C (175° F) with a hot air blower and slide on to input shaft.
Pull out input shaft for this purpose.

* See Specifications

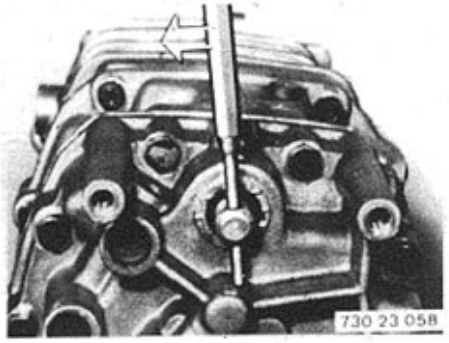
23 11 022 REMOVING AND INSTALLING/ SEALING TRANSMISSION CASE REAR SECTION



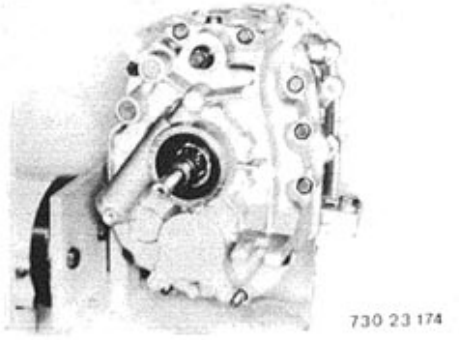
Lift out lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.
Installation:
Tightening torque*.



Pull off output flange with Special Tool 33 1 150 if necessary.

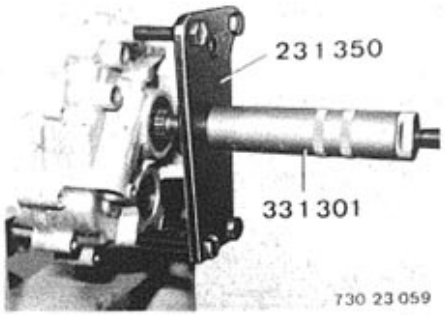


Caution!
Make sure 2nd gear is engaged before pulling off cover.
Swing selector shaft to the left against stop and slide forward.

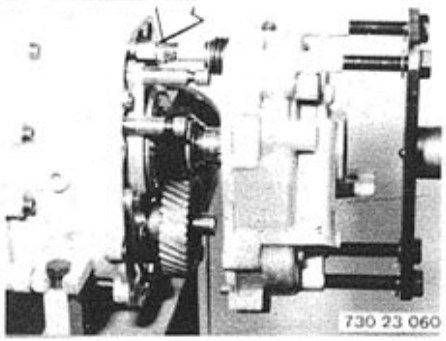


Unscrew rear case section mounting bolts.

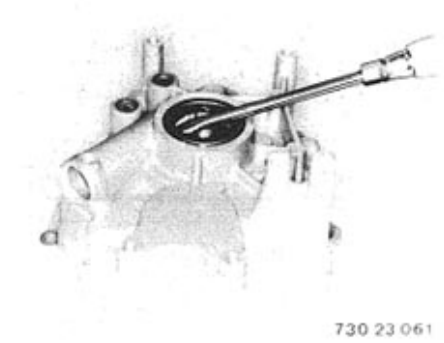
* See Specifications



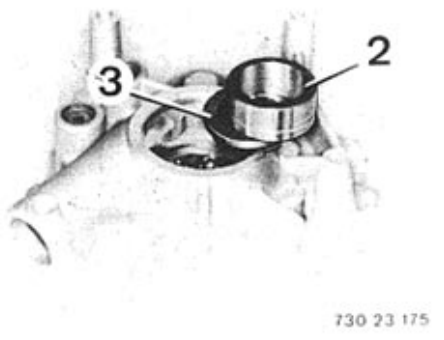
Knock back centering pin.
Pull off transmission case rear section with Special Tool 23 1 350 used in conjunction with Special Tool 33 1 301.



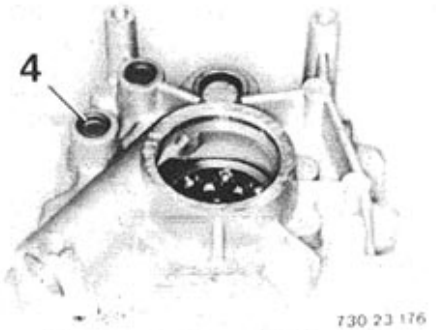
Take off rear section.
Important!
Rollers on selector shaft.



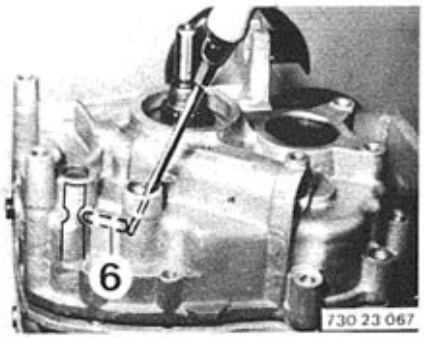
Lift out radial oil seal.
Installation:
Replace radial oil seal.



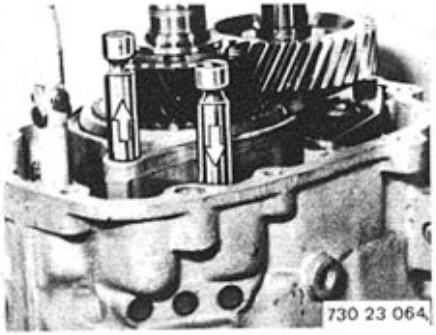
Remove spacer (2) and ball bearing inner race (3).



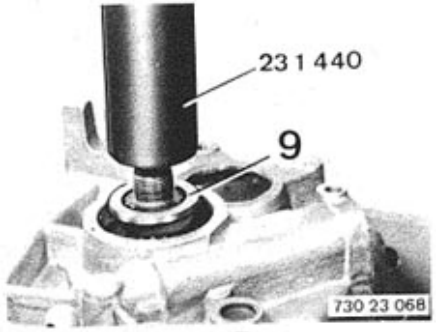
Knock out end cap (4).
Installation:
Replace and install end cap with Loctite No. 573.



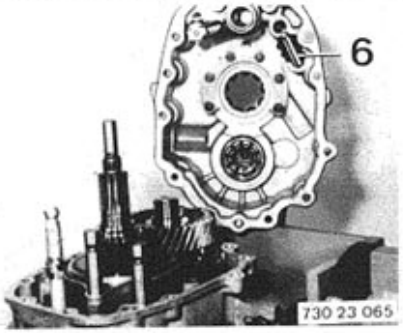
Press lockpin (6) into opening of 1st/2nd gear selector rod.
Push on and bolt down transmission case rear section.
Tightening torque*.
Drive in centering pin.
Install end cap (4).



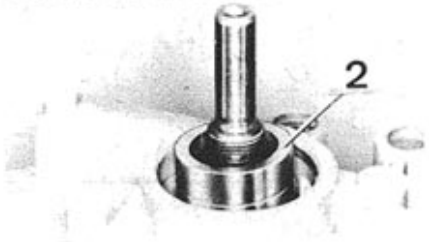
Position output shaft upright.
Second gear is engaged.
Adjust reverse/5th gear selector rod until opening of 5th gear selector rod is aligned with end of 1st/2nd gear selector rod.



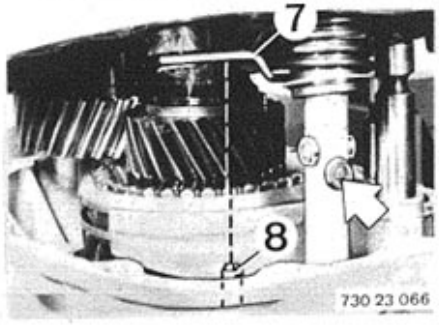
Heat bearing inner race (9) to about 80° C (175° F) with a hot air blower and slide on to output shaft, if necessary knocking on against ball bearing with Special Tool 23 1 440.



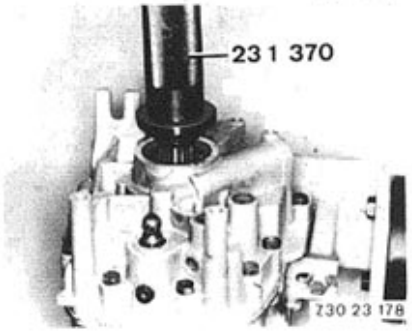
Coat sealing surfaces with Loctite No. 573.
Sealing surfaces must be cleaned thoroughly and dried of oil.
Important!
Lockpin (6) must move easily and face down.



Install spacer (2).

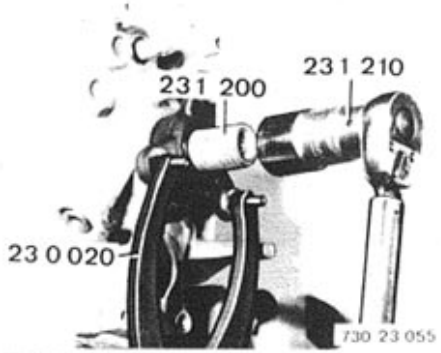


Hold rollers in position with grease.
Mount transmission case rear section.
Make sure spring (7) of selector arm engages on lever (8).

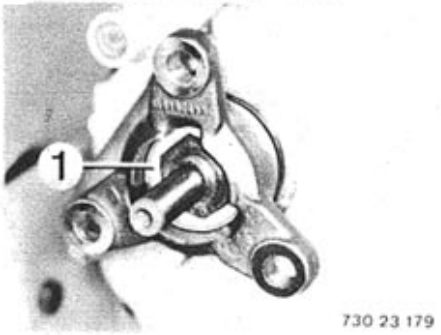


Drive in radial oil seal flush with Special Tool 23 1 370.

* See Specifications

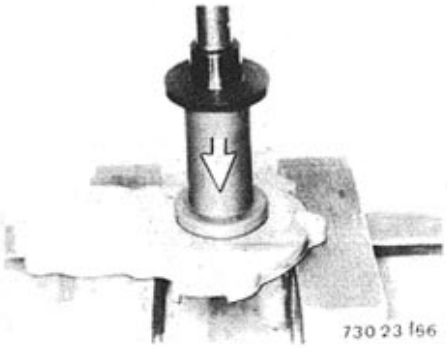


Mount output flange.
Install collar nut with Loctite No. 270.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Tighten collar nut with Special Tool 23 1 210.
Tightening torque*.



Install lockplate (1).

* See Specifications



730 23 166

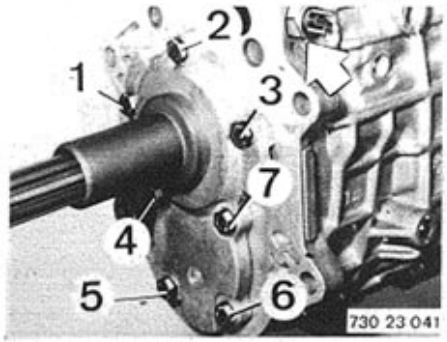
23 11 610 REPLACING CLUTCH RELEASE GUIDE TUBE
– Transmission Removed –

Remove guide flange, see 23 11 623.
Press out guide tube.



730 23 167

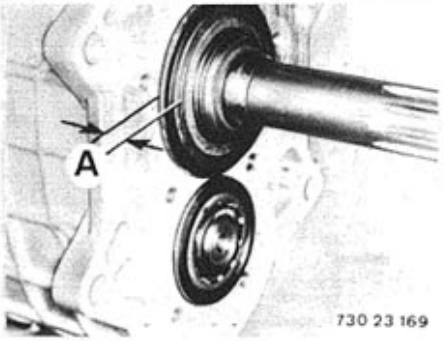
Heat guide flange to about 80° C (175° F) with a hot air blower.
Install guide tube.
Note:
Check turning lock (1).
Install radial oil seal.



730 23 041

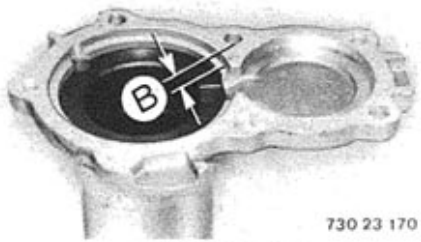
23 11 623 REMOVING AND INSTALLING/ SEALING COVER WITH GUIDE TUBE FOR CLUTCH RELEASE

Unscrew cover.
Important!
Spacers.
Important! – Installation:
Check length of bolts.
Bolts (1 ... 3) = 8 x 30 mm.
Bolts (4 ... 7) = 8 x 22 mm.



730 23 169

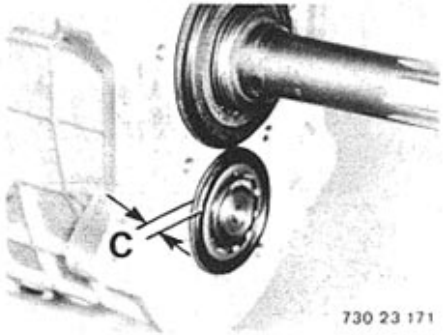
Adjust ball bearing between input shaft and guide flange to 0 ... 0.09 mm (0 to 0.0035").
Measure distance (A) from case to ball bearing.



730 23 170

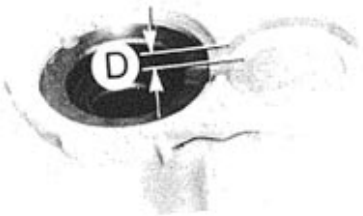
Measure distance (B).
Example:

B	8.1 mm (0.319")
– A	7.8 mm (0.307")
	0.3 mm (0.012") spacer thickness



730 23 171

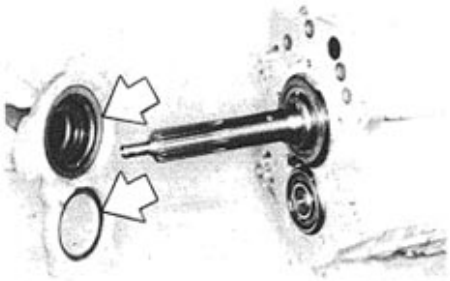
Adjust roller bearing play between layshaft and guide flange.
Measure distance (C) from case to roller bearing outer race.



730 23 172

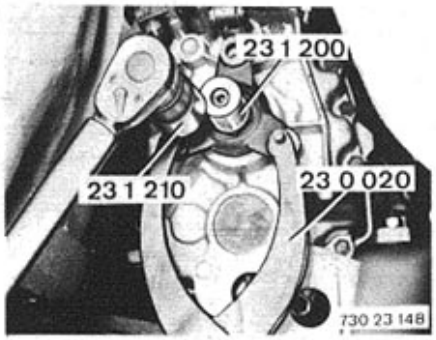
Measure distance (D).
Example:

D	4.8 mm (0.189")
– C	4.3 mm (0.169")
	0.5 mm (0.020")
– 0.1 ... 0.2 mm (0.004 ... 0.008")	axial play
	0.3 mm (0.012") spacer thickness


730 23 173

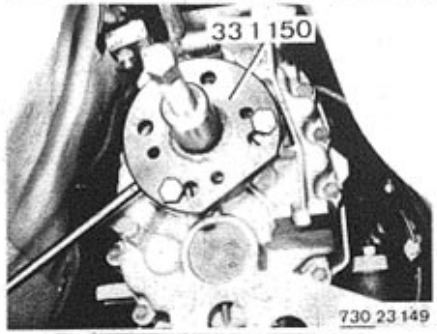
Coat sealing surfaces with Loctite No. 573.
Sealing surfaces must be cleaned thoroughly and dried of oil.
Hold spacers of calculated thickness in position with grease.
Mount cover.
Install bolts with Loctite No. 573.
Tightening torque*.
Threads cleaned to remove old cement.

* See Specifications

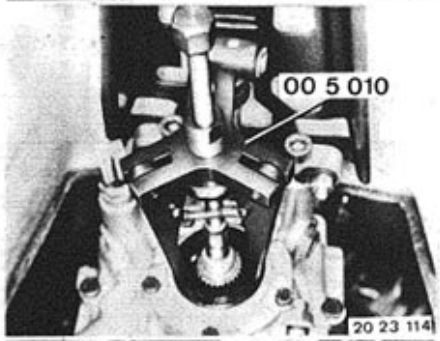


23 12 053 REPLACING RADIAL OIL SEAL FOR OUTPUT FLANGE

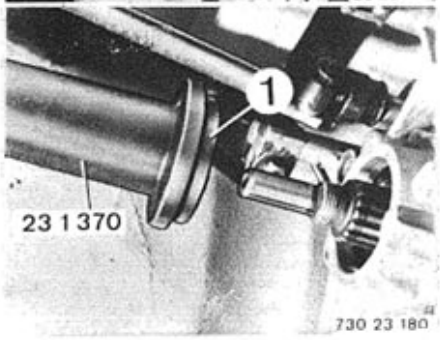
Unscrew exhaust pipes on manifold (see 18 00 020).
Unscrew propeller shaft (see 23 00 022).
Lift out lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.



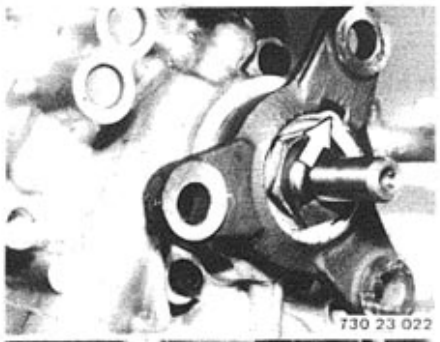
If too difficult, pull off output flange with Special Tool 33 1 150.



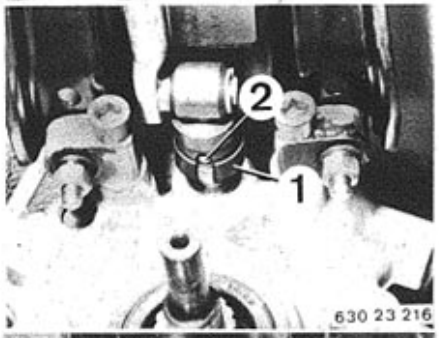
Pull out radial oil seal with Special Tool 00 5 010.



Lift out radial oil seal.
Drive in radial oil seal (1) flush with Special Tool 23 1 370.
Installation:
Lubricate sealing lip with oil.

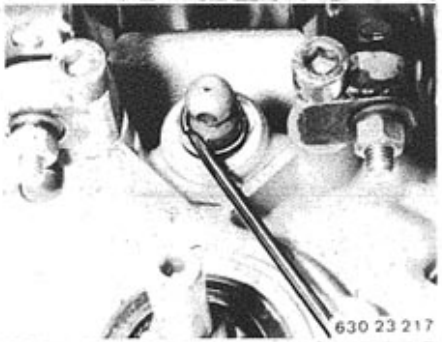


Mount output flange.
Tightening torque*.
Install collar nut with Loctite No. 270.
Install lockplate.



23 12 083 REPLACING RADIAL OIL SEAL FOR SELECTOR SHAFT

Unscrew exhaust pipes on manifold (see 18 00 020).
Unscrew propeller shaft (see 23 00 022).
Unscrew output flange (see 23 12 053).
Engage 3rd gear.
Push away locking sleeve (1) and drive out cylindrical pin (2).

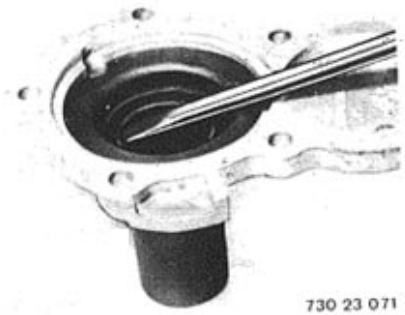


Lift out radial oil seal.



Lubricate sealing lip of radial oil seal with oil.
Drive in radial oil seal with Special Tool 23 1 240.

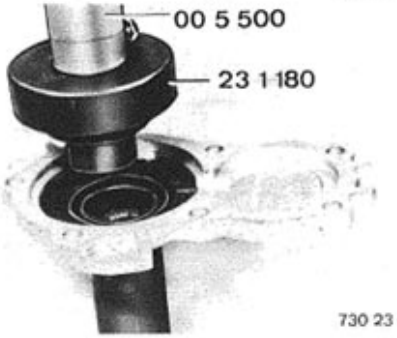
* See Specifications



730 23 071

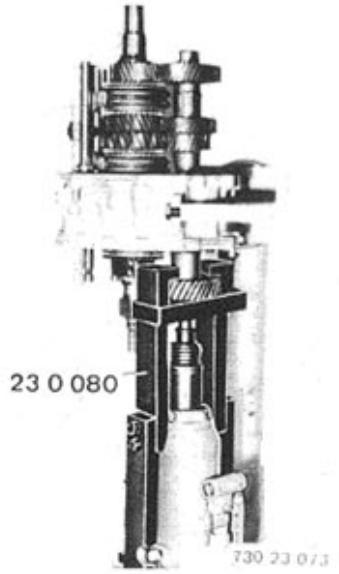
23 12 503 REPLACING RADIAL OIL SEAL FOR INPUT SHAFT
– Transmission Removed –

Remove cover with guide tube, see 23 11 623.
Lift out radial oil seal.



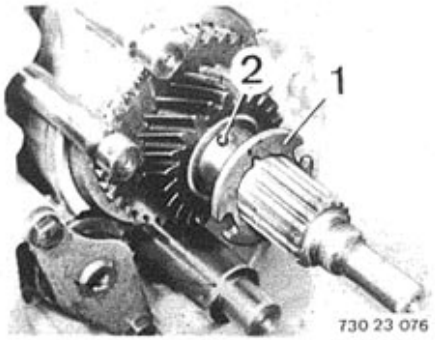
730 23 072

Drive in radial oil seal against stop with Special Tool 23 1 180 used in conjunction with Special Tool 00 5 500.
Open end faces transmission:
Lubricate sealing lip with oil.

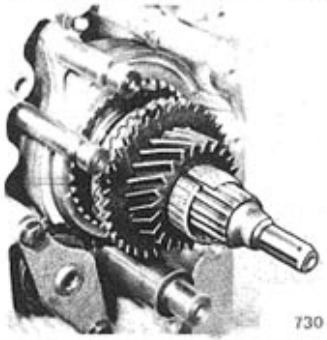


23 21 503 REMOVING AND INSTALLING INPUT AND OUTPUT SHAFT ASSEMBLY
– Front and Rear Transmission Case Sections Removed –

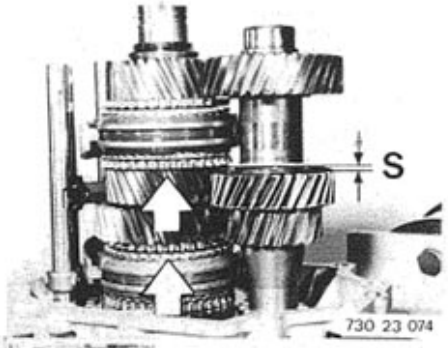
Swing down output shaft.
Pull 5th gear wheel off of layshaft with Special Tool 23 0 080.
This also pulls off the bearing inner race.
Pressing off force*
Caution!
Prevent pulling off tool from falling down.



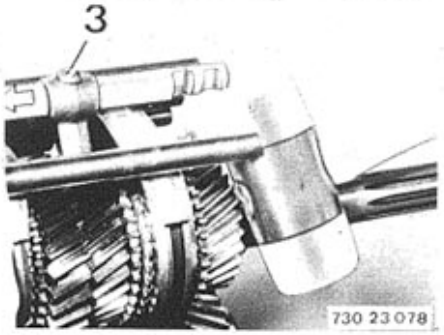
Take off washer (1) and ball (2).



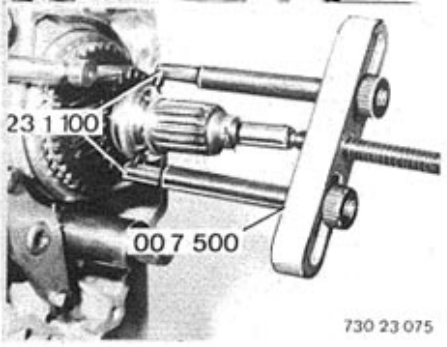
Pull off 5th gear wheel with synchromesh ring and split needle bearing.



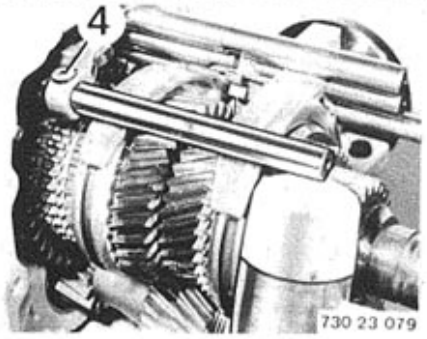
Important!
When installing 5th gear always remember to provide play (S) between 3rd gear and layshaft, to avoid damaging the 3rd gear wheel.
Push up output shaft if necessary.



Remove needles on selector shaft.
Drive out pin (3) in selector shaft, while counterholding.
Pull out selector shaft toward rear.
Remove selector arm.
Installation:
Replace pin.

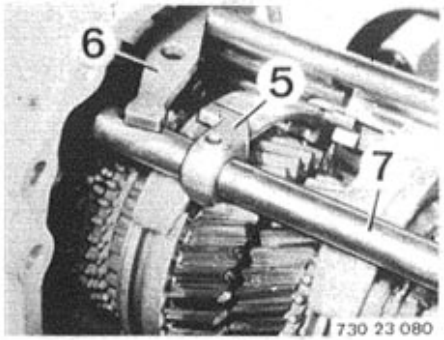


Pull bearing inner race off of output shaft with Special Tools 23 1 100 and 00 7 500.

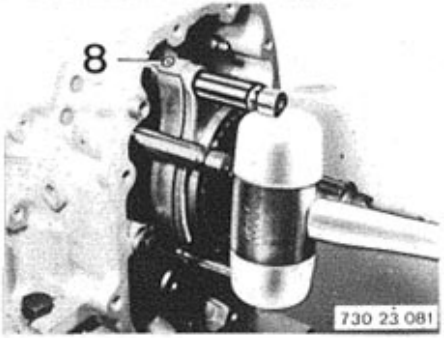


Engage 2nd gear.
Drive out pin (4), while counterholding.
Installation:
Replace pin.

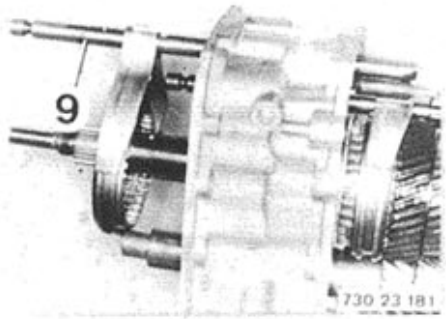
* See Specifications



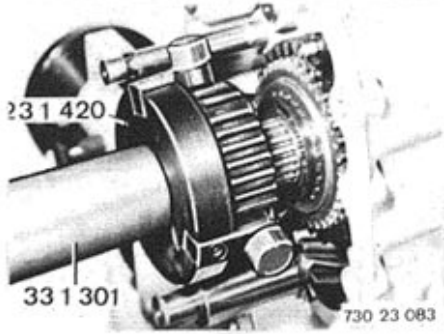
Pull or take off turning lock (5) and reversing lever (6)
Pull out selector rail (7) forward.
Disengage second gear.



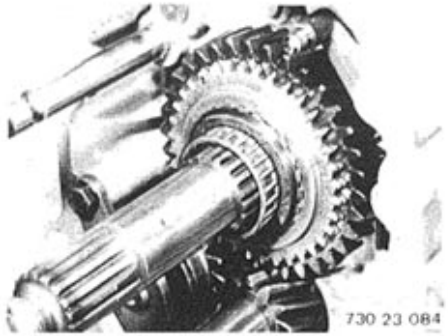
Pull out 5th gear selector rod with selector fork and operating sleeve toward rear far enough, that pin (8) can be driven out while counterholding.
Important!
Loose balls, springs and slides.
Installation:
Replace pin.



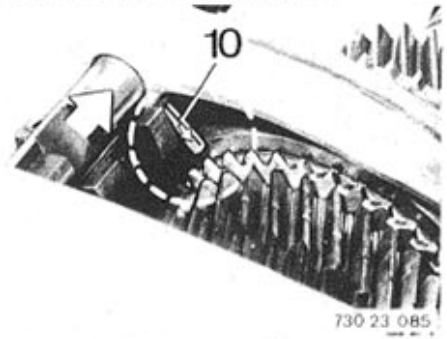
Pull off operating sleeve and fifth gear selector fork.
Pull out selector rod (9) forward.
Important!
Loose balls.



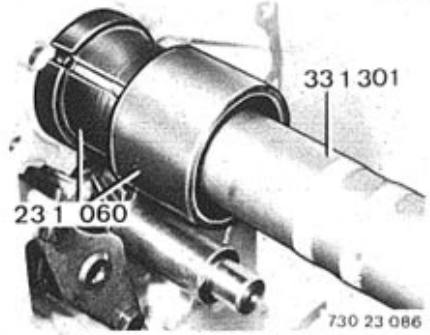
Pull guide sleeve and bearing inner race off of output shaft with Special Tools 23 1 420 and 33 1 301.
Important!
Hold knurled head bolts in recesses of guide sleeve with a pliers.



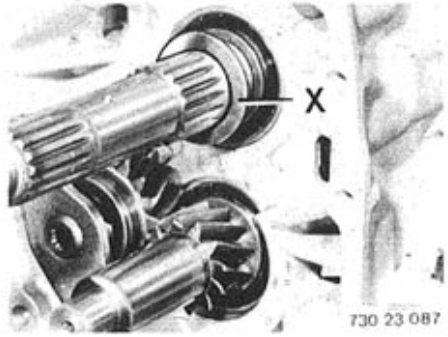
Pull off reverse gear and needle bearing.



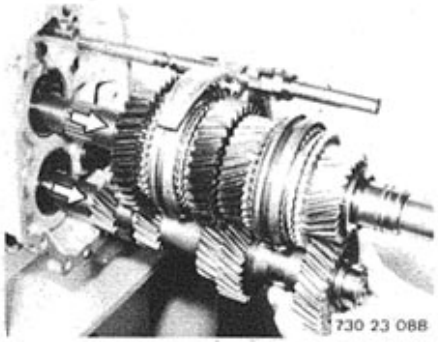
Engage third gear.
Drive out pin (10).
Important!
Drive in pin on to tooth of 3rd gear wheel until selector rod can be pulled out forward.
Remove 3rd/4th gear selector fork.
Loose balls.
Installation:
Replace pin.



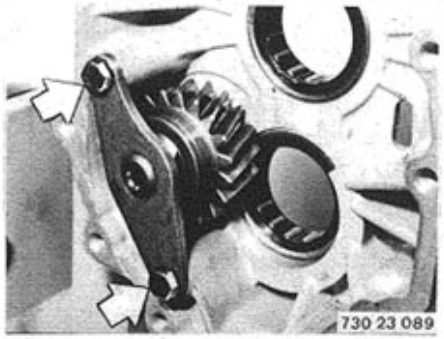
Pull out output shaft toward rear far enough, that bearing inner race can be pulled off with Special Tools 23 1 060 and 33 1 301.



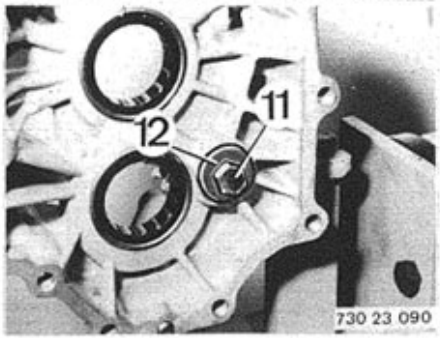
Remove shim X.
Installation:
Determine thickness of shim X (see 23 21 554).



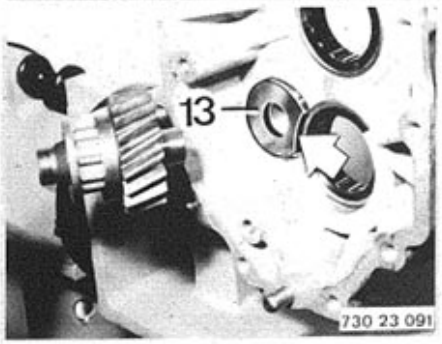
Pull out input and output shaft assembly with layshaft and 1st/2nd gear selector rod in intermediate case.
Important!
Loose balls.



Detach holder.



Unscrew bolt (11), while counterholding on front of shaft.
Installation:
Install bolt with Loctite No. 270.
Tightening torque*.
Remove washer (12).



Knock out reverse gear shaft.
Installation:
Check installed position of thrust washer (13).
Check needle bearing, replacing if necessary.
Check condition of all bearings, replacing if necessary (see 23 21 703).

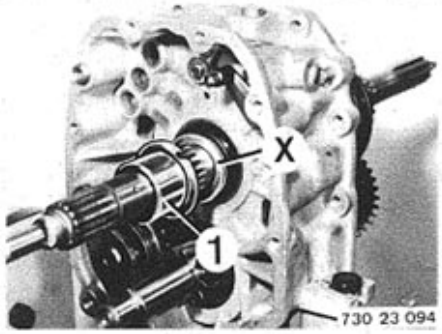
* See Specifications



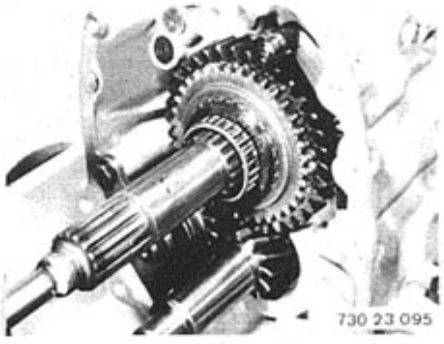
Installation:
Install and mount reverse gear.
Stepped collar of reverse gear faces out.
Tightening torque*.



Install input shaft, ouput shaft and layshaft in intermediate case.

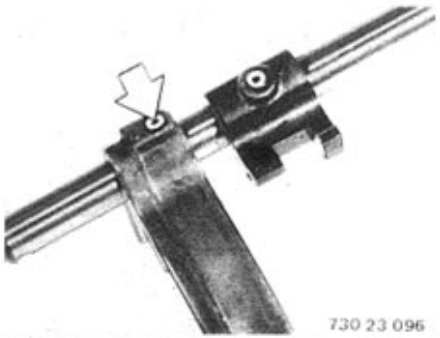


Install shim X.
Heat bearing sleeve (1) to approx. 80° C (175°F) and install on output shaft.
Heat with a hot air blower.

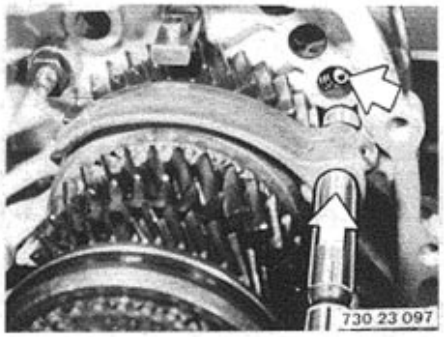


Install needle bearing and reverse gear.
Install synchromesh ring.

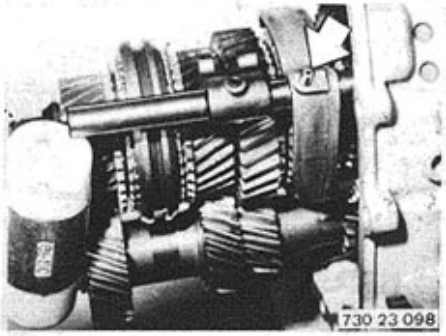
* See Specifications



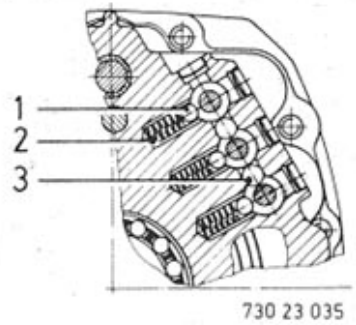
Drive pin out of 1st/2nd gear selector rod.
Installation:
Replace pin.



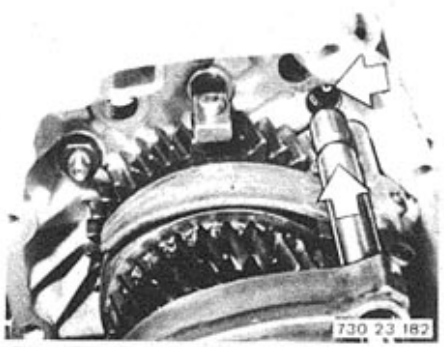
Mount 1st/2nd gear selector fork.
Push in 1st/2nd gear selector rod up to spring.
Insert locking balls and press down.
Push in selector rod against arrest in this position.



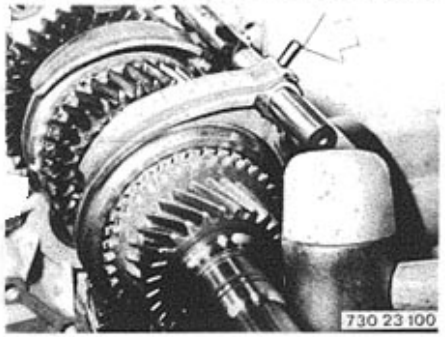
Drive in 6 x 32 mm pin, while counterholding.



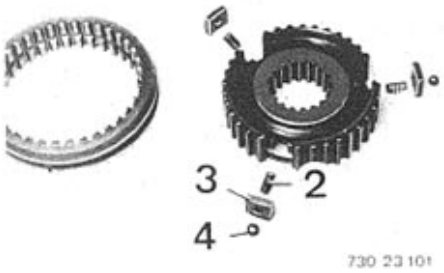
Layout of Selector Arrest:
1 Locking ball
2 Spring
3 Detent ball



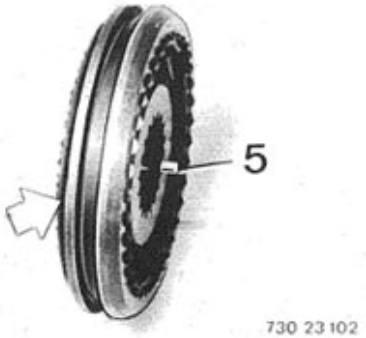
Mount 3rd/4th gear selector fork.
Insert detent ball.
Push in selector rod up to spring.
Insert locking balls and press down.
Push in selector rod against arrest in this position.



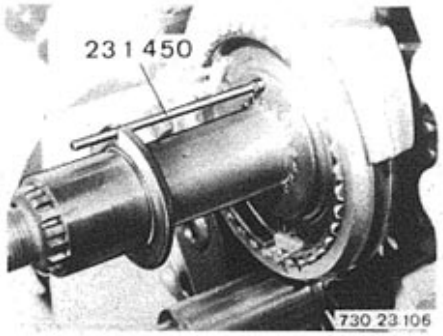
Drive in 6 x 26 mm pin, while counterholding.



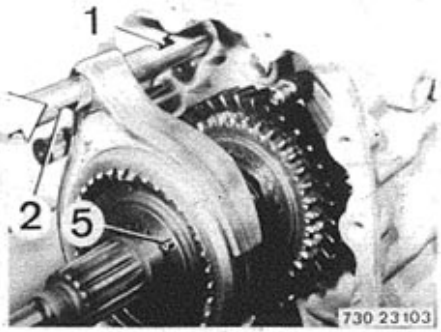
Assemble synchronizer.
Installed Order:
Springs (2), thrust parts (3) and balls (4).
Curved surface of thrust parts (3) faces operating sleeve.



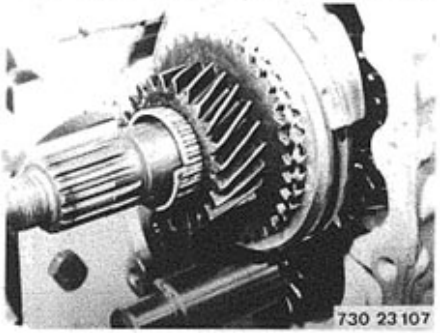
Important!
Stepped end of sliding sleeve must be opposite centering pin (5).



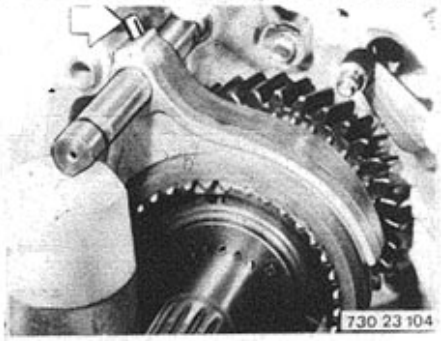
Place Special Tool 23 1 450 in centering pin. Heat bearing sleeve to approx. 80° C (175° F) with a hot air blower and push on to output shaft.



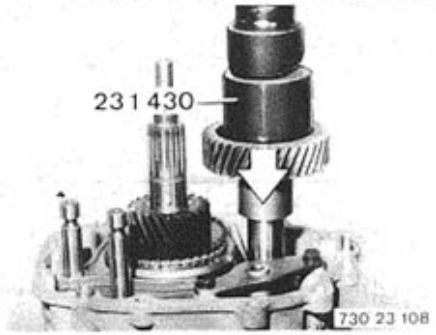
Install guide sleeve.
Centering pin (5) faces 5th gear.
Install 5th/reverse gear selector fork.
Install detent ball.
Push in selector rod up to spring.
Insert locking balls and press down.
Push in and turn selector rod that openings (1 and 2) are always opposite locking balls.



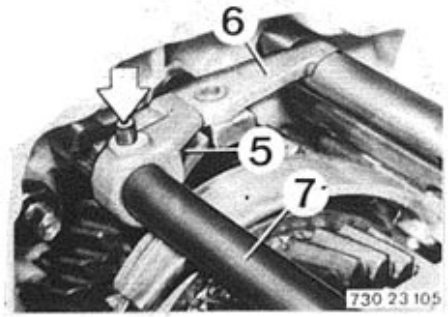
Install split needle bearing, synchromesh ring and fifth gear.



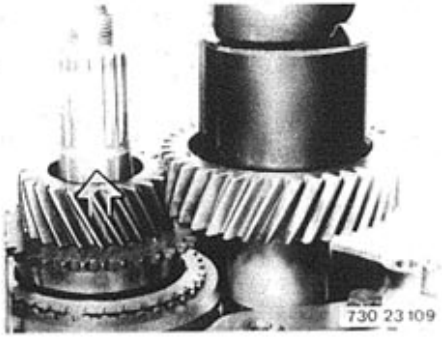
Push in selector rod far enough that 6 x 26 mm pin can be driven in, while counterholding.
Push in selector rod and guide sleeve against arrest.



Detach intermediate case on mounting bracket and set up on a press.
Lubricate pressing surface of layshaft with oil.
Heat 5th gear uniformly to correct temperature* with a hot air blower.
Press on 5th gear to fit tight with Special Tool 23 1 430.
Pressing on force*.

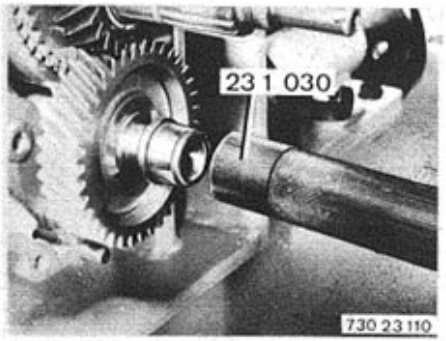


Install reversing lever (6).
Smooth side faces down.
Insert selector rail (7).
Push on turning lock (5).
Lock with 6 x 26 mm pin.

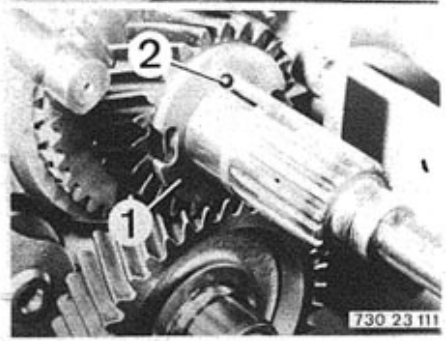


Important!
Lift and turn 5th gear until teeth mesh.

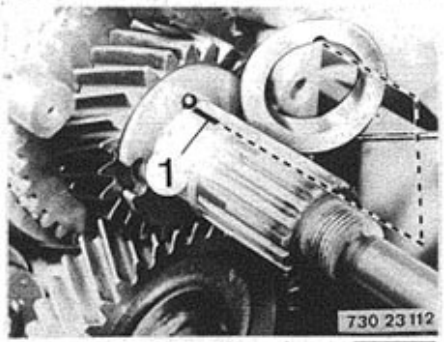
* See Specifications



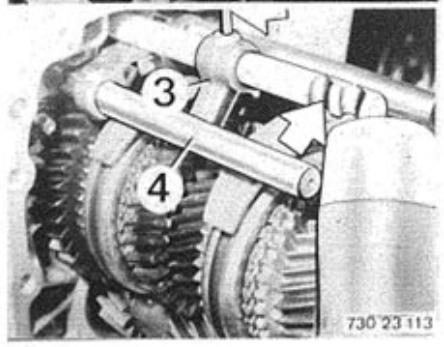
Heat bearing inner race to approx. 80° C (175° F) with a hot air blower and install on layshaft.
If necessary, drive on with Special Tool 23 1 030.
Collar of bearing race faces gear.



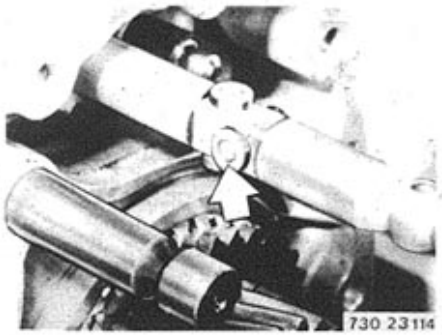
Insert ball (2) with grease.
Push on washer (1).



Installation:
Heat ball bearing inner races to approx. 80° C (175° F) with a hot air blower and install on output shaft.
Important!
Turning lock.
Opening in bearing inner race must engage in ball.
Draw line (1) to make installation of bearing race easier.

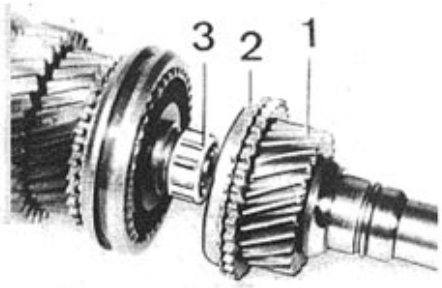


Install selector shaft, while pushing on selector arm (3) with long finger facing 3rd/4th gear selector rod.
Important!
Arrest on selector shaft faces selector rail (4).
Drive in 6 x 32 mm pin, while counterholding.



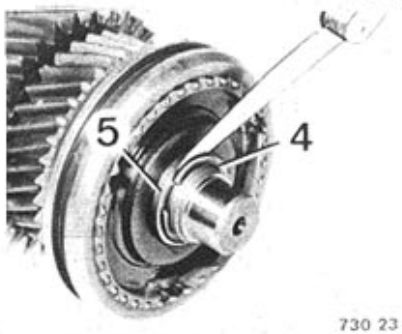
Hold four rollers in position on selector shaft with grease.

23 21 554 REPLACING OUTPUT SHAFT
– Output Shaft Removed –



730 23 115

Pull off input shaft (1), synchromesh ring (2) and needle bearing (3).

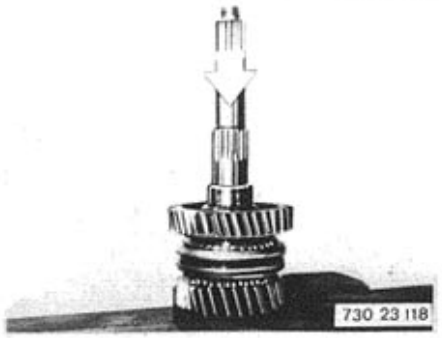


730 23 116

Remove snap ring (4).
Remove washer (5).
Installation:
Adjust play between snap ring and guide sleeve to 0 ... 0.09 mm (0 to 0.0035").
Always replace snap ring.


730 23 117

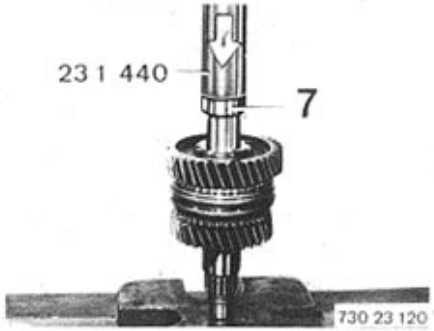
Pull off guide sleeve, synchromesh ring, 3rd gear and needle bearing.


730 23 118

Press 2nd gear, needle bearing, synchromesh ring, guide sleeve, synchromesh ring, 1st gear, needle bearing with bearing sleeve and bearing inner race off of output shaft.
Check condition of all bearings, replacing if necessary.
Check synchromesh rings (see 23 23 505).

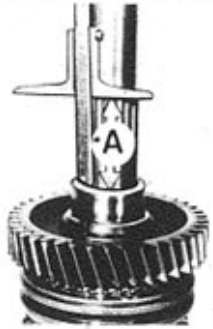

730 23 119

Install needle bearing, 2nd gear, synchromesh ring and guide sleeve with offset groove facing 1st gear.
Install bearing sleeve and needle bearing in 1st gear.
Install synchromesh ring.
Press in output shaft.
Important!
Guide in synchromesh ring with tabs in sliding sleeve.



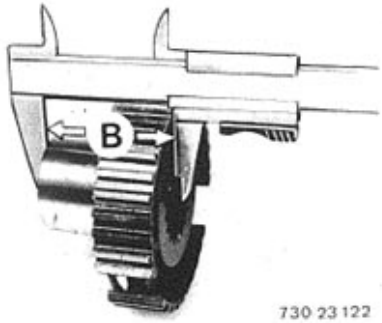
730 23 120

Heat bearing inner race (7) to approx. 80° C (175° F) with a hot air blower and install on output shaft, pressing on with Special Tool 23 1 440 if necessary.



730 23 121

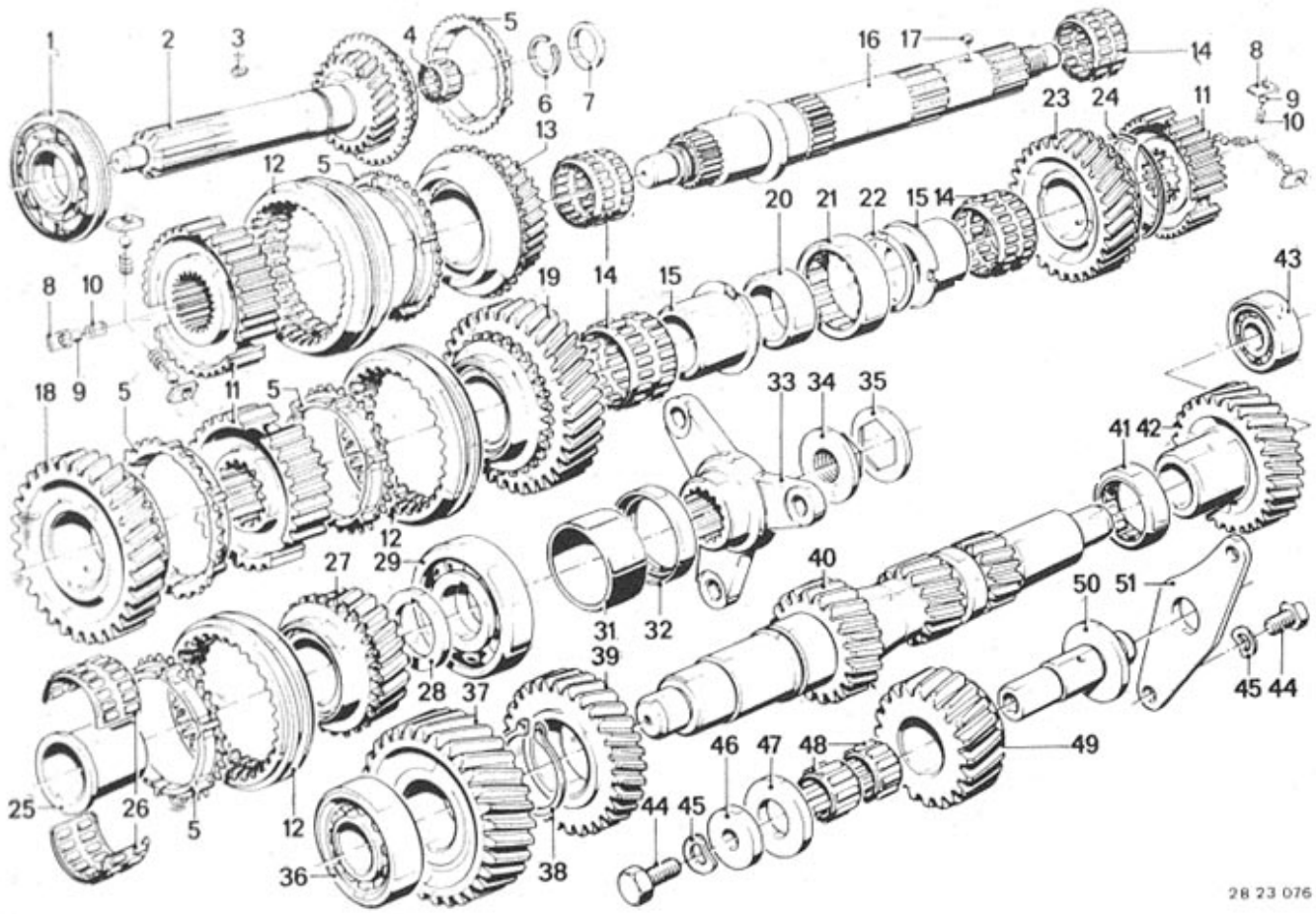
Determine thickness of shim X.
Measure distance (A) from collar of output shaft to bearing inner race.



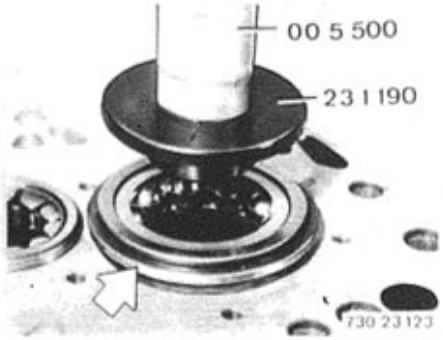
730 23 122

Place bearing sleeve for reverse gear in guide sleeve.
Measure distance (B) from collar of guide sleeve to bearing sleeve.
Example:

A	52.2 mm (2.056")
– B	52,0 mm (2.047")
X	0.2 mm (0.008") shim thickness



1 Ball bearing
2 Input shaft with 4th gear
3 Turning lock
4 Needle bearing
5 Synchromesh ring
6 Snap ring
7 Washer
8 Thrust part
9 Ball
10 Spring
11 Guide sleeve
12 Sliding sleeve
13 3rd gear
14 Needle bearing
15 Bearing sleeve
16 Output shaft
17 Ball
18 2nd gear
19 1st gear
20 Bearing race
21 Roller bearing
22 Shim X
23 Reverse gear
24 Circlip or synchromesh ring
25 Bearing sleeve
26 Split needle bearing
27 5th gear
28 Washer
29 Ball bearing
30 Washer
31 Speedometer drive gear
32 Radial oil seal
33 Output flange
34 Collar nut
35 Lockplate
36 Roller bearing
37 4th gear
38 Circlip
39 3rd gear
40 Layshaft
41 Roller bearing
42 5th gear
43 Roller bearing
44 Bolt
45 Washer
46 Washer
47 Thrust washer
48 Needle bearing
49 Reverse gear
50 Bearing shaft
51 Bearing holder

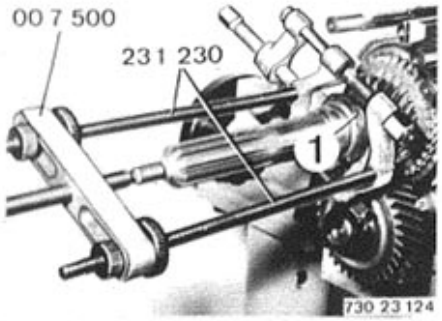


23 21 703 REPLACING BEARINGS OF ALL TRANSMISSION SHAFTS

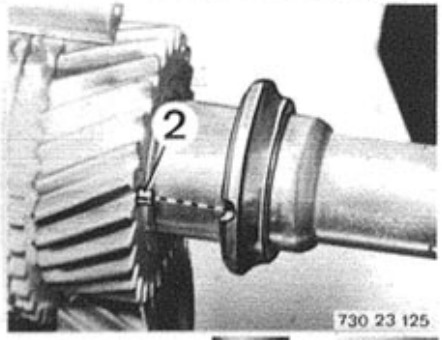
– Transmission Removed –

A) Input Shaft, Layshaft in Case Front Section:

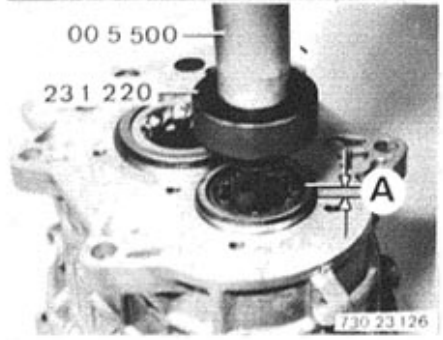
Remove case front section 23 11 013.
Drive ball bearing out of and into case with Special Tools 23 1 190 and 00 5 500.
Important!
Install ball bearing that collar faces out.



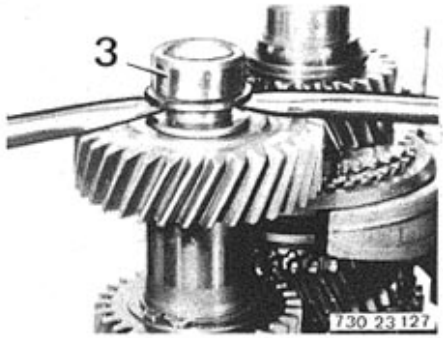
Pull bearing inner race (1) off of input shaft with Special Tools 23 1 230 and 00 7 500.



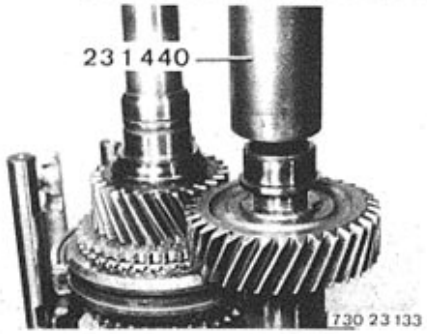
Installation:
Heat bearing inner race to approx. 80° C (175° F) with a hot air blower and install on input shaft.
Important!
Turning lock.
Pin (2) must be in opening of bearing inner race.



Drive layshaft roller bearing out and in with Special Tools 23 1 220 and 00 5 500.
Protrusion A = approx. 5 mm (0.197").
Install roller bearing that open end faces in.



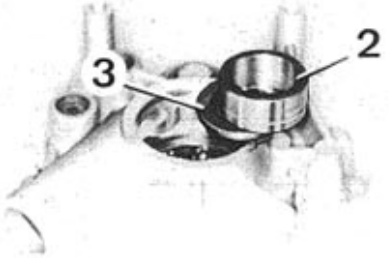
Press bearing inner race (3) off of layshaft with a screwdriver.

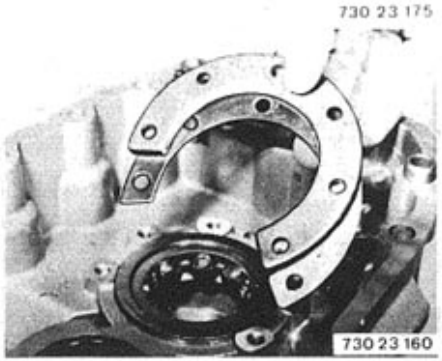


Installation:
Heat bearing inner race to approx. 80° C (175° F) and install on layshaft, driving on to fit tight with Special Tool 23 1 440 if necessary.
Collar of bearing inner race faces gear.

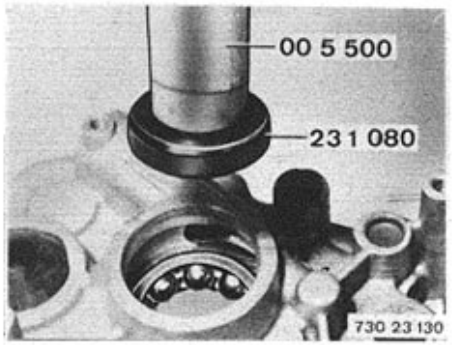
B) Output Shaft, Layshaft in Case Rear Section:

Remove case rear section 23 11 022.
Lift out radial oil seal.
Remove spacer (2) and bearing inner race (3).

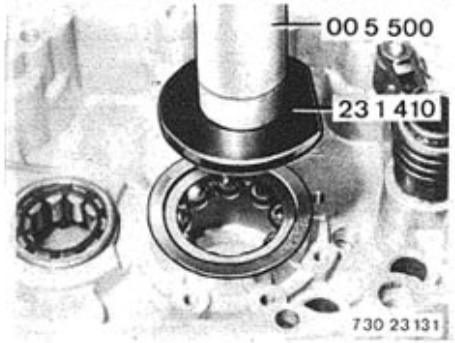




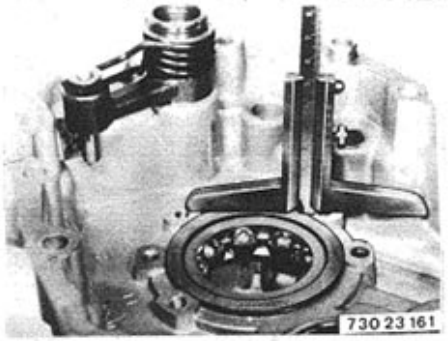
Unscrew bolts.
Remove bearing holder.



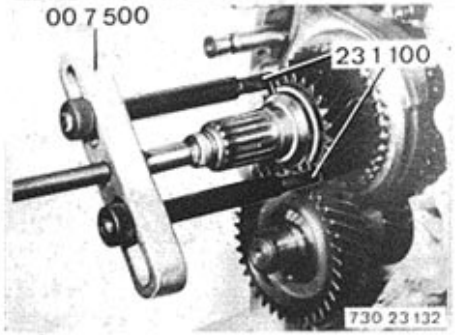
Drive out ball bearing with Special Tools 23 1 080 and 00 5 500.



Drive in ball bearing with Special Tools 23 1 410 and 00 5 500.

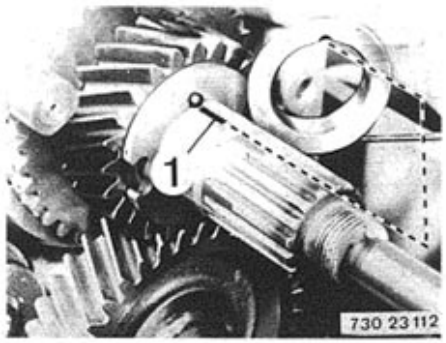


Adjust play between bearing holder and case rear section with shims.
Mount bearing holder.
Tightening torque*.

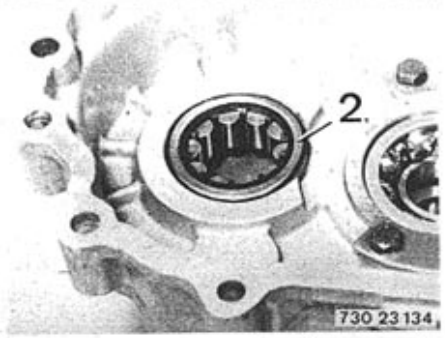


Pull ball bearing inner race off of output shaft with Special Tools 23 1 100 and 00 7 500.

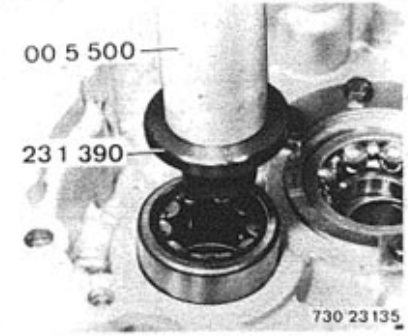
* See Specifications



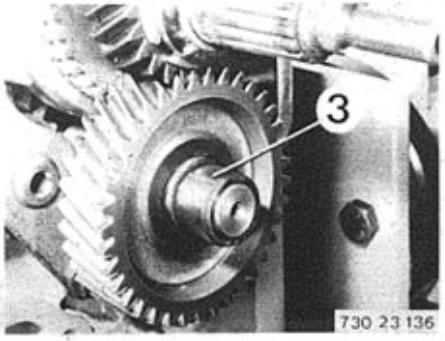
Installation:
Heat ball bearing inner race to approx. 80° C (175° F) with a hot air blower and slide on to output shaft.
Important!
Opening in bearing inner race must engage in ball.
Draw line (1) to make installation of bearing race easier.



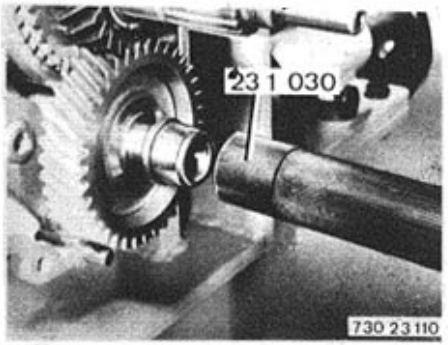
Heat case rear section to approx. 80° C (175° F) with a hot air blower.
Lift out roller bearing (2).
Installation:
Inert bearing that large diameter end of plastic cage faces up.



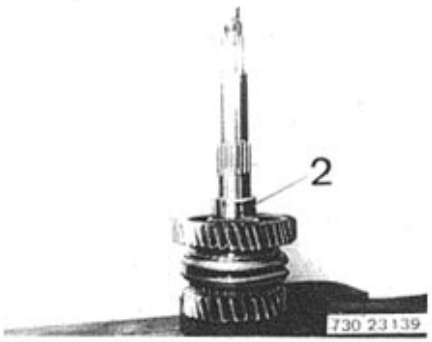
Heat case rear section to approx. 80° C (175° F) with a hot air blower.
Install roller bearing, driving in with Special Tools 23 1 390 and 00 5 500.



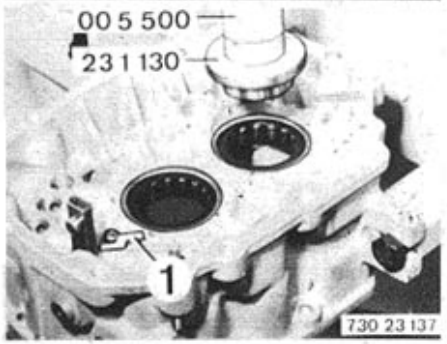
Bearing inner race (3) can only be pulled off together with the 5th gear (see 23 21 503).



Heat new bearing inner race to approx. 80° C (175° F) with a hot air blower and install on layshaft, driving on with Special Tool 23 1 030 if necessary.
Collar of bearing race faces gear.

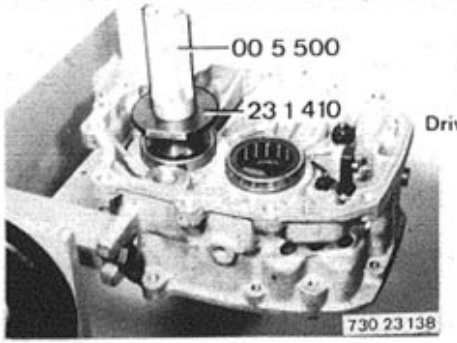


Check condition of bearing inner race (2) on output shaft, replacing if necessary.
If replacement is necessary, press gear set off of output shaft (see 23 21 554).



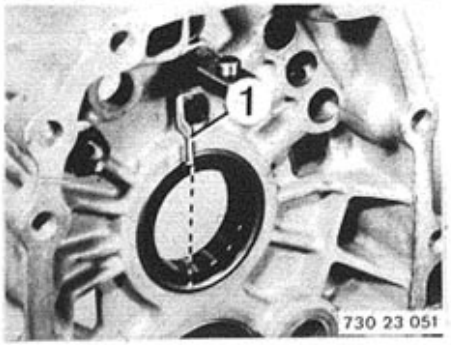
C) Output Shaft, Layshaft in Intermediate Case:

Remove input and output shaft assembly 23 21 503.
Drive roller bearings for input shaft and layshaft out of intermediate case with Special Tools 23 1 130 and 00 5 500.
Important!
Unscrew and turn oil plate (1) in case of roller bearing for output shaft.

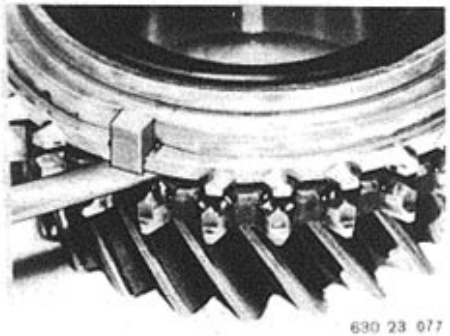


Drive roller bearings for output shaft and layshaft into intermediate case with Special Tools 23 1 410 and 00 5 500.
Drive in roller bearings flush.

Drive



Bolt down oil plate (1) in vertical installed position.



630 23 077

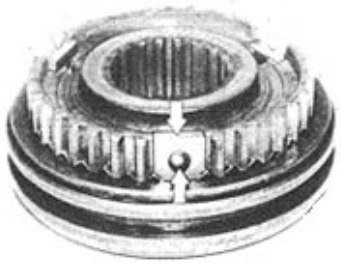
23 23 505 DISASSEMBLING/ASSEMBLING COMPLETE SYNCHRONIZATION
– Output Shaft Removed –

Disassemble output shaft (see 23 21 554).
All synchromesh rings are identical and coated with molybdenum on the inside.
Check distance* between synchromesh ring and clutch.
Measure in area of stops.
Synchromesh rings should bear uniformly all around.



635 23 137

Disassemble synchronization.
Pressure piece (1)
Soring (2)
Ball (3)
Installation:
Bore (4) in operating sleeve must be aligned with ball (3).



630 23 575

Installation:
Install all springs, pressure pieces and balls.
Important!
Curved surface of pressure pieces faces th operating sleeve.
Install guide sleeve that half of it is in the operating sleeve.
Press in balls far enough until the guide sleeve can be pressed into the operating sleeve.

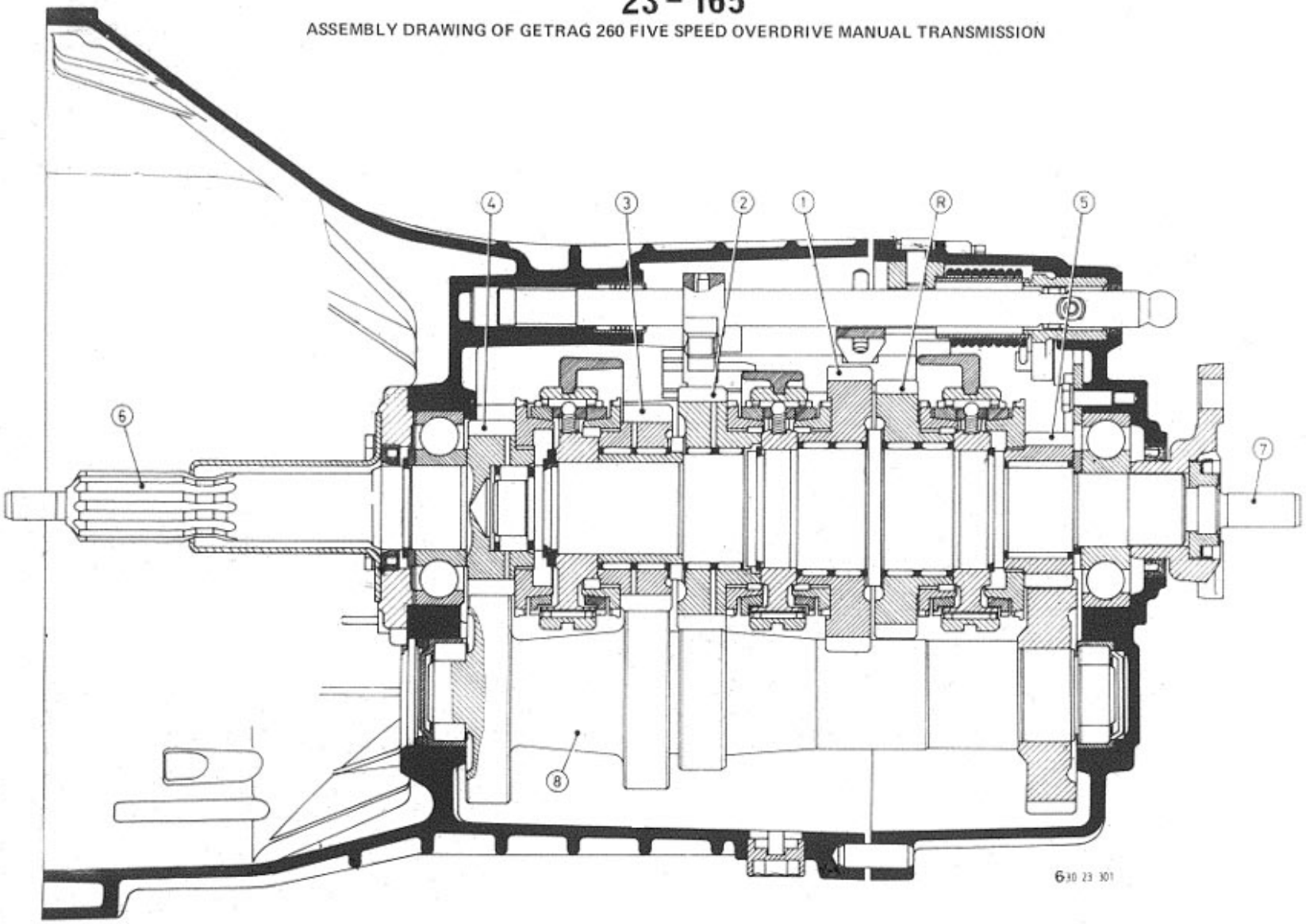
* See Specifications

Condition	Cause	Correction
Oil on clutch housing	a) Guide flange leaks b) Radial oil seal for input shaft leaks c) Gasket on end cover (crankcase) leaks d) Radial oil seal for crankshaft leaks	a) Seal guide flange b) Replace radial oil seal 23 12 503 c) Replace gasket d) Replace radial oil seal 11 14 605
Oil on output flange	a) Radial oil seal for output shaft leaks b) Radial oil seal for selector shaft leaks	a) Replace radial oil seal 23 12 053 b) Replace radial oil seal 23 12 083
Transmission leaks between front and rear sections	a) Gasket defective	a) Replace gasket
Oil on vent	a) Oil level too high b) Wrong oil (excessive foaming)	a) Correct oil level b) Replace oil
Gear does not hold - jumps out	a) Worn sliding sleeve, defective slides, broken springs b) Inversely installed sliding sleeve (1st/2nd gear) c) Shift console loose d) Selector fork worn e) Output flange loose	a) Replace damaged parts 23 23 505 b) Install sliding sleeve correctly 23 21 554 c) Tighten shift console d) Replace selector fork e) Tighten output flange

TROUBLESHOOTING MANUAL TRANSMISSION

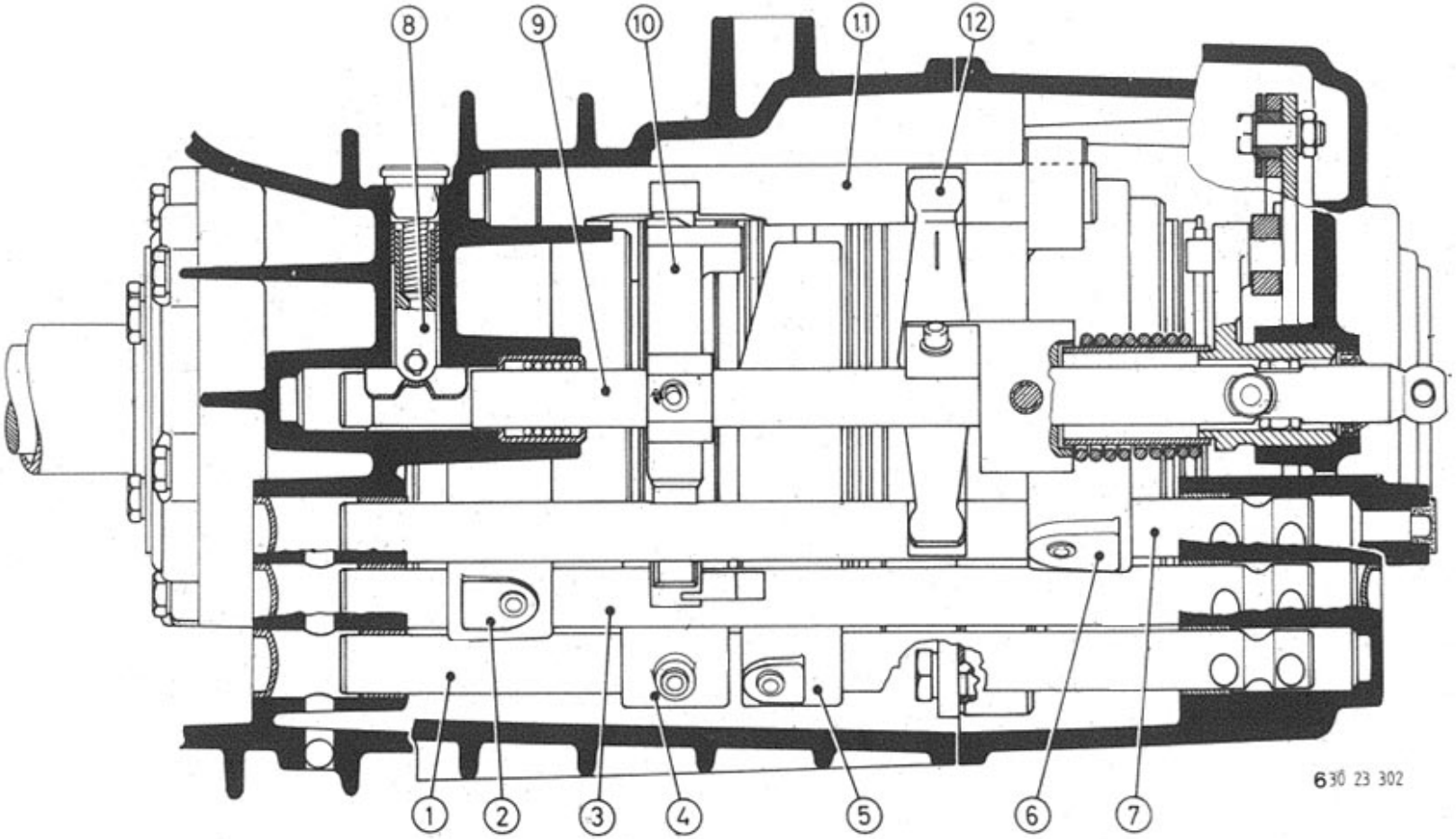
Condition	Cause	Correction
Hard moving, sticking (scratching) shifts	a) Clutch disengagment insufficient 1. Pedal travel insufficient 2. Drive plate worn 3. Liner stuck on flywheel 4. Drive plate seized on transmission input shaft 5. Bearing for transmission input shaft in crankshaft defective 6. Air in clutch hydraulic system b) Thick, viscous gear lube c) Excessive play in selector lever bearings d) Selector fork worn e) Sliding sleeve worn	a) 1 Check pedal travel, adjusting if necessary. Remove excessively thick mats. Floor clutch when shifting. 2. Replace drive plate 21 21 000 3. Clean flywheel, replace drive plate 4. Service or replace drive plate 21 21 000 5. Replace bearing in crankshaft 11 21 571 6. Bleed clutch 21 00 006 b) Use 10 W-50 engine oil in cold climates or sticking on cold transmission c) Check selector lever bearings (shift console mounting), replacing worn ball plates if necessary 25 11 041 d) Replace selector fork e) Replace sliding sleeve 23 23 505
Transmission scratches when shifting	a) Clutch disengagement insufficient b) Synchromesh rings worn, sliding sleeve worn c) Reverse gear: 3 sec. shift pause not made	a) See above b) Check synchronization, replace damaged parts 23 23 505 c) Make shift pause
Transmission loud	a) Oil level too low b) Transmission shaft bearings defective c) Damaged gears d) Needle bearings of output and input shafts defective e) Bearing for transmission input shaft in crankshaft defective	a) Correct oil level b) Replace all bearings 23 23 703 c) Replace gear wheel set or gear assembly d) Replace needle bearings e) Replace bearing in crankshaft 11 21 571

ASSEMBLY DRAWING OF GETRAG 260 FIVE SPEED OVERDRIVE MANUAL TRANSMISSION

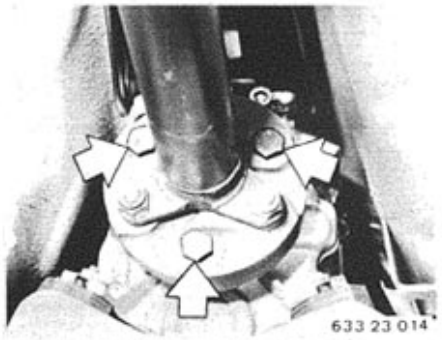


1 First gear
2 Second gear
3 Third gear
4 Fourth gear
5 Fifth gear
6 Reverse gear
6 Input shaft
7 Output shaft
8 Layshaft

ASSEMBLY DRAWING OF SHIFT PARTS FOR GETRAG 260 FIVE SPEED OVERDRIVE MANUAL TRANSMISSION

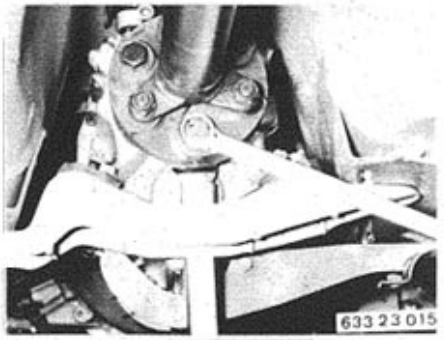


1 Selector rod – 1st/2nd gear
2 Selector fork – 3rd/4th gear
3 Selector rod – 3rd/4th gear
4 Dog
5 Selector fork – 1st/2nd gear
6 Selector fork – reverse/5th gear
7 Selector rod – reverse/5th gear
8 Lockpin
9 Selector shaft
10 Selector arm
11 Selector rail
12 Operating lever

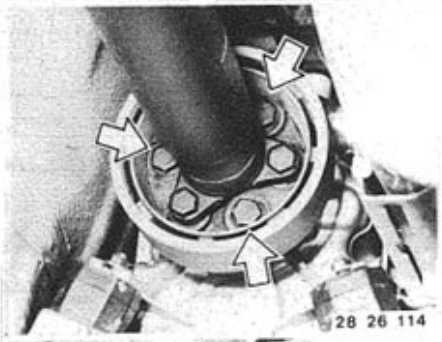


23 00 022 REMOVING AND INSTALLING TRANSMISSION

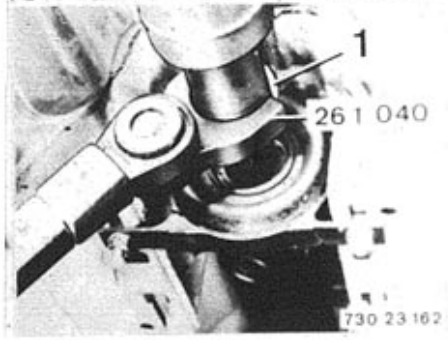
Remove exhaust assembly – 18 00 020.
Remove the heat shield.
Unscrew coupling on the transmission.



Installation:
Replace stop nuts.
Tighten nuts with a standard 19 mm socket and a torque wrench.
Tightening torque*.
Important!
Only tighten the nuts (never the bolts) to avoid stress in the coupling.

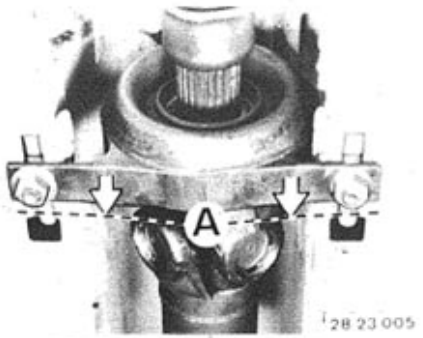


Version with Vibration Damper:
The vibration damper is mounted in the drive flange together with the coupling mounting bolts.
Turn the vibration damper and pull it back over the output flange before pulling the propeller shaft off of the guide pin.
The vibration damper is pulled off together with the propeller shaft.

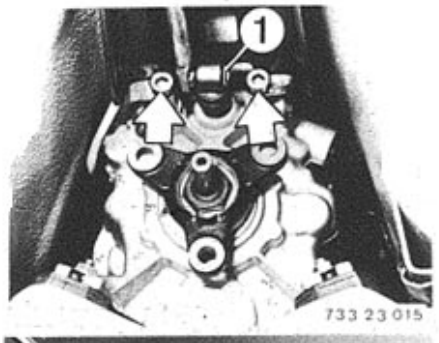


Version with Screw-On Ring:
Loosen the screw-on ring (1) several turns.
Installation:
Tighten the screw-on ring (1) with Special Tool 26 1 040 after finishing installation.
Tightening torque*.

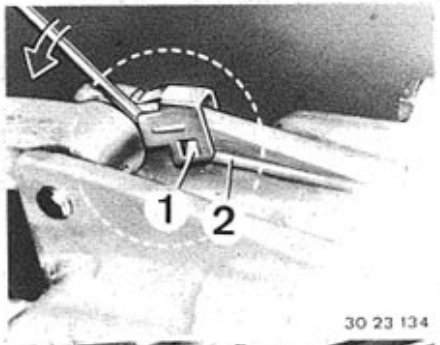
* See Specifications



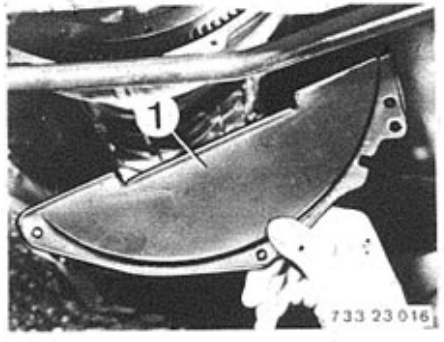
Unscrew the center mount.
Installation:
Preload the center mount forward by distance A = 4 to 6 mm (0.157 to 0.236").
Tightening torque*.
Bend the propeller shaft down and pull it off of the centering pin.
Important!
Suspend the propeller shaft from the car on a piece of wire.



Pull off wires on the reverse gear switch.
Unscrew the shift console on the transmission.
Important!
Self-locking bolts – these bolts will be hard to unscrew.
Installation:
Always replace the self-locking bolts.
When tightening, make sure that brackets are horizontal to the shift console (shift lever noise).
Tightening torque*.
Lift out retainer (1).
Remove the washer.
Pull out the selector rod.

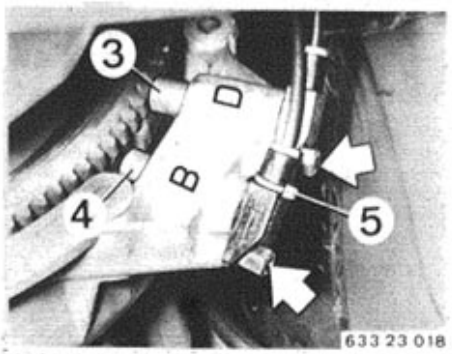


Version with Selector Arm:
Lift out spring (1) from tab (2) on the case with a screwdriver and swing it up.
Pull out the shaft pin.
Installation:
Lubricate the shaft pin lightly with Molykote Longterm 2.

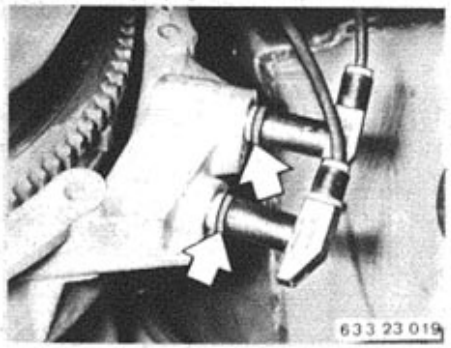


Only for Version with Cover:
Unscrew cover (1).

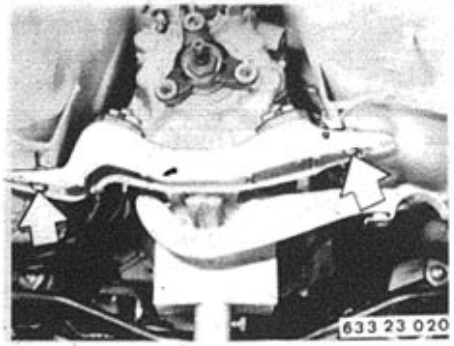
* See Specifications



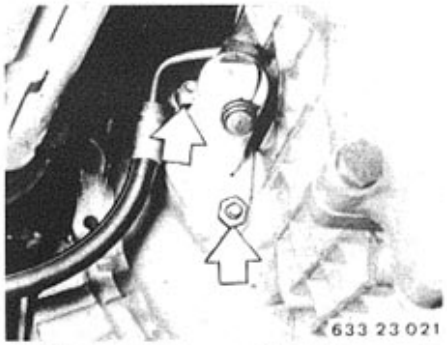
Version with DME:
Unscrew the bolts.
Pull out speed sensor (3) and reference mark sensor (4).
Important! – Installation:
Check the installed position.
Plugs must not be mixed up.
Install speed sensor (3) in bore (D) and reference mark sensor (4) with ring (5) in bore (B).
The engine cannot be started, if plugs are mixed up.



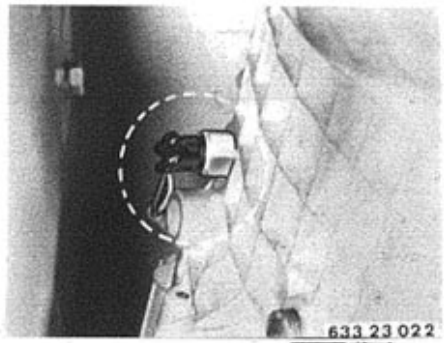
Installation:
Check the O-ring.
Install sensors with Molykote Longterm 2.
Important!
Face of DME sensors must be free of grease and dirt.



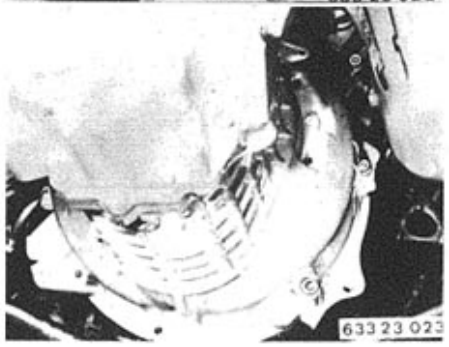
Unscrew the cross member on the body.
Installation:
Tightening torque*.



Unscrew the clutch slave cylinder.
The line remains connected.
The bleeder screw faces down.



Pull off wires on the reverse gear switch.
Lift wires out of the holders.



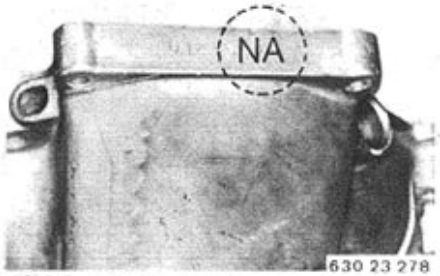
Unscrew the transmission on the engine.
Use Torx socket for the Torx bolts.
Important! – Installation:
Use washers on version with Torx bolts to avoid any increase in the breaking-loose torque.
Tightening torque*.
Remove the transmission toward the rear.
Check the oil level.

* See Specifications

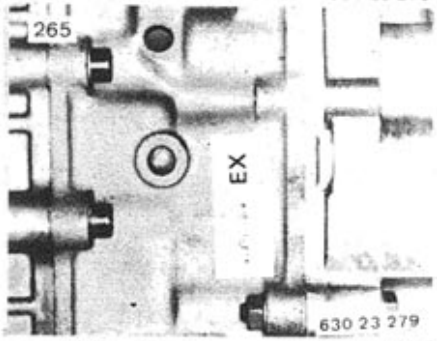
* See Specifications

242/240/260

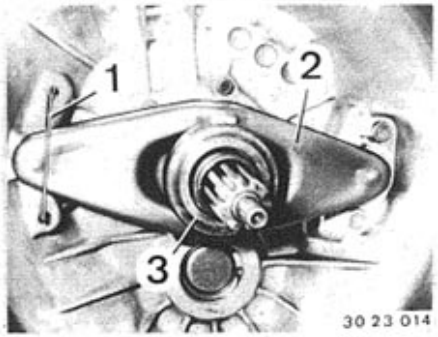
23 00 032 INSTALLING EXCHANGE TRANSMISSION



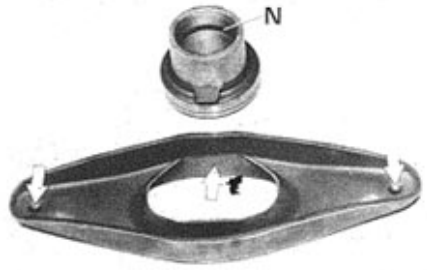
Remove transmission 23 00 022.
Transmission Identification:
BMW code* on front case section.
Transmission Type 260.



BMW code* on intermediate case section.
Transmission Type 265/Overdrive.

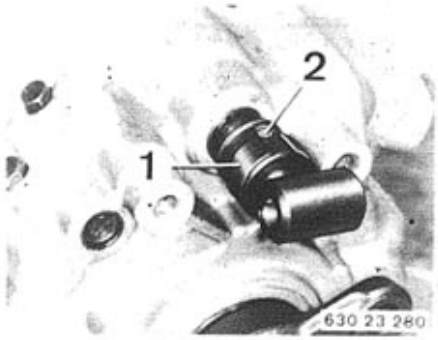


Transfer spring (1) and release lever (2) with release (3).

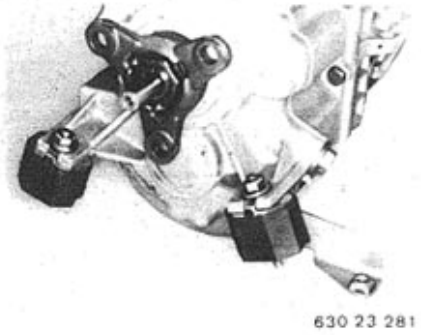


Installation:
Fill lubricating groove (N) with Molykote Longterm 2.
Lubricate guides (F) and bearings (L) with a light coat of Molykote Longterm 2.
Non-conformance could cause bearing to seize on the guide sleeve.

* See Spare Part Microfiche

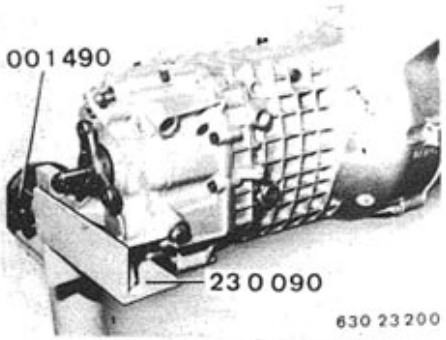


Transfer selector rod joint.
Push back locking sleeve (1)
Drive out dowel pin (2).
Note:
Check installed position of the selector rod joint.
The offset end of the selector rod joint of a Type 260 transmission is installed on the right side as seen looking forward in car, while the offset end of the selector rod joint of a Type 265 transmission is installed on the left side.



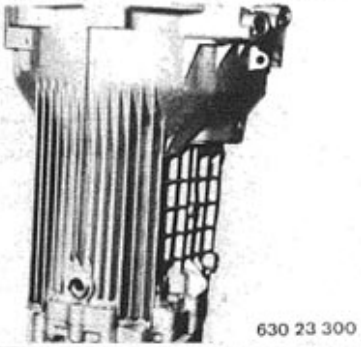
Transfer rubber mounts, exhaust carrier and backup light switch.
After Installation of Transmission:
Fill transmission with oil.
Oil volume*.

* See Specifications

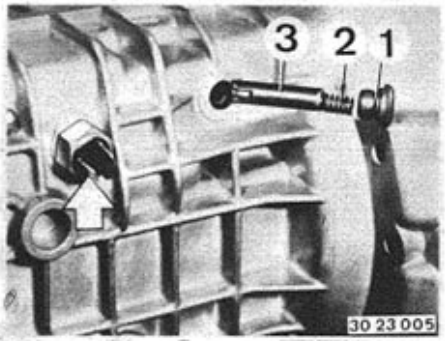


23 11 013 REMOVING AND INSTALLING/ SEALING TRANSMISSION CASE FRONT SECTION

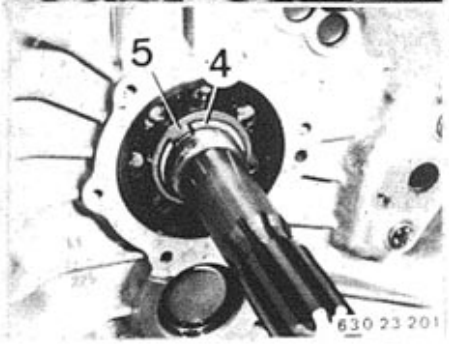
Remove transmission 23 00 022.
Mount Special Tool 23 0 090 on Special Tool 00 1 490.
Mount transmission on special tool assembly.
Drain oil.



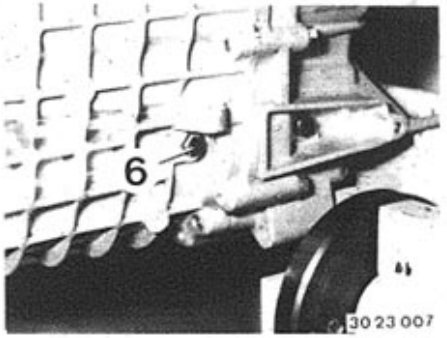
General Information:
A stronger five speed overdrive manual transmission, Type 260/6, is installed since 9.85 in cars with a 3.2 or 3.4 liter M 30 engine.
It can be identified on the additional cooling ribs on the bottom of the case.
The 260/6 overdrive transmission has been included in the following description for the formerly installed Type 260/5 overdrive transmission.



Remove guide sleeve 23 11 623.
Unscrew backup light switch.
Remove cap (1).
Pull out spring (2) and lockpin (3).
Check installed position!



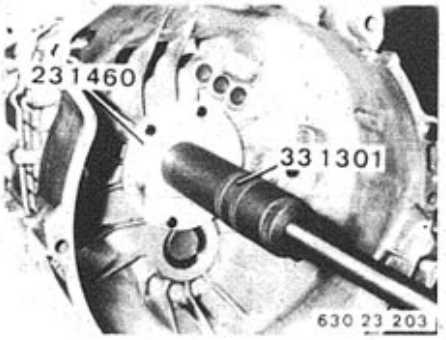
Remove snap ring (4).
Remove washer (5).
Installation:
Always replace snap ring.



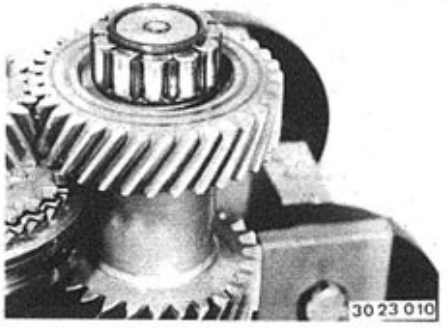
Unscrew bolt (6).
Installation:
Install bolt with Loctite No. 270.
Tightening torque*



Drive out cylindrical pins.
Unscrew bolts.
Installation:
Check length of bolts.
Bolt (1) = 8 x 60 mm.

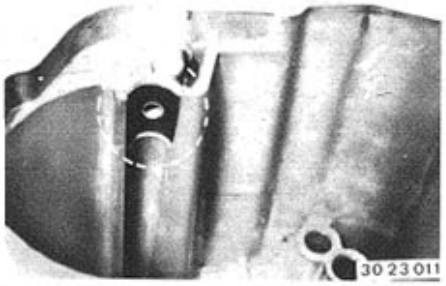


Pull off front case section with Special Tools 23 1 460 and 33 1 301.



Install roller bearing on layshaft that small diameter end faces up.
Note:
Coat rollers with grease and press in, in order to avoid clamping of rollers when mounting the case front section.

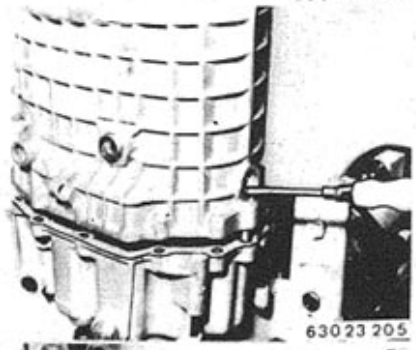
* See Specifications



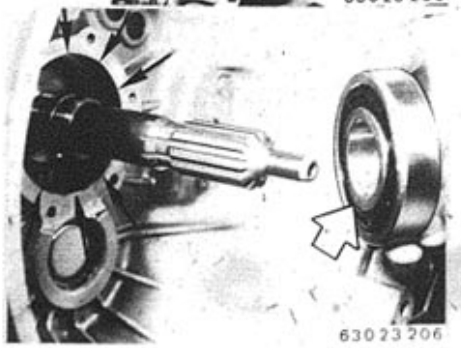
Coat case front section in area of reverse gear shaft with Loctite No. 573.
Surface must be thoroughly cleaned and dried of oil.



Remove grooved ball bearing for input shaft.
Important!
Inner race of grooved ball bearing has a protrusion.
Protrusion faces gear shaft.

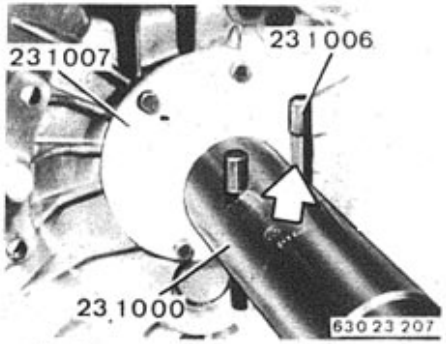


Unscrew oil drain plug.
Coat sealing surface with Loctite No. 573.
Sealing surface must be thoroughly cleaned and dried of oil.
Mount front case section.*
Align layshaft through bore for oil drain plug that roller bearing of layshaft slides into bearing shell.
Bolt front case section.
Tightening torque*.
Install lockpin and reverse gear switch.

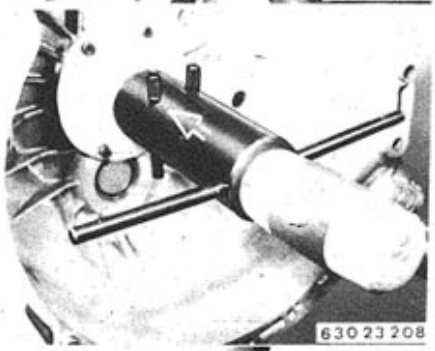


Heat* bearing inner race and front case section in area of grooved ball bearing with a hot air blower.
Push on grooved ball bearing as far as possible.
Inner race protrusion faces gear set.

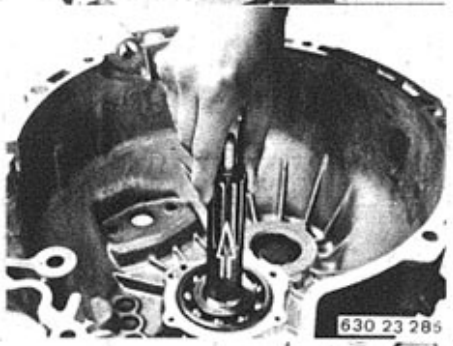
* See Specifications



Press grooved ball bearing on to input shaft and into front case section with Special Tools 23 1 007, 23 1 000 and 23 1 006.
Important!
Insert Special Tools 23 1 006 that flat sides face input shaft.



Keep driving on grooved ball bearing simultaneously with light hammer knocks.

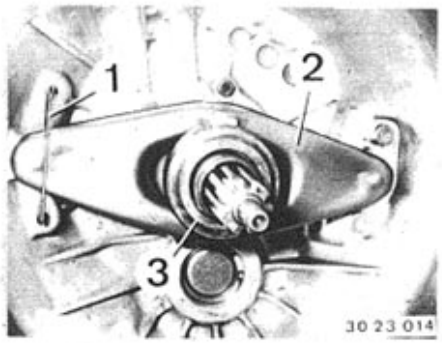


Transmission 260/6:
The front case section cannot be pressed on, because of the uniform thickness of the input shaft.
A double bearing is installed in the front case section.
Heat bearing inner race to about 80° C (175° F) with a hot air blower.
Important!
Protect plastic cage against heat.
Mount front case section, pulling out the input shaft for this purpose.
Bolt front case section.
Tightening torque*.



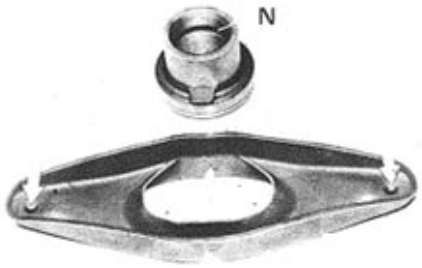
Install spacer and circlip.
Adjust play between bearing inner race and circlip to 0 ... 0.09 mm (0 to 0.0035").

* See Specifications

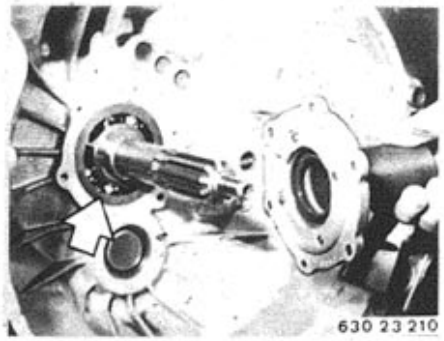


23 11 623 REMOVING AND INSTALLING GUIDE SLEEVE FOR CLUTCH RELEASE
– Transmission Removed –

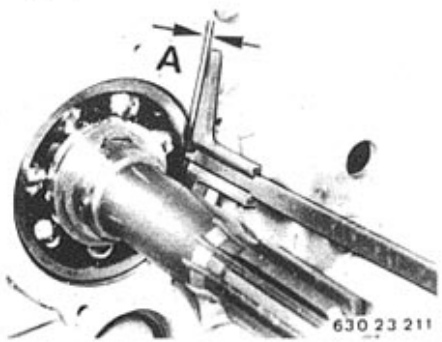
Lift out spring (1) and remove release lever (2) with thrust bearing (3).



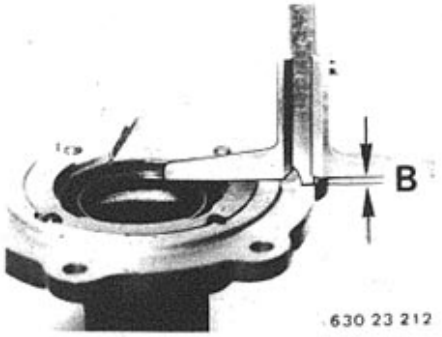
Installation:
Pack lubricating groove N with Molykote Longterm 2.
Coat guides F and bearings L with Molykote Longterm 2.
Non-conformance could cause release bearing to seize on guide sleeve.



Unscrew guide sleeve.
Important!
Spacer.
Installation:
Install guide sleeve and bolts with Loctite No. 573.
Sealing surface and bolts must be thoroughly cleaned and dried of oil.
Tightening torque*



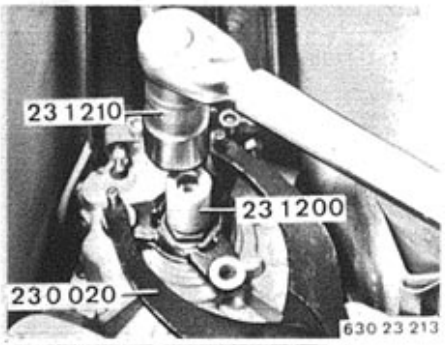
Installation:
Adjust play to 0 ... 0.09 mm (0 to 0.0035").
Determine thickness of spacer.
Measure distance (A).



Measure distance (B).
Example:

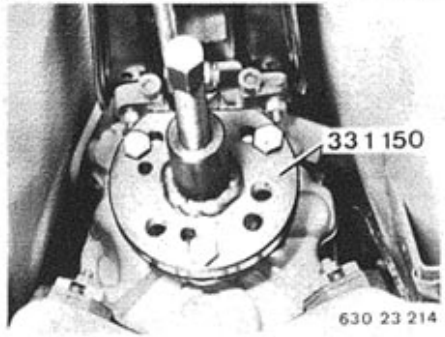
A	3.0 mm (0.118")
– B	2.6 mm (0.102")
	0.4 mm (0.016") spacer thickness

* See Specifications

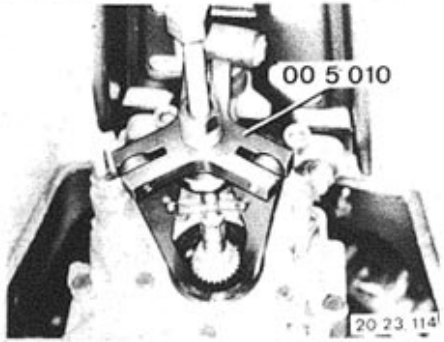


23 12 053 REPLACING RADIAL OIL SEAL FOR OUTPUT FLANGE

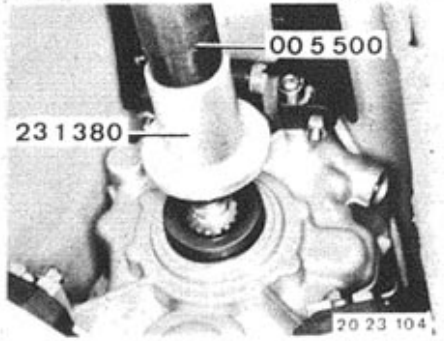
Unscrew propeller shaft – see 23 00 022.
Lift out lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.



If too difficult, pull off output flange with Special Tool 33 1 150.

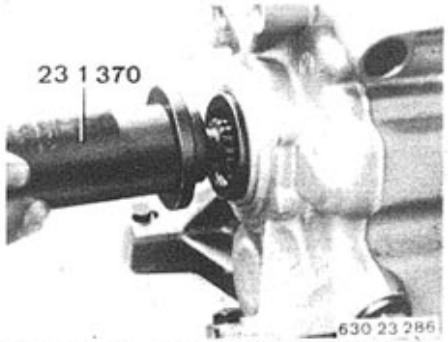


Pull out radial oil seal with Special Tool 00 5 010.

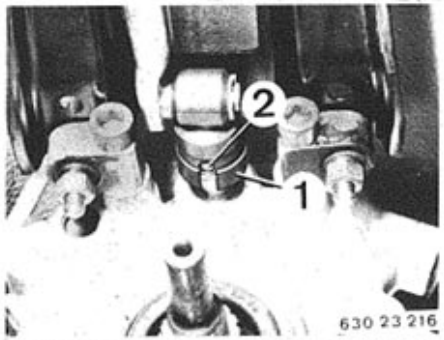


Lift out radial oil seal.
Drive in radial oil seal with Special Tools 23 1 380 and 00 5 500.
Installation:
Lubricate sealing lips with oil.
Bolt output flange.
Tightening torque*.
Install collar nut with Loctite No. 270.
Lock lockplate in groove of output flange.

* See Specifications

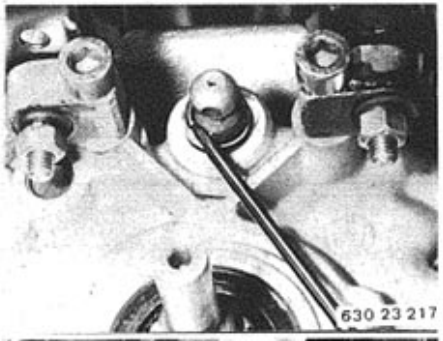


Transmission 260/6:
Drive in radial oil seal flush with Special Tool 23 1 370.

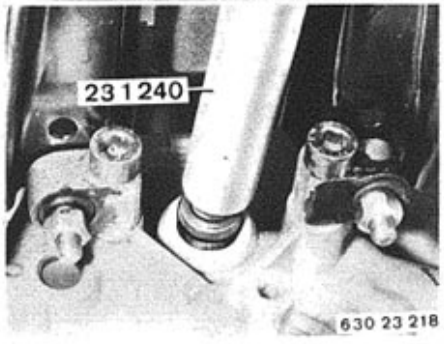


23 12 083 REPLACING RADIAL OIL SEAL FOR SELECTOR SHAFT

Unscrew propeller shaft – see 23 00 022.
Remove output flange – see 23 12 053.
Engage 3rd gear.
Push locking sleeve (1) aside and drive out pin (2).



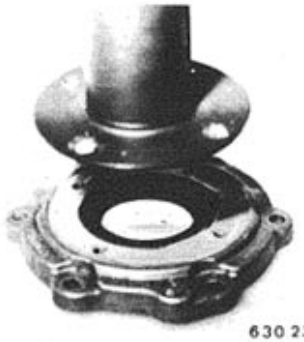
Lift out radial oil seal.



Drive in radial oil seal with Special Tool 23 1 240.

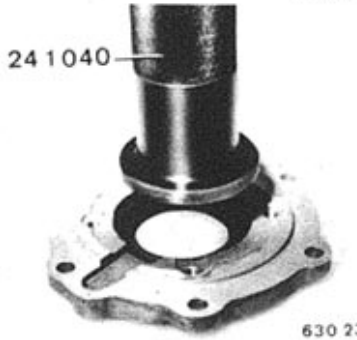
23 12 503 REPLACING RADIAL OIL SEAL FOR INPUT SHAFT

– Transmission Removed –



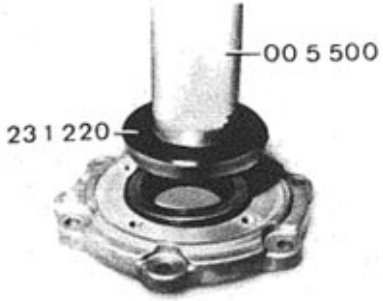
630 23 219

Remove guide sleeve 23 11 623.
Unscrew guide tube.
Installation:
Install guide tube and bolts with Loctite No. 573
Sealing surface and bolts must be thoroughly cleaned and dried of oil.
Tightening torque*.



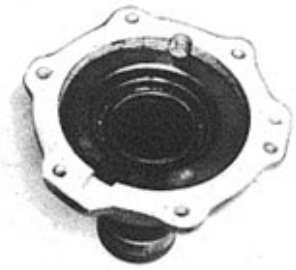
630 23 220

Important!
Collar on inside surface of flange.
Drive out radial oil seal in direction of guide tube with Special Tool 24 1 040.



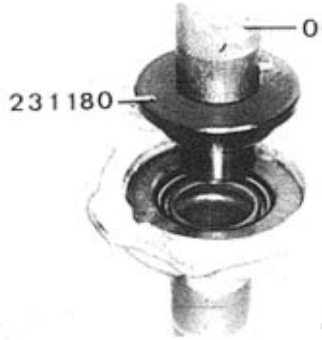
630 23 221

Drive in radial oil seal with Special Tools 23 1 220 and 00 5 500.
Lubricate sealing lips of radial oil seal with oil.



635 23 027

Transmission 260/6:
Lift out radial oil seal.

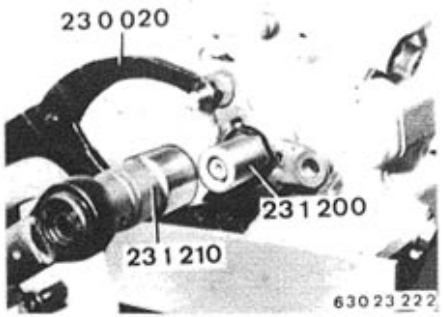


635 23 028

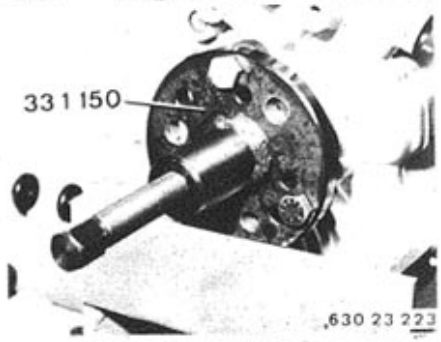
Drive in radial oil seal against stop with Special Tools 23 1 180 and 00 5 500.
Open end faces up.
Lubricate sealing lip with oil.

* See Specifications

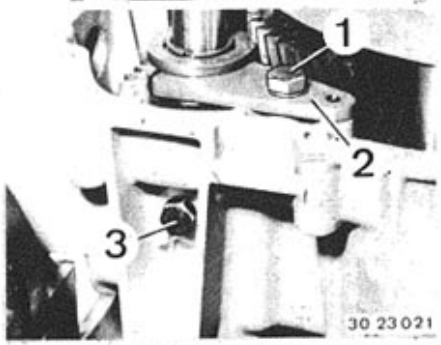
23 21 503 REMOVING AND INSTALLING INPUT AND OUTPUT SHAFT ASSEMBLY
–TRANSMISSION REMOVED–



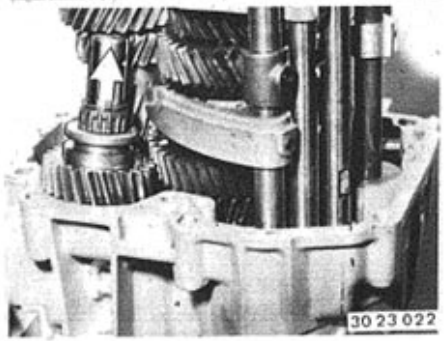
Remove transmission case front section 23 11 013.
Remove lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.



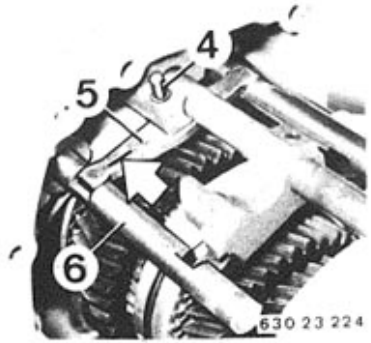
Pull off output flange with Special Tool 33 1 150.



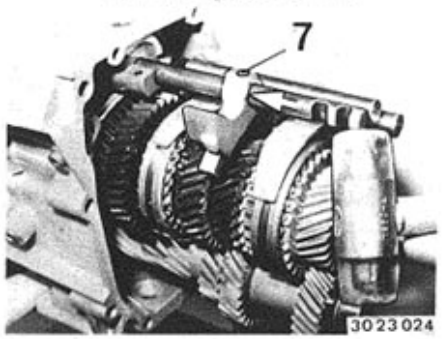
Unscrew bolt (1).
Remove holder (2).
Unscrew bolt (3).



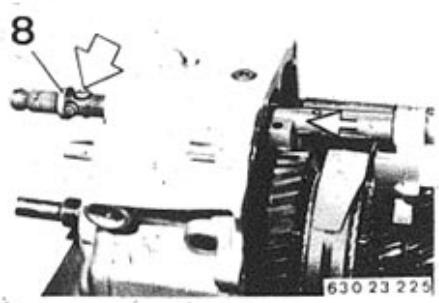
Remove shaft with reverse gear and needle bearing.



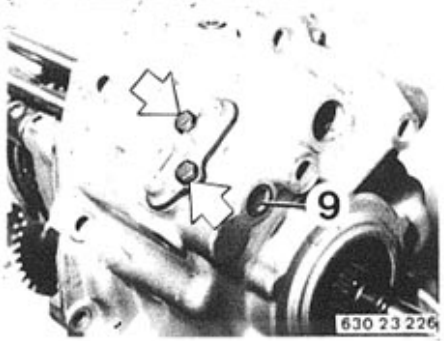
Pull out pin (4) for operating lever (5).
Pull out selector rail (6).
Remove operating lever (5).
Installation:
Install operating lever that notch faces up and in direction of selector rail.



Engage 4th gear.
Drive in pin (7), while counterholding.
Important!
Only drive in pin (7) far enough that selector shaft can be pulled back and out.

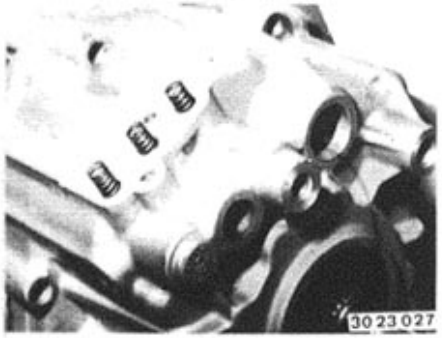


Radial oil seal (8) will also be pulled out.
Important!
Rollers on selector shaft.
Installation:
Replace radial oil seal.
Remove selector arm.

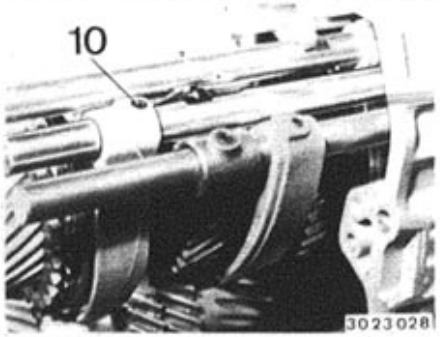


Unscrew end plate.
Installation:
Install end plate with Loctite No. 573*.
Sealing surface must be thoroughly clean and dried of oil.
Remove plug (9).
Installation:
Replace plug.

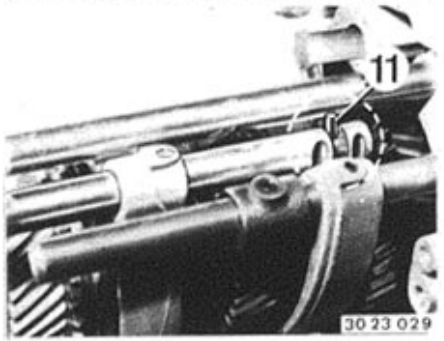
* Source: HWB



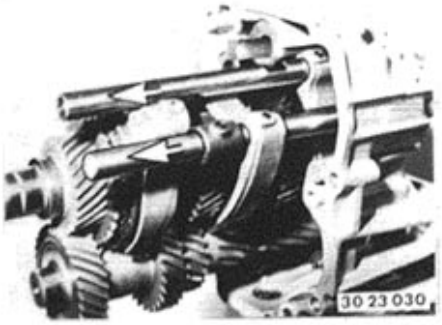
Remove 3 springs and 3 balls.
Note:
Length of springs differs (see installation).



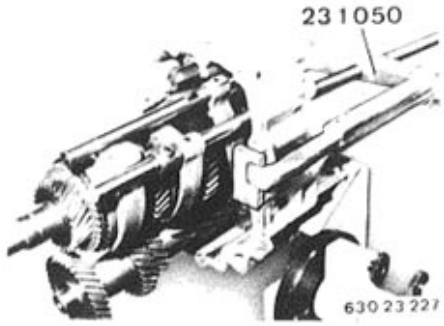
Drive out pin (10) in 3rd/4th gear selector fork.
Installation:
Replace pin.



Knock out 3rd/4th gear selector rod forward.
Important!
Lockpin (11) in selector rod.

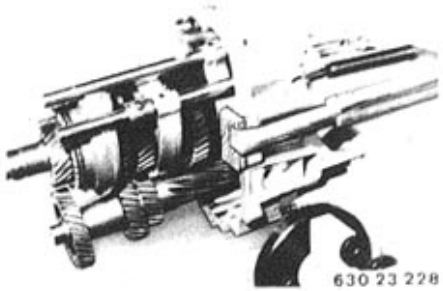


Engage 2nd and reverse gears by pushing 1st/2nd and 5th/reverse gear selector rods forward.

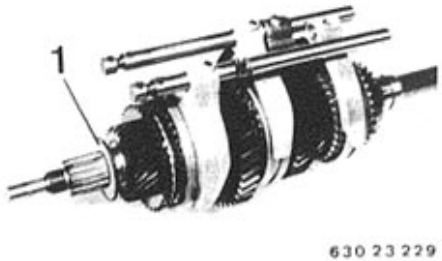


Press input shaft, output shaft and layshaft out of rear case section with Special Tool 23 1 050.
Important!
To avoid sealing surface damage, use a piece of wood, aluminum or similar material between claws and sealing surface.

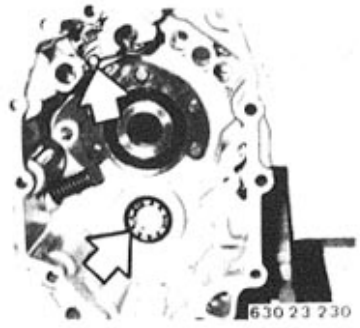
Important!
Be careful not to clamp selector rods and layshaft while pressing out parts.
Installation:
Check condition of all bearings, replacing if necessary.

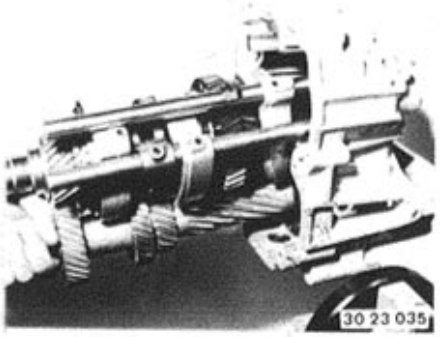


Installing:
Install 3rd/4th gear selector fork and 1st/2nd as well as 5th/reverse gear selector rods with selector forks.
Only 260/5:
Check thrust washer (1).

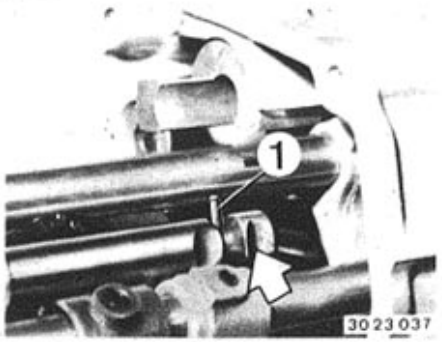


Remove all detent and locking balls in rear case section.
Install roller bearings with large diameter end facing out.
Lubricate lockpin and locking lever with oil.
Transmission 260/6:
The output flange radial oil seal and ball bearing inner race have to be removed prior to installing the input shaft and output shaft.

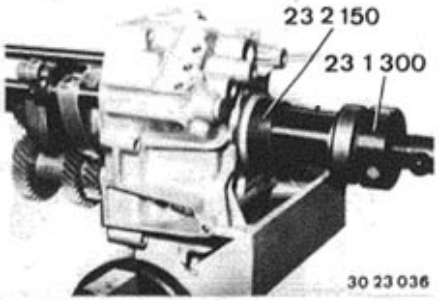




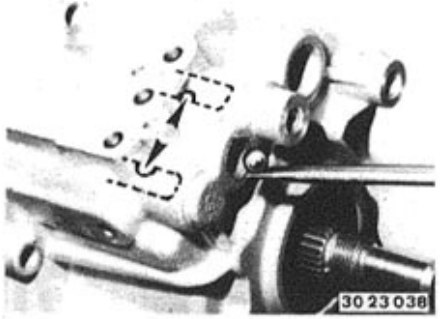
Heat grooved ball bearing inner race in rear case section to about 80° C (175° F) with a hot air blower.
Second and reverse gears are engaged.
Insert input shaft, output shaft and layshaft in case rear section.
Align selector rods.



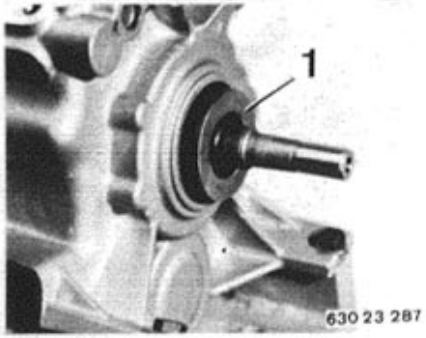
Move selector rods to neutral position.
Slide 3rd/4th gear selector rod through selector forks.
Install lockpin (1) in selector rod with grease.
Push in selector rod up to bore.
Opening in selector rod faces up.



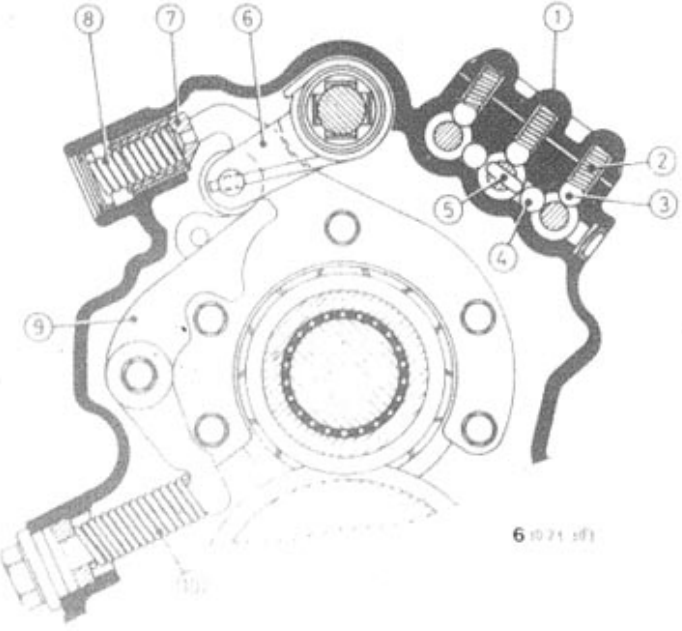
Pull input shaft, output shaft and layshaft into rear case section with Special Tools 23 1 300 and 23 2 150.
Important!
Make sure selector rods and layshaft are not clamped while pulling in parts.



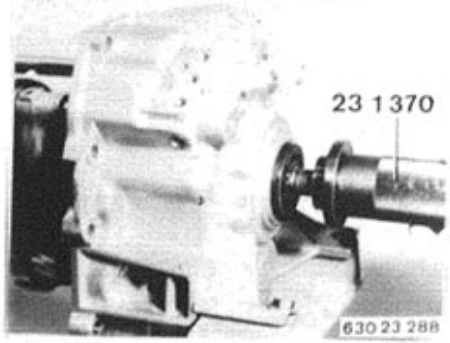
Install two detent balls with grease.
Push in 3rd/4th gear selector rod against lock.



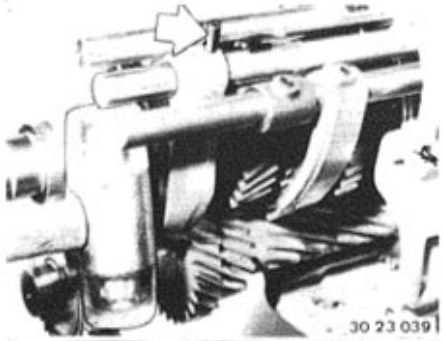
Transmission 260/6:
Place input shaft and output shaft with 3rd/4th gear selector forks and 5th/reverse gear plus 1st/2nd gear selector rods as well as layshaft in the rear case section.
Heat bearing inner race (1) to about 80° C (175° F) with a hot air blower and slide on to the output shaft, pressing on with Special Tool 23 1 160 if necessary.



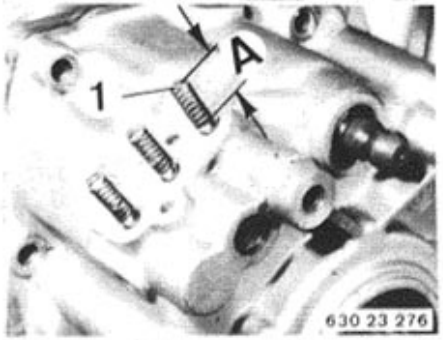
Arrest Assembly:
1 End cap
2 Spring
3 Locking ball
4 Detent ball
5 Lockpin
6 Selector arm
7 Lockpin
8 Spring
9 Locking lever
10 Spring



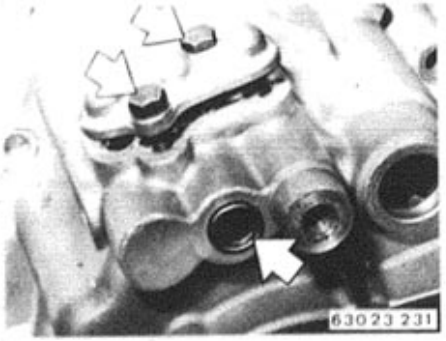
Transmission 260/6:
Drive in radial oil seal flush with Special Tool 23 1 370.
Lubricate sealing lip with oil.



Drive 6 x 26 mm pin into 3rd/4th gear selector fork (counterhold).



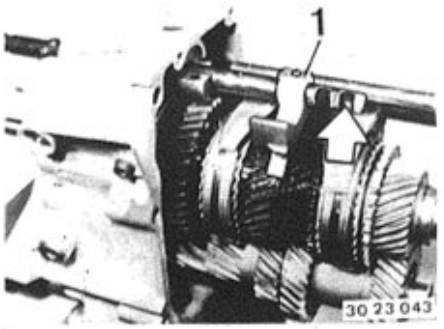
Install 3 locking balls and 3 springs.
Important!
Version with Different Length Springs:
Install the shorter spring (1) with a relaxed length (A) of 15.9 mm (0.626") for the 5th/ reverse gear selector rod.



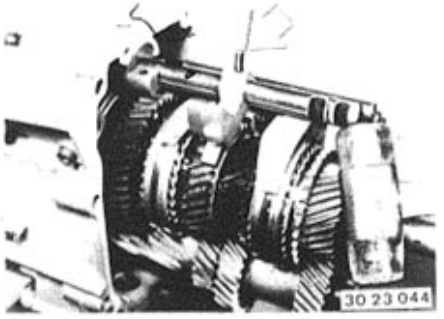
Install end cap after coating with Loctite No. 573.
Install end cover with Loctite No. 573.

Drive pin out of selector arm.

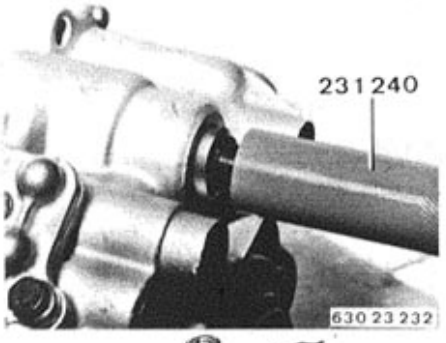




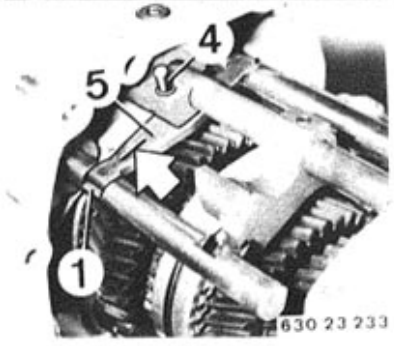
Hold four rollers in position with grease.
Slide in selector shaft and install selector arm (1) at same time.
Important!
Opening in selector shaft faces out.



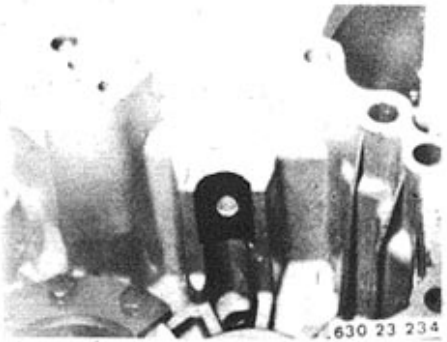
Drive in 6 x 26 mm pin (counterhold).



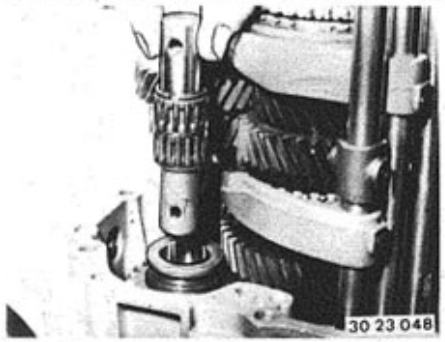
Lubricate sealing lips of radial oil seal with oil.
Drive in radial oil seal with Special Tool 23 1 240.



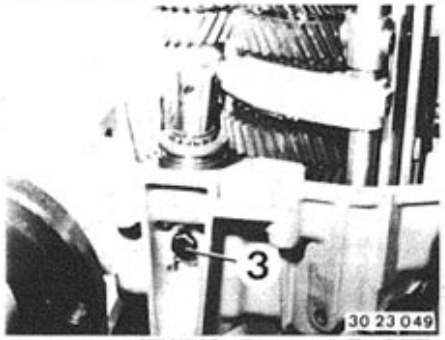
Install selector rail.
Groove (1) in selector rail faces up.
Install operating lever (5) with notch facing up and toward selector rail.
Install pin (4).



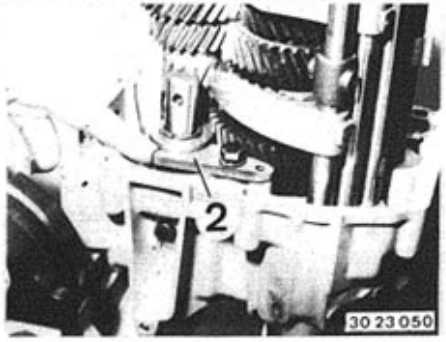
Coat case rear section in area of reverse gear shaft with Loctite No. 573.
Surface must be thoroughly cleaned and dried of oil.



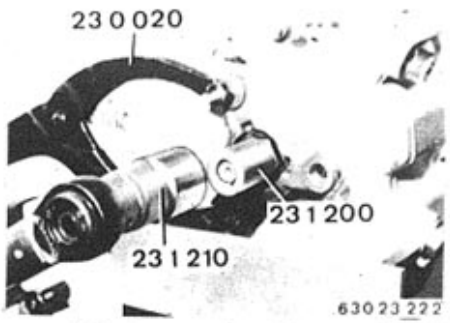
Install shaft with needle bearing and reverse gear.



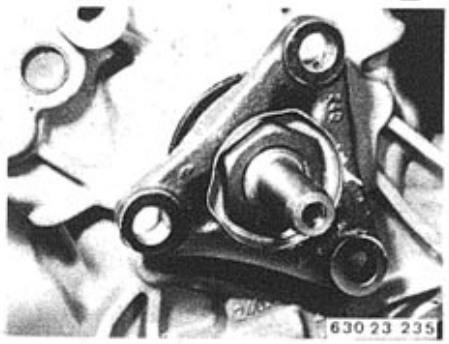
Mount shaft with bolt (3).
Install bolt with Loctite No. 270.



Insert holder (2), press out and secure in this position.

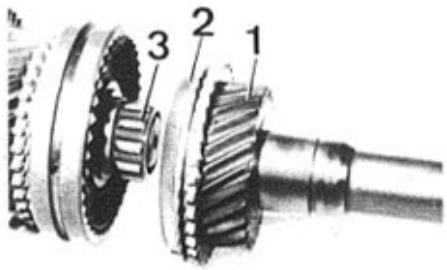


Install output flange.
Install collar nut with Loctite No. 270.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Tighten collar nut with Special Tool 23 1 210.
Tightening torque*.



Install and lock lockplate.

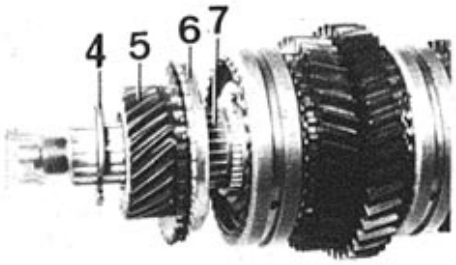
* See Specifications



630 23 236

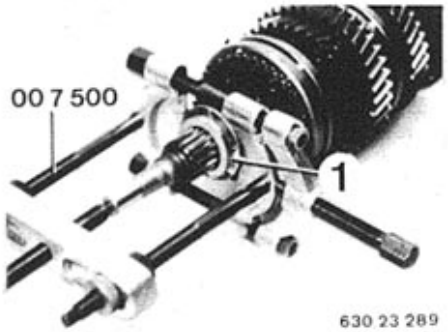
23 21 554 REPLACING OUTPUT SHAFT
– Output Shaft Removed –

Pull off input shaft (1), synchromesh ring (2) and needle bearing (3).
Note:
It is recommended to mark the synchromesh rings for a pertinent gear wheel when disassembling the output shaft, in order to avoid mixing up the synchromesh rings.



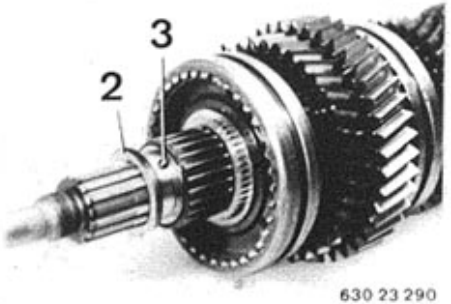
630 23 237

Pull off thrust washer (4), 5th gear (5), synchromesh ring (6) and needle bearing (7).



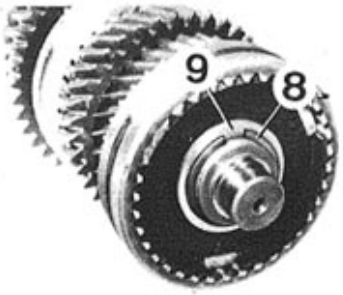
630 23 289

Transmission 260/6:
Pull off bearing inner race (1) on the output shaft with Special Tool 00 7 500.



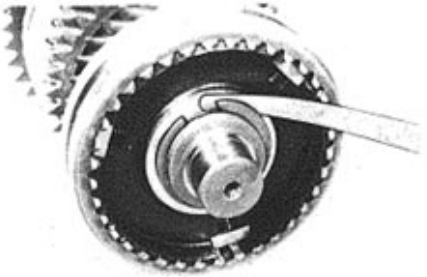
630 23 290

Transmission 260/6:
Pull off the 5th gear and synchromesh ring.
Take off thrust washer (2) and ball (3).
Pull off the needle bearing.



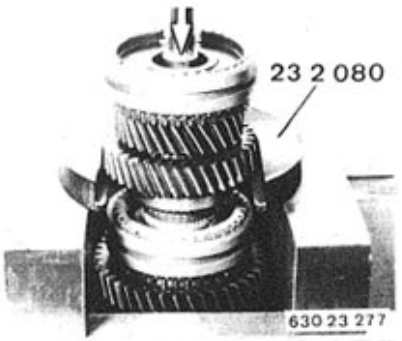
630 23 238

Lift out circlip (8).
Take off spacer (9).
Installation:
Always replace the circlip.



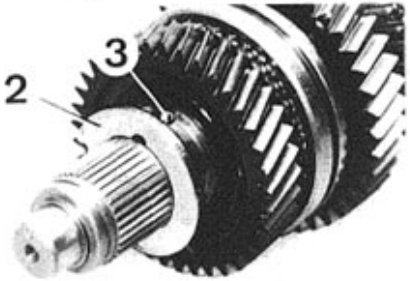
630 23 239

Installation:
Adjust play between the circlip and guide sleeve to 0 ... 0.09 mm (0 to 0.0035").



630 23 277

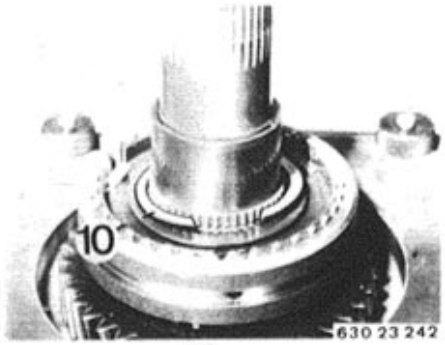
Press 2nd gear, bearing sleeve, 3rd gear, synchromesh ring and guide sleeve off of the output shaft with Special Tool 23 2 080.
Pressing-off force*.



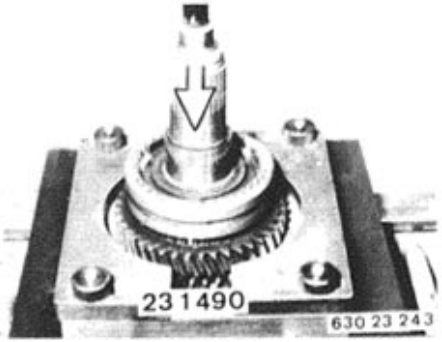
630 23 291

Transmission 260/6; 260/5**:
Note thrust washer (2) and ball (3) between the 2nd and 3rd gear wheels.

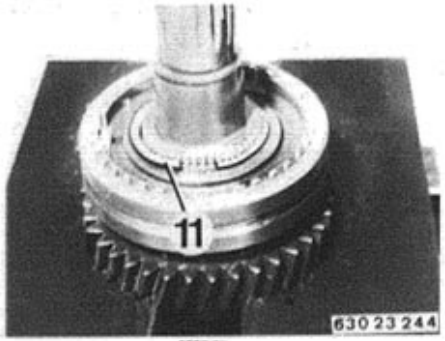
* See Specifications.
** Since 7.85



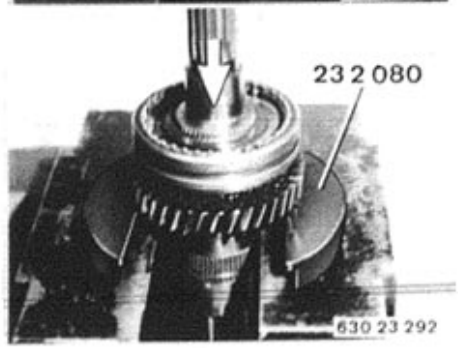
Important!
Circlip (10) has to be removed prior to pressing off the 1st gear wheel.
Installation:
Always replace the circlip.



Press off the 1st gear wheel with guide and operating sleeves with Special Tool 23 1 490.
Take off the needle bearing.
Pressing-off force*.

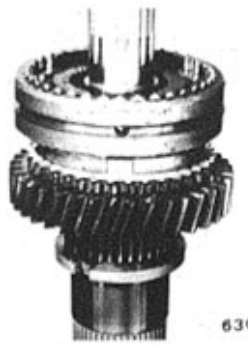


Important!
Circlip (11) has to be removed prior to pressing off the reverse gear wheel.
Installation:
Always replace the circlip.

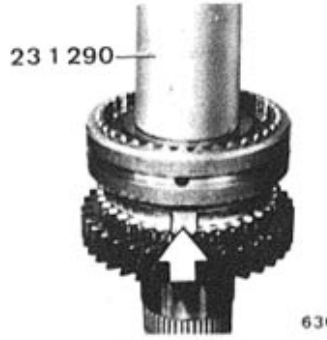


Press off the guide sleeve, operating sleeve and reverse gear wheel with Special Tool 23 2 080, the bottom end of which faces the gear wheel.
Take off the needle bearing.
Pressing-off force*.

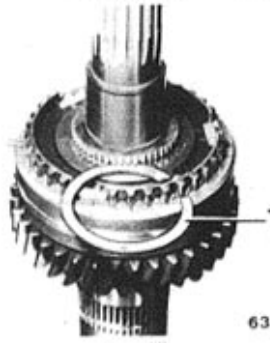
* See Specifications



Assembling:
Note:
Check the synchromesh rings for wear (see 23 23 505) prior to assembling.
Install the needle bearing, reverse gear and synchromesh ring.
Install guide and operating sleeves on splines of the output shaft.
Transmission 260/6; 260/5**:*
The stepped end of the operating sleeve faces the reverse gear wheel



Press on the guide sleeve to fit tight with Special Tool 23 1 290.
Pressing-on force*.
Important!
Make sure that tabs on synchromesh ring are aligned with openings in the guide sleeve while pressing on.

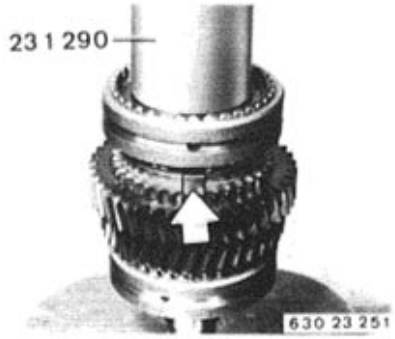


Move operating sleeve in direction of the reverse gear wheel.
Adjust the guide sleeve to be without play with circlip (11).
Circlips are available in thicknesses from 1.7 to 2.0 mm (0.067 to 0.079") from Parts.
Install circlip (11).



Install the needle bearing, 1st gear wheel and synchromesh ring.
Install guide and operating sleeves on splines of the output shaft.
Transmission 260/6; 260/5**:
The stepped end of the operating sleeve faces the 1st gear wheel.

* See Specifications
** Since 5.85



Press on guide sleeve to fit tight with Special Tool 23 1 290.
Pressing-on force*.
Important!
Make sure that tabs on synchromesh ring are aligned with openings in the guide sleeve while pressing on.



Move operating sleeve in direction of the 1st gear wheel.
Adjust the guide sleeve to remove play.
Circlips are available from Parts in different thicknesses from 1.7 to 2.0 mm (0.067 to 0.079").
Install circlip (10).

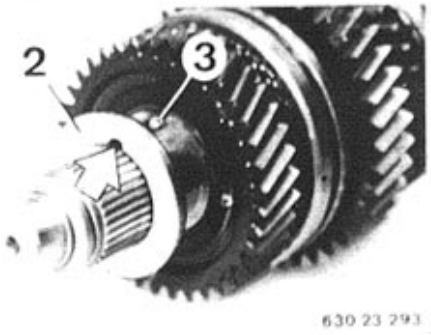


Install the needle bearing, synchromesh ring and 2nd gear wheel.
Important!
The collar for the bearing sleeve must protrude slightly on the output shaft.
If applicable, check the seating of circlip (10).

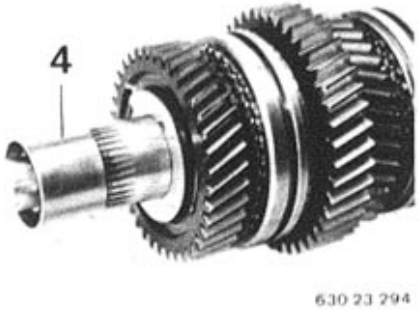


Heat the bearing sleeve to about 80° C (175° F) with a hot air blower and install on the output shaft.

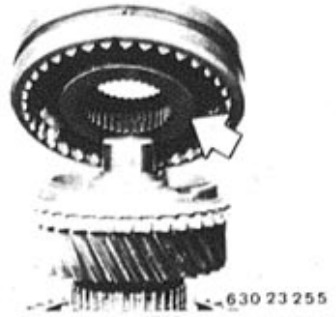
* See Specifications



Transmission 260/6; 260/5**:
Install ball (3) and thrust washer (2) with opening facing ball (3).



Transmission 260/6; 260/5**:
Heat bearing sleeve (4) without collar to about 80° C (175° F) with a hot air blower and install on the output shaft.

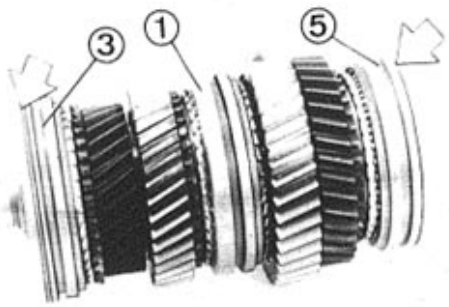


Install the needle bearing, 3rd gear wheel and synchromesh ring.
Install guide and operating sleeves on splines with the long collar facing the 3rd gear wheel.
Transmission 260/5 Since 5.85:
The stepped end of the operating sleeve faces the 3rd gear wheel.



Press on the guide sleeve to fit tight with Special Tool 23 1 290.
Important!
Make sure that tabs on the synchromesh ring are aligned with openings in the guide sleeve while pressing on.
Install the spacer and circlip.
Pressing-on force*.

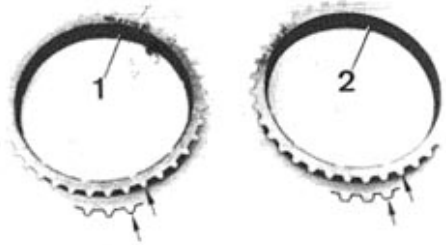
* See Specifications
** Since 7.85



630 23 282

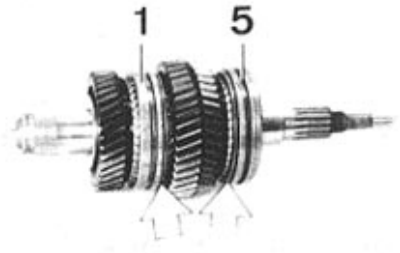
Transmission 260/5:

Important!
Modified operating sleeves, synchromesh rings and gear wheels since 5.85.
Check installed position of operating sleeves and synchromesh rings.
Operating sleeves have asymmetric teeth.
Install operating sleeve (1) without a groove that the stepped end faces 1st gear.
Install operating sleeve (3) with two grooves that the stepped end faces 3rd gear.
Install operating sleeve (5) with one groove that the stepped end faces reverse gear.



630 23 305

Identification of Synchromesh Rings:
Check the identification or tooth width to avoid mixing up the synchromesh rings.
Synchromesh ring (1) for 1st/reverse gears, Drawing No. 011.8.0241.00.
Idenification: narrow teeth.
Synchromesh ring (2) for 2nd, 3rd, 4th and 5th gears, Drawing No. 011.8.0161.00.
Identification: wide teeth.



630 23 297

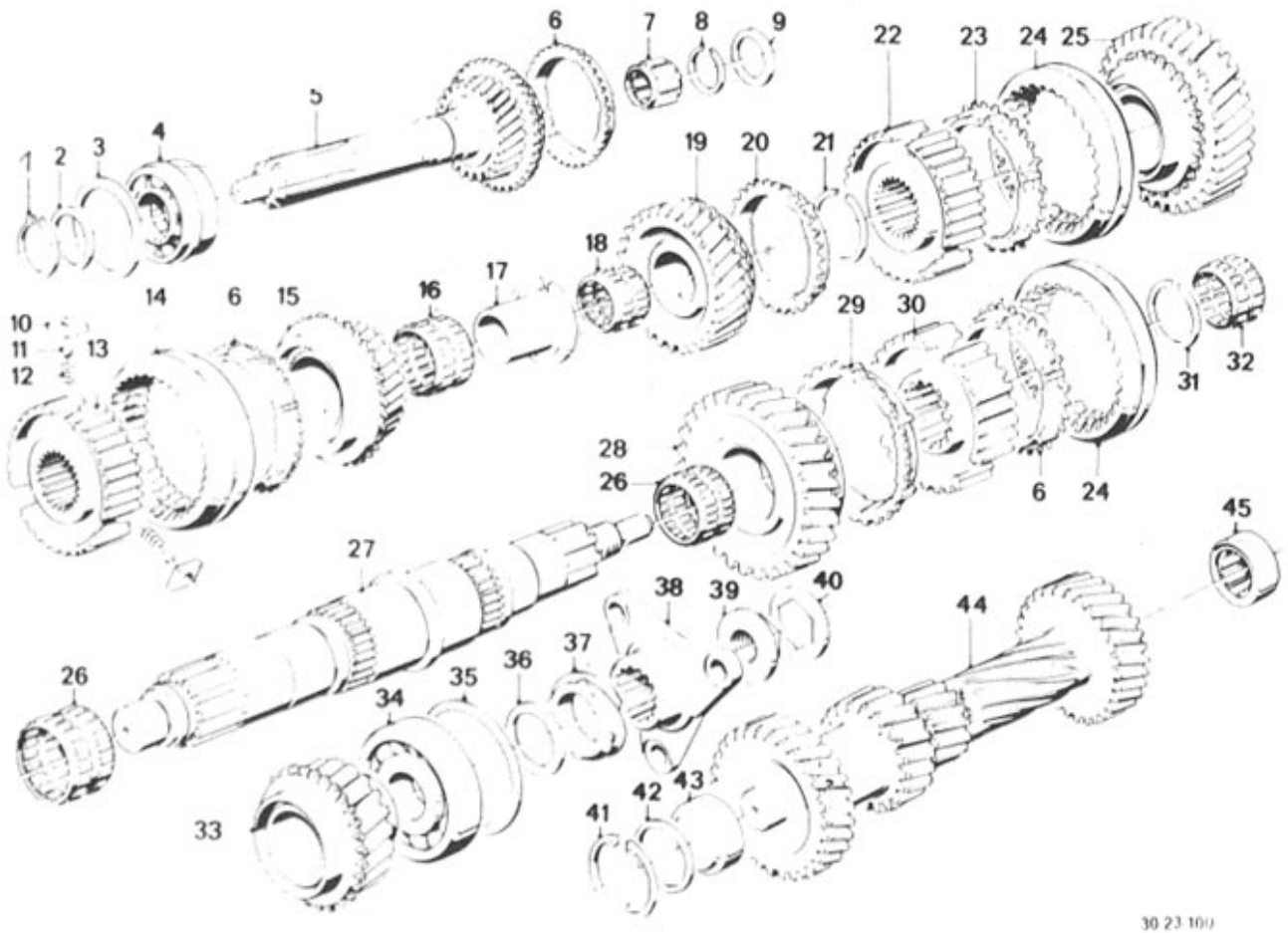
Transmission 260/6:
Installed position of operating sleeves/gear wheels:
Operating sleeve (1) – 1st/2nd gear.
Stepped end facing 1st gear.
Operating sleeve (5) – 5th/reverse gear.
Stepped end facing reverse gear.



630 23 299

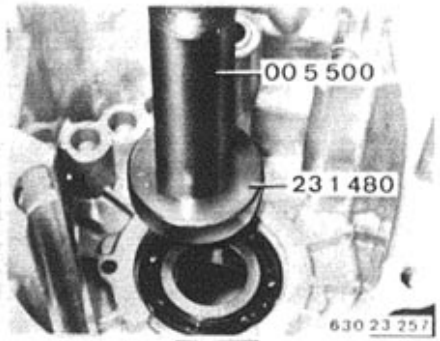
Transmission 260/6:
Identification of Synchromesh Rings:
Check the identification or tooth width to avoid mixing up the synchromesh rings for 1st/2nd gears and 5th/reverse gears.
Synchromesh ring for 1st/reverse gear, Drawing No. 011.8.0241.00.
Identification: narrow teeth.
Synchromesh ring for 2nd/5th gear, Drawing No. 011.8.0161.00.
Identification: wide teeth.

23-181b



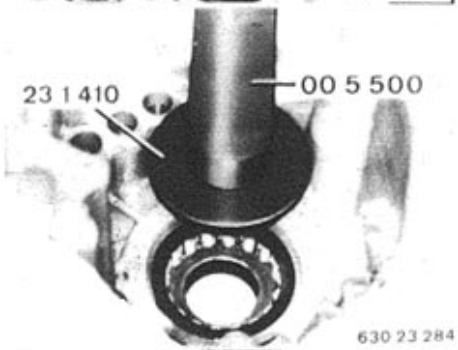
Layout Drawing of Gear Set with Bearings:

1 Circlip
2 Spacer
3 Spacer
4 Bearing
5 Input shaft with 4th gear
6 Synchromesh ring
7 Needle bearing
8 Circlip
9 Spacer
10 Drive dog
11 Ball
12 Spring
13 Guide sleeve
14 Operating sleeve
15 3rd gear
16 Needle bearing
17 Spacer
18 Needle bearing
19 2nd gear
20 Synchromesh ring
21 Circlip
22 Guide sleeve
23 Synchromesh ring
24 Operating sleeve
25 1st gear
26 Needle bearing
27 Output shaft
28 Reverse gear
29 Synchromesh ring
30 Guide sleeve
31 Circlip
32 Needle bearing
33 5th gear
34 Bearing
35 Spacer
36 Spacer
37 Speedometer drive gear
38 Output flange
39 Collar nut
40 Lockplate
41 Circlip
42 Spacer
43 Bearing
44 Layshaft
45 Bearing

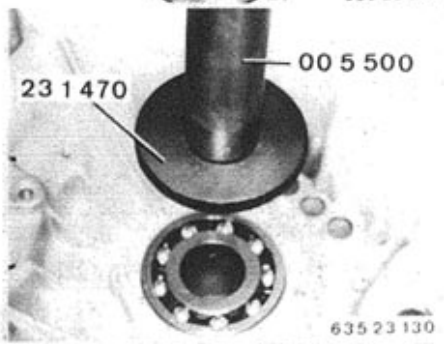


23 21 703 REPLACING BEARINGS OF ALL TRANSMISSION SHAFTS
– Transmission Removed –

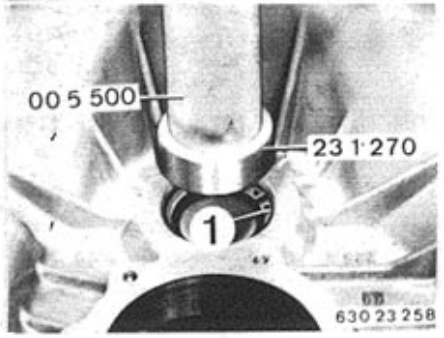
Remove input and output shaft assembly 23 21 503.
A) Input Shaft, Layshaft in Front Case Section:
Input Shaft:
Drive out grooved ball bearing with Special Tools 23 1 480 and 00 5 500.
Installation – see 23 11 013.



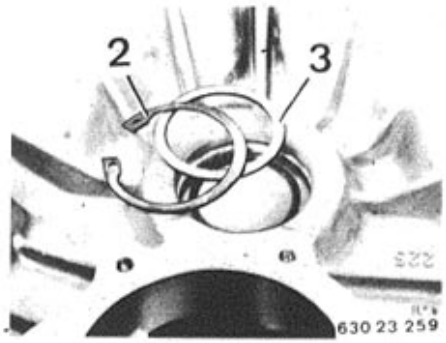
Transmission 260/6:
Drive out double bearing with Special Tools 23 1 410 and 00 5 500.



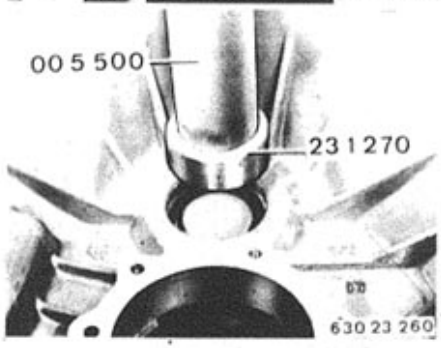
Transmission 260/6:
Heat front case section in area of bearing to about 80° C (175° F) with a hot air blower.
Important!
Install bearings with rollers facing gear set, driving in to fit tight with Special Tools 23 1 470 and 00 5 500 if necessary.



Layshaft:
Loosen circlip (1) with one knock from Special Tools 23 1 270 and 00 5 500.

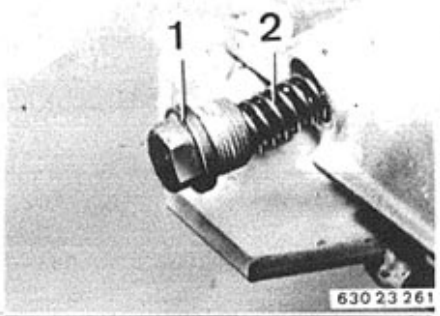


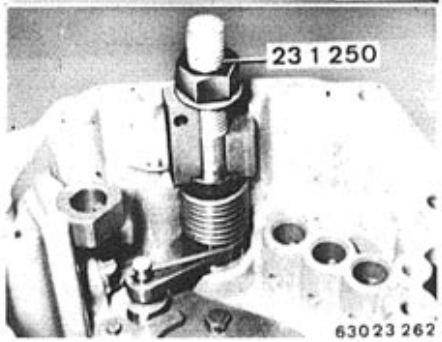
Lift out circlip (2).
Remove spacer (3).



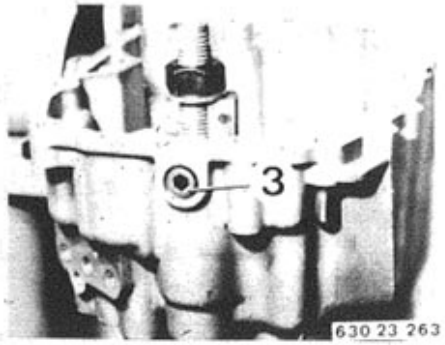
Drive out bearing shell with Special Tools 23 1 270 and 00 5 500.

B) Output Shaft, Layshaft in Rear Case Section:
Output Shaft:
Unscrew bolt (1).
Caution!
Spring force.
Remove spring (2)
Installation:
Install bolt with Loctite No. 270.

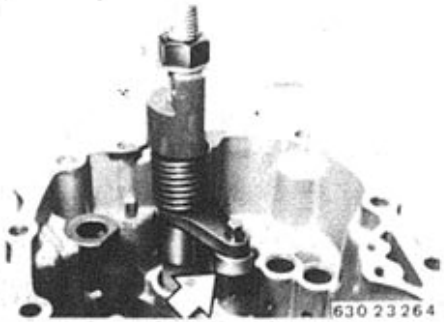




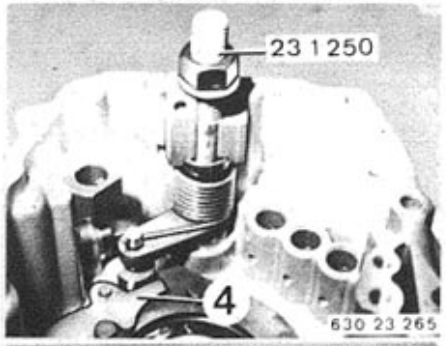
Install Special Tool 23 1 250 for removal of the selector arm.



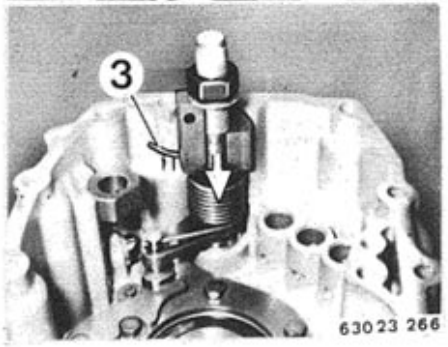
Remove socket head bolt (3).
Installation:
Install bolt with Loctite No. 270.
Tightening torque*.



Remove selector arm from above.
Important!
Roller.

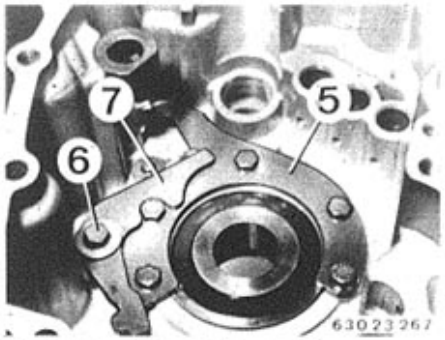


Installation:
Insert selector arm with Special Tool 23 1 250.
Swing out selector arm with roller over locking lever (4).

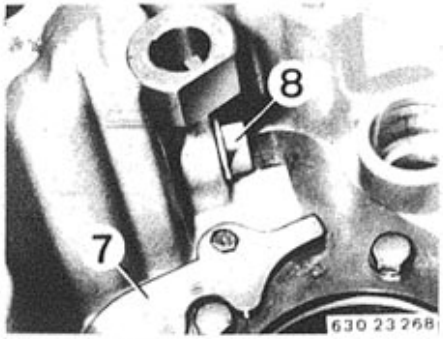


Position end of spring (3) above high spot.
Press (don't knock) down selector arm in this position.
Mount selector arm with socket head bolt before removing th special tool.
Install socket head bolt with Loctite No. 270.
Tightening torque*.

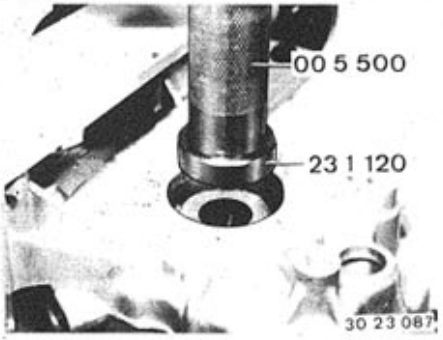
* See Specifications



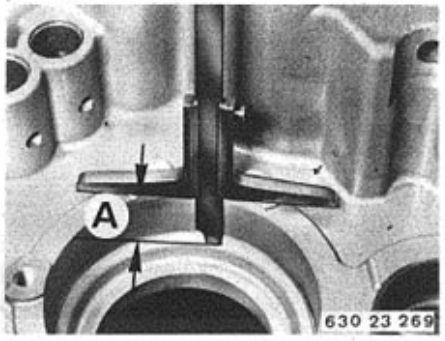
Remove bearing holder (5).
Important!
Don't unscrew bolt (6).
Locking lever (7) remains on bearing holder.



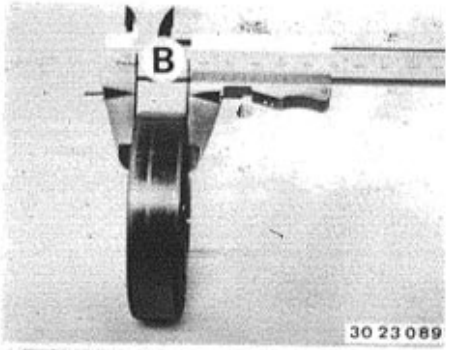
Installation:
Check installed position of locking lever (7) and thrust pin (8).



Lift out radial oil seal.
Drive out grooved ball bearing with Special Tools 23 1 120 and 00 5 500.
Important!
Spacer X.

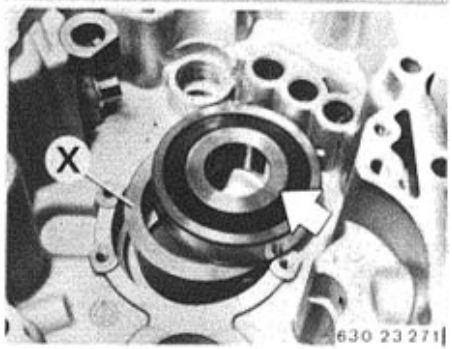


Determine thickness of spacer X.
Measure distance (A).

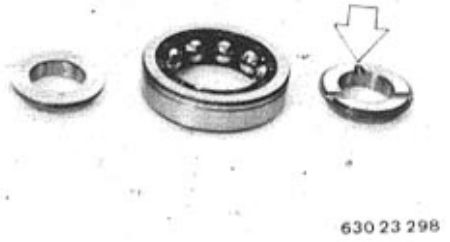


Measure distance (B).
Example:

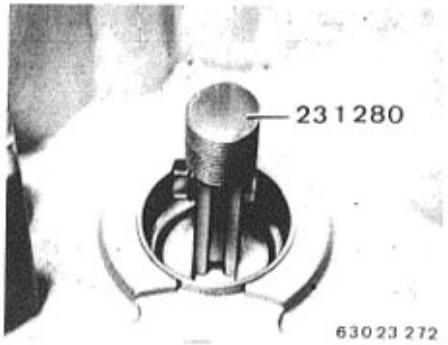
A	20.3 mm (0.799")	
– B	20.0 mm (0.787")	
X	0.3 mm (0.012")	spacer thickness



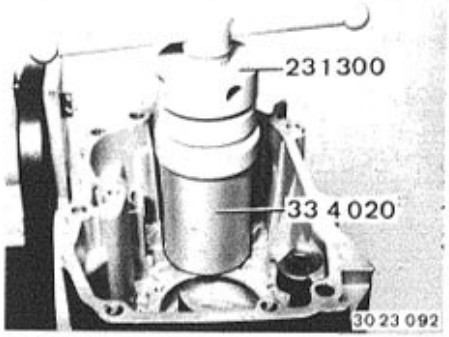
Heat rear case section in area of grooved ball bearing to about 80° C (175° F) with a hot air blower.
Install spacer X.
Install grooved ball bearing.
Important!
Inner race of grooved ball bearing has protrusion.
Install bearing race that this protrusion faces the gear set.
If necessary, drive in bearing against stop with Special Tool 23 1 470.



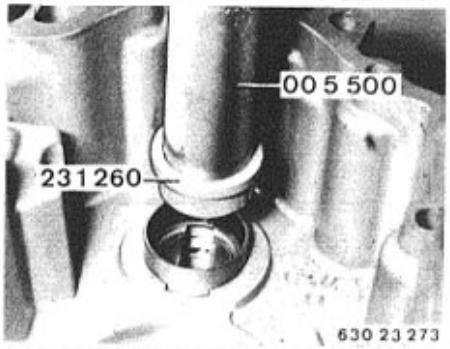
Transmission 260/6:
Split Bearing Inner Races:
The bearing inner race with an opening for the ball (turning lock) must be mounted on the output shaft (see "Replacing Output Shaft" – 23 21 554).



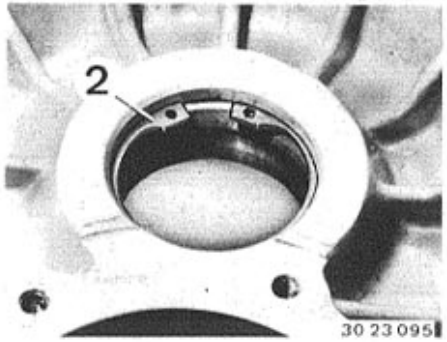
Layshaft:
Apply large end of Special Tool 23 1 280 in bearing shell.



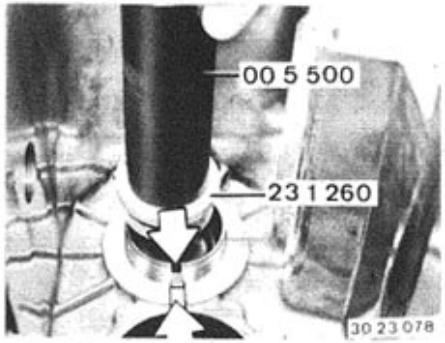
Apply Special Tool 33 4 020.
Screw on Special Tool 23 1 300.
Pull out bearing shell.



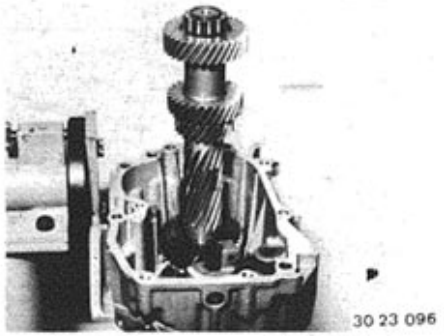
Drive in bearing shell with Special Tools 23 1 260 and 00 5 500.



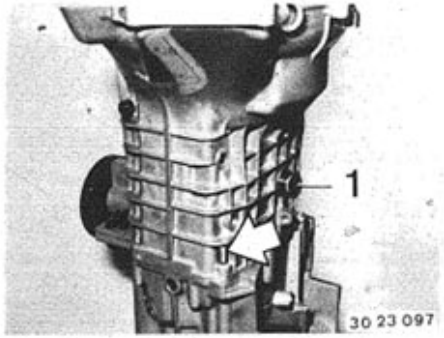
Check axial play of layshaft.
Install circlip (2).



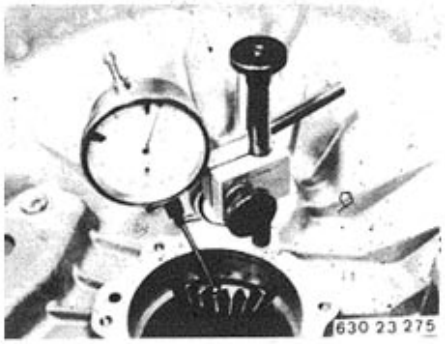
Install old spacers.
Drive in bearing shell to fit tight in front case section with Special Tools 23 1 260 and 00 5 500.
Important!
Oil groove must be aligned with groove in case.



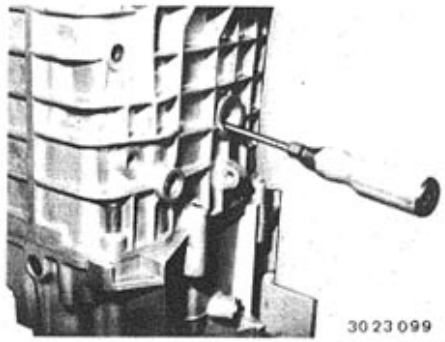
Place layshaft with roller bearings in rear case section.



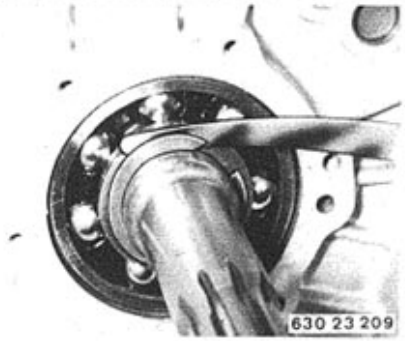
Install case front section and mount with two bolts opposite each other.
Center case front section with dowel pins slightly.
Unscrew oil filler plug (1).



Install dial gage with holder.
Tip of dial gage must bear on tooth of layshaft.

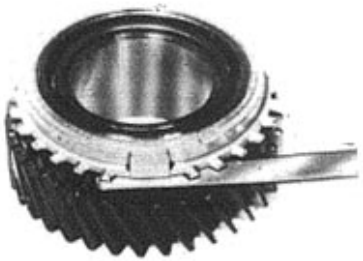


Check layshaft axial play through bore for oil filler plug.
Axial play = 0.13 to 0.23 mm (0.005 to 0.009").
If correction is necessary, bearing shell must be removed again and a spacer of different thickness installed.



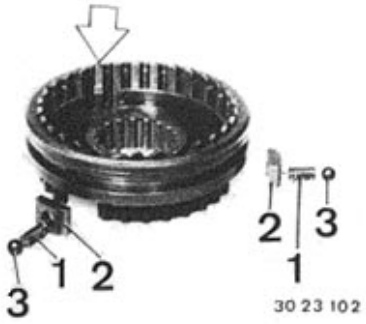
Install gear set.
Determine thickness of drive pinion shim.
Install old shim and circlip.
Adjust play to 0 ... 0.09 mm (0 to 0.0035").
Determine thickness of spacer for guide sleeve (see 23 11 623).

23 23 505 DISASSEMBLING/ASSEMBLING COMPLETE SYNCHRONIZATION
– Output Shaft Removed –



30 23 101

Disassemble output shaft (see 23 21 554).
3rd/4th gear synchromesh ring – brass.
1st/2nd gear synchromesh ring – brass, hard nickle plated.
Reverse gear synchromesh ring – brass with molybdenum coat.
Check distance between synchromesh ring and clutch*.
Measure in area of stops.
Note:
Only use molybdenum coated synchromesh rings for repairs.
Check distance* between synchromesh ring and clutch.
Measure in area of stops.
Synchromesh rings should bear uniformly all around.



30 23 102

Disassemble synchronization.
Spring (1), thrust piece (2) and ball (3).
Installation:
Flat teeth of sliding sleeve must be aligned with thrust pieces.



30 23 104

Install all springs, thrust pieces and balls.
Important!
Shouldered end of thrust pieces faces sliding sleeve.
Place guide sleeve halfways in sliding sleeve.
Push in balls far enough until guide sleeve can be pressed into sliding sleeve.

* See Specifications

24 Automatic transmission

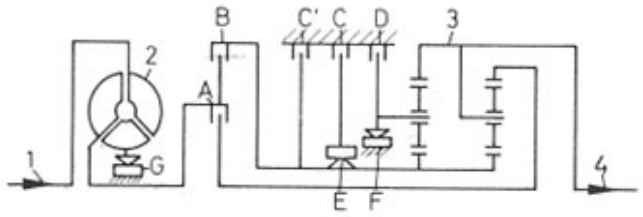
3 HP-22

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4 HP-22

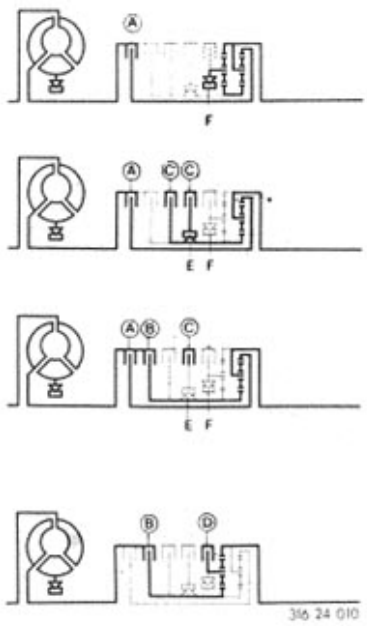
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Layout of Transmission 3 HP-22
1 Input
2 Torque converter
3 Planet gear set
4 Output



530 24 010

Power Flow Diagrams 3 HP-22



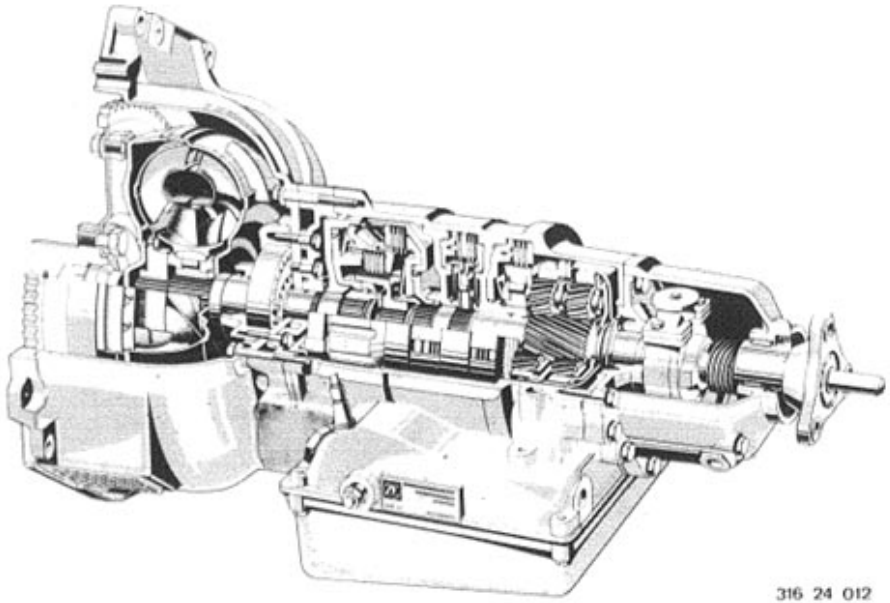
316 24 010

1st Gear
Clutch A is engaged.
Planet gear carrier bears on one-way clutch F during acceleration and is cancelled while coasting. With selector lever in position 1 clutch D also engages in 1st gear, so that engine braking force can be utilized.

2nd Gear
Clutches A, C' and C are engaged.
One-way clutch F is cancelled.
Hollow shaft is fixed with sun gear.

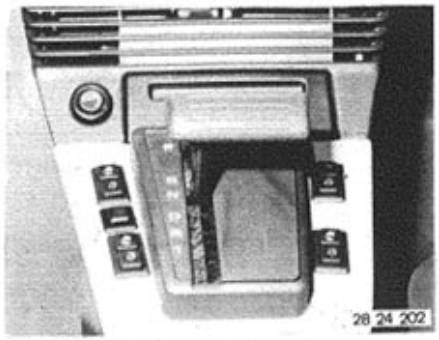
3rd Gear
Clutches A, B and C are engaged.
One-way clutches E and F are cancelled.
The entire set of planet gears turns as an unit at a ratio of 1 : 1.

Reverse Gear
Clutches B and D are engaged.
The output shaft's direction of rotation is reversed by way of the locked planet gear carrier.
Power flow 1st, 2nd, 3rd and reverse gears is by way of emphasized parts.



316 24 012

The torque converter functions as a fluid coupling and a torque booster. The impeller (P) turns at engine speed and directs the oil clockwise into turbine (T). When a range is selected the turbine and input shaft are connected with set of planet gears via the clutches. As the engine speed increases the oil — due to shape of turbine blades will be slung anticlockwise out of the turbine into the supported stator (L) running opposite the engine direction of rotation and thus it is conducted back to impeller with as little disturbance as possible. The back pressure caused by diverting direction will boost the torque. The maximum torque boost occurs on a stationary car when an impeller driven at full throttle is forced to drive a stopped turbine.
As the road speed picks up the difference in speed between impeller and turbine drops until ratio is 1 : 1. At this point the stator is released by the one-way clutch and turns in oil flow direction of impeller and turbine. As road speed increases further or when car is coasting the torque converter acts as a fluid coupling. Consequently when coasting the engine's braking force can be exploited.
The primary pump is driven at engine speed by the torque converter. It has the task of supplying oil to the torque converter, the valve body and the clutches.



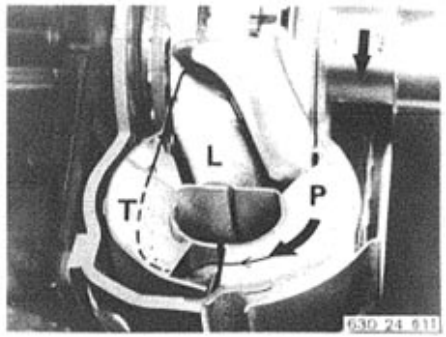
28 24 202

The fully automatic transmission 3 HP-22 is equipped with a torque converter and Simpson planet gear set.

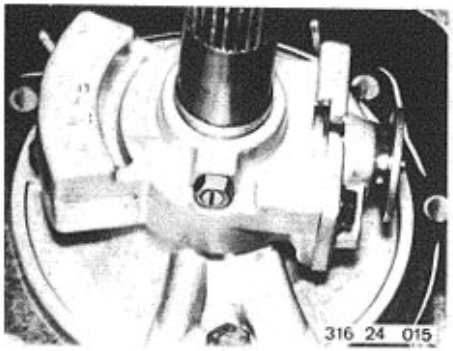
Selector Lever Positions:
P Parking
R Reverse
N Neutral
D 1st, 2nd and 3rd gears = Drive
2 1st and 2nd gears; 3rd gear blocked
1 1st gear; 2nd and 3rd gears blocked

The engine is started with the selector lever at N or P.
In these positions power is not transmitted to the rear wheels.
With the selector lever at P a locking pawl will lock the transmission's output shaft mechanically.
R – Reverse gear
The selector lever is moved to D for normal driving conditions for lower fuel consumption.
Early downshifts are possible with kickdown.
Selector lever position 2 is for driving in mountainous regions to avoid unwanted shifts from 2nd to 3rd gear.
Besides engine's braking effect will be better.
Range 1 is for driving downhill where engine brake is required continuously.

Ranges 1 and 2 can be engaged at any road speed.
If driving too fast, it will merely mean shifting up to the next higher gear automatically.



630 24 611



Explanation of Hydraulic Valve Body

The main pressure valve controls the pressure level in the valve body. As soon as the control unit is filled with oil, the supply of oil to the torque converter is released. If the delivery rate increases, any excessive oil is returned to the primary pump via the intake port.

The converter pressure valve has been given the task of preventing excessive pressures in the torque converter.

The selector slide valve is operated mechanically by the selector lever. This valve directs the oil pressure in the valve body to the desired driving range.

The governor determines in conjunction with the shift valves the shift points depending on the throttle pressure. The governor pressure is produced in accordance with the output shaft's speed.

If the governor piston or governor bushing seize due to dirt, there will be neither upshifts nor downshifts. Clean governor (see 24 32 503).

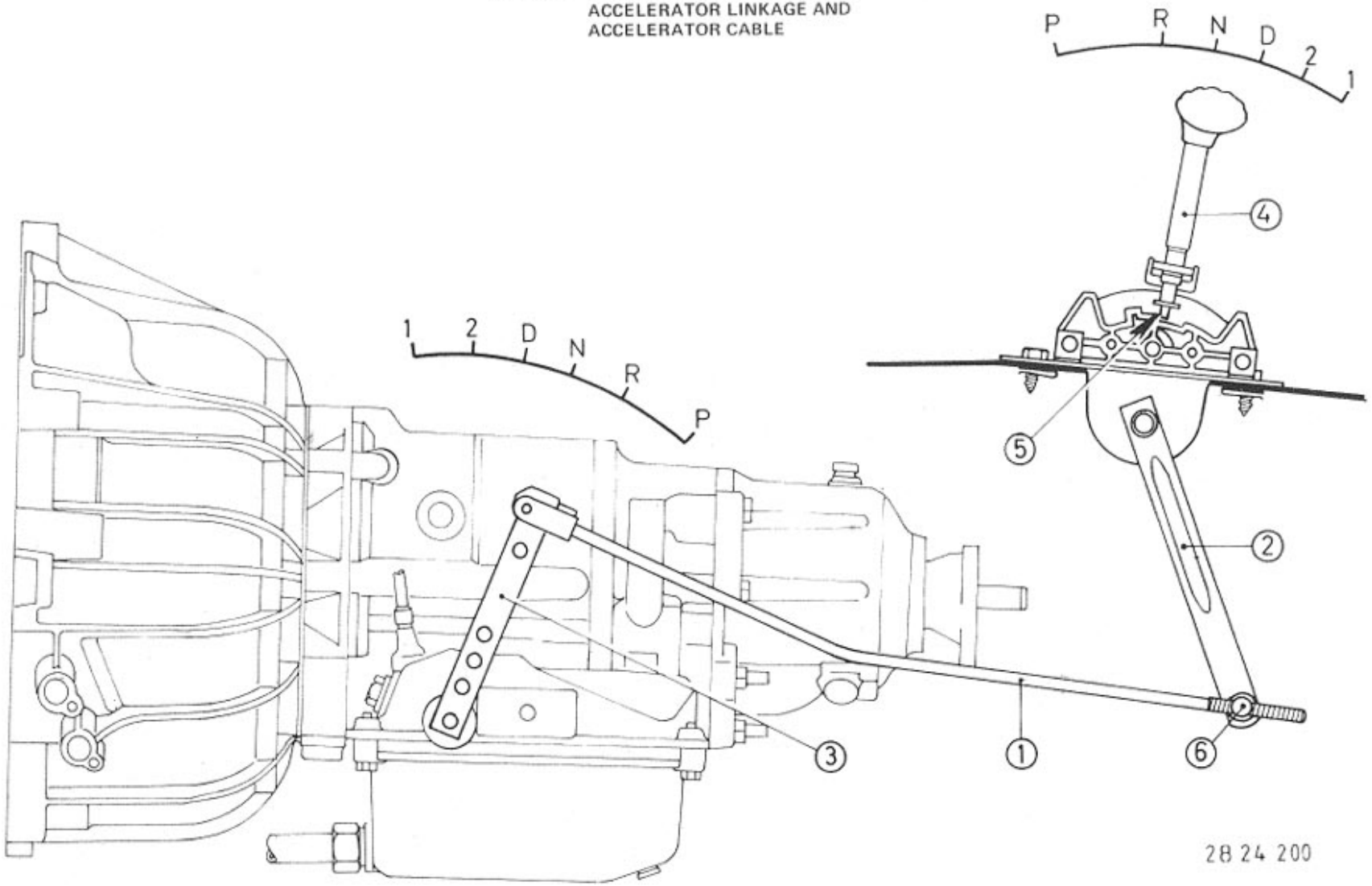
The throttle pressure valve is connected with the accelerator cable and determines with the governor the shift points depending on the throttle valve position.

The locking valves have the task of initiating the downshifts into the different gears regardless of the throttle valve position. Further the locking valves will prevent that other gears are engaged automatically when selector lever is moved to 1 or 2.

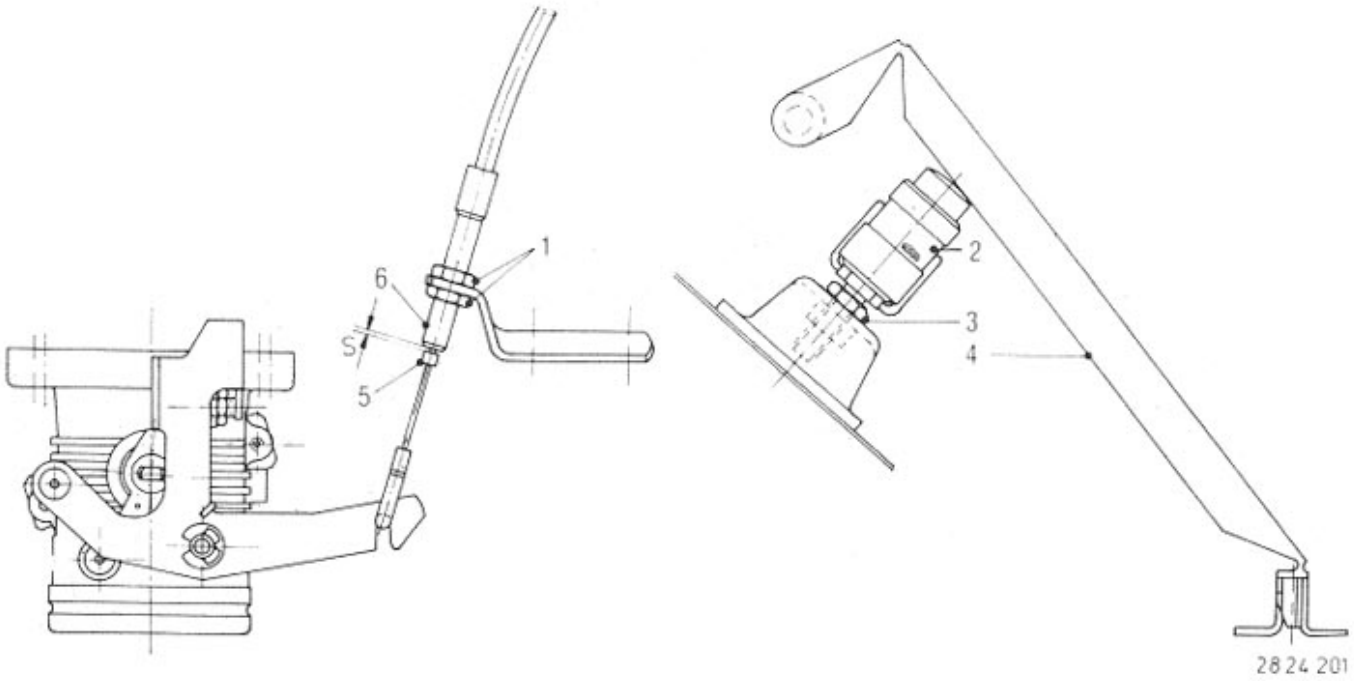
The shift valves determine which gear is engaged. If the spring pressure in a shift valve is overcome by governor pressure, the oil pressure goes to the clutch valves and shuts the pertinent clutches. When kickdown is operated, the spring pressure receives more support from the throttle pressure. Because of this the engine speed must pick up, so that the governor pressure can overcome the spring force and throttle pressure.

The clutch valves and dampers are meant to make gear shifts as smooth as possible.

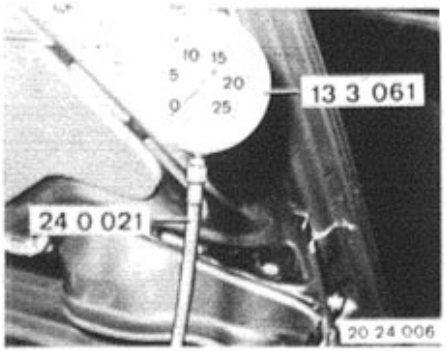
24 00 004 ADJUSTING SELECTOR LEVER, ACCELERATOR LINKAGE AND ACCELERATOR CABLE

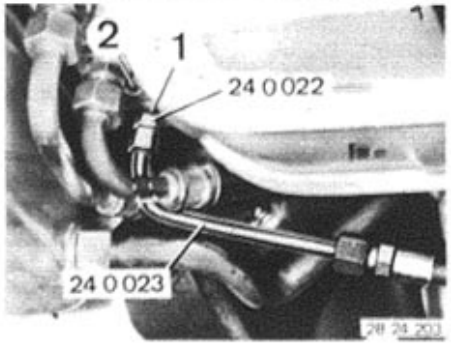


A) Adjusting Selector Lever
Check tightness of bearing bracket before adjusting.
Selector rod (1) must be attached in bore of selector lever (3) without code letters.
Detach selector rod (1) at selector lever lower section (2).
Move selector lever (3) on transmission to position N.
Press selector lever (4) against stop (5) on shift gate:
Alter length of selector rod (1) until pin (6) aligns with bore in selector lever lower section (2).
Now shorten selector rod length by 1 to 2 turns with pin (6).
Attach and secure selector rod.



B) Adjusting Accelerator Cable
Requirement: full throttle setting correct.
In neutral position adjust play (S) to 0.50 ± 0.25 mm (0.020 ± 0.010") with nuts (1).
Check kickdown stop (2).
Unscrew locknut (3) and screw in kickdown stop (2).
Press down accelerator pedal (4) to transmission pressure point.
Unscrew kickdown stop in this position until accelerator pedal touches.
Press accelerator pedal (4) to kickdown (final position).
Now distance (S) from seal (5) to end of sleeve (6) must be at least 44 mm (1.732").





24 00 009 CHECKING HYDRAULIC PRESSURE VALUES

Mount pressure tester 13 3 061 on engine hood in conjunction with hose 24 0 021.

Connect tester on transmission.

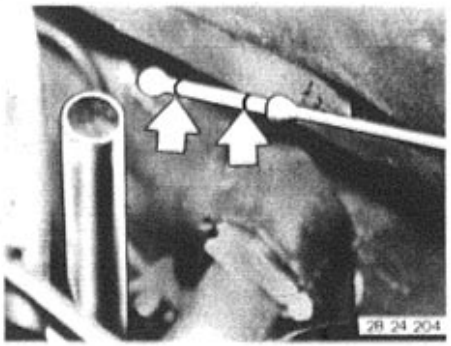
1 Main Pressure
Adapter 24 0 022 and elbow pipe 24 0 023

2 Clutch A

Test:

Accelerator Cable Detached; engine speed 1300 rpm	Selector Lever Position	Accelerator Lever Pos.
Main pressure[1]	R	1. Idle 2. Pulled to kickdown
Main pressure[1]	D,2,1, P,N	Brake pedal pressed down Parking brake applied 1. Idle 2. Pulled to kickdown

[1] See Specifications



Installation:

Correct oil level with selector lever at P, transmission at operating temperature and engine running at idle speed.

Park car on level ground.

Oil level of a transmission having operating temperature should be between both marks.

Amount of oil between min. and max. marks: approx. 0.4 liter (0.8 pint).

Never wipe off dipstick with a cloth losing lint.

Important!

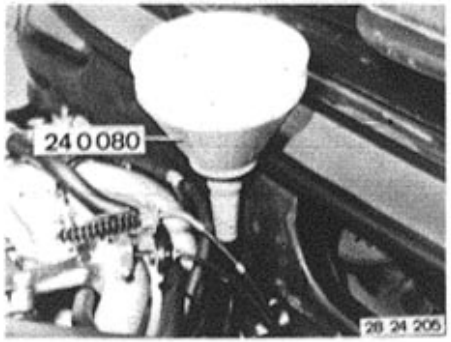
Oil Level Too High:

Excessive foam, oil lost by splashing, high temperature when driving fast, oil lost through vent.

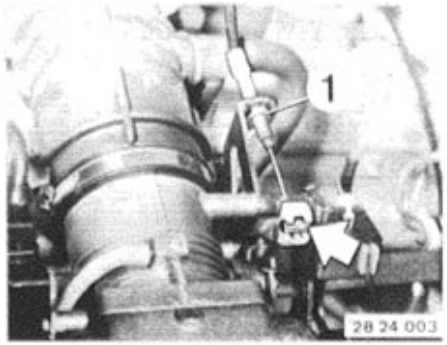
Oil Level Too Low:

Valves rattling, foam, engine slipping when driving in cuves.

General malfunctioning.

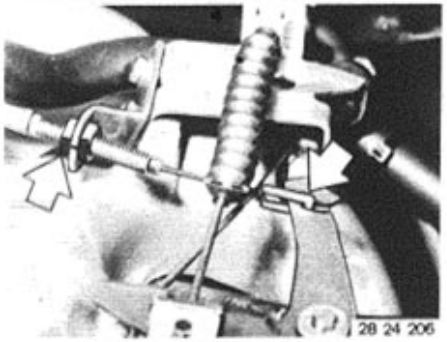


Always use funnel 24 0 080 to add ATF.

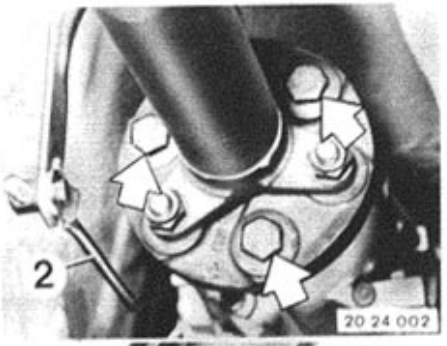


24 00 020 REMOVING AND INSTALLING TRANSMISSION

Disconnect battery ground wire.
Unscrew nut (1).
Disconnect accelerator cable.
Installation:
Adjust accelerator cable, see 24 00 004.



BMW 528e:



Remove exhaust assembly 18 00 020.
Remove heat shield.
Detach joint disc at transmission.
Disconnect selector rod (2).
Installation:
Tighten bolts to specified torque*
Adjust selector lever 24 00 004.

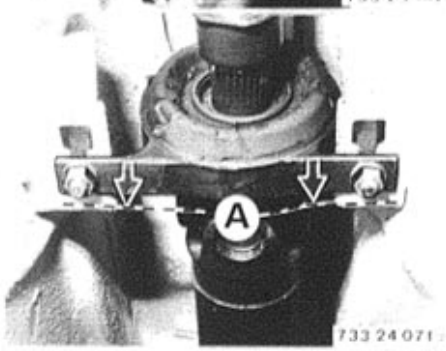


Installation:
Replace stop nuts.
Tighten nuts to specified torque* with a standard 19 mm socket and torque wrench.
Important!
Only tighten nuts (never bolts) to avoid stress in joint disc.

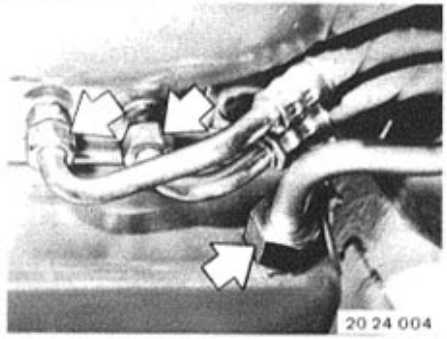
* See Specifications



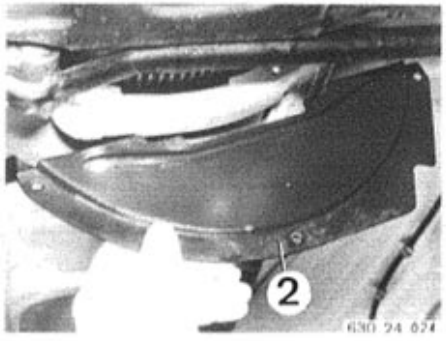
Loosen screw-on ring (1) several turns.
Installation:
Tighten screw-on ring with Special Tool 26 1 040 after finishing installation.
Tightening torque*.



Unscrew center mount.
Installation:
Preload center mount forward by distance A = 2 to 4 mm (0.079 to 0.157").
Tightening torque*.
Bend propeller shaft down and pull off of centering pin.
Important!
Suspend propeller shaft from car on piece of wire.

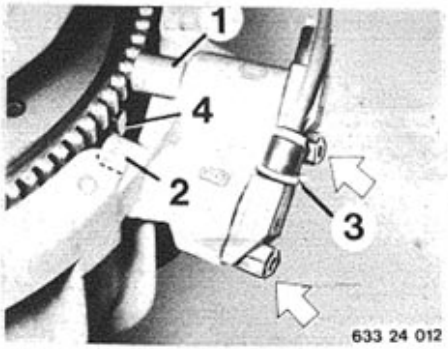


Drain oil.
Important!
Never reuse drained oil.
Installation:
Transmission will have to be disassembled if oil has a burnt odor and is black.
Important!
If transmission was defective, clean oil cooler and lines with compressed air and flush twice with ATF.
Remove oil filler tube.
Disconnect oil cooler lines on transmission.
Tightening torque*.

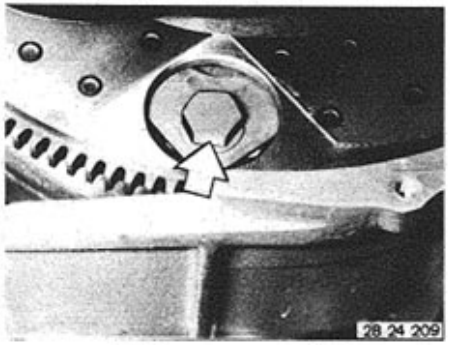


Remove cover (2).

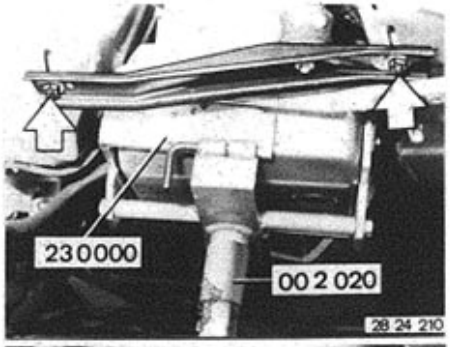
* See Specifications



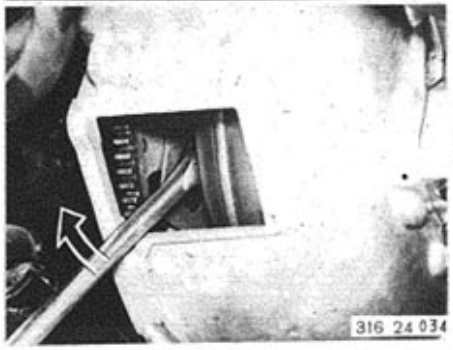
Detach heat shield.
Unscrew bolts.
Pull out speed transmitter (1) and reference mark transmitter (2).
Important!
Check installed position don't mix up plugs.
Install speed transmitter (1), black plug facing gear ring, and reference mark transmitter (2), plug with gray ring (3) facing pin (4).
If mixed up, engine cannot be started.
Engine will not start when plugs are mixed up.
Installation:
Check O-rings, replacing if necessary.
Insert transmitter with Molykote Longterm 2.



Remove grill.
Disconnect torque converter on drive plate at four points.

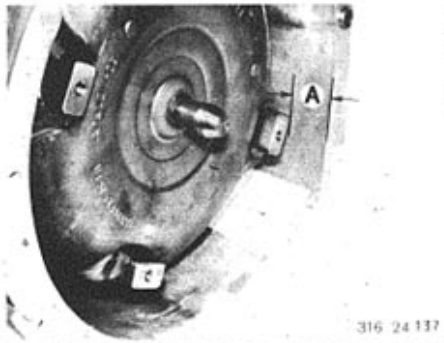


Support transmission with Special Tools 23 0 000 and 00 2 020.
Detach cross strut on body.
Lower transmission to front axle carrier.
Tightening torque*.

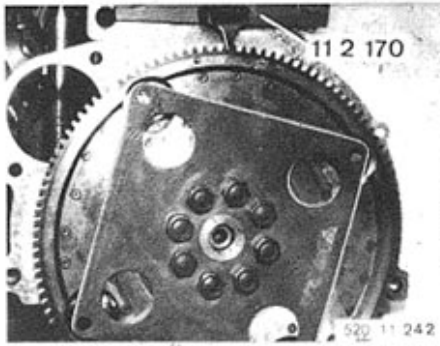


Detach transmission from engine.
Pull transmission off of engine, pressing off torque converter at same time.
Important!
With the transmission attached the lifting fixture may only be moved in completely lowered state.

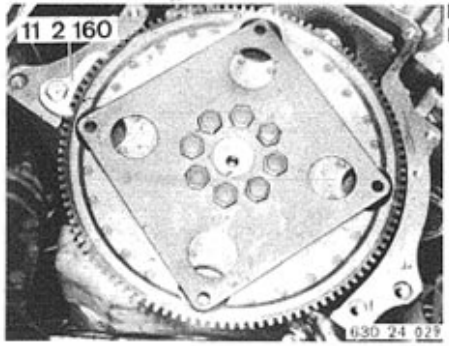
* See Specifications



Important!
Make sure torque converter is positioned correctly prior to installation of transmission.
Drive tabs must be below case edge by distance (A) = approx. 30.5 mm (1.201").

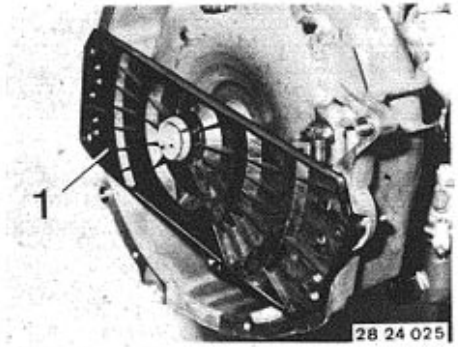


Installation:
Inspect drive plate for breaks and cracks, replacing if necessary.
BMW 528e:
Hold flywheel with Special Tool 11 2 170.
Unscrew expansion bolts.
Important!
Replace expansion bolts and install with Loctite No. 270.
Only coat threads.
Clean tapped bores thoroughly.
Tightening torque*.



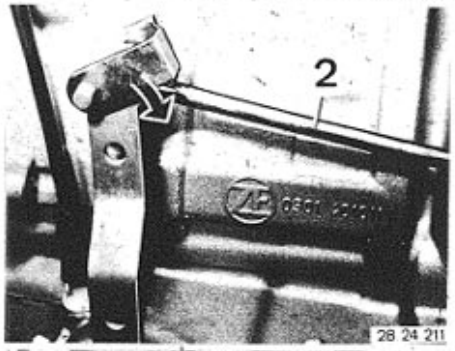
BMW 533i:
Hold flywheel with Special Tool 11 2 160.

* See Specifications

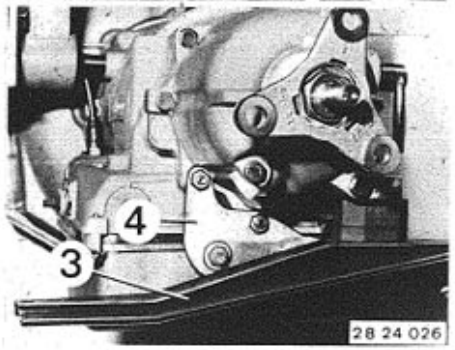


24 00 040 INSTALLING RECONDITIONED TRANSMISSION

Remove transmission 24 00 020.
Important!
Always clean oil cooler and lines with compressed air and flush twice with ATF prior to installing a reconditioned transmission.
Transmission code* on data plate.
Take off transport holder (1).

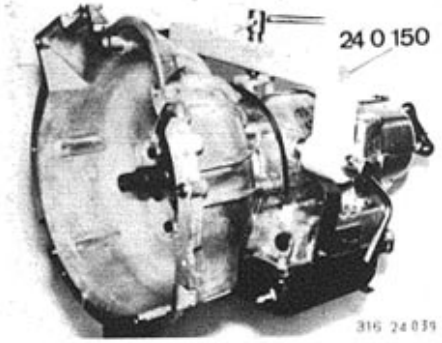


Transfer linkage (2).
Important!
Linkage (2) must be attached in bore without code letters of selector lever.
Mount spring clamp from top to bottom.
Note plastic sleeve.



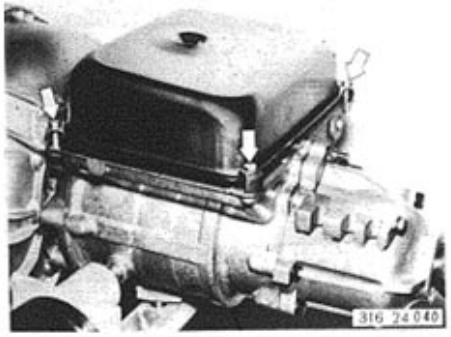
Transfer cross member (3) and exhaust carrier (4).

* See Specifications

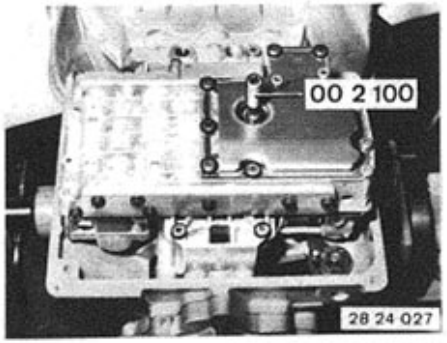


24 00 080 DISASSEMBLING / ASSEMBLING TRANSMISSION

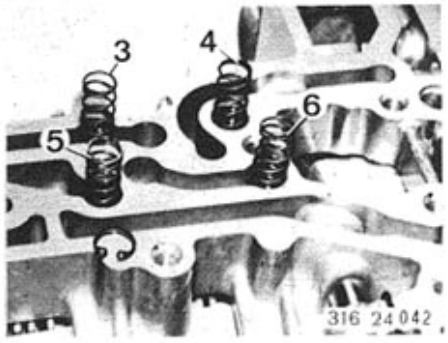
Remove transmission 24 00 020.
Remove torque converter 24 40 000.
Mount transmission on assembly stand in conjunction with Special Tool 24 0 150.
Important!
Tighten bolts only finger tight to prevent damage on transmission case.



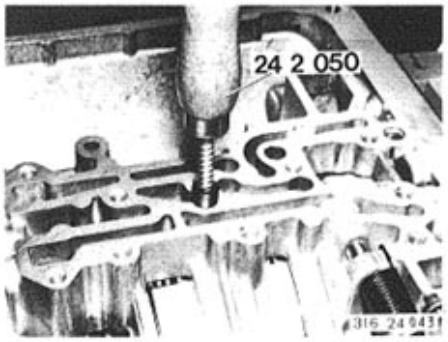
A) Disassembling
Detach oil sump.



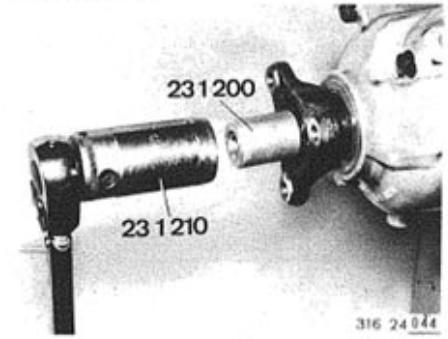
Detach valve body.
Unscrew Torx bolts with Special Tool 00 2 100.



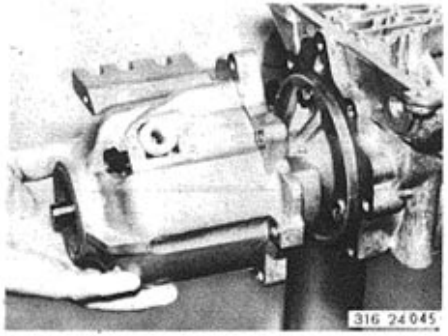
Remove circlips.
Remove springs (3 ... 6).



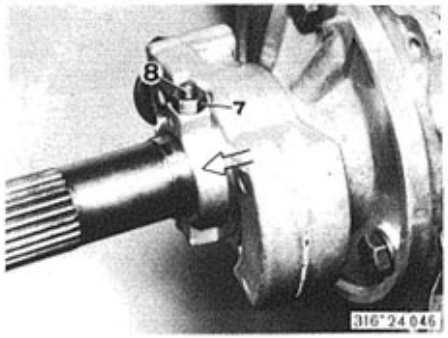
Pull out sealing sleeves with Special Tool 24 2 050.



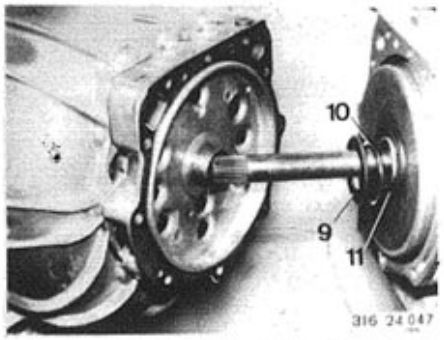
Engage parking lock.
Apply Special Tool 23 1 200.
Unscrew collar nut with Special Tool 23 1 210.
Pull off output flange.



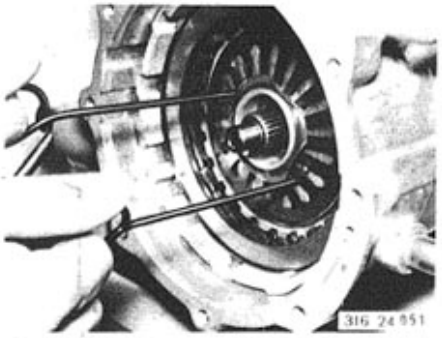
Disconnect exhaust brace.
Detach transmission extension.



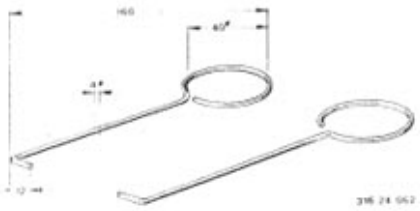
Loosen nut (7) and unscrew stud (8) by about 3 turns.
Pull off governor.

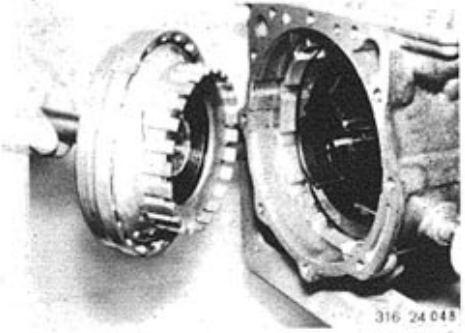


Detach converter bell housing with intermediate plate.
Important!
Thrust washer (9), needle bearing (10) and angled disc (11).

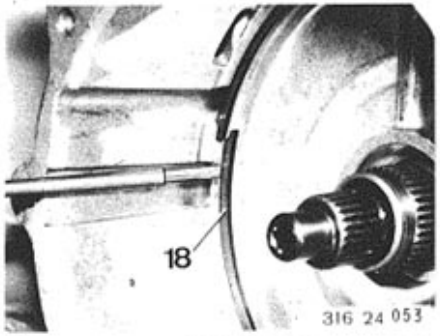


Pull out clutch B with two locally made hooks.
See sketch for local manufacture.
Dimensions in mm.

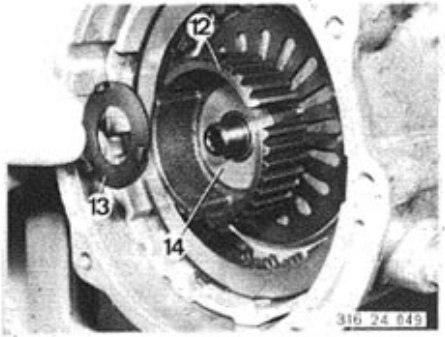




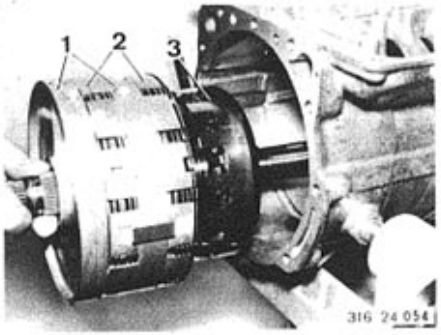
Remove input shaft with clutch A.



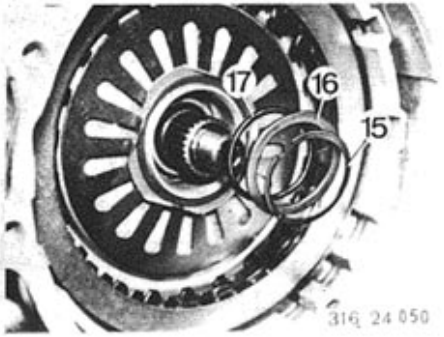
Remove circlip (18).



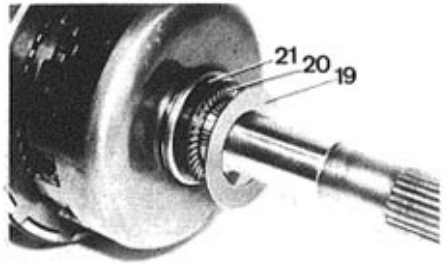
Remove plate carrier (12) for clutch A with plastic thrust washer (13) and metal thrust washer (14).



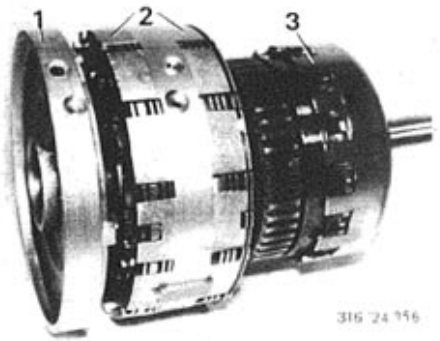
Pull out entire packet of parts.
Centering plates (1), clutches C', C and D (2), planet gear set with output shaft (3).
Important!
Parking lock must not be engaged.



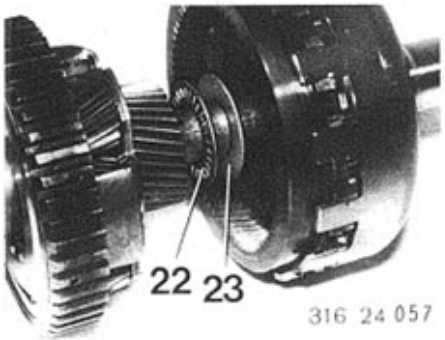
Remove circlip (15).
When removing clutch B, cover (16) and seal (17) will also be pulled out.



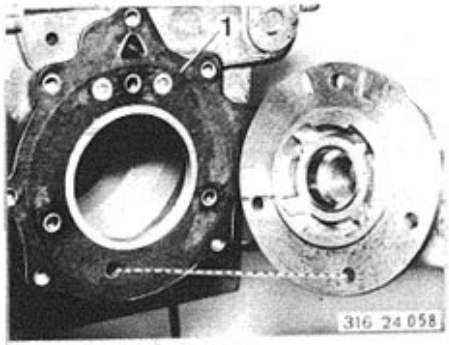
Important!
Thrust washer (19), needle bearing (20) and angled disc (21).



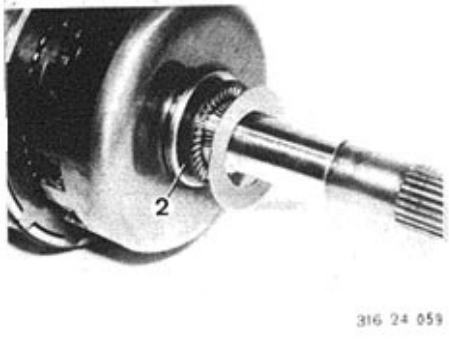
Pull centering plate (1), clutch packet (2) with clutches C , C and D off of output shaft (3).



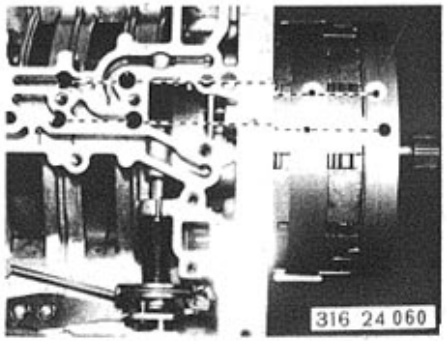
Remove set of planet gears with sun gear shaft.
Important!
Needle bearing (22) and thrust washer (23).



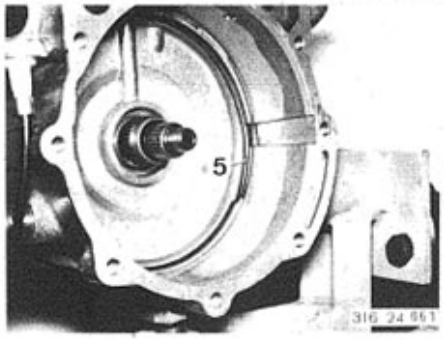
B) Assembling
Detach governor flange.
Replace gasket (1).



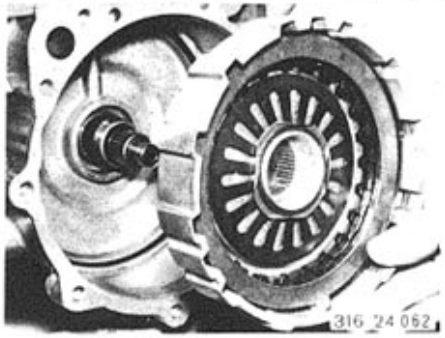
Install angled disc (2) with grease, angled side on output shaft.
Install needle bearing and thrust washer on output shaft.



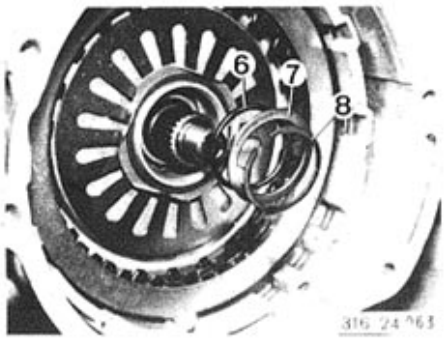
Important!
Keys must be centered in groove of cylinder.
Parking lock must not be engaged.
Insert entire output packet into transmission case that the 4 oil bores in output packet align with bores in underside of transmission case.



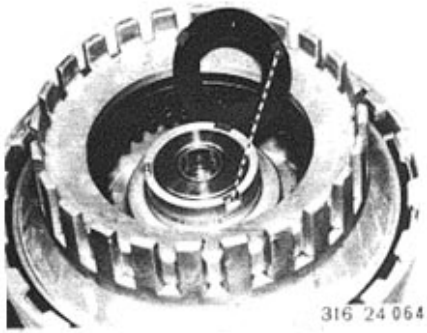
Insert circlip (5).



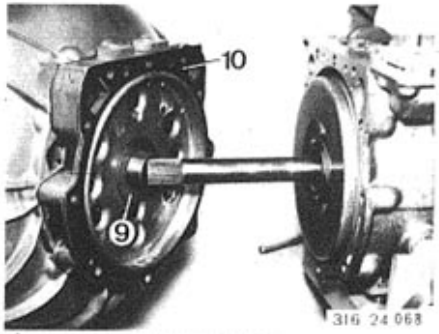
Install clutch B.



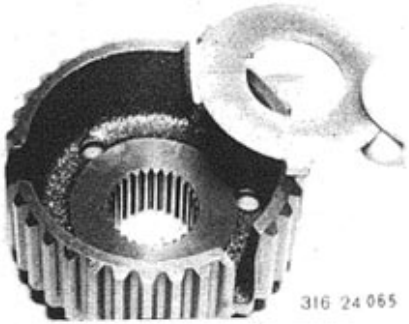
Install seal (6) and press in against stop with support disc (7).
Insert circlip (8).



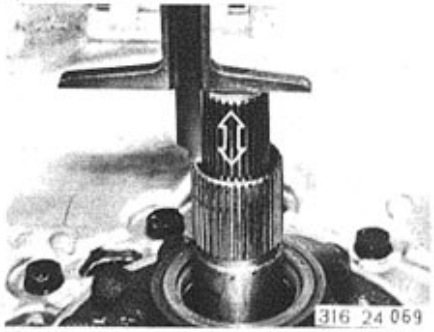
Install plastic thrust washer with grease so that tabs engage in openings of cylinder A.



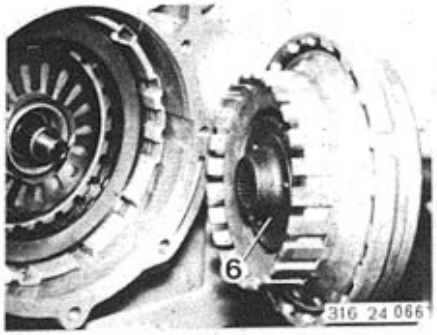
Stick thrust washer (9) and gasket (10) on converter bell housing.
Slide converter bell housing on to input shaft a secure.



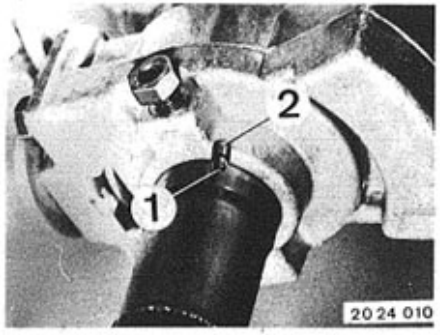
Stick metal thrust washer in plate carrier with grease.



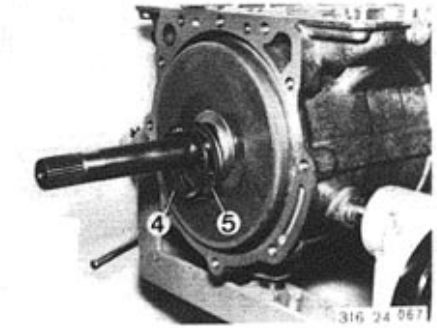
Check axial play of input shaft.
Specifications: 0.3 ... 1.5 mm (0.012 ... 0.059"



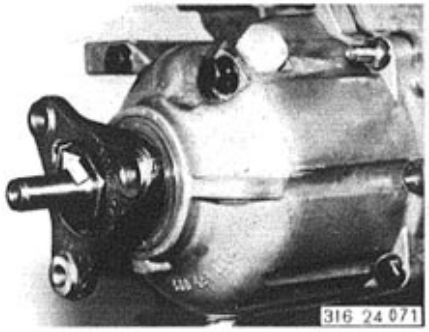
Install plate carrier (6) in clutch A by turning back and forth slightly.
Install clutch A in transmission case.



Compress piston rings slightly and then slide governor on to governor flange.
Important!
Punch mark (1) on output shaft must be aligned with opening (2) in governor hub.
Secure governor.

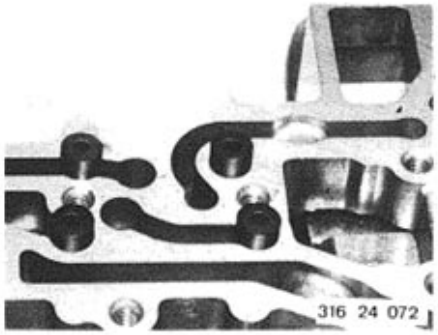


Mount angled disc (5) on input shaft with collar facing needle bearing (4).

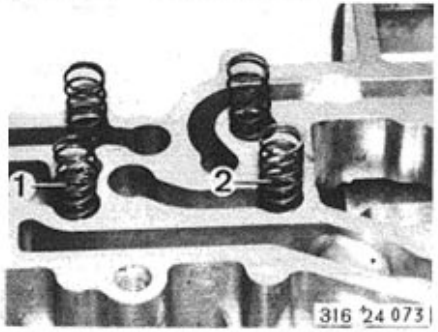


Lubricate sealing lip of radial oil seal with ATF.
Attach transmission extension and output flange.
Install collar nut with Curil K 2 or Loctite 572.
Tighten collar nut[1].
Place lockplate on nut and lock in groove of output flange.

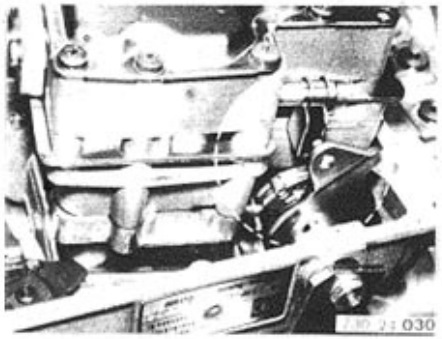
[1] See Specifications for tightening torque



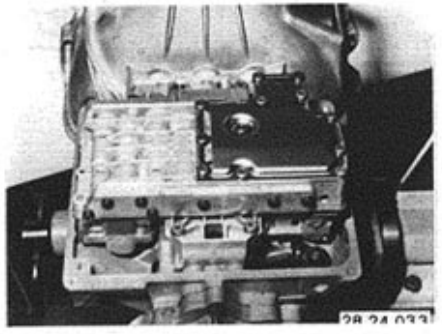
Press in 4 sealing sleeves against stop with a suitable mandrel.



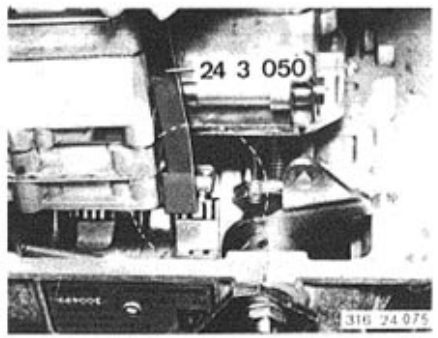
Install and secure springs.
Both short springs (1 and 2) will be on selector lever end.



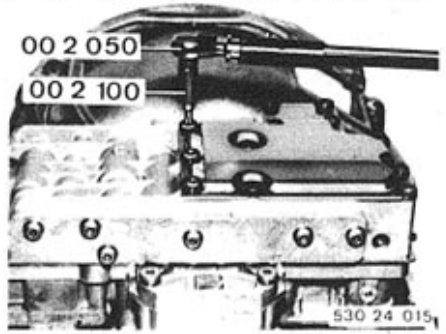
Install valve body that clip on selector sliding valve can be engaged in operating arm of pawl. This requires tightening transmission cable slightly so that throttle cam will not interfere with throttle pressure valve.



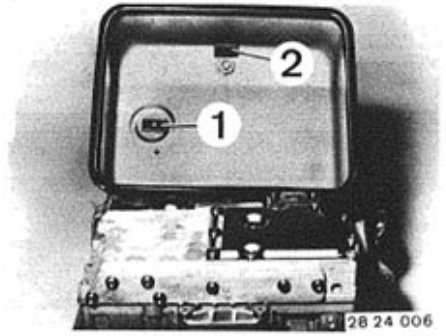
Tighten valve body bolts only finger tight.



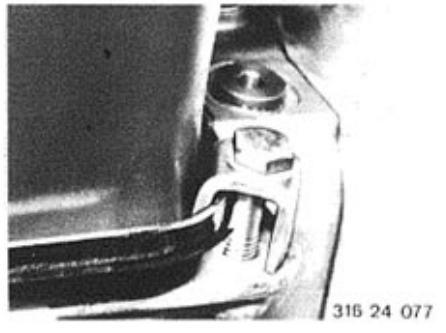
Align valve body with Special Tool 24 3 050. When special tool is not available, check that distance from valve body housing to pin in throttle pressure piston is 11.5 mm (0.453"). Tighten valve body bolts in this position.



Tighten[1] Torx bolts with Special Tools 00 2 100 and 00 2 050.

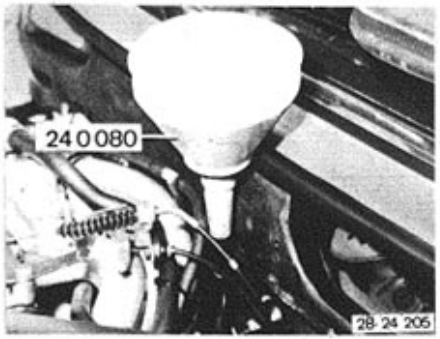


Place gasket on oil sump.
Install magnets (1 and 2).
Note installed position.



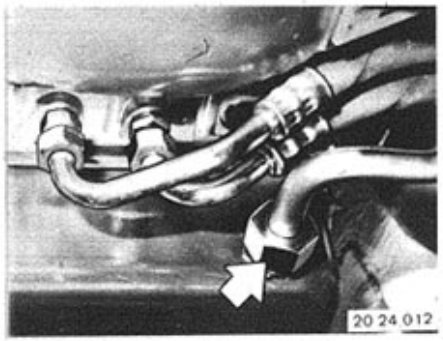
Tighten oil sump mounting bolts with brackets. Short leg of brackets presses down on oil sump.

[1] See Specifications for tightening torque

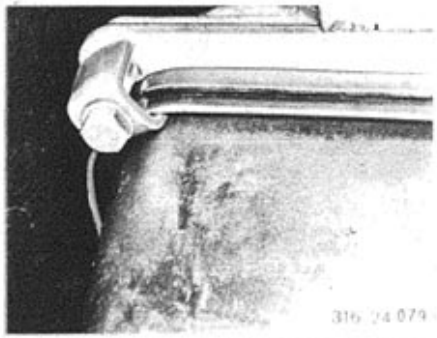


24 11 000 REMOVING AND INSTALLING OIL SUMP

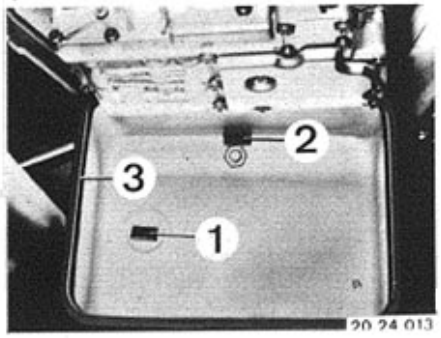
Drain oil.
Important!
Never reuse drained oil.
Installation:
If oil smells burnt and is black, the transmission will have to be disassembled.
Park car on level ground.
Correct oil level with selector lever at P, transmission at operating temperature and engine running at idle speed.
Oil level of transmission having operating temperature should be between both marks.
Amount of oil between min. and max. marks: approx. 0.4 liter (0.8 pint).
Oil Level Too High:
Serious foaming, oil lost by splashing out, high temperature when driving fast, oil lost through vent.
Oil Level Too Low:
Valves rattling, foam, engine slipping, general malfunctioning.
Always use funnel 24 0 080 to add ATF.



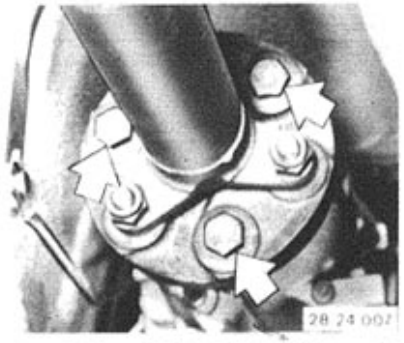
Disconnect oil filler tube on oil sump.
Detach oil sump.



Installation:
Mount oil sump with brackets in such a manner that short legs of brackets exert force on oi sump.

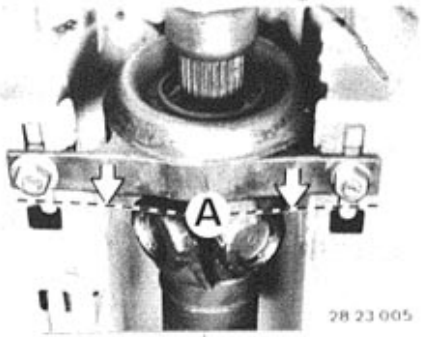


Important!
Place magnets (1 and 2) in oil sump.
Mount gasket (3).

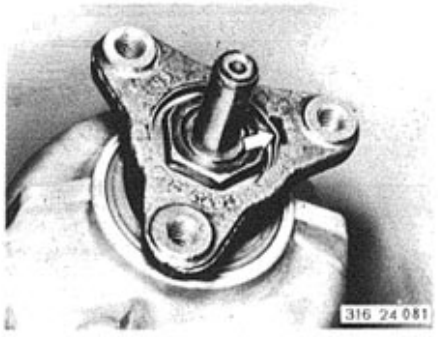


24 11 050 REMOVING AND INSTALLING/ SEALING TRANSMISSION EXTENSION

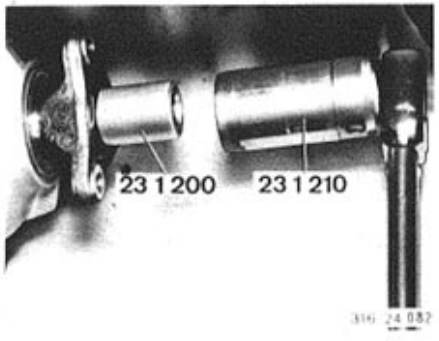
Remove exhaust assembly 18 00 020.
Remove heat shield.
Detach propeller shaft at transmission.
Installation:
Tighten bolts to specified torque[1].



Detach center bearing.
Installation:
Preload center bearing forward by distance (A) 2 mm (0.079").
Push propeller shaft together at slide, bend down and pull off of centering pin.
Installation:
Align propeller shaft with Special Tool 26 1 030 (see 26 11 000).

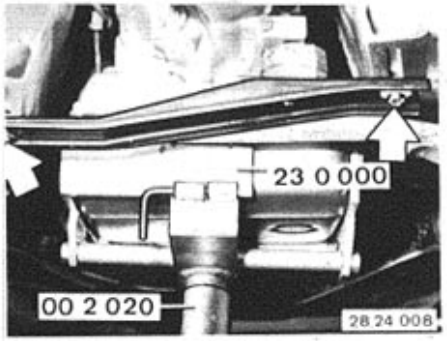


Remove lockplate.
Installation:
Lock lockplate in groove of output flange.

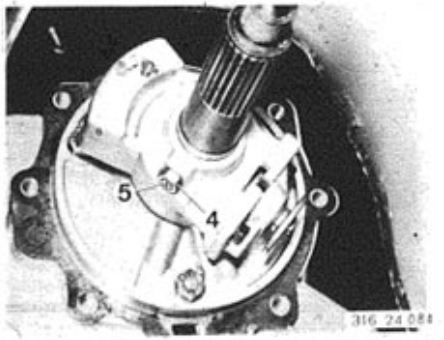


Engage parking lock.
Apply Special Tool 23 1 200.
Unscrew collar nut with Special Tool 23 1 210.
Pull off output flange.
Installation:
Install collar nut with Curil K 2 or Loctite No. 572.
Tightening torque[1].

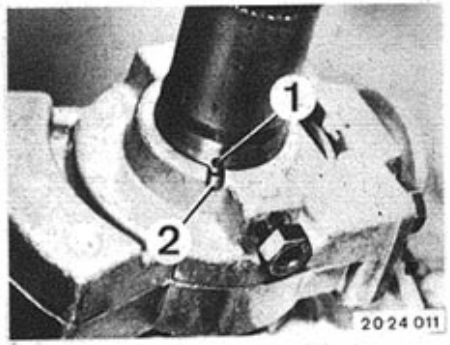
[1] See Specifications



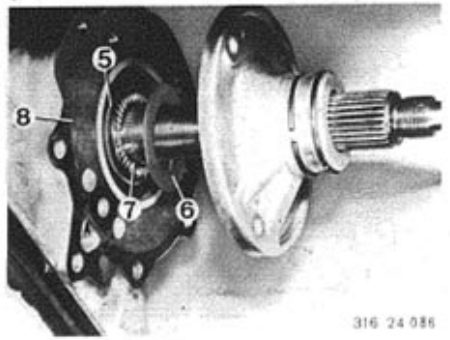
Support transmission with Special Tools 23 0 000 and 00 2 020.
Remove cross member.
Lower transmission.
Detach transmission extension.



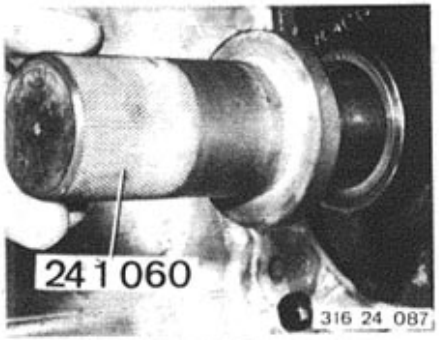
Loosen nut (4) and unscrew stud (5) by about 3 turns.
Pull off governor.



Installation:
Compress piston rings slightly and push governor on to governor flange.
Important!
Punch mark (1) on output shaft must be aligned with opening (2) in governor flange.
Mount governor.

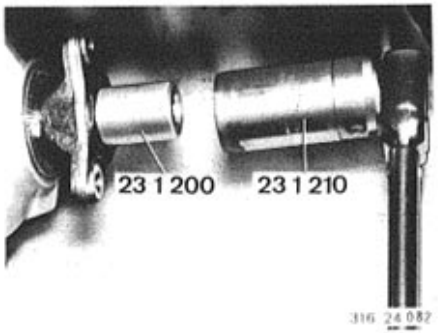


Detach bearing flange.
Important!
Angled disc (5), thrust washer (6) and needle bearing (7).
Replace gasket (8).

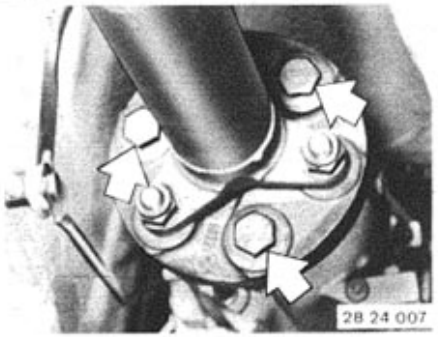


24 12 001 REPLACING RADIAL OIL SEAL FOR TORQUE CONVERTER

Remove and install torque converter 24 40 000.
Remove radial oil seal.
Installation:
Lubricate sealing lip with oil.
Knock in radial oil seal to fit tight with Special Tool 24 1 060.

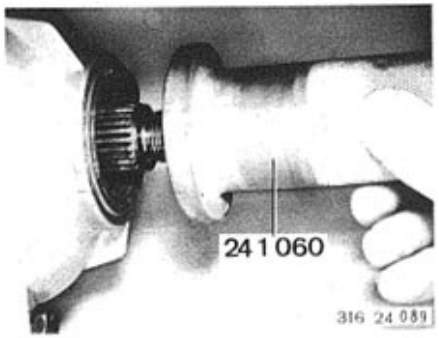


Engage parking lock.
Apply Special Tool 23 1 200.
Unscrew collar nut with Special Tool 23 1 210.
Pull off output flange.
Installation:
Install collar nut with Curil K 2 or Loctite 572.
Tightening torque[1].

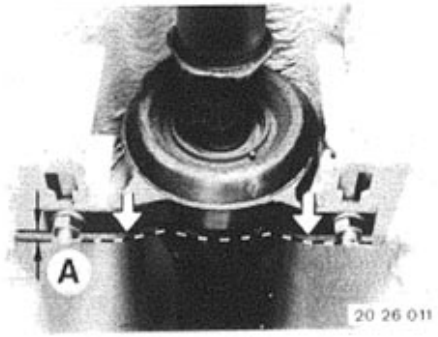


24 12 011 REPLACING RADIAL OIL SEAL FOR OUTPUT FLANGE

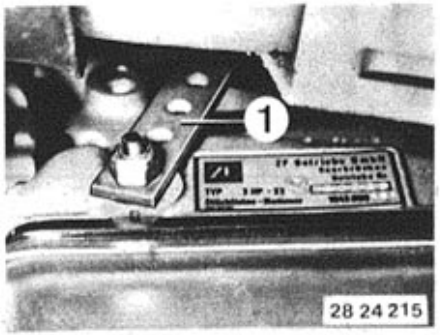
Remove exhaust assembly 18 00 020
Remove heat shield.
Detach propeller shaft at transmission.
Installation:
Tighten bolts to specified torque[1].



Remove radial oil seal.
Installation:
Lubricate sealing lip with ATF.
Knock in radial oil seal to fit tight with Special Tool 24 1 060.

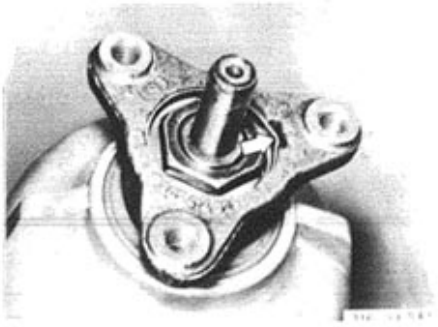


Detach center bearing.
Installation:
Preload center bearing forward by distance (A) = 2 mm (0.079").
Bend down propeller shaft and pull off of centering pin.
Installation:
Align propeller shaft with Special Tool 26 1 030 (see 26 11 000).

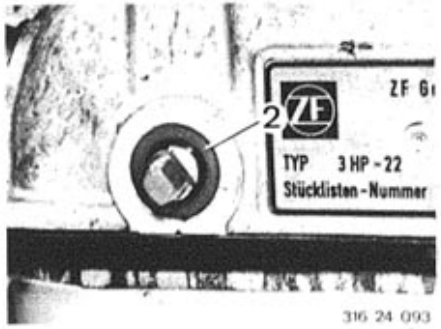


24 12 101 REPLACING RADIAL OIL SEAL FOR MANUAL SHIFT VALVE SHAFT

Detach selector lever (1) on transmission.



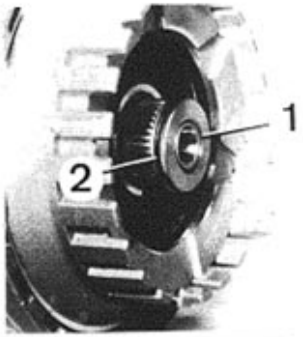
Remove lockplate.
Installation:
Lock lockplate in groove of output flange.



Remove radial oil seal (2).
Installation:
Lubricate sealing lip with ATF.
Knock in radial oil seal flush.

[1] See Specifications

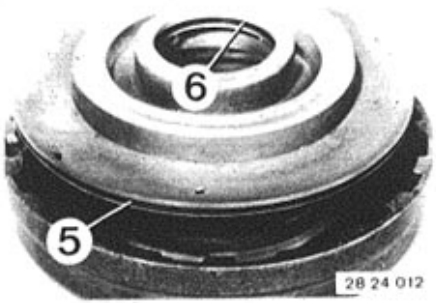
[1] See Specifications



28 24 035

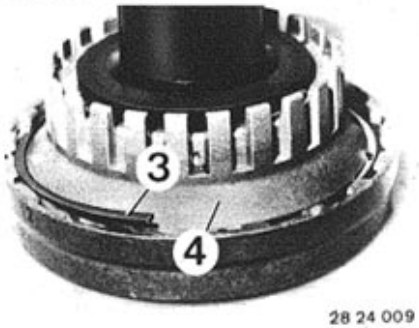
24 23 020 REPLACING PLATE CLUTCHES AND BRAKES

Disassemble transmission 24 00 080.
Clutch A:
Push out input shaft (1).
Check O ring (2), replacing if necessary.



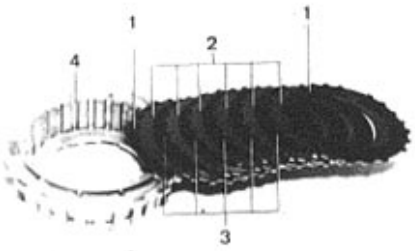
28 24 012

Installation:
Replace O rings (5 and 6).



28 24 009

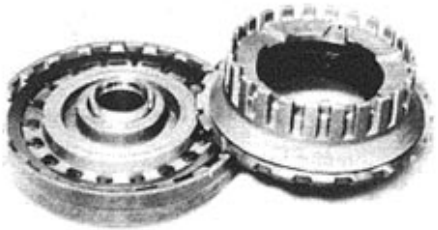
Compress clutch packet and remove circlip (3).
Take off plate carrier (4).

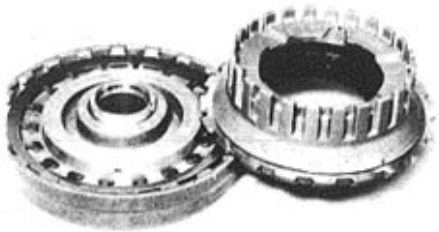


630 24 691

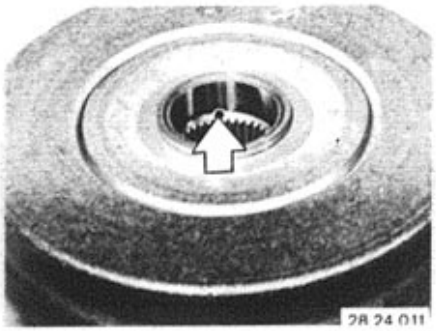
Remove plates.
Installed Order:
1 Spring plates (two)
2 Outer plates (six)
3 Lined plates (five)
4 Plate carrier
Installation:
Place new lined plates in ATF having temperatu of 70° C (158° F) for about 20 minutes.

Lift out plate packet and diaphragm spring.

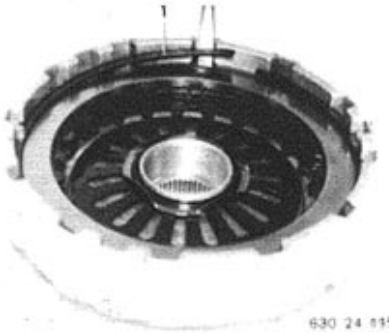

28 24 010


28 24 010

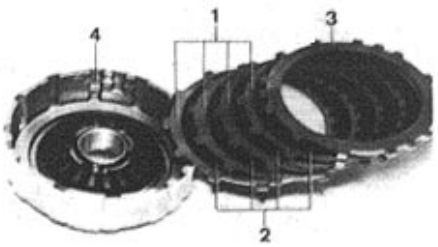
Place diaphragm spring in input shaft housing that curved surface faces down.
Insert plate packet with plate carrier.
Compress clutch packet and insert circlip.


28 24 011

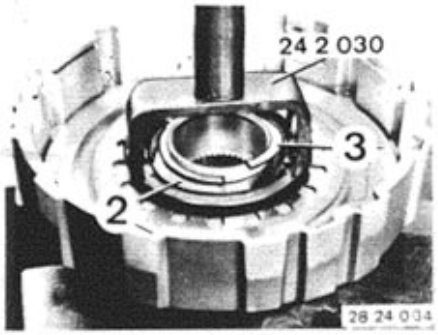
Press out piston for clutch A by applying compressed air at oil bore.



Clutch B:
Remove circlip (1).
Remove outer and lined plates.



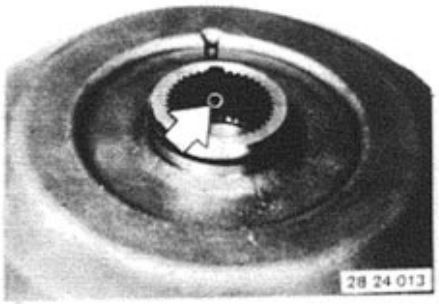
Installed Order:
1 Outer plates 1.8 mm (0.071") (four)
2 Lined plates (four)
3 End plate 4.5 mm (0.177") (one)
Important!
Insert end plate with ground side facing lined plate.
4 Housing
Installation:
Place new lined plates in ATF having temperature of 70° C (158° F) for about 20 minutes.



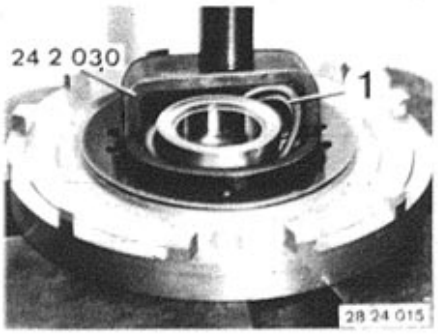
Bend open lockwasher (2).
Push down diaphragm spring with Special Tool 24 2 030 and remove circlip (3).
Installation:
Replace and lock lockwasher.
Insert diaphragm spring with curved surface facing up.



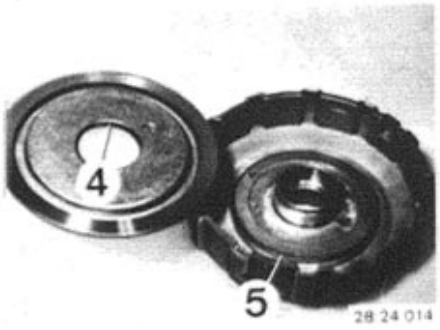
Clutch C:
To make installation easier, insert entire packet in a piece of pipe with an inside dia. of 29 mm and clamp in a vise (29 mm = 1.142").
Lift off centering plate (5).
Remove outer lined plates and one way clutch.



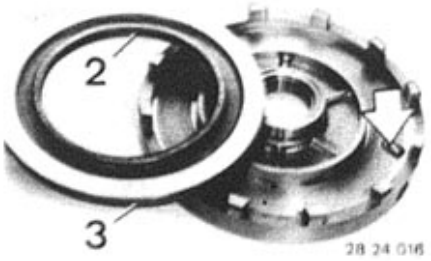
Press out piston for clutch B with compressed air applied in oil bore.



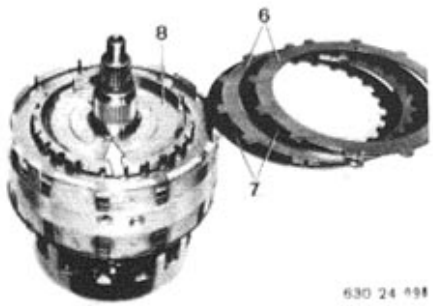
Push down diaphragm spring with Special Tool 24 2 030 and lift out split retaining ring (1).
Installation:
Insert diaphragm spring with curved surface facing up.



Installation:
Check O-rings (4 and 5), replacing if necessary.

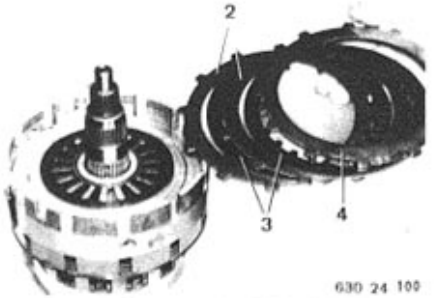


Press out piston for clutch C with compressed air applied in oil bore.
Installation:
Check O-rings (2 and 3), replacing if necessary.



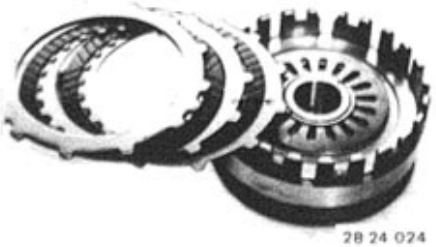
630 24 098

Installation:
Install one-way clutch (8) that bent over tabs of holder are visible from above.
Installed Order:
6 Outer plates (two)
7 Lined plates (two)
Place new lined plates in ATF having temperature of 70° C (158° F) for about 20 minutes.



630 24 100

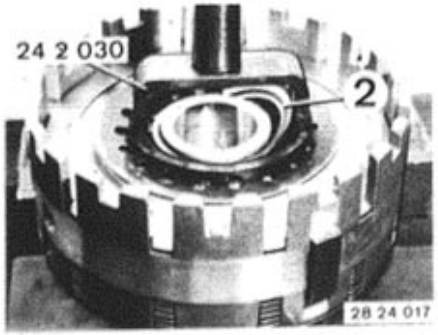
Installed Order:
2 Outer plates 1.8 mm (0.071") (two)
3 Lined plates (two)
4 End plate 4.5 mm (0.177") (one)
Important!
Install end plate with ground side facing lined plate.
Installation:
Place new lined plates in ATF having temperature of 70° C (158° F) for about 20 minutes.


28 24 024

Clutch C:
Remove outer and lined plates.

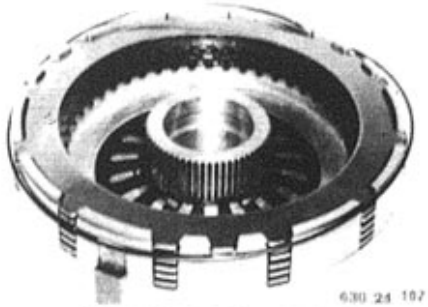

630 24 101

Clutch D:
Lift clutch unit with clutch D off of planet gear set.

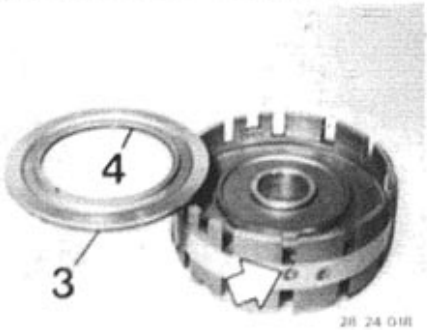


28 24 017

Push down diaphragm spring with Special Tool 24 2 030 and lift out split retaining ring (2).
Installation:
Install diaphragm spring with curved surface facing up.

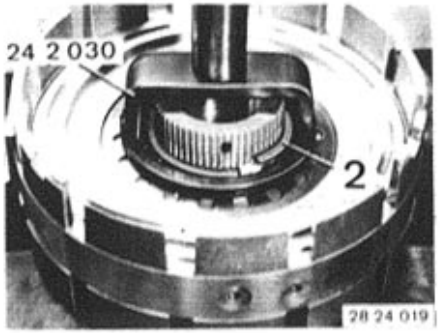

630 24 102

Remove circlip (1).
Remove outer and lined plates.



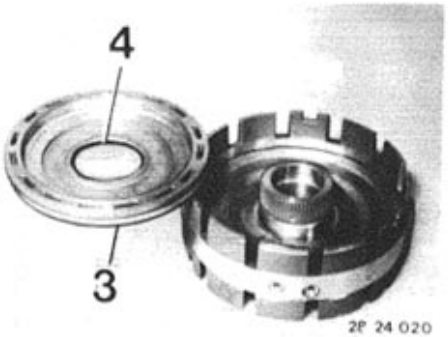
28 24 018

Press out piston for clutch C by applying compressed air in oil bore.
Installation:
Check O-rings (3 and 4), replacing if necessary.



28 24 019

Push down diaphragm spring with Special Tool 24 2 030 and remove circlip (2).
Installation:
Install diaphragm spring with curved surface facing up.

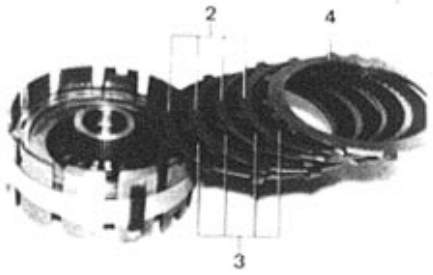


2P 24 020

Press out piston for clutch D by applying compressed air in oil bore.

Installation:

Check O-rings (3 and 4), replacing if necessary.



630 24 161

Installed Order:

2 Outer plates 1.8 mm (0.071") (four)
3 Lined plates (four)
4 End plate 4.5 mm (0.177") (one)

Important!

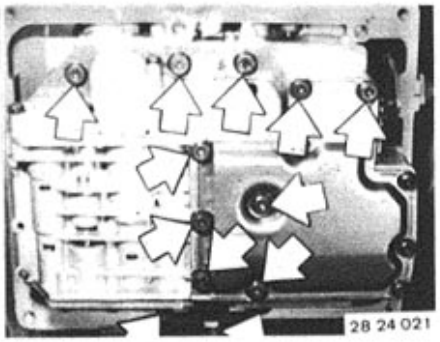
Install end plate with ground side facing lined plate.

Installation:

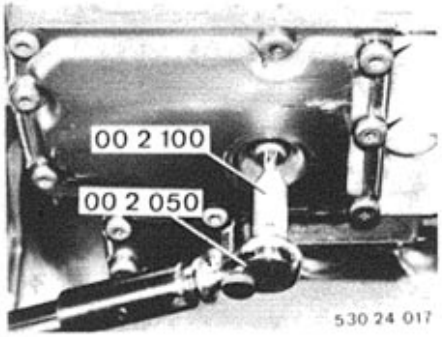
Place new lined plates in ATF having temperature of 70° C (158° F) for about 20 minutes.

24 30 000 REMOVING AND INSTALLING VALVE BODY

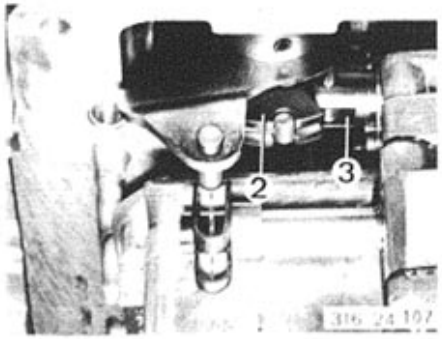
Remove oil sump 24 11 000.
Remove valve body.

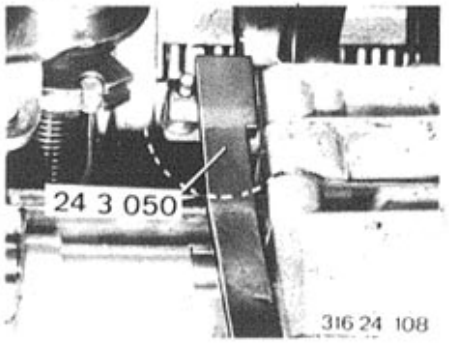


Installation:
Tighten[1] Torx bolts with Special Tools 00 2 100 and 00 2 050.



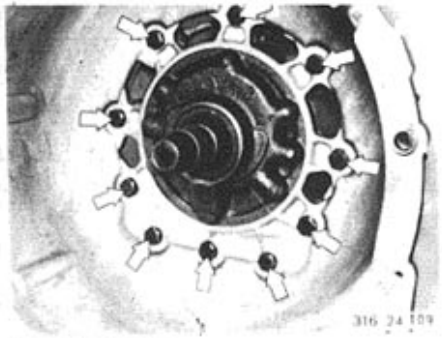
Installation:
Install valve body that clip on selector valve can be engaged in operating arm of pawl.
This will require pulling the transmission cable slightly so that accelerator cam (2) cannot interfere with throttle pressure valve (3).





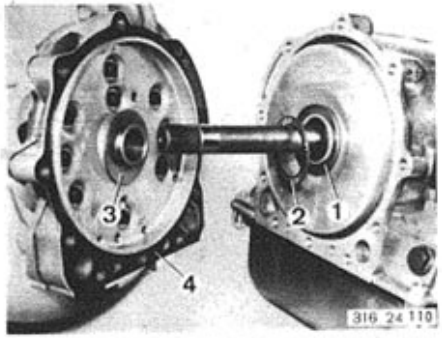
Tighten valve body bolts only finger tight.
Align valve body with Special Tool 24 3 050
If this special tool is not available, check that distance from valve body housing to pin in throttle pressure piston is 11.5 mm (0.453").
Tighten valve body bolts.

[1] See Specifications

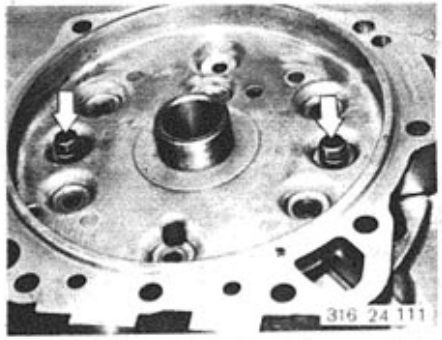


24 31 000 REMOVING AND INSTALLING PRIMARY PUMP

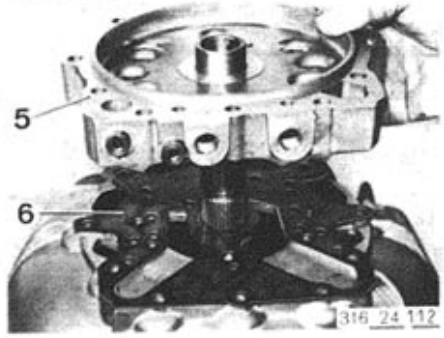
Remove torque converter 24 40 000.
Take off converter bell housing with intermedi ate plate.



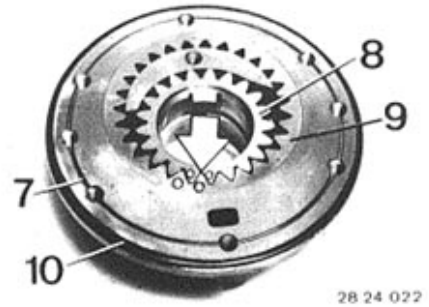
Installation:
Mount angled disc (1) on input shaft with collar facing needle bearing (2).
Hold thrust washer (3) on converter bell housing with grease.
Replace gasket (4).



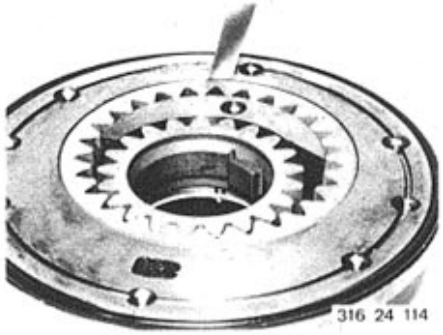
Detach intermediate plate on converter bell housing.
Loosen both opposite bolts by only several turns.
Disconnect primary pump on converter bell housing by applying several light knocks.
Unscrew bolts and take off primary pump.



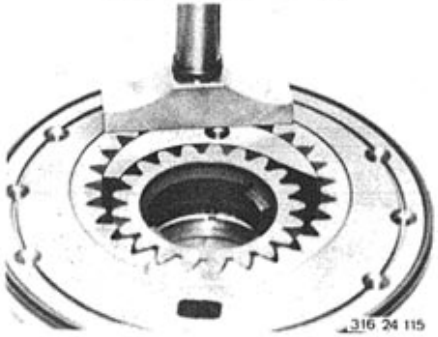
Installation:
Lift off intermediate plate (5).
Replace gasket (6).



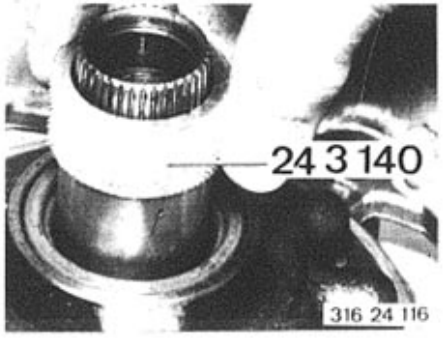
Installation:
The primary pump, consisting of pump body (7), hollow gear (8) and impeller (9), may only be replaced as an assembly.
Check O-ring (10), replacing if necessary.
Install hollow gear (8) and impeller (9), that punch mark faces up.



Check radial play[1] between driven gear and pump body.
Turn gear 360° for this purpose.

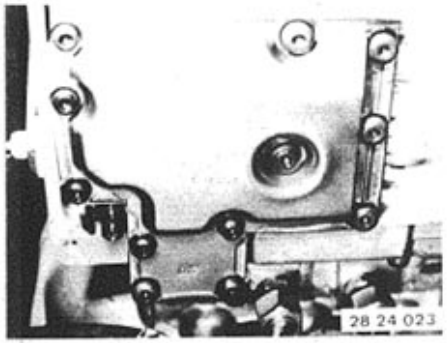


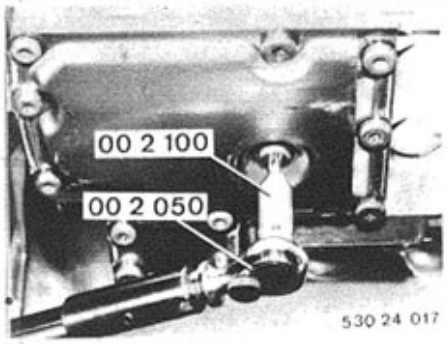
Check axial play[1] of both gears to face surface with a depth micrpmeter.



Check primary pump for perfect light running with Special Tool 24 3 140.
This test must be repeated after installation of intermediate plate.

[1] See Specifications

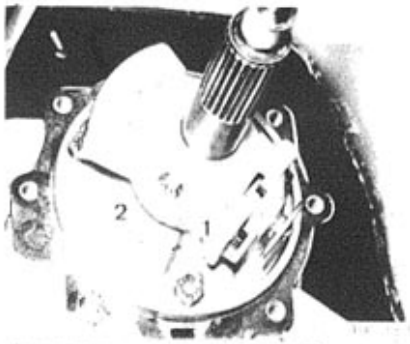


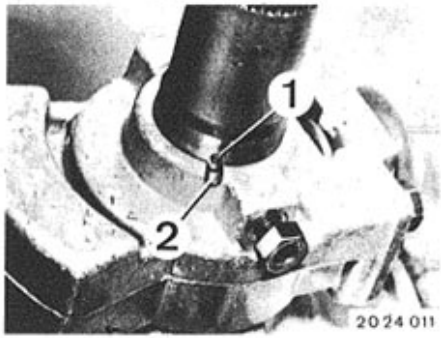


24 31 150 REMOVING AND INSTALLING OIL FILTER SCREEN ON VALVE BODY

Remove oil sump 24 11 000.
Detach oil filter screen.
Installation:
Clean oil filter screen.
Replace oil filter screen which is starting to gum up with a burnt brown resin.
Tightening torque[1].

Installation:
Tighten[1] Torx bolts with Special Tools 00 2 100 and 00 2 050.
Replace oil filter screen (see Group 00).







24 32 000 REMOVING AND INSTALLING CENTRIFUGAL GOVERNOR

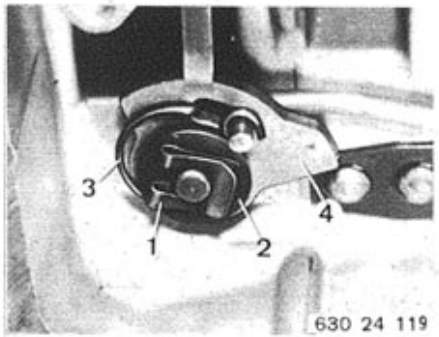
Remove transmission cover 24 11 050.
Unscrew nut (1) and stud (2) by about 3 turns.
Pull off governor.

Installation:
Compress piston rings lightly and then slide governor on to governor flange.
Important!
Punch mark (1) on output shaft must align with opening (2) in governor flange.
Secure governor.

24 32 503 DISASSEMBLING / ASSEMBLING CENTRIFUGAL GOVERNOR GOVERNOR REMOVED

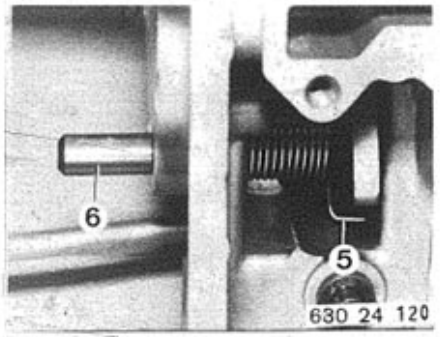
Take off cover (1) from housing (2).
Lift off circlip (3) and remove washer (4).
Remove governor piston (5), spring (6) and governor bush (7).
Installation:
Governor piston must slide in governor bush easily.
Replace circlip (3).

[1] See Specifications

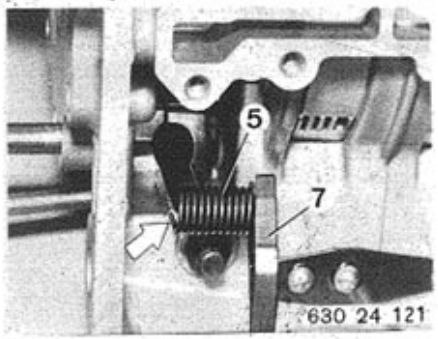


24 34 000 REMOVING AND INSTALLING PARKING LOCK PAWL

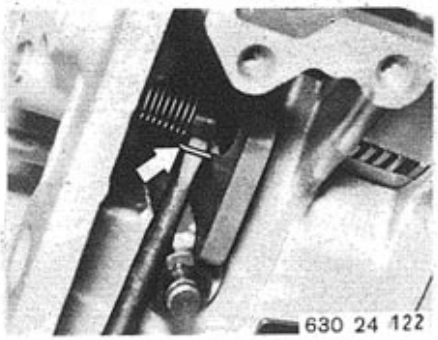
Remove valve body 24 30 000.
Remove transmission cover 24 11 050.
Lift off circlip and remove washer (2).
Disengage spring (3) and pull off parking lock cam (4).



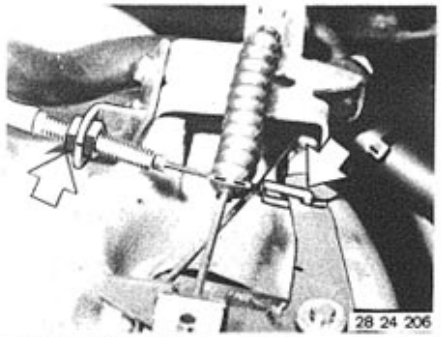
Disconnect spring (5) and push out pin (6) from inside to outside or pull out.



Installation:
Press in pin, pushing spring (5) and pawl (7) on to pin.
Straight end of spring faces up on transmission case.
Front end of spring is behind pawl at left.

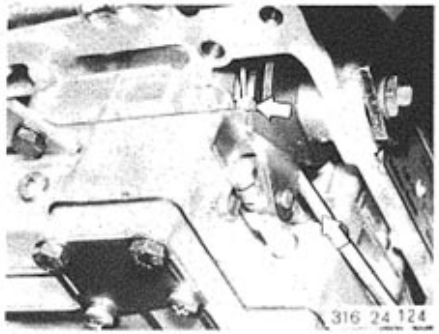


Attach front end of spring on right pawl side.

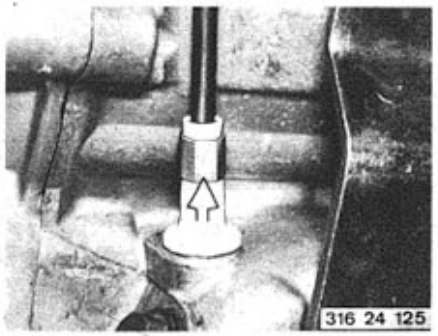


24 34 100 REPLACING ACCELERATOR CABLE

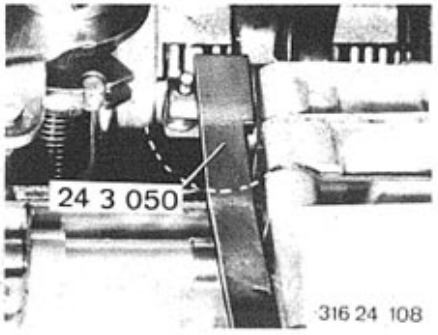
Disconnect accelerator cable and detach on holder.



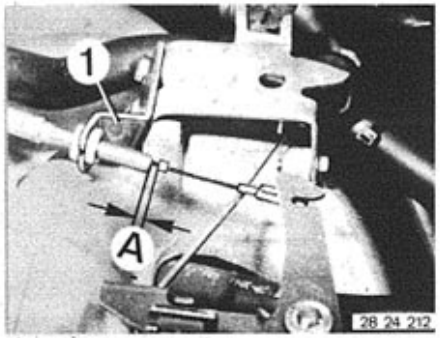
Remove oil sump 24 11 000.
Set selector lever to N.
Push accelerator cam forward and disconnect cable on cam.



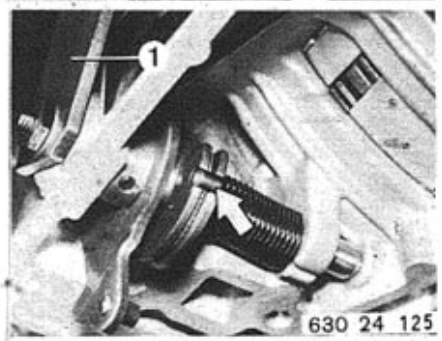
Push out accelerator cable from housing upwarc



Press new accelerator cable into case until retaining tabs engage.
Connect nipple on accelerator cam.
Apply Special Tool 24 3 050 between valve body housing and throttle pressure switch.
Push accelerator cam against throttle pressure valve.

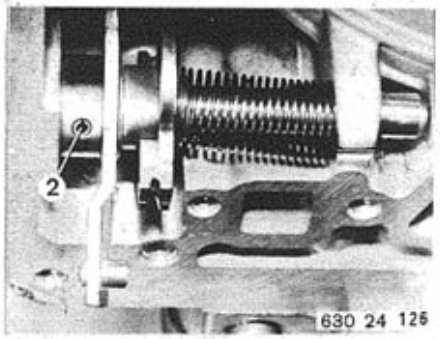


Move accelerator cable to installed position and attach on holder (1).
Tighten cable.
Squeeze loose lead seal on cable firmly at distance (A) = 0.25 ... 0.50 mm (0.010 ... 0.020").
Adjust accelerator cable 24 00 004.

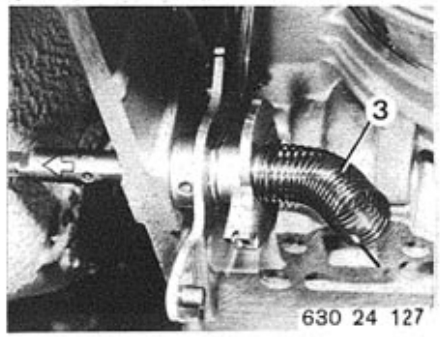


24 34 701 REPLACING ACCELERATOR CABLE SPRING
VALVE BODY REMOVED

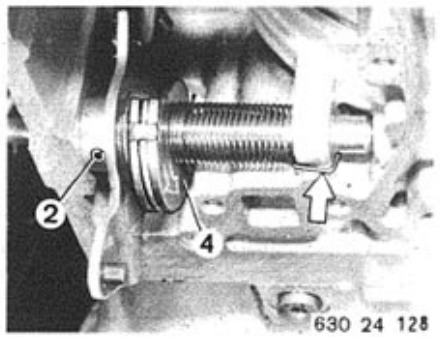
Detach selector lever (1) on transmission.
Disconnect accelerator cable.



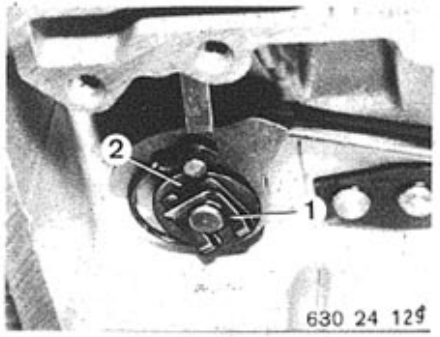
Knock out pin (2) in position N,



Pull out selector shaft far enough that spring (3) can be removed.

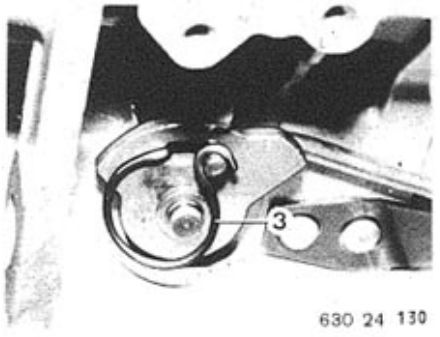


Installation:
Short leg of spring is connected on accelerator cam (4).
Place long leg of spring in groove on housing.
Install gear selector lever.
Preload spring with accelerator cam (4) by turni anticlockwise one turn.
Connect accelerator cable and lock pawl with pin (2).

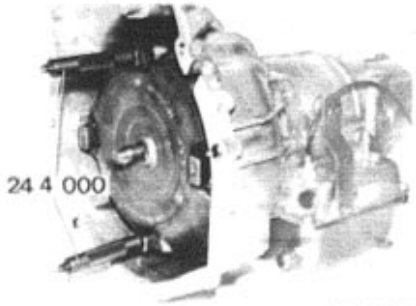


24 34 703 REPLACING SPRING FOR PARK ING LOCK CAM
VALVE BODY REMOVED

Lift off circlip (1) and remove washer (2).



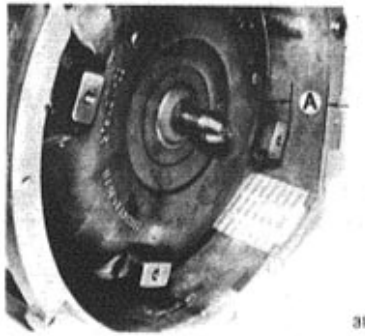
Remove spring (3).



316 24 133

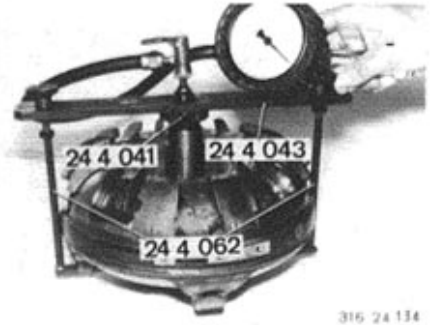
24 40 001 REMOVING AND INSTALLING TORQUE CONVERTER

Remove and install transmission 24 00 020.
Pull torque converter out of primary pump carefully with Special Tool 24 4 000.
Important!
Escaping ATF.



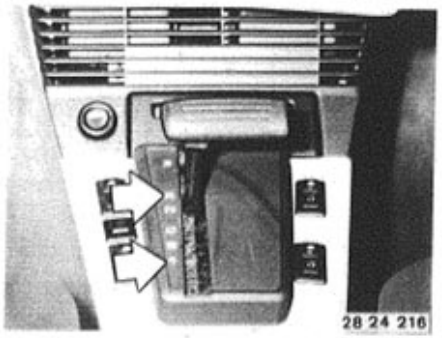
316 24 137

Guide openings on converter into primary pump carefully under slight pressure, using Special Tool 24 4 000 to help.
Important!
Don't damage converter bearings and seal while guiding in.
Converter is in correct installed position when drive dogs (A) are below case edge by approx. 30.5 mm (1.201").



316 24 134

Installation:
Check torque converter for leaks with Special Tools 24 4 041, 24 4 043 and 24 4 062.
Testing pressure: 0.5 bar (7 psi).
Important!
Always use special tool holder to avoid accidents.



Check torque converter installed in car.
Engine and transmission oil must have operating temperature.
Engine must develope full power.
Start engine.
Apply parking brake and depress brake pedal firmly.
Move selector lever to R or 1.
Press to accelerator pedal to full throttle.
Read stall speed[1] on speedometer.

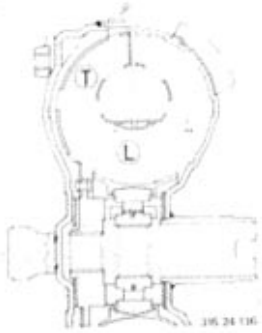


Replace torque converter, if bearing surface on converter shaft is damaged.



316 24 143

Important!
Don't test stall speed longer than 10 seconds to prevent damage from excessive heat.
Stall Speed Much Higher Than Specified[1]:
a) Insufficient oil in converter - correct oil level.
b) Slip in clutches - check clutches.
Stall Speed Much Lower Than Specified[1]:
a) Engine power insufficient - check engine.
b) Converter or pump defective - replace converter or check pump.

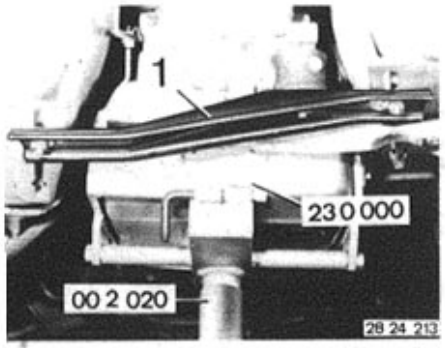


Replace torque converter, if stator (L) or turbine (T) cannot be turned by hand.

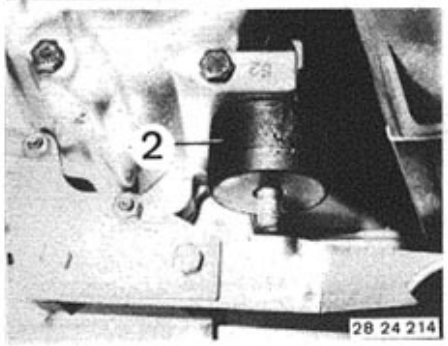
Torque converters cannot be cleaned with standard workshop equipment and must be replaced in the case of transmission damage or torn oil filter screens.
Converter code[1].

[1] See Specifications

24 71 001 REPLACING RUBBER MOUNTS FOR TRANSMISSION SUSPENSION



Support transmission with Special Tools 23 0 000 and 00 2 020.
Remove cross member (1).



Lower transmission and disconnect rubber mount (2).

TROUBLESHOOTING AUTOMATIC TRANSMISSION 3 HP-22

Condition	Cause	Correction
Shift points[1] too high	a) Accelerator cable maladjusted b) Governor bushing seized c) Governor piston rings defective or worn d) Throttle pressure valve malfunctions e) Shift valves jammed	a) Adjust accelerator cable 24 00 004 b) Clean or replace governor 24 32 000 c) Replace piston rings 24 32 000 d) Replace valve body 24 30 000 e) Replace valve body 24 30 000
Shift points[1] too low	a) Accelerator cable maladjusted b) Governor bushing seized c) Throttle pressure valve malfunctions d) Plastic balls in transfer plate leak	a) Adjust accelerator cable 24 00 004 b) Clean or replace governor 24 32 000 c) Replace valve body 24 30 000 d) Replace valve body 24 30 000
Shift points too high or too low and also shift movements too long and too soft	a) Clutches C and C' for 1 2 shift damaged b) Clutch B for 2–3 shift damaged	a) Replace clutches C and C 24 23 080 b) Replace clutch B 24 23 080
No kickdown shifts	a) Accelerator cable maladjusted b) Valve body maladjusted c) Throttle pressure valve stuck d) Plastic balls in transfer plate leak	a) Adjust accelerator cable 24 00 004 b) Adjust valve body 24 30 000 c) Replace valve body 24 30 000 d) Replace valve body 24 30 000
Selector lever cannot be moved to P	a) Selector linkage maladjusted b) Locking mechanism defective	a) Adjust selector linkage 24 00 004 b) Repair locking mechanism 24 34 000
Parking position cannot be taken out	a) Parking lock pawl caught in teeth of output shell b) Excessive friction in parking lock mechanism	a) Replace parking lock pawl 24 34 000 b) Repair parking lock mechanism 24 34 000
Parking position does not hold (slips)	a) Selector linkage maladjusted.	a) Adjust selector linkage 24-00 004
No forward or reverse drive	a) Oil volume insufficient b) Pump drive defective c) Drive plate broken d) Parking lock pawl stuck e) Clutches A and B defective	a) Correct oil level b) Replace converter and pump 24 31 000 c) Replace drive plate d) Replace pawl 24 34 000 e) Disassemble transmission 24 23 020
No forward drive	a) Selector linkage maladjusted b) Clutch A defective or oil loss in feed line	a) Adjust selector linkage 24 00 004 b) Replace clutch A 24 23 020
No reverse drive	a) Selector linkage maladjusted b) Clutch B or D defective c) Clutch valve and damper B malfunction d) Oil level insufficient; pump cannot draw in oil	a) Adjust selector linkage 24 00 004 b) Disassemble transmission 24 00 080. c) Replace valve body 24 30 000 d) Correct oil level

[1] See Specifications

TROUBLESHOOTING AUTOMATIC TRANSMISSION 3 HP 22

Condition	Cause	Correction
Slipping or shaking when moving off in reverse gear	a) Clutch B or D damaged b) Heavy oil loss in feed line to B or D	a) Disassemble transmission 24 00 080 b) Disassemble transmission 24 00 080
No drive in R and 2nd gear	a) Shift valve seized in 3rd gear position	a) Replace valve body 24 30 000; if oil pan has abrasion, disassemble transmission 24 00 080
Hard engagement jolt or definite double knock when engaging reverse	a) Damper B defective or wrong cover parts	a) Replace valve body 24 30 000
Car cannot be started in N	a) Transmission switch defective	a) Replace transmission switch 61 31 260
Car creeps or runs in N	a) Selector linkage maladjusted b) Clutch A discharges too slowly c) Clutch A defective (bonded)	a) Adjust selector linkage 24 00 004 b) Disassemble transmission 24 00 080 c) Disassemble transmission 24 00 080
Drive only in 1st gear when in D	a) Shift valve 1–2 jammed b) Governor bushing seized	a) Replace valve body 24 30 000 b) Clean or replace governor 24 32 503
Drive only in 1st and 2nd gear when in D	a) Shift valve 2 3 jammed	a) Replace valve body 24 30 000
Drive only in 2nd gear	a) Shift valves 1 2 and 2–3 jammed	a) Replace valve body 24 30 000
Drive only in 3rd gear	a) Shift valves 1 2 and 2–3 jammed b) Governor bushirig seized	a) Replace valve body 24 30 000 b) Clean or replace governor 24 32 503
Drive in N	a) Selector linkage maladjusted b) Clutch A (forward) bonded c) Clutch B (reverse) bonded	a) Adjust selector linkage 24 00 004 b) Disassemble transmission 24 00 080 c) Disassemble transmission 24 00 080
No braking effect from 1st gear in 2 or 1	a) Clutch valve and damper D defective b) Clutch D defective	a) Replace valve body 24 30 000 b) Replace clutch D 24 23 020
No braking effect from 2nd gear in 2 or 1	a) Clutch C' defective	a) Replace clutch C' 24 23 020
Transmission shifts too early for manual downshift from 2 to 1 (above 80 km/h or 50 mph)	a) Locking valve pressure too high b) Pressure löss in governor pressure feed between governor and shift valves	a) Replace valve body 24 30 000 b) Disassemble transmission 24 00 080
Transmission shifts too late for manual downshift from 2 to 1 (below 40 km/h or 25 mph)	a) Locking valve pressure too low b) Governor pressure too high	a) Replace valve body 24 30 000 b) Disassemble transmission 24 00 080
Stall speed[1] too high in forward	a) Clutch A or 1st gear one-way clutch slips	a) Disassemble transmission 24 00 080
Stall speed[1] too low in forward	a) Engine power output insufficient b) Converter one-way clutch defective	a) Check engine tuning b) Replace converter 24 40 000

[1] See Specifications

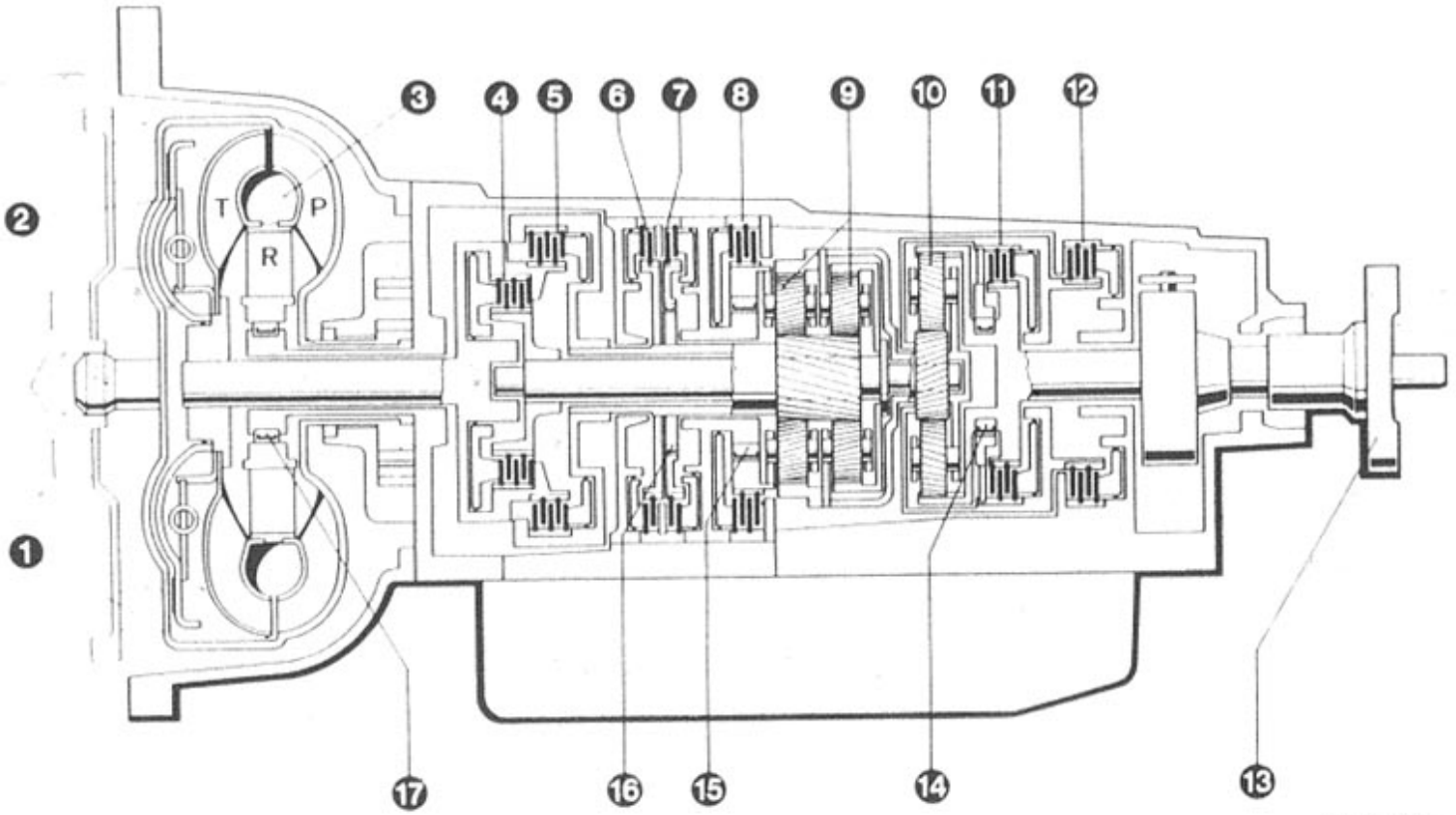
TROUBLESHOOTING AUTOMATIC TRANSMISSION 3 HP-22

Condition	Cause	Correction
Grinding shifts	a) Accelerator cable detached or maladjusted b) Oil volume insufficient c) Throttle pressure valve seized d) Clutch A defective	a) Attach or adjust accelerator cable 24 00 004 b) Correct oil volume c) Replace valve body 24 30 000 d) Disassemble transmission 24 00 080
Grinding shifts from 1st to 2nd gear	a) Clutches C and C' slip b) Clutch valve and damper C malfunction c) Accelerator cable detached or maladjusted d) Oil volume insufficient e) Throttle pressure valve seized f) One-way clutch F defective	a) Disassemble transmission 24 00 080 b) Disassemble transmission 24 00 080 c) Attach or adjust accelerator cable 24 00 004 d) Correct oil level e) Replace valve body 24 30 000 f) Disassemble transmission 24 00 080
Grinding shifts from 2nd to 3rd gear	a) Clutch B slips b) Accelerator cable detached or maladjusted c) Oil volume insufficient d) Oil pressure too low e) Throttle pressure valve seized f) One-way clutch E defective	a) Replace clutch B 24 23 080 b) Attach or adjust accelerator cable 24 00 004 c) Correct oil level d) Disassemble transmission 24 00 080 e) Replace valve body 24 30 000 f) Disassemble transmission 24 00 080
3rd gear slips	a) Clutch B slips b) Accelerator cable detached or maladjusted c) Oil volume insufficient d) Oil pressure too low e) Throttle pressure valve seized	a) Disassemble transmission 24 00 080 b) Attach or adjust accelerator cable 24 00 004 c) Correct oil level d) Disassemble transmission 24 00 080 e) Replace valve body 24 30 000
Stall speed[1] too high	a) Oil volume insufficient b) Engaged clutch slips c) One-way clutch F or G slips	a) Correct oil level b) Disassemble transmission 24 00 080 c) Disassemble transmission 24 00 080
Stall speed[1] too low	a) Torque converter defective b) Engine power output insufficient	a) Replace converter 24 40 000 b) Check engine tuning
Transmission vibrates when moving off quickly	a) Clutch A defective b) Propeller shaft center bearing defective c) One-way clutch F or G defective	a) Replace clutch A 24 23 020 b) Replace center bearing 26 12 501 c) Disassemble transmission 24 00 080
Transmission shifts hard or down	a) Accelerator cable maladjusted b) Clutch A defective	a) Adjust accelerator cable 24 00 004 b) Disassemble transmission 24 00 080

[1] See Specifications

Condition	Cause	Correction
Whining depending on speed and load	a) Propeller shaft center bearing defective b) Needle bearing in transmission extension defective	a) Replace center bearing 26 11 501 b) Replace transmission extension 24 11 050
Rattling noise in neutral	a) Drive plate broken b) Welded converter drive dogs broken off	a) Replace drive plate 11 22 051 b) Replace converter 24 40 000
Grinding noise in neutral, disappearing when accelerating in N	a) Valve chatter in valve body b) Oil pump taking in air	a) Correct oil level b) Tighten valve body mounting bolts. Check gasket 24 30 000
High pitch noise in all selector lever positions	a) Suction noise of oil pump b) Suction noise of valve body	a) Check tightness of valve body. Tightening torque[1)] b) Replace valve body 24 30 000
Oil on converter bell housing	a) Shaft seal defective b) O-ring in primary pump body defective c) Converter leaks at welded seams d) Plugs leak	a) Replace shaft seal 24 12 001 b) Replace O-ring 24 31 000 c) Replace converter 24 40 000 d) Replace seals
Scratching or chirping noise in all selector lever positions	a) Oil level too low b) Suction noise at valve body	a) Correct oil level b) Replace valve body 24 30 000
Oil on output flange	a) Shaft seal defective b) Output flange leaks at threads	a) Replace shaft seal 24 12 011 b) Install collar nut with Curil K 2 or Loctite No. 572
Breather leakage	a) Oil level too high b) Wrong type of oil (excessive foaming) c) Breather defective d) Breather mounted incorrectly e) O-ring in breather defective	a) Correct oil level b) Replace oil c) Replace breather d) Remove transmission extension. Position breather correctly (opening faces left when looking forward) e) Replace O-ring

1) See Specifications



ZF 4 HP 22 Layout Drawing

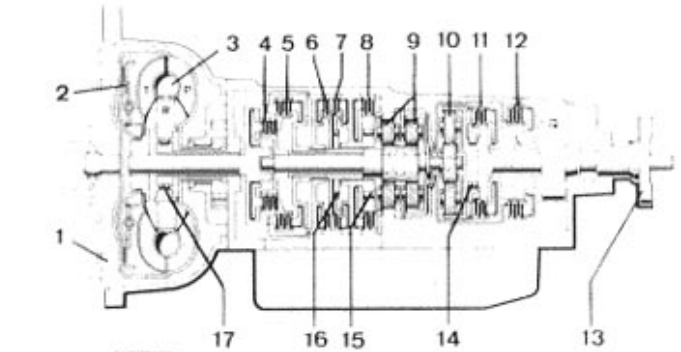
1 Input
2 Converter lockup clutch
3 Hydrodynamic torque converter
P = Impeller
R = Stator
T = Turbine

4 Clutch A
5 Clutch B
6 Clutch C'
7 Clutch C
8 Clutch D

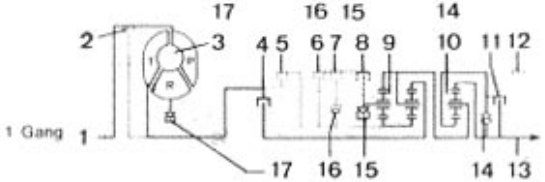
9 Planet gear set
10 Planet gear set – 4th gear
11 Clutch E
12 Clutch F
13 Output

14 One-way clutch
15 One-way clutch
16 One-way clutch
17 One-way clutch

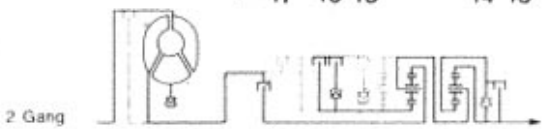
ZF 4 HP 22 Power Flow Diagrams



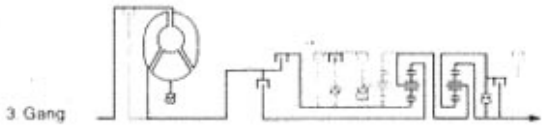
Clutches 4 and 11 are engaged.
Front planet gear carrier of gear set 9 supports on one-way clutch 15 during acceleration and is cancelled while coasting.
Planet gear set 10 rotates as a block.
In selector lever position 1 clutch 8 is also engaged in 1st gear, to have engine brake.



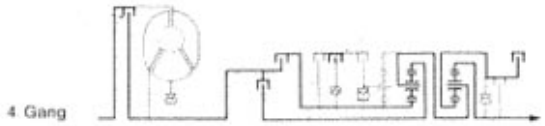
Clutches 4, 6, 7 and 11 are engaged.
One-way clutch 15 is cancelled.
Hollow shaft is fixed with sun gear of planet gear set 9.
Planet gear set 10 rotates as a block.



Clutches 4, 5, 7 and 11 are engaged.
One-way clutches 15 and 16 are cancelled.
Planet gear sets 9 and 10 rotate as a block at ratio of 1 to 1.



Clutches 4, 5, 7 and 12 are engaged.
One-way clutches 14, 15 and 16 are cancelled.
Planet gear set 9 rotates as a block.
Hollow shaft is fixed with sun gear of planet gear set 10.
Torque converter 3 is locked by clutch 2 as from a certain road speed.

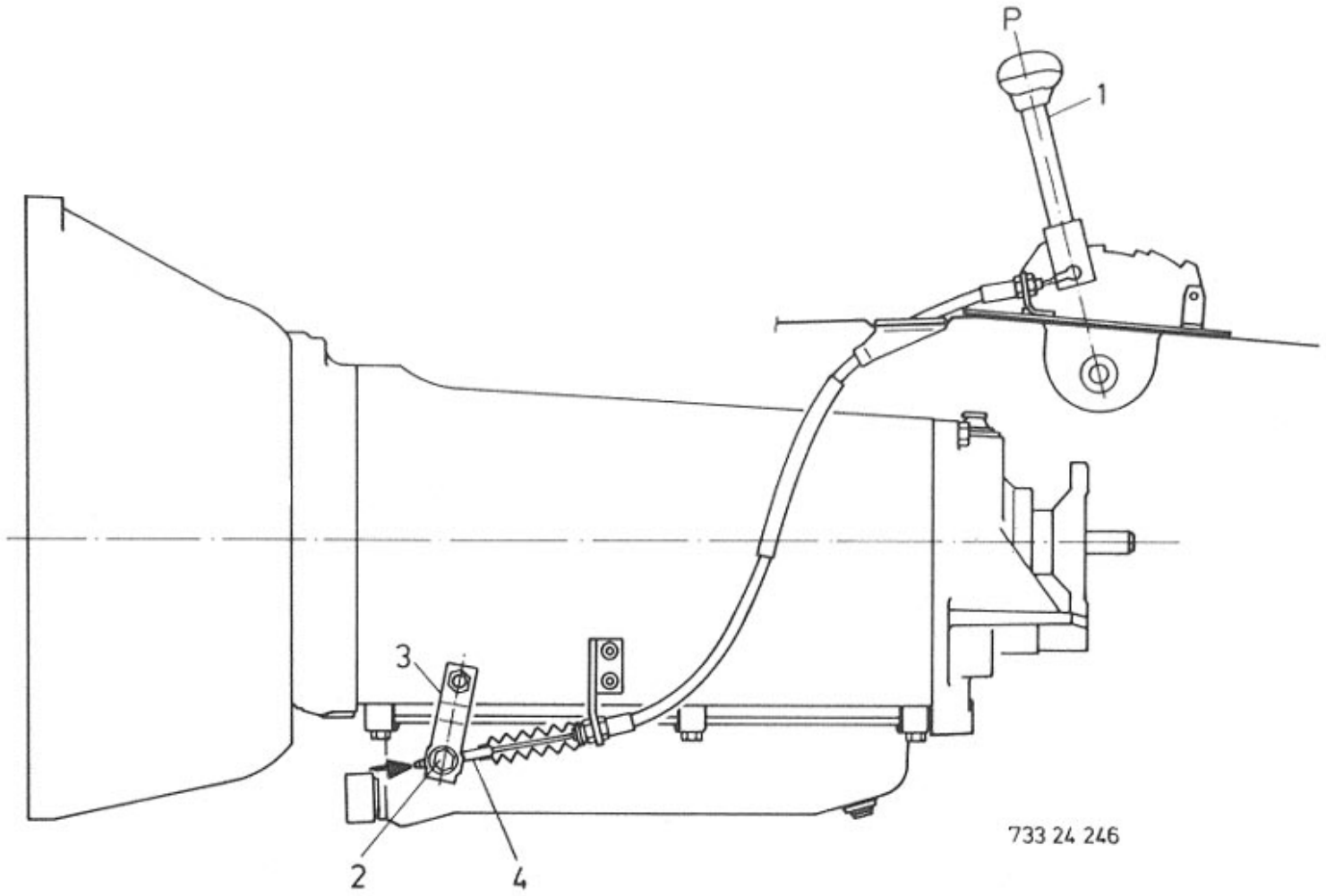


Clutches 5, 8 and 11 are engaged.
Output shaft's direction of rotation is reversed via the held front planet gear carrier of gear set 9.
Planet gear set 10 rotates as a block.

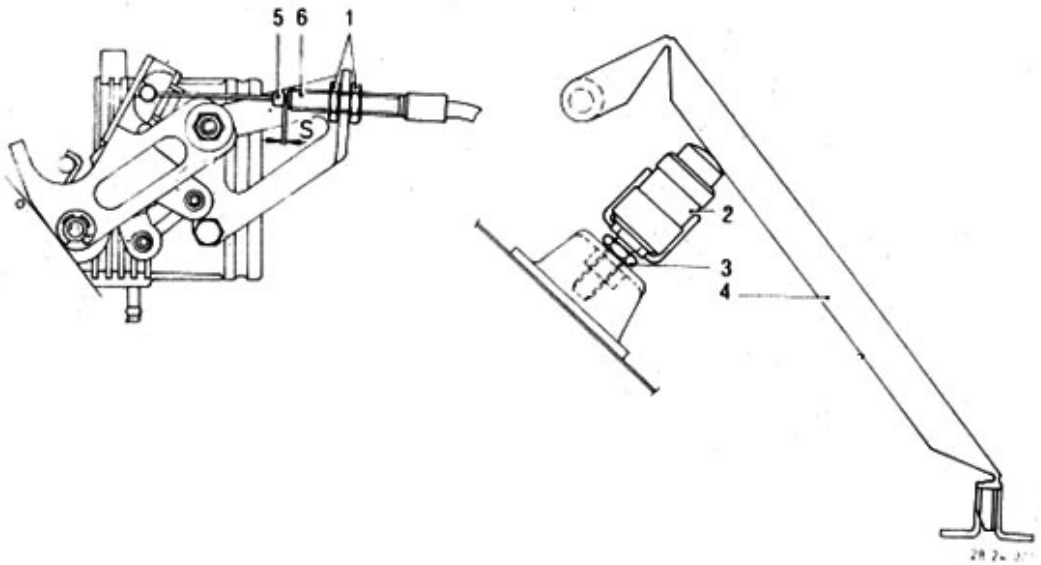


733 24 062

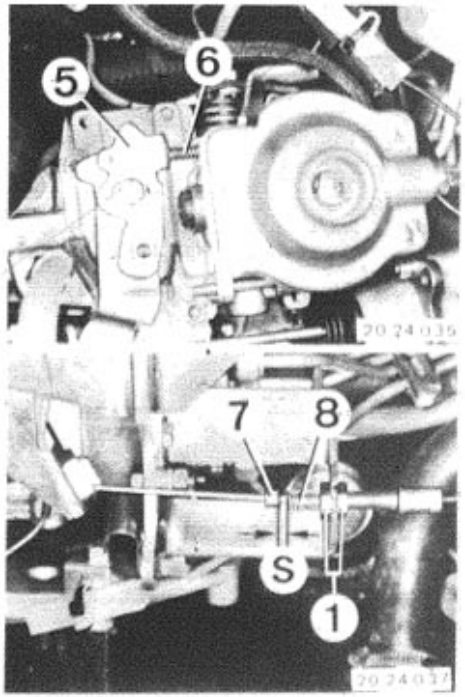
24 00 006 ADJUSTING SELECTOR LEVER, THROTTLE LINKAGE AND THROTTLE CABLE

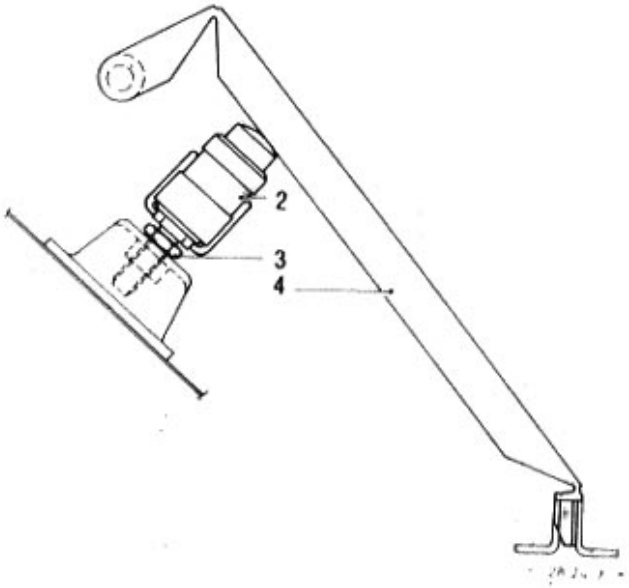


A) Adjusting Selector Lever:
Move selector lever (1) to "P".
Loosen nut (2).
Push lever (3) forward (park position).
Push cable rod (4) opposite forward direction.
Clamp cable rod (4) with nut (2).
Tightening torque: 10 to 12 Nm (7.0 to 8.5 ft. lbs.).

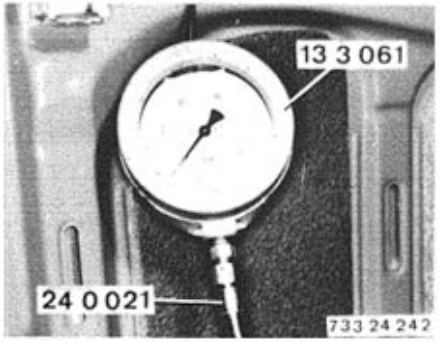


B) Adjusting Throttle Cable:
Requirement: full throttle adjustment correct.
Adjust play (S) to 0.50 ± 0.25 mm (0.020 ± 0.010") with nuts (1) in idle position.
Check kickdown stop (2).
Loosen lock nut (3) and screw in kickdown stop (2).
Push down accelerator pedal (4) to transmission pressure point.
Unscrew kickdown stop in this position, until it contacts the accelerator pedal.
Push down accelerator pedal (4) to kickdown (final position).
Now distance (S) from lead seal (5) to end of sleeve (6) must be at least 44 mm (1.732").





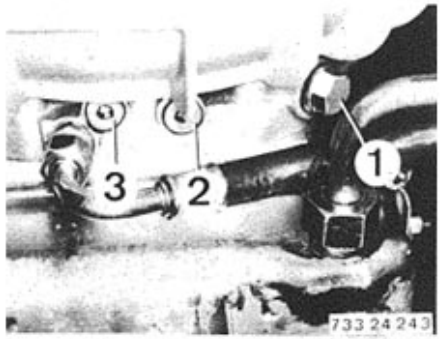
Type 524 td:
B) Adjusting Throttle Cable
Requirement: engine running adjustment correct.
If applicable, adjust engine running – see 13 00 050.
Temperature dependent idle speed boost activated.
This means: operating lever (5) must rest on idle stop (6).
Adjust play (S) to 0.50 ± 0.25 mm (0.020 ± 0.010") with nuts (1).
Check kickdown stop (2).
Loosen nut (3) and screw in the kickdown stop (2).
Press the accelerator pedal (4) to the transmission pressure point.
Unscrew the kickdown stop in this position until it touches the accelerator pedal.
Press the accelerator pedal (4) to kickdown (final position).
The distance (S) from lead seal (7) to adjusting screw (8) must now be at least 44 mm (1.732").



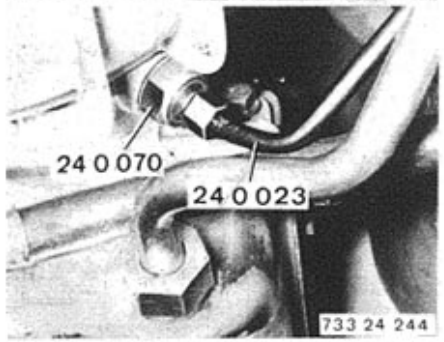
24 00 011 CHECKING HYDRAULIC PRESSURE VALUES

Connect hose 24 0 021 with pressure tester 13 3 061.

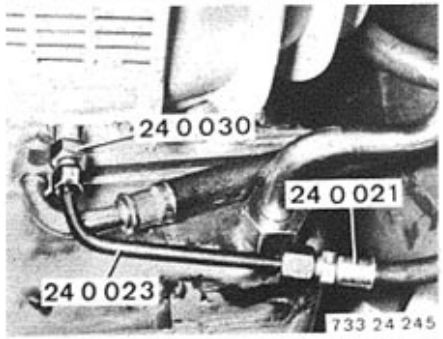
Test	Pos.	Gear	Speed (rpm)	Bar
Pump press.	D	1st	700...1000	6.0...7.5
		2nd/3rd and 4th	app. 4000	4.6...5.8
	R	reverse	700...1000	11 ... 13
Conv. press.	D	4th	converter locked	max. 0.7



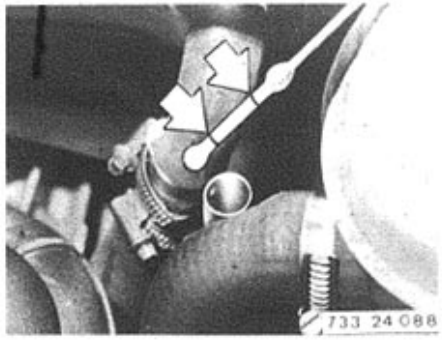
Remove pertinent plugs for testing.
1 Pump pressure
2 Clutch A
3 Converter pressure



A) Pump Pressure:
Install adapter 24 0 070 with seal on transmission.
Connect elbow pipe 24 0 023 in conjunction with hose 24 0 021.



B) Converter Pressure:
Install adapter 24 0 030 on transmission.
Connect elbow pipe 24 0 023 in conjunction with hose 24 0 021.



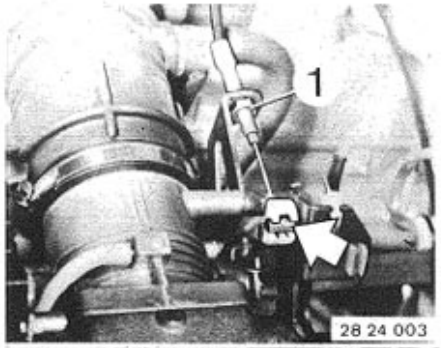
Correct oil level in selector lever position P with transmission at operating temperature and engine running at idle speed.
Car parked on level floor.
The oil level of a transmission at operating temperature = approx. 80° C (175° F) must be between both marks.
Amount of oil between min. and max. marks = approx. 0.4 liters (0.8 pints).
Never wipe off oil dipstick with a cloth losing lint.



An oil dipstick with a longer measuring tip (1) is standard since 2.85.
This produces an earlier display of the oil level in the transmission.
The oil level should not be below ball (2) after a test drive and an oil temperature of approx. 40° C (105° F).
The oil level should be between the min. and max. marks at an oil temperature of approx. 80° C (175° F).
Correct oil level, if necessary.
Note:
The new oil dipstick can be installed retroactively.

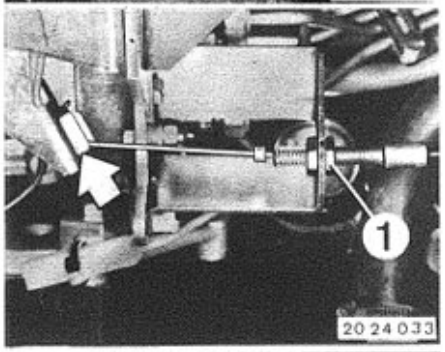


Important!
Oil Level Too High:
Strong foaming, splash loss, high temperature when driving fast, oil lost via vent.
Oil Level Too Low:
Valves rattling, foaming, engine slipping when driving in curves, general operating disturbances.
Only pour in transmission oil with Special Tool 24 0 080 (funnel).

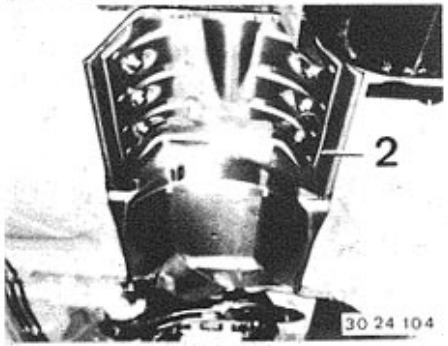


24 00 022 REMOVING AND INSTALLING TRANSMISSION

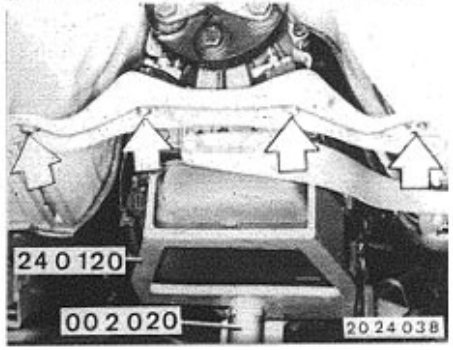
Disconnect the battery ground lead.
Unscrew nut (1).
Disconnect the throttle cable.
Installation:
Adjust throttle cable, see 24 00 006.



BMW 524 td:

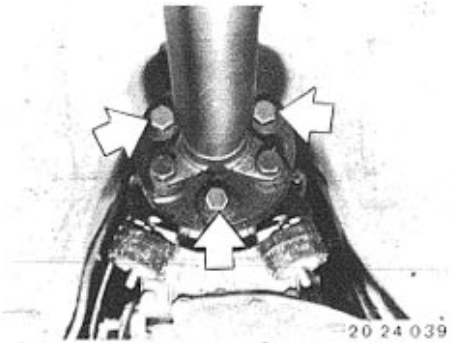


Remove the exhaust assembly – see 18 00 020.
Unscrew heat shield (2).

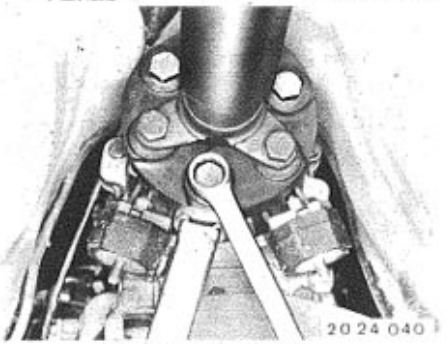


Support the transmission with Special Tools 24 0 120 and 00 2 020.
Remove the cross member.
Installation:
Tightening torque*.

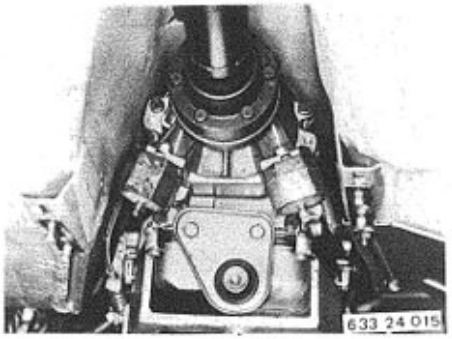
* See Specifications



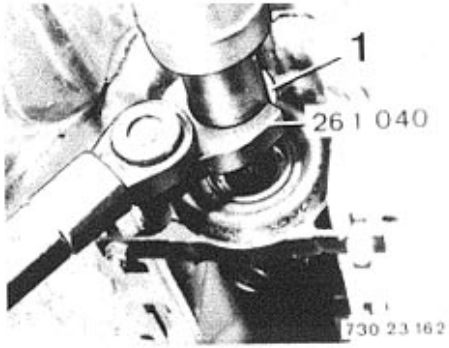
Unscrew propeller shaft on the transmission.



Installation:
Replace stop nuts.
Tighten nuts with a standard 19 mm socket and torque wrench.
Tightening torque*.
Important!
Only tighten the nuts (never bolts) to avoid stress in the coupling.

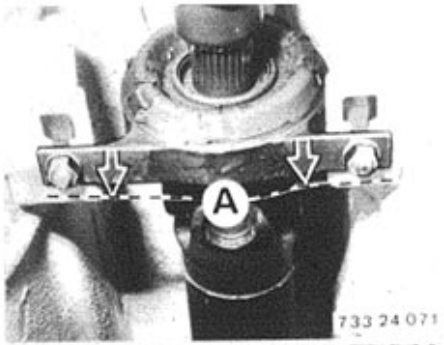


Version with Constant Velocity Joint:
Unscrew the constant velocity joint on the transmission.
Important!
Check the gasket between the constant velocity joint and drive flange.
Protect the constant velocity joint against dirt.

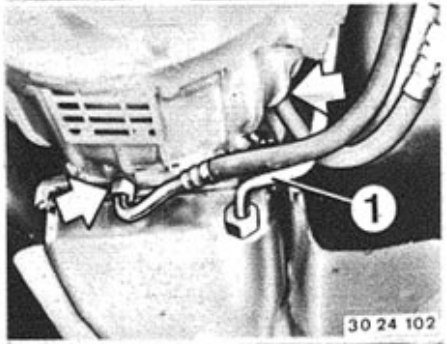


Loosen screw-on ring (1) several turns.
Installation:
Tighten the screw-on ring with Special Tool 26 1 040 after finishing installation.
Tightening torque*.

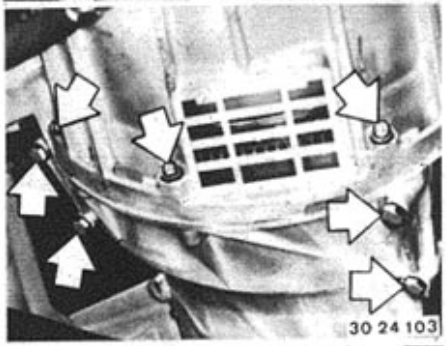
* See Specifications



Unscrew the center mount.
Installation:
Preload the center mount forward by distance (A) = 4 to 6 mm (0.157 to 0.236").
Bend the propeller shaft down and pull it off of the centering pin.
Important!
Suspend the propeller shaft from the car on a piece of wire.



Drain oil.
Important!
Never reuse drained oil.
Installation:
The transmission will have to be disassembled, if oil has a burnt odor and is black.
Important!
If the transmission was defective, clean the oil cooler and lines with compressed air and flush twice with ATF.
Remove oil filler neck (1).
Unscrew oil cooler lines on the transmission and plug open connections with caps.
Installation:
Tightening torque*

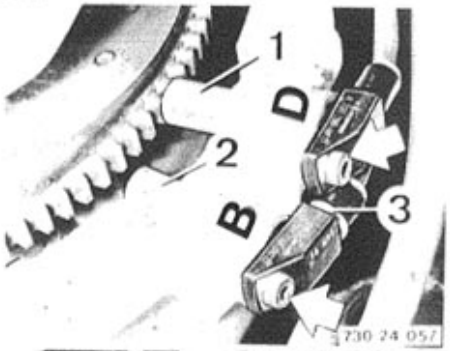


Remove the reinforcement plate.
Unscrew Torx bolts with a Torx socket.
Installation:
Tightening torque*.
Important! – Installation:
Use washers on the version with Torx bolts to avoid an increase in the breaking-loose torque.
Tightening torque*.

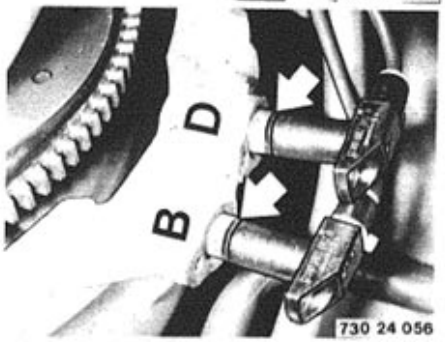


Unscrew the torque converter on the drive plate at three points.
Turn the flywheel away for this purpose.
Important! – Installation:
Tightening torque*.
Only use size M 10 x 16 mm bolts together with spring washers – non-conformance could lead to destruction of the transmission.

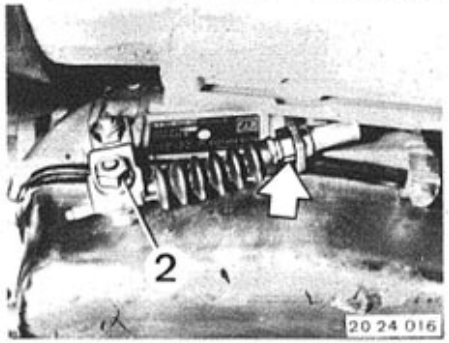
* See Specifications



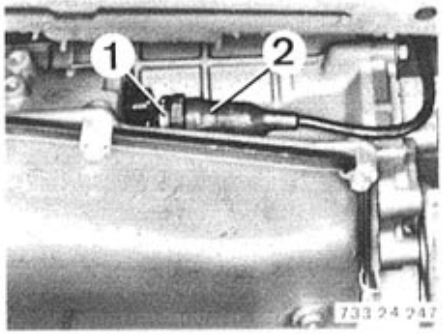
Unscrew the guard.
Unscrew the bolts.
Pull out speed sensor (1) and reference mark sensor (2).
BMW 524 td:
Only reference mark sensor (2).
Important! – Installation:
Check the installed position.
Don't mix up the plugs.
Install speed sensor (1) in bore (D) and reference mark sensor (2) with ring (3) in bore (B).
The engine cannot be started if plugs are mixed up.



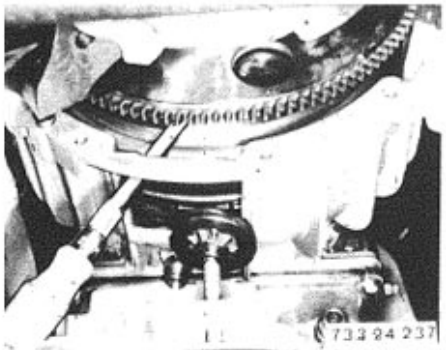
Installation:
Check the O-rings.
Install the sensors with Molykote Longterm 2.
Important!
Keep grease and dirt off of the face of DME sensors.



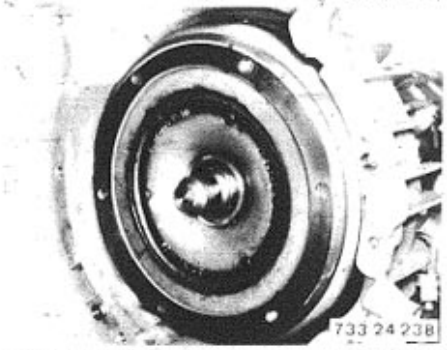
Unscrew nut (2).
Disconnect the cable on the holder.
Pull out the cable.
Installation:
Adjust the cable – see 24 00 006.



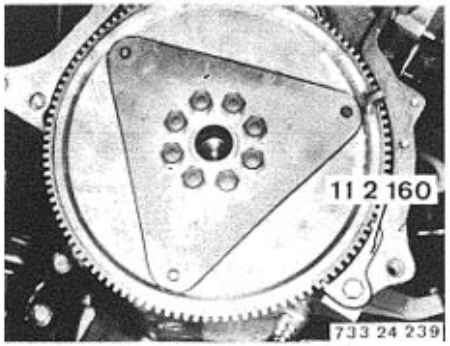
Only Version with EH Transmission:
Turn bayonet fastener (1) to the left.
Pull off plug (2).
Lift the wire harness out of holders.



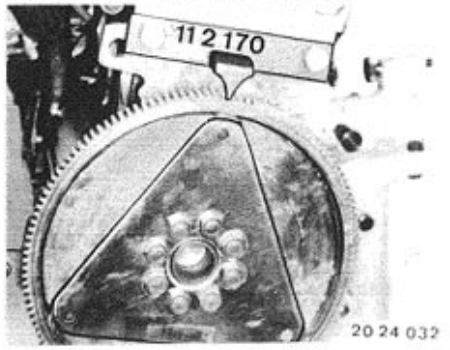
Lift off the grill.
Pull the transmission off of the engine, pressing off the torque converter at the same time.
Important!
When the lifting fixture is carrying the transmission, it may only be moved in the completely lowered position.



Important! – Installation:
Check the installed position of the torque converter – the drive ring must be located below the case edge.

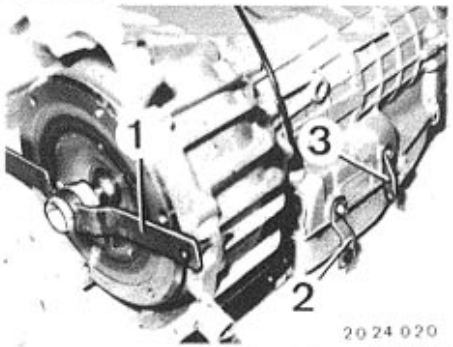


Installation:
Inspect the drive plate for breaks and cracks, replacing if necessary.
BMW 533 i, 535 i:
Hold the flywheel with Special Tool 11 2 160.
Unscrew the expansion bolts.
Important!
Replace and install the new expansion bolts with Loctite No. 270.
Only coat the threads.
Clean the tapped bores thoroughly.
Tightening torque*.



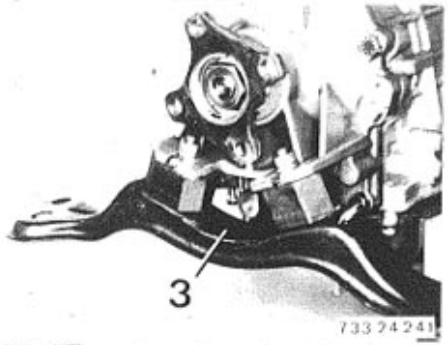
BMW 528 e, 524 td:
Hold the flywheel with Special Tool 11 2 170.

* See Specifications

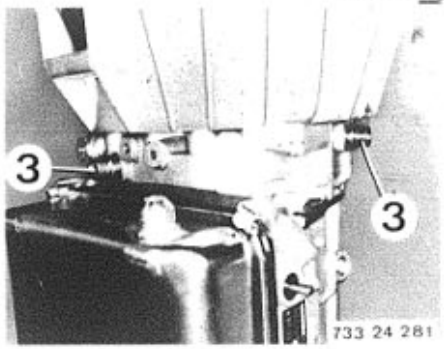


24 00 042 INSTALLING EXCHANGE TRANSMISSION

Remove the transmission – see 24 00 022.
Important!
Always clean the oil cooler and lines with compressed air and flush twice with ATF before installing an exchange transmission.
Check the transmission code* on the data plate.
Attach transport holder (1), lever (2) and bracket (3).

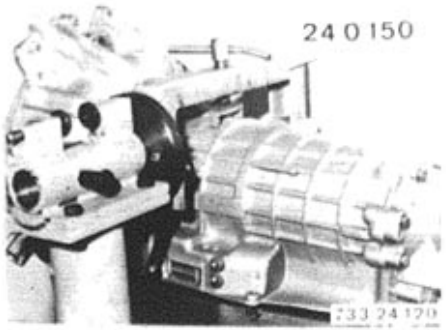


Transfer cross member (3) with rubber mounts and exhaust carrier.



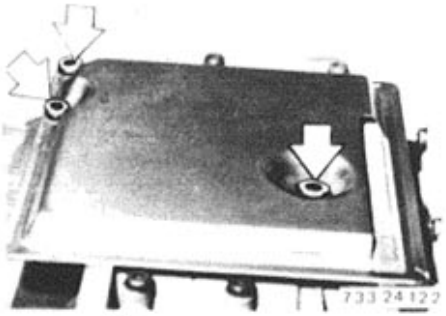
Transfer adapters (3).
Version with Multiple Tooth Socket:
Unscrew adapters with a 12 mm multiple tooth socket or T 55 Torx socket.
Replace seals.
Tightening torque*.

* See Specifications

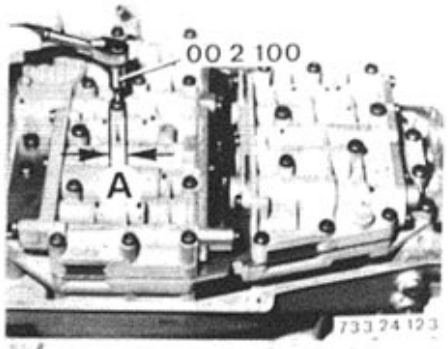


24 00 082 DISASSEMBLING/ASSEMBLING TRANSMISSION

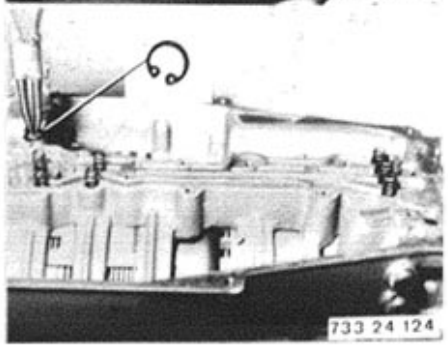
Remove transmission 24 00 022.
Remove torque converter 24 40 003.
Mount transmission on Special Tool 24 0 150 in conjunction with an assembly stand.
Important!
Screw in bolts only finger tight to prevent damaging transmission case.



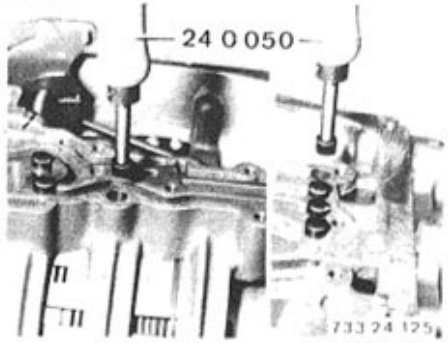
A) Disassembling:
Unscrew oil sump.
Remove oil filter screw.



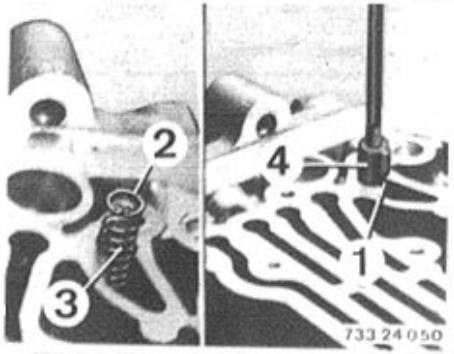
Take off valve body.
Unscrew Torx bolts with Special Tool 00 2 100.
Important!
Only unscrew bolts with 12 mm size head (A).



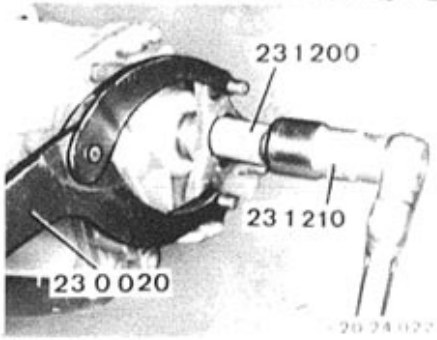
Lift out eight circlips.
Remove eight springs.
Installation:
Install longer springs facing output end.
EH Transmission:
Only remove two circlips and two springs from cylinder F (output end).



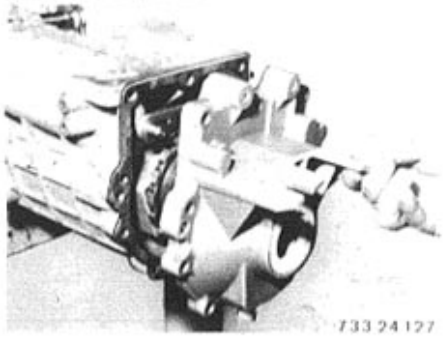
Pull out eight sealing sleeves with Special Tool 24 0 050.
EH Transmission:
Only remove two sealing sleeves from cylinder F (output end).



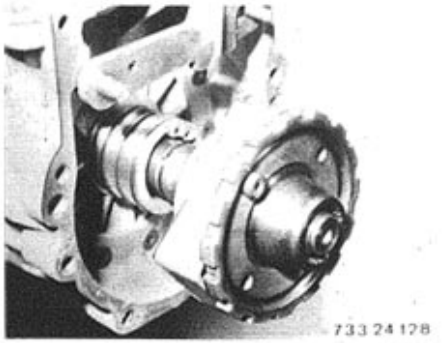
Important!
The lubricating oil feed to the cylinder F gear set was improved and introduced gradually since 7.85.
Circlip (2), spring (3) and sealing sleeve (4) must also be removed at bore (1).
Pull sealing sleeve (4) out of the bore with a M 6 x 65 screw.
Don't cant the screw.



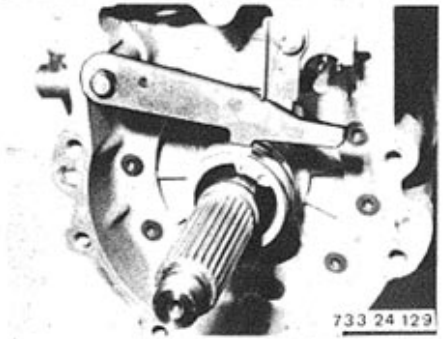
Lift off lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.
Pull off output flange.



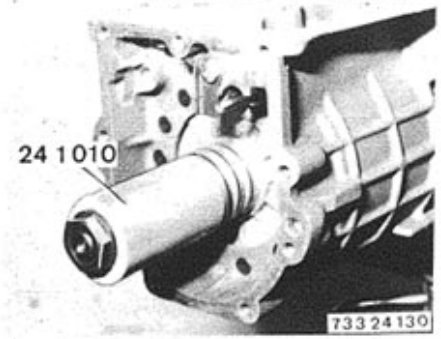
Unscrew transmission extension.
Installation:
Replace gasket.



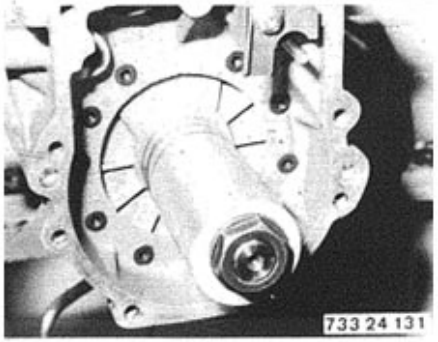
Pull off parking lock gear and governor.
Important!
Pull off parking lock gear with special tool, if necessary (see 24 32 002).



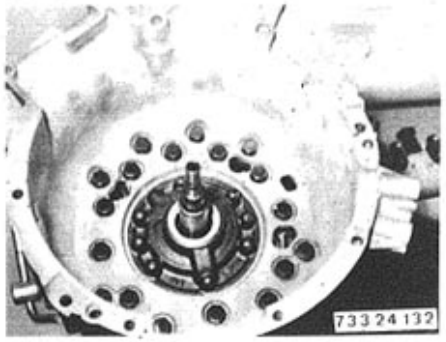
Remove parking lock pawl, spring and shaft.
Caution!
Spring force.



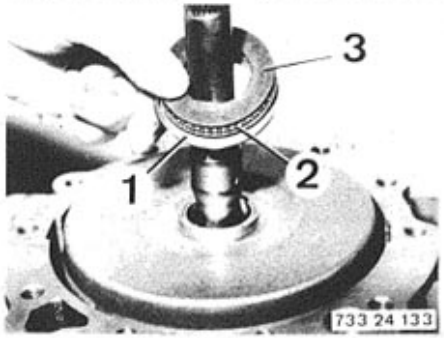
Apply Special Tool 24 1 010 on output shaft and secure with collar nut.



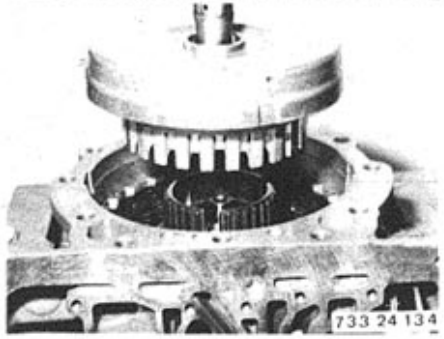
Unscrew Torx bolts with Special Tool 00 2 100.



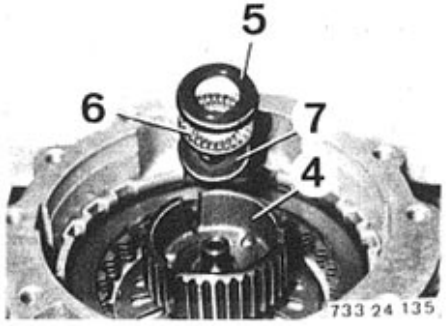
Set transmission upright.
Disconnect converter bell housing and connecting plate.



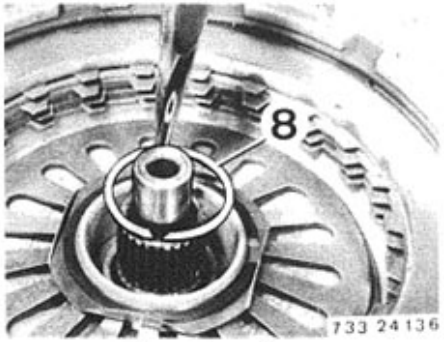
Take off angled washer (1), axial bearing (2) and thrust washer (3).



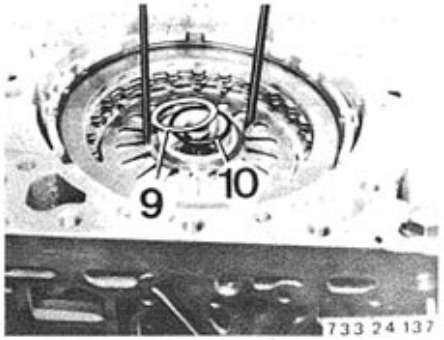
Remove input shaft with clutch A.



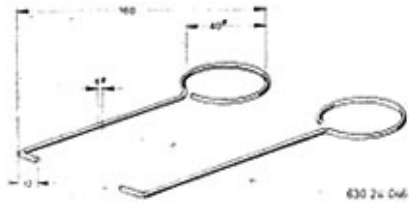
Remove plate carrier (4) for clutch A with angled washer (5), axial bearing (6) and thrust washer (7).



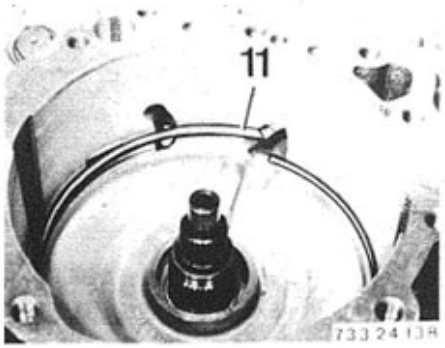
Remove snap ring (8) with help of two screwdrivers.
Installation:
Replace snap ring (8).



Pull out clutch B with two locally made hooks.
Installation:
Lift clutch until resistance is noticed and push back again.
Pull out clutch with one firm pull.
This will also pull out support (9) and seal (10).

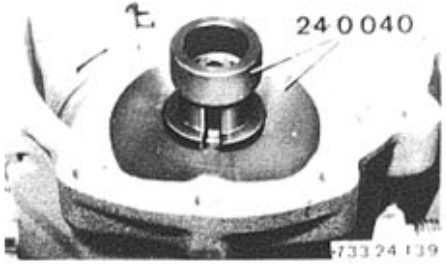


Sketch for local manufacture of hooks.
Dimensions in mm.

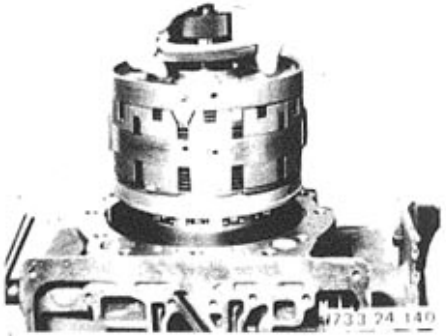


Lift out snap ring (11).

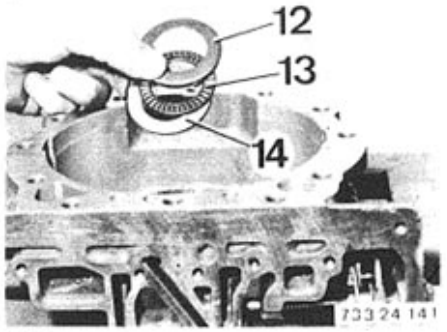
Apply Special Tool 24 0 040 on intermediate shaft.



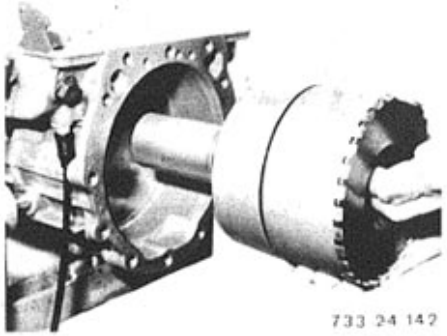
Pull out entire set.

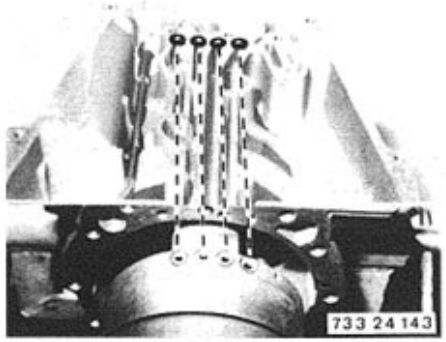


Remove angled washer (12), axial bearing (13) and thrust washer (14).

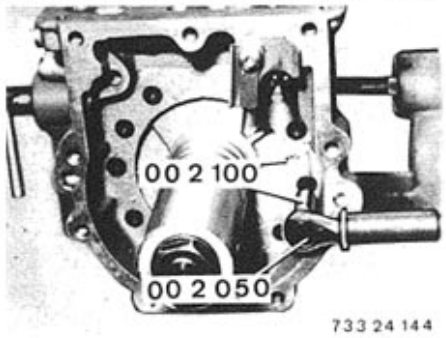


Remove 4th gear clutch set.

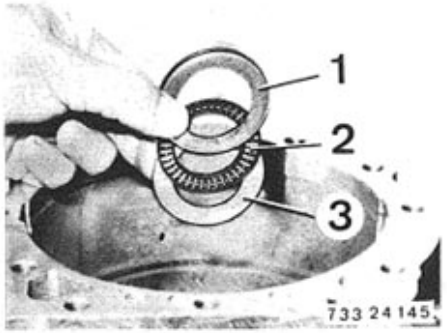




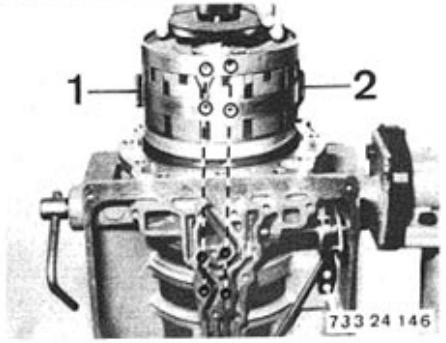
B) Assembling:
Install 4th gear clutch set.
Guide clutch set into transmission case that 4 oil feed bores are aligned with bores in case.



Bolt down clutch set with Special Tools 00 2 100 and 00 2 050.
Tightening torque*.

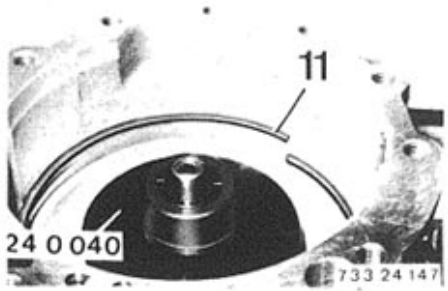


Set transmission upright.
Insert thrust washer (3), axial bearing (2) and angled washer (1) with collar facing up.

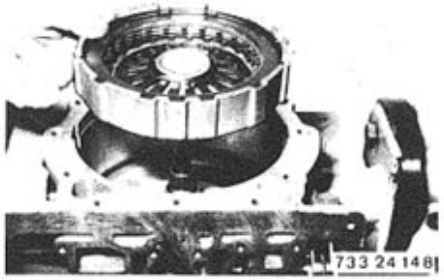


Place entire set in case.
Four oil feed bores must be aligned with bores in case.
Springs (1 and 2) must be in center of cylinder groove.

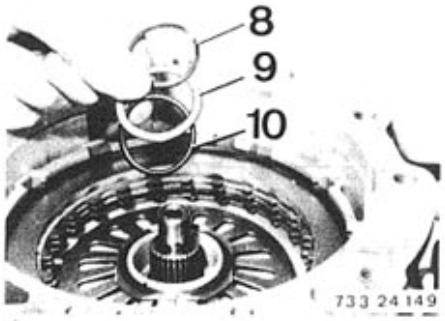
* See Specifications



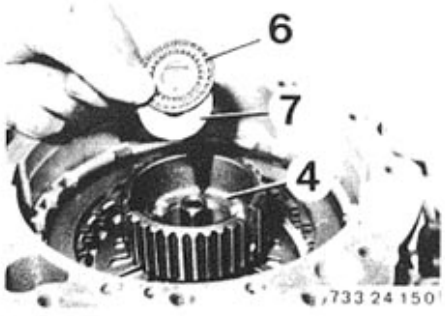
Insert snap ring (11).
Remove Special Tool 24 0 040.



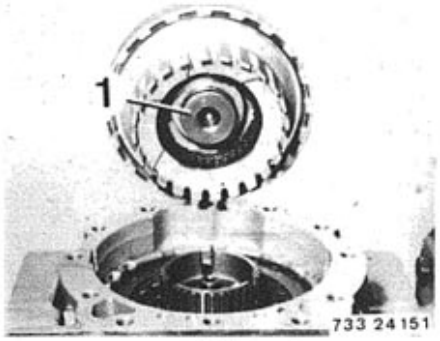
Insert and push clutch B against stop.



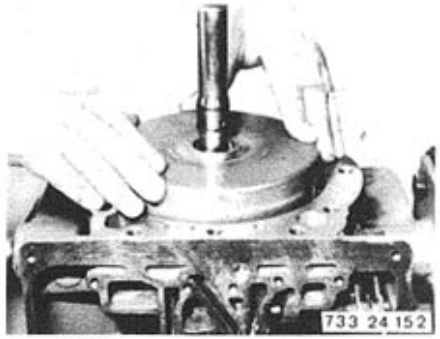
Install seal (10), support (9) and snap ring (8).



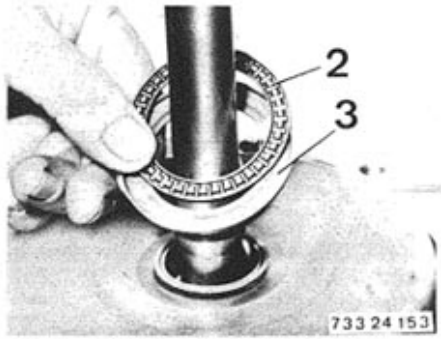
Insert plate carrier (4).
Install thrust washer (7) and axial bearing (6).



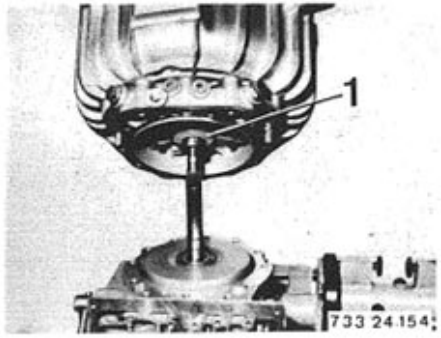
Paste angled washer (1) on cylinder A with grease (vaseline).



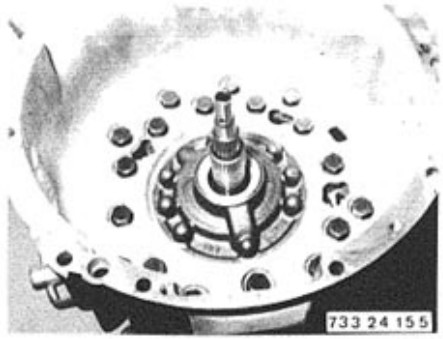
Insert clutch A and move it back and forth until splines of plate carrier and plates match.



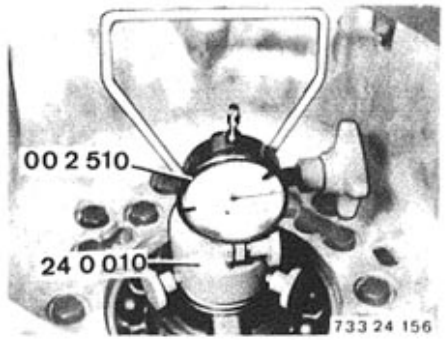
Install angled washer (3) with collar facing up and axial bearing (2).



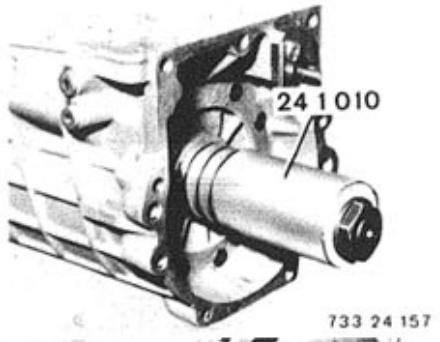
Paste on gasket and thrust washer (1) with grease (vaseline).



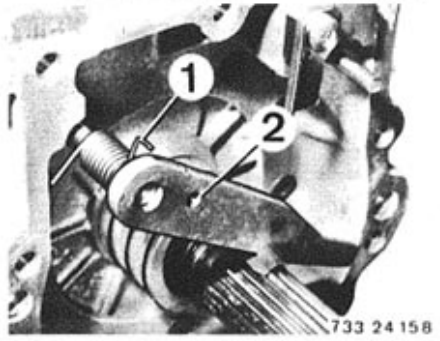
Install converter bell housing and tighten all bolts.
Tightening torque*.



Check axial play of input shaft.
Mount Special Tool 24 0 010 to hold input shaf
Apply Special Tool 00 2 510 (dial gauge).
Check axial play by pulling input shaft.
Specification: 0.2 to 0.4 mm (0.008 to 0.016").
If play deviates, take off converter bell housing again and replace thrust washer with a thicker or thinner one.
Recheck axial play.
Bolt down converter bell housing.
Tightening torque*.

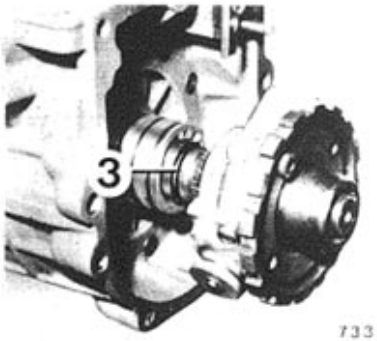


Remove Special Tool 24 1 010.

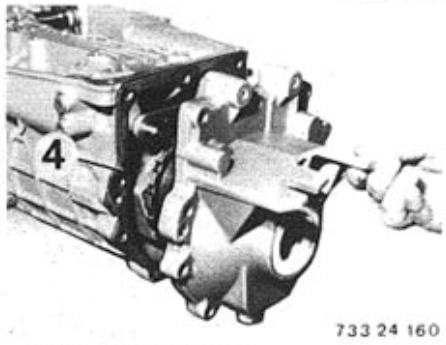


Install parking lock pawl.
Attach return spring (1) in bore (2) of pawl.

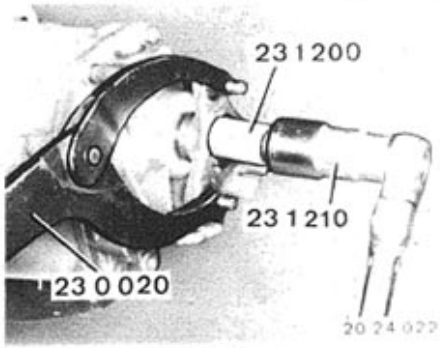
* See Specifications



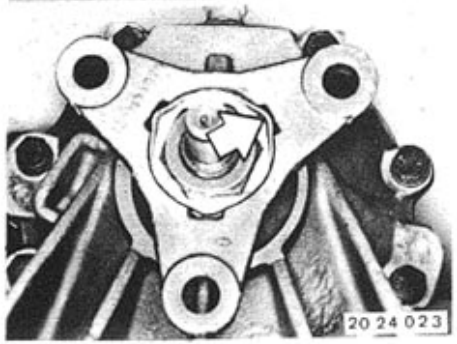
Lubricate O-ring (3) with ATF.
Push on parking lock gear and governor.



Hold gasket (4) in position with grease.
Bolt on transmission extension.
Tightening torque*.

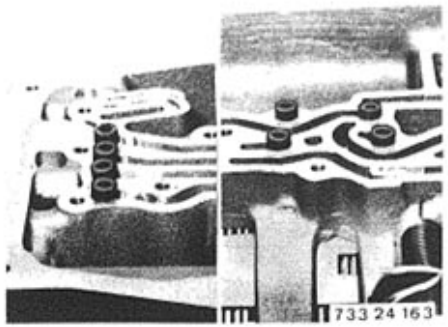


Install output flange.
Screw on collar nut.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Tighten collar nut with Special Tool 23 1 210.
Tightening torque*.

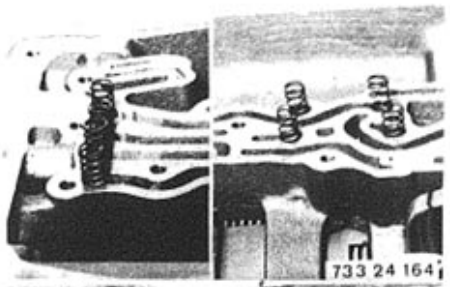


Install lockplate and lock in groove.

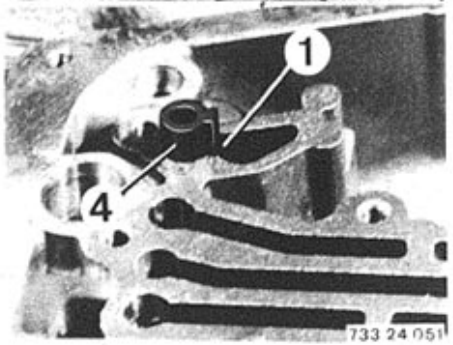
* See Specifications



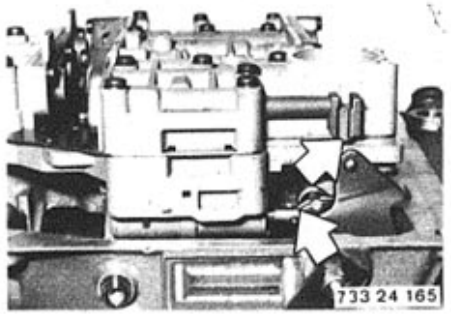
Install eight sealing sleeves.
Press in sealing sleeves against stop.
Be careful not to damage sealing sleeves.
EH Transmission:
Only install two sealing sleeves on cylinder F (output end).



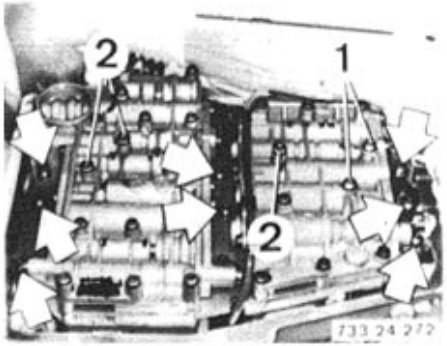
Install eight springs and eight circlips.
Important!
Install longer springs to face cylinder F (output end).
EH Transmission:
Install two springs only on cylinder F (output end).



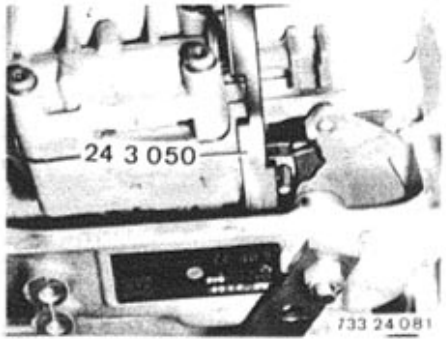
Note:
Version with Improved Lubrication for Cylinder F Gear Set:
Insert sealing sleeve (4) in bore (1) with tab facing oil bore.
Press in sealing sleeve against stop with a suitable mandrel.
Install spring and circlip.



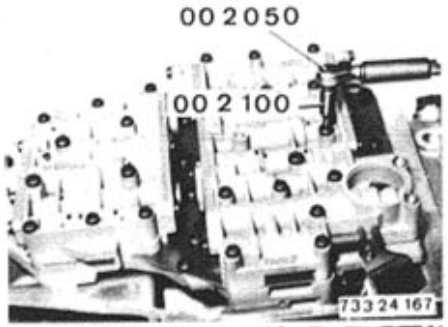
Mount valve body that selector valve can be connected in operating finger of pawl.
This requires pulling throttle cable slightly, so that accelerator cam does not clamp on throttle pressure valve.



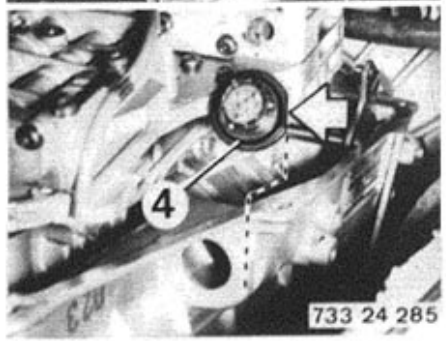
Screw in valve body mounting bolts.
Important!
Bolts differ in length.
Bolts (1) = 65 mm (2.559").
Bolts (2) = 60 mm (2.362").



Tighten valve body bolts only finger tight.
Align valve body with Special Tool 24 3 050.
Distance between valve body case and throttle pressure piston must be 11.5 mm (0.453").

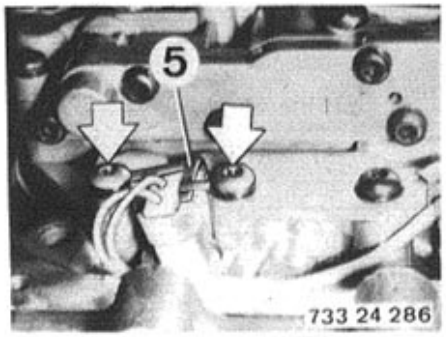


Tighten valve body bolts.
Tightening torque*.
Tighten bolts with Special Tools 00 2 100 and 00 2 050.

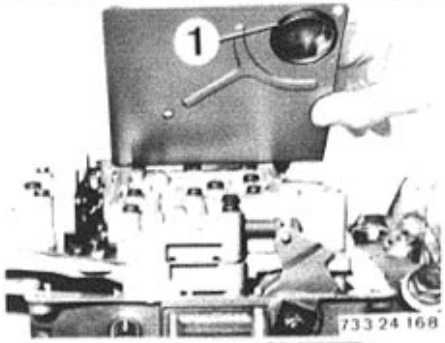


EH Transmission:
Check O-ring (4), replacing if necessary.
Install socket with the flat side facing out and bolt.
Tightening torque*.

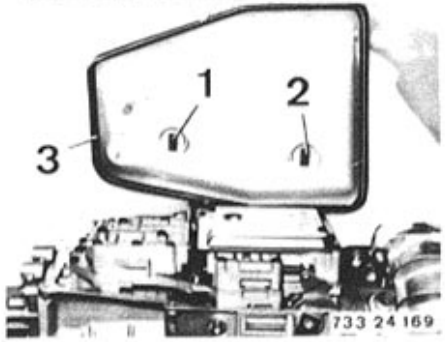
* See Specifications



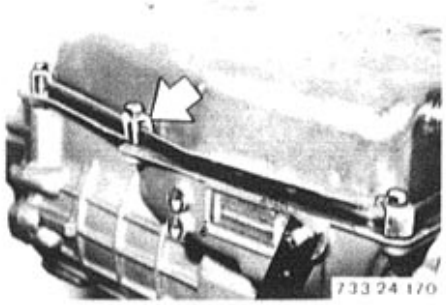
Note:
Also mount pulse transmitter on valve body.
Engage tabs of holder (5) in grooves of plug.



Install O-ring (1) between valve body and oil filter screen.
Install and bolt down oil filter screen.
Tightening torque*.
Check length of bolts.
Bolts with conical head = 65 mm long.

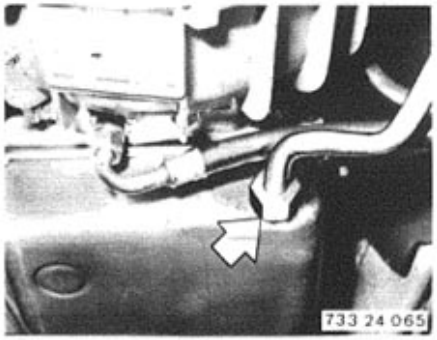


Place magnets (1 and 2) in oil sump.
Install gasket (3).



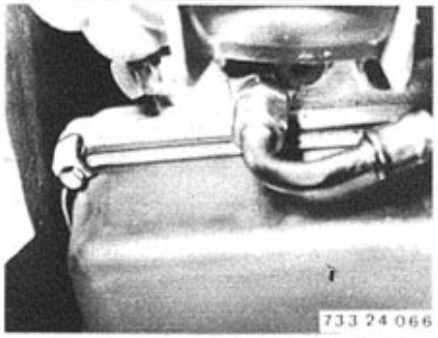
Install oil sump and tighten bolts with brackets.
Tightening torque*.
Important!
Both brackets with straight, short legs must be mounted on straight side of the oil sump.

* See Specifications

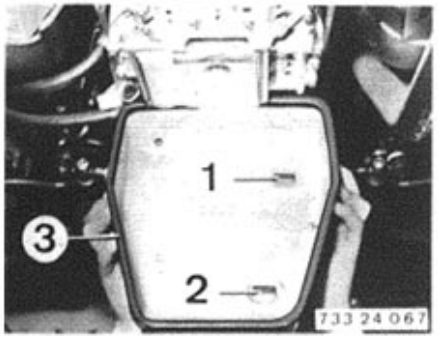


24 11 002 REMOVING AND INSTALLING OIL SUMP

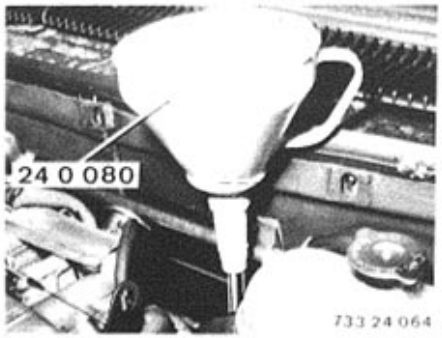
Drain oil.
Important!
Never reuse drained oil.
Installation:
The transmission will have to be disassembled, if the oil smells burnt and is black.
Unscrew oil filler tube on oil sump.
Unscrew oil sump.



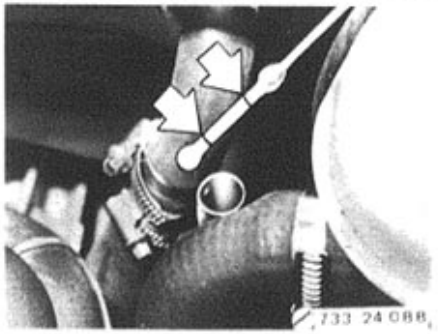
Installation:
Mount oil sump with brackets in such a manner, that short leg presses on oil sump.
Tightening torque*.
Important!
The two brackets with straight legs must be mounted on the sides.



Clean oil pan.
Important!
Place magnets (1 and 2) in oil sump.
Install gasket (3).



Pour in oil*.
Important!
Only pour in transmission oil with Special Tool 24 0 080 (funnel).



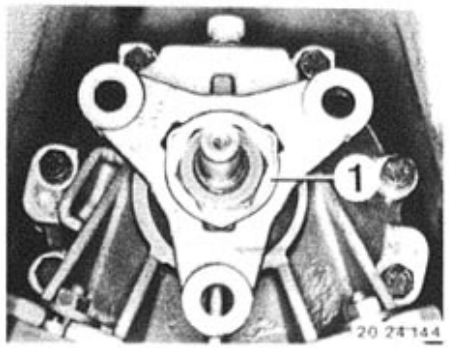
Test drive car.
Check oil level.
Park car on level floor or ground.
Correct oil level in selector lever position P with transmission at operating temperature and engine running at idle speed.
Oil level of transmission at operating temperature = aprrox. 80° C (175° F) must be between both marks.
Amount of oil between min. and max. marks = approx. 0.4 liter (0.8 pint).



An oil dipstick with a longer measuring tip (1) is standard since 2.85.
This produces an earlier display of the oil level in the tranmission.
The oil level must not be below ball (2) after a test drive and an oil temperature of approx. 40° C (105° F).
The oil level must be between min. and max. marks with an oil temperature of approx. 80° C (175° F).
Correct oil level, if necessary.
Note:
The new oil dipstick can be installed retroactively.
Oil Level Too High:
Strong foaming, splash loss, high temperature when driving fast, oil lost via vent.
Oil Level Too Low:
Valves rattling, foaming, engine slipping, general operating disturbances.

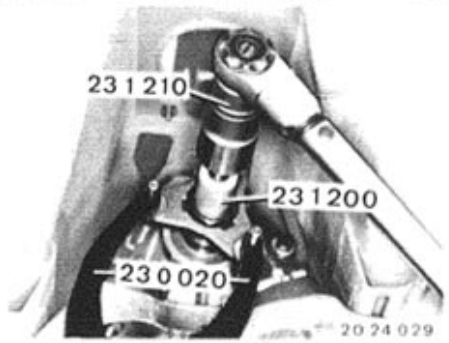
* See Specifications

* See Specifications

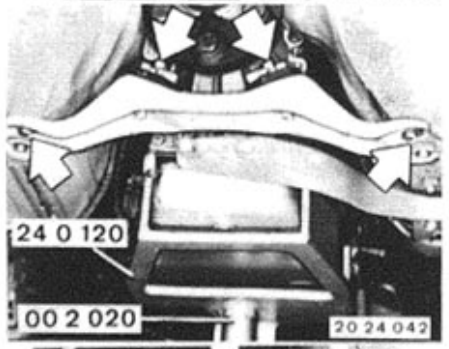


24 11 052 REMOVING AND INSTALLING/ SEALING TRANSMISSION EXTENSION

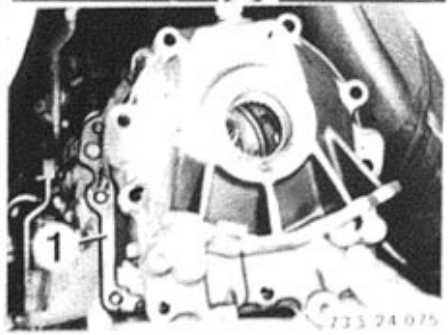
Unscrew propeller shaft – see 24 00 022.
Lift out lockplate (1).
Installation:
Replace lockplate.



Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.
Installation:
Tightening torque*.
Pull off output flange.



Support transmission with Special Tools 24 0 120 and 00 2 020.
Remove cross member with rubber mounts.
Lower transmission.



Unscrew transmission extension.
Installation:
Replace gasket (1).
Tightening torque*.

* See Specifications



24 12 003 REPLACING RADIAL OIL SEAL FOR TORQUE CONVERTER

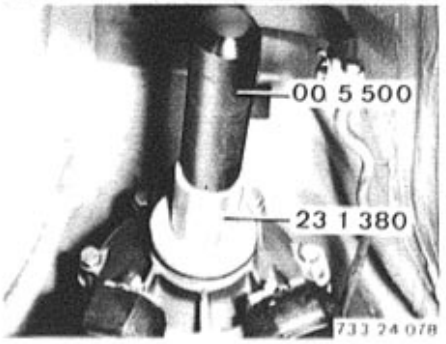
Remove torque converter 24 40 003.
Pull out radial oil seal with Special Tool 00 5 010.



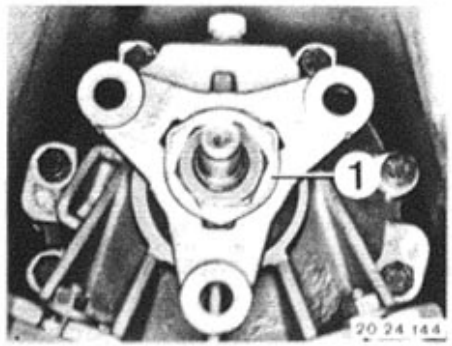
Pull out radial oil seal with Special Tool 00 5 010.



Lubricate sealing lip with ATF.
Drive in radial oil seal to fit tight with Special Tool 24 0 090.

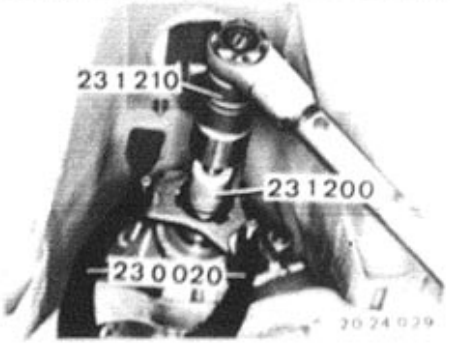


Lubricate sealing lip with ATF.
Drive in radial oil seal with Special Tools 23 1 380 and 00 5 500.



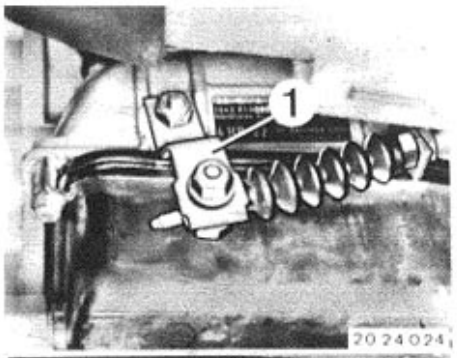
24 12 013 REPLACING RADIAL OIL SEAL FOR OUTPUT FLANGE

Unscrew propeller shaft – see 24 00 022.
Lift out lockplate (1).
Installation:
Replace lockplate.



Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.
Installation:
Tightening torque*.
Pull off output flange.

* See Specifications



24 12 103 REPLACING RADIAL OIL SEAL FOR MANUAL SHIFT VALVE SHAFT

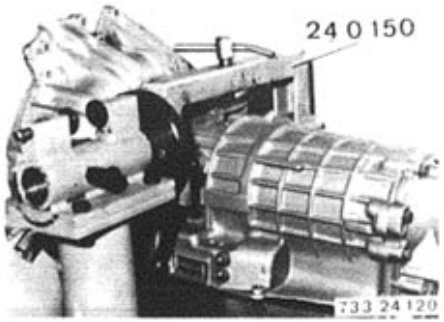
Detach selector lever (1) at transmission.



Remove radial oil seal (2).
Installation:
Lubricate sealing lip with ATF.
Knock in radial oil seal.

24 16 502 REPLACING TRANSFER PLATE

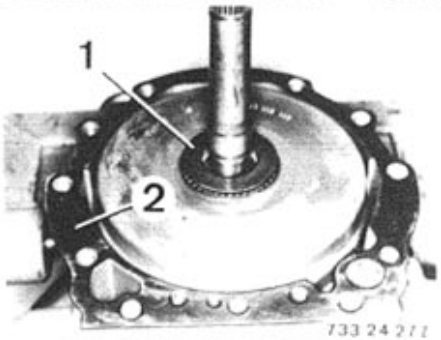
– Transmission Removed –



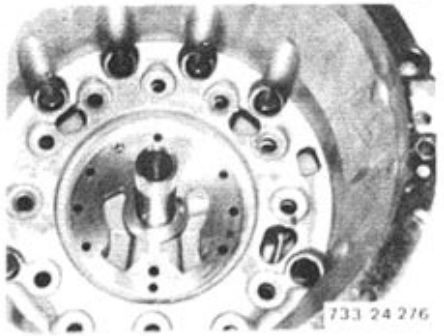
Remove torque converter – see 24 40 003.
Mount transmission on Special Tool 24 0 150 in conjunction with an assembly stand.
Caution!
Only bolt down finger tight to avoid deforming the transmission case.



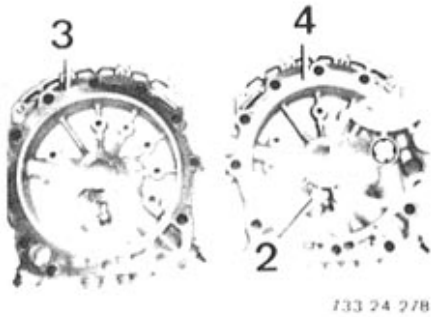
Unscrew converter bell housing with transfer plate.
Only remove the inner bolts for this purpose.
Only loosen the outer bolts.



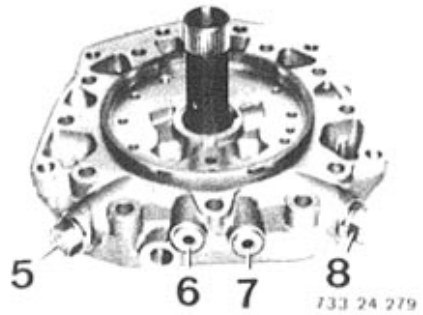
Lift off converter bell housing.
Installation:
Thrust washer (1), needle cage and angled washer.
Note:
The axial play of the input shaft can be adjusted with thrust washer (1).
Replace gasket (2).



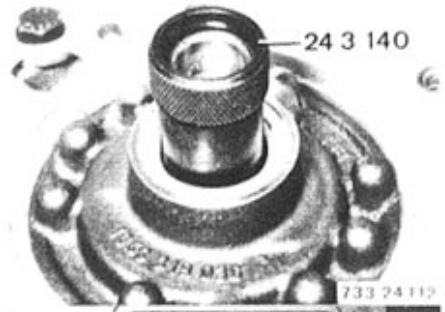
Remove primary pump (see 24 31 002).
Unscrew bolts.
Lift converter bell housing off of transfer plate.



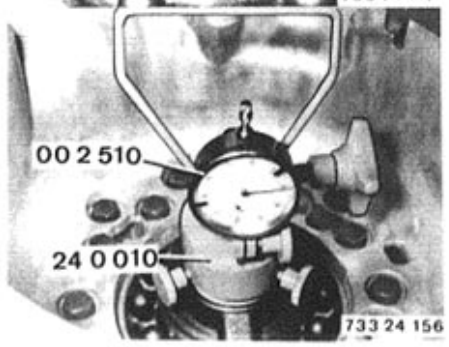
A transfer plate with venting valve (2) is installed since Transm. No. 170 195.
The venting valve provides faster pressure drop for clutch A.
Only use transfer plates with a venting valve for repairs.
Transfer plate (3) without venting valve.
Transfer plate (4) with venting valve.



Transfer plugs (5 ... 8).
Tightening torque*.
Check seals, replacing if necessary.

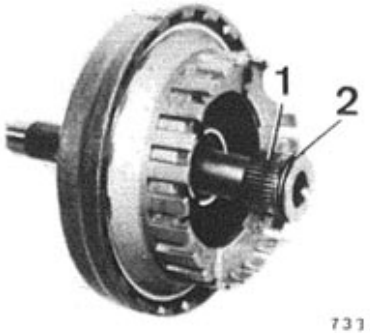


Bolt transfer plate on converter bell housing with outer bolts finger tight.
Align bores for inner bolts.
Install primary pump and check running with Special Tool 24 3 140.



Mount converter bell housing and tighten all bolts with correct torque*.
Check axial play of input shaft.
Build up Special Tool 24 0 010 to hold the input shaft.
Apply dial gage 00 2 510.
Check axial play by pulling the input shaft.
Specification: 0.2 to 0.4 mm (0.008 to 0.016").
Remove converter bell housing again in case of deviation and replace thrust washer with a thicker or thinner one.
Recheck axial play.
Tighten converter bell housing to correct torque*

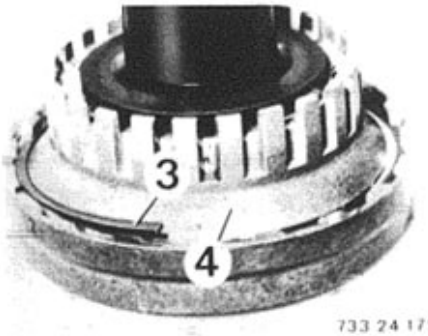
* See Specifications



733 24 171

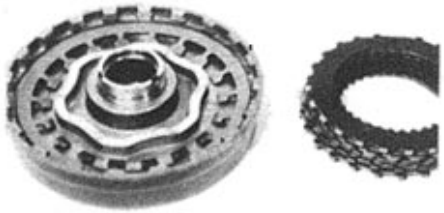
24 23 022 REPLACING MULTIPLE DISC CLUTCHES AND BRAKES

Disassemble transmission 24 00 082.
Important!
Check transfer plate for installation of a venting valve (see 24 16 502) when repairing clutch A.
If applicable, install a transfer plate with a venting valve.
Clutch A:
Press out input shaft (1).
Check O-ring (2), replacing if necessary.

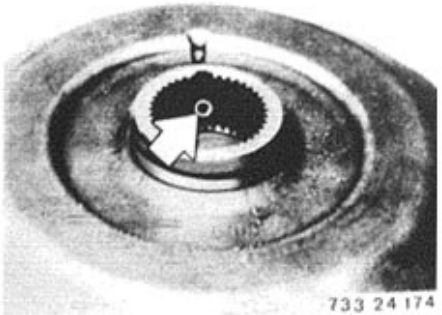


733 24 172

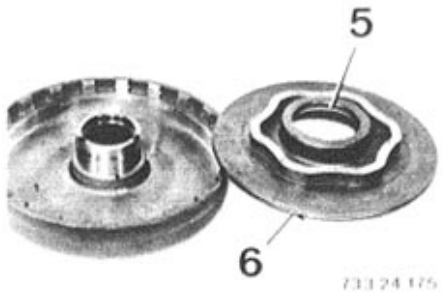
Compress clutch set and remove snap ring (3).
Remove plate carrier (4).


733 24 173

Lift out plate set and diaphragm spring.
Note:
Note number of steel and lined plates.

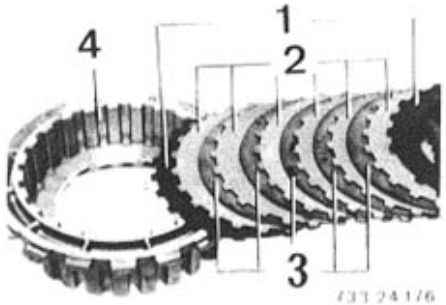

733 24 174

Press out clutch A piston with compressed air applied through bore.



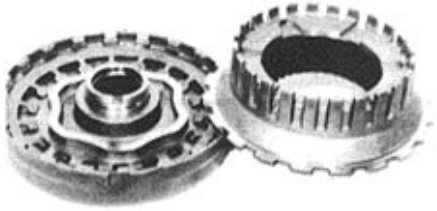
733 24 175

Installation:
Replace O-rings (5 and 6).
Lubricate O-rings with light coat of ATF to make installation easier.

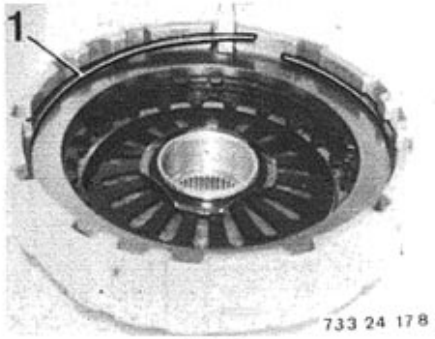


733 24 176

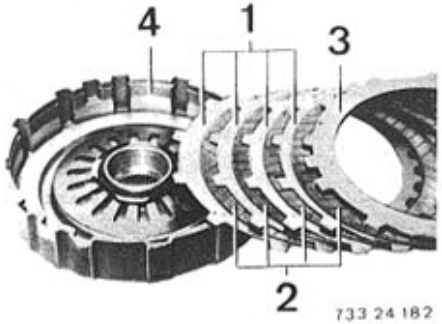
Installed Order of Plates:
Insert noted number of removed steel and lined plates alternately, beginning with a spring and steel plate.
1 Spring plates
2 Steel plates 1.8 mm
3 Lined plates
4 Plate carrier


733 24 177

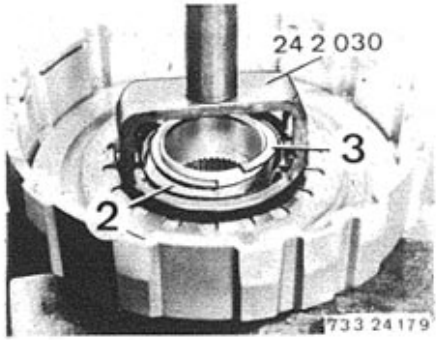
Place diaphragm spring in input shaft case with curved surface facing down.
Insert plate set with plate carrier.
Compress clutch set and insert snap ring.



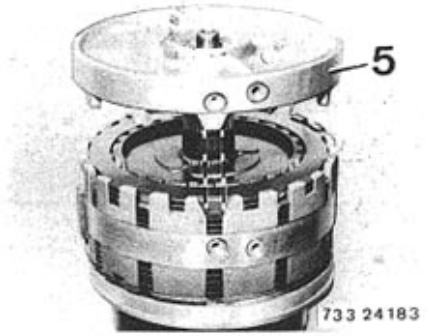
Clutch B:
Remove snap ring (1).
Remove steel and lined plates.
Note:
Note number of steel and lined plates.



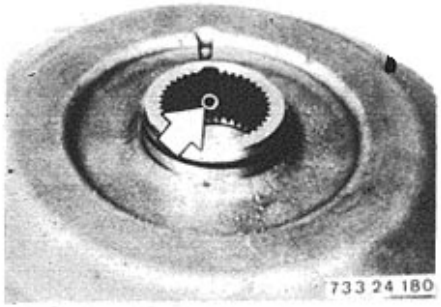
Installed Order of Plates:
Insert noted number of removed steel and lined plates alternately, beginning with a steel plate.
1 Steel plates 1.8 mm (.535 i = 2.1 mm)
2 Lined plates
3 End plate 4.5 mm
Important!
Insert end plate with ground side facing lined plate.
4 Housing



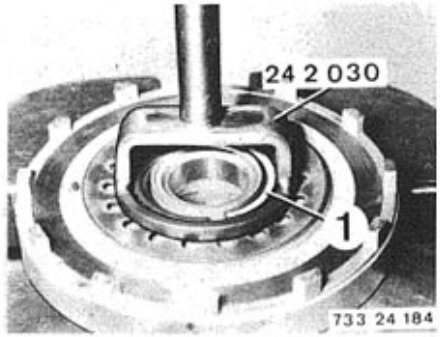
Bend open lockplate (2).
Press down on diaphragm spring with Special Tool 24 2 030 and remove snap ring (3).
Installation:
Replace and lock lockplate.
Insert diaphragm spring with curved surface facing up.



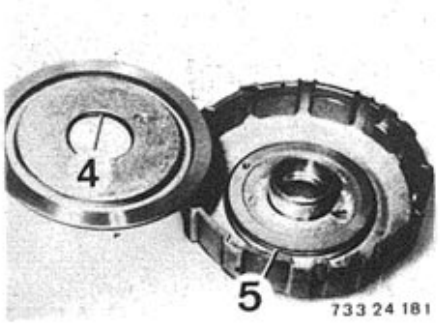
Clutch C' and C:
To make this step easier, place complete set in a pipe with an inside diameter of 29 mm (1.142") and clamp in a vise.
Remove Special Tool 24 0 040.
Lift off centering plate (5).
Installation:
Bevelled beads must engage in bevelled openings.



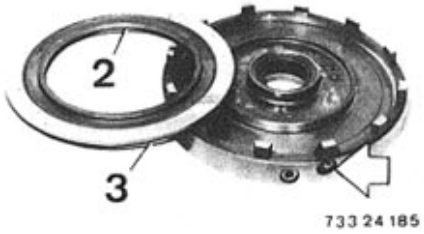
Press out clutch B piston with compressed air applied through oil bore.



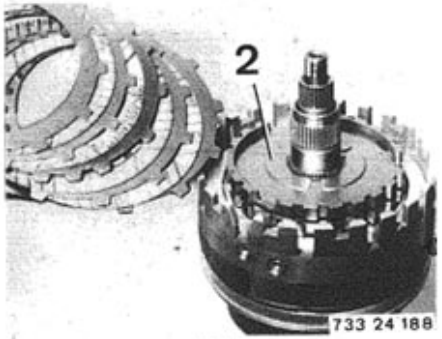
Press down on diaphragm spring with Special Tool 24 2 030 and lift out split retaining ring (1)
Installation:
Insert diaphragm spring with curved surface facing up.



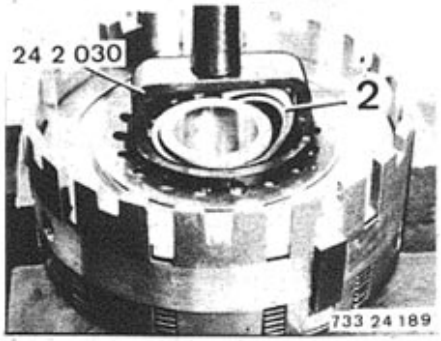
Installation:
Check O-rings (4 and 5), replacing if necessary.
Lubricate O-rings with a light coat of ATF to make installation easier.



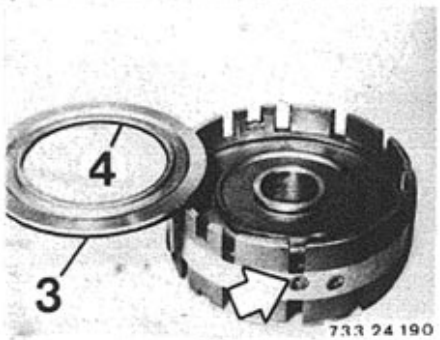
Press out clutch C' piston with compressed air applied through oil bore.
Installation:
Check O-rings (2 and 3), replacing if necessary.
Lubricate O-rings with light coat of ATF to make installation easier.



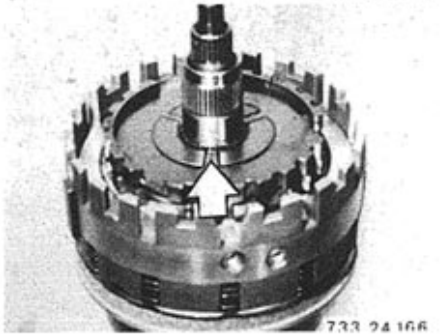
Remove all steel and lined plates.
Note:
Note number of steel and lined plates.
Pull out one-way clutch (2).



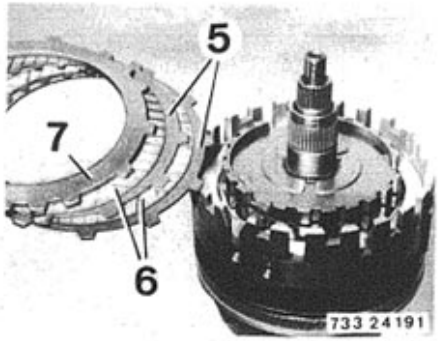
Press down diaphragm spring with Special Tool 24 2 030 and lift out split retaining ring (2).
Installation:
Insert diaphragm spring with curved surface facing up.



Press out clutch C piston with compressed air applied through oil bore.
Installation:
Check O-rings (3 and 4), replacing if necessary.
Lubricate O-rings with a light coat of ATF to make installation easier.



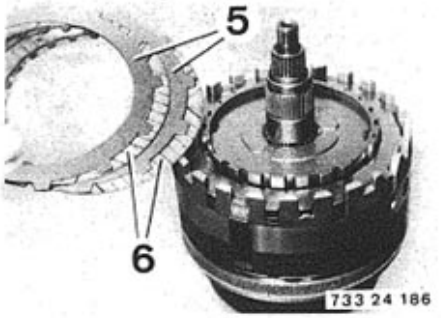
Install one-way clutch.
Important!
Bent over tabs or word "oben" must be seen.



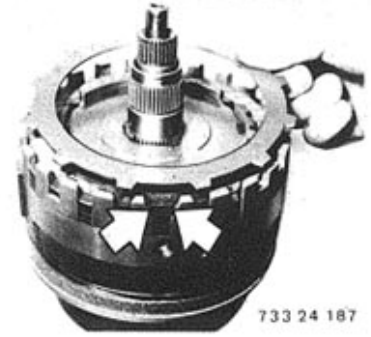
C Installed Order:
Insert noted number of removed steel and lined plates alternately, beginning with a steel plate.
5 Steel plates 1.8 mm
Important!
Steel plates for a BMW 535i have different thicknesses (1.5 and 2.1 mm).
The thinner (1.5 mm) steel plate is installed on the piston end.
6 Lined plates
7 End plate 4.5 mm



Important!
Insert end plate that center tooth of three teeth group engages in opening of cylinder.



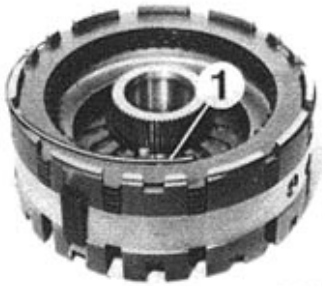
C' Installed Order:
Insert noted number of removed steel and lined plates alternately, beginning with a lined plate.
5 Steel plates 1.8 mm
Important!
Steel plates for a BMW 535 i have different thicknesses (1.5 and 2.1 mm).
The thinner (1.5 mm) steel plate is installed on the piston end.
6 Lined plates



Important!
External splines of steel plates must not be placed in bevelled openings of cylinder.

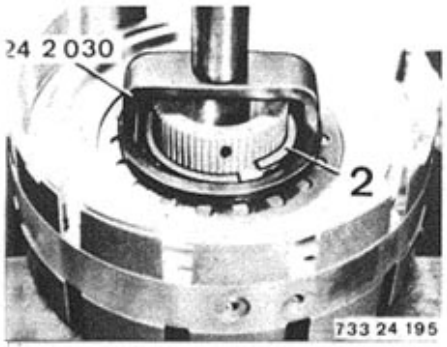

733 24 193

Clutch D:
Clutches C' and C removed.
Lift clutch member with clutch D off of planet gear set.



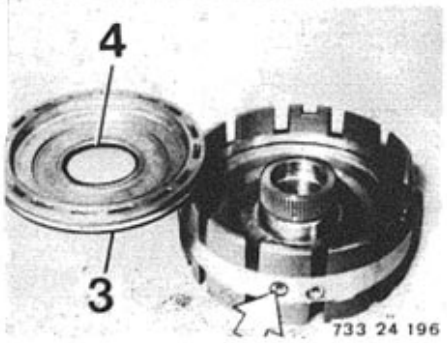
733 24 194

Remove snap ring (1).
Remove steel and lined plates.
Note:
Note number of steel and lined plates.



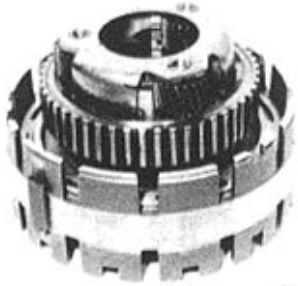
733 24 195

Press down on diaphragm spring with Special Tool 24 2 030 and lift out snap ring (2).
Installation:
Insert diaphragm spring with curved surface facing up.

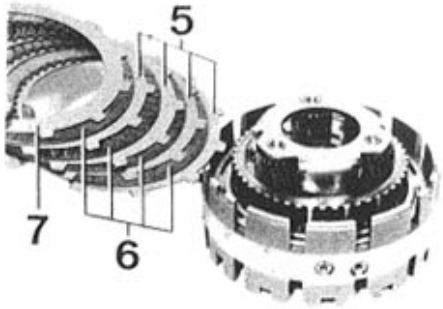


733 24 196

Press out clutch D piston with compressed air applied through oil bore.
Installation:
Check O-rings (3 and 4), replacing if necessary. Lubricate O-rings with a light coat of ATF to make installation easier.

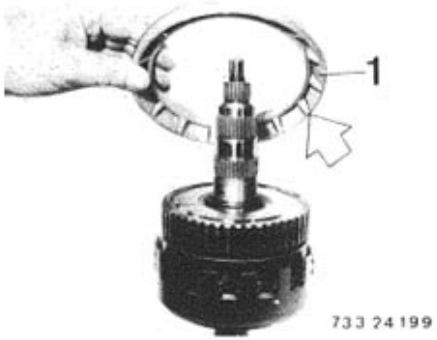

733 24 197

Place planet plate with one-way clutch on hub of cylinder D.



733 24 198

Installed Order of Plates:
Insert noted number of removed steel and lined plates alternately, beginning with a steel plate.
5 Steel plates 1.8 mm
6 Lined plates
7 End plate 1.2 mm



Disassemble planet gear set.
Remove support ring (1).
Installation:
Mount support ring with fins facing down.



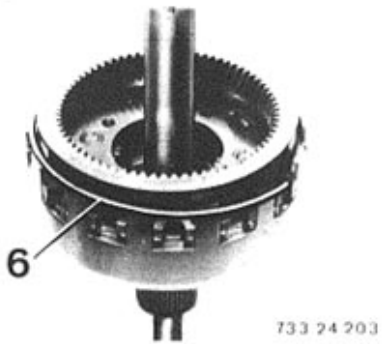
Take off planet gear set (2).



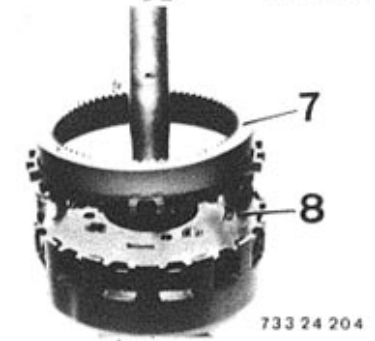
Pull out sun gear shaft (3).



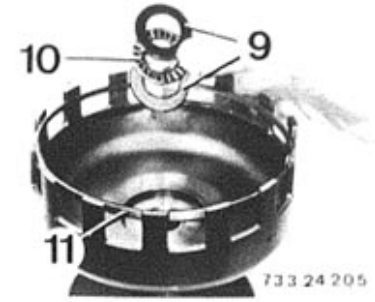
Remove axial bearing (4) and thrust washer (5).



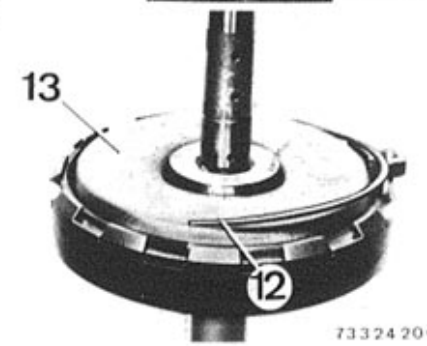
Lift out snap ring (6).



Remove hollow gear (7) and planet plate (8).



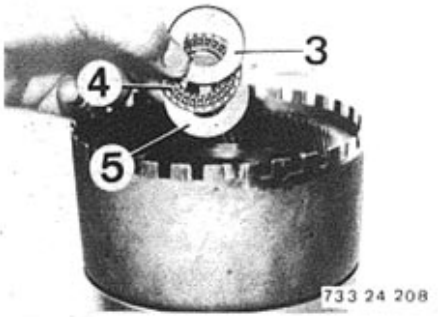
Remove thrust washers (9) and axial bearing (10
Take off spacer (11).



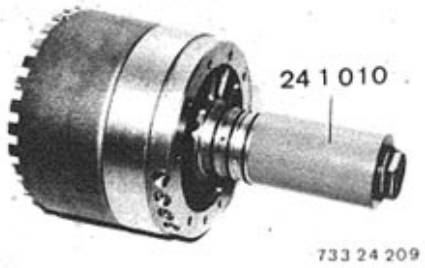
Lift out snap ring (12).
Take off hollow gear (13).



Clutches E and F:
Remove sun gear (1) and planet carrier (2).



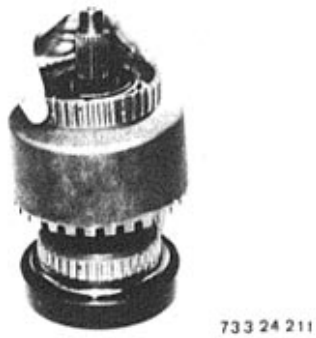
Remove angled washer (3), axial bearing (4) and thrust washer (5).
Installation:
Install angled washer (3) with collar facing planet carrier.



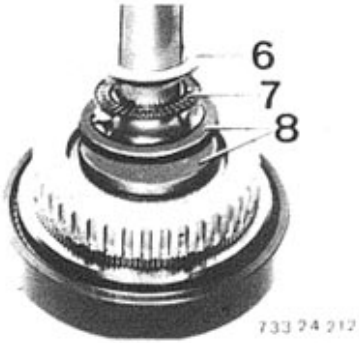
Take off Special Tool 24 1 010.



Lift cylinder F off of cylinder E.



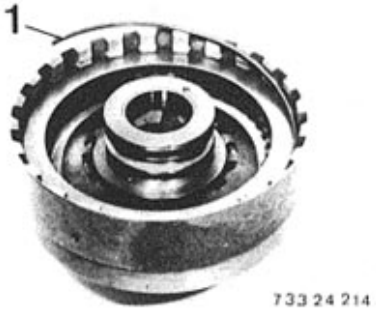
Lift off cylinder E on output shell.



Take off thrust washer (6), axial bearing (7) and steel/copper angled washer (8).

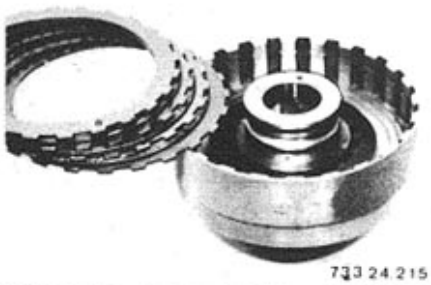


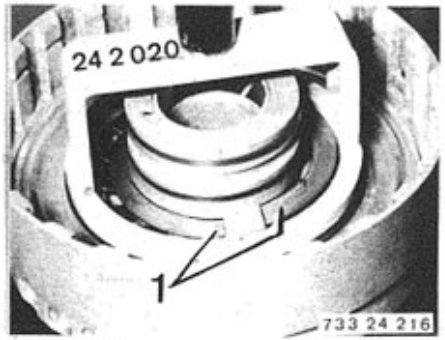
Installation:
Mount cylinder E and turn until it rests on stop.
Cylinder must rest on copper angled washer.
When holding output shaft it must now be possible to turn cylinder E clockwise.
It should lock in opposite direction.



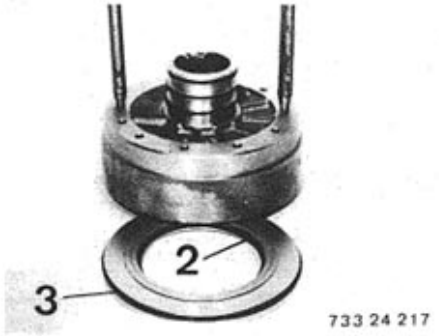
Clutch F:
Lift out snap ring (1).

Remove plate set.
Note:
Note number of steel and lined plates.

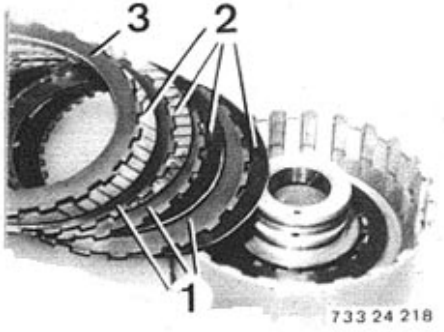




Remove piston for clutch F.
Press down on diaphragm spring with Special Tool 24 2 020, and lift out split retaining ring (1).
Installation:
Insert diaphragm spring with curved surface facing up.

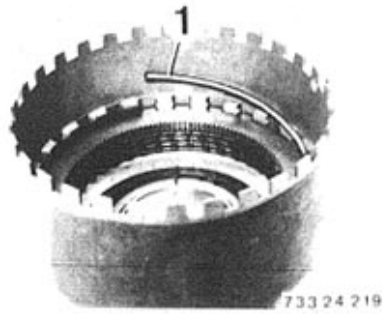


Press out piston for clutch F with two suitable mandrels.
Installation:
Check O-rings (2 and 3), replacing if necessary. Lubricate O-rings with a light coat of ATF to make installation easier.

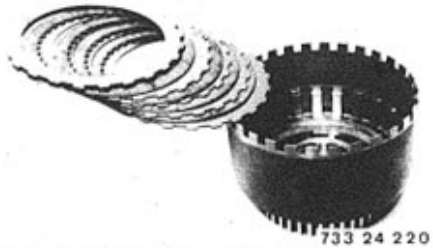


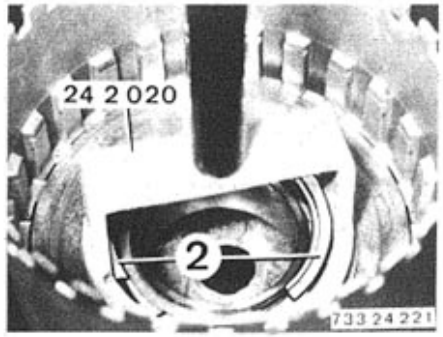
Installed Order of Plates:
Insert noted number of removed steel and lined plates alternately, beginning with a steel plate.
1 Steel plates 2.1 mm
2 Lined plates
3 End plate 4.5 mm

Clutch E:
Lift out snap ring (1).

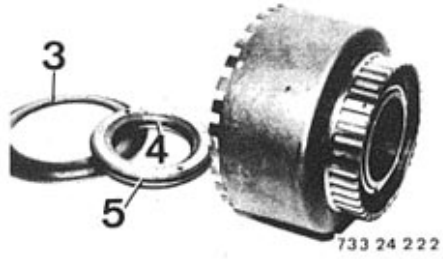


Remove plate set.
Note:
Note number of steel and lined plates.

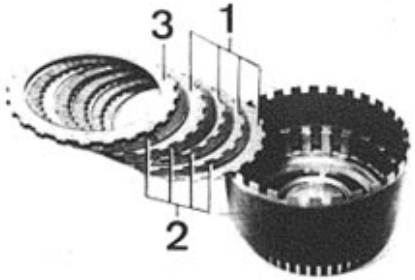




Remove piston for clutch E.
Press down on diaphragm spring with Special Tool 24 2 020 and remove the split retaining ring (2).
Installation:
Insert diaphragm spring with curved surface facing up.

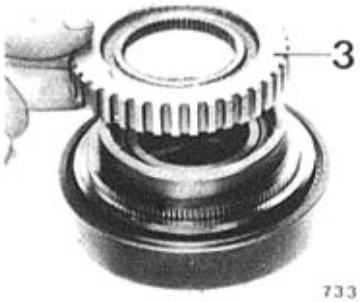


Lift off thrust cover (3).
Press out clutch E piston with compressed air applied through oil bore.
Installation:
Check O-rings (4 and 5), replacing if necessary. Lubricate O-rings with a light coat of ATF to make installation easier.



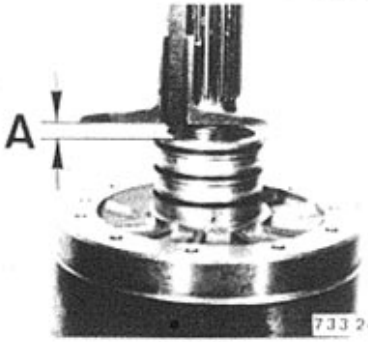
733 24 223

Installed Order of Plates:
Insert noted number of removed steel and lined plates alternately, beginning with a steel plate.
1 Steel plates 1.5 mm
2 Lined plates
3 End plate 4.5 mm



733 24 227

Lift off carrier (3).



733 24 224

Connect cylinders E and F by turning.
Collar on output shaft must protrude by distance A = approx. 10 mm (0.394").
Apply Special Tool 24 1 010.


733 24 228

Pull or press off one-way clutch.



733 24 225

Removing One-way Clutch:
Lift out snap ring (1).

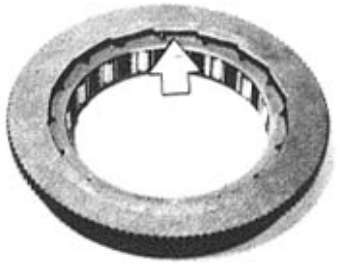

733 24 229

Press one-way clutch cage out of outer race carefully.
Caution!!
Needles could jump out of cage.



733 24 226

Press out output shaft (2).


733 24 230

Installation:
Place one-way clutch cage on the outer race and align.
Press in one-way clutch cage against stop and then turn until metal edge engages in holding groove of outer race.

Use plate carrier (3) to turn one-way clutch outer race clockwise and mount race on inner race.

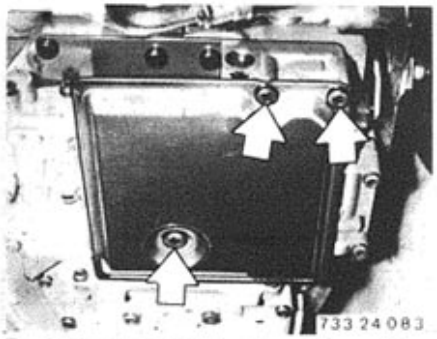


733 24 231

Clearance between one-way clutch inner race and outer race should be at least 0.1 mm (0.004").

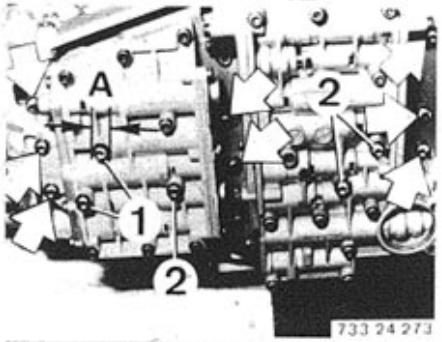


733 24 232

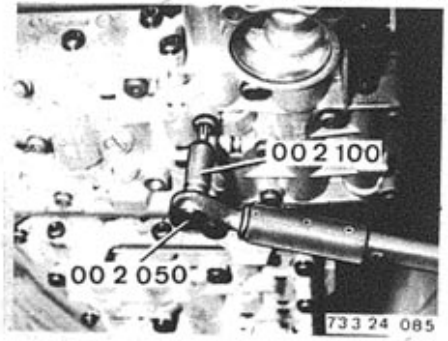


24 30 002 REMOVING AND INSTALLING VALVE BODY

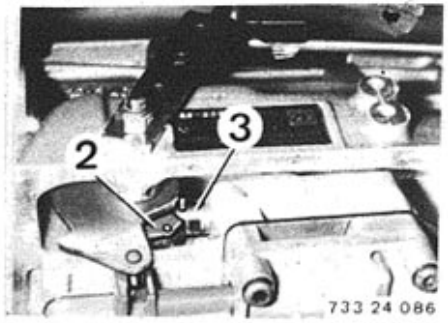
Remove oil sump 24 11 002.
Remove oil filter screen.
Installation:
Tightening torque*.
Check length of bolts.
Bolts with conical bolt head = 65 mm long.



Remove valve body.
Unscrew Torx bolts with Special Tool 00 2 100.
Important!
Only unscrew bolts with bolt head size A = 12 mm.
Installation:
Bolts differ in length.
Bolts (1) = 65 mm (2.559") long.
Bolts (2) = 60 mm (2.362") long.

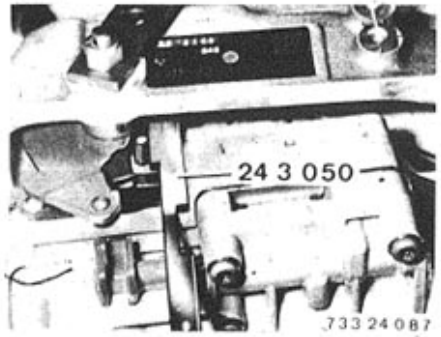


Installation:
Tighten Torx bolts with Special Tools 00 2 100 and 00 2 050.
Tightening torque*.

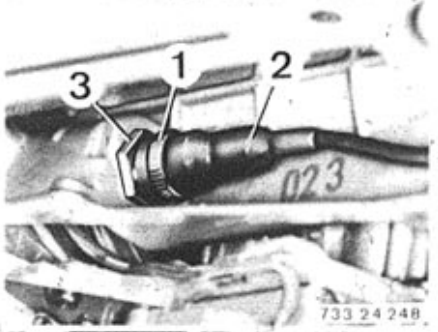


Installation:
Mount valve body that clamp on selector valve can be connected in operating finger of pawl. This requires pulling transmission cable slightly so that throttle cam (2) cannot clamp on throttle pressure valve (3).

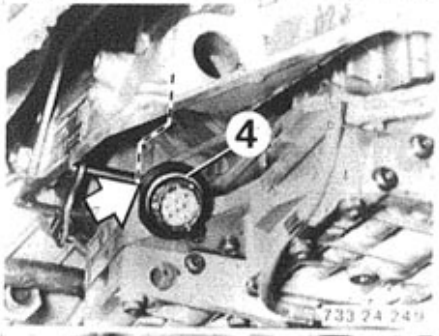
* See Specifications



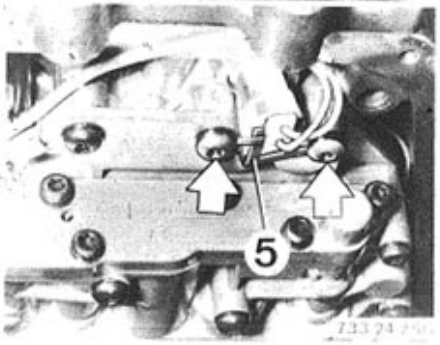
Install valve body and screw in bolts only finger tight.
Align valve body with Special Tool 24 3 050.
If special tool is not available, check that distance from valve body case to pin of throttle pressure piston is 11.5 mm (0.453").
Tighten valve body bolts.



EH Transmission:
Turn bayonet fastener (1) to the left.
Pull off plug (2).
Unscrew nut (3).

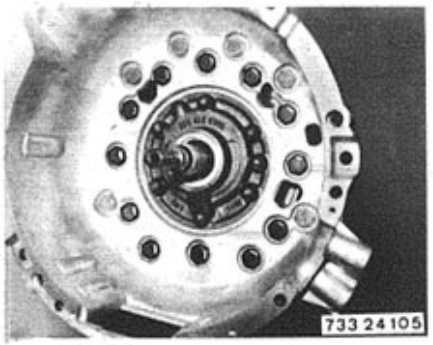


Pull out socket toward inside.
Installation:
Check O-ring (4), replacing if necessary.
Plug in socket with flat side facing out.
Tightening torque*.



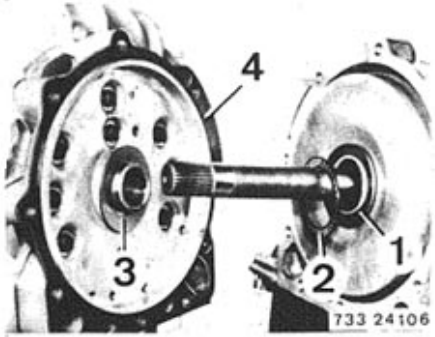
Note:
Also mount pulse transmitter on the valve body.
Tabs on holder (5) must engage in grooves of plug.

* See Specifications

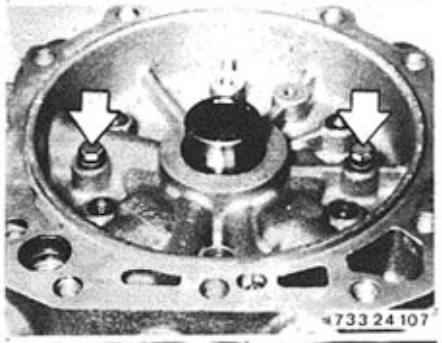


24 31 002 REMOVING AND INSTALLING PRIMARY PUMP

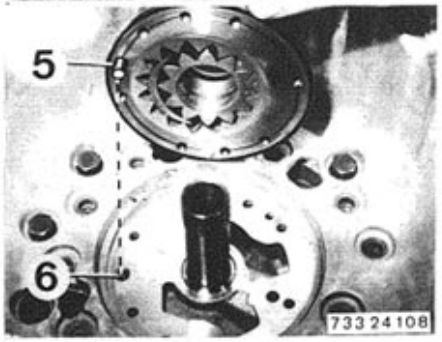
Remove torque converter 24 40 003.
Take off converter bell housing with connecting plate.
Installation:
Tightening torque*.



Installation:
Mount angled washer (1) with collar facing needle bearing (2) on input shaft.
Hold thrust washer (3) on converter bell housing with grease.
Replace gasket (4).

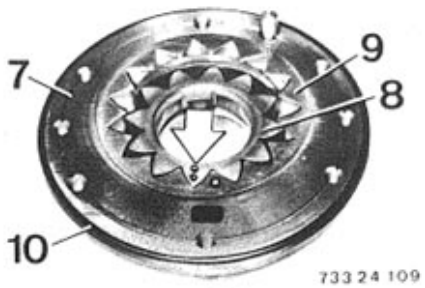


Unscrew primary pump on converter bell housing.
Loosen two bolts opposite each other by only several turns.
Loosen primary pump on converter bell housing with several light knocks.
Tightening torque*.

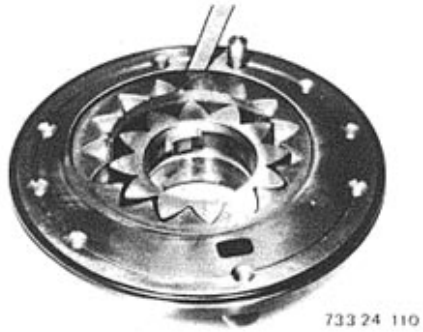


Remove primary pump.
Installation:
Centering pin (5) must engage in bore (6).

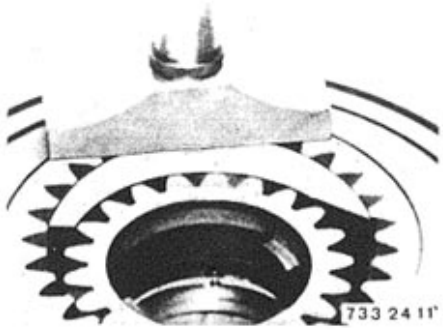
* See Specifications



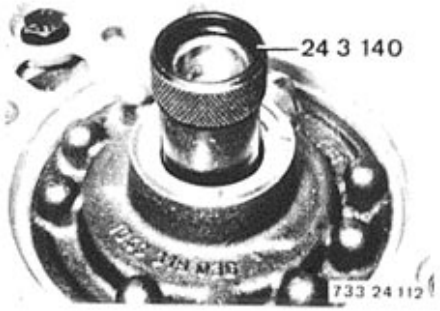
Installation:
Primary pump, consisting of pump body (7), hollow gear (8) and impeller (9), may only be replaced as an assembly.
Check O-ring (10), replacing if necessary.
Important!
Install hollow gear (8) and impeller (9) that punch marks face up.



Check radial play* between driven gear and pump body, while turning gear 360°.

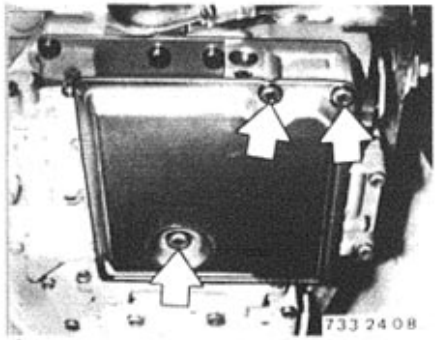


Check axial play* of both gears to face surface with a precision depth micrometer.



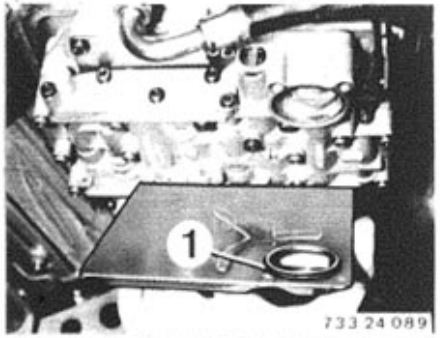
Check running of primary pump with Special Tool 24 3 140.

* See Specifications

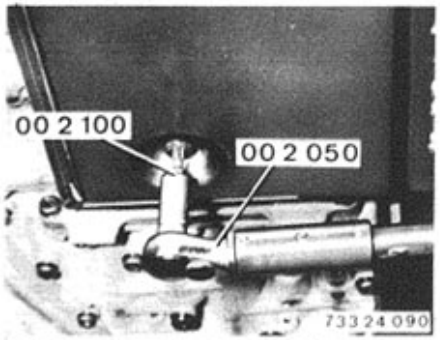


24 31 152 REMOVING AND INSTALLING OIL FILTER SCREEN ON VALVE BODY

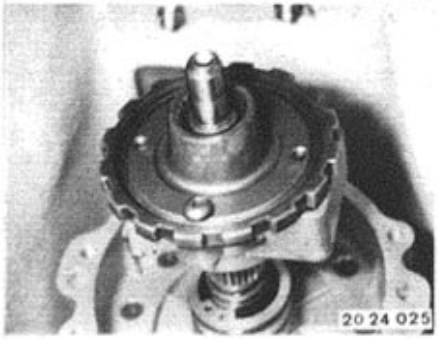
Remove oil sump 24 11 002.
Detach oil filter screen.
Installation:
Clean oil filter screen.
Replace an oil filter screen when it starts to gum up with a brown, burnt residue.
Tightening torque*.



Check rubber ring (1), replacing if necessary.



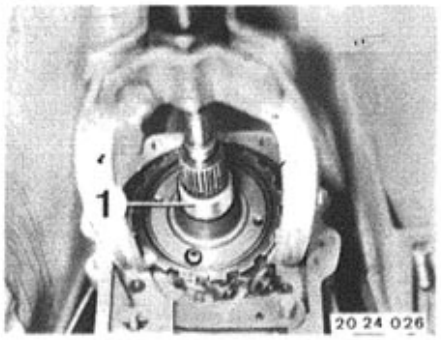
Installation:
Tighten Torx bolts with Special Tools 00 2 100 and 00 2 050.
Tightening torque*.
Replace oil filter screen (see Group 00).



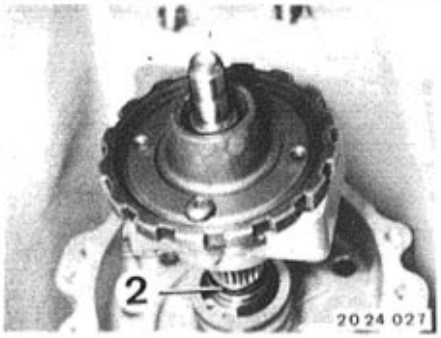
24 32 002 REMOVING AND INSTALLING CENTRIFUGAL GOVERNOR

Remove transmission extension 24 11 052.
Pull off parking lock gear with centrifugal governor.

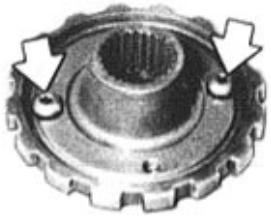
* See Specifications



Version with Bearing Race (1):
Pull off parking lock gear with a Kukko puller.
Installation:
Heat bearing race (1) to about 80° C (175° F) and slide on to output shaft.



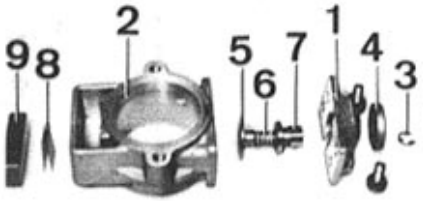
Replace seal (2).
Slide on parking lock gear with centrifugal governor.



24 32 505 DISASSEMBLING/ASSEMBLING CENTRIFUGAL GOVERNOR

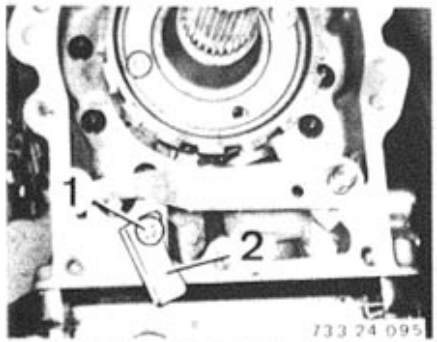
CENTRIFUGAL GOVERNOR REMOVED

Detach parking lock gear on centrifugal governor
Installation:
Tightening torque*.



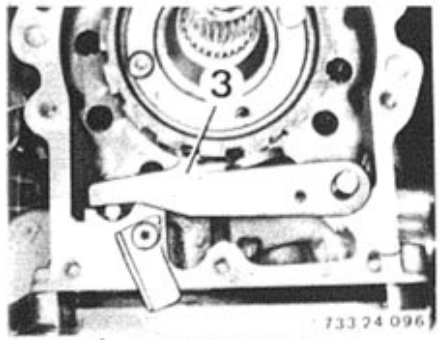
Take off cover (1) on case (2).
Lift out retainer (3) and remove washer (4).
Remove governor piston (5), spring (6) and governor bushing (7).
Installation:
Governor piston must slide easily in governor bushing.
Remove spring clip (8) and balance weight (9).

* See Specifications

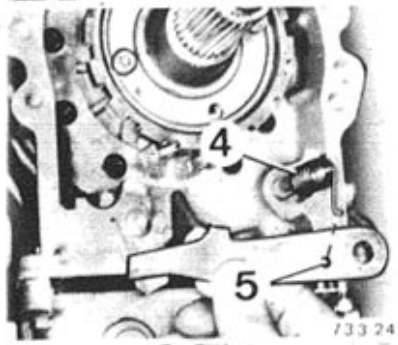


24 34 002 REMOVING AND INSTALLING PARKING LOCK PAWL

Remove transmission extension 24 11 052.
Loosen bolt (1).
Swing holder (2) down.



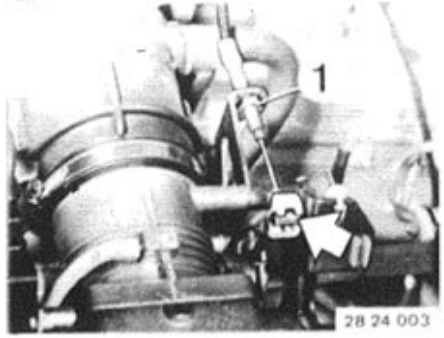
Pull off pawl (3).
Caution!
Spring force.

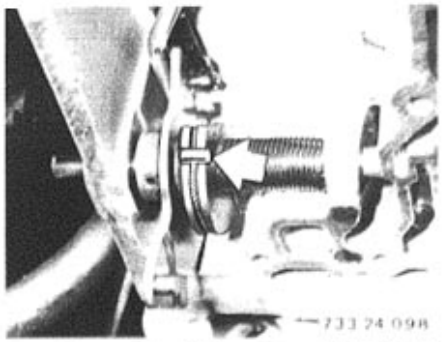


Installation:
Check installed position of spring (4).
It must be possible to connect end of spring (4) in bore (5) of pawl.

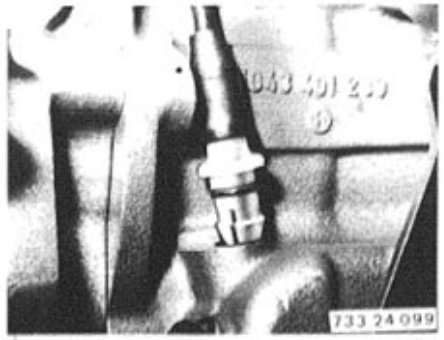
24 34 102 REPLACING THROTTLE CABLE

Unscrew nut (1) and disconnect throttle cable.

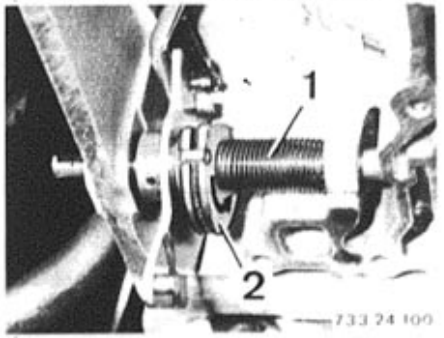




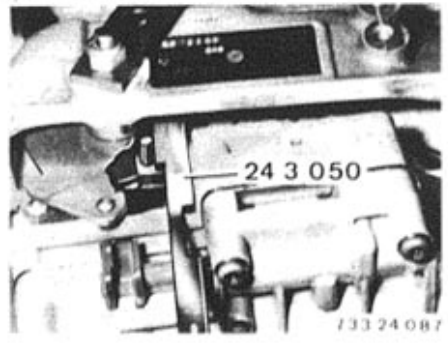
Remove valve body 24 30 002.
Disconnect throttle cable.



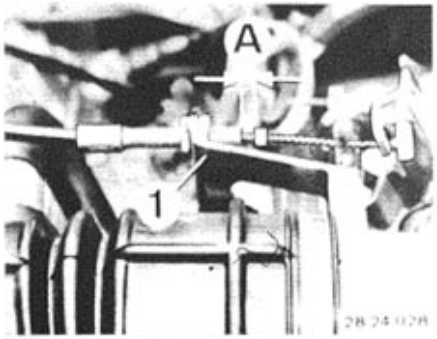
Press throttle cable out of case upwards.
Press new throttle cable into case until retaining tabs engage.



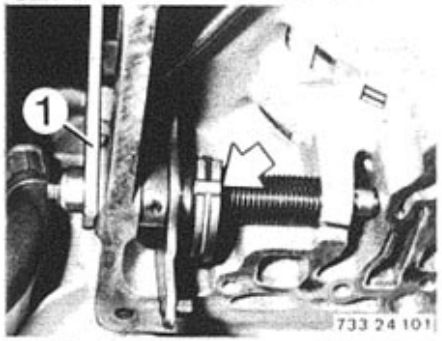
Preload spring (1) by one turn anticlockwise with throttle cam (2).
Connect nipple on throttle cam.



Install valve body.
Insert Special Tool 24 3 050 between valve body case and throttle pressure valve.
Push throttle cam against throttle pressure valve.

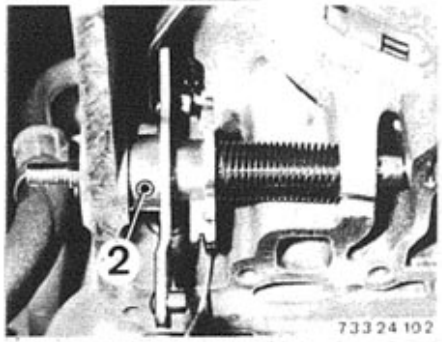


Connect throttle cable in suspension on transmission and holder (1).
Tighten cable.
Squeeze loose lead seal on cable at distance (A) = 0.25 to 0.50 mm (0.010 to 0.020").
Adjust throttle cable 24 00 006.

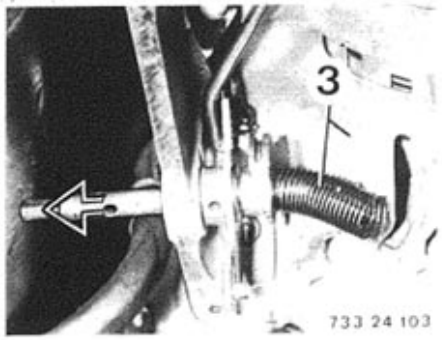


24 34 702 REPLACING SPRING FOR THROTTLE CABLE

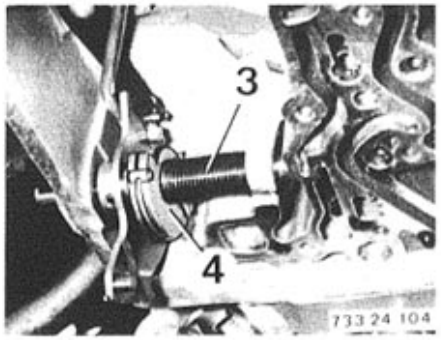
Remove valve body 24 30 002.
Disconnect selector lever (1) on transmission.
Disconnect throttle cable.



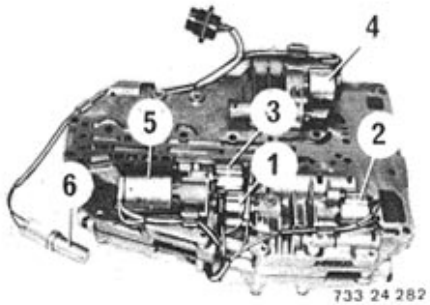
Drive out pin (2) in position N.



Pull out selector shaft far enough that spring (3) can be removed.

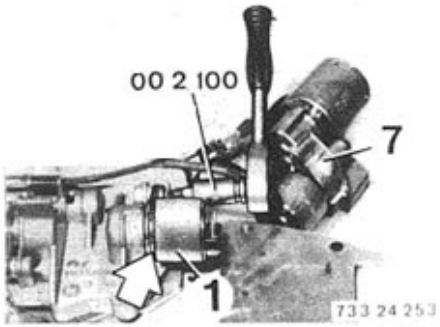


Installation:
Install selector shaft.
Preload spring (3) by one turn anticlockwise with throttle cam (4).
Connect nipple on throttle cam.

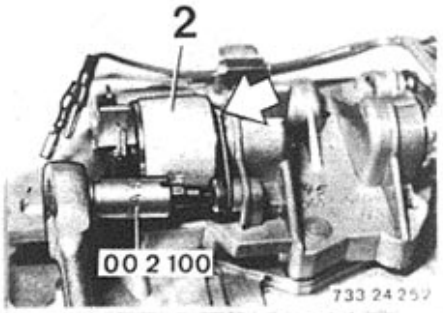


24 34 851 REPLACING ALL SOLENOIDS
– Valve Body Removed –

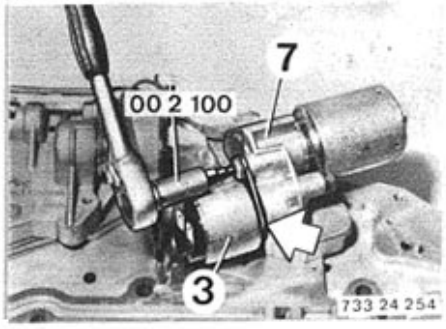
Arrangement:
1 Solenoid - 1st/2nd and 3rd/4th gears
2 Solenoid - 2nd/3rd gears
3 Solenoid - converter lockup clutch
4 Solenoid - reverse gear lock
5 Pressure regulator
6 Pulse transmitter



a) Solenoid (1) – 1st/2nd and 3rd/4th Gears:
Unscrew governor housing (7).
Pull off wire plug.
Unscrew Torx bolt with Special Tool 00 2 100.
Take off holder.
Pull out solenoid.
Installation:
Install holder with tabs facing collar on solenoid.
Tightening torque*.

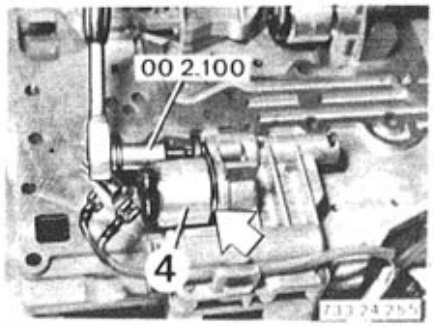


b) Solenoid (2) – 2nd/3rd Gears
Pull off wire plug.
Unscrew Torx bolt with Special Tool 00 2 100.
Take off holder.
Pull out solenoid.
Installation:
Install holder with tabs facing collar on solenoid.
Tightening torque*.

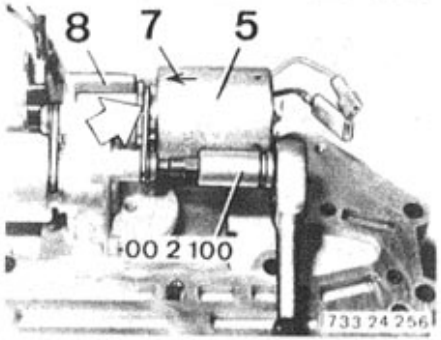


c) Solenoid (3) – Conv. Lockup Clutch:
Unscrew governor housing (7).
Pull off wire plug.
Unscrew Torx bolt with Special Tool 00 2 100.
Take off holder.
Pull out solenoid.
Installation:
Install holder with tabs facing collar on solenoid.
Tightening torque*.

* See Specifications

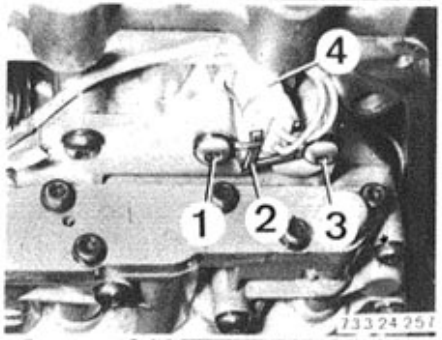


d) Solenoid (4) – Reverse Gear Lock:
Pull off wire plug.
Unscrew Torx bolt with Special Tool 00 2 100.
Take off holder.
Pull out solenoid.
Installation:
Install holder with tabs facing collar on solenoid.
Tightening torque*.



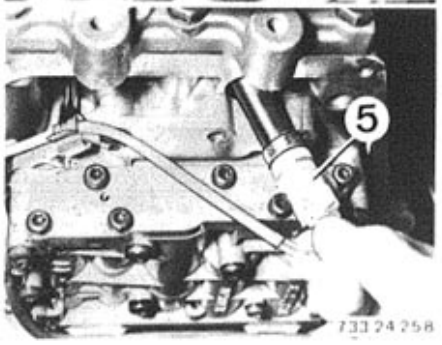
24 34 860 REPLACING PRESSURE REGULATOR
– Valve Body Removed –

Pull off wire plug.
Unscrew Torx bolt with Special Tool 00 2 100.
Take off holder.
Pull out pressure regulator (5).
Important! – Installation:
Arrow (7) on pressure regulator must be aligned with rib (8).
Install holder with tabs facing collar on pressure regulator.
Tightening torque*.



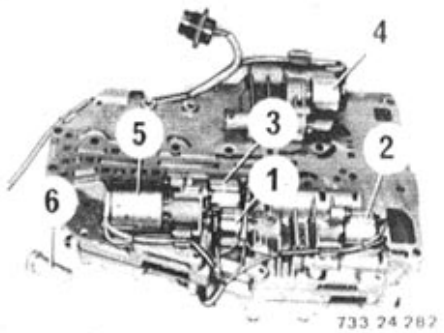
24 34 870 REPLACING PULSE TRANSMITTER
– Oil Sump Removed –

Unscrew Torx bolts (1 and 3) with Special Tool 00 2 100.
Take off holder (2).
Installation:
Engage tabs on holder (2) in grooves of plug (4).



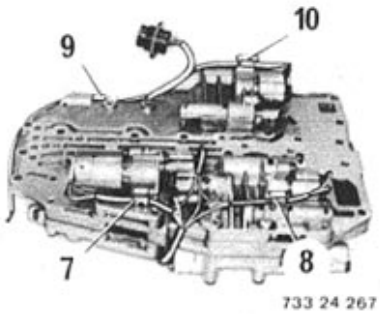
Pull out pulse transmitter.
Pull off plug (5).
Installation:
Tightening torque*.

* See Specifications

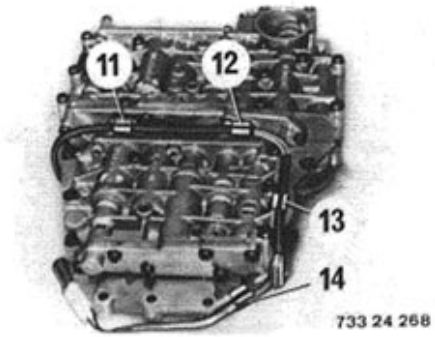


24 35 500 REPLACING WIRE HARNESS FOR AUTOMATIC TRANSMISSION

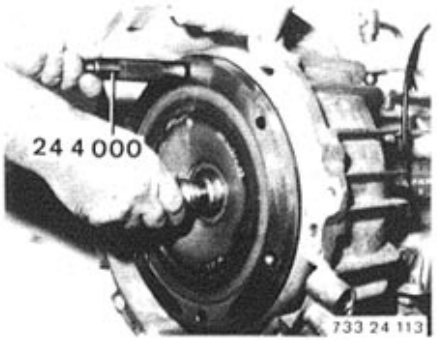
Remove valve body 24 30 002.
Pull off wire harness plugs on solenoids (1...4), pressure regulator (5) and pulse transmitter (6).
Lift wire harness out of holders.
Installation:
Check colors of wires.
Solenoid (1) – gray/violet
Solenoid (2) – green/violet
Solenoid (3) – red/violet
Solenoid (4) – orange/violet
Pressure regulator (5) – blue/violet
Pulse transmitter (6) – brown/brown
Push on plugs against stop and check for tight fit.



Route wire harness and clamp in holders (7 ... 10).

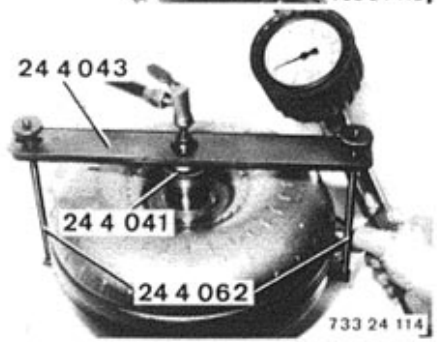


Turn valve body around.
Route wire harness and clamp in holders (11 ... 14).



24 40 003 REMOVING AND INSTALLING TORQUE CONVERTER

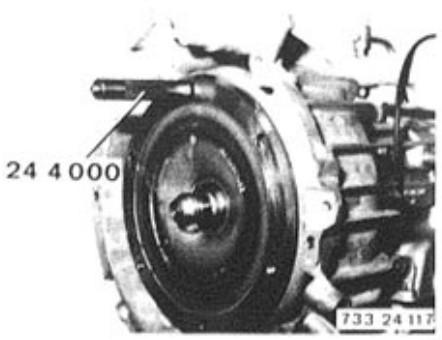
Remove and install transmission 24 00 022.
Pull torque converter out of primary pump carefully with Special Tool 24 4 000.
Important!
Escaping ATF!



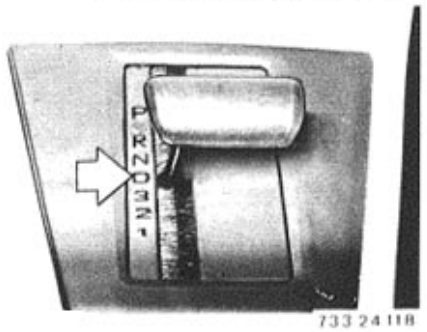
Installation:
Check torque converter for leaks with Special Tools 24 4 041, 24 4 043 and 24 4 062.
Test pressure: 0.5 bar (7 psi).
Important!
Always use Special Tool 24 4 043 to prevent injury.



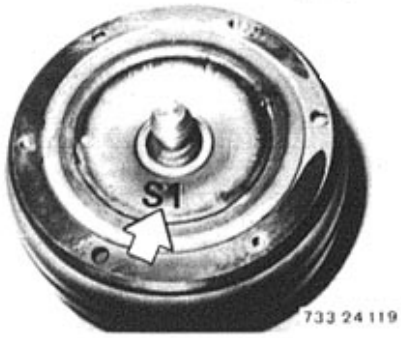
Torque converter must be replaced when bearing surface on converter shaft is damaged.



Turn slightly to guide openings on converter into primary pump carefully, using Special Tool 24 4 000.
Important!
Be careful not to damage converter bearings and seal while guiding in.
Converter is in its correct installed position, if drive ring is below case edge.



Checking Installed Torque Converter:
Engine and transmission oil must have operating temperature.
Engine must produce full rated power.
Start engine.
Pull on parking brake and operate brake pedal firmly.
Move selector lever to D and press accelerator pedal to full throttle.
Read stall speed* from tachometer.



Important!
Never test stall speed longer than 10 seconds to prevent damage from excessive heat.
Stall Speed Much Above Specified Value*:
a) Converter oil volume insufficient – correct oil level.
b) Slip in clutches – check clutches.
Stall Speed Much Below Specified Value*:
a) Engine power insufficient – check engine.
b) Converter or pump defective – replace converter or check pump.

Torque converters cannot be cleaned with conventional workshop equipment and must be replaced when a transmission had been defective or an oil filter screen torn.
Converter identification*.

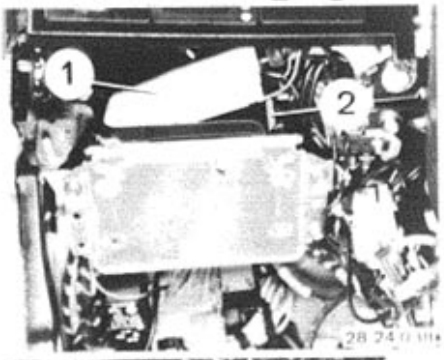
* See Specifications



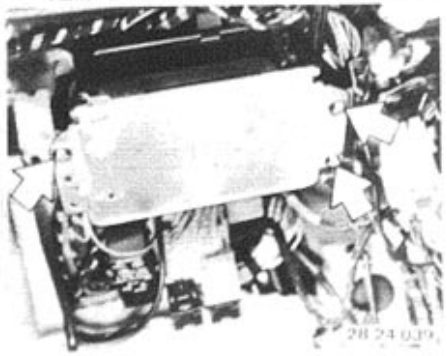
28 24 037

24 61 000 REMOVING AND INSTALLING OR REPLACING EH CONTROL UNIT

The AEGS control unit is located underneath the instrument panel on the left-hand side.
Remove the instrument panel trim at bottom left – see 51 45 180.
Unscrew the control unit holder.



Pull off plug (1) on the control unit after pushing back spring retainer (2).
Caution!
Plug (1) must only be disconnected or connected with the ignition turned off.



Remove the control unit.



735 24 016

Control Unit Identification:
535 i Bosch No. 0 260 002 007
Code F

Condition	Cause	Correction
Position P		
Park will not engage	Selector linkage or cable between selector lever and transmission maladjusted	Adjust selector lever 24 00 006
	Excessive friction in parking lock mechanism	Replace parking lock parts (connecting rod, pawl) 24 34 002
Park does not hold (slips out)	Selector linkage or cable between selector lever and transmission maladjusted	Adjust selector lever 24 00 006
Engine cannot be started in N or P	Transmission switch defective	Replace transmission switch 25 16 080
Position R		
No reverse gear	Selector linkage or cable between selector lever and transmission maladjusted	Adjust selector lever 24 00 006
	Oil filter screen dirty	Replace oil filter screen Replace transmission if liner bits are found in oil sump
	Clutch B destroyed – in this case also no 3rd gear	Disassemble clutches 24 23 022
	Brake D destroyed – in this case also no engine braking in 1st gear of position 1	Disassemble clutches 24 23 022
	Clutch E destroyed – in this case also no engine braking in 2nd and 3rd gears as well as 1st gear in position 1	Disassemble clutches 24 23 022
	Reverse gear arrest does not cancel	Replace valve body 24 30 002
Slipping or shaking when moving off	Clutch B or E or brake D damaged	Disassemble clutches 24 23 022
Hard engaging jolt P–R or N–R or definite double knock for P–R or N–R shifts (engine speed < 1500 rpm)	Damper B defective – in this case shift 2–3 also not correct	Replace valve body 24 30 002

Condition	Cause	Correction
Backup lights do not come on (electric system okay)	Transmission switch defective	Replace transmission switch 25 16 080
Car moves or crawls	Selector linkage or cable between selector lever and transmission maladjusted	Adjust selector lever 24 00 006
	Clutch A defective (bonded)	Replace clutch A 24 23 022
Position D		
No power flow	Oil filter screen dirty	Replace oil filter screen 24 31 152 Replace transmission if liner bits are found in oil sump
	Clutch A defective	Replace clutch A 24 23 022
	1st gear one-way clutch slips	Disassemble transmission 24 00 082
	Selector linkage or cable between selector lever and transmission maladjusted	Adjust selector lever 24 00 006
Slipping or shaking when moving off	Clutch A damaged	Replace clutch A 24 23 022
Hard engaging jolt N–D (engine speed < 1500 rpm)	Clutch A damaged	Replace clutch A 24 23 022
	Damper A defective	Replace valve body 24 30 002
No shift (warm or cold state)		
1–2/2–1 shifts	Governor dirty	Clean or replace governor 24 32 002
	Shift valve 1–2 seized	Replace valve body 24 30 002
1–2 shift	Brake C and/or C defective	Disassemble clutches 24 23 022
2–3/3–2 shifts	Governor dirty	Clean or replace governor 24 32 002
	Shift valve 2–3 seized	Replace valve body 24 30 002
2–3 shift	Clutch B defective	Replace clutch B 24 23 022
3–4/4–3 shifts	Governor dirty	Clean or replace governor 24 32 002
	Shift valve 3–4 seized	Replace valve body 24 30 002
3–4 shift	Brake F defective	Disassemble clutches 24 23 022

Condition	Cause	Correction
Car drives in 2nd gear	Governor bushing seized	Clean or replace governor 24 32 002
	Shift valve 1–2 seized	Replace valve body 24 30 002
Car drives in 3rd gear	Governor bushing seized	Clean or replace governor 24 32 002
	Shift valves 1–2 and 2–3 seized	Replace valve body 24 30 002
Car shifts 1–3	Shift valve 2–3 seized	Replace valve body 24 30 002
Shift points*		
Zero load shift not correct	Governor dirty	Clean or replace governor 24 32 002
	Shift valve sticks	Replace valve body 24 30 002
Full load shift points not correct	Throttle cable maladjusted	Adjust throttle cable 24 00 006
No kickdown shift		
1–2/2–1	Throttle cable maladjusted	Adjust throttle cable 24 00 006
2–3/3–2	Throttle cable maladjusted	Adjust throttle cable 24 00 006
4–3	4–3 kickdown valve seized	Replace valve body 24 30 002
Shift Transitions		
Zero load shifts too hard	Damper defective	Replace valve body 24 30 002
	Modulation pressure too high	Replace valve body 24 30 002
	Plates damaged	Disassemble transmission 24 00 082
Full load and kickdown shifts too long	Damper defective	Replace valve body 24 30 002
	Modulation pressure too low	Replace valve body 24 30 002
	Plates damaged	Disassemble transmission 24 00 082
Full load and kickdown shifts too hard	Modulation pressure deviates	Replace valve body 24 30 002
	Damper defective	Replace valve body 24 30 002

* See Specifications

Condition	Cause	Correction
Position 3 / 3rd Gear		
No engine braking effect	Clutch E damaged	Disassemble clutches 24 23 022
Position 2		
Manual downshift 3–2 not correct	Locking valve 2 sticks	Replace valve body 24 30 002
	Governor hesitates	Replace governor 24 32 002
No engine braking effect	Brakes C or clutch E damaged	Disassemble clutches 24 23 022
Position 1		
Manual downshift 2–1 not correct	Locking valve 1 sticks	Replace valve body 24 30 002
	Governor hesitates	Replace governor 24 32 002
No engine braking effect	Brake D or clutch E damaged	Disassemble clutches 24 23 022
Torque Converter		
Shift speed not correct	Converter hysteresis valve sticks	Replace valve body 24 30 002
	No 4th gear	Replace valve body 24 30 002
	Governor pressure not correct	Replace governor 24 32 002
Shift transition too hard	Converter damper defective	Replace valve body 24 30 002
	Converter not okay	Replace converter 24 40 003
No shift	Valve body not okay	Replace valve body 24 30 002
	Converter defective	Replace converter 24 40 003
	No 4th gear	Replace valve body 24 30 002

Condition	Cause	Correction
Throttle cable sticks	Nipple disconnected on throttle cam	Replace throttle cable 24 34 102
	Excessive friction in throttle cable sleeve	Replace throttle cable 24 34 102
Throttle pressure piston seized	Throttle pressure piston clamped	Replace valve body 24 30 002
Noise and power flow interruption after long drive	Oil filter screen on valve body dirty	Replace oil filter screen and, if burnt clutch liner bits are found in oil sump, also replace transmission
No forward or reverse drive, loud noise	Drive plate between converter and engine torn off	Replace drive plate or converter 11 22 051 or 24 40 003
Noises		
Loud noise in all positions, especially with cold oil. Oil pump intake noise.	Oil level too low	Correct oil level
	Valve body leaks	Replace valve body 24 30 002
Loud, screeching noise depending on speed in all positions, especially with warm oil; occurring after long drive, sometimes accompanied by breaks in power flow	Oil filter screen dirty	Replace oil filter screen and, if burnt clutch liner bits are found in oil sump, also replace transmission
Loud noise when converter closes	Torsion damper defective	Replace converter 24 40 003
Loud engine grumble when converter closes	Engine speed too low, converter shift point not correct	Replace valve body 24 30 002
Leaks		
Oil dripping out of converter bell housing	Seal in pump body damaged	Replace seal 24 31 002
	Pump body leaks	Replace pump assy. 24 31 002
	Converter leaks on welded seam	Replace converter 24 40 003
	Radial oil seal for converter leaks	Replace radial oil seal 24 12 003
Leak between transmission case and oil sump	Oil sump mounting bolts not tightened correctly	Tighten bolts to specified torque*
	Oil sump gasket damaged	Replace gasket 24 11 002
Leak between transfer plate and transmission case (especially in area of pump pressure bore)	Mounting bolts on converter bell housing loose	Tighten bolts to specified torque*
Oil lost through throttle cable connection	O-ring on connection damaged	Replace O-ring or, if necessary, entire throttle cable 24 34 102

* See Specifications

Condition	Cause	Correction
Oil loss on output	Radial oil seal for output flange damaged	Replace radial oil seal 24 12 013
Oil loss through or on vent	Oil level too high	Correct oil level
	Wrong oil (strong foaming)	Replace oil, if necessary remove transmission and drain completely with torque converter
	Vent cover missing	Mount cover or replace vent
	O-ring on vent damaged	Detach transmission extension and replace O-ring
	Lock washer preload insufficient	Replace lock washer
Oil loss on cooler line	Coupling loose	Tighten bolts to specified torque*
	Cooler line damaged	Replace cooler line
	Cooler leaks	Replace cooler 17 11 000
Oil loss on transfer plate	Plug on transfer plate leaks	Tighten plug to specified torque*
		Replace seal
Leak between transmission case and transmission extension	Mounting bolts loose	Tighten bolts to specified torque*
	Gasket damaged	Replace gasket 24 11 052

* See Specifications

TROUBLESHOOTING AUTOMATIC TRANSMISSION 4 HP 22 / EH

Conformance with the following points is necessary for troubleshooting.

a) Engine in perfect operating condition (valves, DME and idle speed okay).

b) Fault indicator, program indicator and range indicator okay.

c) Battery, plugs and ground point okay.

d) Transmission oil level okay.

Other important general tips to avoid damaging the engine, transmission or control units:

a) Never start engine without a correctly connected battery.

b) Avoid wrong power supply poles, e.g. battery connected wrong.

c) Never start the engine with a quick battery charger.

d) Disconnect battery before quick charging.

e) Never disconnect battery while engine is running.

f) Only start engine from outside source with help of starting leads and a second 12 volt battery.

g) Always turn off ignition before disconnecting or connecting plugs on control unit.

h) Only use high-ohmic testers (BMW service tester) for testing with the control unit connected.

TROUBLESHOOTING AUTOMATIC TRANSMISSION 4 HP 22 / EH

Condition	Cause	Correction
Position P		
Park will not engage	Selector linkage between selector lever and transmission maladjusted	Adjust selector linkage 24 00 006
	Excessive friction in parking lock mechanism	Replace parking lock parts (connecting rod, pawl) 24 34 002
Park does not hold (slips out)	Selector linkage between selector lever and transmission maladjusted	Adjust selector linkage 24 00 006
Engine cannot be started in N or P	Transmission switch defective	Replace transmission switch 25 16 080
Position R		
No reverse gear	Linkage between selector lever and transmission maladjusted	Adjust selector linkage 24 00 006
	Oil filter screen dirty	Replace oil filter screen Replace transmission if liner bits are found in oil sump
	Clutch B destroyed – in this case also no 3rd gear	Disassemble clutches 24 23 022
	Brake D destroyed – in this case also no engine braking in 1st gear of position 1	Disassemble clutches 24 23 022
	Clutch E destroyed – in this case also no engine braking in 2nd and 3rd gears as well as 1st gear in position 1	Disassemble clutches 24 23 022
	Reverse gear lock does not cancel	Check transmission electronics (see test plan) Replace valve body 24 30 002
Slipping or shaking when moving off	Clutch B or E or brake D damaged	Disassemble clutches 24 23 022
Hard engaging jolt P–R or N–R or definite double knock for P–R or N–R shifts (engine speed 1500 rpm)	Damper B defective – in this case shift 2–3 also not correct	Replace valve body 24 30 002 Check transmission electronics (see test plan)
Backup lights do not come on (electric system okay)	Transmission switch defective	Replace transmission switch 25 16 080
Car moves or crawls	Linkage between selector lever and transmission maladjusted	Adjust selector linkage 24 00 006
	Clutch A defective (bonded)	Replace clutch A 24 23 022

Condition	Cause	Correction
Position D		
No power flow	Oil filter screen dirty	Replace oil filter screen 24 31 152 Exchange transmission, if liner bits are found in oil sump
	Clutch A defective	Replace clutch A 24 23 022
	1st gear one-way clutch slips	Disassemble transmission 24 00 082
	Linkage between selector lever and transmission maladjusted	Adjust selector linkage 24 00 006
Slipping or shaking while moving off	Clutch A damaged	Replace clutch A 24 23 022
Hard engaging jolt N–D (engine speed 1500 rpm)	Clutch A damaged	Replace clutch A 24 23 022
	Damper A defective	Replace valve body 24 30 002
No shift (warm or cold state)	Kickdown switch defective (only kickdown shifts)	Replace kickdown switch
o Shift 1–2 / 2–1	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (1) defective (see test plan)	Replace solenoid 24 34 851
	Control valve 1–2 / 3–4 seized	Replace valve body 24 30 002
	Shift valve 1–2 seized	Replace valve body 24 30 002
o Shift 1–2	Brake C and/or C defective	Disassemble clutches 24 23 022
o Shift 2–3 / 3–2	Solenoid (2) defective (see test plan)	Replace solenoid 24 34 851
	Shift valve 2–3 seized	Replace valve body 24 30 002
o Shift 2–3	Clutch B defective	Replace clutch B 24 23 022
o Shift 3–4 / 4–3	Solenoid (1) defective (see test plan)	Replace solenoid 24 34 851
	Control valve 1–2 / 3–4 seized	Replace valve body 24 30 002
	Shift valve 3–4 seized	Replace valve body 24 30 002
o Shift 3–4	Brake F defective	Disassemble clutches 24 23 022
	Program switch defective (see test plan)	Replace program switch
o Shift 1–2 Engine speed does not go beyond stall speed in drive and full load	Pulse transmitter defective (see test plan)	Replace pulse transmitter 24 34 870

Condition	Cause	Correction
Car moves off in 2nd gear	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (1) defective (see test plan)	Replace solenoid valve 24 34 851
	Shift valve 1–2 seized	Replace valve body 24 30 002
Car moves off in 3rd gear	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (1 or 2) defective (see test plan)	Replace solenoid valve 24 34 851
	Shift valve 1–2 and 2–3 seized	Replace valve body 24 30 002
Car shifts 1–3	Shift valve 2–3 seized	Replace valve body 24 30 002
	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (2) defective (see test plan)	Replace solenoid valve 24 34 851
Shift Speeds		
– Zero load shift not okay	Control unit defective	Replace control unit 24 61 000
– Full load shift points not okay	No full load signal	Check throttle switch 13 63 544
– No kickdown shift	Kickdown switch defective	Check/replace switch (see test plan)
– Only zero load shifts	Zero load switch on engine defective	Check/replace zero load switch 13 66 554
– Only kickdown shifts	Kickdown switch defective	Check/replace switch (see test plan)
Shift Transitions		
– Zero load shifts too hard	Control unit defective	Replace control unit 24 61 000
	Damper defective	Replace valve body 24 30 002
	Modulation pressure too high	Replace valve body 24 30 002
	Plates damaged	Disassemble transmission 24 00 082
– Full load and kickdown shifts too long	Control unit defective	Replace control unit 24 61 000
	Damper defective	Replace valve body 24 30 002
	Modulation pressure too low	Replace valve body 24 30 002
	Plates damaged	Disassemble transmission 24 00 082

Condition	Cause	Correction
– Full load and kickdown shifts too hard	Modulation pressure not okay	Replace valve body 24 30 002
	Damper defective	Replace valve body 24 30 002
	Control unit defective	Replace control unit 24 61 000
Position 3 – 3rd Gear		
No engine braking effect	Clutch E damaged	Disassemble clutches 24 23 022
Position 2		
Manual downshift 3–2 not okay	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (2) defective (see test plan)	Replace solenoid valve 24 34 851
No engine braking effect	Brake C' or clutch E damaged	Disassemble clutches 24 23 022
Position 1		
Manual downshift 2–1 not okay	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (1) defective (see test plan)	Replace solenoid valve 24 34 851
No engine braking effect	Brake D or clutch E damaged	Disassemble clutches 24 23 022
Converter Clutch		
Shift speed not okay	Control unit defective	Replace control unit 24 61 000
Shift transition too hard	Converter clutch damper defective	Replace valve body 24 30 002
	Converter not okay	Replace converter 24 40 003
No shift	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (3) defective (see test plan)	Replace solenoid valve 24 34 851
	Converter defective	Replace converter 24 40 003
Converter clutch always locked (engine stops in drive position)	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (3) defective (see test plan)	Replace solenoid vlave 24 34 851

Condition	Cause	Correction
General		
Shifts only as positioned	Transmission electronics defective	Check transmission electronics (see test plan)
	Program switch defective (see test plan)	Replace program switch
Defect indicator lights up	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (2) defective (see test plan)	Replace solenoid valve 24 34 851
Defect indicator lights up while driving	Transmission electronics defective	Check transmission electronics (see test plan)
	Poor contact of plug on transmission	Check plug connection
Noise and finally interruption of power flow after long drive	Oil filter screen on valve body dirty	Only replace filter screen, if there are no burnt clutch liner bits in oil sump; otherwise exchange transmission
No power flow forward or reverse, loud noise	Drive plate between converter and engine torn off	Replace drive plate or converter 11 22 051 or 24 40 003
Noise		
High-pitched noise in all positions, especially when oil is cold, intake noise of oil pump	Oil level too low	Correct oil level
	Valve body leaks	Replace valve body 24 30 002
High-pitched, screeching, speed-dependent noise in all positions, especially when oil is warm, occurring after long drive, sometimes accompanied by interruptions in power flow	Oil filter screen dirty	Only replace filter screen, if there are no clutch liner bits in oil sump; otherwise replace complete transmission
Loud noise when converter clutch is locked	Torsion damper defective	Replace converter 24 40 003

Condition	Cause	Correction
Leakage		
Oil dripping out of converter bell housing	Seal in pump body damaged	Replace seal 24 31 002
	Pump body leaks	Replace complete pump 24 31 002
	Converter leaks on welded seam	Replace converter 24 40 003
	Radial oil seal for converter leaks	Replace radial oil seal 24 12 003
Leak between transmission case and oil sump	Oil sump mounting bolts not tightened to correct torque	Tighten bolts to correct torque*
	Oil sump gasket damaged	Replace gasket 24 11 002
Leak between transfer plate and transmission case (especially in area of pump pressure bore)	Converter bell housing mounting bolts loose	Tighten bolts to correct torque*
Oil loss on transmission plug	O-ring defective	Replace O-ring 24 30 002
Oil loss on output	Radial oil seal on output damaged	Replace radial oil seal 24 12 013
Oil loss through or on vent	Oil level too high	Correct oil level
	Wrong type of oil (strong foaming)	Replace oil, if necessary remove transmission and drain entire oil including converter
	Vent cover missing	Mount cover or replace vent
	O-ring on vent damaged	Unscrew transmission extension, replace O-ring
	Circlip pre-load insufficient	Replace circlip
Oil loss on cooler line	Loose connection	Tighten bolts to correct torque*
	Cooler line damaged	Replace cooler line
	Cooler leaks	Replace cooler 17 11 000
Oil loss on transfer plate	Plug on transfer plate leaks	Tighten plug to correct torque*
		Replace seal
Leak between transmission case and transmission extension	Mounting bolts loose	Tighten bolts to correct torque*
	Gasket damaged	Replace gasket 24 11 052

* See Specifications

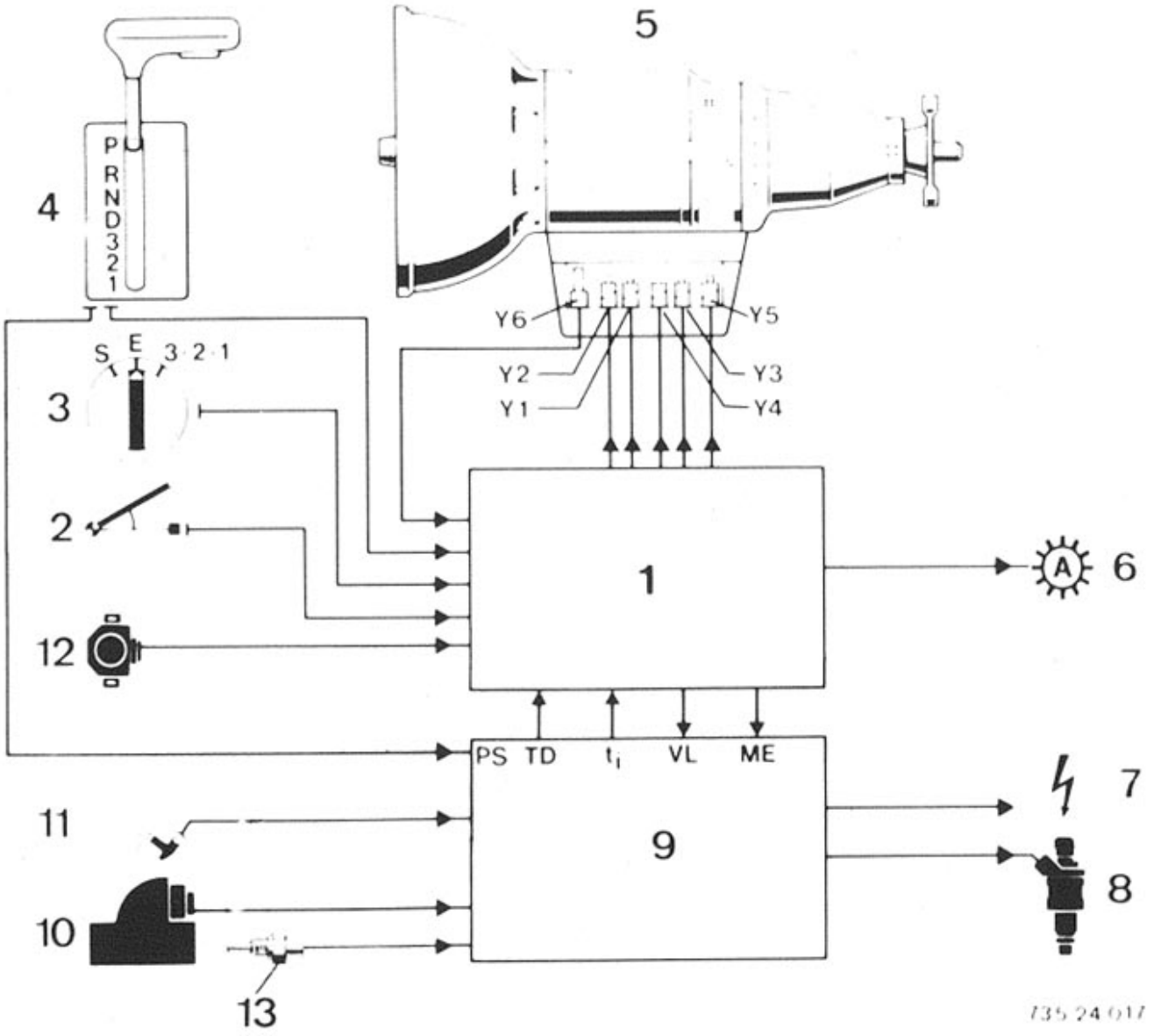
TROUBLESHOOTING VALVE BODY FOR 4 HP 22 / EH

Condition	Cause	Correction
Position R		
No reverse gear	Solenoid (4) defective (see test plan)	Replace solenoid valve 24 34 851
	Wire to solenoid (4) grounded out (see test plan)	Replace wire harness
	Reverse gear locking valve seized	Replace valve body 24 30 002
	Damper B malfunctions	Replace valve body 24 30 002
No reverse or forward gear	Main pressure valve seized, spring broken	Replace valve body 24 30 002
Insufficient power transmission	Pressure too low in clutch B or E, brake D	Replace valve body 24 30 002
Hard jolt when moving into position R	Damper B malfunctions	Replace valve body 24 30 002
	Modulation pressure too high	
Position D		
No forward gear	Main pressure valve seized, spring broken	Replace valve body 24 30 002
Insufficient power transmission	Pressure too low in clutch A	Replace valve body 24 30 002
No shift function	Pulse transmitter defective (see test plan)	Replace pulse transmitter 24 34 870
	Wire to pulse transmitter grounded out (see test plan)	Replace wire harness
No shift function 1–2 / 2–1	Solenoid (1) defective (see test plan)	Replace solenoid valve 24 34 851
	Wire to solenoid (1) grounded out (see test plan)	Replace wire harness
	Shift valve 1–2, control valve 1–2 / 3–4, pressure reducing valve 1 seized	Replace valve body 24 30 002

Condition	Cause	Correction
Position D		
No shift function 2–3 / 3–2	Solenoid (2) defective (see test plan)	Replace solenoid valve 24 34 851
	Wire to solenoid (2) grounded out (see test plan)	Replace wire harness
	Shift valve 2–3 seized	Replace valve body 24 30 002
No shift function 3–4 / 4–3	Solenoid (1) defective (see test plan)	Replace solenoid valve 24 34 851
	Control valve 1–2 / 3–4 seized	Replace valve body 24 30 002
Shifts 1–2 / 2–3 / 3–4 too long	Pressure regulator defective (see test plan)	Replace pressure regulator 24 34 860
	Wire to pressure regulator grounded out (see test plan)	Replace wire harness
	Damper defective	Replace valve body 24 30 002
	Modulation valve, pressure reducing valves 1 and 2 seized	Replace valve body 24 30 002
Upshifts 1–2 / 2–3 / 3–4 too hard	Pressure regulator defective (see test plan)	Replace pressure regulator 24 34 860
	Modulation valve sticks	Replace valve body 24 30 002
	Damper defective	Replace valve body 24 30 002
Downshift 4–3 too hard	Plate F dirty	Replace valve body 24 30 002
Manual downshifts 4–3 / 3–2 too hard	Damper E or C' defective	Replace valve body 24 30 002

Condition	Cause	Correction
Position 1		
Manual downshift 2–1 not okay	Pressure regulator defective (see test plan)	Replace pressure regulator 24 34 860
	Damper D defective	Replace valve body 24 30 002
	Modulation valve sticks	Replace valve body 24 30 002
Converter Lockup Clutch		
No converter clutch locking	Solenoid (3) defective (see test plan)	Replace solenoid valve 24 34 851
	Converter clutch damper defective	Replace solenoid valve 24 34 851
	Converter pressure valve seized	Replace valve body 24 30 002
	Pressure reducing valve 1 seized	Replace valve body 24 30 002
No converter clutch unlocking	Solenoid (3) defective (see test plan)	Replace solenoid valve 24 34 851
	Wire to solenoid (3) grounded out (see test plan)	Replace wire harness
Main pressure too high in all positions	Pressure regulator defective (see test plan)	Replace pressure regulator 24 34 860
	Main pressure valve seized	Replace valve body 24 30 002
	Modulation pressure too high	Replace valve body 24 30 002

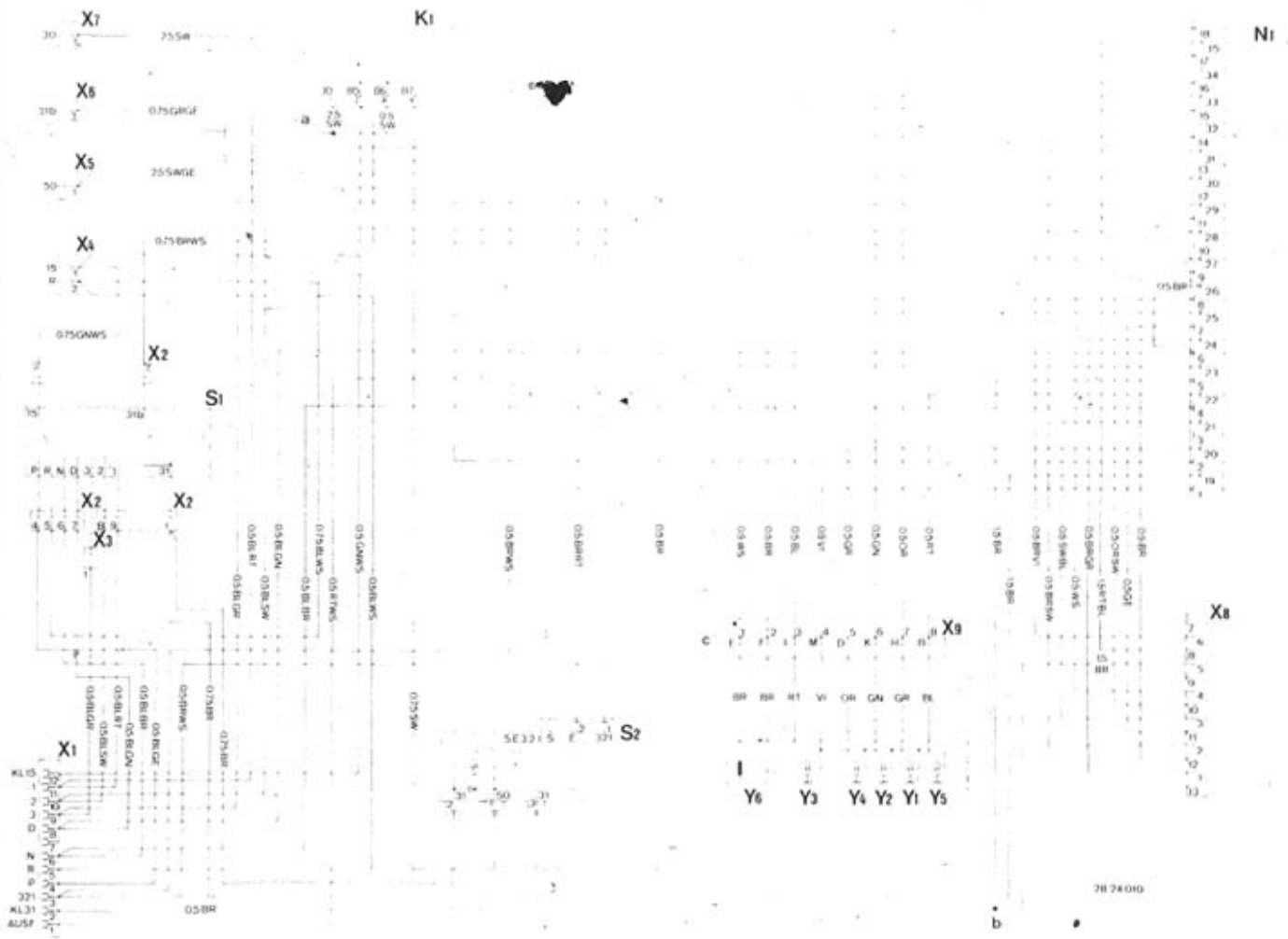
24-149a



AEGS LAYOUT DRAWING

1	AEGS control unit
2	Kickdown switch
3	Program switch
4	Position switch
5	Transmission
6	Fault indicator
7	Ignition
8	Fuel injection
9	DME control unit
10	Air flow sensor
11	Engine speed sensor
12	Throttle valve sensor
13	Temperature sensor
Y1	Solenoid – 1st/2nd and 3rd/4th gears
Y2	Solenoid – 2nd/3rd gears
Y3	Solenoid – converter lockup clutch
Y4	Solenoid – reverse gear lock
Y5	Pressure regulator
Y6	Pulse transmitter
tD	Speed signal
ti	Load signal
VL	Full load
ME	Engine tap
PS	Position switch

4 HP – 22 AEGS WIRING DIAGRAM



N 1 AEGS control unit
K 1 Starter interlocking relay
S 1 Transmission switch
S 2 Program switch
X 1 Range indicator conn.
X 2 Range indicator plug
X 3 Transmission switch plug
X 4 Wire harness conn. - rear section
X 5 Wire harness conn. - center section
X 6 Kickdown switch conn.
X 7 Ignition switch conn.
X 8 Engine wire harness conn.
X 9 Transmission plug
Y 1 Solenoid - 1st/2nd + 3rd/4th gears
Y 2 Solenoid - 2nd/3rd gears
Y 3 Solenoid - converter lockup,clutch
Y 4 Solenoid - reverse gear lock
Y 5 Pressure regulator
Y 6 Pulse transmitter

Plug Connections N 1

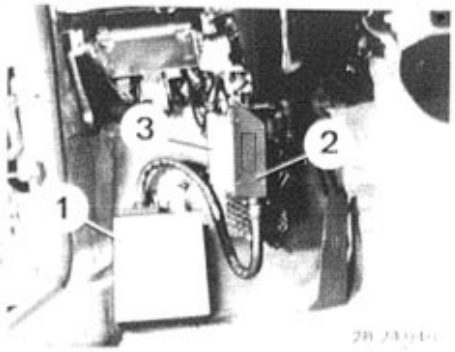
Pin 1 Solenoid +
Pin 2 Kickdown
Pin 4 Range indicator N
Pin 5 Ground
Pin 6 Throttle valve switch –
Pin 7 Load signal
Pin 8 Speed sensor
Pin 9 Throttle valve switch +
Pin 11 Injection signal
Pin 14 Program switch E
Pin 15 Range indicator 3 2 1
Pin 16 Solenoid 1
Pin 17 Solenoid 2
Pin 18 Range indicator 1
Pin 19 Ground
Pin 20 Solenoid - reverse gear
Pin 21 Signal / ignition
Pin 22 Pressure regulator
Pin 23 Shielding
Pin 24 Engine tap
Pin 25 Solenoid - conv. clutch lockup
Pin 26 Coding
Pin 27 Speed sensor
Pin 28 Range indicator 2
Pin 29 Range indicator 3
Pin 30 Range indicator D
Pin 31 Full load signal
Pin 33 Fault indicator
Pin 35 Battery +

Plug Connections X 8
(installed in glove box at control unit for DME)

Pin 1 Engine tap
Pin 2 Full load signal
Pin 3 Signal/ignition
Pin 4 Injection signal
Pin 5 Battery –
Pin 6 Transm. switch P, N
Pin 8 DME +
Pin 10 Throttle valve switch +
Pin 11 Load signal
Pin 12 Throttle valve switch –
a Starting voltage conn.
b Electronics ground conn.
c Shielding

TEST PLAN FOR 4 HP – 22 / AEGS

The AEGS control unit is located underneath the instrument panel on the left-hand side.
Remove the instrument panel trim at bottom left – see 51 45 180.
Unscrew the control unit holder.
Caution!
Never disconnect or connect plug (3) with the ignition turned on.
Connect adapter (1), HWB No. 81 12 9 425 091, on plug (3) in conjunction with connecting lead (2), HWB No. 81 12 9 425 092, for all tests / periphery.
Install the connecting lead (HWB NO. 81 12 9 425 093) between the adapter and control unit for tests in conjunction with the AEGS control unit.
Only test with the BMW service tester.



Test Position 1

Requirement for all tests: ground wire okay. Check ground wires 5 and 19 for correct connection. —— no ——→ Break in ground wire. Connection engine wire harness pin 5 to battery –. ——→ Repair ground wire to wiring diagram. Make connection.

Throttle valve switch signal, see 13 63 544.

Explanations for Independent Electronic Transmission Control (AEGS):
There is a comprehensive test of the entire AEGS each time the engine is started.
Turn on ignition.
The yellow defect indicator lamp in the instrument panel will flash twice briefly, stay on while starting and go out at an engine speed above 450 rpm.

Test Position Defect Indicator	Cause	Correction
Defect indicator not on with ignition turned on.	Check voltage between wires 5/19 and 33 with the ignition on. Nominal value: > 10 volts.	
	Light bulb for defect indicator defective.	Replace printed circuit board for range indicator 62 11 020.
	Break in wire to range indicator on instrument carrier.	Repair wire.
Defect indicator does NOT flash and remains on after starting.	Break in ground wire 5/19.	Repair wire to wiring diagram.
	Check voltage between wires 5/19 and 24 with ignition on. Nominal value: 5 V.	Repair wire to wiring diagram.
	AEGS control unit defective	Replace control unit 24 61 000.
Defect indicator flashes, but remains on after starting.	Power supply to AEGS control unit insufficient. Check voltage between wires 5/19 and 35 with ignition on. Nominal value: > 10 volts.	Repair wire to wiring diagram.
	Wires to solenoid 1 (Y 1), 2 (Y 2), reverse gear (Y 4) or converter lockup clutch (Y 3) have a break or are grounded out. See test plan for checking.	Repair wires to wiring diagram.
	No TD signal from DME control unit. No ti signal from DMF control unit.	Check plug connection (X 8) and power supply lead to AEGS control unit.
Defect indicator comes on while driving.	Power supply between wires 5/19 and 35 insufficient (drops below 10 V). TD signal stops suddenly.	Repair wires to wiring diagram.
	Break in positive wires to solenoids.	Repair wires to wiring diagram.

Test Position 2

Solenoid Valves

a) Solenoid valve (Y 1) – 1st/2nd and 3rd/4th gears. — no → Wire to solenoid valve damaged/shorted. → Repair wire to wiring diagram.
Resistance test (M 06). Solenoid valve defective. Replace solenoid valve 24 34 851.
Measure resistance between wires 1 and 16.
Nominal value: 25 ... 46 ohms.
N o t e: Specified resistance values for solenoid valves and pressure regulator should be measured with a transmission oil temperature of about 20° C (68° F).

↓

Insulation test (M 06). — no → Wire to solenoid valve damaged/grounded out. → Repair wire to wiring diagram.
Measure resistance between wires 5/19 and 1/16. Solenoid valve grounded out. Replace solenoid valve 24 34 851.
Nominal value: > 500 k ohms.

↓

b) Solenoid valve (Y 2) – 2nd/3rd gears. — no → Wire to solenoid valve damaged/shorted. → Repair wire to wiring diagram.
Resistance test (M 06). Solenoid valve defective. Replace solenoid valve 24 34 851.
Measure resistance between wires 1 and 17.
Nominal value: 25 ... 46 ohms.

↓

Insulation test (M 06). — no → Wire to solenoid valve damaged/grounded out. → Repair wire to wiring diagram.
Measure resistance between wires 5/19 and 1/17.
Nominal resistance: > 500 k-ohms.

↓

c) Solenoid valve (Y 4) – reverse gear lock. — no → Wire to solenoid valve damaged/shorted. → Repair wire to wiring diagram.
Resistance test (M 06). Solenoid valve defective. Replace solenoid valve 24 34 851.
Plug pulled off of control unit.
Measure resistance between wires 1 and 20.
Nominal value: 25 ... 46 ohms.

Solenoid valve (Y 4) – reverse gear lock. — no → Wire to solenoid valve damaged/grounded out. → Repair wire to wiring diagram.
Insulation test (M 06). Solenoid valve grounded out. Replace solenoid valve 24 34 851.
Measure resistance between wires 5/19 and 1/20.
Nominal value: > 500 k-ohms.

d) Solenoid valve (Y 3) – conv. lockup clutch. — no → Wire to solenoid valve damaged/shorted. → Repair wire to wiring diagram.
Resistance test (M 06). Solenoid valve defective. Replace solenoid valve 24 34 851.
Measure resistance between wires 1 and 25.
Nominal value: approx. 25 ... 46 ohms.

Insulation test (M 06). — no → Wire to solenoid valve damaged/grounded out. → Repair wire to wiring diagram.
Measure resistance between wires 5/19 and 1/25. Solenoid valve grounded out. Replace solenoid valve 24 34 851.
Nominal value: > 500 k-ohms.

Test Position 3

Pressure regulator (Y 5). — no → Wire to pressure regulator damaged/shorted. → Repair wire to wiring diagram.
Resistance test (M 06). Pressure regulator defective. Replace pressure regulator 24 34 860.
Measure resistance between wires 1 and 22.
Nominal value: 1.8 ... 4.6 ohms.

Insulation test (M 06). — no → Wire to pressure regulator damaged/grounded → Repair wire to wiring diagram.
Measure resistance between wires 5/19 and 1/22. out.
Nominal value: > 500 k-ohms.

Test Position: 4

Program switch (S 2). — no → Wire to program switch damaged/shorted. → Repair wire to wiring diagram.
A magnet returns the program switch to position E — Program switch defective. — Replace program switch 61 31 265.
for each starting procedure.
Resistance test (M 06).
Measure resistance between wires 6 and 14.
Nominal values:
∞ ohms for switch pos. S or 3, 2, 1
0 ohms for switch pos. E

Direct current voltage (M 01). — no → Wire damaged. → Repair wire to wiring diagram.
Measure voltage between black and brown wires
(while starting).
Nominal value: > 8 V.

Test Position 5

Kickdown switch. — no → Wire to kickdown switch damaged/shorted. → Repair wire to wiring diagram.
Resistance test (M 06). — Kickdown switch defective. — Replace kickdown switch 35 41 480.
Measure resistance between wires 19 and 2.
R = ∞ ohms.
Accelerator pedal floored (kickdown).
R = approx. 0 ohm.

Test Position 6

Position switch (S 1). — no → Wire to position switch damaged/shorted. → Repair wire to wiring diagram.
Direct current voltage (M 01). — Position switch defective — Replace position switch.
Turn on ignition. — Display unit defective. — Replace display unit.
Switch off lights. — Fuse no. 9 defective. — Replace fuse.
Pertinent position lamp on. — Battery voltage too low. — Charge battery.
Measure voltage betw. wires 19 and 18 Pos. 1,
19 and 28 Pos. 2,
19 and 29 Pos. 3,
19 and 30 Pos. D,
19 and 4 Pos. N.
Nominal value in pertinent position: > 10 V.
All other positions: < 1 V.

Test Position 7

Pulse transmitter (Y 6).
Resistance test (M 06).
Measure resistance between wires 8 and 27.
Nominal value: 800 ohms ... 1.6 k-ohms.

no → Wire to pulse transmitter damaged/shorted. Pulse transmitter defective. → Repair wire to wiring diagram. Replace pulse transmitter 24 34 870.

↓

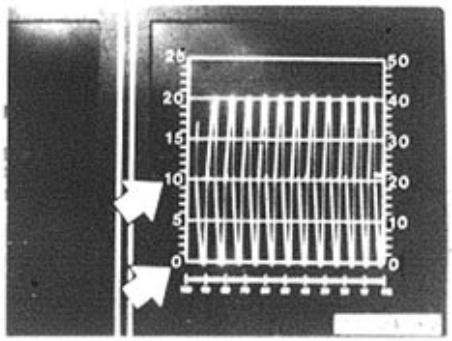
Insulation test (M 06).
Measure resistance between wires 5/19 and 8/27.
Nominal value: > 500 k-ohms.

no → Wire to pulse transmitter damaged/grounded out. Pulse transmitter grounded out. → Repair wire to wiring diagram. Replace pulse transmitter 24 34 870.

↓

Dynamic test (M 22).
Scope test.
Connect test lead between wires 8 and 27 (see operating instructions for BMW service tester).
Lift car.
It should be possible to turn rear wheels easily.
Start engine.
Select position D.
Speed approx. 30 km/h (25 mph).
All sine curves must be uniformly larger than 0 ... 10 (left screen scale).

no → Pulse transmitter defective. Wire to pulse transmitter damaged/grounded out. → Replace pulse transmitter 24 34 870. Repair wire to wiring diagram.



25 Gear shift mechanism

Shift layout – manual transmission

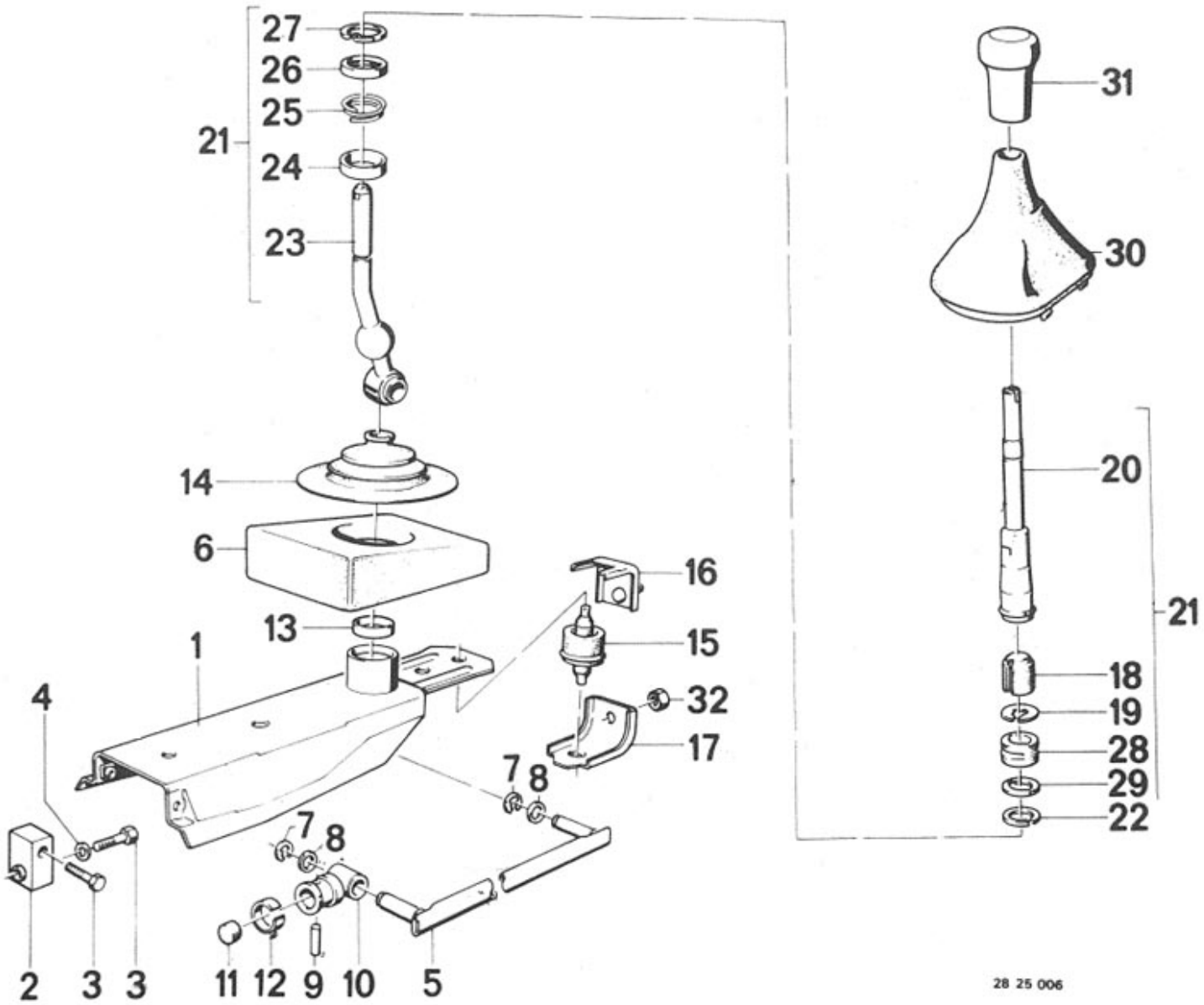
– Sheet metal shift console 25- 1
– Aluminum shift console 25- 2
25 11 000 Shift lever – remove and install
– Sheet metal shift console 25- 3
– Aluminum shift console 25- 4
003 Shift lever – disassemble and assemble
– Sheet metal shift console 25- 5
– Aluminum shift console 25- 5
081 Shift lever dust cover – replace 25- 6
111 Shift rod joint – replace 25- 6
210 Shift lever console – remove and install
– Sheet metal shift console 25- 7
– Aluminum shift console 25- 8

Shift layout – automatic transmission

– Version with shift rod 25- 9
– Version with cable 25- 10
25 16 050 Selector lever complete with base – remove and install
– Version with shift rod 25- 11
– Version with cable 25- 12
061 Selector lever handle – replace 25- 13
080 Selector lever – remove and install
– Version with shift rod 25- 14
– Version with cable 25- 15
202 Range selector lever cable – replace 25- 16

25-1

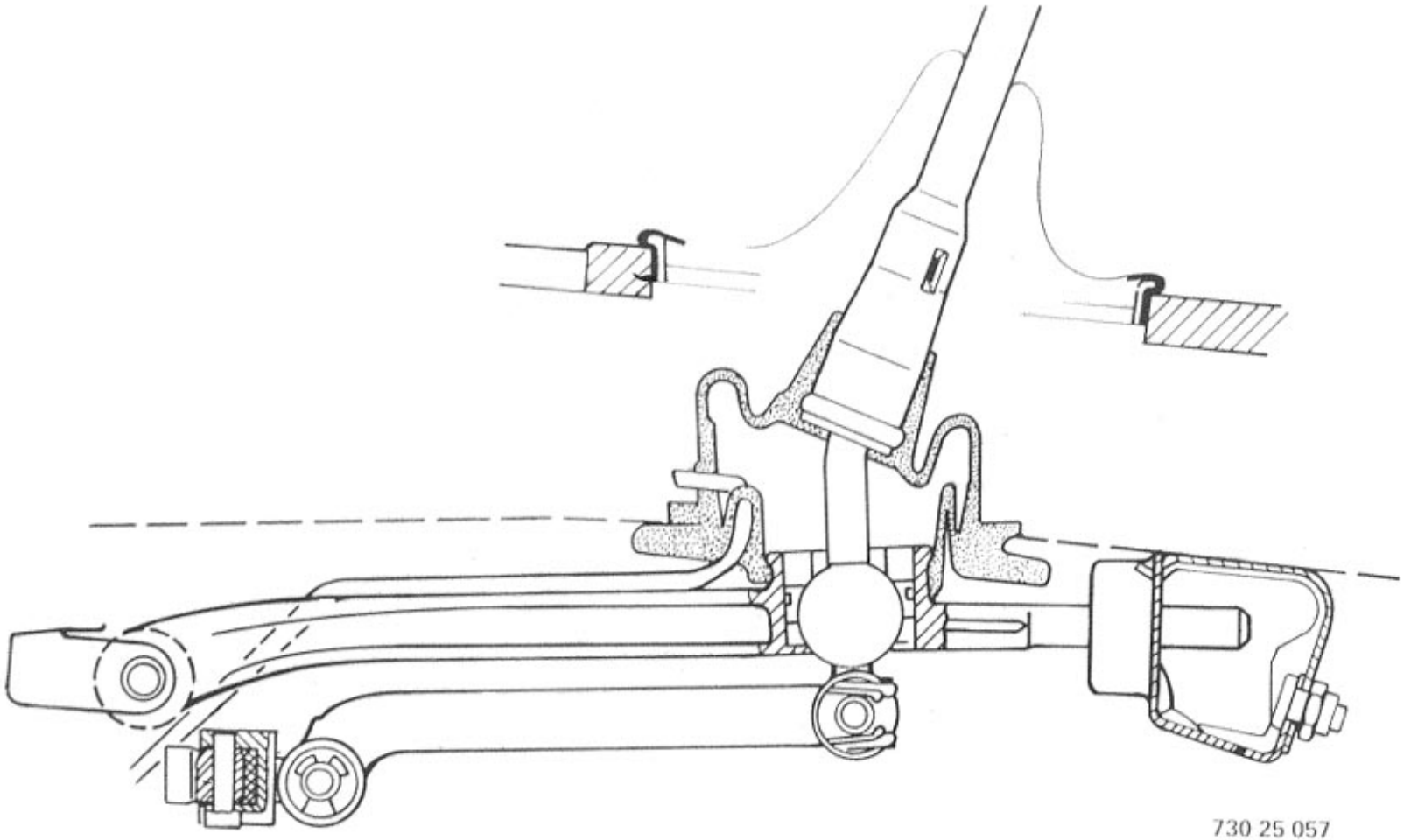
LAYOUT OF SHIFT FOR MANUAL TRANSMISSION
– Sheet Metal Shift Console –



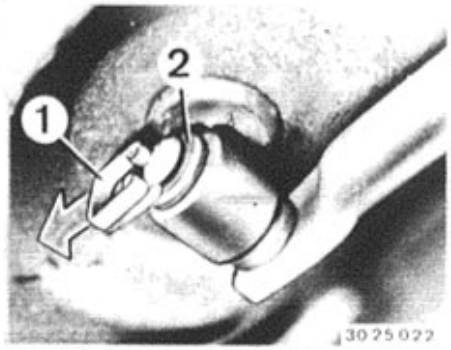
1 Shift arm
2 Console
3 Bolt
4 Washer
5 Selector rod
6 Damper
7 Circlip
8 Washer
9 Cylindrical pin
10 Selector rod joint
11 Lubricating felt
12 Spring sleeve
13 Lower ball plate
14 Rubber cover
15 Rubber mount
16 Holder
17 Holder
18 Cap
19 Lock washer
20 Shift lever upper section
21 Shift lever assembly
22 Circlip
23 Shift lever lower section
24 Upper ball plate
25 Spring
26 Spacer
27 Circlip
28 Rubber ring
29 Washer
30 Dust cover
31 Shift lever knob
32 Hexagon nut

25-2

LAYOUT OF SHIFT FOR MANUAL TRANSMISSION
– Aluminum Shift Console –



730 25 057



25 11 000 REMOVING AND INSTALLING SHIFT LEVER
– Sheet Metal Shift Console –

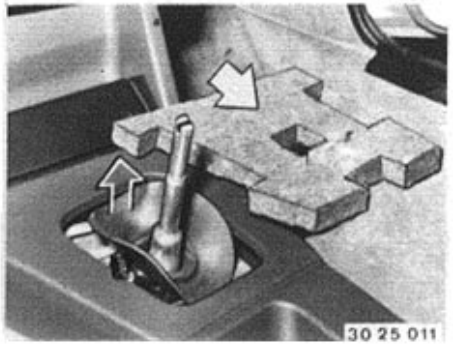
Lift out circlip (1).
Remove washer (2).
Pull out the shift rod.



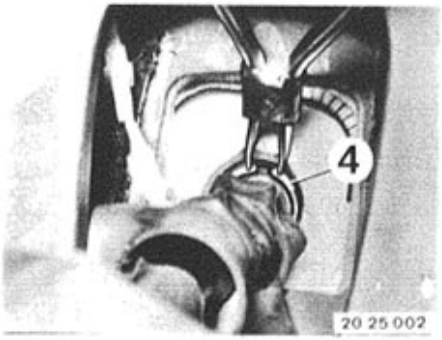
Pull off the shift lever knob.



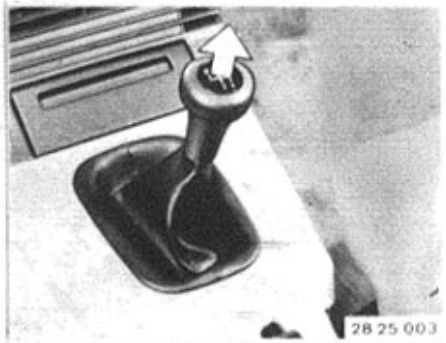
Lift off the dust cover.



Remove the felt insulation.
Pull out the sleeve between the body and shift console.



Lift out circlip (4)
Remove the shift lever.
Installation:
The shift lever is bent toward the rear.

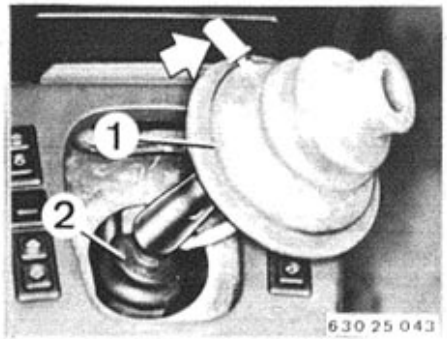


25 11 000 REMOVING AND INSTALLING SHIFT LEVER
– Aluminum Shift Console –

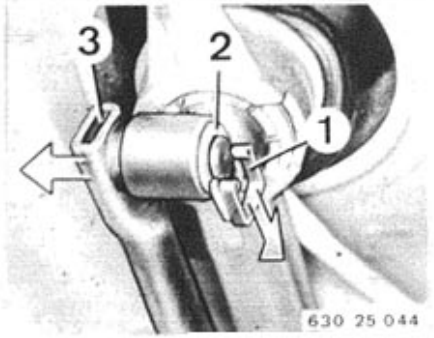
Pull off the shift lever knob.



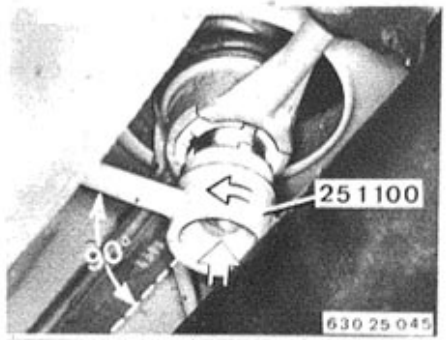
Lift out the dust cover.



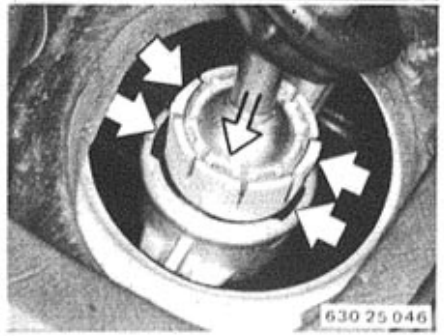
Remove the felt liner.
Disconnect the plug on the backup light lead.
Unsnap dust cover (1) on the body and pull it off of the shift lever.
Loosen dust cover (2) on the shift console.
Installation:
Check the dust covers and make sure of correct seating.



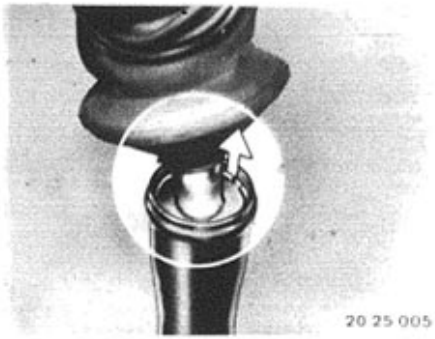
Lift out circlip (1).
Take off washer (2).
Pull out shift rod (3).



Apply Special Tool 25 1 100.
Turn it 90° anticlockwise.
Press the spherical plate upwards.
Remove the shift lever from above.

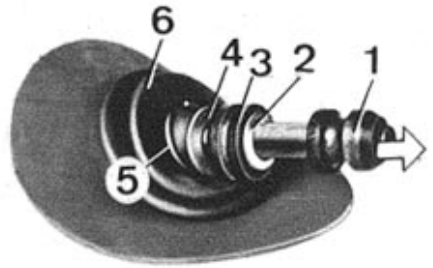


Installation:
Mount the spherical plate in such a manner that the tabs on the spherical plate are aligned with the openings in the shift console.
Press in the shift lever until the retaining tabs are heard to engage twice.

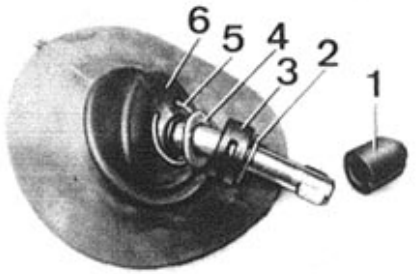


25 11 003 DISASSEMBLING AND ASSEMBLING SHIFT LEVER – Sheet Metal Shift Console –

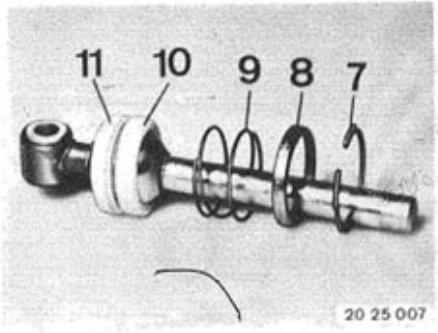
Remove the shift lever – see 25 11 000.
Lift out the snap ring.



Pull off the upper shift lever section.
Installation:
Check the installed position.



Pull off cap (1).
Remove circlip (2).
Take off rubber ring (3), washer (4), snap ring (5) and rubber part (6).

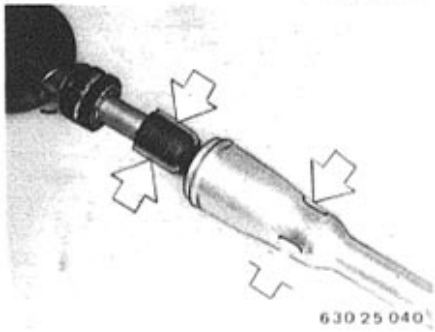


Circlip (7), spring retainer (8), spring (9), upper spherical plate (10) and lower (ribbed) spherical plate (11).
Installation:
Lubricate the spherical plates with Molykote Longterm 2.

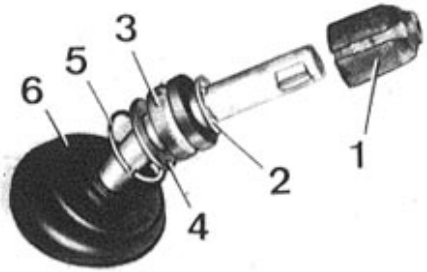


25 11 003 DISASSEMBLING AND ASSEMBLING SHIFT LEVER – Aluminum Shift Console –

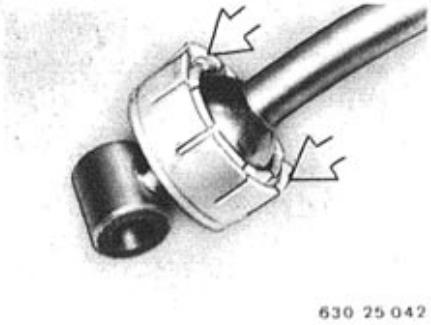
Remove the shift lever – see 25 11 000.
Lift out the snap ring.



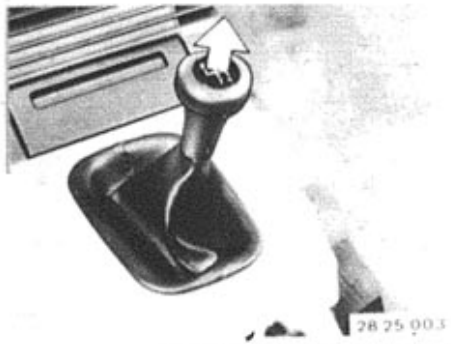
Pull off the upper shift lever section.
Installation:
Check the installed position.



Pull off cap (1).
Remove circlip (2).
Take off rubber ring (3), washer (4), snap ring (5) and rubber part (6).

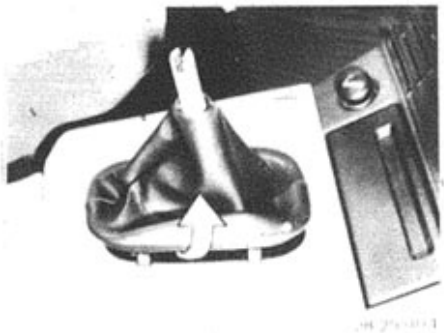


Press off the bearing shell downwards.
Installation:
Lubricate the bearing shell and ball with Molykote Longterm 2.

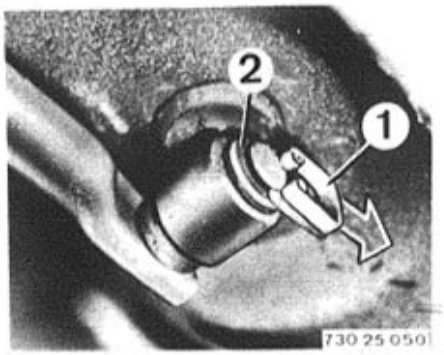


25 11 081 REPLACING DUST COVER FOR SHIFT LEVER

Pull off the shift lever knob.

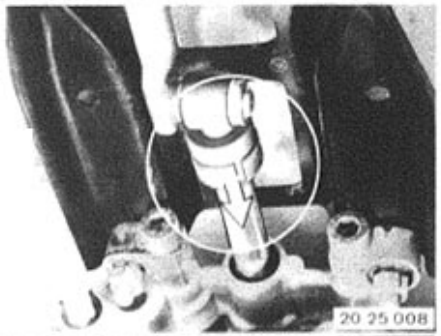


Lift out the dust cover.

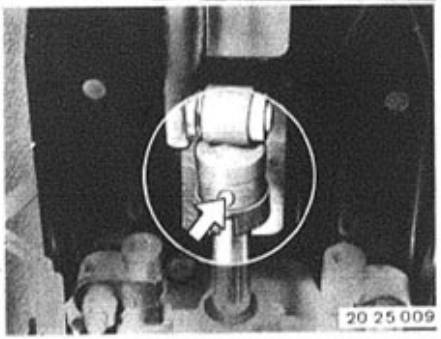


25 11 111 REPLACING SHIFT ROD JOINT

Transmission 260/5:
Unscrew the propeller shaft on the transmission – see 26 11 000:
Engage 5th gear.
Lift out circlip (1).
Take off washer (2).
Pull out shift rod (3).
Note:
Transmission 260/5 without Vibration Damper:
The shift rod is inserted from the left hand side as seen looking forward in car.
Transmission 260/5 with Vibration Damper or Transmission 265/5:
The shift rod is inserted from the right-hand side as seen looking forward in the car.



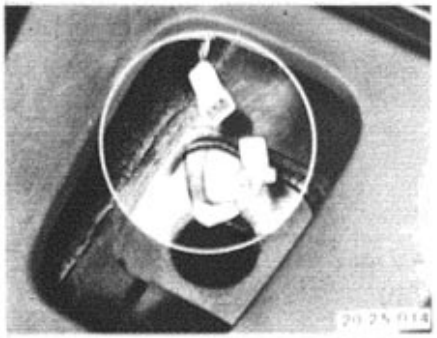
Push back the locking sleeve.



Drive out the pin.
Pull out the shift rod with joint.

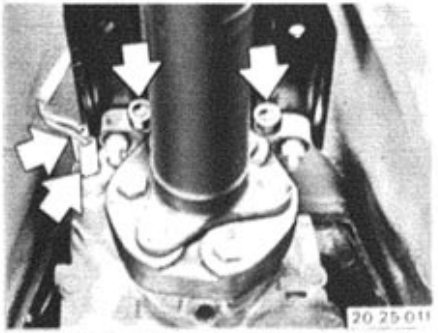


Installation:
Lubricate the bearing sleeve and shift rod joint with Molykote Longterm 2.
Note:
Transmission 260/5:
The bearing sleeve is offset to the right as seen looking forward in car.
Transmission 265/5 or 260/5 with Vibration Damper:
The bearing sleeve is offset to the left as seen looking forward in the car.

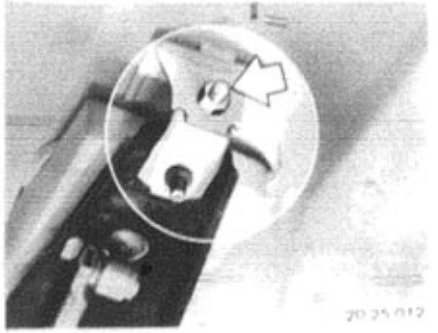


25 11 210 REMOVING AND INSTALLING SHIFT LEVER CONSOLE
– Sheet Metal Shift Console –

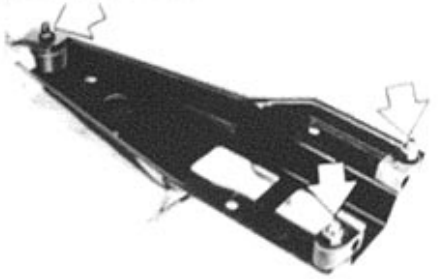
Remove the shift lever – see 25 11 000.
Disconnect the plug.



Pull off the backup light leads.
Unscrew the console mounting bolts.
Important!
Self-locking bolts – loosening these bolts will be difficult.
Installation:
Use new, micro-encased adhesive sealed bolts.
Tightening torque*.

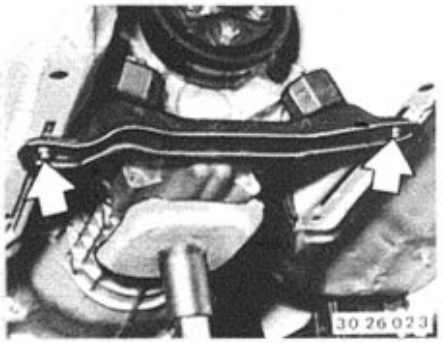


Unscrew the mounting bracket.
Installation:
First insert the shift lever to make installation of the rubber cover easier.



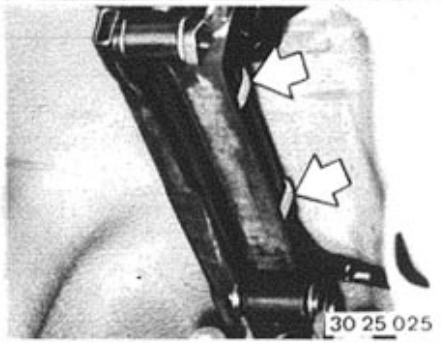
Remove the console.
Installation:
Check the rubber mounts, replacing if necessary.

* See Specifications

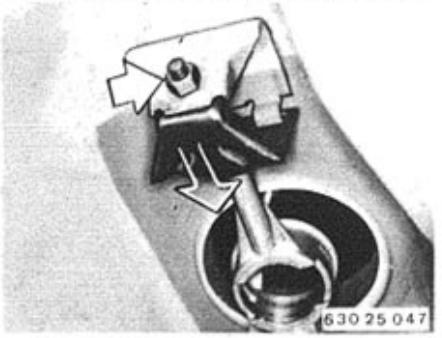


25 11 210 REMOVING AND INSTALLING SHIFT LEVER CONSOLE
– Aluminum Shift Console –

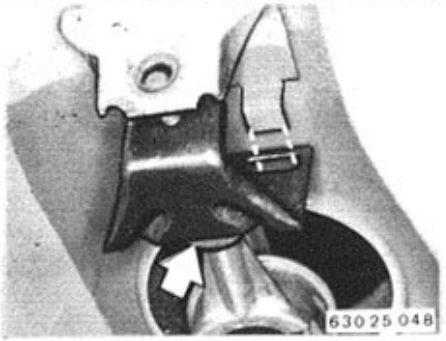
Unscrew the propeller shaft on the transmission see 26 11 000.
Remove the shift lever – see 25 11 000.
Support the transmission.
Unscrew the cross member.
Lower the transmission to the front axle carrier.



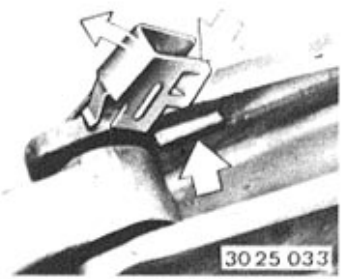
Take the backup light leads out of the holders.



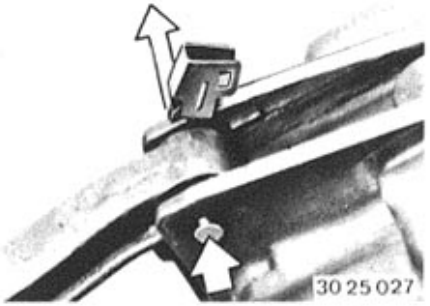
Unscrew the holder.



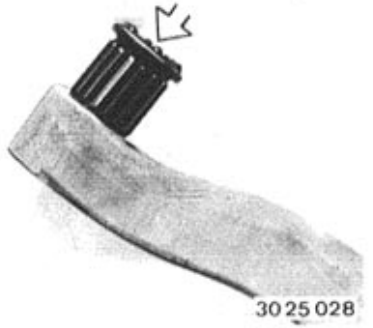
Installation:
Lubricate the support ring with Molykote Longterm 2.
Engage the holder in the retaining tabs.



Lift out the clip on the bearing shaft.
Note:
The clip is accessible with a screwdriver.
Turn to disengage the clip in the retaining tab and swing up.

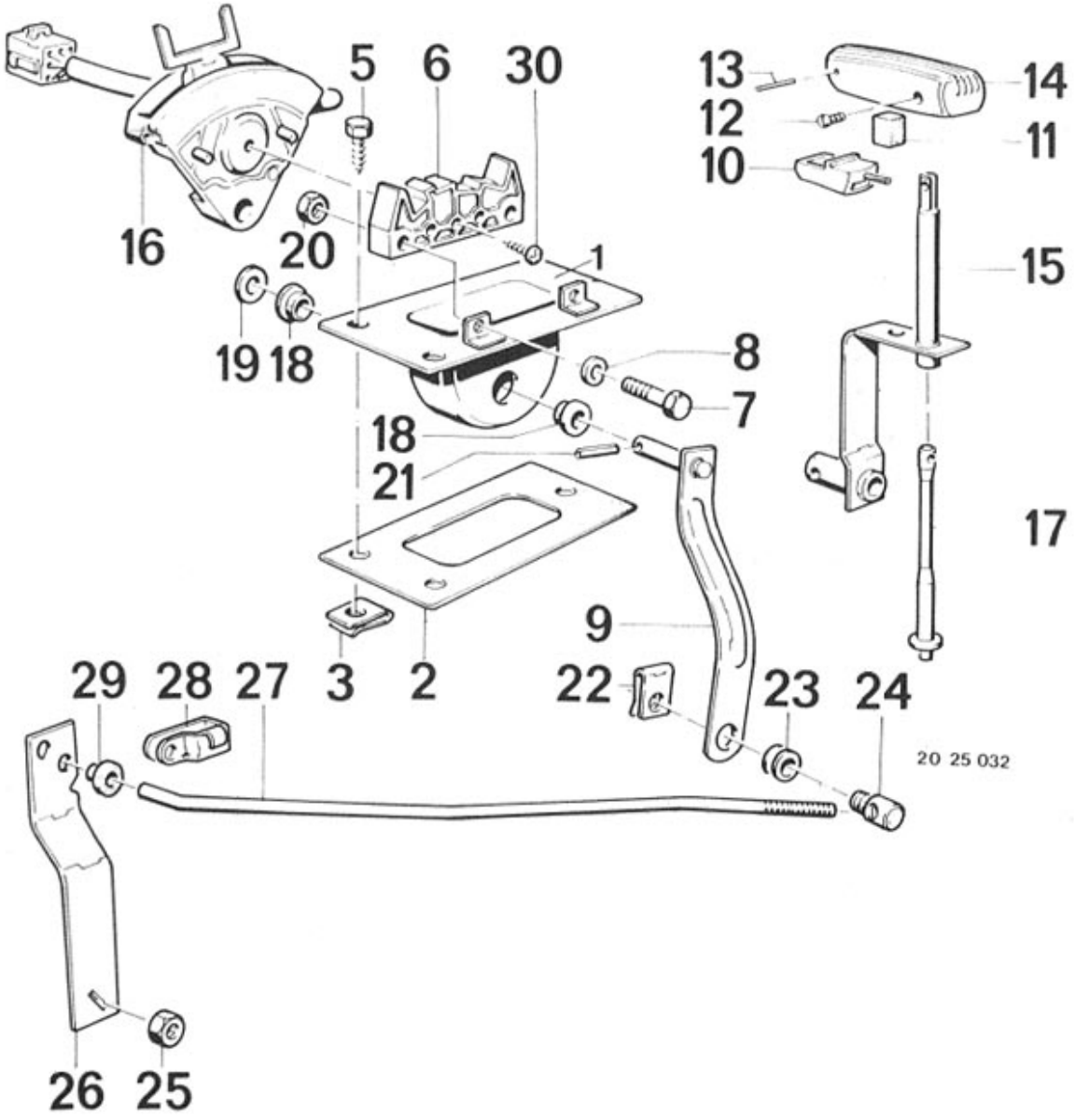


Pull out the bearing shaft.
Take off the shift console.



Lubricate the bearing sleeve with grease and press it into the new console.

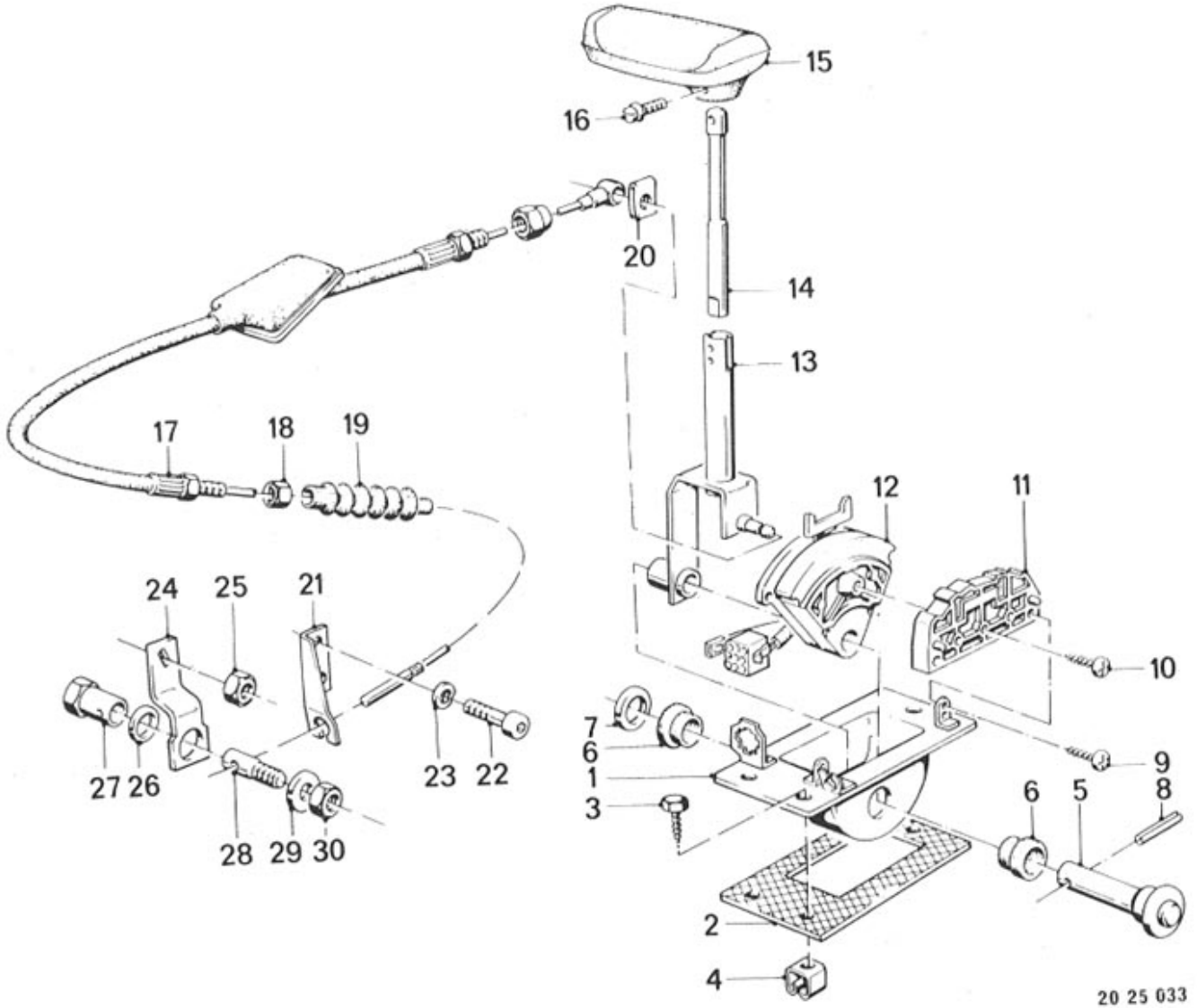
SHIFT LAYOUT DRAWING FOR AUTOMATIC TRANSMISSION
(Version with Selector Rod)



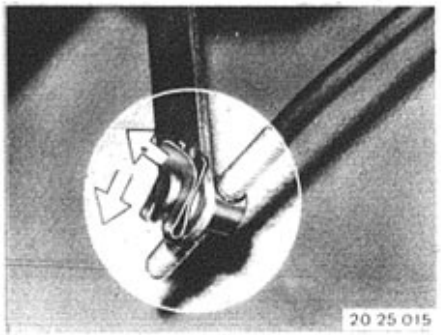
1 Base
2 Insulator
3 Self-tapping nut
5 Self-tapping screw
6 Shift gate
7 Bolt
8 Washer
9 Selector lever lower section
10 Push button
11 Spring element
12 Stud
13 Cyl. pin
14 Handle
15 Selector lever
16 Transmission switch
17 Pull rod
18 Bearing sleeve
19 Shim
20 Nut
21 Key
22 Retainer
23 Pivot sleeve
24 Shaft
25 Nut
26 Selector lever bar
27 Selector rod
28 Spring clip
29 Sleeve
30 Oval head screw

25 - 10

SHIFT LAYOUT DRAWING FOR AUTOMATIC TRANSMISSION
(Version with Cable)



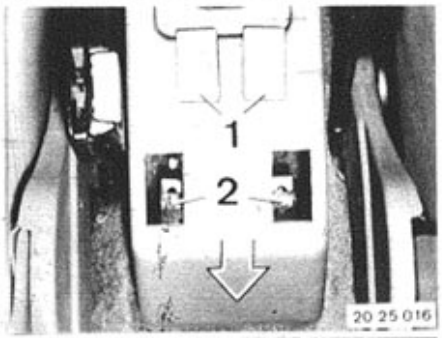
1 Base
2 Insulator
3 Self-tapping screw
4 Self-tapping nut
5 Shaft
6 Bearing sleeve
7 Shim
8 Pin
9 Self-tapping screw
10 Self-tapping screw
11 Shift gate
12 Transmission switch
13 Selector lever
14 Pull rod
15 Handle
16 Stud
17 Cable
18 Nut
19 Dust cover
20 Retainer
21 Bracket
22 Bolt
23 Washer
24 Transmission lever
25 Nut
26 Washer
27 Sleeve
28 Clamping bolt
29 Washer
30 Nut



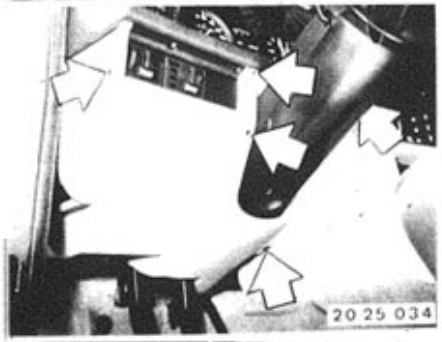
25 16 050 REMOVING AND INSTALLING SELECTOR LEVER COMPLETE WITH BASE

– Version with Shift Rod –

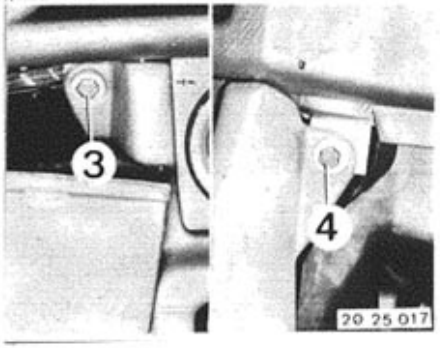
Disconnect the battery ground lead.
Lift out the retainer.
Disconnect the shift rod.
Installation:
Adjust the shift rod – see 24 00 004.



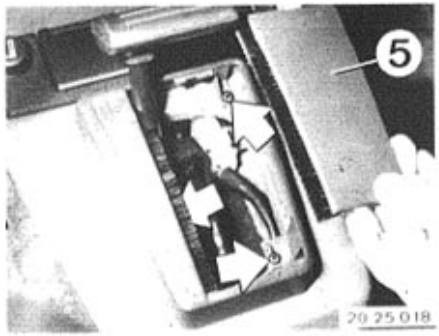
Lift out caps (1).
Loosen bolts (2) and push back the console.



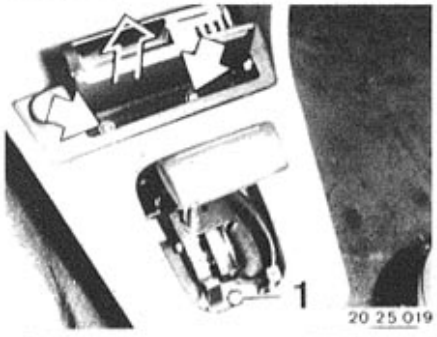
Unscrew the trim panel.



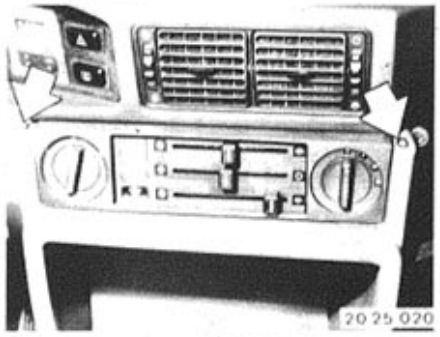
Unscrew the trim panel on the left side.
Remove bolt (3).
Open the glove box.
Remove bolt (4).



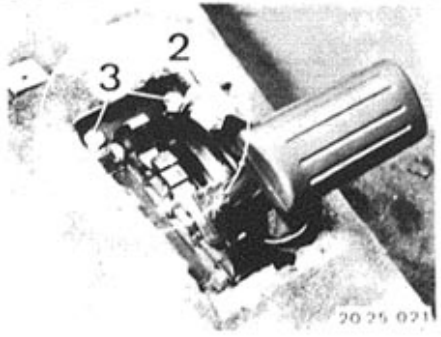
Lift out cover (5).
Take off the mask.



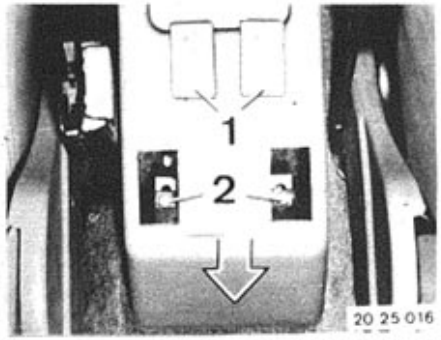
Lift out the ashtray.
Unscrew the ashtray insert.
Remove bolt (1).
Installation:
Connect the leads.



Pull back the console.
Unscrew the heater controls.
Remove the console completely.
Cars with Radio:
Pull off all plugs on the radio and speaker balance control.



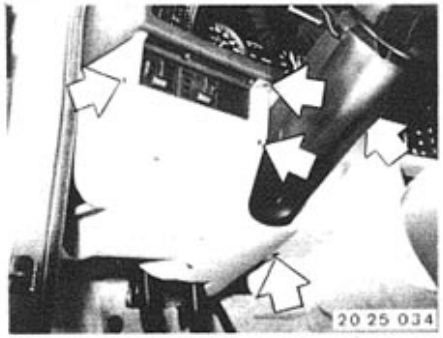
Disconnect plug (2).
Remove bolts (3).
Remove the base.
Installation:
Check the insulating plate between the body and base, replacing if necessary.



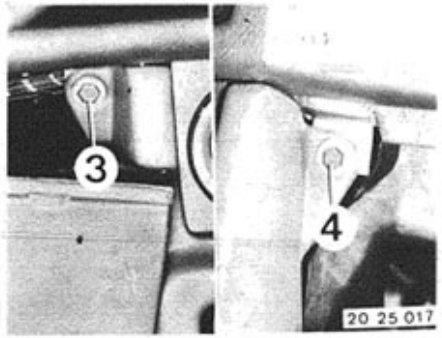
25 16 050 REMOVING AND INSTALLING SELECTOR LEVER COMPLETE WITH BASE

– Version with Cable –

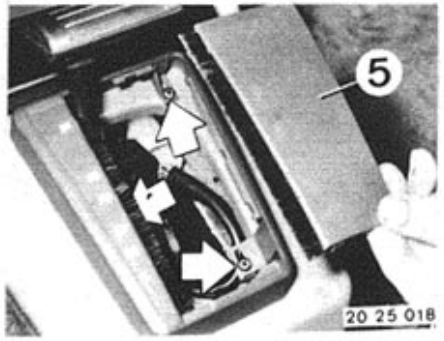
Disconnect the battery ground lead.
Lift out caps (1).
Loosen bolts (2) and push back the console.



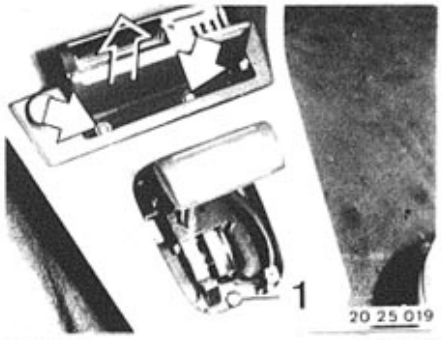
Unscrew the trim panel.



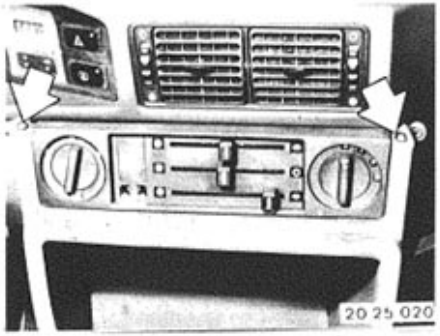
Unscrew the trim panel on the left side.
Remove bolt (3).
Open the glove box.
Remove bolt (4).



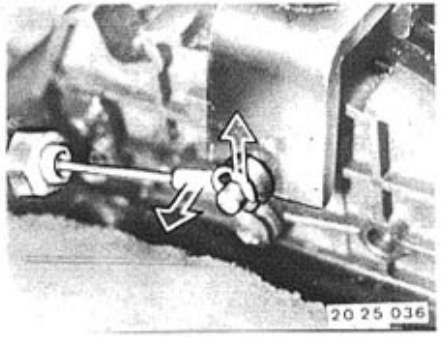
Lift out cover (5).
Take off the mask.



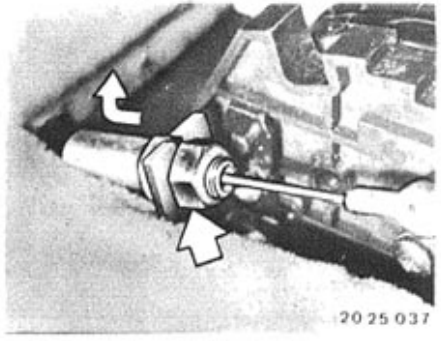
Lift out the ashtray.
Unscrew the ashtray insert.
Remove bolt (1).
Installation:
Connect the leads.



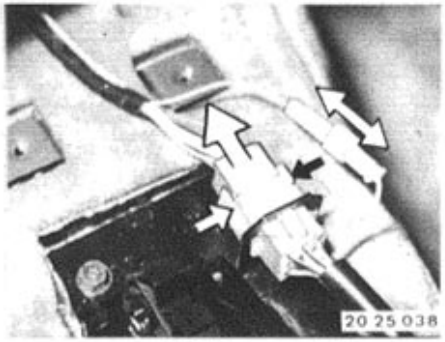
Pull back the console.
Unscrew the heater controls.
Remove the console completely.
Cars with Radio:
Pull off all plugs on the radio and speaker balance control.



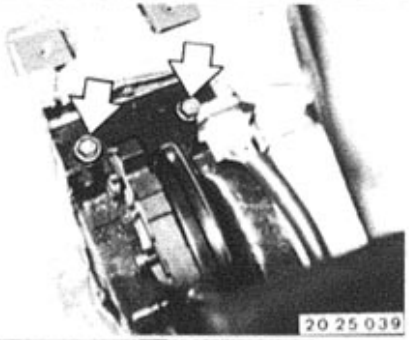
Lift out the retainer.
Unscrew the eye on the shaft.
Important!
Don't bend the steel cable.



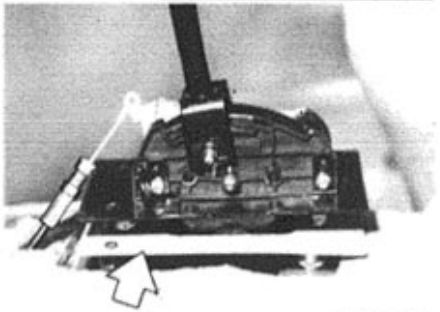
Unscrew the nut.
Disengage the cable sleeve in the holder.



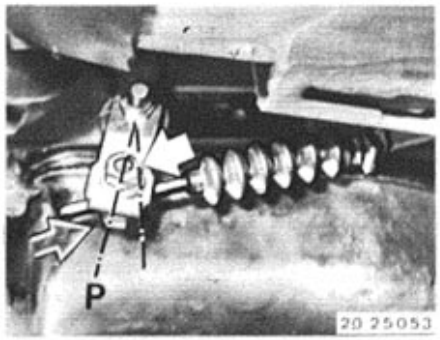
Disconnect plugs.



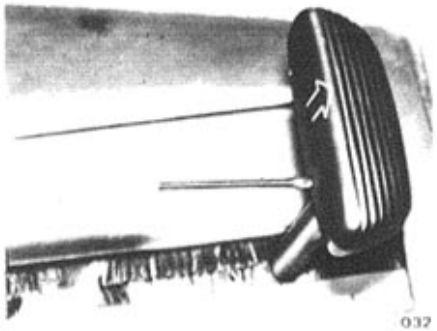
Unscrew the bolts.
Remove the base.



Installation:
Insert the insulating plate.



Installation:
Adjust the cable.
Selector lever in "P" (most forward position).
Transmission lever in "P" (most forward position).
Press the cable pull rod opposite the forward direction.
Clamp the cable pull rod without tension.
Important!
Torque: 10 to 12 Nm (7.5 to 8.5 ft. lbs.).
Don't bend the cable.



25 16 061 REPLACING HANDLE FOR SELECTOR LEVER

Move the selector lever to 1 or 2.
Unscrew clamping bolt.
Pull off the handle.



Installation:
Guide the pin of the button into the pull rod hole.

25 16 080 REMOVING AND INSTALLING SELECTOR LEVER

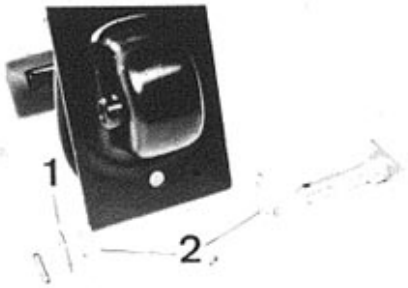
Version with Selector Rod:

Remove selector lever and base assembly 25 16 050.
Drive out pin.



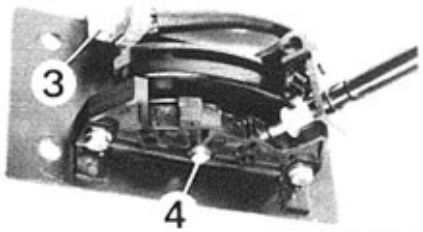
20 25 023

Pull out selector lever lower section.
Remove washer (1) and bearing sleeves (2).
Installation:
Check bearing sleeves, replacing and installing with Molykote Longterm 2 if necessary.



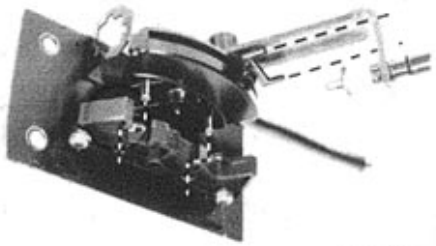
20 25 024

Pull off plug (3).
Unscrew screw (4).
Remove transmission switch together with selector lever upper section.



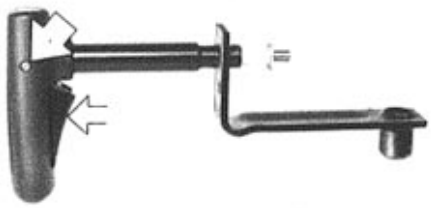
20 25 025

Installation:
Check installed position of transmission switch and drive dog.



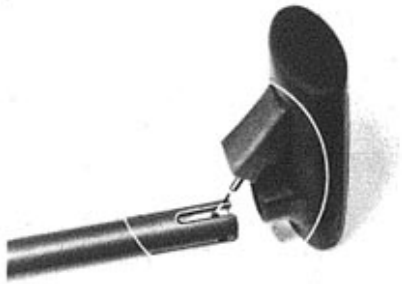
20 25 026

Unscrew screw on handle.
Pull off handle.



20 25 027

Installation:
Guide pin of button into pull rod hole.



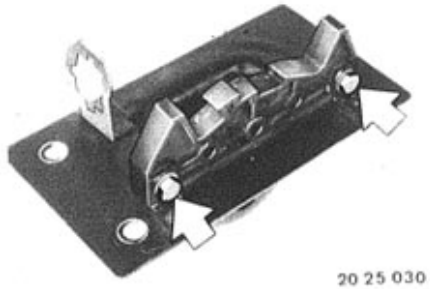
20 25 028

Take pull rod out of selector lever upper section.

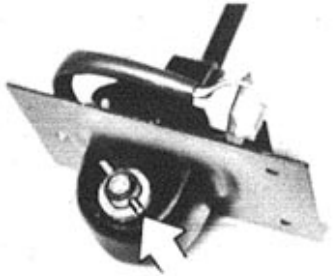


20 25 029

Installation:
Check shift gate, replacing if necessary.



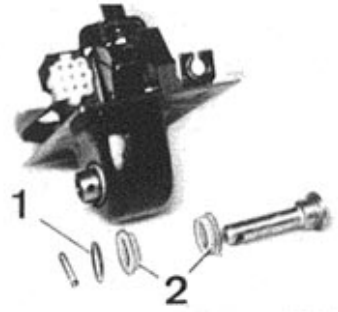
20 25 030



20 25 041

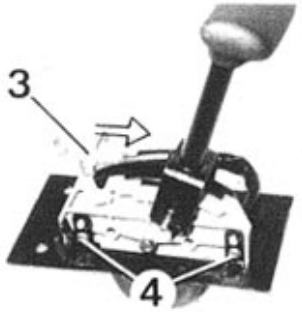
25 16 080 REMOVING AND INSTALLING SELECTOR LEVER
Version with Cable

Remove the selector lever complete with base – see 25 16 050.
Drive out the pin.



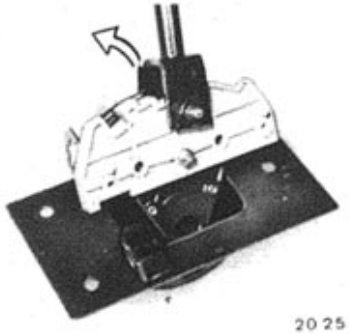
20 25 042

Pull out the shaft.
Take off washer (1).
Pull the bearing sleeves (2) out of the housing.
Installation:
Replace the bearing sleeves.



20 25 043

Pull off plug ( ).
Unscrew bolts (4).
Remove the transmission switch together with the upper selector lever section.



20 25 044

Tilt out the selector lever together with the transmission switch and shift gate.
Installation:
Pivot fork of the transmission switch engages over the selector lever.



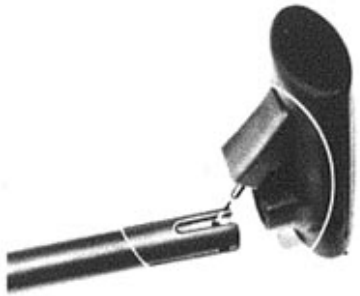
20 25 045

Unscrew the shift gate on the transmission switch.
Installation:
Make sure that the pins on the transmission switch engage in the bores of the shift gate.



20 25 046

Unscrew screw on the handle.
Pull off the handle.
Installation:
Check position of the handle to the selector lever.



20 25 028

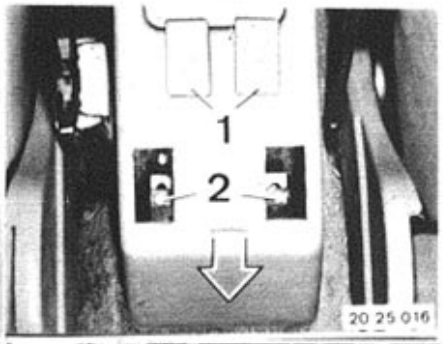
Installation:
Guide pin of button into the pull rod hole.



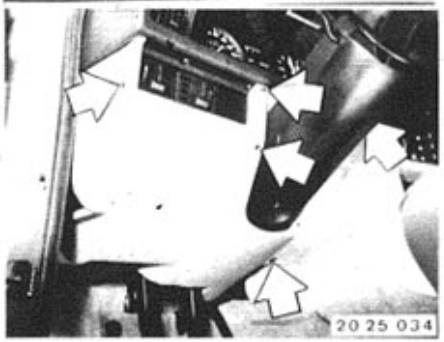
20 25 029

Take the pull rod out of the upper selector lever section.

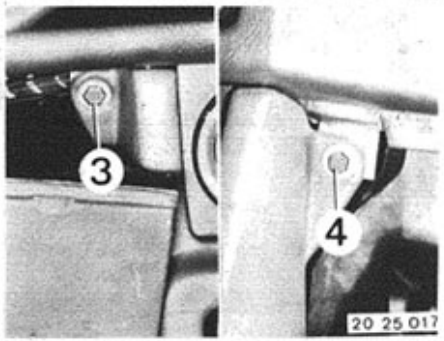
25 16 202 REPLACING CABLE FOR GEAR RANGE SELECTOR LEVER



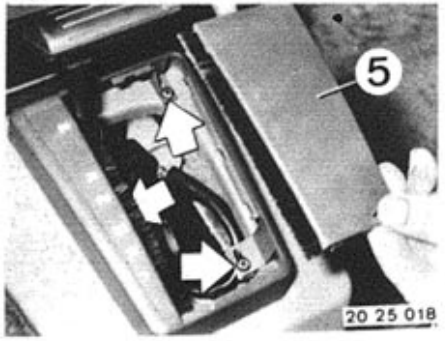
Disconnect battery ground lead.
Lift off caps (1).
Loosen screws (2) and push back console.



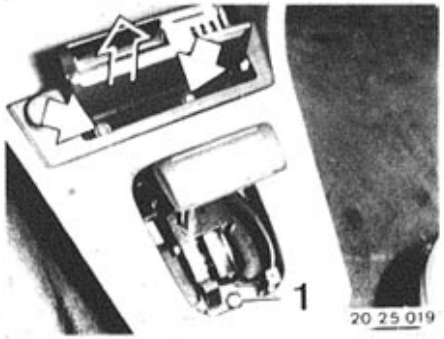
Unscrew trim panel.



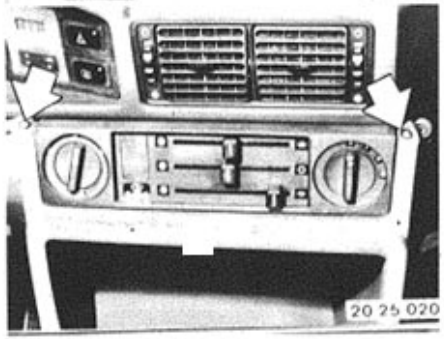
Unscrew left trim panel.
Remove screw (3).
Open glove box.
Remove screw (4).



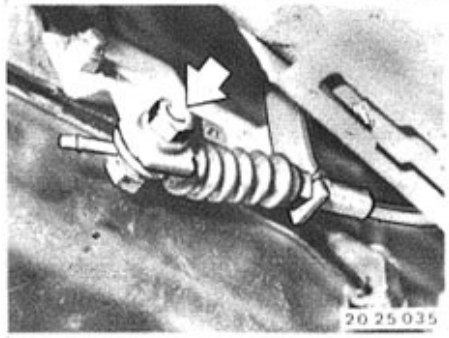
Take off cover (5).
Disconnect mask.



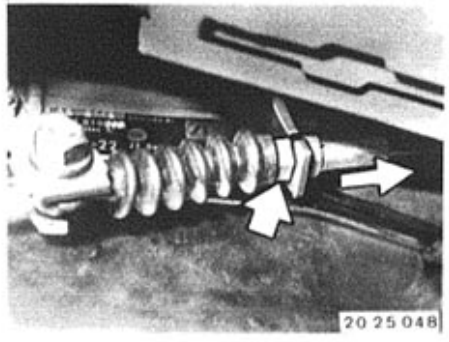
Lift out ashtray.
Unscrew ashtray insert.
Remove screw (1).
Installation:
Connect wire.



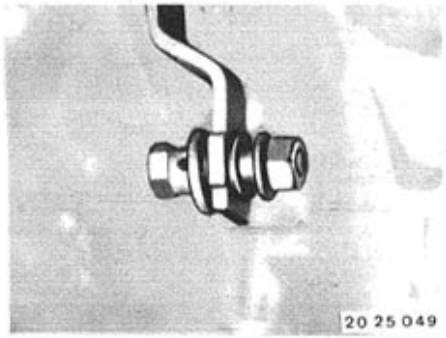
Pull back console.
Unscrew heater controls.
Take out console completely.
Cars with Radio:
Pull off all plugs on radio and speaker balance control.



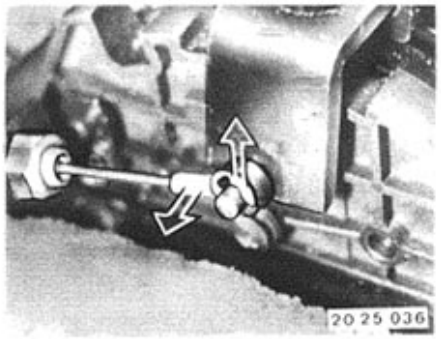
Loosen nut.
Important!
Don't bend the steel cable.



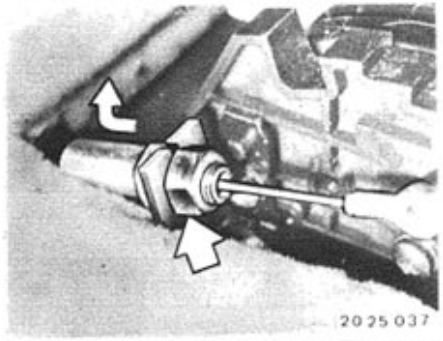
Unscrew nut.
Push back cable sleeve and disconnect in holder.
Pull cable out of operating lever.



Installation:
Check arrangement of washers.
Check rubber mount, replacing if necessary.



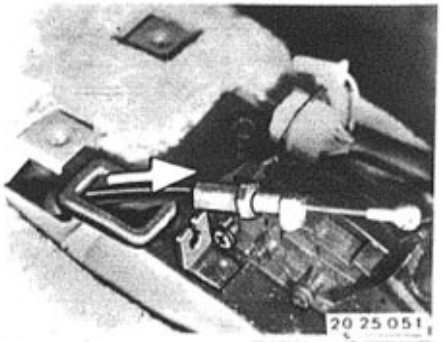
Lift out retainer.
Unscrew eye on pin.
Important!
Don't bend the steel cable.



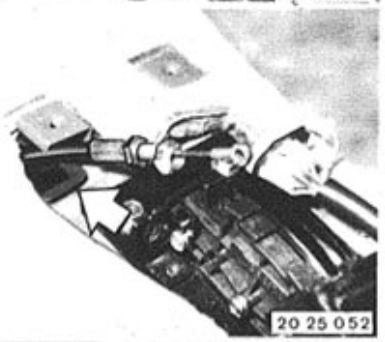
Unscrew nut.
Disconnect cable sleeve in bracket.



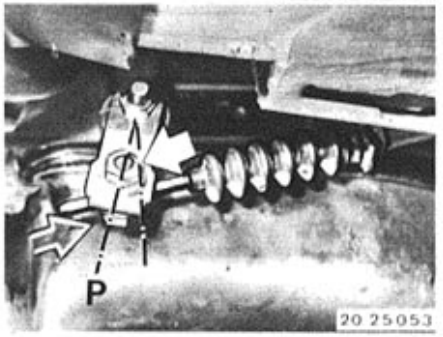
Cut and fold in carpet.



Pull out rubber grommet with cable.



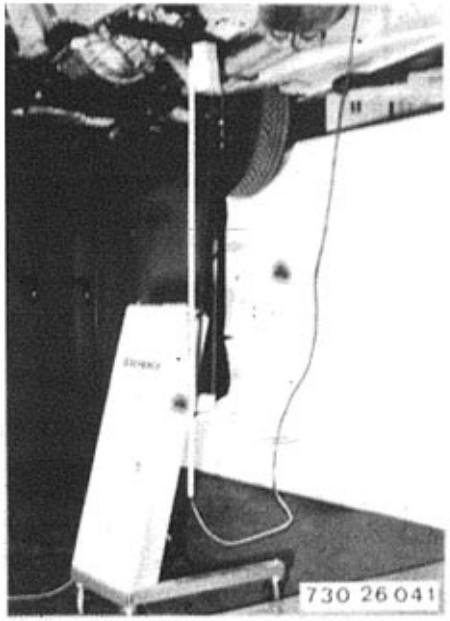
Installation:
Guide in cable from above.
Knock in rubber grommet.
Note:
Recheck seating of rubber grommet before final installation of cable.



Installation:
Adjust cable.
Selector lever in "P" (far forward position).
Transm. lever in "P" (far forward position).
Push cable pull rod against forward direction.
Tighten cable pull rod without tension.
Important!
Tightening torque: 10 to 12 Nm (7 to 8.5 ft. lbs.).
Don't bend the steel cable.

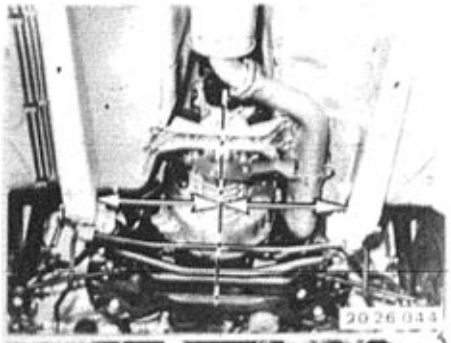
26 Propeller shaft

	Propeller shaft vibration and noise – eliminate	26- 1
26 11 000	Propeller shaft – remove and install	
	– Version with front coupling or universal joint	26- 3
	– Version with front constant velocity joint	26- 5
051	Front rubber coupling – replace	26- 7
160	Constant velocity joint – replace	26- 9
501	Front center – replace (propeller shaft removed)	26- 11
26 12 001	Propeller shaft center mount assembly – replace	
	– Version with slide	26- 12
	– Version without slide	26- 13
	Propeller shaft – troubleshoot	26- 14

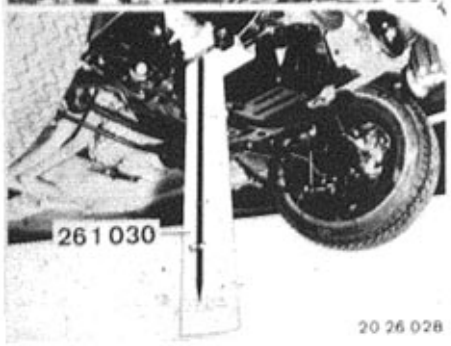


ELIMINATING PROPELLER SHAFT VIBRATION AND NOISE

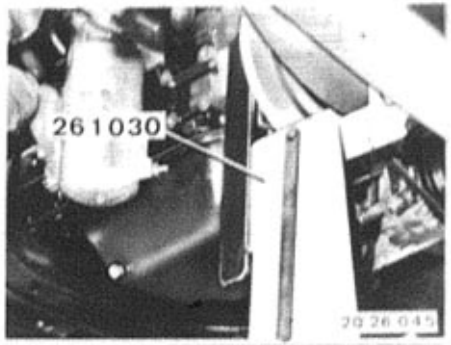
Vibration or Drumming:
Requirements:
Propeller shaft in perfect optical condition. Balance propeller shaft, if balance plates are missing or there is suspicion of imbalance (see instructions supplied with balancing machine).



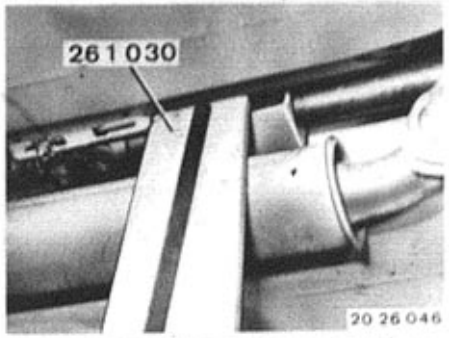
Aligning Propeller Shaft To Eliminate Vibration or Drumming:
Center transmission with measuring tape.



Checking/Correcting Deflection Angle of Joints:
Place Special Tool 26 1 030 on oil pan flange and measure angle of engine inclination.
Note:
When correcting deflection angle by installing shims, remember that this will change the deflection angle of neighboring joints.

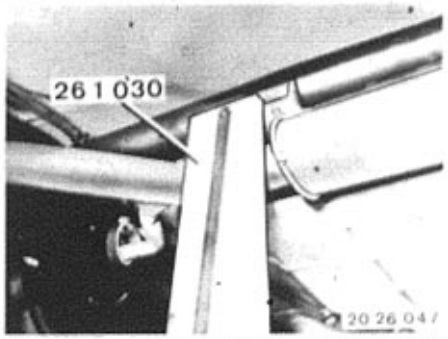


Oil Pan Flange Not Accessible:
Apply Special Tool 26 1 030 with a helping rail (steel ruler) and measure angle of engine inclination.
Note:
When correcting deflection angle by installing shims, remember that this will change the deflection angle of neighboring joints.

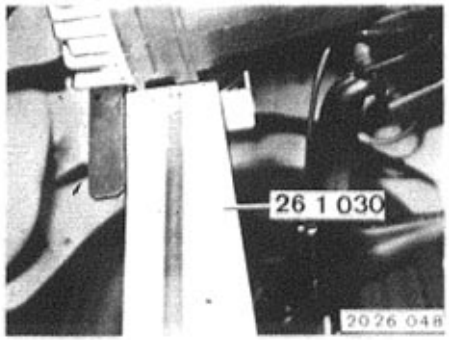


Place special tool gauge on propeller shaft front section and measure angle.
Determine deflection angle* of coupling and, if necessary, correct by installing max. 3 mm (0.118") thick shims on transmission suspension or on center mount.
Example:

Engine angle	2° 16'
Propeller shaft angle	− 2° 06'
Coupling deflection angle	0° 10'



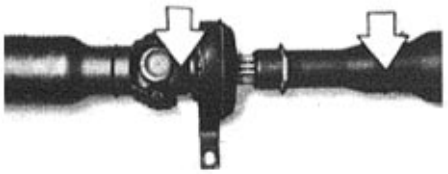
Place gauge on propeller shaft rear section and measure angle.
Determine deflection angle* of center mount and correct by installing max. 3 mm (0.118") shims on transmission suspension or on center mount if necessary.



Place gauge on final drive together with helping rail (steel ruler) and measure angle.
Determine deflection angle* of universal joint and correct by installing max. 3 mm (0.118") shims on center mount if necessary.

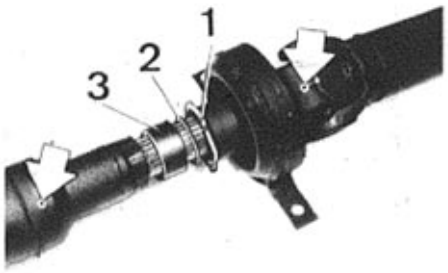
* See Specifications

Hard Moving Slide:



730 26 031

Note:
The propeller shaft was balanced in assembled state and must not be turned in the slide.
Punch mark an unmarked propeller shaft.



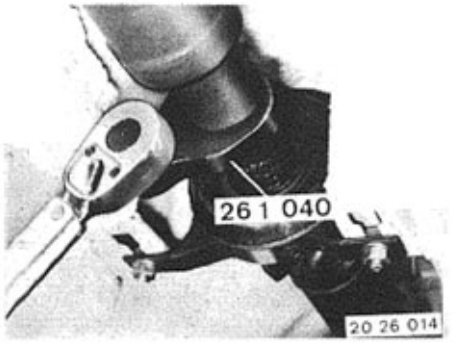
20 26 015

Take off screw-on sleeve (1), washer (2) and rubber ring (3).
Inspect the rubber ring, replacing if necessary.
Disconnect the propeller shaft on the slide.
Clean the keyway and lubricate with Molykote Longterm 2**.
Assemble the propeller shaft that the punch marks are aligned.



30 26 025

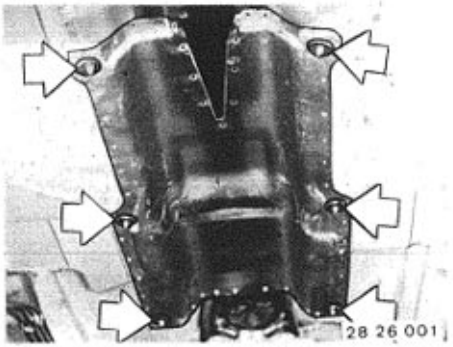
Note:
The propeller shaft sections are mounted in such a manner, that the universal joints are in one plane.
If the slide has been disassembled without marking, only 180° wrong installation is possible because of balancing.



20 26 014

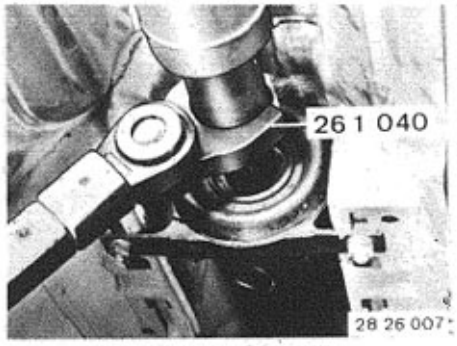
After Finishing Installation:
Tighten the screw-on sleeve with Special Tool 26 1 040.
Tightening torque*.

* See Specifications
** Source: HWB



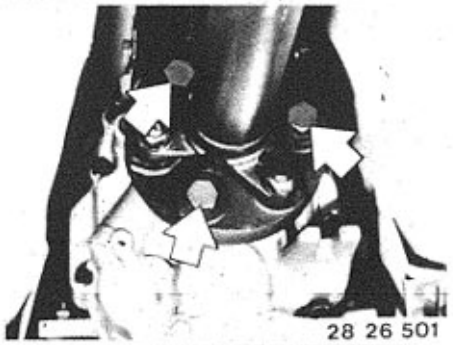
26 11 000 REMOVING AND INSTALLING PROPELLER SHAFT

Remove the exhaust assembly – see 18 00 020.
Unscrew the heat shield.

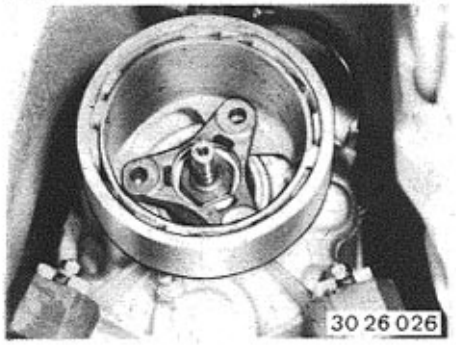


Version with Front Coupling or Universal Joint:

Loosen the screw-on sleeve several turns with Special Tool 26 1 040.
Installation:
Tighten the screw-on sleeve with Special Tool 26 1 040 after finishing installation.
Tightening torque*.



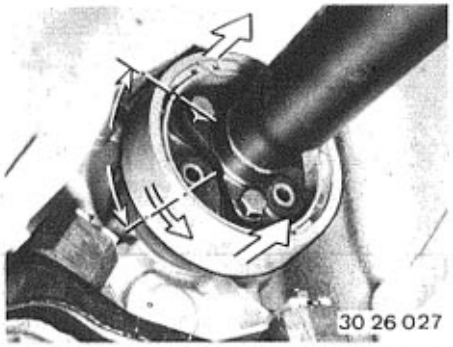
Unscrew the propeller shaft on the transmission.



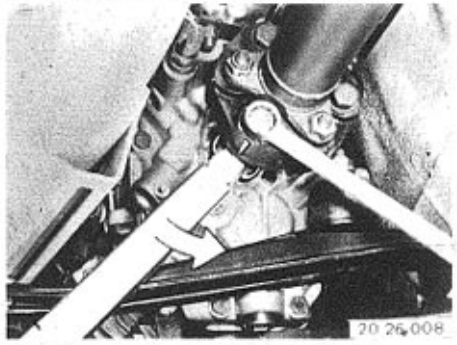
Version with Bolted Vibration Damper:

The vibration damper is mounted on the transmission end output flange.

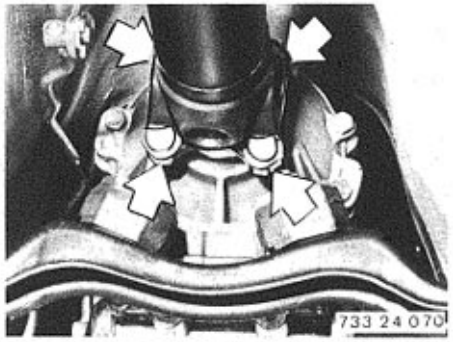
* See Specifications



Unscrew the propeller shaft on the transmission.
Turn the vibration damper 60° and place it on the rubber coupling.
The vibration damper is removed together with the propeller shaft.

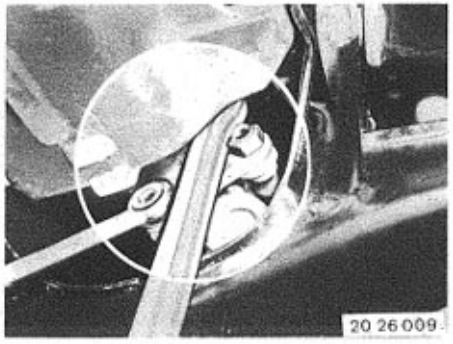


Installation:
Replace the stop nuts.
Tightening torque*.
Important!
Only tighten the nuts or bolts on the flange end to avoid tension in the coupling.
If necessary, loosen and adjust the cross member.



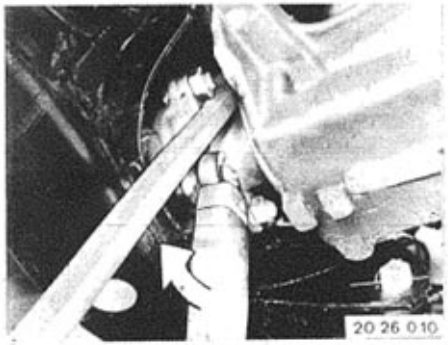
Version with Front Universal Joint:

Unscrew the propeller shaft on the transmission.
Installation:
Replace the stop nuts.
If necessary, adjust the cross member.
Tighten the nuts with a torque wrench.
Tightening torque*.

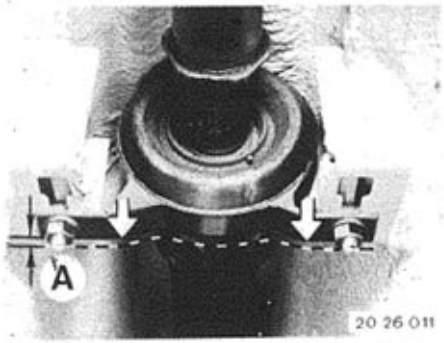


Unscrew the propeller shaft on the final drive.

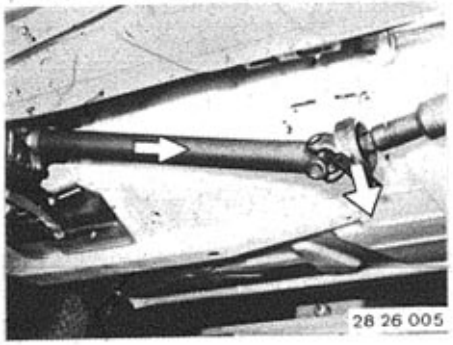
* See Specifications



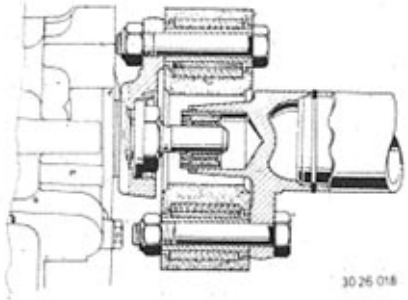
Installation:
Replace the stop nuts.
Tightening torque*.



Unscrew the center mount.
Installation:
Preload the center mount in forward direction
A = 4 to 6 mm (0.157 to 0.236").

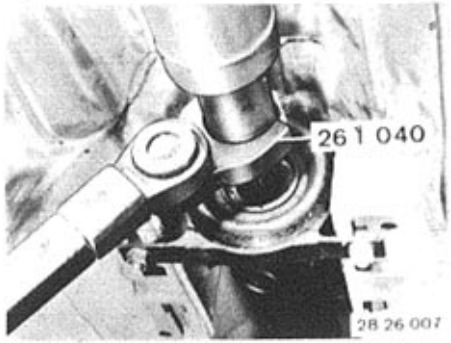


Bend down the propeller shaft and pull it out of the centering pin on the transmission.
Installation:
The propeller shaft was balanced in assembled state and may only be replaced complete.
Check center, lubricating with Molykote Longterm 2 if necessary.
Replace a damaged center.



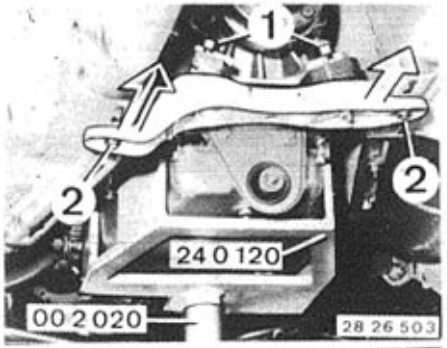
Installation:
Check the center, lubricating with Molykote Longterm 2 if necessary.
Replace a damaged center.

* See Specifications



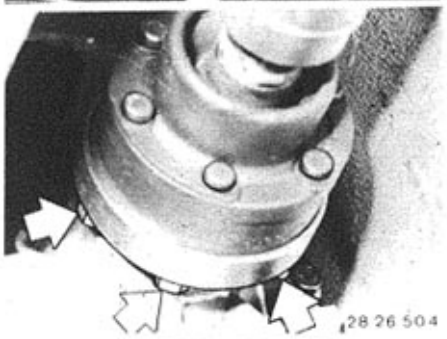
Installation:
Tighten the screw-on sleeve with Special Tool 26 1 040 after finishing installation.
Tightening torque*.

* See Specifications

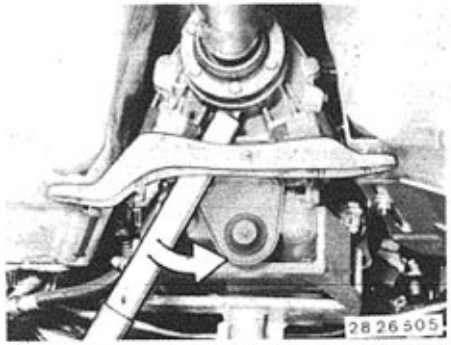


Version with Constant Velocity Joint:

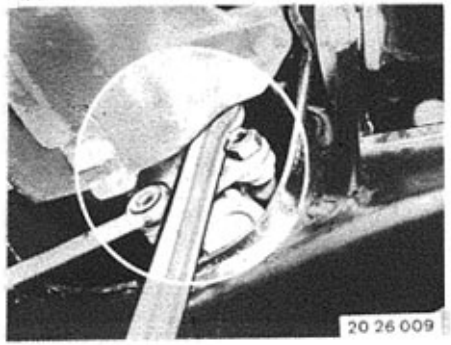
Support the transmission with Special Tools 24 0 120 and 00 2 020.
Remove the nuts and washer (1).
Loosen nuts (2).
Push back the transmission carrier.
Installation:
Tightening torque*.



Unscrew the nuts.

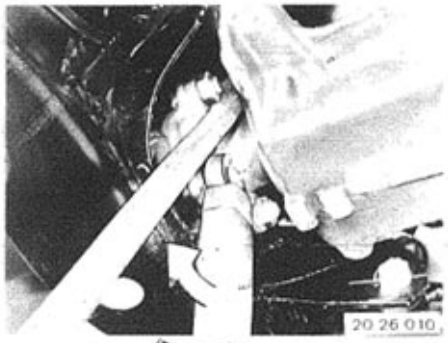


Installation:
Replace the stop nuts.
Tightening torque*.



Unscrew the propeller shaft on the final drive.

* See Specifications

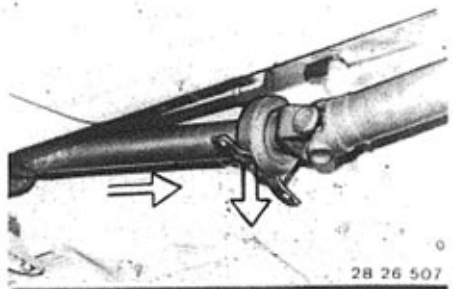


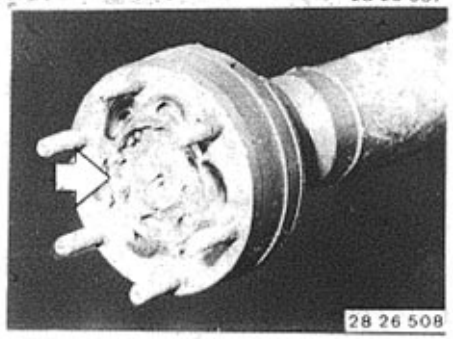
Installation:
Replace the stop nuts.
Tightening torque*.



Unscrew the center mount.
Installation:
Preload the center mount forward by distance A = 4 to 5 mm (0.157 to 0.197").

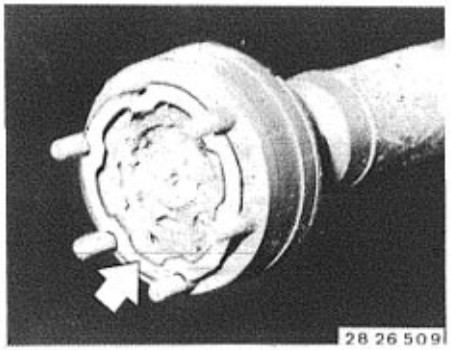
Bend the propeller shaft down and pull it out of the transmission flange.



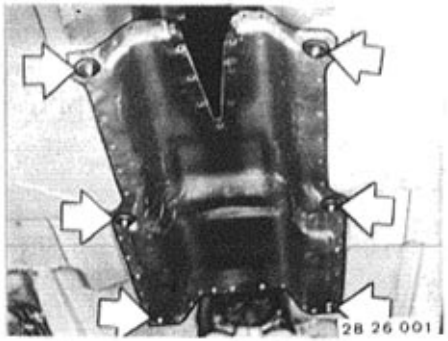


Important!
The constant velocity joint is not enclosed. Cover the constant velocity joint or use the transportation cap.

* See Specifications

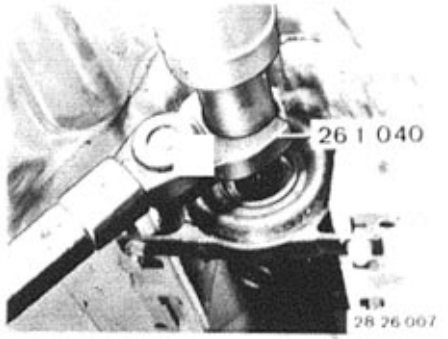


Installation:
Use the gasket between the constant velocity joint and transmission flange.

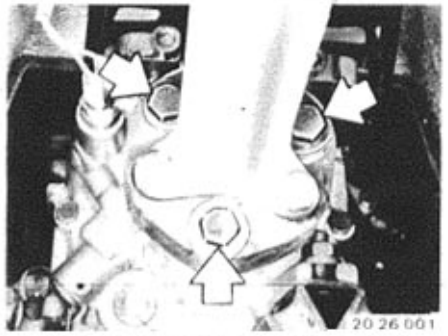


26 11 051 REPLACING FRONT RUBBER COUPLING FOR PROPELLER SHAFT

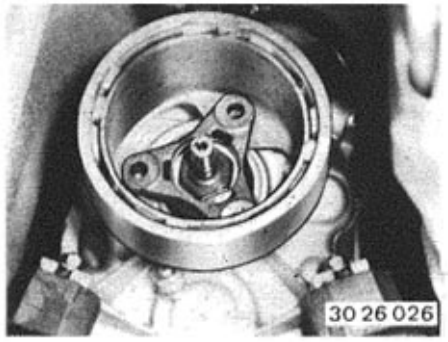
Remove the exhaust assembly – see 18 00 020.
If applicable, unscrew the heat shield.



Loosen the screw-on sleeve several turns with Special Tool 26 1 040.
Installation:
Tighten the screw-on sleeve with Special Tool 26 1 040 after finishing installation.
Tightening torque*.

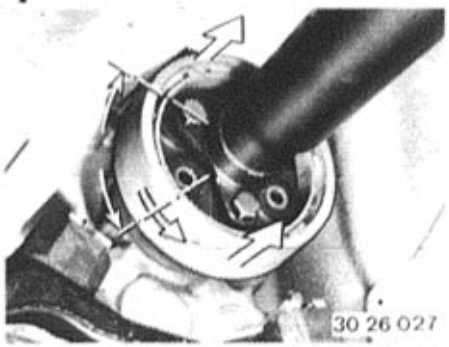


Unscrew the propeller shaft on the transmission.

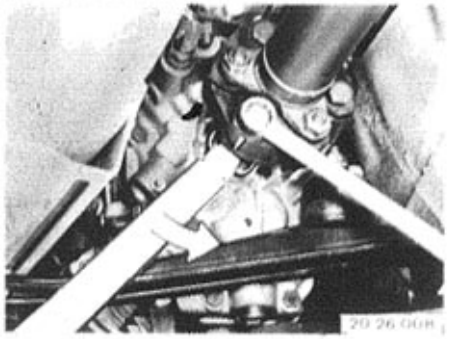


Version with Bolted Vibration Damper:
The vibration damper is mounted on the transmission end output flange.

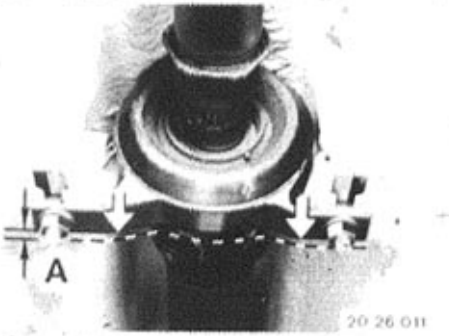
* See Specifications



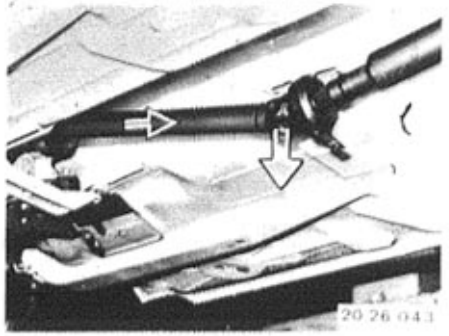
Unscrew the propeller shaft on the transmission.
Turn the vibration damper 60° and place it on the rubber coupling.
The vibration damper is taken off together with the propeller shaft.



Installation:
Replace the stop nuts.
Tightening torque*.
Important!
Only tighten the nuts or bolts on the flange end to avoid tension in the coupling.
Loosen and adjust the cross member, if necessary.

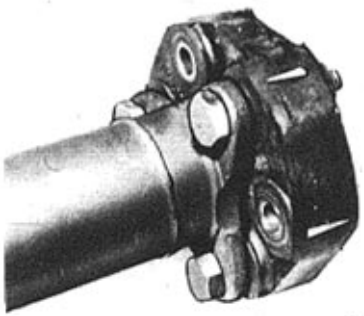


Unscrew the center mount.
Installation:
Preload the center mount forward by distance A = 2 to 4 mm (0.079 to 0.157").



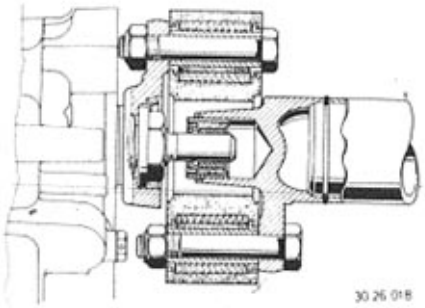
Pull out the propeller shaft from the centering pin on the transmission.
Important!
Do not disconnect the propeller shaft on the slide.

* See Specifications



20 26 036

Replace the coupling.
Install the coupling that the arrows face the flange arms.
Tightening torque*.

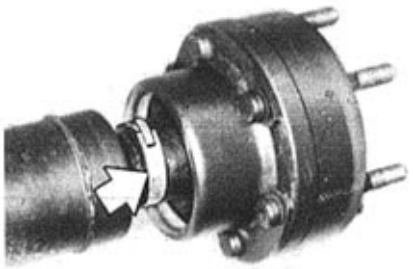


30 26 018

Installation:
Check the center, lubricating with Molykote Longterm 2.
Replace a damaged center.

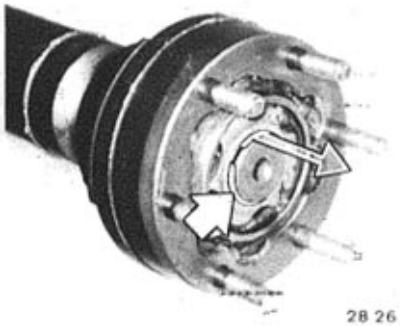
* See Specifications

26 11 160 REPLACING CONSTANT VELOCITY JOINT FOR PROPELLER SHAFT



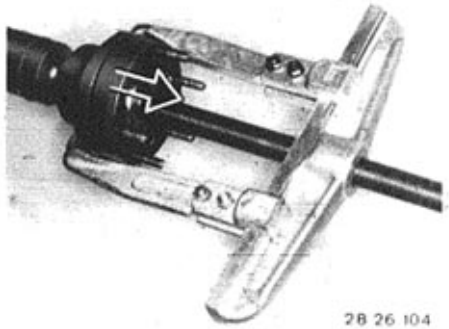
28 26 102

Remove propeller shaft assembly – see 26 11 000.
Remove hose clamp.



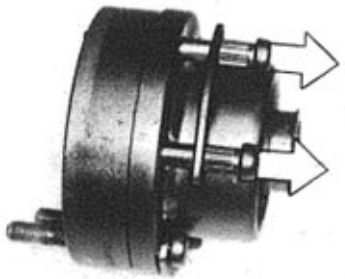
28 26 103

Remove circlip.
Installation:
Replace circlip.



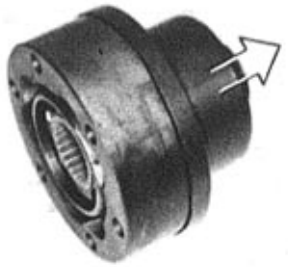
28 26 104

Pull off constant velocity joint complete with dust cover.



28 26 105

Press knurled head bolts and washers out of constant velocity joint.



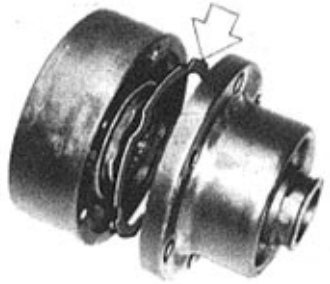
28 26 106

Press off dust cover.



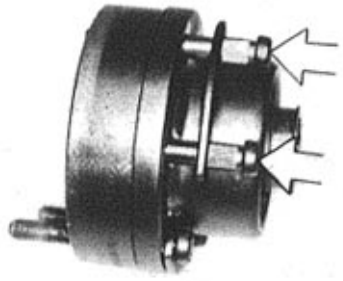
28 26 107

Pack new constant velocity joint with 60 grams of grease*.
Note:
Do not cant inner race with cage, since balls would fall out.



28 26 108

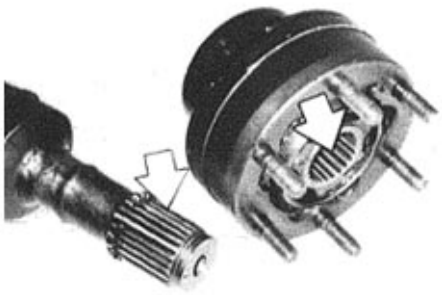
Place gasket in shoulder provided for this purpose.
Press on dust cover.
Installation:
Check that bores are located correctly.



28 26 109

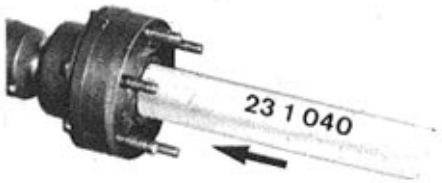
Press in knurled head bolts with washers.

* Source: HWB



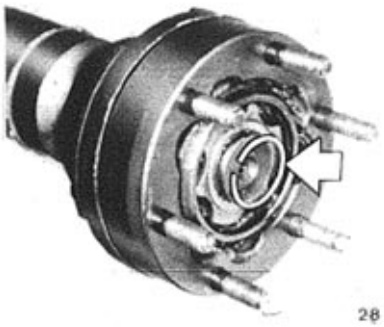
28 26 110

Clean splines to remove grease and then coat with a bolt cement*.
Important!
Keep bolt cement out of ball paths.



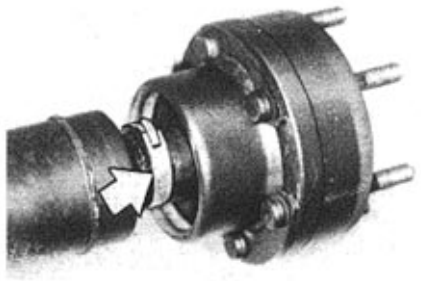
28 26 111

Drive constant velocity joint on propeller shaft with Special Tool 23 1 040.



28 26 112

Insert circlip.
Note:
Check for correct and tight fit.

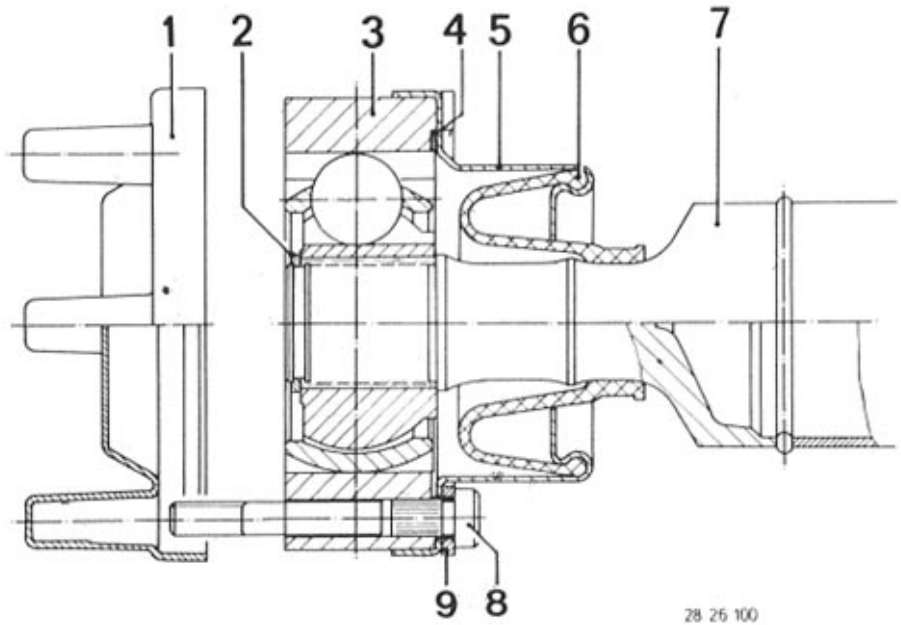


28 26 102

Install hose clamp on dust cover.

* Source: HWB

Constant Velocity Joint Assembly

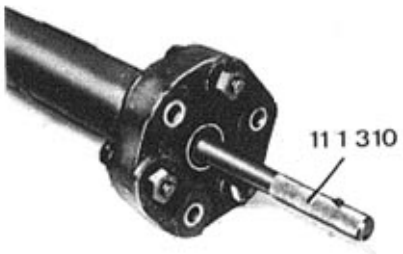


28 26 100

1 Transport cap
2 Circlip
3 Constant velocity joint
4 Gasket
5 End cover
6 Dust cover
7 Propeller shaft
8 Bolt
9 Washer

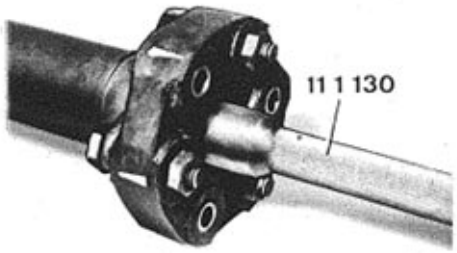
26 11 501 REPLACING PROPELLER SHAFT FRONT END CENTER

– Propeller Shaft Removed –



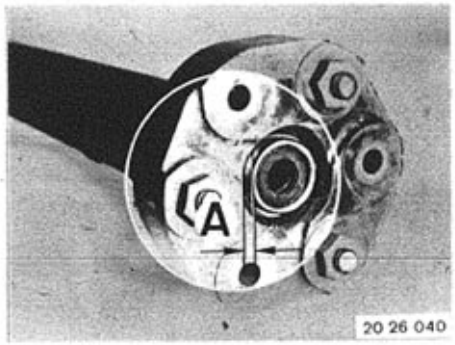
20 26 038

Pack center with viscous grease and drive out with Special Tool 11 1 310.
The pressure on the grease packing drives out the center mount.



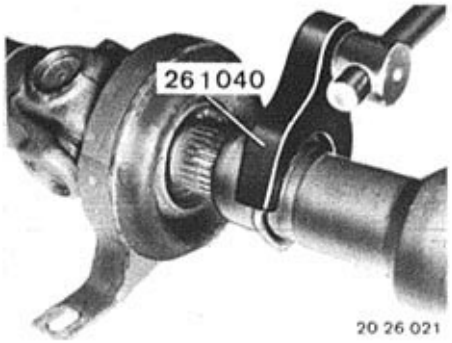
20 26 039

Lubricate center with Molykote Longterm 2 and drive in with Special Tool 11 1 130.
Sealing lip faces out.



20 26 040

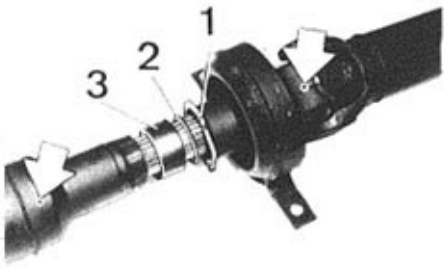
Protrusion A = 4.5 mm (0.177").



20 26 021

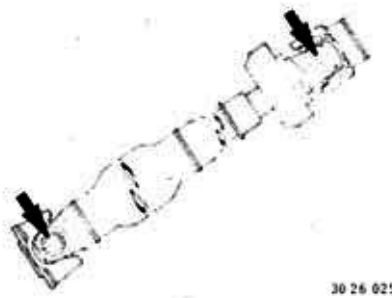
26 12 001 REPLACING PROPELLER SHAFT CENTER MOUNT ASSEMBLY

Version with Slide:
Remove propeller shaft 26 11 000.
Unscrew threaded sleeve with Special Tool 26 1 040.
Pull off front propeller shaft section.
Important!
Propeller shaft was balanced in assembled state and must not be turned in slide.
Punch mark an unmarked propeller shaft.

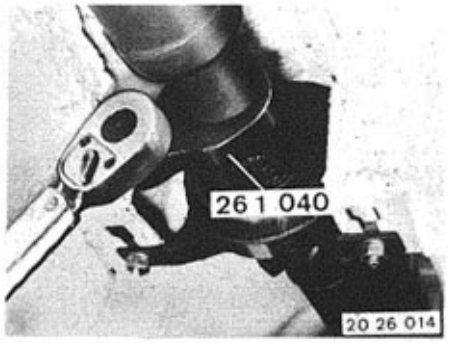


20 26 015

Installation:
Lubricate slide with Molykote Longterm
Slide on threaded sleeve (1), washer (2) a rubber ring (3).
Assemble propeller shaft that punch marks are aligned.

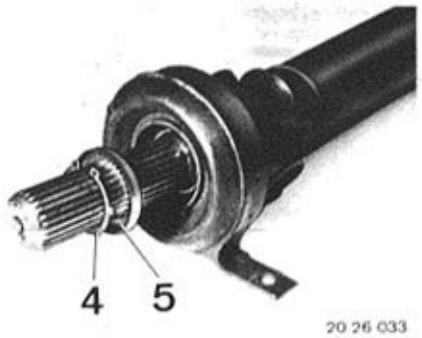

30 26 025

Note:
Propeller shaft sections are mounted to have universal joints in one plane.
If slide had been taken apart without punch marking, only wrong installation by 180° is possible because of balancing.



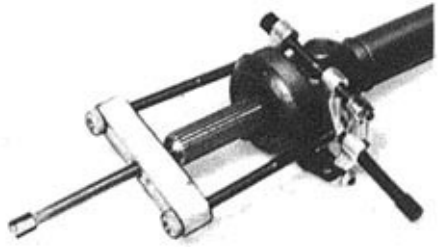
Installation:
Tighten threaded sleeve with Special Tool 26 1 040 after finishing installation.
Tightening torque*.

* See Specifications
** Source: HWB



20 26 033

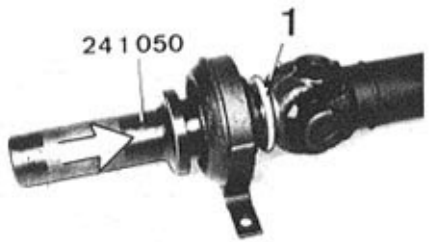
Lift out circlip (4) and remove dust guard (5).


20 26 032

Pull off center mount complete with grooved ball bearing.

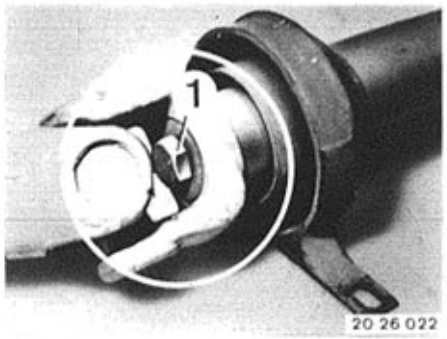


Press grooved ball bearing into center mount.

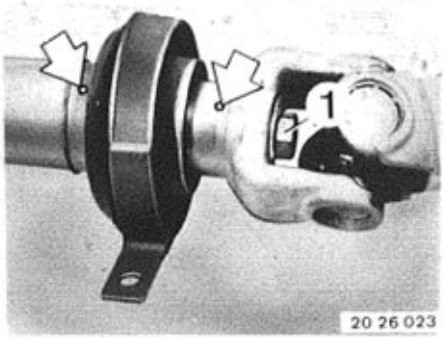


20 26 034

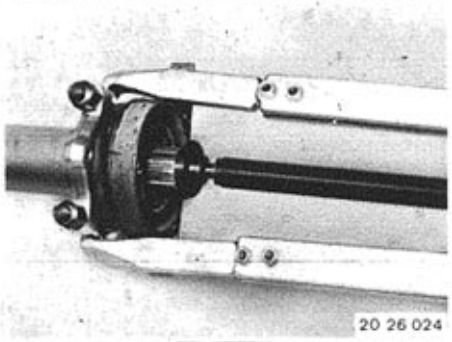
Slide on dust guard (1).
Press on center mount with Special Tool 24 1 050.
Installation:
Check installed position of dust guard – flush with center mount.
Important!
Check clearance of center mount.



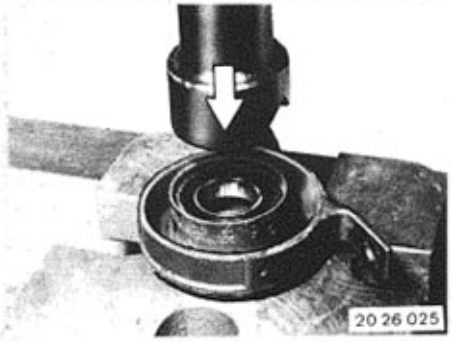
Propeller Shaft without Slide:
Remove propeller shaft 26 11 000.
Unscrew bolt (1).
Punch mark propeller shaft sections to each other.
Pull off front propeller shaft section.
Important!
Propeller shaft was balanced as an assembly – splines must not be displaced.



Installation:
Assemble propeller shaft that punch marks are aligned.
Lock bolt (1) with a bolt cement**.
Tightening torque*.

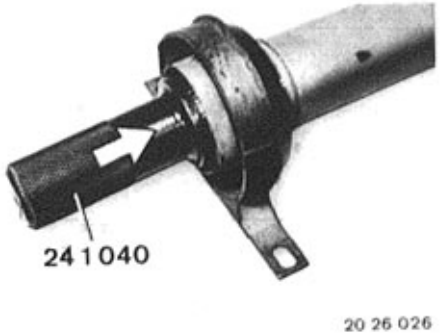


Pull off center mount complete with grooved ball bearing.



Press grooved ball bearing into center mount.

* See Specifications
** Source: HWB



Drive on center mount with Special Tool 24 1 040.
Important!
Check clearance between center mount and dust guard.

TROUBLESHOOTING PROPELLER SHAFT

Condition	Cause	Correction
Grunting from stopped car	Propeller shaft without influence	Check engine tuning – adjust the exhaust assembly
Shaking while moving off in forward or reverse gear (center mount knocking)	Propeller shaft not aligned precisely	Align propeller shaft (S.I. 26 01 77 (235))
	Runout on centering pin, transmission or final drive flanges	Check runout of centering pin and flanges with a dial gage – see Specifications; adjust or replace final drive flange
	Center mount rubber damaged. Propeller shaft length compensator.	Replace center mount – 26 12 001. Important! Tighten* screw-on sleeve with Special Tool 26 1 040.
	Universal joints worn or seized.	Check clearance and movement, replacing propeller shaft if necessary – 26 11 000.
	Engine/transmission mounts not okay.	Check mounts, aligning or replacing if necessary.
	Coupling rubber damaged.	Replace coupling – 26 11 051.
Shaking between 40 and 50 km/h (25 and 30 mph)	Propeller shaft not aligned precisely.	Align propeller shaft.
	Runout on centering pin, transmission or final drive flanges.	Check runout of centering pin and flanges with a dial gage – see Specifications; adjust or replace final drive flange.
	Center mount rubber damaged. Propeller shaft length compensator.	Replace center mount – 26 12 001. Important! Tighten* screw-on sleeve with Special Tool 26 1 040.
	Universal joints worn or seized.	Check clearance and movement, replacing propeller shaft if necessary – 26 11 000.
	Coupling rubber damaged.	Replace coupling – 26 11 051.

* See Specifications for tightening torque.

TROUBLESHOOTING PROPELLER SHAFT

Condition	Cause	Correction
Grunting from 60 km/h (37 mph) on	Propeller shaft not aligned precisely or installed with tension – length compensator.	Align propeller shaft or check movement of length compensator, lubricating slide with Molykote Longterm 2 and tightening screw-on sleeve* if necessary.
	Center damaged.	Replace center – 26 11 501.
	Runout on centering pin, transmission or final drive flanges.	Check runout of centering pin and flanges with a dial gage – see Specifications; adjust or replace final drive flange.
	Centering incorrect due to worn flange bores (bolts loose).	Replace transmission or final drive flange.
	Considerable imbalance of propeller shaft, balancing plate torn off.	Balance or replace propeller shaft.
	Universal joints worn or seized.	Check clearance and movement, replacing propeller shaft if necessary – 26 11 000.
Center mount loud while driving	Center mount not perpendicular to propeller shaft, not or insufficiently preloaded.	Preload center mount at right angle to propeller shaft in forward direction by 4 to 6 mm (0.157 to 0.236").
	Center mount grooved ball bearing not okay.	Replace grooved ball bearing – 26 12 001.

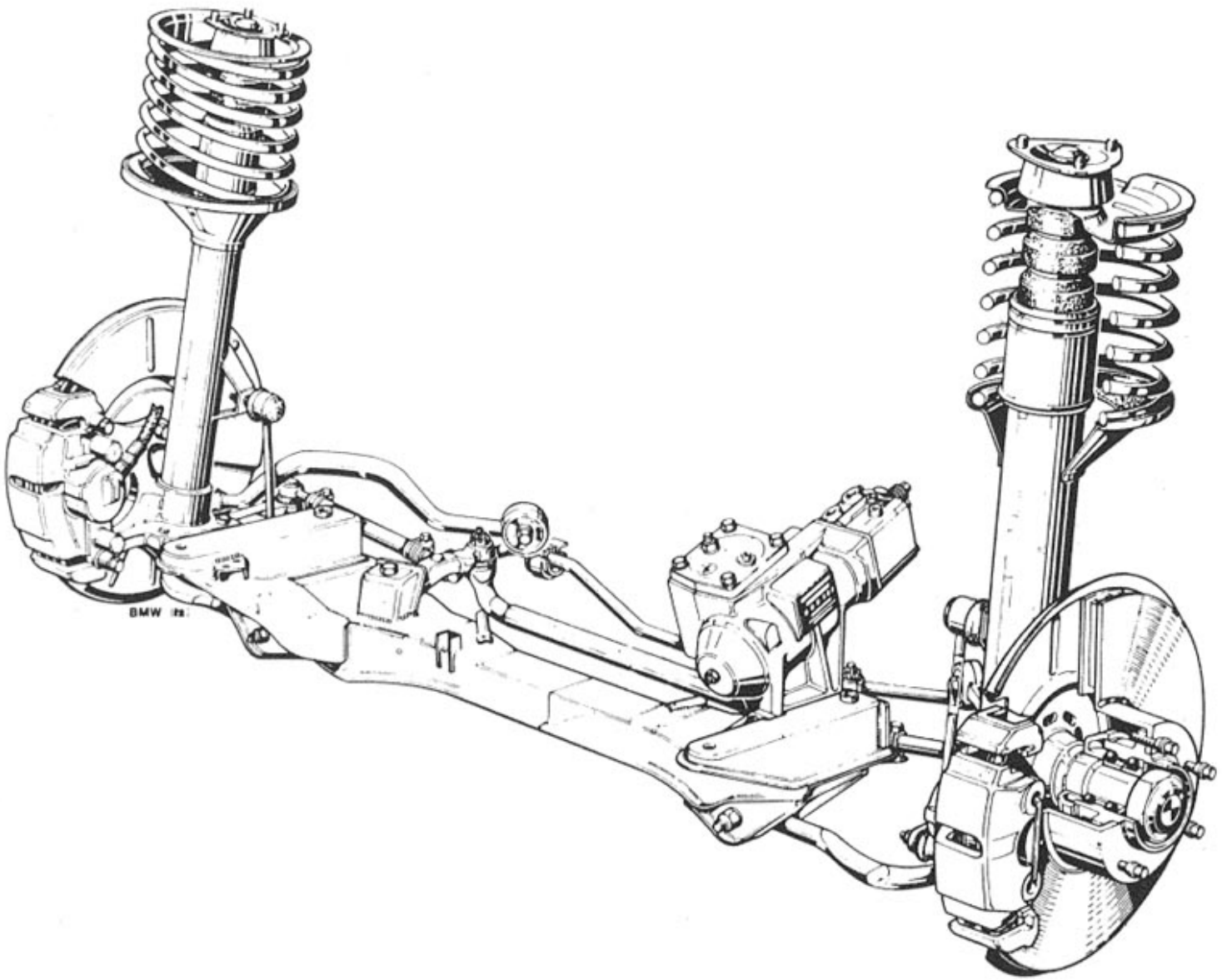
* See Specifications for tightening torque.

31 Front axle

	Introduction	0- 1
	Front wheel suspension layout drawing	31- 0
31 10 000	Front axle assembly – remove and install	31- 1
31 11 001	Front axle carrier – replace	31- 3
	Front axle carrier with control arms and struts layout drawing	31- 4
31 12 000	Control arm, left or right – remove and install	31- 5
090	Thrust strut, left or right – remove and install or replace	31- 6
	Thrust strut mounts – check	31- 6
130	Rubber mount in control arm – replace	31- 7
147	Rubber mount in thrust strut – replace	31- 7
31 21 180	Bearings (wheel hub) for front wheel – replace	31- 8
31 31 000	Spring strut, left or right – remove and install	31- 9
	Spring strut assembly drawing	31- 10
31 32 001	Shock absorber, left or right – replace	31- 11
31 33 001	Spring strut mount, left or right – replace	31- 13
100	Coil spring, left or right – remove and install or replace	31- 14
31 35 000	Stabilizer – remove and install or replace	31- 15
	Front axle – troubleshoot	31- 16
	Shock absorbers – troubleshoot	31- 18

31-0

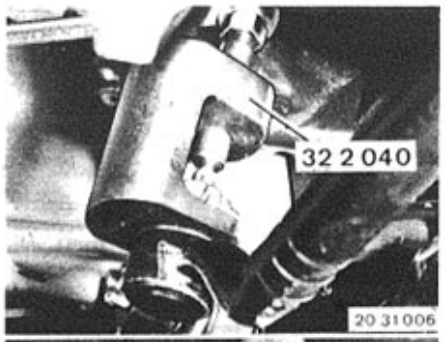
FRONT AXLE LAYOUT DRAWING



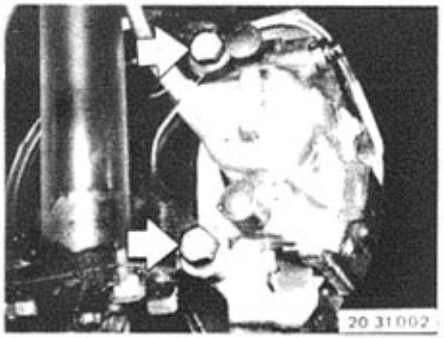
28 31 001

31 10 000 REMOVING AND INSTALLING FRONT AXLE ASSEMBLY

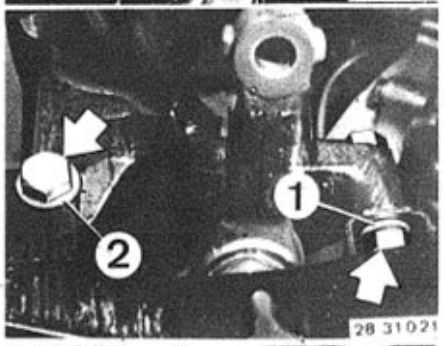
Remove and install front wheels 36 10 300.
Remove splash guard.
Note:
Check front axle alignment with optical tester after installation 32 00 034.



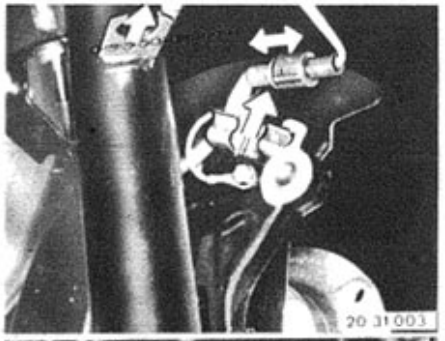
Remove cotter pin and unscrew castle nut.
Press off tie rod on steering drop arm with Special Tool 32 2 040.
Installation:
Tightening torque*
Lock castle nut with cotter pin.



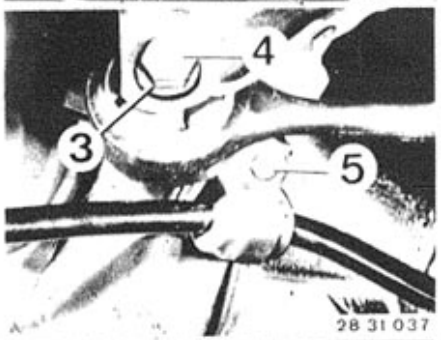
Disconnect and tie down left and right brake calipers.
Brake lines remain connected.
Installation:
Tightening torque*



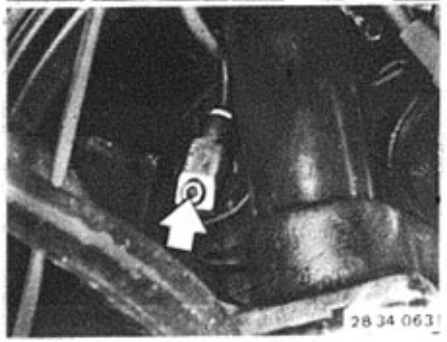
Unscrew steering gear mounting bolts (hold on nuts).
1 = Washer
2 = Washer (both sides)
Tie down steering gear with a piece of wire.
Lines remain connected.
Installation:
Replace self-locking nuts.
Tightening torque*.



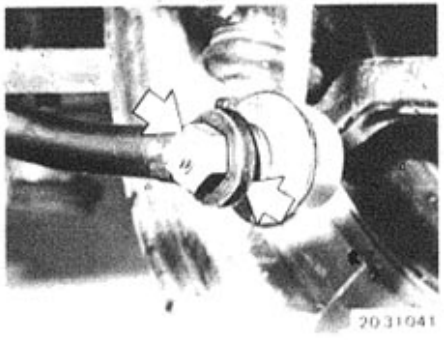
Left Side:
Pull plug out of clamp and rubber grommet out of bracket.
Disconnect ground wire.



Unscrew bolts (4 and 5) on left and right sides.
3 = washer (both sides)
Installation:
Replace self-locking nuts.
Tightening torque* with car in normal position*.



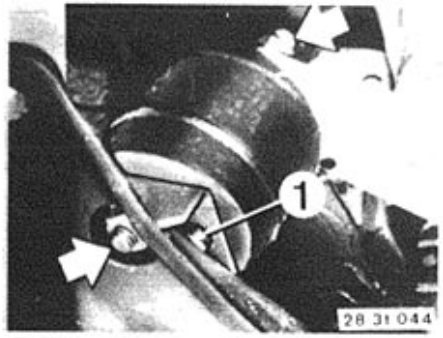
Unscrew ABS pulse sensors on left and right sides.



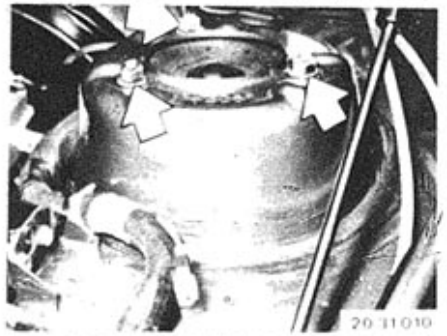
Disconnect push rods on left and right sides.
Hold on ball joint with a fork wrench.
Installation:
Replace self-locking nuts.
Tightening torque*.

* See Specifications of Group 34

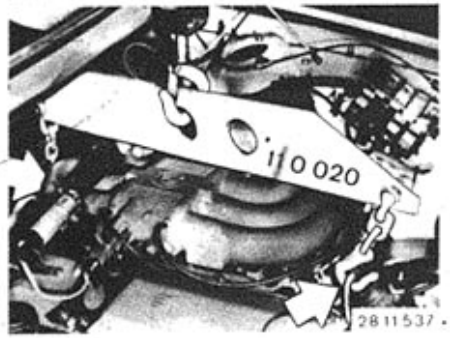
* See Specifications of Group 31/32



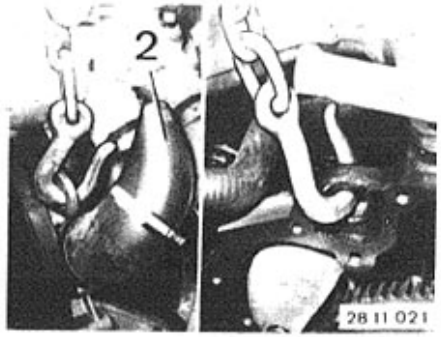
Unscrew engine mounts at bottom on left and right sides.
Loosen engine mount at top right.
Installation:
Check for correct installed position.
Turning lock of mounts is located in bore (1).
Tightening torque*.



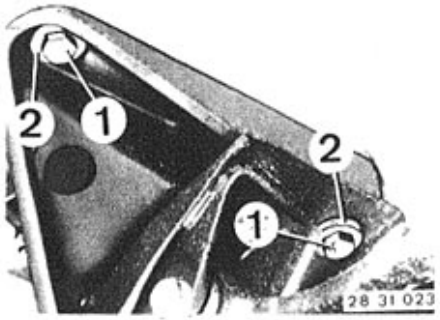
Support spring strut shock absorbers.
Disconnect left and right mounts in wheel houses.
Installation:
Replace self-locking nuts.
Tightening torque*.



Engines M 20 and M 21:
Attach Special Tool 11 0 020 on engine.



Engine M 30:
Drain coolant partially.
Disconnect water hose (2) and attach Special Tool 11 0 020.
Installation:
Fill and bleed cooling system 17 00 039.

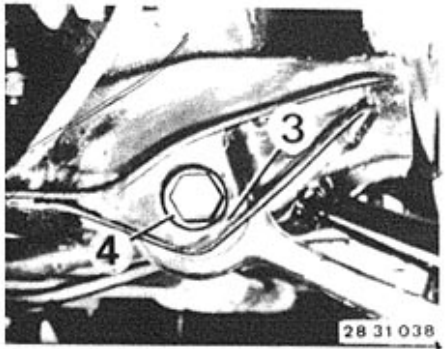


Place workshop jack underneath front axle carrier.
Unscrew engine carrier bolt (1) and lower front axle slowly.
Caution!
Springs struts must not be allowed to fall out or drop down – ball joints would be damaged.
Installation:
Install bolts with washers (2).
Tightening torque*.

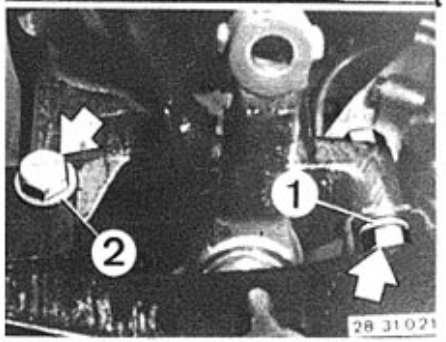
* See Specifications of Gr. 11/31

* See Specifications of Gr. 31

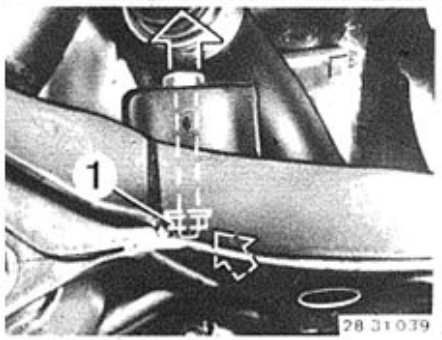
31 11 001 REPLACING FRONT AXLE CARRIER



Unscrew control arm on mount (3) at left and right sides.
4 = Washer (both sides)
Installation:
Replace self-locking nuts.
Tightening torque* for car loaded down to normal position*.
Check front wheel alignment with optical tester – see 32 00 034.



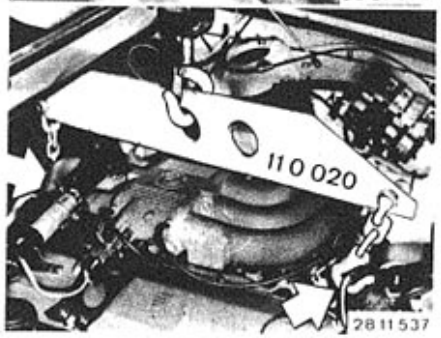
Unscrew steering gear mounting bolts.
1 = Washer
2 = Washer (both sides)
Suspend steering gear from car on a piece of wire.
Installation:
Replace self-locking nuts.
Tightening torque*.



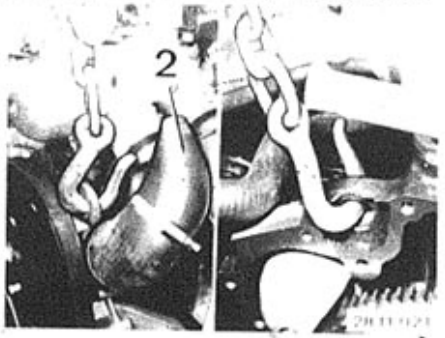
Unscrew steering guide arm.
1 = Washer
Installation:
Replace self-locking nut.
Tightening torque*.



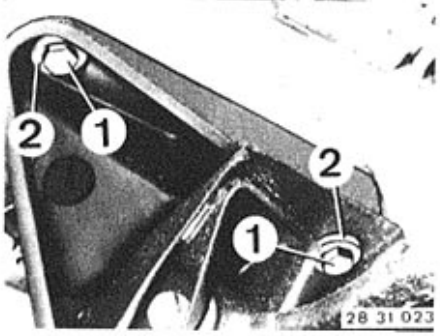
Unscrew engine mounts at bottom left and right.
Loosen engine mount at top right.
Installation:
Check for correct installed position.
Turning lock of mount must be in bore (1).
Tightening torque*.



Engines M 20 and M 21:
Attach Special Tool 11 0 020 on engine.



Engine M 30:
Drain some of coolant.
Disconnect water hose (2).
Attach Special Tool 11 0 020 on engine.
Installation:
Fill and bleed cooling system, see 17 00 039.



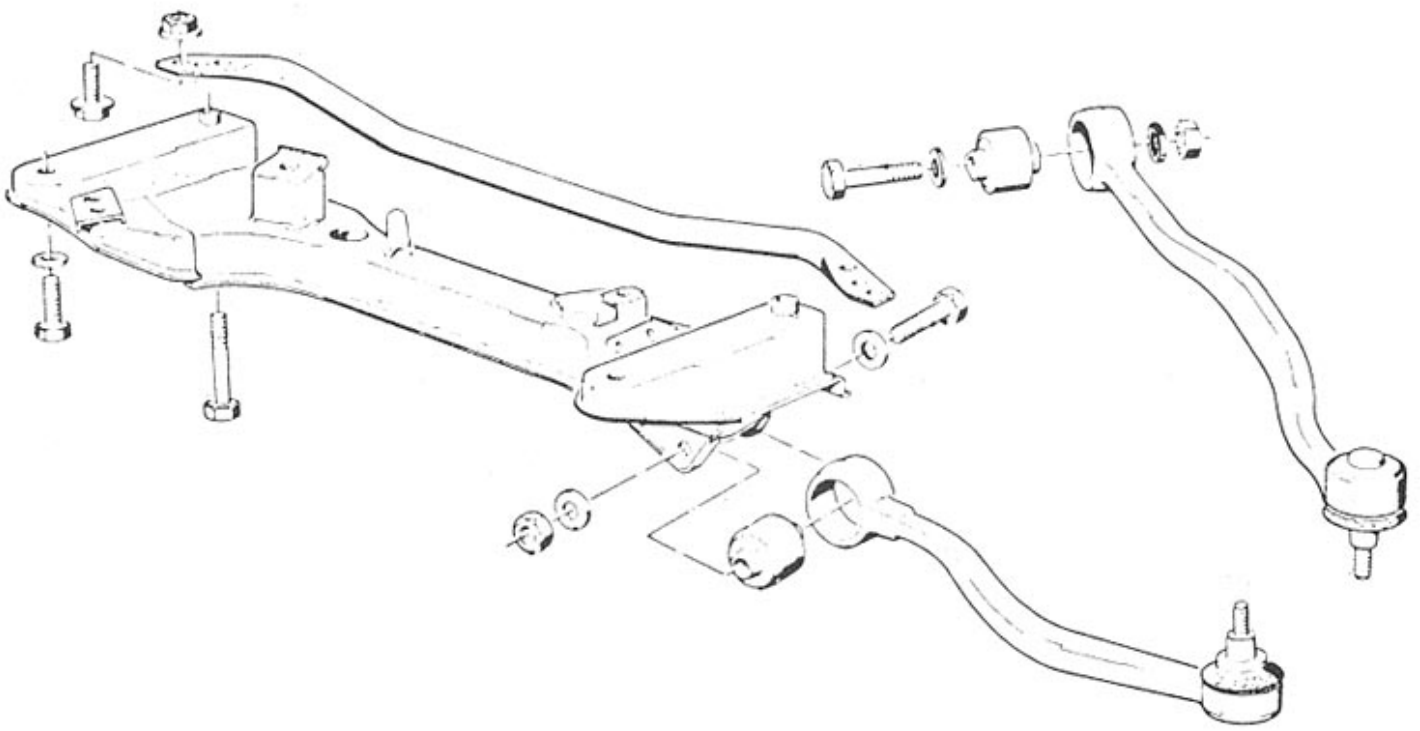
Unscrew engine carrier bolt (1).
Installation:
Install bolts with washers (2).
Tightening torque*.

* See Specifications of Gr. 31/32

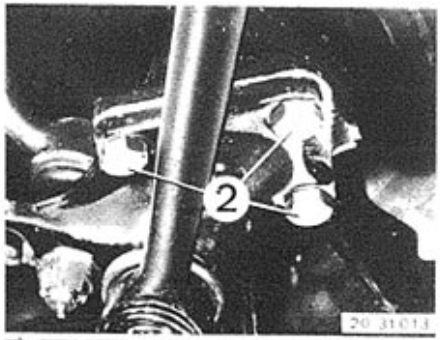
* See Specifications of Gr. 11/31

31 – 4

FRONT WHEEL SUSPENSION LAYOUT DRAWING

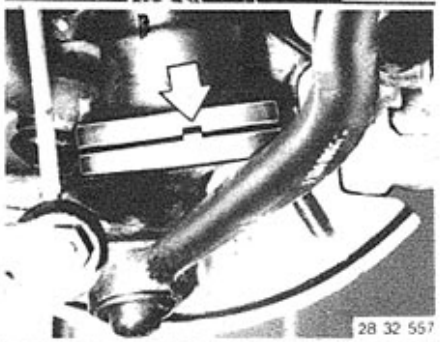


630 31 100

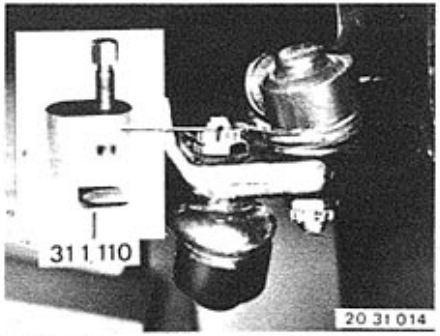


31 12 001 REMOVING AND INSTALLING LEFT OR RIGHT CONTROL ARM

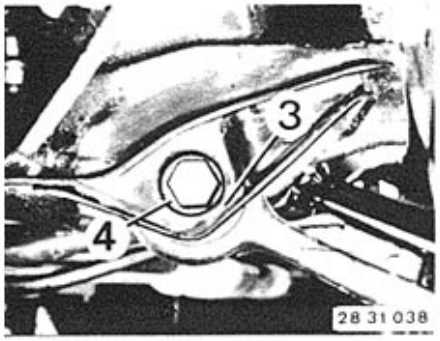
Remove and install front wheel 36 10 300.
Unscrew bolts (2).
Lift off tie rod arm on spring strut.
Installation:
Clean threads of bores and bolts.
Lock bolts with bolt cement**.
Tightening torque*.



Check for correct installed position.

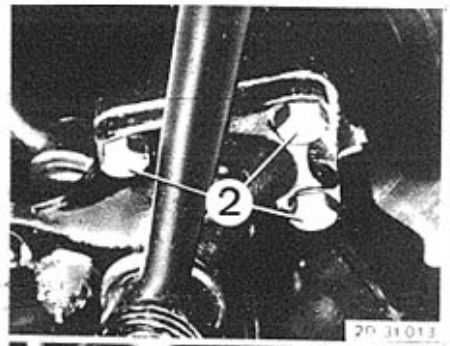


Remove cotter pin and unscrew castle nut.
Press off ball joint with Special Tool 31 1 110.
Installation:
Clean ball journal and bores to remove grease and dirt.
Tightening torque*.
Lock nut with cotter pin.



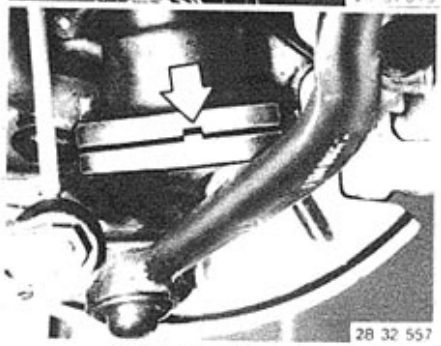
Unscrew control arm on mount (3).
4 = Washer (both sides)
Installation:
Replace self-locking nut.
Tightening torque* for a car in normal position*.

* See Specifications of Group 31/32
** Source: HWB

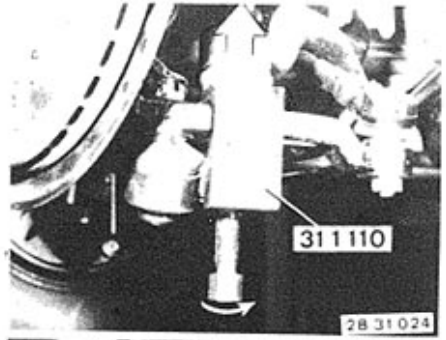


31 12 090 REMOVING AND INSTALLING OR REPLACING LEFT OR RIGHT THRUST STRUT

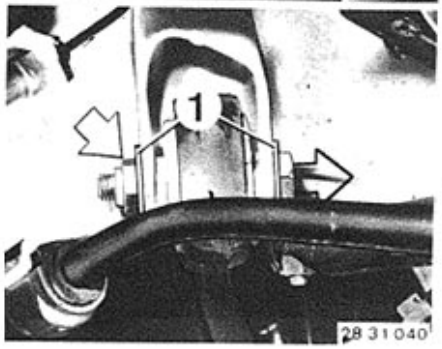
Remove front wheel 36 10 300.
Unscrew bolts (2).
Lift tie rod arm off of spring strut.
Installation:
Clean threads of bores and bolts.
Install bolts with bolt cement**
Tightening torque*.



Check for correct installed position.

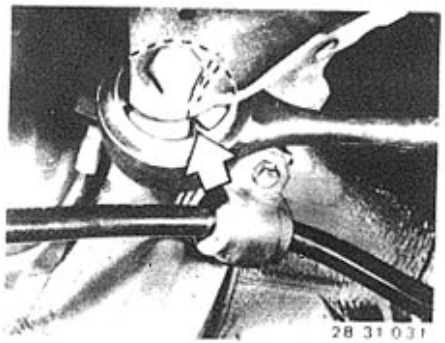


Remove cotter pin and unscrew nut.
Press off ball joint with Special Tool 31 1 110.
Installation:
Clean bore to remove grease and dirt.
Tightening torque*.
Lock castle nut with a cotter pin.



Unscrew thrust strut on mount.
Installation:
Thrust struts are marked with
L for left or
R for right.
Replace self-locking nuts.
1 = Washer (both sides)
Tightening torque* for a car in normal position*.

* See Specifications of Gr. 31/32
** Source: HWB



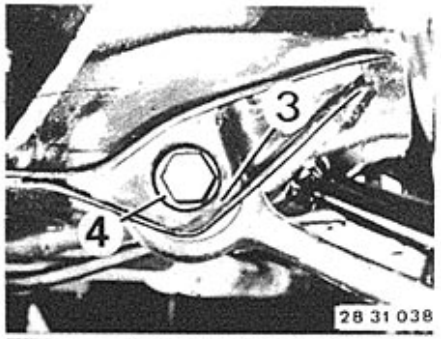
Checking Thrust Strut Mounts:
Car loaded down to normal position*.
Measure distance between rubber mount and centering sleeve with a feeler gage blade.



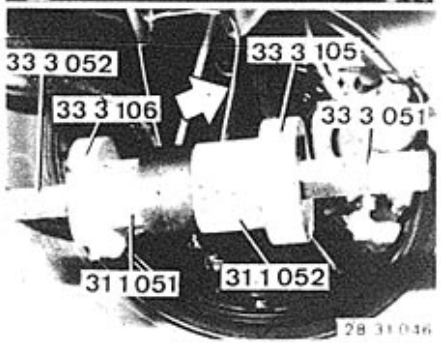
A = 0.8 to 1.8 mm (0.031 to 0.071").
Important!
Engine M 20:
Rubber mount without beads (N).
Engines M 21 and M 30:
Rubber mount with beads (N).
Replace thrust strut mount (see 31 12 147), if measured distance is smaller or greater than specified distance.

* See Specifications of Gr. 32

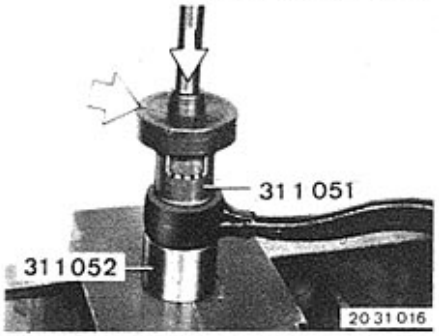
31 12 130 REPLACING RUBBER MOUNT IN LEFT OR RIGHT CONTROL ARM



Unscrew control arm on bracket (3).
Installation:
4 = Washer (both sides)
Replace self-locking nut.
Tightening torque* for car loaded down to normal position*.



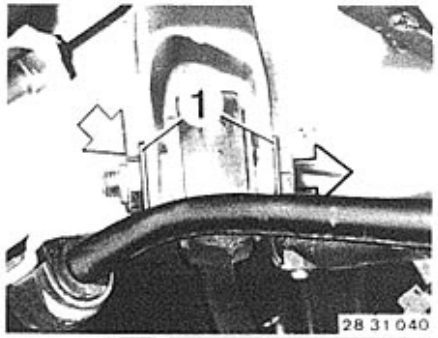
Suspend control arm from car on piece of wire (prevents damage on ball joint).
Pull out rubber mount with Special Tools 31 1 051 / 052 and 33 3 051 / 052 / 105 / 106.
Installation:
Rubber mount and control arm bore free of grease.
Pull in rubber mount from bevelled side of control arm.



Control Arm Removed:
Press rubber mount out and in on a press with Special Tool 31 1 051 / 052.

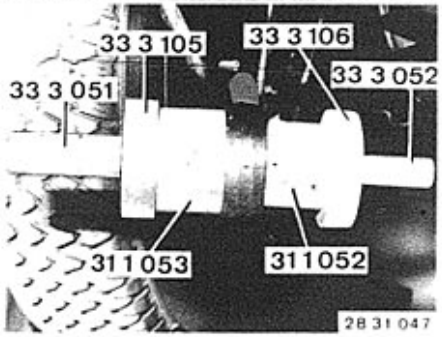
* See Specifications

31 12 147 REPLACING RUBBER MOUNT IN LEFT OR RIGHT THRUST STRUT

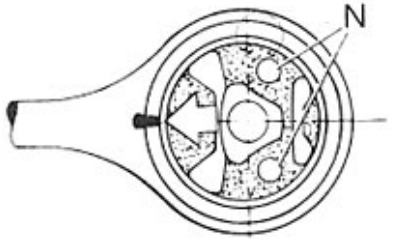


Unscrew bolt.
Installation:
1 = Washer (both sides)
Replace self-locking nut.
Tightening torque* for car loaded down to normal position*.

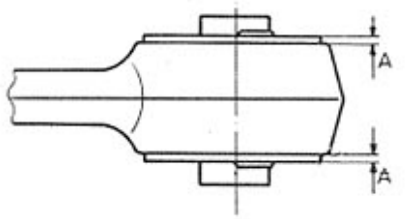
Important:
Always replace both .



Pull out rubber mount with Special Tools 31 1 052 / 053 and 33 3 051 / 052 / 105 / 106.

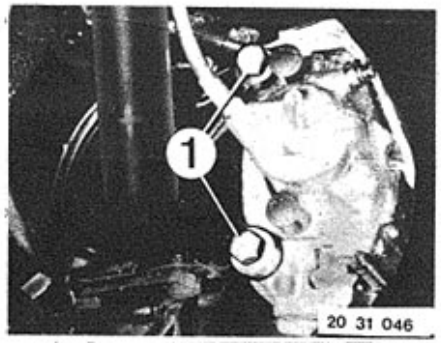


Installation:
Check Rubber Mount Codes:
Engine M 20 = without beads
Engine M 21 = with beads (N)
Engine M 30 = with beads (N)



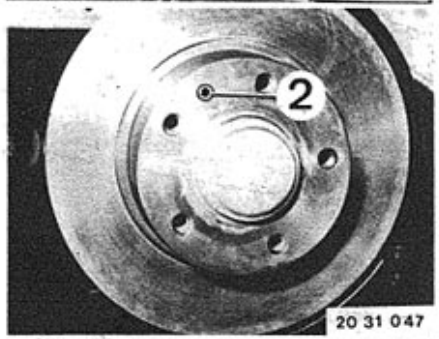
Rubber mount and thrust strut bore free of grease.
Pull in rubber mount with special tools that arrow faces mark.
Protrusion (A) must be uniform.

* See Specifications

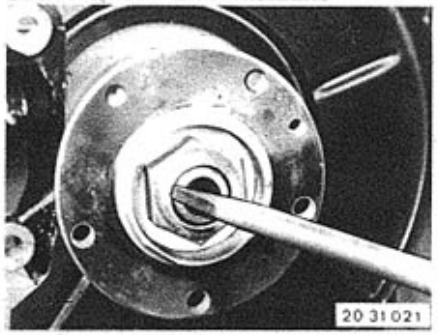


31 21 180 REPLACING BEARINGS (WHEEL HUB) FOR FRONT WHEEL

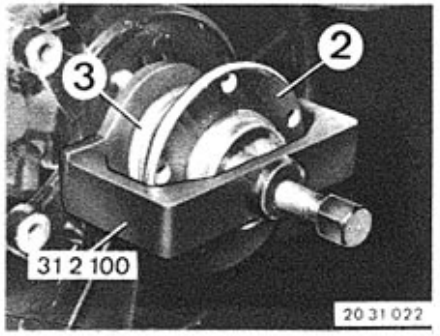
Remove and install front wheel 36 10 300.
Unscrew bolts (1).
Installation:
Tightening torque*.



Pull off and suspend brake caliper with a piece of wire.
Wires and brake line remain connected.
Unscrew bolt (2) with Special Tool 34 1 020.
Remove brake disc.

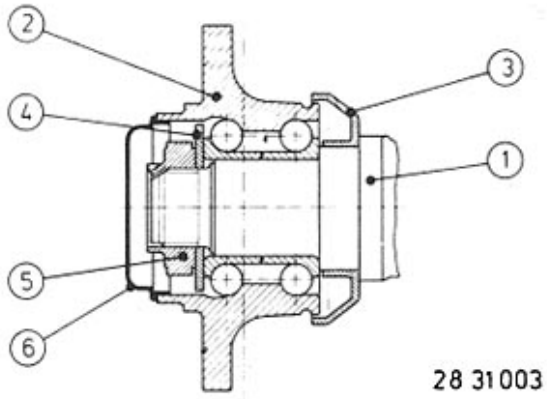


Pry off grease cap.
Chisel locking edge of nut out of groove.
Unscrew nut with Special Tool 31 2 080.
Important:
Use grease cap only once. Fit new grease cap with sealing compound HWB no. 81 22 8 407 420.

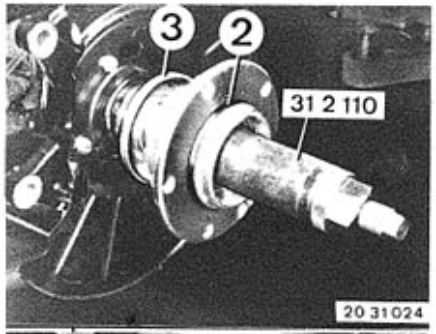


Pull off bearing assembly (2) and cover (3) with Special Tool 31 2 100.

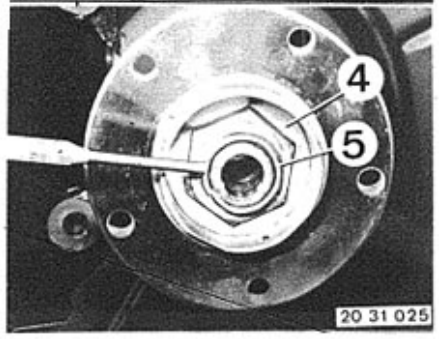
* See Specifications of Gr. 34



Wheel Bearings
1 = Stub axle
2 = Bearing assembly
3 = Cover
4 = Washer
5 = Nut
6 = grease cap
Important!
Bearing assembly is permanently lubricated for service life and cannot be disassembled.

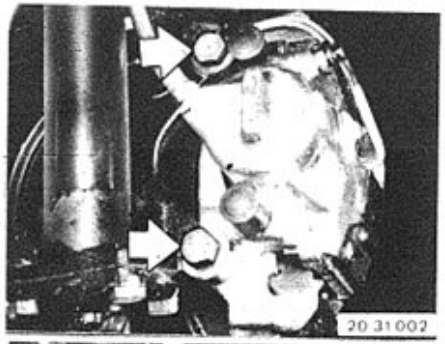


Place cover (3) on stub axle.
Pull on bearing assembly (2) and cover (3) with Special Tool 31 2 110.



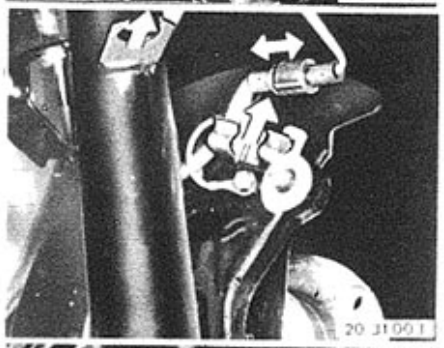
Install washer (4) and new nut (5).
Tighten nut to correct torque* and lock in groove
Pack grease cap with grease* and press on to hub.

* See Specifications of Gr. 31

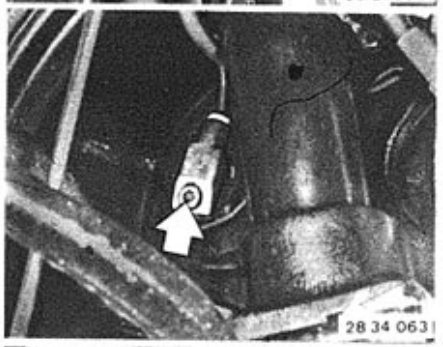


31 31 000 REMOVING AND INSTALLING LEFT OR RIGHT SPRING STRUT ASSEMBLY

Remove and install front wheel 36 10 300.
Disconnect and suspend brake caliper with a piece of wire.
Brake line remains connected.
Installation:
Tightening torque*.



Left Side:
Lift plug out of clip and rubber grommet out of holder.
Disconnect ground wire.
Disconnect plug.

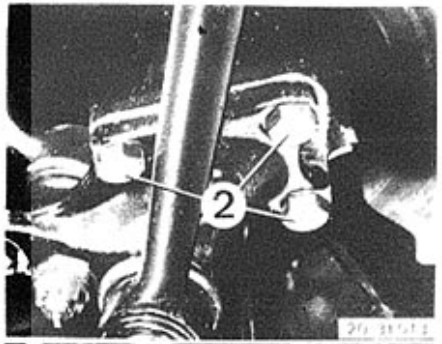


Cars with ABS:
Remove ABS pulse transmitter.

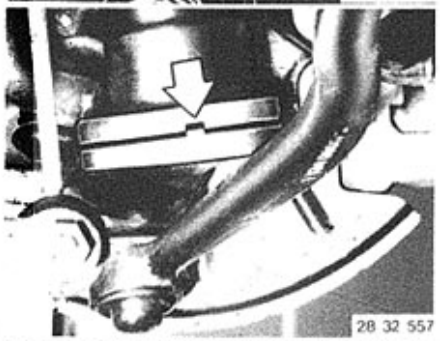


Disconnect stabilizer push rod.
Hold with fork wrench.
Installation:
Tightening torque*.

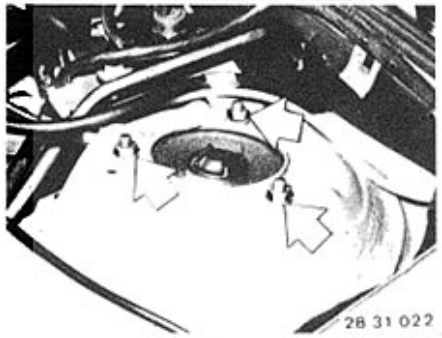
* See Specifications of Gr. 31/34



Unscrew bolts (2) on tie rod arm.
Installation:
Clean threads of bores and bolts.
Lock bolts with bolt cement**.
Tightening torque*.



Check for correct installed position.



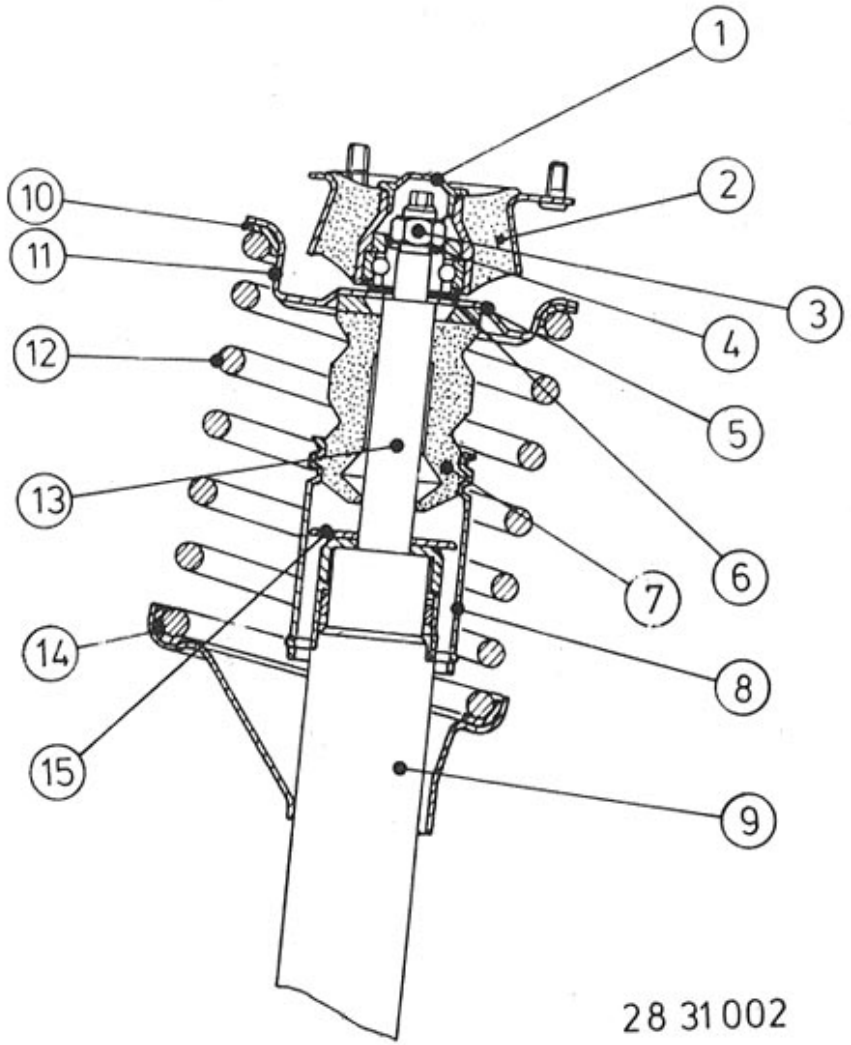
Support spring strut shock absorber.
Unscrew spring strut mount on wheel house.
Installation:
Replace self-locking nut.
Tightening torque*.

Important!
Always store shock absorbers standing upright. If shock absorbers are stored laying down with piston rods run in, they could cause a rattling noise when used again.
Correction:
Store shock absorbers standing upright with piston rods run out at room temperature 24 hours.

* See Specifications of Gr. 31
** Source: HWB

SPRING STRUT ASSEMBLY DRAWING – ENGINES M 20 / M 30

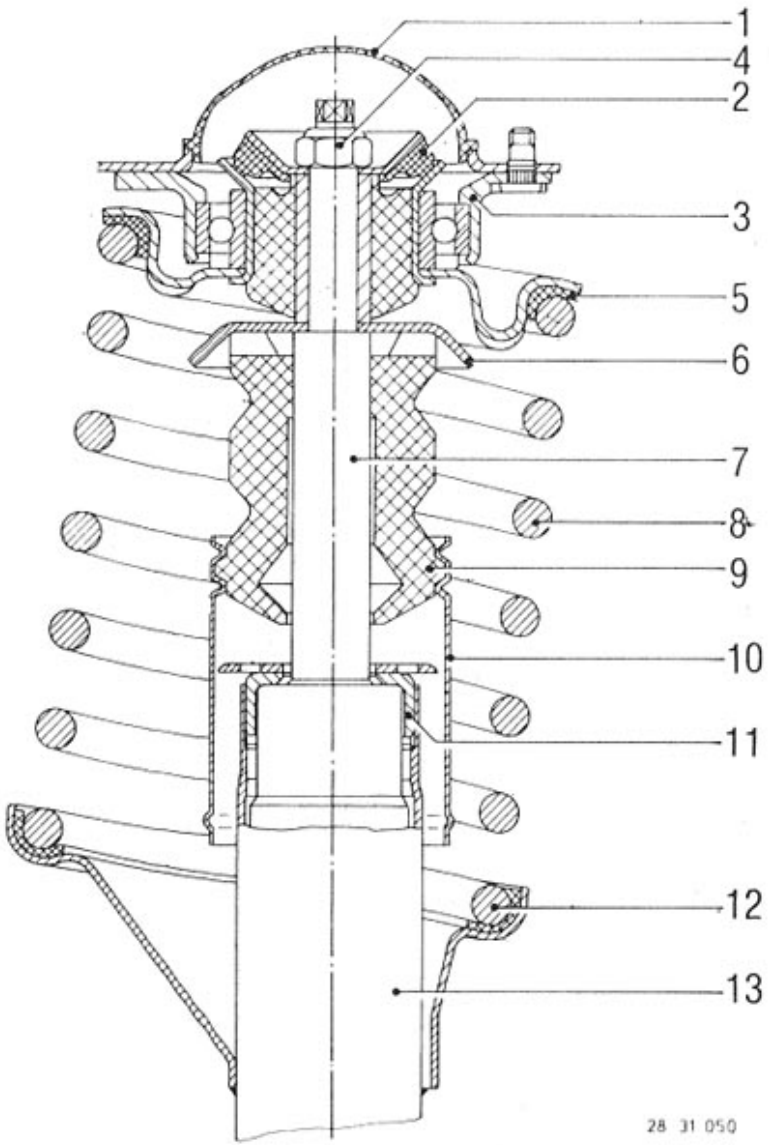
1 = Cap
2 = Mount
3 = Self-locking nut
4 = Washer
5 = Insulator
6 = Washer
7 = Rubber damper
8 = Protective tube
9 = Shock absorber
10 = Upper rubber ring
11 = Upper spring retainer
12 = Coil spring
13 = Shock absorber piston rod
14 = Lower rubber ring
15 = Screw-on ring

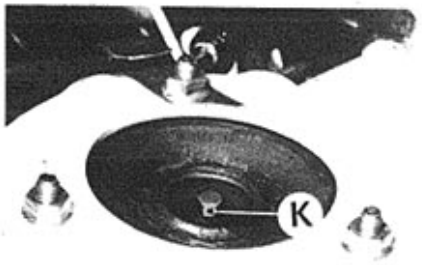


31-10a

SPRING STRUT ASSEMBLY DRAWING – ENGINE M 21

1 = Cap
2 = Rubber mount
3 = Mount
4 = Self-locking nut
5 = Upper rubber ring
6 = Washer
7 = Shock absorber piston rod
8 = Coil spring
9 = Rubber damper
10 = Protective tube
11 = Screw-on ring
12 = Lower rubber ring
13 = Shock absorber

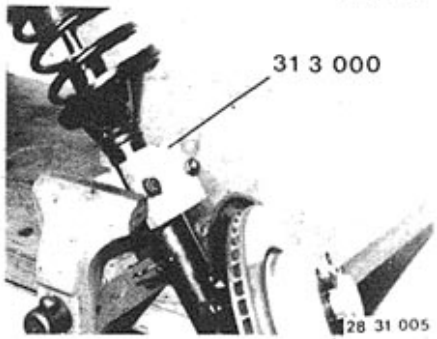




28 31 035

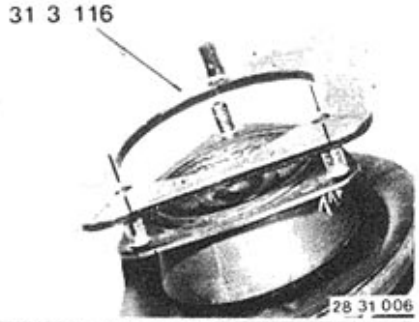
31 32'001 REPLACING LEFT OR RIGHT FRONT SPRING STRUT SHOCK ABSORBER

Important!
Always replace a shock absorber with one having same code* K.
To know whether shock absorbers have to be replaced, check installed absorbers with a "Shok Tester" or removed in a shock absorber testing machine.



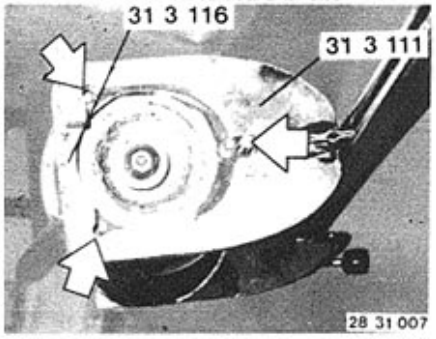
28 31 005

Remove and install spring strut assembly 31 31 000.
Clamp spring strut in a vise with Special Tool 31 3 000.



28 31 006

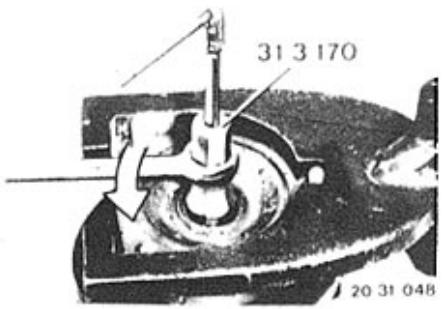
Apply Special Tool 31 3 116 on mount.



28 31 007

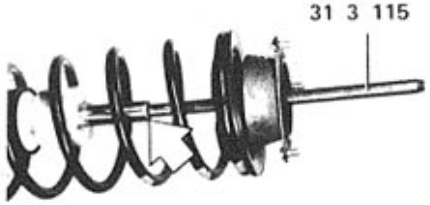
Compress coil spring with Special Tool 31 3 111.
Important!
Bolt of mount and Special Tool 31 3 116 must be in openings.

*** See Specifications of Gr. 31**



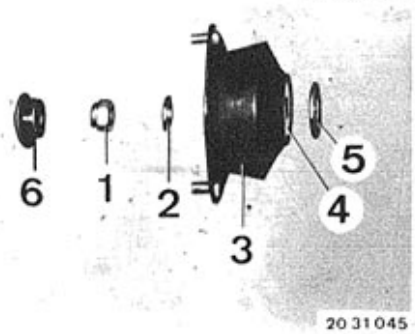
20 31 048

Lift off end cap.
Unscrew self-locking nut with Special Tool 31 3,170, while holding on piston rod.
Installation:
Replace self-locking nut.
Tightening torque*.



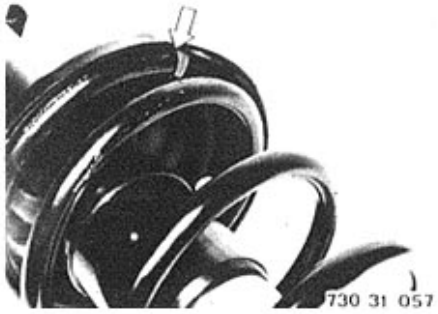
Remove washer (2).
Screw in Special Tool 31 3 115 entire length of threads.
Release and remove spring compressor tool.

28 31 020



20 31 045

Lift off mount.
Installed Order – Engines M 20 / M 30:
1 = Self-locking nut
2 = Washer with small diameter
3 = Mount
4 = Insulator
5 = Washer with large diameter
6 = Cap
Inside curved surface of insulator (4) faces mount.
Installed Order – Engine M 21:
See page 31 - 10a



730 31 057

Take off upper spring retainer with rubber ring and coil spring.
Installation:
Check upper and lower rubber rings, replacing if necessary.
Ends of coil springs must fit on shoulders in lower and upper spring retainers.

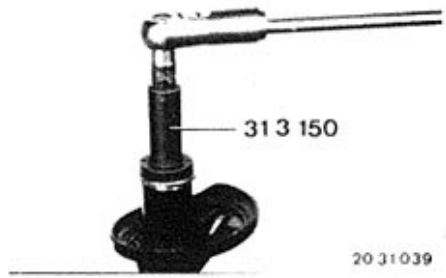
*** See Specifications of Gr. 31**

Installation:
Check protective tube and rubber damper, replacing if necessary.



20 31 038

Unscrew threaded ring with Special Tool 31 3 150.
Installation:
Tightening torque*.

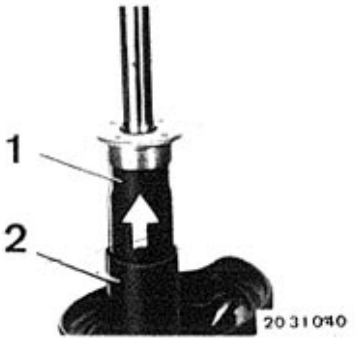


20 31 039

Gas Pressure Absorbers:
Unscrew threaded ring with Special Tool 31 3 190.
Installation:
Tightening torque*



28 31 045

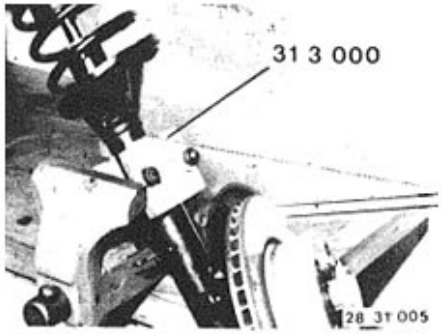


20 31 040

Pull out shock absorber (1).
Installation:
Remove old oil from spring strut tube (2).
Fill new shock absorber with engine oil** prior to installing.
Engine oil will carry off heat from shock absorber to the spring strut tube.
Important!
Front axle gas pressure struts must not be installed with oil.
See Service Information of Group 37.
Only store shock absorbers standing upright. If shock absorbers are stored laying down, with their piston rods run in, this could lead to rattling or knocking noise when used in car again.
Remedy:
Store shock absorbers in upright position with piston rod run out at room temperature for 24 hours.

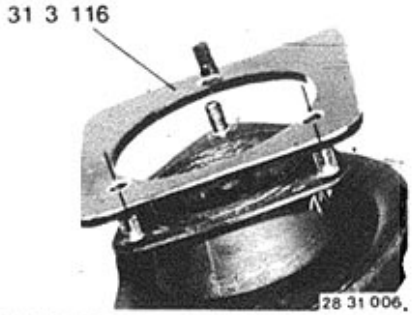
* See Specifications of Gr. 31

** See Service Information of Gr. 00

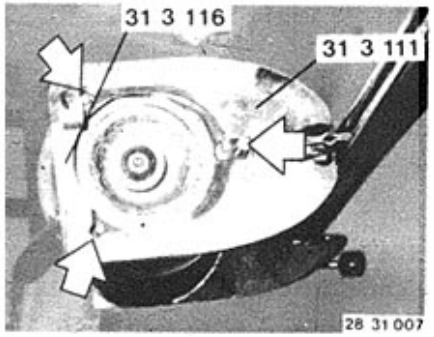


31 33 001 REPLACING LEFT OR RIGHT SPRING STRUT MOUNT

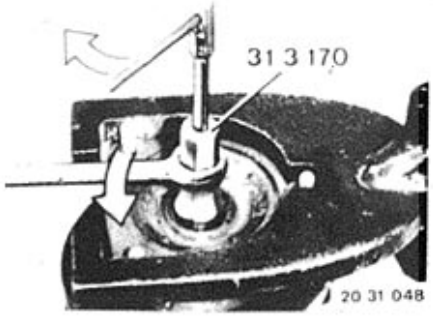
Remove and install spring strut assembly 31 31 000.
Clamp spring strut in a vise with Special Tool 31 3 000.



Apply Special Tool 31 3 116 on mount.

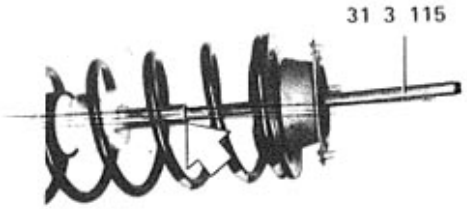


Compress coil spring with Special Tool 31 3 111.
Important!
Bolts on mount and Special Tool 31 3 116 must fit in openings.

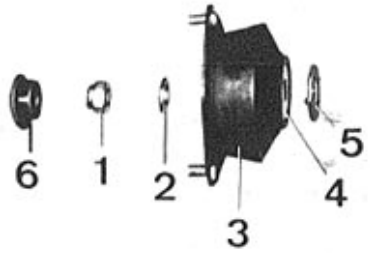


Pull off end cap.
Unscrew self-locking nut with Special Tool 31 3 170, counterholding on piston rod.
Installation:
Replace self-locking nut.
Tightening torque *.

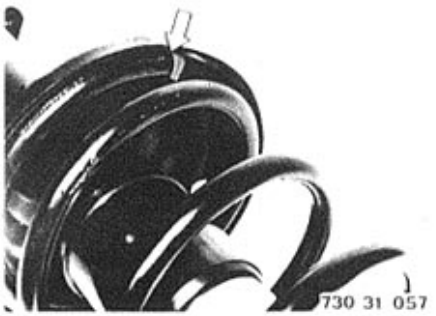
* See Specifications of Gr. 31



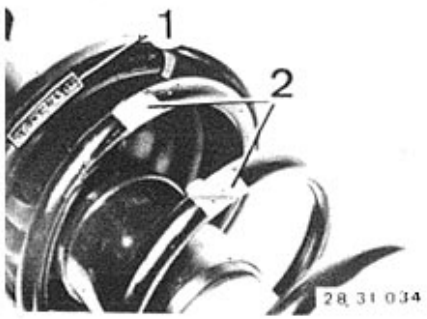
Remove washer (2).
Screw in Special Tool 31 3 115 entire length of threads.
Release and remove coil spring compressor tool.



Lift off mount.
Installed Order – Engines M 20 / M 30:
1 = Self-locking nut
2 = Washer with small diameter
3 = Mount
4 = Insulator
5 = Washer with large diameter
6 = Cap
Inside curved surface of insulator (4) faces mount.
Installed Order – Engine M 21:
See page 31 - 10a



Lift off upper spring retainer with rubber ring and coil spring.
Installation:
Check upper and lower rubber rings, replacing if necessary.
Ends of coil spring must fit on shoulders in lower and upper spring retainers.



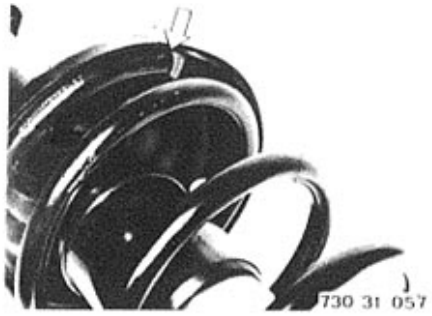
31 33 100 REMOVING AND INSTALLING OR REPLACING COIL SPRING FOR LEFT OR RIGHT FRONT SPRING STRUT

Remove spring strut mount 31 33 001.
Take off upper spring retainer with rubber ring and coil spring.
Important!
Only install pairs of springs with same BMW number (1) (located on end of spring) and same color code (2) (either with or without red paint stripe) on one axle.
Refer to spare part microfiche for cross reference of springs according to vehicle type and, if applicable, special equipment (e.g. air conditioner, sport suspension, etc.) as well as dates of introduction.
The BMW number on the spring can be used to determine the spare part number and therefore the correct spring for a pertinent vehicle type according to the spare part microfiche.
Example:

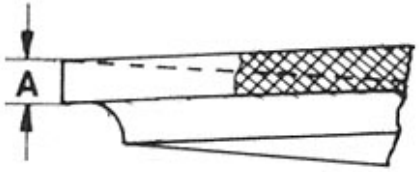
1. Spring with red color code:
   Number on spring = 1 125 332
   Add 1 = part number = 1 125 333
2. Spring without red color code:
   Number on spring = 1 125 332
   Add 2 = part number = 1 125 334



Installation:
Check protective tube and rubber damper, replacing if necessary.

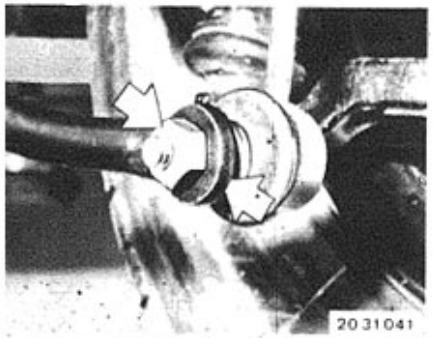


Installation:
Check upper and lower rubber rings, replacing if necessary.
Ends of coil spring must fit on shoulders in lower and upper spring retainers.



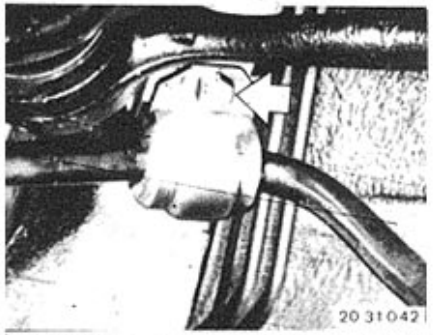
Installation:
Use upper rubber ring* with thickness (A) for springs with red color code.
A = 9 mm (0.354").

* See Specifications of Gr. 31

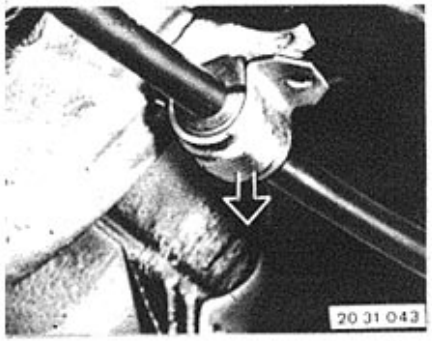


31 35 000 REMOVING AND INSTALLING STABILIZER

Disconnect push rods on left and right sides.
Hold on ball socket joint with a fork wrench.
Installation:
Tightening torque*.



Unscrew bolts.
Installation:
Tightening torque*.



Press off retaining clamps and stabilizer.
Installation:
Slotted end of rubber mount faces forward rear.

* See Specifications of Gr. 31

TROUBLESHOOTING FRONT AXLE

Condition	Cause	Correction
Grinding noise (louder in curves)	a) Wheel bearings defective	a) Replace wheel bearings
Vibration	a) Wheels imbalanced	a) Balance wheels
	b) Rims have lateral/radial runout	b) Replace rims, if necessary
	c) Tires have radial runout	c) Match or replace tires
Steering wheel shake	a) Wheels imbalanced	a) Balance wheels
	b) Rims have lateral/radial runout	b) Replace rims, if necessary
	c) Shock absorber effect insufficient	c) Replace shock absorbers
	d) Thrust strut mount defective	d) Replace thrust strut mount 31 12 090
	e) Wrong thrust strut mount installed	e) Replace thrust strut mount 31 12 090
	f) Steering gear play excessive	f) Adjust pressure point
Rattling noise	a) Shock absorber cartridge loose in spring strut	a) Tighten threaded ring (check threads)
	b) Ball joint on control arm worn	b) Replace control arm
	c) Ball joint on thrust rod worn	c) Replace thrust rod
	d) Stabilizer rubber mount worn	d) Replace rubber mount
	e) Ball joints of push rod worn	e) Replace push rod
	f) Front axle carrier mounted loosely on body	f) Tighten (check threads)

TROUBLESHOOTING FRONT AXLE.

Condition	Cause	Correction
Long after-swinging of body after passing over rough road	Shock absorber efficiency weak (see Troubleshooting Shock Absorbers)	Replace shock absorbers
Wipping of body when passing over successive rough road surfaces	Shock absorber efficiency weak (see Troubleshooting Shock Absorbers)	Replace shock absorbers
Rising of body when accelerating	Shock absorber efficiency weak (see Troubleshooting Shock Absorbers)	Replace shock absorbers
Wheels jumping even on normal road surfaces	Shock absorber efficiency weak (see Troubleshooting Shock Absorbers)	Replace shock absorbers
Car breaking out when braking	Shock absorber efficiency weak (see Troubleshooting Shock Absorbers)	Replace shock absorbers
Breaking out (skidding) in curves due to poor track holding	Shock absorber efficiency weak (see Troubleshooting Shock Absorbers)	Replace shock absorbers

TROUBLESHOOTING SHOCK ABSORBERS

The condition of shock absorbers can only be checked with a Shock Tester or in a shock absorber testing machine.

Condition	Cause	Correction
Shock absorbers knocking (bottoming)	a) Rubber damper defective	a) Check/replace rubber damper
	b) Shock absorber efficiency insufficient	b) Replace shock absorber
Shock absorber noise	a) Shock absorber cartridge loose	a) Tighten screw-on ring – inspect threads
	b) Installed shock absorber had been stored laying down with piston rod run in	b) Store shock absorber standing upright at room temperature 24 hours and with piston rod run out
	c) Shock absorber defective	c) Replace shock absorber
Poor handling	a) Shock absorber efficiency weak	a) Replace shock absorber
Flat spots on tire treads	a) Shock absorber defective	a) Replace shock absorber

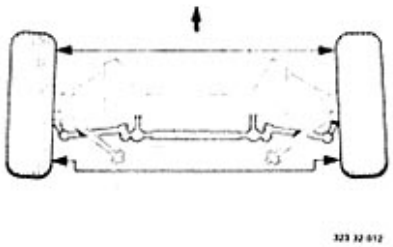
32 Steering and wheel alignment

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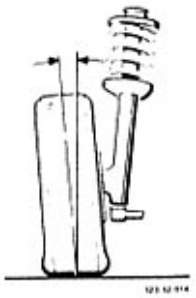
GENERAL INFORMATION / DEFINITIONS



323 32 012

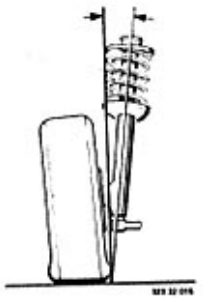
TOE

is the reduction in distance of front of front wheels to rear of front wheels. Toe prevents the wheels from running apart while driving and consequently wheel shimmy and grinding, excessive tire wear, excessive loads on steering linkage and joints as well as hard steering of car. Toe is measured in "straight ahead position".



CAMBER

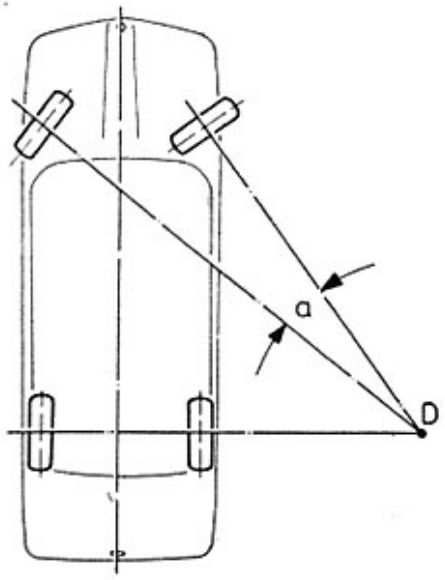
is the inclination of the wheel to the car's axial plane, measured in the car's lateral plane with "straight ahead drive".



KING PIN INCLINATION

is the angle, by which the king pin is iclined inward from a perpendicular line to the lateral axis of the car.
The king pin inclination produces returning forces, which return the road wheels and steering wheel to straight ahead after driving through a curve or around a corner.

Camber and king pin inclination determine the location of the wheel contact point with the road surface. King pin inclination reduces the leverage, on which frictional forces are engaged, which makes it easier to turn the wheels to left or right lock. In addition, the jolts from rough road surfaces do not have strong influence on the steering.

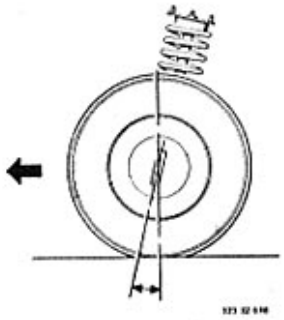


323 32 013

TOE DIFFERENCE ANGLE

is the angular position of the wheel on the inside of a curve to the wheel on the outside of a curve when driving in a curve. The steering is designed that the angular position of the wheels changes as steering lock progresses. The toe difference angle provides information on the pertinent operation of the steering trapezoid for left or right steering lock from the center position. A correctly adjusted toe difference angle produces equal values for left and right lock in due consideration for plant tolerances.

a = Toe difference angle
D = Turning circle center point

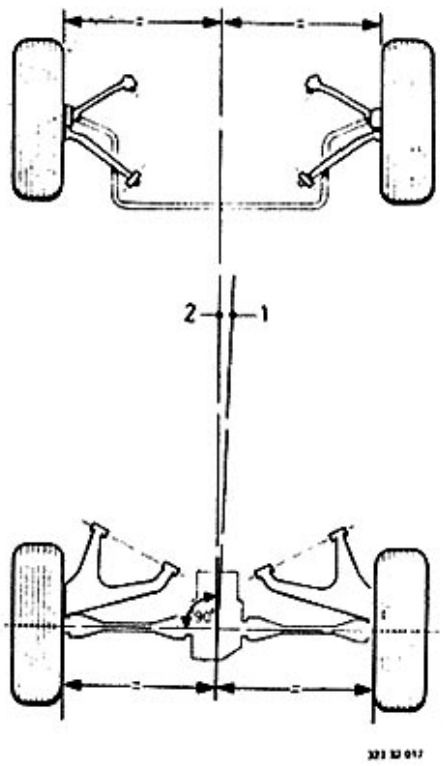


CASTER

is the inclination of the king pin* in forward direction as seen from the side.

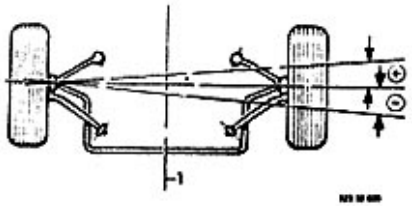
The wheels are pulled and not pushed because of caster. In a similar manner to king pin inclination, when driving in curves or around corners, returning forces are produced to help return the wheels to straight ahead position.

The "king pin" is equal to a line through the center point of the spring strut mount and control arm ball joint.



GEOMETRICAL AXIS 1
is the bisecting line of an angle from the total rear wheel toe. Front wheel measurements are taken in reference to this axis.

SYMMETRICAL AXIS 2
is a center line running through the front and rear axles.



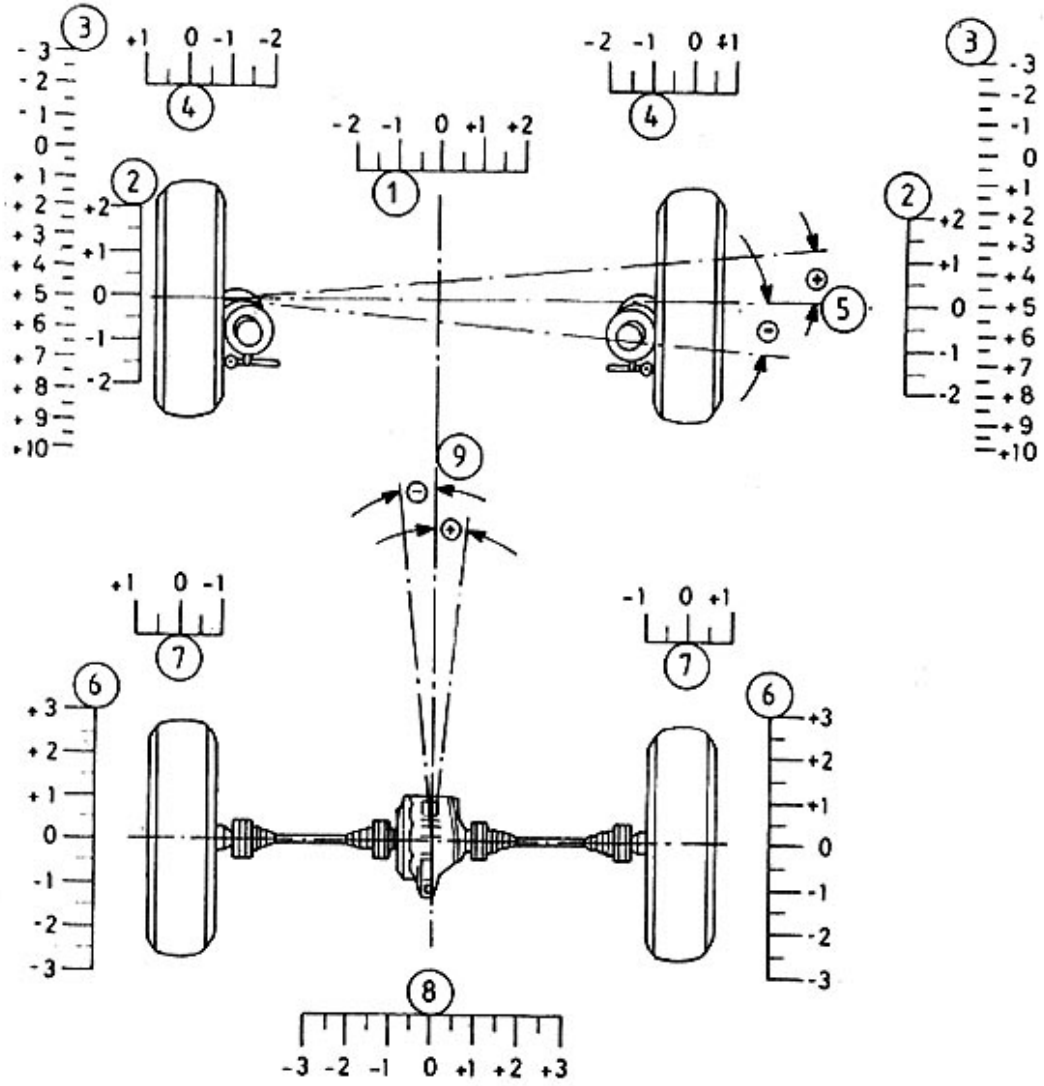
WHEEL OFFSET
is the angle, by which one front wheel is displaced more toward front or rear than the other front wheel.

CHECKING AND ADJUSTING ALIGNMENT OF FRONT WHEELS AND REAR WHEELS WITH OPTICAL TESTER

32 00 034
32 00 054

Requirements prior to checking wheel alignment:
1. Good, uniform tire treads.
2. Specified tire inflation pressure**.
3. Wheel rims in perfect condition*.
4. Specified wheel bearing play
5. Car brought to normal position*.
6. Specified height*.

Check actual values with an optical tester.
Fill in test sheet.
Nominal values*.



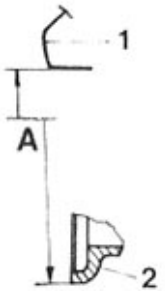
1 = Toe
2 = Camber
3 = Caster (with 10° or 20° wheel lock)
4 = Toe difference angle (with 20° wheel lock)
5 = Wheel offset
6 = Camber
7 = Rear wheel position
8 = Toe
9 = Geometrical axis

730 32 001

* See Specifications of Gr. 31/32/33/36
** See Service Information of Gr. 36

TROUBLESHOOTING FRONT WHEEL ALIGNMENT

Condition	Cause	Correction
1 Toe deviation	a) Car not in normal position b) Tie rod(s) bent c) Track arm on spring strut deformed d) Tie rod ball joints worn e) Rubber mount in control arm defective	a) Height level, see Specifications of Group 31 b) Replace tie rod(s) c) Replace track arm d) Replace tie rods or ball joints e) Replace rubber mount
2 Camber deviation Camber is given by design and cannot be adjusted.	a) Rubber mount in control arm defective b) Control arm deformed c) Spring strut deformed d) Guide joint worn e) Suspension sag excessive f) Front axle carrier deformed g) Spring strut mount holder deformed h) Distortion in floor assembly (engine carrier) i) Unfavorable summation of tolerances	a) Replace rubber mount b) Replace control arm c) Replace spring strut d) Replace control arm e) Replace coil springs Height level, see Specifications of Group 31 f) Replace front axle carrier g) Repair front end of body h) Repair body i) Install eccentric mount
3 Caster deviation Caster is given by design and cannot be adjusted.	a) Strut bent b) Rubber mount for strut defective c) Control arm bent d) Spring strut deformed e) Wheel house (spring strut mount) deformed f) Distortion in floor assembly (engine carrier)	a) Replace strut b) Replace rubber mount c) Replace control arm d) Replace spring strut e) Repair front end of body f) Repair body
4 Toe difference angle deviation	Assuming camber and caster are correct: a) Tie rods not adjusted uniformly b) Track arm on spring strut bent	a) Adjust toe to same value on left and right sides b) Replace track arm
5 Wheel offset deviation (alignment tester Type F 1600)	Assuming front wheels have equal single toe to geometrical axis: a) Front axle carrier deformed b) Engine carrier deformed c) Control arm deformed d) Strut deformed	a) Replace front axle carrier b) Repair body c) Replace control arm d) Replace strut

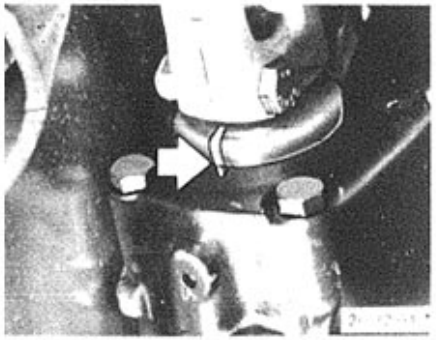


32 00 004 ADJUSTING TOE AND TOE DIFFERENCE ANGLE

Measuring Height Level:
Measure on all wheels, from wheel house lower edge (1) to ring flange (2) at height of wheel center.
A = Nominal value**.

Correcting Camber:
The front axle camber can be corrected by ± 30' with the installation of eccentric mounts, if camber correction is necessary due to summation of unfavorable tolerances (not 524 td).
Important!
Changes in axle geometry (axle – body) caused in an accident may not be eliminated with this measure.

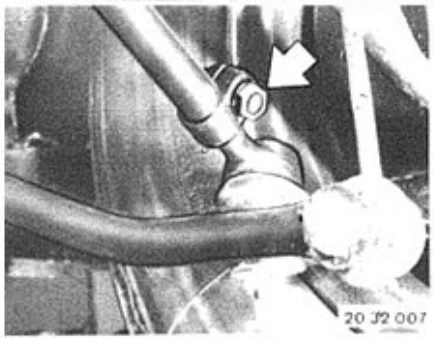
28 32 091



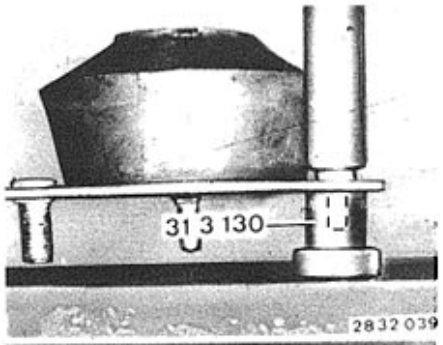
Set steering gear to straight ahead position (marks on case and spindle).

Example:

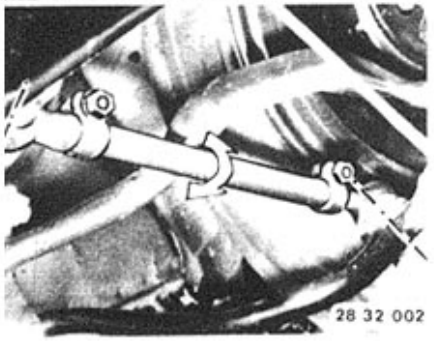
Camber nominal value:	+ 10' ... – 50'
Camber actual value:	– 1° 10'
+ correction	+ 30'
New actual value:	– 40'



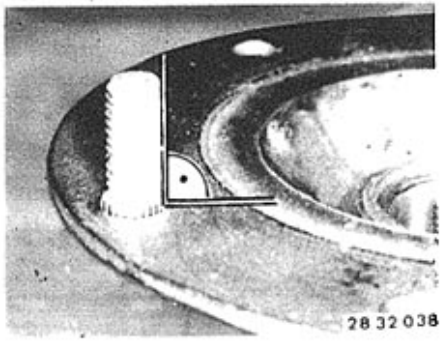
Loosen both tie rod bolts.
Installation:
Tightening torque* for car loaded down to normal position*.



Eccentric mounts are marked at bores with "+" and "–".
Press knurled head bolts into "+" or "–" bores as required (see example) with Special Tool 31 3 130.



Adjust toe on left and right wheels to nominal value* by turning threaded sleeves.
Installation:
Make sure ball joints are not turned.

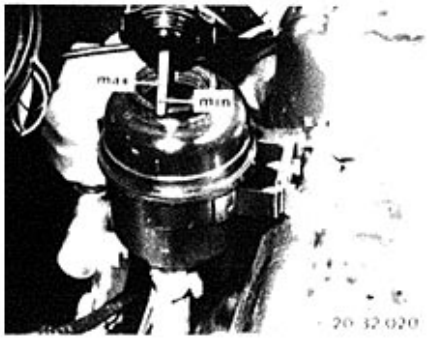


Important!
Knurled head bolts must be perpendicular in mounts and flush.
Replace front spring strut mounts 31 33 001.

* See Specifications
** See Specifications of Gr. 31/33

TROUBLESHOOTING REAR WHEEL ALIGNMENT

Condition	Cause	Correction
6 Camber deviation	a) Car not in normal position/suspension sag excessive b) Rubber mount on rear axle carrier defective c) Rubber mount on final drive defective d) Silent blocks in trailing arm defective e) Rear axle carrier deformed f) Trailing arm deformed g) Distortion in floor assembly	a) Height level, see Specifications of Group 31 b) Replace rubber mount c) Replace rubber mount d) Replace silent blocks e) Check or replace rear axle carrier f) Check or replace trailing arm g) Repair body
7 Rear wheel position deviation	a) Rear axle carrier displaced laterally b) Distortion in floor assembly	a) Check rubber mount on rear axle carrier, replacing if necessary b) Repair body
8 Toe deviation	a) Car not in normal position or suspension sag excessive b) Rubber mount on rear axle carrier defective c) Rubber mount on final drive defective d) Silent blocks in trailing arm defective e) Rear axle carrier deformed f) Trailing arm deformed g) Summation of unfavorable tolerances	a) Height level, see Specifications of Group 31 b) Replace rubber mount c) Replace rubber mount d) Replace silent blocks e) Check rear axle carrier, replacing if necessary f) Check or replace trailing arm g) Install eccentric silent blocks, see 33 22 561
9 Geometrical axis deviation (alignment tester Type F 1600)	Assuming total rear wheel toe is correct: a) Distortion in floor assembly	a) Repair body



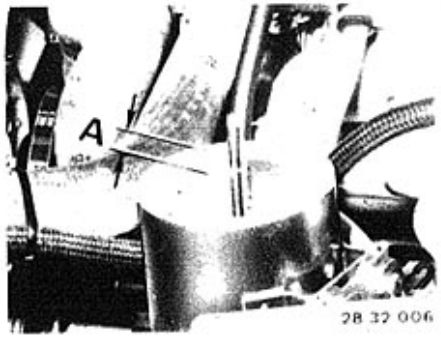
32 13 006 FILLING AND BLEEDING POWER STEERING

A) Cars Without Hydraulic Brake Boost:

1. Filling With Engine Stopped:
   Fill oil tank up to "MAX" mark on oil dipstick.

2. Bleeding:
   Start engine.
   Turn steering twice each against left and right lock.

3. Check oil level with engine stopped.
   Correct hydraulic fluid* level up to "MAX" mark.



B. Cars With Hydraulic Brake Boost:

1. Filling With Engine Stopped:
   Fill oil tank up to (A) = approx. 25 mm (1") below edge.

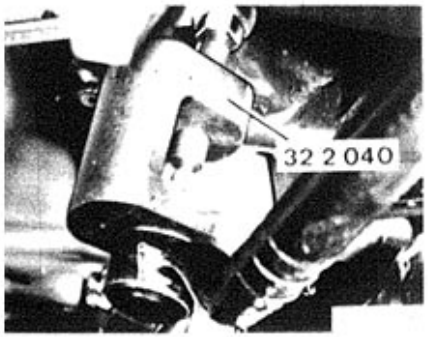
2. Filling and Bleeding With Running Engine:

2.1 Filling:
   Pour in remaining hydraulic fluid* uniformly while starting the engine.

2.2 Bleeding:
   Turn steering wheel twice each against left and right lock. Operate brake pedal 5 times, wait approx. 30 seconds and then operate brakes another 5 times.

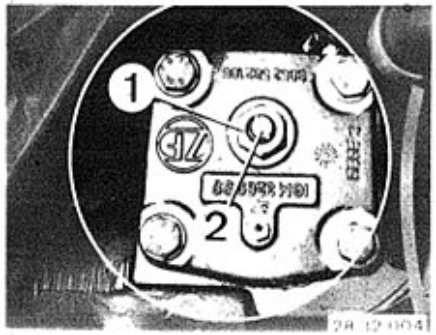
3. Checking Oil Level With Engine Stopped:
   Operate brake pedal until reservoir is discharged (reservoir is empty when oil level stops rising – visual check – or when force on pedal increases suddenly – force test –). Oil level should be approx. 10 mm (0.394") below upper edge of tank when brake pedal is released.
   Correct wrong oil level with engine stopped.

* See Service Information of Gr. 00

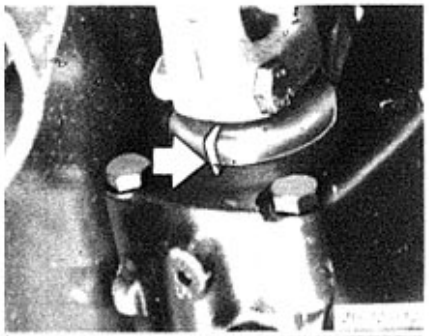


32 13 014 ADJUSTING PRESSURE POINT

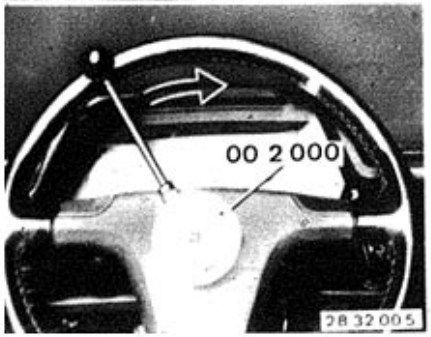
Requirements:
Steering gear and mounts/joints of steering column in perfect condition.
Remove cotter pin and unscrew castle nut.
Pry tie rod off of steering drop arm with Special Tool 32 2 040.
Installation:
Tightening torque*.
Lock castle nut with cotter pin.



Adjusting:
Turn steering wheel counterclockwise about 1 turn from straight ahead position.
Loosen nut (1) on steering gear and turn adjusting screw (2) until specified friction torque* is reached while passing the pressure point.
Installation:
Tightening torque* for lock nut.



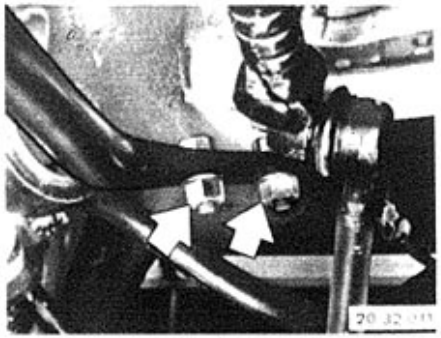
Set steering gear to straight ahead position (marks on spindle and housing aligned).



Take off BMW emblem.
Turn steering wheel counterclockwise about 1 turn.
After mounting friction torque meter 00 2 000 turn steering wheel clockwise past the pressure point and read the friction torque*.

* See Specifications

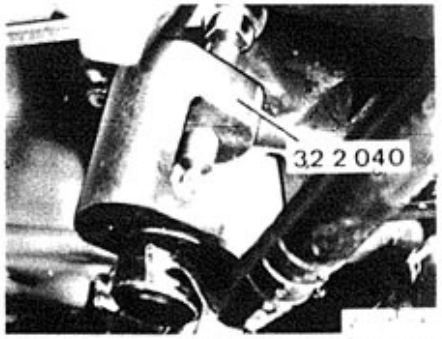
* See Specifications



32 13 060 REMOVING AND INSTALLING POWER STEERING GEAR

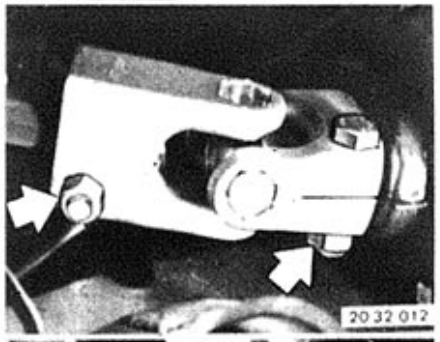
Discharge pressure in reservoir by operating brake pedal about 20 times.
Draw off brake fluid in tank.
Remove connecting pipe.
Installation:
Replace self-locking nuts.
Fill and bleed hydraulic system 32 13 006.

Never reuse drained hydraulic fluid!

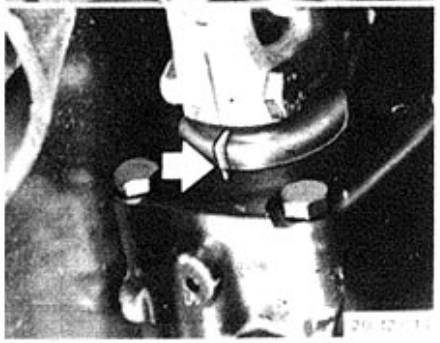


Remove cotter pin and unscrew castle nut.
Press tie rod off of steering drop arm with Special Tool 32 2 040.
Installation:
Tightening torque*.
Lock nut with a cotter pin.

Important:
Cars with SRS remove steering wheel 3233 000

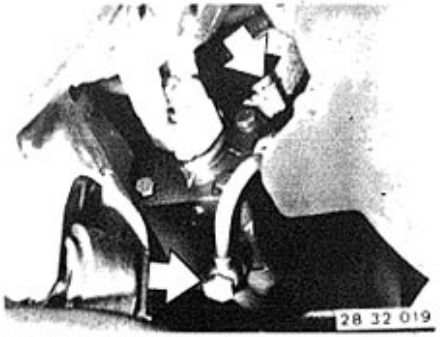


Unscrew bolts.
Push universal joint off of steering gear.
Installation:
Bolts must be in locking grooves of shafts.
Replace self-locking nuts.
Tightening torque*.

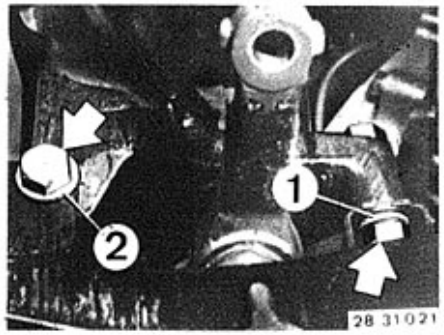


Installation:
Check straight ahead position of steering wheel and steering gear (marks on case and steering spindle).

* See Specifications



Disconnect hydraulic lines.
Plug open connections with dust caps.
Installation:
Replace seals.
Tightening torque*.
Provide sufficient space between hoses and body parts.

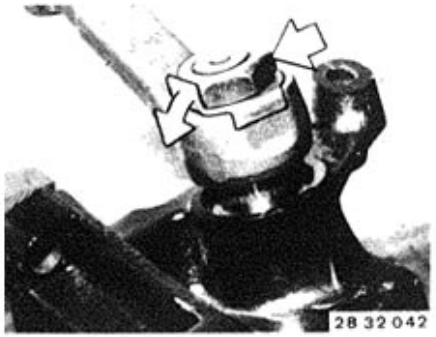


Unscrew steering gear mounting bolts.
1 Washer
2 Washer (both sides)
Remove steering gear from below.
Installation:
Replace self-locking nuts.
Tightening torque*.

* See Specifications

32 13 631 REPLACING RADIAL OIL SEAL FOR SECTOR SHAFT AND STEERING WORM/SEALING INTERMEDIATE COVER POWER STEERING GEAR REMOVED

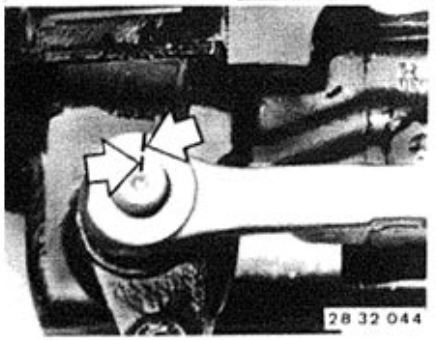
Absolute cleanliness is necessary for work on steering gears!
Power steering gear code number:
8052 955



Bend open lockplate and unscrew nut.
Installation:
Replace lockplate.
Tightening torque*.

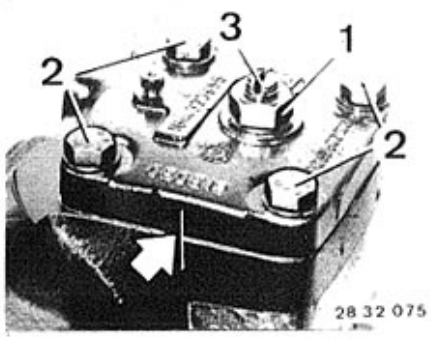


Pull off steering drop arm with Special Tool 32 2 000.

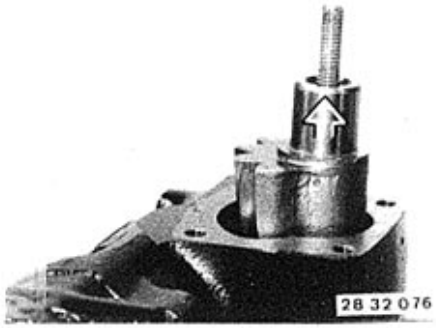


Installation:
Check installed position – marks on steering drop arm and shaft.

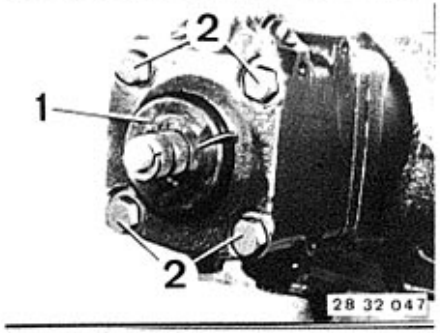
* See Specifications



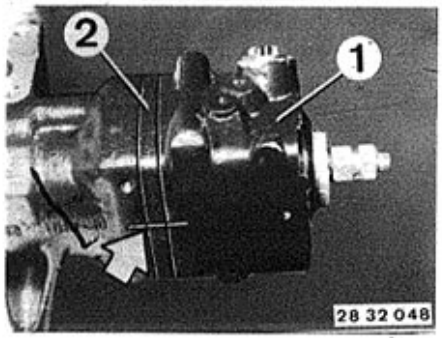
Mark position of cover to case.
Unscrew nut (1).
Unscrew bolts (2) and lift off cover by turning adjusting screw (3).



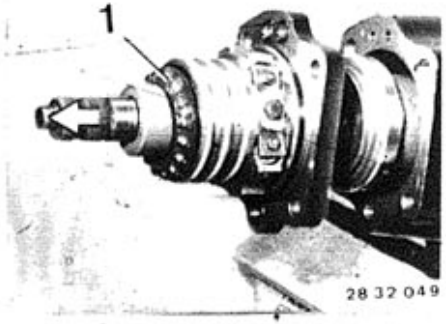
Pull sector shaft out of case.



Pull off cap (1).
Unscrew bolts (2).



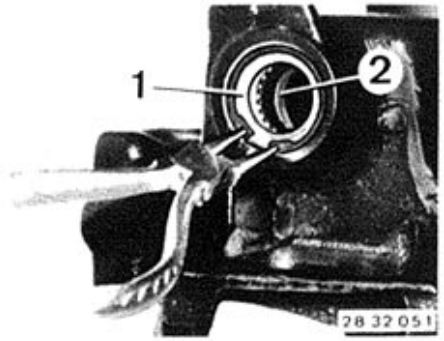
Mark position of valve housing (1) and intermediate cover (2) to case.
Take off valve housing (1).



Take off annular ball bearing (1).
Pull out worm with piston.


28 32 050

Set up piston and remove worm by turning clockwise.
Caution!
23 loose balls.



Remove circlip.
Press out outer radial oil seal (1) and inner radial oil seal (2).



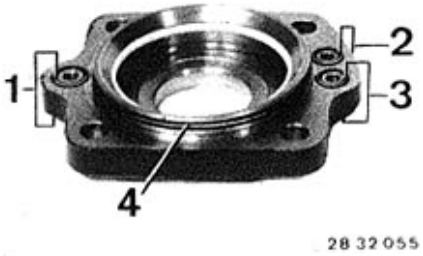
Lubricate lips of the radial oil seal with grease.
Insert support ring (3) and press in radial oil seal (2) (lip facing inside of case) with Special Tool 32 1 060.
Press in radial oil seal (1) with Special Tool 32 1 070 (lip facing inside of case) and install retainer (4).



Replace seals (1 ... 4) and O-rings underneath.
Coat seals with hydraulic fluid*.



Replace seal (1) and O-ring (2) underneath.
Coat seal with hydraulic fluid*.



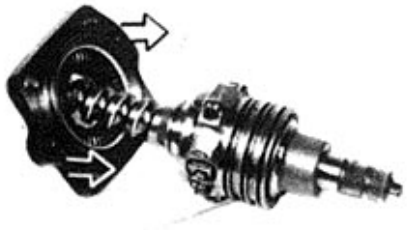
Replace O-rings (1 ... 3) on both sides and O-ring (4).



Place thrust washer (1) and axial bearing (2) in intermediate cover (with a little grease).

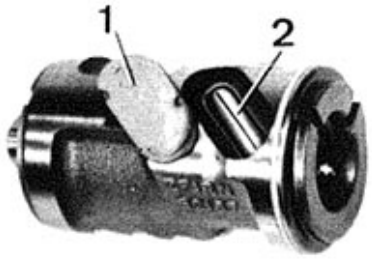
* See Service Information of Gr. 00

Mount intermediate cover (being careful not to damage worm seal) on worm head.



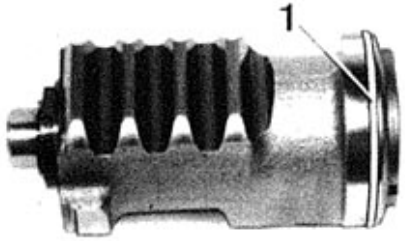
28 32 057

Pull off cap (1) and remove circulating tube (2).



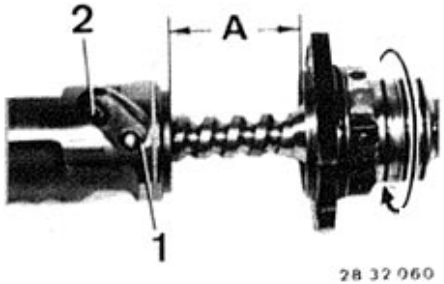
28 32 058

Replace seal (1) and O-ring behind it.
Coat seal with hydraulic fluid*.



28 32 059

Press worm head into piston to depth A = approx. 6 cm (2.362").
Install 16 balls through bore (1) in threaded channel of worm, while turning the worm until balls are carried along to bore (2).



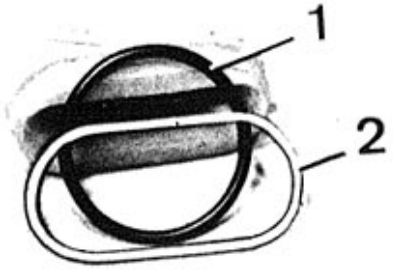
28 32 060

* See Service Information of Gr. 00



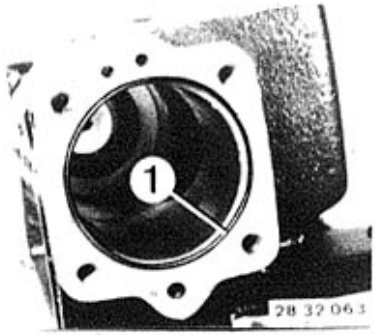
28 32 061

Place 7 balls (both outside balls with grease) in circulating tube and insert circulating tube in piston.



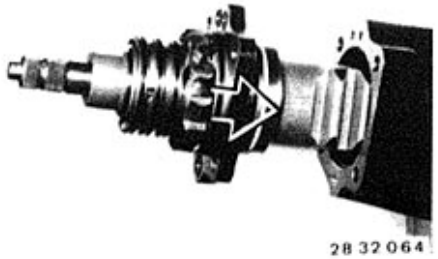
28 32 062

Place O-ring (1) and seal (2) in cap.
Press cap into piston.



28 32 063

Place O-ring (1) in steering gear case.

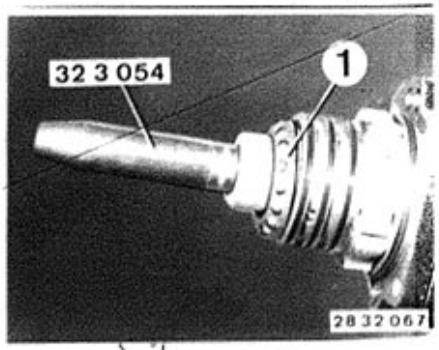


28 32 064

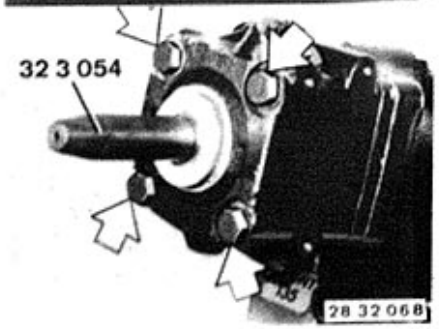
Press piston (being careful not to damage piston seal) into steering gear case.



Install new radial oil seal (lip lubricated with grease) in valve housing with Special Tool 32 1 080 (lip of seal faces inside of case).

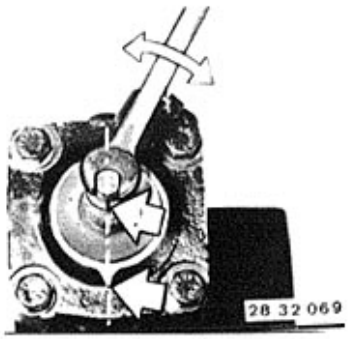


Install ball bearing (1) and Special Tool 32 3 054.

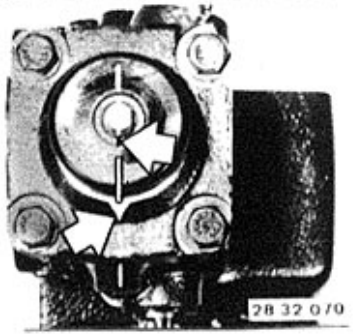


Slide valve housing carefully over seals of worm head and tighten bolts.
Tightening torque*.
Remove Special Tool 32 3 054.

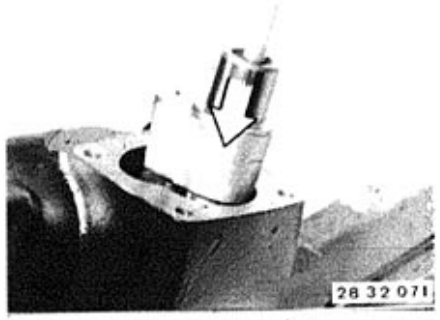
* See Specifications



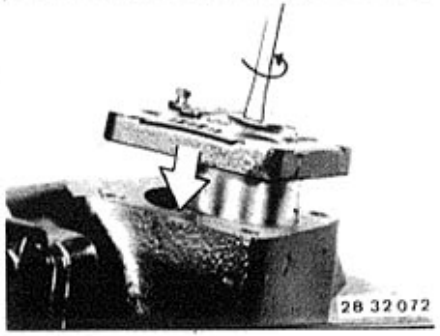
Turn steering to lock on one side.
Turn back about 2 turns until marks on spindle and case are aligned = straight ahead position.



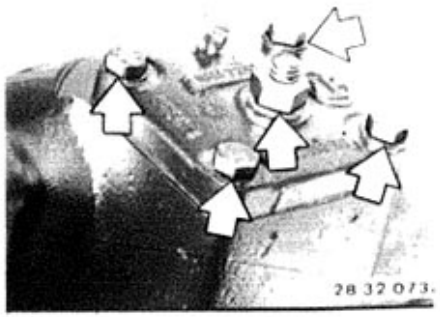
Pack cap with grease and press on to spindle marks on spindle, cap and case must align.



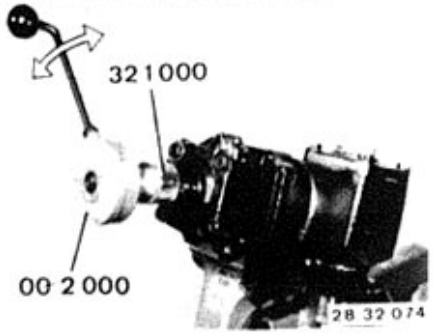
Slide in sector shaft carefully with mark on face at right angle to piston axis (being careful not to damage radial oil seals).



Replace O-ring in cover.
Position cover on case by turning adjusting screw counterclockwise.



Tighten cover bolts.
Tightening torque*.
Screw on lock nut finger tight (sealing surface facing cover).



Adjusting Pressure Point:
Mount Special Tool 32 1 000 on spindle and connect friction torque meter 00 2 000.
Measure friction torque about 1/2 turn before final lock.
Set steering gear to straight ahead position.
Turn adjusting screw until when passing the pressure point the friction torque is 40 to 50 Ncm (3.5 to 4.3 in. lbs.) higher than the value measured earlier.
Total friction torque must not exceed 160 Ncm (14 in. lbs.).
Tighten lock nut with torque of 25 Nm (18 ft. lbs.).
Recheck friction torque.

Attach steering drop arm.
Check operation of system after installing steering gear

* See Specifications

TROUBLESHOOTING POWER STEERING

Condition	Cause	Correction
Steering hard to turn from center to left or right	a) Pressure point adjusted too tight	a) Adjust pressure point
Steering turns automatically to end position on one side	a) Valve maladjusted to hydraulic center	a) Replace steering gear - adjustments only by manufacturer
Steering wheel has excessive play	a) Steering gear loose on front axle carrier b) Universal joints have excessive play c) Coupling loose d) Tie rod ends worn e) Sector shaft not meshing in teeth of piston without play f) Play between worm and piston g) Worm has axial play h) Insufficient oil in system	a) Tighten steering gear b) Replace universal joints c) Tighten coupling d) Replace tie rod ends e) Adjust pressure point f) Replace steering gear g) Replace steering gear h) Add oil* and bleed hydraulic system 32 13 006
Steering wheel shakes	a) Wheels have imbalance or radial runout b) Wheel alignment incorrect c) Thrust strut bent d) Rubber mount for thrust strut defective e) Control arm bent f) Shock absorbers without effect g) Bearing sleeve in steering guide arm defective h) Air in hydraulic circuit	a) Balance wheels; replace rims and/or tires in case of radial runout b) Check/adjust front wheel alignment with optical tester c) Replace thrust strut d) Replace rubber mount e) Replace control arm f) Replace shock absorbers g) Replace bearing sleeve h) Bleed hydraulic system 32 13 006
Steering moves hard against left or right stop	a) No pressure build up in lower pressure chamber b) No pressure build up in upper pressure chamber c) Insufficient oil in system d) Drive belt loose/defective e) Control valve seized in pump f) Filter is clogged g) Valve piston seized or leaks h) Piston seal damaged i) Teflon rings in steering worm head leak k) Teflon ring in intermediate cover leaks l) Air in hydraulic system m) System filled with unsuitable, strong foaming oil	a) Replace steering gear b) Replace steering gear c) Add oil* and bleed hydraulic system 32 13 006 d) Tighten or replace drive belt e) Replace power steering pump f) Replace filter – clean lines g) Replace steering gear h) Seal steering gear i) Seal steering gear k) Seal steering gear l) Bleed hydraulic system 32 13 006 m) Fill hydraulic system with specified oil*

* See Service Information of Gr. 00

TROUBLESHOOTING POWER STEERING

Condition	Cause	Correction
Hydraulic fluid loss	a) Hose connection leaks	a) Tighten hose connections, replacing hoses if necessary
	b) Oil tank seal leaks	b) Replace seal
	c) Radial oil seal for sector shaft leaks	c) Seal steering gear
	d) Radial oil seal for steering spindle leaks	d) Seal steering gear
	e) O-ring in cover leaks	e) Seal steering gear
	f) O-rings in intermediate cover leak	f) Seal steering gear

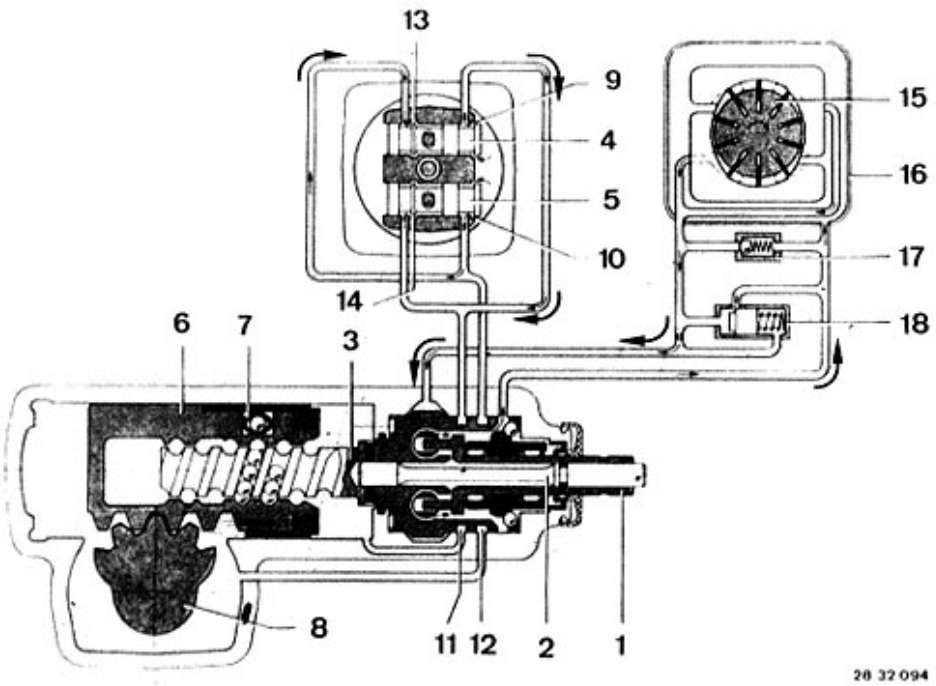
DESIGN AND DESCRIPTION OF BALL AND NUT POWER STEERING

The housing contains a complete mechanical steering gear, the control valve and operating cylinder. Steering spindle (1) is connected elastically with worm (3) via torsion bar (2) and with valve pistons (4 and 5) without play. The valve pistons are installed transversely in the worm head. The connection between piston (6) and worm (3) is accomplished with an infinite line of balls. When turning the worm the balls are taken up at one end by circulating tube (7) and put out again at the other end of the balls. Piston (6) and sector shaft (8) are meshed. The special shape of teeth on the sector shaft permits zero-play adjustment with an adjusting screw.

In neutral position of valves (4 and 5) the oil flow delivered by the pump passes through the steering and can flow through the opened feed and return control edges to the cylinder chamber and return flow. Hydraulic support cuts in when valve pistons (4 and 5) are moved out of neutral position. This happens when force is transmitted from the steering wheel of from the steering drop arm via the sector shaft and pistons to the worm. Torsion bar (2) then serves as a link. It deforms itself in the elastic range and returns the valve pistons to neutral position after releasing the steering wheel. Moving valves (4 and 5) will let the oil flow into only one of the operating cylinder chambers and in this manner support the rotating motion of the steering spindle and/or counteract the jolt from rough roads.

Steering Wheel in Neutral Position:

Oil flows from the impeller pump into the worm head, through feed grooves (9 and 10) ro radial grooves (11 and 12). From here via connecting bores to the right and left cylinder chambers and via opened return flow grooves (13 and 14) back to the oil tank. The valve is also illustrated in cross section.

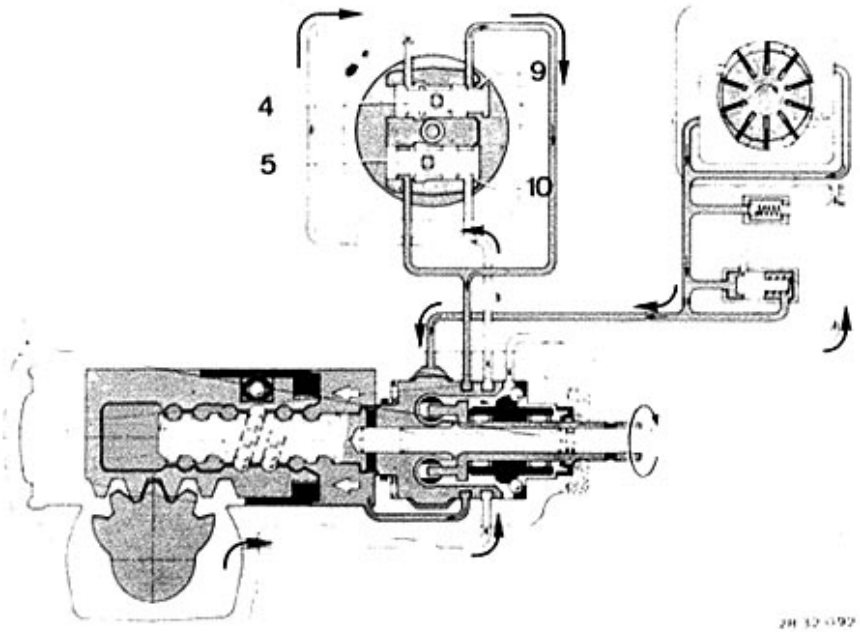


15 = Pump
16 = Oil tank
17 = Safety valve
18 = Control valve

28 32 094

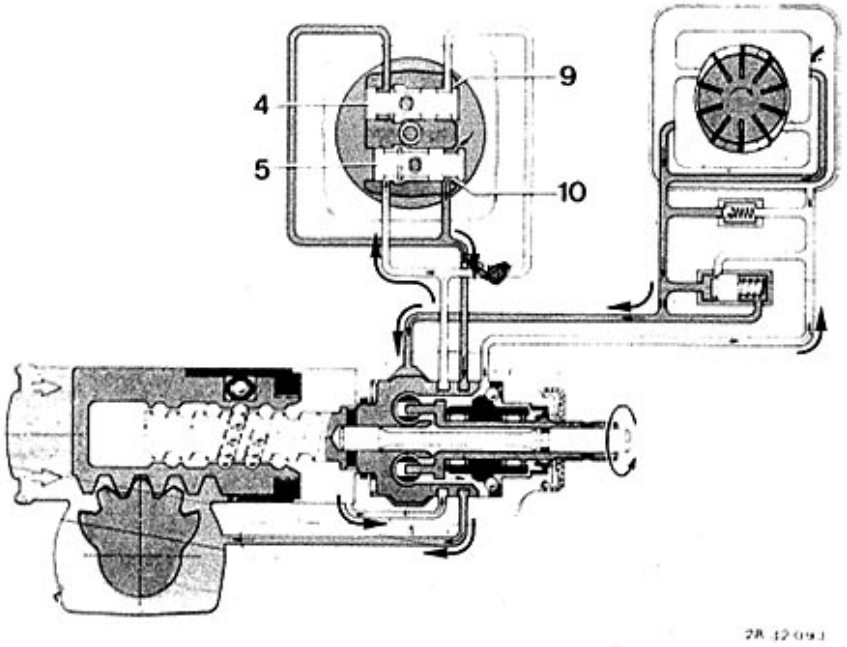
Steering Wheel Turned Clockwise:

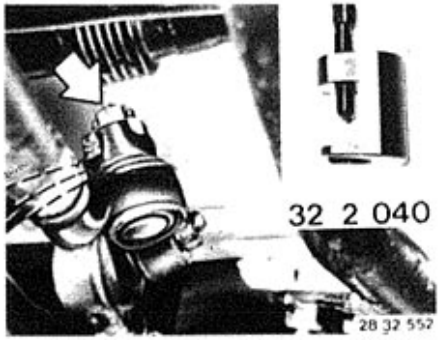
Valve piston (4) is displaced to the right and feed groove (9) opened. Valve piston (5) is displaced to the left and feed groove (10) closed. This lets the oil flow into the right cylinder chamber. Oil in the left cylinder chamber is forced out and flows back into the oil tank.



Steering Wheel Turned Counterclockwise:

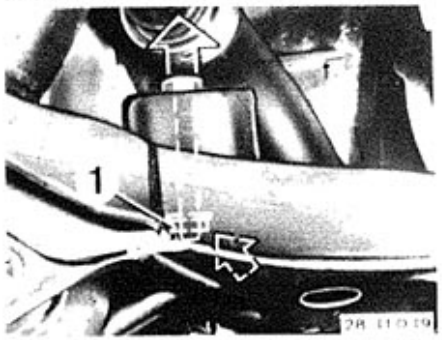
Valve piston (5) is displaced to the right and feed groove (10) opened. Valve piston (4) is displaced to the left and feed groove (9) closed. This lets the oil flow into the left cylinder chamber. Oil in the right cylinder chamber is forced out and flows back into the oil tank.



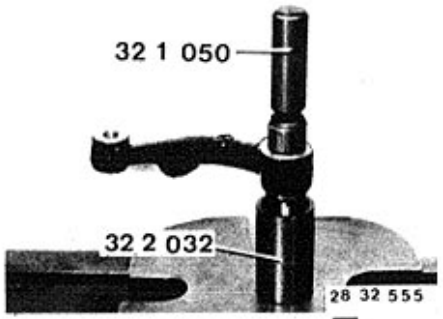


32 21 080 REMOVING AND INSTALLING STEERING GUIDE ARM

Remove cotter pin and unscrew castle nut.
Press off ball joint with Special Tool 32 2 040.
Installation:
Tightening torque*.
Lock castle nut with a cotter pin.

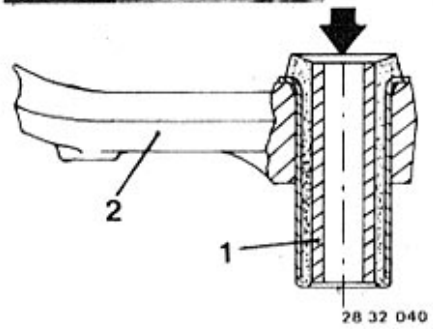


Remove steering guide arm.
1 = Washer
Installation:
Check fluid block, replacing if necessary.
Tightening torque*.

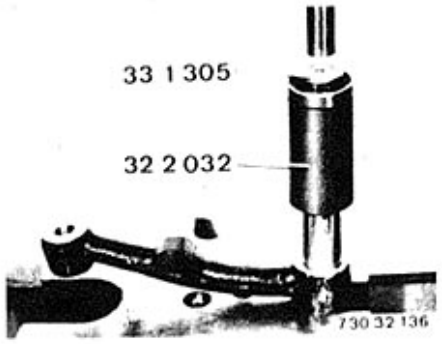


32 21 091 REPLACING FLUID BLOCK FOR STEERING GUIDE ARM

Remove and install steering guide arm 32 21 080.
Press out fluid block with Special Tools 32 1 050 and 32 2 032.

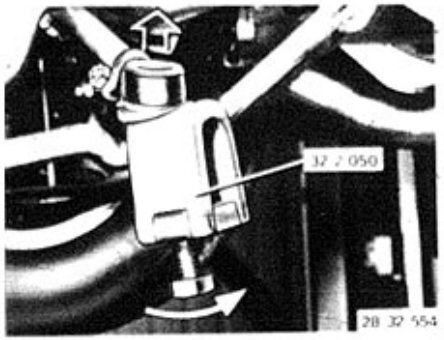


Check pressing in direction.
1 = Fluid block
2 = Steering guide arm



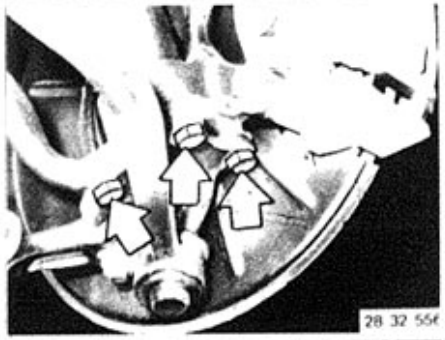
Press in new fluid block against stop with Special Tools 33 1 305 and 32 2 032.

* See Specifications

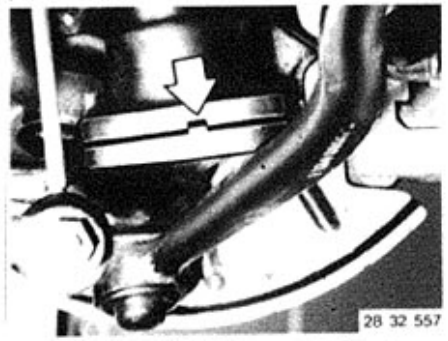


32 21 101 REPLACING LEFT OR RIGHT TIE ROD ARM

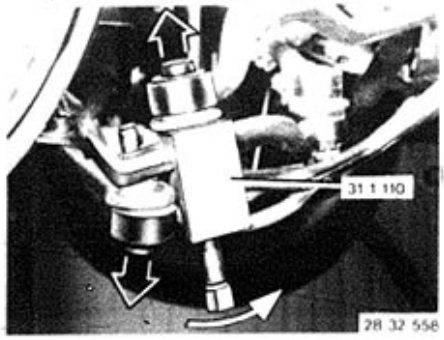
Remove and install front wheel 36 10 300.
Remove cotter pin and unscrew castle nut.
Press off ball joint with Special Tool 32 2 050.
Installation:
Tightening torque*.
Lock nut with cotter pin.
Check front wheel alignment with optical tester 32 00 034.



Unscrew bolts.
Installation:
Clean threads of tapped bores and bolts.
Lock bolts with bolt cement**.
Tightening torque*.

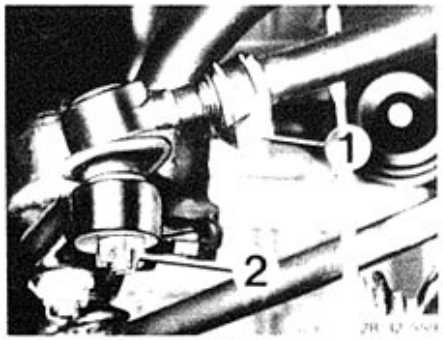


Check for correct installed position.



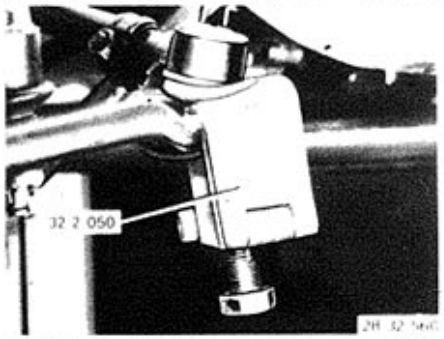
Remove cotter pin and unscrew castle nut on control arm and strut.
Press off ball joints with Special Tool 31 1 110.
Installation:
Tightening torque*.
Lock nut with cotter pin.

* See Specifications of Gr. 32
** Source: HWB

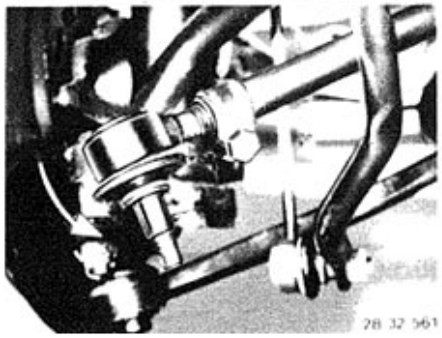


32 21 151 REPLACING LEFT OR RIGHT TIE ROD END

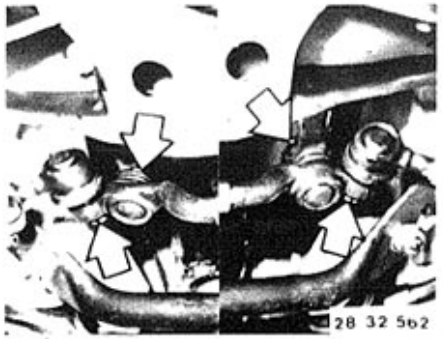
Remove and install front wheel 36 10 300.
Loosen bolt (1).
Remove cotter pin and unscrew castle nut (2).
Installation:
Tightening torque* for bolt (1) with car in normal position*.
Lock castle nut with cotter pin.
Check front wheel alignment with optical tester 32 00 034.



Press off ball joint with Special Tool 32 2 050.

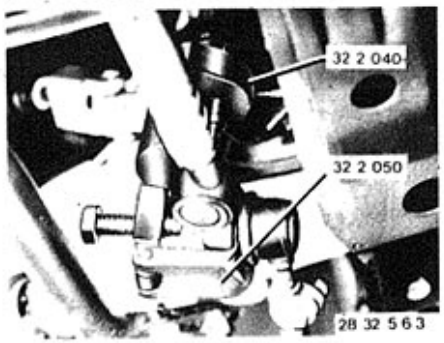


Unscrew tie rod end.

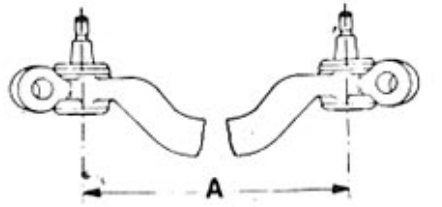


32 21 281 REPLACING CENTER TIE ROD

Remove cotter pin and unscrew castle nut.
Installation:
Tightening torque*.
Lock nuts with cotter pins.
Check front wheel alignment with optical tester 32 00 034.

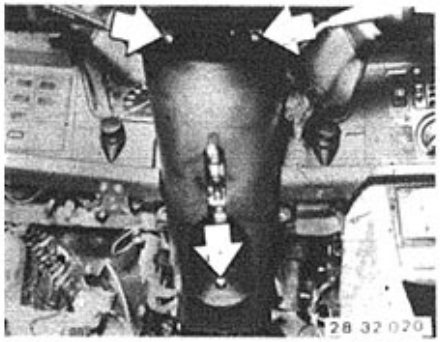


Press off side tie rods with Special Tool 32 2 050 and center tie rod with Special Tool 32 2 040.



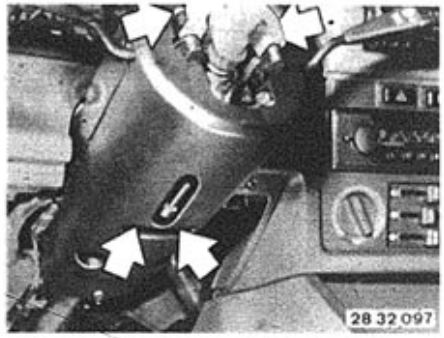
Distance A = 500 ± 1 mm (19.685 ± 0.039").

* See Specifications of Gr. 32

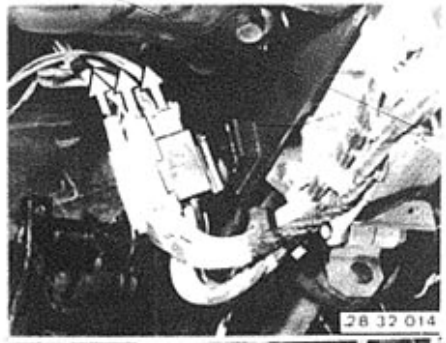


32 31 090 REMOVING AND INSTALLING COMPLETE STEERING COLUMN

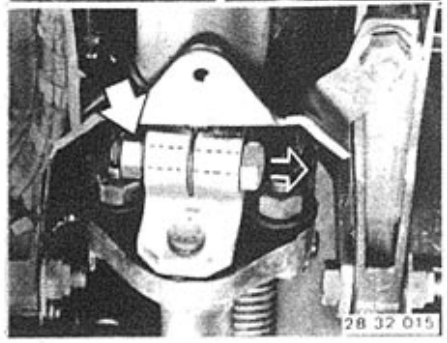
Disconnect the battery ground lead.
Remove the steering wheel – see 32 33 000.
Remove the instrument panel trim at bottom – see 51 45 180.
Remove the lower steering column casing.



Since 1986 Models:
Unscrew the steering column casing.

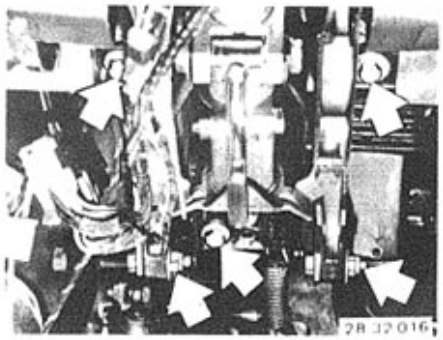


Disconnect the central electric plugs.



Remove the bolt and pull the coupling off of the upper steering spindle.
Installation:
The bolt must be in the locking groove.
Replace the self-locking nut.
Tightening torque*.

* See Specifications



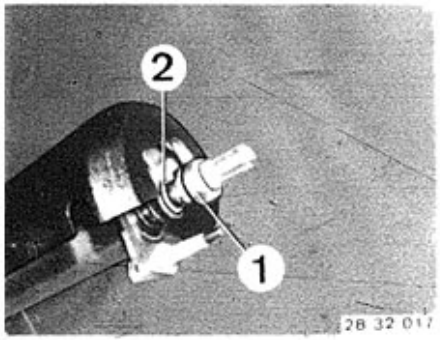
Unscrew bolts and remove the steering column.
Installation:
Replace self-locking nuts.
Tightening torque*.

* See Specifications

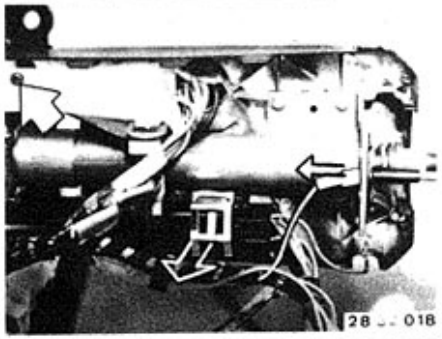


32 31 . . . DISASSEMBLING/ASSEMBLING STEERING COLUMN – STEERING COLUMN ASSEMBLY REMOVED

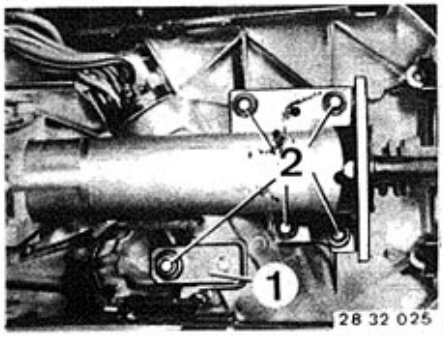
Unscrew headlight dimmer and windshield wiper switch.



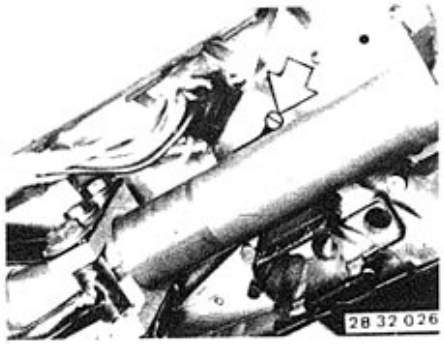
Remove collar (1).
Installation:
Recess of collar (1) must lock snap ring (2).



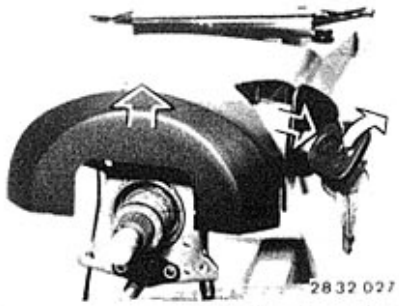
Remove flasher relay with holder.
Pull off wires for horns.
Unscrew bolt.



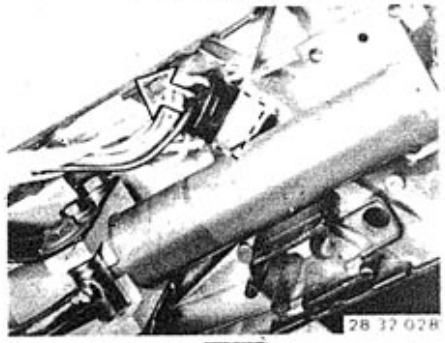
Remove shear-off screws (2) with a chisel or similar tool.
Take off steering lock plate (1).



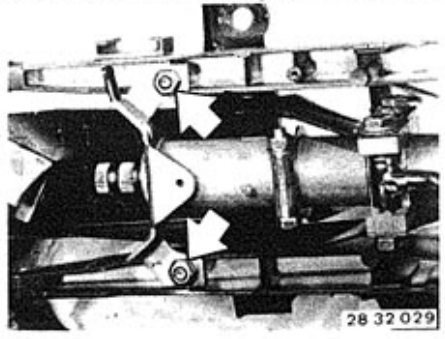
Unscrew setscrew.
Installation:
Lock setscrew with paint.



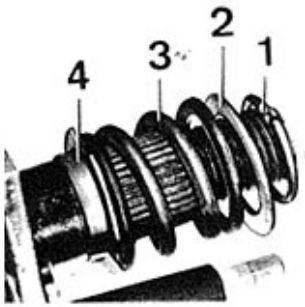
Press casing upper section away from outer tube.
Turn ignition key in "start" direction and pull out complete steering lock.



Remove ignition/starter switch.

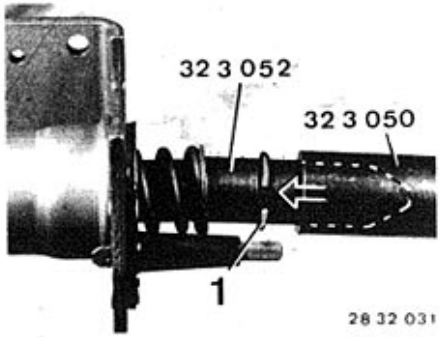


Unscrew bolts and take off outer tube on casing upper section.



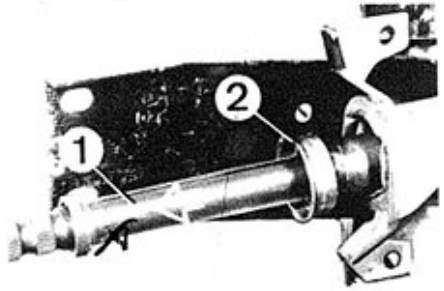
28 32 030

Remove snap ring (1), washer (2), spring (3) and ring (4).
Installation:
Stem of ring (4) faces bearing.



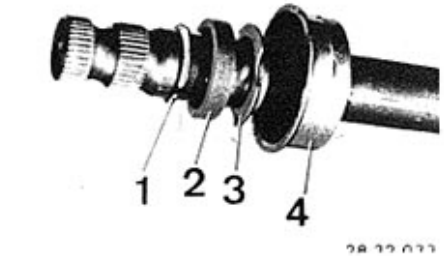
28 32 031

Installation:
Mount snap ring (1) with Special Tools 32 3 052 and 32 3 050.

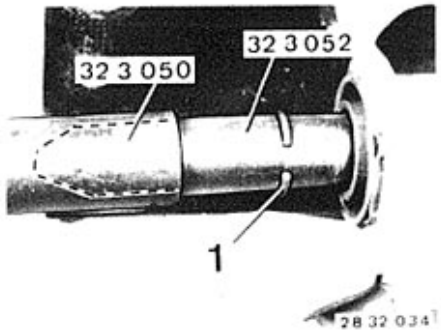


28 32 032

Pull steering spindle (1) and lower bearing (2) out of outer tube.

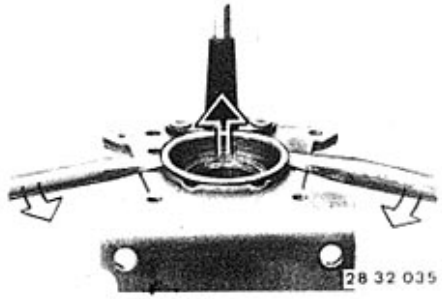


Take off snap ring (1), collar ring (2), ring (3) and bearing (4).
Installation:
Stem of ring (3) faces bearing.
Snap ring (1) locks in recess of collar ring (2).

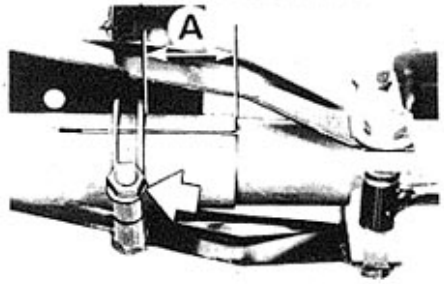


28 32 034

Installation:
Push steering spindle into outer tube.
Knock in bearing with Special Tool 00 5 550.
Install ring (3) and collar ring (2).
Mount snap ring (1) with Special Tools 32 2 052 and 32 3 050.


28 32 035

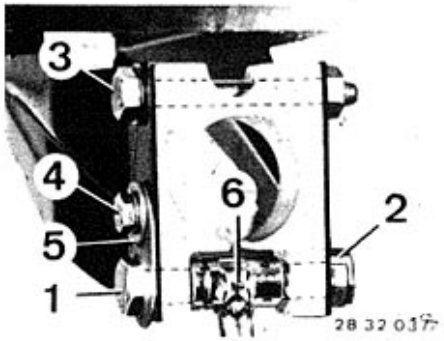
Lift upper steering spindle bearing out of outer tube with a screwdriver.
Installation:
Knock in bearing with Special Tool 00 5 550.



28 32 036

Loosen clamp.
Installation:
Check distance (A) from clamp to end of outer tube.
A = 42 to 45 mm (1.653 to 1.772").
Tighten clamp only after screwing outer tube on casing upper section.
Tightening torque*.

* See Specifications of Gr. 32



Bend open lockplate.
Unscrew bolts (1 ... 4).
Bolt (1) has left-hand threads.

Installing Instructions and Step Order for Clamp:

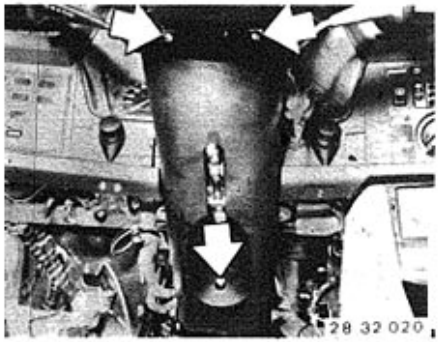
1. Screw in bolt (2) with lockplate, tighten to specified torque* and lock.
   Lever (6) will be in center of clamp in "OFF" position.

2. Screw in bolt (1) (with left-hand threads) and tighten to specified torque*.
   Lever (6) in "OFF" position.

3. Tighten bolt (3) to specified torque*.
   Lever (6) in "OFF" position.

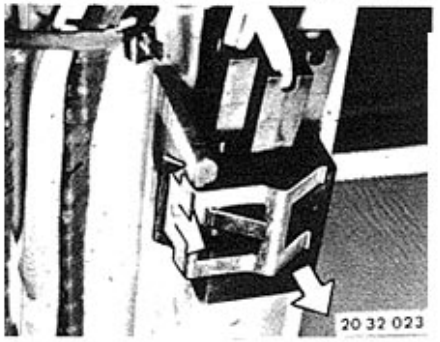
4. Bolt lockplate (5) with bolt (4).

* See Specifications



32 32 001 REPLACING COMPLETE STEERING LOCK

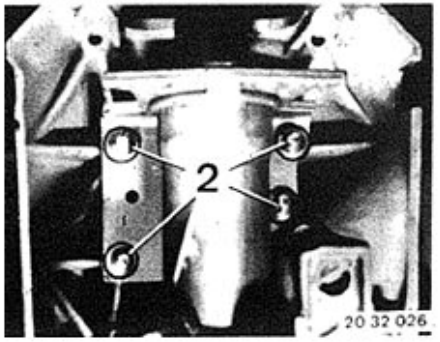
Disconnect battery ground lead.
Remove and install steering wheel 32 33 000.
Remove and install instrument panel trim at bottom 51 45 180.
Detach steering column casing at bottom.



Pull off flasher relay with holder.



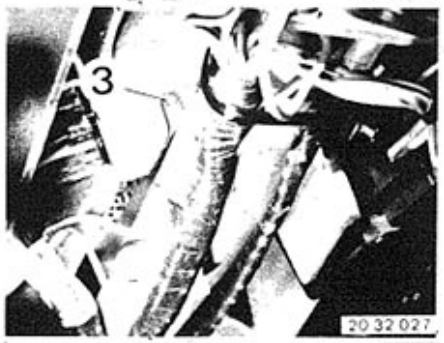
Unscrew headlight dimmer and windshield wiper switch.



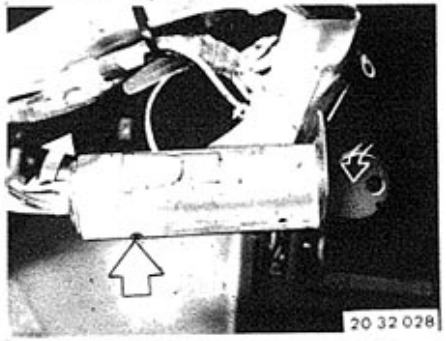
Remove shear-off screws (2) with a chisel or similar tool.



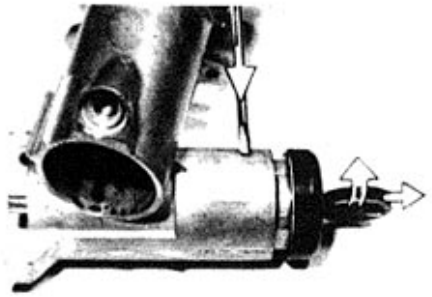
Remove shear-off screw (1) with a chisel or similar tool.



Unscrew setscrew (3).
Installation:
Lock setscrew with paint.

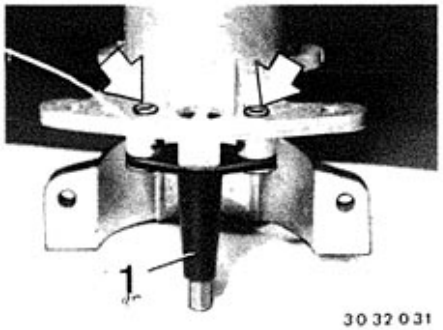


Press down on steering column and pull out steering lock.
Installation:
Check positioning of steering lock and ignition switch to each other.



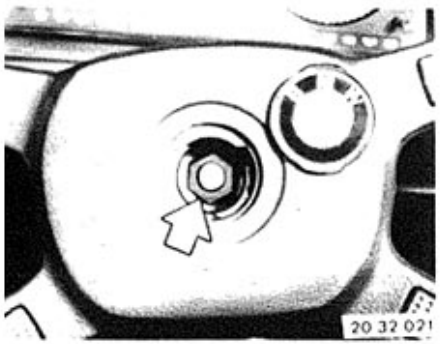
30 32 030

Press down the lock with a screwdriver.
Turn the key until it is stopped and pull out the lock cylinder.



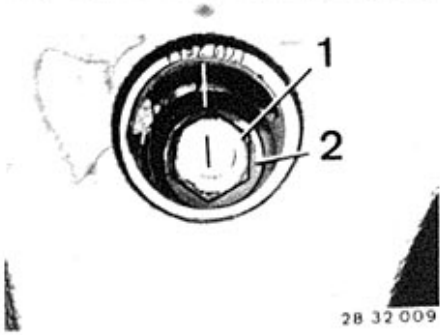
30 32 031

Drill off the rivets and screw the carbon brush contact (1) on the new steering lock.



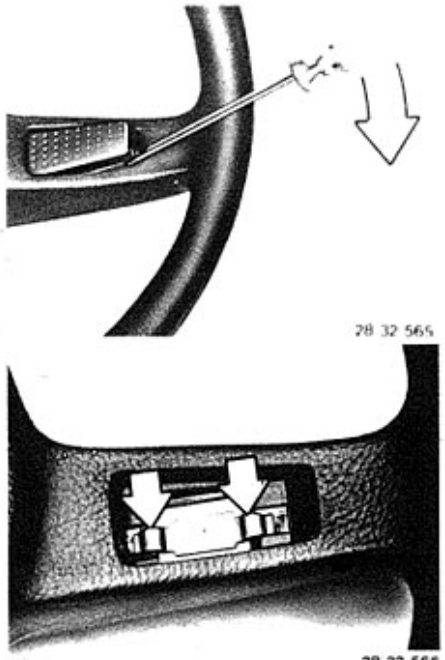
32 33 000 REMOVING AND INSTALLING OR REPLACING STEERING WHEEL

Lift out BMW emblem.



Unscrew nut (1) and remove with washer (2).
Mark position of steering wheel to steering spindle.
Pull off steering wheel.
Installation:
Replace self-locking nut.
Tightening torque*.
Important!
Don't damage turn signal cancelling cams.

from 1986 models on:
Steering wheel can only be pulled off after unlocking steering lock..



32 33 041 REPLACING HORN BUTTON ON STEERING WHEEL

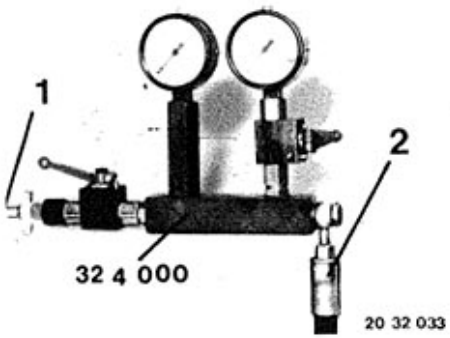
Lift out horn button carefully with a screwdriver.

Installation:
Install spring contact with curved surface facing up.

* See Specifications of Gr. 32

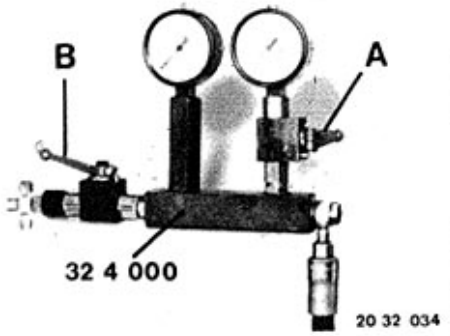
32 41 005 CHECKING OPERATION OF POWER STEERING (H-31 SYSTEM)

– Engine At Operating Temperature –
Check hydraulic fluid level in tank.
Check all hose connections and equipment (pump, brake booster, power flow regulator and steering gear) for leaks before checking operation.



20 32 033

Discharging Pressure:
Operate brake pedal about 20 times with engine stopped.
Install pressure tester 32 4 000 between pump and power flow regulator.
1 = Power flow regulator or steering gear connection
2 = Pump connection



20 32 034

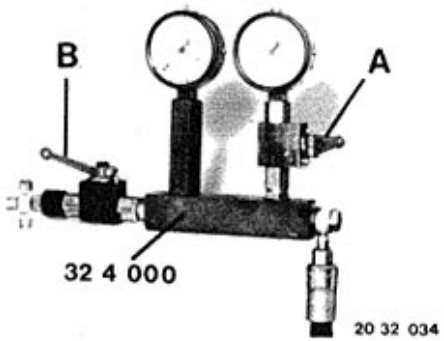
A = Shutoff valve (low pressure: 0 to 15 bar or 0 to 213 psi)
Caution!
Shutoff valve (A) must always be closed for high pressure tests to avoid damaging pressure tester.
B = Shutoff valve (high pressure: 0 to 150 bar or 0 to 2133 bar)
Open valve (B).
Close valve (A).
Start engine – fill hydraulic fluid** in tank.
Bleeding System:
Turn steering wheel two times each against left and right locks.
Operate brake pedal 5 times, wait 30 seconds and operate pedal another 5 times.
Hydraulic fluid temperature should be approx. 50° C (122° F) for all tests.
Turning steering wheel against locks with engine running could cause a rise in temperature.

** See Service Information of Gr. 00

1. Checking Flow Pressure:
Open valve (B).
Close valve (A) and run engine.
Open valve (A) and read pressure when pressure is less than 15 bar (213 psi).
Max. permissible flow pressure of 8 bar (114 psi) must not be exceeded.
Pressure Greater Than 8 Bar (114 psi):

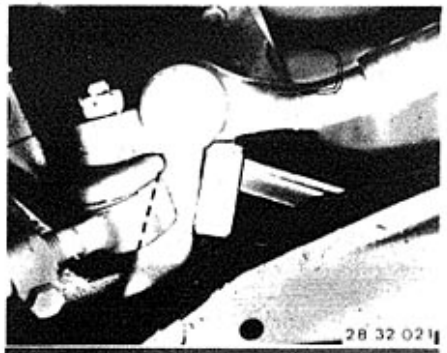
32 41 505 CHECKING POWER FLOW REGULATOR AND STEERING GEAR

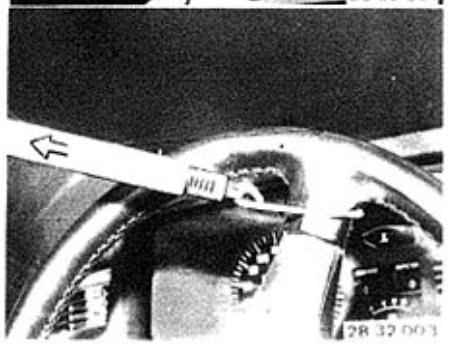
Discharge pressure.
Install pressure tester between power flow regulator and steering gear.
Bleed system.
Carry out test as described above.
If pressure is less than 8 bar (114 psi), replace power flow regulator 34 33 100.
If pressure is more than 8 bar (114 psi), replace steering gear 32 13 060.
Recheck flow pressure between pump and power flow regulator.



2. Checking Pump:
Inställ pressure tester between pump and power flow regulator.
Close valve (A).
Start engine.
Close valve (B) max. 10 seconds and read pressure.
Rated pump pressure* ± 10 % should be reached.
Rated pressure* not reached, check drive belt tightness – 32 41 109.
Rated pressure* exceeded, replace pump – 32 41 061.
Repeat test.
Rated pressure* still not reached, replace pump – 32 41 061.

3. Checking Reservoir Charging Pressure:
Pressure tester between pump and power flow regulator.
System bled.
Engine not started.
Valve (B) open.
Valve (A) closed.
Start engine and observe pressure tester.
Pressure must rise to max. 57 bar (811 psi) and then drop immediately to less than 8 bar (114 psi).
If max. permissible pressure of 57 bar (811 psi) is exceeded or there is no immediate pressure drop after reaching max. permissible pressure, replace power flow regulator – see 34 33 100.

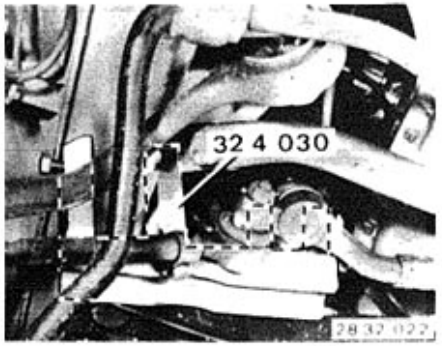




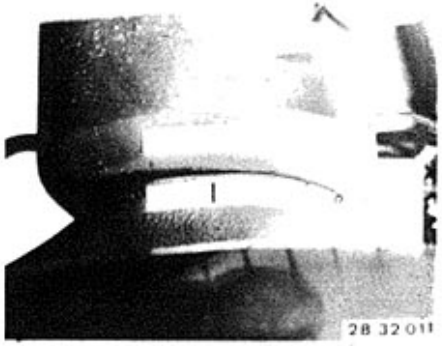
4. Power Steering:
Pressure tester between pump and power flow regulator.
System bled.
Valve (B) open.
Valve (A) closed.
Engine not started.
Lift car.
Stop steering from reaching final left lock by 1/2 to 3/4 steering wheel turn with a piece of wood or similar item.

Start engine.
Pull steering wheel against final left lock with a force of 100 N (22 lbs.) (force meter) about 5 seconds and read pressure.
Limit final right lock and repeat test on right lock.
If pressure values are lower than pump pressure determined in point 2, replace steering gear – 32 13 060.

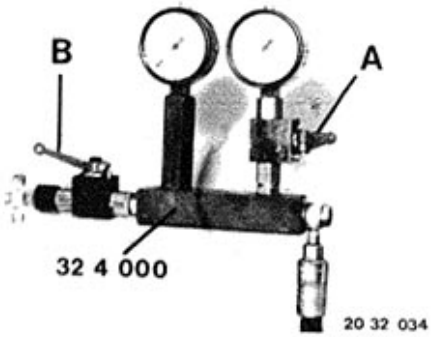
* See Specifications



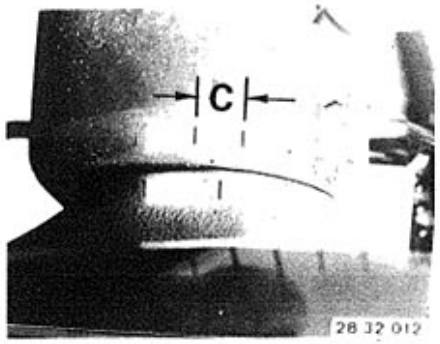
5. Checking Mechanical Play of Steering:
– Pressure point adjusted 32 13 014.
– No play in steering column.
Pressure meter between pump and power flow regulator.
System bled.
Valve (B) open.
Valve (A) closed.
Engine not started.
Steering drop arm held in straight ahead position with Special Tool 32 4 030.



Paste strips of paper on steering wheel hub and casing upper section.
Make mark (center) on steering wheel hub.

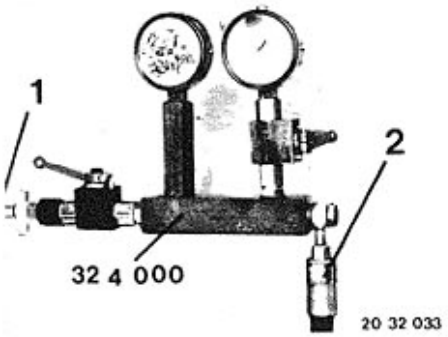


Start engine.
Open valve (A).
Read flow pressure.



Turn steering wheel counterclockwise until pressure-meter shows 1 bar (14 psi) more pressure than flow pressure value.
Mark position of steering wheel hub.
Repeat this in clockwise direction.
If max. permissible travel (C) = 7 mm (0.276") is exceeded, replace steering gear 32 13 060.
Remove special tool holder and pressure meter.
Bleed hydraulic system and, if necessary, add hydraulic fluid**.

** See Service Information of Gr. 00

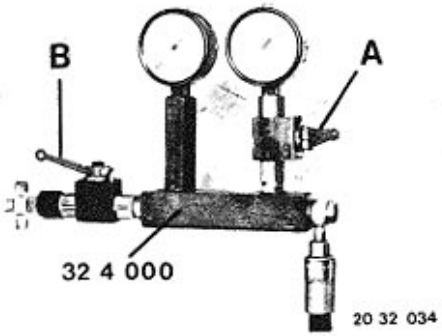


32 41 009 CHECKING POWER STEERING PUMP

– Engine At Operating Temp. –

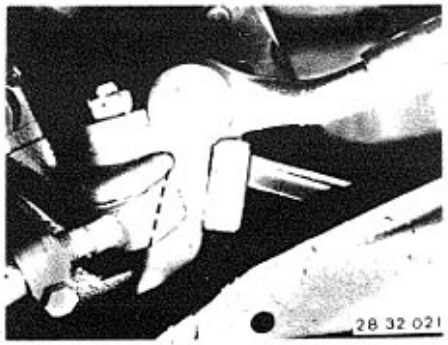
Cars Without H-31 System:

1. Power Steering Pump:
Disconnect pressure line (1) on power pump and connect it on pressure tester 32 4 000.
Connect pressure line (2) from pressure tester 32 4 000 on power pump.
Installation:
Tightening torque*.
Bleed hydraulic system 32 13 006.

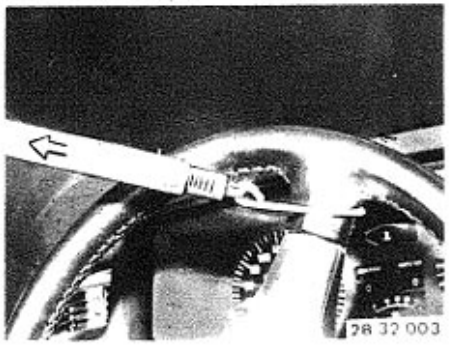


Test:
Valve (A) must always be closed for high pressure tests (pressure tester would be damaged!).
Open valve (B) and bleed hydraulic system – 32 13 006.
Close valve (B) max. 10 seconds with engine running and read pressure.
Rated pump pressure* must be reached with a tolerance of max. – 10 %.

If this pressure is not reached, check drive belt tightness – 32 41 109.
If pressure is still not reached, replace power steering pump – 32 41 060.

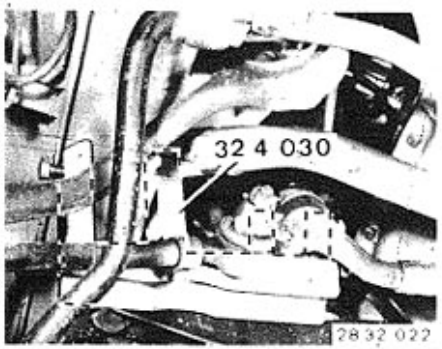


2. Power Steering:
Lift car.
Stop steering from reaching final left lock by 1/2 to 3/4 of a steering wheel turn with a piece of wood or similar item.



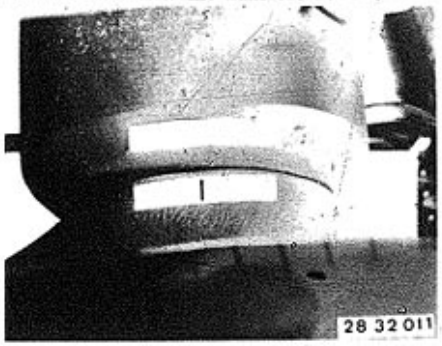
Run engine warm.
Pull steering wheel against final left lock about five seconds with a force of 100 N or 22 lbs. (check with force meter).
Read pressure on pressure tester 32 4 000.
Limit final right lock and repeat same test on right lock.
If pressure values are less than the previously measured pump pressure, replace steering gear – see 32 13 060.

* See Specifications

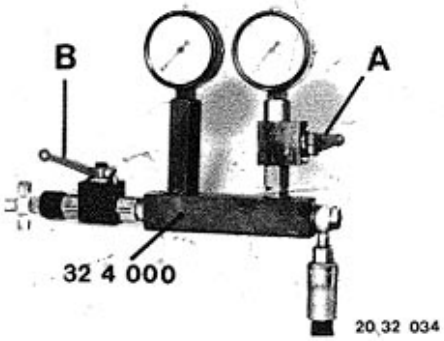


3. Mechanical Play in Steering:
Pressure Point Adjusted –

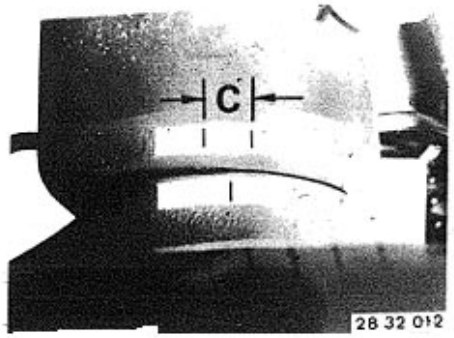
Hold steering drop arm in straight ahead position with Special Tool 32 4 030.
(marks on housing and steering shaft)



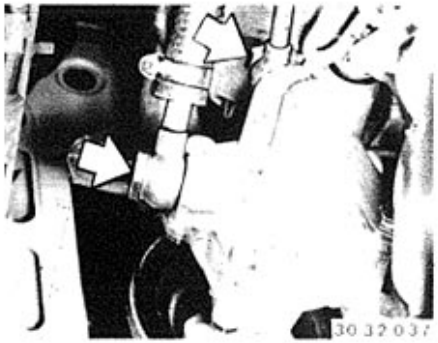
Paste strips of paper on steering wheel hub and casing upper section.
Mark center on steering wheel hub.



Open valve (B).
Close valve (A).
Run engine at idle speed.
Open valve (A).
Read flow pressure.

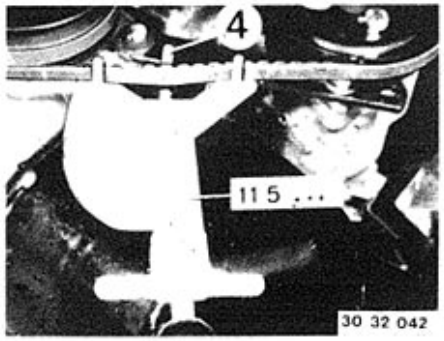


Turn steering wheel anticlockwise until pressure tester shows 1 bar (14 psi) more pressure than the measured flow pressure value.
Mark position on steering wheel hub.
Repeat procedures on right lock.
If maximum permissible travel (C) = 7 mm (0.276") is exceeded, check joint disc.
If joint disc is okay, replace steering gear.
Remove pressure tester 32 4 000 and bleed hydraulic system – 32 13 006.

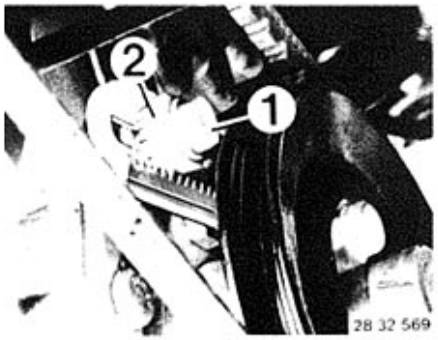


32 41 060 REMOVING AND INSTALLING POWER STEERING PUMP

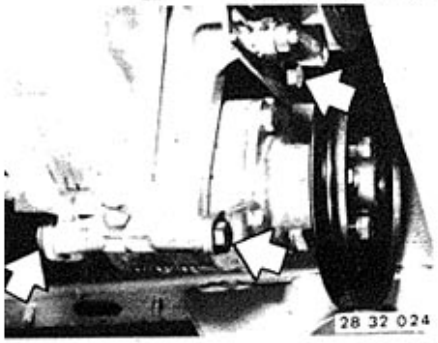
If applicable, discharge pressure reservoir by operating brake pedal about 20 times.
Draw off hydraulic fluid in tank.
Disconnect lines.
Plug open connections with dust caps.
Installation:
Replace seals.
Tightening torque*.
Fill and bleed hydraulic system – see 32 13 006.
Important!
Never reuse drained hydraulic fluid.



Installation:
Tighten drive belt before tightening bolts.
Tighten toothed element with 8 to 8.5 Nm (5.8 to 6.1 ft. lbs.) and tighten nut.
Check drive belt tightness with Special Tool 11 5 . . ..
Hook (4) rests on tooth tip.

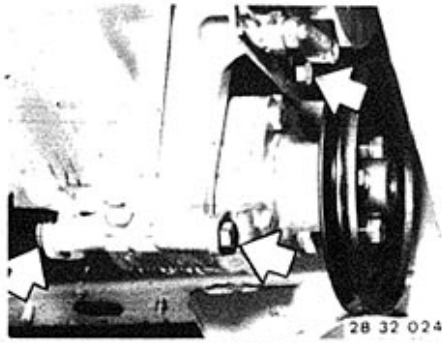


Loosen nut (1) and release drive belt by turning toothed element (2).
Unscrew bolts.



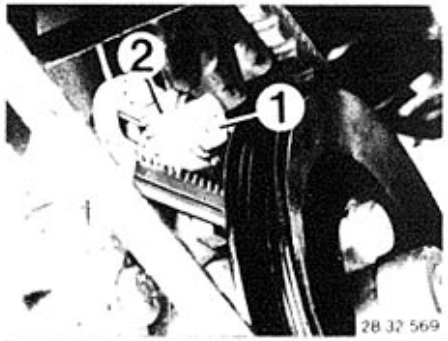
Unscrew bolts.

* See Specifications of Gr. 32

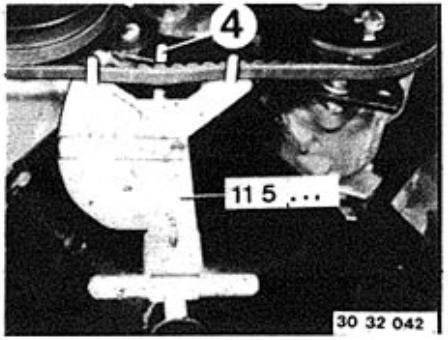


32 41 109 TIGHTENING DRIVE BELT FOR POWER STEERING PUMP

Unscrew splash guard.
Loosen mounting bolts of pump and tensioning bar.



Loosen clamping bolt (1).
Tighten toothed element (2) with 8 to 8.5 Nm (5.8 to 6.1 ft. lbs.) and lock with bolt (1).



Check belt tightness with tester 11 5 . . .
Hook (4) rests on tip of tooth.
Tighten bolts.
Caution!
Make sure of sufficient space between hoses and body-mounted parts, making corrections on hose connections if necessary.



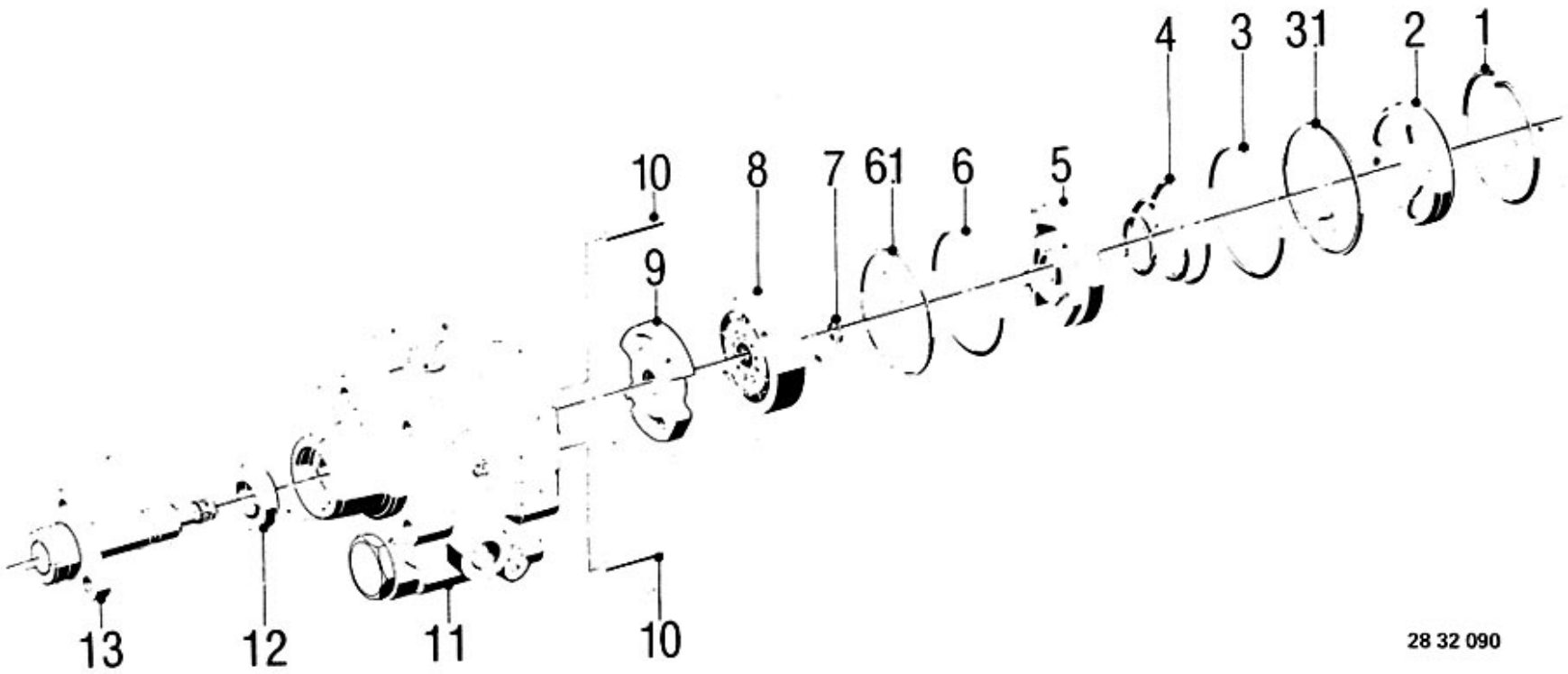
32 41 131 REPLACING CONSOLE FOR POWER STEERING PUMP

Engine M 30:
Remove and install alternator 12 31 020.
Remove and install power steering pump 32 41 060.
Take off console.
Installation:
Tightening torque*.
Check distance between engine oil pan and console with a feeler gauge and correct with shims of pertinent thickness (see Parts Catalog)

* See Soecifications

32-35

POWER STEERING PUMP ASSEMBLY DRAWING – Code No. 7671 955 ..

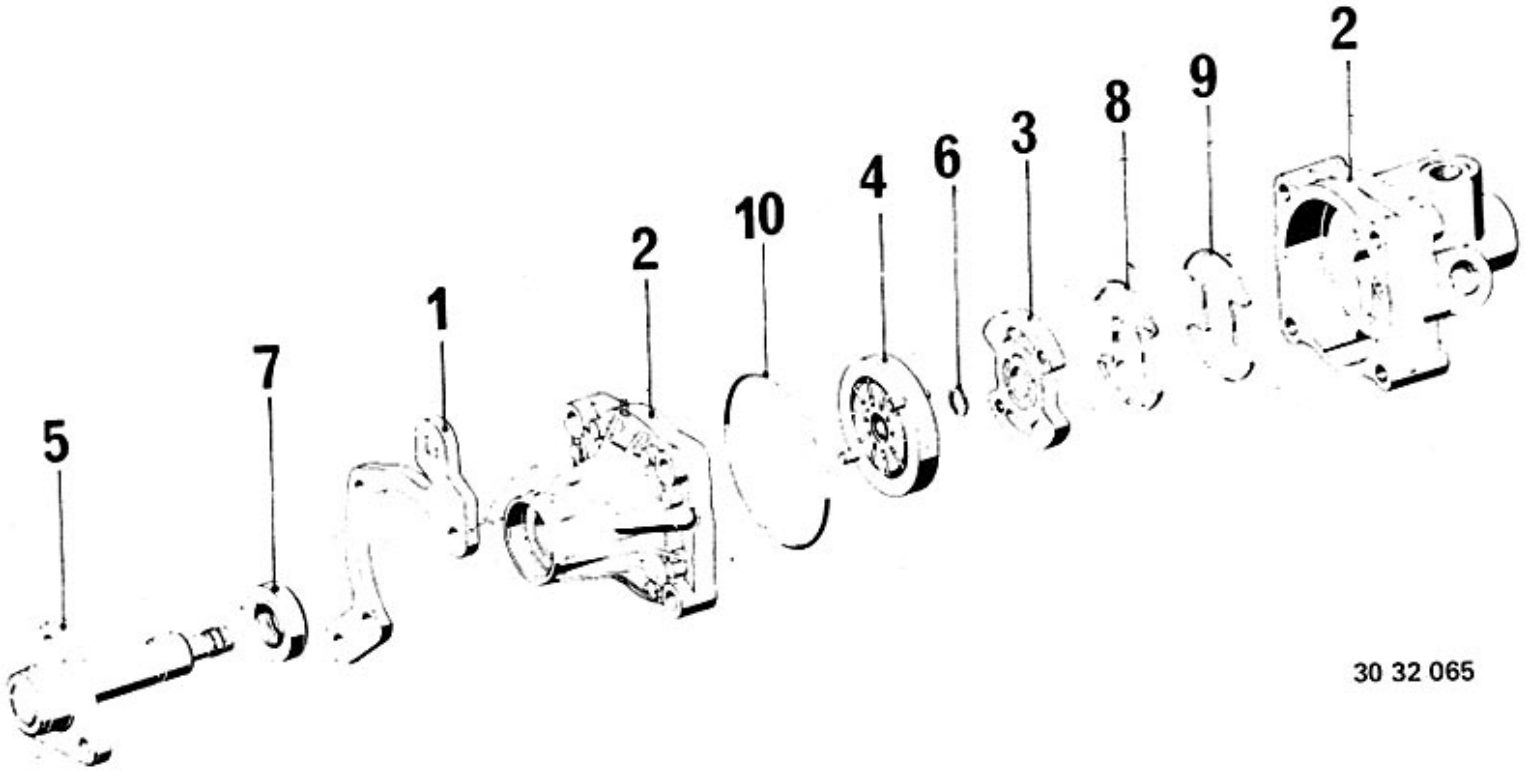


28 32 090

1 Hook-type snap ring
2 Cover
3 O-ring
3.1 Support ring
4 Spring
5 Face plate
6 O-ring
6.1 Support ring
7 Snap ring
8 Rotor set
9 Face plate
10 Dowel pin
11 Housing
12 Radial oil seal
13 Input shaft

32-36

POWER STEERING PUMP ASSEMBLY DRAWING – Code No. 7681 955 . . .

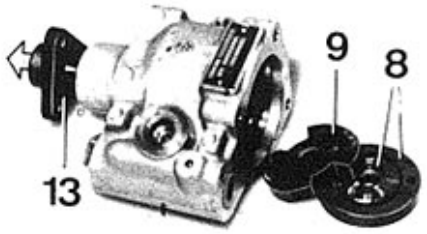


30 32 065

1 Holder
2. Housing
3. Face plate
4 Rotor
5 Shaft
6 Snap ring
7 Radial oil seal
8 Seal
9 Guide
10 O-ring

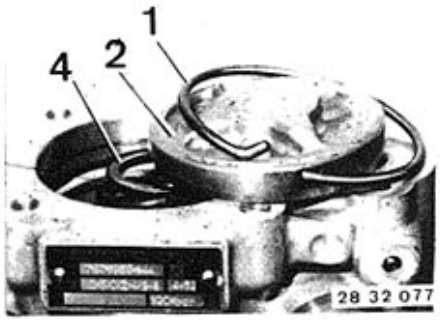
32 41 553 DISASSEMBLING/ASSEMBLING POWER STEERING PUMP – PUMP REMOVED –

A) Pump Code Number: 7671 955 144.
Absolute cleanliness is essential when working on power steering pumps



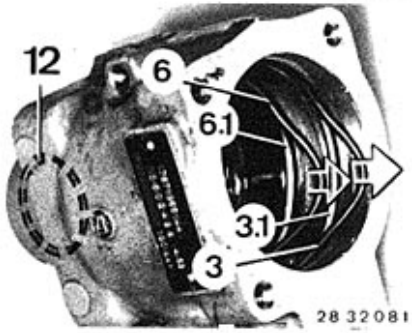
28 32 080

Tilt out rotor set (8) and face plate (9).
Pull out input shaft (13).



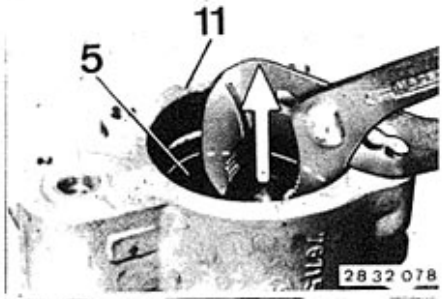
28 32 077

Pull hook-type snap ring (1) out of groove with a pliers.
Take off cover (2) and spring (4).



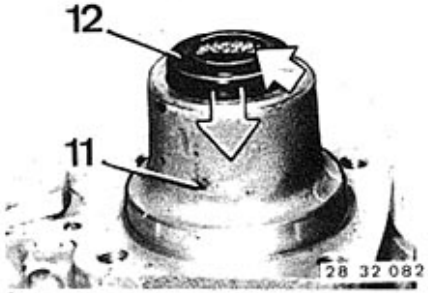
28 32 081

Remove radial oil seal (12) and O-rings (3 and 6).
Support rings (3.1 and 6.1) remain in housing.
Clean all parts thoroughly.



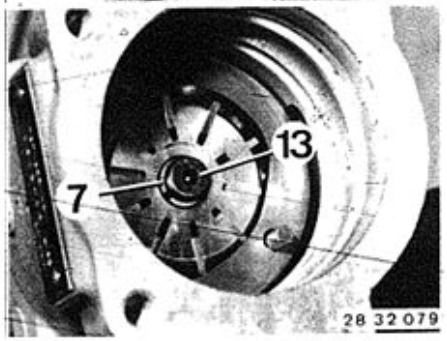
28 32 078

Pull out face plate (5) from housing (11).



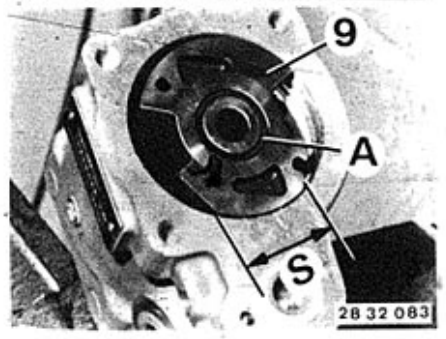
28 32 082

Assembling.
Lubricate all parts with hydraulic fluid.
Pack radial oil seal (12) between sealing lip and dust lip with grease and install seal in housing (11) with a suitable mandrel (sealing lip faces in).



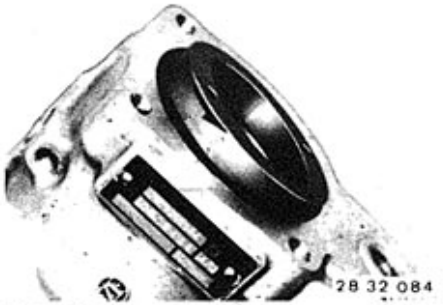
28 32 079

Push rotor on shaft (13) and lift out snap ring (7).

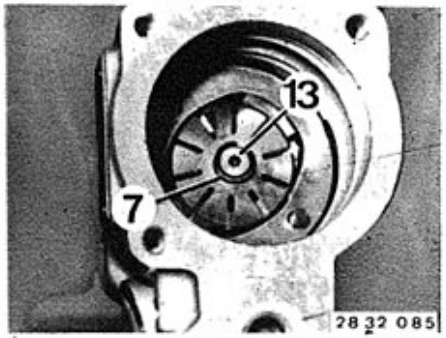


28 32 083

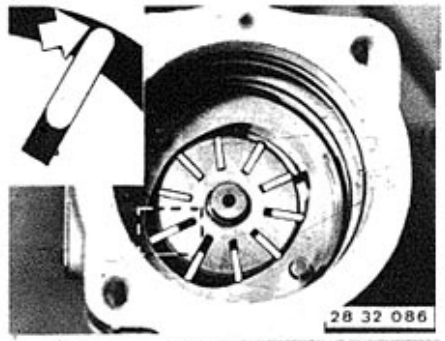
Guide drive shaft (13) into housing (11).
Insert dowel pins (10) in housing bores.
Mount face plate (9) on dowel pins (10) with short side (S) facing valve.
Groove (A) faces cover.



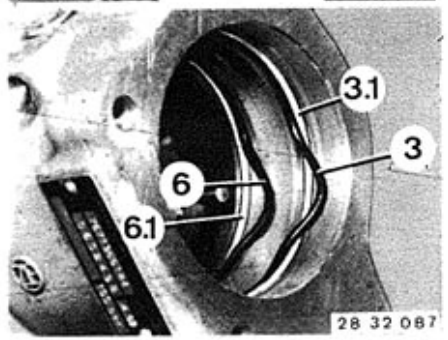
Mount cam ring with cast arrow facing cover end (arrows show turning direction of pump) on dowel pins (10).



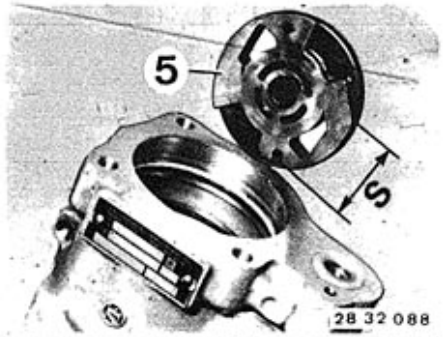
Install rotor with chamfer facing drive end on shaft (13)
Install snap ring (7) in radial groove of shaft (13).
Push down on shaft (13) until snap ring (7) rests in opening of rotor.



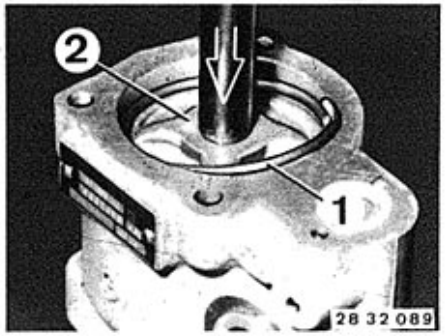
Insert wings with polished, rounded outside surfaces facing cam ring.
Check that wings move easily.



Insert O-rings (3 and 6).
Support ring (3.1) is in front of and support ring (6.1) behind O-ring.



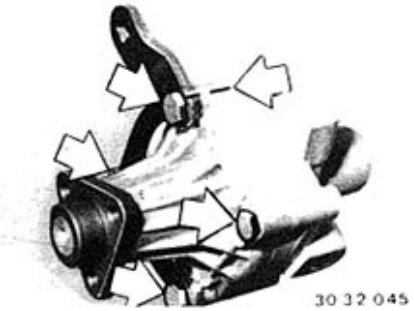
Install face plate (5) on dowel pins (10) with short side (S) facing valve.



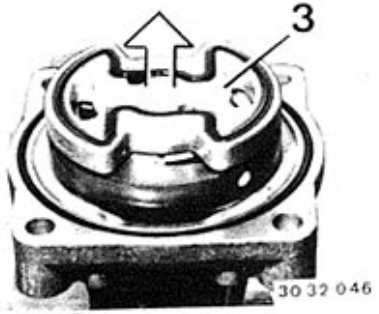
Install spring (4) with large diameter end facing cover.
Press cover (2) into housing with a hydraulic press far enough, that hook-type snap ring can be installed in groove.

Check operation of power steering pump after installation

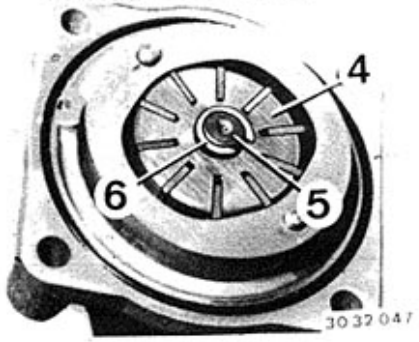
B) Pump Code Number: 7681 955 . . .
Absolute cleanliness is essential when working on power steering pumps.



Mark position of holder (1) to pump body (2).
Unscrew bolts and take body apart.

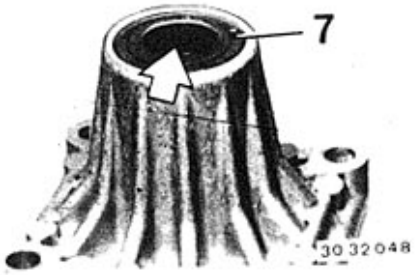


Remove face plate (3).

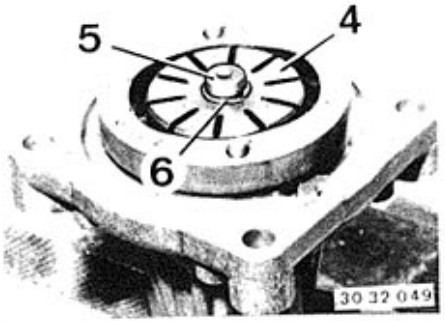


Press rotor (4) on shaft (5) downward.
Remove circlip (6) and pull shaft out of body.
Remove rotor (4) with wings.

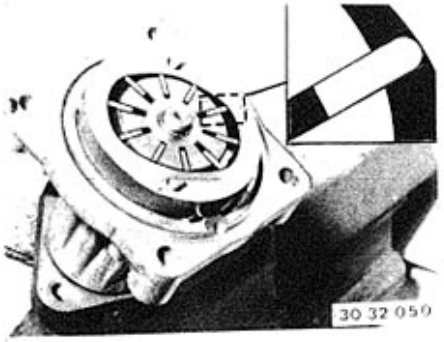
Assembling:
Clean all parts and lubricate with hydraulic fluid.
Replace radial oil seal (7) – sealing lip faces in and pack space between sealing and dust lips with grease.



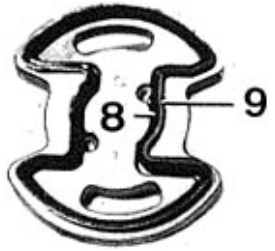
Guide shaft (5) into body.
Install rotor (4) – groove for snap ring faces up – and insert snap ring (6) in radial groove of shaft.

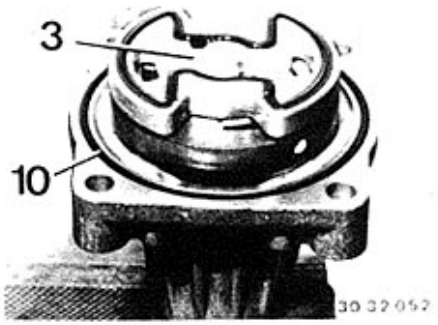


Insert wings with polished, rounded outside surfaces facing cam ring.
Check that wings move easily.

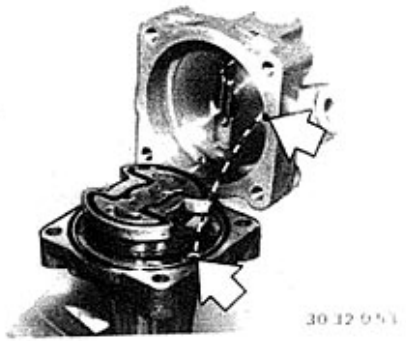


Install seal (8) – wide side facing down – and place guide (9) in face plate (3).





Place face plate (3) on dowel pins.
Replace O-ring (10).



Mount body -- check position of bores -- and bolt down with holder.
Tightening torque = 16 to 19 Nm (12 to 14 ft. lbs.).

After finishing installation, check operation of power steering pump

32 - 50

SUPPLEMENT RESTRAINT SYSTEM

COMPONENTS

a) SRS steering wheel with impact shell and padded cap, in which airbag, gas generator and ignition pill are integrated.

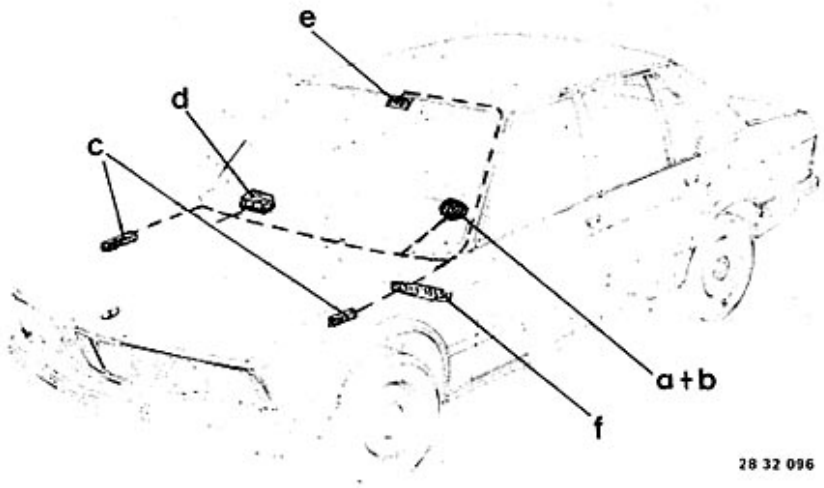
b) Contact ring – guarantees power supply to ignition pill.

c) Two crash sensors (front left and right on wheel house) and safety switch (left).

d) Electronic diagnosis unit (in glove box) with integrated safing sensor (prevents unwanted activation).

e) SRS indicator lamp integrated in check control.

f) Knee guard.



28 32 096

DESCRIPTION

The supplement restraint system (SRS) does not replace fastening the seat belts!.

The system is activated by sensors, whereby there must be car deceleration equal to a direct head-on collision impact of at least 18 km/h (11 mph) against a solid (non-giving) obstacle.

The electric circuit is made and a gas generator ignited. This causes sudden burning of a solid fuel mixture, which in turn releases a non-poisonous gas to completely inflate the folded airbag in the SRS steering wheel within approximately 30 milliseconds.

The crash inflated airbag reduces the severity of injury to the head and upper part of the body in head-on collisions. Discharging takes place through two holes on the side of the airbag facing away from the driver.

MONITORING

The supplement restraint system is monitored continuously by a diagnosis unit from ignition switch position 1 on. The SRS indicator lamp comes on and goes out again after about 6 seconds to show that the system is ready for use.

If this lamp comes on again, there is a detected defect in the system – see "Troubleshooting".

Important!

Always first call the flashing code check control before disconnecting the battery. Disconnecting the battery will cancel the memory of the diagnosis unit and a briefly occurring defect could no longer be pinpointed.

SAFETY REGULATIONS FOR HANDLING "AIRBAG" GAS GENERATORS

Non-conformance with these instructions could lead to unwanted activation of the system and injury.

The airbag unit is a pyrotechnical object. Handling, transporting and storing are subject to "legislation concerning explosive materials" (Explosive Substance Laws of Sept. 13, 1976).

The specifications listed below are in reference to the Federal Republic of Germany. There must always be conformance with pertinent legislation in other countries.

1. Transporting

1.1 It is forbidden to transport airbag gas generators in the passenger compartment of a car!

1.2 Company level transportation must always be in the trunk (luggage compartment) or cargo room of a vehicle and in packed state – the quantity of units is limited to 50.

2. Storing

2.1 The maximum permitted quantity of airbag gas generators in one working room is twenty (20).

2.2 Storage of up to 200 units is permitted in a suitable and lockable room.

2.3 Airbag generators must be stored in packaging suitable for transportation.

3. Installation and Removal:

SRS components and plugs can be recognized immediately on the orange color code.

Tests and installation/removal may only be performed by personnel with qualified training in BMW service.

Working on the "supplement restraint system" always requires the battery to be disconnected, the negative pole or terminal to be covered and the SRS plug (steering column) to be disconnected. If work on the system has to be interrupted, the gas generator must not be left laying around without supervision.

Components of the supplement restraint system may not be repaired. Instead they must always be replaced.

Conformance with the following points is essential.

- Never treat the airbag unit with cleaning solutions or grease.
- Never subject an airbag unit to temperatures above 100° C (212° F).
- Airbag units, front sensors and electronic diagnosis units, which have fallen down from a height of 0.5 meters (1 and 1/2 feet) or more, cannot be installed in cars again.
- The supplement restraint system can only be checked electrically in the car, see "Troubleshooting", and only with the testers mentioned in pertinent section.
- Airbag units may only be stored with the padded side facing up, since if the generator of an airbag facing down would be ignited, the generator would be catapulted up and could cause injury.
- The ignition pill of gas generators must never be aimed at persons regardless of the circumstances.

Procedures for Repairing and After Accidents:

Always disconnect the battery, cover the negative pole or terminal and disconnect both plugs of the front sensors in the engine compartment and the SRS plug (steering column), to be sure that power supply to the gas generator is interrupted, prior to performance of body straightening work or welding work with an electric welder. Also refer to other instructions in the repair manual.

After Accidents:

If the airbag had been activated, always replace all components with exception of wiring when not damaged.

4. Scrapping "SRS" Cars:

In accordance with accident prevention regulations "SRS" gas generators must be rendered unusable prior to scrapping. This is necessary since the gas generator is a pyrotechnical object and could cause injury if activated incorrectly (for example with a torch during scrapping). SRS gas generators must be ignited in the cars meant for scrapping from the outside and with the doors of the car closed. The igniter, Special Tool 62 1 270, developed by BMW for this purpose must be used.

Non-ignited generators are a source of danger (also for the environment)!

1. Remove lower section of steering column casing and disconnect the SRS plug (orange).
2. Connect the igniter on the SRS plug.
3. Connect the igniter on a 12 V battery. Distance from car: 10 meters (32 feet)
4. Keep as far away from car as the length of the igniting lead permits – always stand in front of the car (this also concerns other persons).
5. Operate the ignition switch.

Caution!
The burning off of solid fuel will heat the airbag unit – danger of burning hands!
Wash hands after touching ignited generators!

TROUBLESHOOTING

The "supplement restraint system" employs a defect detector and memory, even for briefly occurring defects. If the "SRS" indicator lamp does not go out after starting, there could be one or more defects. A flashing code from the indicator lamp will help only personnel with qualified training in BMW service to pinpoint and eliminate the defect(s).

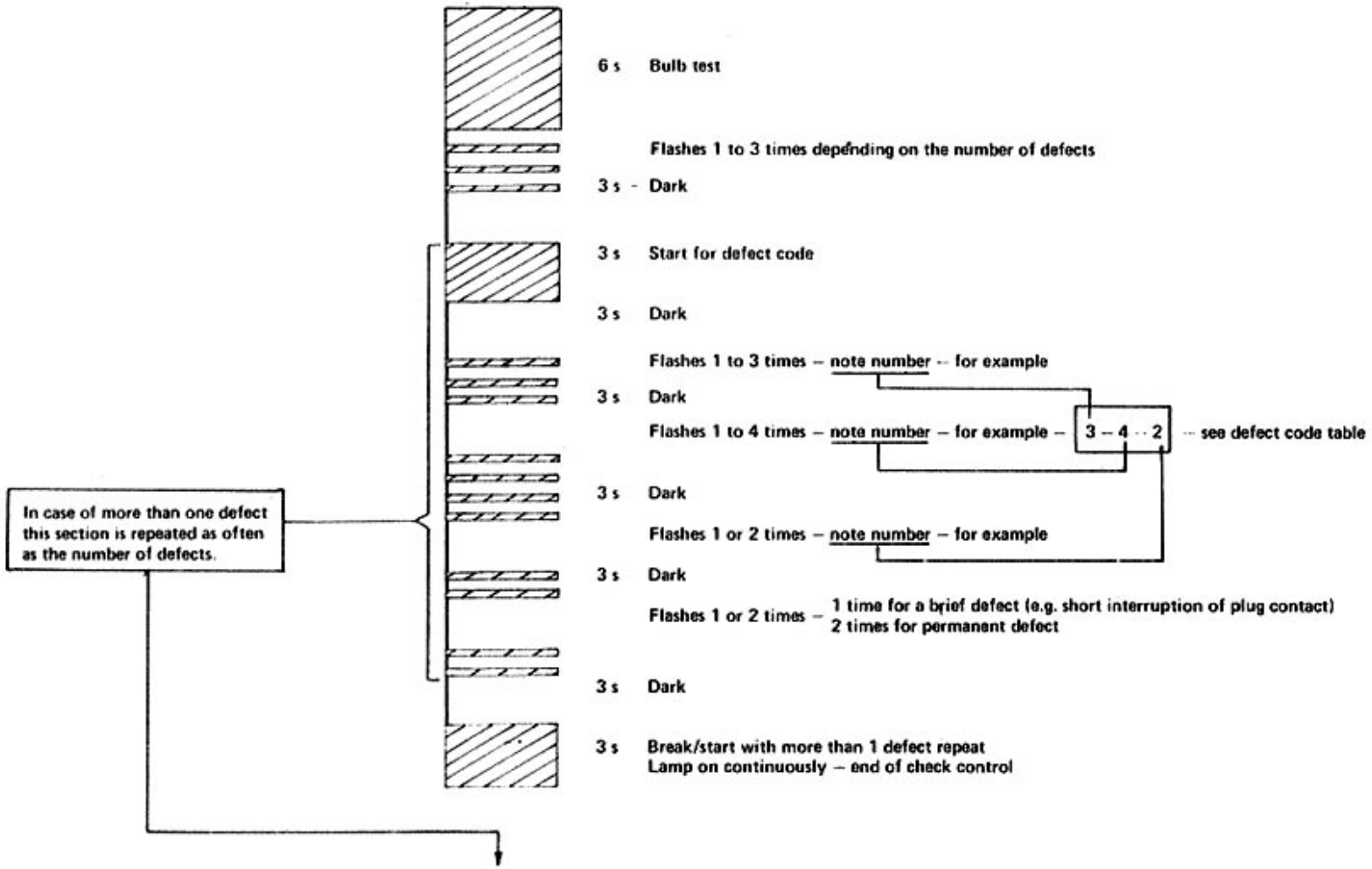
The flashing code can be called by performing the following procedures and as often as desired.

A) Turn off the ignition.

B) Connect SRS diagnosis plug 62 1 250 in the engine diagnosis socket (pins 1 and 6 are bridged).

C) Turn the ignition lock to position 1.

Flashing code will now run off and the number of flashes must be counted.



32 - 53

DEFECT CODE TABLE

1 – 1 – 1 = B
1 – 1 – 2 = A
1 – 4 – 1 = H
1 – 4 – 2 = G
2 – 1 – 1 = K
2 – 1 – 2 = J
2 – 2 – 1 = M
2 – 2 – 2 = L
2 – 3 – 1 = O
2 – 3 – 2 = N
2 – 4 – 1 = Q
2 – 4 – 2 = P
3 – 1 – 1 = S
3 – 1 – 2 = R
3 – 2 – 1 = U
3 – 2 – 2 = T
3 – 3 – 1 = W
3 – 3 – 2 = V
3 – 4 – 1 = Y

Example: 3 – 4 – 2 = X – see defect code X in testing instructions

TESTING INSTRUCTIONS

After finishing the flashing code call, always disconnect the battery for troubleshooting and cover the negative pole or terminal. Make tests with a BMW service tester or digital tester II at room temperature. Using different testers could activate the SRS.
Pull off the SRS diagnosis plug.

After finishing repairs the last step would be connecting the battery again and checking the function of the system.

If there is a brief defect, cancel the memory of the diagnosis unit by disconnecting and connecting the battery. Check pertinent parts for tight fit and damage with the ignition on. Replace pertinent parts, if a defect is displayed.

Defect Code A or B =

Higher or lower resistance in gray-white/gray wire to SRS unit.

↓

Disconnect plug for diagnosis unit (in glove box). Connect SRS test plug 62 1 260 and check wire with an ohmmeter.
3.0 to 5.0 ohms?

— yes → Defect Code A:
Measure resistance of wire against car ground.
Resistance 200 to 600 ohms? — yes → See defect code H.

no → Replace diagnosis unit.

— yes → Defect Code B:
Replace diagnosis unit.

no

↓

Disconnect plug (on steering column). Connect SRS test plug 62 1 260 and check wire with an ohmmeter.
3.0 to 5.0 ohms?

— yes → Replace wire.

no

↓

Take SRS unit off of steering wheel and pull off plug.
Connect wires of SRS test plug 62 1 260 and measure resistance on disconnected plug with two test points.
1.4 to 1.8 ohms?

— yes → Replace SRS unit.

no

↓

Replace contact ring.

Defect Code H = G =

Insulation of power supply wire to SRS unit against ground or against positive insufficient.

↓

Visual inspection of wires and plugs for cracks, dirt and moisture, replacing if necessary.

Defect Code K = J =

Insulation of power supply wire to left sensor against ground or against positive insufficient.

→ or break in wire (only J or L)

↓

Visual inspection of wires and plugs for cracks, dirt (salt film) and moisture, replacing if necessary.

↓

Disconnect 4-pin plug on diagnosis unit and measure wire resistance.

9.5 to 10.5 k-ohms? — yes → Replace diagnosis unit.

↓ no

Defect Code M = L =

Right sensor – see K + J above.

Defect Code O =

Insufficient ground connection between sensors or diagnosis unit and body.

↓

Visual inspection of mounting parts and plugs for corrosion, replacing if necessary.

↓

Disconnect plug on front sensor and measure resistance of front sensor.

9.5 to 10.5 k-ohms? — yes → Replace wire.

↓ no

Defect Code N + H + K =

Left front sensor closed.

↓

Replace left front sensor.

Replace front sensor.

Defect Code N + H + M =

Right front sensor closed.

↓

Replace right front sensor.

Defect Code N + V + K =

See K.

Defect Code N + V + M =

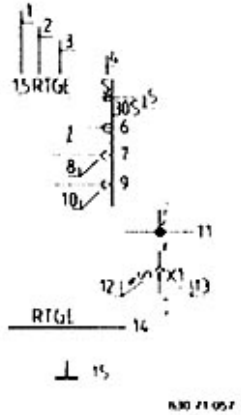
See M.

Defect Code Q, P, S, R, U, T, W, Y, X =

Defect in diagnosis unit.

↓

Replace diagnosis unit.



Explanation of Wiring Diagram Codes:

1 = Wire cross section size in mm^2
2 = Basic wire color
3 = Spiral wire color
4 = Socket number
5 = Terminal designation
6 = Screwed connection (wire connector)
7 = Round male plug
8 = Round female plug
9 = Flat male plug
10 = Flat female plug
11 = Soldered point or connector
12 = Socket number
13 = Plug designation
14 = Wires without size data always 0.75 mm^2
15 = Ground

Wire Color Codes:

BL	blue
BR	brown
GE	yellow
GN	green
GR	gray
RT	red
SW	black
VI	violet
WS	white
TR	transparent

A	(+,-) check control
G1	Generator driver
N1	SRS electronics
S1	Front sensor left
S2	Front sensor right
S3	Safety switch

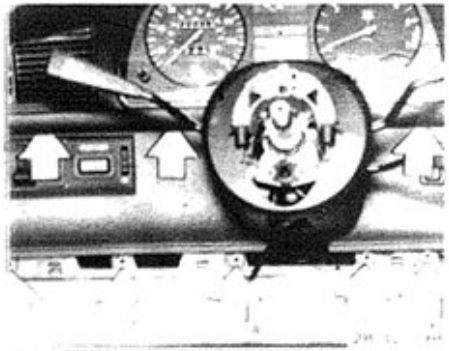
X1	Plug - front sensor left
X2	Plug - front sensor right
X3	Plug - electronics
X4	Plug - generator electronics
X5	Plug - generator steering column
X6	Plug - wire harness center section

– – – Electronics - Cipro

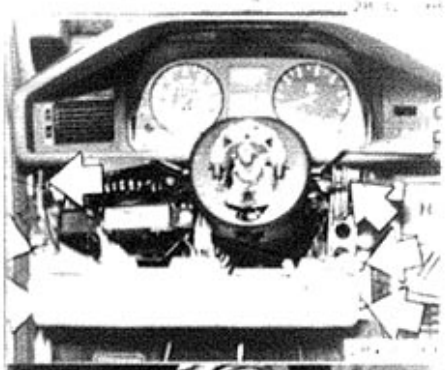
–.–.– Electronics - Siemens

32 31 090 REMOVING AND INSTALLING STEERING COLUMN ASSY. (SRS)

Caution!
Conform with the safety regulations.
Improper handling could cause unwanted activation of SRS and in turn lead to injury!
Remove the steering wheel — see 32 33 000.
Remove the instrument panel trim at bottom left — see 51 45 180.



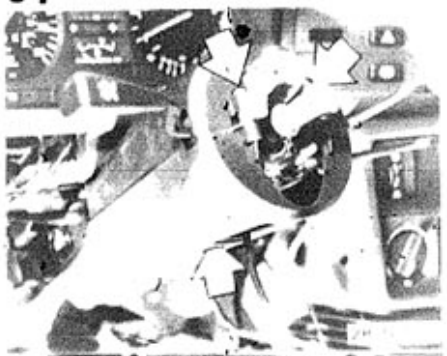
Remove trim panels.



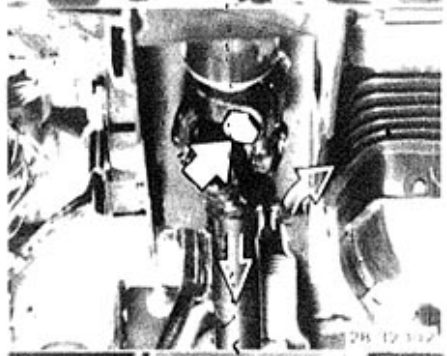
Remove knee guard.



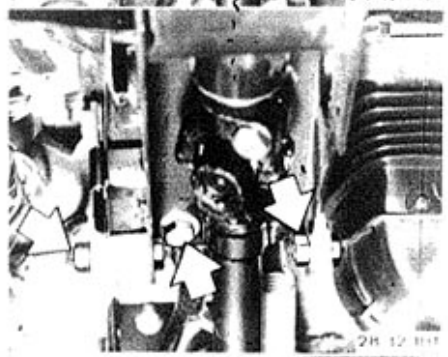
Disconnect plugs.



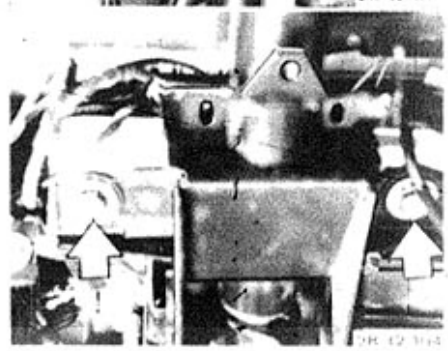
Remove trim panel.



Unscrew the bolts.
Installation:
Install the spacer.
Replace the self-locking nuts.
Tightening torque*.

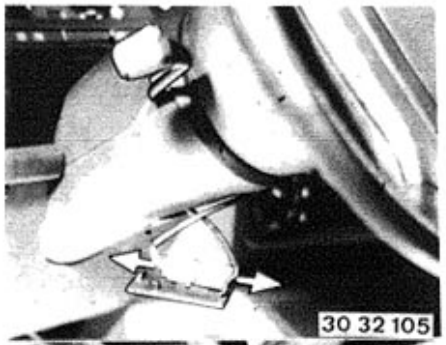


Disconnect the return spring.
Unscrew bolt and pull joint off of the steering spindle.
Installation:
The bolt must be located in the locking groove of the steering spindle.
Replace the self-locking nut.
Tightening torque*.



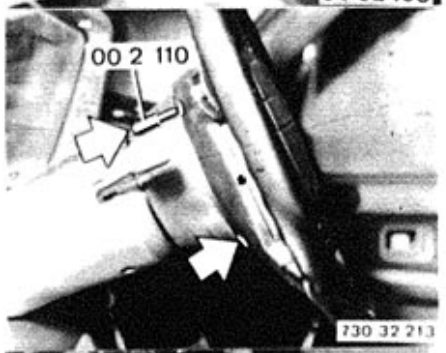
Unscrew bolts and remove the steering column.
Installation:
Install plastic sleeves.
Tightening torque*.

* See Specifications

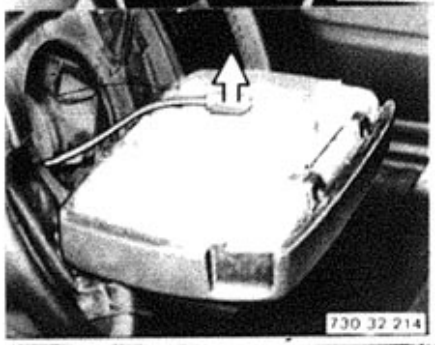


32 33 000 REMOVING AND INSTALLING STEERING WHEEL (SRS)

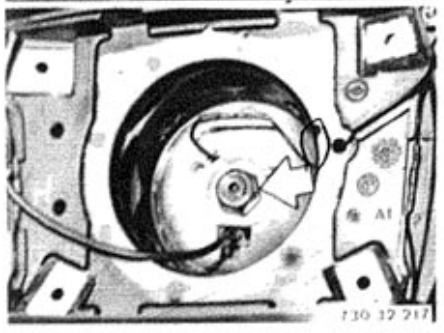
Caution!
Conform with the safety regulations.
Improper handling could cause unwanted activation of SRS and in turn lead to injury!
Disconnect the battery and cover the negative pole or terminal.
Lift cap out of the lower steering wheel casing section and disconnect the plug.



Unscrew four bolts with Special Tool 00 2 110.
Installation:
Tightening torque*.

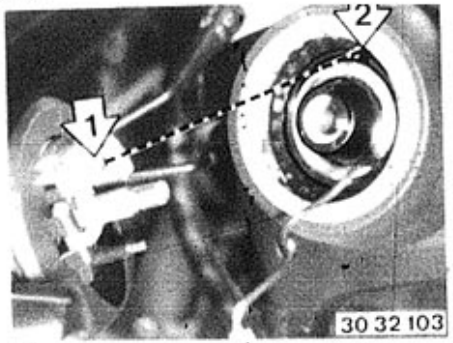


Pull off the plug and remove the airbag unit.
Caution!
The airbag unit must always be laid aside (in trunk of car) with the impact pad facing up.
Installation:
Be careful not to clamp the wires.

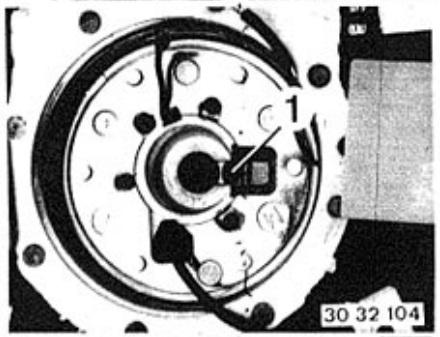


Turn the steering wheel to straight ahead position (marks on steering gear and steering spindle aligned).
Unscrew and remove the nut with washer.
Important!
The steering wheel can only be pulled off after unlocking the steering lock.

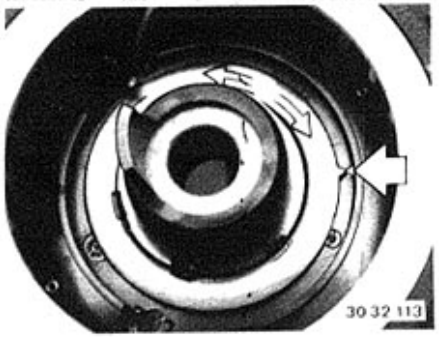
* See Specifications



Installation:
Lock pin (1) must engage in opening (2).
Replace the self-locking nut.
Tightening torque*.



Note:
Loosening the nut will activate spring lock (1) which holds the contact ring in center position.

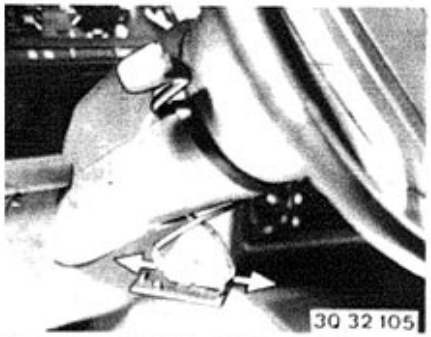


Adjusting Center Position If Necessary.
Press down spring (1), turn the contact ring against the left or right stop and then turn it back about 3 turns until the arrow marks for the center position are aligned.
Now release spring (1).

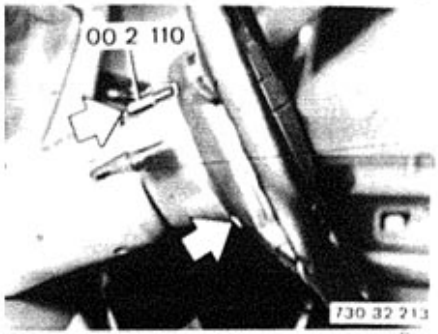
* See Specifications.

32 34 020 REMOVING AND INSTALLING OR REPLACING AIRBAG UNIT (SRS)

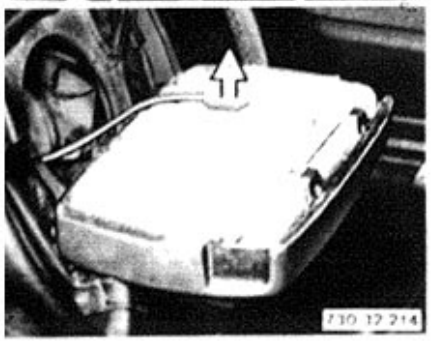
Caution!
Conform with the safety regulations! Improper handling could cause unwanted activation of SRS and in turn lead to injury! Disconnect the battery and cover the negative pole or terminal.



Lift cap out of the lower steering wheel casing section and disconnect the plug



Unscrew four bolts with Special Tool 00 2 110.
Installation
Tightening torque*.

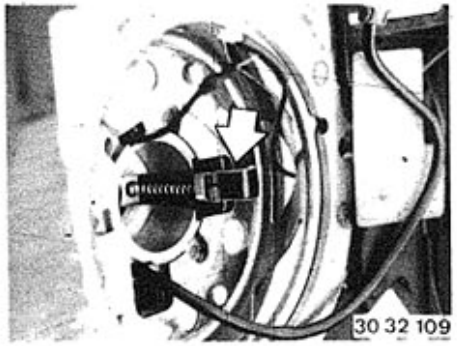


Pull off the plug and remove the airbag unit.
Caution!
The airbag unit must always be laid aside (in trunk of car) with the impact pad facing up.
Installation
Be careful not to clamp the wires.

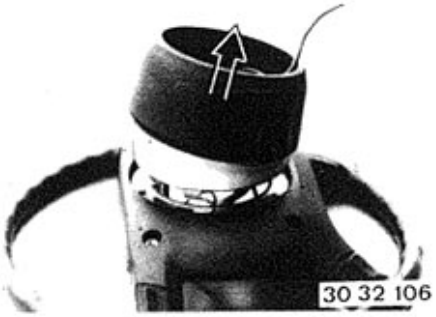
* See Specifications

32 34 510 REPLACING CONTACT RING (SRS)

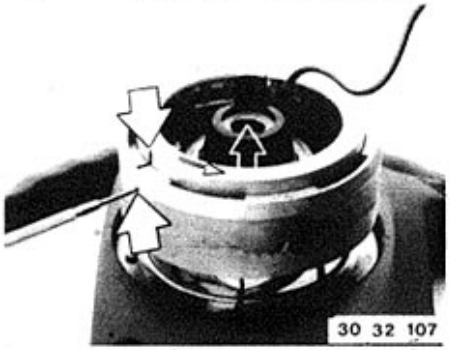
Caution!
Conform with the safety regulations!
Improper handling could cause unwanted activation of SRS and in turn lead to injury!
Remove the steering wheel – see 32 33 000.



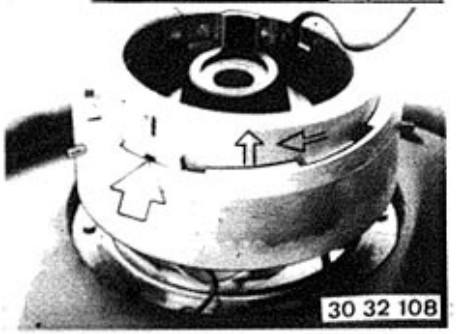
Lift out the lock with a screwdriver.
Installation:
Connect the spring on the lock and insert it in the bore.
Press the lock down until it engages.



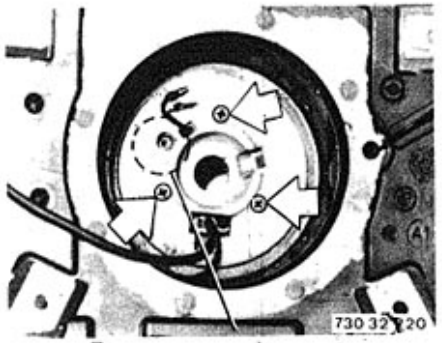
Pull off the casing.
Installation:
Lubricate the horn slip ring with grease.



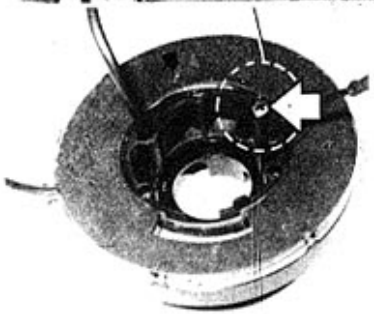
Mark the position of the circlip to the hub.
Unscrew three studs.
Press the circlip down, turn and remove it.



Installation:
Place the circlip in the hub, turn and pull it up.
The studs must be in the openings of the circlip.



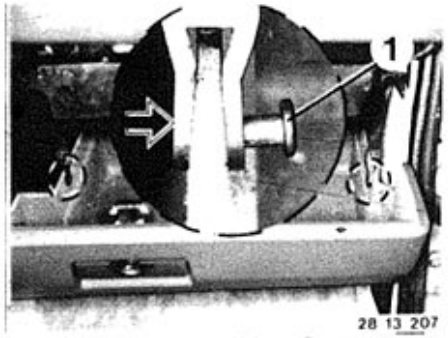
Disconnect the plug.
Unscrew the screw and take off the contact ring.



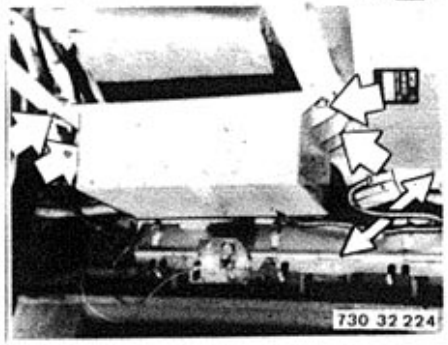
Important!
A new contact ring is held in the center position with a screw.
Remove this screw after screwing the contact ring on the steering wheel.

65 77 010 REMOVING AND INSTALLING OR REPLACING DIAGNOSIS UNIT (SRS)

Caution!
Conform with the safety regulations!
Improper handling could cause unwanted activation of SRS and in turn lead to injury!
Disconnect the battery and cover the negative pole or terminal.



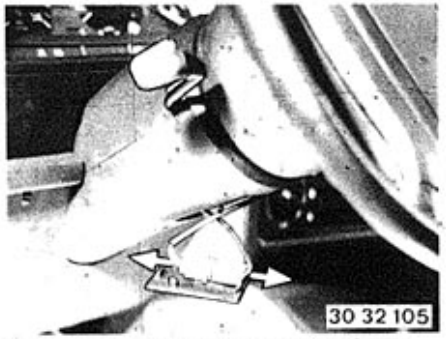
Push out the pin.
Disconnect the strap on the left and right sides.
Remove the trim panel.



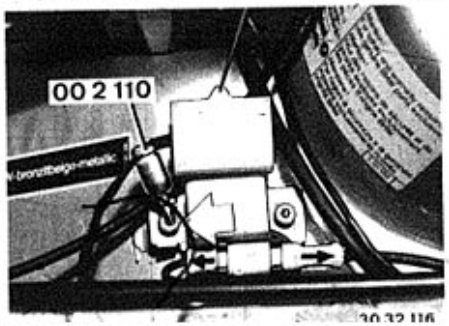
Disconnect the plugs (behind the insulation sheet).
Remove the diagnosis unit.

65 77 020 REMOVING AND INSTALLING OR REPLACING ONE FRONT SENSOR (SRS)

Caution!
Conform with the safety regulations!
Improper handling could cause unwanted activation of SRS and in turn lead to injury!
Disconnect the battery and cover the negative pole or terminal.



Lift the cap out of the lower steering column casing section and disconnect the plug.

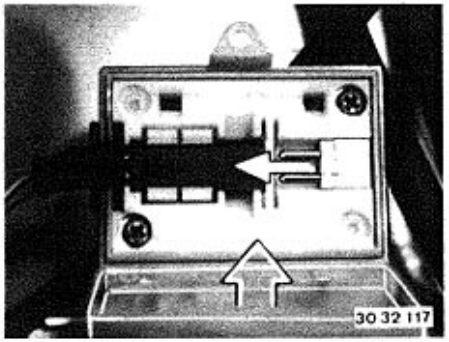


Disconnect the plug and unscrew the bolts with Special Tool 00 2 110.
Installation:
The arrow faces forward.
Tightening torque*.

* See Specifications

65 77 040 REPLACING SAFETY SWITCH (SRS)

Caution
Conform with the safety regulations!
Improper handling could case unwanted activation of SRS and in turn lead to injury!
Disconnect the battery and cover the negative pole or terminal.



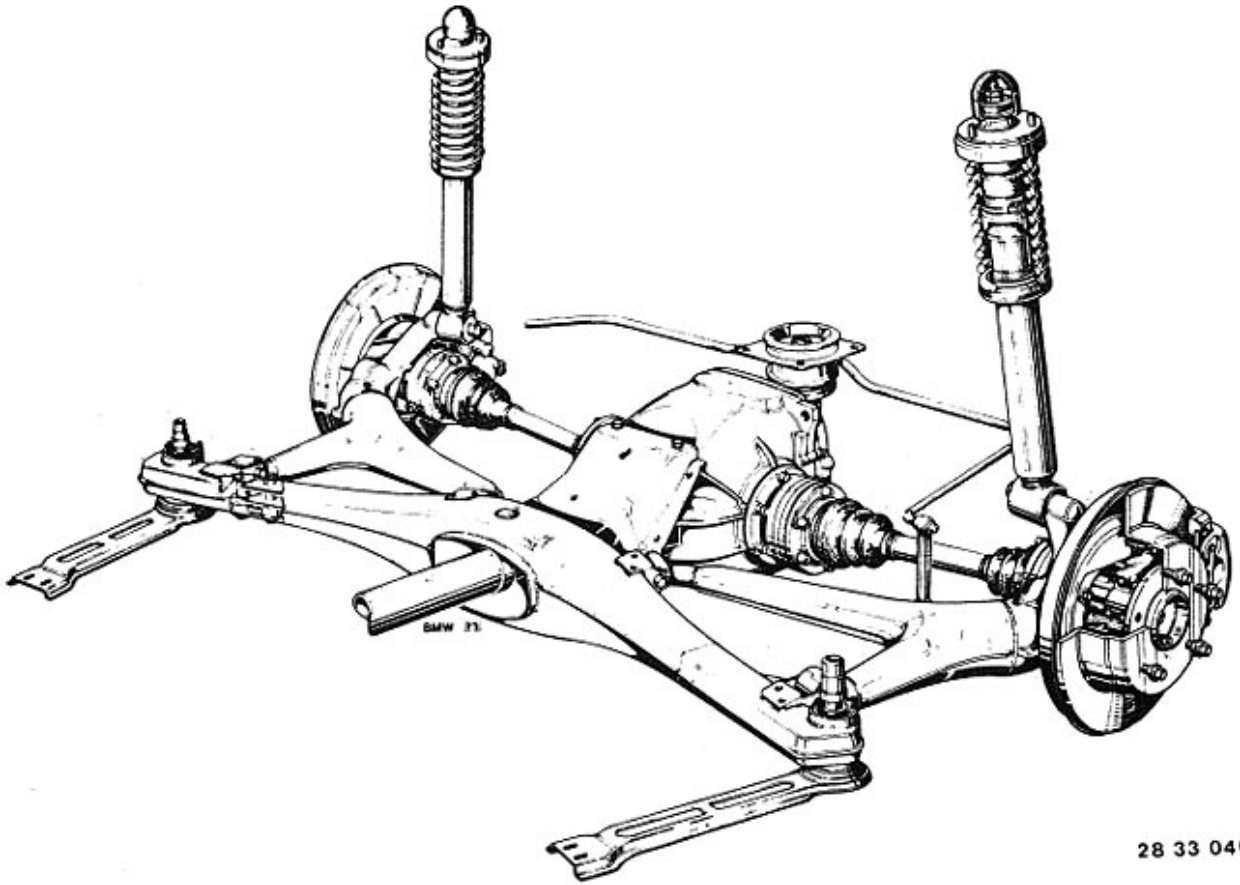
Open the cover, take off the plug and unscrew the screws.
Note:
Opening the cover will destroy the safety switch, which must then be replaced.
Installation:
Screw on the safety switch.
Insert the plug.
Push the contact bridge toward the plug.
Close the cover.

33 Rear axle

	Rear axle layout drawing	33- 0
33 20 010	Final drive – remove and install	33- 1
	Final drive – breaking-in instructions after replacement/repair	33- 1
33 11 011	Shaft seal and input flange of final drive – replace	33- 2
512	Shaft seal for input flange – replace	33- 4
151	Shaft seal for drive flange – replace	33- 6
33 12 551	Drive pinion with ring gear – replace	33- 7
33 13 611	Differential gears – replace	33- 15
	Limited slip differential with 25% locking ratio	33- 18
33 14 011	Limited slip differential assembly – replace	33- 18
045	Limited slip differential – service install	33- 21
613	Limited slip differential – disassemble and assemble	33- 22
33 21 000	Output shaft – remove and install	33- 25
031	Dust cover – replace	33- 25
33 31 000	Rear axle carrier assembly – remove and install	33- 26
33 32 000	Trailing arm – remove and install	33- 27
021	Trailing arm – replace	33- 28
561	Silent blocks (both) – replace	33- 28
	Trailing arm layout drawing	33- 29
33 33 001	Strut – replace	33- 30
071	Rubber mount for rear axle carrier – replace	33- 30
33 41 151	Wheel bearings and shaft seals of rear axle shaft – replace	33- 31
33 52 100	Spring strut assembly – remove and install	33- 33
131	Shock absorber – replace	33- 34
33 53 000	Coil spring – remove and install	33- 35
	Rear axle – troubleshoot	33- 36

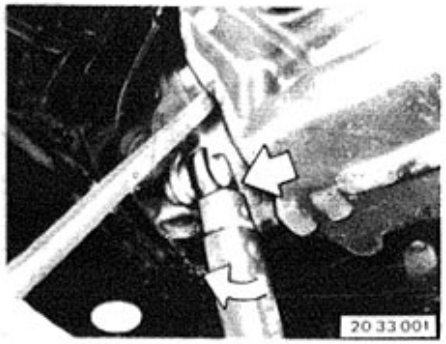
33-0

LAYOUT DRAWING OF RAER AXLE ASSEMBLY

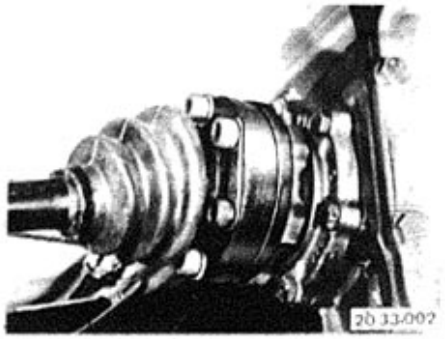


28 33 046

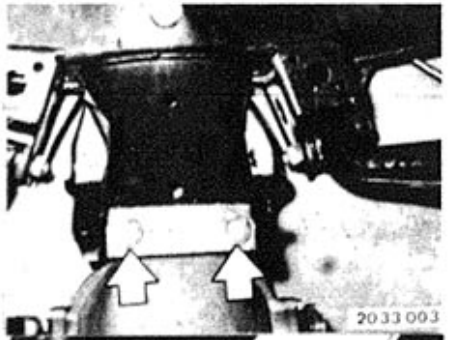
33 10 010 REMOVING AND INSTALLING FINAL DRIVE



Unscrew propeller shaft.
Installation:
Replace self-locking nuts.
Tighten nuts with a torque wrench and special wrench socket**
Tightening torque*.



Unscrew output shafts and suspend from car on pieces of wire.
Installation:
Tightening torque*.

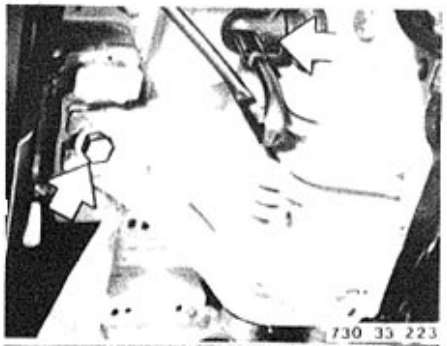


Unscrew final drive bolts on rear axle carrier at top.
Installation:
First locate final drive on rear axle carrier with the top bolts.
Tightening torque*.

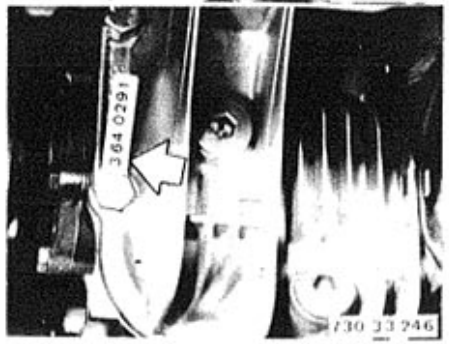


Support final drive with a jack.
Unscrew front bolts on left and right sides.
Installation:
Tightening torque*.

* See Specifications
** Source: HWB



Pull off wires on speedometer pulse sensor.
Unscrew mounting bolt of rubber mount and lower final drive.
Installation:
Tightening torque*.



Installation:
When replacing, check ratio* and final drive version.
Ratio digits are stamped on the data plate (1).

BREAKING IN PROCEDURES AFTER REPLACING/REPAIRING FINAL DRIVE

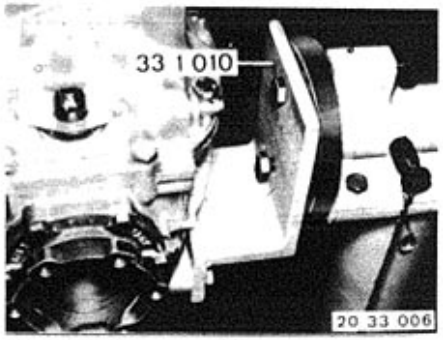
The preload of the tapered roller bearing requires strict conformance with the breaking-in procedures.

According to these breaking-in procedures the car must be operated during the first 1,000 km (600 miles) with alternating engine speeds and road speeds, however never faster than 2/3rds of the permissible top speed in 4th gear (direct).
In the case of cars with a five speed manual transmission (overdrive) 2/3rds of the permissible top speed in 4th gear is applicable for 5th gear.

In case of non-conformance with these breaking-in procedures the tapered rollers and inner race guide collar would seize and lead to constant noise, excessive heat and oil loss.

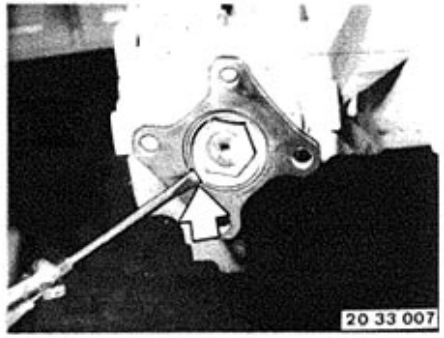
Mount label with information on next oil change in view of driver.

* See Specifications

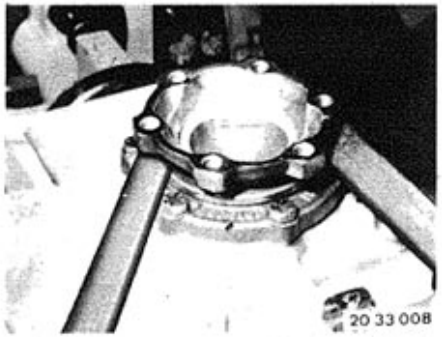


33 11 011 REPLACING SHAFT SEAL FOR FINAL DRIVE INPUT FLANGE

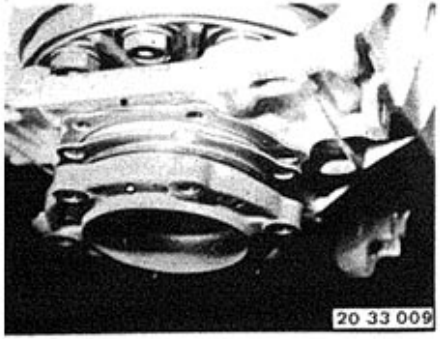
Remove final drive – see 33 10 010 in pertinent model repair manual microfiche, beginning with 1985 models.
Mount final drive on Special Tool 33 1 010.
Drain oil. Take off case cover.
Installation:
Replace gasket. Tightening torque*.
Add oil – oil volume*
See Service Information of Group 00 for approved oil.



Remove lockplate.

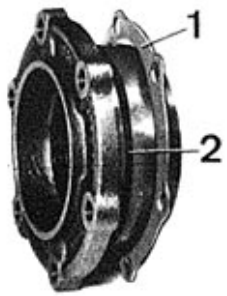


Press off drive flanges with a tire iron.

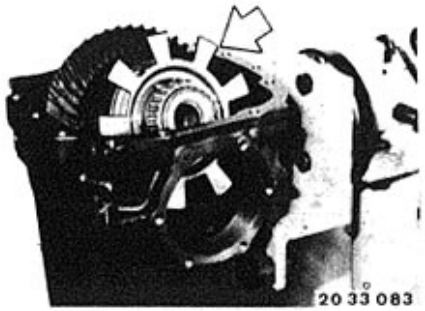


Punch mark both bearing caps.
Remove both bearing caps.
Important!
Don't mix up the bearing caps and spacers.
If necessary, hold the spacers on bearing caps with pieces of wire.
Installation:
Tightening torque*.

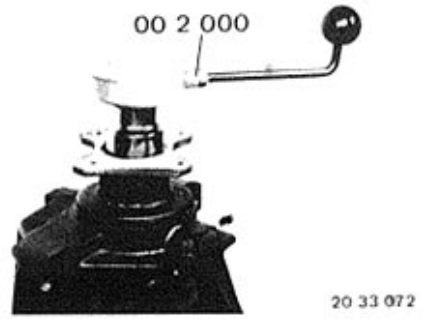
* See Specifications



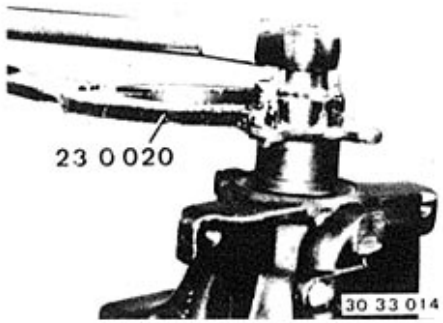
Differential case bearings and backlash are adjusted with shims (1).
Check O-ring (2), replacing if necessary.



Remove differential assembly.
Important!
Don't bend the pulse spider.

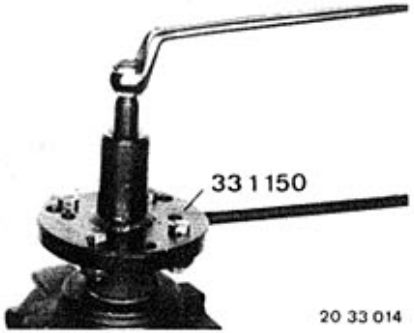


Measure friction torque with torque meter 00 2 000 and note the value.
Important!
The measured friction torque value + friction torque of new shaft seal (20 Ncm/2 in. lbs.) must be reached when assembling, but not exceeded.

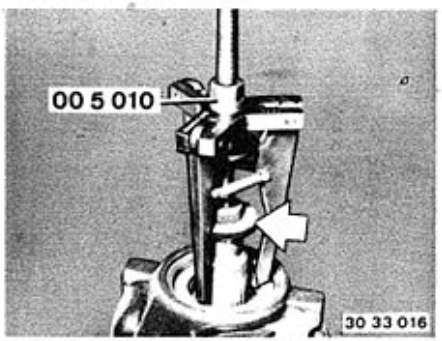


Hold the input flange with Special Tool 23 0 020
Unscrew the collar nut.
Installation:
Tightening torque*.

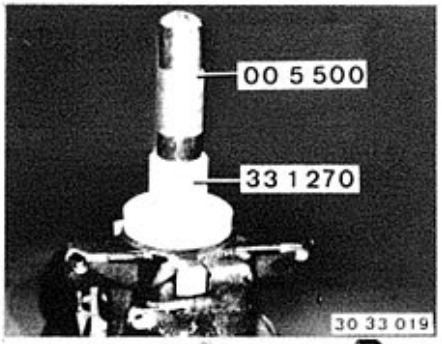
* See Specifications



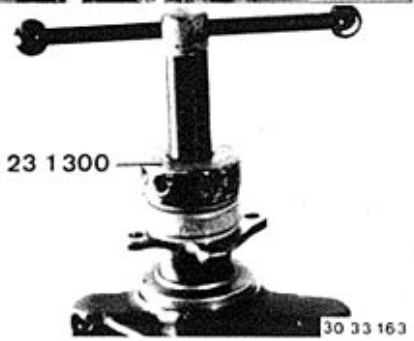
Pull off the input flange with Special Tool 33 1 150.



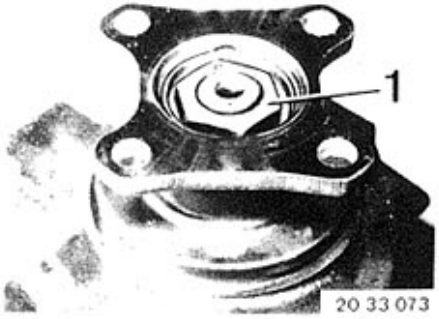
Pull out the shaft seal with Special Tool 00 5 010 and a thrust piece.



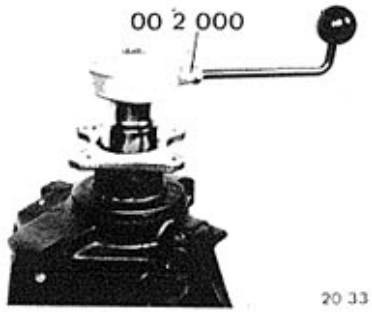
Dip the shaft seal in final drive gear lube and drive in the seal flush with Special Tool 33 1 270.



Press new input flange on to the input shaft with Special Tool 23 1 300, but do not tighten. The bushing does not have to be replaced when replacing the input flange.

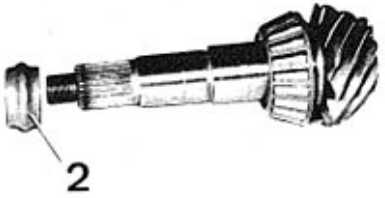


Tighten the input flange with the collar nut in steps, measuring the friction torque between steps.



Adjust the drive pinion to the friction torque value measured prior to disassembling and add 20 Ncm (2 in. lbs.).
Example:

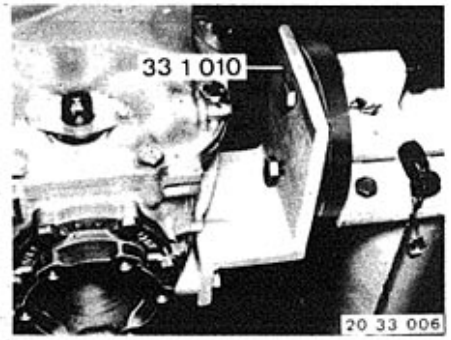
Measured torque	160 Ncm (14 in. lbs.)
New shaft seal	+ 20 Ncm (2 in. lbs.)
Pinion bearing adjusted to	180 Ncm (16 in. lbs.)



If the friction torque value (see example) is exceeded, replace bushing (2) and repeat the measuring procedures.
This requires removing and installing drive pinion – see 33 12 551.
Installation:
Drive in a new lockplate with Special Tools 33 4 050 and 00 5 500.

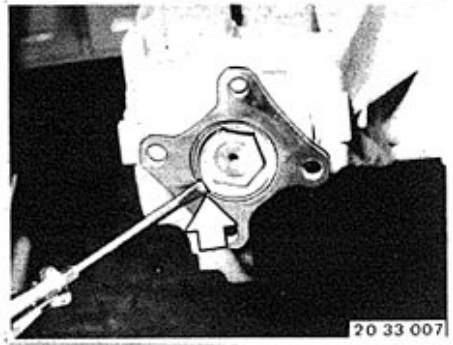


Installation:
Install complete differential, checking for correct installation of bearing caps.
The differential bores (1) always face up when the differential is installed correctly and this can be seen on the outside by way of tab (2).
If applicable, check backlash and tooth contact pattern.
See 33 12 551 for additional information.

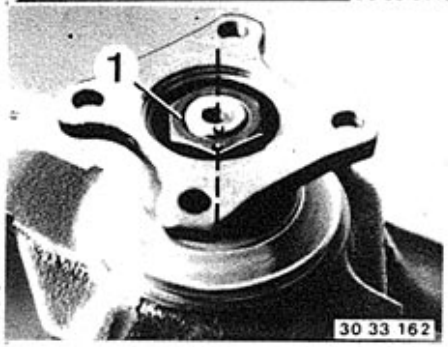


33 11 512 REPLACING SHAFT SEAL FOR INPUT FLANGE
– Final Drive Removed –

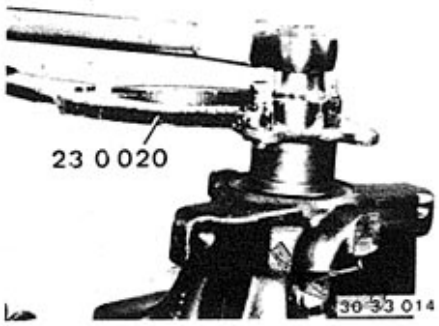
Remove final drive – see 33 10 010 in the pertinent model repair manual microfiche, beginning with 1985 models.
Mount final drive on Special Tool 33 1 010.
Drain oil.
Installation:
Pour in oil – oil volume*.
See Service Information of Group 00 for oil grade.



Lift out the lockplate.
Installation:
Drive in the new lockplate with Special Tools 33 4 050 and 00 5 500.

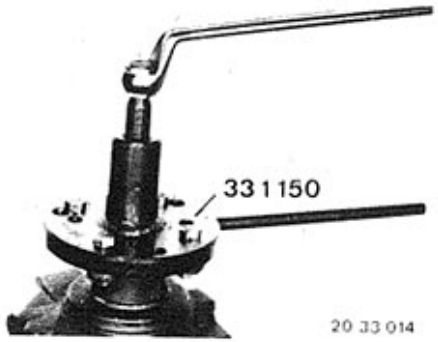


Punch mark position of nut (1) to the input shaft.

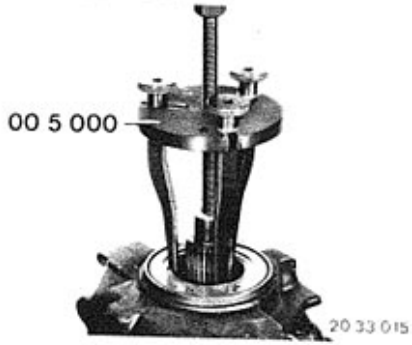


Unscrew nut (1), counterholding on the flange with Special Tool 23 0 020.

* See Specifications



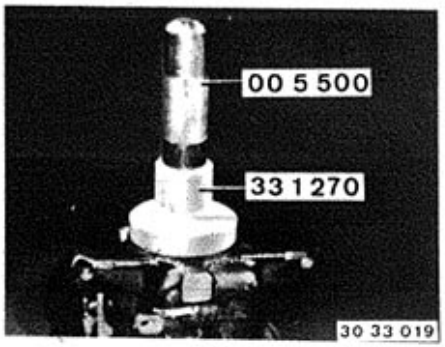
Pull off the input flange with Special Tool 33 1 150.



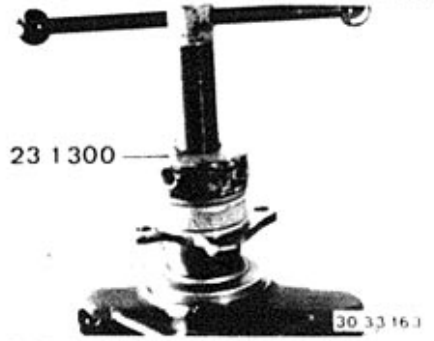
Pull out the shaft seal with Special Tool 00 5 010 and a suitable thrust piece.



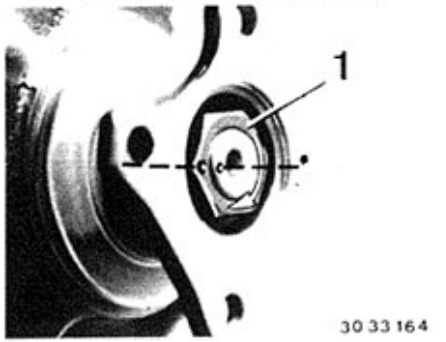
Installation:
If the bearing surface on the input flange is scored seriously, replace the input flange.
Important!
If the input flange has to be replaced, measure the friction torque with the old input flange.
If applicable, tighten the nut to the punch mark, measure and note the friction torque value – see 33 11 011.
The old shaft seal does not have to be installed for measuring.



Dip a new shaft seal in final drive gear lube** and drive in the seal flush with Special Tool 33 1 270.

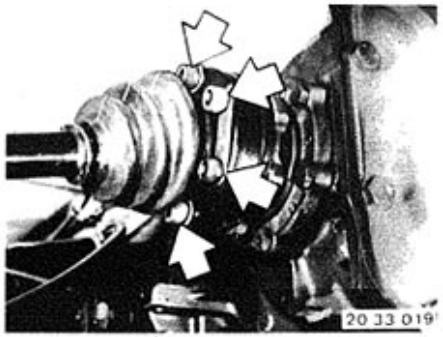


Press on the input flange, if necessary with Special Tool 23 1 300; do not tighten.



Tighten the input flange with collar nut (1) and then turn the nut further until the punch marks are aligned precisely.
Important!
Never tighten the collar nut past the punched marks and then back again, since then the bushing would have to be replaced – see 33 12 551.
Installation:
Replace the lockplate.
Pour in final drive gear lube**.

** See Service Information of Gr. 00

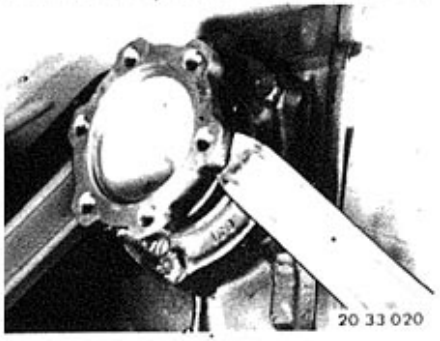


33 11 151 REPLACING SHAFT SEAL FOR DRIVE FLANGE

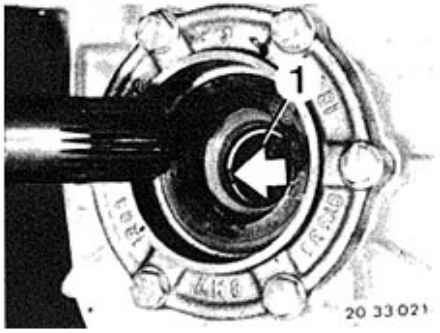
Detach output shaft at drive flange.
Suspend output shaft with a piece of wire.

Installation:

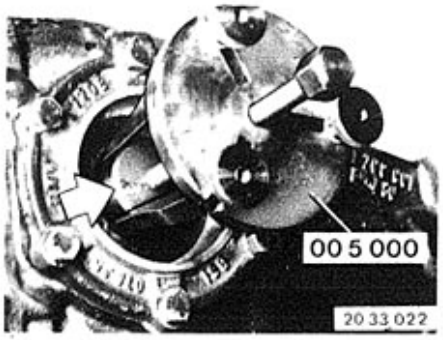
Tightening torque [1].



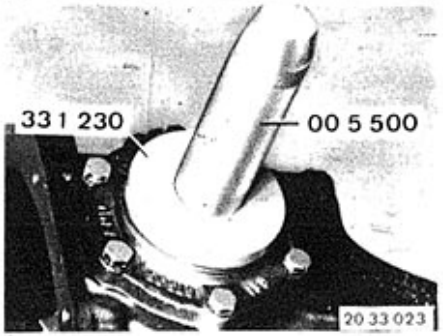
Press off drive flange with a tire iron.



Installation:
Before installing the drive flange, place round wire snap ring in groove of differential case that both ends of snap ring are recessed in groove. This will prevent lateral bending of the ring. Press in drive flange by hand and turn slightly until round wire snap ring is heard to engage. Replace stretched snap rings.

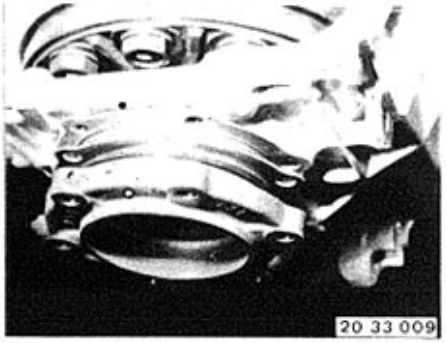


Pull out shaft seal with Special Tool 00 5 000 and pressure pad.



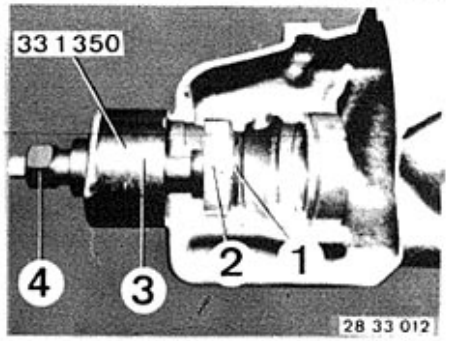
Installation:
Dip shaft seal in final drive oil.
Knock in shaft seal against stop with Special Tools 33 1 230 and 00 5 500.
Replace drive flange when bearing surface has extreme scoring.

See Specifications

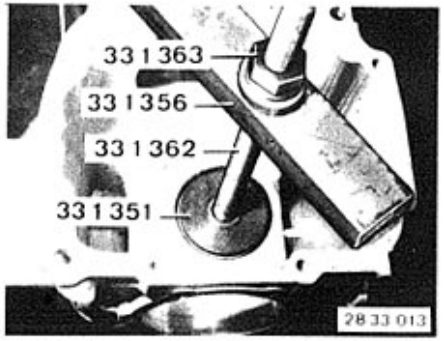


33 12 551 REPLACING DRIVE PINION AND RING GEAR
FINAL DRIVE REMOVED

Remove drive pinion (see "Replacing Shaft Seal for Input Flange" 33 11 011).
Important!
Measure total friction torque and note value.
Mark bearing caps.
Don't mix up washers.
Measure friction torque of drive pinion bearings and note value.



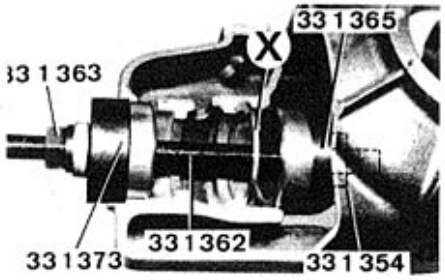
Pull out front bearing outer race with Special Tool 33 1 350.
1 Spreader
2 Front bearing outer race
3 Pulling bell
4 Pressure bolt



Pull out rear bearing outer race with Special Tool 33 1 360.
Puller consists of:

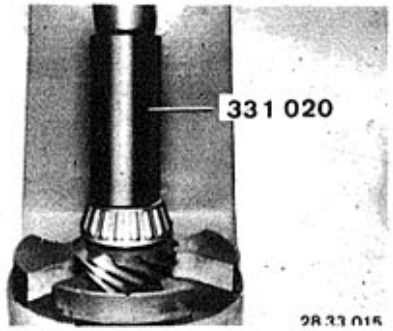
Puller head	33 1 351
Threaded spindle	33 1 362
Bearing bridge	33 1 356
Pressure nut	33 1 363

Important!
Shim (X) is located underneath the rear bearing outer race and will be required again for adjustment of drive pinion.

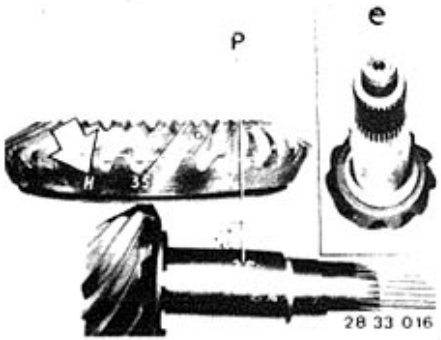


Install old shim (X) in front of rear bearing outer race.
Pull in bearing outer races with Special Tool 33 1 360.
Puller consists of:

Pulling disc for front race	33 1 373
Pulling disc for rear race	33 1 365
Threaded spindle	33 1 362
Pressure nut	33 1 363
Nut	33 1 354



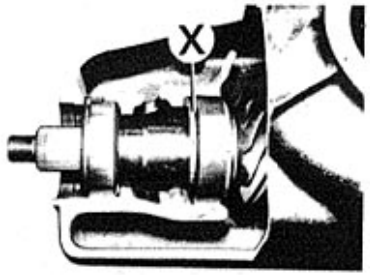
Press taper roller bearing on to drive pinion with Special Tool 33 1 020.



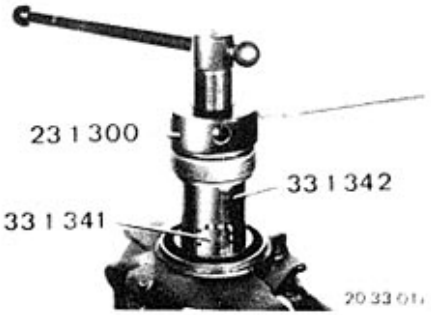
Important!
Drive pinions and ring gears are matched for optimum smooth running in special machines. The match code (P) is electrically inscribed in the drive pinion and ring gear.
Never install a ring gear and drive pinion with different match codes (P) together.



The number inscribed with a + or – sign is the deviation from basic setting C in hundreths of millimeters and is required to determine thickness of shim.
e + is added to C.
e – is subtracted from C.
K or H is tooth type code.
K = Klingelnberg teeth
H = Gleason teeth



To determine the correct thickness of shim (X), install drive pinion with new taper roller bearing but without the clamping bush.

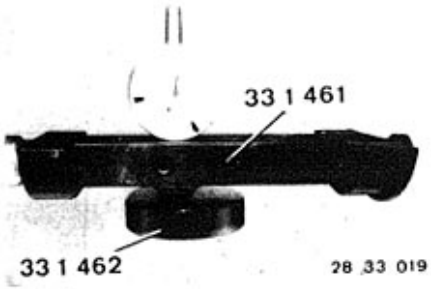


Place drive pinion in rear bearing outer race. Screw Special Tool 33 1 341 on drive pinion and pull front taper roller bearing on to drive pinion with Special Tools 23 1 300 and 33 1 342



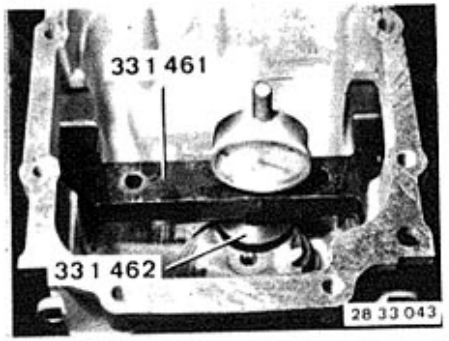
Attach drive flange.
Tighten collar nut to adjust friction torque of drive pinion taper roller bearing to 250 Ncm (22 in. lbs.).

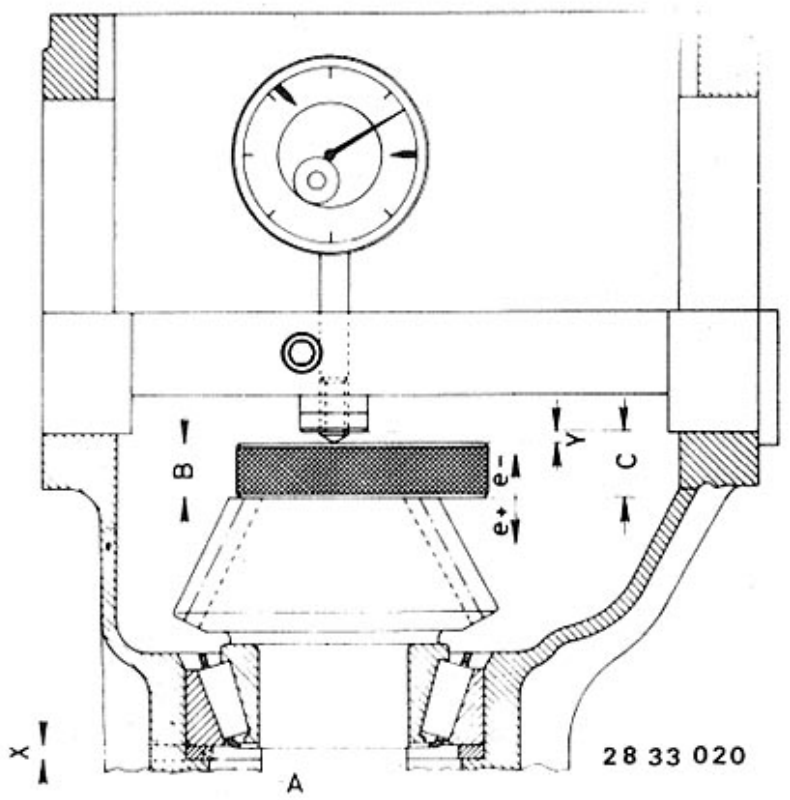
Mount dial gauge in Special Tool 33 1 461.
Place Special Tool 33 1 461 with dial gauge on Special Tool 33 1 462 and set dial gauge with preload to 0 (zero).



Place Special Tool 33 1 462 on drive pinion.
Place Special Tool 33 1 461 in case.
Determine Y.

Basic setting	C	11.50 mm (0.453")
Master gauge	B	9.50 mm (0.374")





Example I

C		11.50 mm (0.453")
e –		0.10 mm (0.004")
C target		11.40 mm (0.449")
Value Y measured with dial gauge		1.80 mm (0.071")
Sum B		9.50 mm (0.374")
Sum Y	+	1.80 mm (0.071")
C actual		11.30 mm (0.445")
C target		11.40 mm (0.449")
C actual	–	11.30 mm (0.445")
a		0.10 mm (0.004")
Master gauge A		4.14 mm (0.163")
– a		0.10 mm (0.004")
Shim X		4.04 mm (0.159")

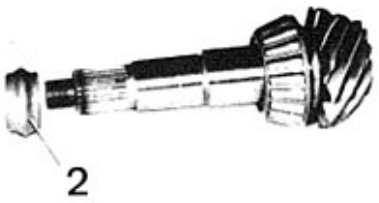
If C target is greater than C actual, "a" is subtracted (–) from shim thickness X.

Example II

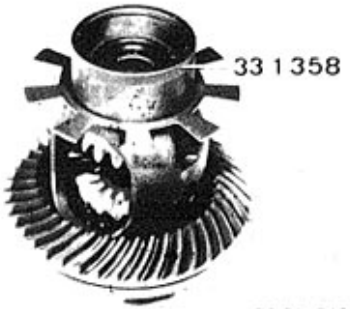
C		11.50 mm (0.453")
e +		0.10 mm (0.004")
C target		11.60 mm (0.457")
Value Y measured with dial gauge		2.20 mm (0.087")
Sum B		9.50 mm (0.374")
Sum Y	+	2.20 mm (0.087")
C actual		11.70 mm (0.461")
C actual		11.70 mm (0.461")
C target	–	11.60 mm (0.457")
a		0.10 mm (0.004")
Master gauge A		4.10 mm (0.161")
+ a		0.10 mm (0.004")
Shim X		4.20 mm (0.165")

If C target is smaller than C actual, "a" is added (+) to shim thickness X.

The permissible tolerance for distance (X) depends on the tolerances for a certain shim thickness ranging from 0.01 to 0.03 mm (0.0004 to 0.0012").



Remove drive pinion and rear bearing outer race.
Press in shim (X) of determined thickness and bearing outer race.
Install drive pinion with new clamping sleeve (2).
Knock in shaft seal and attach input flange.



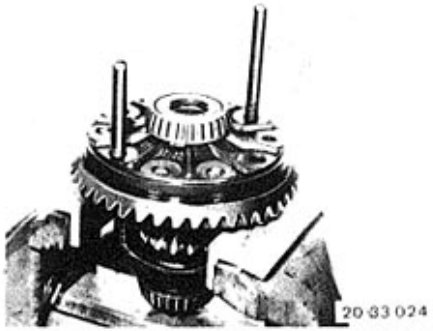
20 33 012

Press pulse spider off of differential case.
Installation:
Press on pulse spider with Special Tool 33 1 358.

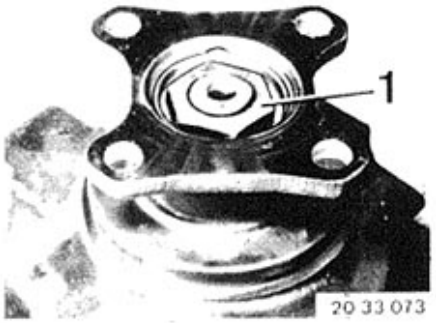
20 33 016



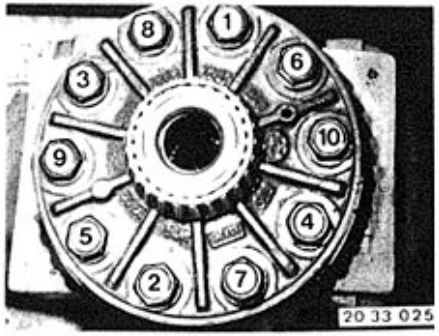
Tighten collar nut and measure friction torque.
Adjust drive pinion bearing to friction torque value measured prior to disassembling plus 20 Ncm (2 in. lbs.) for new shaft seal.



Detach ring gear (cold).
Installation:
Clean threads thoroughly with a tapper.
Heat ring gear to max. 100° C (212° F), checking temperature with a thermocolor pencil.
Mount ring gear with 2 staybolts (made locally) as guides.



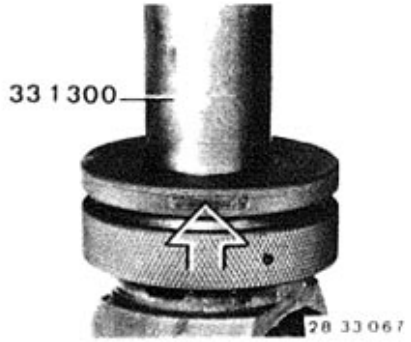
Important!
Collar nut (1) must be tightened to at least the specified torque value[1].
If this value is not reached or the friction torque is exceeded, replace clamping bush (2) and repeat check.



Install new bolts with Loctite No. 270 and tighten in order of 1 through 10.
Tightening torque[1].
Tighten bolts to torque angle[1].

[1] See Specifications

[1] See Specifications



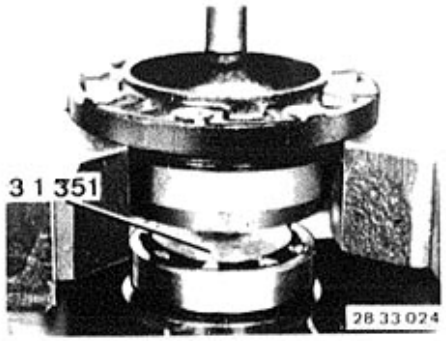
Pull off tapered roller bearing on differential case with Special Tools 33,1 300 and 33 1 305.



Installation:
Press on new tapered roller bearing cold with Special Tool 31 1 003.



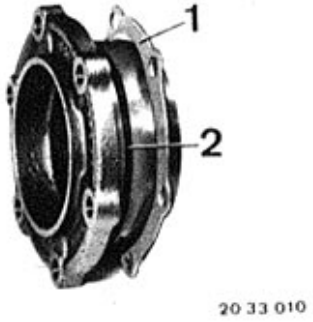
Remove shaft seals from both bearing covers.
Installation:
Dip new shaft seals in final drive oil.
Knock in shaft seals against stop with Special Tools 33 1 230 and 00 5 500.



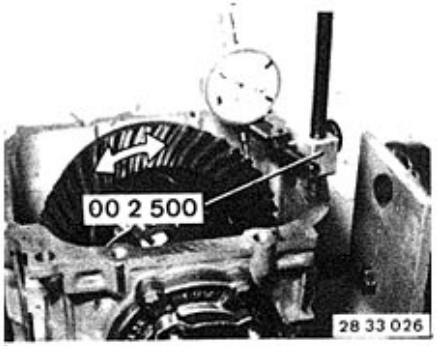
Press out bearing outer race with Special Tool 33 1 351.
Important!
Puller spider must engage in bearing outer race.



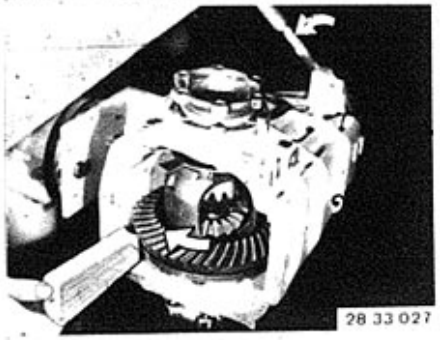
Installation:
Press in new bearing outer races with Special Tool 33 1 365.



Install bearing covers (marked) with corresponding washers (1).
Check O-ring (2), replacing if necessary.



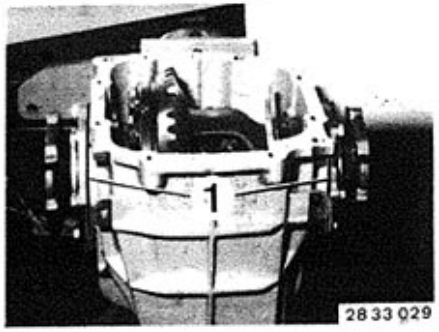
Mount Special Tool 00 2 500 and measure backlash[1].
Important!
The tooth contact pattern is always deciding for correctly adjusted drive pinion/ring gear sets.



To check the tooth contact pattern, coat ring gear with printer's ink, turn ring gear several times in both directions and stop suddenly with a piece of hard wood.
Correct backlash and tooth contact pattern by changing shims from one side to the other.



Measure total friction torque and compare with value determined prior to disassembling.
Add 20 Ncm (2 in. lbs.) for each replaced shaft seal.



Important!
Changing the total thickness of shims (1) would change the friction torque value.
The backlash and tooth contact pattern must be adjusted again after adjusting the friction torque.

[1] See Specifications

Basic Information on Tooth Contact Patterns

Gleason Teeth:

A
Correct tooth contact pattern without load.

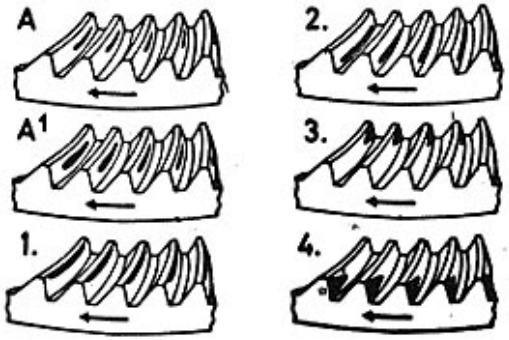
A 1
Loads will shift tooth contact pattern outward slightly.
Moving the ring gear will mainly change the backlash, but will also displace the contact pattern in longitudinal direction of teeth.
Moving the drive pinion will displace the contact pattern in favor of tooth height, but the backlash will be altered just very slightly.
Here are the four basic incorrect tooth contact patterns, which usually appear in combination. Knowing these patterns will facilitate making adjustments.

1. High, narrow contact pattern (tip contact) on ring gear. Move drive pinion toward ring gear shaft and perhaps correct backlash by backing ring gear off of drive pinion.
2. Deep, narrow contact pattern (root contact) on ring gear. Move drive pinion away from ring gear shaft and perhaps correct backlash by moving in ring gear.
3. Short contact pattern on small tooth end (toe contact) of ring gear. Move ring gear away from drive pinion. Maybe move drive pinion closer to ring gear shaft.
4. Short contact pattern on large tooth end (heel contact) of ring gear. Move ring gear toward drive pinion. Prehaps back drive pinion away from ring gear shaft.

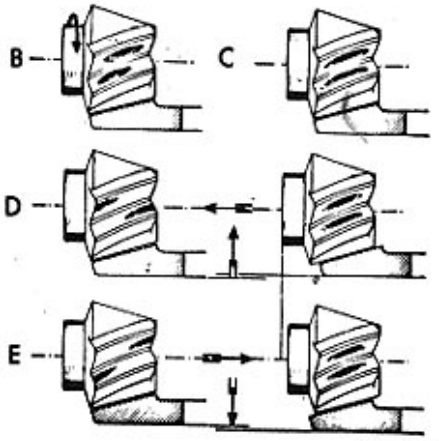
Klingelnberg (Palloid) Teeth:

Tooth contact pattern on forward and reverse flanks of drive pinion should be at approximately center of tooth length and tooth height.

B Tooth contact pattern off load.
C Tooth contact pattern under load.
D By installing a thicker shim X behind drive pinion the contact pattern of forward flank will shift toward the large drive pinion diameter, while on the reverse flank it will move closer to the small drive pinion diameter.
E Other possible changes (see drawing).

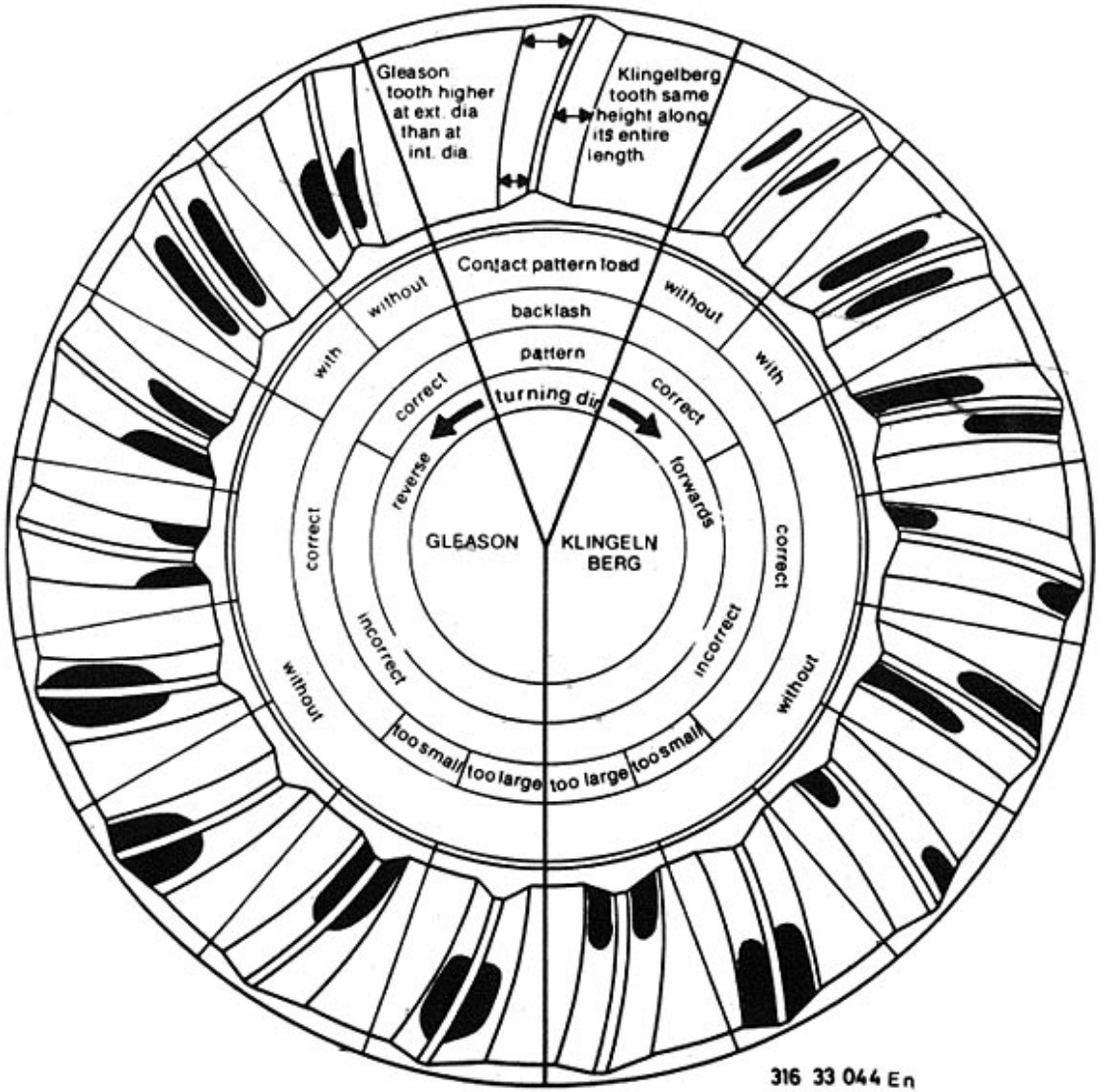


28 33 030



28 33 031

Adjustment of contact pattern



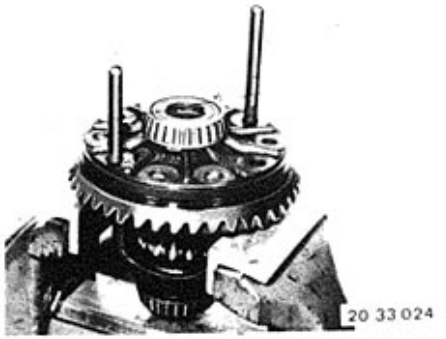
33 13 611 ·REPLACING DIFFERENTIAL GEARS –DIFFERENTIAL REMOVED–

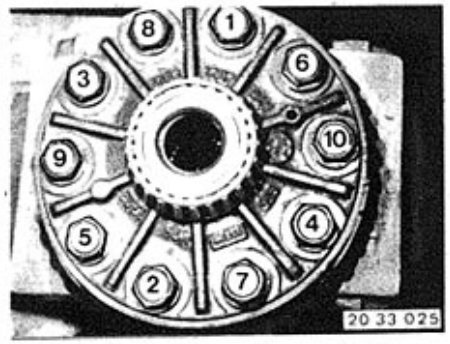


20.33 012

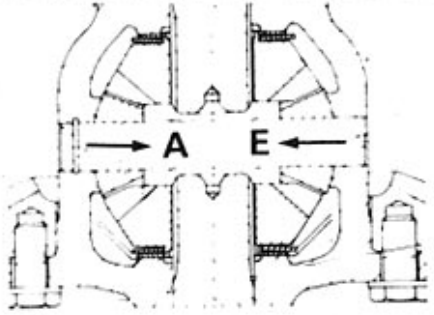
Press off pulse spider.
Installation:
Press on pulse spider with Special Tool 33 1 358.

Take off ring gear (cold).
Installation:
Clean threads thoroughly (tapper).
Heat ring gear to max. 100° C (212° F) and check temperature with a thermocolor pencil.
Install ring gear with 2 locally manufactured staybolts as guides.





Install new bolts with Loctite No. 270 and tighten in order of 1 through 10.
Tightening torque*.
Retighten bolts to torque angle*.



Press out differential gear shaft from large countersunk end with Special Tool 33 1 470.
A = Pressing-out direction
E = Pressing-in direction

* See Specifications

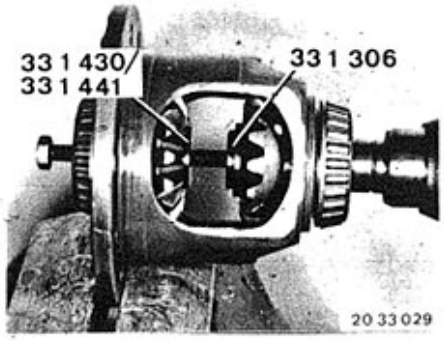


Turn out differential bevel gears with drive flange.
Remove differential side gears with diaphragm springs and shims.



20 33 028

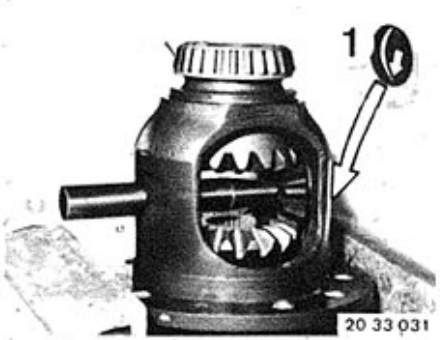
Install both differential side gears with diaphragm springs (1) and shims (2).
Inside curved surfaces of diaphragm springs (1) face differential side gears.
Center differential side gears with drive flanges.



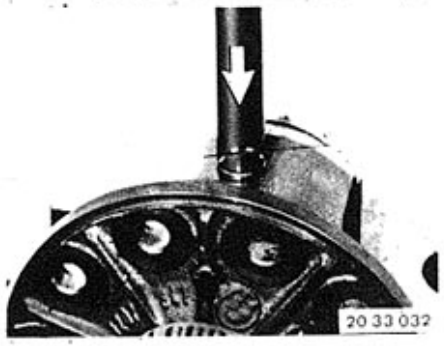
Insert Special Tool 33 1 306 on one side.
Apply Special Tools 33 1 441 and 33 1 430.
Tighten special tool spindle to press differential side gears so far apart, that the drive flange can just barely be turned.



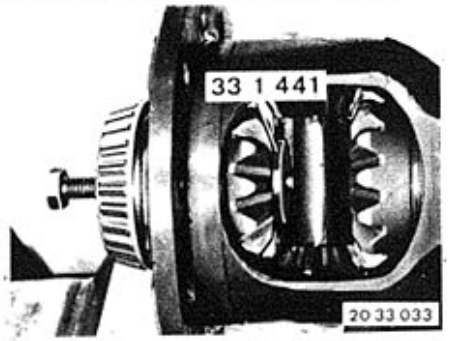
Install differential bevel gears exactly opposite each other.
Move differential gears to installed position by turning drive flange.
Remove special tools.



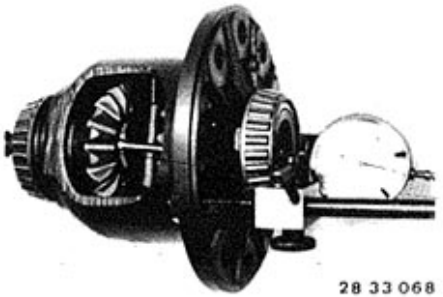
Make sure circlip (1) is installed in correct position.
Push in mandrel from side without circlip.



Position differential gear shaft's chamfer on mandrel and press in.
The pressing-in force will increase considerably when circlip has engaged.
Important!
Stop pressing-in procedure when force rises danger of shearing off the circlip!
Don't push back differential gear shaft after installation.



Measuring Pre-load of Diaphragm Springs:
Install Special Tools 33 1 441 and 33 1 431.
Tighten special tool spindle by hand.



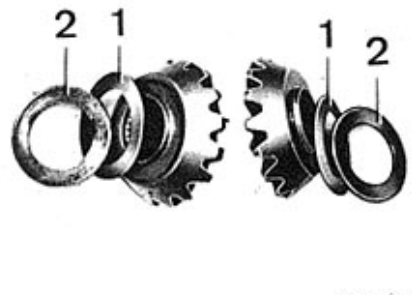
Mount dial gauge with holder, consisting of Special Tools 33 1 420, 00 2 505 and 00 2 506, on differential case.
Set dial gauge on stopped shaft gear to zero with pre-load.



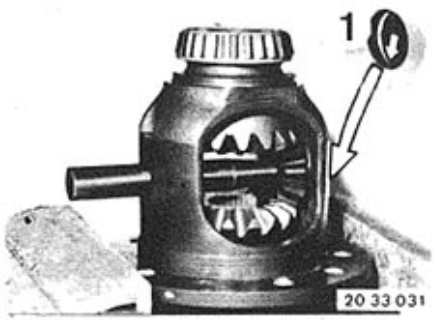
Tighten spindle that diaphragm springs are pressed flat.
Read dial gauge.
Loosen spindle.
Turn shaft gear and repeat test at several points.
A play of 0.03 to 0.1 mm (0.0012 to 0.0040") is required to prevent pressing diaphragm springs flat.
The lower value would be ideal.
Repeat test on opposite shaft gear.



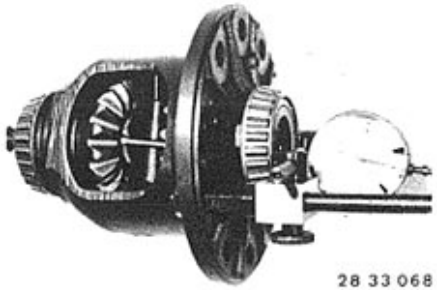
Excessive Play:
Install thicker shim.
Insufficient Play:
Install thinner shim.
Shims (2) are available in thickness steps of 0.05 mm (0.0020").
Apply same procedures for opposite side.



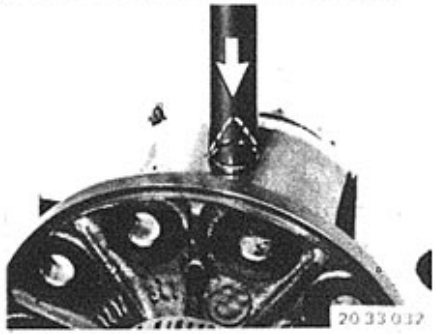
Install shims (2) of determined thickness and diaphragm springs (1).
Inside curved surfaces of diaphragm springs (1) face differential case.



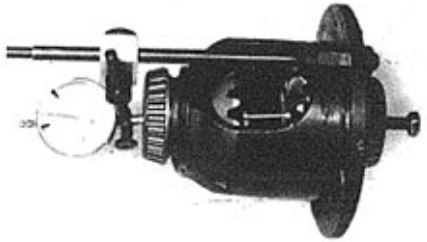
Step performed with Special Tool 00 8 500:
Check for correct installed position of circlip (1).
Slide in Special Tool 33 1 470 from end without a circlip.



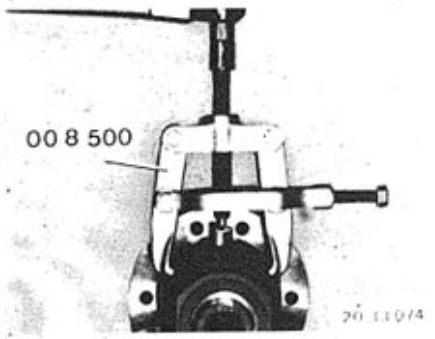
Apply dial gauge with holder.
Set dial gauge to zero with preload.



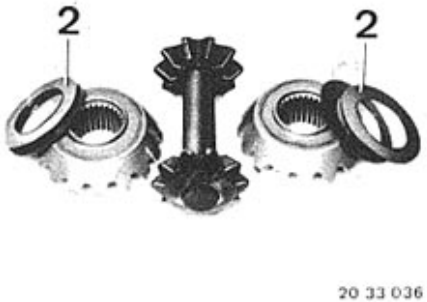
Apply differential gear shaft with large opening on mandrel and press in, until approx. 1 to 2 cm (3/8" to 3/4") of shaft is still visible.



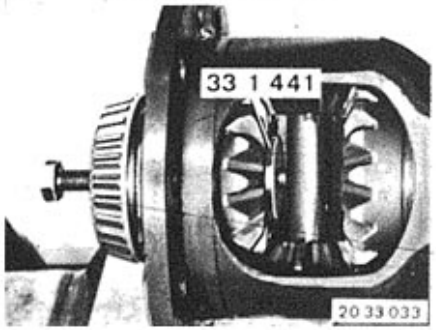
Tighten spindle enough that diaphragm spring is pressed flat.
Read dial gauge.
Loosen spindle.
Turn differential side gear and repeat test at several points.
A play of 0.03 to 0.1 mm (0.001 to 0.004") is required to prevent pressing diaphragm springs flat.
Lowest value would be ideal.
Repeat test on opposite differential side gear.



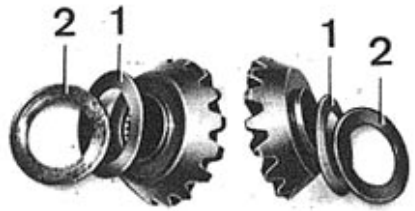
Apply Special Tool 00 8 500 on differential cage and pull in differential gear shaft with a torque breaking wrench.
Torque Adjusting Value:
22 Nm (16 ft. lbs.) for 18 mm (0.709") spindle diameter.
22 Nm (16 ft. lbs.) for 20 mm (0.787") spindle diameter.
Important!
Lubricate centering point on differential gear shaft with oil before applying the spindle.
Do not push back differential gear shaft after installation.
Make sure last quarter of torque, from approx. 17 Nm (12 ft. lbs.), is made at constant speed (not suddenly).



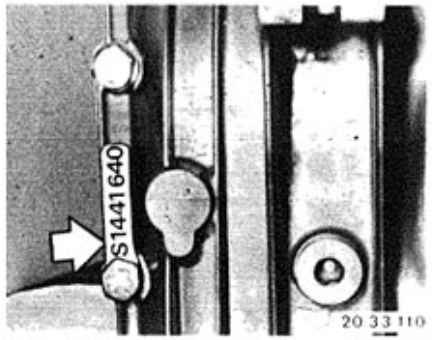
Excessive Play:
Install thicker shim.
Insufficient Play:
Install thinner shim.
Shims (2) are available in thickness steps of 0.05 mm (0.0020").
Opposite end procedures are identical.



Measuring Preload of Diaphragm Springs:
Install Special Tool 33 1 441 and spindle.
Tighten spindle by hand.



Install shims (2) of determined thickness and diaphragm springs (1).
Inside curved surface of diaphragm springs (1) faces differential case.



LIMITED SLIP DIFFERENTIAL WITH 25 % LOCKING RATIO

The limited slip differential is marked with a "S" on the case or data plate.
A limited slip differential has the following advantages.

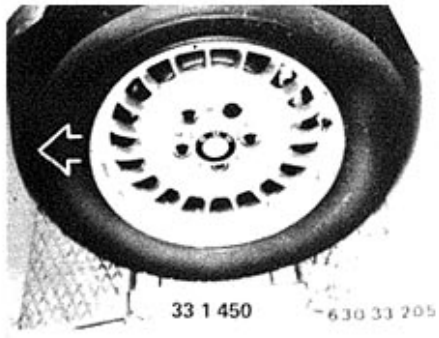
a) Prevention of wheel slip when driving on rough road surfaces.

b) Prevention of wheel slip when moving off with different traction underneath left and right sides of car wheels.

c) Prevention of wheel slip when driving fast on wet roads.

d) Prevention of wheel slip on inside of curve when driving fast in curves.

e) Prevention of slip when driving fast on roads with different traction between left and right.



Checking Function Without Removing:

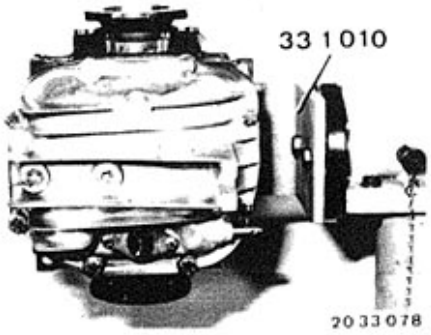
a) Level workshop floor.

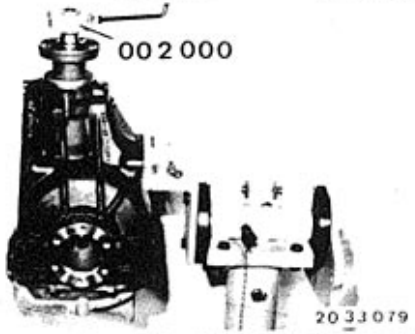
b) Drive car with left rear wheel on Special Tool 33 1 450.

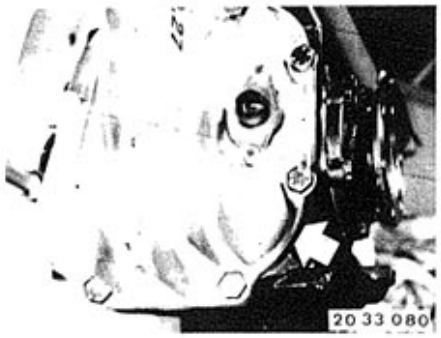
c) Release parking brake completely.

d) Engage 1st gear and accelerate engine.

e) Function of limited slip differential is okay, if the car can be driven off of Special Tool 33 1 450.







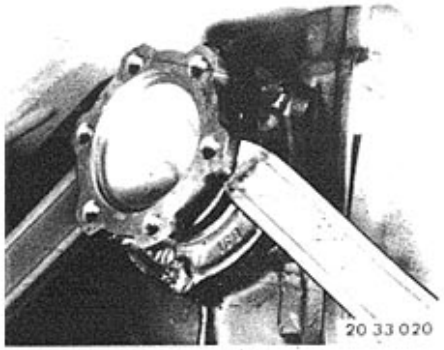
33 14 011 REPLACING LIMITED SLIP DIFFERENTIAL ASSEMBLY

Remove and install final drive 33 10 010.
Drain oil.
Mount final drive on Special Tool 33 1 010.
Installation:
Add oil – oil volume*.
Refer to Service Information of Group 00 for approved oil.

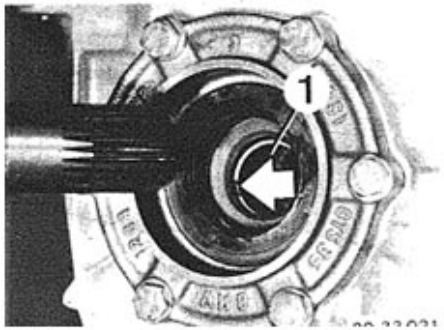
Determine total friction torque with Special Tool 00 2 000 before disassembling and note value.
For Example:
280 Ncm (24 in. lbs.).

Detach transmission cover.
Installation:
Replace gasket.
Tightening torque*.

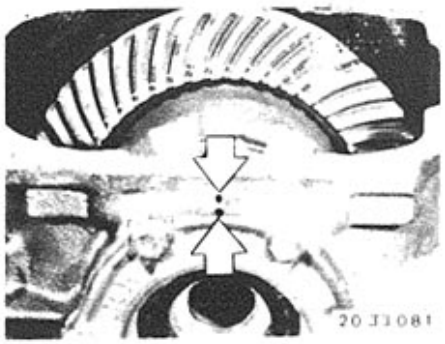
* See Specifications



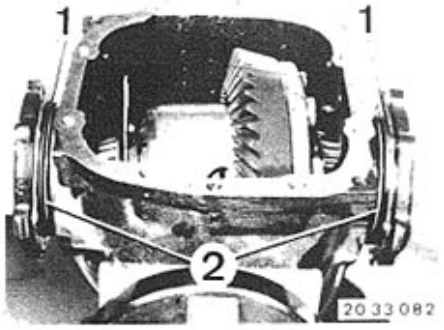
Pry off both drive flanges with a tire iron.



Installation:
Before installation of the drive flange, place round wire snap ring (1) in groove of differential case that both ends are recessed in groove.
This prevents lateral bending of the ring.
Push in and turn drive flange slightly by hand until round wire snap ring is heard to engage.
Replace stretched snap rings.

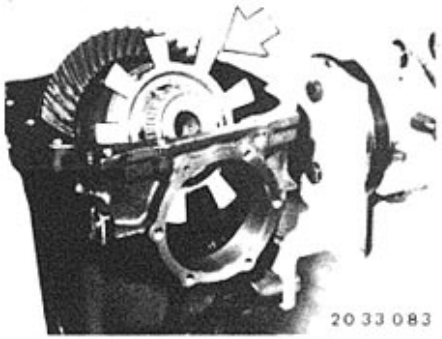


Detach both bearing caps.
Important!
Mark bearing caps – don't mix them up.
Installation:
Tightening torque*.

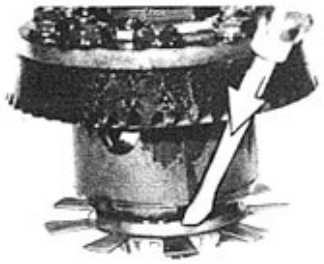


Differential case bearings and backlash are adjusted with shims (1).
Check O-ring (2), replacing if necessary.
Important!
A change in total thickness of shims (1) will change the friction torque value.
After adjusting the friction torque, the backlash and tooth contact pattern must be adjusted again.

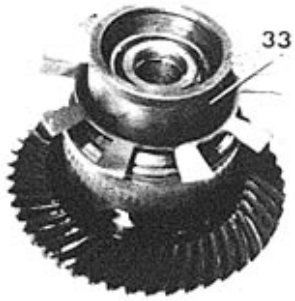
* See Specifications


20 33 083

Remove complete limited slip differential.
Installation:
Don't bend pulse spider.

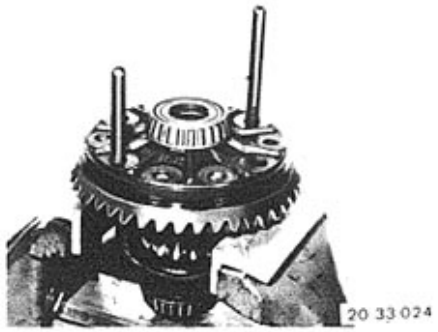

20 33 084

Press off pulse spider.



20 33 086

Installation:
Press on pulse spider with Special Tool 33 1 358.

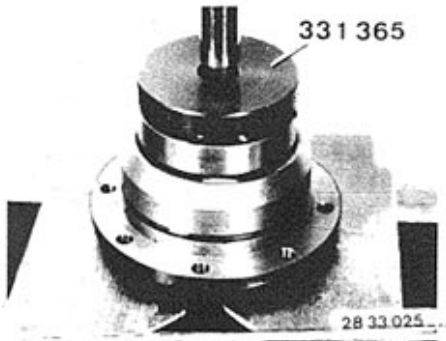

20 33 024

Detach ring gear (cold).
Installation:
Clean threads thoroughly (with a tapper).
Heat ring gear to max. 100° C (212° F), checking temperature with a thermocolor pencil.



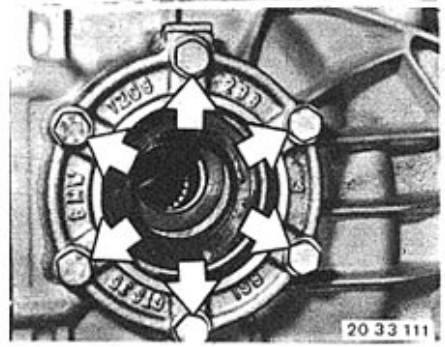
2033085

Mount ring gear with 2 locally made staybolts as guides.
Install new bolts with Loctite No. 270 and tighten in order of 1 through 10.
Tightening torque*.
Retighten bolts to torque angle*.



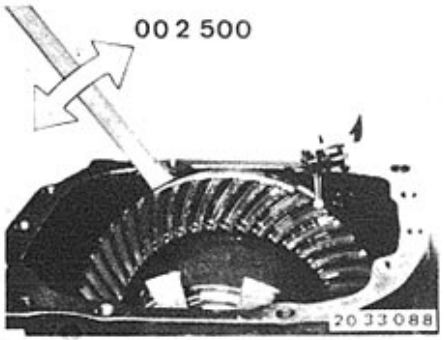
28 33 025

Install new limited slip differential with ring gear and pulse spider.
Installation:
Press in new bearing outer races with Special Tool 33 1 365.

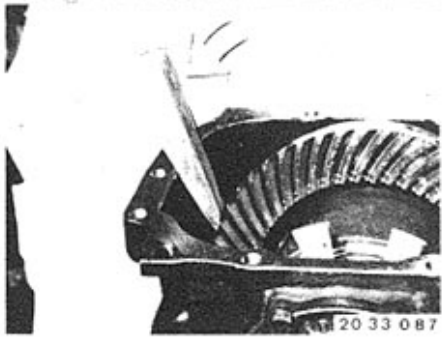

20 33 111

Tighten bearing cap bolts uniformly.
Measure total friction torque with Special Tool 00 2 000.
The value found before disassembling plus 20 Ncm (1.7 in. lbs.) for each replaced shaft seal should be reached, but not exceeded.
Friction torque too high = use thinner shims.
Friction torque too low = use thicker shims.

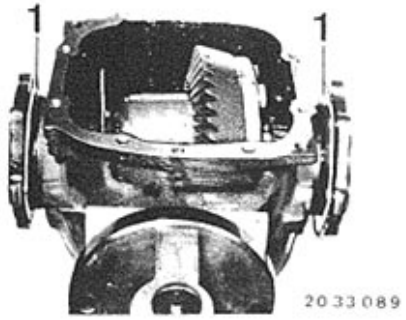
* See Specifications



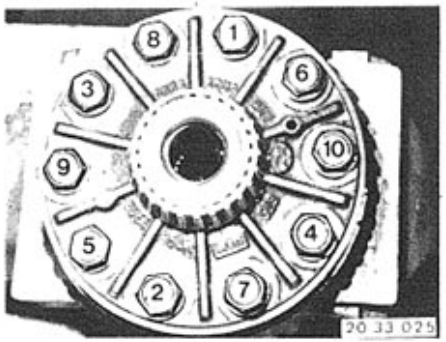
Mount Special Tool 00 2 500 and measure backlash*.
Important!
The tooth contact pattern is always important for a perfectly adjusted pinion/ring gear set.

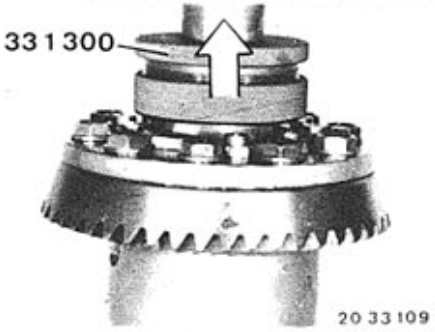


To check the tooth contact pattern, coat ring gear with printer's ink, turn gear ring in both directions several times and stop suddenly with a piece of hard wood.



To correct backlash* and tooth contact pattern, exchange shims (1) from one side to the other.
Important!
Don't change total thickness of shims.





33 14 045 SERVICE INSTALLING LIMITED SLIP DIFFERENTIAL

Remove and install complete differential 33 13 010.
Detach ring gear on differential case (cold).
Installation:
Clean bolt threads.
Heat ring gear to max. 100° C (212° F).
Install new bolts with Loctite*.
Tightening torque*.
Tighten bolts in order of 1 through 10.
Tighten bolts to torque angle*.

Pull off tapered roller bearing on differential case with Special Tool 33 1 300.
Installation:
Press on tapered roller bearings cold.
Replace defective tapered roller bearings.
Further procedures are identical with those for replacing complete limited slip differential, see

See Specifications

* See Specifications

33 14 613 DISASSEMBLING/ASSEMBLING LIMITED SLIP DIFFERENTIAL
LIMITED SLIP DIFFERENTIAL REMOVED

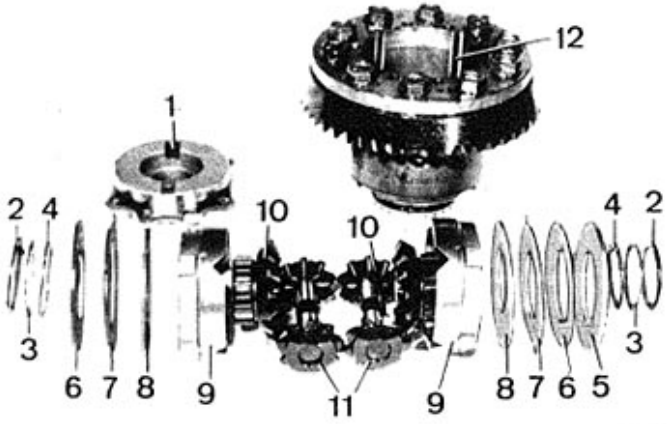

2033091

Unscrew case cover mounting bolts.
Take off case cover.


2033092

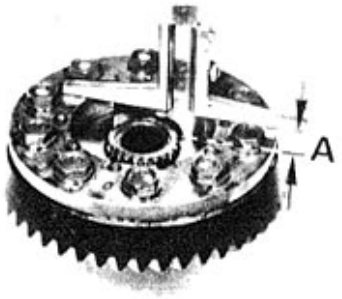
Turn case upside down and let parts slide out.
Installed Order:

1 Case cover
2 Thrust washer
3 Diaphragm spring
4 Stepped washer
5 Spacer
6 Diaphragm spring
7 Outer plate
8 Inner plate
9 Thrust ring
10 Differential side gear
11 Differential gears with differential shafts
12 Differential case



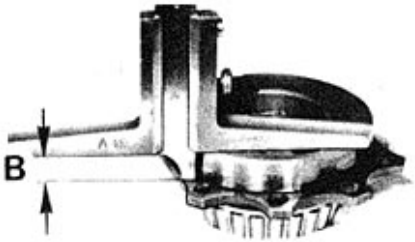
2033093

Installation:
Check all parts for wear, e.g. Molybdenum coat, splines, etc..
Lubricate all parts with approved final drive oil before assembling.



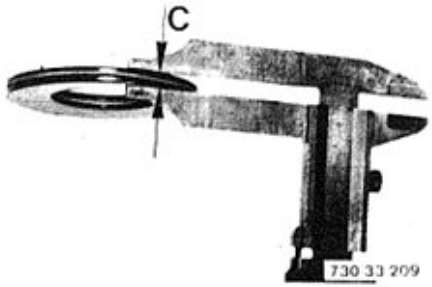
2033094

Install following parts in correct installed order to measure the pre-load.
Spacer (5), outer plates (7), inner plate (8), thrust rings (9), differential side gears (10) and differential gears with differential shafts (11).
Measure distance A from case edge to outer plate, e.g. A = 19.5 mm (0.768").



2033095

Measure distance B on cover, e.g.
B = 14.4 mm (0.567").



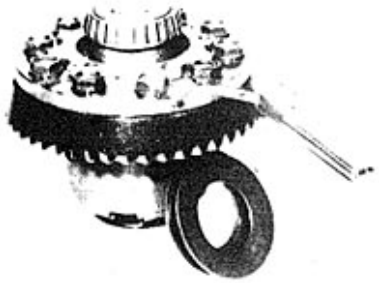
730 33 209

Place both diaphragm spring curved surfaces together.
Measure distance C on diaphragm springs, e.g.
C = 4.8 mm (0.189").

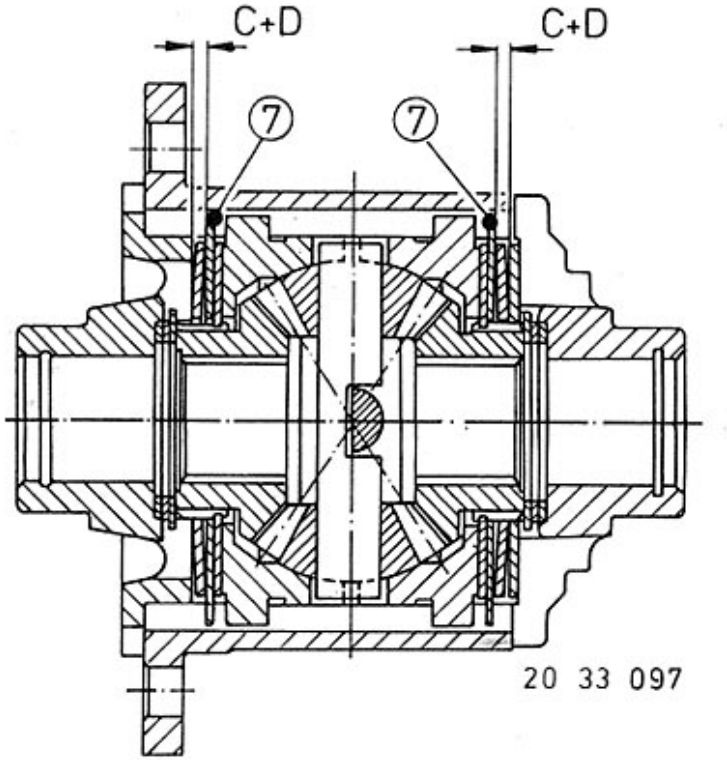
An installed clearance of 0.1 to 0.4 mm (0.004 to 0.016") is required to prevent pressing the diaphragm springs flat.
Example:

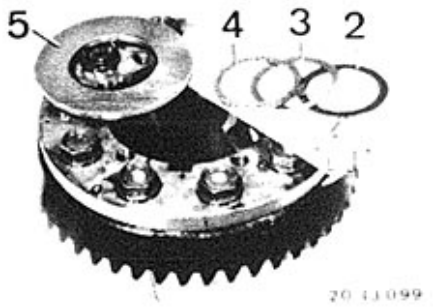
B (cover)	14.4 mm (0.567")
C (diaphragm springs)	4.8 mm (0.189")
A (case)	19.5 mm (0.768")
Sum of B + C	19.2 mm (0.756")
Installed clearance D	0.3 mm (0.012")

Correct any deviation in installed clearance D by installing outer plates of appropriate thickness.

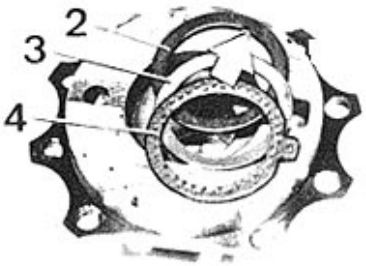


Remove all parts from case and insert with the additional parts, thrust washers (2), diaphragm springs (3) and stepped washers (4).
Mount and press on case cover (12) firmly (don't bolt).
The pre-load of small diaphragm springs (3) should produce an uniform gap all around (check with feeler gauge blade).
If there is no clearance between cover and case, check diaphragm springs (3), thrust washers (2) and stepped washers (4).

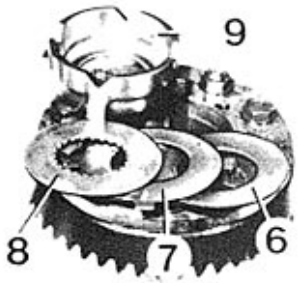




Installed Order:
Thrust washer (2) with oil pockets facing case (down).
Diaphragm spring (3) with inside curved surface facing differential shaft (up).
Stepped washer (4) with smooth side facing diaphragm spring (down) and tab engaging in guide in case.



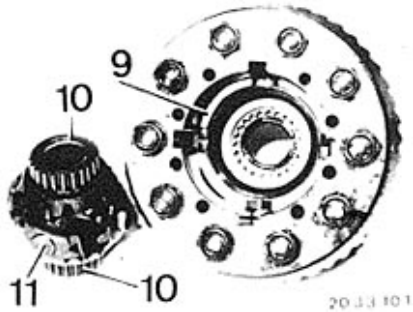
Insert thrust washer (2) with oil pockets facing cover, diaphragm spring (3) with inside curved surface facing out and stepped washer (4) with smooth side facing diaphragm spring and with tab in case cover groove in case with grease.



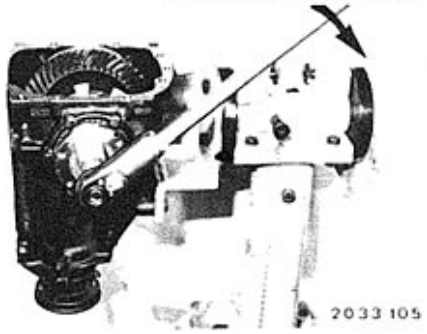
Install spacer (5), diaphragm spring (6) with inside curved surface facing differential shaft and outer plate (7) with 4 tabs.
Install molybdenum coated inner plate (8).



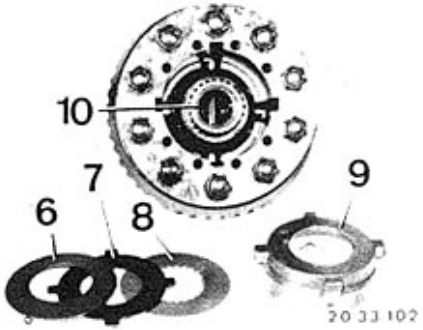
Mount case cover with washers (don't let steppe washer slide out of groove).
Install bolts with Loctite No. 270 and tighten cover uniformly.
Installation:
Tightening torque*.



Install thrust ring (9) and differential side gear (10) by turning in guides or spline of inner plate.
Install differential gears with shafts (11), second differential side gear (10) and thrust ring (9).

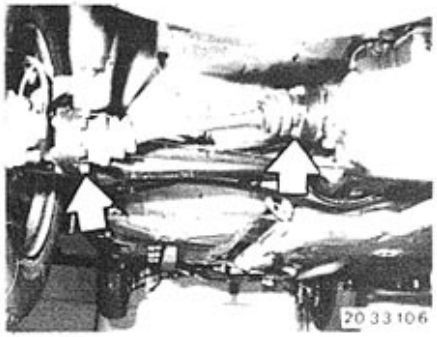


Check slip torque* of differential lock by holding one and driving other differential side gear.
Make up tool locally for this purpose by, for example, welding a nut on a drive flange which is no longer required.



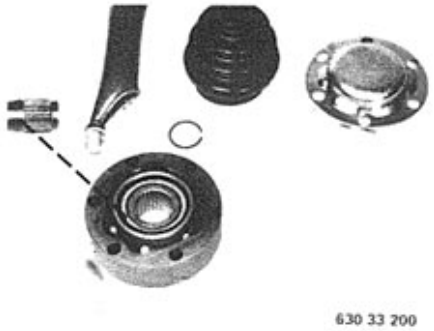
Install molybdenum coated inner plate (8) and outer plate (7).
Insert diaphragm spring (6) with inside curved surface facing differential shaft (down).

* See Specifications

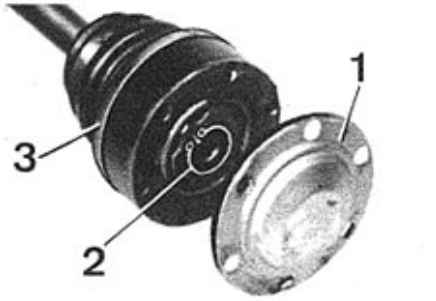


33 21 000 REMOVING AND INSTALLING OUTPUT SHAFT

Unscrew output shaft on final drive and rear axle shaft.
Installation:
Tightening torque*.

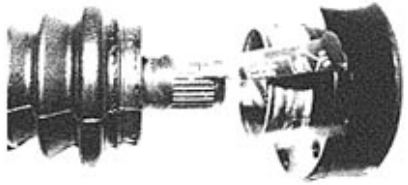


Place dust cover and inside cover on output shaft.
Joint must be installed with collar on inner race facing output shaft.
Important!
Use repair kit.

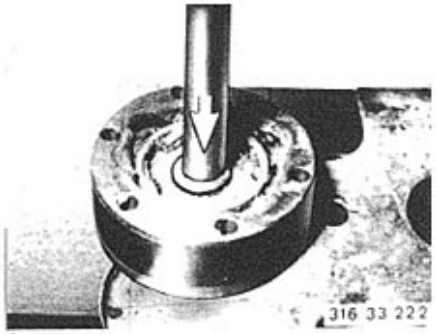


33 21 031 REPLACING DUST COVER

Remove and install output shaft 33 21 000.
Remove sealing cover (1).
Remove circlip (2).
Unscrew clamp on dust cover.
Take off dust cover.
Press off cover (3).



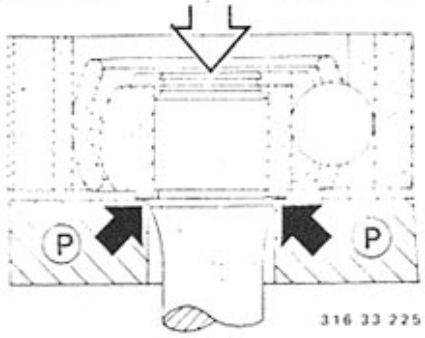
Clean threads of joint to remove grease.
Coat threads with Loctite No. 270.
Caution!
Keep Loctite out of ball passages.



Press output shaft out of constant velocity joint.



Press on joint with cap and install circlip.
Installation:
If only one side is disassembled, the sealing cover of the other side has to be removed to press on the joint.



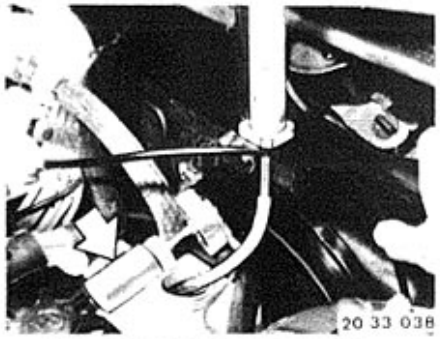
Important!
Bearing inner race must be on counterpressure plate (P).
Do not disassemble joint.
Check joint for dirt or damage.



Pack joint and dust cover with grease*.
Clean sealing surfaces for dust cover to remove grease.
Coat large diameter end of dust cover with an adhesive* and secure with new clamps.
Seal the sealing cover with Curil and install.

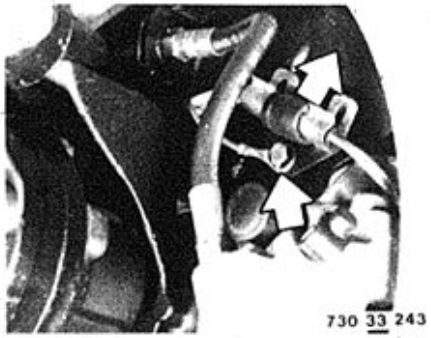
* See Specifications

* See Specifications

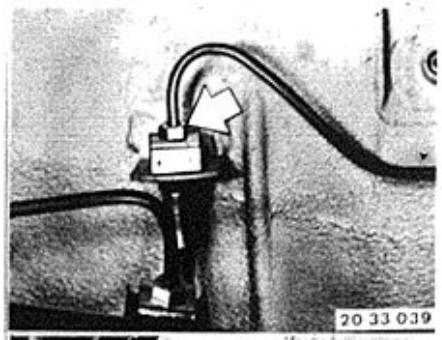


33 31 000 REMOVING AND INSTALLING REAR AXLE CARRIER ASSY.

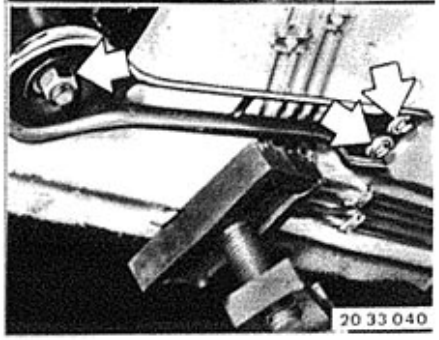
Remove and install primary and final muffler assembly 18 12 000.
Remove and install propeller shaft assembly 26 11 000.
Remove and install parking brake lever.
Draw off brake fluid through tank with a syringe used exclusively with brake fluid.
Remove float housing.
Installation:
Add brake fluid* and bleed lines.



Unplug brake pad wear indicator on right side.
Disconnect ground wire and lift wire out of clamp.



Unscrew left and right brake lines.
Installation:
Tightening torque*.

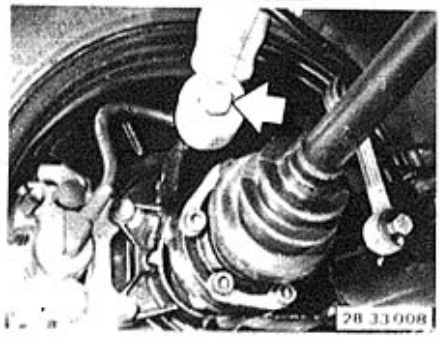


Support final drive with floor jack.
Unscrew left and right thrust struts on floor plate.
Unscrew nuts on mount.
Installation:
Replace self-locking nuts.
Tightening torque*.

* See Specifications



Pull off wires on speed transmitter.
Unscrew mounting bolt on rubber mount.
Installation:
Tightening torque*.

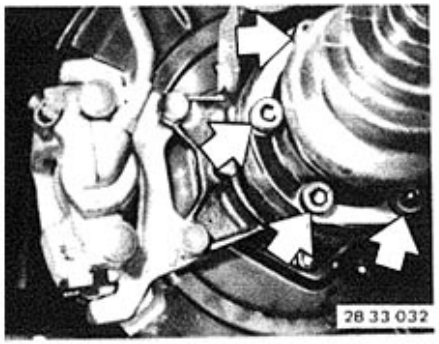


Detach left and right spring struts on trailing arms.
Lower rear axle carrier.
Pull parking brake cables out of tube.
Installation:
Tighten mounting bolts with car in normal position**.
Tightening torque*.

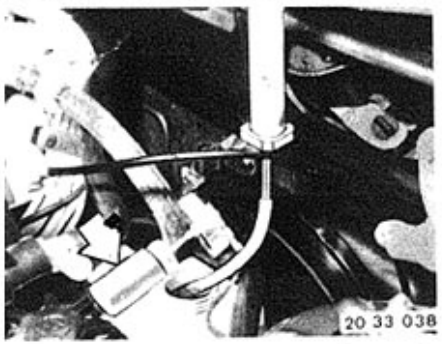
Lift car.
Pull out rear axle carrier and rear axle assembly.

* See Specifications
** See Specifications of Gr. 32

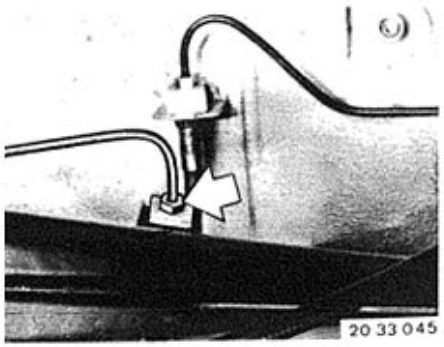
33 32 000 REMOVING AND INSTALLING TRAILING ARM ASSEMBLY



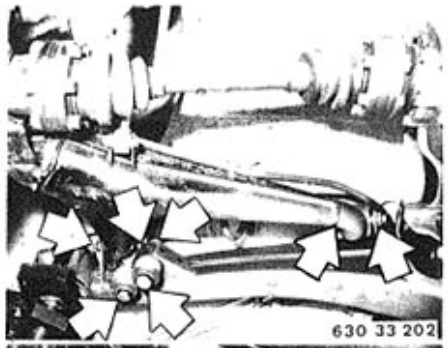
Remove and install rear wheel 36 10 300.
Apply parking brake and disconnect output shaft at drive flange.
Installation:
Tightening torque*.



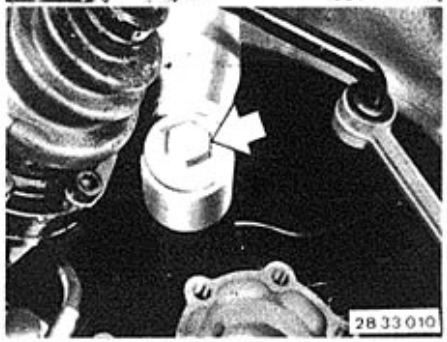
Remove and install parking brake lever 34 41 000.
Draw off brake fluid through tank with a syringe used exclusively with brake fluid.
Remove float housing for this purpose.
Installation:
Add brake fluid* and bleed brakes.



Disconnect brake line.
Installation:
Tightening torque*.



Detach trailing arm on rear axle carrier.
Installation:
First insert bolt on inner bracket.
Important!
Tighten bolts with car in normal position**.
Tightening torque*.

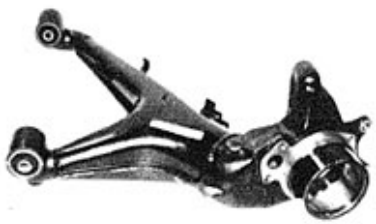


Detach spring strut and take off trailing arm.
Important!
Tighten bolts with car in normal position**.
Tightening torque*.

* See Specifications

* See Specifications
** See Specifications of Gr. 32

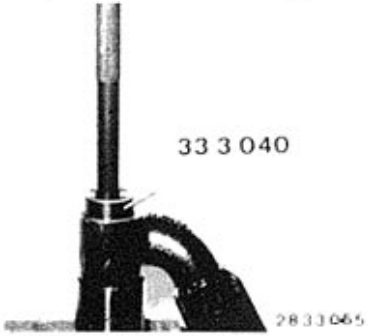
33 32 021 REPLACING TRAILING ARM



28 33 054

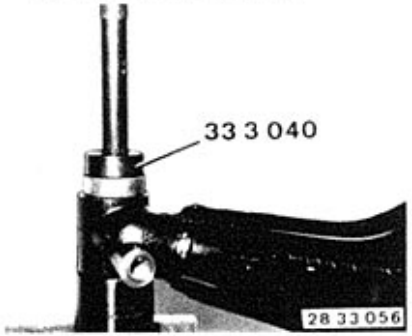
Remove and install trailing arm 33 32 000.
Replace both silent blocks 33 32 561.
Replace wheel bearings and shaft seal 33 32 151.
Transfer guard.

33 32 561 REPLACING BOTH SILENT BLOCKS – TRAILING ARM REMOVED –



28 33 065

Press out silent block with Special Tool 33 3 040.

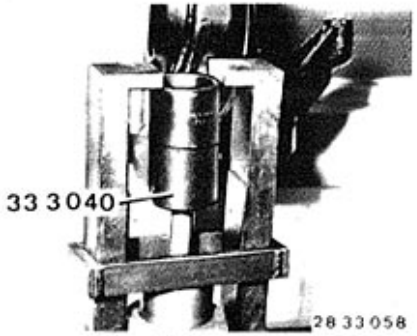


Coat new silent block with lubricating oil II and press in with Special Tool 33 3 040.

Installation:
Longer section of each inner sleeve faces center of car.



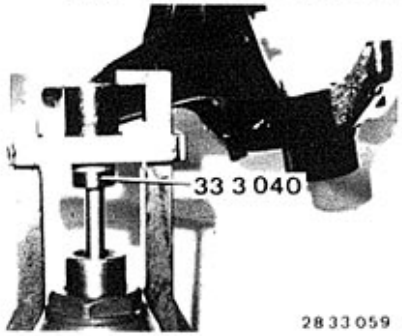
28 33 057



28 33 058

Step Procedures with Special Tool 23 0 080:
– Trailing Arm Removed

Clamp special tool in a vise.
Place trailing arm in Special Tool 23 0 080 with Special Tool 33 3 040 and a suitable sleeve as a counterholder.
Press out silent block.

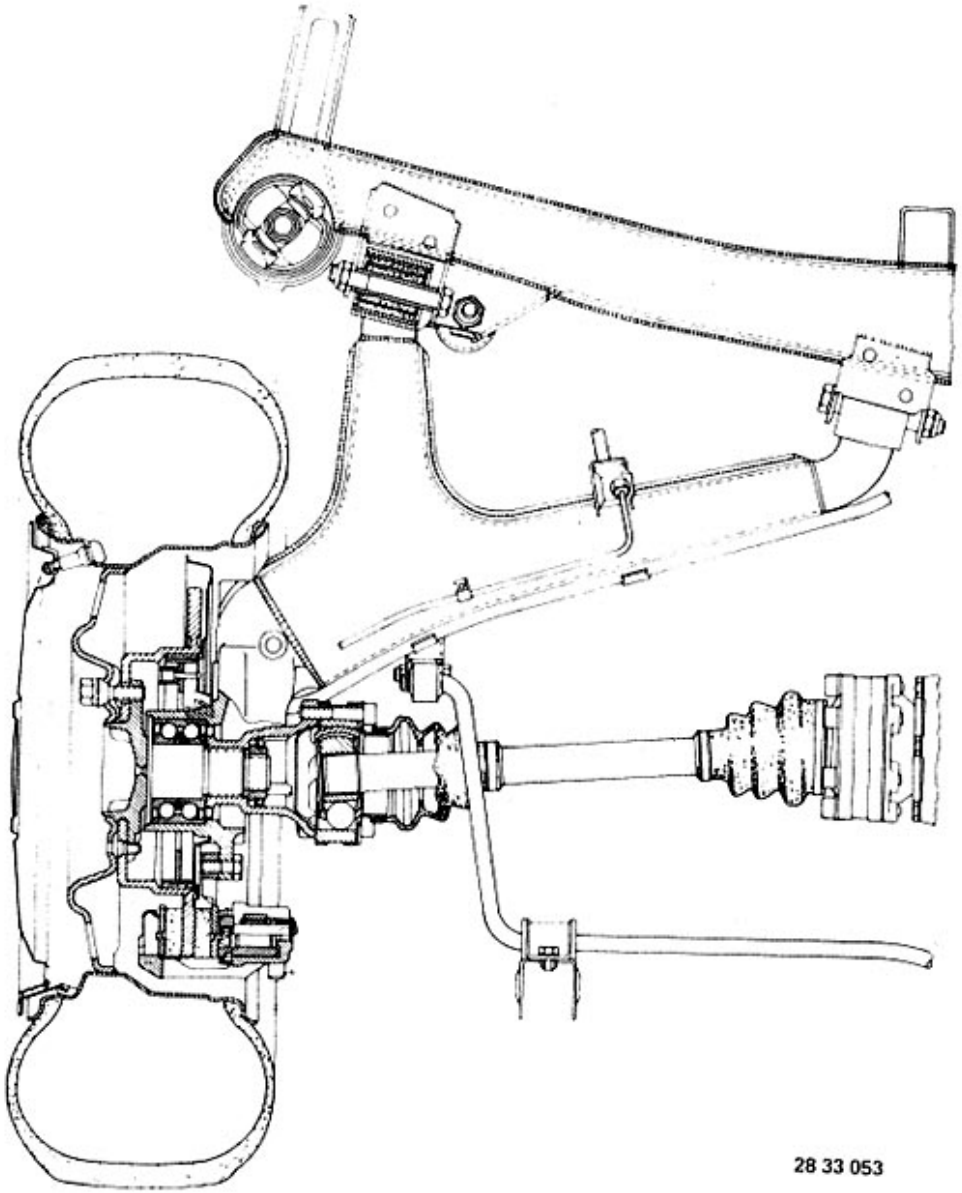


28 33 059

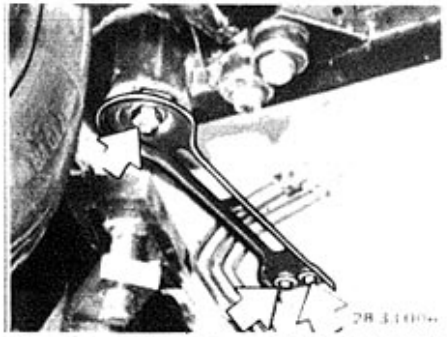
Coat new silent block with lubricating oil II and also press in from inside with Special Tool 33 3 040, suitable sleeve and Special Tool 23 0 080.

33-29

TRAILING ARM LAYOUT DRAWING
13° AXLE

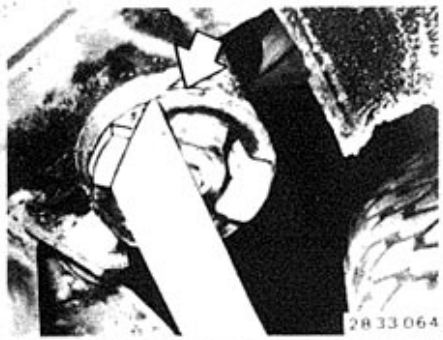


28 33 053

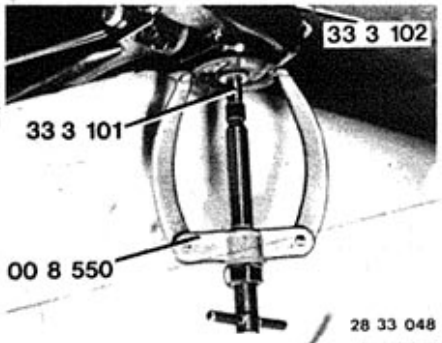


33 33 071 REPLACING RUBBER MOUNT FOR REAR AXLE CARRIER

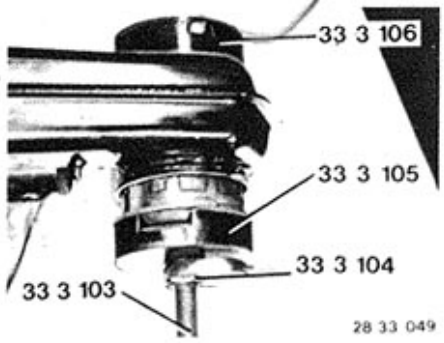
Remove rear seat.
Support trailing arm.
Detach strut.
Installation:
Replace self-locking nut.
Tightening torque*.



Knock out threaded pin upwards.
Caution!
Do not damage threads.
If applicable, cut off protruding rubber in openings.

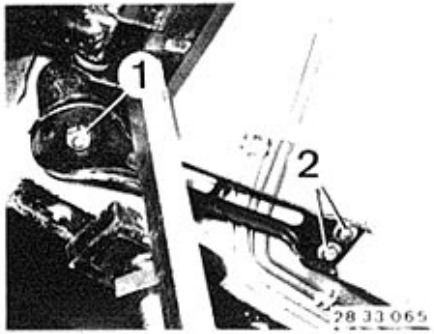


Lower trailing arm.
Place Special Tool 33 3 102 between body and rear axle carrier on rubber mount and screw in Special Tool 33 3 101.
Apply Special Tool 00 8 550 with claws in openings, bolt on Special Tool 33 3 101 and pull out rubber mount.



Place Special Tool 33 3 106 between body and rear axle carrier on edge of bushing and screw in Special Tool 33 3 103.
Coat rubber mount with diluted Cresta, lubricating oil II or relaxed water and apply on rear axle carrier.
Pull in rubber mount with Special Tools 33 3 105 and 33 3 104.

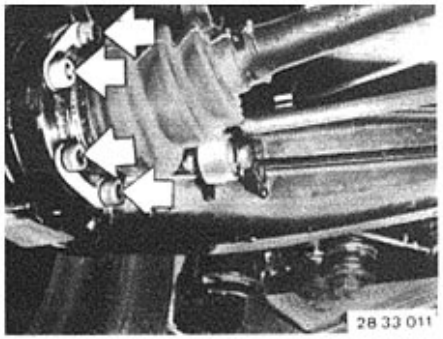
* See Specifications



33 33 001 REPLACING PUSH STRUT

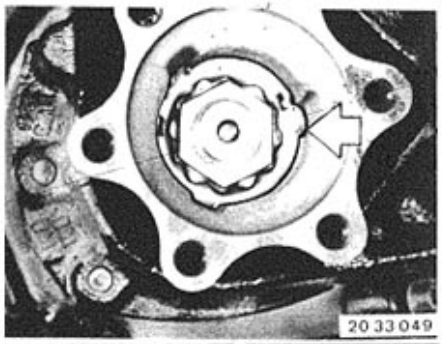
Support trailing arm.
Unscrew bolts (1).
Unscrew nuts (2).
Detach strut.
Installation:
Replace self-locking nut.
Tightening torque*.

* See Specifications

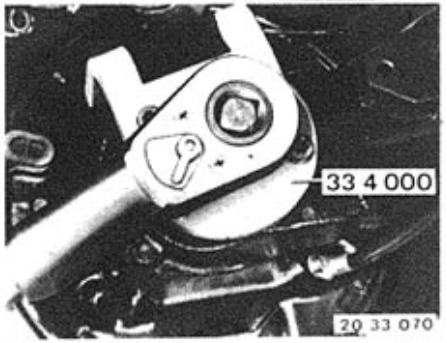


33 41 151 REPLACING WHEEL BEARINGS AND SHAFT SEALS

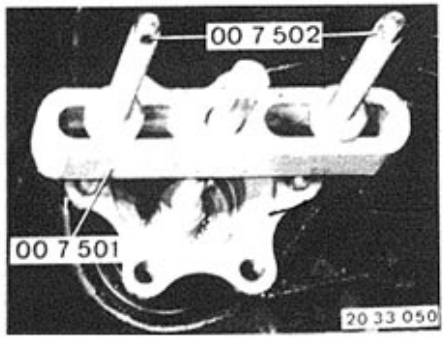
Disconnect output shaft at drive flange and suspend with a piece of wire.
Remove and install rear brake disc 34 21 320.



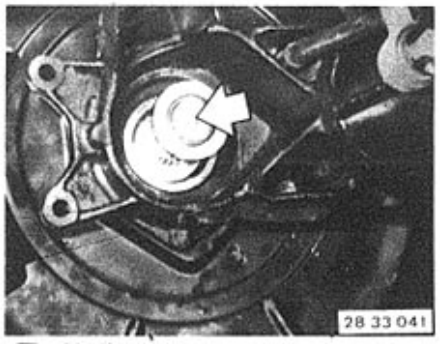
Take off lockplate.



Apply Special Tool 33 4 000.
Unscrew collar nut.

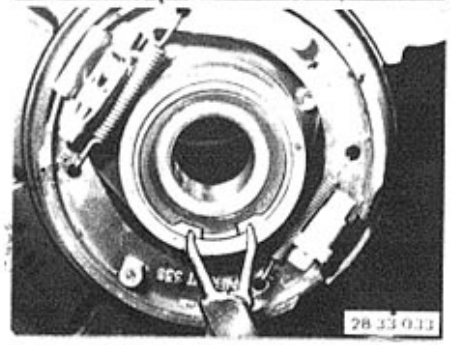


Pull off drive flange with Special Tools 00 7 501 and 00 7 502.

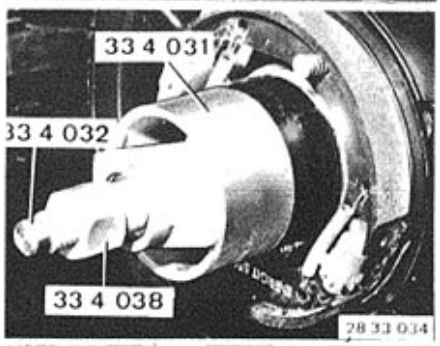


Screw on collar nut flush with end of shaft and knock out with a nylon hammer.

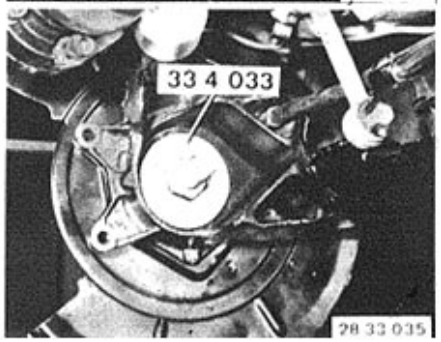
Installation:
Check spline.
Check drive flange, replacing flange if necessary.



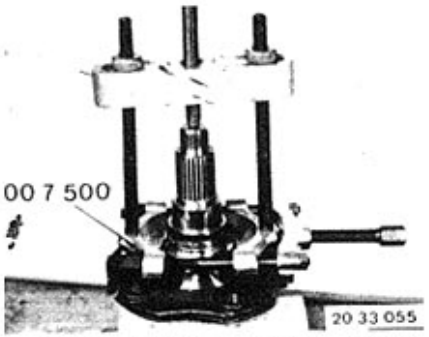
Remove circlip.



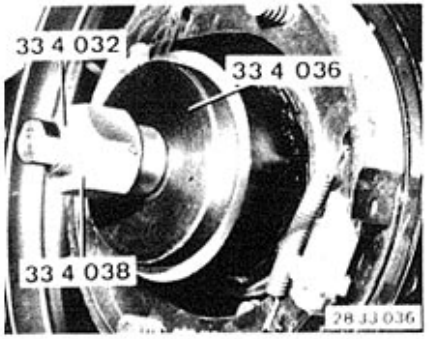
Pull out wheel bearings with Special Tools 33 4 031, 33 4 032 and 33 4 038.



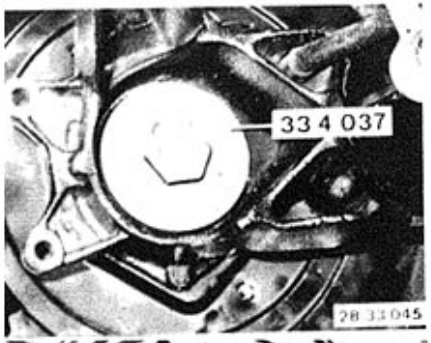
Apply Special Tool 33 4 033.



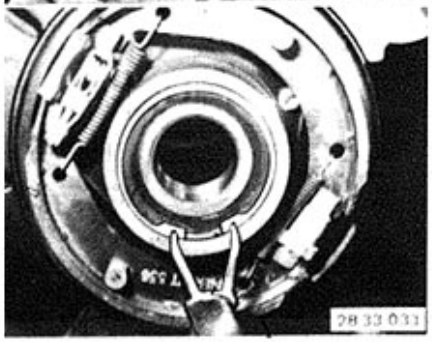
Pull inner bearing shell off of rear axle shaft with Special Tool 00 7 500.



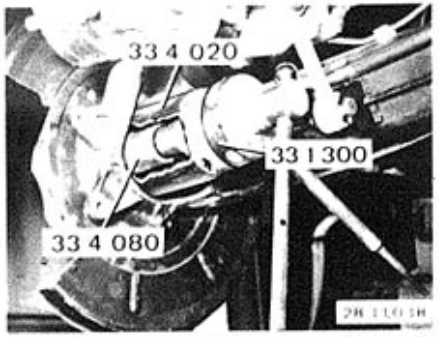
Pull in wheel bearing assembly with Special Tools 33 4 036, 33 4 032 and 33 4 038.



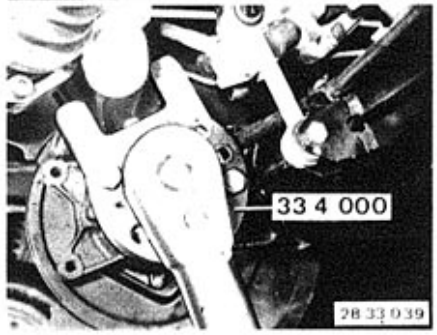
Apply Special Tool 33 4 037.



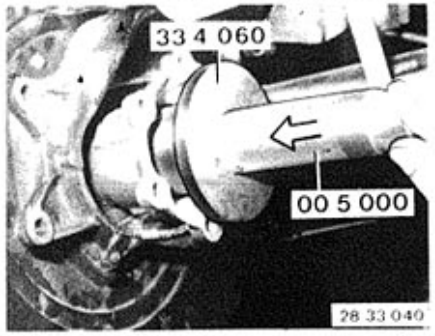
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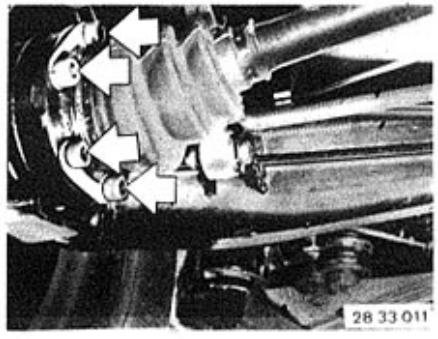
Pull in rear axle shaft with Special Tools 23 1 300, 33 4 080 and 33 4 020.



Apply Special Tool 33 4 000.
Tighten collar nut.
Tightening torque *).

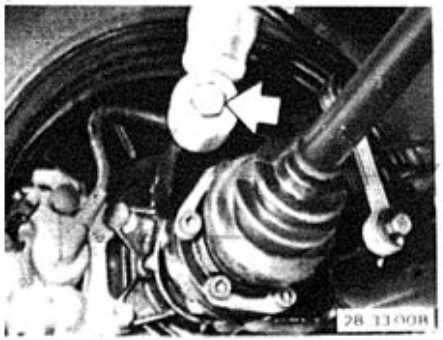


Knock in lockplate with Special Tools 33 4 060 and 00 5 000.



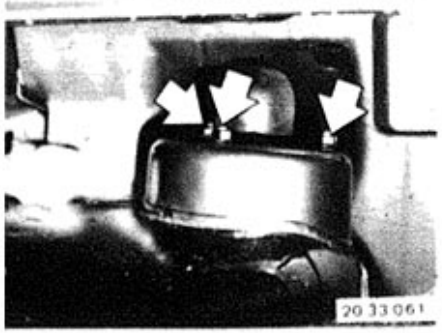
Install output shaft.
Fit reinforcement plates.
Tightening torque *).

*) See Specifications

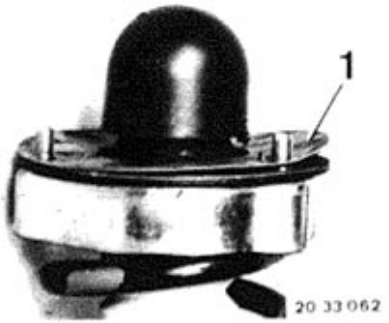


33 52 100 REMOVING AND INSTALLING SPRING STRUT ASSEMBLY

Lift car and support semi-trailing arm.
Detach spring strut at semi-trailing arm.
Caution!
Spring strut absorber acts as a retaining strap.
Installation
Tighten bolt with car in normal position[1].



Remove trunk trim partially.
Disconnect centering shell on wheel house.
Installation
Tightening torque[1].
Replace self-locking nuts.



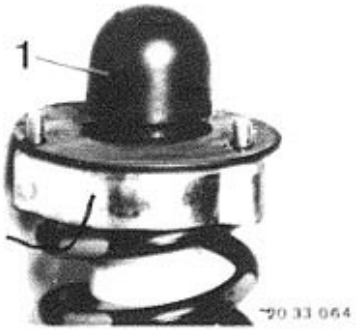
Remove spring strut.
Important!
Gasket (1).

Important!
Only store shock absorbers standing upright.
If shock absorbers with run in piston rods are stored laying down, when installed in car again there could be rattling noise.
Remedy:
Store shock absorbers with run out piston rods at room temperature and standing upright for 24 hours.

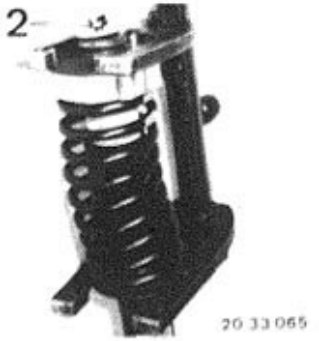
[1] See Specifications

33 52 131 REPLACING REAR SPRING STRUT SHOCK ABSORBER

Always replace a shock absorber with one of same make.
To know whether a shock absorber has to be replaced, test absorbers in car with a shock tester or removed in a shock absorber testing machine[1].
Both shock absorbers of one axle should be replaced.
Remove and install spring strut assembly 33 52 100.
Important!
Always store shock absorbers standing upright.
Pull off cap (1).



20 33 064



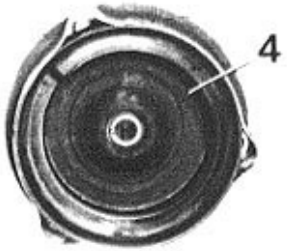
20 33 065

Compress coil spring with Special Tool 31 3 111.
Unscrew nuts (2) and remove joint plate.
Installation
Tightening torque[1]

Release coil spring.
Remove centering shell from coil spring.


20 33 066

[1] See Specifications

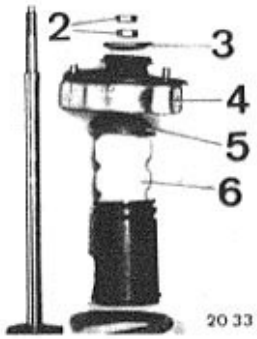


20 33 067

Check rubber mount (4).

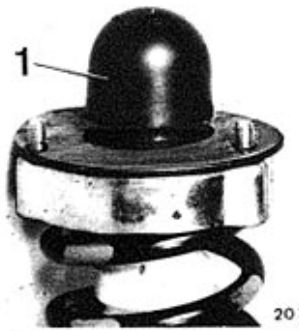

20 33 068

Pull off and inspect rubber damper.



20 33 069

Installed Order:
Lock nuts (2), washer (3), rubber mount with gasket (4), cap (5), rubber damper (6) with cover.



20 33 064

33 53 000 REMOVING AND INSTALLING LEFT OR RIGHT REAR COIL SPRING

Remove and install spring strut assembly 33 52 100.



20 33 065

Compress coil spring with Special Tool 31 3 111.
Unscrew nuts (2) and remove joint plate.
Installation:
Tightening torque[1].

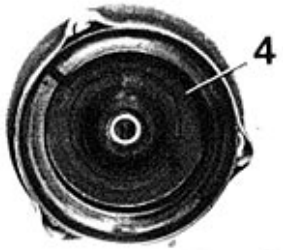
Important!
Always store shock absorbers standing upright. If shock absorbers with run in piston rods are stored laying down, when installed in car again there could be rattling noise.
Remedy:
Store shock absorbers with run out piston rods at room temperature and standing upright for 24 hours.



20 33 066

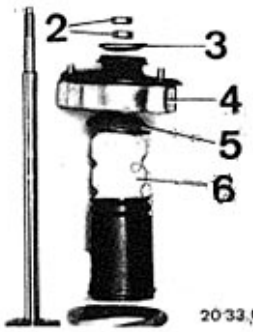
Release coil spring.
Remove centering shell on coil spring.

Important!
Only replace coil springs in pairs and note color code[1].



20 33 067

Installation:
Check rubber mount (4).
Check protective tube and rubber damper, replacing if necessary.



20 33 069

Installed Order:
Lock nuts (2), washer (3), rubber mount with gasket (4), cap (5) and rubber damper (6) with protective tube.

[1] See Specifications

[1] See Specifications

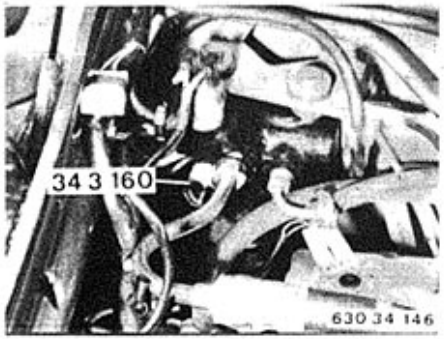
TROUBLESHOOTING REAR AXLE

Condition	Cause	Correction
Load change knock	Backlash excessive Output shaft defective Play in propeller shaft slide	Adjust backlash 33 12 551 Replace output shaft Install slide with Loctite No. 75 for joints
Traction or compression noise	Backlash excessive or insufficient	Adjust backlash 33 12 551
Drumming	Propeller shaft Rubber mount on rear axle carrier defective	See "Troubleshooting Propeller Shaft" Replace rubber mount
Oil loss	Radial oil seals leak Vent clogged Oil grade incorrect	Replace radial oil seals Clean vent Replace final drive oil
Vibration	Wheels unbalanced Output shaft defective Propeller shaft	Balance wheels, replacing rims if necessary Replace output shaft See "Troubleshooting Propeller Shaft"
Rattling or knocking noise	Horizontally stored shock absorbers installed Shock absorber bolts loose Upper shock absorber rubber mount defective Lower shock absorber rubber mount defective Rubber mount on rear axle carrier defective	Remove shock absorbers and store standing upright for at least 24 hours at room temperature of about 20° C (68°F). Tighten shock absorbers Replace rubber mount Replace shock absorber 33 52 100 Replace rubber mount 33 33 071
Grinding noise only when driving in curves	Wheel bearings defective Differential gears defective	Replace wheel bearings 33 41 601 Replace differential gears 33 13 611

[1] See Specifications

34 Brakes

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34 00 015 CHECKING POWER BRAKE SYSTEM

BMW 535 i/A

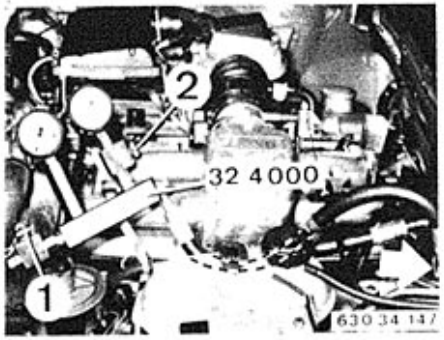
Discharge hydraulic reservoir by operating brake pedal about 20 times with same amount of force required for full stop braking action with the engine stopped.

Pull off wires and unscrew hydraulic pressure switch.

Mount Special Tool 34 3 160.

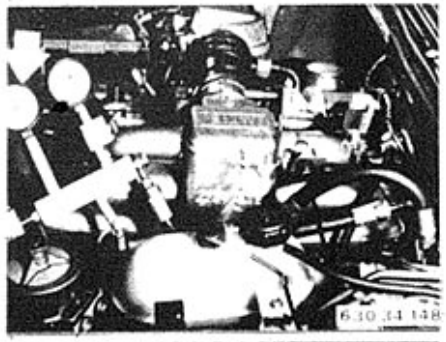
Installation:

Tightening torque*.



Connect pressure meter 32 4 000 on Special Tool 34 3 160.

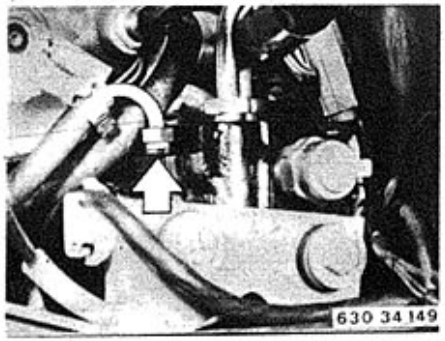
Shut both valves (1 and 2).



Check power flow regulator and brake booster for leaks.

Run engine and observe pressure meter.

Stop engine when reaching the top switching off pressure value*.

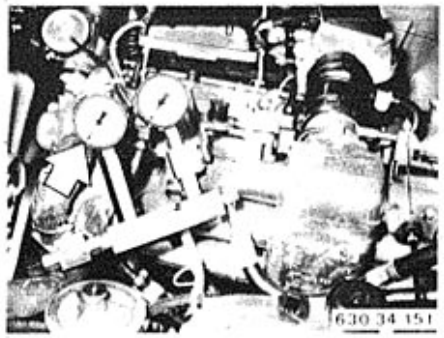


If reservoir pressure (pressure gauge) drops by more than 5 bar (71 psi) within 5 minutes, disconnect return line on power flow regulator.

If oil leaks at return line bore in power flow regulator, power flow regulator has a leak and must be replaced.

If oil does not leak and reservoir pressure still drops, brake booster has internal leakage and must be replaced.

* See Specifications



Checking Function of Hydraulic Reservoir:

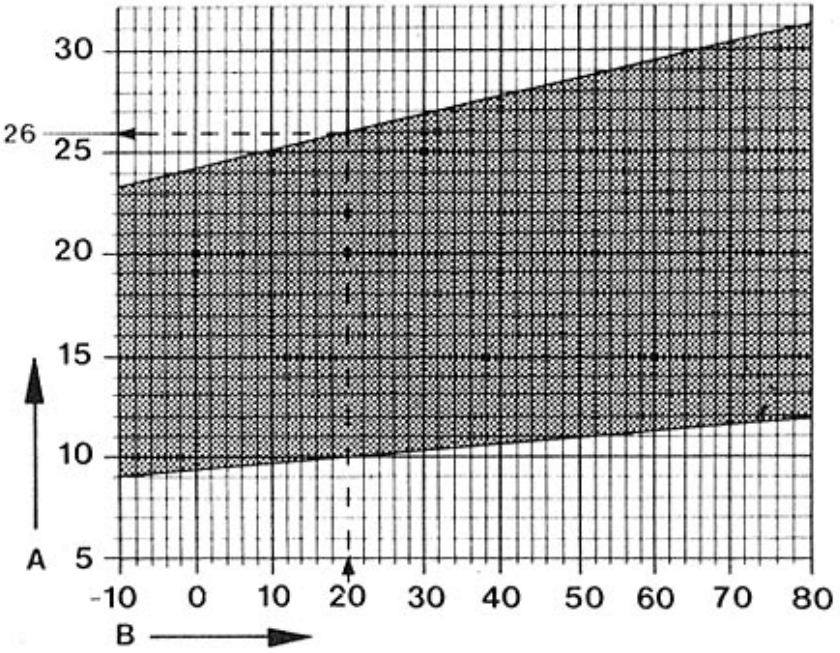
Discharge reservoir pressure to zero on pressure gauge by operating brake pedal about 20 times.

Start engine and observe pressure gauge.

Pressure gauge should show a value as indicated in diagram immediately.

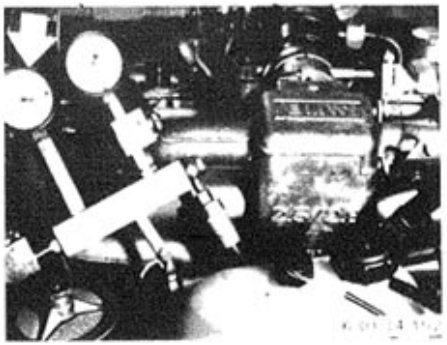
Replace hydraulic reservoir if this value is not reached or exceeded.

Permissible Gas Charge Pressure for Hydraulic Reservoir in Different Temperature Conditions

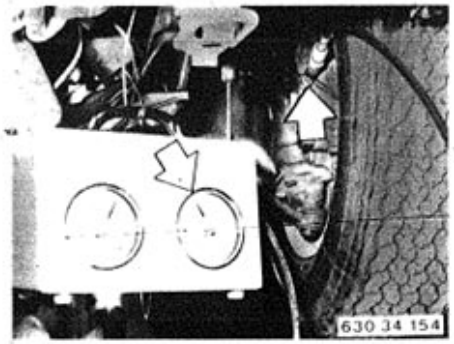


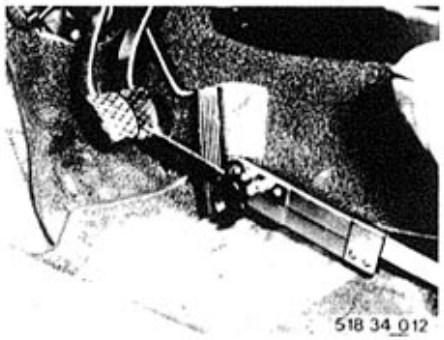
A = Gas charge pressure in bar

B = Hydr. reservoir temperature in ^{o} C



BMW 535 i/A
Checking Power Flow Regulator:
Start engine.
Pressure rises up to switching off pressure*.
Reduce reservoir pressure to switching-on pressure value* on pressure gauge by operating brake pedal with engine running.
Afterwards power flow regulator will switch to charging reservoir; the pressure rises again.
Replace power flow regulator when test values are not reached.
Discharge reservoir pressure to zero on pressure gauge by operating the brake pedal about 20 times.
Remove pressure meter.
Check oil level in supply tank.





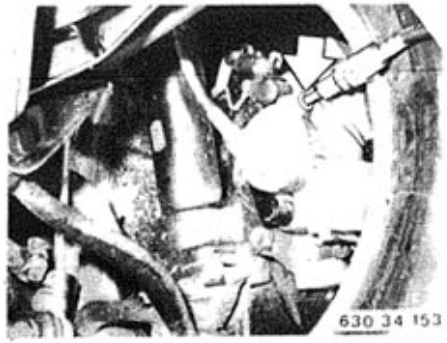
34 00 019 CHECKING SERVICE BRAKES WITH HIGH AND LOW PRESSURE TESTS

High Pressure Leak Test:
Discharge hydraulic reservoir by operating brake pedal about 20 times with same force required for full stop braking action with engine stopped.
Check both brake circuits.

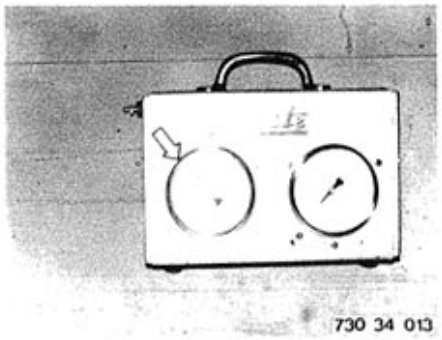
1. Front right and rear left brake circuit

2. Front left and rear right brake circuit

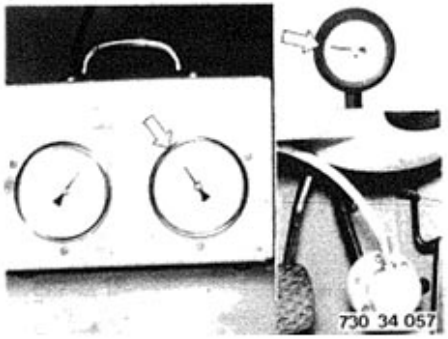
Unscrew bleeder screw of 2nd brake circuit.
Connect pressure tester and bleed.



Checking Brake Booster with Tandem Master Cylinder:
Unscrew bleeder screw on caliper.
Connect pressure tester and bleed.



Apply a force* on brake pedal.
This should cause hydr. line pressure of service brakes to show pressure value*.
Pressure must not have dropped by more than 8 % after 2 minutes.
Repeat test in 1st brake circuit.
Caution!
Engine must be stopped for high pressure leak tests.



Mount pedal force tester on brake pedal.
Apply a force* on brake pedal with the engine running (fully charged hydraulic reservoir).
This should cause the hydraulic line pressure of service brakes to show specified pressure*.
Replace brake booster, if these values are not reached on a brake system in perfect condition.
Note:
This test does not include the service brake leak test.

* See Specifications

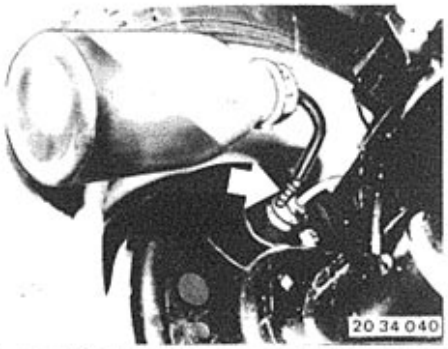
Low Pressure Test:
Check both brake circuits.
Release pedal prop that brake system has test pressure of 2 to 5 bar (28 to 71 psi).
Car and tester must remain motionless.
Motion could cause incorrect readings.
Pressure should remain constant during 5 minute test.
Check all rubber parts, if pressure drops considerably.
Bleed brake calipers after finishing test.

* See Specifications

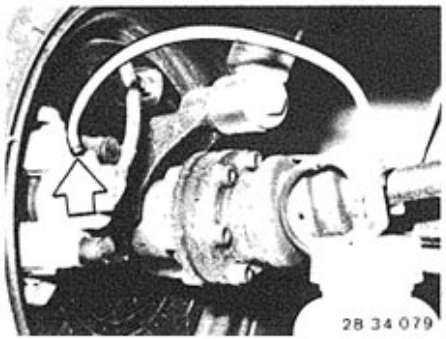


34 00 046 BLEEDING BRAKES

Brake fluid* must be replaced annually.
Brake fluid is hygroscopic and consequently takes on moisture in the air through vent hole in brake fluid tank.
This could drop brake fluid boiling point from + 240° C (464° F) to + 160 ... 180° C (320 ... 356° F).
Caution!
Keep brake fluid off of painted car parts paint finish would be damaged.
Connect bleeder on brake fluid tank.
Check operating instructions supplied with bleeder.
Charging pressure must not exceed 2 bar (28 psi).

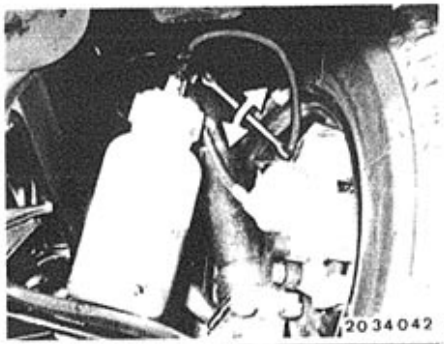


Rear Wheel Brakes (Drums):
Connect bleeder hose with bottle on bleeder screw.
Unscrew bleeder screw.
Tighten bleeder screw when escaping brake fluid is without air bubbles.

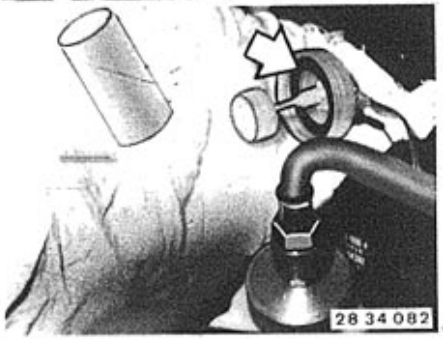


Rear Wheel Brakes (Discs):
Connect bleeder hose with bottle on bleeder screw.
Unscrew bleeder screw.
Tighten bleeder screw when escaping brake fluid is without air bubbles.

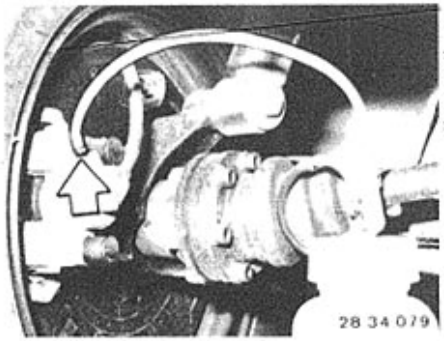
* See Service Information of Gr. 00



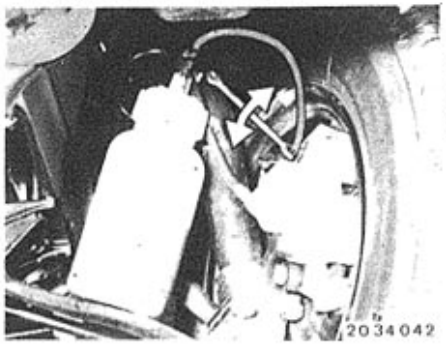
Front Wheel Brakes:
Connect bleeder hose with bottle on bleeder screw.
Unscrew bleeder screw.
Tighten bleeder screw when escaping brake fluid is without air bubbles.



Bleeding Brakes with ABS:
Connect bleeder on brake fluid tank.
Check operating instructions supplied with bleeder.
Note:
Do not use air flushing.
Press and hold brake pedal down.



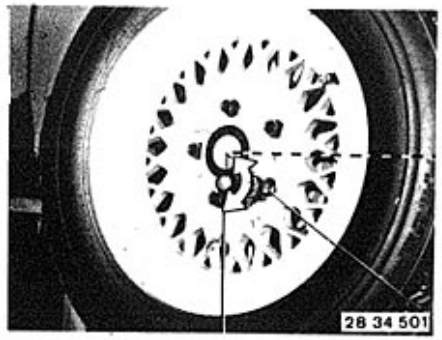
Connect bleeder hose with bottle on bleeder screw and open bleeder valves on wheel brakes, beginning at rear right.
Release brake pedal and operate 12 times against stop.



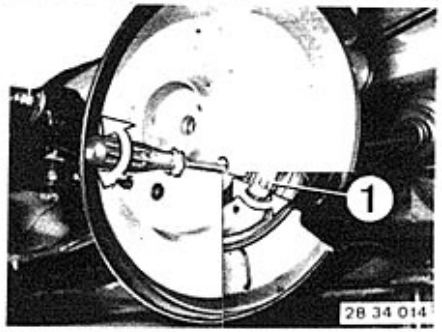
Hold brake pedal in down position.
Shut bleeder valves.
Release brake pedal.
Repeat bleeding on rear left, front right and front left.

34 10 014 ADJUSTING PARKING BRAKE

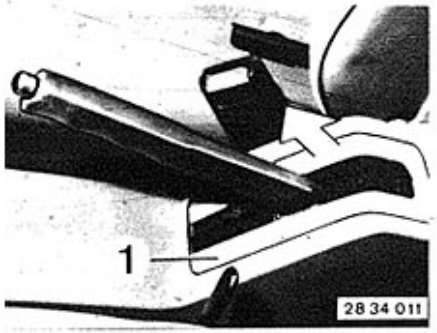
Note:
The parking brake system, which is completely independent of the service brakes, is subjected to only a minimum amount of wear since the parking brake is not applied in normal operating conditions. Consequently there is reduction of friction torque, e.g. from corrosion of brake drums or contamination of liners.
The operating forces which have to be applied increase to the same extent.
To have optimal effect from the parking brake it will normally be sufficient, to drive the car max. 400 meters (1300 feet) from parking lot to workplace with the parking brake lever pulled up until resistance is felt and then one catch further prior to adjusting the parking brake.



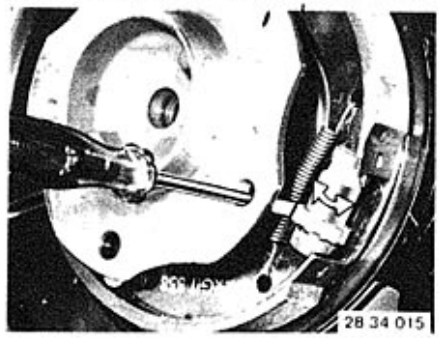
Unscrew one wheel bolt on each rear wheel and remove.
The tapped bore must be positioned approx. 45° behind the perpendicular line at bottom.



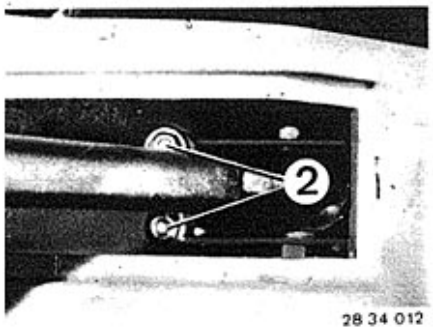
Turn adjusting nut (1) with a screwdriver to move the parking brake shoes against the brake disc and prevent it from turning.
Then turn back the adjusting nut 4 to 6 threads
Adjusting nut turned clockwise = tightening.
Adjusting nut turned anticlockwise = loosening.
Brake discs must turn easily.



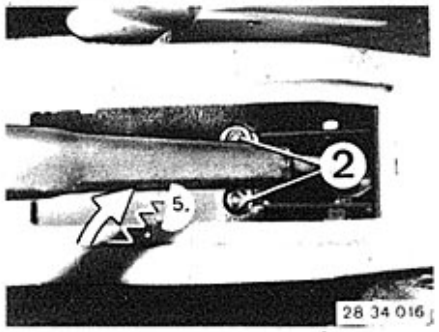
This requires that both parking brake cables move easily.
Parking brake must be adjusted when parking brake lever can be pulled up by more than 8 teeth.
Lift off brush cover plate (1).



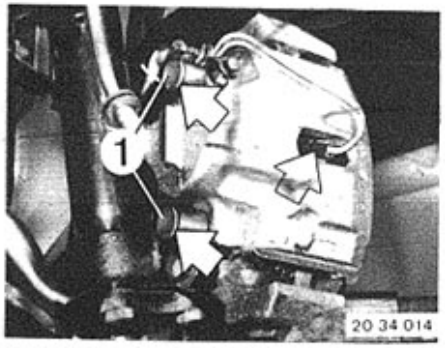
Important!
When adjusting nuts are hard to turn, remove rear wheels 36 10 300.
If applicable, detach brake discs.



Unscrew adjusting nuts (2).

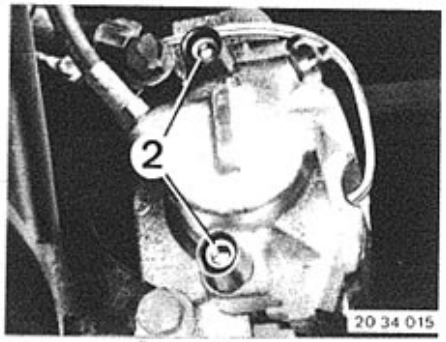


Pull up parking brake lever 5 teeth and turn adjusting nuts (2) until the left and right rear wheels can just be turned uniformly.
Release parking brake lever and check, whether the wheels can be turned easily.

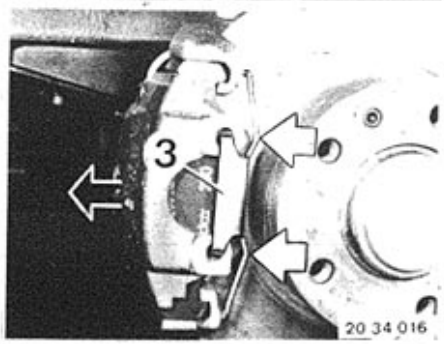


34 11 000 REMOVING AND INSTALLING FRONT BRAKE PADS

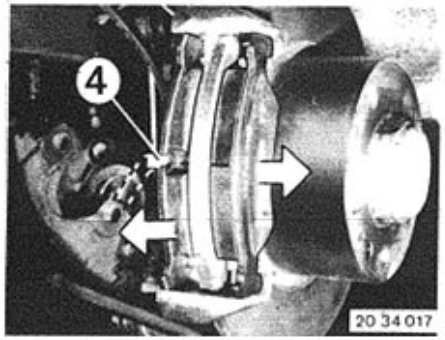
Remove and install front wheels 36 10 300.
Pry off plastic caps (1).
Pull off plug for brake pad wear indicator on left side.



Unscrew guide bolts (2).
Installation:
Only clean guide bolts – don't lubricate:
Check guide bolts for condition, renew if necessary.
Tightening torque*.

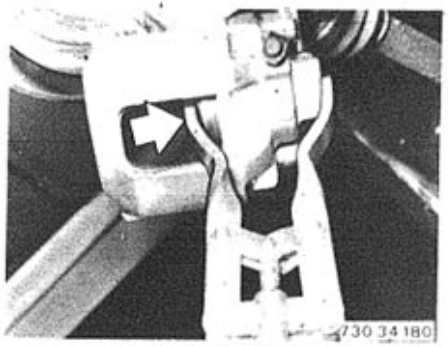


Press out clamp (3).
Pull off brake caliper toward front.

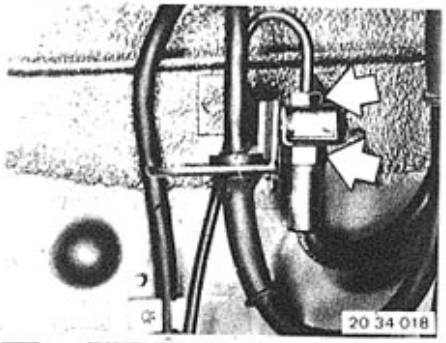


Remove outer brake pad.
Inner brake pad is located in piston with spring (4).
Installation:
Check pad thickness*.
Renew brake pads always on both calipers of one axle, Note make*) of pads.

* See Specifications

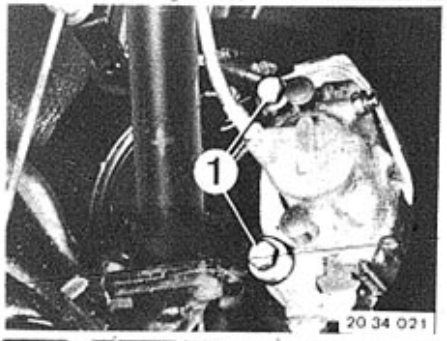


Installation:
Press piston back completely.
Clean brake pad guides and recesses with a special brush**).
Check dust cover for damage.

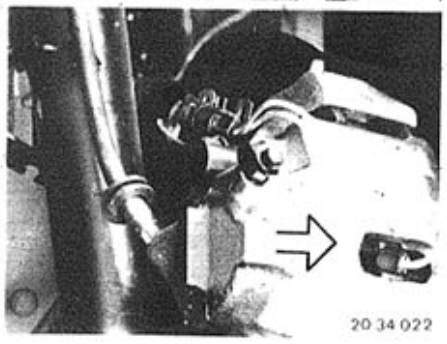


34 11 020 REMOVING AND INSTALLING FRONT BRAKE CALIPER

Remove and install front wheel 36 10 300.
Draw off brake fluid with a syringe reserved exclusively for brake fluids.
Disconnect brake line.

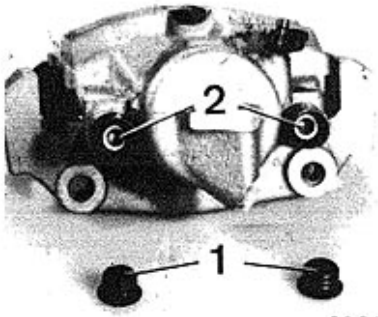


Unscrew caliper mounting bolts (1).
Installation:
Tightening torque*.



Unplug brake pad wear indicator.
Pull off brake caliper toward front.

* See Specifications
** See BMW Handels & Werkstättenbedarf

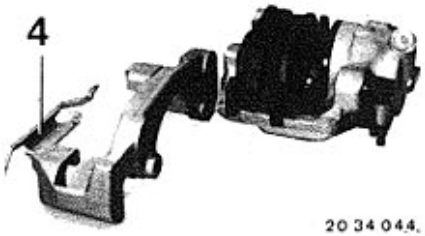


20 34 043

34 11 092 OVERHAULING FRONT BRAKE CALIPER USE REPAIR KIT –

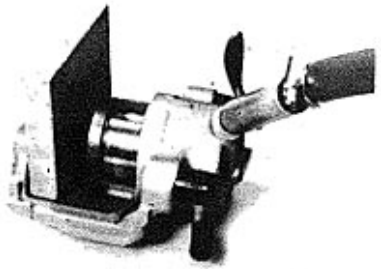
Remove and install front brake caliper 34 11 020.
Pry off plastic caps (1).
Unscrew guide bolts (2).
Installation:
Only clean guide bolts – don't lubricate.
Check guide bolts for condition, renew if necessary.
Tightening torque*.

Disassemble caliper and remove brake pads.
Installation:
Push brake pads all the way out before installing spring (4).



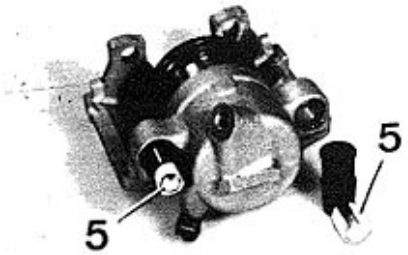
20 34 044

Place a liner made of hard wood, hard felt or similar material in caliper recess for protection of piston.
Press out piston with compressed air applied through connection bore.
Caution!
10 bar (140 psi) air pressure is equal to a force of about 1250 N (275 lbs.).



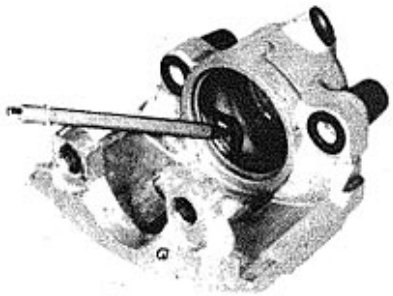
20 34 045

Check guide sleeve (5), replacing with guide sleeve in repair kit if necessary.



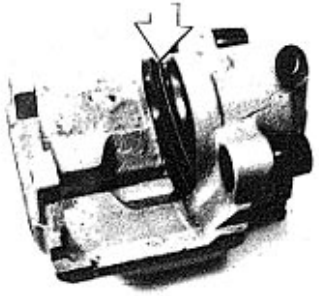
20 34 046

* See Specifications



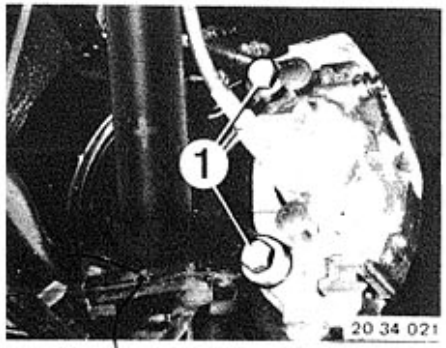
20 34 047

Remove seal carefully with a plastic needle.
Clean cylinder bores and parts with alcohol and dry with compressed air.
Check cylinder bore, piston and flange surfaces for damage thoroughly.
Machining of cylinders and pistons is not permitted.
Installation:
Give all parts a light coat of ATE brake cylinder paste and install.
Installation:
First pull rubber cap on to piston.
Don't cant piston.
Press in with a piece of hard wood.



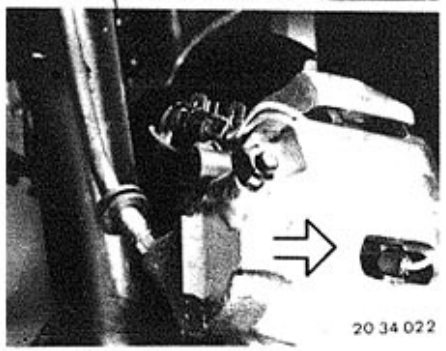
20 34 048

Press rubber cap into groove of cylinder bore with a blunt plastic needle.
Assemble caliper.

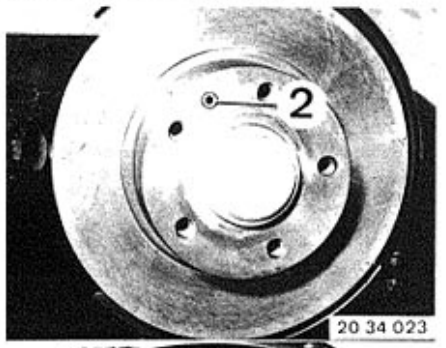


34 11 220 REMOVING AND INSTALLING FRONT BRAKE DISCS

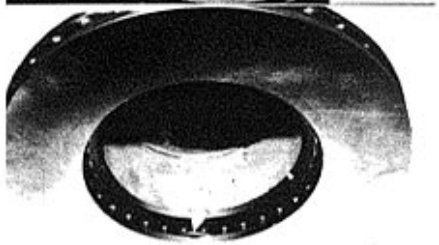
Remove and install front wheels 36 10 300.
Unscrew brake caliper mounting bolts (1).
Installation:
Tightening torque*.



Unplug brake pad wear indicator.
Pull off brake caliper toward front and suspend with a welding rod (eg.).



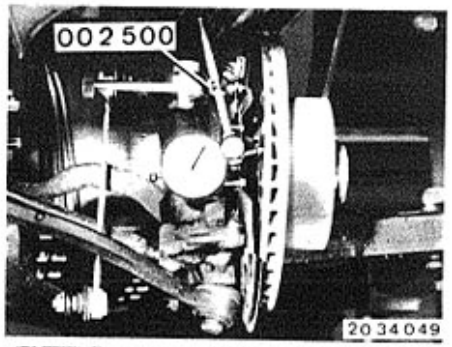
Unscrew bolt (2) and take off brake disc.
Installation: Tightening torque[1].
Important: Always replace both brake discs of one axle, even if only one needs to be replaced.



Important: Inboard vented brake discs are balanced.
Never remove or reposition balance weight clips.

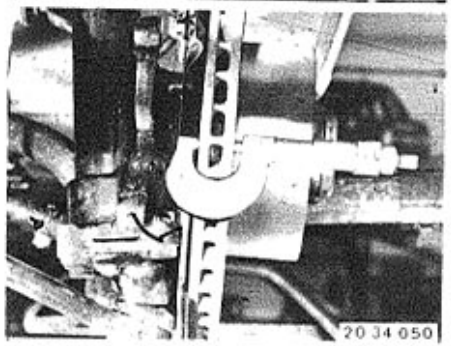
630 34 037

* See Specifications



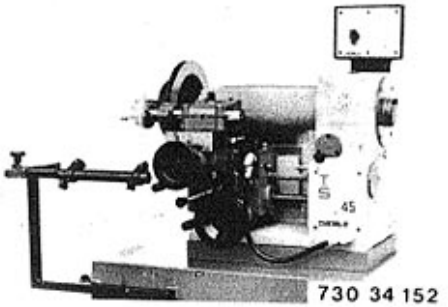
34 11 599 CHECKING FRONT BRAKE DISC FOR RUNOUT AND THICKNESS DEVIATION – FRONT WHEEL REMOVED –

Requirement: wheel bearings okay.
Remove and install front brake caliper 34 11 020
Mount Special Tool 00 2 500 and check lateral runout* of brake disc with dial gauge.
Note:
Mount brake disc with two M 12 x 1.5 bolts.



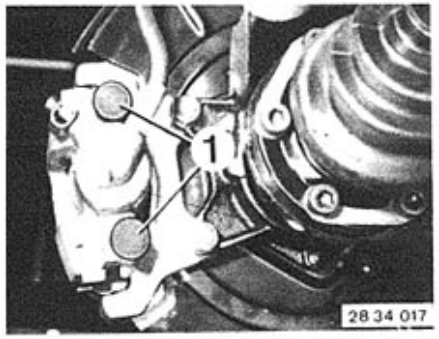
Measure thickness deviation* within braking surface at about 8 points with a micrometer.

34 11 667 GRINDING FRONT BRAKE DISCS BRAKE DISCS REMOVED –



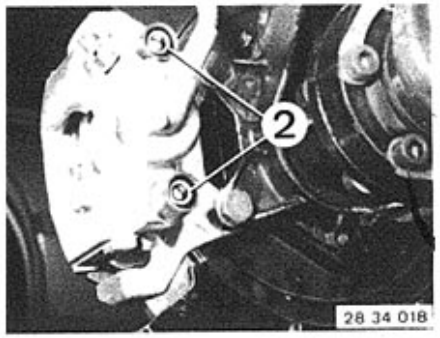
Important!
Always fine grind both brake discs of one axle on both sides.
Check minimum thickness*.
Installation:
Always replace both brake discs of one axle, even if only one needs to be replaced.

* See Specifications

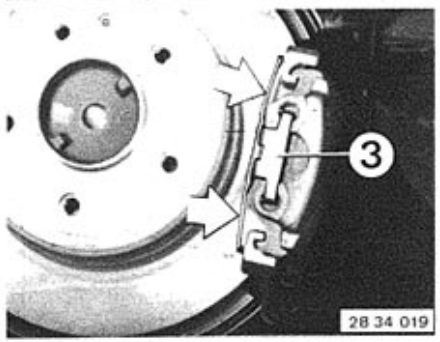


34 21 200 REMOVING AND INSTALLING REAR BRAKE PADS

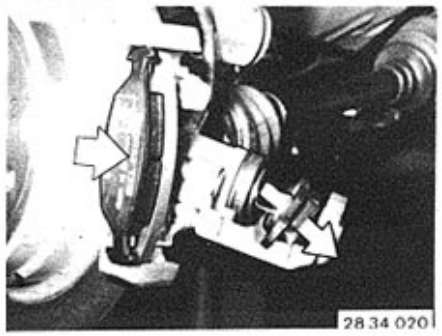
Remove and install rear wheels.
Press off plastic caps (1).
Pull off plug for brake pad wear indicator on right side.



Unscrew guide bolts (2).
Installation:
Only clean guide bolts – don't lubricate.
Check condition of guide bolts, replace if necessary.
Tightening torque*.



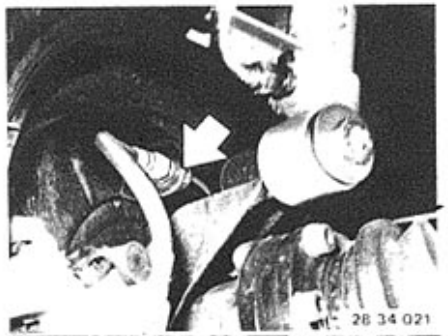
Press out clamp (3).
Pull off floating caliper from behind.



Remove outer brake pad.
Inner brake pad seats in piston with spring.
Important!
Brake pads must always be replaced on both brake calipers of one axle.
Check make*.

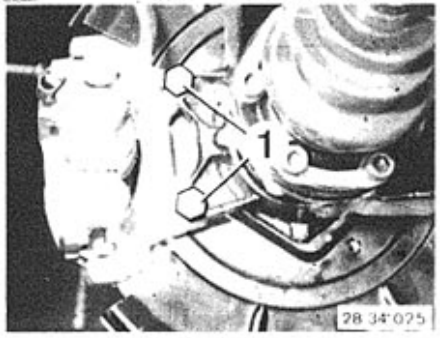
* See Specifications

Installation:
Push back piston completely.
Clean brake pad guides and rexesses with a brush**.
Check dust cover for damage.



34 21 220 REMOVING AND INSTALLING REAR BRAKE CALIPER

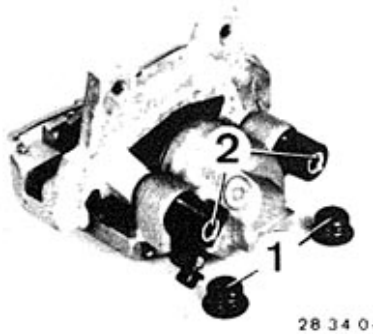
Remove and install rear wheel.
Draw off brake fluid with a syringe, which is used exclusively with brake fluids.
Disconnect brake line.



Unscrew bolts (1).
Disconnect plug for brake pad wear indicator.
Pull off floating caliper from behind.
Installation:
Tightening torque .

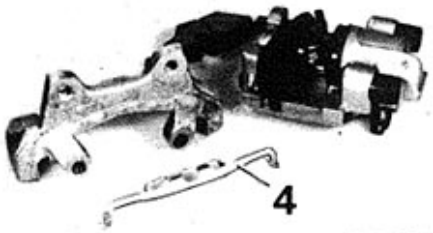
* See Specifications
** Source: HWB

34 21 292 OVERHAULING REAR BRAKE CALIPER – USE REPAIR KIT –



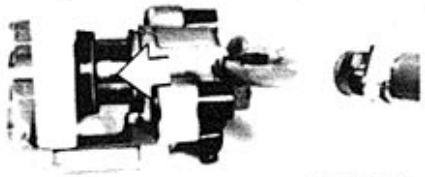
28 34 040

Remove and install rear brake caliper 34 21 220.
Press off plastic caps (1).
Unscrew guide bolts (2).
Installation:
Only clean guide bolts – don't lubricate.
Check condition of guide bolts, replace if necessary.
Tightening torque*.



28 34 041

Disassemble caliper.
Remove brake pads.
Installation:
Press brake pad toward outside fully prior to installing spring (4).



28 34 042

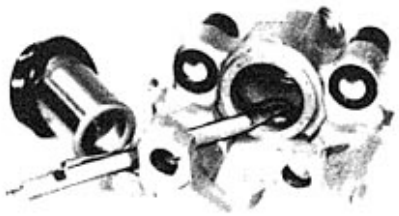
Press off rubber cap and clamping ring.
Place a liner (hard wood, hard felt or similar material) in caliper recess to protect piston.
Press out piston with compressed air applied through connection bore.
Caution!
10 bar (140 psi) air pressure is equal to a force of about 1250 N (275 lbs.).



28 34 043

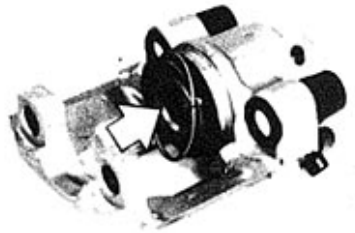
Check guide sleeves (5), using guide sleeves in repair kit if necessary.

* See Specifications



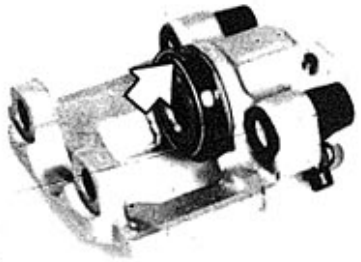
28 34 044

Remove seal carefully with a plastic needle.
Clean cylinder bores and parts with alcohol and dry with compressed air.
Inspect cylinder bore, piston and flange surfaces for damage thoroughly.
Machining of cylinder bores and pistons is not permitted.
Installation:
Give all parts a light coat of ATE brake cylinder paste before installing.



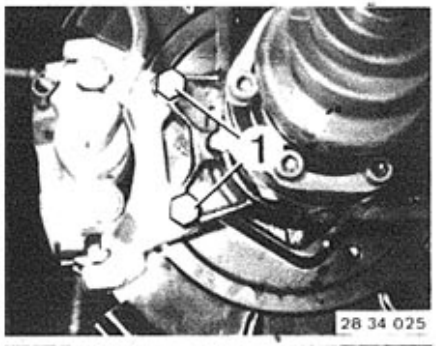
28 34 045

Pull rubber cap on to piston first.
Do not cant piston.
Press in piston with a piece of hard wood.



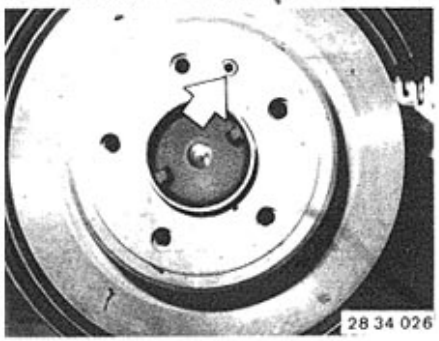
28 34 046

Pull rubber cap over edge of cylinder bore and secure with clamping ring.
Assemble caliper.



34 21 320 REMOVING AND INSTALLING REAR BRAKE DISC

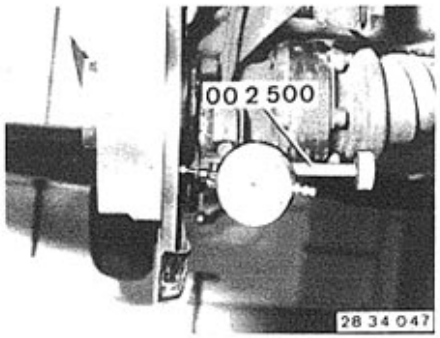
Remove and install rear wheel.
Unscrew bolts (1).



Pull off caliper from behind and suspend with a piece of wire.
Brake line remains connected.
Unscrew bolt and take off brake disc.

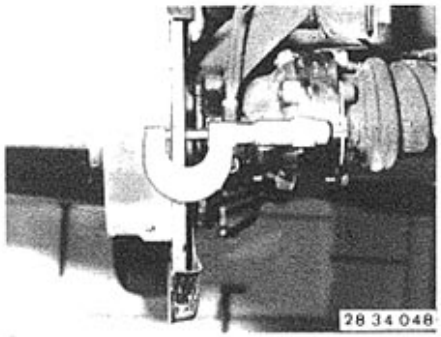
Important!
Always replace both brake discs of one axle, even if only one needs to be replaced.
Adjust parking brake 34 10 014.
Breaking In Parking Brake After Replacing Brake Discs:
Car must be broken in in three phases.

Phase 1:	5 x full stop braking action from 50 km/h (30 mph).
Phase 2:	Brakes allowed to cool off.
Phase 3:	5 x full stop braking action from 50 km/h (30 mph).

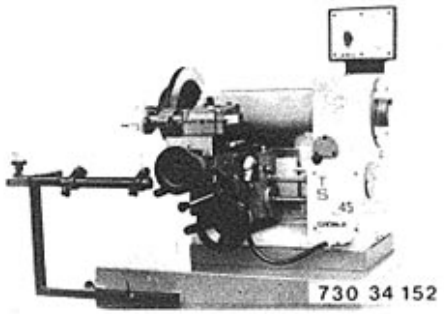


34 21 869 CHECKING RUNOUT AND THICKNESS DEVIATION OF REAR BRAKE DISC – REAR WHEEL REMOVED –

Remove brake caliper 34 21 220.
Mount brake disc with two bolts.
Apply Special Tool 00 2 500 and check lateral runout* of brake disc with dial gauge.



Check thickness deviation* within braking surface at about 8 points with a micrometer.
Installation:
Tightening torque*.

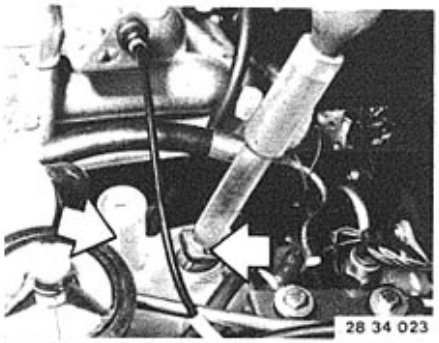


34 21 947 FINE GRINDING REAR BRAKE DISCS – BRAKE DISCS REMOVED –

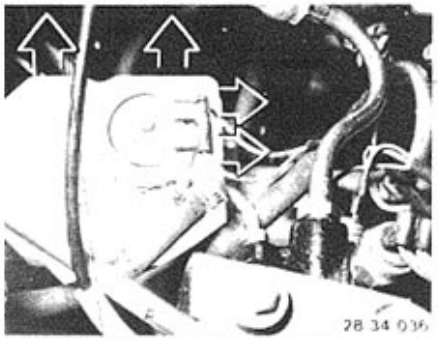
Important!
Always fine grind both brake discs of one axle on both sides.
Check minimum thickness*.
Installation:
Always replace both brake discs of one axle, even if only one needs to be replaced.

* See Specifications

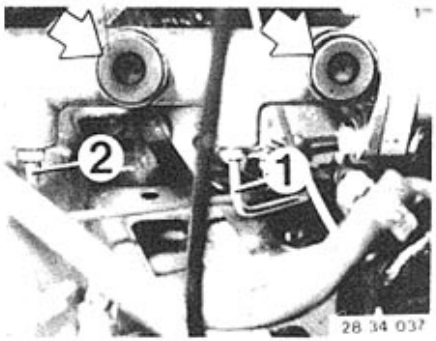
34 31 000 REMOVING AND INSTALLING BRAKE MASTER CYLINDER



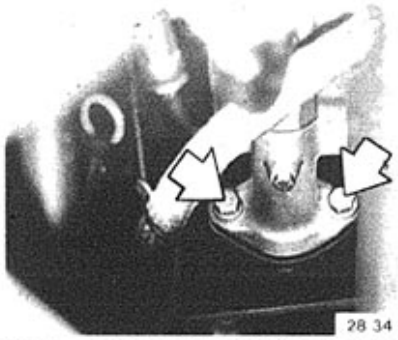
Hydraulic Boost – H-31 System:
Draw off brake fluid in tank with a syringe, pulling out float housing for this purpose.

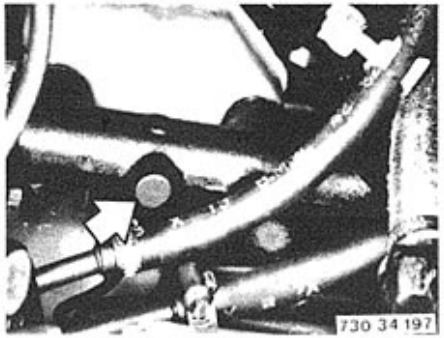


Pull off tank.
Installation:
Check rubber seal.



Disconnect brake lines.
1 = 1st brake circuit (right front and left rear)
2 = 2nd brake circuit (left front and right rear)
Installation:
Tightening torque*.
Bleed brakes – 34 00 046.





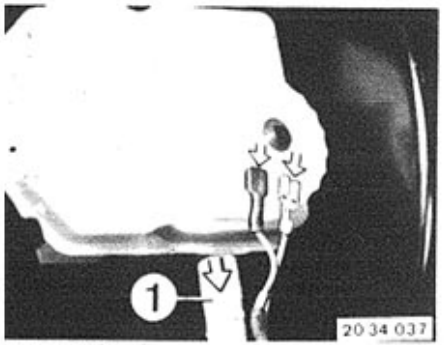
Unscrew tandem brake master cylinder on brake booster.
Installation:
Tightening torque*.
If replacing, check for correct diameter and type (see part no.) of brake master cylinder.

Note:
On ABS brake system use only brake mastercylinder with central valve (has no 6 mm stop bolt in housing underside).

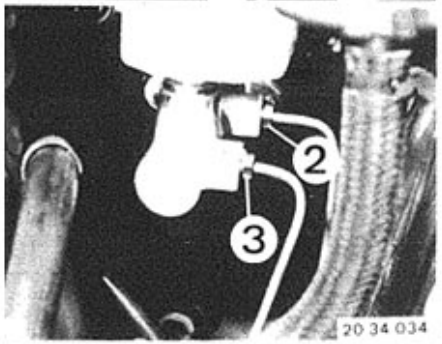
see specifications

see specifications

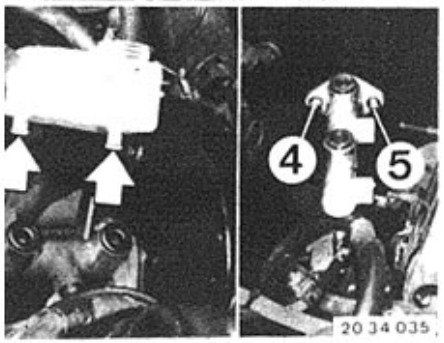
34 31 000 REMOVING AND INSTALLING BRAKE MASTER CYLINDER



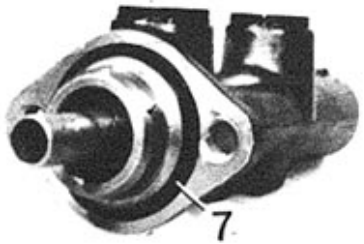
Vacuum Boost:
Draw off brake fluid in tank with a syringe used exclusively with brake fluids.
Pull off plug.
Pull off clutch hydraulic hose (1).



Disconnect brake lines (2 and 3).



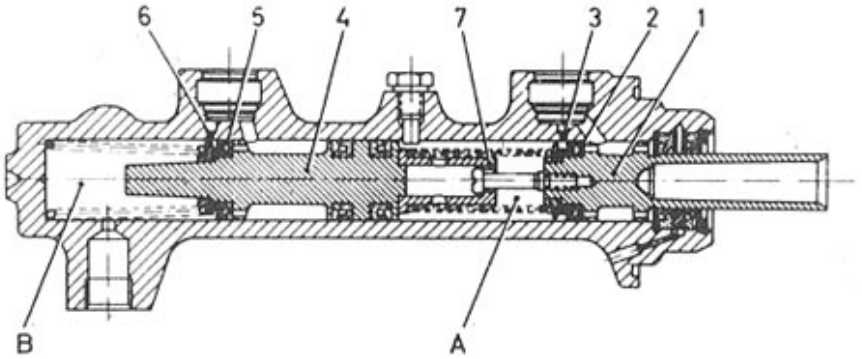
Pull off tank.
Unscrew mounting bolts (4 and 5).
Installation:
Check rubber seal and connections.



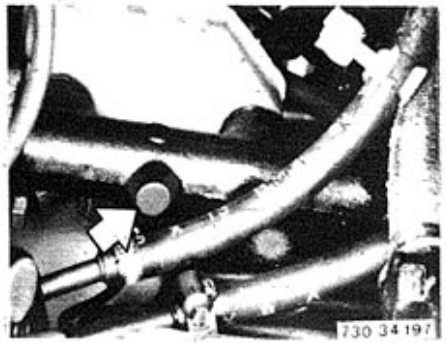
Installation:
Check rubber ring (7).
If sealing is not perfect, the building up of vacuum will be impaired.

Description of Tandem Brake Master Cylinder:
Operating the brake pedal will move pistons (1 and 4) forward.
Primary cups (2 and 5) slide over compensation bores (3 and 6).
Now there is equal pressure in chambers A and B.

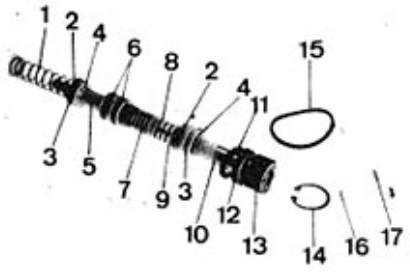
Diagonal Dual Circuit System:
Chamber A serves right front and left rear.
Chamber B serves left front and right rear.
If a brake circuit fails, the brake pedal travel will increase considerably.
If the second brake circuit fails, the pressure building up in chamber A will act on piston (1) to move piston (4) in the pressureless chamber B against the tandem brake master cylinder housing and restore function of the first brake circuit.
If the first circuit fails, piston (1) will be pressed against spring cap (7) in pressureless chamber A and the second brake circuit will function normally via chamber B.



34 31 012 OVERHAULING BRAKE MASTER CYLINDER

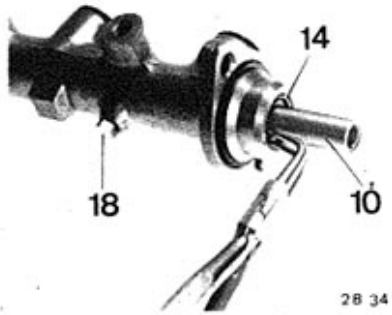


Remove and install tandem brake master cylinder 34 31 000.
Replacement parts are not available for brake master cylinders with a recessed stop pin (ABS).



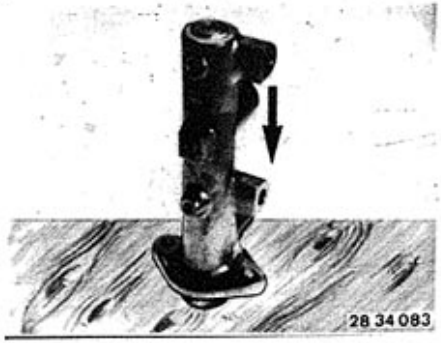
28 34 084

Important!
Use repair kit:
(1) spring, (2) support, (3) primary cup, (4) fill-in washer, (5) intermediate piston, (6) separating cup, (7) stop sleeve, (8) spring, (9) screw, (10) push rod piston, (11) stop washer, (12) secondary cup, (13) plastic bushing, (14) circlip, (15) seal, (16) aluminum seal and (17) silicone grease.

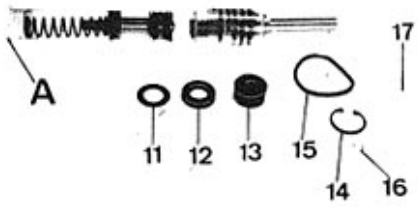


28 34 094

Apply light pressure on push rod piston (10), lift out circlip (14) and unscrew stop screw (18).
Release push rod piston (10) slowly and pull out.

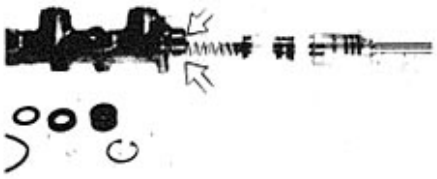


Knock out intermediate piston by knocking housing on a piece of wood lightly.
Clean cylinder housing and other parts not contained in the repair kit with alcohol and dry with compressed air.
Tandem brake master cylinders with surface damage in the cylinder bore may not be reused.
Check whether all connecting, compensating and feeding bores are clean.



28 34 085

Give cylinder bore a very thin coat of ATE brake cylinder paste.
Remove large plugs from assembly sleeve.
Slide short sleeve section on long sleeve pipe far enough that stop washer (11), secondary cup (12), plastic bushing (13), circlip (14), seal (15), aluminum seal (16) and silicone grease (17) can be removed.
Remove small plugs.

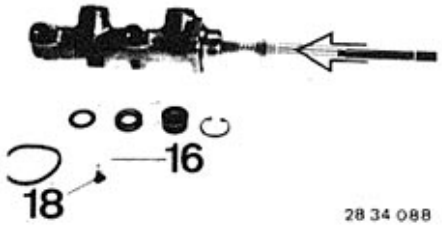


Clamp cylinder housing in a vise fitted with aluminum jaws.
Guide assembly sleeve with long sleeve pipe into cylinder bore.



28 34 086

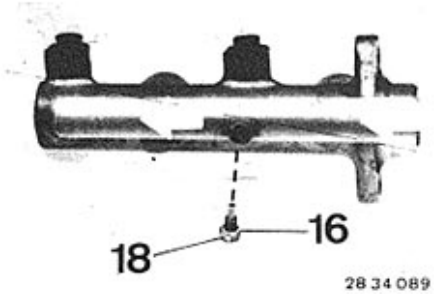
Push stepped short sleeve pipe into cylinder bore against shoulder and hold.



28 34 087

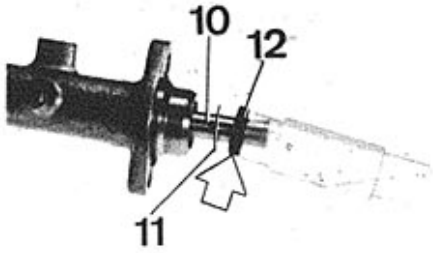
Push contents of assembly sleeve into cylinder bore carefully with a suitable mandrel until the intermediate piston touches the bottom of the cylinder.

28 34 088



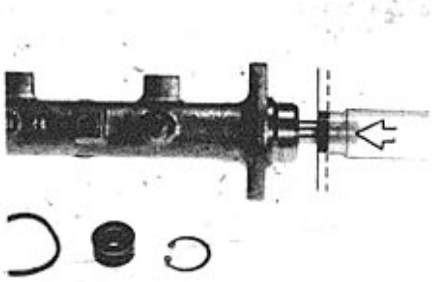
28 34 089

Hold intermediate piston against stop firmly and screw in screw (18) with a new aluminum ring (16).
Tighten stop screw (18) with a torque of 5 to 8 Nm (3.7 to 5.7 ft. lbs.).

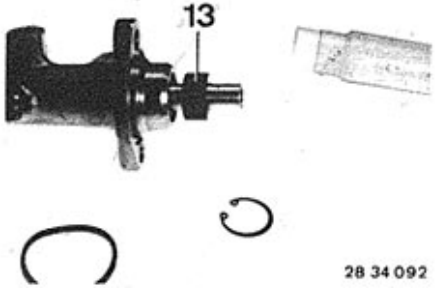


28 34 090

Let push rod piston (10) come back carefully.
Push on stop washer (11).
Coat secondary cup (12) with silicone grease and install.
Let short stepped section of assembly sleeve protrude and slide it over secondary cup (12), while holding cup with two fingers.

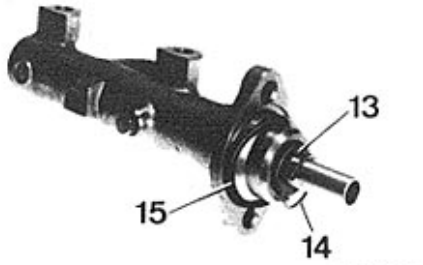

28 34 091

Adjust secondary cup flush with long sleeve pipe and push complete assembly sleeves into cylinder bore.
Push in long sleeve pipe carefully up to point of resistance.



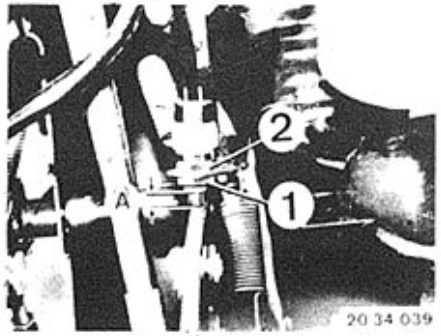
28 34 092

Hold long sleeve pipe and pull back short sleeve section.
Remove complete assembly sleeve.
Give plastic bushing (13) a light coat of silicone grease and push it on push rod piston in cylinder bore.



28 34 093

Press in push rod piston (10) and plastic bushing (13).
Install circlip (14) with a special circlip pliers.
Circlip must have perfect seat in groove of cylinder bore.
Install new seal (15) before mounting on the brake booster.



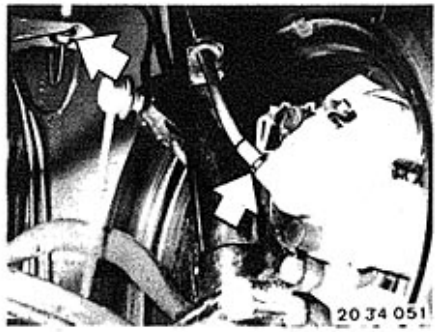
20 34 039

34 31 104 ADJUSTING BRAKE LIGHT SWITCH

Adjust brake light switch with nut (1) and lock nut (2) that with the brake pedal released the contact button will be visible by distance A = 5 to 6 mm (0.197 to 0.236").

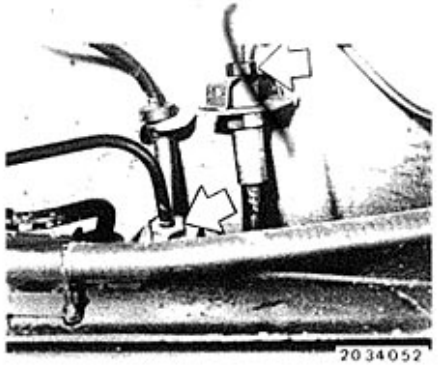
34 32 361 REPLACING ALL BRAKE LINES

Brake lines are now only available in straight version and supplied in correct length with connecting nipples.
The removed brake line should be used as a template for bending.
Use bending tool**.
Do not damage surface finish of lines.
Do not bend lines sharply or attempt to bend back an incorrectly bent brake line.
Also refer to Service Information of Gr. 34.



34 32 381 REPLACING FRONT BRAKE HOSE

Draw off brake fluid.
Disconnect brake hose.
Installation:
Never twist brake hose while installing.
Bleed brakes 34 00 046.
Tightening torque*.
See Service Information of Gr. 00 for approved brake fluid.



34 32 451 REPLACING REAR BRAKE HOSE

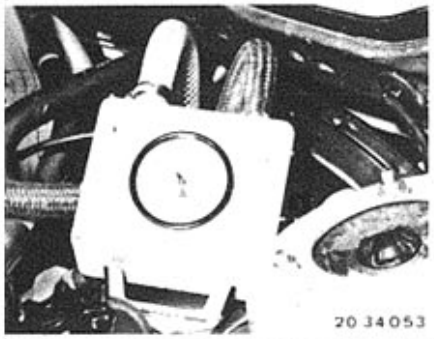
Draw off brake fluid.
Disconnect brake hose.
Installation:
Never twist brake hose while installing.
Bleed brakes 34 00 046.
Tightening torque*.
See Service Information of Gr. 00 for approved brake fluid.

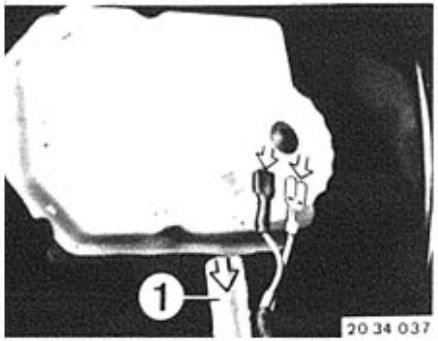
** Source: HWB

* See Specifications

34 33 000 REMOVING AND INSTALLING BRAKE BOOSTER WITH TANDEM BRAKE MASTER CYL.

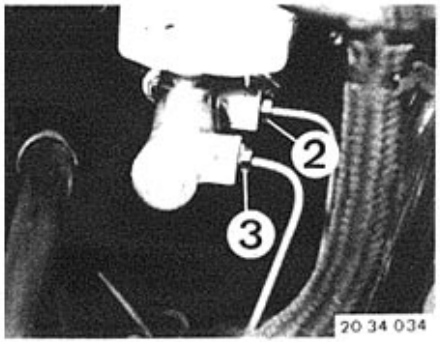
Checking Operation:
Operate brake pedal 10 times with engine stopped. Hold brake pedal down and start engine. System is okay if brake pedal gives.
If brake pedal does not give, the defect could be in check valve, vacuum hose or rubber ring between tandem brake master cylinder and brake booster. Engine's vacuum could be insufficient or filter screen of brake booster completely clogged with dirt.
Checking Engine Vacuum for Brake Booster:
Disconnect vacuum hose on brake booster.
Install vacuum tester 34 3 100 between brake booster and check valve. Check available vacuum when releasing accelerator, going from an engine speed of 3000 rpm with engine at operating temperature.
Min. value = – 0.35 bar (5 psi).
Repeat test several times.
Minimum value with specified idle speed and engine at operating temperature:
– 0.50 bar (7 psi).


20 34 053



20 34 037

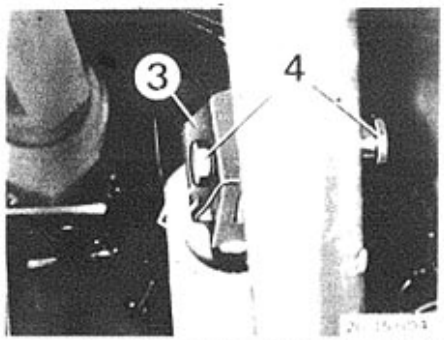
Draw off brake fluid in tank with a syringe used exclusively with brake fluids.
Pull off plugs.
Pull off hose (1) for clutch.



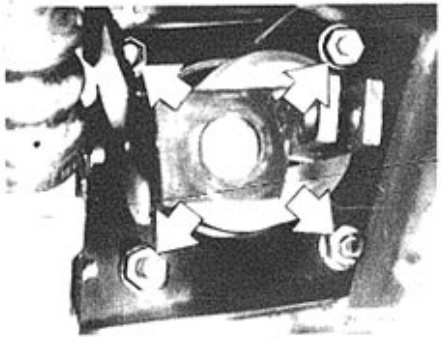
20 34 034

Disconnect brake lines (2 and 3).
Brake line 2
front right = 1st brake circuit
rear left

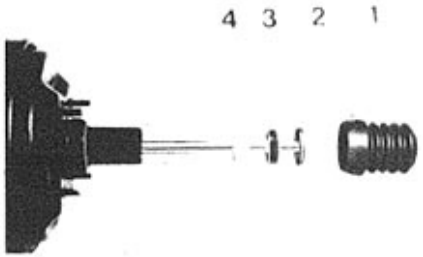
Brake line 3
front left = 2nd brake circuit
rear right



Remove and install instrument panel trim at bottom left 51 45 180.
Disconnect spring.
Press off clip (3) and pull out shaft (4).



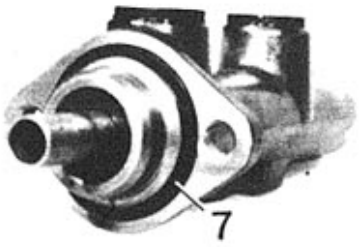
Disconnect brake booster on pedal assembly base.
Take off brake booster with master cylinder toward front.
Installation:
Tightening torque*.
Adjust stop light switch 34 31 104.



525 34 071

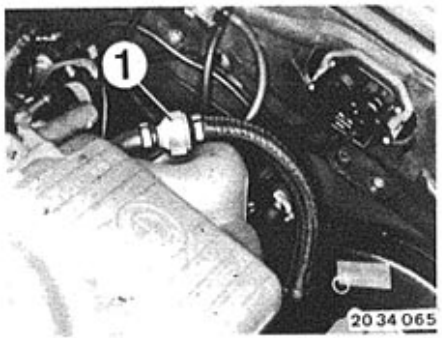
If filter screen in brake booster is clogged with dirt, remove cap (1), holder (2), damper (3) and filter (4).
Installation:
Clean damper (3) and filter screen (4).
Offset slots of damper (3) and filter screen (4) by 180° to each other.

* See Specifications



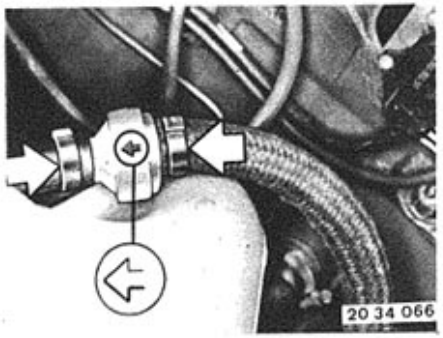
34 33 001 REPLACING BRAKE BOOSTER

Vacuum Boosted:
Remove brake booster with tandem brake master cylinder – 34 33 000.
Unscrew tandem brake master cylinder on brake booster.
Installation:
Tightening torque*.
Check rubber ring (7) between tandem brake master cylinder and brake booster, replacing if necessary.

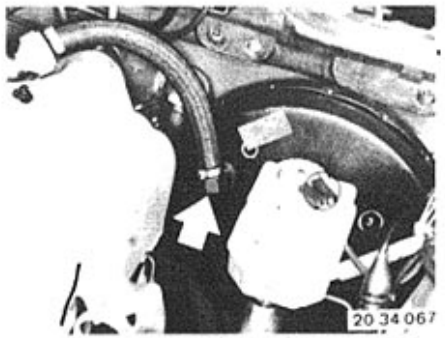


34 33 051 REPLACING CHECK VALVE FOR BRAKE BOOSTER

Disconnect vacuum hoses on check valve (1).
Installation:
Replace clamp.

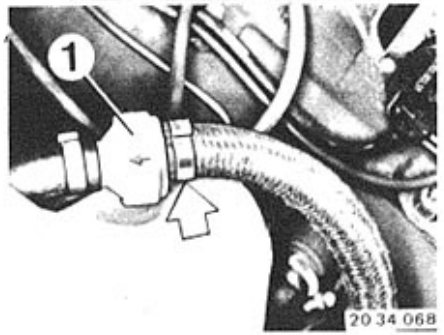


Loosen clamp and take off check valve.
Installation:
Arrow faces intake manifold.
Replace clamp.



34 33 071 REPLACING VACUUM HOSE FOR BRAKE BOOSTER

Disconnect vacuum hose on brake booster.
Installation:
Replace clamp.

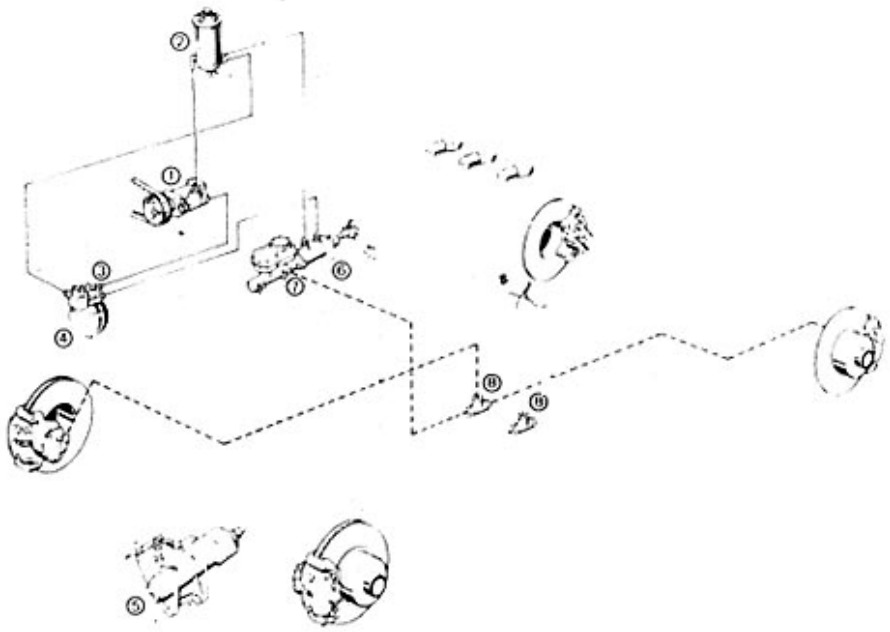


Disconnect vacuum hose oncheck valve (1).
Installation:
Replace clamp.

* See Specifications

34 33 000 REMOVING AND INSTALLING BRAKE BOOSTER WITH BRAKE MASTER CYLINDER

BMW 535 i/A
1 = Pump
2 = Oil tank
3 = Power flow regulator
4 = Hydraulic reservoir
5 = Steering
6 = Hydraulic booster
7 = Tandem master cylinder
8 = Brake force regulator



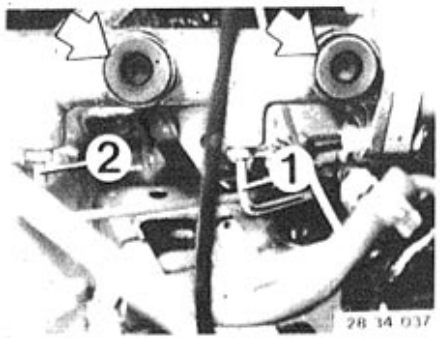
28 34 019

Description of Entire H 31 System

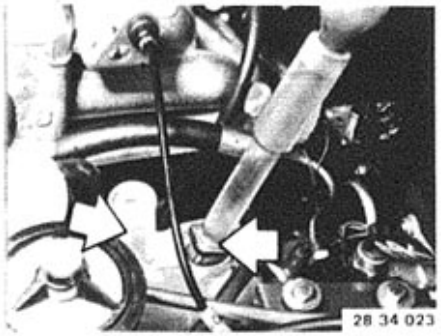
The power flow regulator diverts a small flow (approx. 0.7 ltr. or 1.4 pints) from the power steering operating circuit for the power assisted brake system.
It charges the hydraulic reservoir in a high pressure range without impairing the function of power steering.
The pressurized hydraulic oil volume is supplied to the booster for the sake of power assistance and is applied by operating the connected standard tandem master cylinder.
Should the power steering pump fail, the hydr. reservoir will have sufficient reserve pressure to permit many full stop braking actions.
After using up this reserve pressure, brake operation without power assistance is still possible, but greater force will be required on the brake pedal.

Function Test:

Operate brake pedal 20 times with engine stopped.
Hold brake pedal down and start engine.
System is okay, if brake pedal gives.
If brake pedal does not give, the power steering pump, power flow regulator, hydr. reservoir or hydraulic brake booster could be defective.

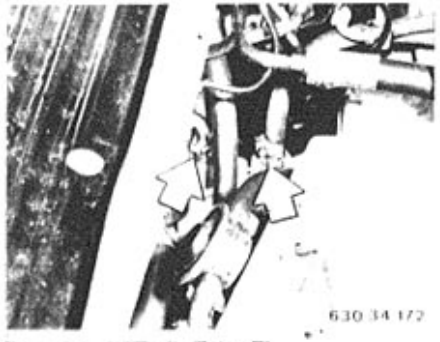


Disconnect brake lines.
1 Front right
2 Front left
Installation:
Tightening torque*.
Bleed brakes 34 00 046.

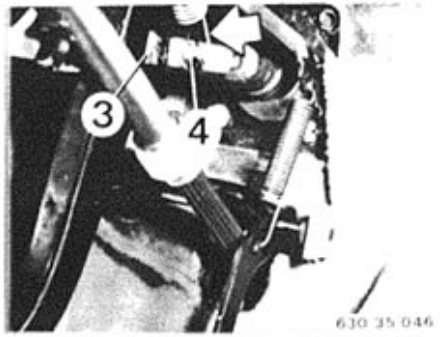


Removing and Installing Brake Booster with Brake Master Cylinder:

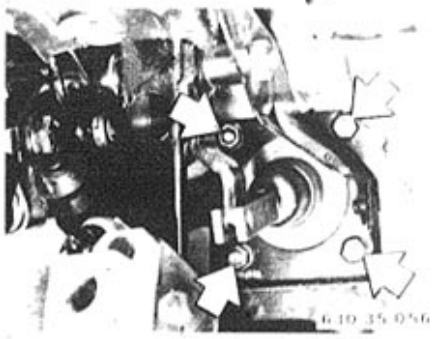
Discharge hydraulic reservoir by operating brake pedal about 20 times with same force required for full stop braking action with engine stopped.
Draw off brake fluid through supply tank with a syringe used exclusively with brake fluids.



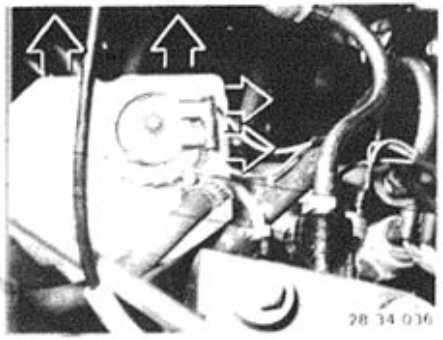
Detach hydraulic hoses on brake booster.
Installation:
Make sure that all pipe and hose connections are clean before connecting.
Tighten return line with Special Tool 34 3 153 and pressure line with Special Tool 34 3 152, both in conjunction with a torque wrench.
Tightening torque*.



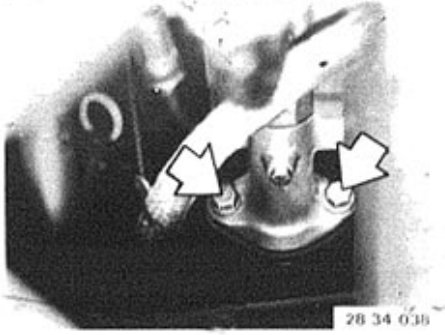
Remove and install instrument panel trim at bottom left 51 45 180.
Lift out clip (3) and remove pin (4) on piston rod.



Unscrew brake booster on pedal base assembly.
Remove brake booster and tandem brake master cylinder.
Installation:
Tightening torque*.

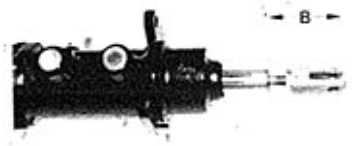


Pull off supply tank.
Installation:
Check rubber seal.



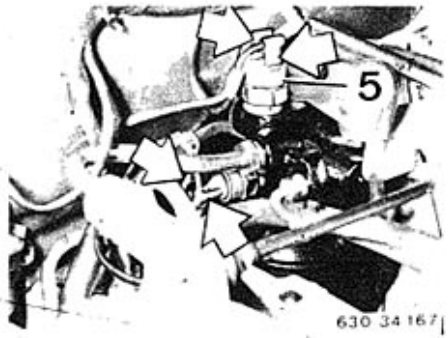
Detach master cylinder on brake booster to replace brake booster.
Installation:
Tightening torque*.

* See Specifications



730 34 097

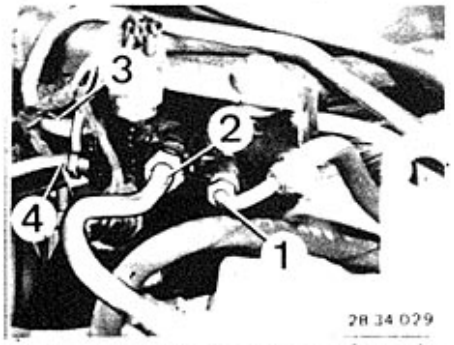
Installation:
Detach pivot on brake booster.
Attach pivot on new brake booster and adjust to same distance B.
If necessary, check distance A on brake pedal in installed state (see 35 21 000).



630 34 167

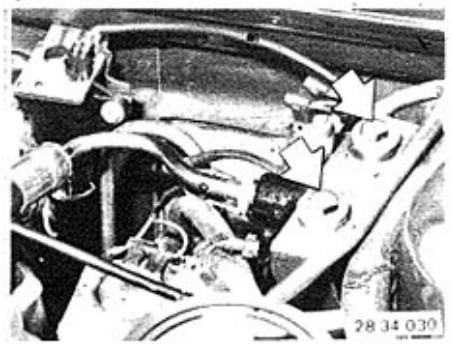
34 33 100 REMOVING AND INSTALLING POWER FLOW REGULATOR

Discharge hydraulic reservoir by operating brake pedal about 20 times with same force required for full stop braking action with engine stopped.
Pull off wires on circulating pressure warning switch (5) and hydraulic pressure switch.



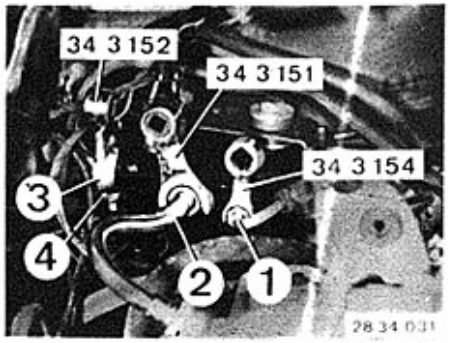
28 34 029

Line (1) from power flow regulator to tank.
Line (2) from power flow regulator to power steering gear.
Line (3) from power flow regulator to power steering pump.
Line (4) from power flow regulator to brake booster.
Disconnect lines (1 ... 4).



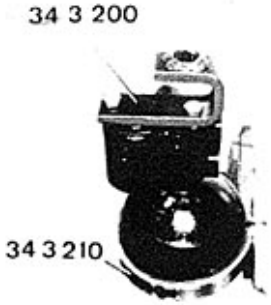
28 34 030

Unscrew power flow regulator mounting bolts.



28 34 031

Caution!
Solid particles of dirt could impair the function of the power flow regulator in H 31 systems, which in turn could cause failure of power steering and brake boost.
Make sure that all pipes and hoses are clean when connecting.
Installation:
Tighten line (1) with Special Tool 34 3 154, lines (2 and 4) with 34 3 151 and line (3) with 34 3 152; all in conjunction with a torque wrench.
Tightening torque*.
Bleed power steering 32 13 006.



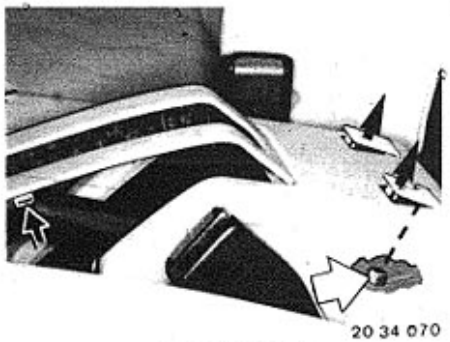
28 34 022

34 33 110 REMOVING AND INSTALLING HYDRAULIC RESERVOIR

Remove and install power flow regulator 34 33 100.
Clamp hydraulic reservoir with Special Tool 34 3 210.
Mount Special Tool 34 3 200 on power flow regulator that square faces threads of hydraulic reservoir.
Unscrew hydraulic reservoir.
Installation:
Hydraulic reservoir tightening torque*.

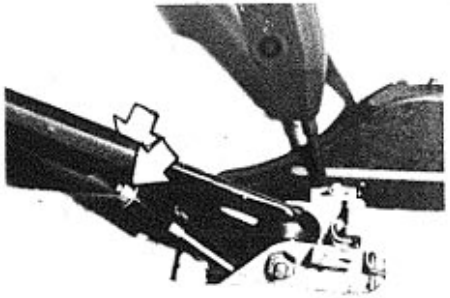
* See Specifications

34 41 000 REMOVING AND INSTALLING PARKING BRAKE LEVER



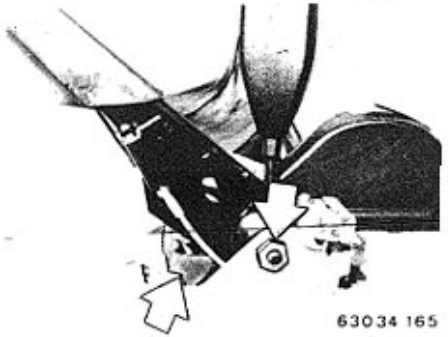
20 34 070

Lift out the brush plate.
Only loosen the screws.
Push back, disengage and remove the center console.



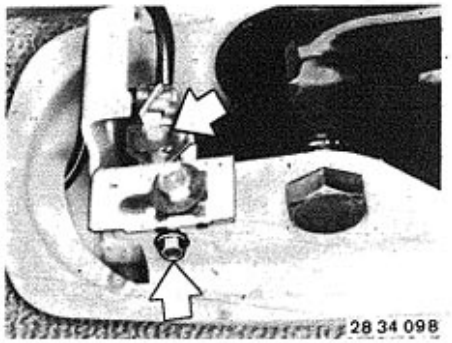
630 34 166

Unscrew the adjusting nuts for parking brake cables.



630 34 165

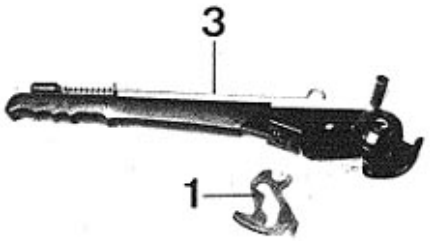
Unscrew the stop nut and press out the pin.
Important!
Don't press in the locking button while pulling the parking brake lever out of the holder.
Installation:
Slide in the locking element on the opening.



28 34 098

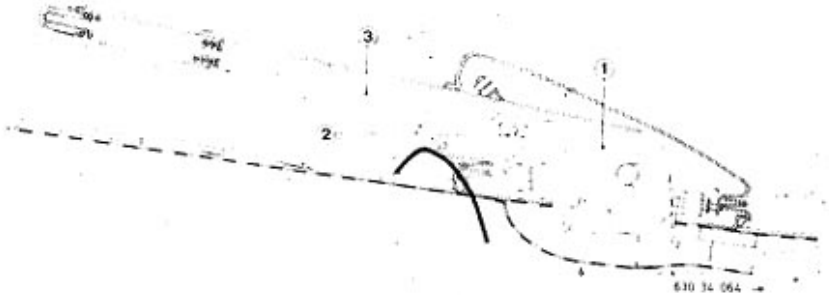
Be careful not to damage the warning switch during removal and installation.
Check the adjustment.
Installation:
Adjust the parking brake – see 34 10 014.
Replace the stop nut.

34 41 011 REPLACING LOCKING ELEMENT

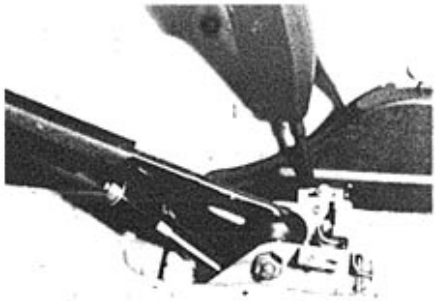


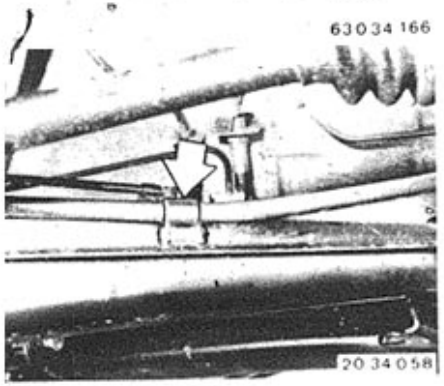
630 34 163

Remove the parking brake lever – see 34 41 000.
Important!
Installed position of locking element (1), pawl (2) and push rod (3).



630 34 064

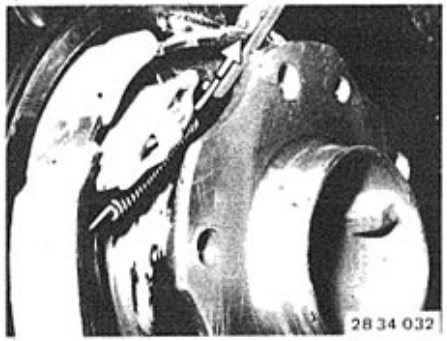




34 41 100 REMOVING AND INSTALLING PARKING BRAKE CABLE

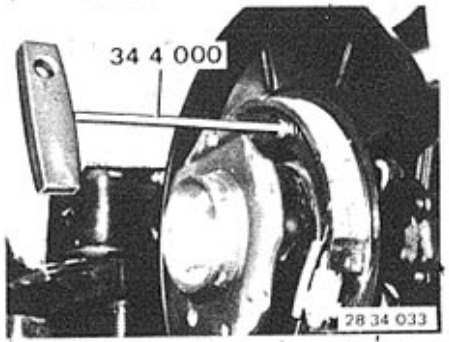
Remove and install spreader lock for parking brake shoes 34 41 220.
Remove and install parking brake lever 34 41 000.
Installation:
Adjust parking brake 34 10 014.

Disconnect parking brake cable on trailing arm.

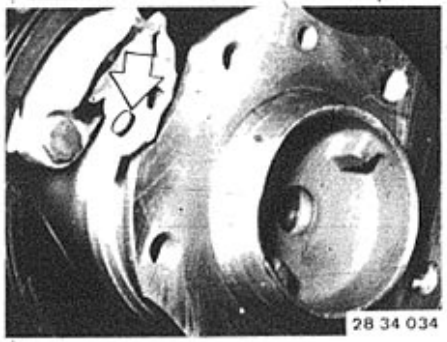


34 41 220 REMOVING AND INSTALLING PARKING BRAKE SHOES

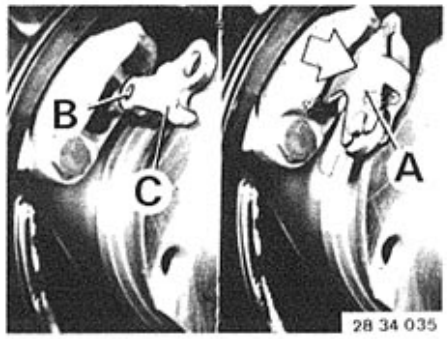
Remove and install rear brake disc 34 21 320.
Disconnect upper return spring with a brake spring pliers.



Turn springs 90° and disconnect with Special Tool 34 4 000.



Spread brake shoes apart at top and remove from below.
Important!
Pin of spreader lock could fall out.
After replacing brake liners, break in as for replacement of brake discs 34 21 320.



Checking, Removing and Installing Spreader Lock:
Pull part A forward.
Press out part B.
Pull out part C.
Installation:
Give sliding surfaces and pin a light coat of Molykote G Paste.
Adjust parking brake 34 10 014.

Condition	Cause	Correction
Brakes pulling to one side	a) Tire inflation pressure incorrect b) Tire treads worn unevenly c) Oil on pads d) Type of pads incorrect e) Dirty fist caliper recesses f) Rear axle alignment incorrect g) Corrosion in fist calipers h) Shock absorbers without effect I) Pads of one caliper worn k) Pad surface glazed	a) Correct tire inflation pressure b) Change or replace tires c) Replace brake pads; find cause d) Replace brake pads e) Remove and install, clean fist calipers f) Check rear axle wheel alignment g) Remove and install, repair or replace fist calipers h) Check or replace shock absorbers I) Replace brake pads; check fist calipers k) Replace brake pads; check fist calipers
Brakes overheated excessively while driving	a) Compensation bore in master cylinder clogged b) No play between push rod and master cylinder piston c) Rubber parts swollen from use of wrong brake fluid d) Vent hole in brake fluid tank clogged e) Corroded fist calipers f) Cross spring broken g) Parking brake not fully released	a) Overhaul or replace master cylinder b) Adjust push rod c) Overhaul or replace master cylinder d) Clean brake fluid tank e) Remove and install, repair or replace fist calipers f) Replace cross spring g) Check parking brake and parking brake cables, repairing if necessary
Poor braking effect in spite of great force on brake pedal Brake pedal travel normal short long	 a) Oil on brake pads or burnt; type of pads incorrect b) Brake booster malfunctions – insufficient vacuum from engine c) One brake circuit failed because of leak or damage	 a) Replace brake pads b) Check vacuum hose and connections, check seal on brake master cylinder, replacing if necessary. Check brake booster c) Check brake system for leaks
Brake pedal movement soft and spongy	a) Air in brake system b) Insufficient brake fluid in tank – see a) c) Overheated brake fluid – vapor lock due to high water content of brake fluid or excessive braking loads	a) Add or replace brake fluid, bleed brakes b) Add or replace brake fluid, bleed brakes c) Add or replace brake fluid, bleed brakes
Brakes bled and adjusted, but brake pedal travel is still excessive	a) Primary cup in master cylinder damaged b) Separating cups on floating piston of tandem master cylinder leak c) Leak in brake system	a) Overhaul or replace brake master cylinder b) Overhaul or replace brake master cylinder c) Check brake system for leaks
Uneven brake pad wear	a) Type of pads incorrect b) Dirty fist caliper recesses, damaged caps c) Corrosion in fist calipers d) Rubber ring for piston control swollen	a) Replace brake pads b) Remove and install, repair or replace fist calipers c) Remove and install, repair or replace fist calipers d) Remove and install, repair or replace fist calipers
Brake pads worn at an angle	a) Cross spring force insufficient b) Wheel bearing play excessive c) Brake disc not aligned with fist caliper d) Corrosion in fist calipers e) Brake disc worn at an angle f) Brake pads worn below minimum thickness	a) Replace cross spring b) Replace wheel bearings c) Check fist caliper installation d) Remove and install, repair or replace fist calipers e) Grind or replace brake discs f) Replace brake pads

TROUBLESHOOTING BRAKES

Condition	Cause	Correction
Seized brake pads; pads stuck tight on brake discs	a) Dirty fist caliper recesses, caps damaged b) Corrosion in fist calipers c) Compensation bore in master cylinder clogged	a) Remove and install, repair or replace fist calipers b) Remove and install, repair or replace fist calipers c) Overhaul or replace brake master cylinder
Brakes squeak or rattle	a) Type of pads incorrect b) Dirty fist caliper recesses c) Cross spring force insufficient d) Brake disc not aligned with fist caliper e) Brake disc runout f) Excessive difference in thickness within braking surface g) Rust edge on brake discs h) Pads loose i) Wheel bearing play excessive	a) Replace brake pads b) Remove and install, clean fist calipers c) Replace cross springs d) Check fist caliper installation e) Check brake disc runout or replace brake discs f) Measure brake disc thickness; grind or replace discs g) Grind or replace brake discs h) Replace brake pads i) Replace wheel bearings
Brake pedal dead travel excessive	a) Wheel bearing play excessive b) Brake disc not aligned with fist caliper c) Brake disc runout d) Excessive difference in thickness within braking surface e) Brake system leaks f) Air in brake system g) Type of pads incorrect	a) Replace wheel bearings b) Check fist caliper installation c) Check brake discs for runout of replace brake discs d) Measure brake disc thickness; grind or replace discs e) Check brake system for leaks f) Bleed brakes g) Replace brake pads
Pistons seized in brake calipers	a) Dirty fist caliper recesses, damaged caps b) Brake disc not aligned with fist caliper c) Corrosion of pistons in fist calipers	a) Remove and install, repair or replace fist calipers b) Check fist caliper installation c) Remove and install, repair or replace fist calipers
Pulsating action on brake pedal	a) Wheel bearing play excessive b) Brake disc not aligned with fist caliper c) Brake disc runout d) Excessive difference in thickness within braking surface	a) Replace wheel bearings b) Check fist caliper installation c) Check brake discs for runout or replace brake discs d) Measure brake disc thickness; grind or replace discs
Parking brake effect insufficient	a) Oil on brake shoes b) Excessive dead travel between brake shoes and drums c) Excessive dead travel in cables d) Cables maladjusted e) Corroded transmission parts	a) Replace brake liners; find cause b) Adjust parking brake c) Adjust parking brake d) Adjust parking brake e) Remove and install parking brake and spreader locks; check cables, replacing if necessary

1. ANTIBLOCK SYSTEM (ABS) – DESCRIPTION AND DESIGN

Description:

The basis of a braking action is the friction between the tires and road surface.
To brake a vehicle the tires have to transmit a frictional force to the road surface. In so doing there will be slip between the tires and road surface, i.e. the tire peripheral velocity will be slower than the road speed of the vehicle.

Figure 730 34 112 shows the relation between the frictional force and slip for a typical case on a dry road surface. The transmitted braking force reaches its maximum value in shaded area A. This is also the control range of ABS. When a wheel is locked, i.e. when there is 100 % slip, the frictional force will normally be lower than when a wheel is rolling.

Consequently the ABS must control the brake pressure in the wheel brake cylinder in such a manner taht the slip remains in the shaded area, because here the highest frictional force is available.

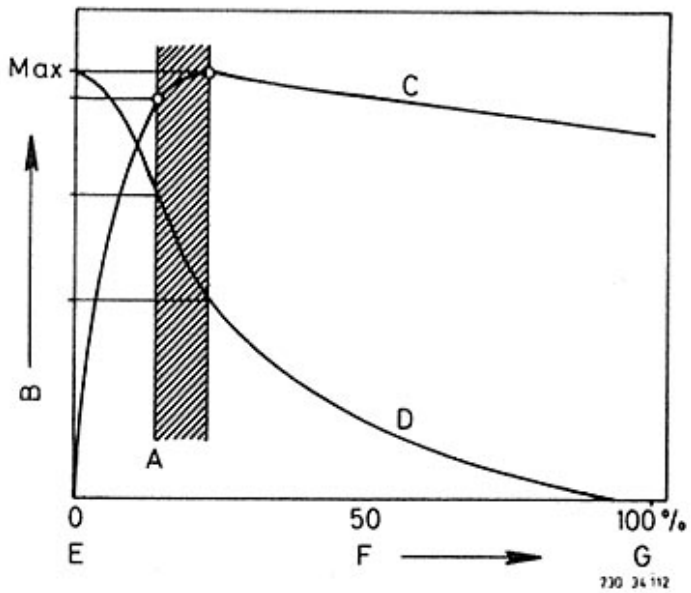
At the same time there will then be sufficient lateral cornering force to guarantee steering and directional stability.

The amount of slip, with which there is maximum frictional force, and the amount of frictional force itself depend chiefly on the tires (type, treads, rubber composition), the road surface (material, surface condition, wet, ice), the road speed and the slip angle of the wheels.

The ABS detects the frictional conditions between the tires and road surface prevailing at the moment. It automatically adjusts to each change in road surface/tire relation and makes use of the highest coefficient of friction, without that the vehicle slips or skids because of wheel lock.

Non-uniform friction conditions between separate wheels will be held under control just as also instantaneous changes in the road surface condition, e.g. through patches of ice.

BRAKING AND LATERAL FORCES IN RELATION TO SLIP



A = ABS operating range
B = Braking and lateral force
C = Braking force
D = Lateral force
E = Rolling wheel
F = Slip
G = Locked wheel

Design

The ABS consists of a control unit, hydraulic unit, speed sensors and a wire harness.
Description of Separate Components:
Speed Sensors:
Each speed sensor has a gear wheel, which runs past the permanently magnetized edge of the speed sensor and is installed in the wheel hub.
The rotary motion of the wheels is recorded by inductive sensors and an electric signal is sent to the electronic control unit.

Electronic Control Unit:
The electronic control unit is located in the passenger compartment (above the glove box).

In a small multi-channel electronic computer acceleration, deceleration and slip factors are derived from the electric signals of the speed sensors, which are proportional th the wheel velocity. By logical connection of these factors there are control demands for the electromagnetically operated valves in the hydraulic unit.

The signal processing in the computer determines the control behavior of the system. The expected degree of dependability is based on digital engineering with highly integrated circuitry.

The control unit contains electronic monitoring circuits, which control the function prior to each trip and the ABS wire harness with equipment constantly during a trip. If the control unit detects a defect in the wire harness or electrical part of the equipment, the monitoring circuit will switch off the ABS and guarantees normal use of the brake system. An ABS indicator lamp reports this condition to the driver.

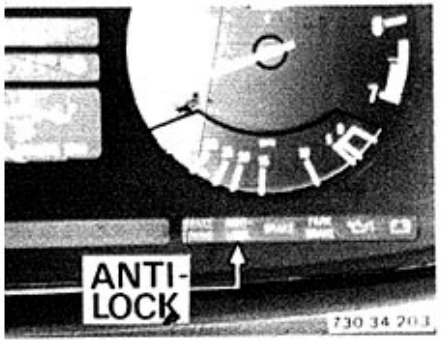
Hydraulic Unit:
The hydraulic unit is located in the engine compartment and was added to the conventional brake svstem.

To control the brake pressure in the wheel brake cylinders, tne brake hydraulic unit has three-way valves which permit three brake pressure conditions.

Pressure build-up, pressure holding and pressure drop. These three pressure phases adapt themselves in the sequences and length to the reuqirements of the desired control characteristic and power flow between the road surface and tires. In principle the control procedures are as follows. As soon as a wheel deceleration or slip indicates the locking of a wheel, the brake pressure is first held. If the wheel still tends to lock, the pressure will be dropped so-long until the wheel accelerates or the slip limit is exceeded. Afterwards the pressure is raised again and the control phases begin from new.

An electrically driven return delivery pump returns the brake fluid taken from the wheel brake cylinder while dropping the pressure to the appropriate brake circuit.
The pump is designed as a two-piston pump, so that the circuits of a dual brake circuit system remain fully separated.

Wire Harness:
The control unit is connected with the speed sensors and electric part of the hydraulic unit via a special wire harness for the sake of signal input and order output as well as power supply.



2. Description of and Checking ABS Indicator Lamp

The ABS indicator lamp comes on after turning on the ignition. The indicator lamp should go out when the engine has started, if the ABS is okay.

These procedures are repeated each time the ignition is turned off and on.

The causes for erroneous indication (indicator lamp doesn't come on, doesn't go out or comes on while driving – even occasionally – can be found with the help of a BMW service test unit and a brake test stand (dynamometer).

Important!
Each started step must be finished completely without a break!

The control unit will automatically switch to "normal braking" when there is an electric or electronic defect in ABS.
This means the car can still be braked, but without control (the wheels could lock!).
The defective system will be indicated by a continuously burning ABS indicator lamp in the instrument panel.

3. General Information on Repairs and Brake Systems

Basically the ABS does not require servicing. However, the following must be observed when working on cars with ABS.

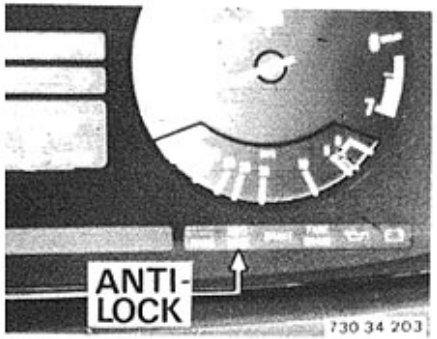
a) Remove plugs from the electronic control unit and turn off ignition when welding with an electric welder.

b) When painting, the electronic control unit can be subjected to max. 95° C (203° F) briefly and to max. 85° C (185° F) for a longer period (about 2 hours).

c) If the battery had been removed, the battery terminals must be tightened on the end poles perfectly after reinstallation of the battery.

d) After replacement of the hydraulic unit, the control unit, the speed sensors or the wire harness as well as after performance of jobs which were in contact with ABS equipment (e.g. repair of accident damage), the entire antiblock system has to be checked with the BMW service test unit. It is important that brake lines be routed correctly.

e) After each job the brakes must be bled and high/low pressure tests carried out. Check all connections for leaks.

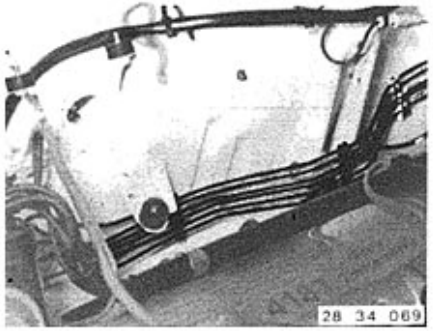


34 50 000 CHECKING FUNCTION OF ABS

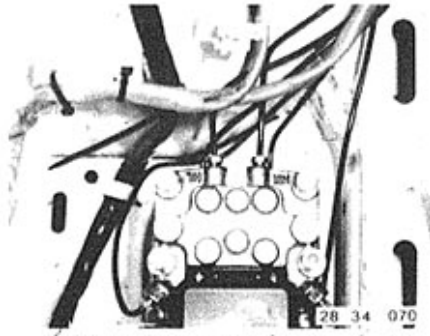
An electronic circuit in the control unit monitors ABS constantly.
The function must be checked when the ABS indicator lamp does not go out, comes on while driving or does not come on when turning on the ignition or performing jobs on the ABS.


730 34 121

The function is checked with BMW service test unit.
Connect tester on wire harness and control unit with a suitable plug.
See Wiring diagram in ABS nominal value microfiche.
Important!
Each started step must be finished completely, without a break.

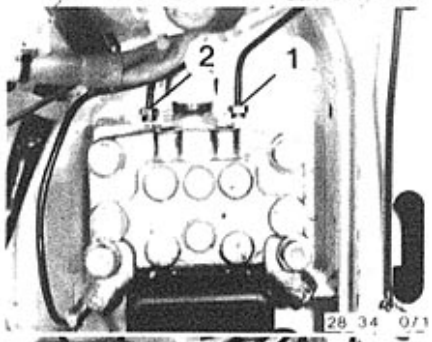


Servicing ABS:
Basically the ABS does not require servicing.
Check brake lines to and from the hydraulic unit for correct routing and leaks together with the general brake system.

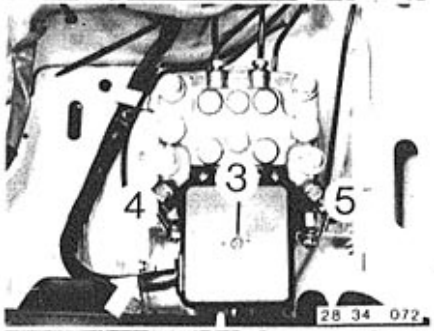


34 51 520 REMOVING AND INSTALLING/ REPLACING HYDRAULIC UNIT ASSEMBLY FOR ABS

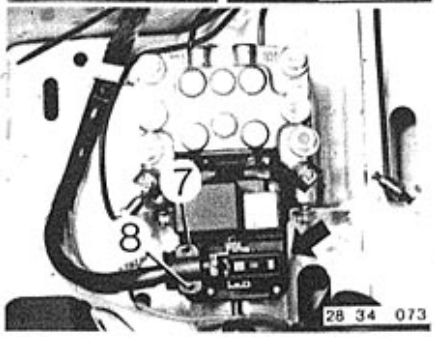
Disconnect battery ground lead.
Remove air cleaner with air flow sensor.
Disconnect front left, front right, rear left and rear right brake lines.
Installation:
Front left to front left brake caliper.
Front right to front right brake caliper.
Rear left to rear left brake caliper.
Rear right to rear right brake caliper.
Don't mix up lines (mark them)!



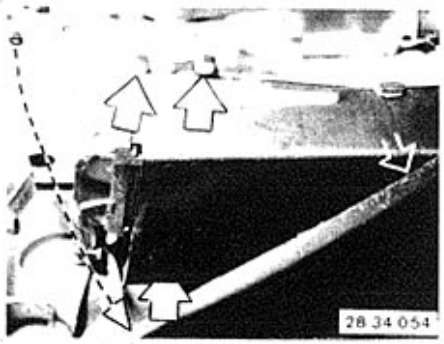
Disconnect brake lines (1 and 2).
Installation:
Line (1) to brake master cylinder, front.
Line (2) to brake master cylinder, rear.
Caution!
Catch escaping brake fluid and keep it off of clothes and paint.
Never reuse drained brake fluid.



Unscrew bolt (3) and take off cover.
Unscrew nuts (4 and 5).
Disconnect ground wire.

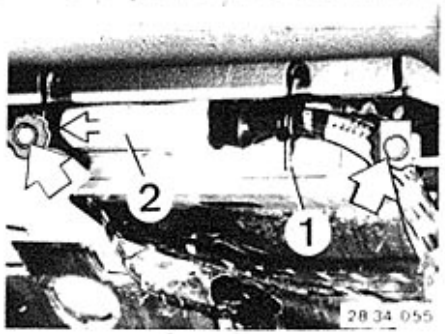


Unscrew bolts (7 and 8).
Pull off multiple pin plug.
Pull up front end of hydraulic unit, diconnect rear and remove.
Installation:
Bleed brakes 34 00 046.
Check ABS function with BMW service test unit 34 50 000.

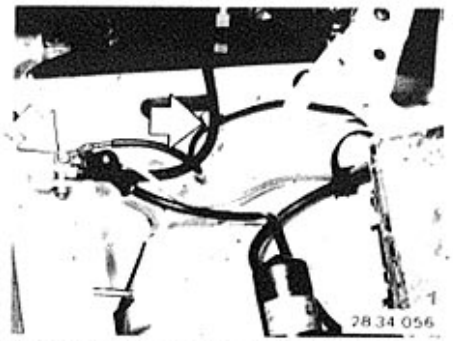


34 52 510 REPLACING CONTROL UNIT FOR ABS

Pull down glove box cover.
Unscrew or remove L-Jetronic control unit.
Caution!
Turn off ignition before removing and installing control unit.

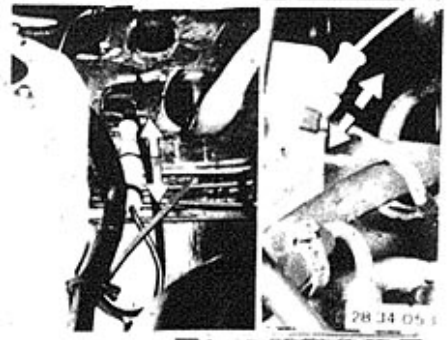


Push back clamp (1) and pull out multiple pin plug (2) to the right and then disconnect on the left.
Detach control unit on body.
When replacing control unit, check for correct connections and unit code number.
Multiple pin plug has a tab on left side, for which control unit must have an opening.
Installation:
First connect left side of plug and then press right side into clamp.
Check ABS function with BMW service test unit 34 50 000.

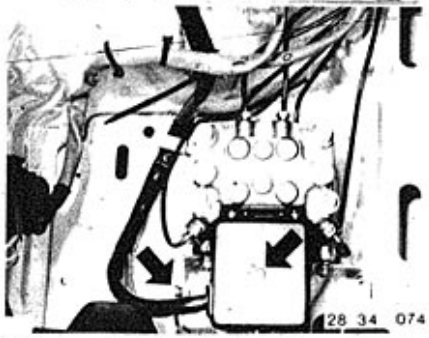


61 11 530 REPLACING WIRE HARNESS FOR ABS

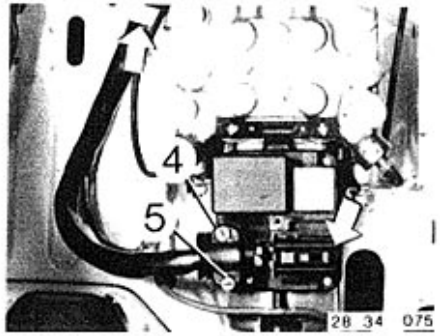
Disconnect battery ground lead.
Disconnect lead on battery positive terminal.
Loosen clamps on body and strap on heater separating wall.



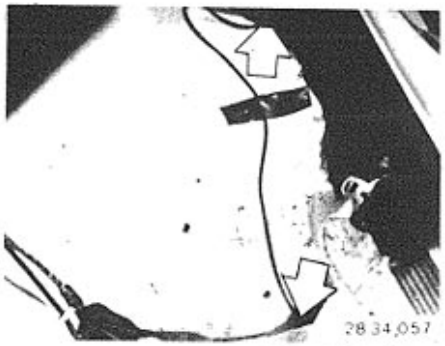
Disconnect both plugs for front pulse transmitter.



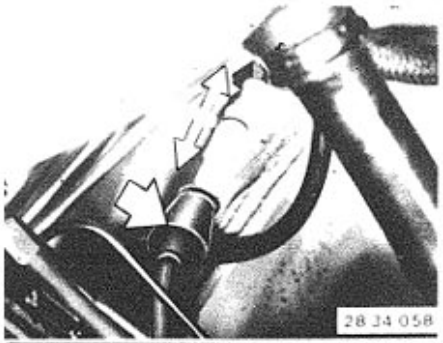
Unscrew cover on hydraulic unit.
Disconnect ground wire on body.



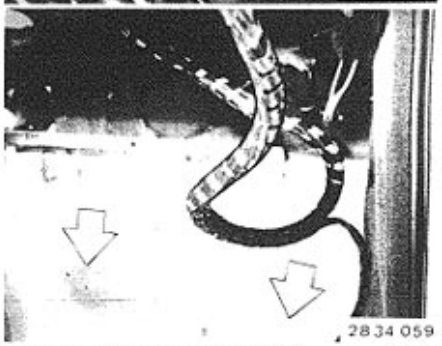
Unscrew bolts (4 and 5).
Pull off multiple pin plug on hydraulic unit.
Loosen plastic clips on body.



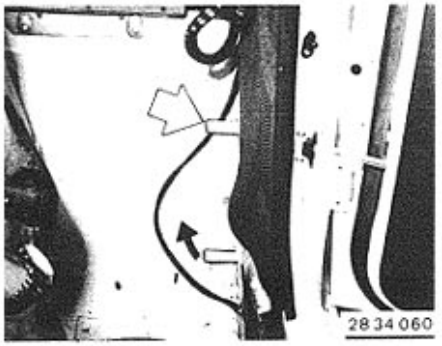
Remove rear seat 52 20 010.
Remove B pillar trim on right side.
Pull off entrance covers on right side.



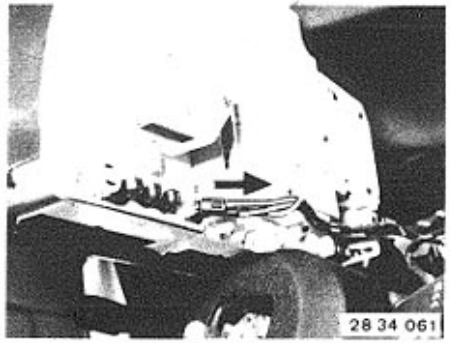
Lift car.
Pull down and disconnect both plugs for pulse transmitters.
Caution!
Be careful not to damage rubber grommet.



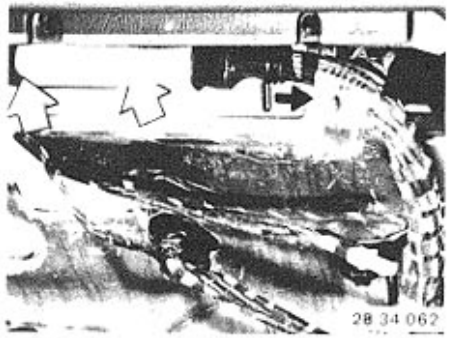
Position wires inside.
Disconnect carpets and trim on right side to extent necessary.



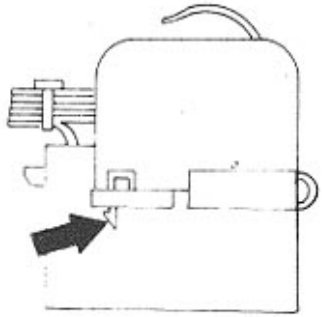
Pull out wires forward in car.



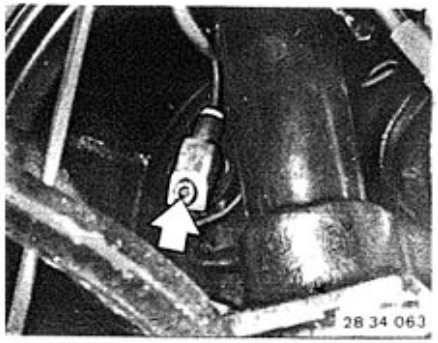
Remove instrument cluster 62 11 000.
Pull out indicator lamp socket.
Pull out wires toward right side.



Remove L-Jetronic control unit.
Pull off ABS control unit plugs.
Installation:
First connect plug on left side and then press right side into clamp.

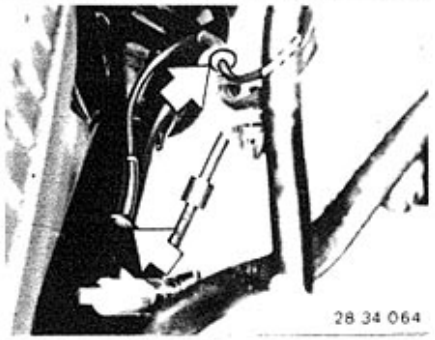


Pull in wire harness from engine compartment side.
Fold up hydraulic unit plug for this purpose.
Installation:
Replace a damaged rubber grommet.
Check ABS function with BMW service test unit 34 50 000.

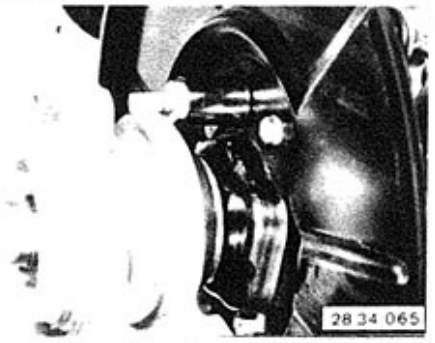


61 12 510 REMOVING AND INSTALLING/ REPLACING ONE FRONT PULSE (SPEED) SENSOR FOR ABS

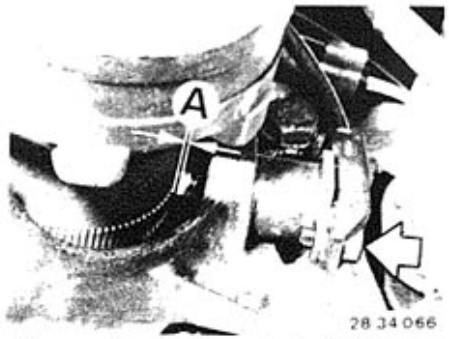
Turn off ignition.
Unscrew socket head screw, lift out wire and pull out pulse sensor.
Installation:
Check seal, replacing if necessary.
Lubricate pulse sensor and housing with Molykote Longterm 2 before installing.



When replacing pulse sensor, disconnect contact plug in engine compartment and pull wires down.
Disconnect wires.
Installation:
Distance is given by take-up bore for pulse sensors.
Pulse sensors are installed without spacers.
Check ABS function with BMW service test unit 34 50 000.

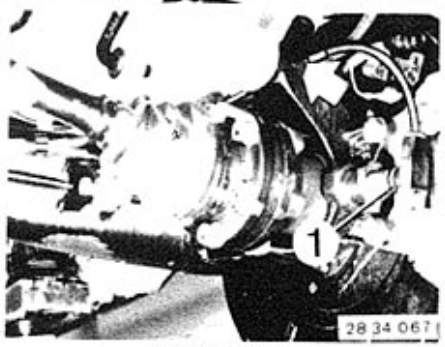


Removing and Installing/Replacing ABS Pulse Wheel:
Pulse wheels are pre-assembled with the bearing unit, see "Replacing Front Wheel Bearing Unit" – 31 21 180.

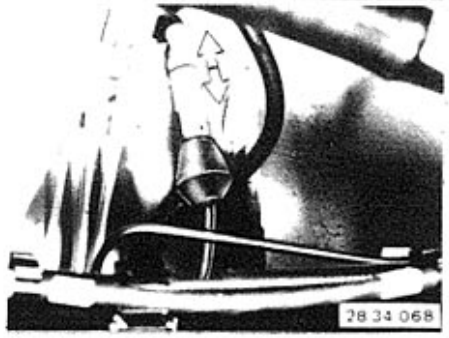


61 12 520 REMOVING AND INSTALLING/ REPLACING ONE REAR PULSE (SPEED) SENSOR FOR ABS

Turn off ignition.
Remove rear wheel 36 10 300.
Remove rear brake caliper 34 21 220.
Unscrew socket head screw.
Installation:
Distance* between pulse sensor and pulse wheel (A) is given by design and cannot be adjusted. However, pulse wheel has to be visually inspectec for dirt or damage.



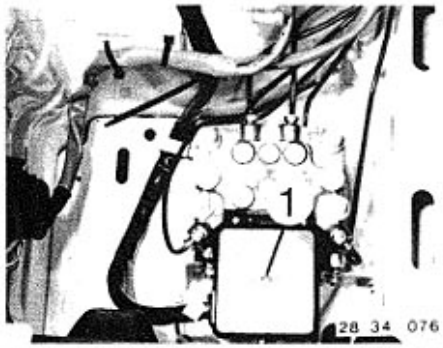
Lift out wire and pull out pulse sensor.
Check seal (1), replacing if necessary.
Installation:
Lubricate pulse sensor and housing with Molykote Longterm 2 before installing.



Replacing Rear Pulse Sensor:
Take wires out of clips.
Pull out rubber grommet and wires.
Disconnect contact plug.
Detach pulse sensor.
Important!
Do not damage rubber grommet.

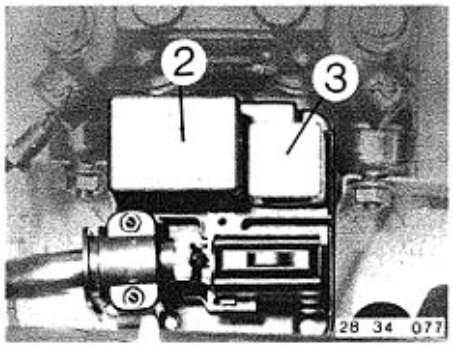
Rear pulse wheel ABS is integrated in drive flange.
See "Replacing Wheel Bearings and Shaft Seals" – 33 41 151.

* See Specifications

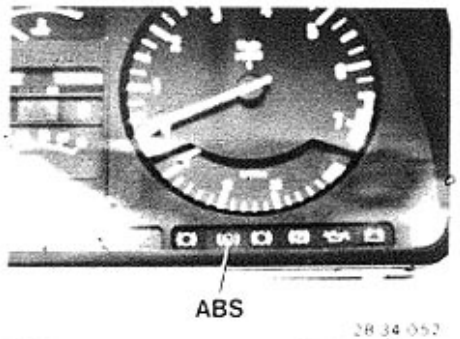


61 31 570 REPLACING RELAYS ON ABS HYDRAULIC UNIT

Take off cover on hydraulic unit.

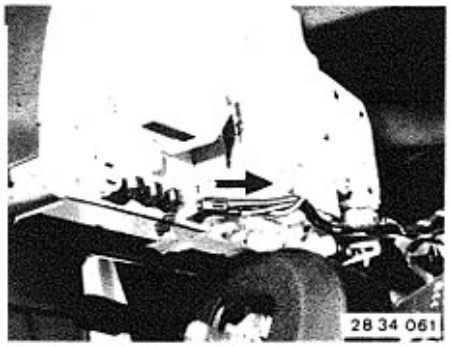


Pull out engine relay (2) or valve relay (3).



62 99 080 REPLACING ABS INDICATOR LAMP

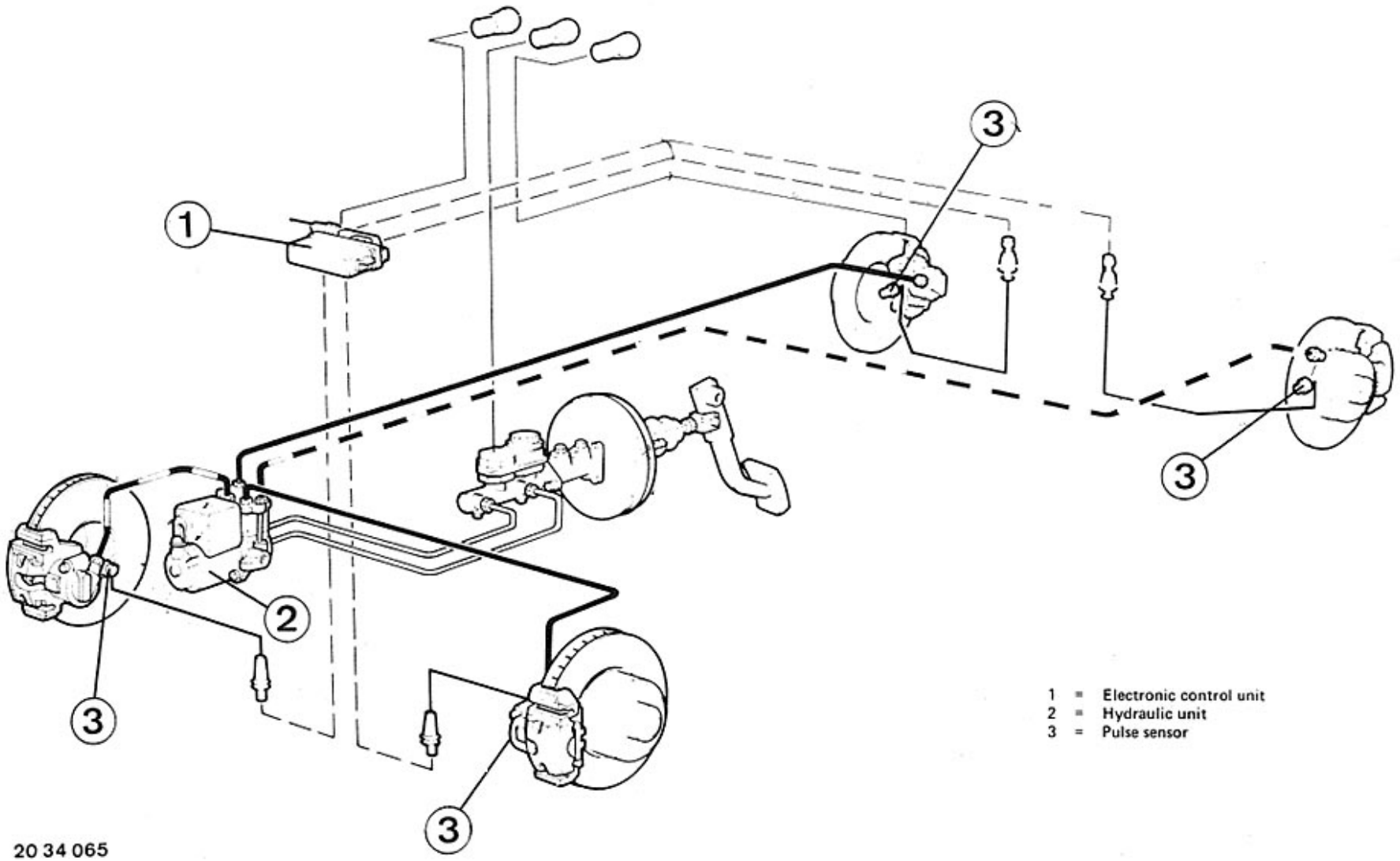
Remove instrument cluster 62 11 000.



Pull out indicator lamp socket.

34-35

ABS LAYOUT DRAWING

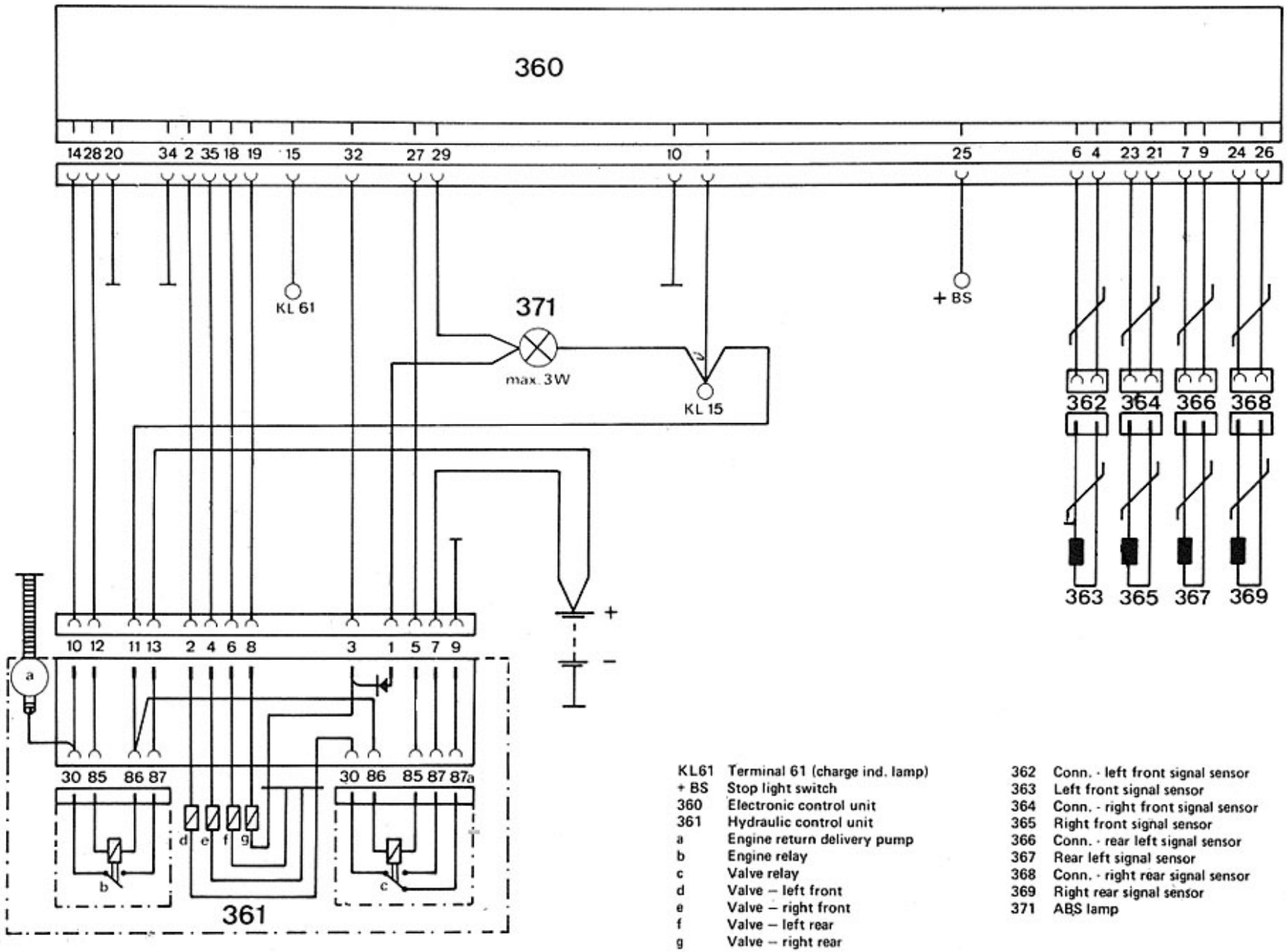


1 = Electronic control unit
2 = Hydraulic unit
3 = Pulse sensor

20 34 065

34-36

ABS WIRING DIAGRAM



KL61	Terminal 61 (charge ind. lamp)
+ BS	Stop light switch
360	Electronic control unit
361	Hydraulic control unit
a	Engine return delivery pump
b	Engine relay
c	Valve relay
d	Valve – left front
e	Valve – right front
f	Valve – left rear
g	Valve – right rear

362	Conn. - left front signal sensor
363	Left front signal sensor
364	Conn. - right front signal sensor
365	Right front signal sensor
366	Conn. - rear left signal sensor
367	Rear left signal sensor
368	Conn. - right rear signal sensor
369	Right rear signal sensor
371	ABS lamp

7. TROUBLESHOOTING ABS / BMW 5 - E 28 SERIES

Test Step	Tested	Troubleshoot, If Nominal Values Not Reached	Job Position
01 Wire harness Speed sensors	Speed sensors (DF)	Turn off ignition for single tests, control unit not connected.	Gr. 34
	front left	1. Check front left plug connection (visual inspection). 2. Disconnect front left plug, DF reading must then be > 999 k-ohms; DF reading lower: defect in wire harness. 3. Check flow in wires 4 and 6: bridge front left plug on wire harness side, DF reading should then be < 1 ohm; DF reading higher: defect in wire harness. 4. Measure resistance at plug on speed sensor side (M 06). Specification not reached: replace front left speed sensor.	 61 11 530 61 12 510
	front right	1. and 2. as above, however front right plug connection. 3. Check flow in wires 21 and 23: bridge front right plug on wire harness side, DF reading should then be < 1 ohm; DF reading higher: defect in wire harness. 4. As above: replace front right speed sensor.	 61 11 530
	rear left	1. and 2. as above, however rear left plug connection. 3. Check flow in wires 7 and 9: bridge rear left plug on wire harness side, DF reading should then be < 1 ohm; DF reading higher: defect in wire harness. 4. As above, replace rear left speed sensor.	 61 11 530 61 12 520
	rear right	1. and 2. as above, however rear right plug connection. 3. Check flow in wires 24 and 26: bridge rear right plug on wire harness side, DF reading should then be < 1 ohm; DF reading higher: defect in wire harness. 4. As above: replace rear right speed sensor.	 61 11 530
	Speed sensor resistance to ground Speed sensor resistance to B +	1. Visual inspection for line and wire damage (connection to vehicle ground – insulation resistance). 2. Disconnect speed sensor plugs in order for reading > 999 k-ohms: replace pertinent speed sensor. 3. Reading remains < 999 k-ohms: defect in wire harness.	 61 12 510/520 61 11 530
		Also refer to test step 03 when testing speed sensors!	
	Safety lamp	Reading > 80 ohms: ABS indicator lamp defective or poor contact. Check or replace lamp. Check connections on lamp and term. 15. Reading < 10 ohms: check wires 1 and 29 for ground out.	 62 99 080

Test Step	Tested	Troubleshoot, If Nominal Values Not Reached	Job Position
02 Wire harness Relays Valves		Turn off ignition for single tests, control unit not connected.	Gr. 34
	Valve relay coil resistance	Check plug connections on hydraulic unit (plugs, relays). Replace valve relay. Measured value reading > 100 ohms: break in wire to valve relay. (from ignition switch wire 27, wires in hydraulic unit) Measured value reading < 50 ohms: short circuit in wire to valve relay. (wires 1 and 27, wires in hydraulic unit)	61 31 570 61 11 530
	Motor relay coil resistance	Check plug connections on hydraulic unit (plugs, relays). Replace motor relay. Measured value reading > 58 ohms: break in wire to motor relay (from ignition switch wire 28, wires in hydraulic unit). Measured value reading < 34 ohms: short circuit in wire to motor relay (wires 1 and 28, wires in hydraulic unit).	34 51 520 61 31 570 61 11 530 34 51 520
	Valve resistance	Specifications not reached on all four valves: First check wire 32 for break or short circuit. Pull off plugs on hydraulic unit.	
	front left	Measure resistance direct on hydraulic unit between wires 2 and 3. Specification not reached: replace hydraulic unit. Check wire 2 from hydraulic unit plug to control unit plug for break or short circuit.	 34 51 520 61 11 530
	front right	Measure resistance direct on hydraulic unit between wires 4 and 3. Specification not reached: replace hydraulic unit. Check wire 35 from hydraulic unit plug to control unit plug for break or short circuit.	 34 51 520 61 11 530
	rear left	Measure resistance direct on hydraulic unit between wires 6 and 3. Specification not reached: replace hydraulic unit. Check wire 18 from hydraulic unit plug to control unit plug for break or short circuit.	 34 51 520 61 11 530
	rear right	Measure resistance direct on hydraulic unit between wires 8 and 3. Specification not reached: replace hydraulic unit. Check wire 19 from hydraulic unit plug to control unit plug for break or short circuit.	 34 51 520 61 11 530

Test Step	Tested	Troubleshoot, If Nominal Values Not Reached	Job Position
03 Dynamic speed sensor test	Speed sensors (DF)	Wire harness and control unit connected.	Gr. 34
	front left front right rear left rear right	1. Cycle time	
		Cycle time < specified value: wheel turns too fast. Cycle time > specified value: wheel turns too slow.	
		Visual inspection: Excessive clearance between speed sensor and pulse wheel. Speed sensor loose or dirty, check installation.	 61 12 510 61 12 520
		Check arrangement of wheel with gauge. Hold opposite wheel on rear axle. Replace speed sensor.	 61 12 510
		2. Pulse	
		Wheel rotation not uniform enough. Check pulse wheel teeth (condition, dirt). Check clearance between speed sensor and pulse wheel. Replace pulse wheel.	 61 12 510/520

Test Step	Tested	Troubleshoot, If Nominal Values Not Reached	Job Position
04 Dynamic voltage		*Caution!* Turn off ignition before pulling off a plug and measuring resistance.	Gr. 34
	Voltage between wires 1 and 10	Ignition turned on. Engine running. Battery charged, check. Voltage drop checked at: battery connection (+ and −), term 15 and from ignition lock to control unit wire 1.	
	Stab. voltage between wires 12 and 10	Replace control unit. Also refer to test step 05 test line 2.	34 52 510
	Valve relay home contact voltage drop	1. Replace valve relay. 2. Ground connection has excessive transition resistance or break. 3. Check flow in following wires: wire 9 from ground to hydraulic unit plug. From hydraulic unit wire 9 to wire 87a, flow from wire 3 to valve relay term. 30, from wire 3 to multiple pin plug (control unit) wire 32.	61 31 570
	Valve relay opening contact voltage drop	1. Replace valve relay. 2. Check flow in following wires: wire 7 from term. B + to hydraulic unit plug, from wire 7 to valve relay wire 87, from wire 5 to multiple pin plug (control unit) wire 27, from hydraulic unit wire 5 to valve relay wire 85, from wire 86 (valve relay) to wire 86 (motor relay) and wire 11, from hydraulic unit wire 11 to ignition lock term. 15.	61 31 570
	Motor relay operating contact voltage drop	1. Replace motor relay. 2. Check ground terminals of pump motor for tight fit and transmission resistance. 3. Check flow in following wires: from term. B + to plug hydraulic unit wire 13, from multiple pin plug (control unit) wire 14 to hydraulic unit plug, from wire 10 in hydraulic unit to motor relay term. 30 and positive terminal on pump motor. 4. Pump motor defective: replace hydraulic unit.	61 31 570 34 51 520
	Safety circuit Lamp, Diode	Check wire 29 from multiple pin plug (control unit) to hydraulic unit plug wire 44 for break and voltage drop. Check plug connection on indicator lamp. Valve relay plugged in? Pull off hydraulic unit plug. Diode test between wires 1 and 3 (M 09) − replace hydraulic unit.	34 51 520
		Excessive voltage drop or break in wires: replace wire harness.	61 11 530

Test Step	Tested	Troubleshoot, If Nominal Values Not Reached	Job Position
05 Dyn./Ground/ Overvoltage / Bits		*Caution!* Turn off ignition before pulling off a plug and measuring resistance.	Gr. 34
	Voltage between wires 1 and 10	Turn on ignition. Run engine. Battery charged, check.	
	Ground wire 10	Check ground connection in glove box. Check flow of multiple pin plug on wire harness (control unit) wire 10 to ground connection.	61 11 530
	Ground wire 20	Check ground connection in glove box. Check flow of multiple pin plug on wire harness (control unit) wire 20 to ground connection.	61 11 530
	Ground wire 34	Check ground connection in glove box. Check flow of multiple pin plug on wire harness (control unit) wire 34 to ground connection.	61 11 530
	Wire 14/return delivery pump ground	Check ground connection on battery console. Check ground connection on return delivery pump. Check flow in ground wire. Check flow in multiple pin plug on wire harness (control unit) wire 14 to plug on hydraulic unit and wire 10 to term. 87 in hydraulic unit. If there is power flow break: replace wire harness. Wire power flow okay: replace hydraulic unit, see test step 08 ABS pump.	61 11 530 34 51 620
	Overvoltage protector	Replace control unit (watch above mentioned points!).	34 52 510
	Test cycle	Replace control unit (watch above mentioned points!). If motor relay only switches (clicks) at intervals without the pump motor running, the voltage will briefly drop excessively due to the high switching on power at the feed wires from the battery. Repeat test with engine running. See test step 04 and test steps 06/07.	34 52 510
	Defect simulation	Replace control unit (watch above mentioned points!).	34 52 510

Test Step	Tested	Troubleshoot, If Nominal Values Not Reached	Job Position
06 Control unit/ simulation – front wheels			Gr. 34
	Voltage between wires 1 and 10	Turn on ignition. Run engine. Battery charged (check).	
	(solenoid)	Due to high switching on power, possibly repeat test with engine running.	
	left pressure build-up	Replace control unit and repeat test step.	34 52 510
	drop hold	If in test steps 08, 09 and 10 valves do not switch or pump does not run: replace hydraulic unit.	34 51 520
	right pressure build-up	Due to high switching on power, possibly repeat test step with engine running.	
	drop	Replace control unit and repeat test step.	34 52 510
	hold	If in test steps 08, 09 and 10 valves do not switch or pump does not run: replace hydraulic unit.	34 51 520

Test Step	Tested		Troubleshoot, If Nominal Values Not Reached	Job Position
07 Control unit/ simulation – rear wheels				Gr. 34
	Voltage between wires 1 and 10		Turn on ignition. Run engine. Battery charged, check.	
	(solenoid) left pressure	build-up drop hold	Due to high switching on power, possible repeat test step with engine running. Replace control unit and repeat test step. If in test steps 08, 09 and 10 valves do not switch or pump does not run: replace hydraulic unit.	34 52 510 34 51 520
	right pressure	build-up drop hold	Due to high switching on power, possibly repeat test with engine running. Replace control unit and repeat test step. If in test steps 08, 09 and 10 valves do not switch or pump does not run: replace hydraulic unit.	34 52 510 34 51 520

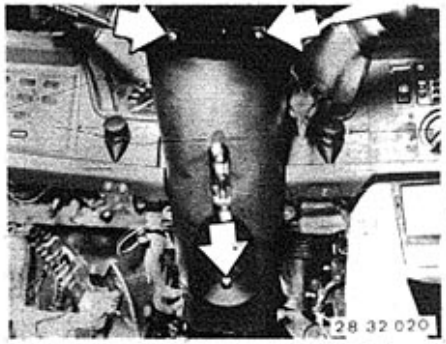
Test Step	Tested	Troubleshoot, If Nominal Values Not Reached	Job Position
08 ABS return delivery pump			Gr. 34
	Voltage between wires 1 and 10.	Ignition turned on. Engine running. Battery charged, check.	
	Front left right Left/right	Due to high switching on power, possibly repeat test step with engine running. Refer to test steps 05, 06 and 07. Testing the ABS requires the conventional brake system to be okay: bled properly, brake line connections tight, brake pads okay, master and wheel cylinders okay.	
	Rear left right left/right	Watch uniformity of wheels on one axle. Observe relation between wheel – reading.	
		Brake lines mixed up on hydraulic unit. Replace hydraulic unit.	34 51 520

Test Step	Tested	Troubleshoot, If Nominal Values Not Reached	Job Position
09 Hydraulic unit pressure drop			Gr. 34
	Voltage between wires 1 and 10	Turn on ignition. Run engine. Battery charged, check.	
	Front left right left/right	Due to high switching on power, possibly repeat test step with engine running. Refer to test steps 05, 06 and 07. Testing the ABS requires the conventional brake system to be okay: bled properly, brake line connections tight, brake pads okay.	
	Rear left right left/right	Watch uniformity of wheels on one axle.	
		Replace hydraulic unit.	34 51 520

Test Step	Tested	Troubleshoot, If Nominal Values Not Reached	Job Position
10 Hydraulic unit pressure build-up pressure hold			Gr. 34
	Voltage between wires 1 and 10	Turn on ignition. Run engine. Battery charged, check.	
	Front left right left/right	Due to high switching on power, possibly repeat test step with engine running. Refer to test steps 05, 06 and 07. Testing the ABS requires the conventional brake system to be okay: bled properly, brake line connections tight, brake pads okay.	
	Rear left right left/right	Watch uniformity of wheels on one axle.	
		Check lines to and from hydraulic unit for leaks.	
		Replace hydraulic unit.	34 51 520

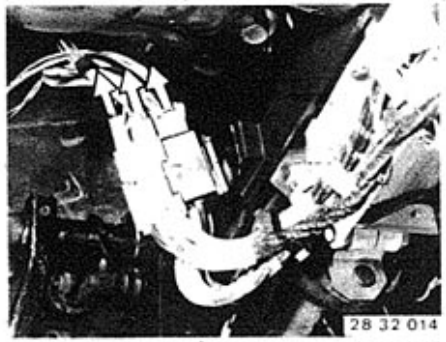
35 Pedals

35 11 000	Pedal base assembly – remove and install	35- 1
35 21 000	Brake pedal – remove and install	35- 3
35 31 000	Clutch pedal – remove and install	35- 3
35 21 011	Bearing sleeve for brake pedal – replace	35- 4
35 31 011	Bearing sleeve for clutch pedal – replace	35- 4
35 41 030	Accelerator pedal shaft (accelerator shaft) – remove and install	35- 5
421	Accelerator cable – replace/adjust	35- 6
480	Kickdown switch – replace (EH transmission)	35- 7
	Accelerator cable adjusting procedures	35- 7
	Control distances – clutch, brake and accelerator pedals	35- 8
	Control distances – accelerator pedal side spacing	35- 9

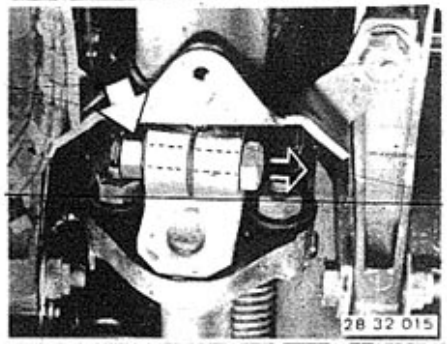


35 11 000 REMOVING AND INSTALLING PEDAL BASE ASSEMBLY

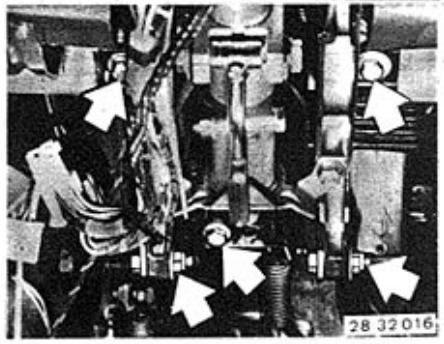
Set steering gear to straight ahead position.
Disconnect battery ground lead.
Remove and install steering wheel 32 33 000.
Remove and install instrument panel trim at bottom 51 45 180.
Unscrew bottom steering column casing



Disconnect central electric connections.
Pull off plugs on stop light switch.

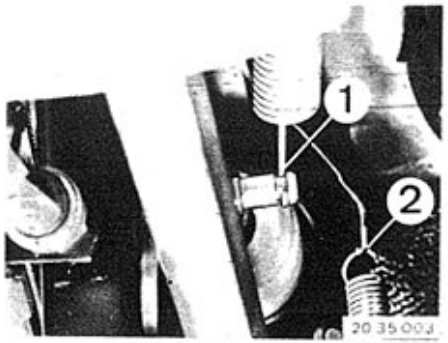


Remove bolt and pull off joint disc on upper steering spindle.
Installation:
Bolt must engage in locking groove.
Tightening torque*.



Unscrew bolts and remove steering column.
Installation:
Replace self-locking nuts.
Tightening torque*.

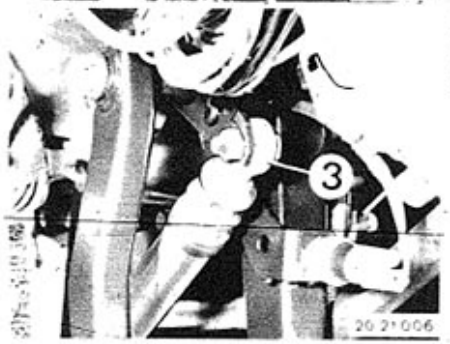
* See Specifications



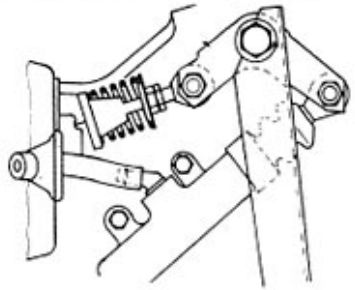
Disconnect return springs (2) for accelerator pedal and (1) for brake pedal.



If applicable, disconnect return spring for clutch pedal.

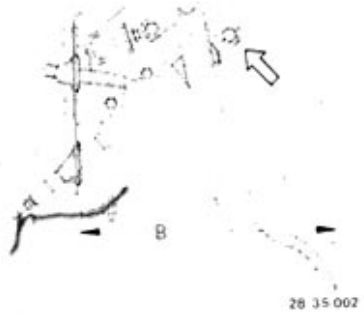


Unscrew piston rod (3) on clutch pedal.
Installation:
Install setscrew with Molykote Longterm 2.
Tightening torque*.

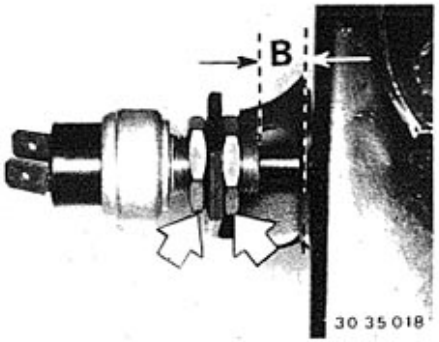


Installation:
If applicable, check for correct position of top dead center spring.

* See Specifications



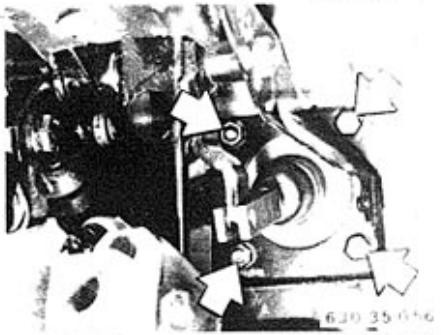
Installation:
Adjust clutch pedal to distance (B)* with the eccentric.
Tightening torque*.



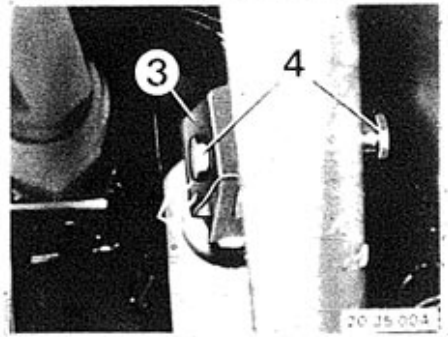
Installation:
Adjust stop light switch.
B = 5 to 6 mm (0.197 to 0.236").
Check function of stop lights.



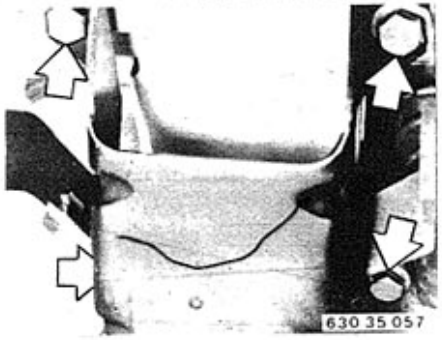
Unscrew master cylinder on base.



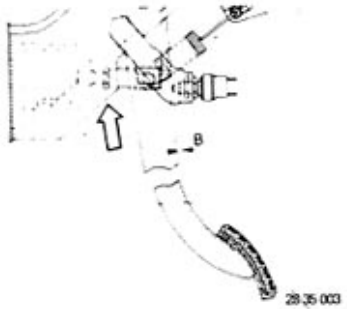
Unscrew nuts.
Installation:
Tightening torque*.



Press off clamp (3) on brake linkage.
Pull out shafts (4).



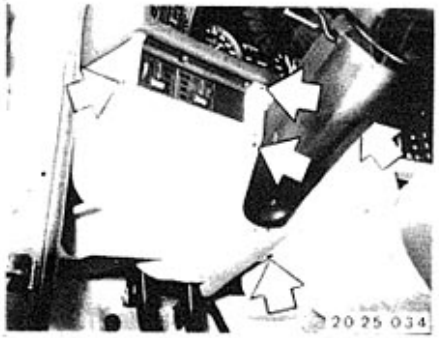
Unscrew bolts.
Remove base.
Installation:
Tightening torque*.



Installation:
Adjust brake pedal to distance (A)* on push rod of brake master cylinder.
Important!
Travel must be stopped in the brake master cylinder and not, for example, by the stop light switch (distance "B").

* See Specifications

* See Specifications



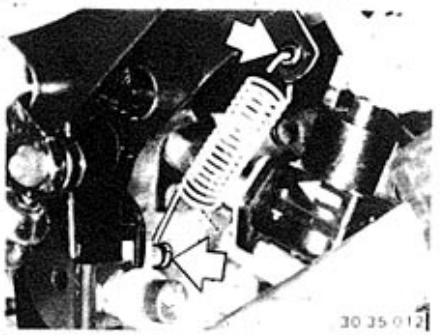
35 21 000 REMOVING AND INSTALLING BRAKE PEDAL

35 31 000 REMOVING AND INSTALLING CLUTCH PEDAL

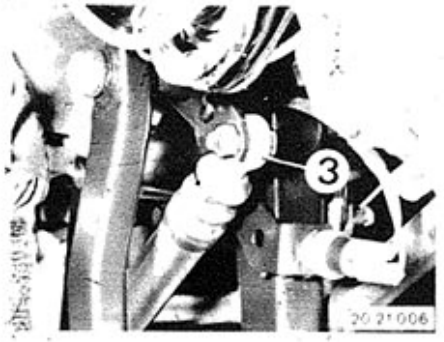
Remove and install instrument panel trim at bottom left 51 45 180.



Cars with Clutch Pedal Return Spring:
Disconnect spring.

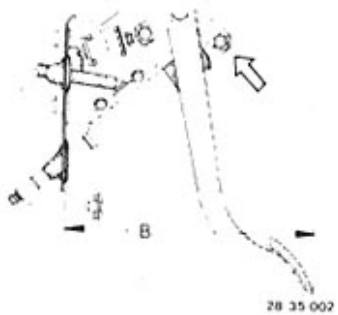


Disconnect brake pedal return spring.

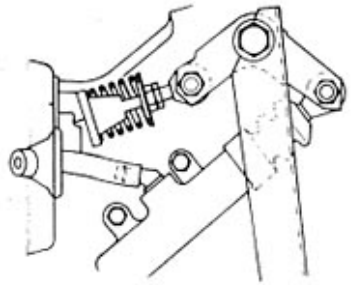


Unscrew piston rod (3) on clutch pedal.
Installation:
Install setscrew with Molykote Longterm 2.
Tightening torque*.

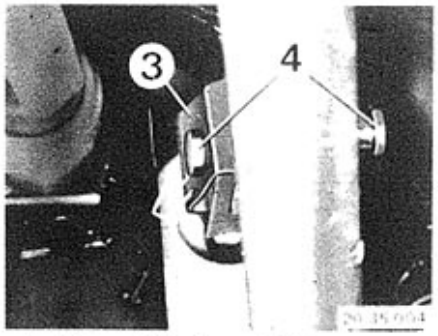
* See Specifications



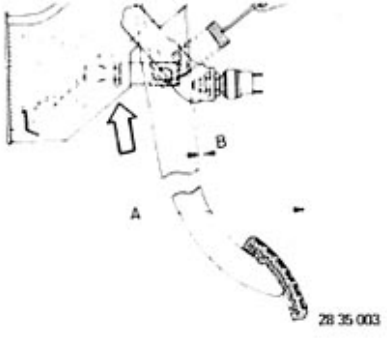
Installation:
Adjust clutch pedal to distance (B)* with the eccentric.
Tightening torque*.



Installation:
Cars with Top Dead Center Spring:
Check for correct installed position.

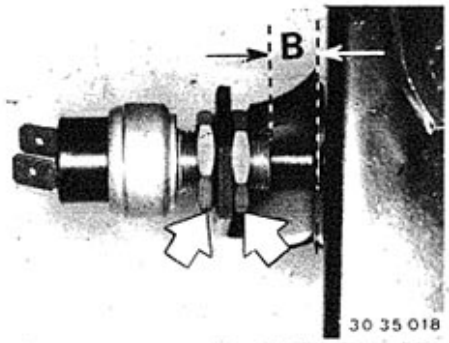


Press clamp (3) off of brake linkage.
Pull out shafts (4).

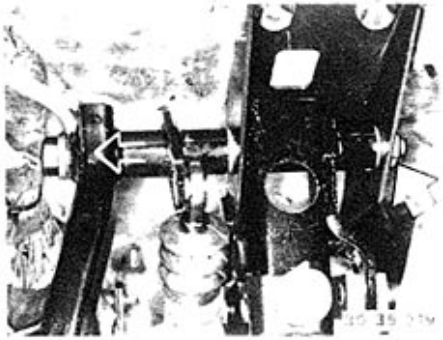


Installation:
Adjust brake pedal to distance (A)* on push rod of brake master cylinder.
Important!
Travel must be stopped in brake master cylinder and not, for example, by the stop light switch (distance "B").

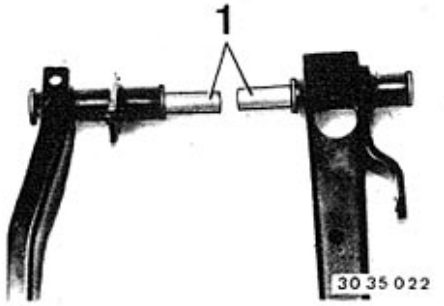
* See Specifications



Installation:
Adjust stop light switch.
B = 5 to 6 mm (0.197 to 0.236").



Unscrew nut.
Pull out bolt.
Remove pedal.
Installation:
Replace self-locking nut.
Tightening torque*.



Installation:
Lubricate spacers with grease*



35 21 011 REPLACING BEARING SLEEVE FOR BRAKE PEDAL

35 31 011 REPLACING BEARING SLEEVE FOR CLUTCH PEDAL

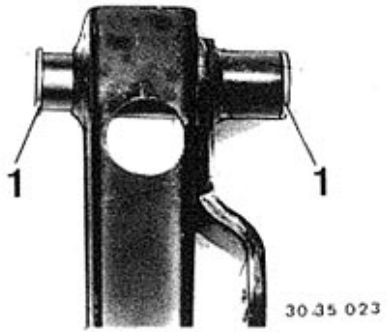
Remove and install pedal 35 21 000 or 35 31 000.

Pedal with Molded Bearing Sleeve:

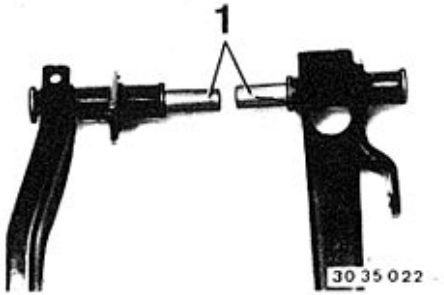
If worn, replace pedal.
If pedal moves hard, drill and ream out bearing sleeve to 14.2 + 0.1 mm (0.559 + 0.004") diameter.
Lubricate bearing with grease*.

Pedal with Pressed in Bearing Sleeves:

Identification:
Bearing sleeves protrude into guide tube on left and right sides by only approx. 17 mm (0.669").
Press out bearing sleeves (1) for brake and clutch pedals.

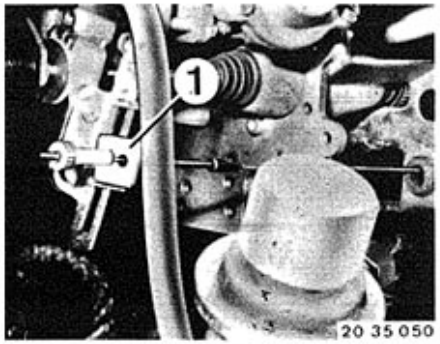


Installation:
Lubricate spacers with grease*.



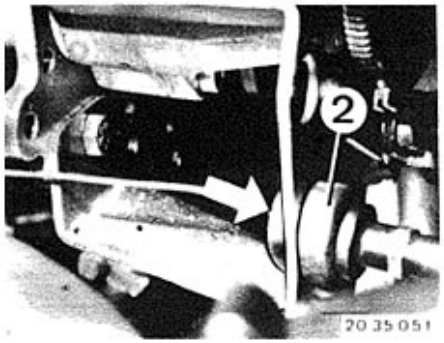
* See Specifications

* See Specifications



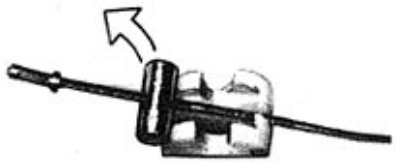
35 41 421 REPLACING/ADJUSTING ACCELERATOR CABLE

Unclip clamp (1) on throttle lever for fuel injection engines or speed lever for diesel engines.

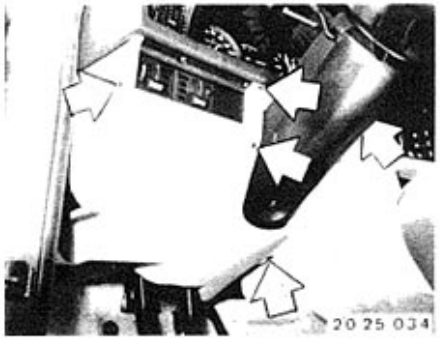


Press out cable with rubber grommet on holder (2).

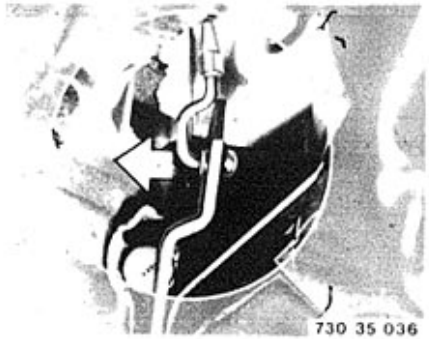
Take off clamp on cable.



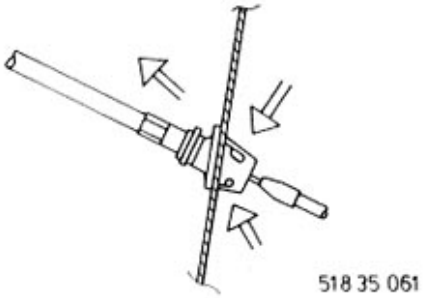
30 35 029



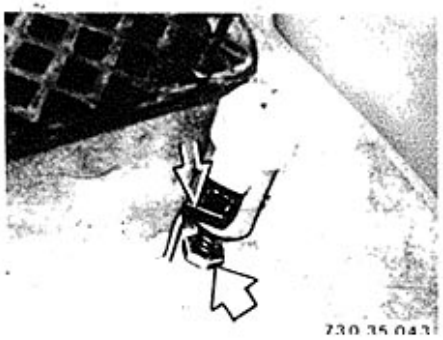
Remove and install instrument panel trim at bottom left.



Disconnect cable on pedal.
Installation:
Check plastic bushing, replacing if necessary.



Compress safety hooks and pull cable out of engine separating wall in direction of engine compartment.
Installation:
Lubricate sliding surfaces with grease.
Check that pedal and cable move easily.
Adjust cable – see page 35 – 7



35 41 480 REPLACING KICKDOWN SWITCH
(for EH Transmission)

Pull off the flat male plug and unscrew the lock nut.
Unscrew the switch.
Installation:
Adjust the switch to the adjusting procedures for the accelerator cable (EH transmission).

Accelerator Cable Adjusting Procedures

Manual Transmission:

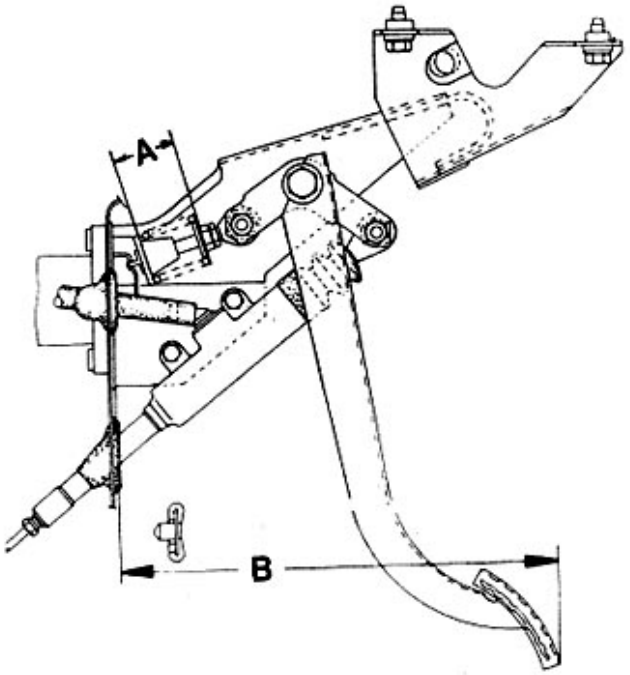
1. Accelerator pedal on neutral stop.
2. Throttle valve in neutral position (automatic choke switched off).
3. Adjust the cable to remove tension.
4. Turn adjusting screw on full throttle stop of pedal base that there is still 0.5 mm (0.020") play on the full throttle stop of the throttle valve with the accelerator pedal plate in full throttle position. Unscrewing the adjusting screw one and one half turns = 0.5 mm (0.020") play. Lock with the M 8 nut.

Automatic Transmission:

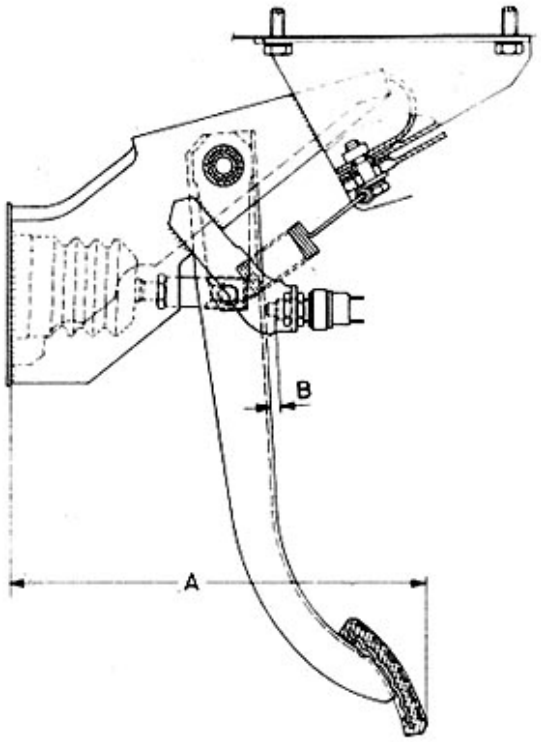
1.–3. same as for manual transmission.

4. Adjust full throttle stop that there is still 0.5 mm (0.020") play on full throttle stop of the throttle valve in kickdown position (pedal pressed beyond full throttle stop). Unscrewing the full throttle stop one and one half turns = 0.5 mm (0.020") play. Lock with the M 8 nut.
5. Check the pressure point for automatic transmission – see 24 00 004.

CONTROL DISTANCES FOR CLUTCH, BRAKE AND ACCELERATOR PEDALS



630 35 065



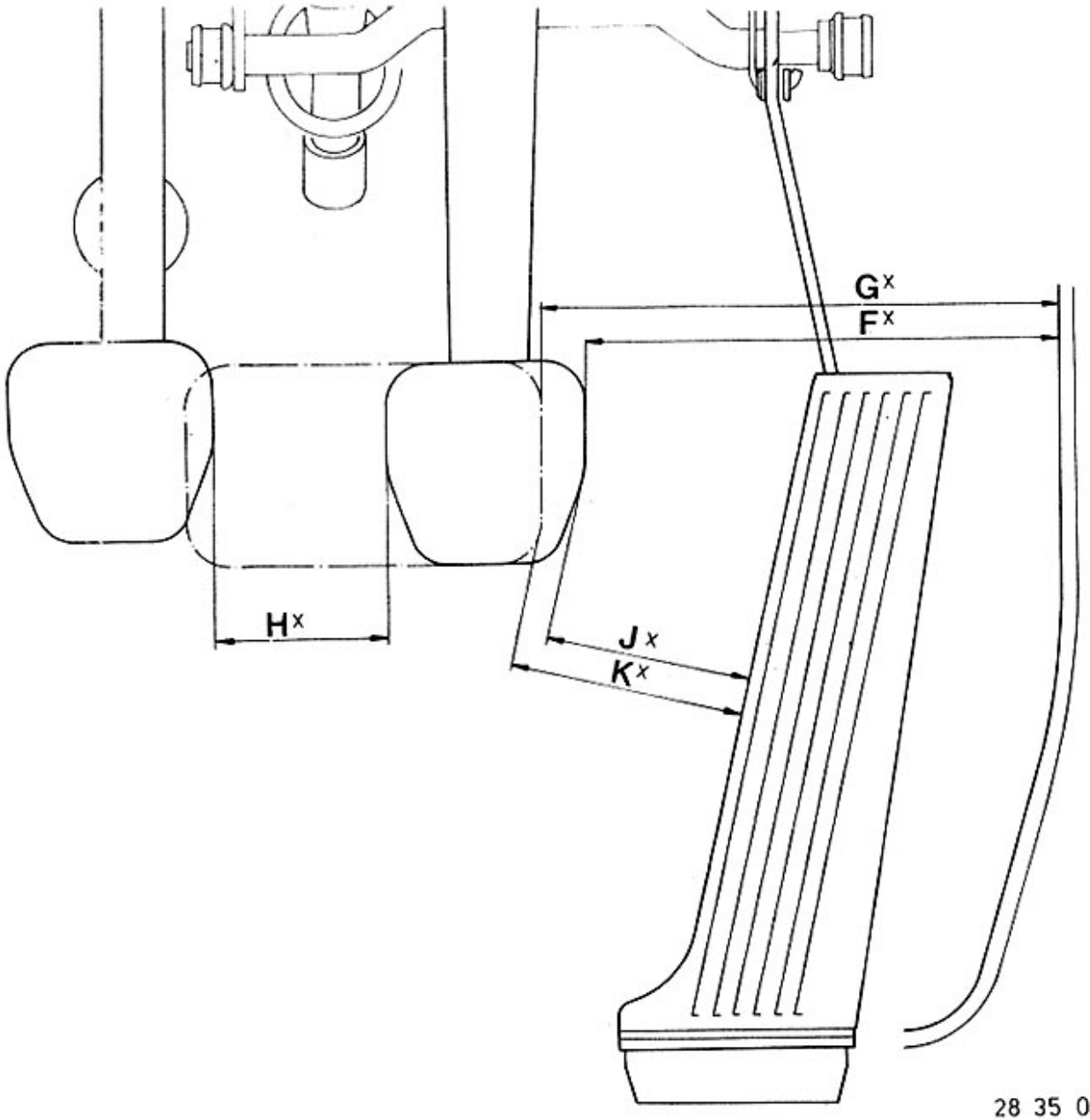
30 35 466

* See Specifications
** See Group 34

35 - 9

SIDE SPACING OF ACCELERATOR PEDAL

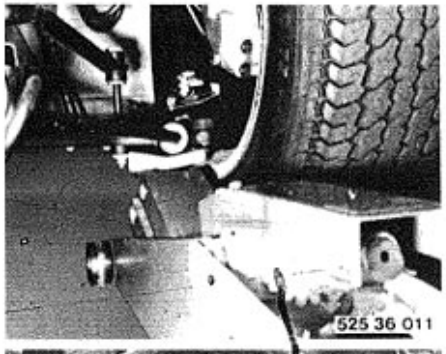
* See Specifications for distances



28 35 004

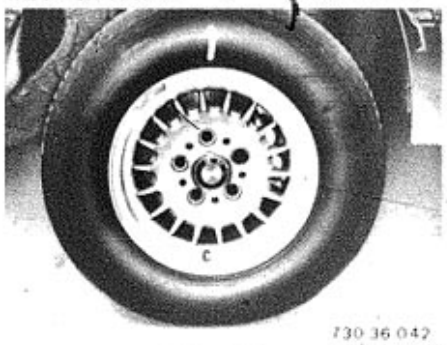
36 Wheels and tires

36 10 008	Front wheel, left or right – electronic balancing (finish balancer)	36- 1
058	Rear wheel, left or right – electronic balancing (finish balancer)	36- 1
209	Wheel, front or rear – checking for lateral and radial runout	36- 2
300	Wheel, front or rear – remove and install	36- 2
508	Wheel – dynamic balancing (wheel removed)	36- 3
36 12 501	Tire – replacing	36- 4

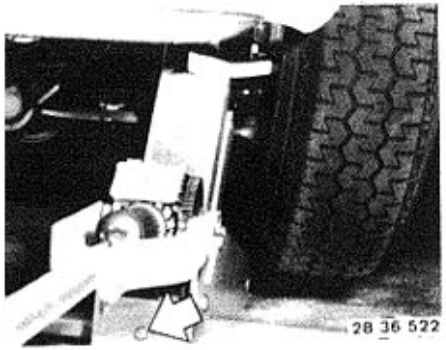


36 10 008 ELECTRONIC BALANCING FRONT WHEEL ON CAR (FINISH BALANCER)

Always first balance wheels stationary, see 36 10 508, prior to electronic balancing.
Check front wheel lateral and radial runout 36 10 209.
Apply gauge for balancing on control arm end.
Use suitable take-up fork or additional fork (see Service Information and other information in Workshop Equipment Publications).
Lift car with gauge.

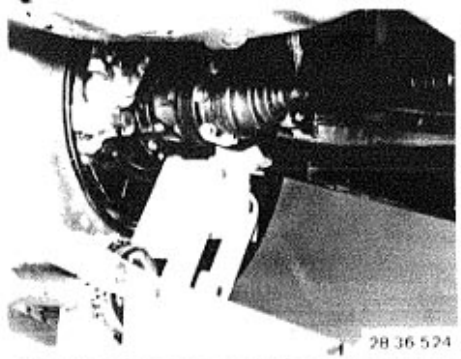


Paste a 3 to 4 cm (1 3/16 to 1 9/16") long strip of tape or make a chalk mark of same length on outside of tire on wheel being balanced, opposite the valve.



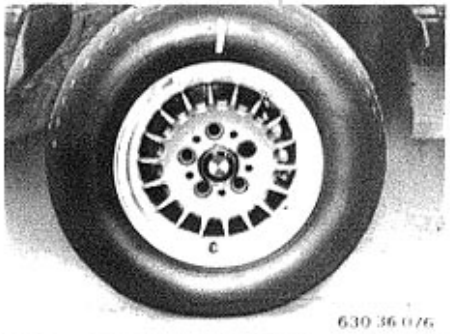
Connect wires for tester.

Important!
Balance wheel according to instructions supplied with balancing equipment.

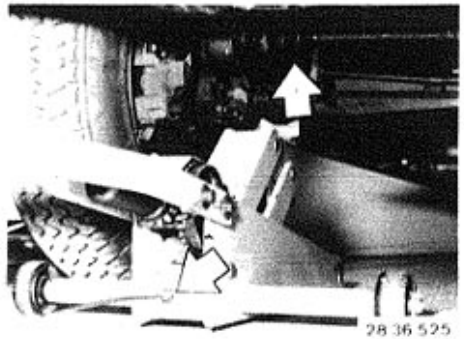


36 10 058 ELECTRONIC BALANCING REAR WHEEL ON CAR (FINISH BALANCER)

Always first balance wheels stationary, see 36 10 508, prior to electronic balancing.
Check rear wheel lateral and radial runout 36 10 209.
Detach and suspend output shaft with a piece of wire.
Apply gauge for balancing on trailing arm, as close as possible to wheel.
Lift car with gauge.
Be careful not to pinch parking brake cables.

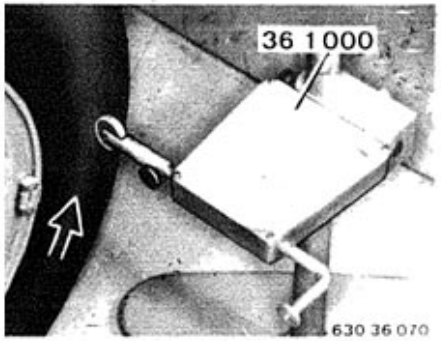


Paste a 3 to 4 cm (1 3/16 to 1 9/16") long strip of tape or make a chalk mark of same length on outside of tire on wheel being balanced, opposite the valve.



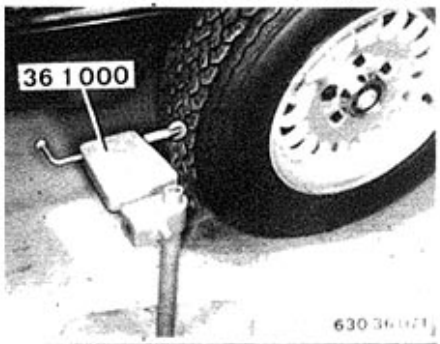
Connect wires for tester.

Important!
Balance wheel according to instructions supplied with balancing equipment.

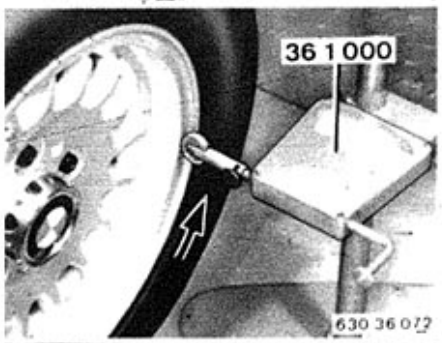


36 10 209 CHECKING WHEEL FOR LATERAL AND RADIAL RUNOUT

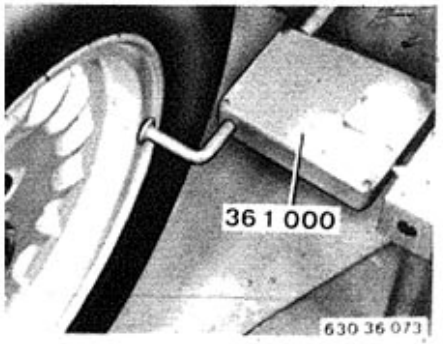
Wheel bearings must be okay.
Lift car.
Check wheel for lateral runout *) with Special Tool 36 1 000.



Check wheel for radial runout *) with Special Tool 36 1 000.

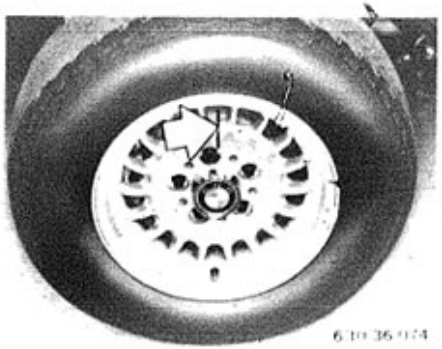


Press off ornamental ring, if appicable.
Check rim for lateral runout *) with Special Tool 36 1 000.



Check rim for radial runout *) with Special Tool 36 1 000.

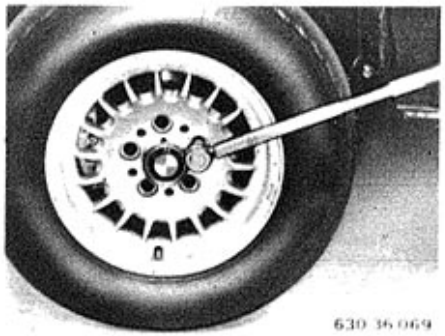
*) See Specifications



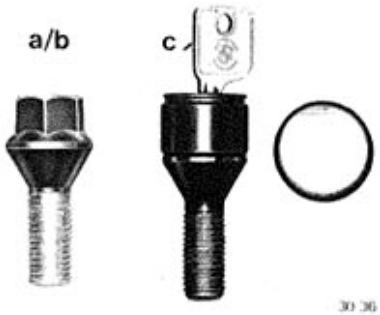
36 10 300 REMOVING AND INSTALLING FRONT OR REAR WHEEL

Loosen wheel bolts.
Important!
Wheel was balanced electronically – mark wheel to wheel hub position before removing.

Installation:
Check wheel bolt threads and tapers for wear, replacing wheel bolts if necessary.
Give wheel bolt threads a light coat of grease, the taper part however must stay free of grease.
Clean mating area – centering collar and bearing surface of wheel rim - to remove dirt and old grease.
Coat with Plastilube **) No. 81 22 9 407 103.

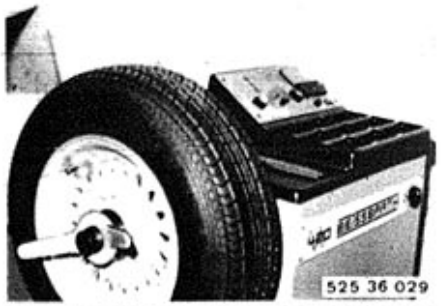


Tighten wheel bolts crosswise.
Tightening torque *).
If new wheel rims are installed for first time, recheck tightening torque *) after 1.000 km (600 miles).



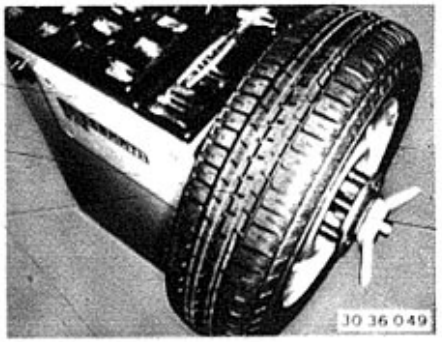
Wheel bolts can be used for either steel or aluminum wheel rims since 9.82.
a) Wheel bolt – galvanized
b) Wheel bolt – black chrome plated
c) Wheel bolt – black chrome plated and locable (special equipment)

*) See Specifications
**) Source: HWB



36 10 508 DYNAMIC WHEEL BALANCING – WHEEL REMOVED –

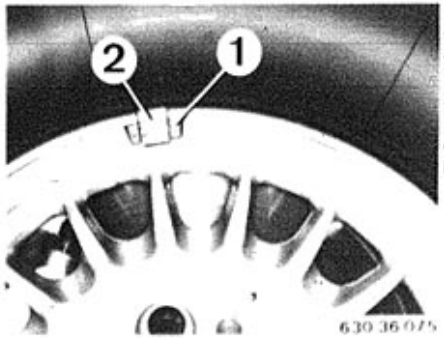
Remove old balance weights, stones in tire treads and large pieces of dirt.
Check tyre pressure, condition of tyre and tyre treads. Look also for distortions or flat spots.
If necessary check wheel and tyre for lateral and radial runout before removing, see 36 10 209.



Balance wheel according to instructions supplied with pertinent balancing equipment.



Use suitable center of pertinent balancing machine supplier.
See Service Information 7 01 81 (831).
1 = Basic flange
2 = Center
3 = Type flange
4 = Clamp



Arrangement of Balance Weights for Aluminium Wheel Rims:
1 = Balance weight
2 = Spring clip
Take up imbalance up to 60 grams with only one weight.
Maximum imbalance per wheel and side *).

REPLACING TIRE:
Refer to operating instructions supplied with pertinent tire mounting machine for correct mounting of tires.
However, also make sure that the machine is in perfect condition and that the wheel rim and tire are not damaged.



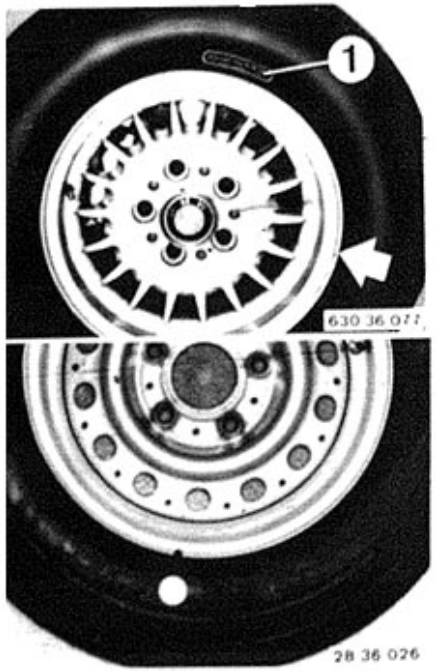
28 36 023

General Tire Removing/Mounting Instructions

Removing

Removal of a tire begins at the valve.
After pressing the tire off of the rim flange, remove balance weights, press tire bead into well and coat thoroughly with tire mounting paste.
Clean wheel rim thoroughly and inspect rim for damage before mounting the tire.
The valve and valve insert must be replaced each time a tubeless tire is removed and installed.

Because of a tight fitting tire, it could often be necessary to loosen the tire on the inside and outside by applying the pressing-off horn on the bead periphery at several points before pressing off the tire.



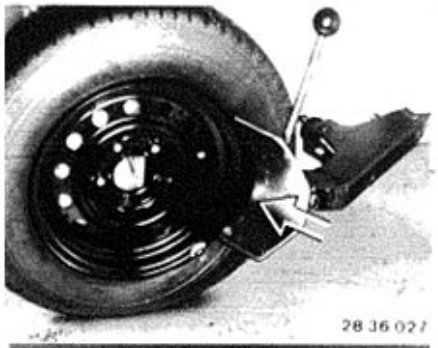
28 36 026

Mounting

Coat tire bead with tire mounting paste.
Make sure tire is mounted on correct side, especially in case of asymmetric tires.
The "outside" of these tires is marked (1).
In addition, the green dot on the tire must be aligned with the punch mark in the rim flange.
Mount tire with as little as possible stress on the beads, since otherwise there would be danger of damaging the tire.

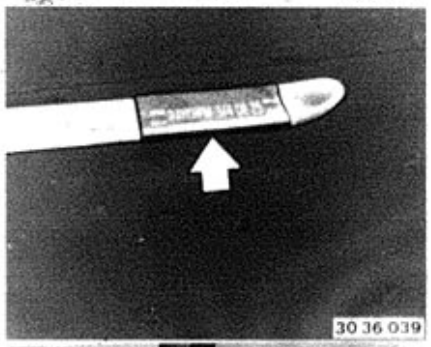
After inflating the tire with max. 4 bar (57 psi) inflation pressure, visually check the tire seating on the basis of the bead grooves.

If the tire is not seated on the rim correctly, increasing the inflation pressure will not improve the tire seating!
Instead it will be necessary to press off both tire beads, apply another coat of tire mounting paste and to inflate the tire again.
Refer to Service Information of Group 36 for approved tires, tire sizes and wheel rims as well as special equipment.



Mounting Tires with a Modern Mounting Machine

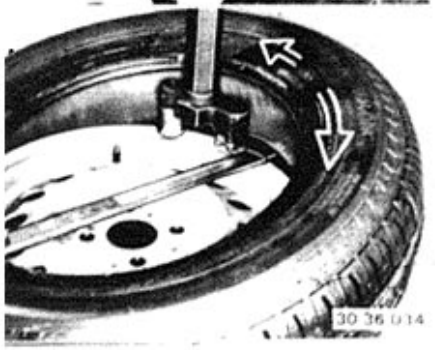
Unscrew valve and deflate the tire.
Press off tire bead from rim flange all around on outside and inside with pressing-off horn of the machine.
If tire beads fit too tight, first only loosen tire from flange at several points with the pressing-off horn prior to the actual pressing-off.
Push both tire beads into rim well completely until they are loose.
Pull off balance weights on rim and clean rim to remove large pieces of dirt.
Coat tire beads with mounting paste.
Clamp wheel on mounting machine.
Narrow rim shoulder always faces up.



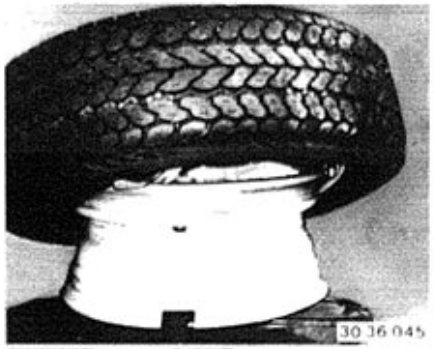
Swing mounting pillar into position or fold and let it engage.
Adjust mounting head, whereby it must be pressed on the rim edge fully and turn down the lever for the clamp; normally the distance of the mounting head will set in automatically.
Valve should be about 10 cm (4") to the right of the mounting head.
Lift tire bead over mounting finger with tire irons.
Use coated or shrink-fit hose covered tire irons for aluminum rims.



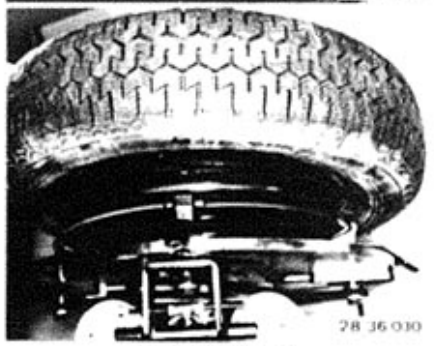
Let mounting machine run back a short distance (counterclockwise) so that the tire bead can slide fully on to the mounting finger.
Then let mounting machine run forward (clockwise) a short distance.
In so doing always check, whether the bottom bead is fully in the well and the tire is given enough time to move.
Stop the machine and let it run back slightly, if the bead clamps.



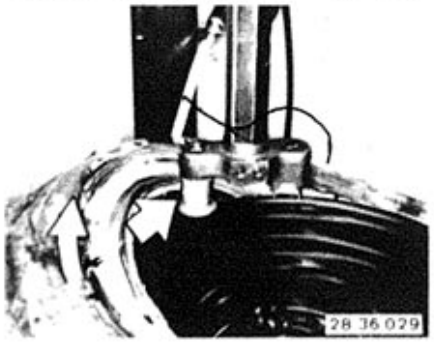
Now also lift the bottom bead over the mounting finger with the tire iron.
Let machine run back a short distance again and then forward (clockwise) briefly, until there is complete separation of the tire from the rim.



Release lock and tilt back or swing away the mounting pillar.
Unclamp and clean the rim.
Replace the valve.
Coat the rim flange and tire beads with mounting paste
Clamp the rim on the mounting machine.
Slide on the tire with the lower bead over the rim flange partially.
Valve is 10 cm (4") to the right of the mounting head.



Swing or tilt the mounting pillar into position and lock.
Check adjustment of the mounting finger, readjusting if necessary and clamp.
Press the tire underneath the mounting finger by hand.
Tire bead should seat in the roller next to the mounting finger.
Let the mounting machine run forward (clockwise) a short distance.
The lower tire bead will drop into the well.



Press the upper tire bead underneath the mounting finger.
Tire bead should seat in rollers next to the mounting finger.
Important!
Don't pinch or damage the bead.
Run the mounting machine forward (clockwise) a short distance, while checking that the lower tire bead remains in the well.

After mounting, first release the clamps and then inflate the tire (without valve).
Increase pressure to 3 bar (43 psi).
If the tire bead does not slide on to the rim edge all around, do not increase the pressure.
Instead the tire must be deflated and the tire bead pressed off, then coat the rim flange with mounting paste again and inflate again with 3 bar (43 psi) pressure.
Screw in the valve and correct the tire inflation pressure.

41 Body

	Introduction	41- 001
	Welding galvanized sheet metal	41- 001
	Safety precautions for working on bodies of cars with SRS	41- 001a
	Die stamping chassis numbers	41- 001b
	Frame control dimensions	41- 002
41 00 151	Front end assembly – replace	41- 003
41 11 016	Engine carrier, right front, with wheel house – replace	41- 101
121	Cover for side member – replace	41- 105
41 12 100	Console for parking brake – replace	41- 107
41 21 051	Door pillar, center, left or right – replace	41- 201
501	Door pillar, front, left or right – replace	41- 203
41 31 001	Roof panel – replace	41- 301
41 32 510	Cowl panel – replace (partial replacement)	41- 304
41 33 001	Front panel complete with front wall – replace	41- 306
081	Front panel lower section – replace	41- 308
41 35 000	Side panel, front – replace	41- 309
281	Side panel, rear, left – replace (partial replacement up to window line)	41- 310
351	Side panel, rear, right (partial replacement up to wheel house) and tail panel – replace	41- 313
41 51 004	Front door, left or right – adjust	41- 501
101	Front door, left or right – replace	41- 503
41 52 004	Rear door, left or right – adjust	41- 508
101	Rear door, left or right – replace	41- 510
41 61 014	Engine hood – align	41- 601
41 62 014	Trunk lid – align	41- 602

GENERAL INFORMATION

The body repair jobs described in this repair manual are limited to the complete or partial replacement of parts with original BMW spare parts or spare part sections.

The pictures show in most cases an unfinished body shell. All parts, which are easily flammable and sensitive to sparks, must be covered accordingly or removed.

Disconnect battery ground lead. Protect electric leads against damage and heat. Conform with fire and accident prevention regulations.

The repairing of any deformed adjacent parts has not been considered in job descriptions.

When removing dents and straightening parts the pertinent welded and spot welded seams have to be inspected and, if necessary, repaired.

In spite of continuous control over welding in standard production there could be isolated cases of defective welding. Such welding will be subsequently repaired by inert gas spot welding or 15 mm (0.591") long inert gas welded seams on flange end in inaccessible zones. Consequently repaired welding seams on the body do not necessarily indicate repairs carried out by a third party.

Example: left engine carrier resistance spot welded – right engine carrier inert gas repair welded.

Important!
New sheet metal parts or the cavities, seams, cracks and folds formed by new sheet metal parts must be sealed with a body sealing compound immediately.

Refer to Specifications of Group 41 for a table of adhesives, sealing compounds and other products.

REMOVING PVC MATERIAL IN REPAIR AREA

Corrosion inhibition after repairing begins already with the professional removal of PVC undercoating, anti-drumming compound and seam sealing compound in the repair area.

Remove PVC material with a rotating steel brush, or heat PVC to maximum 180° C (355° F) with a hot air blower and scrape off with a spatula. Burning off the PVC material or heating it above 180° C (355° F) with a gas flame torch or similar tool would produce strong corrosion-promoting hydrochloric acid. Health impairing vapors would also be set free. New undercoating would not have sufficient adhesion on burnt PVC material and consequently undersurface rusting would be possible.

WELDING GALVANIZED SHEET METAL

Hot galvanized and galvanized sheet metal is used to a greater extent for components of the body, which are especially subject to corrosion.

Conformance with the following points is necessary when working with these parts.
The welding smoke contains poisonous zinc oxide, so that especially good extraction is necessary in the welding bay.
Do not grind off zinc coat for resistance spot welding and inert gas welding.
The zinc coat must be ground off for brazing jobs.

If at all possible welded connections should be made with resistance spot welding. Welding current is boosted by at least 10 % as compared with blank sheet metal. Apply as high as possible electrode contact force (make break out test on sample sheet metal). A coat of spot welding paste can be applied for better sealing.

Inert gas welding should be preferred to autogen welding in areas not accessible for resistance spot welding, because of the reduced heat dispersion.
Machining or forming of galvanized sheet metal in warm state is normal.
Make sure of thorough extraction of poisonous vapors.
Remove burnt residual zinc completely.
Align, grind down and tin out visible joints as normally.

41- 001a

SAFETY PRECAUTIONS FOR WORKING ON BODIES OF CARS WITH SRS

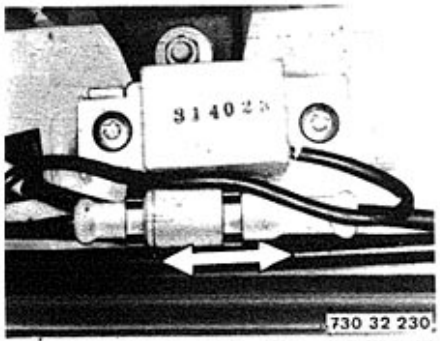
Caution!
Improper handling could cause unwanted activation of SRS and in turn lead to injury! Refer to Group 32 for complete details on safety regulations.

Parts of SRS must not be subjected to heat greater than 100° C (212° F), not even briefly.

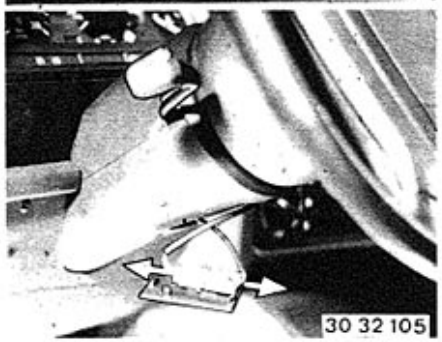
If there is danger that working on the body could subject the parts of SRS to strong vibrations, they should be removed as a precautionary measure.

In case of deformation or when installing the holders for both crash sensors in the left and right front wheel houses, make sure that the holders are aligned parallel to the car's longitudinal axis precisely.

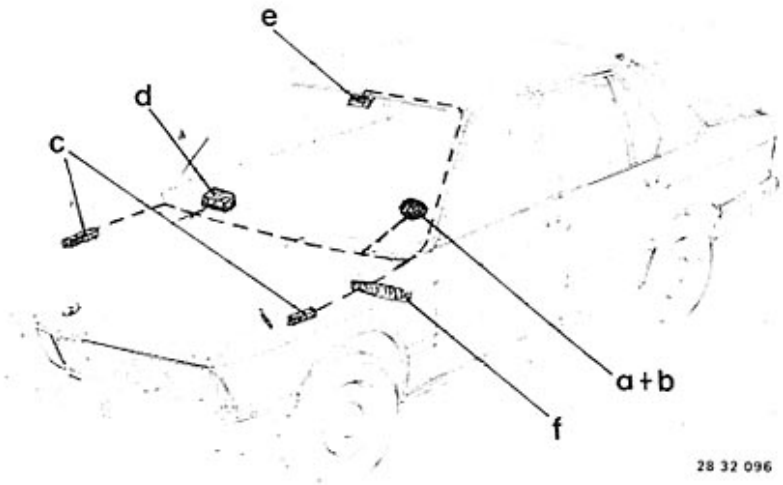
Also refer to the repairing instructions and safety regulations concerning SRS in Group 32.



Disconnect both poles of the car's battery and cover the battery poles before working with an electric welder.
Disconnect the plugs of both front sensors in the left and right wheel houses.



Lift the cap out of the lower steering wheel casing section and disconnect the plug.



Components

a) SRS steering wheel with impact shell and impact pad, in which the airbag, gas generator and ignition pill are integrated.

b) Contact ring – guarantees power supply to the ignition pill.

c) Two crash sensors (left and right in front wheel houses) and safety switch left.

d) Electronic diagnosis unit (in glove box) with integrated safing sensor (prevents unwanted activation).

e) SRS indicator lamp integrated in check control unit.

f) Knee guard

STAMPING CHASSIS NUMBER

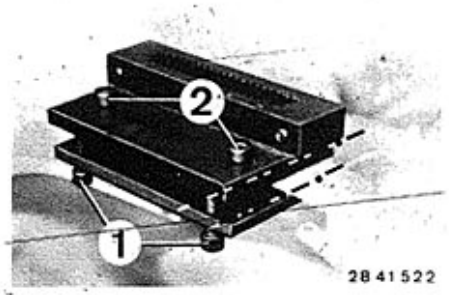
If the stamped chassis number is removed in a repair operation, it must be stamped again.
Important!
The chassis number can only be stamped after removing the side panel.



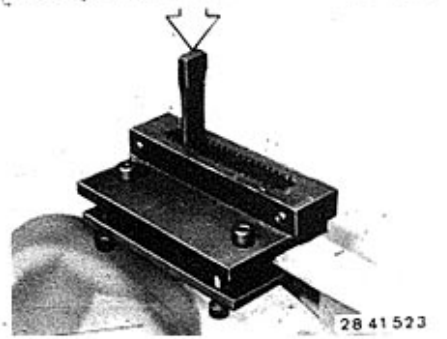
Apply Special Tool 41 1 000 that baseplate rests on support and wheel house.



Align baseplate to be parallel with bolts (1).
Tighten bolts (2).



Marking Punches:
Insert and drive in to fixture separately.
If parts or the body have been replaced in workshops, stamp a "+" in place of the BMW emblem for definite front and rear bordering.



41-002a

FRAME REFERENCE DIMENSIONS – BMW '5' SERIES E 28

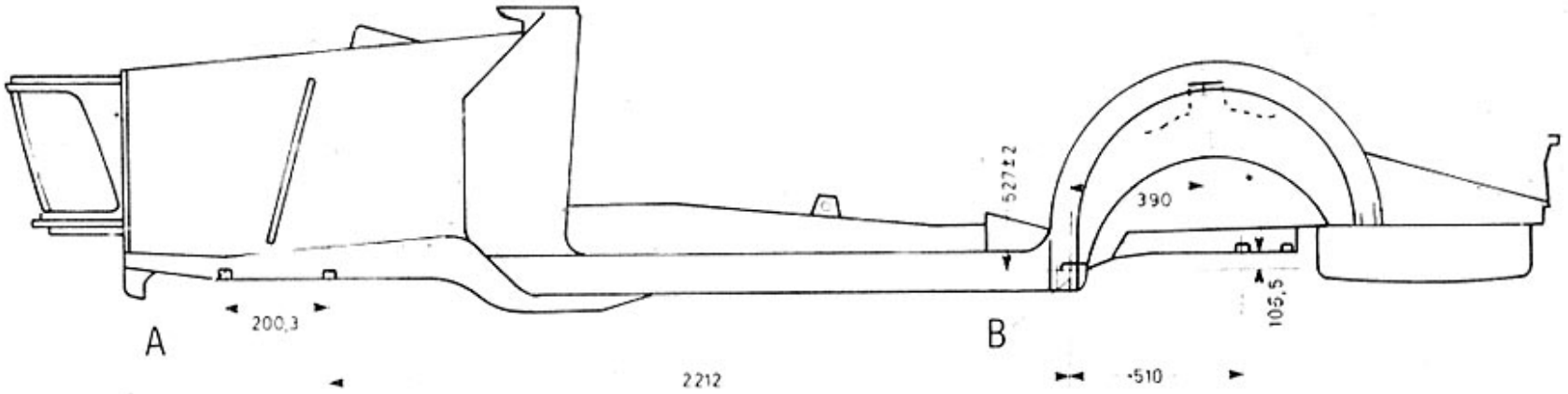
Distance between rear axle rubber mount holes, front: 90 mm

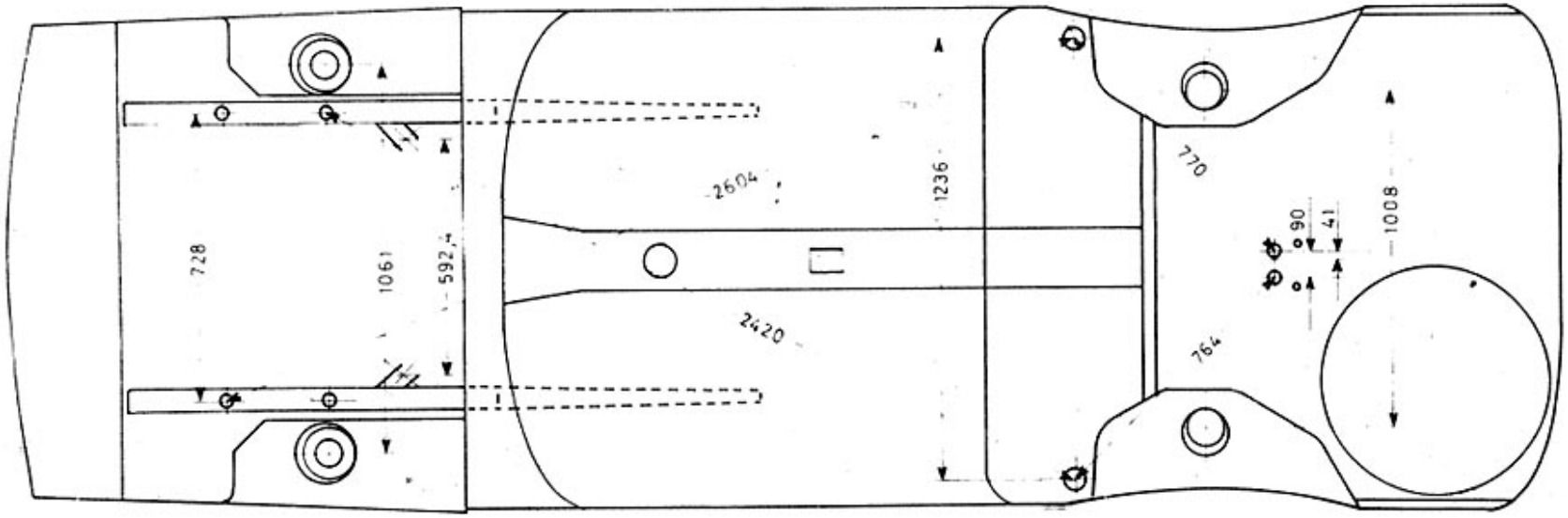
A Front axle take-up

B Rear axle take-up

Dimensions in mm. Tolerance for dimensions when not specified: ± 1.5 mm.

Note:
Only use the following values for rough checks. Precision repairs can only be made with the set of approved attachments in conjunction with a straightening bench.





41-002 b

FRAME REFERENCE DIMENSIONS – BMW '5' SERIES E 28

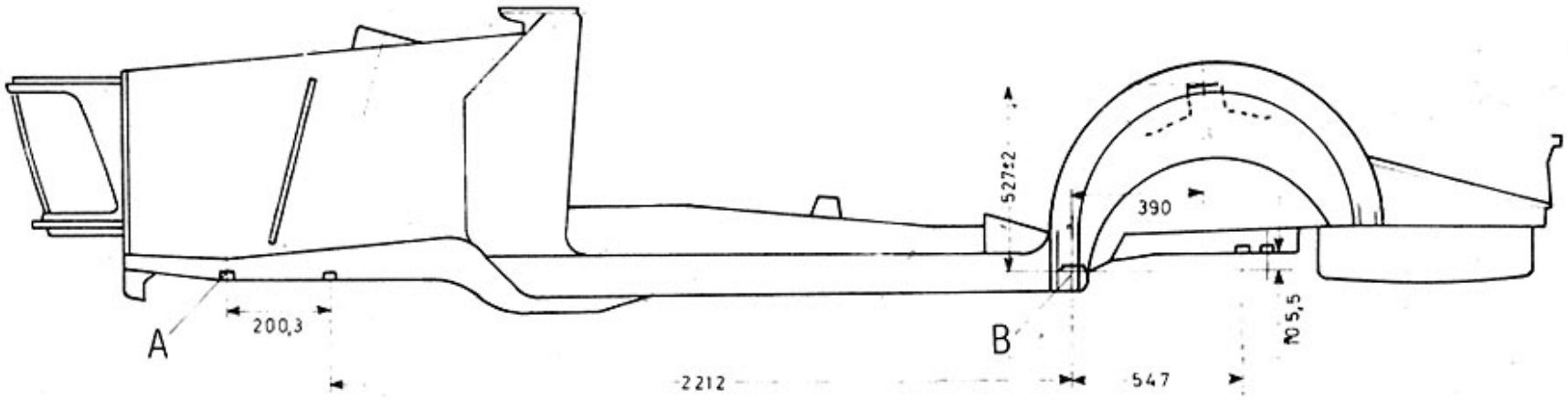
Distance between rear axle rubber mount holes: 154 mm.

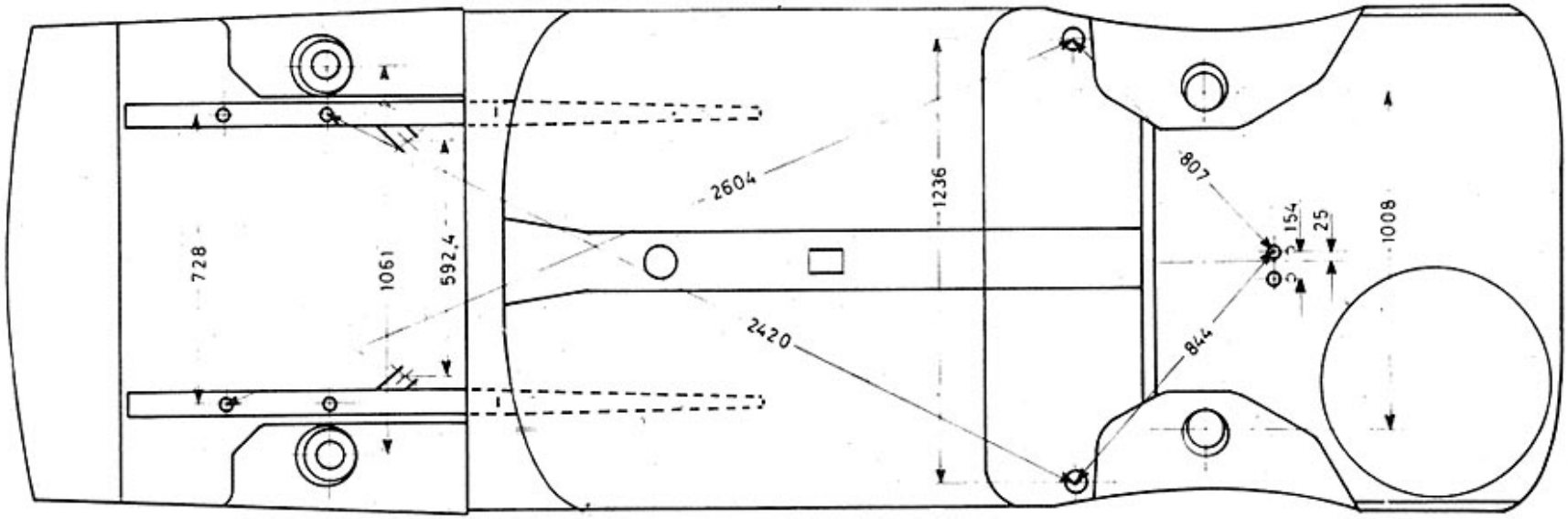
A Front axle tanke-up

B Rear axle take-up

Dimensions in mm. Tolerance for dimensions when not specified: ± 1.5 mm.

Note:
Only use the following values for rough check. Precision repairs can only be made with the set of approved attachments in conjunction with a straightening bench.



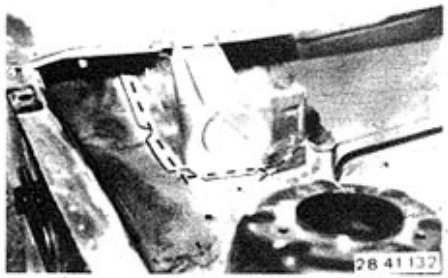


28 41 201

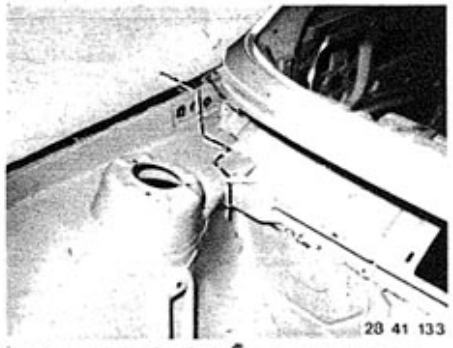
41 00 151 REPLACING FRONT END ASSEMBLY

Refer to information on 41 - 001.
Remove engine hood, both side panels, radiator, engine complete with transmission and front axle, battery, engine oil cooler, exhaust assembly, propeller shaft, brake lines and fuel lines in engine compartment, fuse/relay carrier and wire harness, speedometer drive cable, pedal base assembly, ignition coil, washing fluid tank, power steering oil tank, windshield, instrument panel trim, front bumper, all radiator grills, both double headlights, both horns, windshield wipers, rain moldings, engine hood locks, carpet in passenger compartment and insulation sheet on firewall.
Check and adjust front and rear wheel alignment.
Bleed brakes and clutch.
Adjust engine idle speed and fuel/air mixture.
Aim headlights.
Die stamp chassis number and transfer data plate.

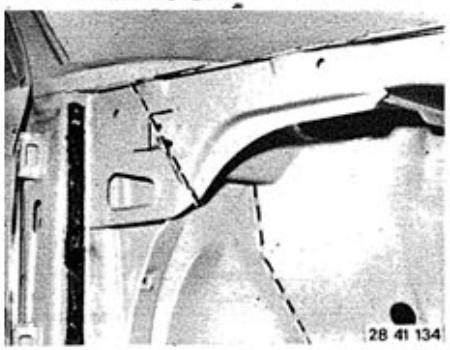
Cut off connecting plate.



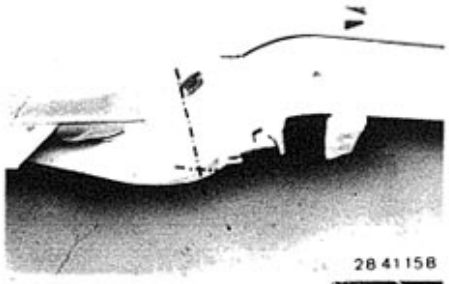
Cut off wheel house along line.



Cut through support member.
Cut off wheel house along line.



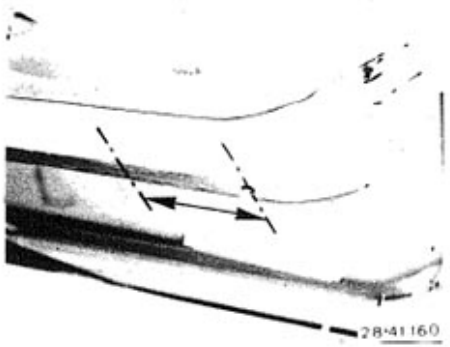
Cut off engine carrier along line.
Lift off front end.



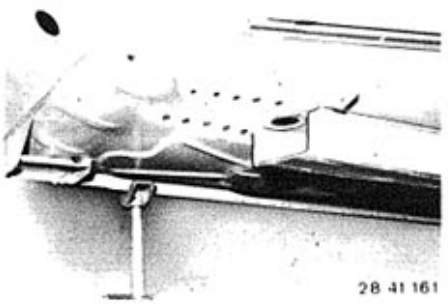
Measure off distances for cutting new front end, correcting angle if necessary.

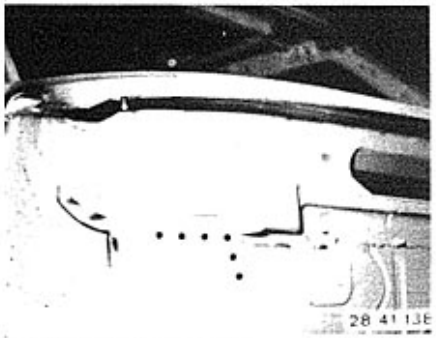


Transfer determined distances to remaining section of engine carrier.
Cut through engine carrier along line.

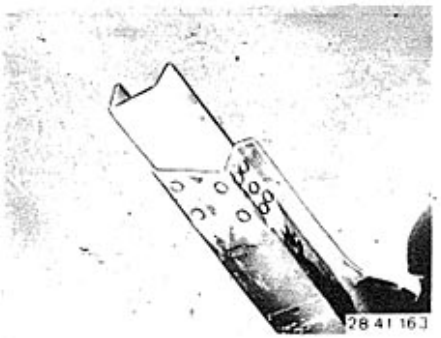


Drill off welding spots.
Grind off welding seams.
Remove scrap metal.

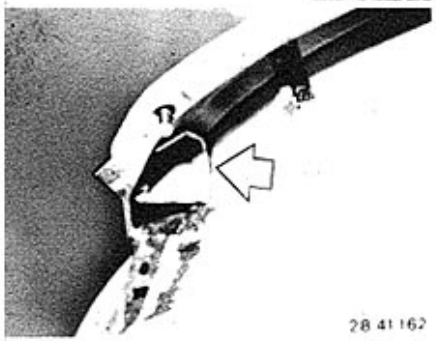




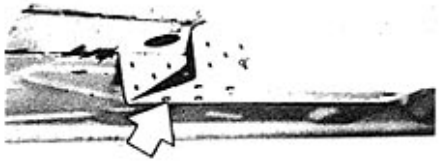
Remove scrap metal.
Straighten and grind mating surfaces.
Drill holes for plug spot welding.



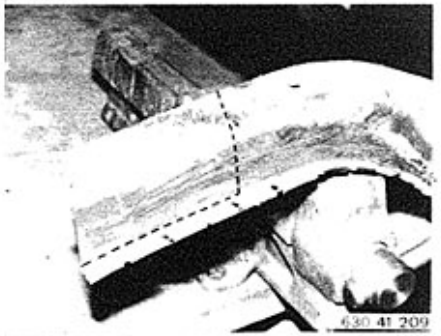
Drill holes in new engine carriers for plug spot welding.
Insert and plug spot weld reinforcement.



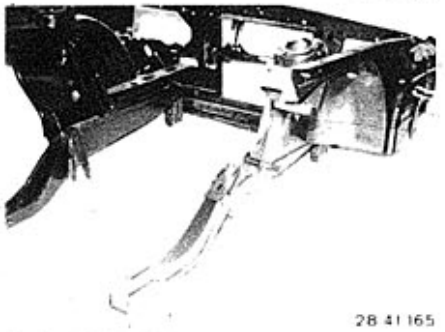
Note:
Note sheet metal triangle underneath cowl panel.



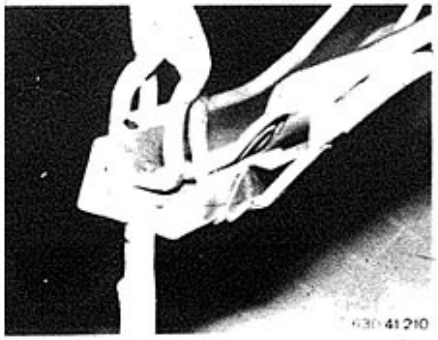
Drill holes in remaining engine carrier sections for plug spot welding.



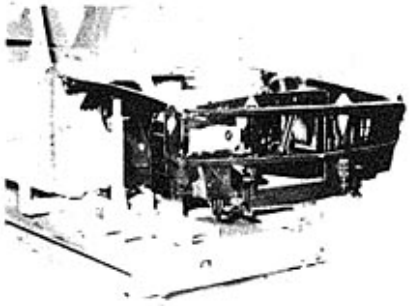
Cut off approx. 120 mm (4.724") ahead of cut out engine carrier section and prepare for use as a reinforcement.
Sheet metal thickness = 1.75 mm (0.069").



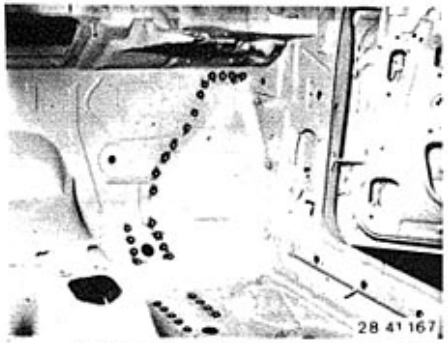
Grind mating surfaces on new front end.



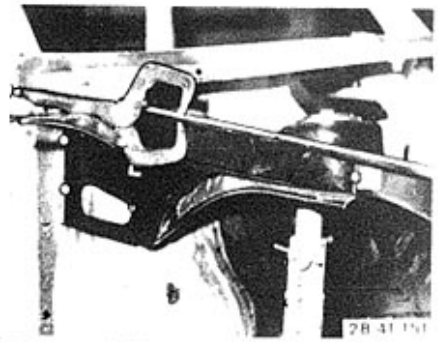
Cut u-section member apart and cut off twice the sheet metal thickness.
Place and tack weld u-section member in new engine carrier.



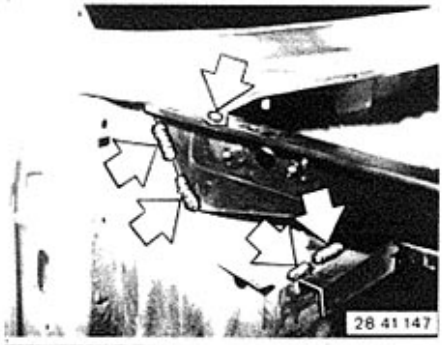
Set up car on straightening bench and fit in front end.



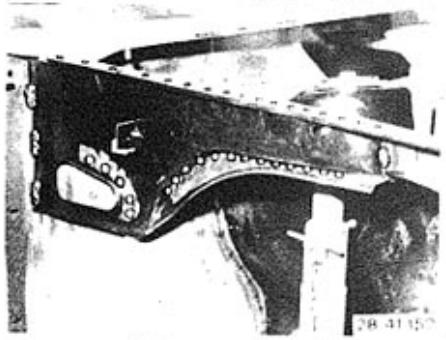
Inert gas plug spot weld front end on firewall.



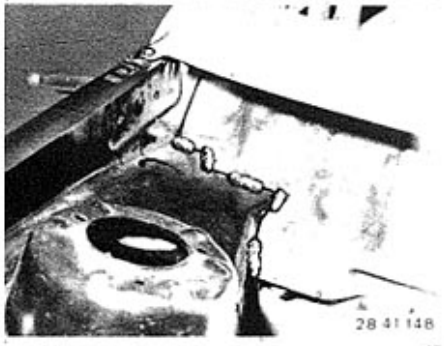
Grind mating surfaces on support member.
Coat spot welding edges with spot welding paint.
Clamp on and tack weld support member.



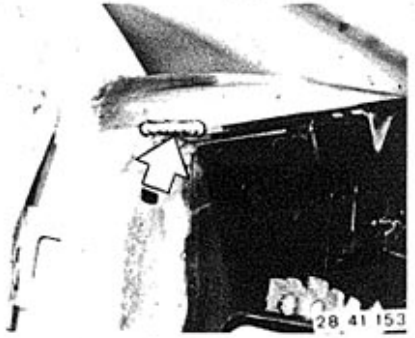
Weld front end on firewall and spot weld on cowl panel.



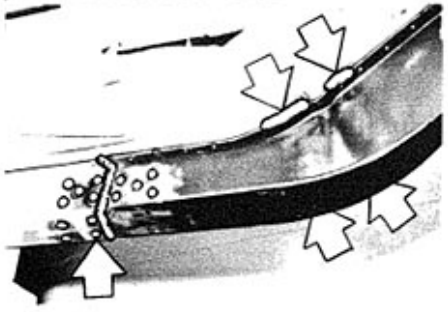
Spot weld and weld support member.



Weld front end on firewall.

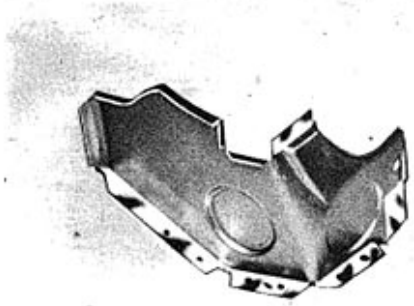


Plug spot weld support member on heater wall and braze in area of cowl panel.
Note:
If not damaged, coat visible painted surface on cowl panel with heat protection paste.



Inert gas plug spot weld engine carrier.
Weld cut.
Produce inert gas welding seams on inside and outside.

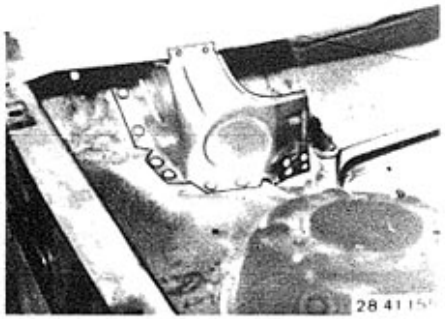
28 41 168



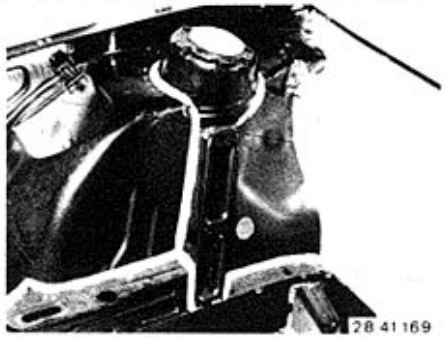
Grind mating surfaces on connecting plate and prepare for plug spot welding.

28 41 154

Spot and/or plug spot weld connecting plate.
Note:
Seal off connecting plate on cowl panel.



Coat joints and spot welding edges on front end on inside and outside with a joint sealing compound.
Spray outside of wheel housings with an anti-drumming compound.

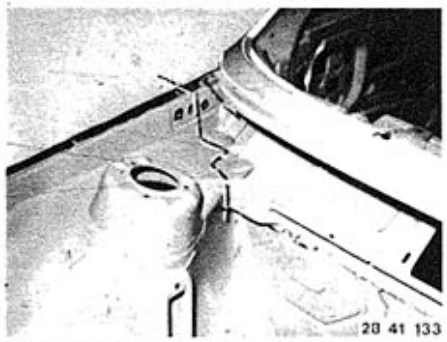


41 11 016 REPLACING FRONT RIGHT ENGINE CARRIER WITH WHEEL HOUSE

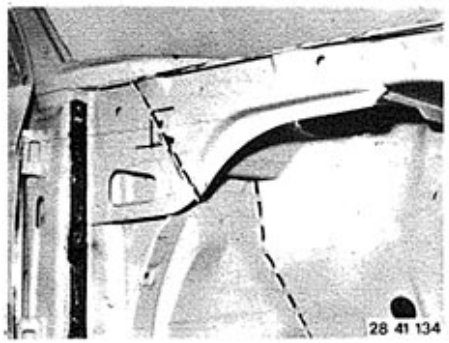
Refer to information on 41 - 001.
Remove front bumper assembly, all radiator grills, entrance strips, instrument panel trim, glove box assembly, front seat, front and rear entrance strips, B pillar trim, heater insulation sheet, A pillar carpet, carpet folded away, heater wall insulation sheet, engine hood assembly, all headlights and turn signals, both horns, heater end wall, left and right engine hood locks with cables, exhaust assembly, front axle carrier with engine, transmission and spring struts, brake lines as required, engine and car wire harnesses partially, front panel lower section and both front side panels.
Remove front panel complete with front wall 41 33 001.
Check and, if necessary, adjust front and rear wheel alignment.



Cut out connecting plate.



Cut off wheel house along line.

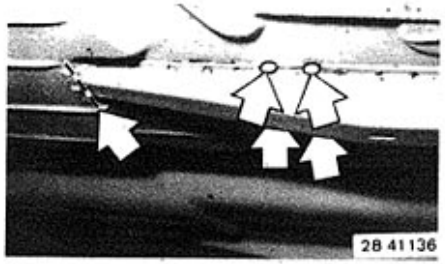


Cut through support member.
Cut off wheel house along line.



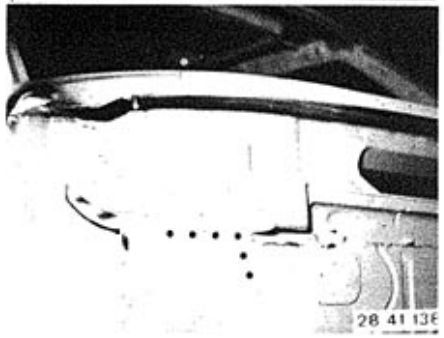
Remove insulation sheet.
Drill off welding spots.

Grind off welding seams.
Drill off welding spots in area of cross member from below.

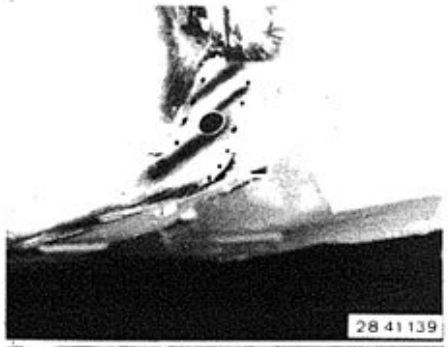




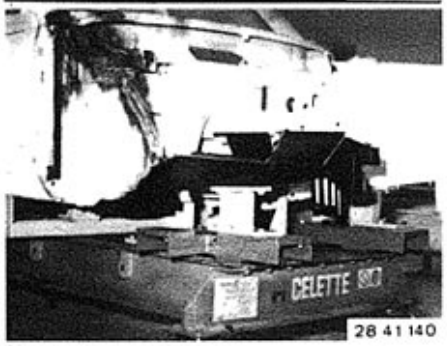
Grind off left and right welding seams.
Take off engine carrier with wheel house.



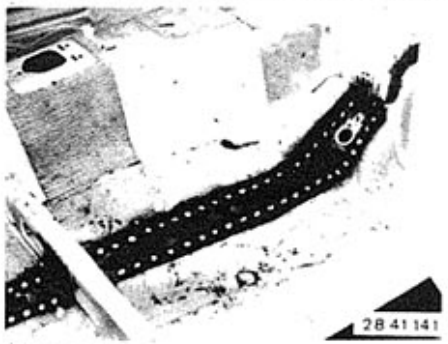
Straighten and grind mating surfaces.
Drill holes for inert gas plug spot welding.



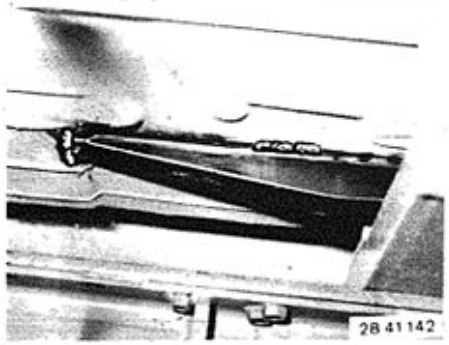
Straighten and grind mating surfaces.



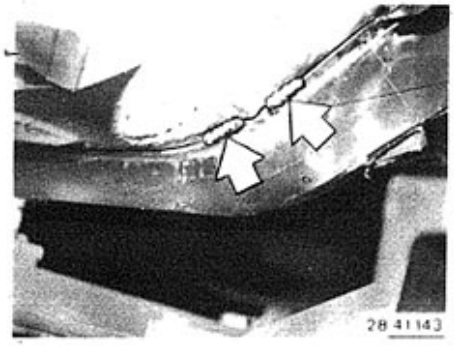
Set up car on straightening bench and fit in engine carrier.



Inert gas plug spot weld engine carrier.



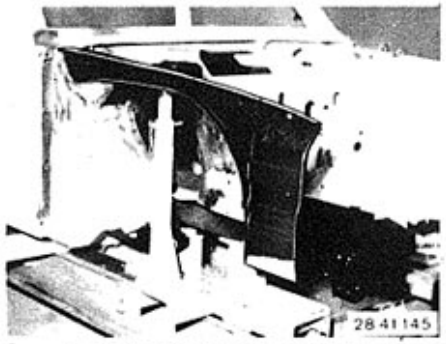
Inert gas weld engine carrier at rear and in area of cross member.



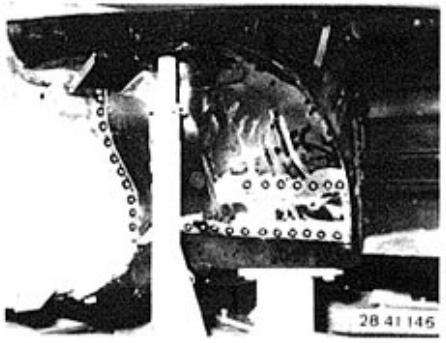
Inert gas weld inside and outside of engine carrier.



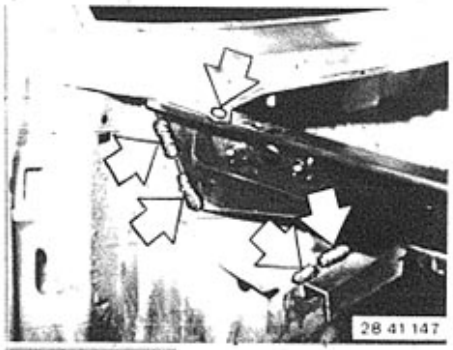
Grind mating surfaces on new wheel house. Drill holes for plug spot welding.



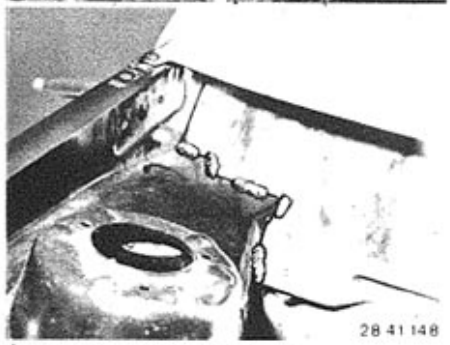
Set up wheel house on straightening bench and tack weld.



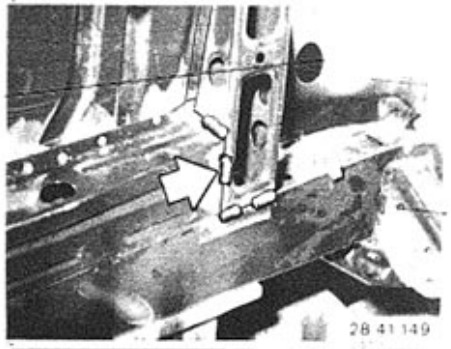
Inert gas plug spot weld wheel house on firewall and engine carrier.



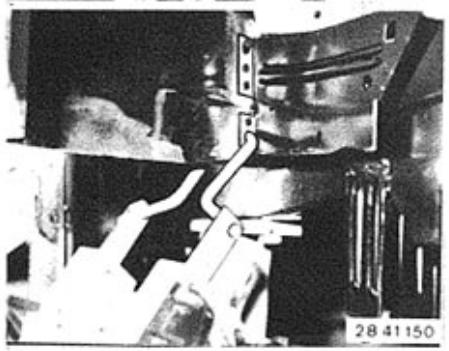
Weld wheel house on firewall and spot weld on cowl panel.



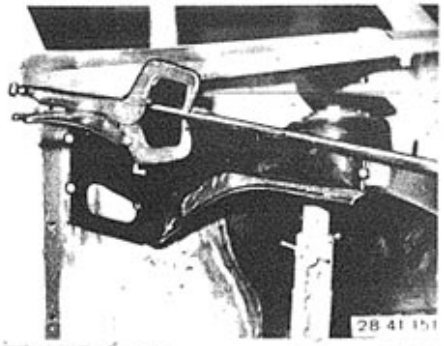
Weld wheel house on firewall.



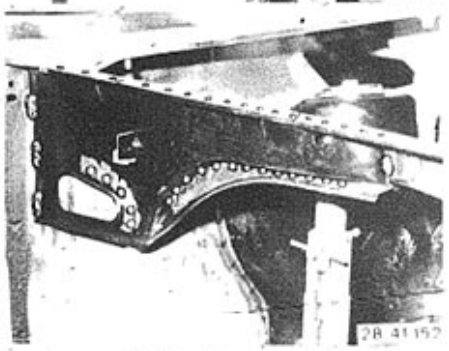
Weld reinforcement on engine carrier.



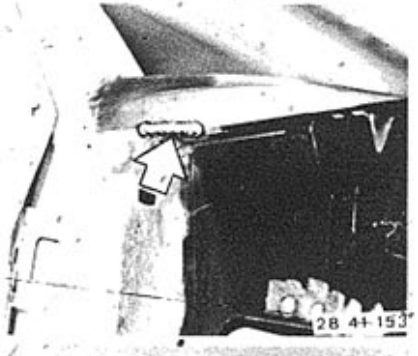
Spot weld engine carrier on wheel house.



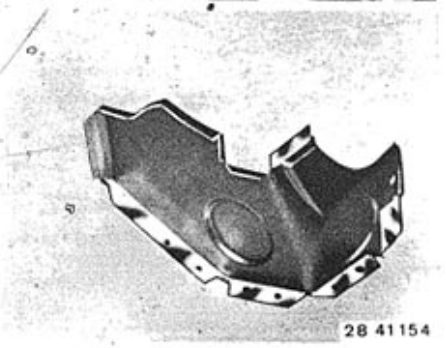
Grind mating surfaces on support member.
Coat spot welding edges with spot welding paint.
Clamp on and tack weld support member.



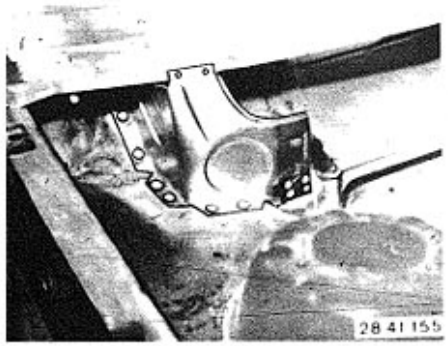
Spot weld and weld support member.
Plug spot weld on heater wall.



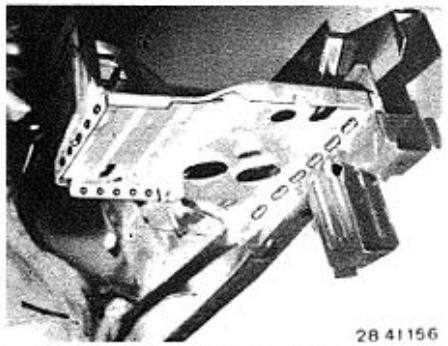
Braze support member in area of cowl panel.
Note:
If not damaged, coat visible painted surfaces on cowl panel with heat protection paste.



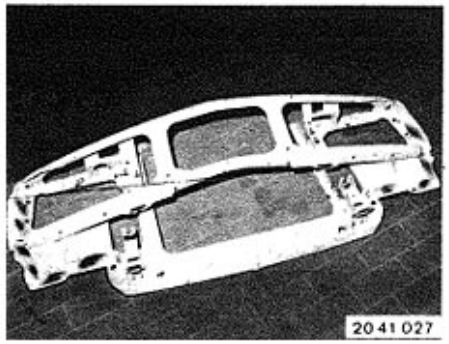
Grind mating surfaces on connecting plate and prepare for plug spot welding.



Spot weld and plug spot weld connecting plate.
Note:
Seal off connecting plate on cowl panel.



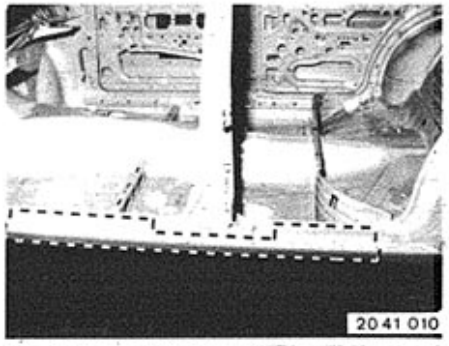
Insert and spot weld or weld end plate.



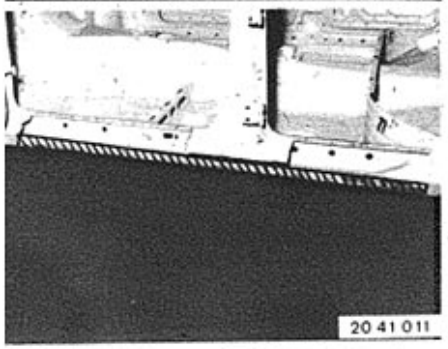
Install front panel with front wall 41 33 001.
Coat joints with a joint sealing compound.
Spray wheel house with an anti-drumming compound.

41 11 121 REPLACING COVER FOR SIDE MEMBER

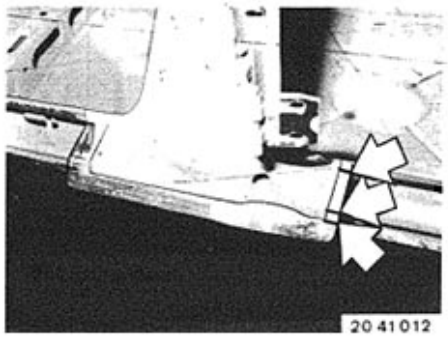
Refer to Introduction – 41 - 001
Remove rear door.
Remove edge guard on roof frame, plate for B pillar, front and rear seats, edge guard on B pillar.
Detach front and rear carpets as required.



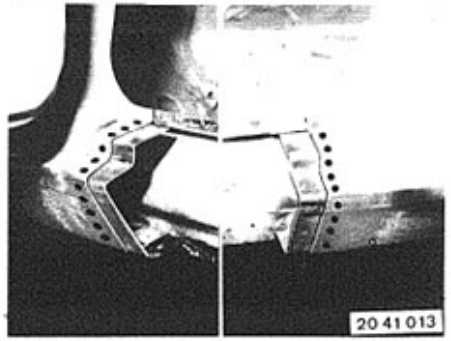
Cut off cover along line.



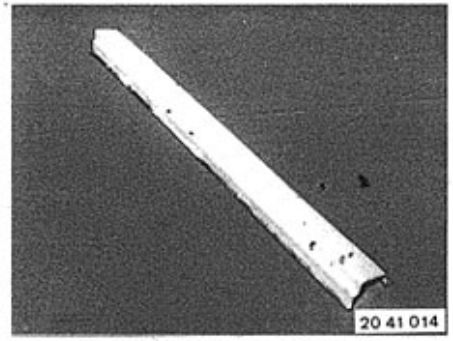
Remove scrap metal.
Straighten mating surfaces and grind both sides.
Coat with zinc dust paint.



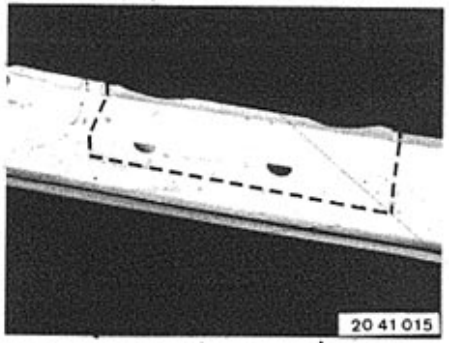
Make cuts in edges in B pillar area and shoulder with a shouldering pliers.



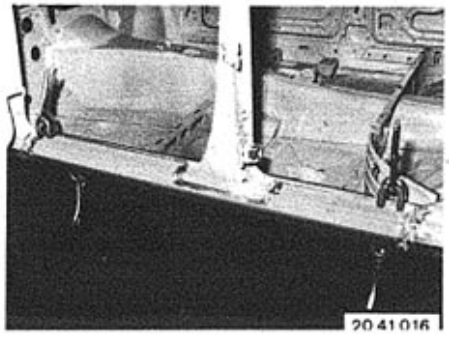
Cut off 2 approximately 60 mm (2.362") wide strips from rest of new cover and spot weld to reinforce.



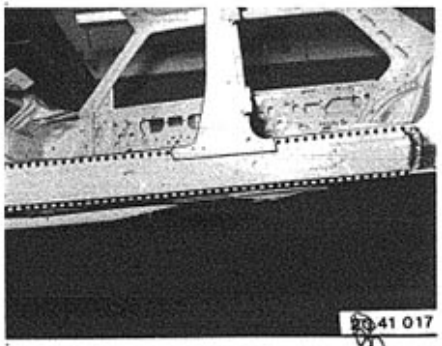
Grind mating surfaces of new cover on both sides and coat with zinc dust paint.



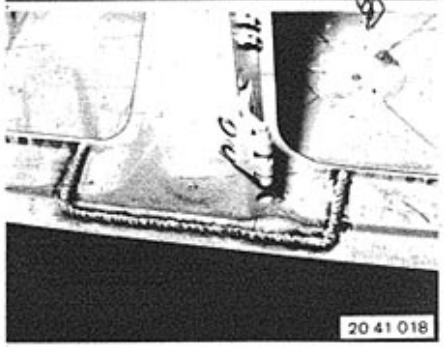
Cut out new cover in area of B pillar.



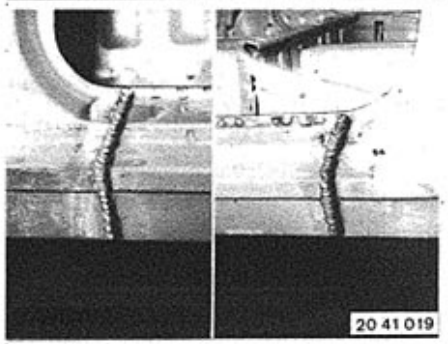
Fit in cover and hold with pliers.



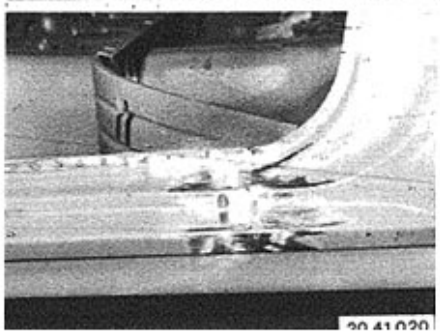
Spot weld cover.



Inert gas weld cover in area of B pillar.
Caution!
Danger of distortion from excessive heat.



Inert gas weld cover in area of A and C pillars.
Caution!
Danger of distortion from excessive heat.



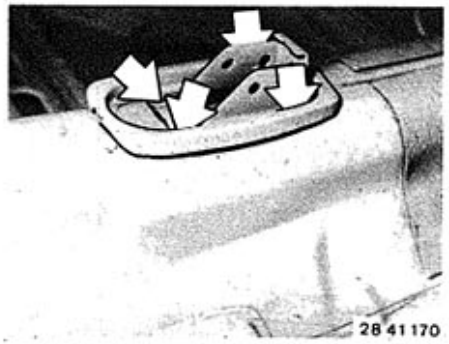
Grind down and, if necessary, tin out welded seams.
Spray underside of cover with a body sealing compound.

41 12 100 REPLACING PARKING BRAKE CONSOLE

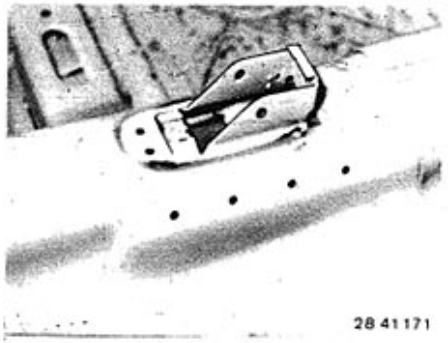
Refer to information on 41 - 001.
Remove both front seats, carpets, insulation sheet, exhaust assembly, propeller shaft and parking brake lever.
Adjust parking brake and parking brake switch.



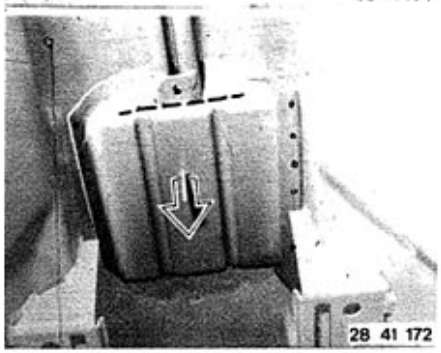
Straighten and grind mating surfaces.
Insert console.
Plug spot weld console.
Grind down welding spots.



Cut out retaining ring for sleeve carefully.

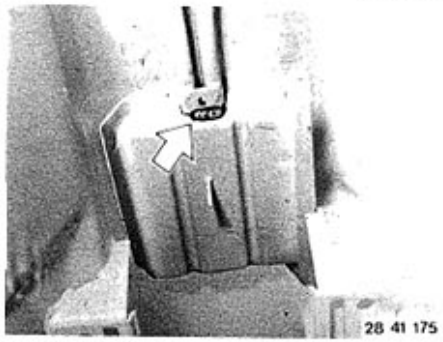


Drill off welding spots.
Caution!
Don't damage the guide tubes.

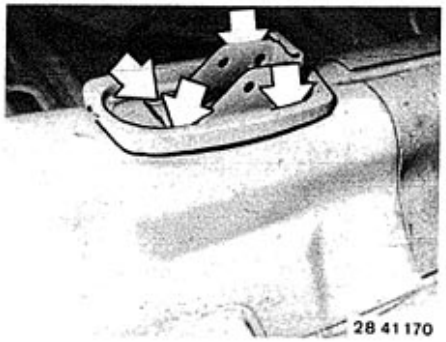


Cut through console/guide tube welded seam connection.
Pull out console toward front.

28 41 174



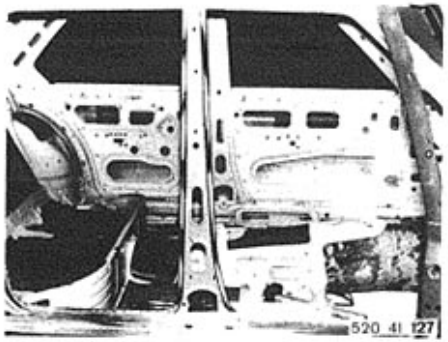
Tack weld guide tubes.



Position and weld retaining ring.
Spray over damaged antidrumming compound.

41 21 051 REPLACING RIGHT CENTER DOOR PILLAR

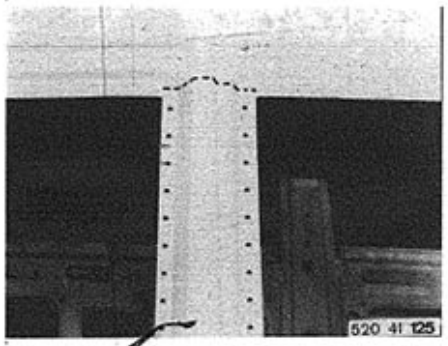
Refer to Introduction – 41 · 001
Remove rear door 41 52 080.
Remove front seat 52 10 010.
Remove door pillar trim 51 43 150.
Remove rear seat, plate on door pillar, ornamental strip on rain molding, grab handle and front and rear entrance cover strips.
Pull off edge guards and weatherstrips on door pillar.
Detach roof liner and carpets as required.



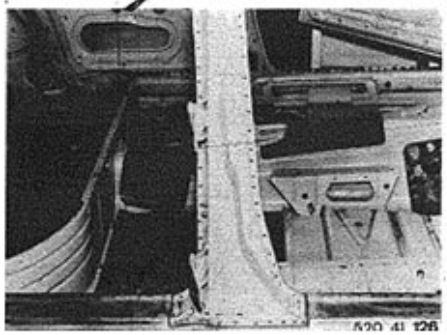
Remove door pillar with a hammer and chisel.
Grind mating surfaces of door pillar end plate on both sides and straighten end plate.

Grind mating surfaces of new door pillar on both sides.

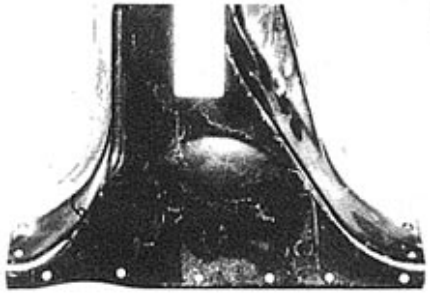




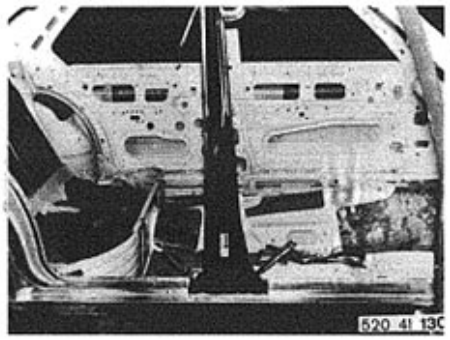
Cut top of door pillar along line down to the end plate with an iron saw.
Drill off spot welding.



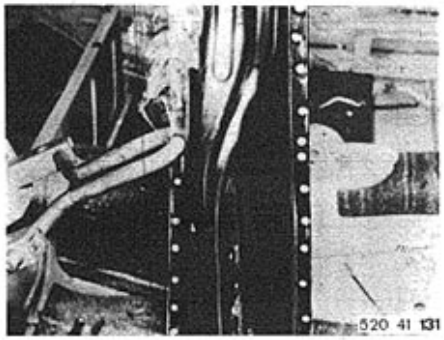
Drill off spot welding on door pillar.



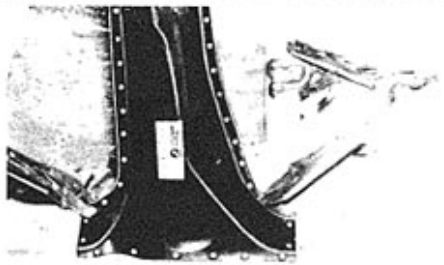
Drill holes in new door pillar to facilitate spot welding in area of entrance.



Hold door pillar with body pliers and align.
If applicable, install rear door and check door gap.

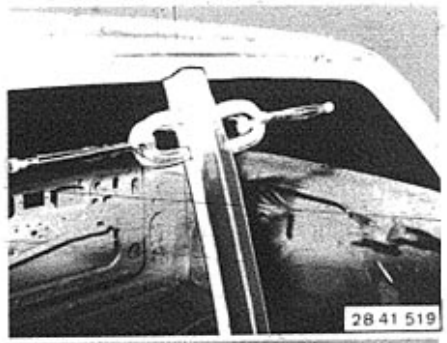


Spot weld door pillar on end plate without stress.

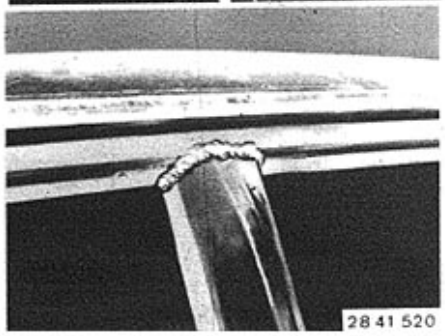


Spot weld door pillar in area of entrance with an inert gas welder.

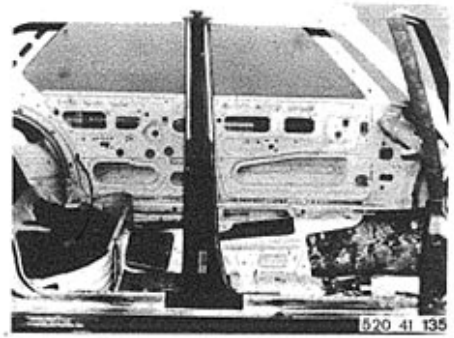




Align top of door pillar with roof frame with a clamp and tack weld.
Remove clamp.



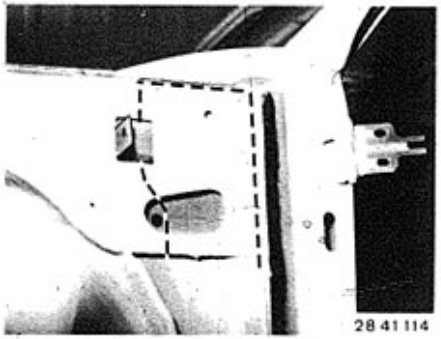
Inert gas weld door pillar at top.



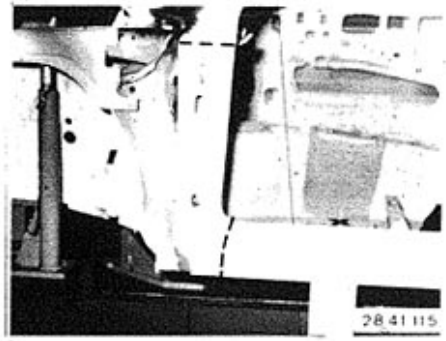
Grind down and deburr spot welded edges and welded seams.

41 21 501 REPLACING LEFT OR RIGHT FRONT DOOR PILLAR

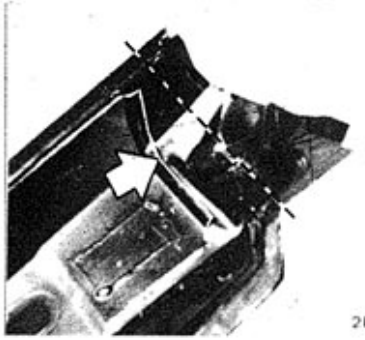
Refer to information on 41 - 001.
Remove front seat, front door, instrument panel trim, rear weatherstrip for engine hood, contact switch for inside light, engine hood release lever with base, inside and outside entrance cover strips, edge guards and weatherstrips for door, carpet on side in passenger compartment, roof pillar trim, foam rubber for roof pillar trim, strip on rain molding, battery ground lead, if applicable fuse box and wire harness.
Disconnect rubber insulation sheet on firewall partially.


28 41 114

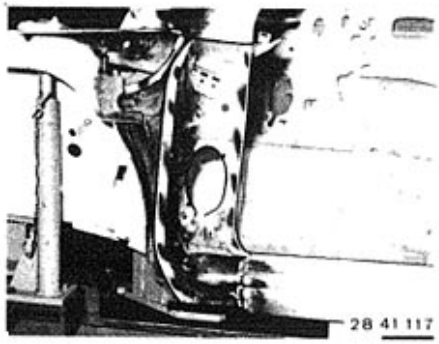
Cut out support member partially.
Remove scrap metal.


28 41 115

Make cuts that new part overlaps approx. 20 mm (3/4").

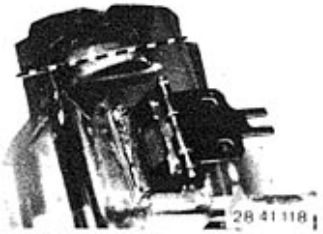

28 41 116

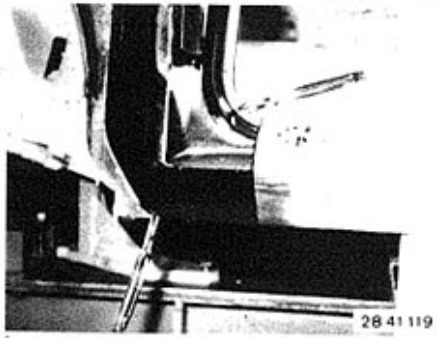
Note:
Place top cutting line above reinforcement plate.


28 41 117

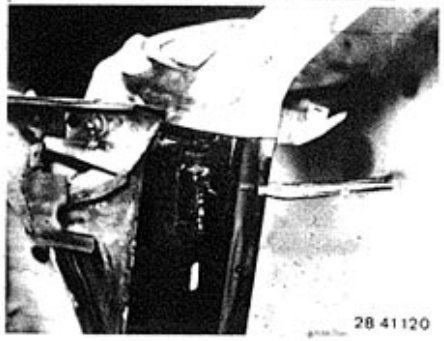
Remove scrap metal.
Straighten mating surfaces.

Cut off new door pillar above reinforcement plate.

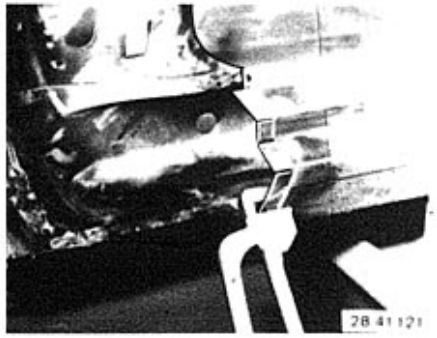

28 41 118


28 41 119

Clamp on and straighten new door pillar.
Mark cutting line.


28 41 120

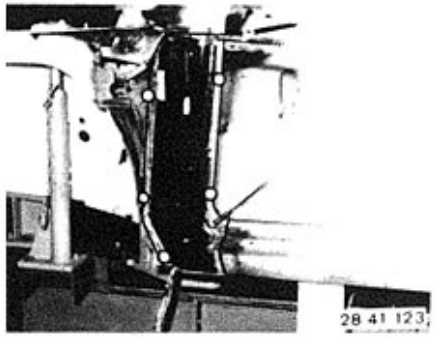
Mark cutting line and cut off door pillar flush.



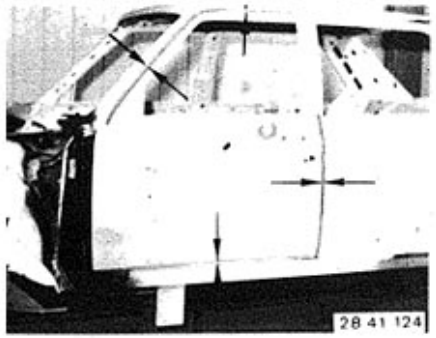
Cut off remaining sheet metal on entrance approx. 15 mm (0.591") longer.
Saw cuts in edges and shoulder with a shouldering pliers.



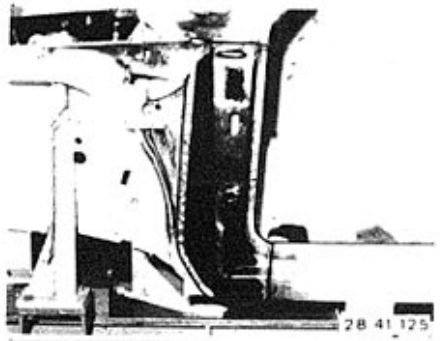
Grind mating surfaces.
Coat rear spot welding edge with spot welding paint.
Prepare front spot welding edge for plug spot welding.



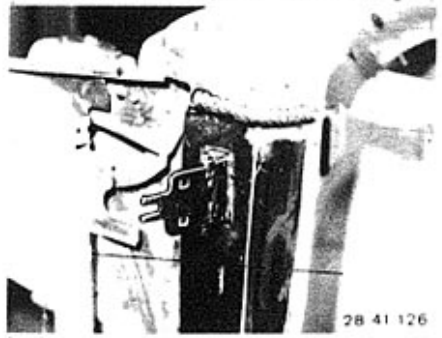
Clamp on and tack weld door pillar at several points.



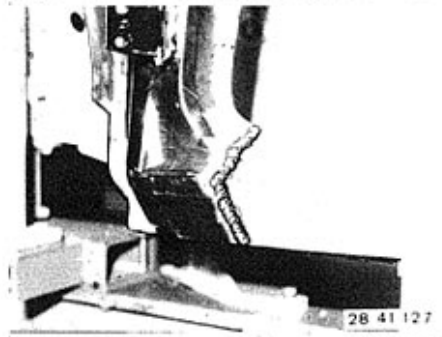
Bolt on doors and check gap.



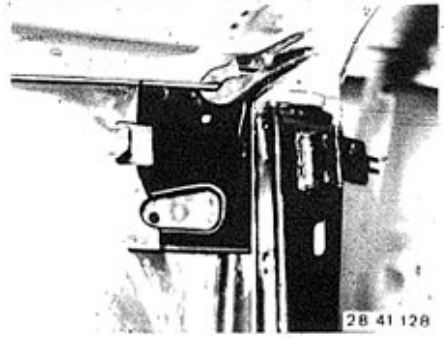
Spot weld and plugspotweld door pillar.



Weld door pillar at top.

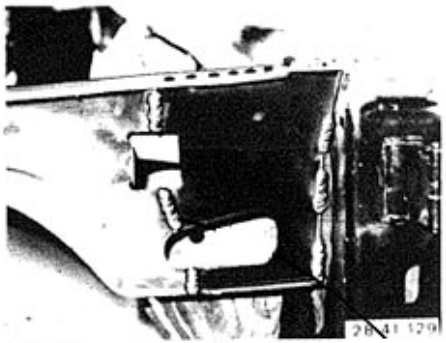


Weld door pillar at bottom.

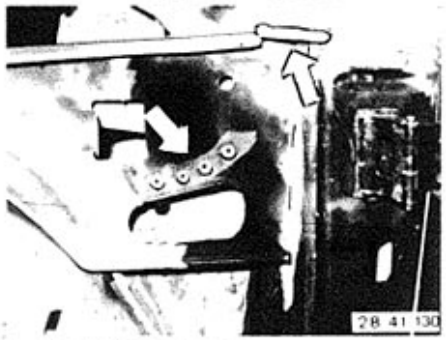


Fit in partial replacement support member section.
Coat spot welding edges with spot welding paint.

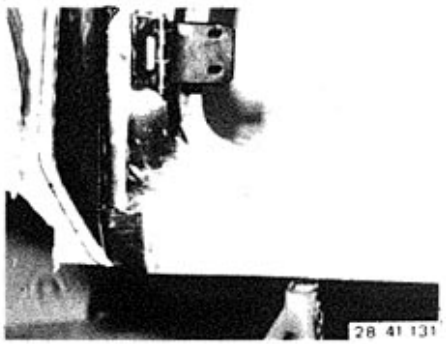
Weld in or spot weld support member.

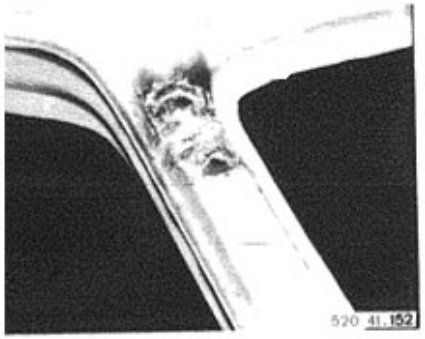


Braze on cowl panel.
Plug spot weld connection for heater wall.



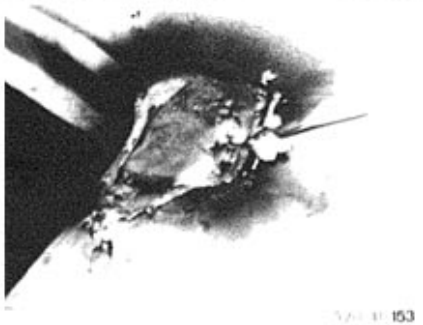
Grind down and tin joints.





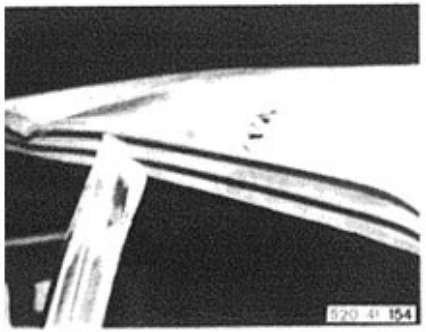
41 31 001 REPLACING ROOF SHEET PANEL

Refer to Introduction – 41 · 001
Disconnect battery ground wire.
Remove both front seats 52 10 020.
Remove inside mirror, sun visors and holders, rear grab handles, inside light, both plates on door pillars, both ornamental strips on rain moldings, weatherstrip on center door pillar, edge guard on roof frame and door pillars.
Remove trim on both door pillars 51 43 170.
Remove windshield 51 31 000.
Remove rear window 51 31 210.
Remove roof liner.
Pull out wires for inside light.
Cover inside of car to protect against sparks.
Remove tin from joints at front roof corners.

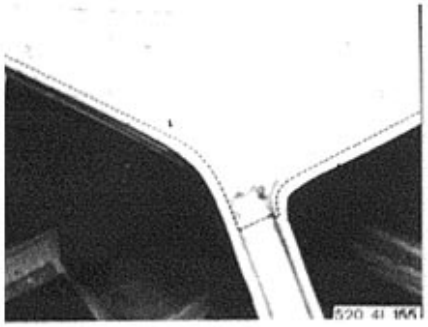


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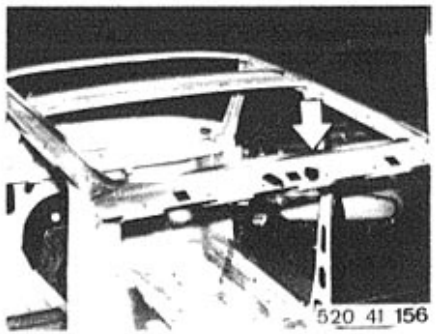
Remove tin from joints at rear roof corners.



Cut off rain molding with a sheet metal shears.



Cut off roof panel along line with a cutting wheel.

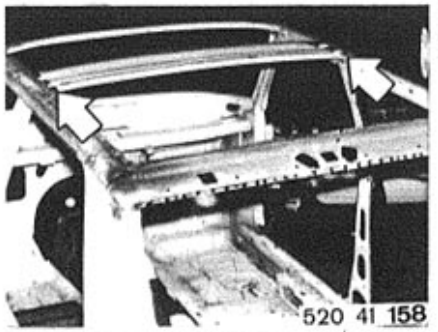


Remove scrap metal from mating surfaces.
Straighten mating surfaces for roof sheet panel and grind both sides.
Remove foam rubber.

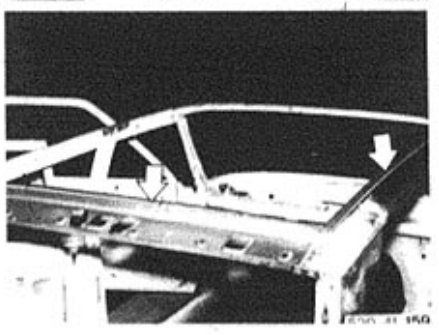
Grind mating surfaces of new roof sheet panel on both sides.



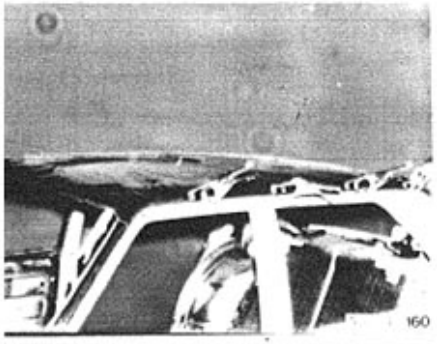
157



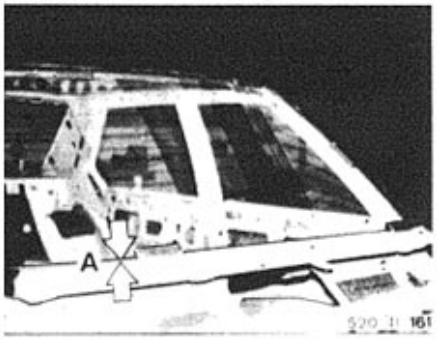
It is recommended to cut out the roof hoopstick, even when it is not damaged, to avoid problems when fitting in the new roof panel.



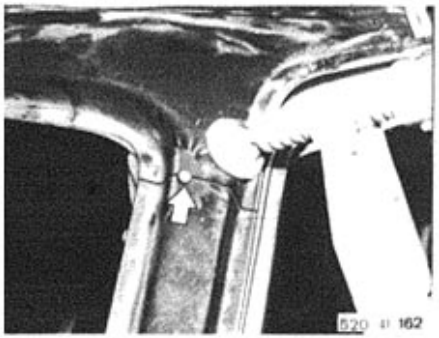
Place foam rubber or Terostat tape on roof frame.
Coat mating surfaces on roof panel with a spot welding compound.



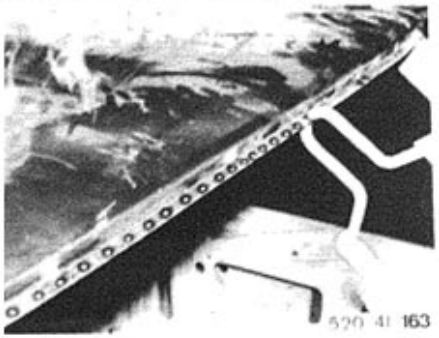
Hold roof panel in position with body pliers; tack welding with one spot in window opening if necessary.



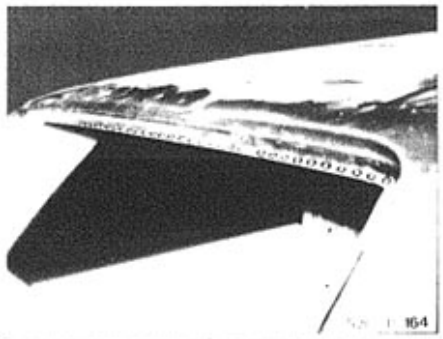
Fit in windshield and rear window.
Install window glass with several pieces of an old window rubber frame.
Distance A between glass and frame = 9 mm (0.354").
Remove windows.



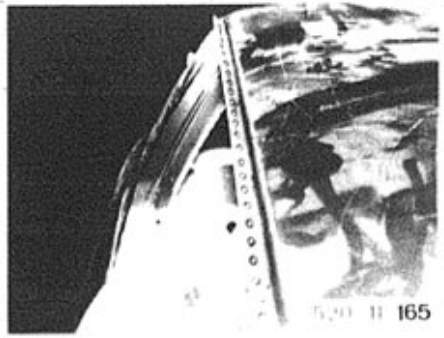
Tack weld roof panel at all four corners.



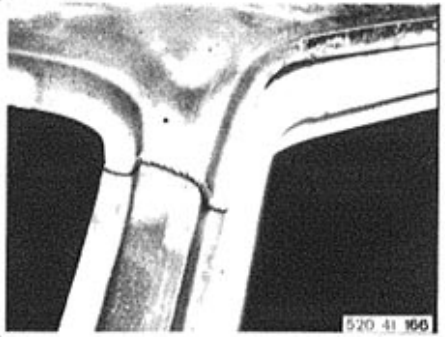
Spot weld roof panel in windshield opening.



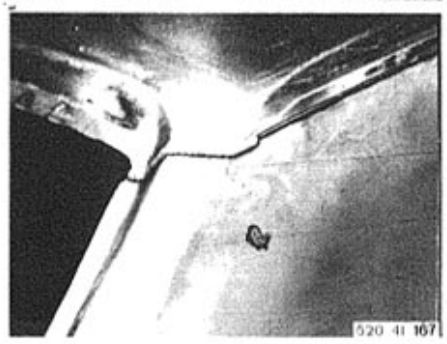
Spot weld roof panel in rear window opening.



Spot weld roof panel to rain molding on side.



Weld front of roof panel on cowl panel.

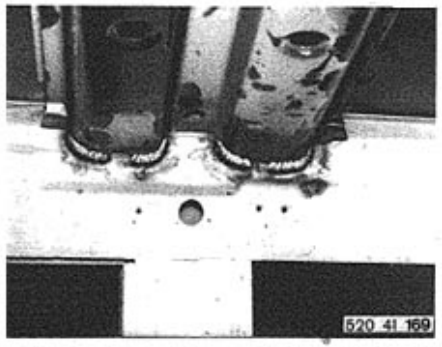


Weld rear corner of roof panel.

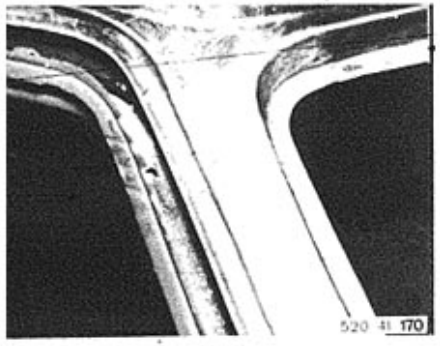
Use foam rubber or Terostat tape on center roof hoopstick in roof panel contact area.



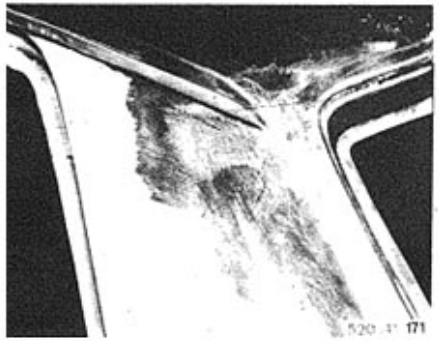
168



Press roof hoopstick against roof panel lightly and weld.

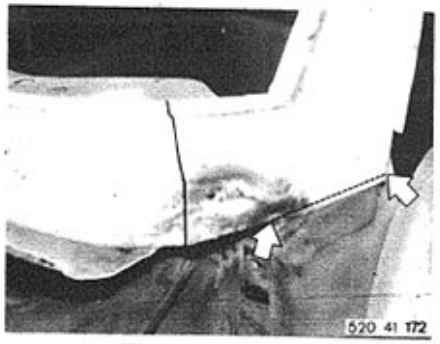


Align and weld both rain moldings.
Tin out joints at front corners of roof panel.



Tin out joints at rear corners of roof panel.

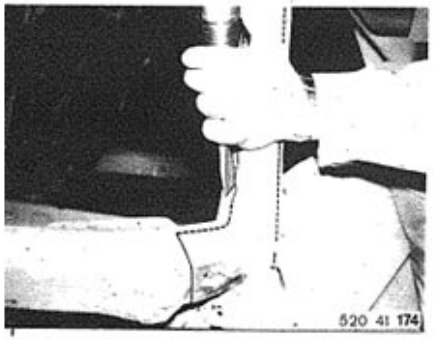
41 32 510 REPLACING COWL PANEL (PARTIAL REPLACEMENT)



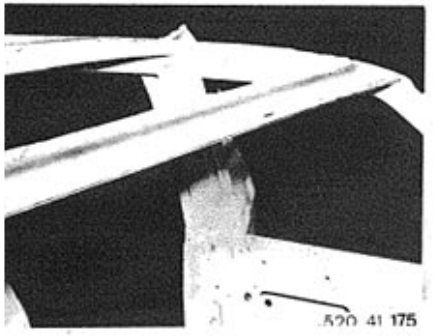
Cut out roof panel 41 31 001.
Remove instrument panel trim 51 45 030.
Detach front side panel 41 35 040.
Saw cuts in cowl panel and remove brazing solder along line with a welding torch.



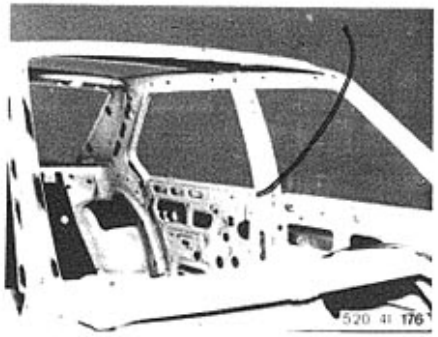
Cut off cowl panel along line.



Cut off cowl panel along line.



Remove scrap metal and grind mating surfaces on both sides.



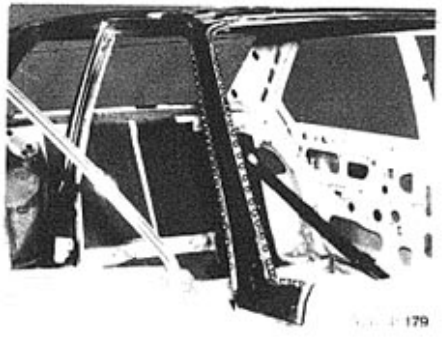
Remove scrap metal and grind mating surfaces on both sides.



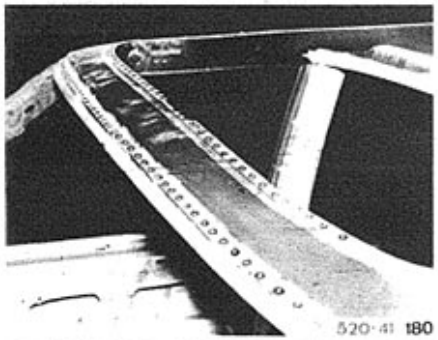
Fit in new cowl panel and grind mating surfaces on both sides; then coat with spot welding compound.



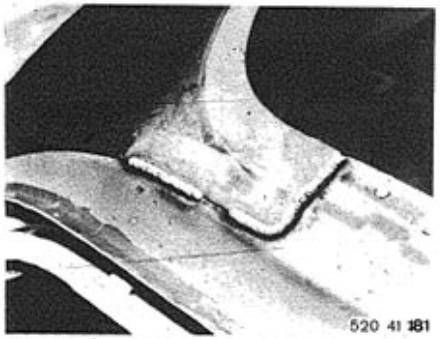
Hold cowl panel in position with body pliers and tack weld at several points.
Install windshield and check gap between glass and frame (9 mm / 0.354").
Remove windshield.



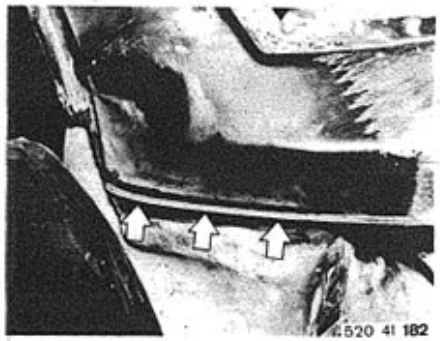
Spot weld cowl panel on door pillar.
Weld joint with remaining section of cowl panel.



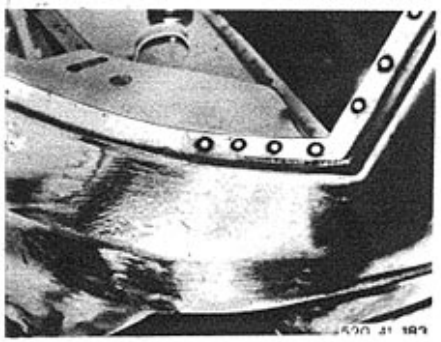
Spot weld cowl panel on front roof frame.



Weld cowl panel ends on roof frame.



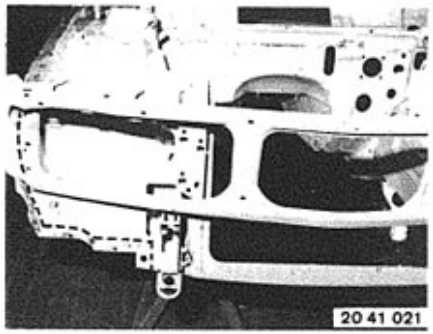
Braze cowl panel bottom on door pillar.



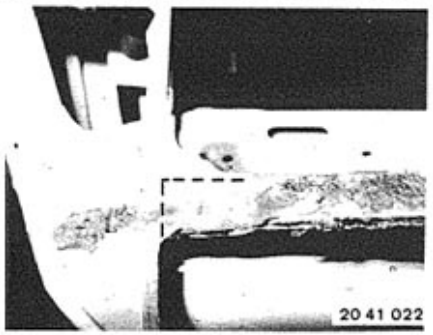
Tin out joints between new and old cowl panel sections.
Install roof panel 41 31 001.

41 33 001 REPLACING FRONT PANEL AND FRONT WALL ASSEMBLY

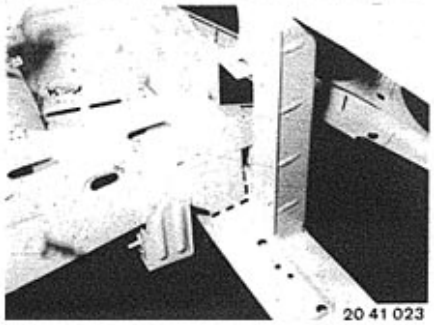
Refer to Introduction – 41 - 001
Remove battery, bumper, all radiator grill sections, both headlights, both turn signals, both engine hood locks, engine hood release cable as applicable, horns, air ducts and radiator.
Disconnect wire harnesses as required and remove all clips and sheet metal nuts.
Detach both front side panels 41 35 040.
Remove front panel lower section 41 33 081.



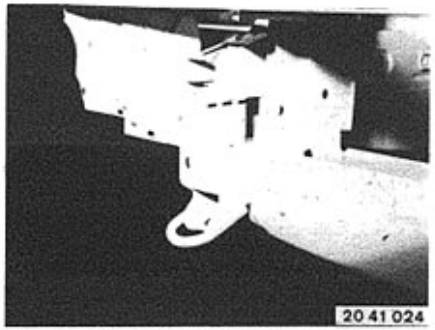
Cut front panel along line.



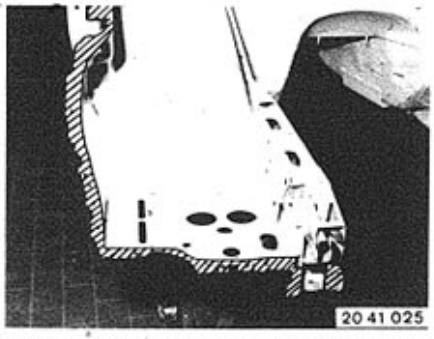
Cut front panel at top on wheel house.



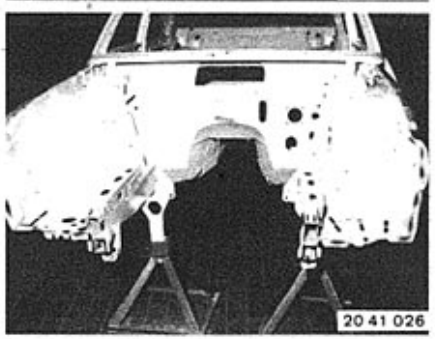
Cut front panel on engine carrier.



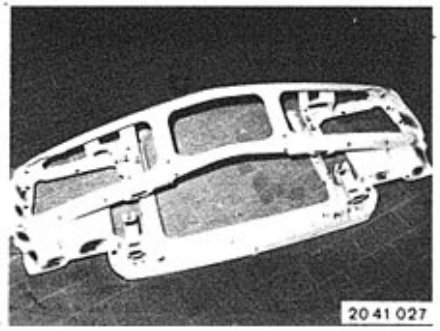
Cut off front panel on engine carrier.



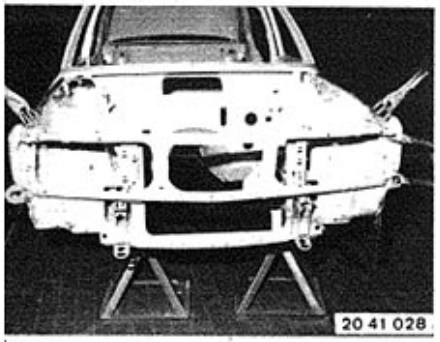
Remove scrap metal.



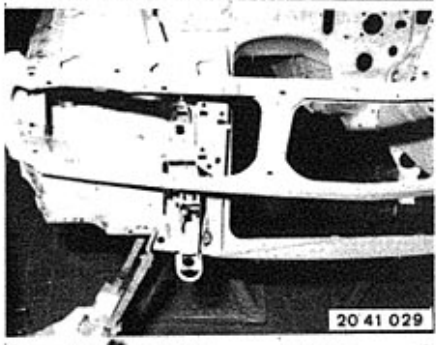
Straighten mating surfaces, grind down and coat with zinc dust paint.



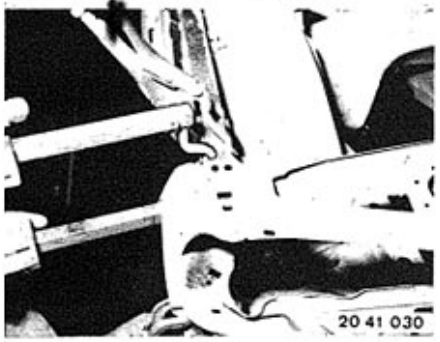
Grind mating surfaces of new front panel on both sides and coat with zinc dust paint.



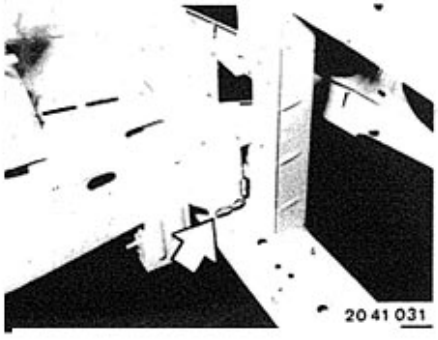
Fit in front panel and clamp with body pliers.



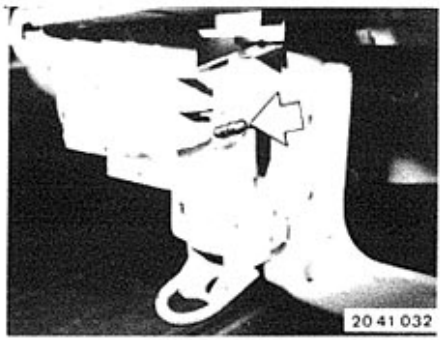
Spot weld front panel on wheel house.



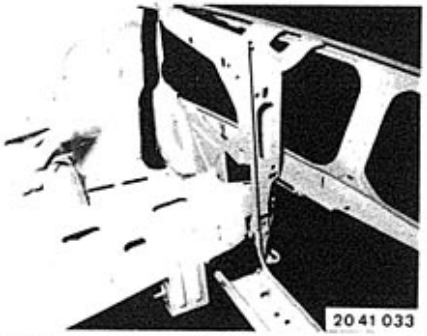
Spot weld front panel at top on wheel house.



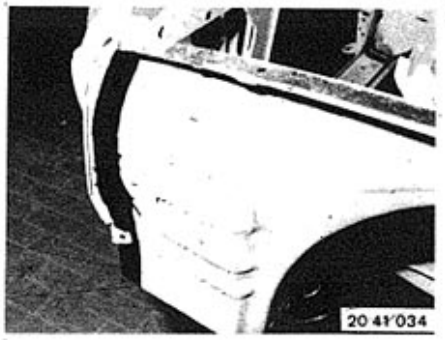
Inert gas weld front panel on engine carrier.



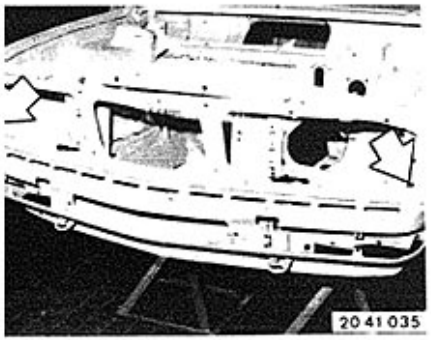
Inert gas weld front panel on engine carrier.



Seal welded seams with a joint sealing compound.



Seal welded seams with a joint sealing compound.

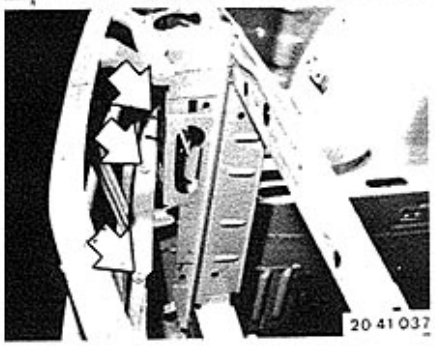


41 33 081 REPLACING FRONT PANEL LOWER SECTION

Remove bumper, all radiator grill sections and headlights.
Unscrew left and right mounting bolts.

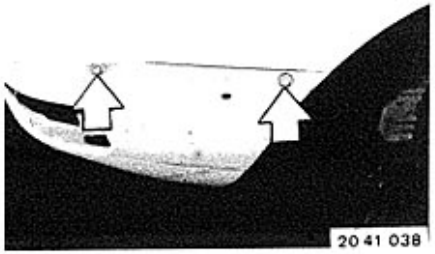


Unscrew mounting bolts from below.

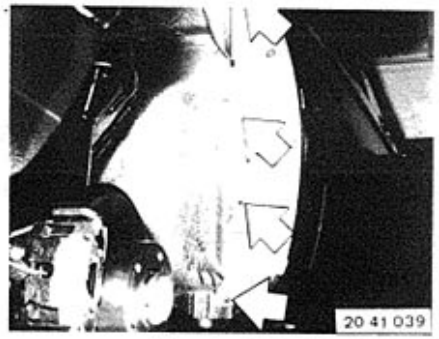


Unscrew mounting bolts from inside.

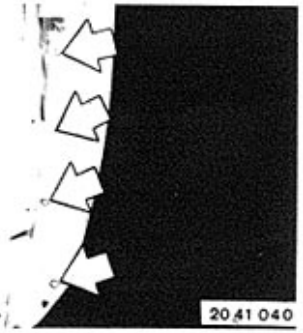
Unscrew mounting bolts on sides.
Take off front panel lower section.
Spray new front panel lower section with a body sealing compound.



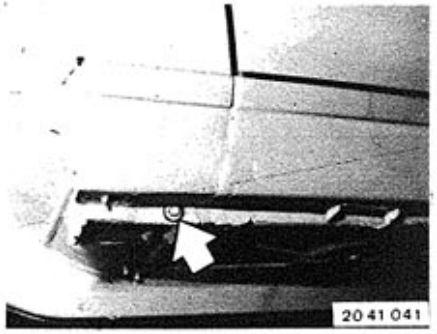
41 35 000 REPLACING FRONT SIDE PANEL



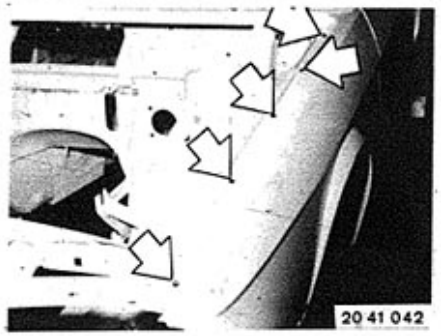
Remove front bumper, grill, turn signal, side marker light and rubbing strip.
Remove cover.



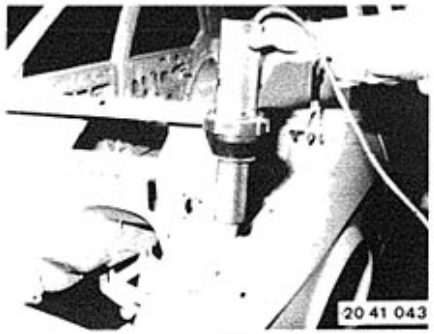
Unscrew mounting bolts in wheel house.



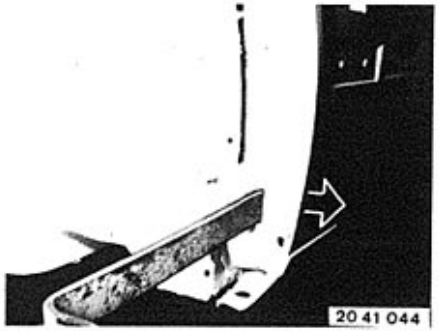
Unscrew mounting bolt at bottom.



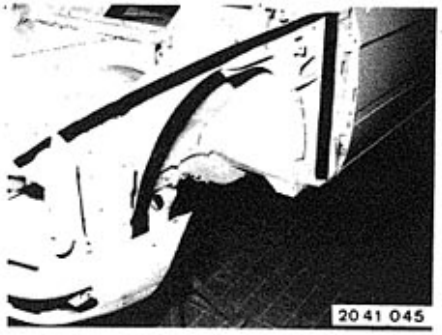
Unscrew mounting bolts at top.



Heat undamaged side panels in area of bearing surfaces with a hot air blower and disconnect carefully.



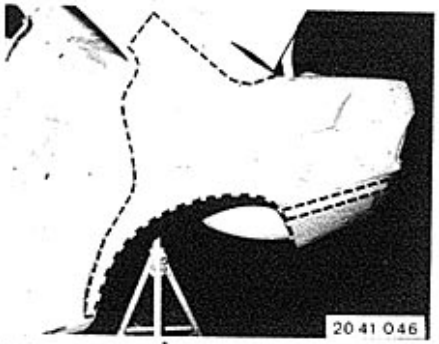
Press off side panel carefully with a tire iron or similar tool.



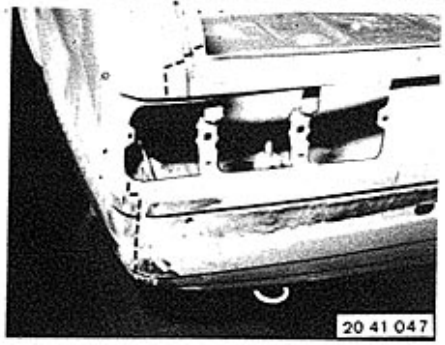
Remove old Terostat tape and PVC.
Cover bearing surfaces with new Terostat tape.
Seal off front stone guard with a joint sealing compound.
Fit in side panel – watching door gap and engine hood gap.
Spray bottom of side panel with body sealing compound.

41 35 281 REPLACING LEFT REAR SIDE PANEL (PARTIAL REPLACEMENT TO WINDOW LINE)

Refer to Introduction – 41 - 001
Remove trunk mat, tail panel trim, bumper assembly, tail lights, rear wheel, rear seat cushion and backrest, hatrack, seat belt and roof liner as required, trunk lid weatherstrip, cover and roof pillar and rear entrance rail.



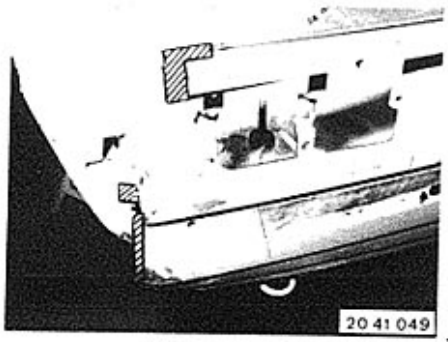
Cut out side panel along line.



Cut side panel along line.



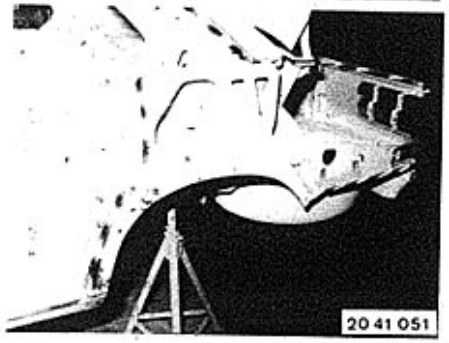
Remove scrap metal.



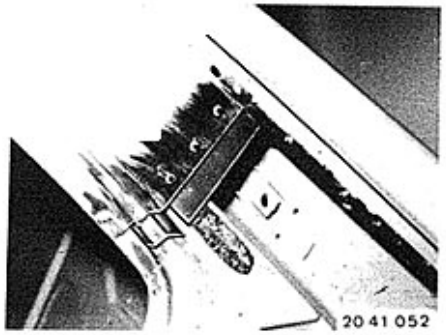
Remove scrap metal.



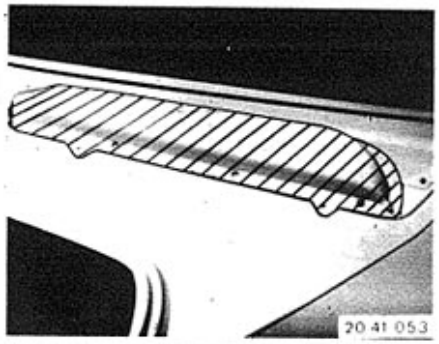
Remove scrap metal.



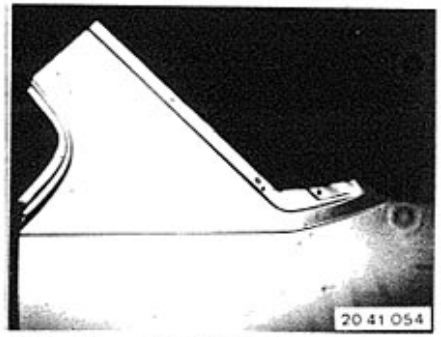
Straighten mating surfaces, grind and coat with zinc dust paint.



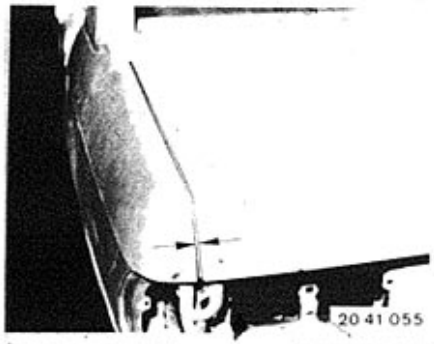
Inert gas butt weld reinforcement plates in C pillar.



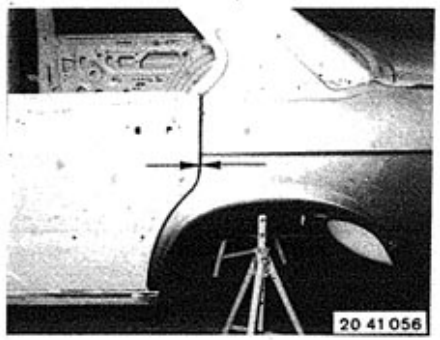
Cut the air guide plate out of a new side panel carefully.



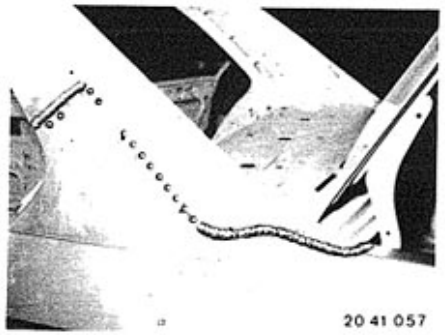
Cut the new side panel to size roughly in area of the C pillar.
Mount the side panel, mark the cutting line, cut out and fit in.
Grind both sides of mating surfaces and coat with zinc dust paint.



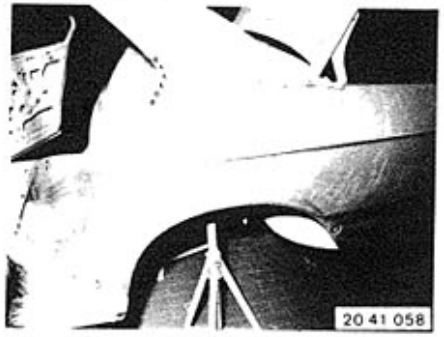
Fit in the side panel and tack weld.
Check the trunk lid gap.



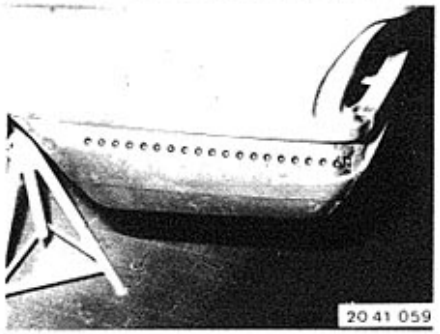
Check the door gap.



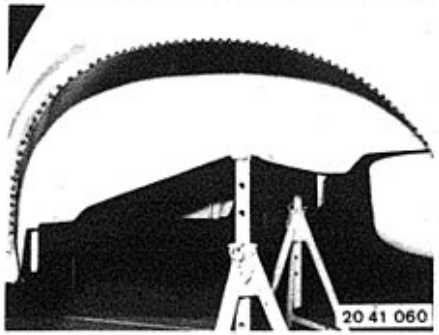
Inert gas weld the side panel in area of the C pillar.



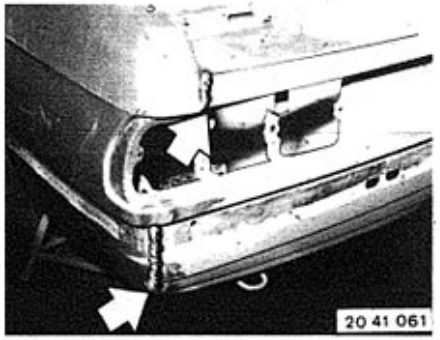
Braze or spot weld the side panel in the door opening.



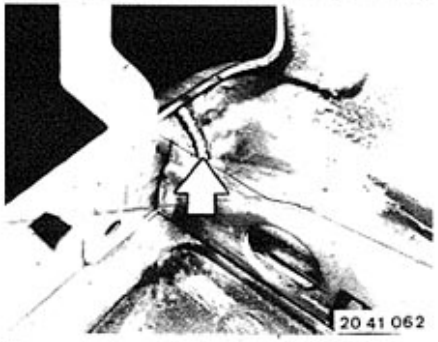
Spot weld the side panel on the trunk floor plate.



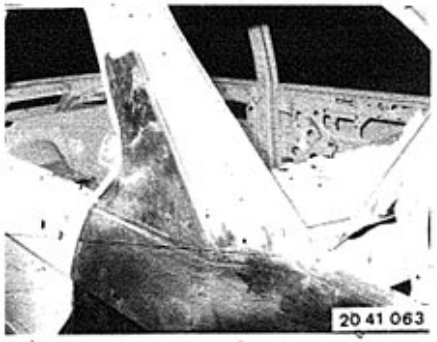
Spot weld the side panel on the wheel house.



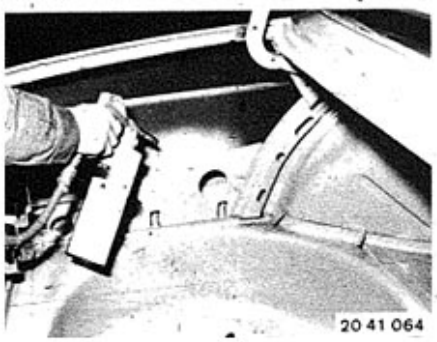
Inert gas weld bottom and braze top of side panel to tail panel.



Autogen weld web from inside.



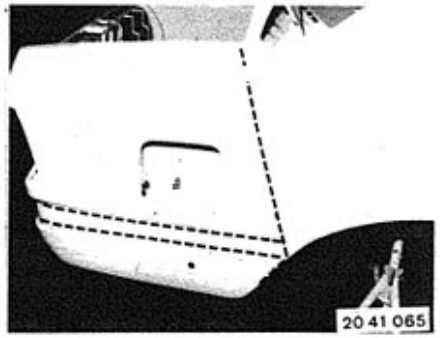
Grind down all welded seams.
Tin out joints in area of C pillar and underneath tail lights.



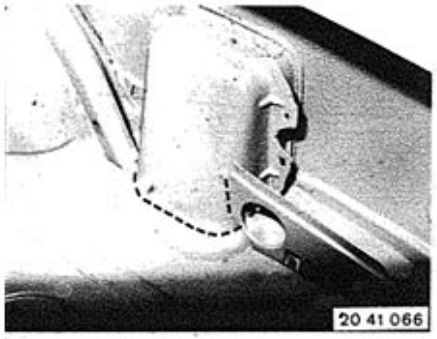
Seal off joints between side panel and trunk floor plate as well as in C pillar area with a joint sealing compound.
Spray side panel with a body sealing compound.

41 35 351 REPLACING RIGHT REAR SIDE PANEL (PARTIAL REPLACEMENT TO WHEEL HOUSE) AND TAIL PANEL

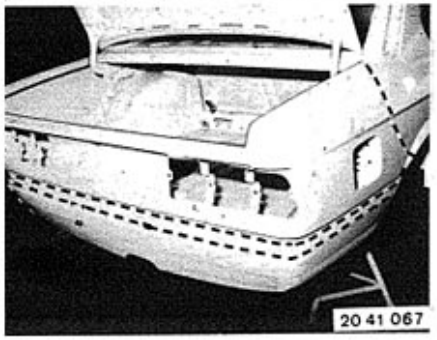
Refer to Information – 41 - 001
Remove trunk mat, tail panel trim, bumper assembly, both tail light assemblies, both license plate lights, wiring for trunk light, trunk lid, fuel tank, jack, spare wheel, trunk lid weatherstrip, lock cylinder and wire harness section.



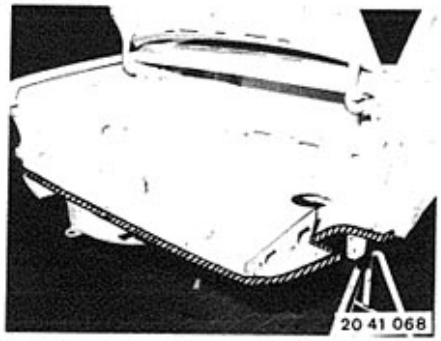
Cut out side panel along line.



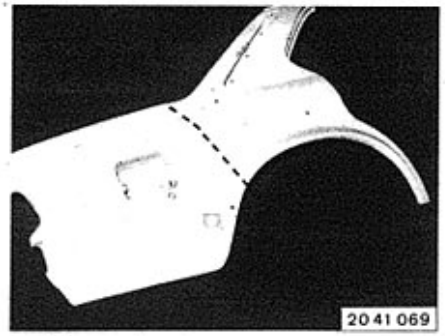
Cut tank filler neck housing off of trunk floor plate along line.



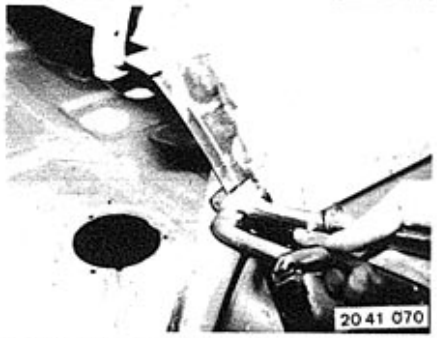
Cut off tail panel from trunk floor plate along line.
Cut off lock braces on trunk floor plate.



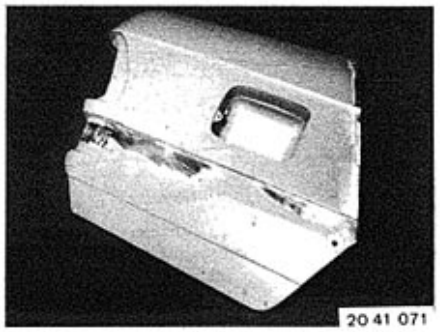
Remove scrap metal.
Straighten mating surfaces, grind both sides and coat with zinc dust paint.



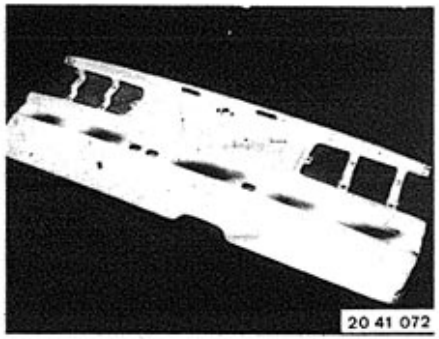
Prepare side panel section.



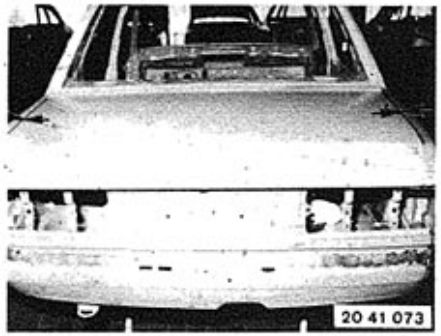
Make cuts in edges of remaining side panel metal and shoulder with a shouldering pliers.



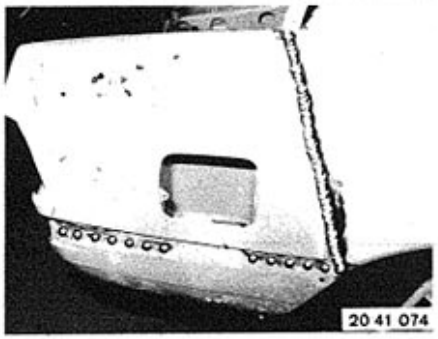
Fit in side panel section.
Grind mating surfaces on both sides and coat with zinc dust paint.
Tack weld side panel.



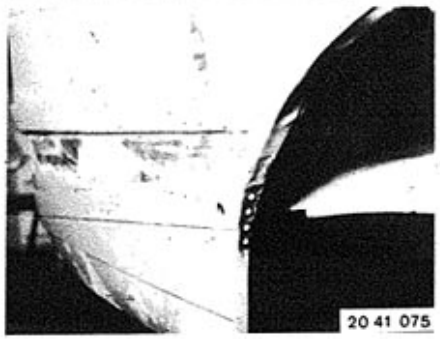
Grind mating surfaces of tail panel on both sides and coat with zinc dust paint.



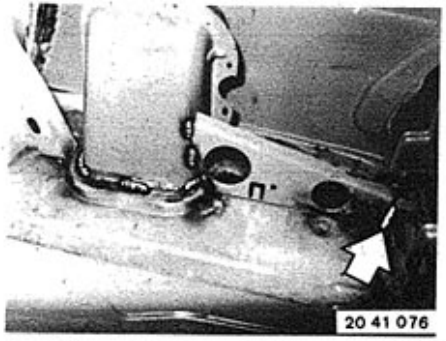
Fit in and tack weld tail panel.
Check trunk lid gap.



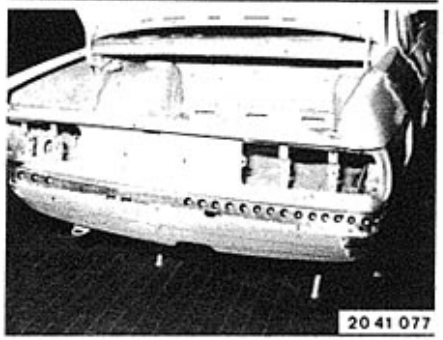
Inert gas weld side panel joints.
Caution!
Danger of distortion from excessive heat.
Spot weld side panel on trunk floor plate.



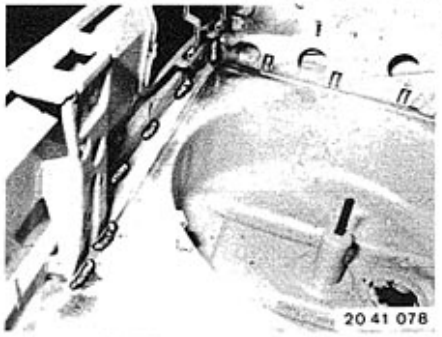
Spot weld side panel on wheel house.



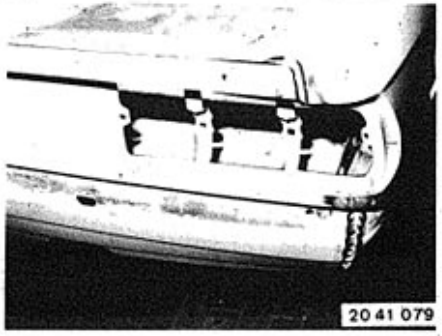
Inert gas weld tank filler neck housing on trunk floor plate and partition wall.
Inert gas weld tail panel on partition wall.



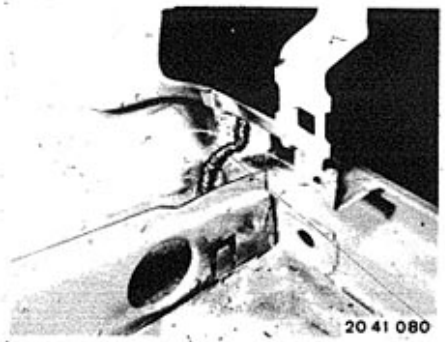
Spot weld tail panel on trunk floor plate.



Inert gas weld tail panel in area of lock braces and spare wheel well.



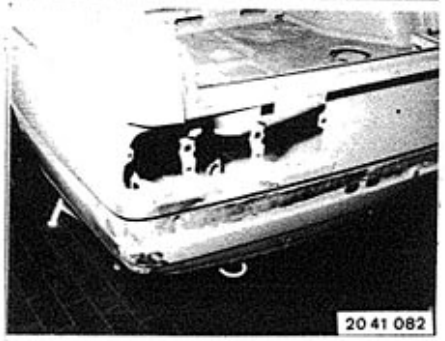
Inert gas weld tail panel on left and right sides underneath the tail lights, and braze at top.



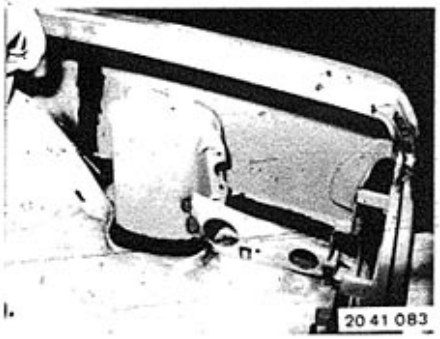
Autogen weld web at left and right from inside.



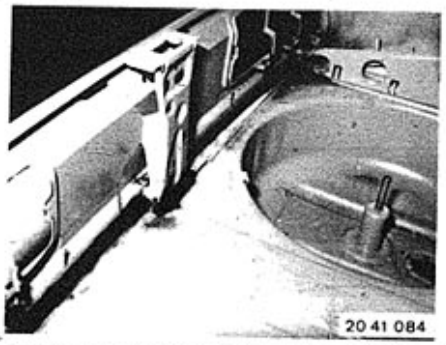
Tin out side panel joint.



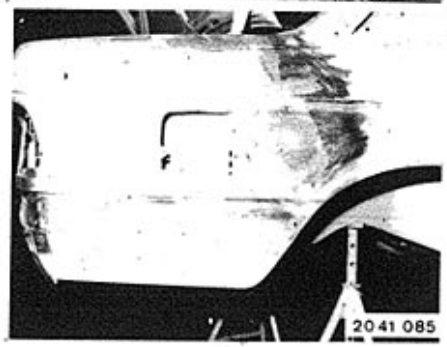
Tin out joints underneath both tail lights.



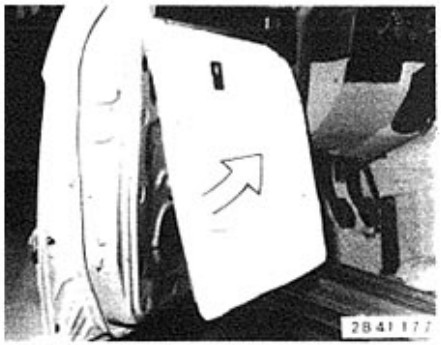
Grind down and clean all welded seams.
Seal off mating surfaces with a joint sealing compound.



Seal off joint between tail panel and trunk floor panel with a joint sealing compound.



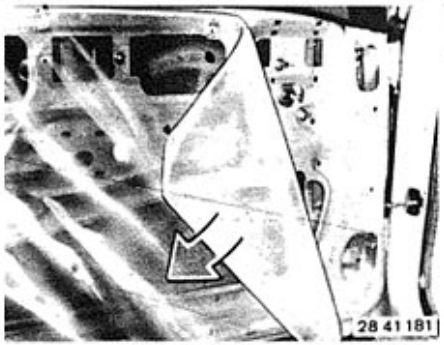
Spray side panel on inside and underneath bumper with a body sealing compound.



41 51 004 ADJUSTING LEFT OR RIGHT FRONT DOOR

Adjusting Front Door On Hinges:

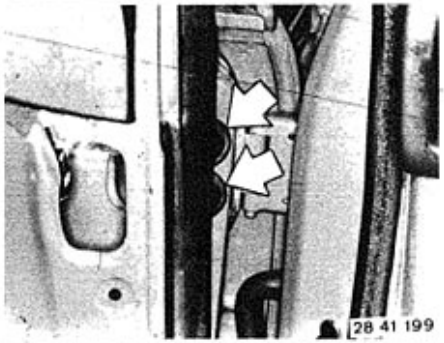
Remove door trim panel 51 41 001.



Pull off plastic sheet partially.

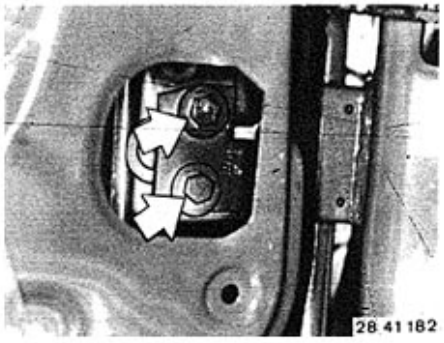
Installation:

Replace damaged plastic sheet.

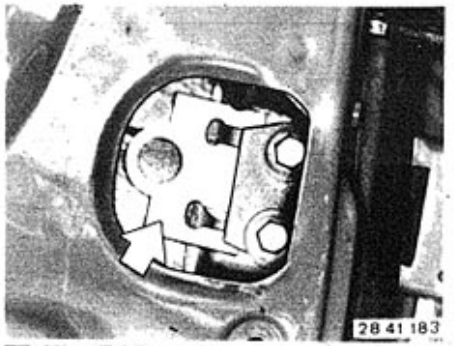


Lift out plugs.

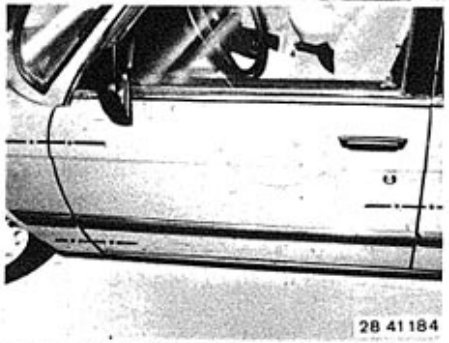
Loosen bolts.



Loosen bolts.

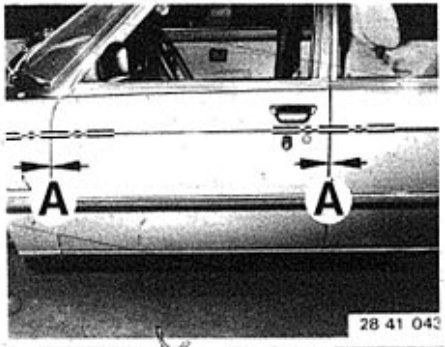


Use shims to adjust door outside surface to same plane as front side panel surface.



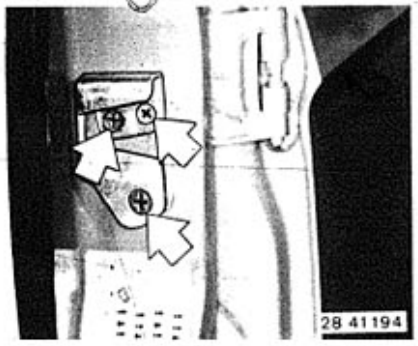
Note:

The door outside surface could be adjusted "deeper" than the front side panel surface by up to max. 1 mm (0.039") in order to prevent wind noise and damage from flying stones as well as to compensate irregularities (tolerances in the curvature).



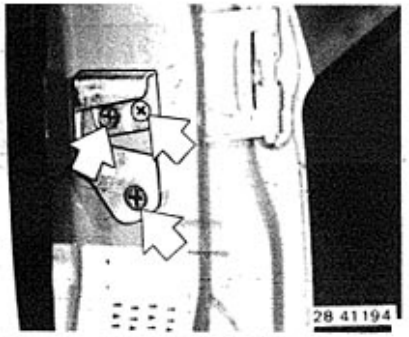
Align door in forward and backward direction in such a manner to produce an uniform gap (A).

Align door height with the embossed edges.



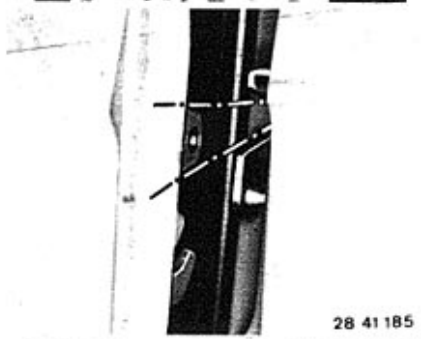
Note:

If necessary, loosen striker on door lock.

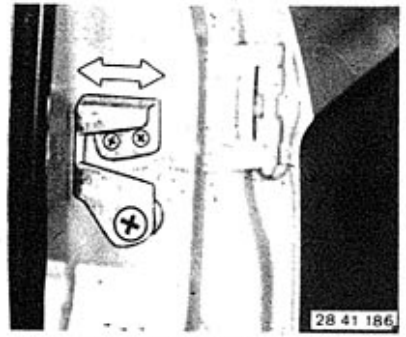


Adjusting Door Lock:

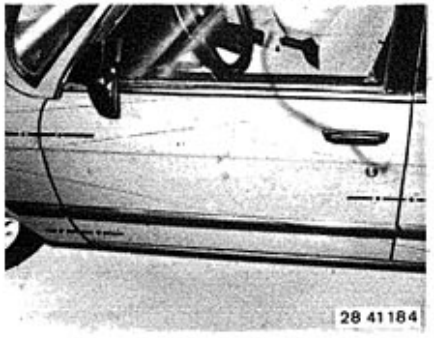
Loosen screws.



Adjust striker to stand perpendicular. Rubber pad on door lock must engage without tension.



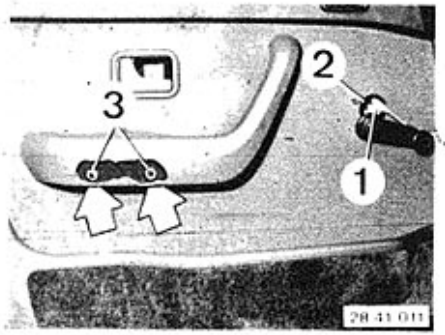
Adjust striker horizontally that after closing the door, the door's outside surface is in same plane with the rear door surface (door closed in second catch).



Note:

The neighboring rear door can be adjusted "deeper" by up to max. 1 mm (0.039") in order to prevent wind noise and damage from flying stones as well as to compensate optical irregularities.

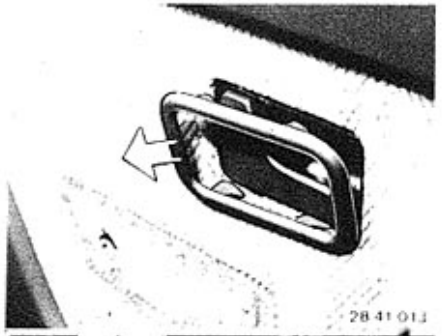
41 51 101 REPLACING LEFT OR RIGHT FRONT DOOR



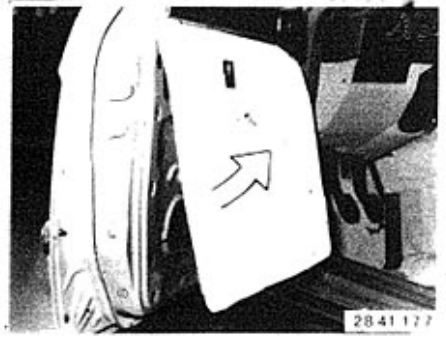
Refer to information on 41 - 001.
Lift off cover.
Unscrew bolt (1).
Take off winder with escutcheon (2).
Unscrew bolts (3).
Installation:
Winder faces forward and is horizontal when window is raised.



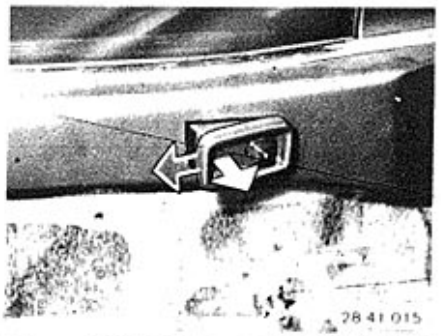
Turn armrest about 45° and pull out of holder.



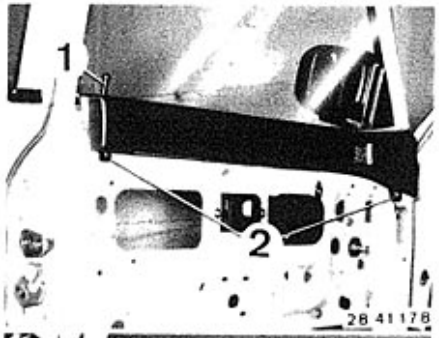
Pull off cover for door opener toward rear.



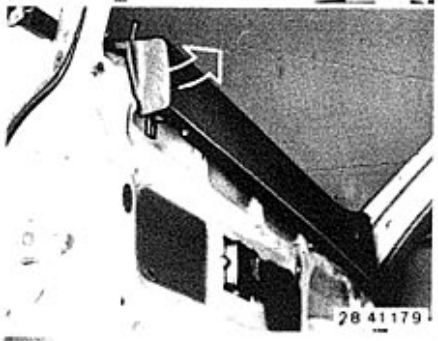
Lift off door trim panel lower section.
Installation:
Large diameter end of spring for window winder faces trim panel.
Replace damaged clips.



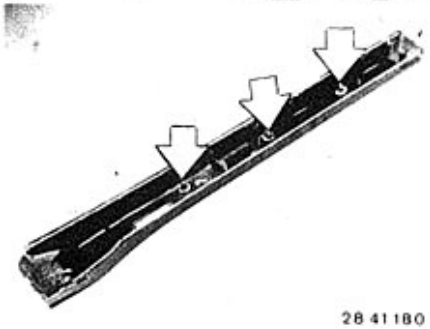
Lift and pull out switch.
Pull off plug.



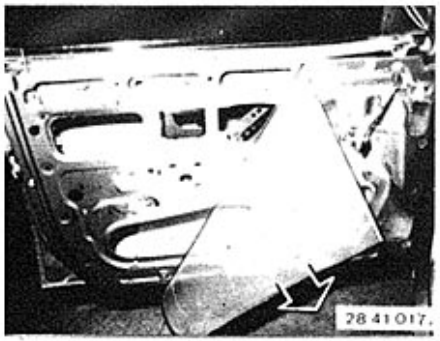
Unscrew catch button (1).
Unscrew bolts (2).



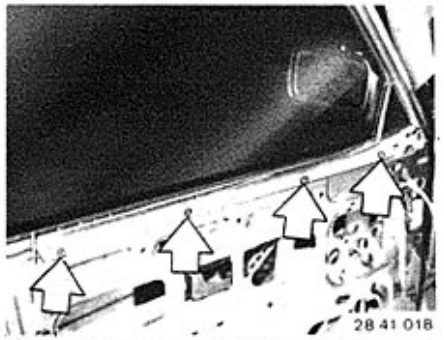
Pull off trim panel upper section.



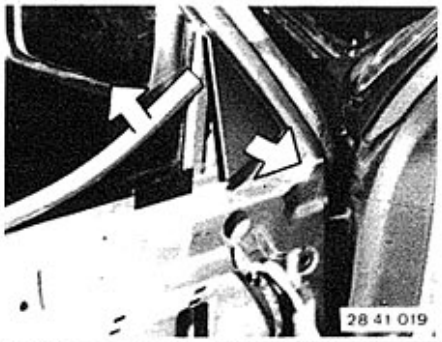
Installation:
Replace damaged clips.



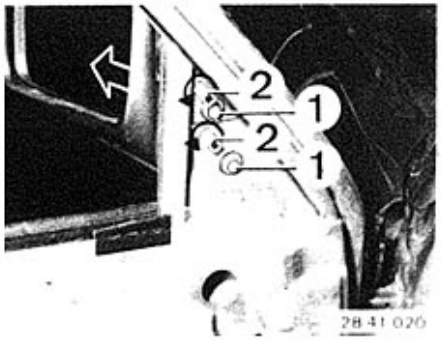
Pull off Acella plastic sheet.
Installation:
Replace damaged sheet.



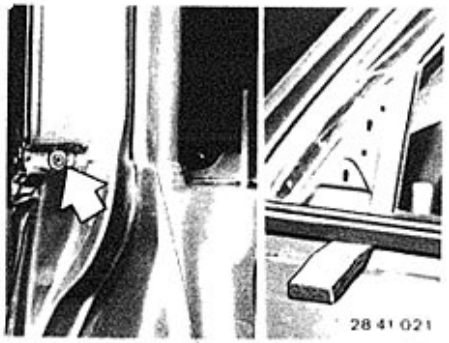
Unscrew bolts and take off strip.



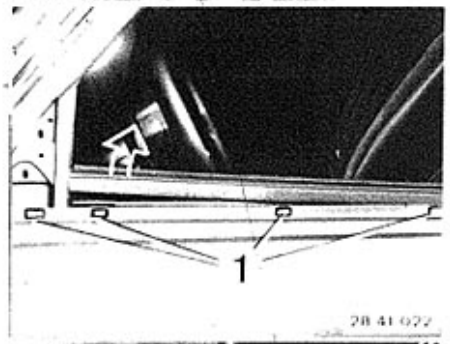
Pull off window recess cover from above.
Take off triangular plate.



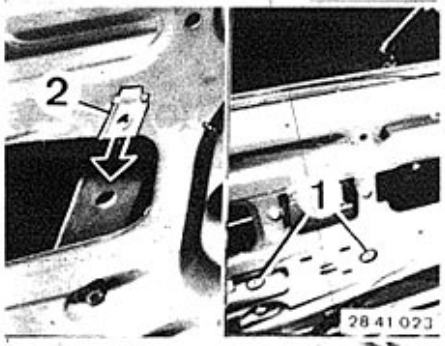
Unscrew bolts (1).
Disconnect plug and remove outside mirror.
Turn and pull off clips (2).



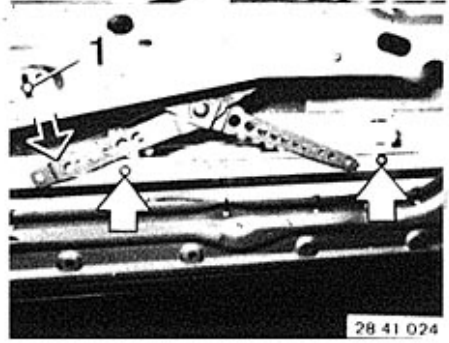
Unscrew bolt.
Push up cover strip with a wooden wedge being careful not to damage the paint finish.
Installation:
First insert window recess cover and then cover strip.



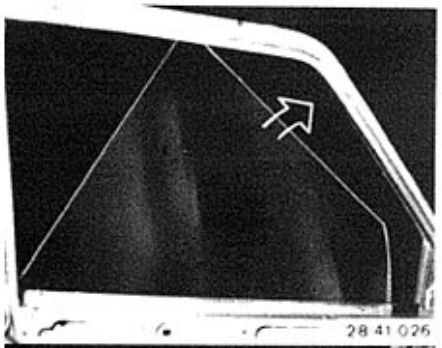
Pull off window recess cover.
Pull off clips (1).
Installation:
Replace damaged clips.



Pull-off spreader nuts (1) and clips (2).
Installation:
Check position of clips.



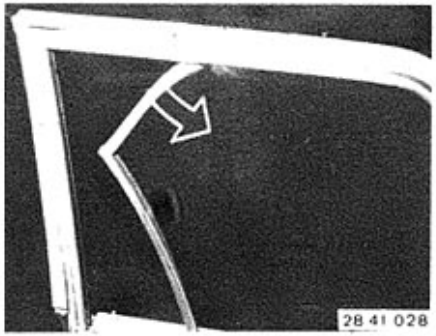
Position window that nuts (1) are accessible.
Pull off plug (2).
Unscrew nuts (1).
Installation:
Push down cross arm lift and tighten screw (3).



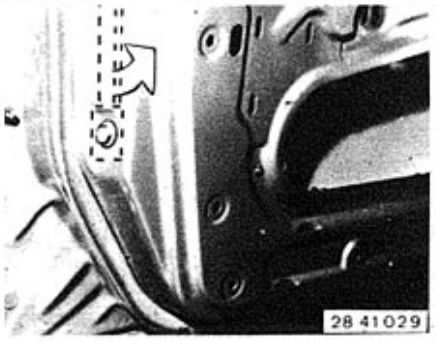
Tilt window and remove from above.



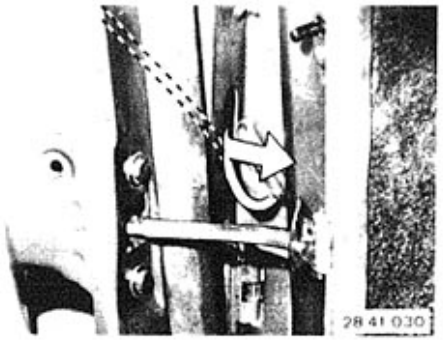
Unscrew screws and remove cross arm lift.



Installation:
Place slide in guide rail.

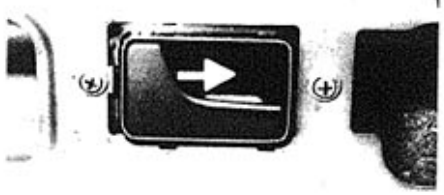


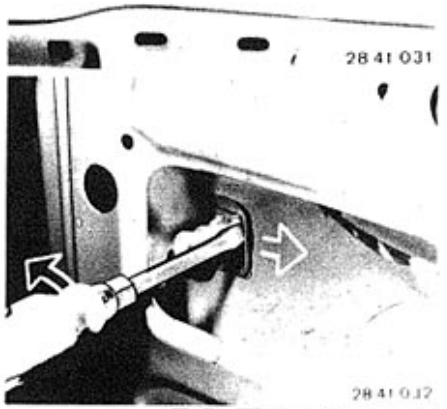
Pull window guide out of rail.



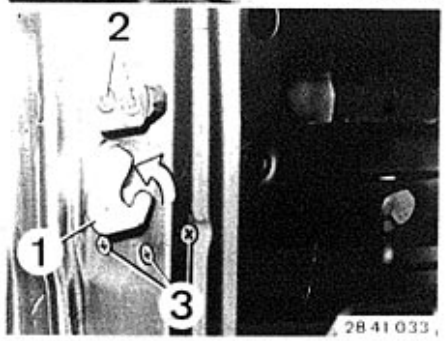
Unscrew screw, take wiring for inside light delayed action out of clips and remove rail.

Installation:
Check routing of wires.

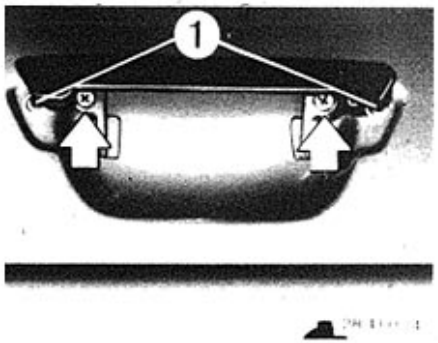




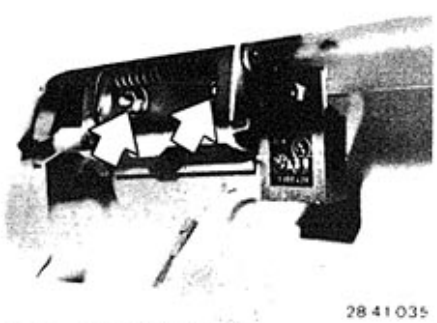
Disconnect plugs for central locking system and inside light delayed-action relay.
Pull wire harness out of door.



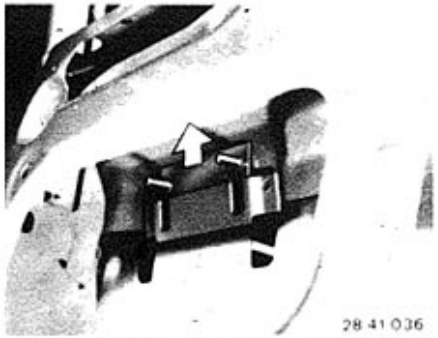
Unscrew screws.
Disconnect central locking system at linkage.
Installation:
Pre-load central locking system downward slightly.



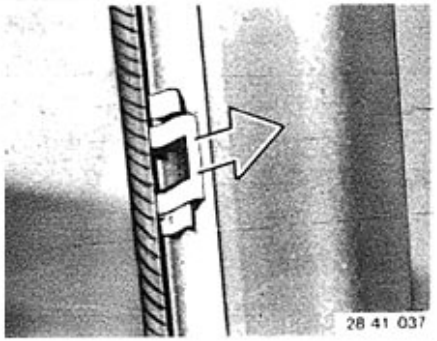
Unscrew handle plate.
Installation:
Handle plate rests on rubber pads (1).



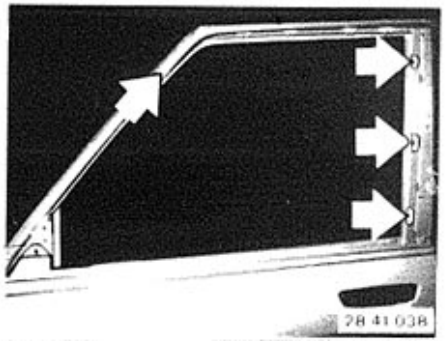
Unscrew nuts and remove lock control.
Installation:
Replace stop nuts.
Screw on handle plate before tightening.
Also align lock control with handle plate before tightening.



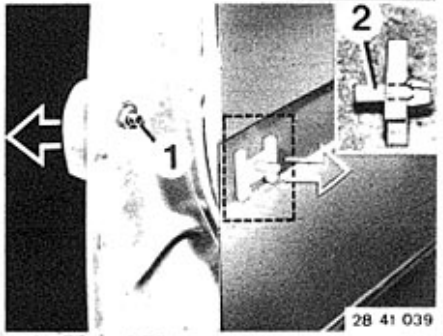
Remove threaded plate.



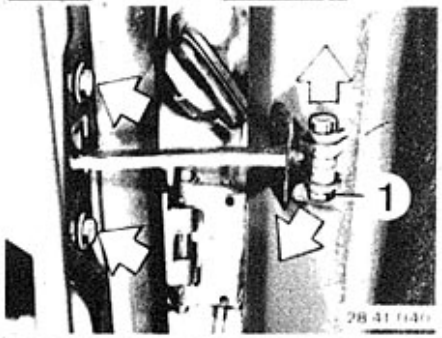
Disconnect frame plates.
Push back clamp in direction of arrow until plates have cleared.



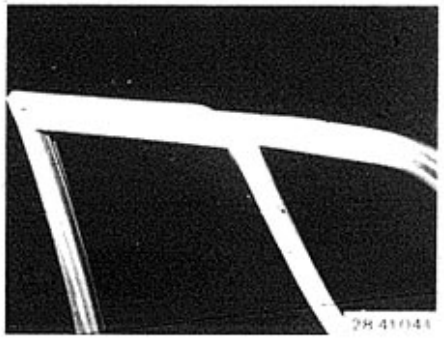
Pull lower part of chrome plate off of door frame in direction of arrow.
Take off black plate.
Installation:
Replace clips and use Terostat seal in area of clips.



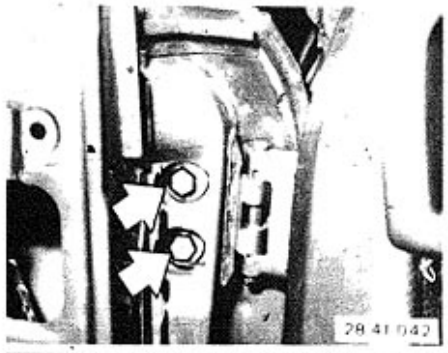
Unscrew nut (1) and lift off rubbing strip.
Press pin (2) toward outside.
Installation:
Replace damaged clips.



Pull off retainer (1) and knock out shaft upwards.
Unscrew bolts and remove door retarder.



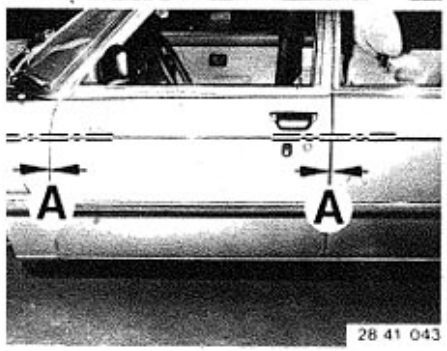
Pull rubber frame off of door.



Lift out covers and unscrew hinge bolts at top and bottom.

Installation:

Tap bores in new door and lubricate with grease.



Installation:

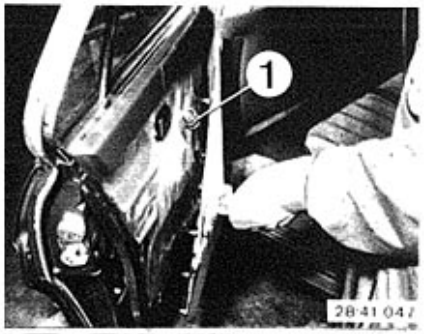
Adjust door to same plane as side panel with shims.

Adjusting Door On Hinges:

Gap (A) same front and rear.

Align height with beaded edge.

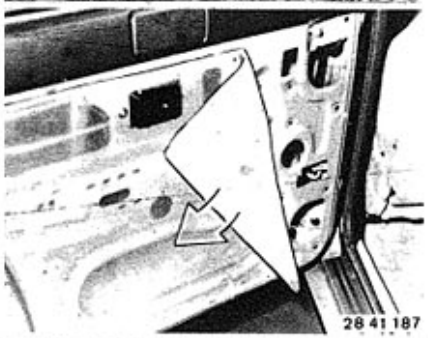
Transfer all clamps, hinge covers, clips, etc..



41 52 004 ADJUSTING LEFT OR RIGHT REAR DOOR

Adjusting Rear Door On Hinges:

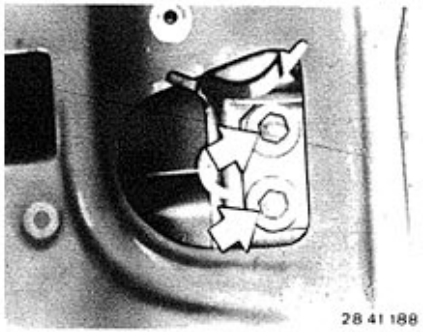
Remove door trim panel 51 42 001.



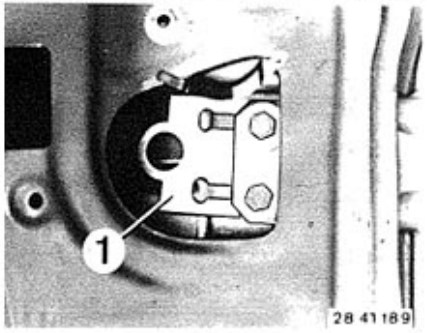
Pull off plastic sheet partially.

Installation:

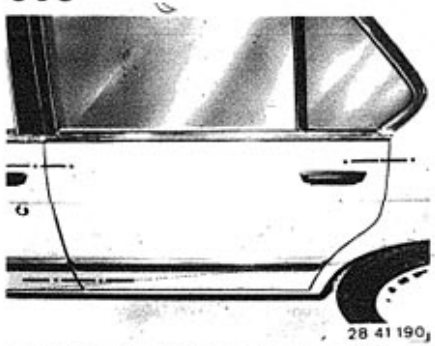
Replace damaged plastic sheet.



Loosen bolts at top and bottom.

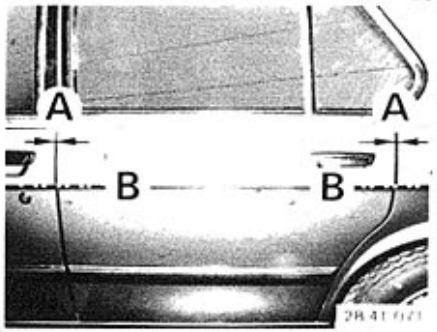


Use shims (1) to adjust door outside surface to same plane as front door outside surface.



Note:

The door outside surface may be adjusted "deeper" than the front door outside surface by up to max. 1mm (0.039") in order to prevent wind noise and damage from flying-stones as well as to compensate optical irregularities (tolerances in the curvature).



Align door toward front and rear in such a manner to produce an uniform gap (A). Align door height with the embossed edges.



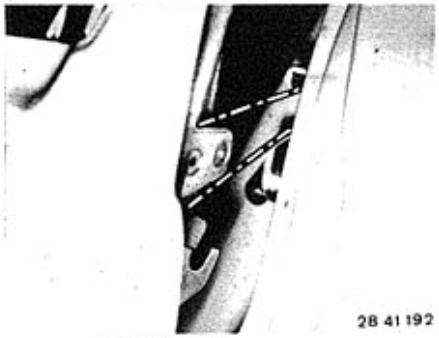
Note:

If necessary, loosen striker on door lock.

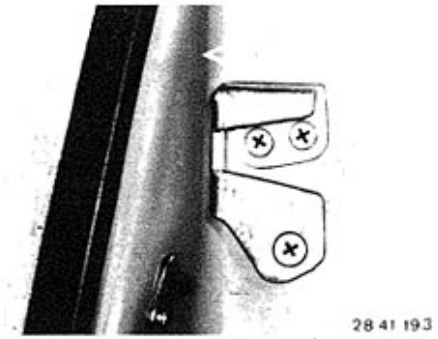

28 41 191

Adjusting Door Lock:

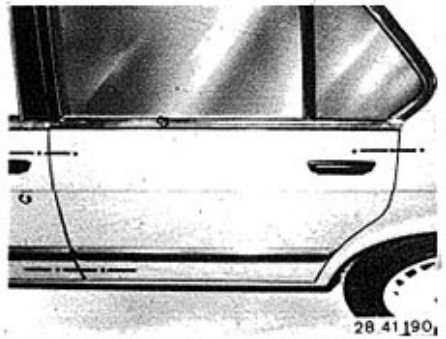
Loosen screws.


28 41 192

Adjusting striker to stand perpendicular. Rubber pad on door lock must engage without tension.


28 41 193

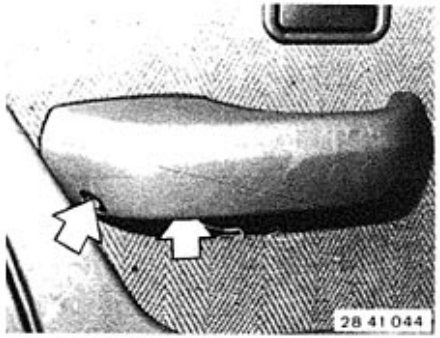
Adjust striker horizontally that after closing the door (second catch), the door's outside surface is in same plane with the side panel surface.


28 41 190

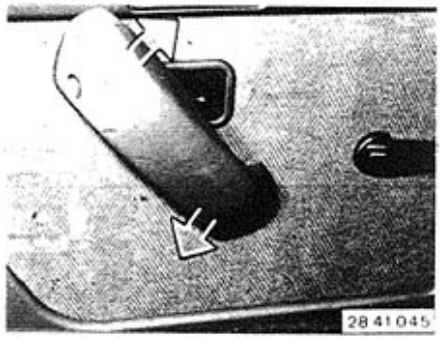
Note:

Teh rear door outside surface can be adjusted "deeper" than the adjacent side panel outside surface by up to max. 1 mm (0.039") to prevent wind noise and damage from flying stones as well as to compensate optical irregularities.

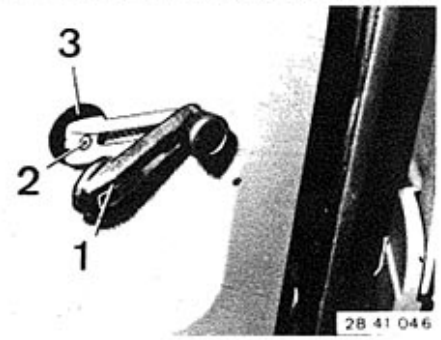
41 52 101 REPLACING LEFT OR RIGHT REAR DOOR



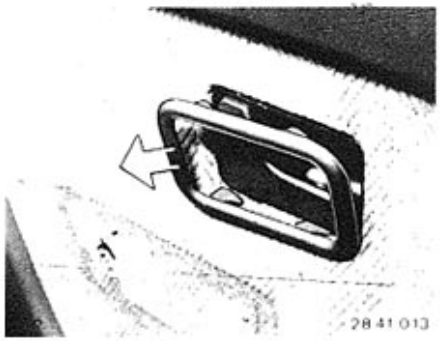
Refer to information on 41 - 001.
Unscrew bolts.



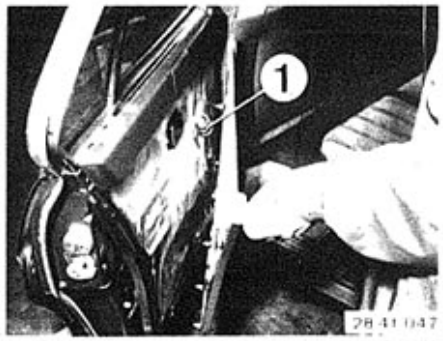
Turn armrest about 45° and pull out of holder.



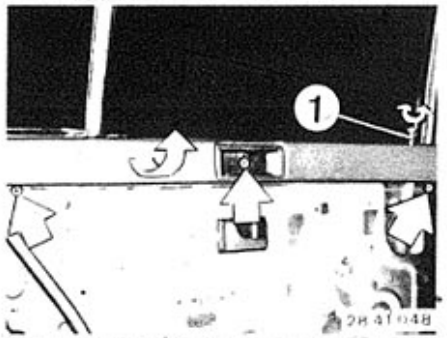
Lift off cover (1).
Unscrew bolt (2).
Take off winder with escutcheon (3).
Installation:
Winder faces forward and is horizontal when window is raised.



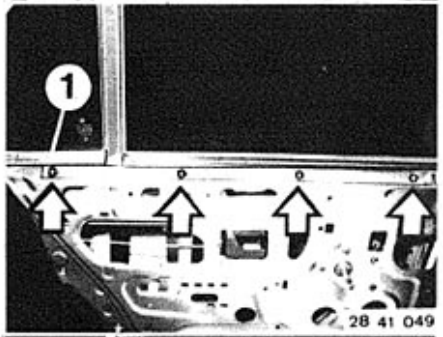
Pull off cover for door opener toward rear.



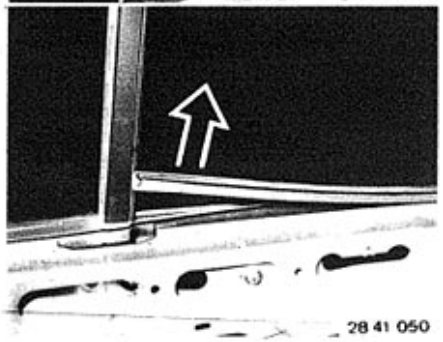
Lift off door trim panel lower section.
Installation:
Large diameter end of spring (1) faces trim panel.
Replace damaged clips.



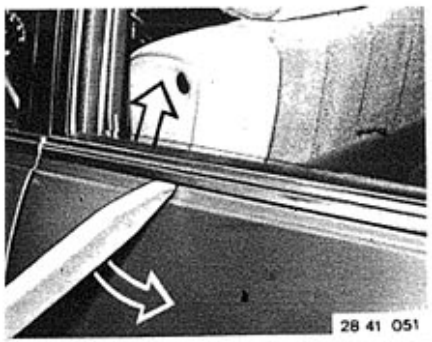
Unscrew catch button (1).
Remove ashtray.
Unscrew bolts.
Lift off trim panel upper section.
Installation.
Replace damaged clips.



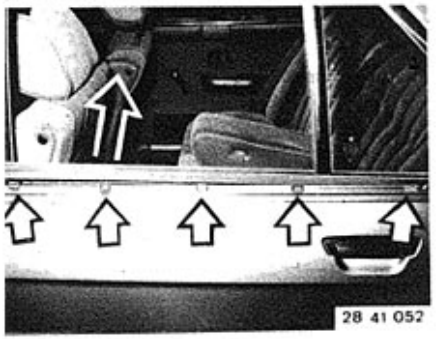
Pull off Acella sheet.
Unscrew bolts.
Installation:
Rubber window frame (1) rests on shoulder plate.
Replace damaged sheet.



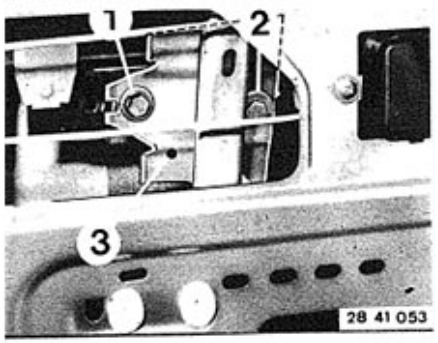
Pull off window recess cover strip.



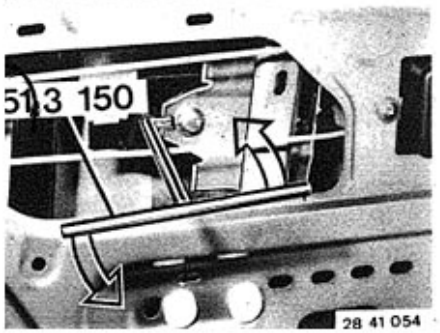
Push up cover strip with a wooden wedge or similar item (be careful not to damage paint).



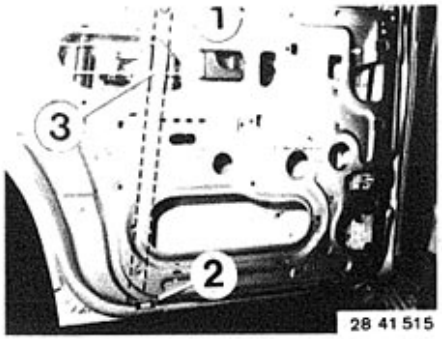
Pull off window recess cover strip.
Installation:
Replace damaged clips.



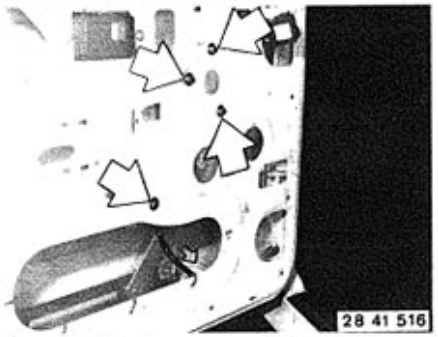
Position window control switch and window glass correctly.
Unscrew screws (1 and 2).
Remove bracket (3).



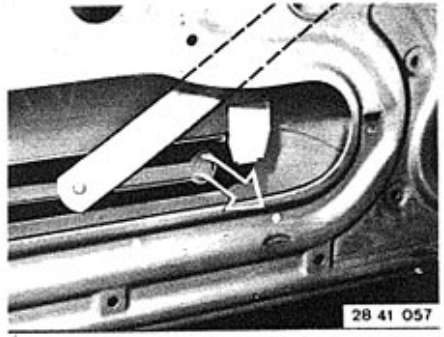
Installation:
Lubricate slides of bracket with grease.
Press window glass at rear window guide with Special Tool 51 3 150.



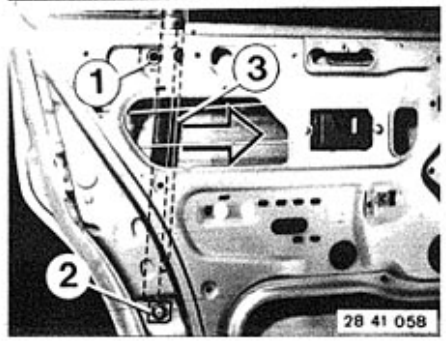
Unscrew screws (1 and 2).
Remove running rail (3).



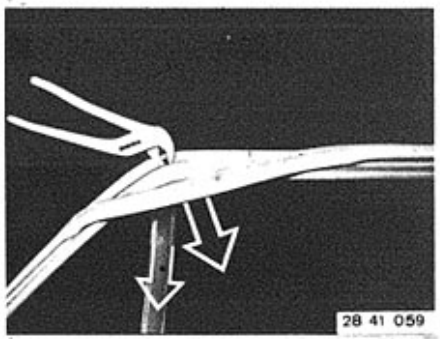
Run window glass down.
Pull off plugs on window motor.
Unscrew screws.
Caution!
Hold window glass.



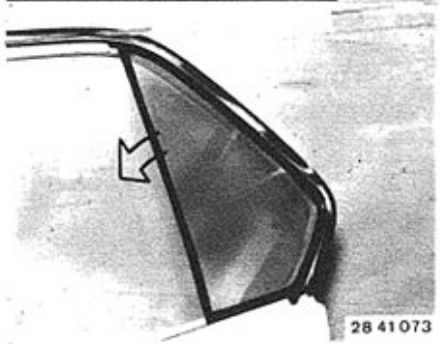
Disconnect lifting arm on lifting rail.
Remove winding mechanism.
Installation:
Lubricate toothed segment and lifting rail with a brand name multi-purpose grease.



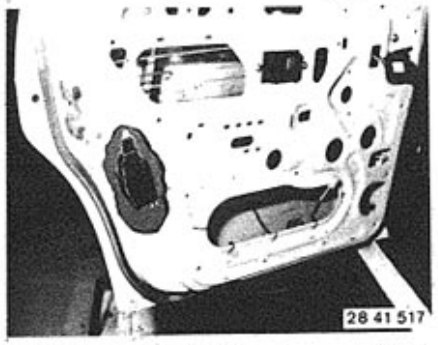
Unscrew screws (1 and 2).
Pull off window guide (3).



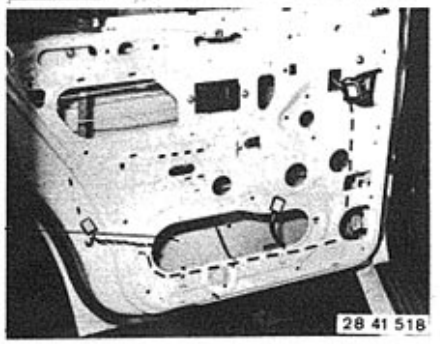
Pull off rubber profiles as required.
Bend bar straight and push rail down.



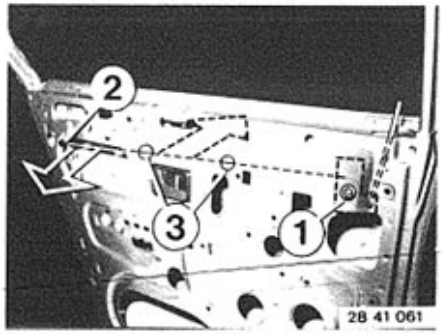
Pull out window with frame forward.
Remove guide rail and window glass from above.



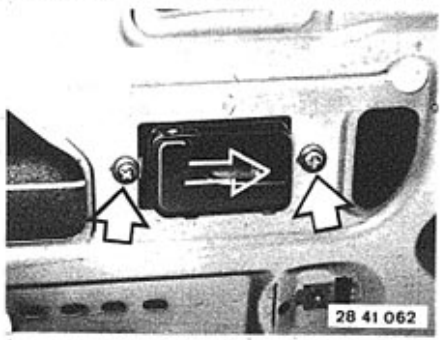
Unscrew screws.
Disconnect central locking system at linkage.
Disconnect plugs.
Installation:
Preload central locking system downward slightly.



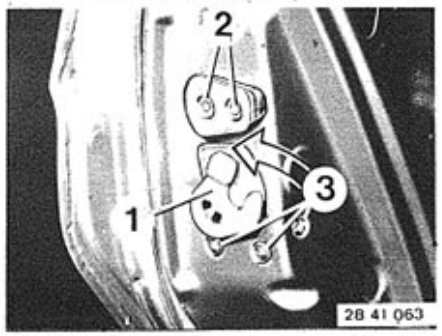
Pull wire harness out of door.



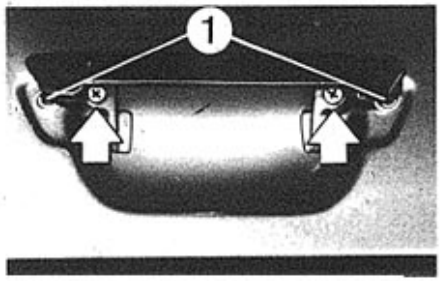
Unscrew nut (1).
Press operating rod out of clips (2) and clamps (3).



Unscrew screws.
Installation:
Push controls forward.

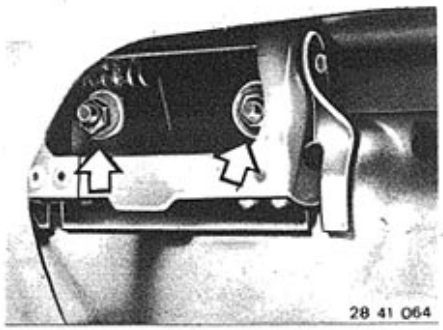


Turn up catch bolt (1).
Unscrew bolts (2 and 3).
Remove catch bolt lock.

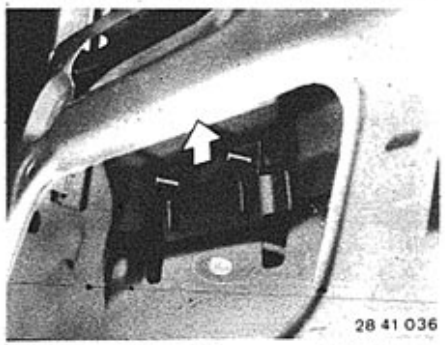


Unscrew grip plate.
Installation:
Grip plate rests on rubber pad (1).

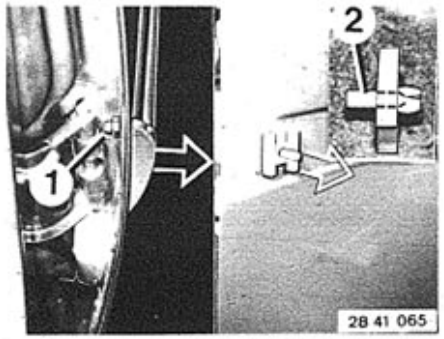
28 41 034



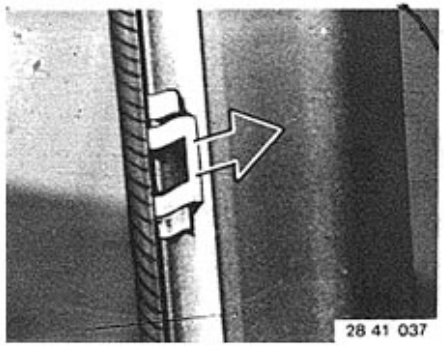
Unscrew nuts and remove lock controls.
Installation:
Replace stop nuts.
Before tightening, screw on grip plate and align lock controls with grip plate.



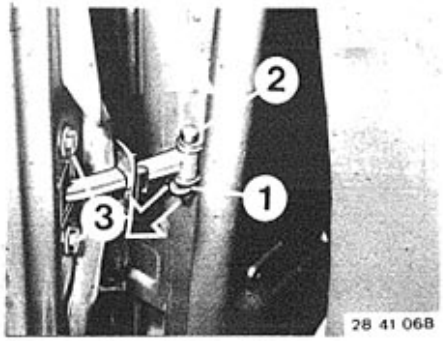
Remove threaded plate.



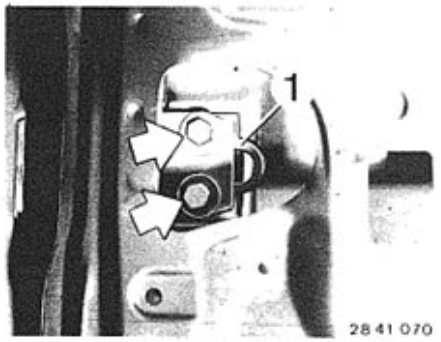
Unscrew plastic nut (1) and lift off rubbing strip.
Push out pin (2).
Installation:
Replace damaged clips.



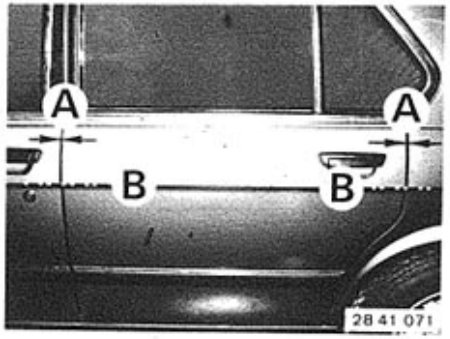
Take off frame plate.
Push back clips in direction of arrow until frame plate is cleared.
Installation:
Replace clips and use Terostat tape in area of clips.



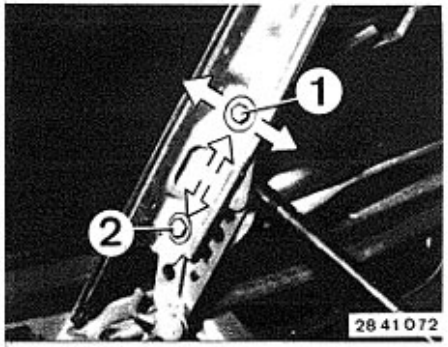
Pull off retainer (1) and knock out pin (2) upward.
Unscrew bolts (3) and remove door retarder.
Pull off rubber profiles on door.



Unscrew upper and lower hinge bolts.
Remove shim (1).
Installation:
Tap and lubricate threads of new door with grease.



Installation:
Adjust door to same plane with front door with shims (1).
Adjust door on hinges.
Gap (A) equal front and rear.
Align height to conform with beaded edge (B).
Transfer all clamps, clips, etc..

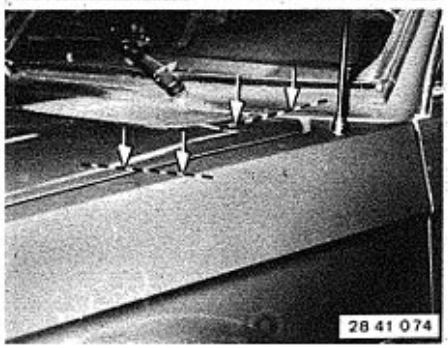


41 61 014 ALIGNING ENGINE HOOD

Loosen bolts (1 and 2).
Engine hood can be adjusted in height and axial direction.

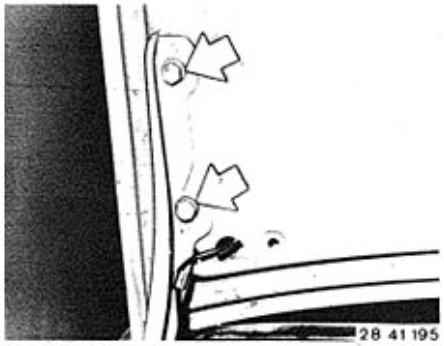


Adjust an uniform gap between engine hood and cowl panel as well as between engine hood at front and side panels.



Adjust an uniform height between engine hood and side panels as well as engine hood and cowl panel.
Also refer to "Adjusting Engine Hood Release" – 51 23 004.

41 62 014 ALIGNING TRUNK LID

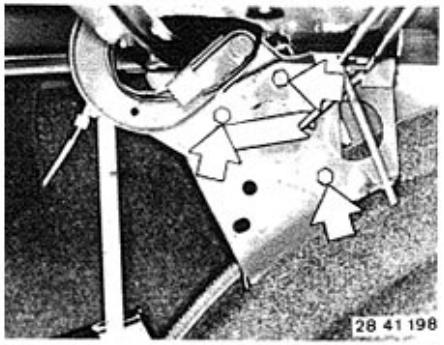


Adjusting Trunk Lid Horizontally:

Loosen hinge bolts.



Adjust trunk lid until there is an uniform gap on left and right sides and the transition of the trunk lid to both side panels (B) is optically in one line.

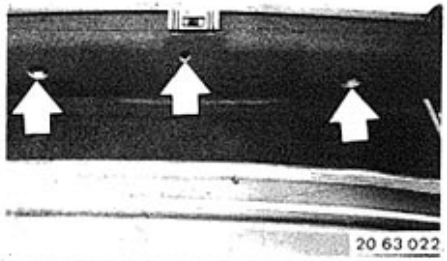


Adjusting Trunk Lid Height at Front:

Loosen bolts on trunk lid hinge.

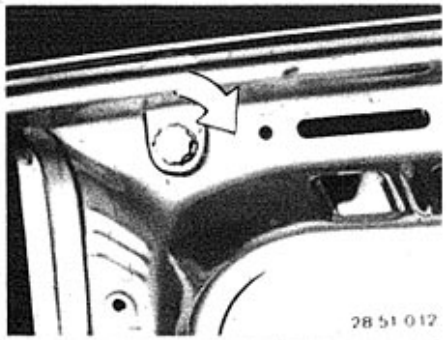


Adjust transition (C) between trunk lid and side panels.
Tighten hinge bolts.

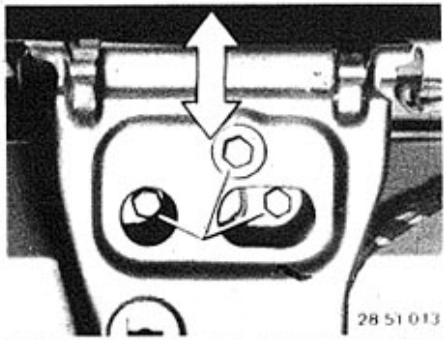


Adjusting Trunk Lid Lock:

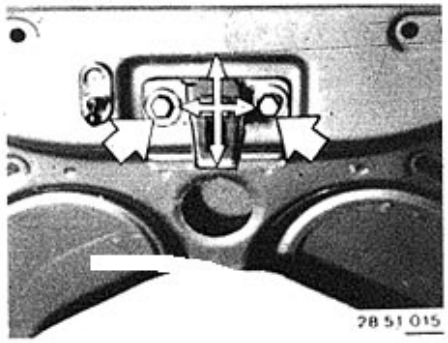
Remove trim panel.



Screw in stop pads on left and right sides.



Loosen bolts.
Adjust height of lock lower section.
Adjustment:
A closed trunk lid should be in the same plane with the edges of the side panels.
Turn stop pads until they contact the tail panel without play.

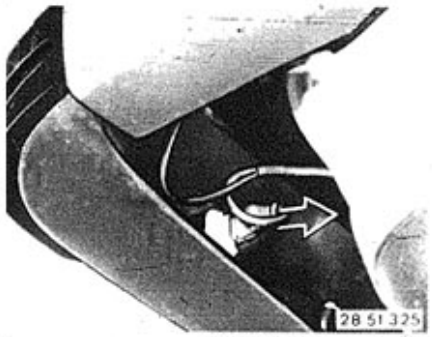


Loosen bolts of lock upper section slightly.
Close trunk lid.
This centers the lock upper section in the trunk lid lock.
Open trunk lid and tighten bolts.

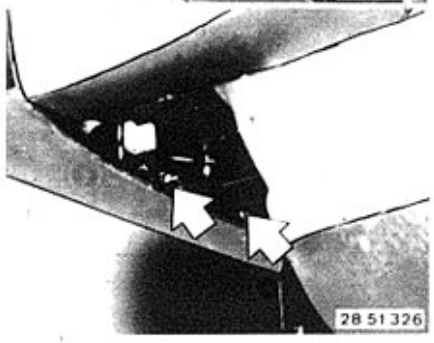
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51 11 000 REMOVING AND INSTALLING FRONT BUMPER ASSEMBLY



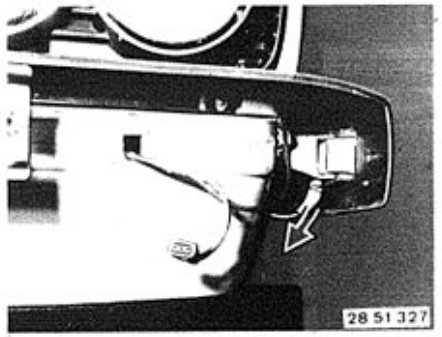
Disconnect battery ground lead.
Pull off plugs.



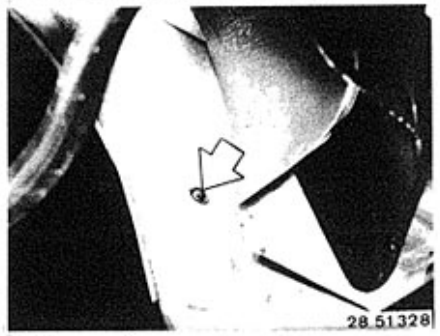
Unscrew bolts on left and right sides.
Take off bumper.
Installation:
Tightening torque*.

* See Specifications

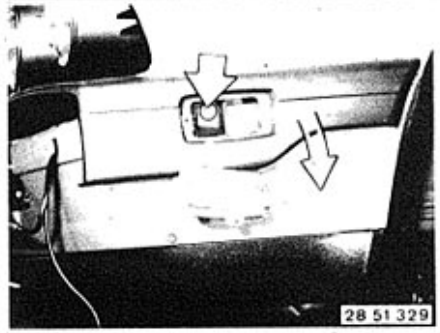
51 11 071 REPLACING LEFT OR RIGHT FRONT BUMPER SIDE SECTION



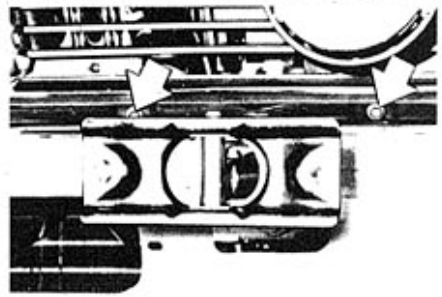
Remove front bumper assembly – 51 11 000.
Pull off plugs.



Unscrew bolt.



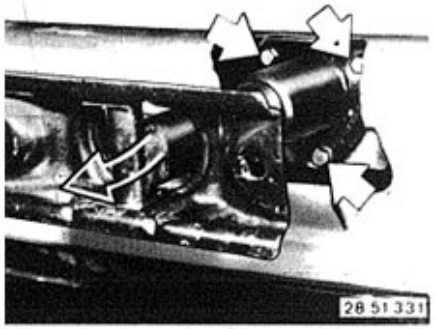
Unscrew lights.
Unscrew bolt.



Unscrew bolts.
Take off bumper side section.
Installation:
Check for uniform spacing between body and bumper side section.

28 51 330

51 11 163 REPLACING BOTH FRONT BUMPER IMPACT ABSORBERS



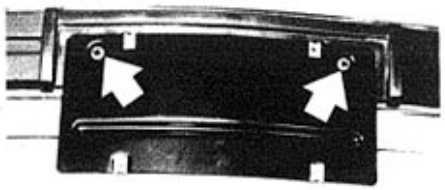
Remove front bumper assembly 51 11 000.
Unscrew bolts.
Remove absorbers.

Installation:
Adjust brackets.

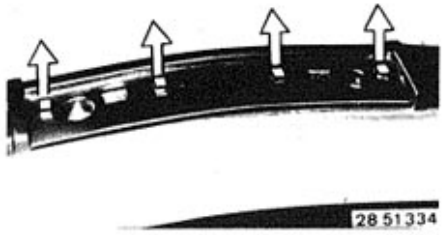


51 11 167 REPLACING RUBBER GUARD ON FRONT BUMPER

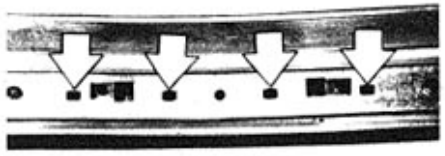
Remove front bumper assembly 51 11 000.
If applicable, unscrew license plate.
Unscrew bolts.



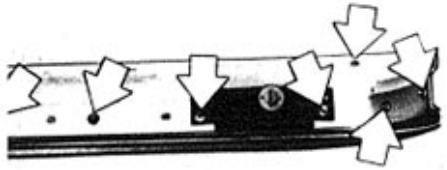
Lift out clips.

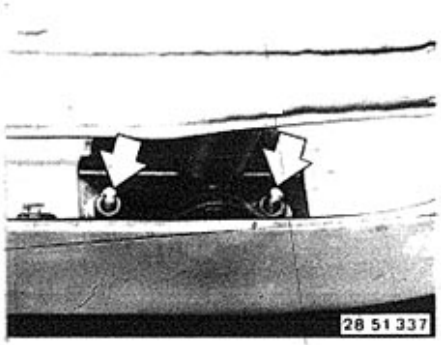


Compress and lift out clips.



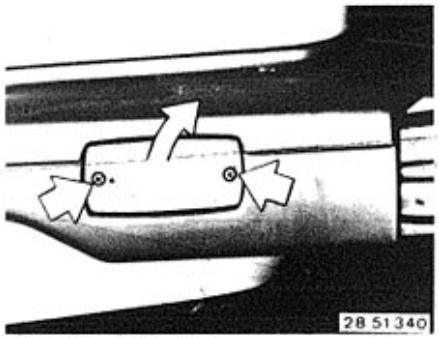
Unscrew bolts.
Take off rubber guard.
Installation:
Insert bolts for bumper brackets.





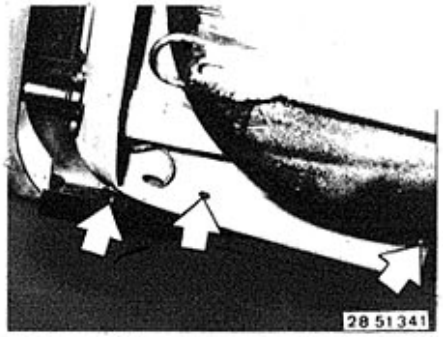
51 12 000 REMOVING AND INSTALLING REAR BUMPER ASSEMBLY

Unscrew bolts.
Take off bumper.

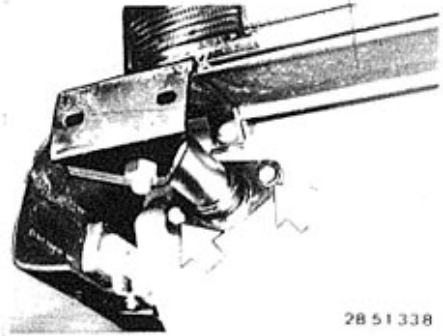


51 12 201 REPLACING LEFT OR RIGHT REAR BUMPER SIDE SECTION

Disconnect battery ground lead.
Unscrew lights.
Pull off plugs.

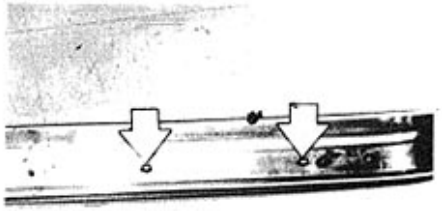


Unscrew bolts.



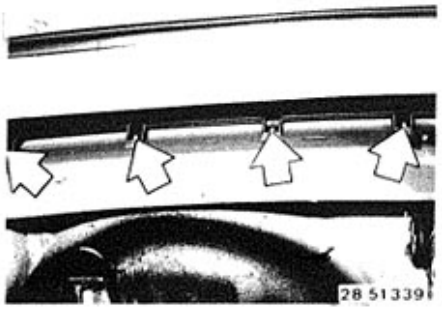
51 12 170 REPLACING REAR BUMPER IMPACT ABSORBER

Remove rear bumper assembly 51 12 000.
Unscrew bolts.
Remove absorber.



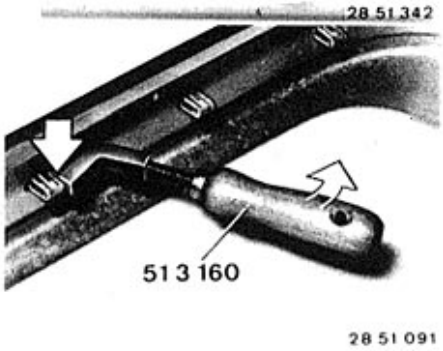
51 12 421 REPLACING RUBBER GUARD ON REAR BUMPER

Remove rear bumper assembly 51 12 000.
Press out clips.
Take off rubber guard.

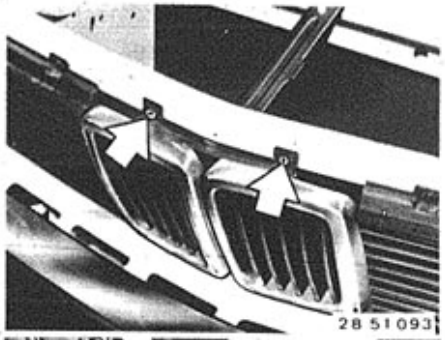


51 12 190 REPLACING COVER FOR REAR BUMPER

Unscrew bolts.
Take off cover.

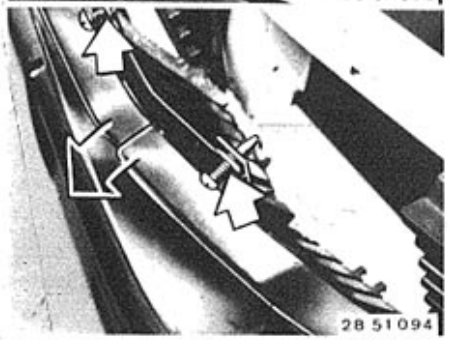


Installation:
Insert bolts for bumper brackets before installing the rubber guard.
Pull in clips with Special Tool 51 3 160 and make sure that clips engage correctly.

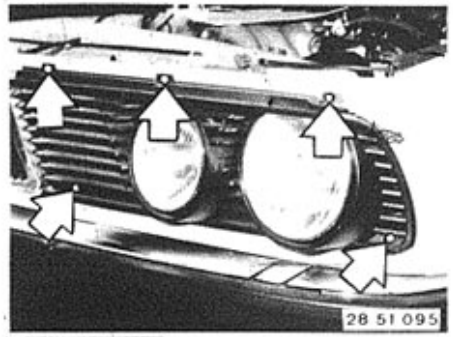


51 13 000 REMOVING AND INSTALLING CENTER RADIATOR GRILL SECTION

Raise the engine hood.
Unscrew the screws.

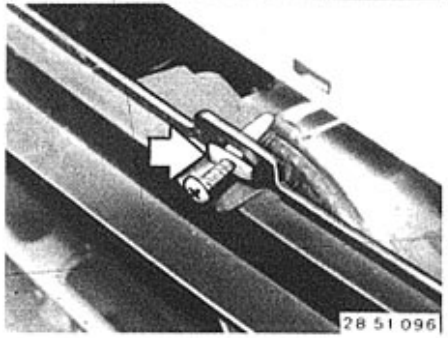


Lift off the center radiator grill section.
Installation:
Check clips, replacing if necessary.

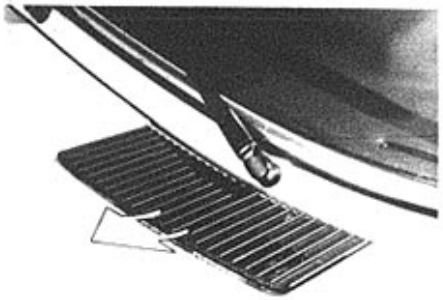


51 13 040 REMOVING AND INSTALLING SIDE RADIATOR GRILL SECTION

Unscrew the screws and lift off the side radiator grill section.

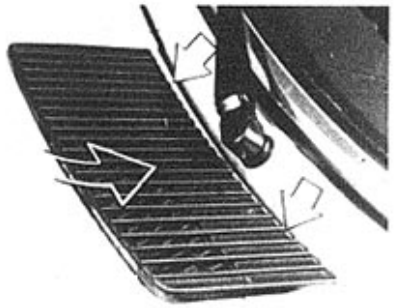


Installation:
Check clips, replacing if necessary.



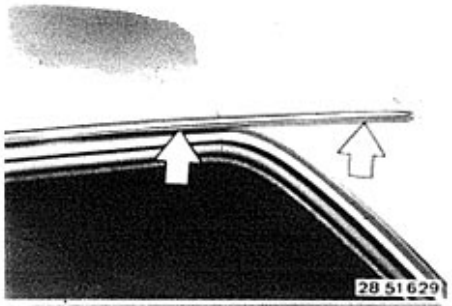
51 13 076 REMOVING HEATER AIR INLET GRILL

Lift out grill.

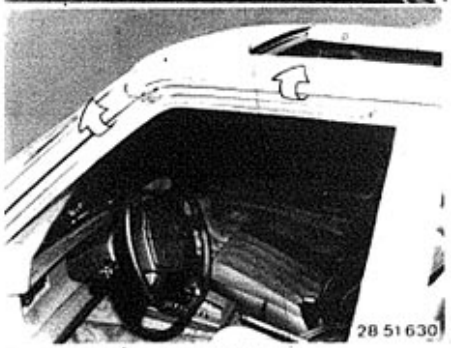


Installation:
Engage the rear of the grill first

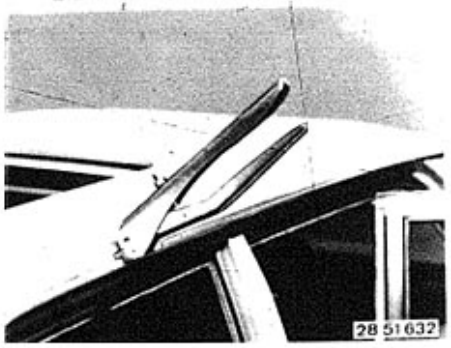
51 13 311 REPLACING LEFT OR RIGHT RAIN MOLDING STRIP



Lift off the strip carefully.

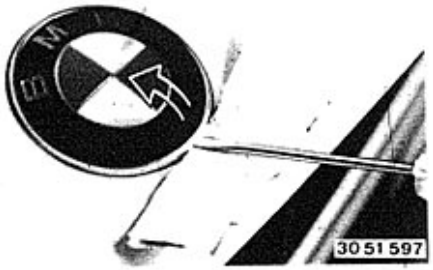


Turn the strip slightly and lift it out.



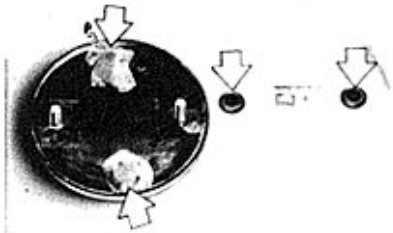
Installation:
Check the clips, replacing if necessary.
Make sure that the four clips are seated correctly.
Press on the strip lightly with BMW tool.

51 14 000 REMOVING AND INSTALLING FRONT BMW EMBLEM



Lift off the emblem carefully.

Installation:
Replace the plastic clip, if necessary.
Use Terostat tape.



51 14 010 REMOVING AND INSTALLING REAR BMW EMBLEM



Lift off the emblem carefully.



Installation:
Replace the plastic clip, if necessary.
Use Terostat tape.

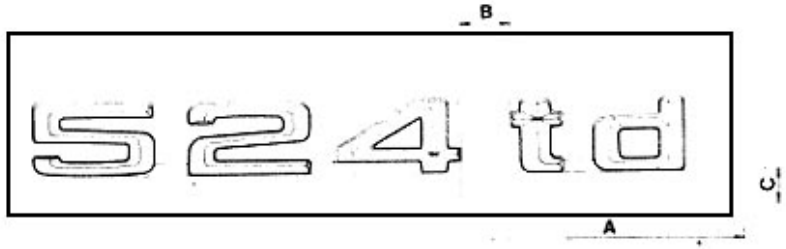


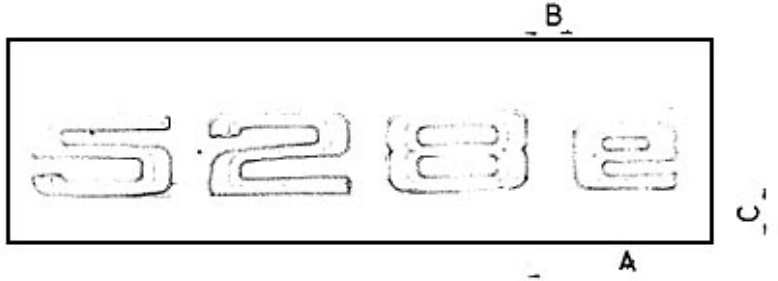
51 14 110 REPLACING REAR MODEL SIGN

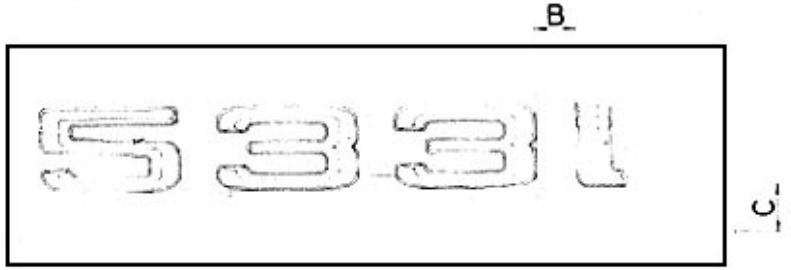
The model sign is cemented and cannot be reused.
Coat a nylon string or garn with Tenside (e.g. dish washing detergent) and "saw through" coat of cement between trunk lid and model sign.
Remove residual cement on trunk lid with gasoline.
Model signs may only be installed at room temperature.
Locate tape up to upper edge "C" and mark distances according to table.
Heat model sign to approx. 40 – 50° C (105 to 120° F) and press on firmly 5 to 10 seconds.

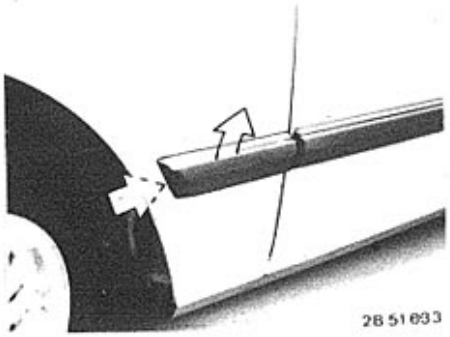
Distances for Model Signs:	A	B	C
BMW 528 e	76 mm (2.992")	18 mm (0.709")	18 mm (0.709")
BMW 524 td	120 mm (4.724")	21 mm (0.827")	18 mm (0.709")
BMW 533 i – 535 i	76 mm (2.992")	15.5 mm (0.610")	18 mm (0.709")
III M	51 mm (2.008")	–	22 mm (0.866")

Note:
Model sign must be removed when baking paint at temperatures above 80° C (175° F).



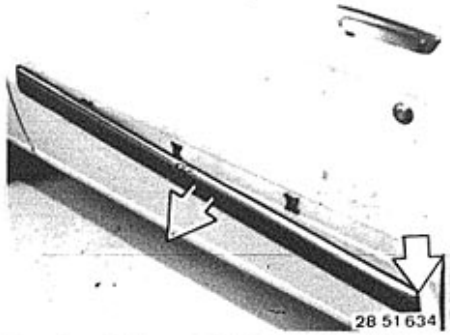


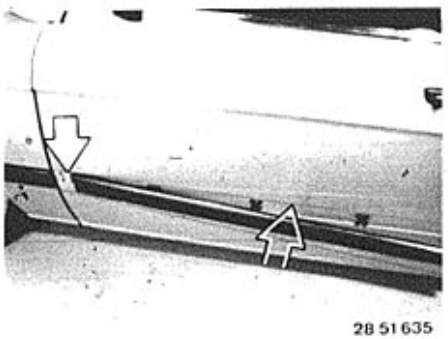



28 51 633

51 15 300 REMOVING AND INSTALLING RUBBING STRIP ON LEFT OR RIGHT SIDE PANEL

Unscrew screw.
Lift off the rubbing strip.
Installation:
Replace clips, if necessary.

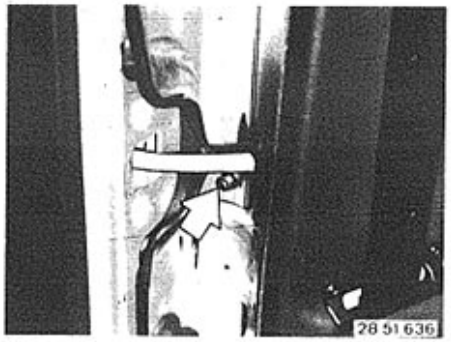

28 51 634

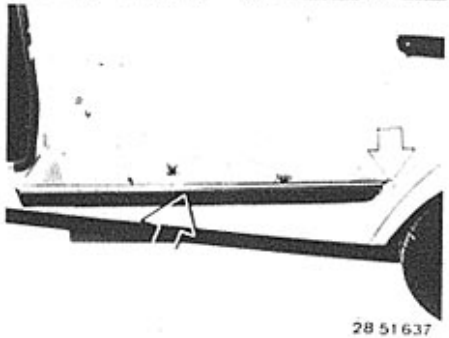

28 51 635

51 15 330 REMOVING AND INSTALLING RUBBING STRIP ON LEFT OR RIGHT FRONT DOOR

Unscrew screw.
Pull off the rubbing strip.

Installation:
Replace clips, if necessary.
First engage the rubbing strip in the bevelled clip and then press on.


28 51 636


28 51 637

51 15 360 REMOVING AND INSTALLING RUBBING STRIP ON LEFT OR RIGHT REAR DOOR

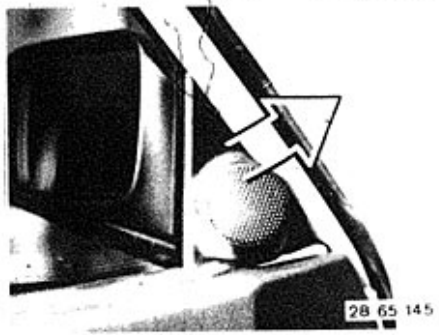
Unscrew screw.

Pull off the rubbing strip.
Installation:
First engage the rubbing strip in the bevelled clip and then press on.
Replace clips, if necessary.

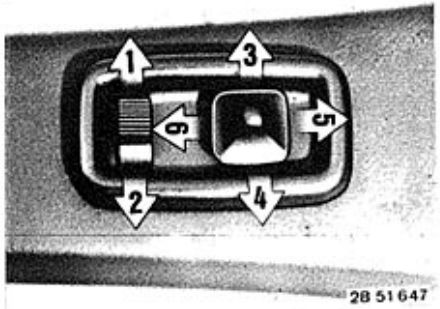


51 16 000 REMOVING AND INSTALLING OR REPLACING MIRROR ON LEFT OR RIGHT FRONT DOOR

Disconnect the battery ground lead.
Pull off cover toward the rear.
Unscrew mirror mounting screws and disconnect the plug.
Note:
A blue dot indicates a heated outside mirror.



Cars with Radio Speaker System:
Lift off the mirror triangle.
Pull off the wires.

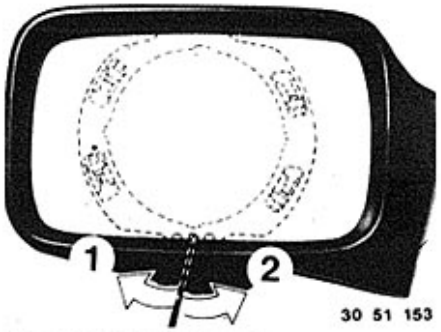


Turn on ignition and check operation.
Switch Position:
1 = Left outside mirror
2 = Right outside mirror
Adjusting Mirror:
3/4 Vertical plane
5/6 Horizontal plane

DESCRIPTION

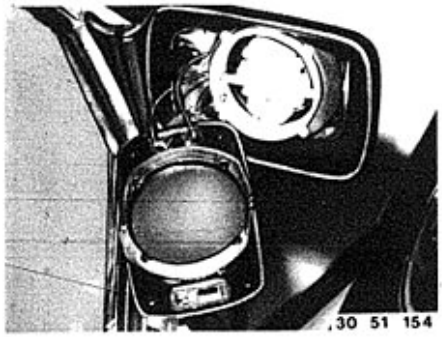
The outside mirror can be adjusted and heated after turning on the ignition.
Heating is controlled automatically.
Heating is switched on by an integrated temperature switch when the mirror glass temperature is below + 15 ± 5° C (59 ± 9° F).
Heating is switched off automatically when a temperature of 50 ± 10° C (122 ± 18° F) is reached.
Heating switches in again when the temperature would drop below + 15 ± 5° C (59 ± 9° F).
The melting speed at – 10° C (+ 14° F) for a frozen mirror is about 5 minutes with a power consumption of approx. 1.5 A.

51 16 026 REPLACING GLASS FOR MIRROR

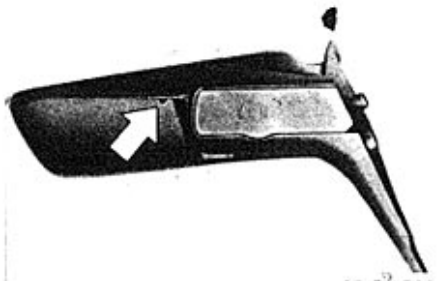


30 51 153

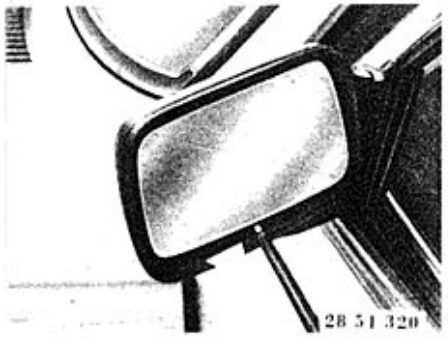
Guide a screwdriver into the housing opening (bottom) and turn the retaining ring.
1 = Unlocking
2 = Locking


30 51 154

Heated Outside Mirror:
Pull off the flat male plug and connect it on the new mirror glass.
Check function – see 51 16 000.


28 51 318

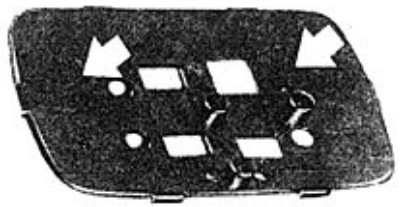
Important!
The baseplate of the version with a cemented mirror glass (recognized by the smaller housing opening) is mounted on three ball sockets.


28 51 320

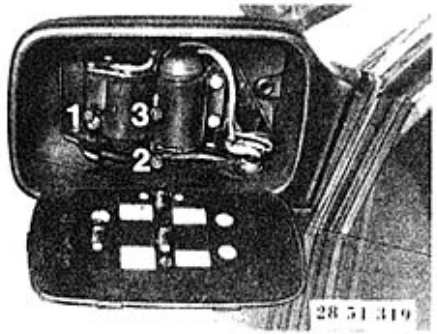
Pry out the mirror glass and baseplate with an electric screwdriver.


28 51 321

Heat mirror glass with a hot air blower, e.g. HWB Order No. 81 12 9 426 253, until it can be lifted off of the baseplate with a wooden wedge, screwdriver or similar item (approx. 75° C / 165° F).
Remove any residual cement with a cloth, whereby the baseplate might have to be heated again slightly.

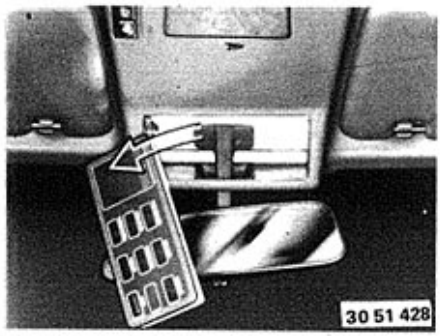

28 51 322

Cement the mirror glass on a cold baseplate and press it on firmly.



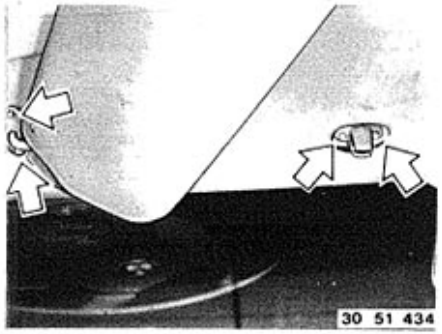
28 51 319

Clip in the baseplate with new mirror glass on the moving take-up balls (1 and 2) first and then on the fixed ball (3).

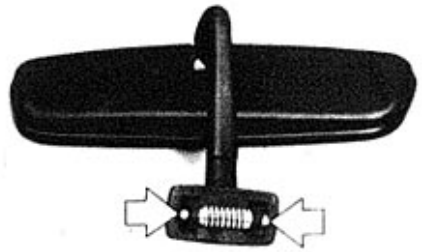


51 16 060 REMOVING AND INSTALLING INSIDE MIRROR

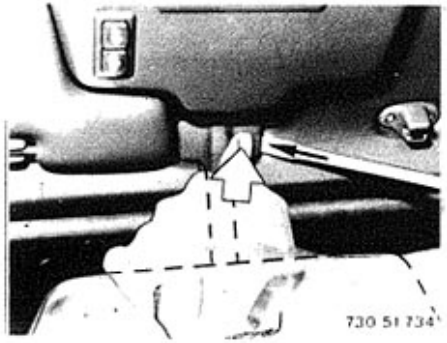
Lift out the check control – also see pulling off the mirror.



Cars with Front Roof Liner Plate and Without Check Control:
If applicable, remove front roof liner plate – see 51 44 150.

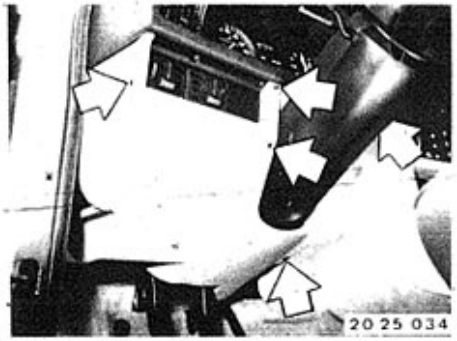


Installation:
The spring must be compressed.

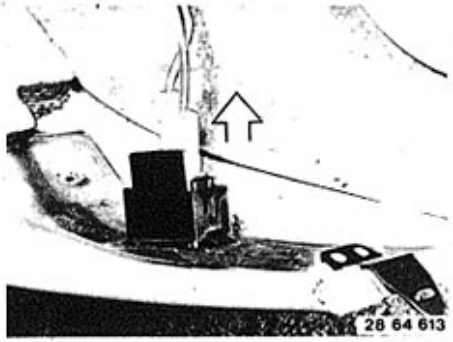


Installation:
Apply the mirror diagonally and press on, if necessary with the butt of a hammer.

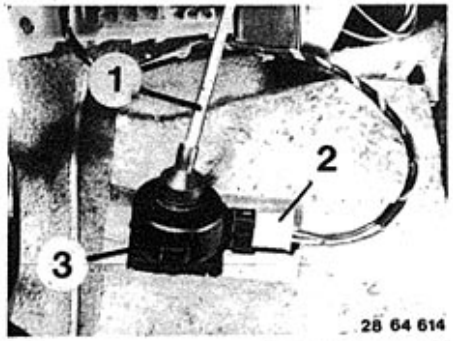
51 16 200 REMOVING AND INSTALLING CENTER CONSOLE



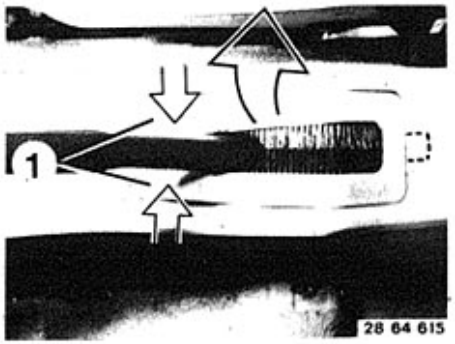
Disconnect the battery ground lead.
Unscrew screws and take off the trim panel.
Cars with SRS:
See 51 45 180.



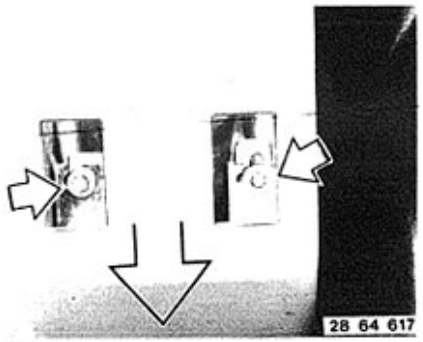
Cars with Power Windows:
Pull off both plugs on the automatic cutouts.



Cars with Electronic Heating Control:
Pull off the vacuum hose (1) and plug (2) on the inside temperature sensor (3).
Take off the trim panel.



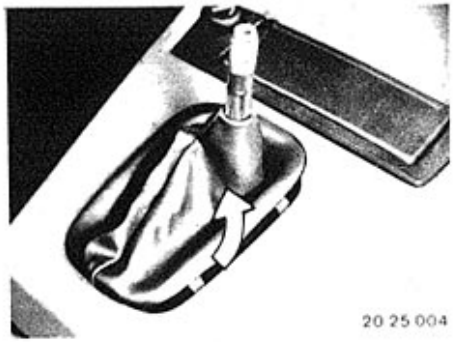
Compress and fold up the parking brake lever cover (1).



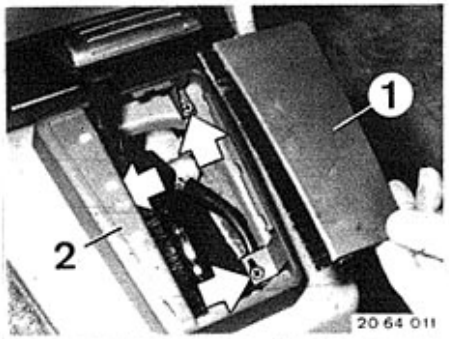
Unscrew both screws and take off or push back the cover.



Pull off the shift lever knob.



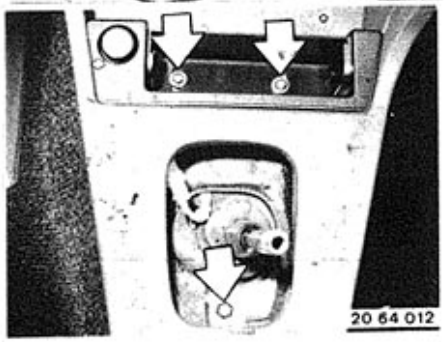
Lift out the dust cover.



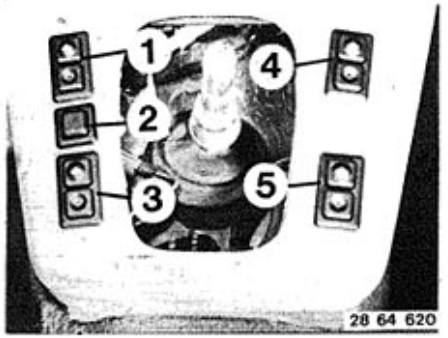
Cars with Automatic Transmission:
Lift out cover (1).
Remove plate (2).



Remove insulation sheet.



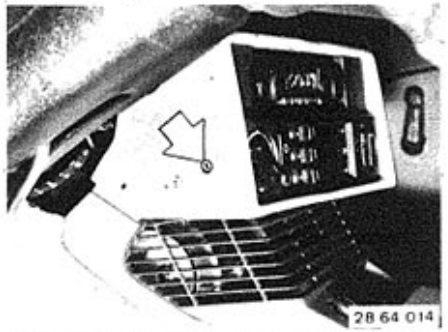
Lift out ashtray.
Unscrew screws.
Pull off plugs on cigar lighter and ashtray light.
Remove ashtray holder.



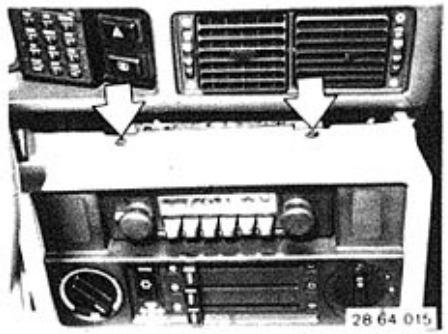
Lift switches (1 — 5) out of cover.
Pull off plugs on switches.



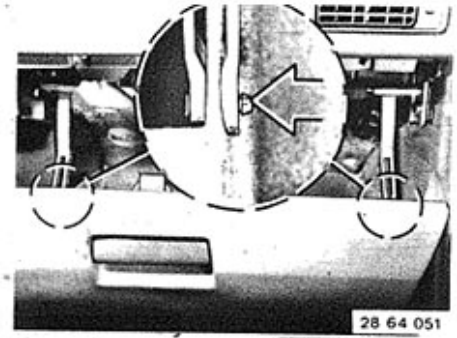
Open glove box and unscrew screws.



Unscrew left and right screws.

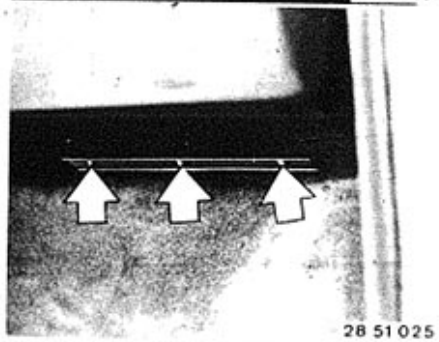


Push back center console.
Unscrew screws.
Disconnect radio plugs, if applicable.
Remove center console.

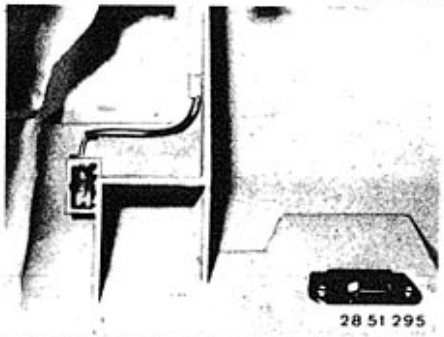


51 16 360 REMOVING AND INSTALLING RIGHT GLOVE BOX

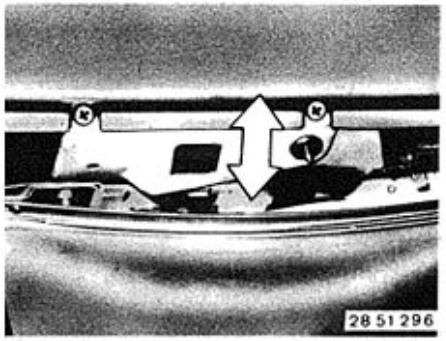
Push out the pins.
Disconnect the straps on left and right sides.
Remove the trim panel.



Unscrew screws.

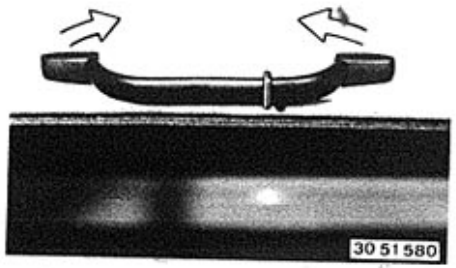


Lift out the plug.



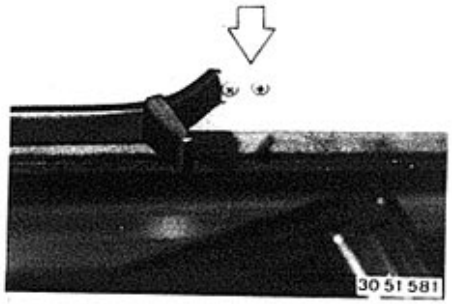
Installation:
If applicable, adjust the striker for the lock.

51 16 450/480 REMOVING AND INSTALLING GRAB HANDLE

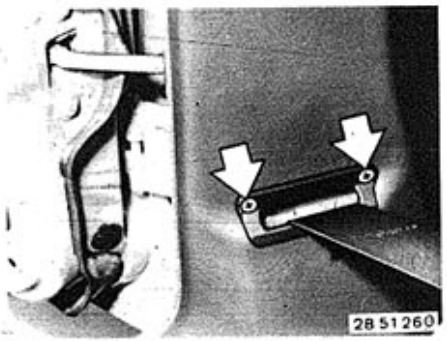


Lift out the covers.

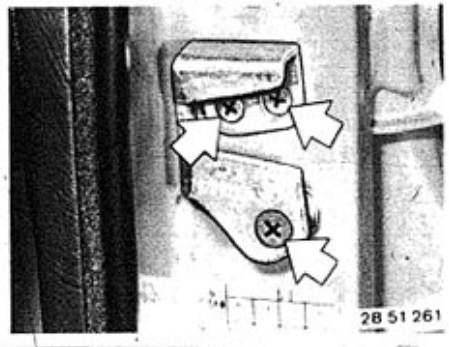
Unscrew screws.



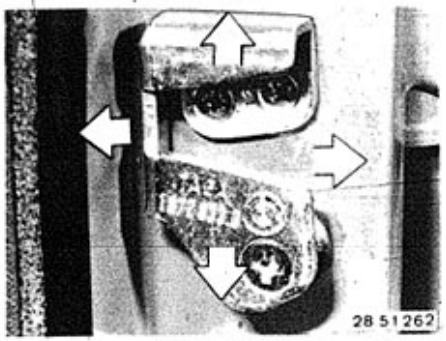
51 21 003 REPLACING LEFT OR RIGHT FRONT DOOR STRIKER



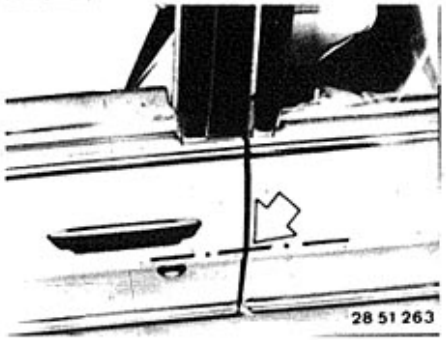
Unscrew screws on the B pillar trim.



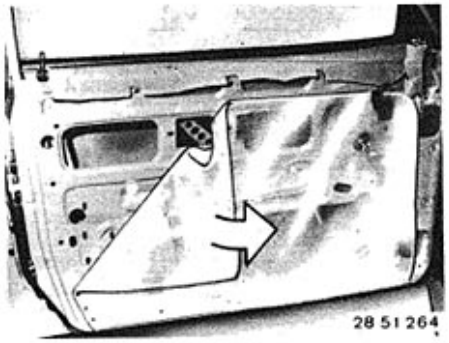
Unscrew screws.
Take off the door striker.
Installation:
Align the sheet metal plate.



Installation:
Tighten the striker in center position finger tight.
Shut the door with the opened door handle.
This will align the striker.

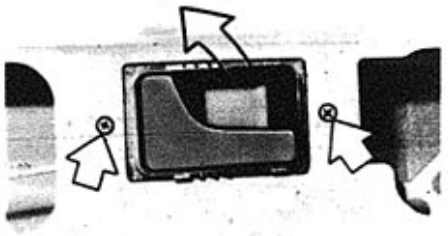


Tighten the striker.
Shut the door.
Check, correcting if necessary.
Edge of front door must be in same plane with the rear door.

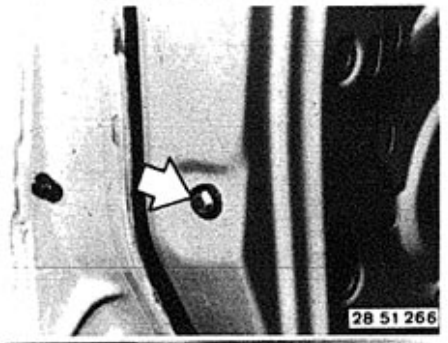

28 51 264

51 21 090 REMOVING AND INSTALLING OR REPLACING LEFT OR RIGHT FRONT DOOR LOCK

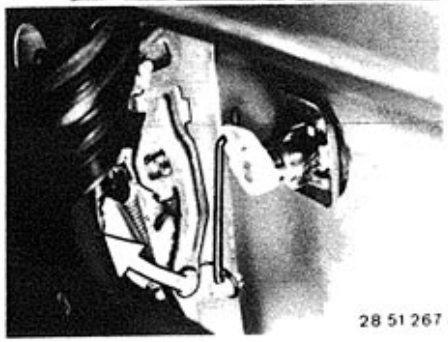
Shut the window.
Remove the door trim panel – see 51 41 001.
Pull off the plastic sheet.
Installation:
Replace damaged plastic sheet.


28 51 265

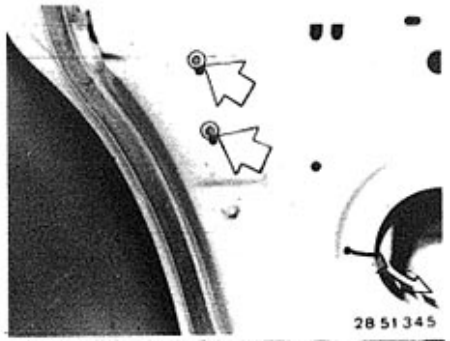
Unscrew the catch button.
Unscrew the door remote control, turn it up and remove.
Installation:
Preload the door remote control slightly.


28 51 266

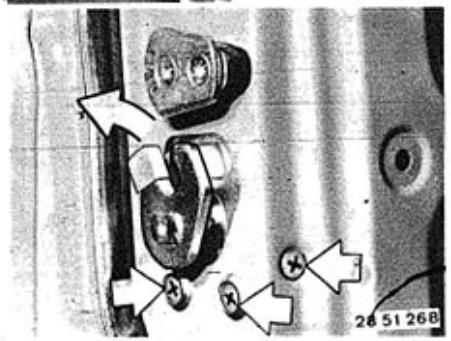
Unscrew bolt.
Pull out the rubber window guide.
Remove the window guide rail.
Installation:
Check that guide rail and rubber guide are seated correctly.


28 51 267

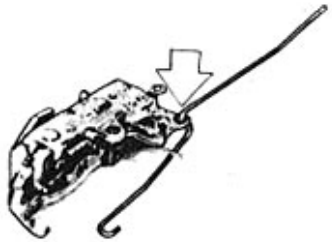
Disconnect the linkage.
Installation:
Check for correct seating of the linkage.
Cars with Central Locks:
Lift out the clip.


28 51 345

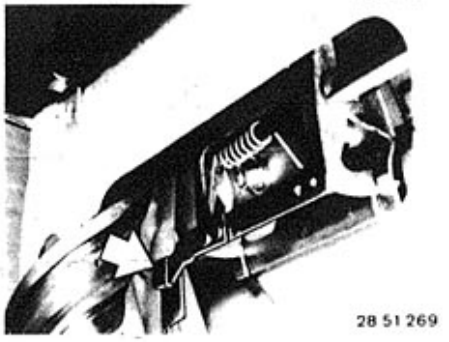
Cars with Central Locks:
Pull off plug.
Unscrew screws.
Disconnect the drive.
Installation:
Adjust drive see 51 26 000.


28 51 268

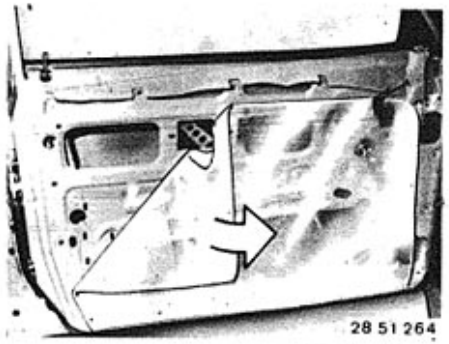
Turn the latch up.
Unscrew screws.
Remove the lock.


28 51 621

Cars with Central Locks:
Check that the connecting rod fits correctly.

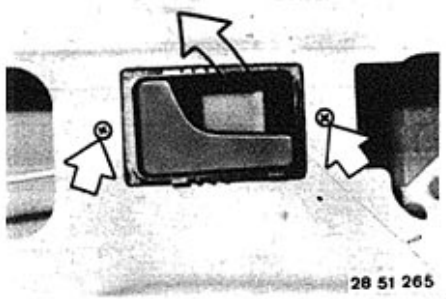

28 51 269

Installation:
Lubricate the lock with grease.
Check the installed position.
Close the latch.

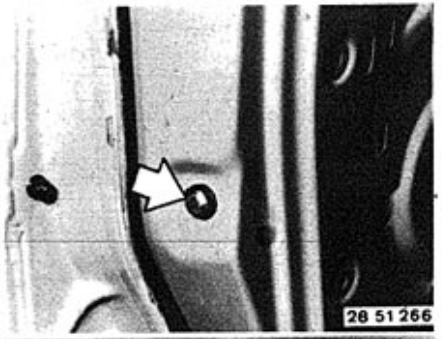

28 51 264

51 21 140 REMOVING AND INSTALLING OR REPLACING LEFT OR RIGHT FRONT DOOR LOCK CYLINDER ASSEMBLY

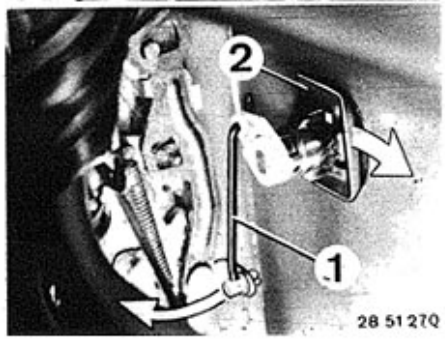
Remove door trim panel – see 51.41 001.
Pull off the plastic sheet carefully.
Installation:
Replace damaged plastic sheet.


28 51 265

Unscrew screws, turn up and remove the door remote control.
Installation:
Preload the door remote control slightly.

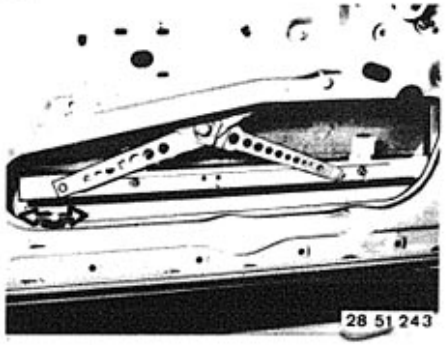

28 51 266

Unscrew bolt.
Pull out the rubber window guide.
Remove the window guide rail.
Installation:
Check for correct seating of the guide rail and rubber guide.

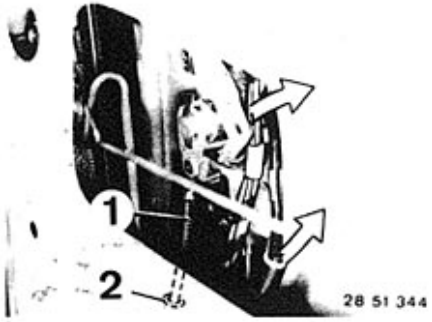


28 51 270

Disconnect linkage (1).
Press off lockplate (2) and remove the washer, pulling off the wires if applicable.
Remove the lock cylinder.

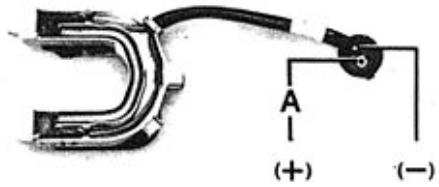

28 51 243

Cars with Central Locks:
Pull off the plug and loosen wire straps.



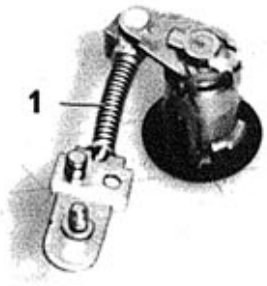
28 51 344

Disconnect linkage (1).
Press off lockplate (2).
Cars with Heated Door Locks:
Pull off wires for door lock heating.
Pull off the heating ring together with the lockplate.
Remove the lock cylinder.



28 51 622

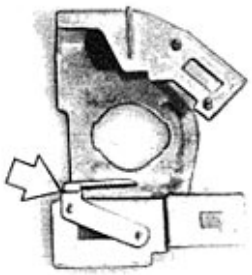
View of Door Lock Heating:
See Specifications in Group 61 for testing the power input.



28 51 639

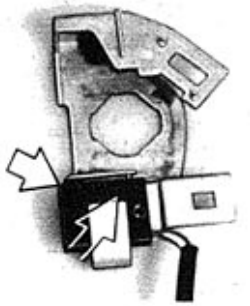
Driver's Door:
View of lock cylinder 1 = spring for mechanical unlocking arrest.

Installation:
Place the microswitch activator on the holder.

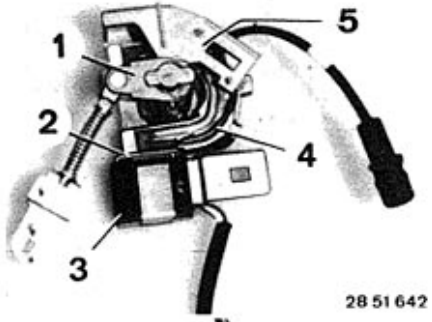


28 51 640

Installation:
Mount the microswitch and secure it with a clamp.



28 51 641



28 51 642

Layout of Lock Cylinder in Driver's Door:
1 = Lock cylinder
2 = Microswitch activator
3 = Microswitch
4 = Clamp
5 = Holder



28 51 643

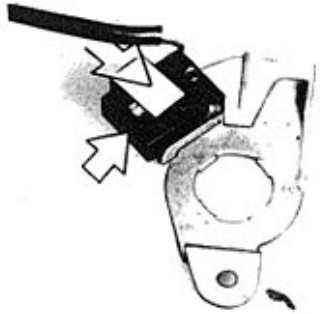
Passenger's Door:
View of lock cylinder with operating linkage.

Installation:
Place the microswitch activator on the holder.

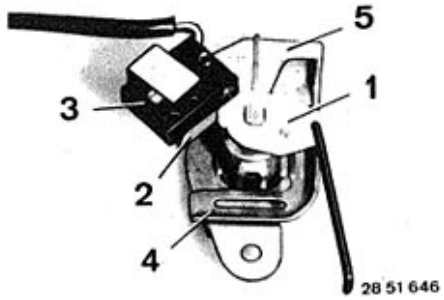


28 51 644

Installation:
Mount the microswitch and secure it with a clamp.

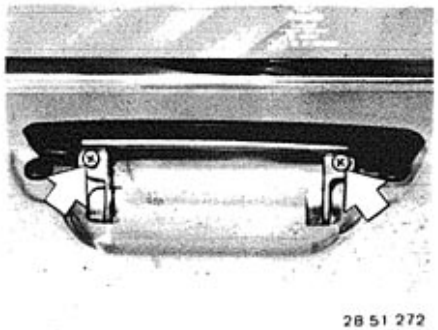


28 51 645



28 51 646

Layout of Lock Cylinder in Passenger's Door:
1 = Lock cylinder
2 = Microswitch activator
3 = Microswitch
4 = Clamp
5 = Holder



28 51 272

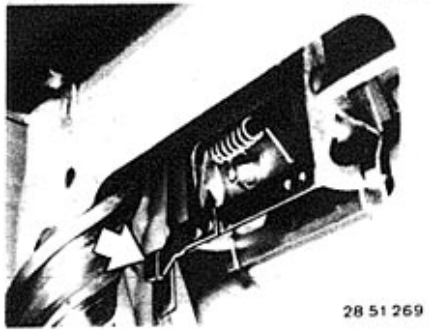
51 21 200 REMOVING AND INSTALLING/ REPLACING OUTSIDE HANDLE AND LOCK MECHANISM OF LEFT OR RIGHT FRONT DOOR

Remove left or right front door trim panel 51 41 001.
Unscrew screws.
Unscrew screws.
Remove window guide rail.



28 51 273

Unscrew screws.
Remove lock mechanism.



28 51 269

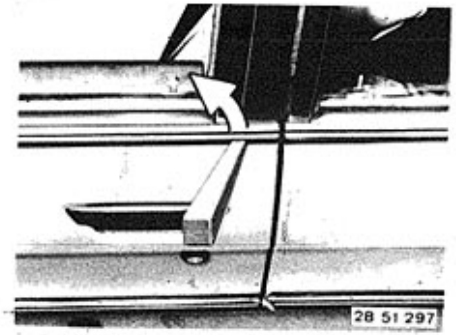
Installation:
Check for correct fit of lock mechanism.



Installation:
Adjust to have uniform spacing.



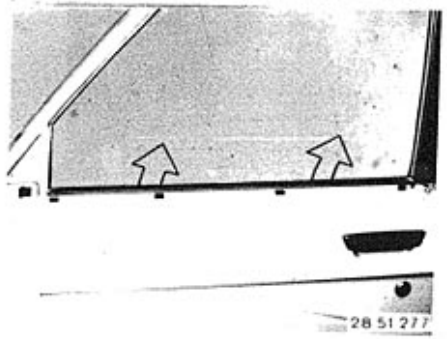
28 51 274



28 51 297

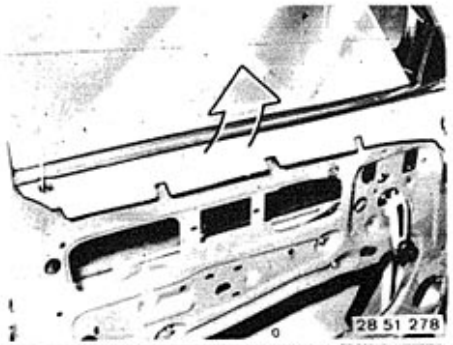
51 21 300 REMOVING AND INSTALLING/ REPLACING WINDOW RECESS COVER STRIP ON OUTSIDE OF LEFT OR RIGHT FRONT DOOR

If applicable, remove mirror 51 16 000.
Lower window.
Lift off chrome strip carefully.



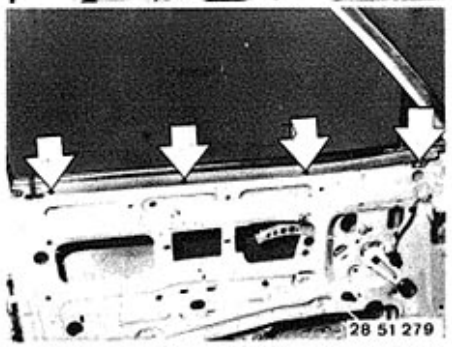
28 51 277

Lift out cover strip.
Installation:
Replace clamps if necessary.

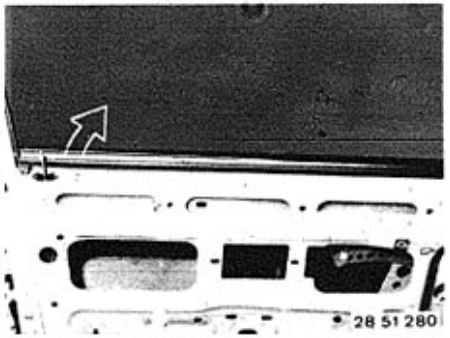


51 21 330 REMOVING AND INSTALLING/ REPLACING WINDOW RECESS COVER STRIP ON INSIDE OF LEFT OR RIGHT FRONT DOOR

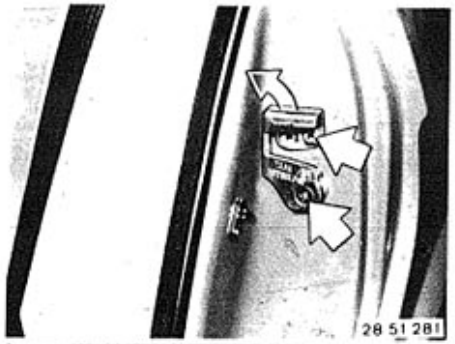
Remove front door trim panel 51 41 001.
Remove front door trim upper section 51 41 020.
Take off insulation sheet.



Unscrew screws.
Take off chrome strip.
Lower window.

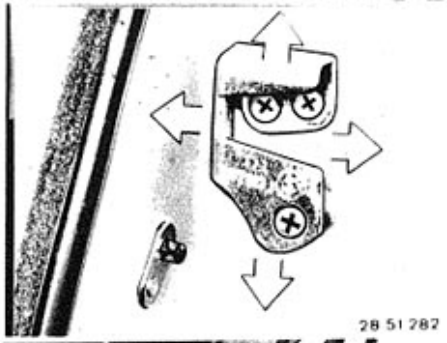


Lift out cover strip.
Installation:
Replace clamps if necessary.

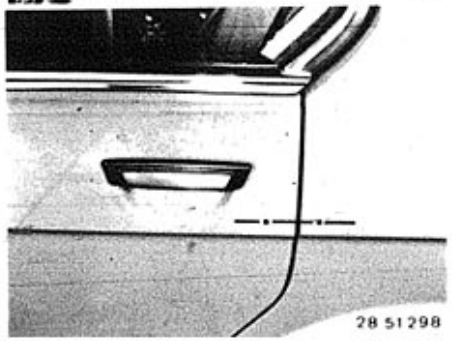


51 22 001 REPLACING LEFT OR RIGHT REAR DOOR STRIKER

Unscrew screws.
Take off door striker.

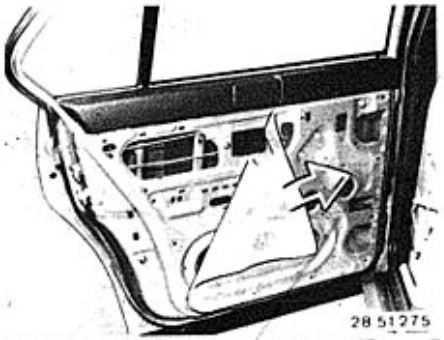


Adjusting:
Tighten striker screws in center position finger tight.
Close door with opened door handle.
This aligns the striker.

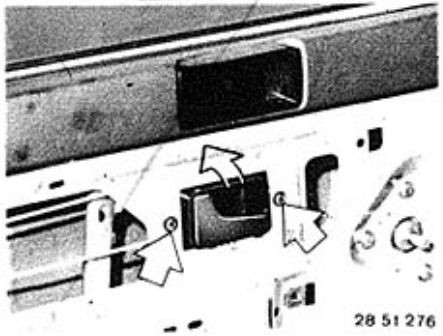


Tighten striker screws.
Close door.
Check, correcting if necessary.
Edge of rear door must be in same plane with side panel.

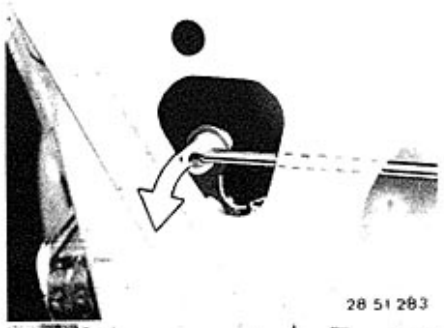
51 22 090 REMOVING AND INSTALLING/ REPLACING DOOR LOCK OF LEFT OR RIGHT REAR DOOR



Close window.
Remove door trim panel 51 42 001.
Pull off plastic sheet carefully.
Installation:
Replace damaged plastic sheet.



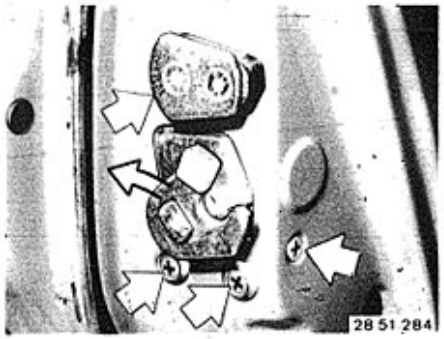
Unscrew screws.
Turn up and remove door remote control.
Installation:
Preload remote control slightly.



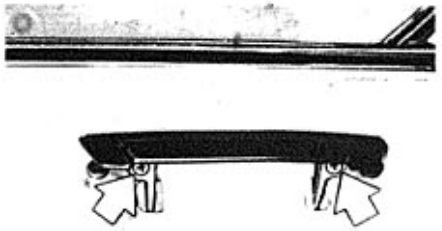
Disconnect locking linkage.



Pull off plug.
Unscrew screws.
Disconnect drive.
Installation:
Adjust drive – see 51 26 010.



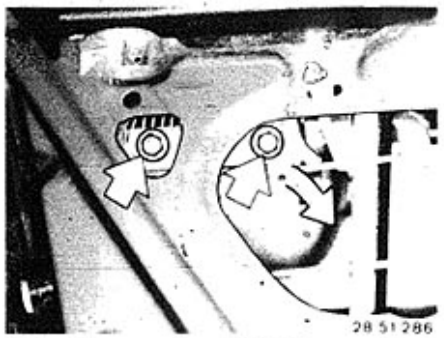
Turn latch to face up.
Unscrew screws.
Remove door lock.
Installation:
Make sure lock operator fits correctly.



28 51 285

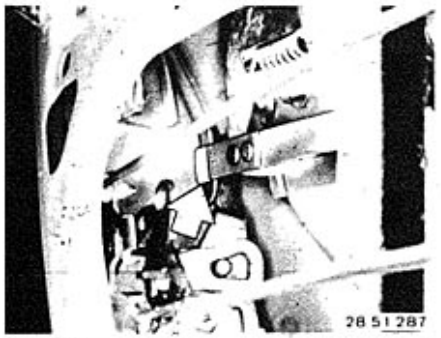
51 22 200 REMOVING AND INSTALLING/ REPLACING OUTSIDE HANDLE AND LOCK MECHANISM OF LEFT OR RIGHT REAR DOOR

Close (raise window).
Remove and install door trim panel 51 42 001.
Pull off plastic sheet.
Unscrew screws.
Installation:
Replace damaged plastic sheet.



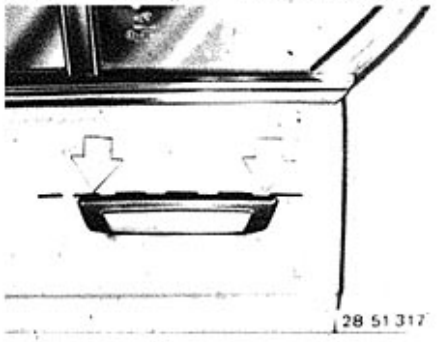
28 51 286

Unscrew screws.
Remove door lock mechanism.



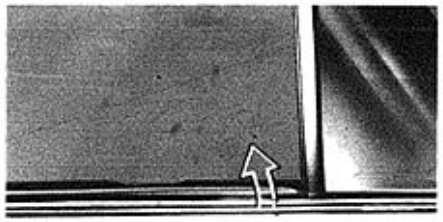
28 51 287

Installation:
Check for correct fit of lock mechanism.



28 51 317

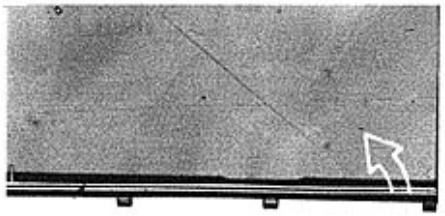
Installation:
Adjust to have uniform spacing.



28 51 300

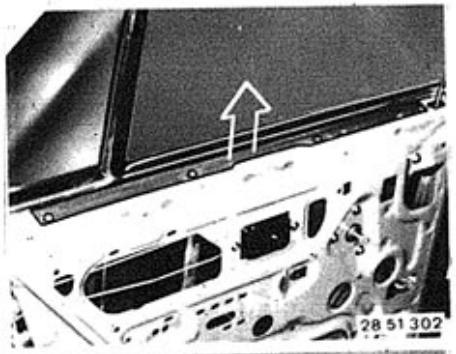
51 22 300 REMOVING AND INSTALLING/ REPLACING WINDOW RECESS COVER STRIP ON OUTSIDE OF LEFT OR RIGHT REAR DOOR

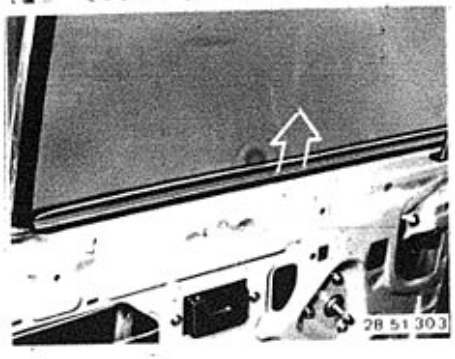
Lower window.
Lift off chrome strip carefully.



28 51 301

Lift out cover strip.
Installation:
Replace clamps if necessary.

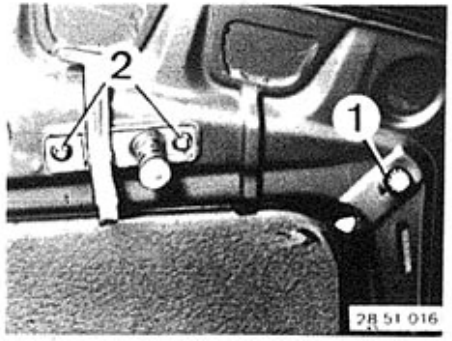


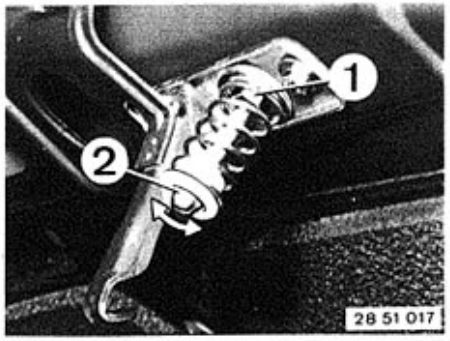


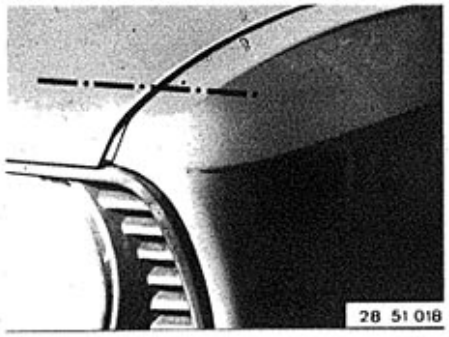
51 22 330 REMOVING AND INSTALLING/ REPLACING WINDOW RECESS COVER STRIP ON INSIDE OF LEFT OR RIGHT REAR DOOR

Remove door trim panel 51 42 001.
Remove door trim panel upper section 51 42 020.
Unscrew screws.
Take off chrome strip.

Lift out cover strip.
Installation:
Replace clips, if necessary.







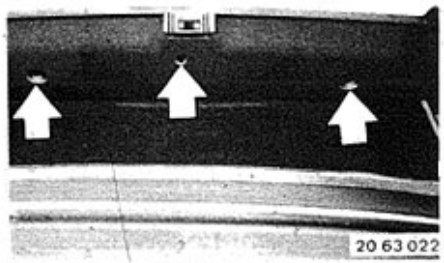
51 23 004 ADJUSTING ENGINE HOOD RELEASE

Screw in stop pads (1) on left and right sides.
Loosen bolts (2) of left and right engine hood locks slightly, close engine hood (lock upper section is centered), open engine hood and tighten bolts.

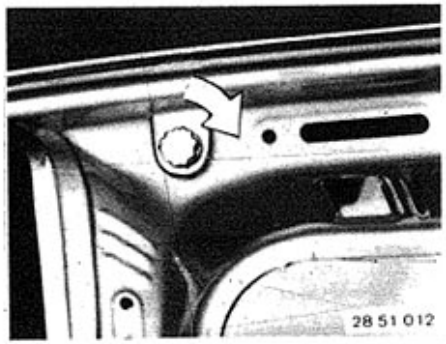
Loosen lock nut (1).
Turn adjusting base (2) to correct height.
Tighten lock nut.

Adjusting:
A closed engine hood should be in same plane as side panels with its edges.
Turn stop pads until they rest on front panel without play.

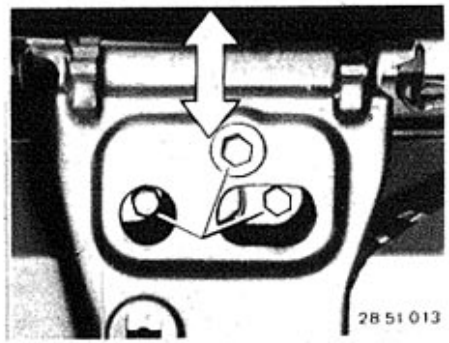
51 24 004 ADJUSTING TRUNK LID RELEASE



Adjust lock upper section 51 24 134.
If applicable, turn screw 90°.



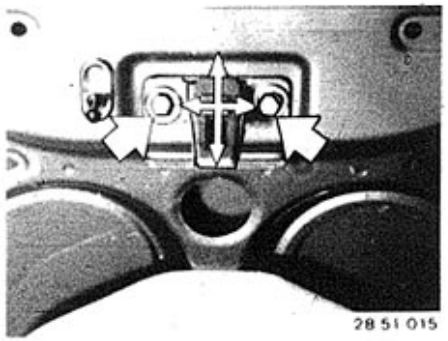
Screw in left and right stop pads.



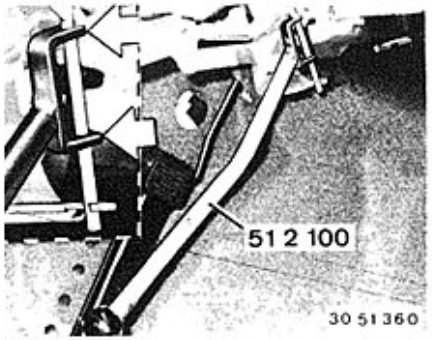
Loosen screws.
Adjust lock lower section in height.

Adjusting:
Shut trunk lid should be in same plane with edges of side panels.
Turn stop pads until they contact tail panel without play.

51 24 134 ADJUSTING TRUNK LID LOCK UPPER SECTION

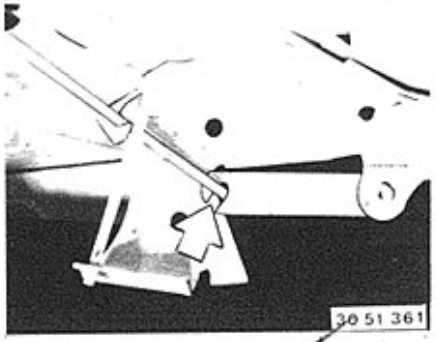


Loosen screws slightly and shut trunk lid.
This centers lock upper section in trunk release.
Raise trunk lid and tighten screws.

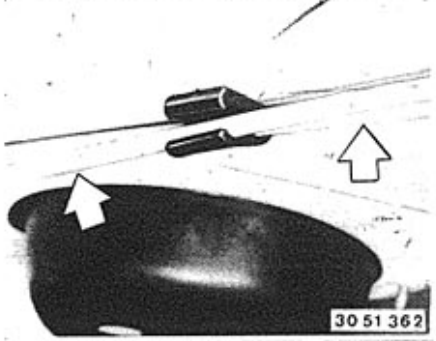


51 24 341 REPLACING TRUNK LID TORSION BARS

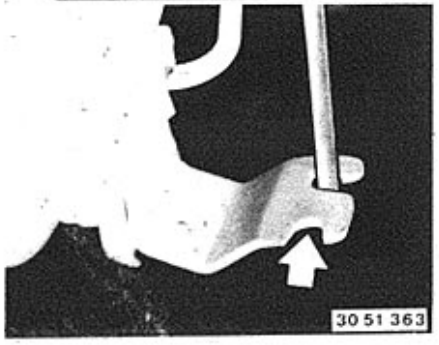
Prevent trunk lid from falling down.
Disconnect torsion bars with Special Tool 51 2 100.



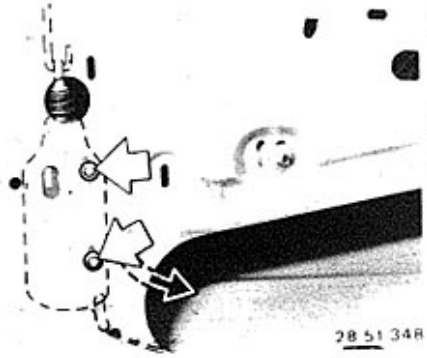
Installation:
Torsion bars have only weak preload.



Installation:
Check torsion bars for rubbing damage in case of a grinding noise.
If necessary, lubricate joints and align rubber mounts.



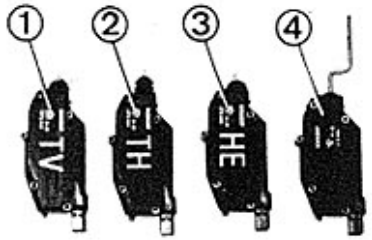
Installation:
Torsion bar tension can be increased by using the second catch.
This could be necessary, for example, when large toolbox is installed.



28 51 348

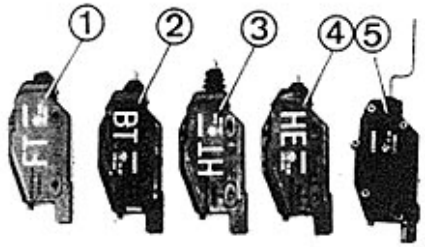
51 26 000 REPLACING SWITCH FOR LEFT OR RIGHT FRONT DOOR LOCK DRIVE

Remove door trim panel – see 51 41 001.
Unscrew screws.
Pull off plug.
Disengage the drive.



28 51 349

Installation:
Identification of Central Lock Drives Without Unlocking Arrest:
1 = TV (front door, left or right)
2 = TH (rear door, left or right)
3 = HE (trunk lid)
4 = Tank flap



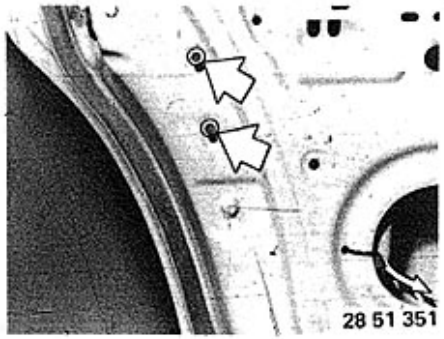
28 51 350

Identification of Central Lock Drives With Unlocking Arrest:
1 = FT (driver's door)
2 = BT (passenger's door)
3 = HT (rear door, left or right)
4 = HE (trunk lid)
5 = Tank flap



28 51 631

Close the lock and press the drive into the connecting eye.
The bevelled surface faces forward.



28 51 351

51 26 010 REPLACING SWITCH FOR LEFT OR RIGHT REAR DOOR LOCK DRIVE

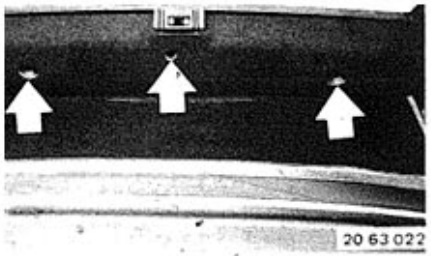
Remove door trim panel – see 51 42 001.
Unscrew screws.
Pull off plug.
Disengage the drive.



28 51 631

Installation:
Check identification of drive see 51 26 000.
Close the lock and press the drive into the connecting eye.
The bevelled surface faces forward.

51 26 020 REPLACING SWITCH FOR TRUNK LID LOCK DRIVE



Remove trim panel in the trunk.

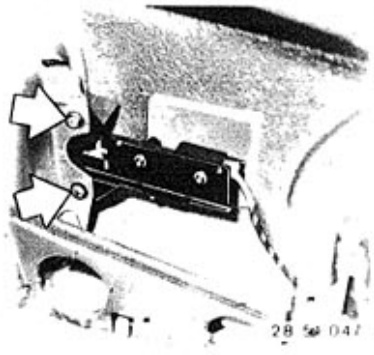


If applicable, unscrew screws (1).
Unscrew screws.
Disengage the drive.
Pull off plug.

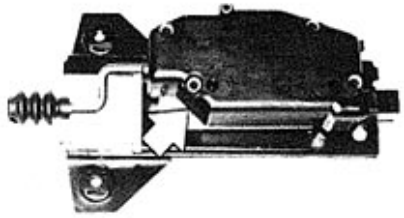


Installation:
Check identification of drive – see 51 26 000.
Position the key slot horizontal and press the connecting eye into the drive.
The bevelled surface faces to the right as seen looking forward in car.

51 26 025 REPLACING SWITCH FOR TANK FLAP LOCK DRIVE

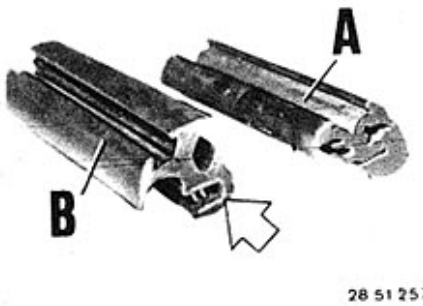


Lift out trim panel.
Unscrew screws.



Installation:
Check identification of drive – see 51 26 000.
The bevelled surface faces down.

51 31 011 REPLACING WINDSHIELD



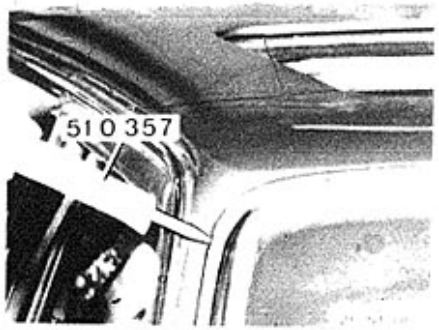
28 51 257

Note:
Two different versions of rubber frames with different installing procedures are used for the windshield and rear window.

A) Rubber Frame without Bracing on Window Opening Edge of Body:
This version has to be cemented*.

B) Rubber Frame with Bracing on Window Opening Edge of Body:
This version is not sealed.

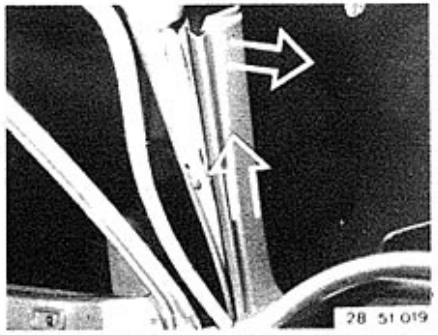
Different Features:
The rubber lip of the version without bracing lifted off of the body opening edge on inside with fingers.



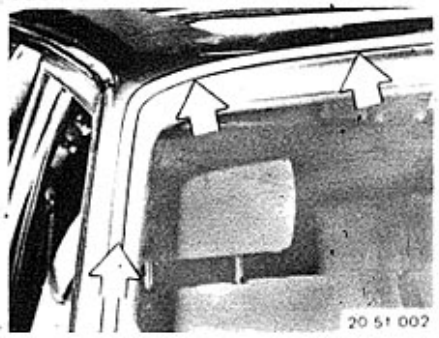
Loosen rubber frame on body edge carefully with Special Tool 51 0 357.


20 51 004

Press out glass beginning at an upper corner, while pressing the rubber frame over the edge of the body opening with a wooden wedge.

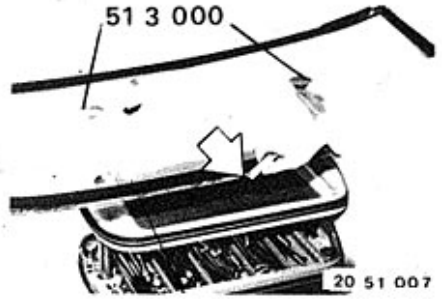

28 51 019

A) Rubber Frame without Bracing:
Remove front roof liner plate 51 44 150.
Pull off A pillar trim at top and remove from above.


20 51 002

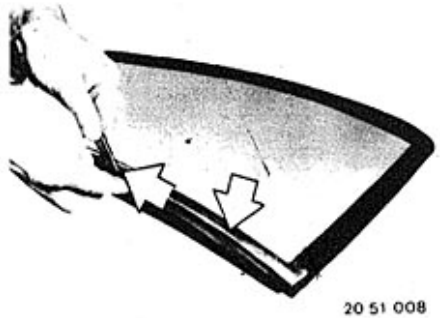
Remove both wiper arms.
Pull out ornamental frame from above.

* See Specifications



20 51 007

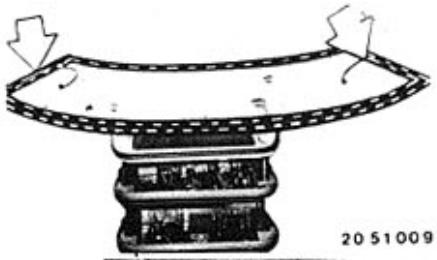
Place Special Tool 51 3 000 in the "assistent" and place glass pane on it.
Check whether rubber frame can be reused and remove old sealing compound (plastic scraper or similar item).

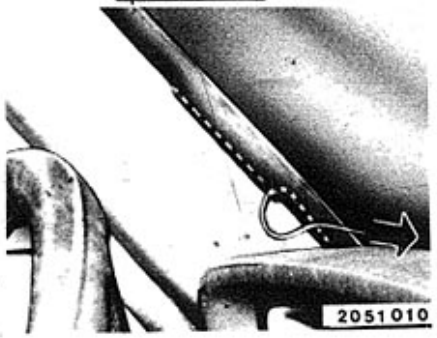

20 51 008

The rubber frame is not glycerinized and therefore must be coated with a special lubricant*.
Install rubber frame on new glass.
Insert ornamental strip at bottom.
Installation;
Check whether glass is tinted!

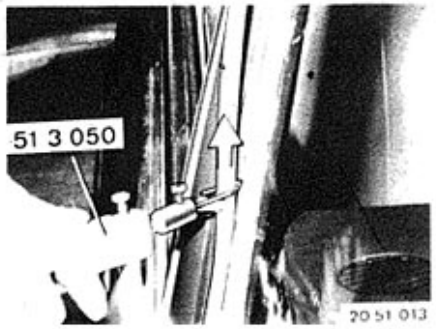
* See Specifications

Pull an approx. 7 meters (22 feet) long piece of 3 mm (0.118") ida. string or wire into lip of rubber frame.



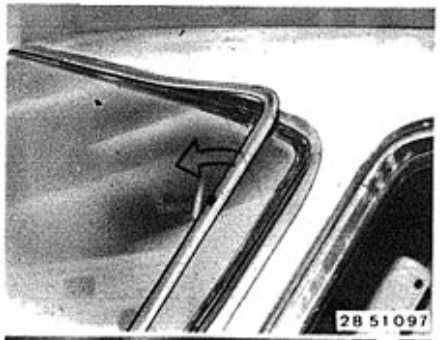


Clean body opening to remove old cement.
Place pre-assembled window in body opening and pull rubber lip over edge of body with the string or wire.
Move window glass to correct installed position by applying moderate knocks on glass pane with an impact pad or flat hand while installing the window.
Check that rubber lip seats correctly and, if necessary, pull over edge of body with Special Tool 51 0 357.
Sealing Window:
Seal window with cement* between glass and rubber frame as well as between rubber frame and body.

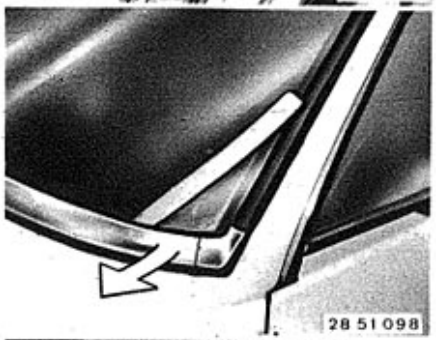


Insert filler strips with Special Tool 51 3 050.

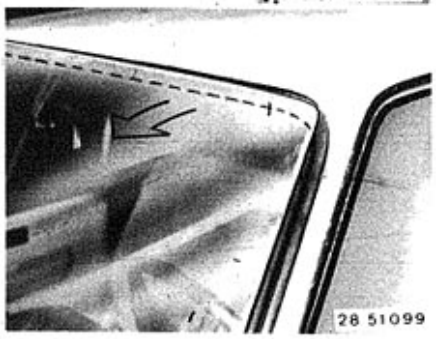
* See Specifications



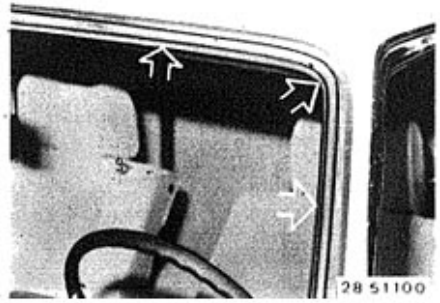
B) Rubber Frame With Reinforcement:
Pull out filler strips.



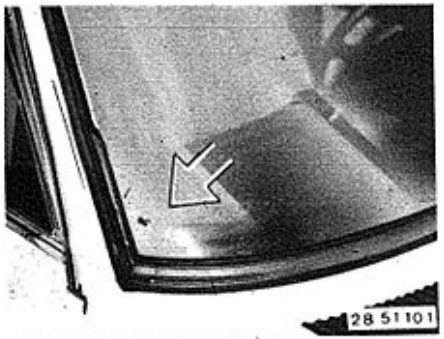
Lift out lower ornamental strip and corner parts carefully.



Loosen and press out window glass carefully, beginning at a corner.
Important!
Rubber frame remains in body opening.



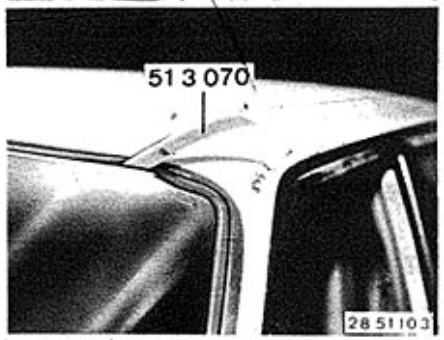
Replacing Rubber Frame:
Position new rubber frame and press firmly into body opening.



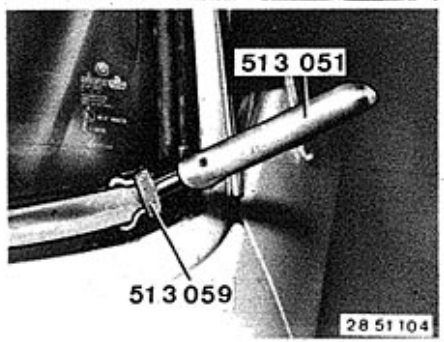
Coat rubber frame with glycerine.
Place window glass in bottom crease and push to the right into rubber frame.



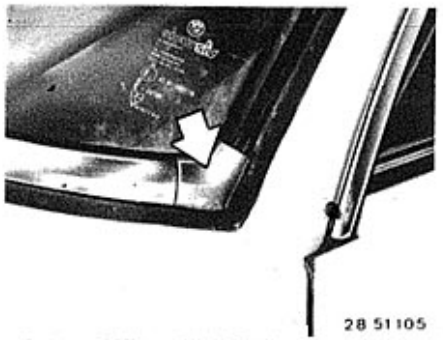
Lift rubber lip on left side over edge of glass with Special Tool 51 3 070.
Center window glass with light knocks from flat hand.



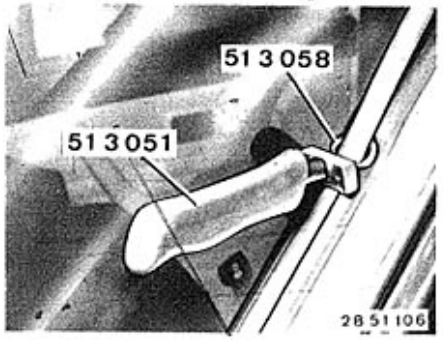
Lift rubber lip uniformly over window glass edge on both sides and top.



Pull in lower ornamental strip with Special Tools 51 3 059 and 51 3 051.
Caution!
Cover free end of ornamental strip with plastic or something similar – danger of scratching paint finish!

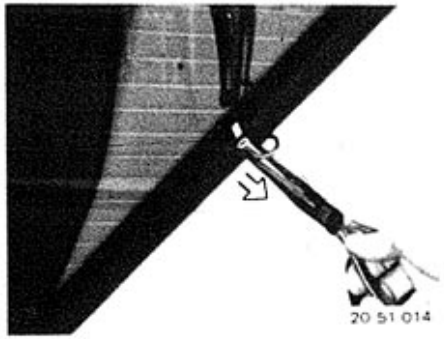


Insert corners.



Pull in filler strips with Special Tools 51 3 058 and 51 3 051.

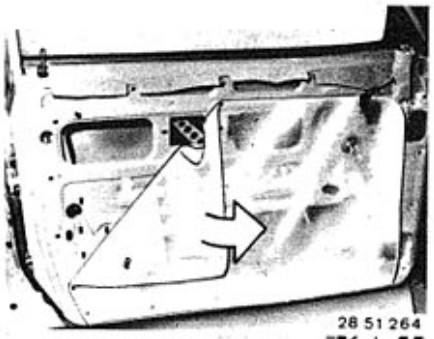
51 31 221 REPLACING REAR WINDOW


20 51 014

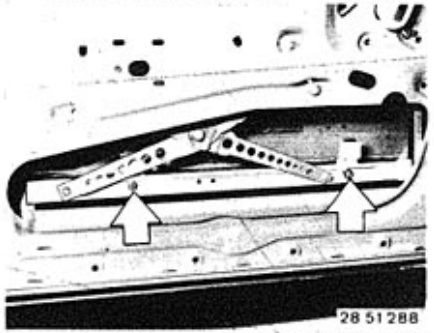
Pull off connections for rear window defogger.
Installation:
Check function.

Further steps are identical with those in 51 31 011.
If rear window had been broken, remove rear seat cushion,and clean seat belt automatic reels to remove glass splitters.

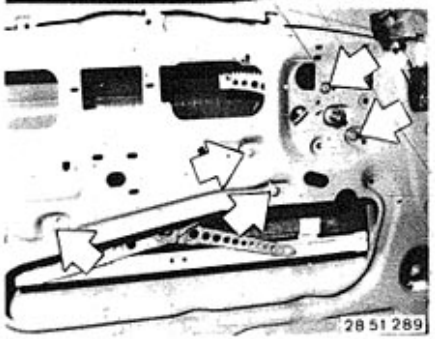
51 32 020 REMOVING AND INSTALLING/ REPLACING WINDOW WINDER IN LEFT OR RIGHT FRONT DOOR



Remove front door trim panel 51 41 001.
Pull off plastic sheet.

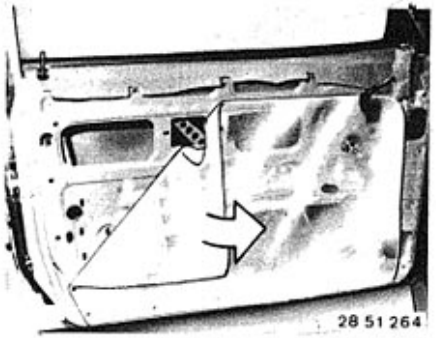


Unscrew screws.
Disconnect door window glass.

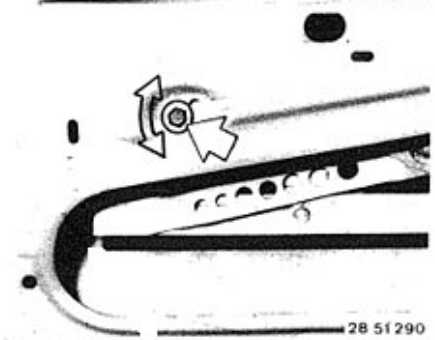


Unscrew screws.
Remove window regulator.
Installation:
Adjust door window 51 32 154.

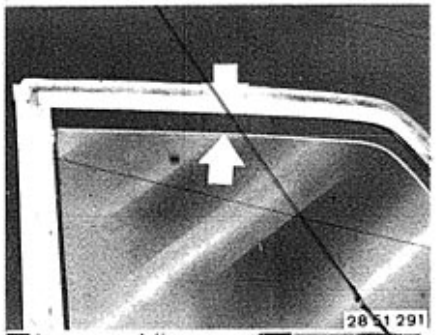
51 32 154 ADJUSTING LEFT OR RIGHT FRONT DOOR WINDOW



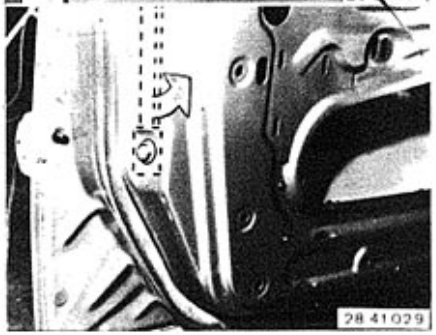
Remove front door trim panel 51 41 001.
Pull off plastic sheet.



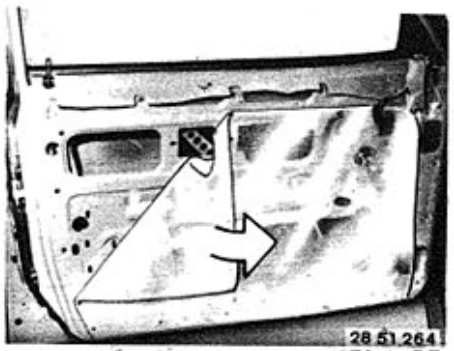
Unscrew screws.



Check window glass for uniform spacing to door frame.
Tighten screw.

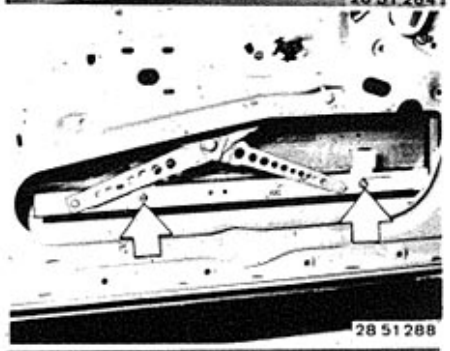


Check function.
If window is hard to lower and raise, adjust lower guide rail.

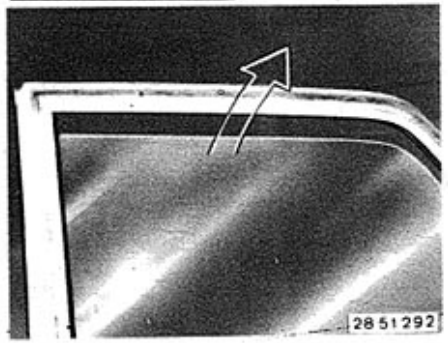


51 32 170 REMOVING AND INSTALLING/ REPLACING LEFT OR RIGHT FRONT DOOR WINDOW GLASS

Remove door trim panel 51 41 001.
Remove door trim upper section 51 41 020.
Pull off plastic sheet.



Remove window recess cover strip on inside of front door 51 21 330.
Remove window recess cover strip on outside of front door 51 21 300.
Unscrew screws.

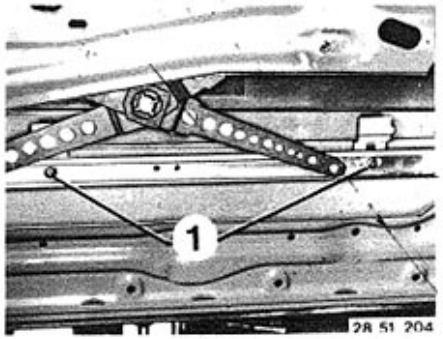


Remove door window glass from above.

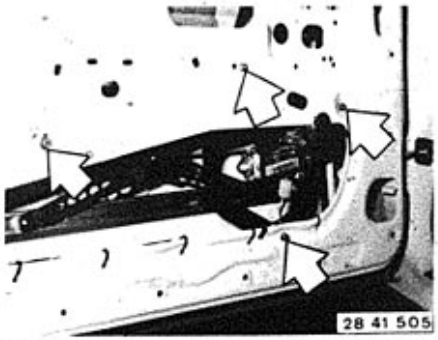
Installation:
Make sure of correct fit of door window glass in guide rail.
Adjust door window 51 32 154.

51 33 000 REMOVING AND INSTALLING POWER WINDOW REGULATOR IN LEFT OR RIGHT FRONT DOOR

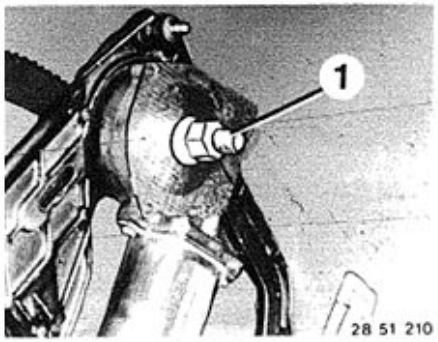
Remove door trim panel 51 41 001.



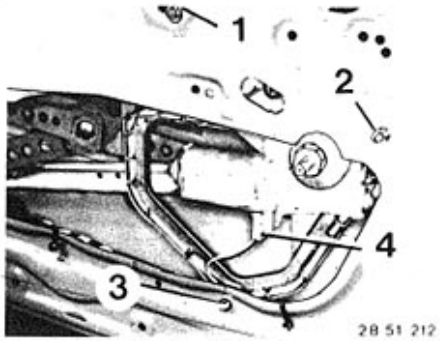
Unscrew nuts (1).
Disconnect window glass, push up and clamp.



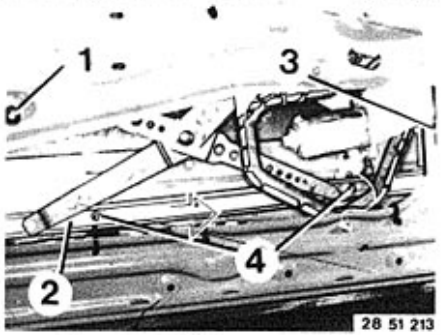
Unscrew screws.
Pull off plug on motor.
Remove window regulator.



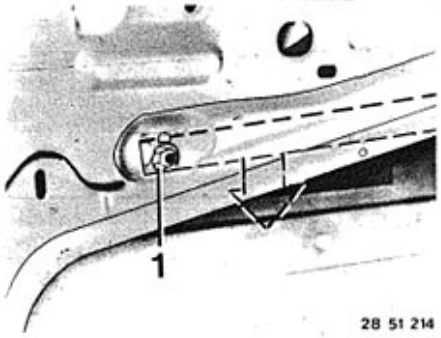
Installation:
Pull off rubber guard on power window motor.
Insert emergency operating adapter (1) and tighten with key (part of car tools).
Move window regulator to center position.



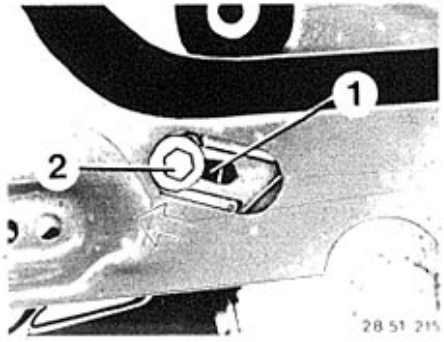
Installation:
Place window regulator in door and mount with screws (1 ... 3).
Connect plug (4) on motor.



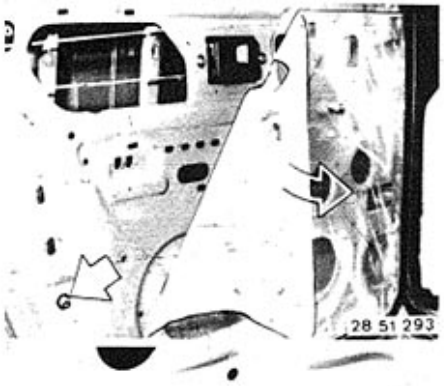
Installation:
Screw in screw (1).
Connect mounting pin of window glass in rail (2).
Press rail (2) in direction of arrow until it rests on guide rail (3).
Tighten nuts (4).
Close window about 3/4ths.



Installation:
Loosen screw (1).
Pull down rail until window glass is pressed against rear window frame with light tension.
Tighten screw (1).

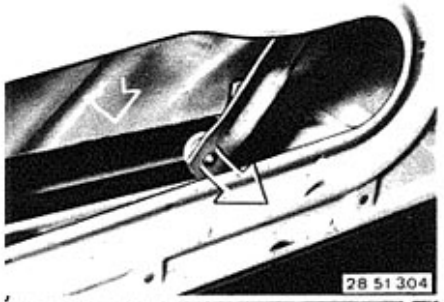


Installation:
Close window.
Move final stop (1) in direction of arrow until it makes contact and mount with screw (2).
The final stop must prevent the window glass from stopping on the upper window frame when the window is closed.
Check this by lowering and raising window several times.
Remove emergency operating adapter.

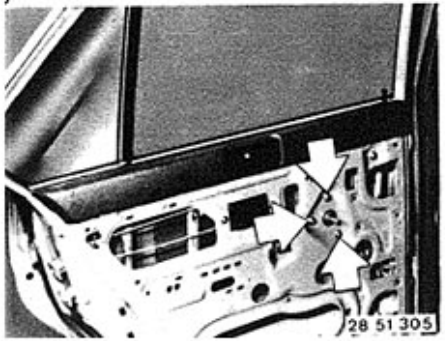


51 34 020 REMOVING AND INSTALLING WINDOW REGULATOR IN LEFT OR RIGHT REAR DOOR

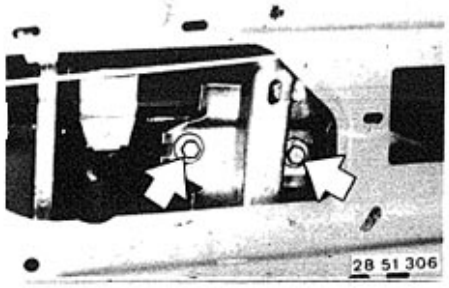
Remove rear door trim panel 51 42 001.
Pull off plastic sheet.
Loosen screw.



Lower window glass.
Disconnect window regulator.



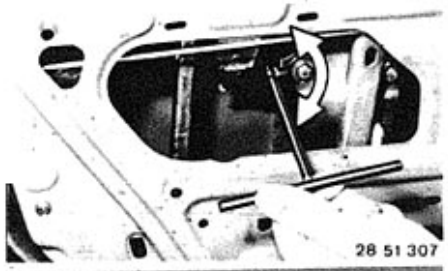
Lift and hold window glass to keep it from falling down.
Unscrew screws.
Remove window regulator.

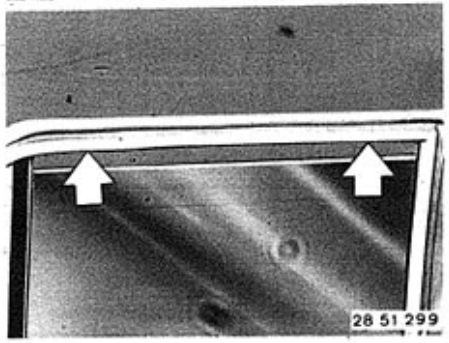


51 34 154 ADJUSTING LEFT OR RIGHT REAR DOOR WINDOW

Remove rear door trim panel 51 42 001.
Loosen screws.

Adjust window with Special Tool 51 3 150.

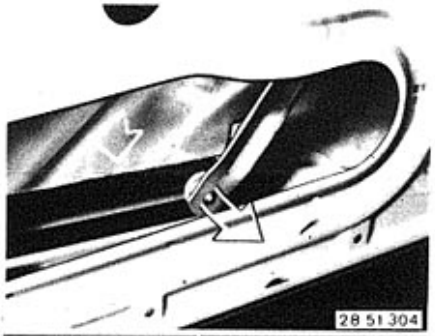




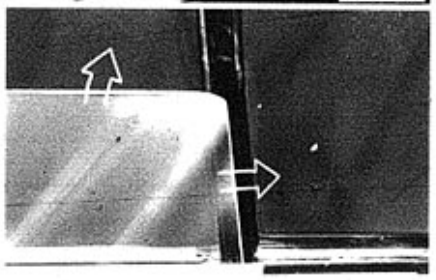
Installation:
Adjust to have uniform spacing between glass and door frame.

51 34 171 REPLACING LEFT OR RIGHT REAR DOOR WINDOW GLASS

Remove rear door trim panel 51 42 001.
Pull off plastic sheet.
Remove rear door trim upper section 51 42 020.
Remove window recess cover strip on inside of rear door 51 22 330.
Remove window recess cover strip on outside of rear door 51 22 300.

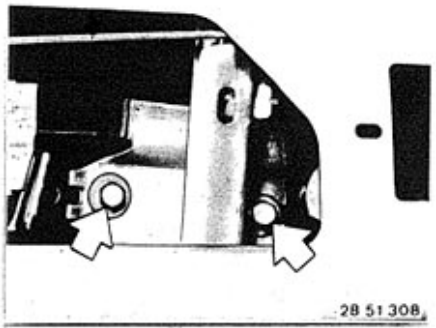


Disconnect door window glass.

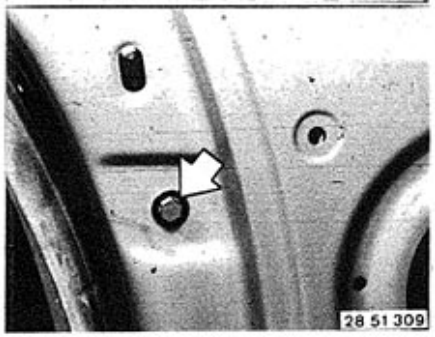


Disconnect door window glass in guides on left and right sides, push toward rear and remove from above.

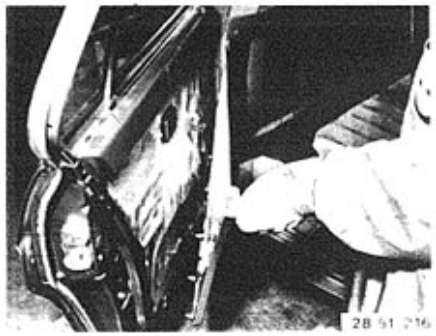
28 51 310



Lower door window about 1/4th of distance so that screws are accessible.
Unscrew screws.
Installation:
Adjust door window 51 34 154.

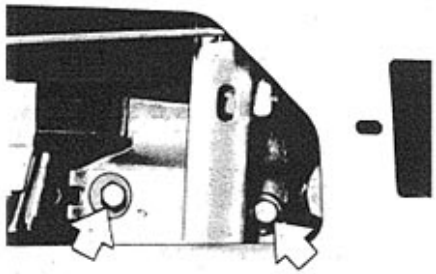


Lower door window glass and regulator.
Unscrew screw.

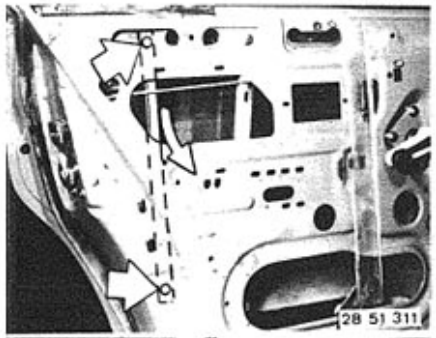


51 34 191 REPLACING WINDOW FIXED IN WINDOW FRAME OF LEFT OR RIGHT REAR DOOR

Remove rear door trim panel 51 42 001.
Remove rear door trim upper section 51 42 020.
Remove window recess cover strip on inside of rear door 51 22 330.
Remove window recess cover strip on outside of rear door 51 22 300.
Pull off plastic sheet.
Unscrew screws.
Remove guide.
Lower door window.

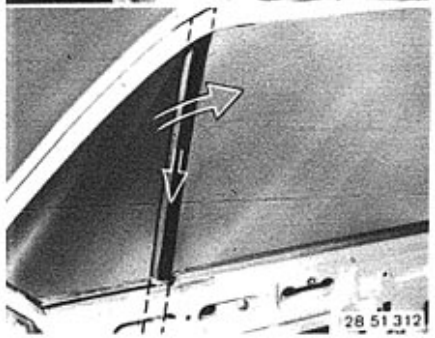


28 51 308



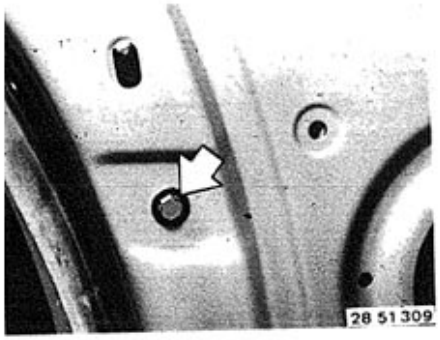
28 51 311

Unscrew screws.



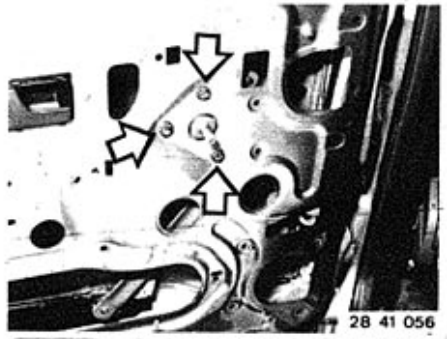
28 51 312

Pull down and tilt guide rail.
Remove door window glass.
Installation:
Check for correct fit of rubber window frame.

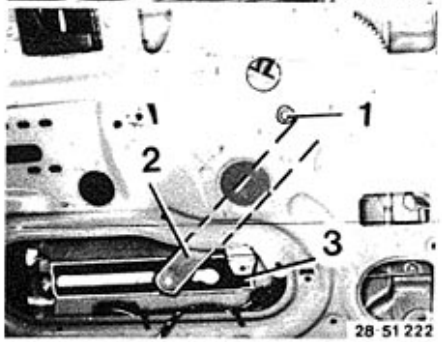


51 37 000 REMOVING AND INSTALLING POWER WINDOW REGULATOR IN LEFT OR RIGHT REAR DOOR

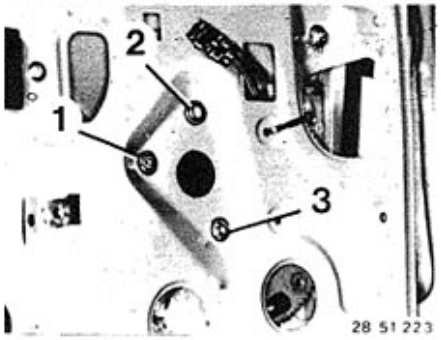
Remove door trim panel 51 42 001.
Unscrew screw.



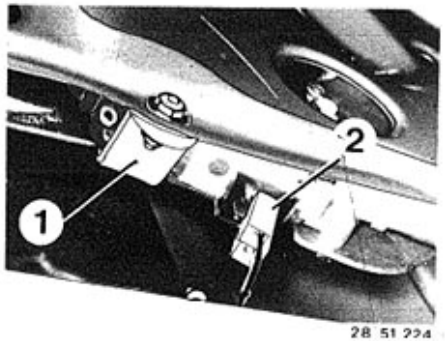
Open window.
Unscrew screws.
Disconnect lifting arm on rail.
Push up and clamp window glass.
Remove window regulator.



Installation:
Insert complete window regulator in door and hold in position with screw (1).
Lower window glass.
Connect lifting arm (2) in rail (3).



Installation:
Raise or lower window glass enough that screws (1 and 2) can be installed.
Tighten screws (1 ... 3).



Installation:
Mount plastic holder (1) on door with screw, nut and washer.
Connect plug (2) on motor.

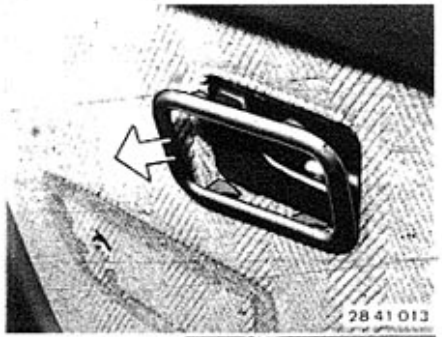

28 41 012

51 41 001 REPLACING LEFT OR RIGHT FRONT DOOR TRIM PANEL

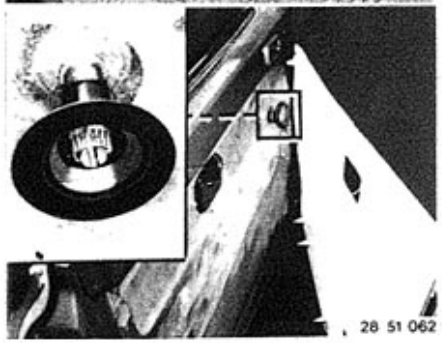
Unscrew armrest screws.
Turn armrest about 45° and pull out of holder.


28 51 060

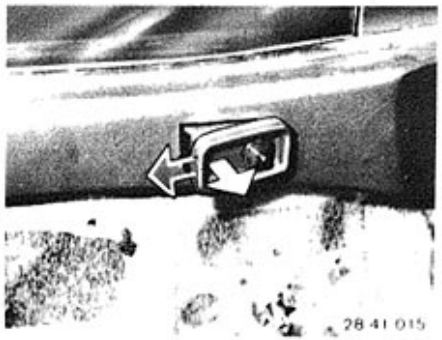
If applicable, lift window winder cover and remove screw.
Take off washer.


28 41 013

Pull off plate toward rear.
Lift off trim panel carefully with a screwdriver.
Installation:
Replace damaged clips.

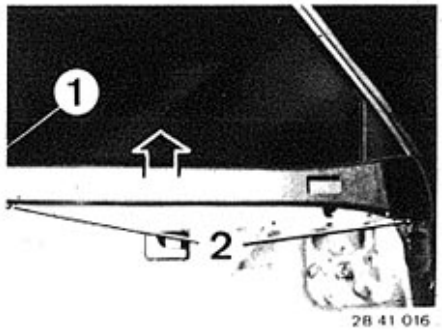

28 51 062

Installation:
Use spacer behind door trim panel.


28 41 015

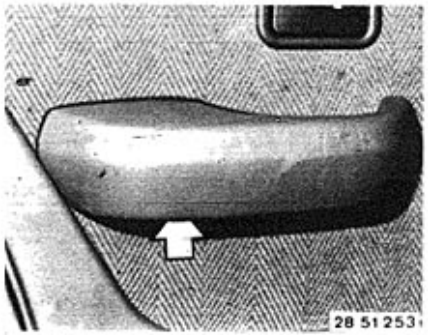
51 41 020 REMOVING AND INSTALLING/ REPLACING LEFT OR RIGHT FRONT DOOR TRIM PANEL UPPER SECTION

Remove front door trim panel 51 41 001.
Lift out mirror switch and pull off of plug from behind.



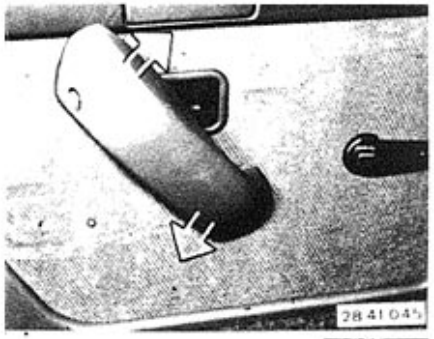
28 41 016

Unscrew catch button (1).
Unscrew screws (2).
Lift out trim panel with a screwdriver.
Installation:
Winder faces forward when window is closed (raised).

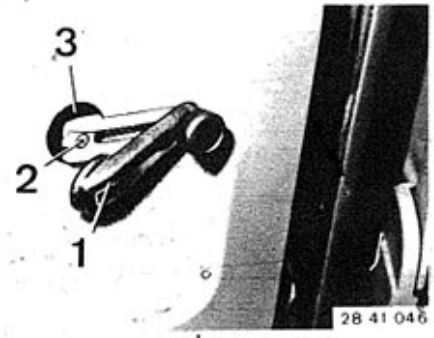


51 42 001 REPLACING LEFT OR RIGHT REAR DOOR TRIM PANEL

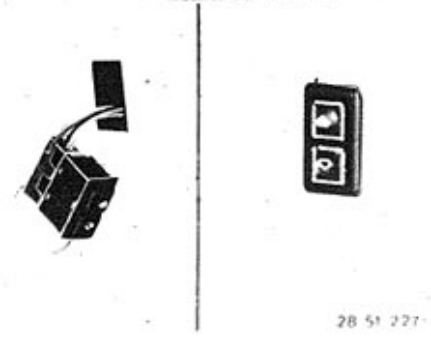
Loosen screw.



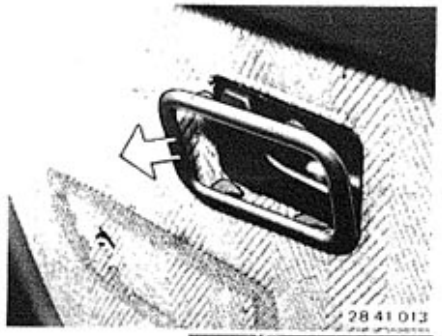
Twist armrest about 45° and pull out of holder.



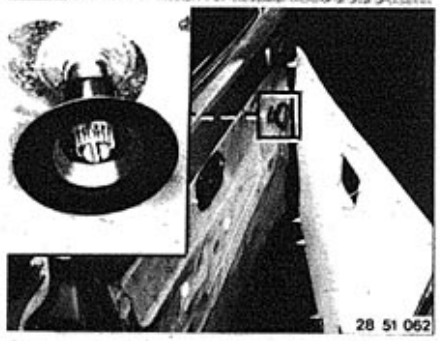
If applicable, lift off cover (1).
Unscrew screw (2).
Take off winder with washer (3).
Installation:
Winder faces forward with window closed.



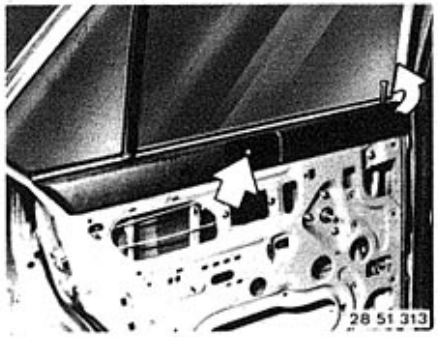
If applicable, lift out power window switch and pull off plugs.



Pull off mask toward rear.
Lift out trim panel with a screwdriver carefully.
Installation:
Replace damaged clips.



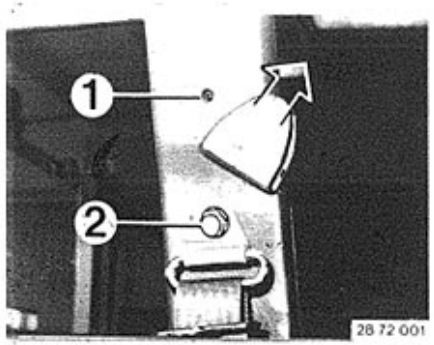
Take off spacer.
Check installed position.



51 42 020 REMOVING AND INSTALLING OR REPLACING LEFT OR RIGHT REAR DOOR TRIM PANEL UPPER SECTION

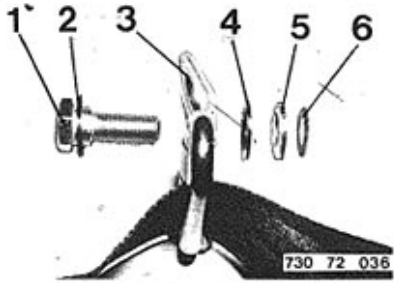
Remove door trim panel 51 42 001.
Lift out ashtray.
Loosen screw and remove mask.
Unscrew door catch button.

Unscrew screws on left and right sides.
Pry off trim panel upper section with a screwdriver.

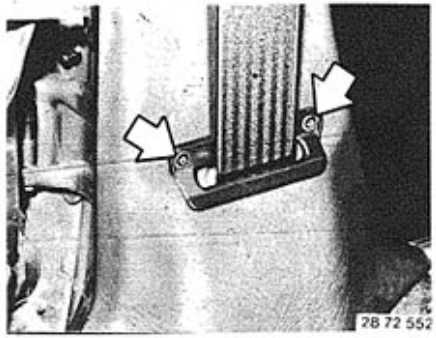


51 43 150 REMOVING AND INSTALLING OR REPLACING TRIM FOR LEFT OR RIGHT DOOR PILLAR

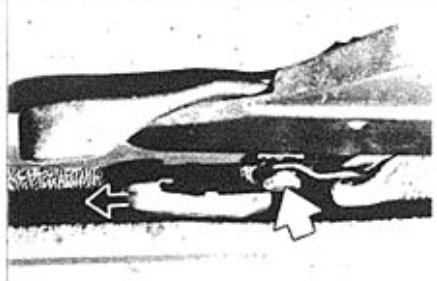
Pull off cap.
Unscrew bolts (1 and 2).



Installed Order:
1 = Bolt
2 = Plastic washer
3 = Stirrup
4 = Plastic washer
5 = Washer
6 = Lock washer
Stirrup must still move after tightening bolt.
Tightening torque*



Unscrew screws and take off trim panel.

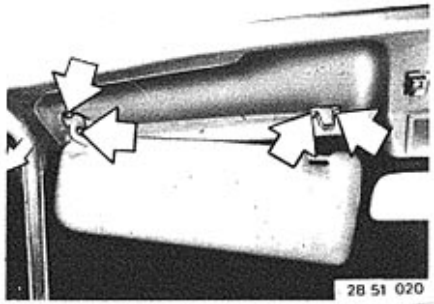


Pull off cover and unscrew bolt.
Insert belt bar through slot in door pillar trim panel.

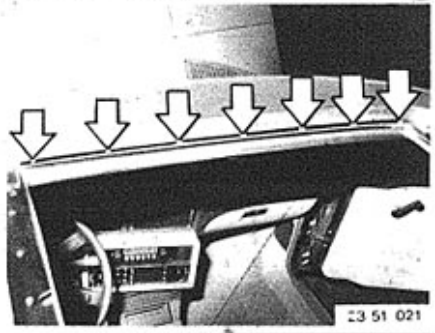
* See Specifications

51 44 150 REMOVING AND INSTALLING FRONT ROOF LINER PLATE

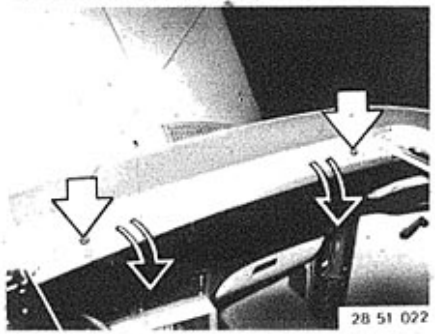
Remove and install check control 62 14 070.
Remove and install sun roof switch 54 13 000.



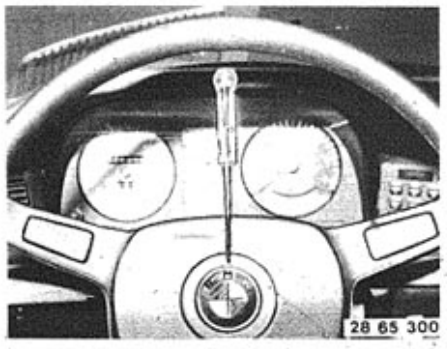
Pull off left and right edge guards partially.
Remove sun visors with holders.
Remove cover.



Cars with Sun Roof:
Open roof.
Unscrew screw and take off strip.
Installation:
Use Terostat tape in strip.

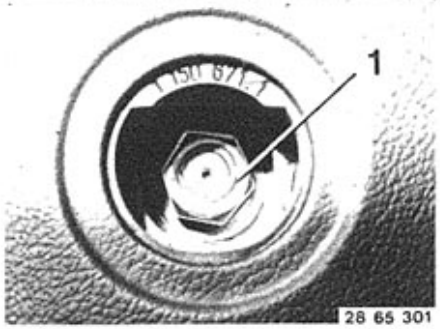


Pull off plate cover.
Unscrew screws and remove plate.

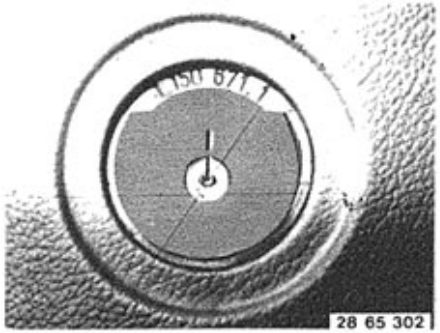


51 45 030 REMOVING AND INSTALLING INSTRUMENT PANEL TRIM

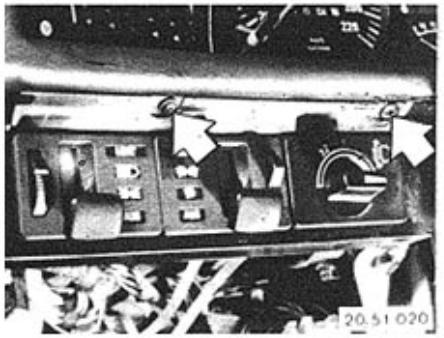
Disconnect battery ground lead.
Pry off BMW emblem carefully with a small screwdriver.



Unscrew nut (1).
Remove nut and corrugated washer.
Installation:
Replace self-locking nut.
Tightening torque*.

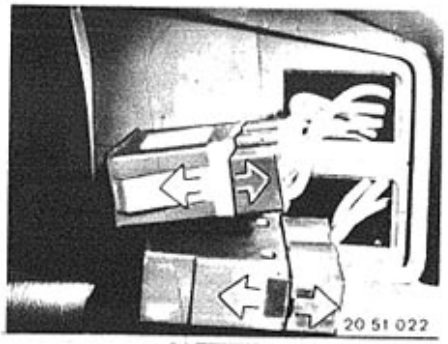


Mark steering wheel to steering column position (for example by punching).
Pull off steering wheel.



Remove tray 51 16 200.
Remove switch plate.
Remove instrument carrier assembly 62 21 000.

* See Specifications

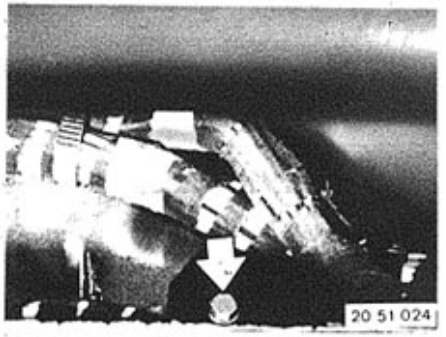


Remove hazard light switch and rear window defogger switch.
Disconnect plugs.

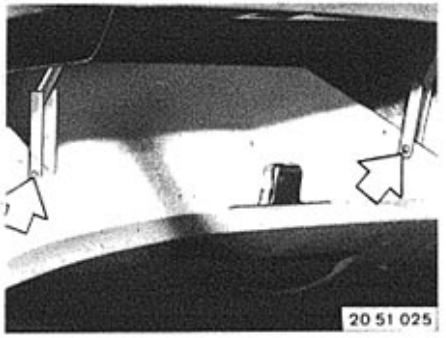


Unscrew bolt (2).



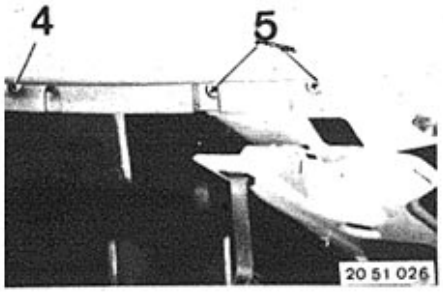


Unscrew bolt (3).

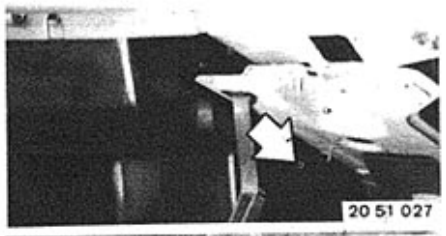


Disconnect glove box joints.

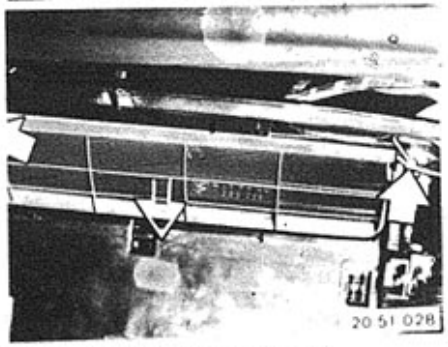
Unscrew bolt (4).
Loosen bolts (5).



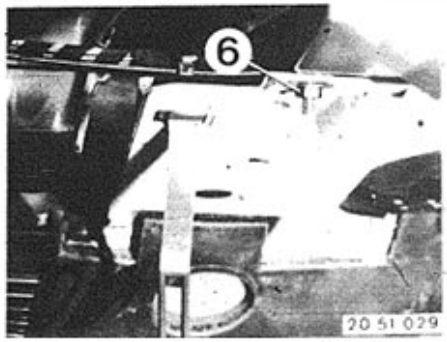
Remove plate.



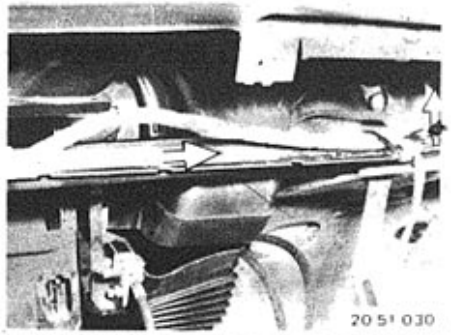
Remove cover.



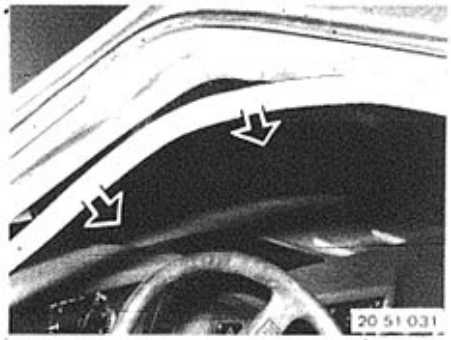
Unscrew nut (6).



Push brace to the right and disconnect.



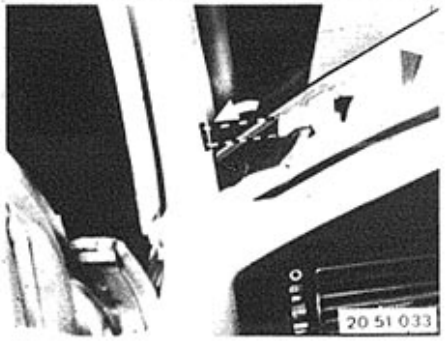
Pull off left and right edge guards partially.

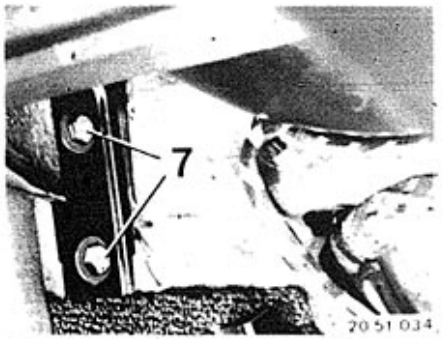


Remove trim on left and right A pillars.
Installation:
Mount trim panels and edge guards before tightening mounting screws.

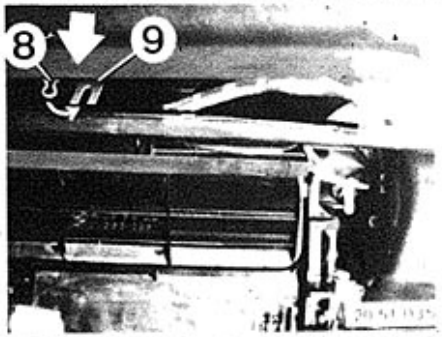


Installation:
First guide clamp into opening.

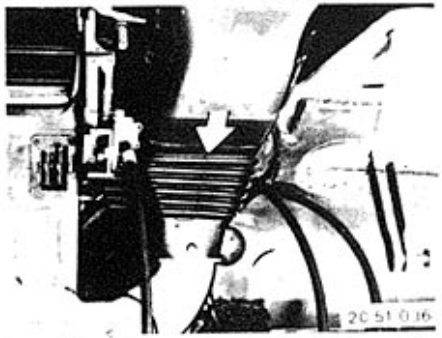




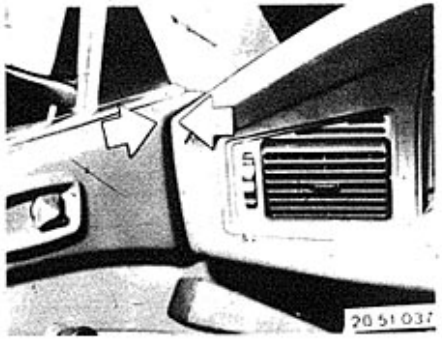
Unscrew screws (7).
Remove the instrument panel trim.



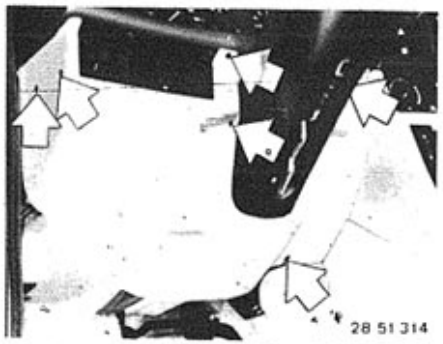
Installation:
Slide clamp (8) into opening (9) and press down.



Installation:
Insert the air supply connectors correctly.

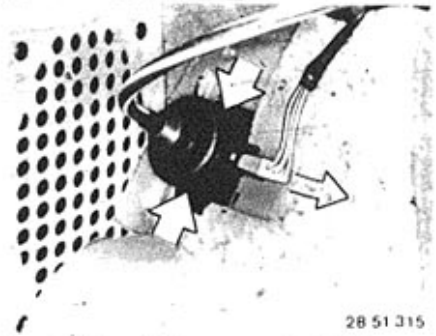


Installation:
Check the gap to the door trim panel on the left and right sides while tightening the mounting screws.

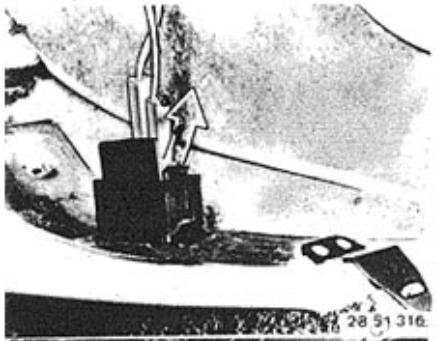


51 45 180 REMOVING AND INSTALLING OR REPLACING INSTRUMENT PANEL TRIM AT BOTTOM LEFT

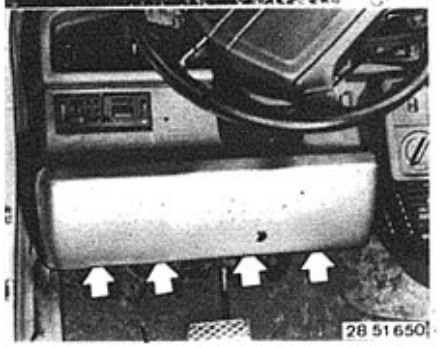
If applicable, disconnect the battery.
Unscrew screws.



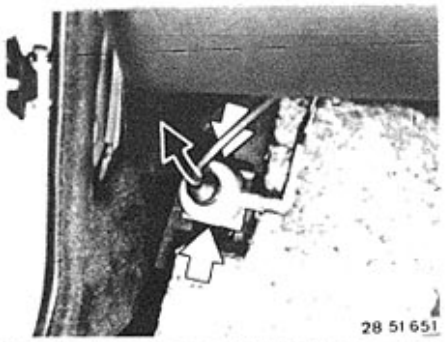
If applicable, pull off the wires.
Disengage the temperature sensor.



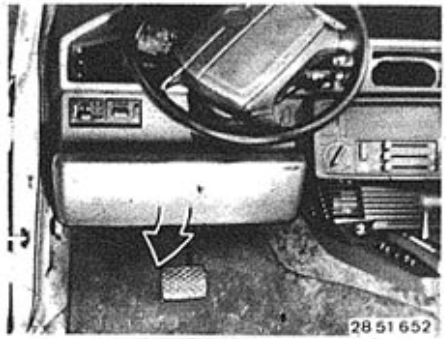
If applicable, pull off wires on the automatic cutouts.
Remove the trim panel.



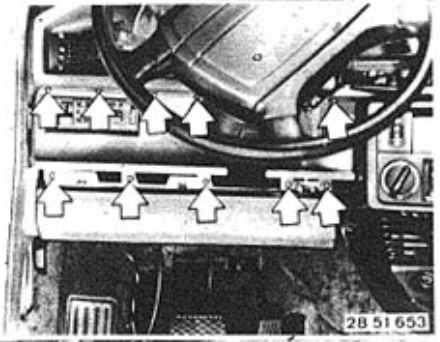
Cars with SRS:
Unscrew screws.
Lift out the trim panel.



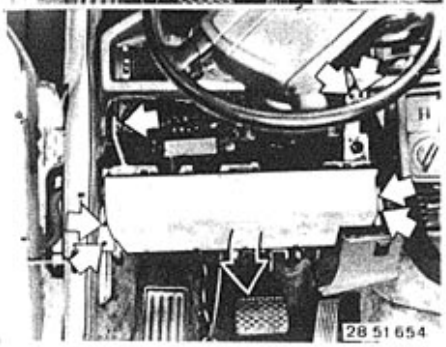
If applicable, pull off the temperature sensor.



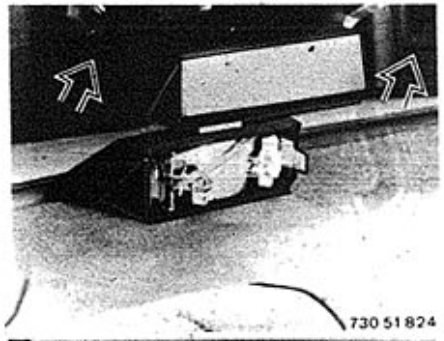
Pull off the trim.



If applicable, unscrew screws.
Lift out the trim panel.
Pull off plugs.

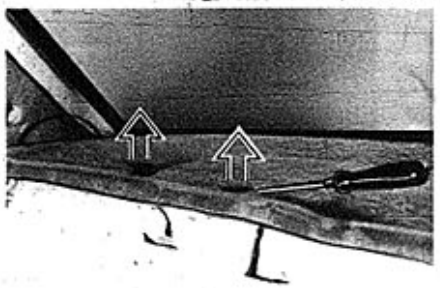


Unscrew screws.
Lift out the knee guard.

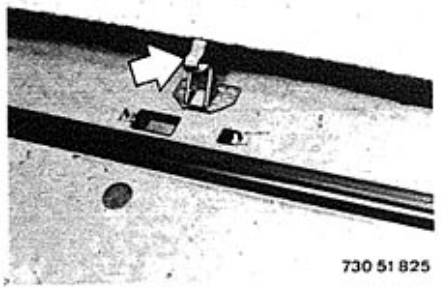

730 51 824

51 46 000 REMOVING AND INSTALLING HATRACK TRIM PANEL

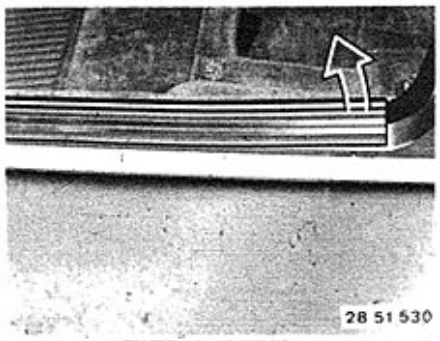
Remove complete rear seat – see 52 20 000.
If applicable, pull off the trim and lift out the additional stop light.


730 51 533

Lift out holders.
Remove the trim panel.
If applicable, pull off the radio speaker wires.

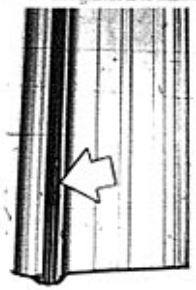

730 51 825

Installation:
Check for correct position of the engaging eye.

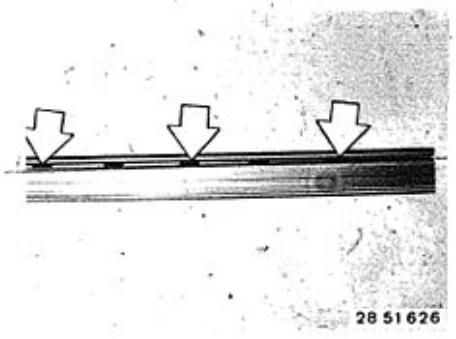

28 51 530

51 47 000 REMOVING AND INSTALLING OR REPLACING LEFT OR RIGHT FRONT ENTRANCE COVER STRIP

Lift off the cover strip carefully.

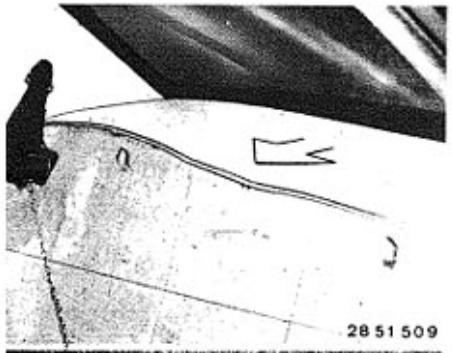

28 51 625

Installation:
Replace clamps, if necessary.

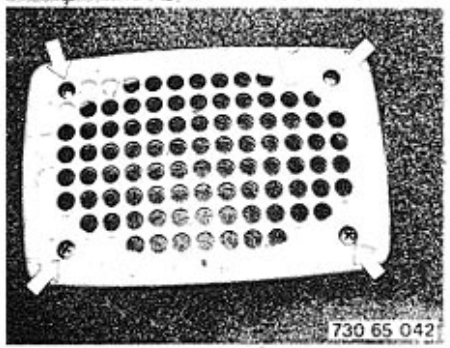

28 51 626

Installation:
Straighten the clamps and press on the cover strip.

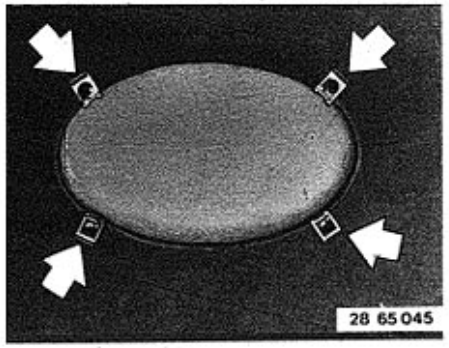
51 46 010 INSTALLING SUN SHADE



Remove and install rear seat cushion and backrest 52 20 000.
Lift and pull out hatrack.



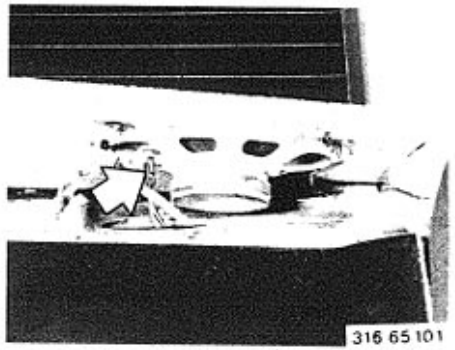
Cars with Rear Radio Speakers:
Pull off speaker wires.
Take speakers out of hatrack.



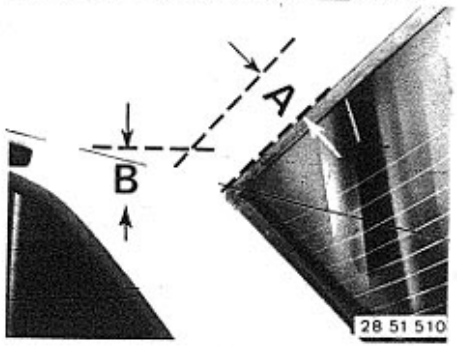
Cut out pre-punched openings for radio speakers in hatrack with sun shade.
Insert self-tapping nuts in provided holes.



Install speakers on hatrack.
Installed Order:
1 Hatrack
2 Spacer
3 Radio speaker
4 Mask
5 Self-tapping screws

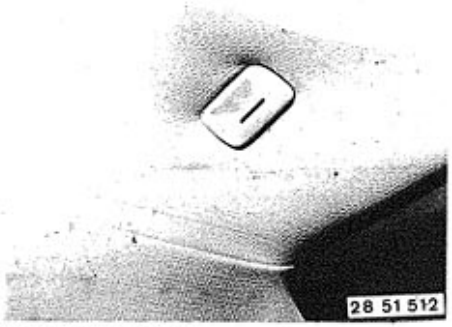


Connect speaker wires on speakers.
Install hatrack with sun shade.
Make sure brackets engage underneath metal.
Install seats.



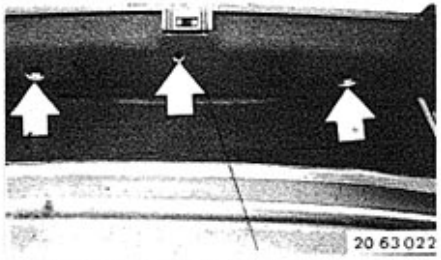
Feel out location of openings in roof frame for suspenders.
Distance A = approx. 8 cm (3.150")
Distance B = approx. 7 cm (2.756")
Cut a cross in roof liner and fold over toward inside.

Clip in suspenders on left and right sides.

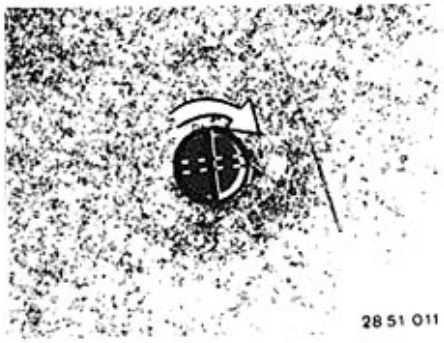


Checking Operation:
Pull out sun shade on tab and hang in suspenders.
Sun shade should wind up automatically when taken out of the suspenders.

51 47 120 REMOVING AND INSTALLING TRUNK TRIM PANEL ON BODY TAIL PANEL

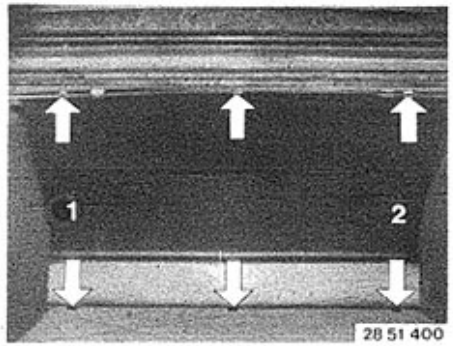


Lift out the trunk liners.
Remove the trim panel on the tail panel.



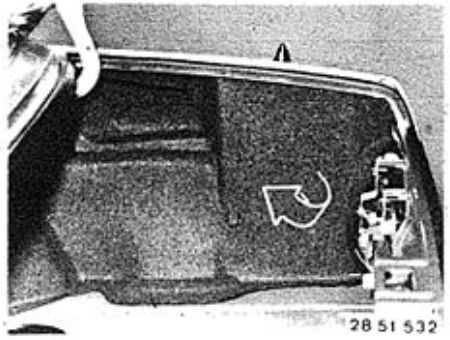
Installation:
Insert screw and turn 90°.

51 47 140 REMOVING AND INSTALLING TRUNK TRIM PANEL ON REAR WALL



Remove the trunk floor mat.
Disconnect the rear wall trim panel in the holders at top and bottom.
Lift out plugs (1 and 2) and remove the trim panel.

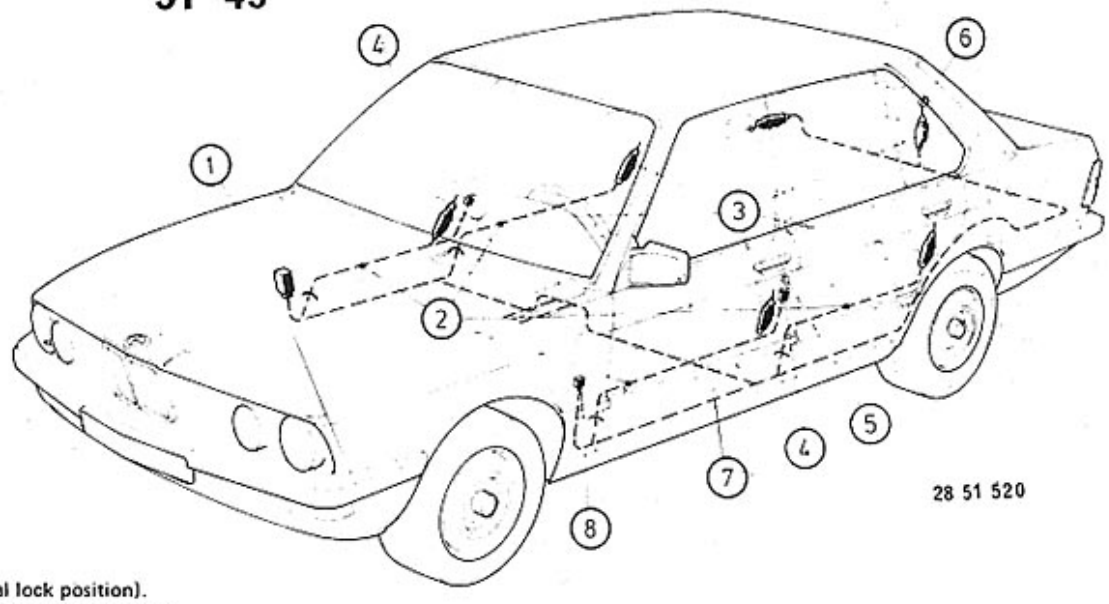
51 47 220 REMOVING AND INSTALLING TRUNK TRIM PANEL ON RIGHT SIDE WALL



Remove the trunk floor mat.
Lift out the trim panel.

CENTRAL LOCKS WITH UNLOCKING ARREST – DESCRIPTION AND TROUBLESHOOTING –

1 Control unit / impact switch
2 Door wire harness
3 Drive for doors, trunk lid and tank flap
4 Microswitch – driver's/passenger's door
5 Lock cylinder – driver's door
6 Trunk lid lock
7 Main wire harness
8 Connection on special equipment plug

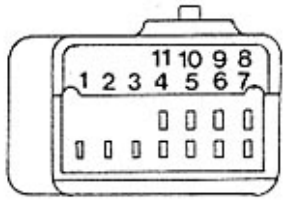


28 51 520

The locks of all doors, trunk lid and tank flap can be operated

a) with the driver's door lock (keyed turned 45°),
b) with the passenger's door lock,
c) with the trunk lid lock or
d) with the catch button on inside of the driver's door.

The unlocking arrest can only be operated via the driver's door lock (horizontal lock position). The locks cannot be unlocked with the unlocking buttons on the doors when the unlocking arrest is operated.
The trunk lid can still be unlocked and locked by turning the key clockwise even with the unlocking arrest operated.
The impact switch will unlock all locks automatically in case of a collision.
Note:
The tank flap can be unlocked manually by moving the locking rod (accessible from the trunk) in case of central locking system failure.
The central locking system is equipped with a multiple identifier (overload protector) since 9/85 models. Frequent operation of the locks within a brief period of time will activate the integrated overload protector, which switches off the system for a short time.



730 51 823

Control Unit/Impact Switch Connections:

Pin	Description		Wire Colors
1	Outlet LOCKED		blue
2	Outlet UNLOCKED		white
3	Battery +		red/white
4	Battery –		brown
5	Sensor +		green
6	Inlet I UNLOCKED	driver's and passenger's door	green/blue
7	Inlet I LOCKED		yellow/blue
8	Inlet II LOCKED	trunk lid	green/black
9	Inlet II UNLOCKED		yellow/black
10	Inlet III LOCKED	unlocking arrest	red/brown
11	Outlet	unlocking arrest	red/yellow

TROUBLESHOOTING CENTRAL LOCKS

Test Requirements: Battery charged, at least 11 V. —— no → Check other connected electrical equipment. → Hazard lights, inside lights, glove box light, trunk light, flashlight, clock, on-board computer, burglar alarm, service indicator, door lock heating, check control.
Fuse no. 5 okay.

yes

If applicable: check voltage on both contact tongues of fuse no. 5.
Locks and lock cylinders in perfect mechanical condition.
Perform all test against car ground.
Tests on plug connections should be made on both sides of plug.
Perform tests with the BMW service tester or digital tester II.
Check the installed position (see print) of the control unit/impact switch.

1. Failure of Entire System: Locking is not possible from the driver's door, passenger's door or trunk lid with the central locking system unlocked.

Does pin 3 (red/white) of control unit have voltage? —— no → Does red/white wire in socket no. 12 of 13-pin plug behind the radio speaker opening on the driver's side have voltage? —— yes → Repair wire harness.
With connected plug: > 11 V.

yes

no

yes

no

Is there voltage in socket no. 3 (red/white) of 6-pin plug behind the radio speaker opening of the driver's door?
> 11 V.

yes → Repair wire harness of driver's door.

no

Is there voltage in socket no. 21 (red/white) of special equipment plug?
> 11 V.

yes → Break in wire harness – repair.

no

Continue checking the wire harness for breaks up to the fuse box.

Does pin 4 (brown) of the control unit have ground?
Ω ≈ 0.

no → Check wire (brown) of socket no. 4 on control unit plug for breaks – repairing if necessary. Also refer to ground supply on central ground point behind the instrument panel at bottom left

yes

Replace control unit.

2. No function when operating driver's door lock (unlocking – locking)
– See Test Requirements –

Linkage connected – drive adjusted and mounted correctly – plug connected on drive?
- no → Connect linkage, adjust/mount drive correctly, connect plug. See 51 26 000.
- yes ↓

Pull off plug on drive. Supply car ground to socket 4 wire (green/blue) or socket 3 wire (yellow/blue). Does system unlock or lock?
- no → Make connection between pin 6 (green/blue) or pin 7 (yellow/blue) on control unit with connected plug and ground. Does system unlock or lock?
  - no → Break in wire (blue) or (white) to drive – repair.
  - yes → Break in wire (green/blue) or (yellow/blue) – repair. Also refer to sockets 3 and 4 of 13-pin plug behind radio speaker opening in driver's door.
- yes ↓

Check socket 5 (brown) on plug for driver's door drive against car ground. Resistance: approx. 0 ohm?
- no → Break in drive ground supply – repair. Also refer to socket 2 (brown) of 6-pin plug behind radio speaker opening on driver's side.
- yes ↓

Does drive switch through ground?
- no → Replace drive.

1. Between pin 5 (brown) and pin 4 (green/blue)
   Eye pulled out – approx. 0 ohm
   Eye pushed into drive – approx. ∞ ohms
2. Between pin 5 (brown) and pin 3 (yellow/blue)
   Eye pulled out – approx. ∞ ohms
   Eye pushed into drive – approx. 0 ohm

3. No function when operating passenger's door lock
– See Test Requirements –

A. Unlocking Not Possible

Linkage connected/moves – drive adjusted and mounted correctly – plug connected on drive?
- no → Connect/repair linkage – adjust/mount drive correctly – connect plug/check contact. See 51 26 000.
- yes ↓

Pull off plug on drive. Supply car ground to socket 4 wire (green/blue). Does system unlock?
- no → Make connection between pin 6 (green/blue) on control unit with connected plug and car ground. Does system unlock?
  - no → Break in wire (blue) or (white) to drive – repair.
  - yes → Break in wire (green/blue) – repair. Also refer to socket 4 of 13-pin plug behind radio speaker opening on passenger's side.
- yes ↓

Check socket 5 (brown) on plug of drive for passenger's side against car ground. Resistance: approx. 0 ohm?
- no → Break in drive ground supply – repair. Also refer to socket 5 (brown) of 12-pin plug behind radio speaker opening on passenger's side.
- yes ↓

Does drive switch through ground? Between pin 5 (brown) and pin 4 (green/blue)
Eye pulled out approx. 0 ohm
Eye pushed into drive approx. ∞ ohms
- no → Replace drive.

3. No function when operating passenger's door lock
– See Test Requirements –

A. Unlocking Not Possible

Linkage connected/moves – drive adjusted and mounted correctly – plug connected on drive?
- no → Connect/repair linkage – adjust/mount drive correctly – connect plug/check contact. See 51 26 000.
- yes ↓

Pull off plug on drive. Supply car ground to socket 4 wire (green/blue). Does system unlock?
- no → Make connection between pin 6 (green/blue) on control unit with connected plug and car ground. Does system unlock?
  - no → Break in wire (blue) or (white) to drive – repair.
  - yes → Break in wire (green/blue) – repair. Also refer to socket 4 of 13-pin plug behind radio speaker opening on passenger's side.
- yes ↓

Check socket 5 (brown) on plug of drive for passenger's side against car ground. Resistance: approx. 0 ohm?
- no → Break in drive ground supply – repair. Also refer to socket 5 (brown) of 12-pin plug behind radio speaker opening on passenger's side.
- yes ↓

Does drive switch through ground? Between pin 5 (brown) and pin 4 (green/blue)
Eye pulled out approx. 0 ohm
Eye pushed into drive approx. ∞ ohms
- no → Replace drive.

B. Locking Not Possible

Is microswitch operated – is microswitch plug connection okay?
- no → View of microswitch – see 51 26 000.
- yes ↓

Pull off plug on microswitch.
Supply car ground to wire end socket 2 (yellow/blue).
Does system lock?
- no → Make connection between pin 7 (yellow/blue) on control unit with connected plug and car ground.
  Does system lock?
  - no → Break in wire (blue) or (white) to drive – repair.
  - yes ↓ Break in wire (yellow/blue) – repair.
- yes ↓

Check socket 1 (brown) on microswitch plug against car ground.
Approx. 0 ohm resistance?
- no → Break in microswitch ground supply – repair. Also refer to socket 5 (brown) of 13-pin plug behind radio speaker opening on passenger's side.
- yes ↓

Does microswitch switch through ground?
Between pin 1 (brown) and pin 4 (yellow/blue).
Switch pressed approx. 0 ohm
Switch opened approx. ∞ ohms
- no → Replace microswitch.

4. No function when operating trunk lid lock (unlocking – locking)
   – See Test Requirements –

Linkage connected – drive adjusted and mounted correctly – plug connected on drive?
- no → Connect linkage – adjust/mount drive correctly – connect plug. See 51 26 020.
- yes ↓

Pull off plug on drive.
Supply car ground to socket 4 wire (green/black) or socket 3 (yellow/black).
Does system unlock or lock?
- no → Make connection between pin 8 (green/black) or pin 9 (yellow/black) on control unit with connected plug and ground.
  Does system unlock or lock?
  - no → Replace control unit. If applicable, check (blue) or (white) wire for breaks.
  - yes → Break in wire (green/black) or (yellow/black) – repair.
- yes ↓

Check socket 5 (brown) on plug for trunk lid drive against car ground.
Approx. 0 ohm resistance?
- no → Break in ground supply to drive – repair. Also refer to connection on central ground point behind instrument panel at bottom left.
- yes ↓

Does drive switch through ground?
- no → Replace drive.

1. Between pin 5 (brown) and pin 4 (green/black).
   Eye pulled out approx. 0 ohm
   Eye pushed into drive approx. ∞ ohms
2. Between pin 5 (brown) and pin 3 (yellow/black).
   Eye pulled out approx. ∞ ohms
   Eye pushed into drive approx. 0 ohm

5. No function of one or both rear doors (unlocking – locking – arresting)
– See Test Requirements –

Linkage connected – drive adjusted and mounted correctly – plug connected on drive correctly?

no → Connect linkage – adjust/mount drive correctly – connect plug.
See 51 26 010.

yes

Pull off plug on drive.
Measure voltage:
Wire (blue) while locking briefly > 3 V
Wire (white) while unlocking briefly > 3 V
Wire (white/black) while arresting briefly ≈ 1 V
Voltage values correct?

no → Pull off plug on control unit and check wires (blue/white) and (white/black) for breaks.
Approx. 0 ohm resistance?

no → Repair wires.

yes

Replace drive.

6. No function when operating the unlocking arrest
– See Test Requirements –

Is the microswitch of the passenger's door operated? — no → Repair the activator.

yes

Measure voltage on control unit pin 10. > 3 V? — no → Replace control unit.

yes

Pull off plug on microswitch.
Switch opened betw. 2 and 3 approx. ∞ ohms?
Switch pressed betw. 2 and 3 approx. 0 ohm? — no → Replace microswitch.

yes

Check power flow in (red/brown) wire between socket 3 of microswitch plug and socket 10 of control unit plug.
Approx. ∞ ohms? — no → Repair wire.

yes

Check power flow in wire end socket 2 (brown/blue) of microswitch plug.
Approx. 0 ohm? — no → Break in ground supply – repair.

7. Passenger's door and rear doors do not unlock or lock
when operating the driver's door lock or trunk lid lock.
No function of rear doors when operating passenger's door lock (unlocking – locking)
– See Test Requirements –

Check ground supply of microswitch for driver's door. Does wire end socket 2 (brown/blue) have car ground = approx. 0 ohm?
- no → Break in ground supply – repair.
- yes ↓

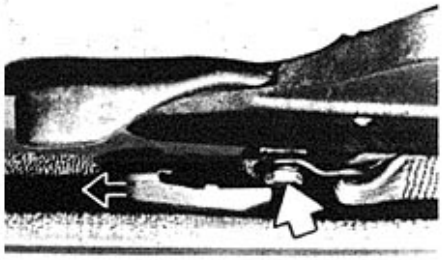
Does power flow between socket 1 (white/black) and socket 2 (brown/blue) of an opened microswitch = approx. 0 ohm?
- no → Check microswitch (see point 6), repairing if necessary.
- yes ↓

Pull off drive plug on passenger's side and check socket 6 (white/black) against car ground. Approx. 0 ohm?
- no → Break in ground – repair.

52 Seats

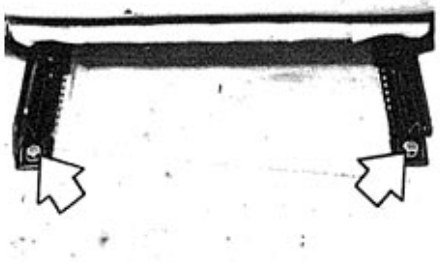
52 10 000	Front seat, left or right – remove and install	52- 1
030	Front seat height control – remove and install	52- 2
205	Front seat armrest – remove and install	52- 2
230	Front seat reclining mechanism – remove and install	52- 3
907	Power drive and gearbox for seat forward/back and up/down, outside and inside – remove and install or replace	52- 4
927	Power drive and gearbox for backrest, outside and inside – remove and install or replace	52- 6
937	Power drive and gearbox for headrest – remove and install or replace	52- 7
52 20 000	Rear seat cushion and backrest – remove and install	52- 8
61 31 099	Power seat control unit – remove and install or replace	52- 9
199	Power seat control unit with memory – remove and install or replace	52- 10
	Power seats – troubleshoot	52- 11
	Power seats with memory – operation and description	52- 14
	Power seats with memory – troubleshoot	52- 15

52 10 000 REMOVING AND INSTALLING LEFT OR RIGHT FRONT SEAT



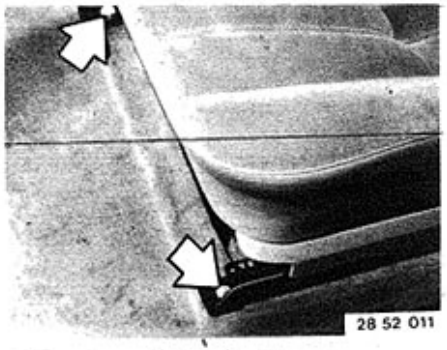
28 52 010

Pull off cover and unscrew bolt.
Installation:
Tightening torque*.



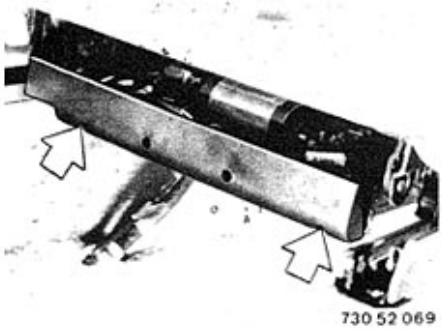
28 52 012

Unscrew rear bolts.



28 52 011

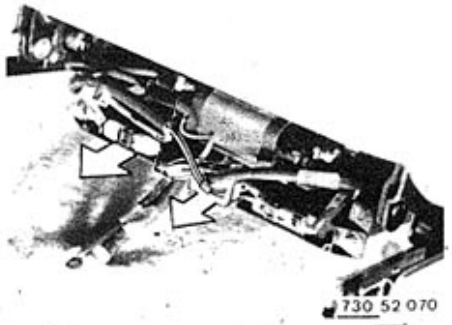
Unscrew front bolts.
Disconnect plugs on Fasten Seat Belt sign, seat heating and power seats without memory.
Remove seat.



730 52 069

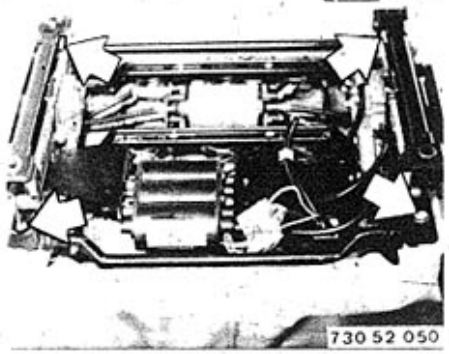
Power Seats with Memory:
Unscrew cover.

* See Specifications



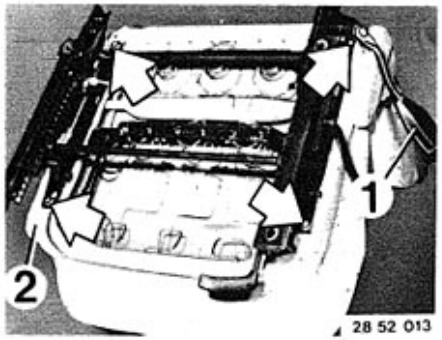
730 52 070

Pull off central electric plug (white) and 2-pin plug.
Remove seat.



730 52 050

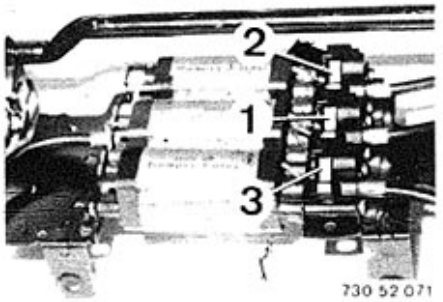
Note:
If mounting bolts are not accessible due to failure of the eletric forward/back seat movement, disconnect spring core on rails, disconnect plugs and remove seat.



28 52 013

52 10 030 REMOVING AND INSTALLING FRONT SEAT HEIGHT CONTROL

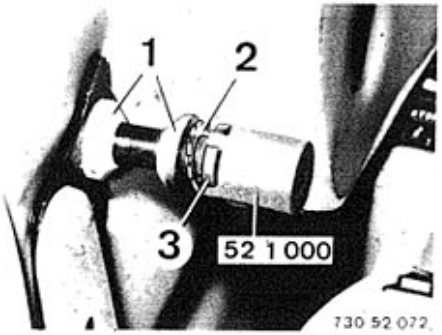
Remove front seat 52 10 000.
Unscrew bottom strap (1).
If applicable, disconnect plugs.
Unscrew screws and remove complete seat height control.
Installation:
Tightening torque*.



730 52 071

Important!
Power Seats with Memory:
Do not mix up plugs for potentiometers.

Wire Color	Motor/Potentiometer
blue	1/seat forward - back
red	2/seat up/down - front
gray	3/seat up/down - rear



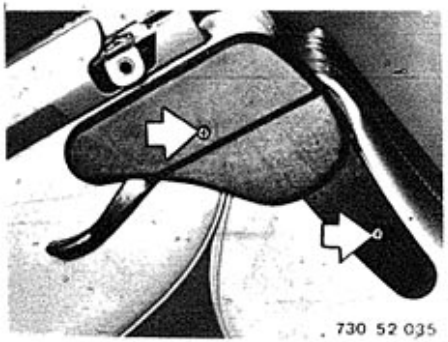
730 52 072

52 10 205 REMOVING AND INSTALLING ARMREST ON FRONT SEAT

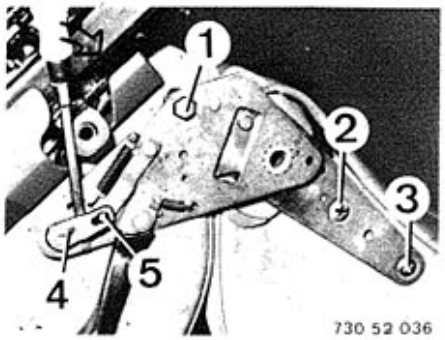
Lift out cover.
Bend open lockplate (2).
Unscrew nut (3) with Special Tool 52 1 000.
Take off armrest.
Installation:
Taper of plastic sleeve (1) fits on taper of armrest.
Tighten nut and lock lockplate.

* See Specifications

52 10 230 REMOVING AND INSTALLING RECLINING MECHANISM ON FRONT SEAT

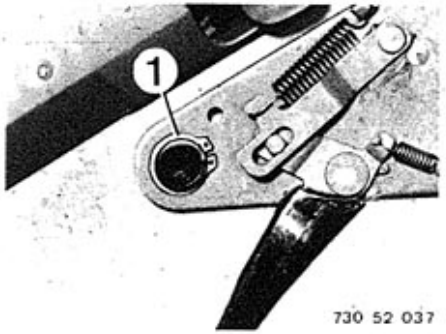

730 52 035

Remove front seats 52 10 000.
Unscrew screws and take off cover.
Cars with Power Seats:
Remove gearbox for outside and inside backrest control – see 52 10 927.



730 52 036

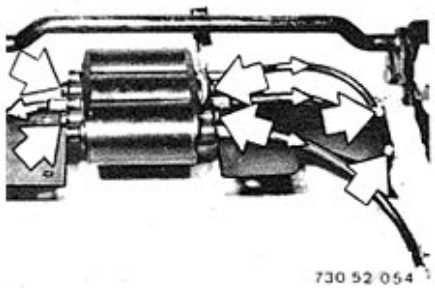
Unscrew screws (1 ... 3).
Pry out transmitting lever (4) with a screwdriver.
Installation:
Install screws with Loctite No. 270.
Engage transmitting lever (4) in pin (5) and transmitting tube for left side.



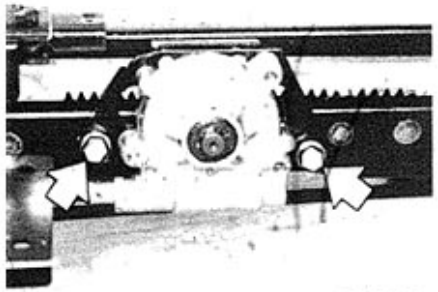
730 52 037

Lift out circlip (1) and remove reclining mechanism.

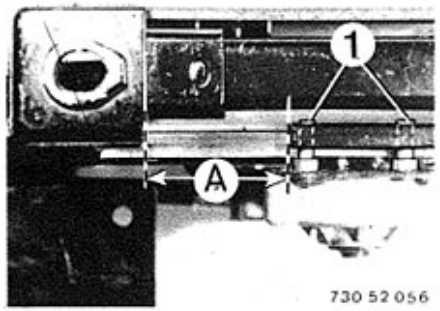
52 10 907 REMOVING AND INSTALLING OR REPLACING DRIVE AND GEARBOX FOR OUTER AND INNER SEAT FORWARD / BACKWARD AND UP / DOWN CONTROL
– Front Seat Removed –


730 52 054

Remove control unit – see 61 31 099.
Unscrew bolts, pull off connecting shafts and remove drive as well as, if applicable, potentiometer.

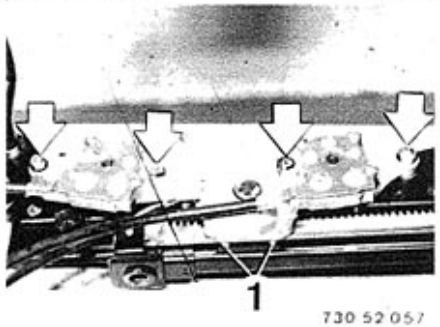

730 52 055

Unscrew screws.
Take off gearbox.



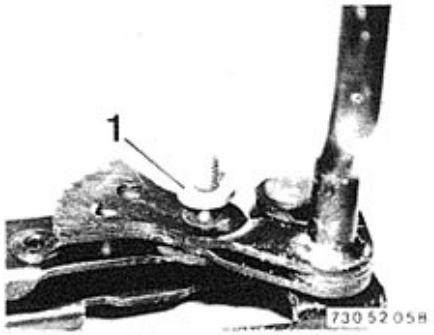
730 52 056

Installation:
Distance (A) must be identical for both rails.
Pins (1) are located in holders.



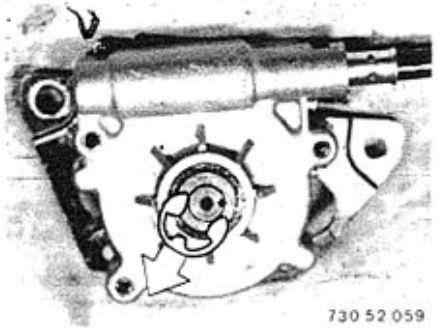
730 52 057

Unscrew screws (1) and nuts (2).
Take off gearbox assembly.
Installation:
Pins (1) are located in holders.

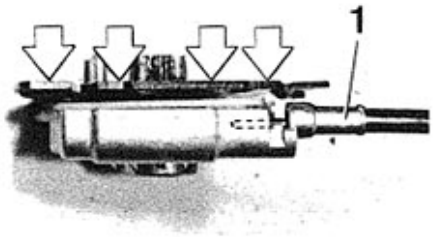


730 52 058

Installation:
Use spacers (1) on both studs.


730 52 059

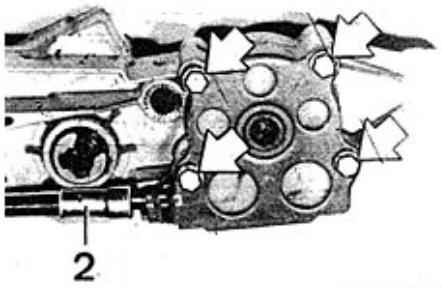
Removing Connecting Shafts:
Pull off circlip.



730 52 060

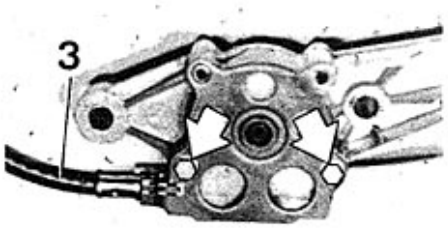
Unscrew screws.
Lift cover off of gearbox slightly and pull out connecting shaft (1).

Loosen screws.
Lift cover and pull out connecting shaft (2).



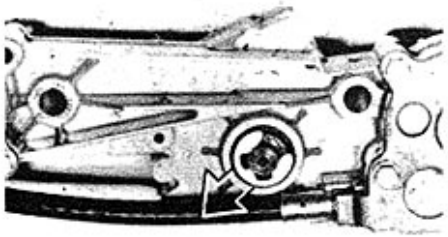
730 52 062

Loosen screws.
Lift cover and pull out connecting shaft (3).



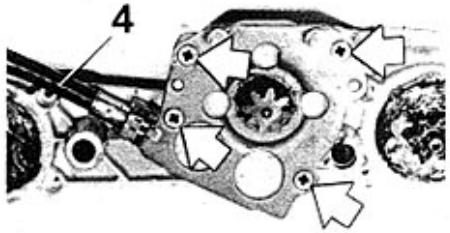
730 52 063

Remove circlip.

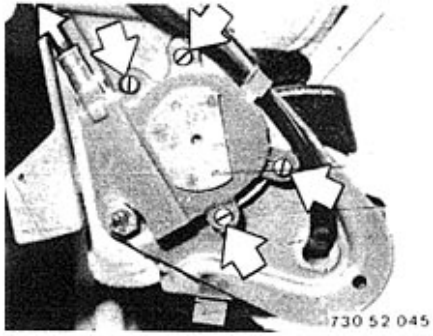


730 52 064

Loosen screws.
Lift cover and pull out connecting shaft (4).

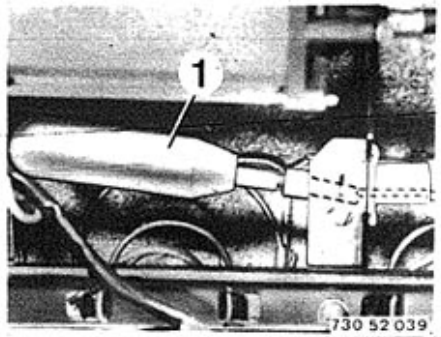


730 52 065

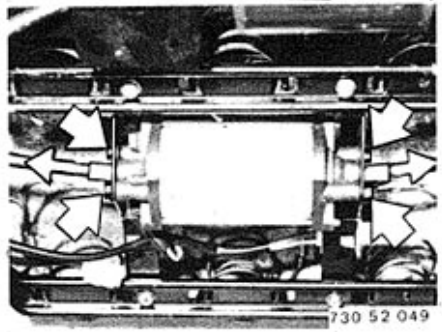


52 10 927 REMOVING AND INSTALLING OR REPLACING DRIVE AND GEARBOX FOR OUTER AND INNER BACKREST CONTROL
– Front Seat Removed –

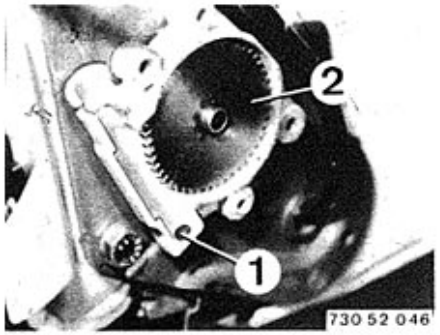
Take off reclining backrest mechanism trim.
Unscrew screw and remove gearbox.
Pull off connecting shaft.



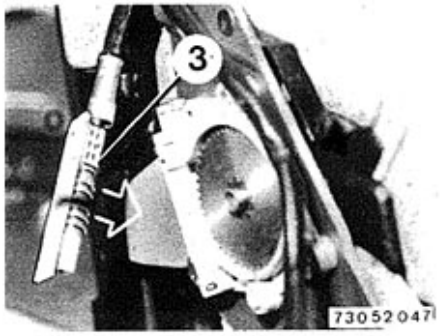
Compress locking tabs and disconnect plug.
Pull plug out of plug receptacle with Special Tool (1)**.
Installation:
Connect plug (wires) that colors match.



Unscrew screws.
Pull connecting shafts out of drive and, if applicable, potentiometer.

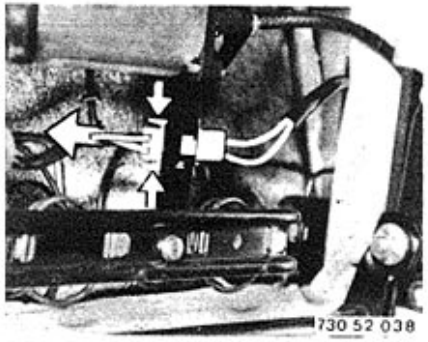


Installation:
Install axial bearing (1) with grease.
Insert gear (2) by turning.



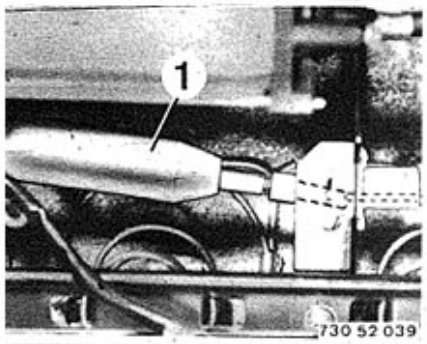
Install drive worm (3) on drive shaft and insert in gearbox case.
Collar of connecting shaft rests on case.

** Source: HWB

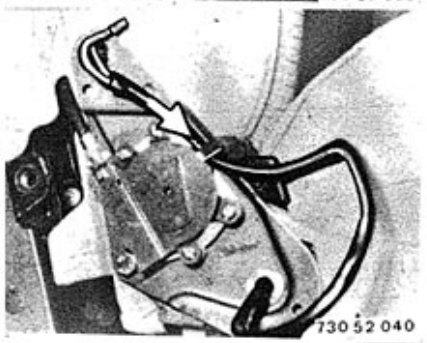


52 10 937 REMOVING AND INSTALLING/ REPLACING DRIVE AND GEARBOX FOR HEADREST CONTROL
– Front Seat Removed –

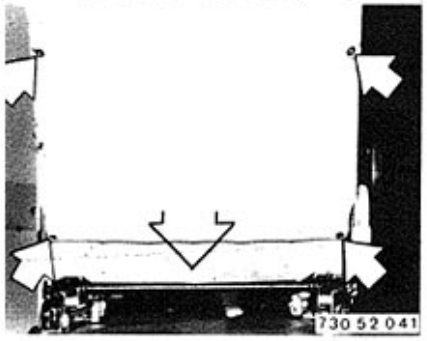
Compress retainers and disconnect plug.



Pull wires out of plug receptacle with special tool** (1).
Installation:
Connect plug that wire colors match.

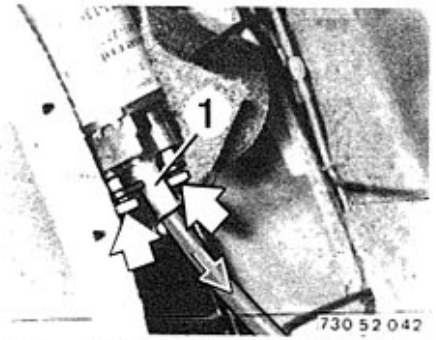


Remove trim panel and-pull out wires.

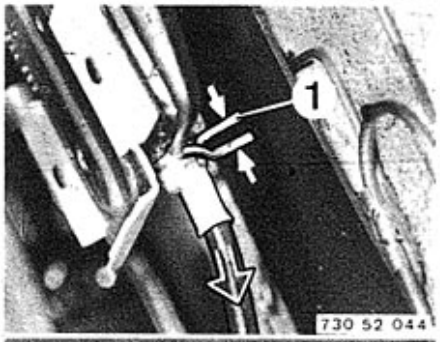


Unscrew screws and pull off backrest panel downwards.

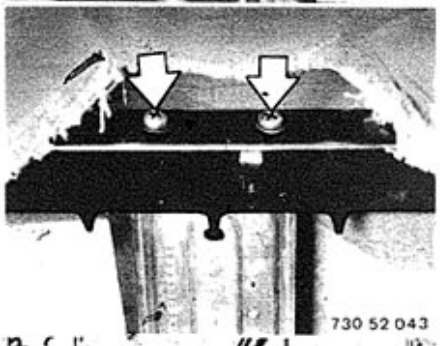
** Source: HWB



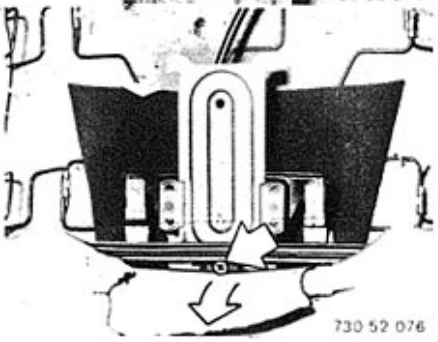
Unscrew screws and remove drive.
Pull connecting shaft (1) off of drive potentiometer.



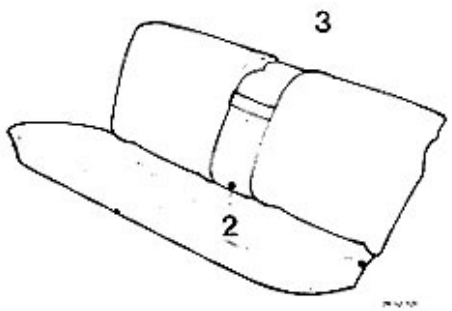
Remove shaft retainer (1) with a pliers.
Pull connecting shaft out of gearbox.



Loosen backrest cover partially and remove gearbox.

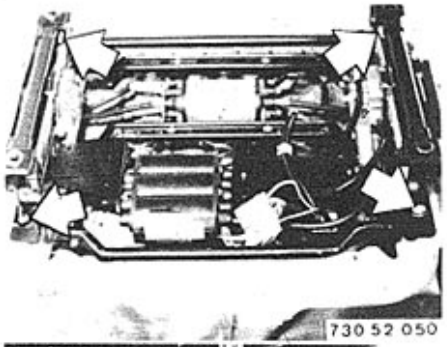


Since 1984 Models:
Drive shaft is fixed on gearbox.
Loosen screw and remove gearbox.



52 20 000 REMOVING AND INSTALLING REAR SEAT CUSHION AND BACKREST

Unscrew bolt (1) and remove rear seat cushion. Unscrew bolts (2), push backrest up out of hook (3) and remove.


730 52 050

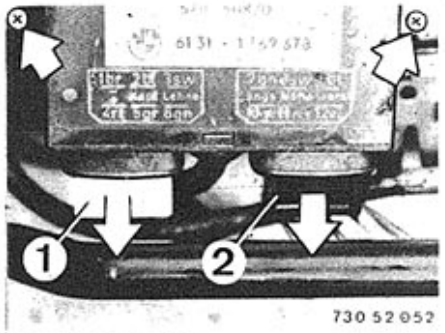
61 31 099 REMOVING AND INSTALLING/ REPLACING CONTROL UNIT FOR POWER SEATS

Remove front seat 52 10 000.
Unscrew bolts.
Disconnect plug.
Remove seat rails.



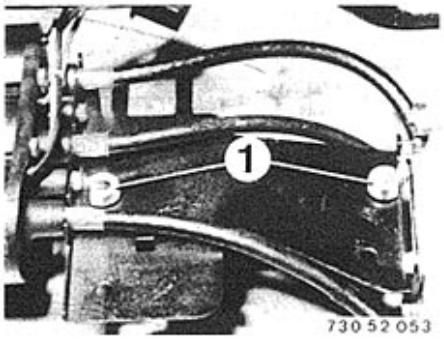
730 52 051

Pull wires (1 and 2) out of plug receptacle with special tool**.
Installation:
Wire (1) brown – socket no. 13
Wire (2) red – socket no. 7
Bend open plug retainers slightly.



730 52 052

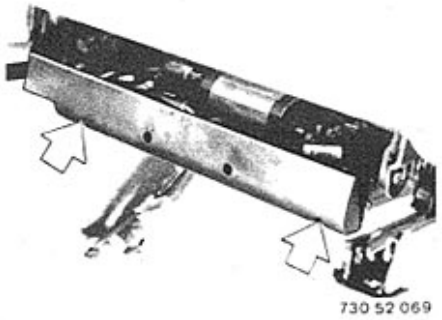
Pull off plugs (1 and 2).
Remove control unit.



730 52 053

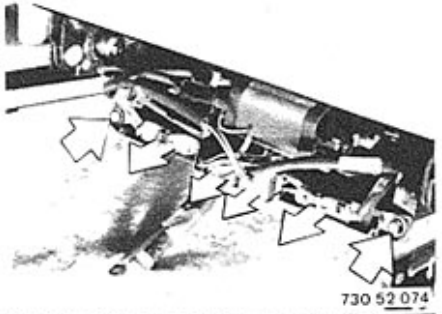
Installation:
Install spacers (1).

** Source: HWB

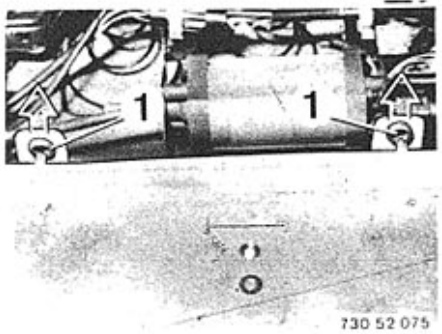

730 52 069

61 31 199 REMOVING AND INSTALLING/ REPLACING CONTROL UNIT FOR POWER SEATS WITH MEMORY

Remove front seat 52 10 000.
Unscrew cover.

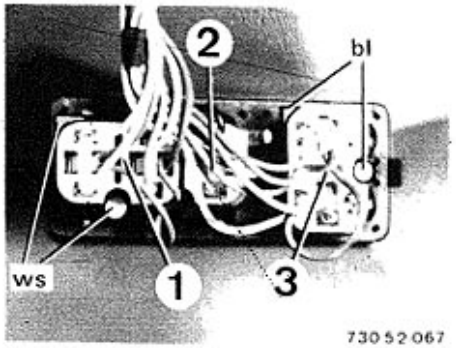

730 52 074

Pull off plug.
Unscrew screws.
Remove control unit.



730 52 075

Installation:
Place rubber mount (1) in retainers.
Pins of control unit must be in rubber mounts (1).



73052067

61 31 204 REMOVING AND INSTALLING OR REPLACING POWER SEAT SWITCH

Lift out switch from above.
Pull off plugs (1 ... 3).
Installation:
Connect plugs (1 and 3) to match colors of coding pins.
ws = white
bl = blue

Important!
Only pull off plug on memory after turning off the ignition.

TROUBLESHOOTING ELECTRICALLY OPERATED SEATS

Test Requirements: Fuse no. 4 in fuse box okay; automatic cutout (in instrument trim) switched on.
Battery cahrged – at least 11.5 volts.
Testing performed with BMW service test unit or digital tester II.

A) Failure of All Control Operations

Voltage U > 9 V on 6-pin plug (white) of control unit (underneath seat) okay? — no → Check wire from fuse no. 4 via special equipment plug (behind instrument panel trim at bottom left), automatic cutout and central electric plug for breaks – repair.
Wire color red – chamber no. 4.

yes

Ground on 6-pin plug (white) of control unit okay? — no → Check wire for breaks – repair.
Wire color brown – chamber no. 1.

yes

Ground on 13-pin central electric plug okay? — no → Replace control unit.
(6-pin plug (white) connected) Wire color brown – chamber no. 12.

yes

Ground on combination switch okay? — no → Check wire for breaks – repair.
Wire color brown (all).

yes

Replace control unit.

B) Failure of Different Control Operations

Check wire leading to switch combination.
Disconnect 13-pin central electric plug.
Is there power flow from chamber no. 12 / brown 0.5 mm^2 wire of central electric plug to chamber no. ... / wire color ... of central electric plug? — no → Power flow to switch connections? — no → Replace wire harness.

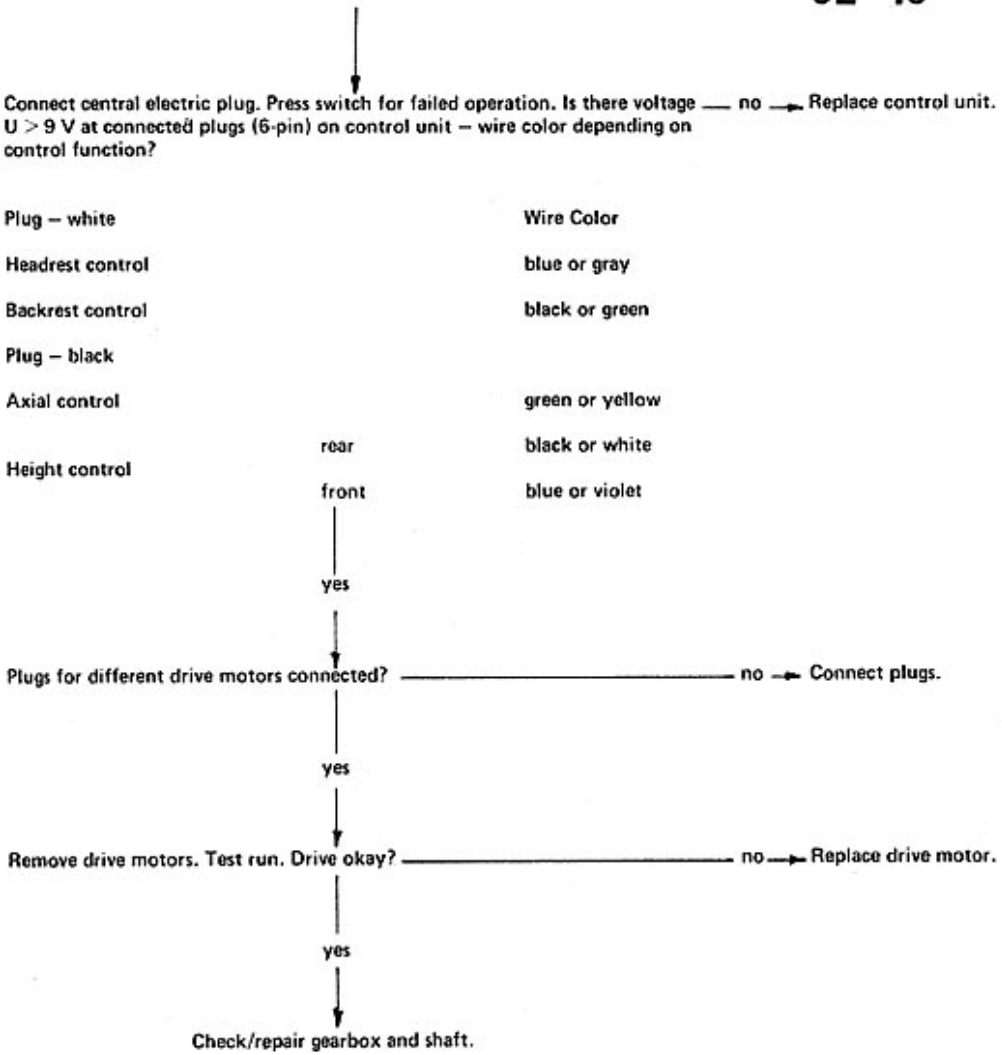
yes

Replace switch.

Note:
Switch of function being tested must be operated.

Headrest control	down	1 / white
	up	2 / black
Backrest control	back	3 / yellow
	forward	4 / white-green
Seat forward/back	forward	5 / gray
	back	6 / green
Height control	rear up	8 / pink
	rear down	9 / red
	front up	10 / violet
	front down	11 / blue

yes


Connect central electric plug. Press switch for failed operation. Is there voltage U > 9 V at connected plugs (6-pin) on control unit – wire color depending on control function?
no
Replace control unit.
Plug – white
Wire Color
Headrest control
blue or gray
Backrest control
black or green
Plug – black
Axial control
green or yellow
Height control
rear
black or white
front
blue or violet
yes
Plugs for different drive motors connected?
no
Connect plugs.
yes
Remove drive motors. Test run. Drive okay?
no
Replace drive motor.
yes
Check/repair gearbox and shaft.

OPERATION AND DESCRIPTION OF POWER SEATS WITH MEMORY

Adjust position of seat with manual position switches.
Turn on ignition and press recessed switch (1, 2 or 3) in switch assembly.
A flashing green LED indicates storage in memory of control unit.
The automatic seat position (1, 2 or 3) can be called.

1. with the engine stopped and ignition turned on by briefly touching the call button (green LED comes on and goes out after reaching the final position), or

2. with the engine running by pressing the call button until automatic running-off has stopped (green LED flashes until final position has been reached).

The red LED indicates malfunctioning of the program running-off or a defect in the system – see Troubleshooting.

Automatic positioning can be interrupted with the stop button in case of malfunction.
The manual position switch has priority over the memory circuit and, when operated, will stop the automatic positioning
[illegible]

Description of Operation:

An adjusted seat position is reported to the control unit in form of a certain voltage value by way of potentiometer positions (potentiometers are bolted on each drive) and, if desired, stored in the memory.
When calling a stored position there is comparision of the instantaneous voltage value and the pertinent stored voltage signal.
The control unit operates drive motors to position the seat so long until both signals correspond with each other.

TROUBLESHOOTING POWER SEATS WITH MEMORY

Test Requirements: Fuses 4 and 8 in power distributor okay.
Battery charged – at least 11.5 volts.
Tests performed with BMW service test unit or digital tester II and universal adapter* with 26-pin connecting lead*.
Control unit and plug connections underneath seat.

A) Failure of All Control Operations (Automatic and Manual)

Voltage U > 9.5 V on 4-pin plug (control unit) red/gray wire color? — no → Check wire from fuse via special equipment plug and central electric plug connection for breaks – repair.

↓ yes

Groupd on 4-pin plug (control unit) brown wire color? — no → Check wire for breaks – repair.

↓ yes

Pull off white plug on control unit and series connect adapter. Ground on terminal 26? — no → Replace control unit.

↓ yes

Ground on combination switch / brown wire color (all)? — no → Check wire for breaks – repair.

↓ yes

All functions of combination switch checked with an ohmmeter? — no → Replace switch.

↓ yes

Replace control unit.

* Source: HWB

B) Failure of Different Control Operations (Manual)

Pull off white plug on control unit and series connect the adapter.
Ground on terminal numbers (see below)?
Switch pressed:

Backrest control	forward	term. no. 24
	back	term. no. 18
Seat forward/back	forward	term. no. 15
	back	term. no. 20
Headrest control	down	term. no. 17
	up	term. no. 5
Seat up/down	rear up	term. no. 21
	rear down	term. no. 16
	Front up	term. no. 22
	front down	term. no. 23

yes

no → Ground on switch of pertinent operation (brown wire)?

no → Check ground connection to other switches.

yes

Replace switch.

Remove adapter and connect plug on control unit
Voltage U > 9.5 V on connected 6-pin and 4-pin plugs, wire colors corresponding with control operation?
Pertinent switch pressed.

— no → Replace control unit.

Six Pin Plug		Wire Color:
Seat forward/back		green or yellow
Seat up/down	rear	black or white
	front	blue or violet
Four Pin Plug		
Height control		black or green
Headrest control		blue or gray

yes

Plugs connected on different drives? — no → Connect plugs.

yes

Remove and test run drives – drives okay? — no → Replace drive(s).

yes

Check gearbox and shaft – repair.

C) Failure of Automatic Seat Positioning

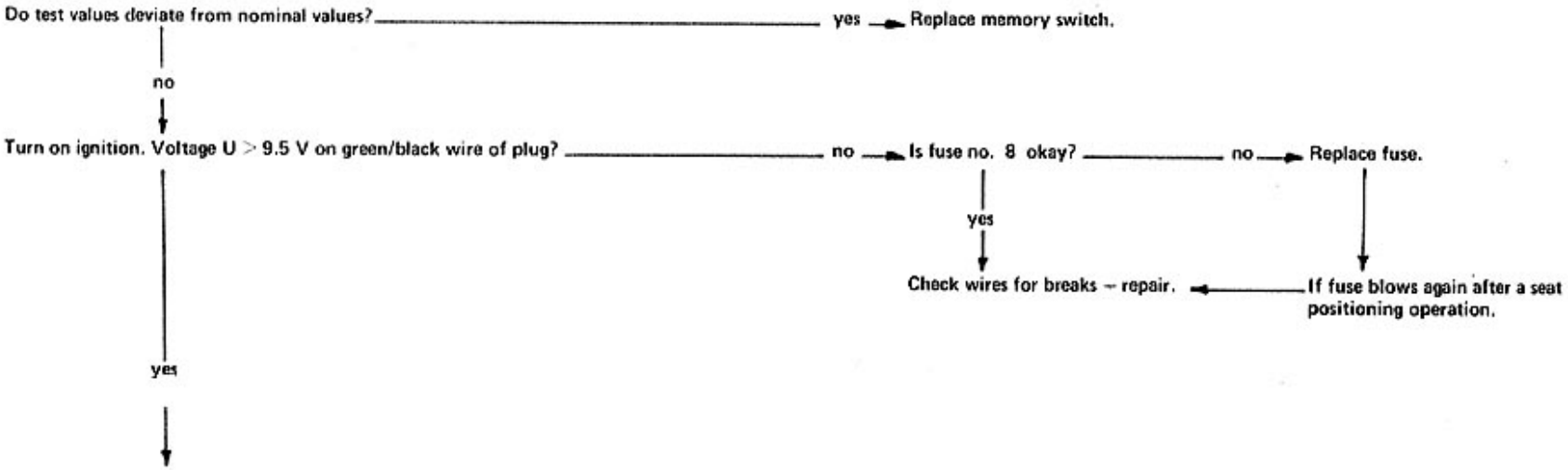
Manual operation okay.

Check memory switch:

Remove switch and pull off plug. *Caution!* Only pull off plug after turning off the ignition

Measure resistance:

Between pin numbers (located on plug):	In switch position:	Nominal value:
5 and 7	Stop pressed	∞ Ω
5 and 7	Stop not pressed	0 Ω
3 and 2		2.28 ... 2.52 k-Ω
	Memory 1 pressed	160 ... 175 Ω
	Memory 2 pressed	320 ... 360 Ω
	Memory 3 pressed	760 ... 840 Ω
3 and 4		2.28 ... 2.52 k-Ω
	Call 1 pressed	160 ... 175 Ω
	Call 2 pressed	320 ... 360 Ω
	Call 3 pressed	760 ... 840 Ω



Connect plug and install switch.
Pull blue plug off control unit
and connect adapter in series.
Ignition switched on.

Check voltage between terminals

1 and 14 (backrest control)
2 and 15 (seat forward/back)
3 and 16 (headrest control)
4 and 17 (seat height, rear)
5 and 18 (seat height, front)

Voltage U = 4.0 ... 5.0 V? —— no —— Replace control unit

Yes

Voltage against vehicle ground on

terminal

8 (backrest)
9 (seat forward/back)
10(headrest)
11(seat height, rear)
12(seat height, front)

Check during manual operation
of corresponding functions.
Is voltage continuously rising
or falling (between 1 V and 5 V)? —— no —— Replace potentiometer

Yes

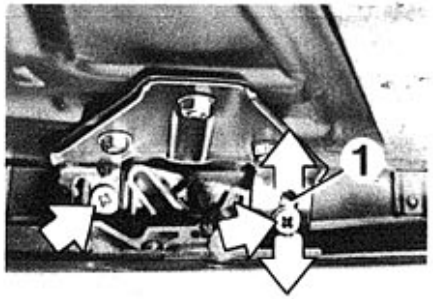
Replace control unit

54 Hood, sunroof

54 12 004	Sunroof – adjust	54- 1
090	Sunroof lid – convert (from steel to glass)	54- 2a
100	Sunroof lid – remove and install	54- 3
120	Sunroof lid seal – replace	54- 4
230	Sunroof gearbox (manual) – remove and install	54- 5
241	Sunroof drive cables (both) – replace	54- 5
54 13 010	Sunroof motor and gearbox – remove and install	54- 6
012	Sunroof motor microswitch – replace	54- 6
	Sunroof – troubleshoot	54- 7

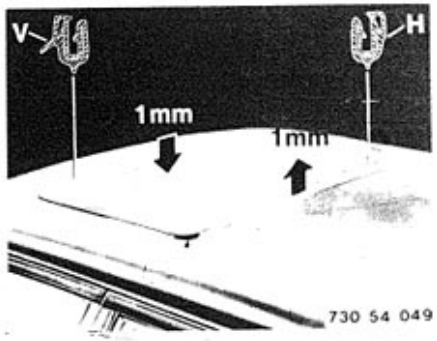
54 12 004 ADJUSTING SUN ROOF

Description:
The steel sun roof operates as a
A) sliding roof and
B) lifting roof.
Switching to lift is only possible in closed state.
For electric sun roofs with switch in "closed" position via a microswitch.



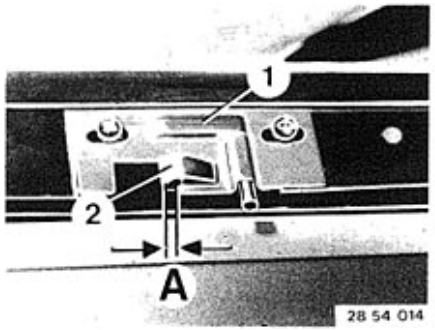
28 54 013

Rear Height:
Unscrew bolts on gate holder.
Lid can now be adjusted in slot (1).
Tighten bolts again.



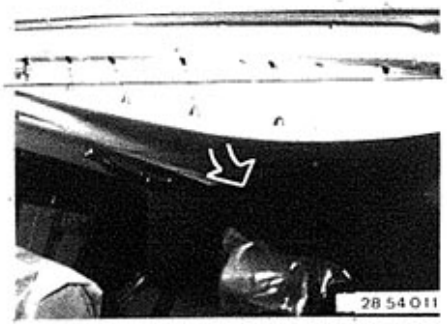
730 54 049

Ideal Adjustment of Sun Roof:
Height:
Front = 1 mm (0.039") deeper than roof panel.
Rear = 1 mm (0.039") higher than roof panel.
Axial:
Equal distance between lid and roof at front and rear – check with plastic gauge (approx. 0.2 mm/0.008").
Check velvet strips:
V = Front with sealing lip
H = Rear without sealing lip



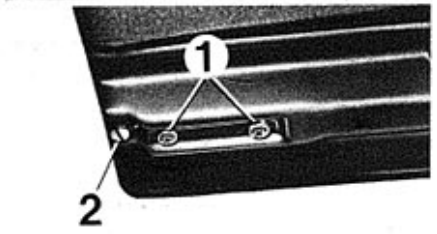
28 54 014

Basic "Lift" Setting:
Center left and right guide pins (1) in slots.
Distance (A).
Guide plate (2).
Guide pin (1).
A = 2 mm (0.079").
In lift position sun roof lid should rest on front roof opening edge.
If necessary, correct by adjusting guide pins and guide plates.



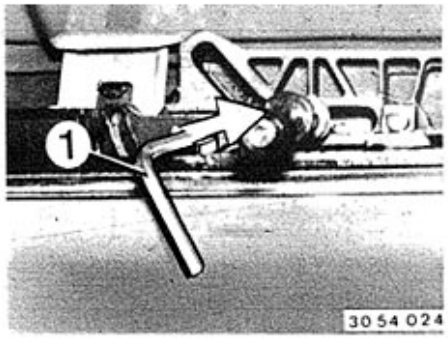
28 54 011

Open sun roof about 5 cm (2").
Press off front roof liner frame.
Close sun roof and push back roof liner frame completely.
Installation:
Close sun roof.
Pull roof liner frame forward uniformly.
Open sun roof slightly, holding roof liner frame by hand.
Press in clips for front roof liner frame.

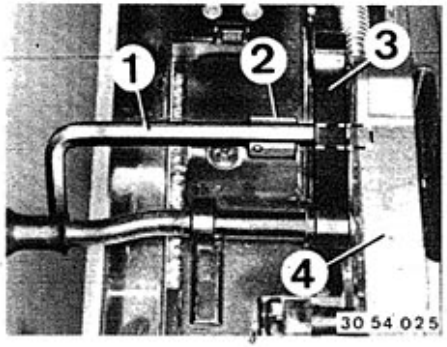


28 54 012

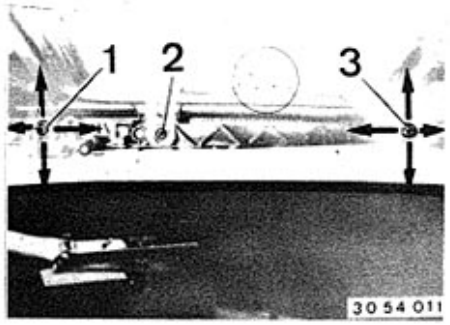
Version Without Plastic Gate:
Front Height:
Unscrew bolts (1) and turn height adjusting screw (2).
Tighten bolts (1) again while pressing in roof.



Version With Plastic Gate:
Sun roof closed = 0 position.
Lock sun roof in 0 position on left and right sides with a 4 mm hexagon key (1).



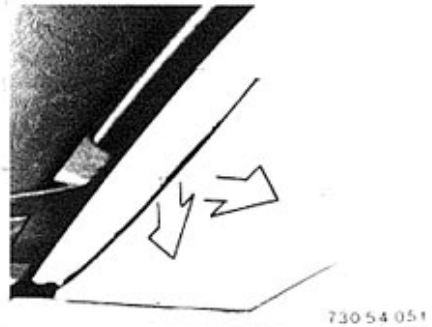
Note:
Apply key (1) in holder of guide pin (2) and in bores of opening lever (3) and gate (4).



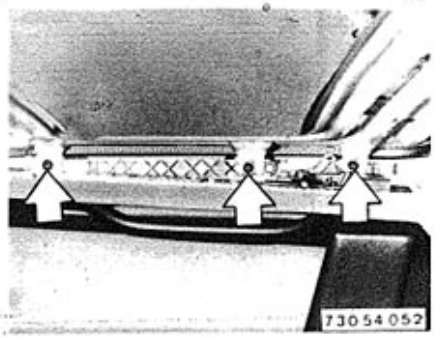
Loosen screws (1 ... 3) on left and right sides.
Adjust sun roof lid in slots.
Note:
Tool* = Torx wrench T 25.
Replace self-locking bolts.

* Source: HWB

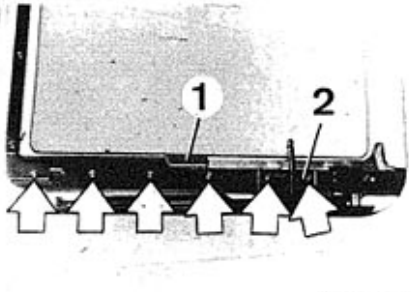
54 12 090 CONVERTING SUN ROOF LID FROM STEEL TO GLASS VERSION



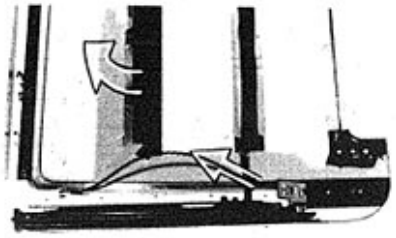
Open sun roof about 5 cm (2").
Pull roof liner frame down out of clamps and push back.
Close sun roof.



Unscrew screws on left and right sides with a T 25 wrench and lift off sun roof lid.



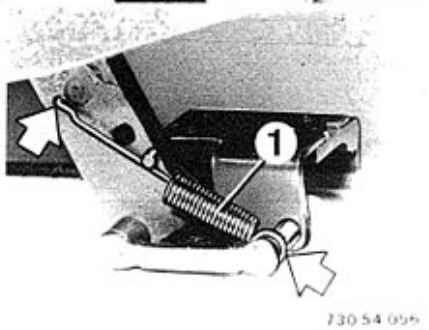
Unscrew screws on both sides.
Remove sliding rail (1) and guide pins (2).



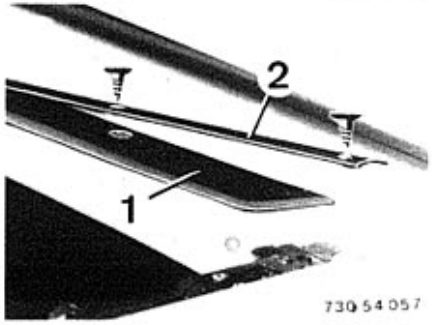
Pull left and right drive cables forward out of guides.
Remove roof liner frame toward front.



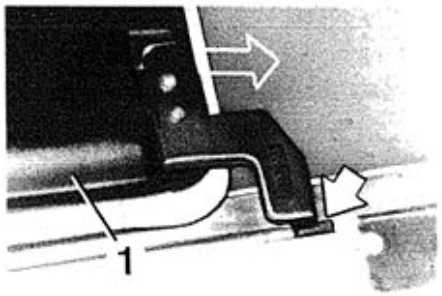
Saw off opening levers of both drive cables (on shoulder after the roller).
Deburr and coat cut edges with paint.



Connect springs (1) on both drive cables with a pointed pliers.

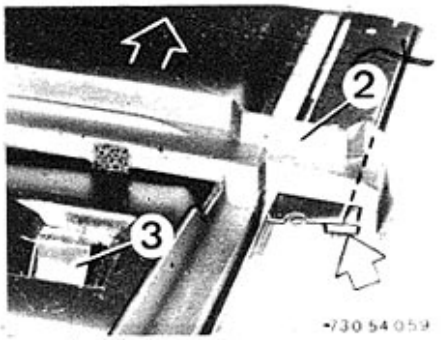


Install slide (1) underneath the clamping strip (2) with broken edge side facing forward and down.



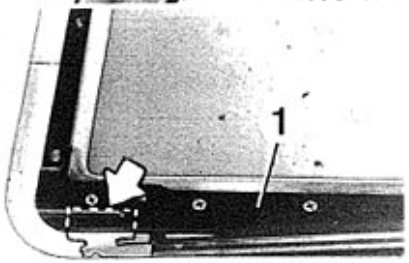
730 54 058

Insert roof liner frame (1) in guide on left and right sides, and slide back.



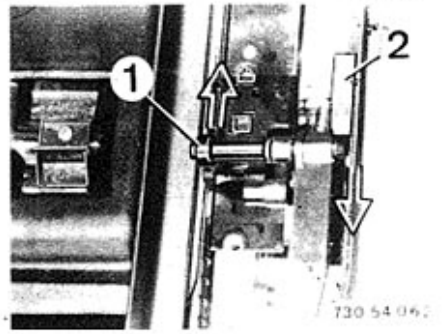
730 54 059

Guide cover (2) with slides in sliding rail on left and right sides and slide back.
Stop (3) of roof liner frame is located in front of cover (2).



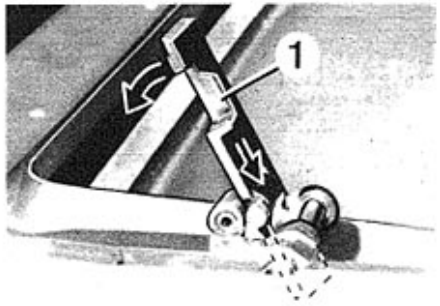
730 54 060

Insert drive cables in guides on left and right sides.
Install sliding rails (1) on left and right sides.
Slides are located underneath sliding rails.



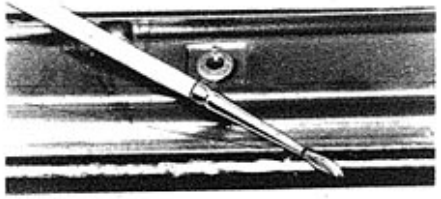
730 54 061

Pull opening lever (1) back and gate (2) forward.



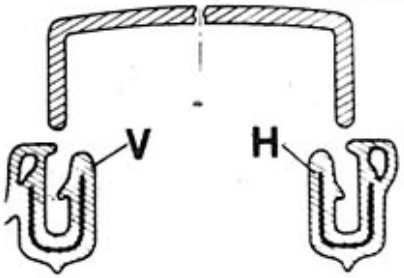
730 54 062

Guide pins (1) are marked with
L for left or
R for right.
Insert guide pins, press down and tighten screws.



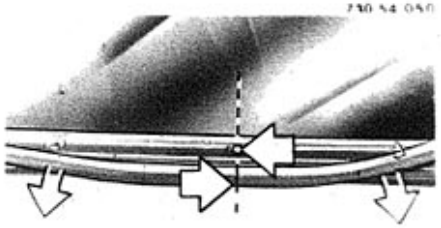
730 54 064

Coat edge of lid with a cement.



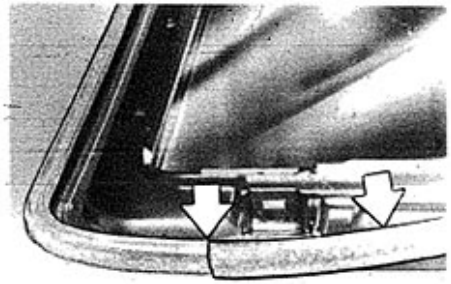
730 54 063

Installed Position of Seals:
V = Short seal – front
H = Long seal – rear



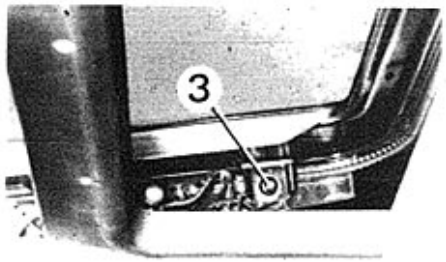
730 54 065

Determine center of short seal, mark and install, beginning at center of lid.

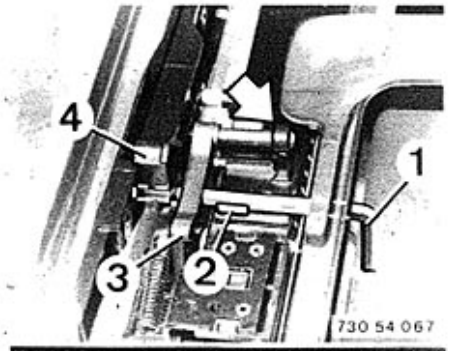


730 54 066

Install long seal and cut off with a saw to size.

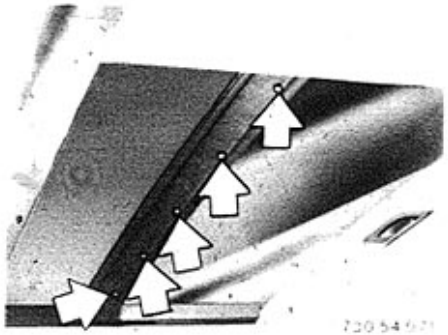


Take off both hexagon keys.
Move sun roof lid to lift position and tighten screw (3).



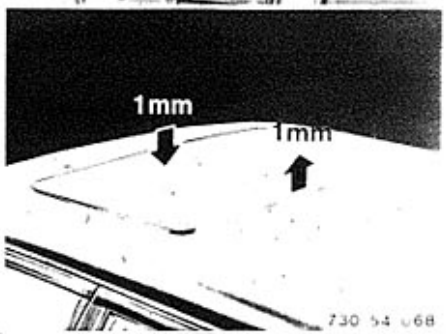
730 54 067

Apply 4 mm hexagon keys (1) in holders of guide pins (2) on left and right sides, and insert in bores of drive cable (3) and gate (4).
Slide back cover against stop on opener.



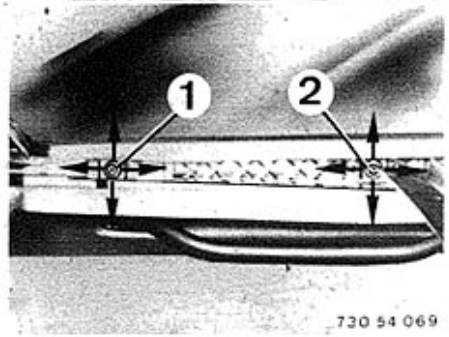
730 54 071

Close sun roof.
Pull cover forward against stop.
Open sun roof and screw on cover.



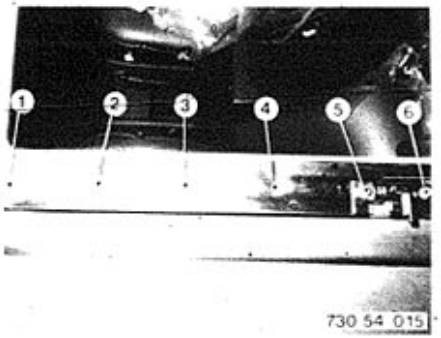
730 54 068

Place glass lid (short seal forward) in roof opening.
Adjust sun roof.
Front = 1 mm (0.039") deeper than roof panel.
Rear = 1 mm (0.039") higher



730 54 069

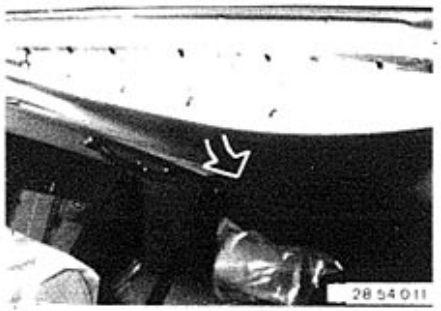
Screw in screws (1 and 2) on both sides.
Adjust glass lid.
Tighten screws.



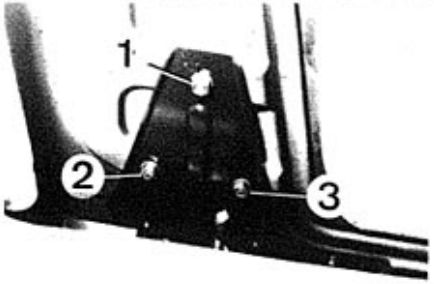
730 54 015

54 12 100 REMOVING AND INSTALLING SUN ROOF LID

Version without Plastic Gate:
Open sun roof completely.
Remove left and right upper guide rails after unscrewing screws (1 ... 5).
Loosen screw (6).
Installation:
Lubricate guide rails with vaseline.
Use Terostat tape on front corners.

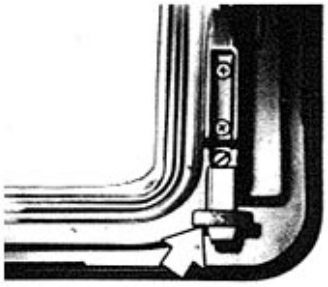

28 54 011

Close sun roof but for about 5 cm (2").
Press off front roof liner frame.
Close sun roof and push back roof liner frame completely.
Installation:
Close sun roof, pulling roof liner frame forward uniformly at same time.
Open sun roof slightly, holding roof liner frame by hand.
Press in clips for front roof liner frame.

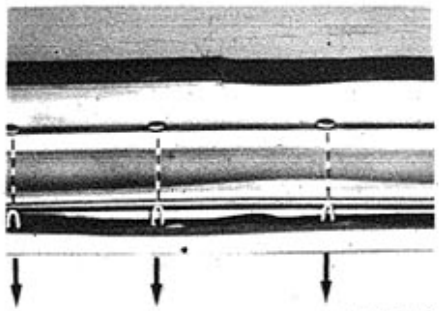


28 54 016

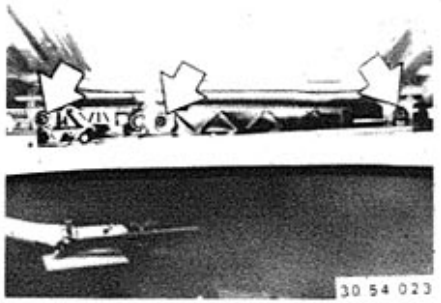
Unscrew nuts (1 ... 3) on left and right sides.
Remove sun roof lid.
Installation:
Attach sun roof lid on holder at rear, pulling in holder slightly.
Open sun roof by hand and with help of gearbox.
Caution!
Don't clamp roof liner frame.


28 54 017

Installation:
Check left and right slides, replacing if necessary.
Adjust sun roof 54 12 004..


30 54 010

Version with Plastic Gate:
Close sun roof but for about 5 cm (2").
Press off front roof liner frame.
Close sun roof and push back roof liner frame completely.
Installation:
Close sun roof.
Pull roof liner frame forward uniformly.
Open sun roof slightly, holding roof liner frame by hand.
Press in clips for front roof liner frame.

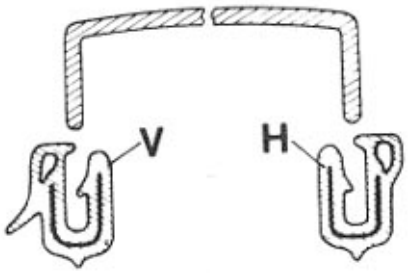

30 54 023

Unscrew left and right bolts.
Lift off sun roof lid.
Installation:
Adjust sun roof 54 12 004.

Note:
Replace self-locking bolts.
Tool* = Torx wrench T 25.

* Source: HWB

54 12 120 REPLACING SUN ROOF LID SEAL

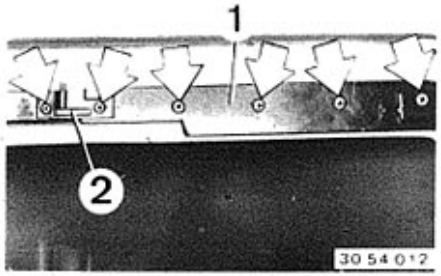


730 54 050

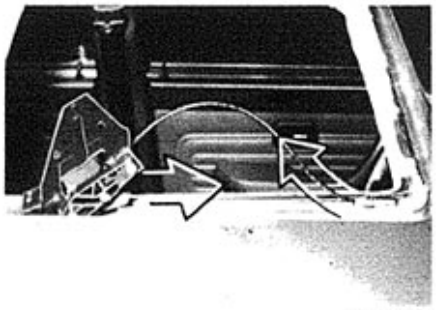
Remove and install sun roof lid 54 12 100.
Pull seal off of lid.
Installation:
Mount seals with cement*
V = Front velvet strip, short
(sealing lip faces forward)
H = Rear velvet strip, long

54 12 241 REPLACING BOTH DRIVE CABLES FOR SUN ROOF

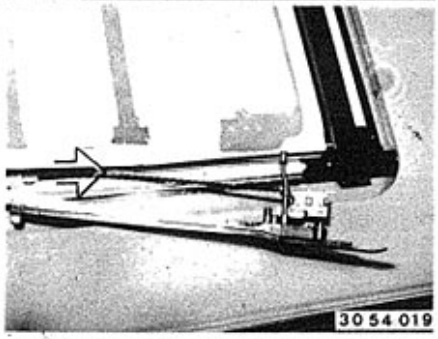
Remove and install sun roof lid 54 12 100.
Remove and install motor/gearbox unit 54 13 010.



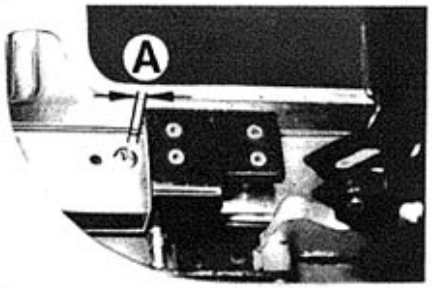
Version with Plastic Gate:
Unscrew left and right bolts.
Remove cover rail (1) and guide pin (2).
Guide pins (2) are marked with
L = left or
R = right.



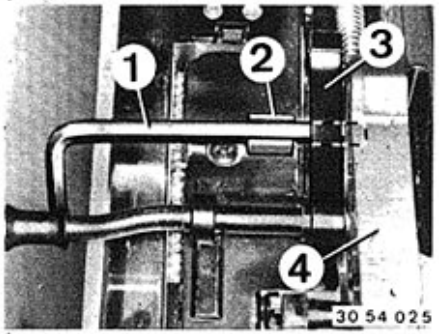
Version without Plastic Gate:
Push left and right guides forward and pull drive cables out of guide tubes.
Installation:
Lubricate drive cables lightly.



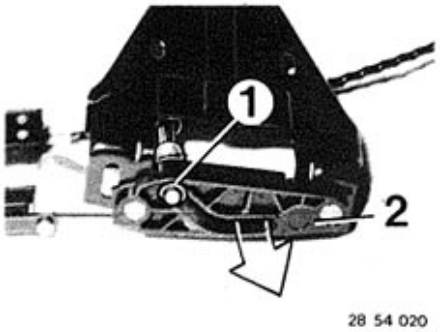
Pull drive cables out of guide tubes.
Installation:
Lubricate drive cables lightly with grease*.



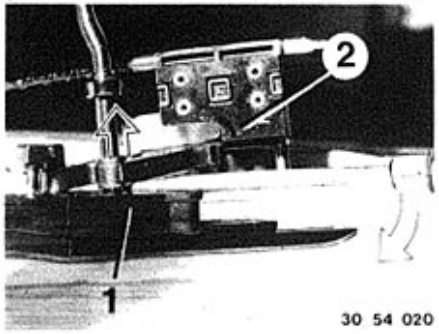
Installation:
Distance (A) = 2 mm (0.079").
Line up rear edge of gate holder with mark on guide rail.
Set gearbox or motor/gearbox unit to 0 and tighten bolt.



Installation:
Apply 4 mm hexagon keys (1) in left and right holders of guide pins (2) and insert in bores of opening lever (3) and gate (4).
Set gearbox or motor/gearbox unit to 0 and tighten bolt.

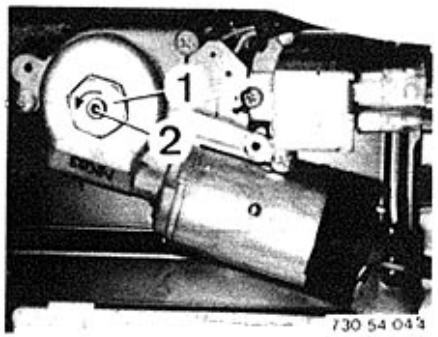


Pull off circlip (1) and remove gate holder (2).



Press gate (1) off of drive cable (2).
Drive cables (2) are marked with
L for left or
R for right.

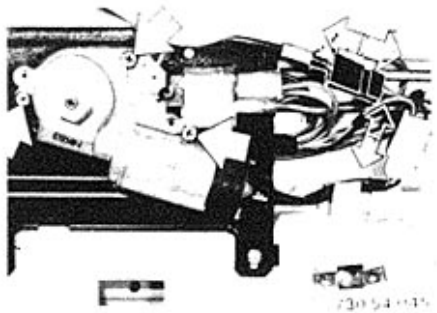
* Source: HWB, No. 81 22 9 407 171



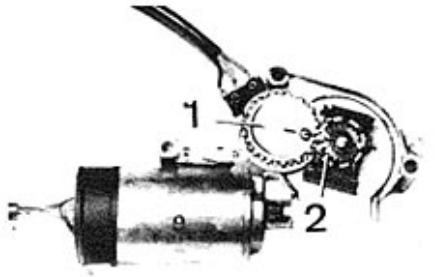
730 54 043

54 13 010 REMOVING AND INSTALLING MOTOR/GEARBOX UNIT FOR SUN ROOF

Disconnect battery ground lead.
Remove and install front roof liner plate 51 44 150.
Sun roof must be closed.
Manual Operation:
Unscrew nut (1) and turn drive shaft (2) with socket head wrench to close the roof.

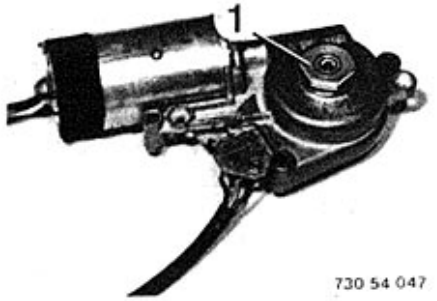


Disconnect plugs.
Unscrew bolts and remove motor/gearbox unit.



730 54 046

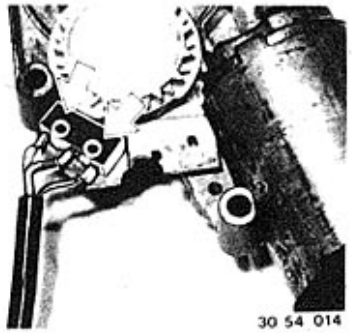
Installation:
Mark of switching gear (1) must be opposite mark of control gear (2).
Lubricate teeth of pinion, control gear and switching gear with grease*.



730 54 047

Adjusting Motor/Gearbox Unit:
Unscrew nut (1) and make adjustments with socket head wrench as described above.
Tighten nut with 450 ± 35 Ncm (39 ± 3 in. lbs.).

* Source: HWB, No. 81 22 9 407 171


30 54 014

54 13 012 REPLACING MICROSWITCH FOR SUN ROOF MOTOR

Remove and install motor/gearbox unit 54 13 010.
Drill out hollow rivets and rivet on new microswitch.

TROUBLESHOOTING SUN ROOF

Condition	Cause	Correction
Rattling noise	a) Front slides loose / defective b) Maladjustment c) Guide tubes knocking on each other d) Gate holder knocking on sun roof e) Roof liner frame knocking on sun roof when open f) Connecting linkage for water drain knocks on guide rail	a) Tighten/replace front slides b) Adjust sun roof c) Wrap tape around guide tubes d) Use Terostat tape between sun roof and gate holder e) Paste foam rubber on corners of roof liner frame f) Paste material on rivets and guide linkage
Sun roof lifts, but does not slide	a) Pins on gate holder bent	a) Replace gate holder
Sun roof lifts onesidedly	a) Drive cables maladjusted in 0 position b) Rear guide twisted on drive cable c) Gearbox and winder loose	a) Adjust drive cables in 0 position b) Lock drive cable with punch marks or squeezing before and after guide c) Tighten gearbox and winder
Grinding noise when opening and closing	a) Sliding rails and plastic parts lubricated b) Guide plate maladjusted	a) Remove grease or replace slides b) Guide plate must be adjusted (back)
Grinding noise when lifting	a) Front seal dry b) Contact pressure of front seal excessive	a) Lubricate seal with vaseline b) Adjust guide plate (back) or adjust lid
Water entering car in roof liner area	a) Sun roof maladjusted in 0 position b) Seals loose / damaged c) Wrong seal installed/front and rear seals different d) Drain hoses plugged e) Guide rails and covers for roof frame have insufficient sealing f) Corners in rear roof opening leak g) Hose outlets clogged with body sealant foam	a) Adjust in 0 position b) Tighten / replace seals c) Install original spare parts d) Clean drain hoses e) Seal guide rails and covers f) Seal corners g) Clean hoses

TROUBLESHOOTING SUN ROOF

Condition	Cause	Correction
Exhaust odor inside car	a) Backflow flaps do not close	a) Service flaps
Whistling noise when sun roof is closed	a) Excessive gap between roof profile and sun roof lid at rear or front	a) Adjust guide plate/replace rubber seal or adjust lid
Sun roof operation difficult	a) Front slides press down onesidedly in guide rails/sun roof lid cants	a) Press slides uniformly toward center of car and secure
Drive motor does not run	a) Fuse blown b) Switch defective c) Wire harness has a break d) Drive motor defective	a) Replace fuse b) Replace switch c) Repair or replace wire harness d) Replace drive motor
Drive motor runs, but sun roof does not move	a) Contact pressure of slip clutch insufficient	a) Adjust slip clutch
Sun roof does not lift	a) Guide plates maladjusted (too far forward) b) Relay defective c) Maladjustment	a) Adjust guide plates b) Replace relay c) Adjust sun roof in 0 position
Sun roof goes to lift immediately after closing	a) Microswitch defective	a) Replace microswitch on drive motor

TROUBLESHOOTING SUN ROOF

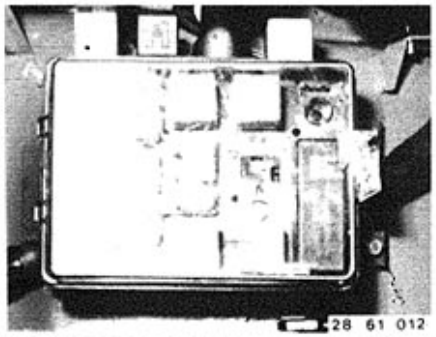
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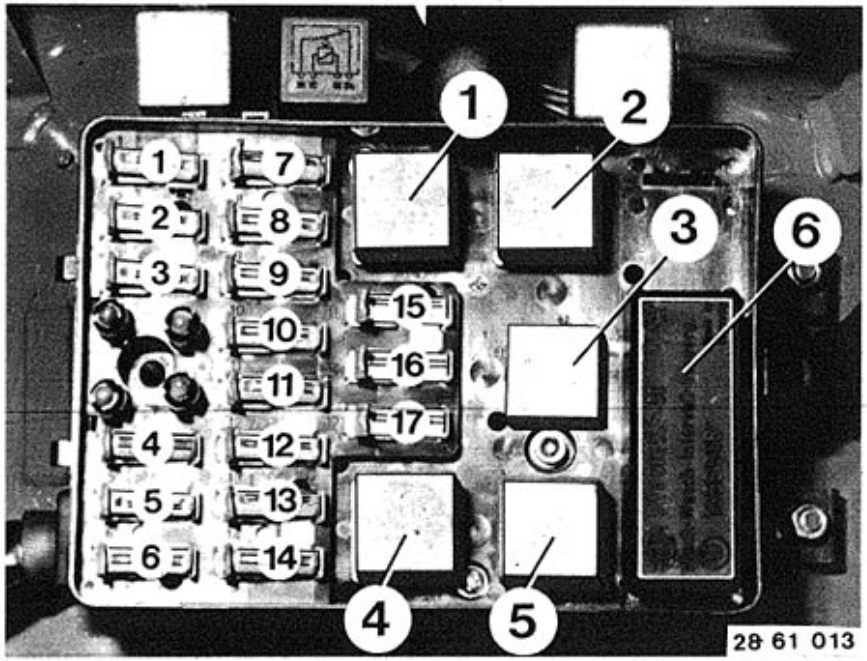
61 Electrical system

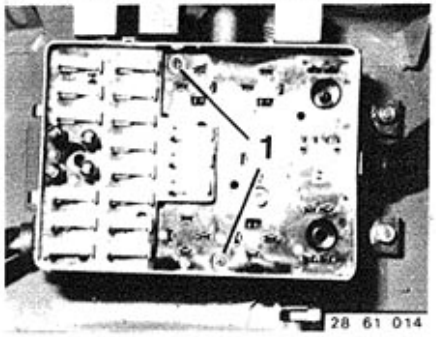
61 13 021	Central electric fuse / relay box – replace	61- 0
61 31 016	Turn signal / dimmer switch – replace	61- 1
018	Electronic cruise control switch – remove and install	61- 1
020	Steering lock / ignition switch – remove and install	61- 2
028	Light switch – remove and install	61- 2
040	Windshield wiper switch – remove and install	61- 3
050	Heater (blower) switch – remove and install	61- 3
060	Rear window defogger switch – remove and install	61- 4
070	Front fog lamp switch – remove and install	61- 4
074	Inside light switch – replace	61- 4
080	Hazard light switch – remove and install	61- 4
099	Control unit for power seats – remove and install	see group 52
204	Power seat switch – replace	see group 52
270	Backup light switch – replace	61- 4
280	Oil pressure switch – remove and install	61- 5
282	Engine oil level switch – replace	61- 5
310	Brake light switch – replace	61- 6
390	Check control bulb tester (for tail and brake lights) – replace	61- 6
61 61 081	Windshield wiper arm, left or right – replace	61- 7
61 61 250	Windshield wiper motor – remove and install	61- 7



61 13 021 REPLACING CENTRAL ELECTRIC FUSE/RELAY BOX

Take off cover.
Pull out all relays.
Lift out all fuses.





Unscrew bolts (1).
Lift carrier.
Disconnect all wires.
Installation:
Connect according to wiring diagram.

Fuse No.	Current (A)*	Description
1	16	Electric fuel pump
2	8	Low beam right
3	8	Low beam left
4	25	Cigar lighter, automatic antenna, seat control, seat heating
5	8	Hazard lights, passenger compartment light, luggage compartment light, reading lamp, clock, central locks, on-board computer, burglar alarm, service indicator, door lock heating, check control
6	8	Indicator lamps, tachometer, mirror, on-board computer, central warning lamp, fuel consumption, service indicator, check control, window regulators, reversing, cruise control, backup lights
7	8	High beam right
8	8	High beam left
9	8	Park/side marker and tail lights right, instrument and license plate lights
10	8	Park/side marker and tail lights left
11	16	Turn signal indicators, windshield wipers and washer, horn relay, headlights
12	8	Stop lights, radio
13	16 (25)	Rear window defogger, electric sun roof
14	25	Heater blower, air conditioner
15	8	Front fog lamp right
16	8	Front fog lamp left
17	25	Supplementary fan

Relay	Description*
1	High beams
2	Low beams
3	Fog lamps
4	Two-tone horns
5	Power saving relay
6	Wipe/wash intermittent action control unit (intensive cleaning)

Relays attached to the relay box:
See group 12.

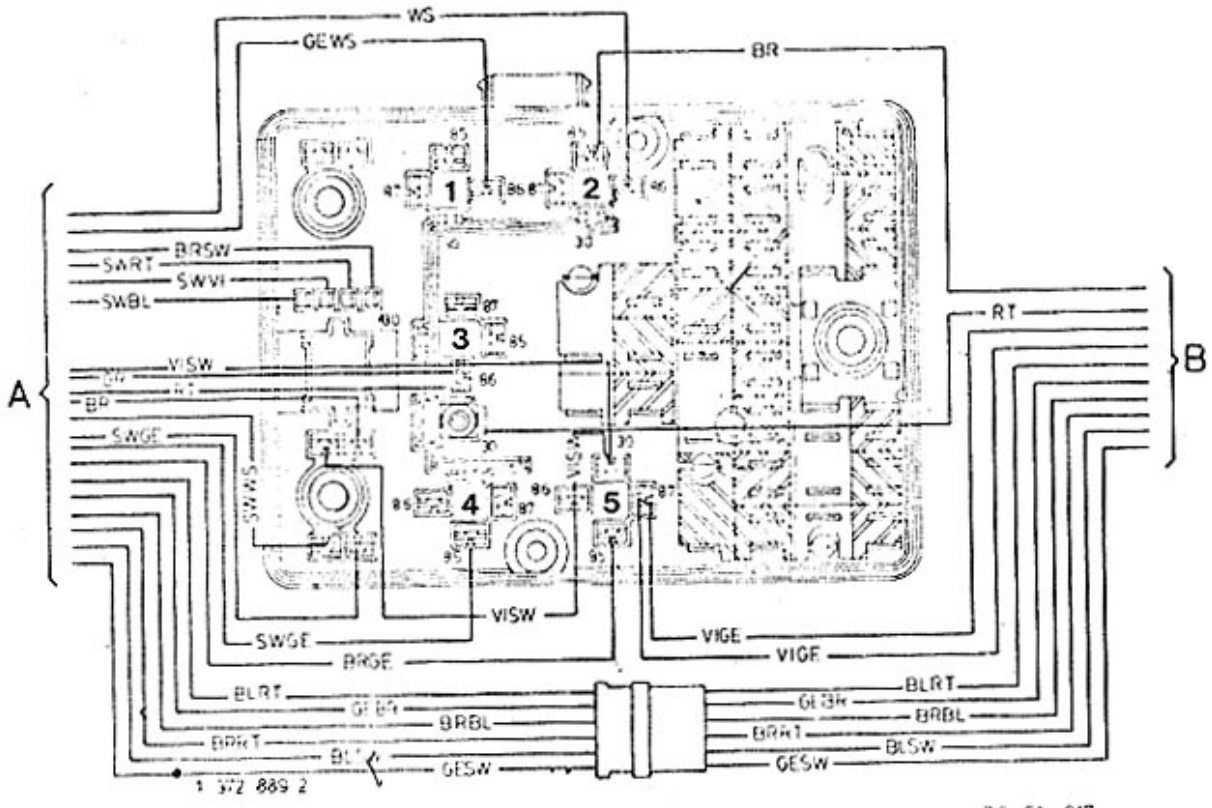
Spare Fuses
2 x 8 amps (white)
1 x 16 amps (red)
1 x 25 amps (blue)

* Stamped in cover

61-00

CENTRAL ELECTRIC BOARD CONNECTION PLAN

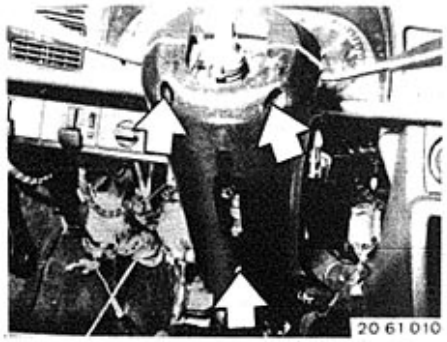
1 = Low beam relay
2 = High beam relay
3 = Fog light relay
4 = Power saving relay
5 = Two-tone horn relay
A = Wire harness – center section
B = Wire harness – front section



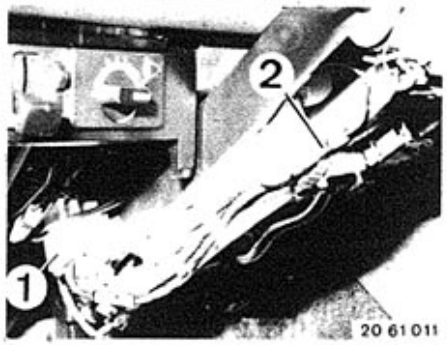
28 61 017

Connect all other wires that colors match, according to code sheet included in central electric board.

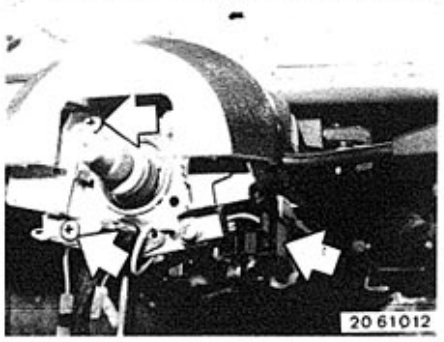
61 31 016 REPLACING TURN SIGNAL/ DIMMER SWITCH



Disconnect battery ground lead.
Remove steering wheel 32 33 000.
Remove instrument panel trim at bottom left – 51 45 180.
Unscrew steering column casing.



Disconnect plugs (1 and 2).

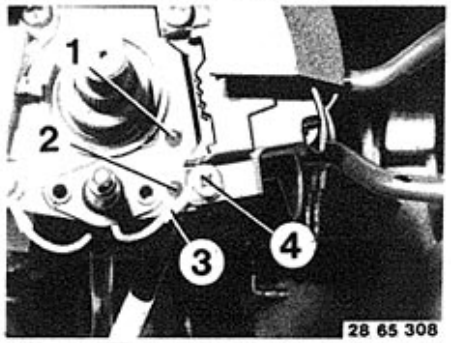


Unscrew screws.
Pull relay out of holder.
Pull off plug on relay.

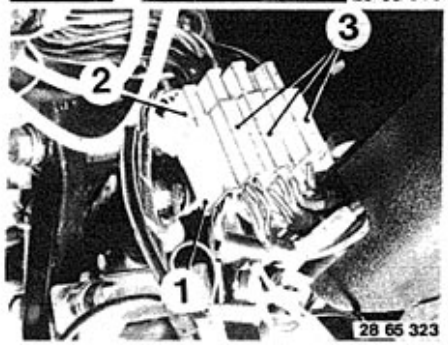
61 31 018 REPLACING CRUISE CONTROL SELECTOR SWITCH



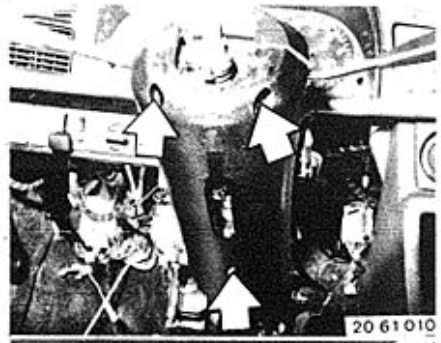
Disconnect battery ground lead.
Remove steering wheel 32 33 000.
Remove instrument panel trim at bottom left – 51 45 180.
Unscrew steering column casing.



Unscrew screw (4).
Installation:
Also mount ground wire (3).
Both tabs on switch must protrude into bores (1 and 2).



Disconnect plugs (1 and 2) on plug connection (3).
Disconnect plugs (1 and 2).

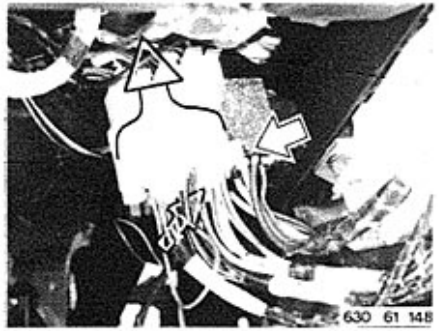


61 31 020 REMOVING AND INSTALLING STEERING LOCK/IGNITION SWITCH

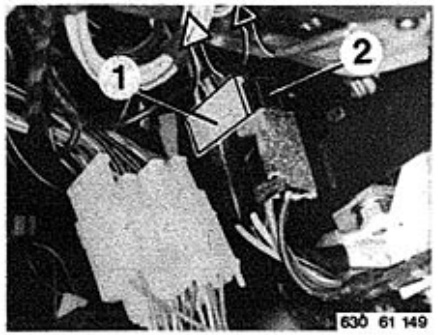
Disconnect battery ground lead.
Remove instrument panel trim at bottom left – 51 45 180.
Unscrew steering column casing.



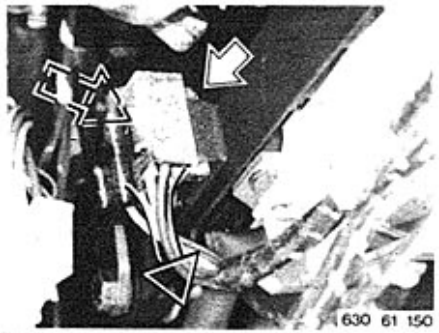
Cut open clamp and pull wire harness out of holder.



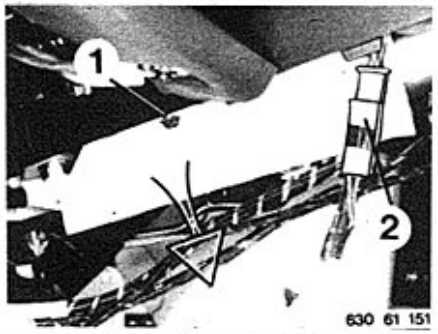
Compress retainers.
Push up and disconnect outer plugs.



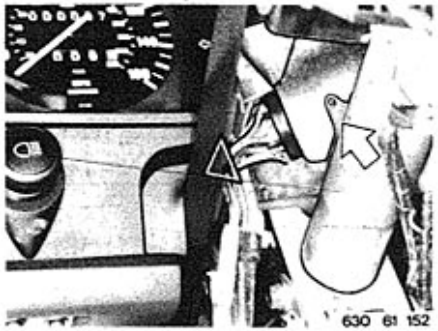
Pull off plugs (1 and 2).



Compress retainers.
Pull plug out of holder.



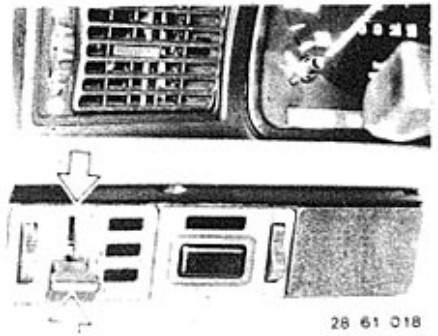
Unscrew screw (1) and remove plastic holder.
Disconnect plug (2).

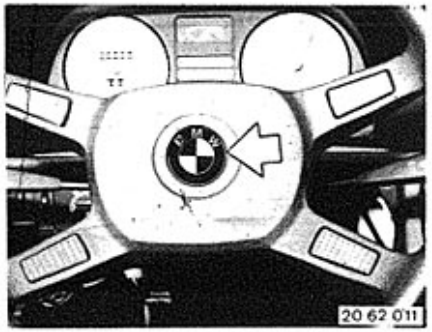


Unscrew headless screw and pull out ignition switch.
Installation:
Lock headless screw with clear lacquer.

61 31 028 REMOVING AND INSTALLING LIGHT SWITCH

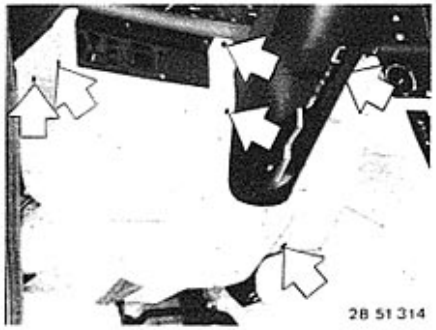
Pry out switch carefully with a small screwdriver applied at top and bottom.
Pull off plug.





61 31 040 REMOVING AND INSTALLING WINDSHIELD WIPER SWITCH

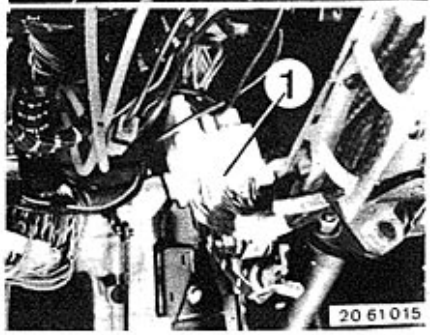
Disconnect battery ground wire.
Lift off BMW emblem.
Unscrew nut.
Pull steering wheel off of steering spindle.
Installation:
Replace self-locking nut.
Tightening torque[1].



Unscrew screws.
Remove trim.

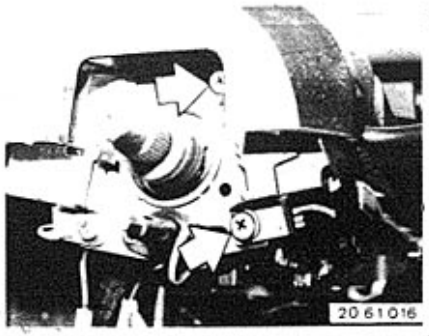


Take off steering column casing.

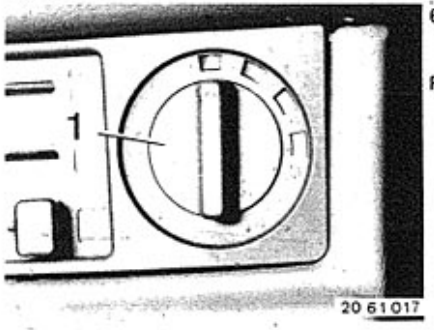


Disconnect plug (1).

1) See Specifications

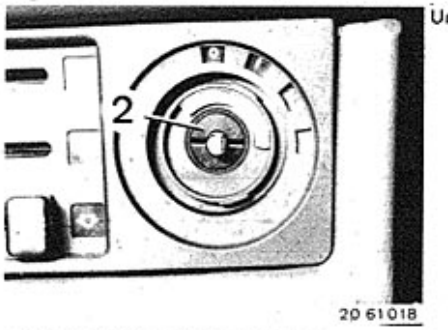


Unscrew screws.

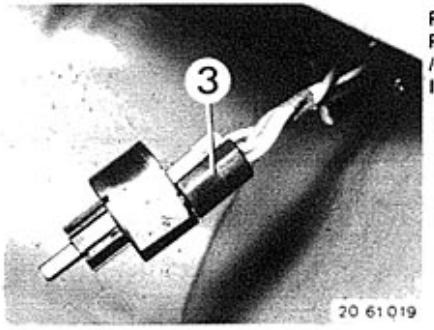


61 31 050 REMOVING AND INSTALLING HEATER (BLOWER) SWITCH

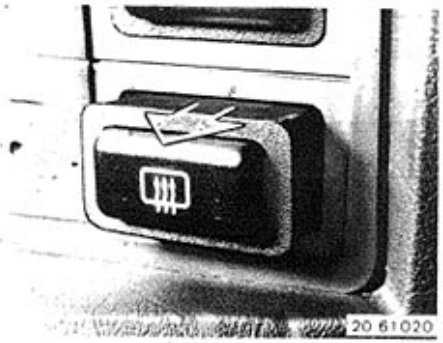
Pull off knob (1).

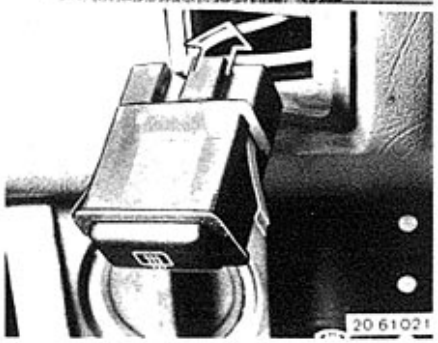


Unscrew nut (2).



Pull switch out of instrument panel.
Pull off plug (3).
Installation:
Insert switch in arrest.

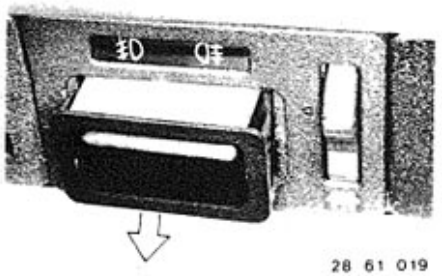




61 31 060 REMOVING AND INSTALLING REAR WINDOW DEFOGGER SWITCH

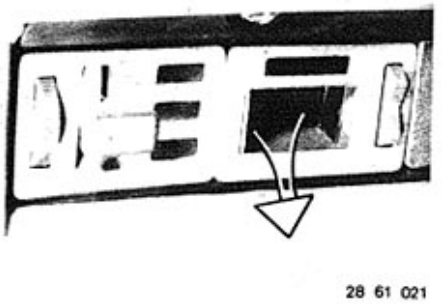
Pull out switch.

Pull off plug.



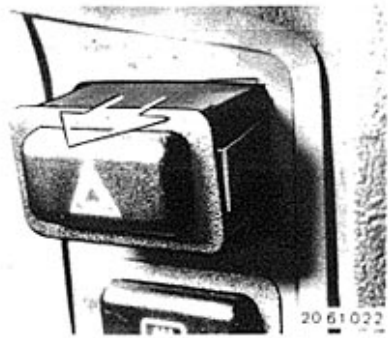
61 31 070 REMOVING AND INSTALLING FRONT/REAR FOG LIGHT SWITCH

Pry out switch with a small screwdriver applied on the sides.
Pull off plug.



61 31 074 REMOVING AND INSTALLING INSIDE LIGHT SWITCH

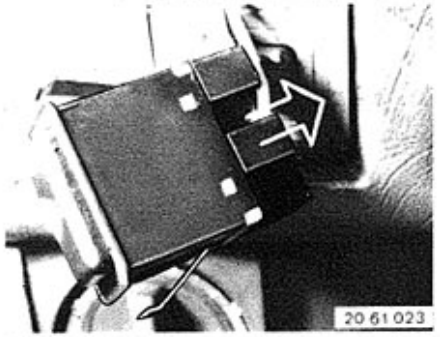
Remove front/rear fog light switch – see 61 31 070.
Pull out inside light switch.
Pull off plug.

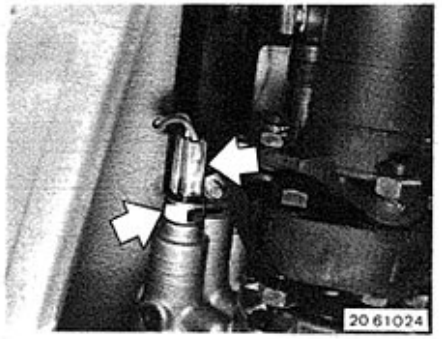


61 31 080 REMOVING AND INSTALLING HAZARD LIGHT SWITCH

Pull out switch.

Pull off plug.



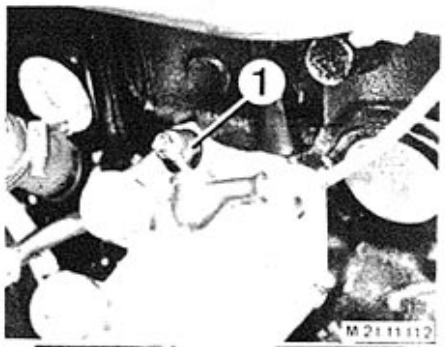


61 31 270 REPLACING BACKUP LIGHT SWITCH

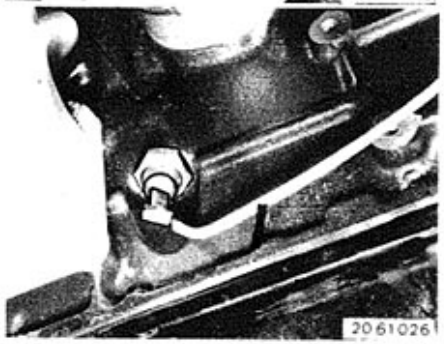
a) Manual Transmission:
Pull off plug.
Unscrew switch.
b) Automatic Transmission:
See Group 25.

61 31 280 REMOVING AND INSTALLING OIL PRESSURE SWITCH

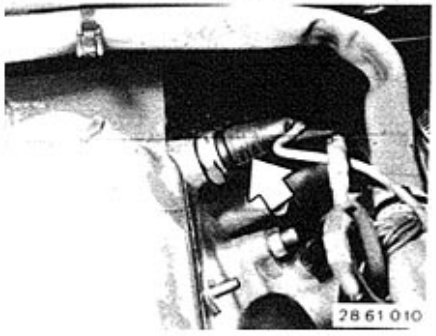
Pull off plug
Unscrew switch



BMW 524 td



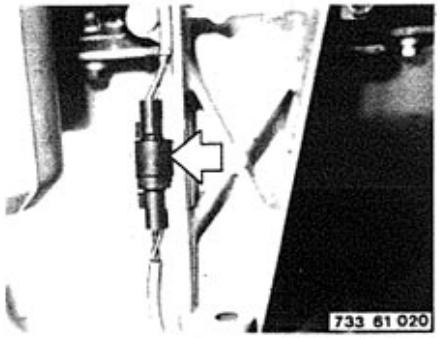
BMW 528 e



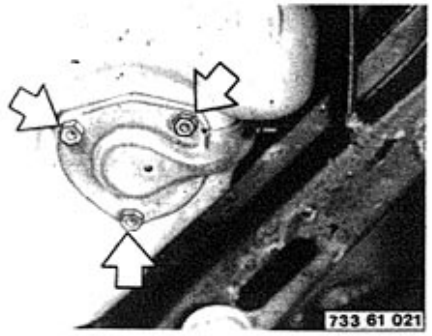
BMW 535 i

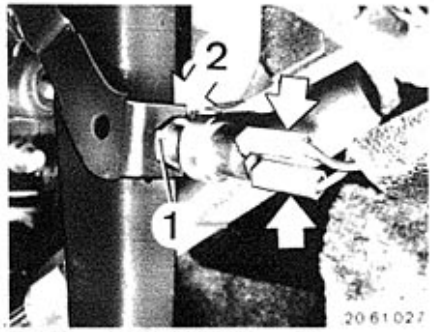
61 31 282 REPLACING ENGINE OIL LEVEL SWITCH

Disconnect plug.



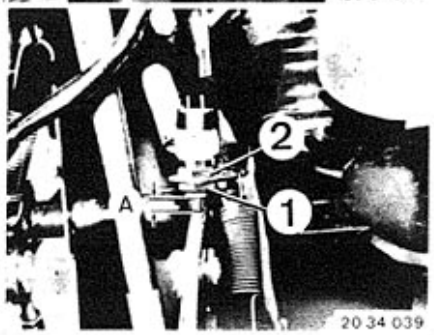
Drain engine oil
Unscrew screws.
Note:
Testing – see Specifications of Gr. 12.



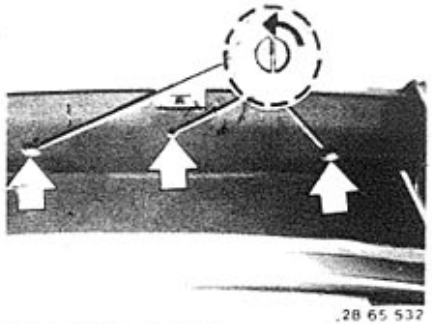


61 31 310 REPLACING BRAKE LIGHT SWITCH

Pull off plug.
Loosen lock nut (1).
Unscrew nut (2).

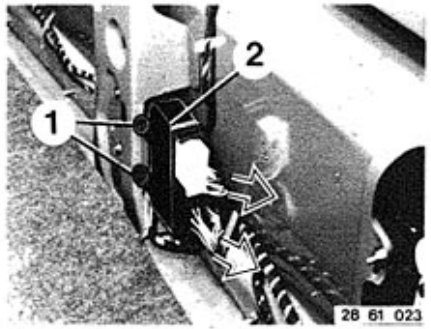


Adjusting:
Adjust brake light switch with nut (1) and lock nut (2) in such a manner that distance A = 5 to 6 mm (0.197 to 0.236") of contact button is visible with brake pedal released.



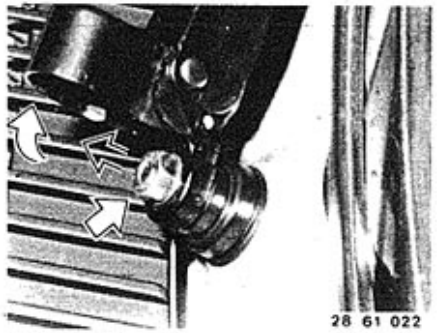
61 31 390 REPLACING BULB TESTER FOR CHECK CONTROL – Tail, Brake and License Plate Lights –

Turn retainer 90°.
Take trim panel out of trunk.



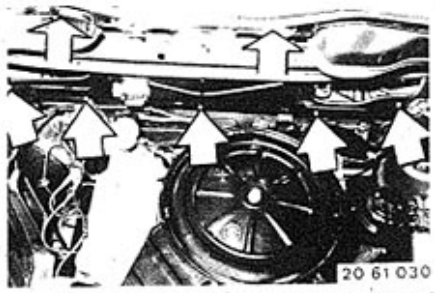
Pull off plug.
Unscrew screws (1).
Remove tester (2).

61 61 081 REPLACING LEFT OR RIGHT WINDSHIELD WIPER ARM

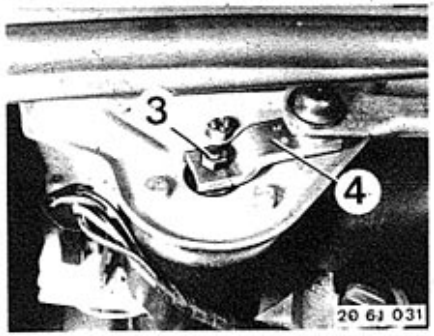


Fold over cover.
Unscrew nut.
Take off washer.
Pull off wiper arm.

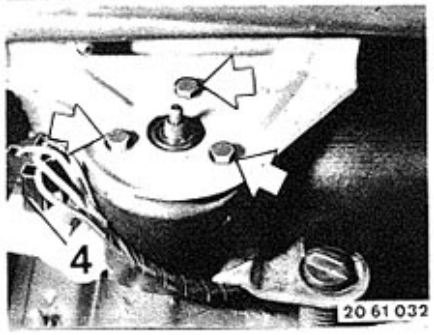
61 61 250 REMOVING AND INSTALLING WINDSHIELD WIPER MOTOR



Pull off rubber profile (2).
Unscrew screws.



Unscrew nut (3).
Pull off linkage (4) on motor shaft.



Pull off plug (4).
Unscrew screws.
Remove windshield wiper motor.

62 Instruments

62 11 000	Instrument cluster – remove and install	62- 1
020	Printed circuit board for range indicator – replace	62- 2
030	Printed circuit board for service indicator – replace	62- 2
040	Service indicator LED's – replace	62- 3
62 12 000	Speedometer – remove and install	62- 4
62 13 000	Tachometer – remove and install	62- 5
050	Clock – remove and install	62- 5
62 14 070	Check control – remove and install	62- 5
62 16 000	Fuel level transmitter for fuel gauge – check or replace	see group 16
62 21 000	Instrument carrier assembly – remove and install	62- 6
62 99 . . .	Light bulbs in instrument carrier – replace	62- 6
	Troubleshooting – service indicator	62- 51
	Troubleshooting – economy control	62- 61
	Troubleshooting – check control	62- 71
	Simulator for instrument cluster testing	62- 81

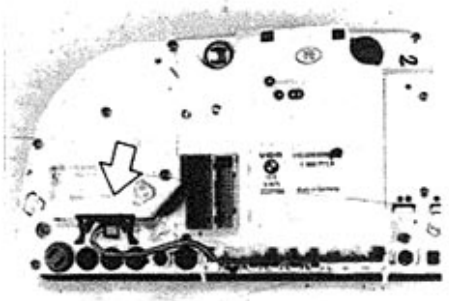
62 11 000 REMOVING AND INSTALLING INSTRUMENT CLUSTER

Remove instrument carrier assembly – see 62 21 000.

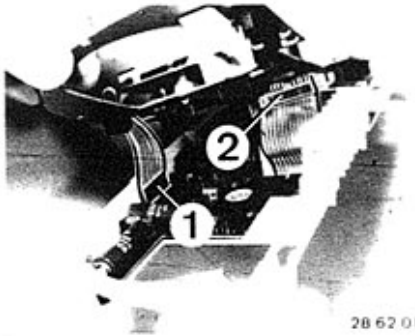


28 62 011

Remove speedometer and clock or tachometer with fuel consumption gauge.
Installation:
Check for correct fit of lugs in plug on printed circuit board.



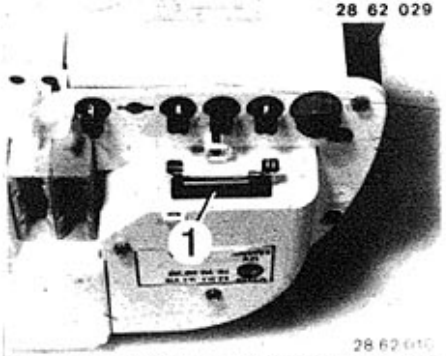
Instrument Carrier for Cars with Automatic Transmission:
Pull off plugs for indicator lamps.



28 62 012

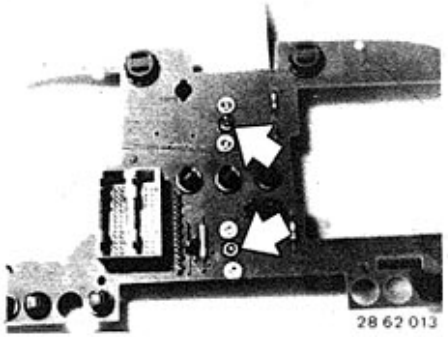
Pull off plugs (1 and 2).

28 62 029



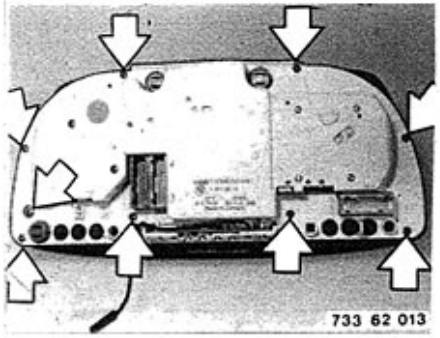
28 62 010

Pull out coding plug (1).
Note:
Check coding plug indentification *.



28 62 013

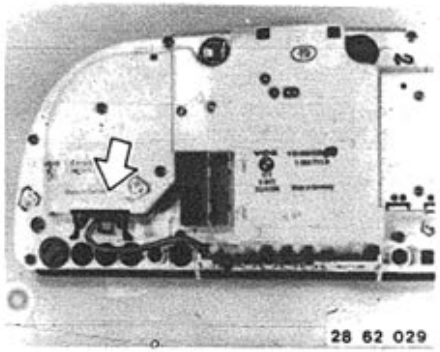
Unscrew nuts.
Pull off instrument cluster.



733 62 013

Unscrew screws.
Take off instrument carrier housing.
Caution!
Never touch printed circuit board with bare fingers!
Installation:
Insert indicator lamp windows.

*) See Specifications

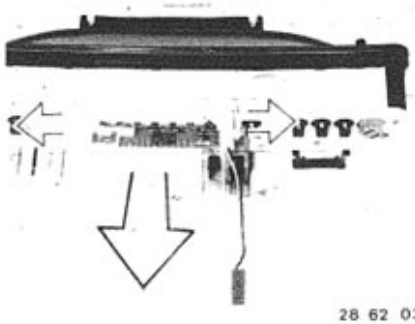


62 11 020 REPLACING RANGE INDICATOR PRINTED CIRCUIT BOARD

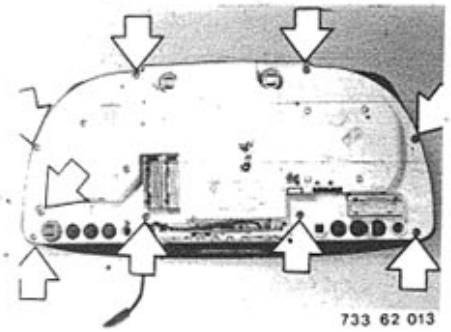
Pull off plug.



Pull out coding plug (1).
Note:
Check coding plug identification *.



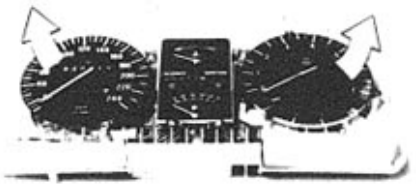
Pry clamps apart and pull out printed circuit board.



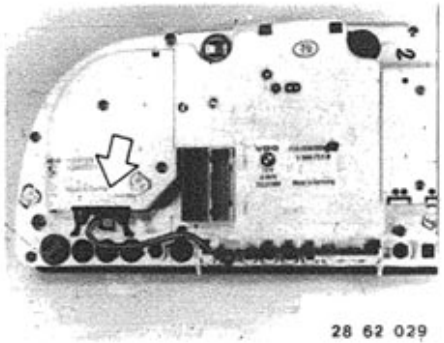
Unscrew screw.
Take off instrument carrier housing.
Caution!
Never touch printed circuit board with bare fingers.
Installation:
Insert indicator lamp windows.

62 11 030 REPLACING PRINTED CIRCUIT BOARD FOR SERVICE INDICATOR

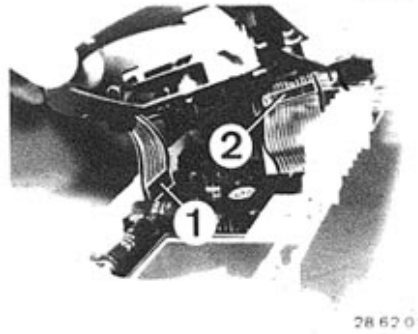
Remove instrument carrier assembly – see 62 21 000.



Remove speedometer and clock or tachometer with fuel consumption gauge.
Installation:
Check for correct fit of lugs in plug on printed circuit board.

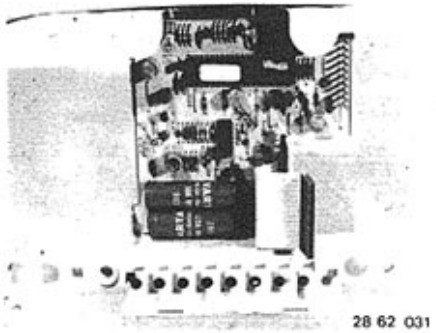


Instrument Carrier for Cars with Automatic Transmission:
Pull off plugs for indicator lamps.



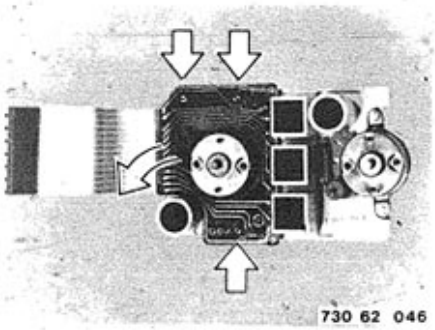
Pull off plugs (1and 2).

* See Specifications


28 62 031

Replace printed circuit board with cover.

Note:
Transfer light bulbs for indicator lamps, if applicable.


730 62 046

62 11 040 REPLACING LEDs FOR SERVICE INDICATOR

Remove instrument carrier assembly – see 62 11 000.
Unscrew screws.
Take off printed circuit board with row of LEDs.

62 12 000 REMOVING AND INSTALLING SPEEDOMETER



28 62 014

Remove instrument cluster up to the step of removing the speedometer – see 62 11 000.
Installation:
Check constant W (K) *.

Checking Speedometer:

a)
Pull of plug for speedometer on final drive.
Connect BMW service test unit (multimeter test step 13) on plug for speedometer according to operating instructions.
Connections:
Black clip on brown wire.
Blue clip on brown/red wire.
Turn on ignition.
Put in frequency * on BMW service test unit.

b)
Instrument cluster removed.
See simulator for checking instrument clusters – page 62 - 81.

* See Specifications

62 13 000 REMOVING AND INSTALLING TACHOMETER

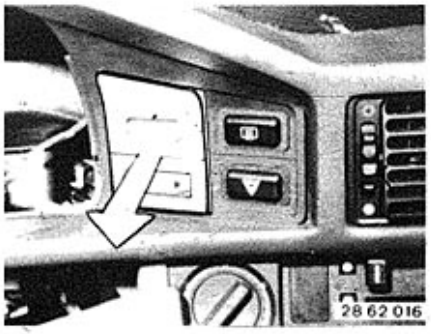


28 62 015

Remove instrument cluster up to point of removing tachometer – see 62 11 000.

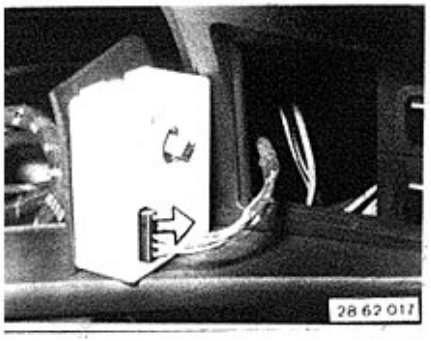
Checking Tachometer:
Remove instrument cluster.
Check – see simulator for testing instrument clusters 62-81.
Check speed signal – see Group 12.

62 13 050 REMOVING AND INSTALLING CLOCK



28 62 016

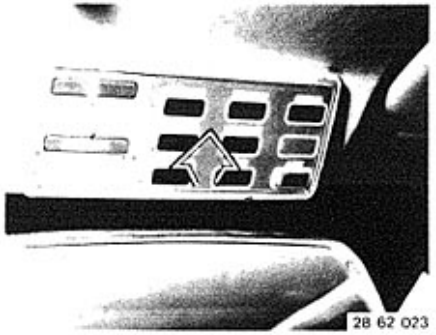
Lift out mask.
Push back retainers on clock at top and bottom.
Remove clock.



28 62 017

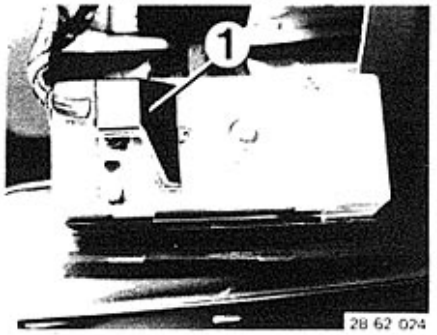
Pull off plug.

62 14 070 REMOVING AND INSTALLING/ REPLACING CHECK CONTROL



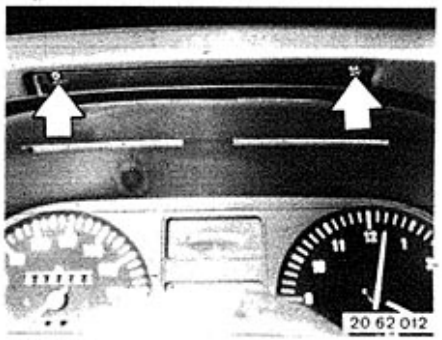
28 62 023

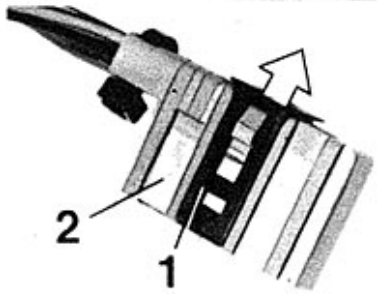
Lift check control out of mask.



28 62 024

Pull off plug (1).





733 62 019

62 21 000 REMOVING AND INSTALLING INSTRUMENT CARRIER ASSY.

Disconnect battery ground lead.
Lift instrument carrier out of instrument panel.
Pull off all plugs.

Note:
First pull out slide (1) on combination plug (2) when pulling off combination plug on instrument carrier.

62 99 . . . REPLACING LIGHT BULBS IN INSTRUMENT CARRIER

Remove instrument carrier assembly 62 21 000.
Unscrew light bulbs (bayonet catch).

Note:
Light bulbs for ABS, preheating time, ready-to-start and trailer turn signal indicator lamp are plugged in.

TROUBLESHOOTING SERVICE INDICATOR

Defect	Cause	Correction
One or more LEDs not on, i.e. break in diode series (ignition turned on)	– LED defective	– Replace LED series of service indicator (62 11 040)
Green LEDs on while engine is running or do not go out within 2 seconds after starting	– Brief break in term. 15 – Signal from term. 50 (starter) interrupted or too short – Engine push started (without starter)	– Check term. 15 or term. 50 – Check blue plug connection on instrument cluster – Check plug connection inside cluster – Repeat starting > 0.5 sec. – Replace SI printed circuit board (62 11 030)
Undefined coming on (flashing) of LEDs	– SI printed circuit board defective – Loose contact in cluster or on plug connections	– Replace SI printed circuit board (62 11 030) – Check plug connections on inside and outside of cluster
1 yellow LED, 3 red LEDs, OIL SERVICE and INSPECTION signs come on suddenly	– SI printed circuit board defective – Ground connections – Wrong relay installed – Z-diode in heater wire harness defective (only E 30)	– Replace SI printed circuit board (62 11 030) – Replace SI printed circuit board for clock/tachometer or economy control – Check central ground point on body (battery neg. conn.), cleaning if necessary – Check central ground point underneath instrument carrier, cleaning if necessary – Horn relay, heater blower relay and low beam relay must be diode relays – Check Z-diode (in heater wire harness close to water valve)
Yellow LED, three red LEDs and OIL SERVICE sign on	– Low discharging of buffer batteries	– Check charging cycle: Replace SI printed circuit board (62 11 030), if the INSPECTION sign does not light up after 1 minute. If applicable, replace SI printed circuit board for clock/tachometer or economy control.
Only INSPECTION sign on continuously	– Both buffer batteries discharged – SI printed circuit board defective	– Check charging cycle and make reset – Replace SI printed circuit board (62 11 030) – Replace SI printed circuit board for clock/tachometer or economy control

Defect	Cause	Correction
Only 3 green LEDs and yellow LED on	– SI printed circuit board defective	– Replace SI printed circuit board (62 11 030) – Replace SI printed circuit board for clock/tachometer or economy control
Inspection interval > 24,000 km (15,000 miles) > 11 months	– Distance pulse putout for tachometer – Coding plug wrong or missing – Time quartz on SI printed circuit board defective – Reset was made at wrong time	– Replace tachometer – Check coding plug* – Replace SI printed circuit board (62 11 030) – See wrong resets
Oil service interval too short < 6,000 km (4,000 miles)	– Printed circuit board damaged	– Replace SI printed circuit board (62 11 030) – Replace SI printed circuit board for clock/tachometer or economy control
Inspection interval too short < 12,000 km (8,000 miles)	– Coding plug wrong or missing	– Check coding plug*
Resetting not possible	– SI resetter defective – Break in reset wire (engine plug, diagnosis plug, instrument cluster plug) – Tachometer defective	– Check blue/white wire connection 7 on diagnosis plug up to power distributor (5 volts – only check with a multimeter). – Check blue plug connection 14 on instrument cluster – Replace tachometer

* See Specifications

SERVICE INDICATOR RESETTING

Gasoline Engine

Oil Service

After an oil service it is only possible to reset the input wear signals, but not the input time signals.

Example:

1) If an oil service reset is made 10 months after the last inspection reset (no green LEDs and OIL SERVICE sign on), then only one green LED will come on. It will go out abter the 11th month and be time for the annual check.

2) If an oil service reset is made earlier (one green LED still on) and the last inspection reset was made about 10 months ago, then no other green LED will come on. The last green LED wil go out after the 11th month and it ist time for an annual check.

Caution!

Resetting an oil service with the INSPECTION button cannot be corrected. Service Intervals would be mixed up – a necessary Inspection could show up as OIL SERVICE – also refer to BMW Technik information of Group 62.

Inspection

Wear or time factors have activated the INSPECTION sign.
If an inspection is not indicated due to wear (e.g. low mileage), the time factor takes over and triggers the INSPECTION sign after 11 months, so that at least one inspection will be carried out per year.

Inspection reset switches off the INSPECTION sign, yellow or yellow and red LEDs and activates all five green LEDs.

Diesel Engine

Uncoupling of Time Factor

The time factor is uncoupled from the green LEDs. This means that it is time for an annual check when the INSPECTION sign comes on and the green LEDs have not yet gone out.

Oil service

There are always "two" oil services between wear-dependent inspections and they are indicated by all five green LEDs going out and activation of the OIL SERVICE sign.

Oil resets after the 1st and 2nd oil services switch off the OIL SERVICE sign and activate all five green LEDs.

Inspection

A. Wear factors have activated the INSPECTION sign.
B. Time factor has activated the INSPECTION sign.

A. Wear Dependent Inspection

All five green LEDs have gone out – the INSPECTION sign is on.

Inspection reset switches off the INSPECTION sign and activates all five green LEDs.

B. Time Dependent Inspection

One or more green LEDs are still on – the INSPECTION sign is on.

Inspection reset switches off the INSPECTION sign, but the green LEDs are not influenced and depend on the wear factor.

EXCEPTION: Wear and time factors activated simultaneously.

All five green LEDs go out – the INSPECTION sign is activated.

Inspection reset made twice in order!

The first inspection reset will cancel the inspection, which had activated the INSPECTION sign first. This could be either the wear dependent or time dependent inspection.

TROUBLESHOOTING FUEL CONSUMPTION INDICATOR (ECONOMY CONTROL)

– EC will always display infinite fuel consumption when idling (car stopped – engine running).

– The display will be close to zero in the coasting phase with coasting shutoff, i.e. no fuel injection.

Condition	Cause	Correction
Unrealistic display, e.g. only 6 liters in 4th gear and full load	– Coding plug wrong – Coding plug broken	– Check/replace coding plug*
EC display excessive	– Wrong temperature on quartz – Coding plug wrong	– Replace tachometer with economy control – See coding plug table*
No display	– Injection signal missing – Loose plug connection – Meter failed (mechanical defect)	– Check injection signal on instrument cluster plug (blue) pin 2 – Check plug connection – Replace tachometer with economy control
Display needle wanders in idle	– Disturbance from term. 1	– Disconnect black wire of term. 1 on instrument cluster plug, pull out wire in wire harness and wrap it around the wire harness
Display needle wanders when switching on lights or operating headlight flasher	– Disturbance from dimmer relay	– Replace low beam (dimmer) relay – Only install a diode relay, Part No. 61 31 1 373 154

* See Specifications

TROUBLESHOOTING CHECK CONTROL

Caution! Never test or measure with a test lamp, because the high power of a test lamp would destroy the reed contacts in transmitters and bulb testers. Always use your multimeter!

Checking Input Signals on Disconnected Plug of Check Control

Pin No. Designation	Wire Colors	Function in Car	Input Signals Test Results with Multimeter Pin	Tester	Pin	Test Value
1 'R' Terminal 'R'	violet/gray	Ignition key in 'R'	1 (+)	V	9 (–)	= U_B
2 'ZHL' Central warning lamp	brown/yellow	Ignition turned on	2 connected with 9 (–) = central warning light on continuously			
3 Japan: 'OH' Overheat USA: 524 td INJECTION			3 (–)	V	4 (+) see Group 12	= U_B
4 '15' Terminal '15'	green/white	Ignition turned on	4 (+)	V	9 (–)	= U_B
5 (without diesel) 'OX' oxygen sensor 524 td FUEL FILTER	blue/white	Ignition turned on	5 (–)	V	4 (+) see Group 12	= U_B
6 'AB' (USA) Air bag (+)			6 (+)	V	9 (–)	= U_B
7 'AB' (USA) Air bag (–)			7 (–)	V	4 (+)	= U_B
8 'FS' (USA) Fasten seat belts	brown/violet	Ignition turned on	8 (–)	V	4 (+)	= U_B
9 '31' Terminal '31'	brown	ground	9 (–)	V	15 (+)	= U_B

Pin No. Designation	Wire Colors	Function on Car	Input Signals Test Results with Multimeter Pin	Tester	Pin	Test Value
10 Not used		–	–	–	–	–
11 '58R' Tail lights right	gray/white	Tail lights on	11 (+)	–voltmeter–	9 (–)	= U_B
12 '58L' Tail lights left	gray/yellow	Tail lights on	12 (+)	–voltmeter–	9 (–)	= U_B
13 '58KL'	gray/blue	Tail lights on, bulb tester okay	13	–ohmmeter–	9 (–)	= 4.7 ohms
14 Not used	–	–	–	–	–	–
15 '30' Terminal '30'	red/white	Positive from term. 30 via fuse no.	15 (+)	–voltmeter–	9 (–)	= U_B
16 'Öl stat.' Oil level static	blue/violet	Max. oil level and transmitter okay	16	–ohmmeter–	9 (–)	= approx. 0 ohm
17 'W' Washing fluid	brown/red	Washing fluid level and transmitter okay	17	–ohmmeter–	9 (–)	= approx. 0 ohm
18 'KW' Coolant	brown/blue	Coolant level and transmitter okay	18	–ohmmeter–	9 (–)	= approx. 0 ohm
19 Not used	–	–	–	–	–	–

Pin No. Designation	Wire Colors	Function on Car	Input Signals Test Results with Multimeter Pin	Tester	Pin	Test Value
20 'Öl dyn. Oil level dynamic	white	Oil level + transm. okay. Min. oil level and transmitter okay	20 20	ohmmeter ohmmeter	9 (–) 9 ( )	= 1 k-ohm = 0 ohm
21 '56b' Low beams	yellow	Low beams on	21 (+)	voltmeter	9 (–)	= U_B
22 'K' Low beam ind.	yellow/black	Low beams and bulb tester okay	22	ohmmeter	9 (–)	= 0 ohm
23 '54Si' Fuse monitor	violet/white	Ignition key in 'R'	23 (+)	voltmeter	9 (–)	= U_B
24 '54KL' Stop light ind.	green/black	Stop lights and bulb tester okay	24	ohmmeter	9 (–)	= 4.7 ohms
25 '54' Stop lights	green/red	Brake applied, stop lights okay	25 (+)	voltmeter	9 (–)	= U_B
26 'KKL' License plate light indicator	gray/violet	License plate lights and bulb tester okay	26	ohmmeter	9 (–)	= 4.7 ohms

TEST: ENGINE OIL

Check engine oil level – okay? — no → Add oil.

yes

Check transmitter in oil pan – static 0 ohm – dyn. 1 k-ohm – okay? — no → – Apply extra ground wire. – Replace transmitter

yes

Transmitter wire plug connection okay? — no → Repair or replace transmitter.

yes

Check power flow in wires from transmitter to check control static oil term. and dyn. oil terminal. Okay? — no → Repair or replace wires.

yes

Check plug connections of check control. Replace check control.

TEST: COOLANT AND WASHING FLUID

Coolant and washing fluid levels okay? — no → Add coolant and/or washing fluid with pertinent antifreeze concentration.

yes

Check coolant/washing fluid level transmitters with ohmmeter – 0 ohm. Okay? — no → Replace ground wire. Replace transmitters.

yes

Plug connections on transmitters okay? — no → Repair or replace transmitters.

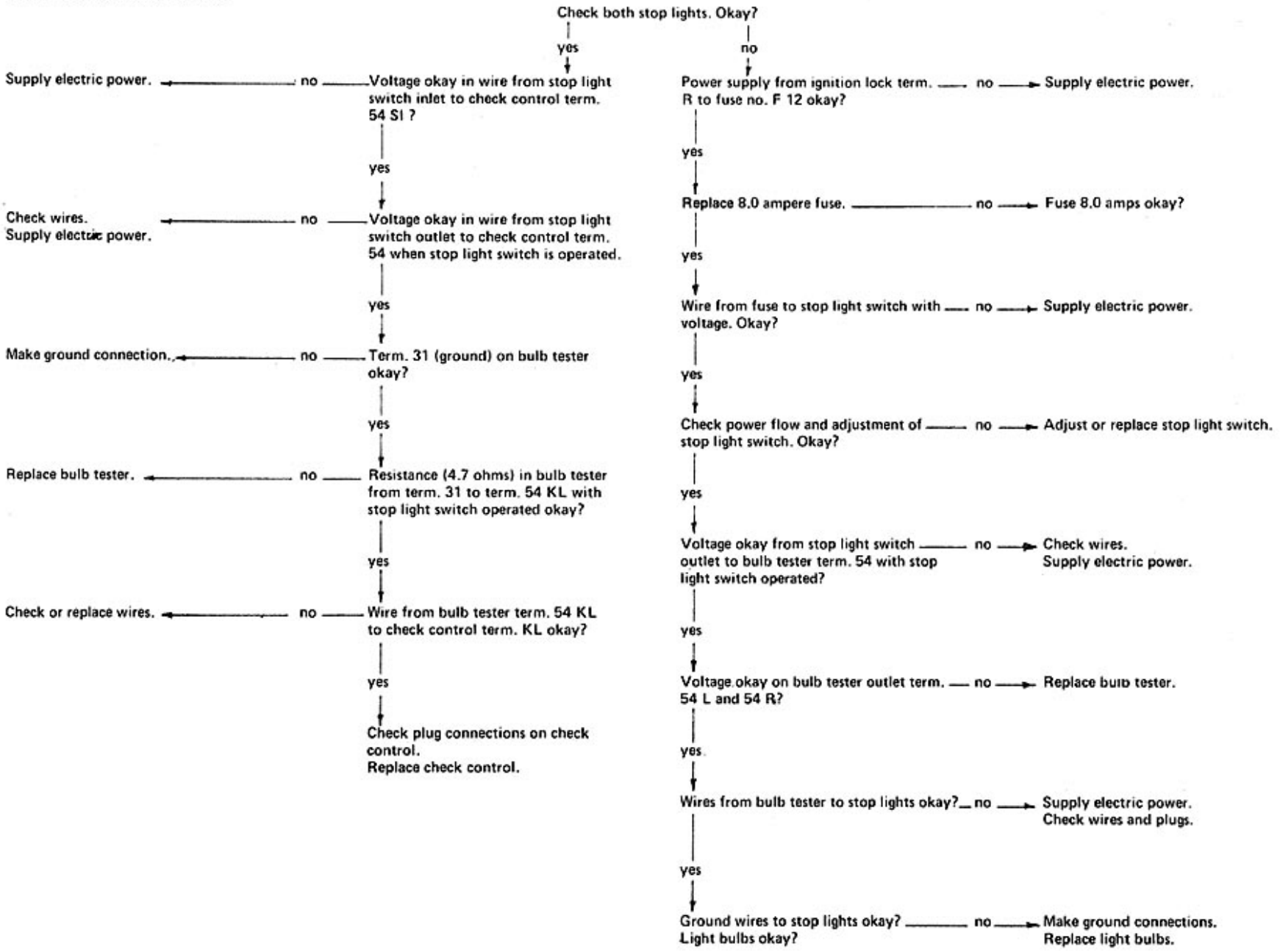
yes

Wires from transmitters to check control term. KW and WW with power flow. Okay? — no → Repair or replace wires.

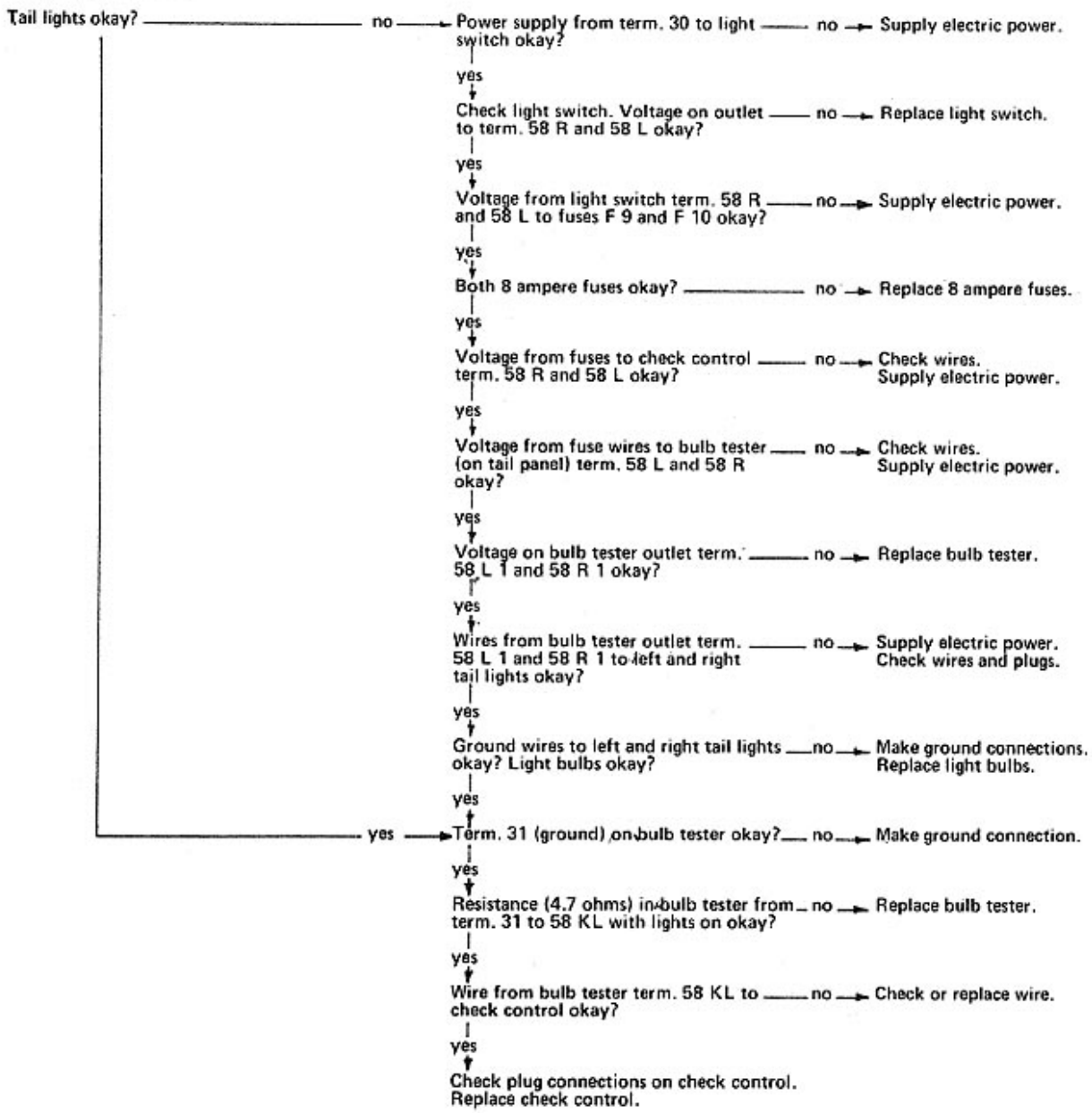
yes

Check plug connections on check control. Replace check control.

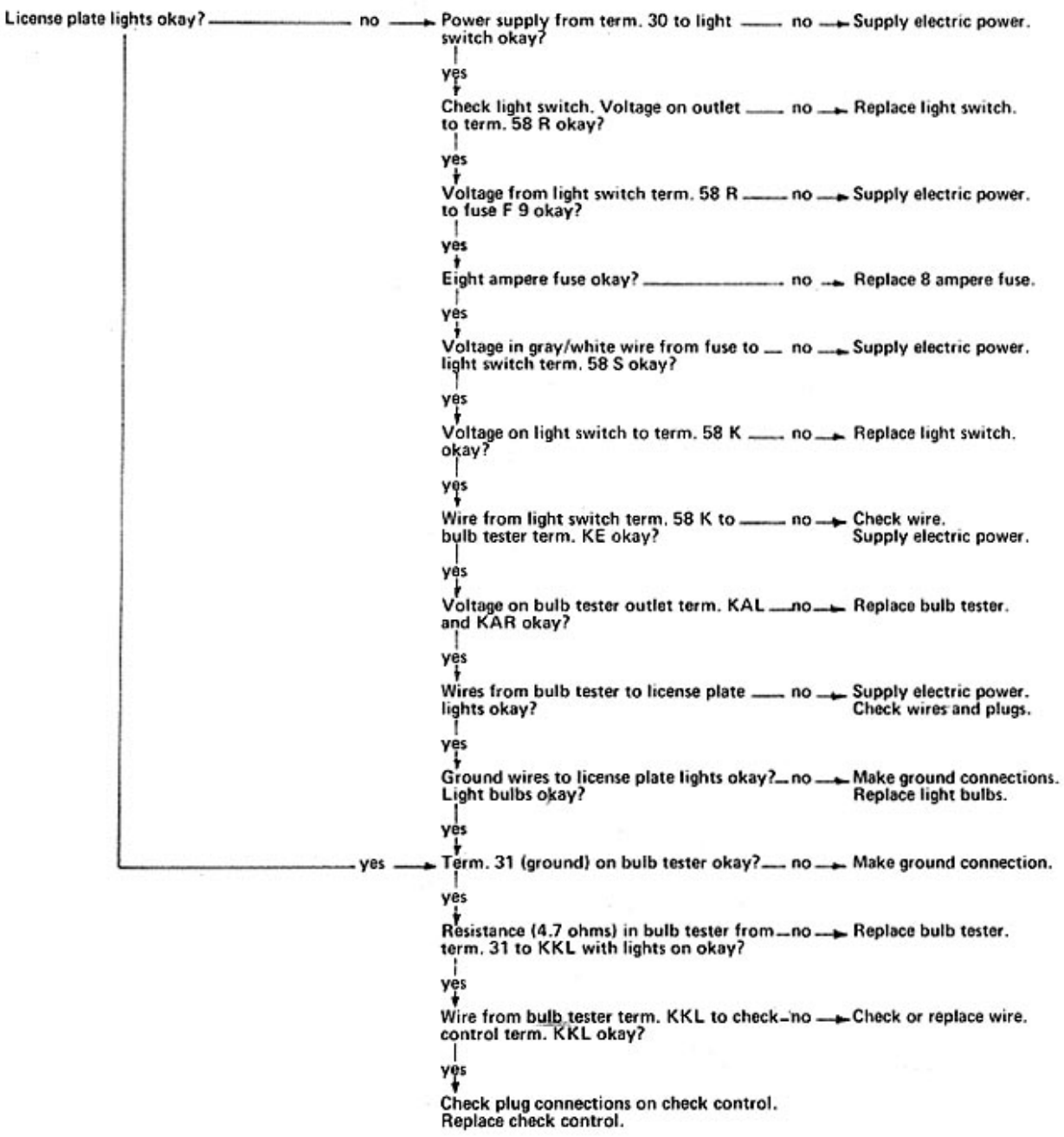
TEST: STOP (BRAKE) LIGHTS



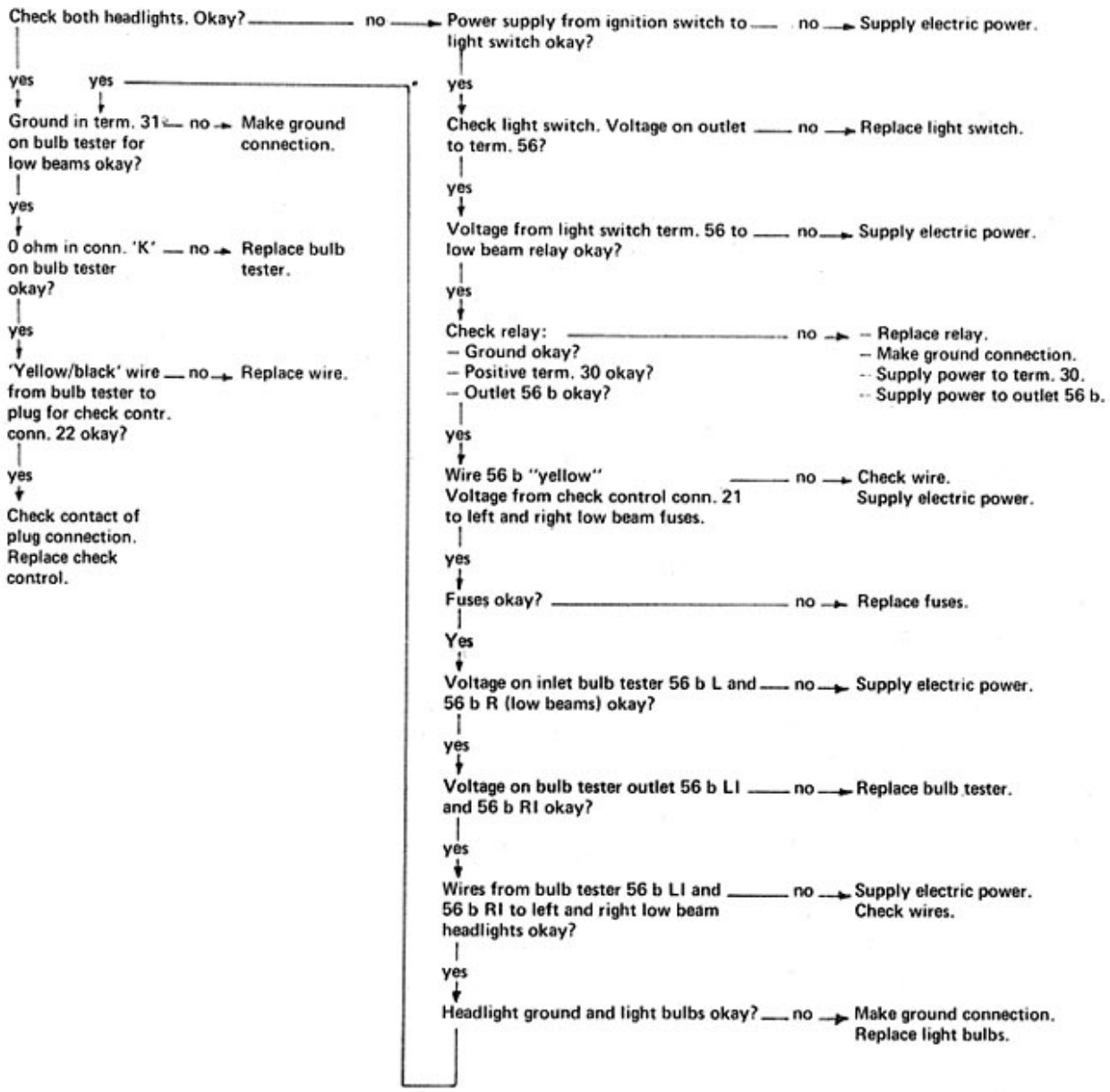
TEST: TAIL LIGHTS



TEST: LICENSE PLATE LIGHTS



TEST: LOW BEAM HEADLIGHTS



TEST: POWER SUPPLY AND OUTLET WIRE ON CHECK CONTROL

Term. 30s electric power supply okay? — no → Check wire to fuse no. F\5.
Check fuse no. F 5, replacing with 7.5 amp fuse if necessary.
Check power rail in central electric board for fuse no. F 5.

yes

Term. 15 electric power supply with ignition turned on okay? — no → Check wire to fuse no. F 6.
Check fuse no. F 6, replacing with 7.5 amp fuse if necessary.
Check wire from fuse no. F 6 to ignition lock term. 15.

yes

Term. R electric power supply with ignition key in "R" okay? — no → Check wire to fuse no. F 8.
Check fuse no. F 8, replacing with 7.5 amp fuse if necessary.
Check bridge between fuse no. F 8 and fuse no. F 11.
Check wire from fuse no. F 11 to ignition lock term. R.

yes

Term. 31 ground connection okay? — no → Check ground wire, replacing if necessary.

yes

Central warning lamp in instrument cluster okay? — no → Check wire from check control term. ZH to pin 9 of blue instrument cluster plug.
– With turn signal on a ground signal of 1 Hz can be measured on pin 9 of blue instrument cluster plug.

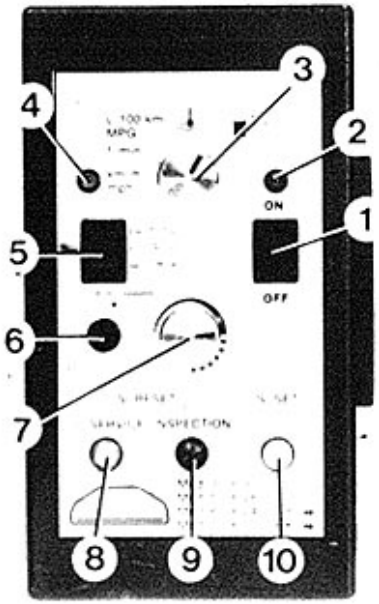
BMW 524 td:

Display: "Fuel Filter" → See 13 32 . . . "Draining Water in Fuel Filter"

Display: "Injection" → See Group 13 "Troubleshooting Fuel Injection"

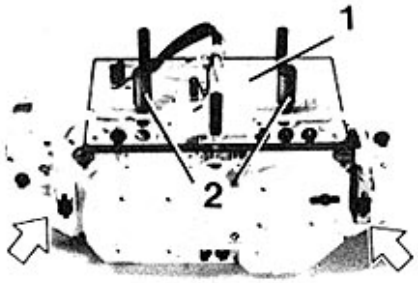
SIMULATOR FOR CHECKING INSTRUMENT CLUSTERS

*)Order No. 81 12 9 425 009



30 62 033

1 ON / OFF switch
2 Power supply control lamp
3 Selector switch
4 Distance pulse control lamp
5 Tachometer changeover switch
6 Starting simulation button
7 Display range running off knob
8 Oil service reset button
9 Inspection reset button
10 SI running off and adjusting button



30 62 034

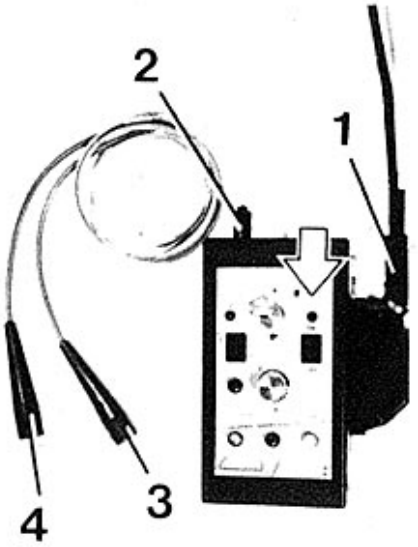
1 Checking Complete Instrument Cluster
1.1 Connecting Simulator
1.1.1 '3' Series Cars

Plug connection plate (1) * of '3' series wire harness on instrument cluster and secure with clamps (2).

Caution!
Be careful not to bend the spring contacts when mounting the connection plate.

Connect blue and white plugs of wire harness on the instrument cluster.

*)Order No. 81 12 9 425 010
(HWB)



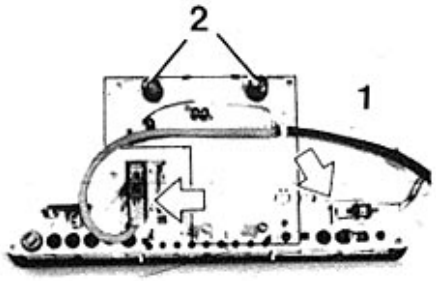
30 62 035

Connect lead (1) and power supply lead (2) * on simulator.

Connect red terminal (3) on B + and black terminal (4) on B – of a 12 V battery.
Turn on simulator with switch (1).

The red control lamp will not come on with battery voltage of <11.5 V; simulator is not ready for use.

*) Order No. 81 12 9 425 013
(HWB)

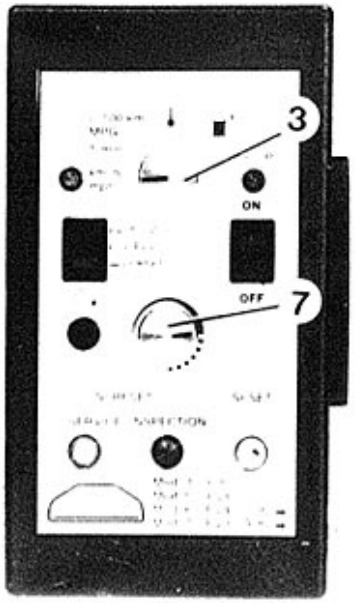


30 62 036

1.1.2 '5', '6' and '7' Series Cars

Plug connection plate*(1) * of '5', '6' and '7' series wire harness on instrument cluster and secure with clamps (2).
Caution!
Be careful not to bend spring contacts when mounting the connection plate.

Connect blue and white plugs of wire harness on instrument cluster.
*) Order No. 81 12 9 425 011 (HWB)



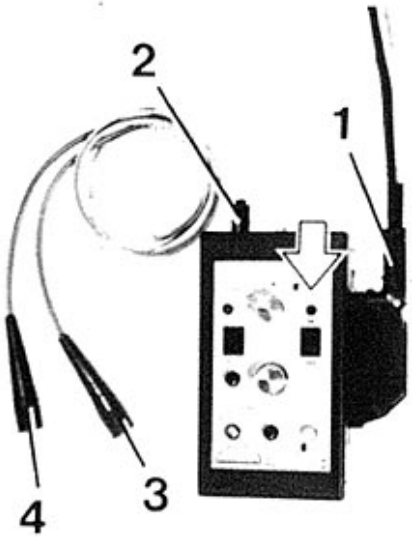
30 62 037

1.2 Checking

1.2.1 Speedometer
Set selector switch (3) to km/h or mph, and turn knob (7) against left stop; speedometer needle points to 0.

Turn knob (7) clockwise slowly; speedometer needle passes through the display range.

Note:
The simulator is designed for speedometers with a display range of 280 km/h. If the display range of a speedometer is smaller, it could happen that after reaching the final display value and increasing the frequency with knob (7) the needle would fall back to an undefined display value. When increasing the frequency again, the needle would start from this display value and pass through the display range.

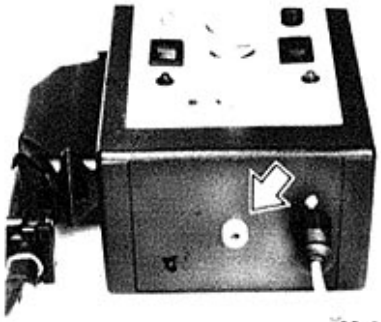


30 62 035

Connect lead (1) and power supply lead (2) on the simulator.

Connect red terminal (3) on B + and black terminal (4) on B – of a 12 V battery.
Turn on simulator with switch (1).

The red control lamp will not come on with a battery voltage of < 11.5 V; the simulator is not ready for use.

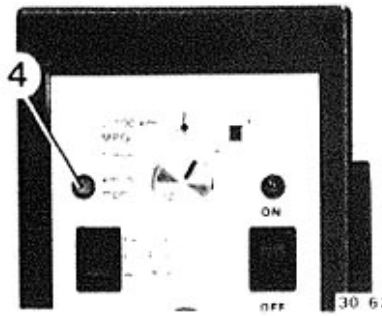


30 62 038

The set frequency can be measured on the yellow jack with a BMW service test unit (multimeter 14) – see operating instructions of BMW service test unit.

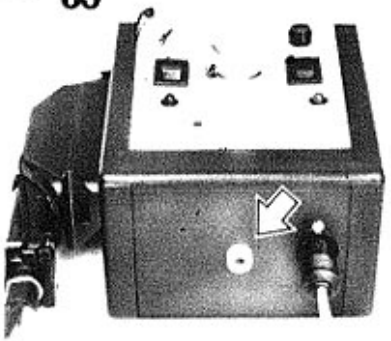
Yellow connection terminal
FREQ in +
in yellow jack;
Black connection terminal
FREQ in –
on B – of battery

See Specifications for test values.



30 62 039

Green LED (4) indicates the 100 mtr. pulse, which is required for SI and EC.
This LED must come on and go out in 100 meter cycles (not at final display value).

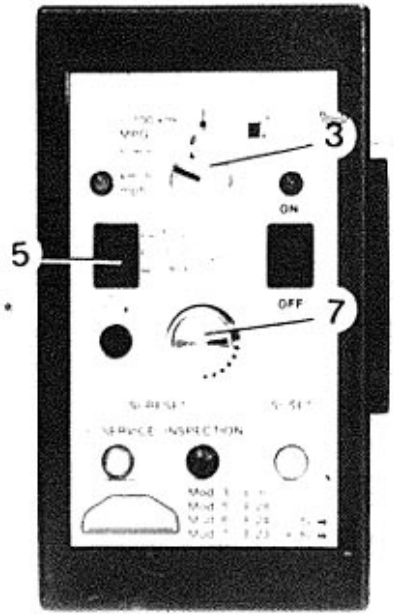


30 62 038

The set frequency can be measured on the yellow jack with a BMW service test unit (multimeter 14) – see operating instructions of BMW service test unit.

Yellow connection terminal
FREQ in +
in yellow jack;
black connection terminal
FREQ in –
on B – of battery.

See Specifications for test values.



30 62 040

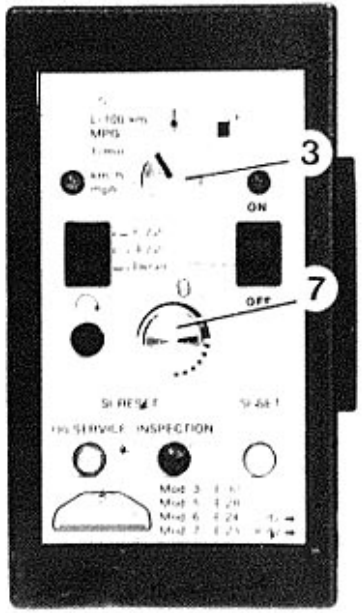
1.2.2 Tachometer
Selector switch (3) set to 1/rpm.
Turn knob (7) against left stop; needle of tachometer points to 0.

Set switch (5) to correct position!

Tachometer for:

6 cylinder engines ——→ 6 zyl
4 cylinder engines ——→ 4 zyl
diesel engines ——→ Diesel

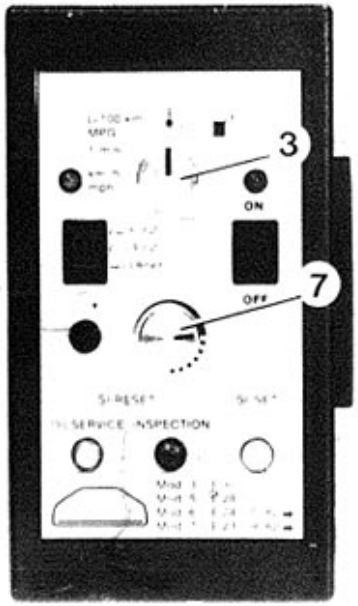
Turn knob (7) clockwise slowly; needle of tachometer passes through display range.
N o t e:
The simulator is designed for tachometers with a display range of 8000 rpm. When the tachometer has a 5000 rpm display range, it could happen that after reaching the display value and increasing the frequency with knob (7) the needle will fall back to an undefined display value. When increasing the frequency even more, the needle starts from this display value and passes through the display range again.



30 62 041

1.2.3 Economy Control (EC)
Selector switch (3) set to L/100 km or MPG.
Turn knob (7) against left stop; EC needle points to 0 (for L/100 km) or ∞ (for MPG).

Turn knob (7) clockwise slowly; EC needle passes through display range up to approx. ∞ (for L/100 km) or up to approx. 0 (for MPG).



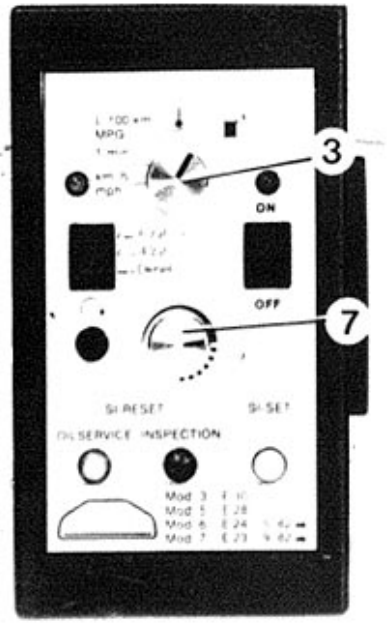
30 62 042

1.2.4 Temperature Gauge

Selector switch (3) set to temperature.
Turn knob (7) against left stop; needle of temperature gauge in blue range.

Turn knob (7) clockwise slowly; needle of temperature gauge passes through display range.

N o t e:
Needle deflection takes place only in last third of turning range for knob (7).



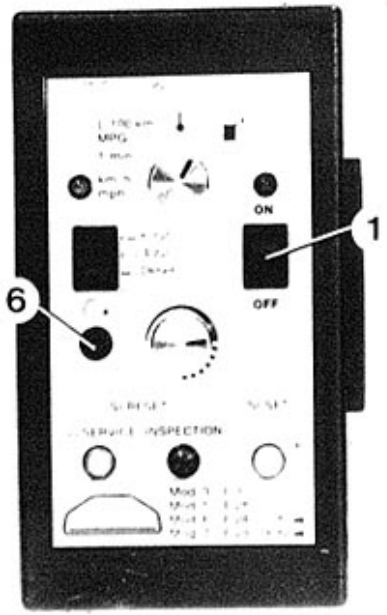
30 62 043

1.2.5 Fuel Gauge

Selector switch (3) set to tank.
Turn knob (7) against left stop; needle of fuel gauge points to R.

Turn knob (7) clockwise slowly; needle of fuel gauge passes through display range.

N o t e:
Needle deflection takes place only in last third of turning range for knob (7).



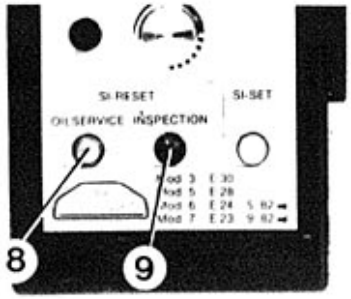
30 62 044

1.2.6 Service Indicator (SI)

Engine starting can be simulated with button (6).

Press button (6) at least 2 seconds and release again.
Green LEDs of SI go out.

LEDs will come on again by switching the simulator off and on with switch (1).



30 62 045

SI can be reset with buttons (8 and 9).

Button 8: Reset for OIL SERVICE
Button 9: Reset for INSPECTION

Pertinent interval is reset by pressing the button briefly.

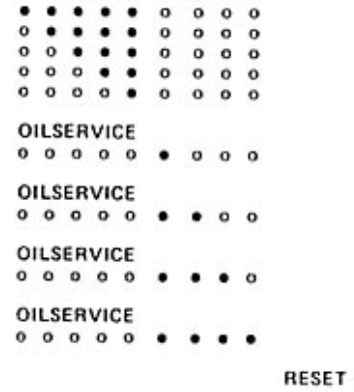
The duration of resetting is indicated by a lamp in pertinent button.



30 62 046

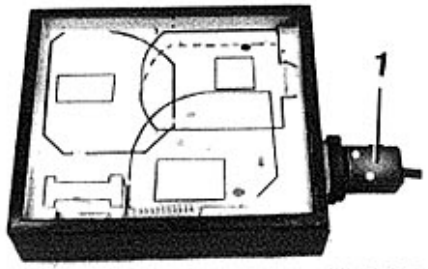
The SI can be adjusted with button (10).

The SI runs off at intervals of about 10 seconds by pressing button (10).

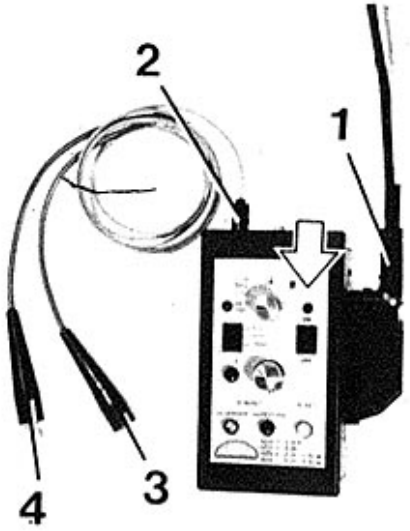


30 62 032

This diagram shows the run-off of SI.
Note:
The BMW 524 td has two OIL SERVICES between each inspection.



30 62 047



30 62 035

2 Checking Instruments Separately

2.1 Connecting Simulator

2.1.1 '3' Series Cars

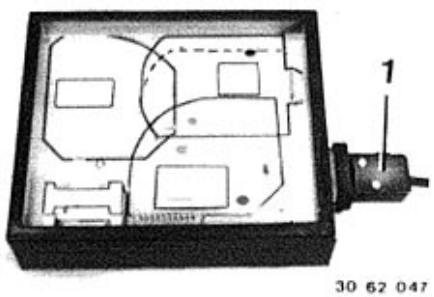
Connect plug (1) and '3' series wire harness on adapter for instruments.

Connect lead (1) and power supply lead (2) on simulator.
Connect red terminal (3) on B + and black terminal (4) on B – of a 12 V battery.

Turn on simulator with switch (1).

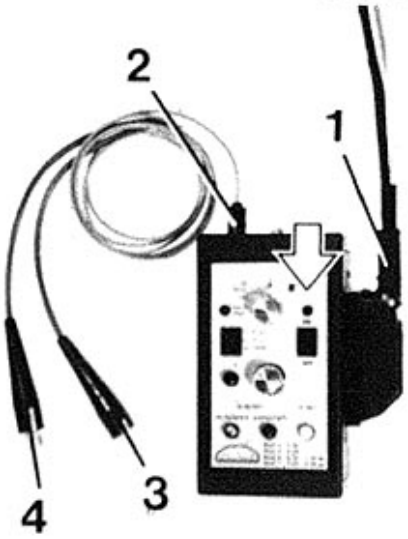
The red control lamp will not come on with a battery voltage of < 11.5 V; the simulator is not ready for use.

2.1.2 '5', '6' and '7' Series Cars



30 62 047

Connect plug (1) of '5', '6' and '7' series wire harness on adapter for instruments.



30 62 035

Connect lead (1) and power supply lead (2) on simulator.
Connect red terminal (3) on B + and black terminal (4) on B – of a 12 V battery.

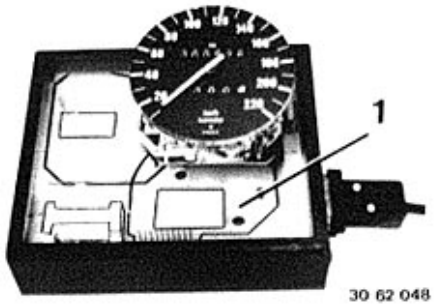
Turn on simulator with switch (1).

The red control lamp will not come on with a battery voltage of < 11.5 V; the simulator is not ready for use.

2.2 Checking

Disassemble instrument carrier – see Group 62 of repair manual.

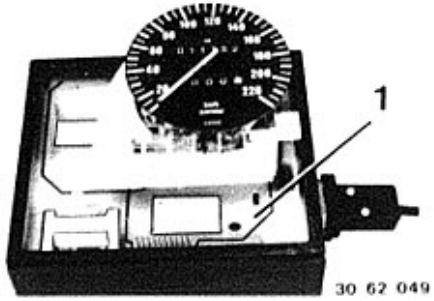
2.2.1 Speedometer



30 62 048

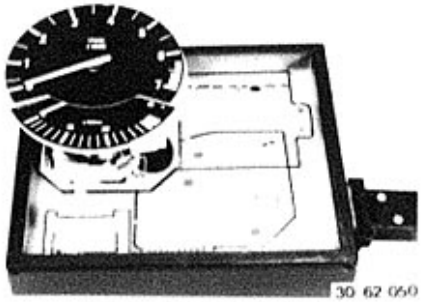
Connect speedometer on adapter (1)
Check as described in 1.2.1.
'3' Series Cars

'5', '6' and '7' Series Cars



30 62 049

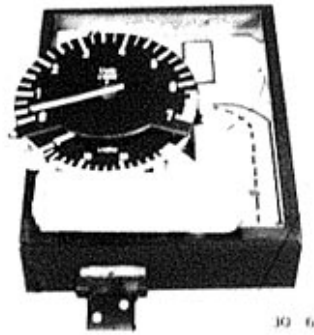
2.2.2 Tachometer and EC



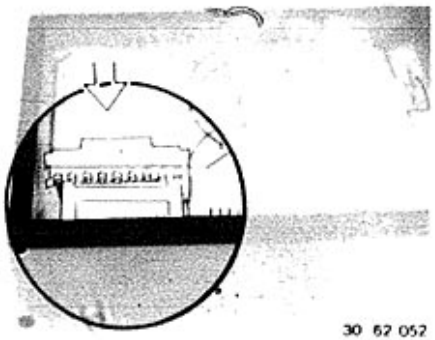
30 62 050

Connect tachometer, with or without EC, or clock with EC on adapter (1).
Check as described in 1.2.2 or 1.2.3.
N o t e:
Connect coding plug
'3' Series Cars

'5', '6' and '7' Series Cars



30 62 051

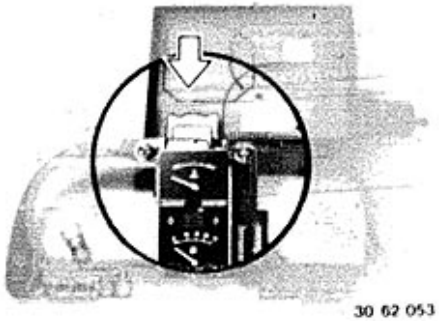


30 62 052

2.2.3 LEDs and Light Bulbs for SI Signs

'3' Series Cars:
Connect printed circuit board.

All LEDs must come on.



30 62 053

'5', '6' and '7' Series Cars:
Connect plug of printed circuit board.

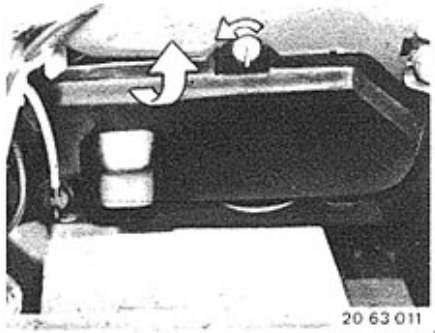
All LEDs must light up.

63 Lights

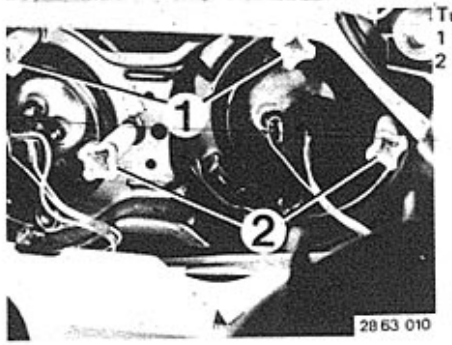
63 10 004	Headlights – aiming	63- 1
63 12 100	Double headlight, left or right – remove and install	63- 1
250	High beam lamp – remove and install	63- 2
280	Low beam lamp – remove and install	63- 2
63 13 150	Turn signal, front, left or right – remove and install	63- 2
180	Side marker light, front, left or right – remove and install or replace	63- 3
63 14 000	Side marker light, rear, left or right – remove and install or replace	63- 3
63 21 180	Tail light assembly, left or right – remove and install	63- 4
63 99 271	Bulb for left or right front turn signal – replace	63- 4
63 99 . . .	Bulb for left or right front side marker light – replace	63- 4
63 99 . . .	Bulb for left or right rear side marker light – replace	63- 5
63 99 . . .	Bulb for left or right tail light assembly – replace	63- 5
381	Bulb for center stop light – replace	63- 5

63 10 004 AIMING HEADLIGHTS

Check tire inflation pressure, correcting if necessary.
Bring car to normal position[1].
Check aiming of low and high beams with an optical aimer according to instructions supplied with pertinent equipment.



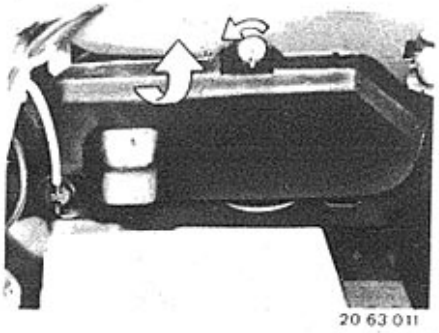
Correcting:
Remove headlight cover.



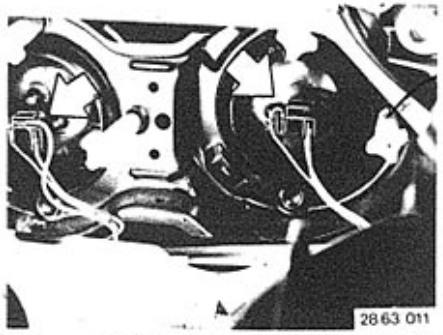
Turn knurled head screws.
1 = Vertical control
2 = Lateral control

63 12 100 REMOVING AND INSTALLING LEFT OR RIGHT DOUBLE HEADLIGHT

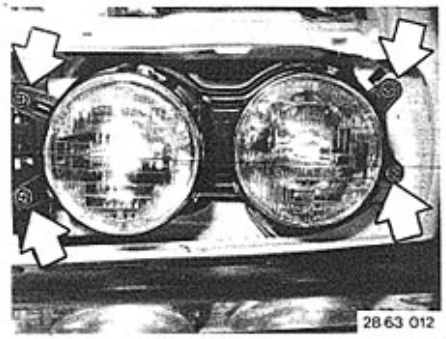
Remove and install radiator grill 51 13 040.
Remove headlight cover.



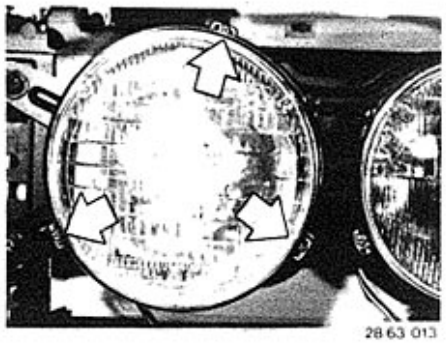
Pull off plug.



Unscrew screws.

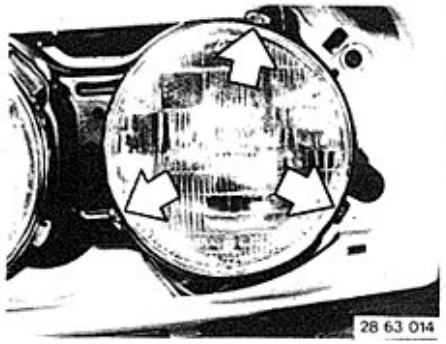


[1] See Specifications


28 63 013

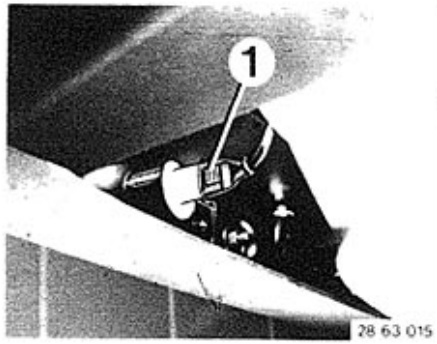
63 12 250 REMOVING AND INSTALLING HIGH BEAM LAMP

Remove and install radiator grill 51 13 040.
Detach retaining ring.
Pull off plug.
Installation:
Insert lamp in opening of console.
Aim headlights 63 10 004.


28 63 014

63 12 280 REMOVING AND INSTALLING LOW BEAM LAMP

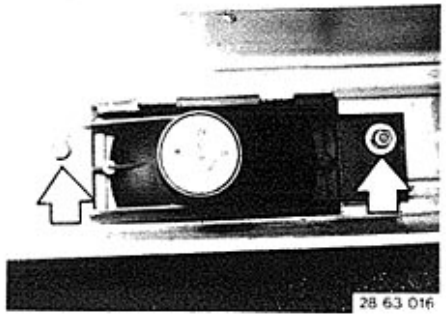
Remove and install radiator grill 51 13 040.
Pull off plug.
Installation:
Insert lamp in opening of console.
Aim headlights 63 10 004.



28 63 015

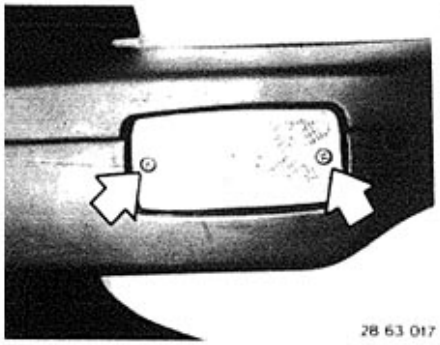
63 13 150 REMOVING AND INSTALLING LEFT OR RIGHT FRONT TURN SIGNAL ASSEMBLY

Pull off plug (1).


28 63 016

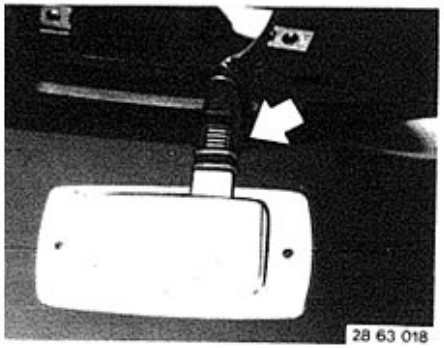
Unscrew nuts.
Lift turn signal out of bumper toward rear.

63 13 180 REMOVING AND INSTALLING OR REPLACING LEFT OR RIGHT FRONT SIDE MARKER LIGHT



28 63 017

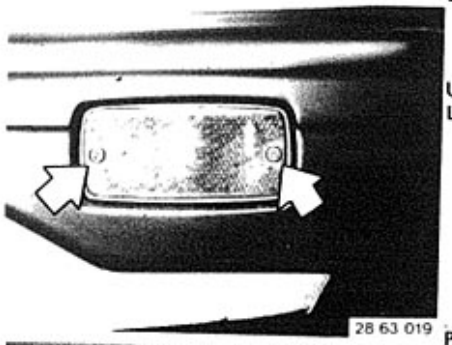
Unscrew screws.
Lift out marker light.



28 63 018

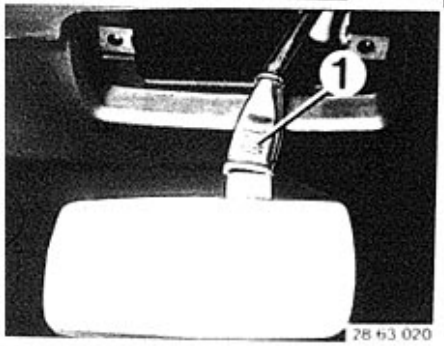
Pull off plug.

63 14 000 REMOVING AND INSTALLING OR REPLACING LEFT OR RIGHT REAR SIDE MARKER LIGHT



28 63 019

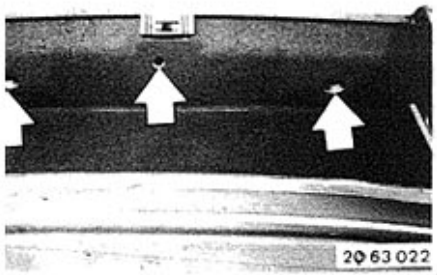
Unscrew screws.
Lift out marker light.



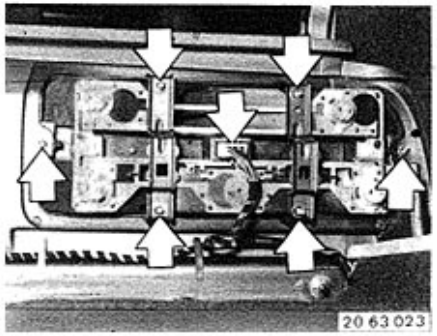
28 63 020

Pull off plug (1).

63 21 180 REMOVING AND INSTALLING LEFT OR RIGHT TAIL LIGHT ASSEMBLY

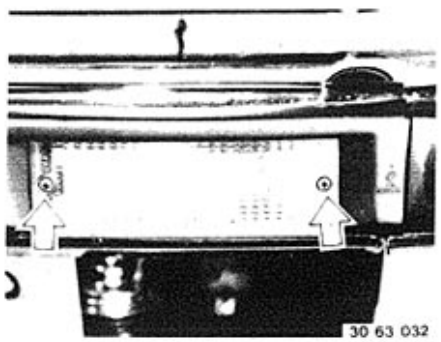


Remove trim in trunk.



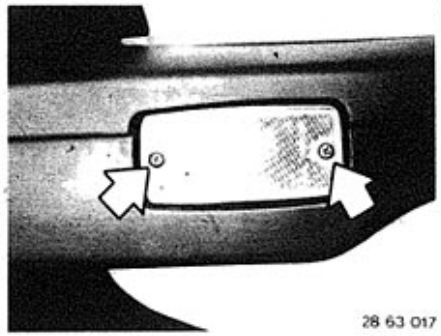
Pull off plug.
Unscrew nuts.

63 99 271 REPLACING LEFT OR RIGHT FRONT TURN SIGNAL LIGHT BULB



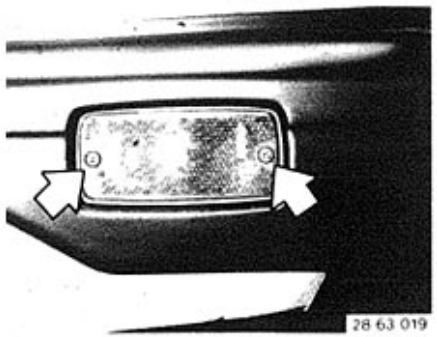
Unscrew screws.
Lift off turn signal lens.
Unscrew bulb[1].
Installation:
Check seal, replacing if necessary.

63 99 . . . REPLACING LEFT OR RIGHT FRONT SIDE MARKER LIGHT BULB



Unscrew screws.
Lift off turn signal lens.
Unscrew bulb[1].
Installation:
Check seal, replacing if necessary.

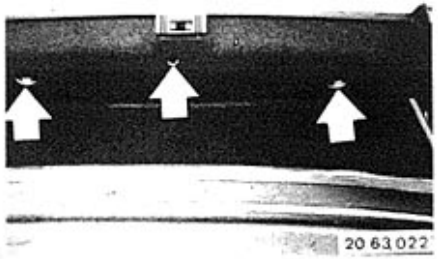
[1] See Specifications



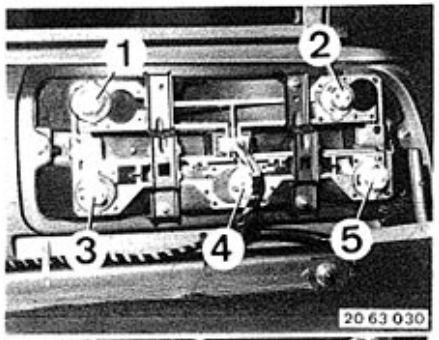
63 99 . . . REPLACING LEFT OR RIGHT REAR SIDE MARKER LIGHT BULB

Unscrew screws.
Lift off turn signal lens.
Unscrew bulb[1].
Installation:
Check seal, replacing if necessary.

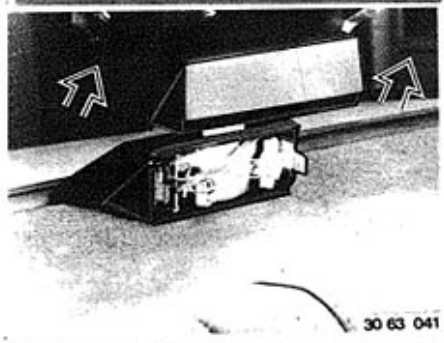
63 99 . . . REPLACING LIGHT BULB IN LEFT OR RIGHT TAIL LIGHT ASSEMBLY



Remove trim in trunk.

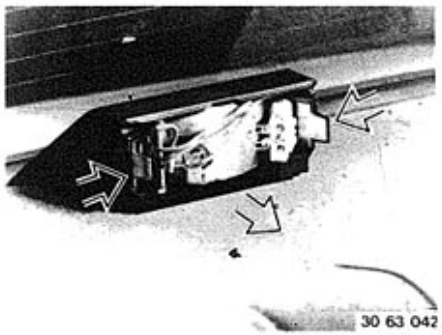


Unscrew bulb holder (bayonet catch).
1 = Backup light
2 = Turn signal
3 = Fog light
4 = Tail light
5 = Stop light



63 99 381 REPLACING LIGHT BULB FOR CENTER STOP LIGHT

Pull off cover in an angle.



Press both tabs and pull out reflector.
Unscrew light bulb.

[1] See Specifications

64 Heating and air conditioning

General information

Component survey 64- 1
Air flow diagram 64- 3
Refrigerant circuit description 64- 4
Air conditioner – discharge and charge 64- 6
Precautions for handling refrigerant 64- 6

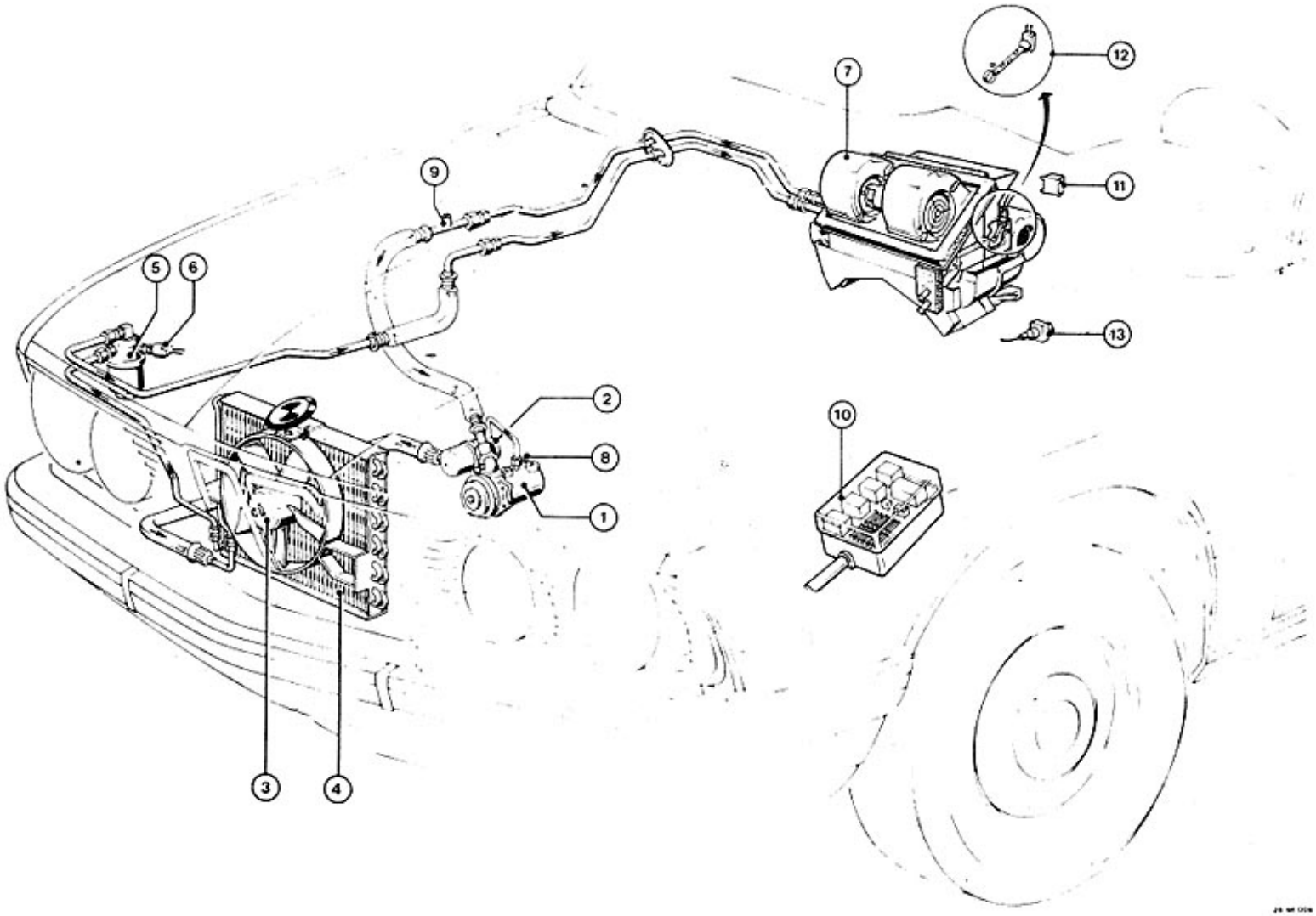
Heater

64 10 010 Temperature regulation – check 64- 100
64 11 071 Cable for footwell – remove and install 64- 110
081 Cable for windshield – remove and install 64- 110
091 Cable for fresh air flap – remove and install 64- 111
200 Heater housing – remove and install 64- 112
210 Heater blower – remove and install 64- 113
271 Water valve for heater housing – remove and install 64- 114
500 Heater blower – remove and install (heater housing removed) 64- 114
531 Heater core – remove and install (heater housing removed) 64- 115
765 Control unit for temperature regulation – remove and install 64- 116
938 Temperature sensor for passenger compartment – remove and install 64- 117
939 Temperature sensor for heater housing – remove and install 64- 117

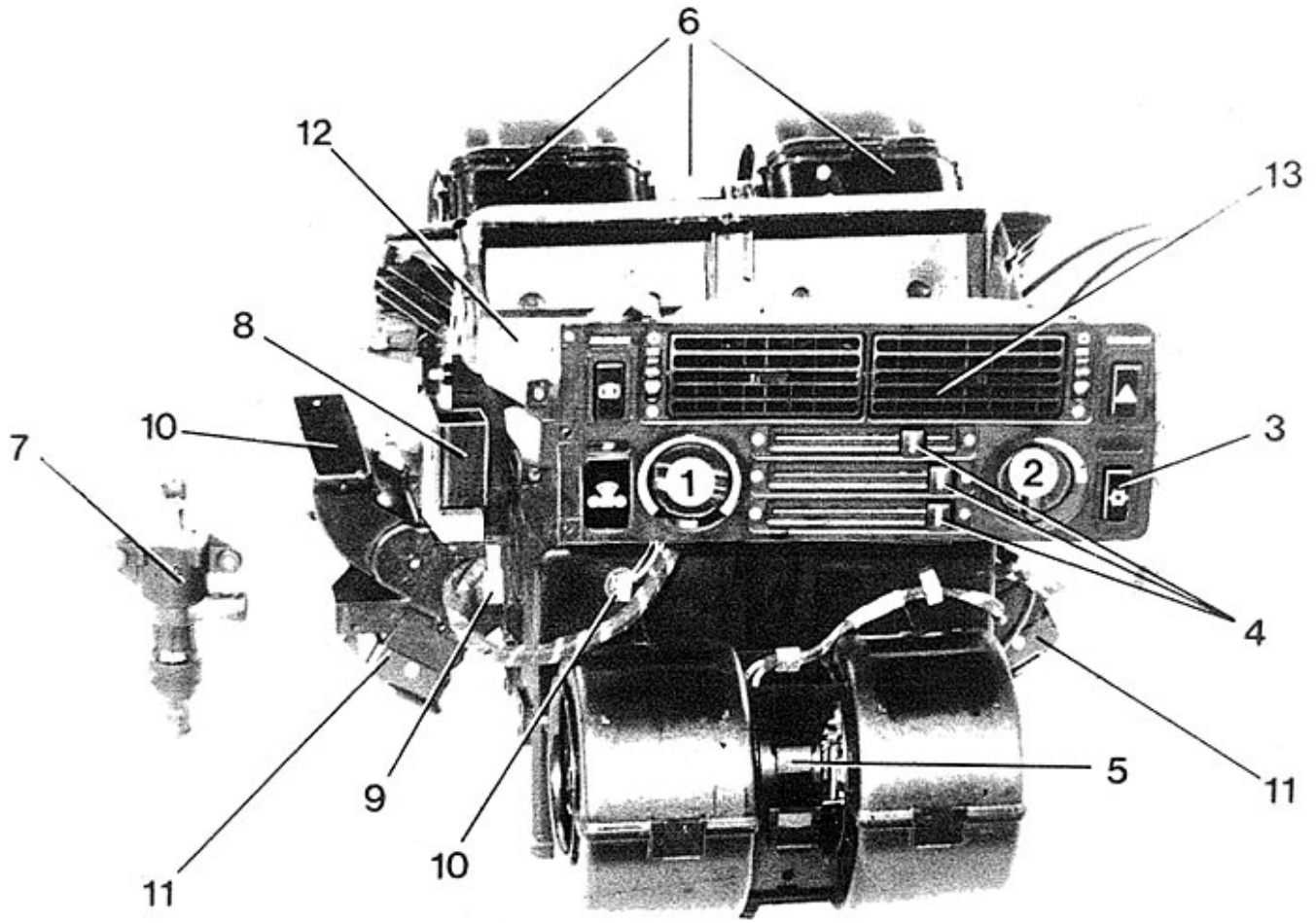
Air conditioner

64 50 . . . Evaporator temperature regulator – remove and install 64- 500
64 51 020 Evaporator housing – remove and install 64- 501
050 Expansion valve – remove and install 64- 502
. . . Temperature sensor for evaporator – remove and install 64- 502
. . . Resistor plate for evaporator housing – remove and install 64- 503
550 Blower of evaporator housing – remove and install 64- 503
590 Evaporator – remove and install 64- 504
64 52 009 Compressor drive belt – remove and install 64- 504
020 Compressor – remove and install 64- 505
64 53 010 Drier – remove and install 64- 506
050 Condenser – remove and install 64- 507

64 – 1
COMPONENT SURVEY



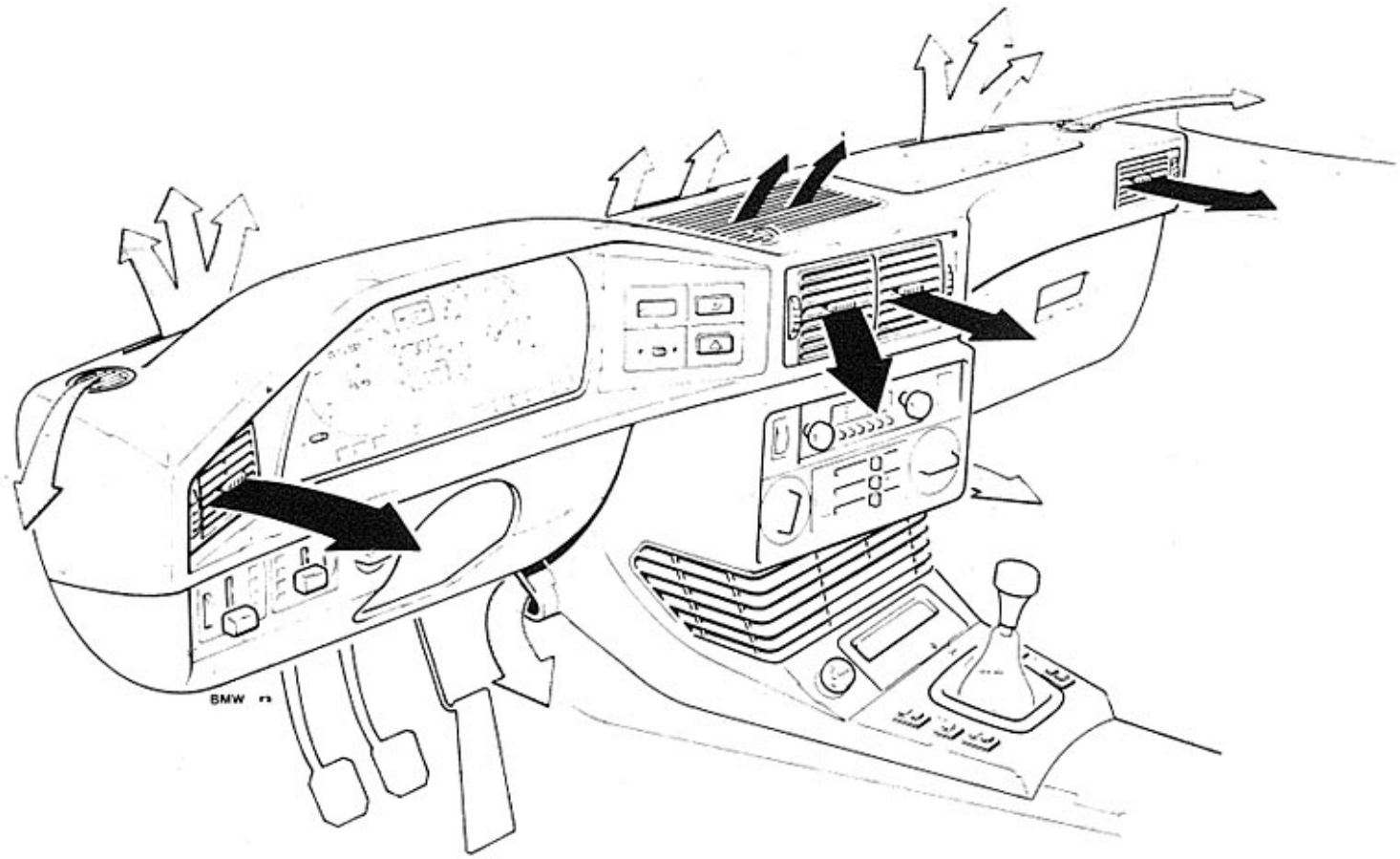
1 Compressor
2 Stabilizer
3 Auxiliary fan
4 Condenser
5 Drier
6 Safety pressure switch
7 Blower
8 Oil inspection bolt
9 Schrader valve
10 Central electric board
11 Evaporator temperature regulator
12 Temperature sensor – heater
13 Temperature sensor – passenger compartment



28 64 599

1 Temperature selection wheel with control unit
2 Blower speed selection wheel
3 Air conditioner switch
4 Sliding control
5 Auxiliary blower motor
6 Heater blower motor
7 Water valve
8 Evaporator temperature regulator
9 Temperature sensor – heater
10 Evaporator temperature sensor
11 Air outlet duct (footwell)
12 Connecting cover
13 Air outlet grill (center)

64-3
AIR FLOW DIAGRAM



28 64 009

1 = Fresh air
2 = Heated/cooled air

DESCRIPTION OF AIR CONDITIONER OPERATION

Switching on the air conditioner activates the electromagnetic coupling (1) of compressor (2). Compressor (2) is now driven by the running engine.

Compressor (2) increases the pressure of the refrigerant gas (Frigen); the temperature of the refrigerant is also boosted automatically.

The refrigerant releases heat in condenser (3), where the refrigerant is condensed and turned into a liquid.

Residual water is drawn out of the refrigerant in the drier (4) and the refrigerant is consolidated.

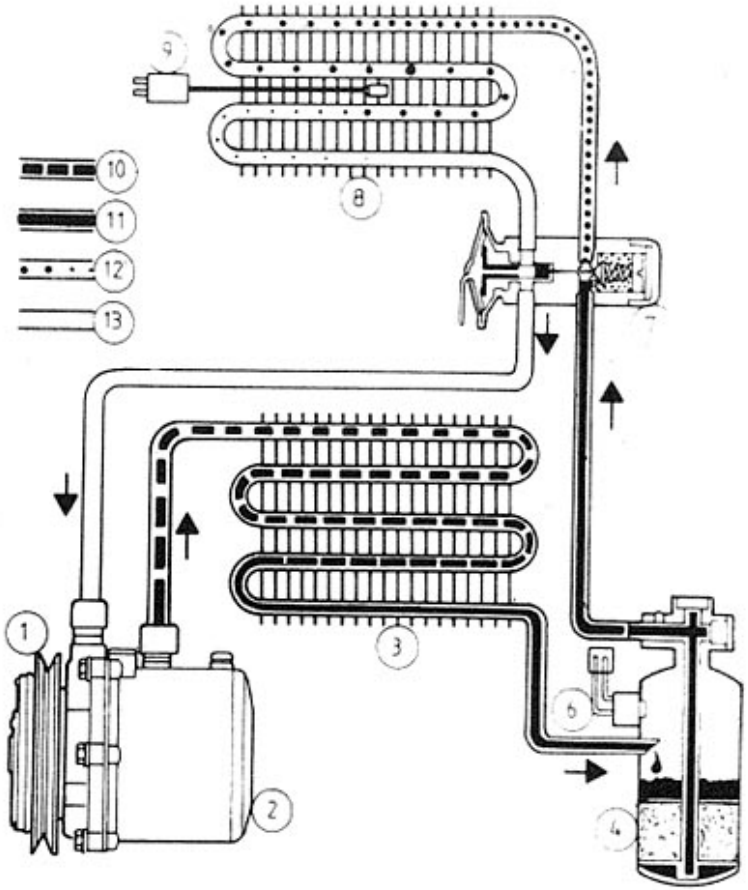
Safety switches (5 and 6) turn off the compressor when pressure is too high or too low*. This prevents damage in the air conditioning system.

The expansion valve (7) meters the quantity of refrigerant, which is injected into evaporator (8). The quantity of refrigerant depends on the temperature and pressure of refrigerant at the outlet of the evaporator.

The liquid refrigerant expands in the evaporator (8) and turns into a gas. This change in state produces strong cooling down of the refrigerant and evaporator. The fresh (or circulated) air streaming past the evaporator is cooled in this manner.

The ice-up protection switch (9) switches the compressor to prevent ice from building up on the evaporator. Ice would restrict openings and impair cooling efficiency.

Moisture from the fresh (or circulated) air condenses on the evaporator and is discharged outside via lines on the transmission tunnel. This is normal and does not indicate leakage.



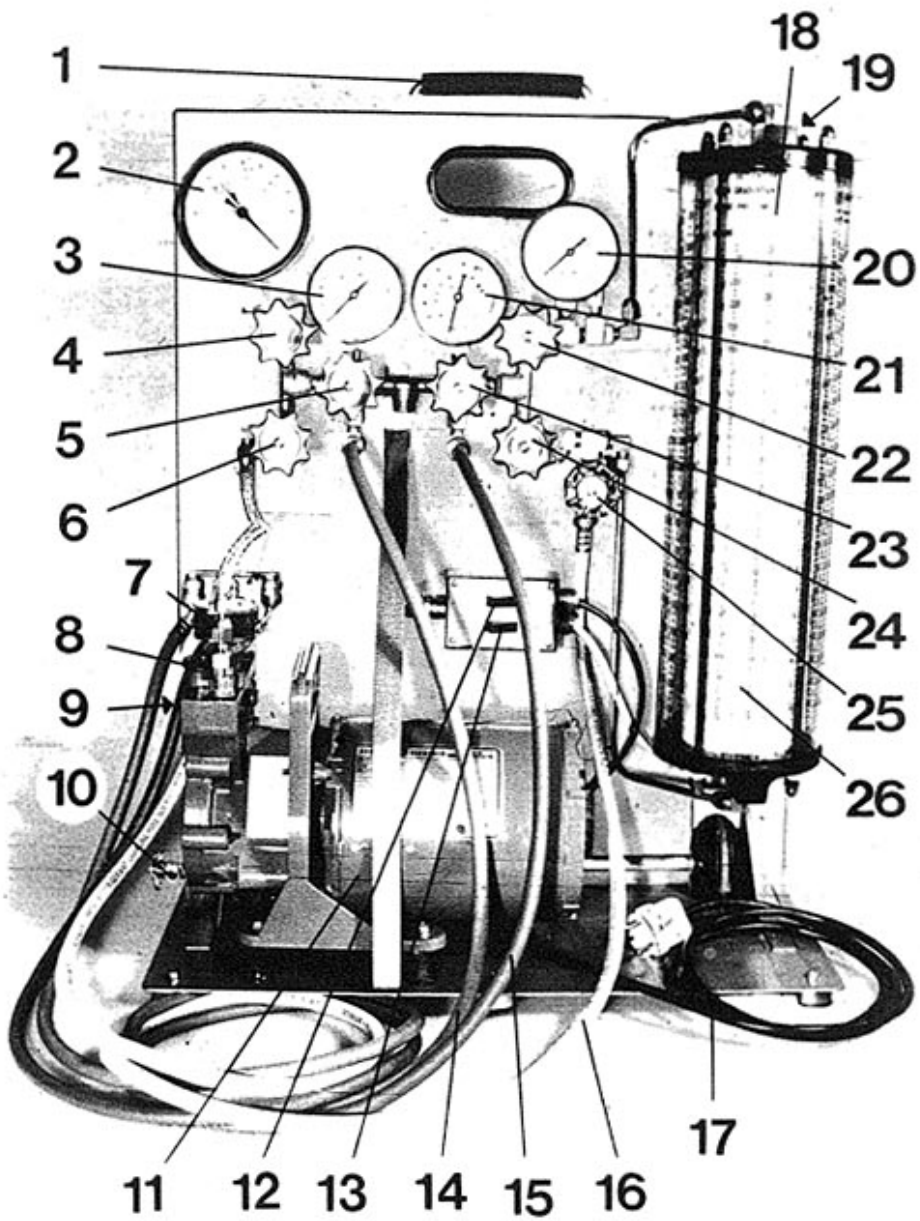
MAJOR COMPONENTS OF AIR CONDITIONER

1 Pulley with electromagnetic coupling
2 Compressor
3 Condenser
4 Drier
6 Safety switch (high pressure pressostat)
7 Expansion valve
8 Evaporator
9 Ice-up protection switch
10 High pressure gas
11 High pressure liquid
12 Low pressure liquid
13 Low pressure gas

* See Specifications

DISCHARGING AND CHARGING STATION

1 Pull-out handle
2 Torrmeter
3 Low pressure gauge
4 Vacuum valve
5 Charging valve "low pressure"
6 Shut-off valve
7 Filter
8 Gas ballast valve
9 Oil level sight glass
10 Shut-off valve – compressor oil
11 Vacuum pump
12 Switch
13 Switch
14 Charging hose (blue) "low pressure"
15 Charging hose (red) "high pressure"
16 Charging hose (white)
17 Power cord
18 Volume scale
19 Schrader valve
20 Pressure gauge "charging pressure"
21 Pressure gauge "high pressure"
22 Charging valve "gas"
23 Charging valve "high pressure"
24 Charging valve "liquid"
25 Charging valve "refrigerant"
26 Charging cylinder



730 64 342

64 50 009 DISCHARGING AND CHARGING AIR CONDITIONER

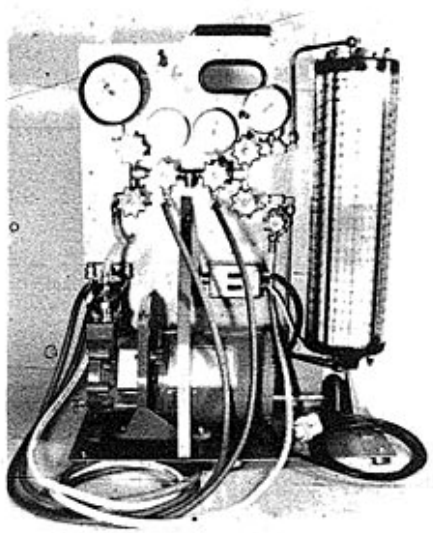
Safety Precautions for Handling Refrigerants

The air conditioning system must be filled with a safety refrigerant (Frigen 12).
Although this refrigerant is non-toxic, non-flammable and non-explosive in any mixture ratio with air at normal temperature, it can still be dangerous unless the appropriate safety precautions are observed.

Avoid any contact with liquid or gaseous refrigerant. When working on the refrigerant circuit of an air conditioner, protect hands with gloves and eyes with goggles.

Refrigerant on the skin will cause frostbite. Wash off concerned parts of the body with cold water thoroughly. If refrigerant gets in the eyes, also rinse out with water and then contact a physician immediately.

Frigen is heavier than air and therefore should not be discharged in closed rooms. Especially in working pits there would be an acute danger of asphyxiation, which would not be noticed since the gas has neither color nor oder.
Turn on available exhaust extraction systems.
Never perform welding work on a charged air conditioner or in the vicinity. The pressure which would occur could lead to an explosion.
In addition Frigen decomposes at high temperatures or when exposed to an open flame. The decomposed products are injurious to health.
Store full refrigerant cylinders that they are not subjected to direct sunshine or other sources of heat (max. temperature 45° C / 113° F).



730 64 315

Discharging and Charging Air Conditioner:
Conform with operating instructions supplied with pertinent charging equipment.
Major Procedures:
1) Connecting charging equipment.
2) Discharging (time depends on condition of air conditioner).
3) Flushing with refrigerant.
4) Discharging.
5) Charging with refrigerant – volume*.
   Caution!
   Don't operate air conditioner while charging
6) Checking operation of air conditioner.

* See Specifications

64 50 009 DISCHARGING AND CHARGING AIR CONDITIONER

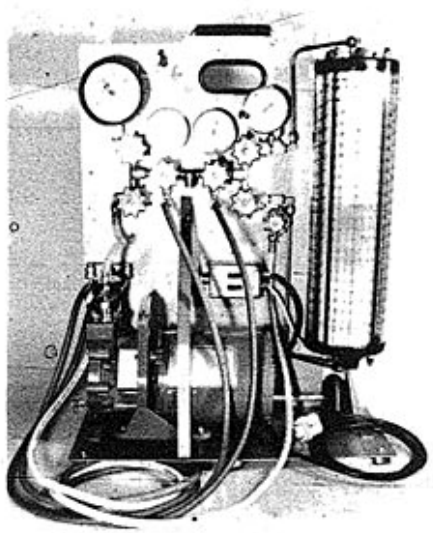
Safety Precautions for Handling Refrigerants

The air conditioning system must be filled with a safety refrigerant (Frigen 12).
Although this refrigerant is non-toxic, non-flammable and non-explosive in any mixture ratio with air at normal temperature, it can still be dangerous unless the appropriate safety precautions are observed.

Avoid any contact with liquid or gaseous refrigerant. When working on the refrigerant circuit of an air conditioner, protect hands with gloves and eyes with goggles.

Refrigerant on the skin will cause frostbite. Wash off concerned parts of the body with cold water thoroughly. If refrigerant gets in the eyes, also rinse out with water and then contact a physician immediately.

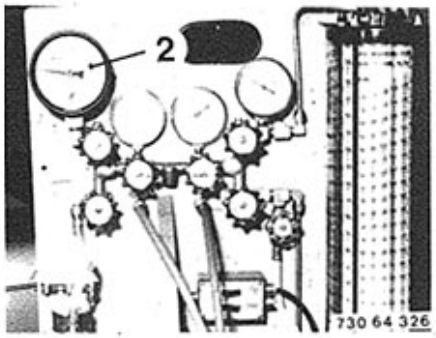
Frigen is heavier than air and therefore should not be discharged in closed rooms. Especially in working pits there would be an acute danger of asphyxiation, which would not be noticed since the gas has neither color nor oder.
Turn on available exhaust extraction systems.
Never perform welding work on a charged air conditioner or in the vicinity. The pressure which would occur could lead to an explosion.
In addition Frigen decomposes at high temperatures or when exposed to an open flame. The decomposed products are injurious to health.
Store full refrigerant cylinders that they are not subjected to direct sunshine or other sources of heat (max. temperature 45° C / 113° F).



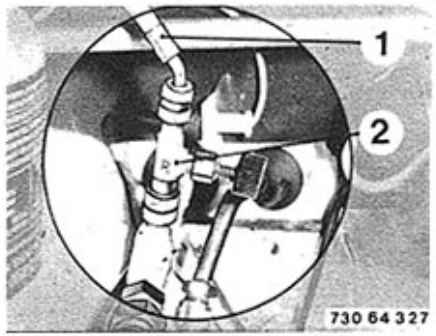
730 64 315

Discharging and Charging Air Conditioner:
Conform with operating instructions supplied with pertinent charging equipment.
Major Procedures:
1) Connecting charging equipment.
2) Discharging (time depends on condition of air conditioner).
3) Flushing with refrigerant.
4) Discharging.
5) Charging with refrigerant – volume*.
   Caution!
   Don't operate air conditioner while charging
6) Checking operation of air conditioner.

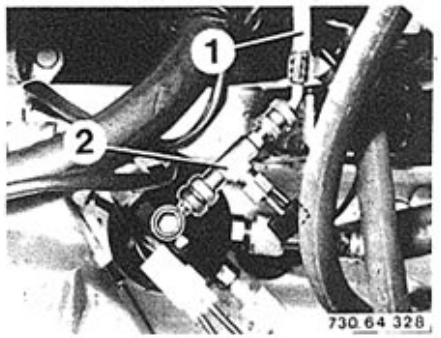
* See Specifications



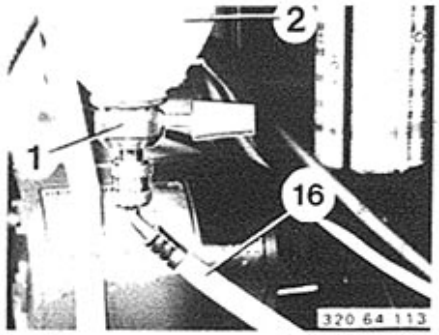
Check condition of the discharging and charging station before operation.
Check level and grade of oil in the compressor. Also refer to the operating instructions supplied with the charging station.
Caution!
Never leave high pressure on pressure gage (2) during the operating procedures – danger of destruction.
Note:
The air conditioner can also be discharged and charged with only one charging hose (high or low pressure).
However, working with a valve core remover and two charging hoses will speed up discharging and charging procedures.
Absolute cleanliness is required for the performance of work on an air conditioner.
Wear protective clothing!
Close all valves of the discharging station prior to starting the procedures.
The following procedures are only applicable with the illustrated charging station.



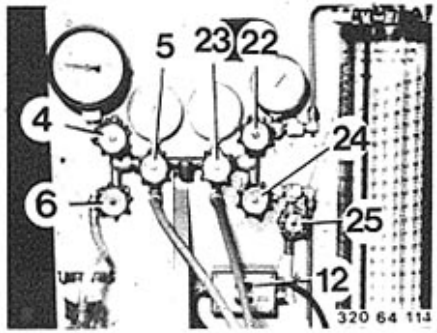
Remove the protective cap.
Connect blue charging hose (1) on the low pressure side (thick pipe) of the air conditioner.



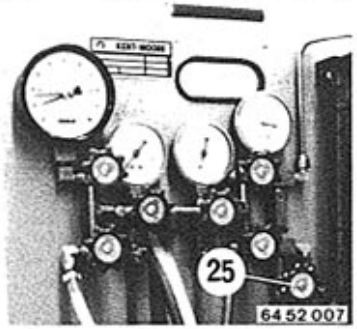
Remove the protective cap.
Connect red charging hose (1) on the high pressure side (thin pipe or drier) of the air conditioner.



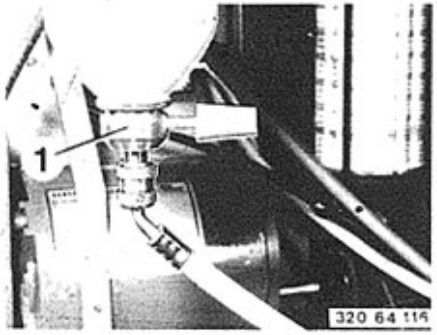
Connect the refrigerant cylinder (2) and charging hose (16) with charging valve (1).
Charging valve (1) remains connected until the charging cylinder has been filled.



Open valves (4, 6 and 22).
Turn on the pump with switch (12) and discharge the charging station.
Close valve (22) and open valves (5 and 23).
Discharge the air conditioner.

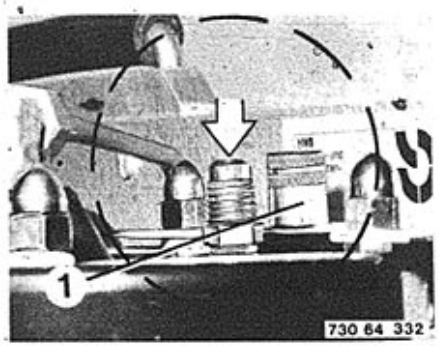


Open valve (25).

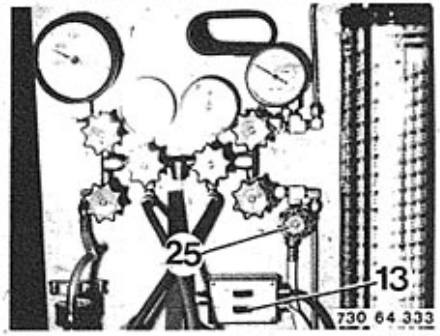


Open charging valve (1) and fill the charging cylinder with refrigerant while the air conditioner is still being discharged.
Type and amount of refrigerant*.

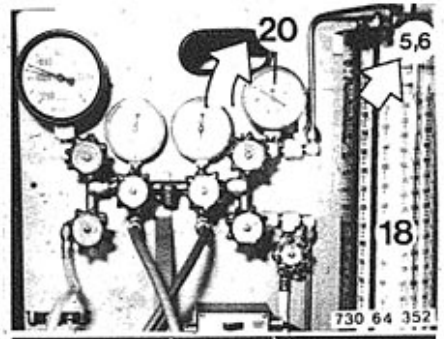
* See label in engine compartment



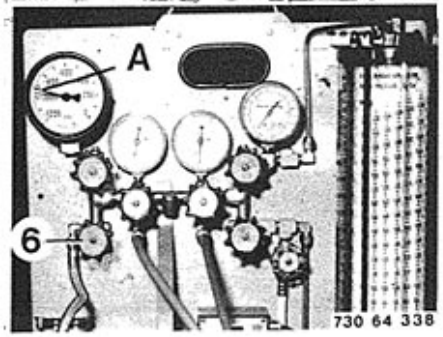
To fill the charging cylinder, unscrew protecting cap (1) and apply pressure on the valve core to let pressure escape from the charging cylinder.
This is necessary so that refrigerant can flow into the charging cylinder.



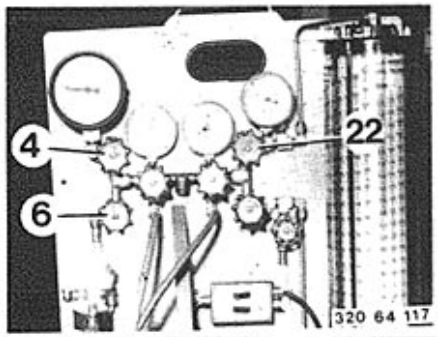
Close charging valve (25) and operate the heater with switch (13) after finishing the charging procedure.



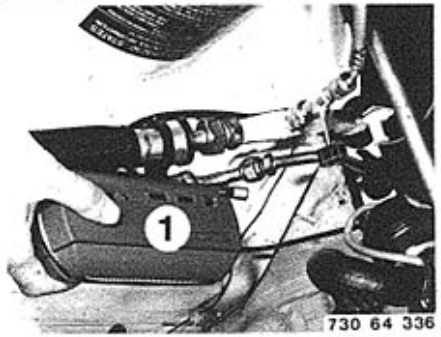
Read the rising pressure in the charging cylinder on gage (20) and set the same pressure (e.g. 5.6 bar/80 psi) on the volume scale (18).
The amount of refrigerant in the charging cylinder can now be read on the volume scale.
The heater can be switched off after reaching the charging pressure of 4.9 to 9.1 bar (70 to 129 psi).



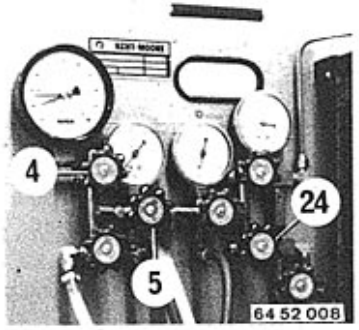
After Finishing Discharging:
Close shutoff valve (6).
Mark the red indicator (A) with the displayed value.
The air conditioner does not have moisture or leaks, if the pressure does not rise.
Switch off the vacuum pump.



Detecting Leaks:
Close valve (6).
Close vacuum valve (4).
Switch off the vacuum pump.
Open charging valve (22) about 1 second and then close it again.



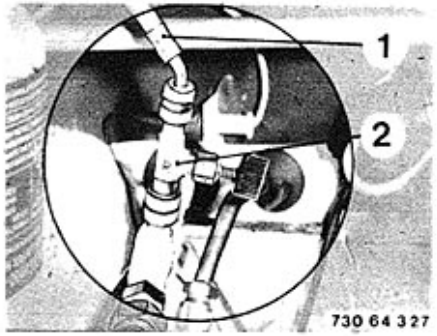
Calibrate leak detector (1) to the operating instructions.
Check air conditioner for leaks with leak detector (1).
Eliminate any leaks.
Note:
Always look for a leak underneath a possible leak point, since refrigerant is heavier than air.



Charging the System:
Close vacuum valves (4 and 5).
Open liquid valve (24) and let the correct amount* of refrigerant flow into the system.

Shut the liquid valve (24) when the system has the correct amount* of refrigerant.
Disconnect hoses and screw on the protective caps.

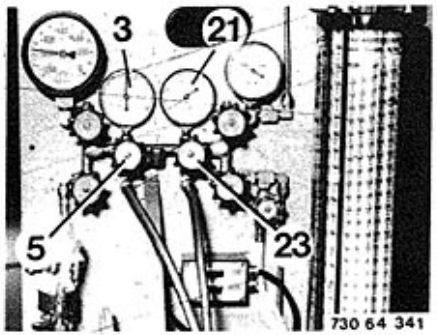
* See label in engine compartment



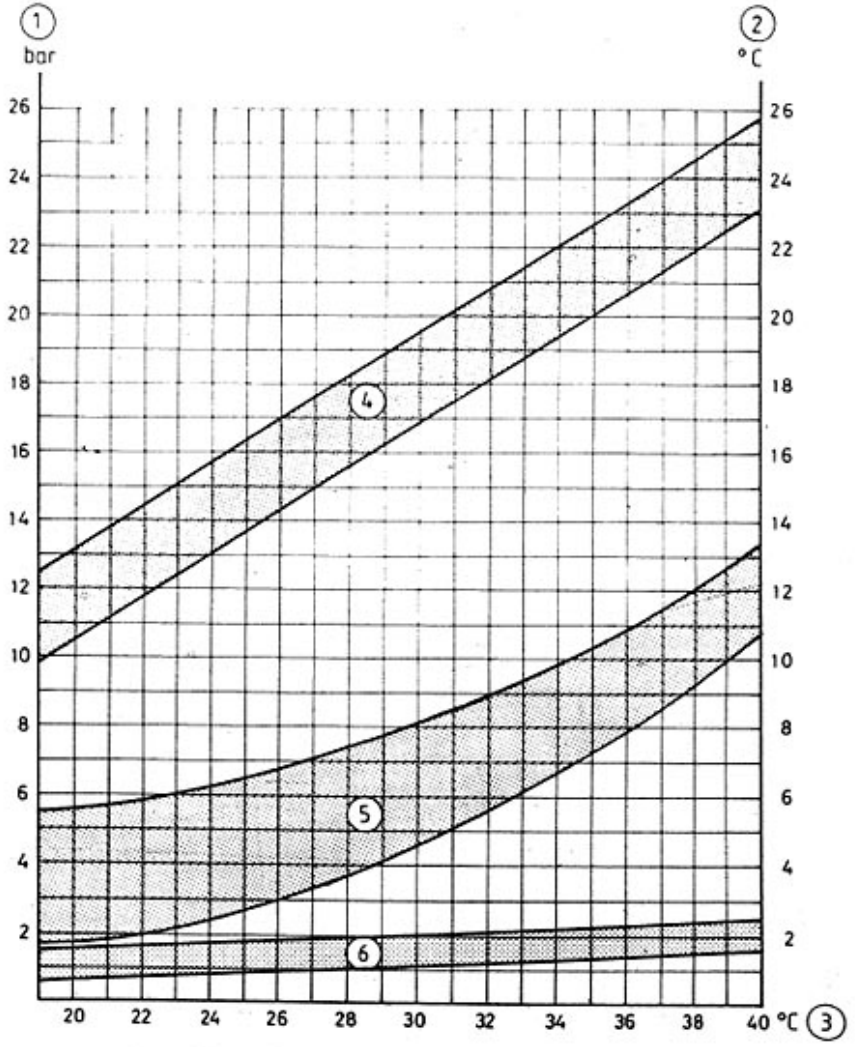
Checking Air Conditioner:
Unscrew the protective cap.
Connect blue charging hose (1) with the valve core remover (2) on the low pressure side of the air conditioner.
Connect the high pressure hose in the same manner as the low pressure hose.



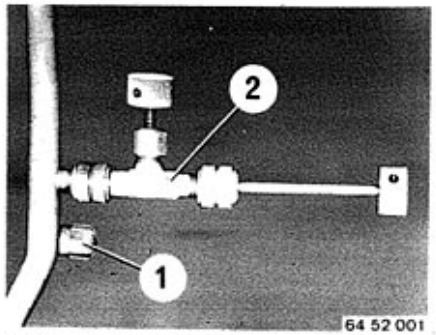
Insert the thermometer in the air outlet grill.
Testing Conditions:
1. Car parked in shade (indoors).
2. Air conditioner discharged and charged. Correct type and amount of oil in the compressor.
3. Engine running at 2,000 rpm and air conditioner switched on.
4. Doors shut.



Close all valves of the discharging and charging station.
Only open charging valve (5) or (23).
Read operating pressure values on low or high pressure gages (3 or 21) and compare with the nominal value graph 730 64 334.
Always check only one pressure range.



(1) = Pressure scale in bar
(2) = Temperature scale in degrees Celsius
(3) = Temperature scale – ambient temperature – in degrees Celsius
(4) = Tolerance range – high pressure range
(5) = Tolerance range – center nozzle air outlet
(6) = Tolerance range – low pressure range



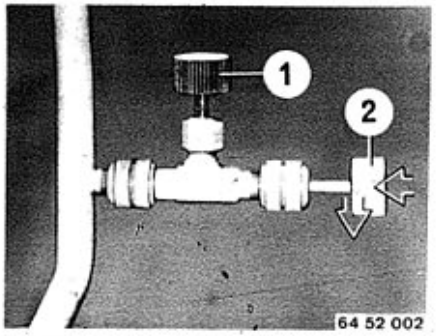
64 52 . . . REMOVING AND INSTALLING VALVE CORE

Unscrew protective cap (1).
Screw on valve core remover (2).

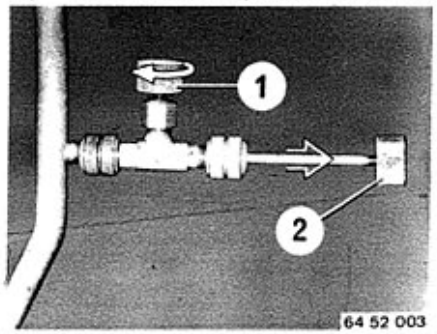


730 64 304

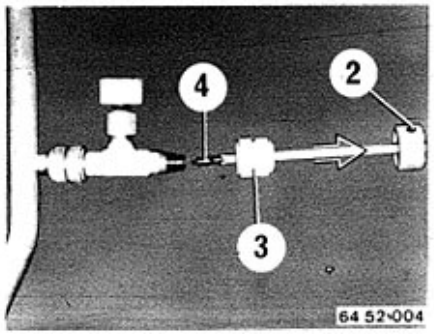
Installation:
The refrigerant-resistant valve cores can be recognized on the transparent seal (1).



Open shutoff valve (1).
Unscrew the valve core with valve turner (2).



Pull back valve turner (2) together with the valve core.
Close shutoff valve (1).

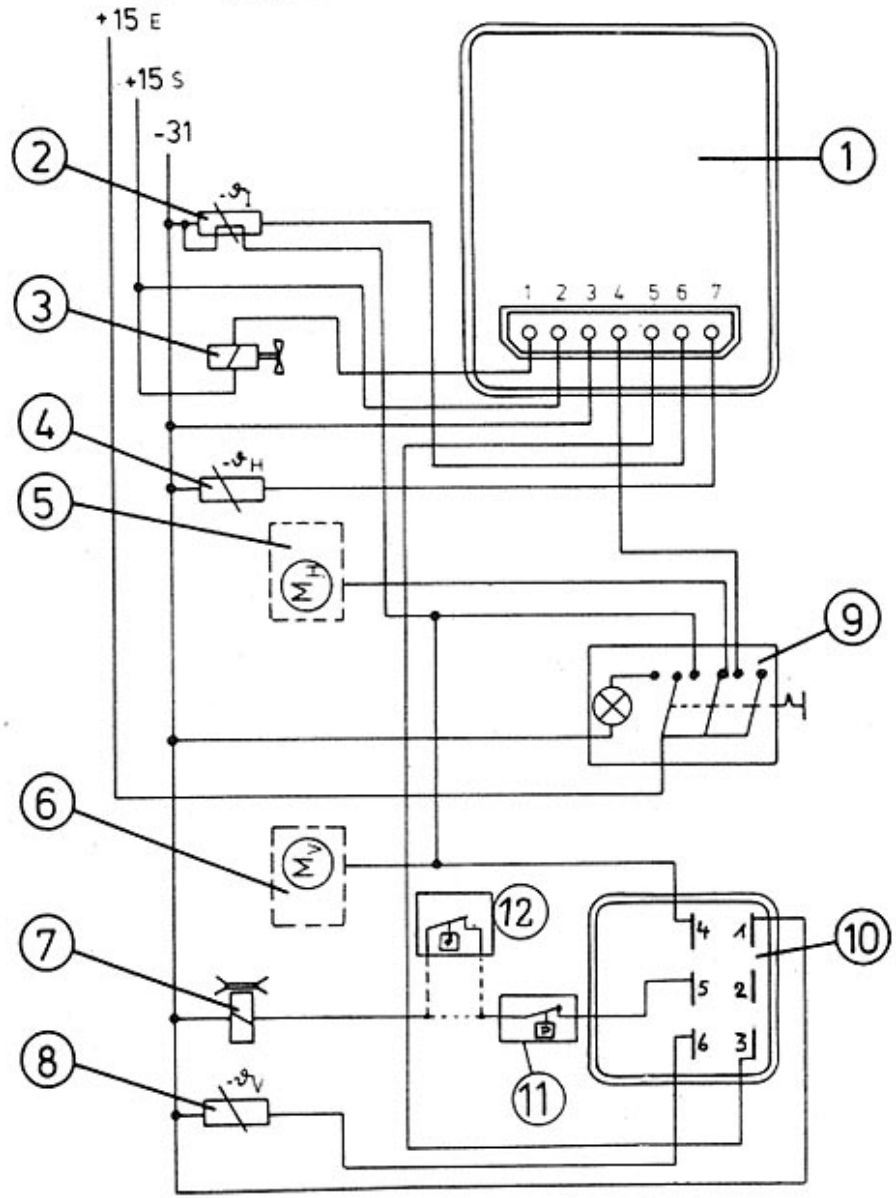


Unscrew coupling nut (3) and take off valve turner (2) with valve core (4).

64 10 010 CHECKING HEATING AND EVAPORATOR TEMPERATURE REGULATION

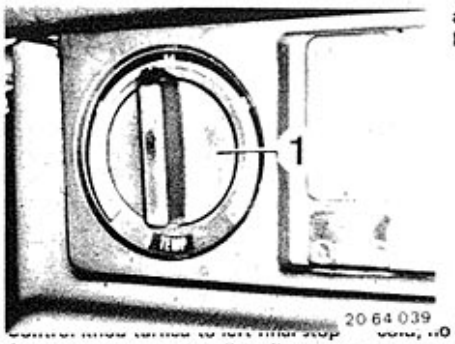
Heating and Evaporator Temperature Regulation

Principle Wiring Diagram:



1 Heating regulator (control unit)
2 Inside temperature sensor
3 Water valve
4 Heater temperature sensor
5 Heater blower
6 Evaporator blower
7 A/C compressor clutch
8 Evaporator temperature sensor
9 Air conditioner switch
10 Evaporator temperature regulator
11 Low pressure pressostat
12 Temperature switch 110° C (230° F) (only for 524 td) (protection switch)

+ 15 E = Power saving relay
+ 15 S = Power fuse
– 31 = Ground



The inside temperature of the car can be adjusted with the heating regulation control knob (1).

Control knob turned to left final stop = cold, no heating.
Control knob turned to right final stop = warm, maximum heating.

A so-called "control range" is between both end positions of the heating regulator (control unit). A temperature (nominal value) set in this range will be regulated by the control unit. The temperature inside of the car and the heater blowing out temperature are measured with one each temperature sensor and compared with the given nominal value in the control unit. A valve in the feed of the hot water circuit will be opened more or less long depending on the amount of deviation from the nominal value and the temperature inside of the car is regulated in this manner. The water valve is operated electromagnetically. The electric control of the water valve is designed that the water valve will be opened and therefore maximum heating will be provided, if the electrical system would fail (e.g. faulty control unit). In case of malfunctioning and/or failure of the heating regulation system, defects must be found in the system with the following test plan.

The heating and evaporator temperature regulation corresponds with the previously described heating regulation when the air conditioner is switched off. Heating regulation and the heater blower do not work when the air conditioner is switched on.
The A/C compressor clutch is activated by the evaporator temperature regulator, which works in accordance with the evaporator temperature sensor and heating regulator (control unit).

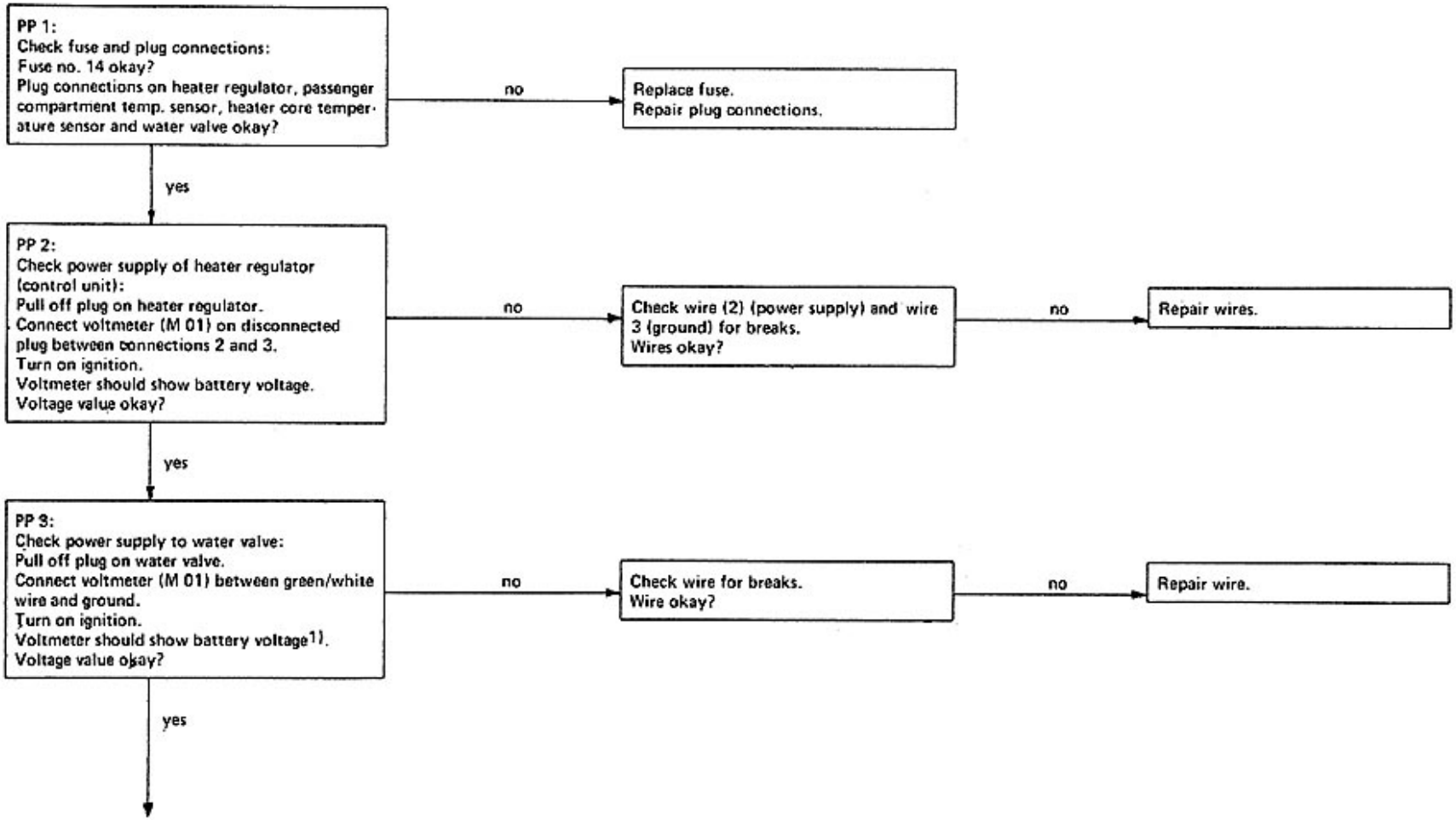
Testing Procedures for Heating and Evaporator Temperature Regulation

a) Heating Regulation

Requirements: Battery fully charged.
Air conditioner turned off!

Important! Instructions in the testing procedures refer to the "BMW SERVICE TEST" and quote the multimeter (M) function.
Make connections according to BMW SERVICE TEST operating instructions.

Explanations: PP = Test Position
1) = See Specifications



PP 4:
Check activation of water valve:
Requirement: engine at operating temperature.
Start engine.
Set heater blower to speed 3.
Pull off plug on water valve.
Connect test lamp (10 W) between both connections.
a) Turn control knob for heating regulation to left final stop.
Test lamp should be on bright.
Test lamp on?

b) Turn control knob for heating regulation to a temperature, which is greater than the instantaneous temperature in passenger compartment (e.g. passenger compartment temperature 22° C/72° F, set heater regulator to 26° C/79° F).
To quickly compensate the difference in temperature (actual and nominal values), the water valve should be wide open, i.e. test lamp is not on. When values are approx. identical, test lamp should flash on and off in about 4 second intervals.
When passenger compartment temperature is greater than set temperature, water valve should close, i.e. test lamp on without interruption.
When values are approx. identical, test lamp should again flash on and off at intervals.
Test lamp flashing on and off?

c) Set control knob for heating regulation to right final stop.
Test lamp should not come on.
Test lamp not on?

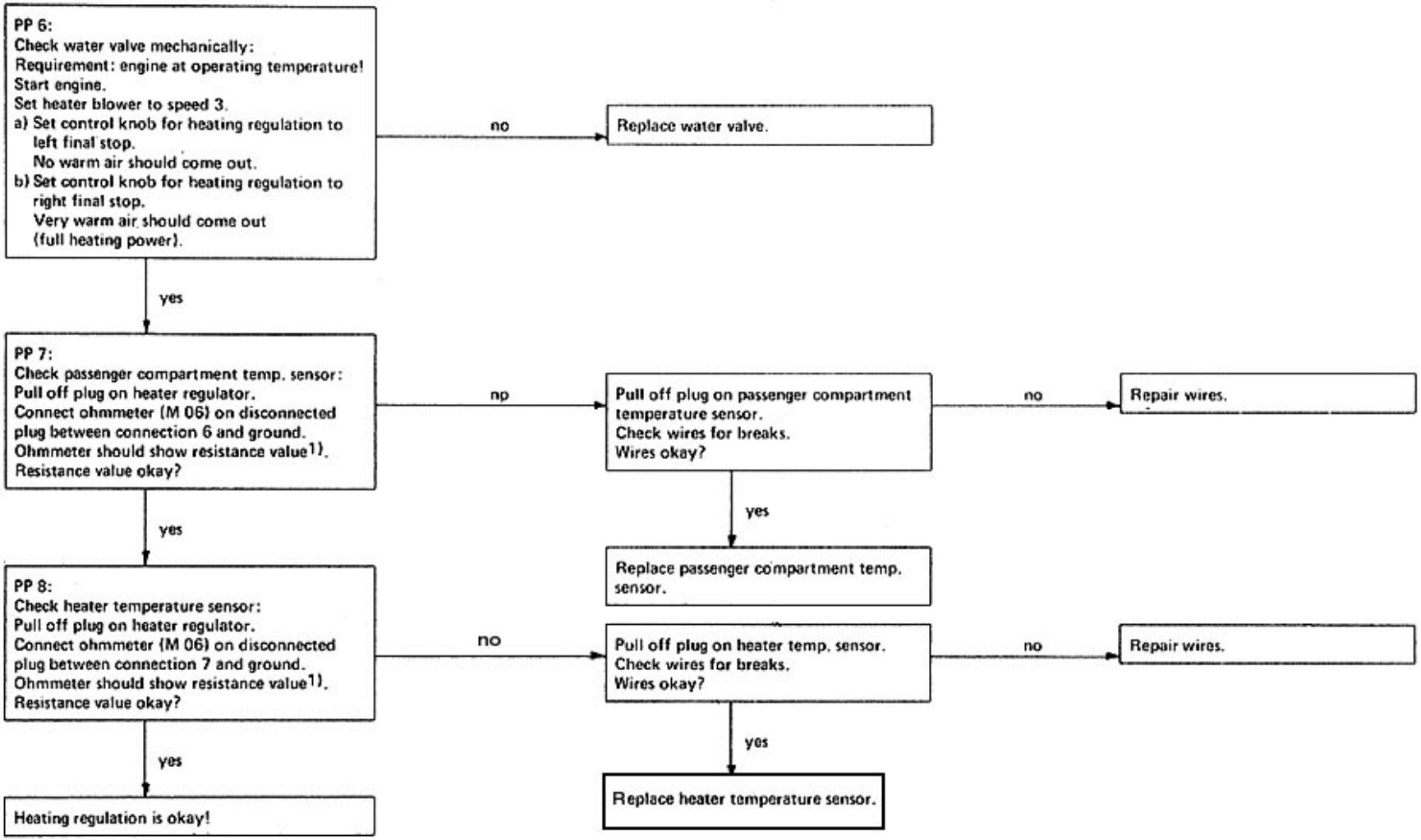
no → Replace heater regulator.

yes

Check electric water valve:
Pull off plug on water valve.
Connect water valve with B + and ground.
Valve with voltage = valve closed.
Valve without voltage = valve open.
Water valve motion can be felt and heard.
Water valve operating?

no → Replace water valve.

yes


PP 6:
Check water valve mechanically:
Requirement: engine at operating temperature!
Start engine.
Set heater blower to speed 3.
a) Set control knob for heating regulation to left final stop.
No warm air should come out.
b) Set control knob for heating regulation to right final stop.
Very warm air should come out (full heating power).
no
Replace water valve.
yes
PP 7:
Check passenger compartment temp. sensor:
Pull off plug on heater regulator.
Connect ohmmeter (M 06) on disconnected plug between connection 6 and ground.
Ohmmeter should show resistance value1).
Resistance value okay?
np
Pull off plug on passenger compartment temperature sensor.
Check wires for breaks.
Wires okay?
no
Repair wires.
yes
Replace passenger compartment temp. sensor.
yes
PP 8:
Check heater temperature sensor:
Pull off plug on heater regulator.
Connect ohmmeter (M 06) on disconnected plug between connection 7 and ground.
Ohmmeter should show resistance value1).
Resistance value okay?
no
Pull off plug on heater temp. sensor.
Check wires for breaks.
Wires okay?
no
Repair wires.
yes
Heating regulation is okay!
yes
Replace heater temperature sensor.

b) Evaporator Temperature Regulation:

Requirements: Battery fully charged, air conditioner charged, engine temperature ≤ 110° C (230° F) (switch function).
Important! Testing instructions in this test plan refer to the "BMW service tester" and indicate the multimeter functions (M).
See operating instructions of the BMW service tester for connections.
Explanations: PP = Test Position
1) = See Specifications

PP1

Check activation of clutch: —— no → Check power supply of clutch:
Turn temperature control wheel to left final stop.
Turn on ignition.
Press A/C switch button.
The switching of the electromagnetic clutch of the compressor will be heard (loud click).
Clutch activated?

PP 2

Check power supply of clutch: —— no → Check power supply of evaporator temperature regulator:
Connect voltmeter (M 01) between connection 5 on connected plug of evaporator temperature regulator and ground.
Turn temperature control wheel to left final stop.
Turn on ignition.
Press A/C switch button.
Voltmeter must display battery voltage.
Voltage value okay?

yes ↓

Check ground wire from A/C compressor.

yes ↓

Check clutch, replacing if necessary.

PP 3

Check power supply of evaporator temperature regulator: —— no → Check wire for connection 4 (power supply) and wire for connection 1 (ground) for breaks.
Pull off plug on evaporator temperature regulator.
Connect voltmeter (M 01) between connections 4 and 1
Turn temperature control wheel to left final stop.
Turn on ignition.
Press A/C switch button.
Voltmeter must display battery voltage.
Voltage value okay?

yes ↓

Check evaporator temperature sensor: —— no → Pull off plug on evaporator temperature sensor.
Pull off plug on evaporator temperature regulator.
Connect ohmmeter (M 06) between connection 6 and ground.
Resistance 1).
Resistance value okay?

PP 4

Check wire for connection 4 (power supply) and wire for connection 1 (ground) for breaks.
Wires okay? —— no → Repair wire.

Pull off plug on evaporator temperature sensor.
Check wire for breaks.
Wire okay? —— no → Repair wire.

yes ↓

Replace evaporator temperature sensor.
Repeat test PP1.
Clutch activated?

no ↓

Replace heating regulator (control unit).

Checking in case of non-uniform regulation:
Press air conditioner button.
There must be 0.7 to 8.2 DC voltage on pin 2 with the ignition turned on.
Replace evaporator temperature regulator, if actual value is not within these tolerances.

b) Evaporator Temperature Regulation:

Requirements: Battery fully charged, air conditioner charged, engine temperature ≤ 110° C (230° F) (switch function).
Important! Testing instructions in this test plan refer to the "BMW service tester" and indicate the multimeter functions (M).
See operating instructions of the BMW service tester for connections.
Explanations: PP = Test Position
1) = See Specifications

PP1

Check activation of clutch: —— no → Check power supply of clutch:
Turn temperature control wheel to left final stop.
Turn on ignition.
Press A/C switch button.
The switching of the electromagnetic clutch of the compressor will be heard (loud click).
Clutch activated?

PP 2

Check power supply of clutch: —— no → Check power supply of evaporator temperature regulator:
Connect voltmeter (M 01) between connection 5 on connected plug of evaporator temperature regulator and ground.
Turn temperature control wheel to left final stop.
Turn on ignition.
Press A/C switch button.
Voltmeter must display battery voltage.
Voltage value okay?

yes ↓

Check ground wire from A/C compressor.

yes ↓

Check clutch, replacing if necessary.

PP 3

Check power supply of evaporator temperature regulator: —— no → Check wire for connection 4 (power supply) and wire for connection 1 (ground) for breaks.
Pull off plug on evaporator temperature regulator.
Connect voltmeter (M 01) between connections 4 and 1
Turn temperature control wheel to left final stop.
Turn on ignition.
Press A/C switch button.
Voltmeter must display battery voltage.
Voltage value okay?

yes ↓

Check evaporator temperature sensor: —— no → Pull off plug on evaporator temperature sensor.
Pull off plug on evaporator temperature regulator.
Connect ohmmeter (M 06) between connection 6 and ground.
Resistance 1).
Resistance value okay?

PP 4

Check wire for connection 4 (power supply) and wire for connection 1 (ground) for breaks.
Wires okay? —— no → Repair wire.

Pull off plug on evaporator temperature sensor.
Check wire for breaks.
Wire okay? —— no → Repair wire.

yes ↓

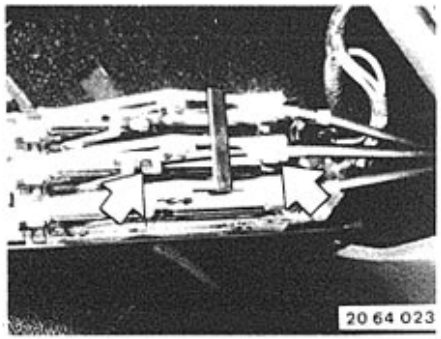
Replace evaporator temperature sensor.
Repeat test PP1.
Clutch activated?

no ↓

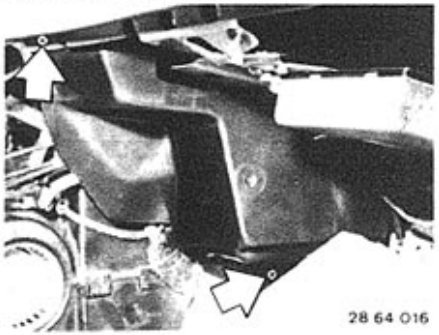
Replace heating regulator (control unit).

Checking in case of non-uniform regulation:
Press air conditioner button.
There must be 0.7 to 8.2 DC voltage on pin 2 with the ignition turned on.
Replace evaporator temperature regulator, if actual value is not within these tolerances.

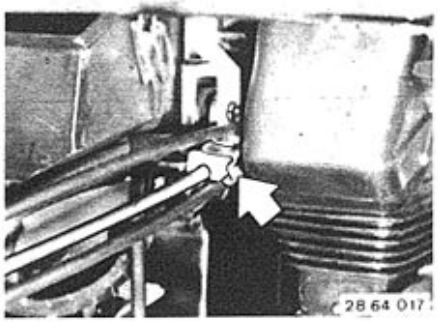
64 11 191 REPLACING FRESH AIR FLAP CABLE



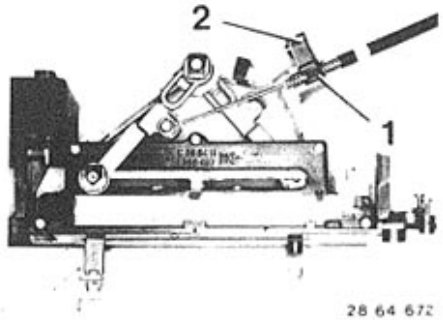
Remove and install tray 51 16 200.
Lift out clip.
Disconnect cable.



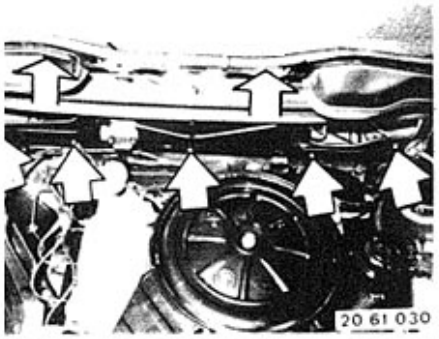
Remove cover.



Lift out clip.
Disconnect cable.

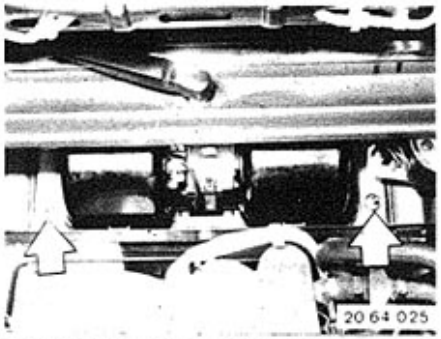


Installation:
Adjust cable.
Connect cable on sliding control lever.
Push sliding control lever against stop.
Turn ring (1) until it can be placed in opening.
Secure cable with clip (2).

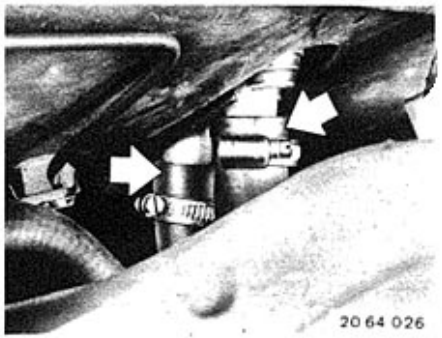


64 11 200 REMOVING AND INSTALLING HEATER HOUSING

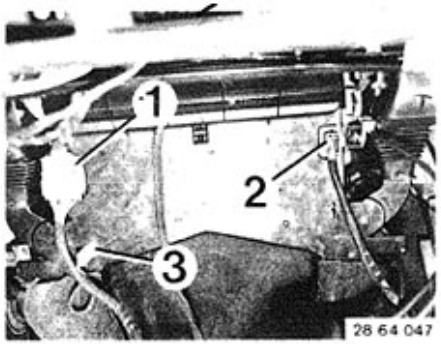
Remove evaporator assembly 64 51 200.
Pull off rubber profile (2).
Unscrew bolts.



Unscrew nuts.



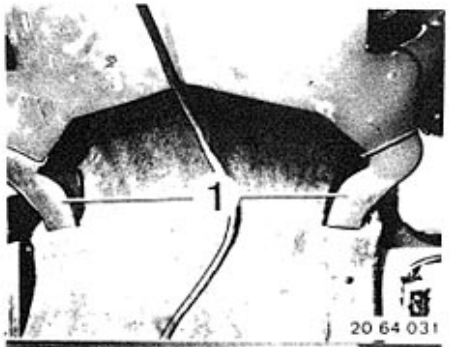
Disconnect both water hoses.
Installation:
Add coolant, see Group 17.



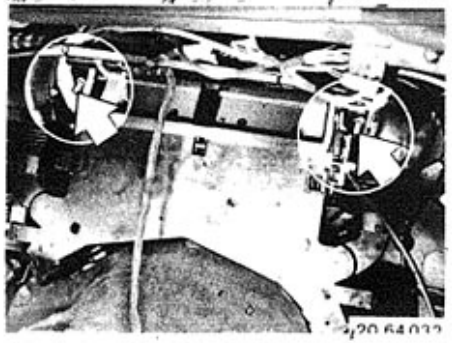
Pull off plugs (1···3).

Connections on Plug (1):
Numbers are on plug receptacle.
1 = blue
2 = green/yellow
7 = brown
8 = brown/green
9 = brown/white
10 = gray/red
11 = brown
12 = green/white
13 = green/brown

Connections on Plug (2):
Numbers are on plug receptacle.
1 = black
2 = yellow
5 = green/brown
6 = blue

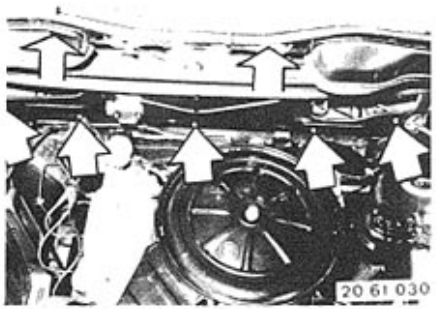


Lift out air guides (1).

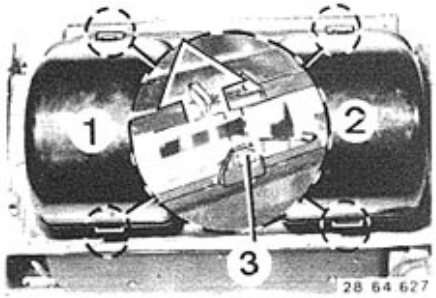


Unscrew nuts.
Remove heater.

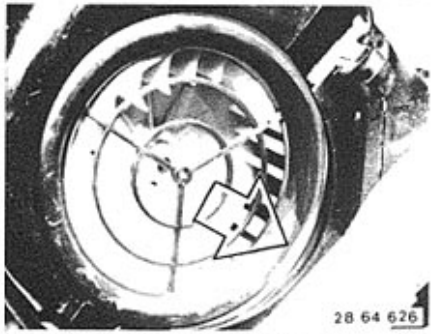
64 11 210 REMOVING AND INSTALLING HEATER MOTOR



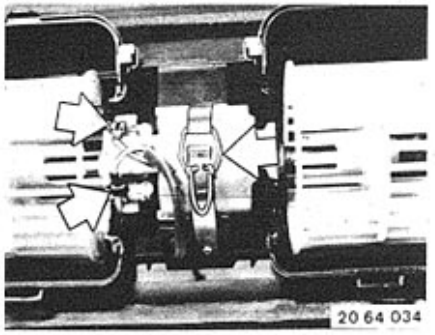
Disconnect battery ground lead.
Pull off rubber strip.
Unscrew bolts.



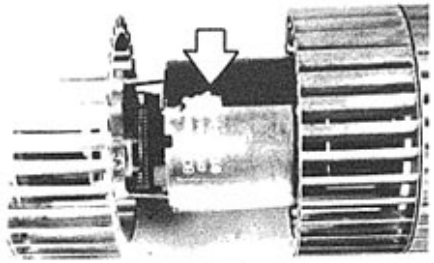
Push back retaining tabs (3) and remove blower shells (1 and 2).



Installation:
Flat surfaces on inlet cowls face body.

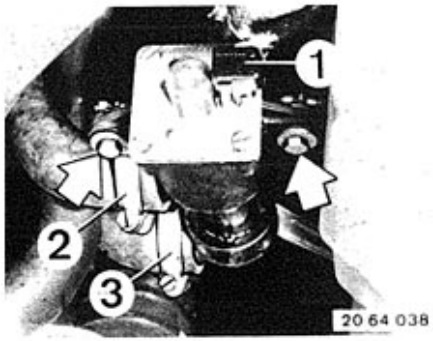


Pull off plug.
Disconnect retaining strap.
Remove motor with fan.



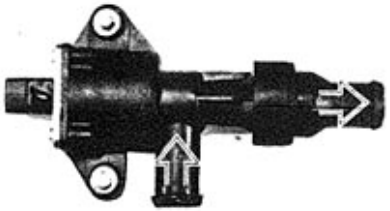
Installation:
Positioning of blower motor is given by shape of housing.
Check code number*.
Check armature axial play*.
Important!
Do not take fan off of motor shaft or turn on shaft, since motor was balanced with fan as an assembly.

* See Specifications

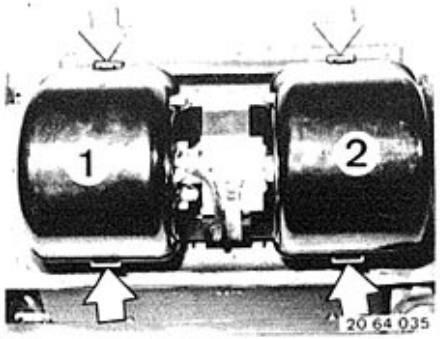


64 11 271 REPLACING WATER VALVE FOR HEATER

Pull off plug (1) on water valve.
Disconnect hoses (2 and 3).
Unscrew bolts.
Remove water valve.

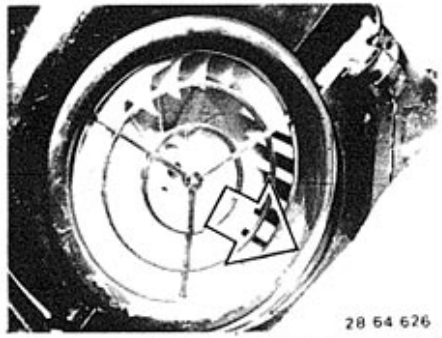


Checking Water Valve:
Water valve should be open when without voltage.
Water valve must only have flow in given direction of flow.

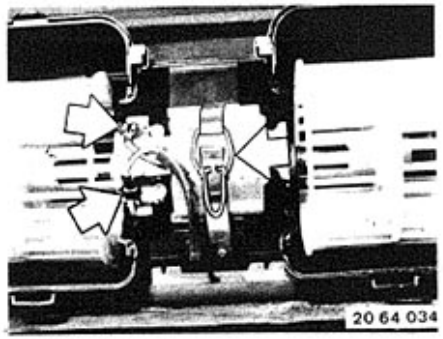


64 11 500 REMOVING AND INSTALLING HEATER MOTOR – HEATER REMOVED –

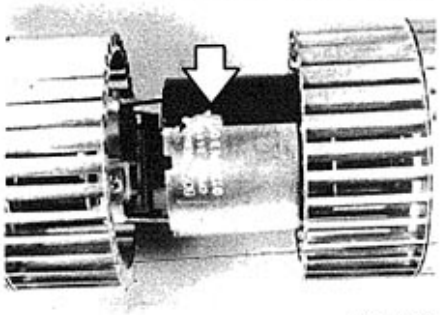
Push back retainers (3) and remove blower shells (1 and 2).



Installation:
Flat surface on inlet cowls faces body.

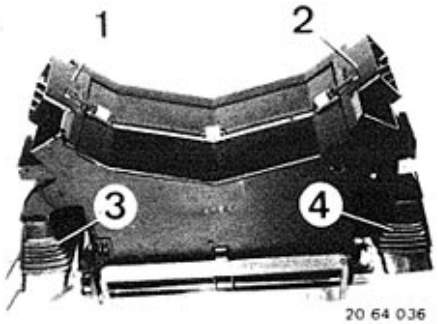


Pull off plug.
Disconnect retaining strap.
Remove motor with fan.



Installation:
Position of blower motor is given by shape of housing.
Check code number*.
Check armature axial play*.
Important!
Do not remove fans on motor shaft or turn on shaft, since motor and fans have been balanced as an assembly.

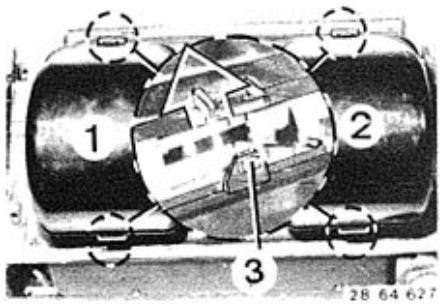
* See Specifications



20 64 036

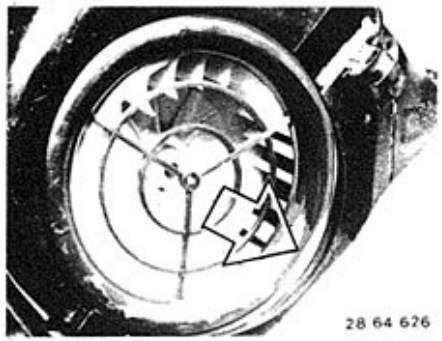
64 11 531 REPLACING HEATER CORE HEATER REMOVED

Pull off air guides (1 ··· 4).

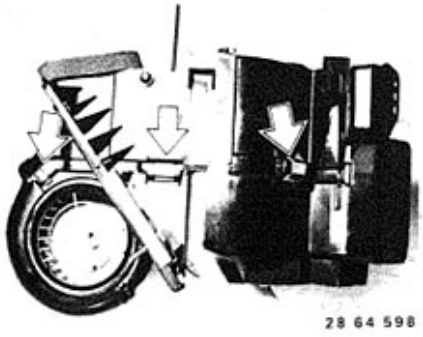


28 64 627

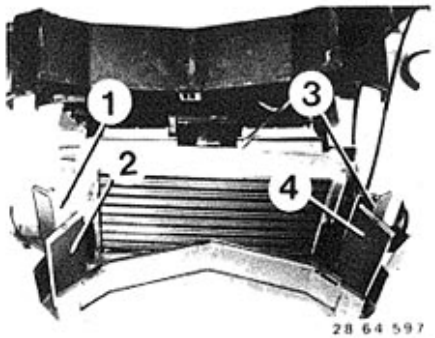
Push back retaining bar (3) and remove blower shells (1 and 2).


28 64 626

Installation:
Flat surface on inlet cowls faces body.

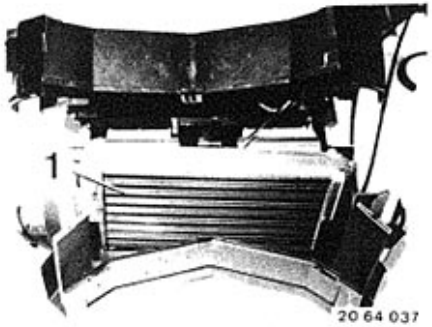

28 64 598

Lift off all retaining clips on heater housing (13 clips).
Take housing sections apart.



28 64 597

Installation:
Make sure that bearings of distributor flaps (1···4) are located in bearing bores.

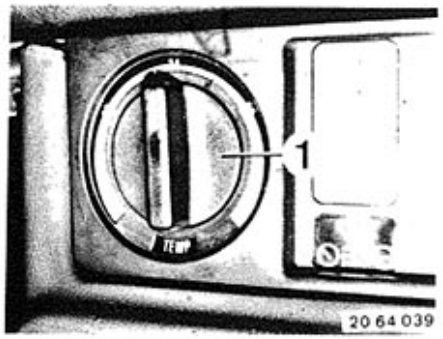


20 64 037

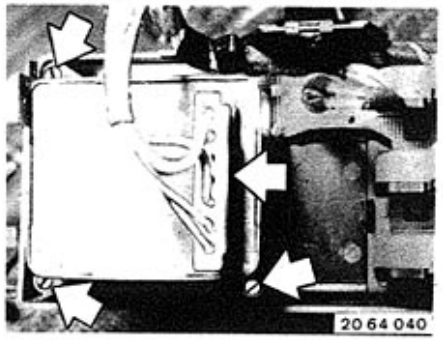
Remove heater core (1).
Installation:
Paste new foam rubber frame on heater core.

64 11 765 REMOVING AND INSTALLING CONTROL UNIT FOR TEMPERATURE REGULATION

Disconnect battery ground lead.
Remove and install instrument panel trim at bottom left 51 45 180.
Remove and install tray 51 16 200.



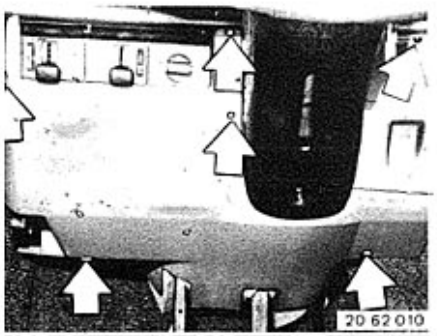
Pull off control knob (1).



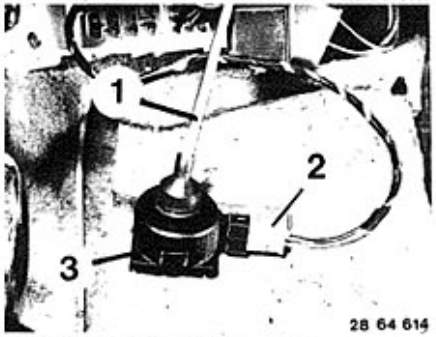
Pull off plugs.
Unscrew bolts.

Connections of Multiple Pin Plug:
Numbers are located on back of plug receptacle.
1 = brown/green
2 = green/white
3 = brown
4 = green/yellow
5 = blue/yellow
6 = blue
7 = blue/white

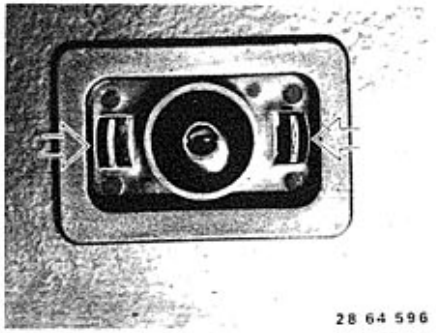
64 11 938 REPLACING TEMPERATURE SENSOR FOR PASSENGER COMPARTMENT



Disconnect battery ground lead.
Unscrew bolts.
Place trim panel in footwell.

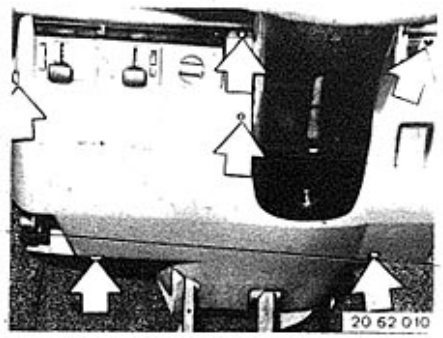


Pull off vacuum hose (1) and plug (2) on temperature sensor.

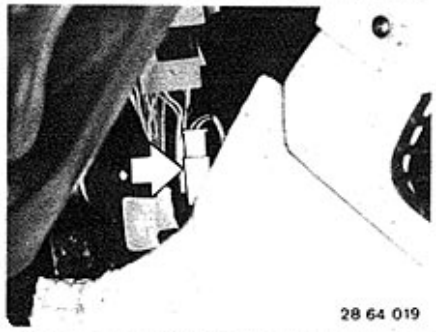


Squeeze clamps and pull back temperature sensor out of mask.
Check code number*.

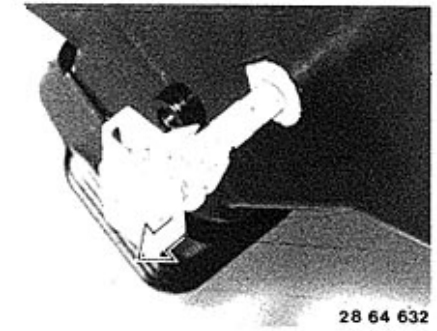
64 11 939 REPLACING TEMPERATURE SENSOR FOR HEATER



Disconnect battery ground lead.
Unscrew bolts.
Place trim panel in footwell.



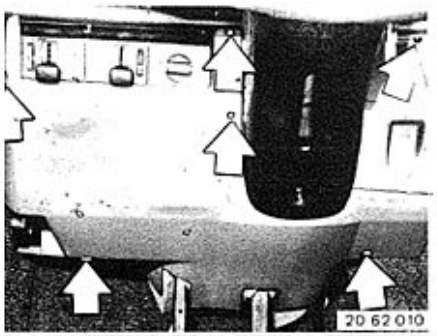
Pulf off plug on temperature sensor.



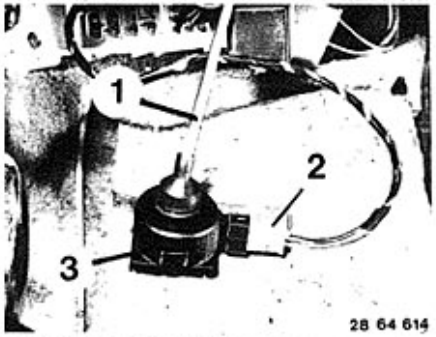
Pull temperature sensor out of housing.
Note:
Temperature sensor clamps fit tight in heater housing.

* See Specifications

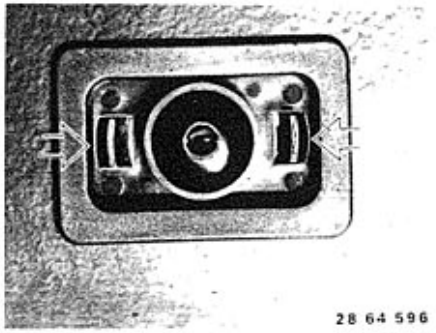
64 11 938 REPLACING TEMPERATURE SENSOR FOR PASSENGER COMPARTMENT



Disconnect battery ground lead.
Unscrew bolts.
Place trim panel in footwell.

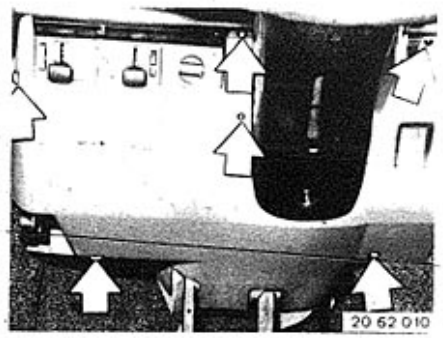


Pull off vacuum hose (1) and plug (2) on temperature sensor.

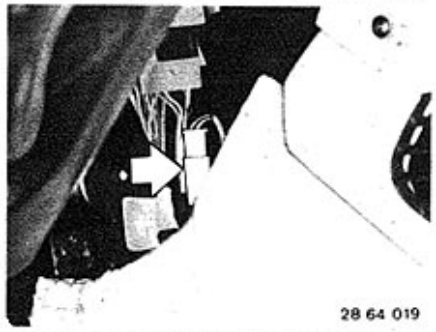


Squeeze clamps and pull back temperature sensor out of mask.
Check code number*.

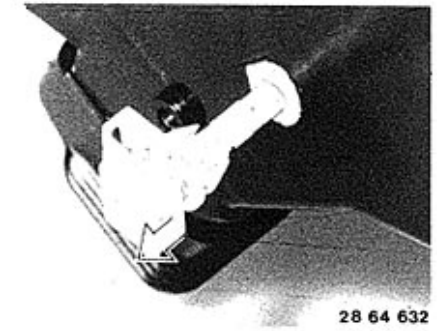
64 11 939 REPLACING TEMPERATURE SENSOR FOR HEATER



Disconnect battery ground lead.
Unscrew bolts.
Place trim panel in footwell.

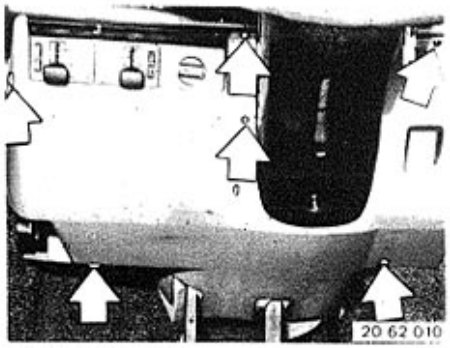


Pulf off plug on temperature sensor.



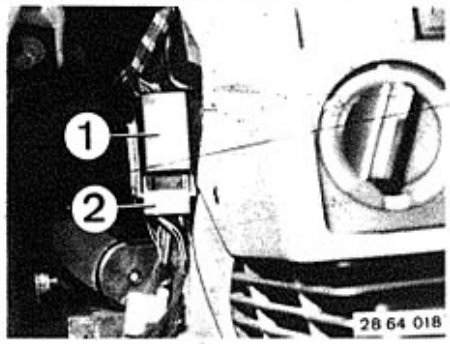
Pull temperature sensor out of housing.
Note:
Temperature sensor clamps fit tight in heater housing.

* See Specifications



64 50 REMOVING AND INSTALLING EVAPORATOR TEMPERATURE REGULATOR

Disconnect battery ground lead.
Unscrew bolts.
Place trim panel in footwell.



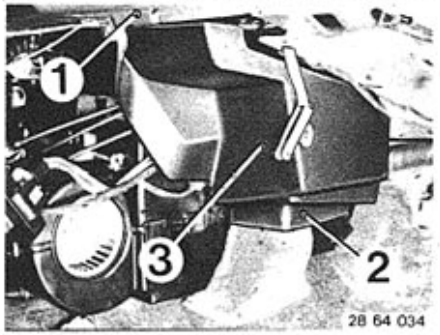
Pull evaporator temperature regulator (1) off of plug (2).

Connections of Multiple Pin Plug:
Numbers are located on back of plug receptacle.
1 = brown
3 = blue/yellow
4 = green/yellow
5 = black
6 = white

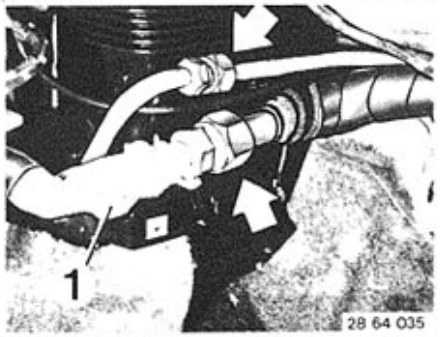


64 51 020 REMOVING AND INSTALLING EVAPORATOR HOUSING ASSEMBLY

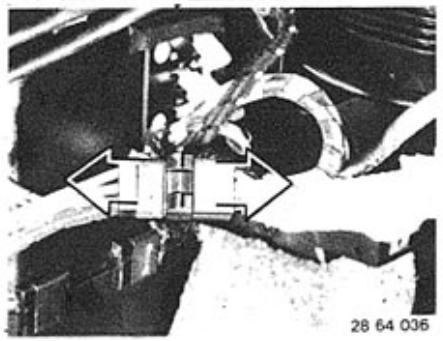
Disconnect battery ground lead.
Remove and install instrument panel trim at bottom left 51 45 180.
Remove and install tray 51 16 200.
Discharge pressure in air conditioner with a valve core remover.
Installation:
Discharge, charge and check air conditioner for leaks after installing evaporator housing.



Unscrew bolts (1 and 2) and take off trim panel (3).*

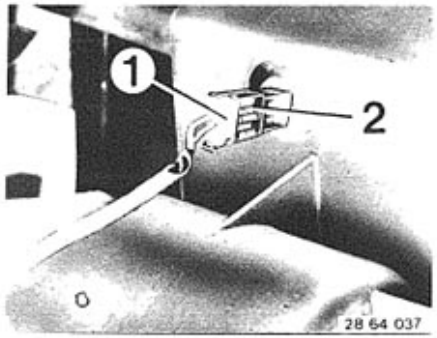


Remove insulation (1).
Disconnect pipes.
Inert plugs in open connections immediately.
Installation:
Coat threads with refrigerating machine oil.
Replace gaskets.
Tightening torque*
Check connections of charged system for leaks.

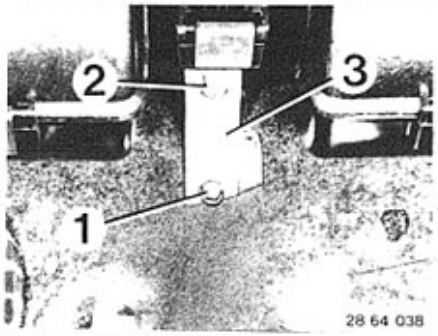


Disconnect plug.
Connections of Multiple Pin Plug:
Numbers are located on back of plug receptacle.
1 = gray
2 = violet
3 = white
4 = green/yellow
5 = brown
6 = –

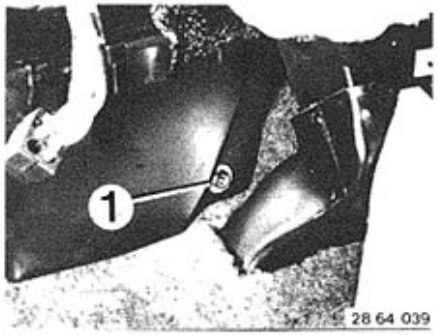
* See Specifications



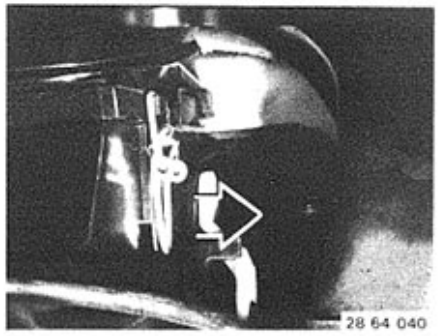
Pull off plug on temperature sensor.



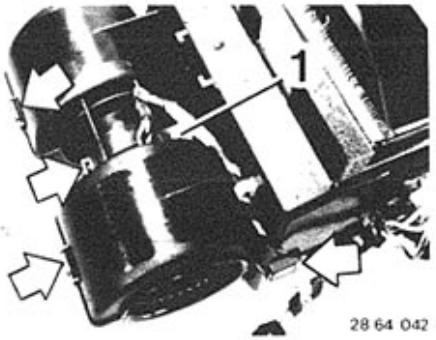
Unscrew bolts (1 and 2).
Remove bracket (3).



Unscrew bolts (1) on left and right sides.

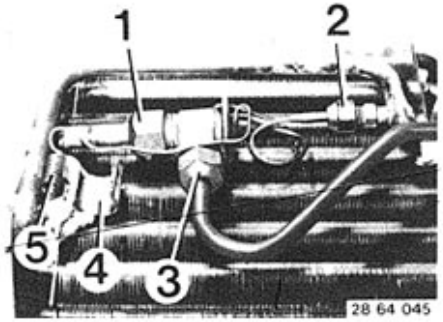


Open left and right fasteners.
Remove evaporator housing.



64 51 050 REMOVING AND INSTALLING EXPANSION VALVE

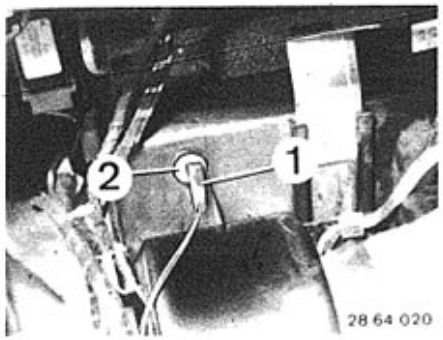
Remove evaporator housing 64 51 020.
Lift out clips (seven).
Unscrew bolt (1).
Cut off plastic rivet.



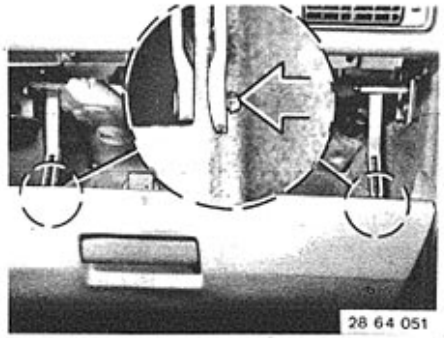
Take off upper housing section with blower motor.
Pull evaporator out of housing.
Disconnect hoses (1 ··· 3).
Insert plugs in open connections immediately.
Remove sealing compound and disconnect clamp (4).
Installation:
Secure coil (5) on pipe with clamp (4) and insulate against ambient temperature with insulating compound.

64 51 ... REMOVING AND INSTALLING EVAPORATOR TEMPERATURE SENSOR

Disconnect battery ground lead.
Remove and install instrument panel trim at bottom left 51 45 180.
Remove and install tray 51 16 200.

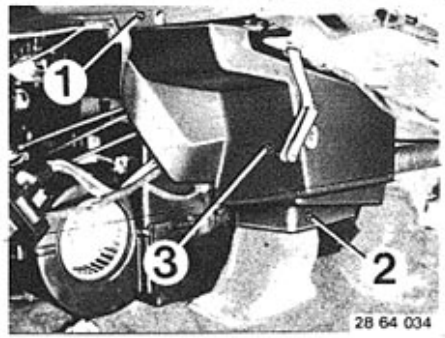


Pull off plug (1).
Pull out evaporator temperature sensor (2).


28 64 051

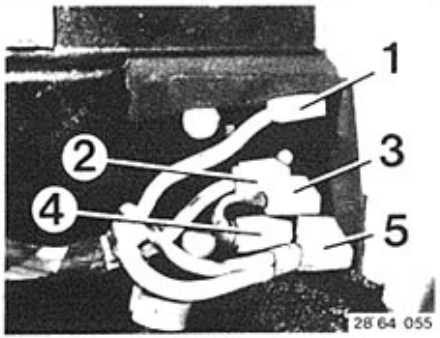
64 51 . . . REMOVING AND INSTALLING RESISTOR PLATE ON EVAPORATOR HOUSING

Open glove box.
Disconnect pins of both retaining straps.



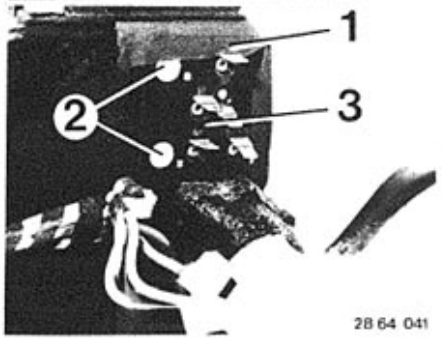
28 64 034

Unscrew bolts (1 and 2) and remove trim panel (3).



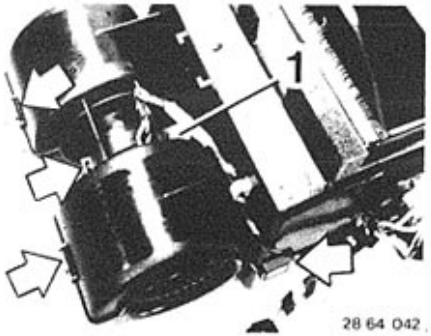
28 64 055

Pull off plug.
Installation:
Plug Connections of Resistor Plate:
1 = violet
2 = gray
3 = brown
4 = brown
5 = brown/black and white



28 64 041

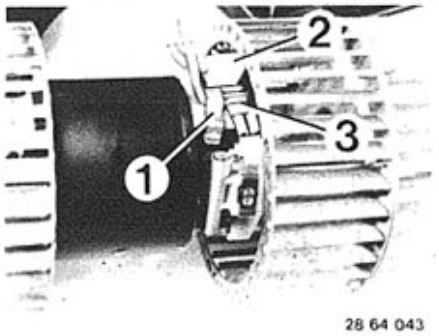
Pull off insulating tape (1).
Cut off rivets (2).
Remove resistor plate (3).



28 64 042

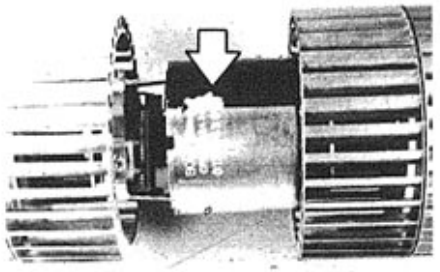
64 51 550 REMOVING AND INSTALLING BLOWER OF EVAPORATOR HOUSING

Remove evaporator housing 64 51 020.
Lift out seven clips.
Unscrew bolt (1).



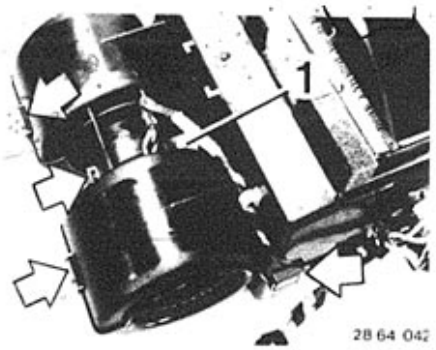
28 64 043

Remove upper housing section with blower.
Lift off clip (1).
Pull off plugs (2 and 3).
Remove blower motor.


28 64 052

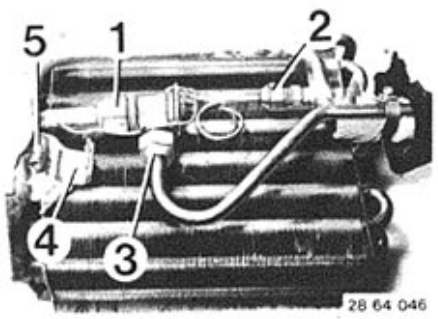
Installation:
Check code number*.
Check armature axial play*.
Important!
Do not turn or remove fan on motor shaft, since motor was balanced together with fan.

* See Specifications

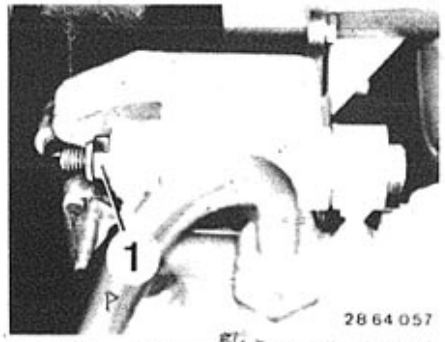


64 51 500 REMOVING AND INSTALLING EVAPORATOR

Remove evaporator housing 64 51 020.
Lift out seven clips.
Unscrew bolt (1).
Cut off plastic rivet.
Replace rivet.

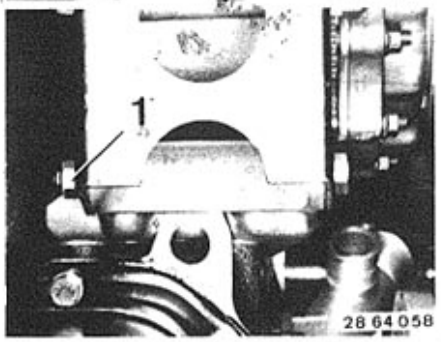


Remove upper housing section with blower.
Pull evaporator with expansion valve out of housing.
Unscrew bolts (1 and 2).
Disconnect hose (3).
Insert plugs in open line connections immediately.
Remove insulation and disconnect clamp (4).
Installation:
Secure coil (5) on pipe with clamp (4) and protect against ambient temperature with insulating compound.

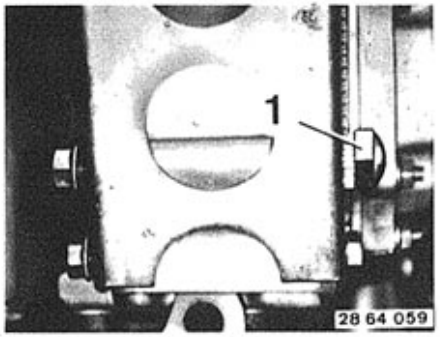


64 52 009 TIGHTENING DRIVE BELT FOR COMPRESSOR

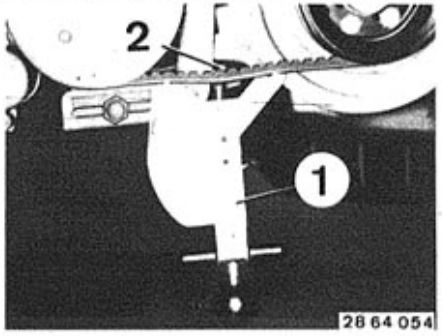
Loosen nut (1).



Loosen nut (1).



Tighten drive belt with tensioning element (1).

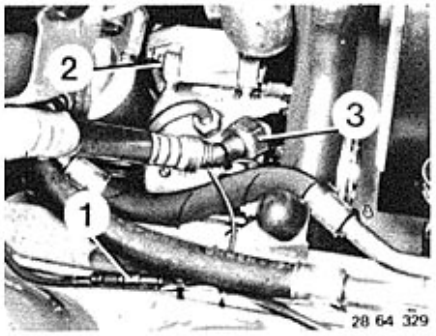


Check drive belt tightness with tester (1) and correct, if necessary.
Note:
Pulling hook must rest on tip of tooth.
Tighten all nuts again after tightening drive belt.

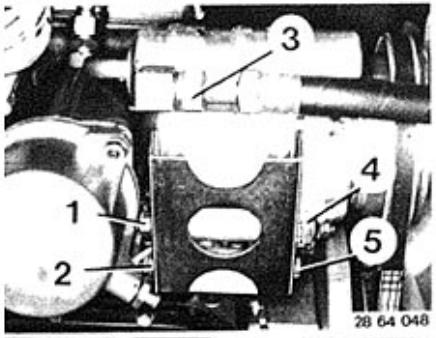


64 52 020 REMOVING AND INSTALLING COMPRESSOR

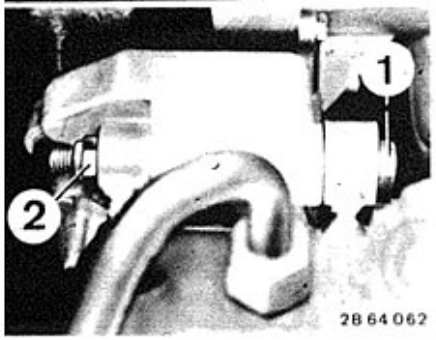
BMW 528 e:
Discharge air conditioner with help of a valve core remover.
Installation:
Discharge, charge and check air conditioner for leaks after installation of compressor.



Remove air cleaner.
Disconnect plug (1).
Unscrew nut (2).
Disconnect hose (3).
Insert plugs in open connections immediately.
Installation:
Tightening torque*.
Replace seal.

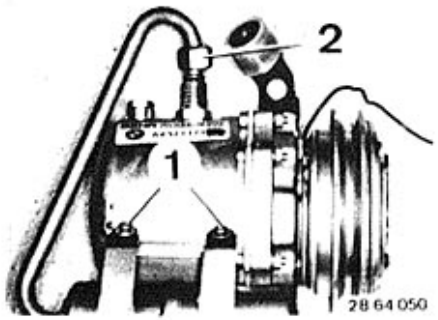


Unscrew nuts (1 and 2).
Disconnect hose (3).
Insert plugs in open connections immediately.
Remove bolts (4 and 5).
Installation:
Tightening torque*.
Replace seal.

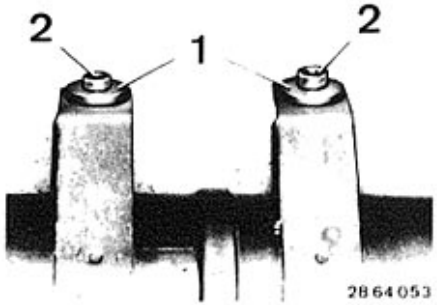


Remove bolt (1).
Take off compressor.

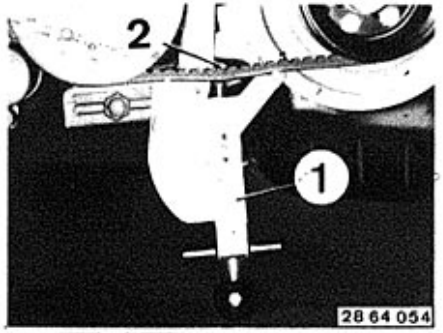
* See Specifications



Unscrew bolts (1).
Unscrew nut (2) and take off stabilizer.
Installation:
Tightening torque*.
Replace seal.



Installation:
Check rubber mount (1), replacing if necessary.
Don't forget spacers (2).



Installation:
Check drive belt tightness with tester (1).
Note:
Pulling hook must always rest on tip of tooth.

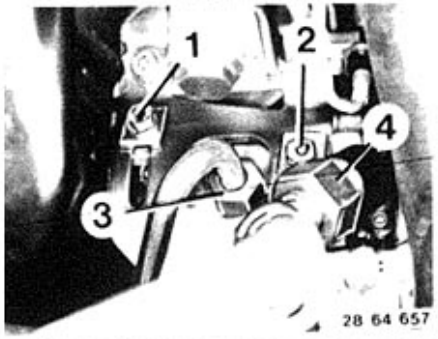


Note:
Replace compressor oil.
Unscrew bolt (1).
Drain oil in compressor.
Oil volume*.
Oil grade*

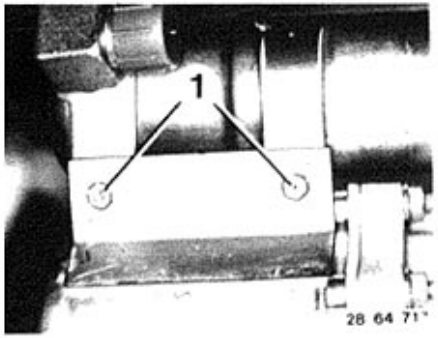
* See Specifications



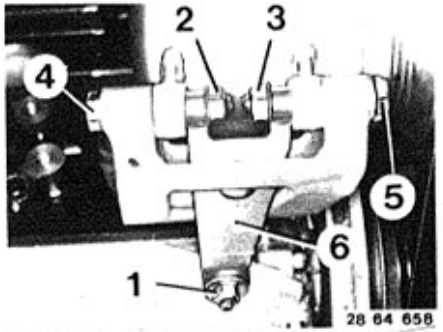
BMW 533 i:
Discharge air conditioner with help of a valve core remover.
Installation:
Discharge, charge and check air conditioner for leaks after installing compressor.



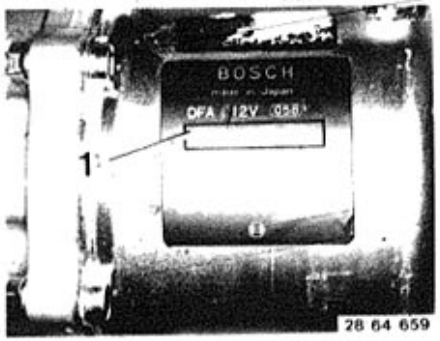
Disconnect plug for magnetic coupling of pulley.
Unscrew bolts (1 and 2).
Unscrew lines (3 and 4).
Insert plugs in open connections immediately.
Installation:
Replace seals.
Tightening torque*.



Unscrew bolt (1).
Remove stabilizer on compressor.



Remove splash guard.
Unscrew nuts (1 — 3).
Unscrew bolts (4 and 5).
Remove brace (6).
Take off compressor.



Installation:
Check code number (1)*.
Tightening torque*.
Check drive belt tightness.



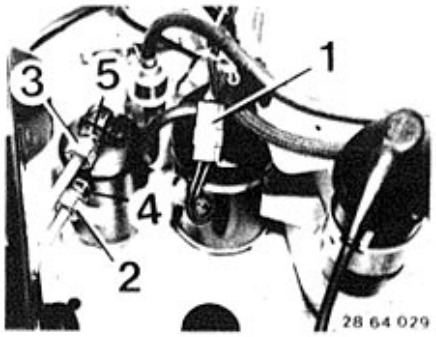
Changing Compressor Oil:
Unscrew bolt (1).
Let oil run out of compressor.
Pour in new oil — oil volume and oil grade*

* See Specifications

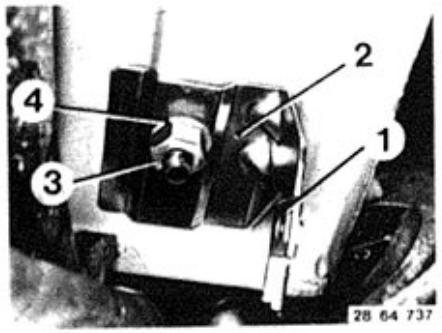


64 53 010 REMOVING AND INSTALLING DRIER

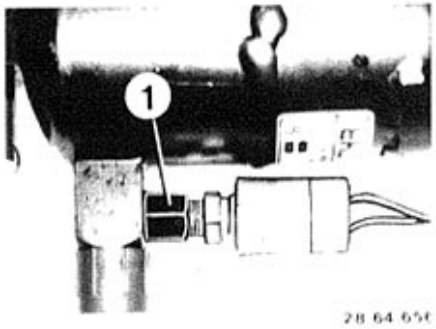
Discharge air conditioner with help of a valve core remover.
Installation:
Discharge, charge and check air conditioner for leaks after installation of drier.



Disconnect plug (1).
Unscrew connections (2 and 3), while holding on hexagons (4 and 5).
Insert plugs in open connections immediately.
Installation:
Replace gaskets.
Coat threads with refrigerating machine oil.
Tightening torque*.



Unscrew nut (3).
Installation:
Tightening torque*.
1 = Nut
2 = Holder
3 = Washer

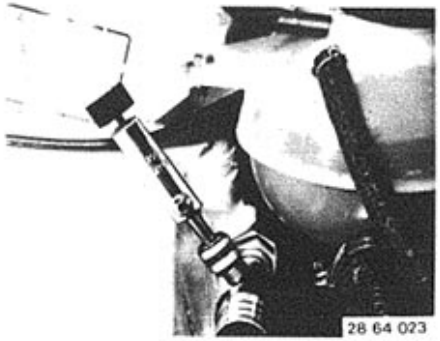


Unscrew safety switch on drier.
Hold on hexagon (1).
Installation:
Screw in safety switch with a bolt cement, HWB No. 81 22 9 407 144.
Tightening torque*

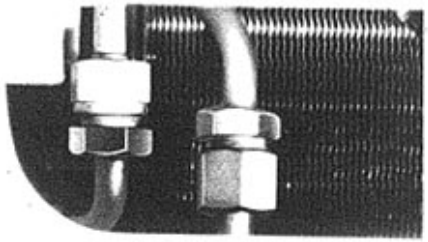
* See Specifications

* See Specifications

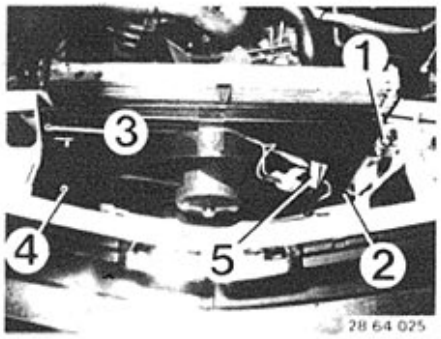
64 53 050 REMOVING AND INSTALLING CONDENSER


28 64 023

Discharge air conditioner with help of a valve core remover.
Installation:
Discharge, charge and check air conditioner for leaks after installing condenser.


28 64 024

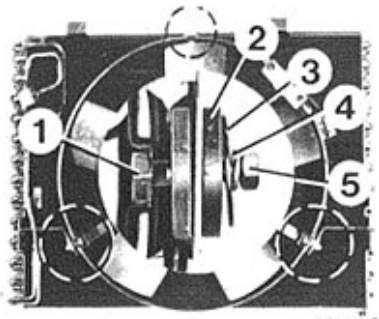
Unscrew both pipes for condenser.
Insert plugs in open connections immediately.
Installation:
Coat threads with refrigerating machine oil.
Tightening torque*.
Replace seals.



28 64 025

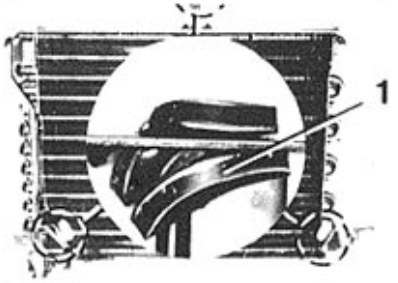
Unscrew bolts (1 ··· 4).
Disconnect plug (5).

Connections of Multiple Pin Plug:
Numbers are located on back of plug receptacle.
1 = brown
2 = red/white
3 = black



28 64 651

Unscrew bolts.
Remove auxiliary fan on condenser.
1 = Bolt
2 = Rubber mount
3 = Washer
4 = Lock washer
5 = Nut



28 64 701

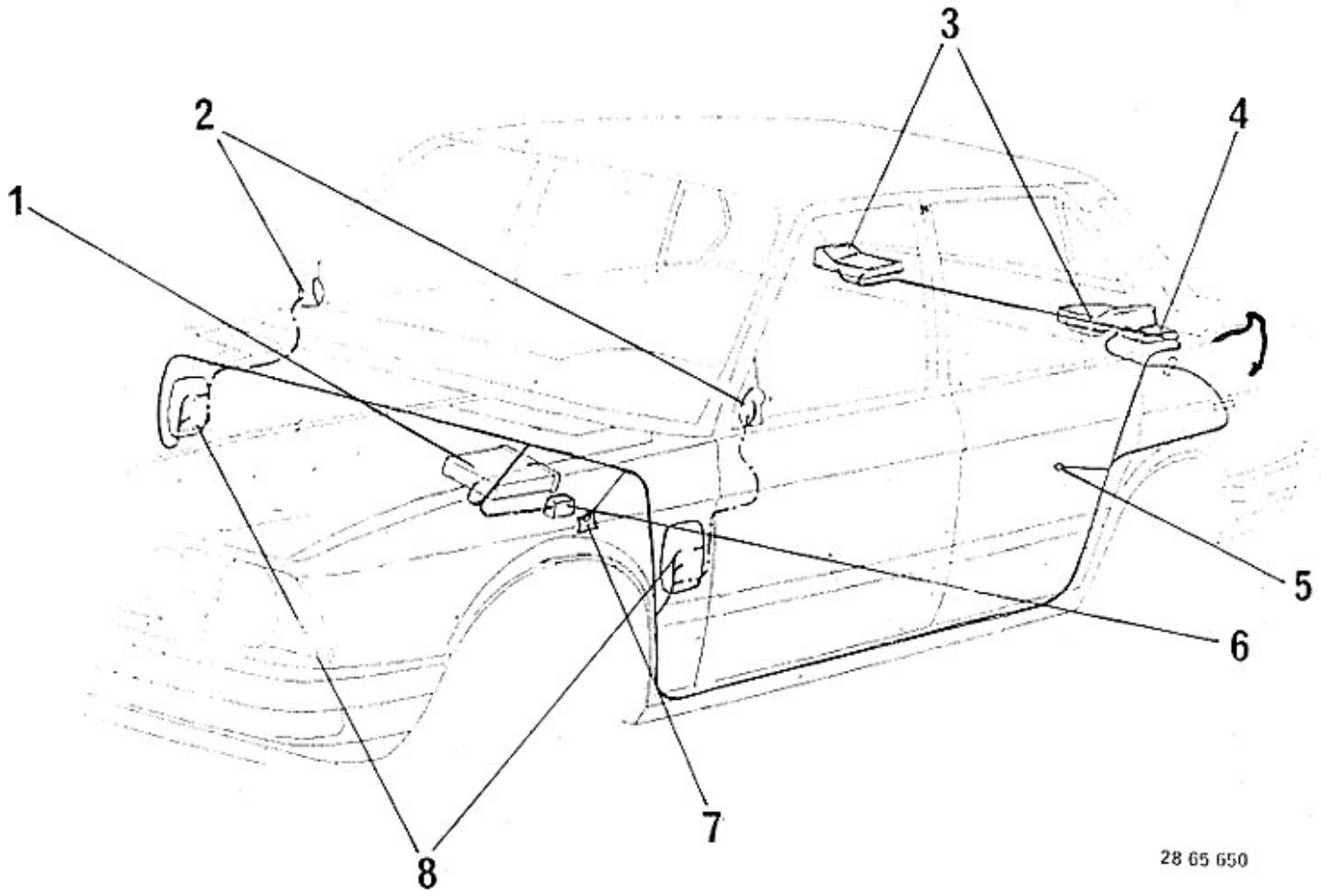
Installation:
Check rubber mount (1), replacing if necessary.

* See Specifications

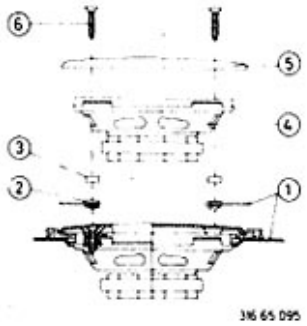
65 Radio and special equipment

65	Sound system survey	65- 27
65 12 000	Radio speakers, front – remove and install	65- 30
020	Radio speakers, rear – remove and install	65- 30
060	Radio speaker balance control – remove and install	65- 31
65 21 100	Retractable antenna – install	65- 101
101	Retractable antenna – install (rear mounted)	65- 126
65 22 005	Automatic antenna – install	65- 151
040	Automatic antenna telescope – replace	65- 191
65 31 000	Radio shielding – install	65- 250
65 71 000	Cruise control – service install	65- 301
	Cruise control – description	65- 307
	Cruise control – troubleshoot	65- 351
	Cruise control unit – remove and install	65- 371
	Cruise control operator – remove and install	65- 371
	Cruise control cable – replace	65- 372
	Cruise control switch – remove and install	65- 373
65 81 . . .	On-board computer I – troubleshoot	65- 451
	On-board computer II – troubleshoot	65- 500

SOUND SYSTEM SURVEY



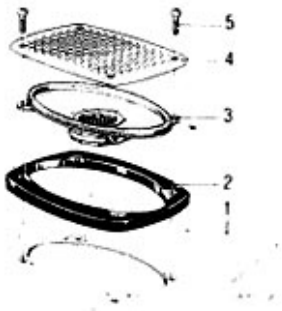
1 Radio
2 High tuner
3 Speaker, rear (incl. high tuner)
4 Amplifier
5 Ground connection
6 Fade control
7 Special equipment plug
8 Speaker, front



65 12 000 REMOVING AND INSTALLING FRONT SPEAKER

Unscrew screws.
Remove mask and speaker.
Pull off plugs.
Installation:
Install parts in correct order.
1 End plate of door beam
2 Self-tapping nut
3 Spacer
4 Speaker
5 Mask
6 Self-tapping screw

Lift out trim panel with high tuner.
Disconnect plug.

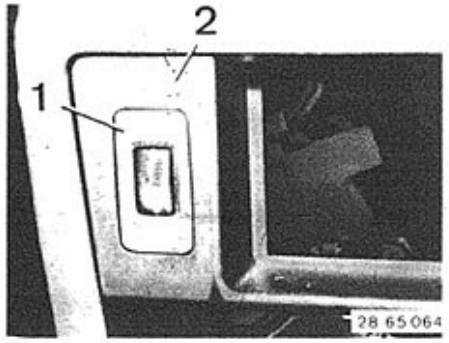


65 12 020 REMOVING AND INSTALLING REAR SPEAKER

Unscrew screws.
Remove mask and speaker.
Pull off plugs.
Installation:
Install parts in correct order.
1 Hatrack
2 Spacer
3 Speaker
4 Mask
5 Self-tapping screw

Lift out speaker plates.

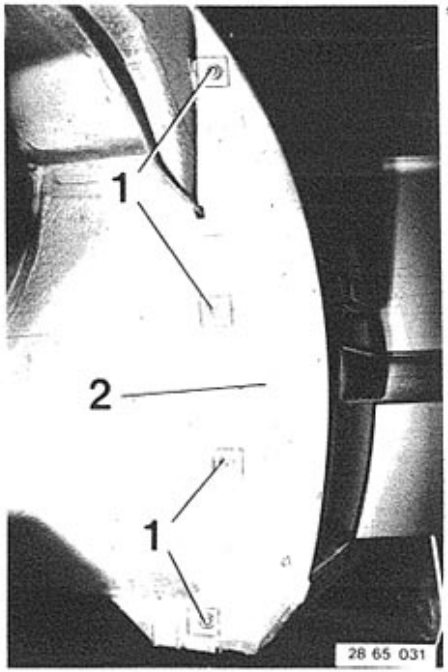
Unscrew screws.
Disconnect plug.



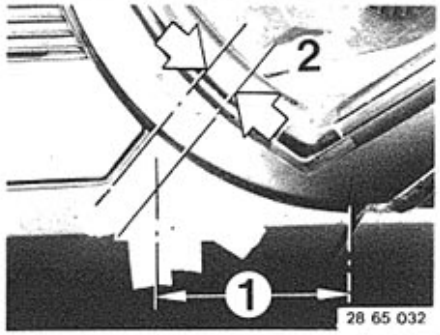
65 12 060 REMOVING AND INSTALLING SPEAKER BALANCE CONTROL

Left balance control (1) out of face plate (2) with a screwdriver.
Pull off plugs.

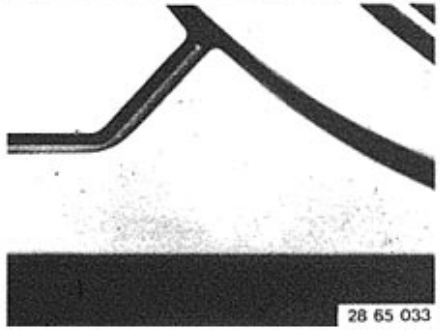
65 21 100 INSTALLING RETRACTABLE



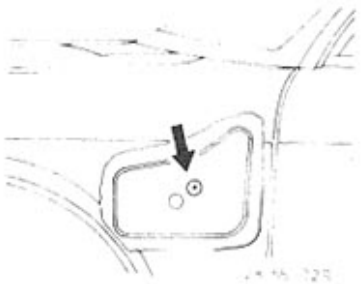
Unscrew screws (1) and take off trim (2).



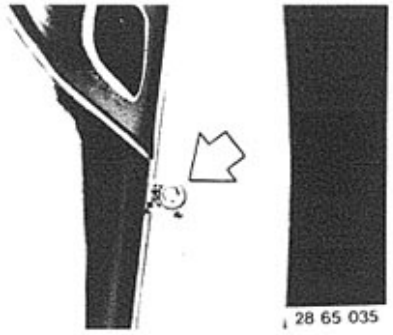
Use tape in area of hole to avoid damaging the paint finish with burrs from drilling and to provide a better method of marking hole's position.
Mark position of hole.
Distance 1 = 146 mm (5.748")
Distance 2 = 34 mm (1.339")



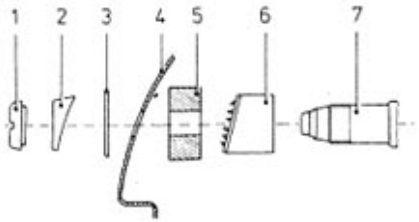
Punch mark point of intersection and drill a 22 mm (0.866") dia. hole.
Remove tape.
Deburr hole and coat edges of hole with zinc dust paint.



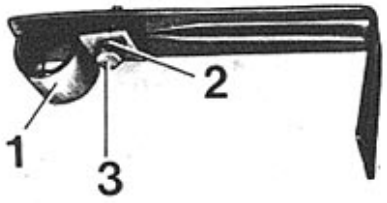
Knock out the punch marked, pre-stamped 12 mm (0.472") dia. hole.



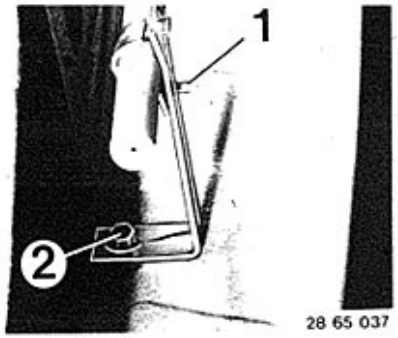
Unscrew screw.



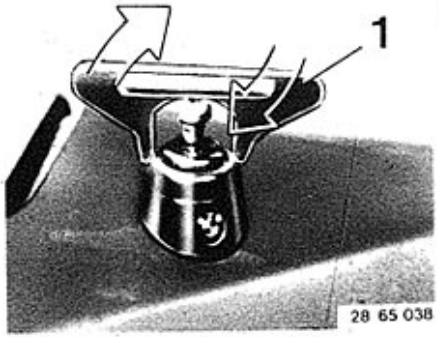
Install antenna.
Installed Order of Parts:
1 = Nut
2 = Shim
3 = Insulator
4 = Side panel
5 = Seal
6 = Brass ring
7 = Antenna



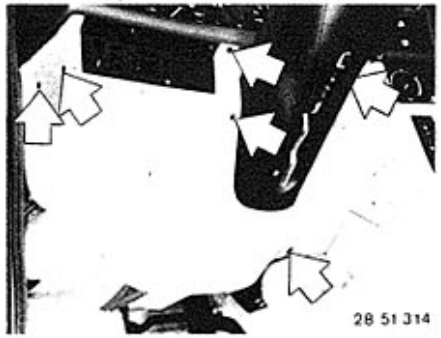
Install bracket with holder (1), lock washer (2) and bolt (3).



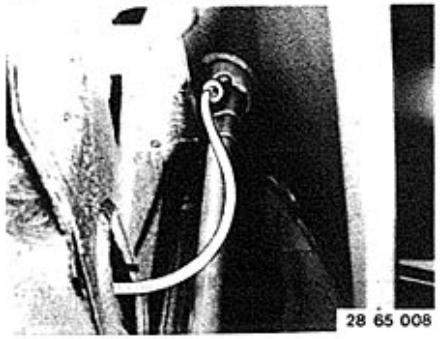
Place bracket on antenna.
Tighten bolts (1 and 2).
Watch position of antenna telescope.
Perpendicular as seen from front.
Slight inclination toward rear as seen from side.



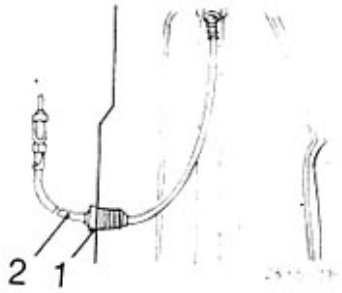
Tighten nut with wrench (1).



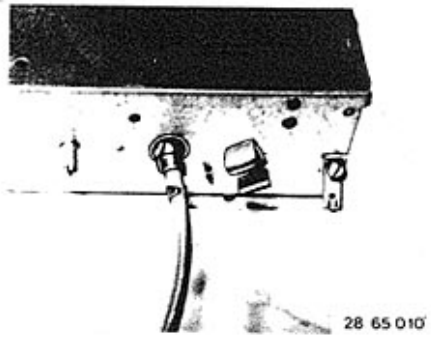
Unscrew bolts.
Place trim aside in footwell.



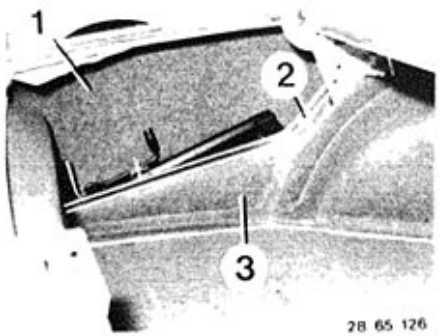
Screw antenna cable on antenna.
Route antenna cable through hole in partition wall to place of radio installation and secure with wire straps.



Locate antenna wiring (2) in hole with grommet (1).



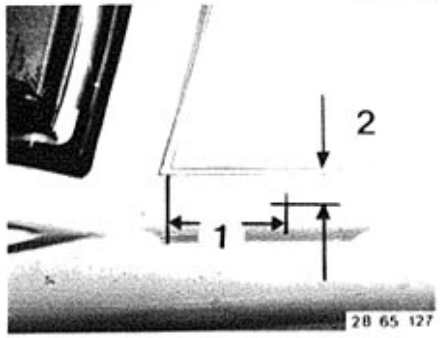
Plug antenna cable (1) in antenna jack of radio.



28 65 126

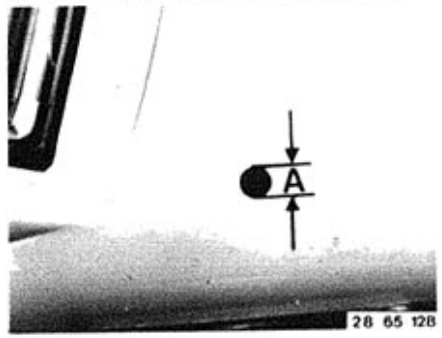
65 21 101 INSTALLING RETRACTABLE ANTENNA AT REAR OF CAR

Remove car jack and wheel bolt wrench.
Pull off side panel trim (1), edge guard (2) and trim (3).



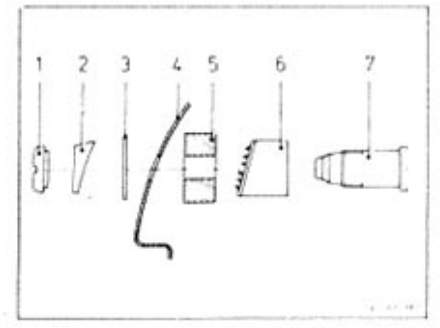
28 65 127

Use masking tape in area of hole to avoid damage on paint through burrs from drilling and to make it easier to mark location of hole.
Mark location of hole.
Distance 1 = 95 mm (3.740")
Distance 2 = 17 mm (0.669")

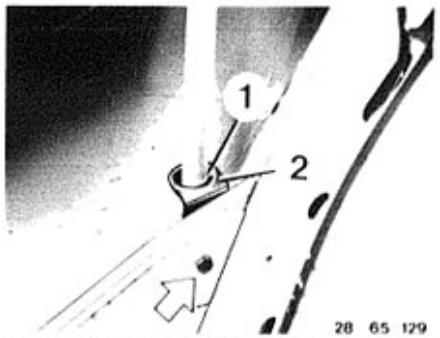


28 65 128

Center punch point of intersection and drill hole A = 22 mm (0.866") diameter.
Note:
After completion of drilling, pull off masking tape carefully in direction of hole to avoid pulling off paint on edges of hole.
Deburr and coat edges of hole with zinc dust paint.
Remove burrs from trunk floor plate – danger of rust.



Install antenna.
Install parts in correct order.
1 = Nut
2 = Adapter
3 = Insulator
4 = Rear side panel, left
5 = Seal
6 = Brass ring
7 = Antenna
Note:
Do not tighten nut (1) fully yet.

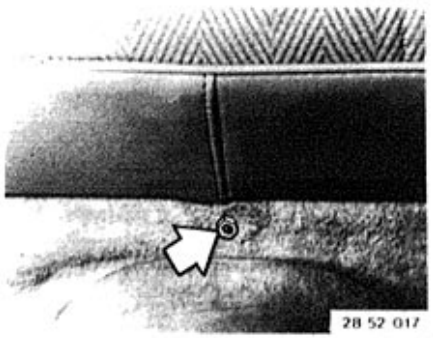


28 65 129

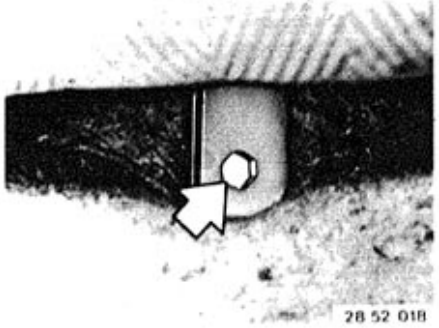
Insert rubber grommet (1) in holder (2).
Mount holder (2) with a M 6 x 16 screw.


30 65 104

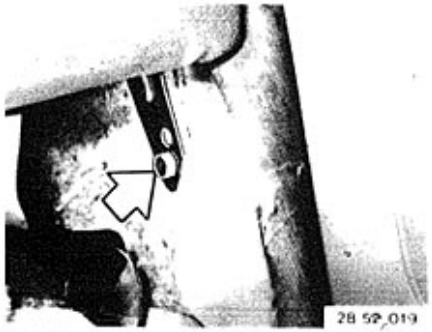
Tighten nut with supplied wrench.
Install trim in trunk again.
Cut out side panel trim in area of antenna.


28 52 017

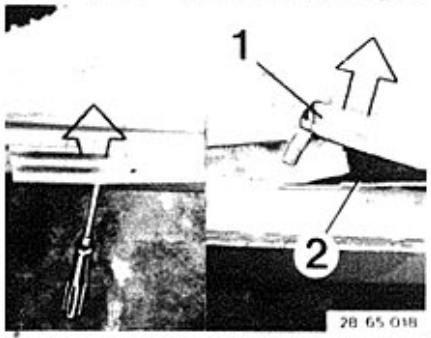
Unscrew bolt.
Lift and take rear seat cushion out of car.


28 52 018

Unscrew center backrest mounting bolt.



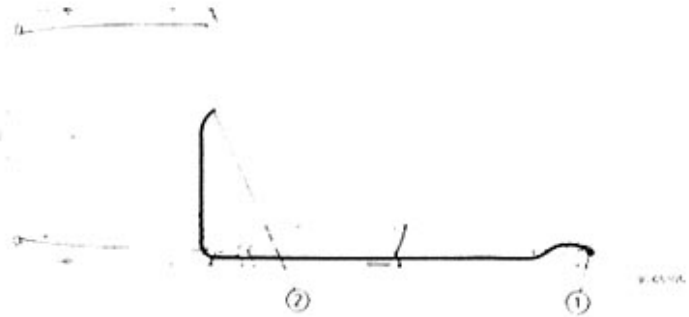
Unscrew backrest mounting bolts on left and right sides.
Push up, disconnect and take backrest out of car.



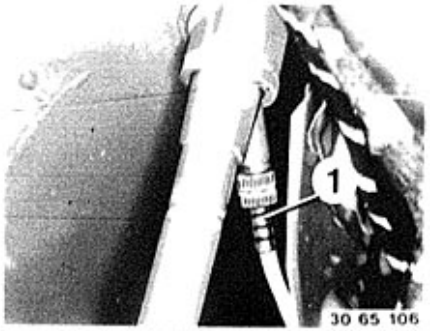
Lift out covers on left front door beam and left rear door beam with a screwdriver.
Pull off carpet (1) and insulation sheet (2) on door beams.



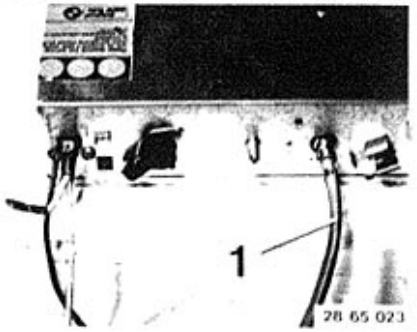
Unscrew bolts.
Place trim panel in footwell.
Wires and hose remain connected on passenger compartment temperature sensor.



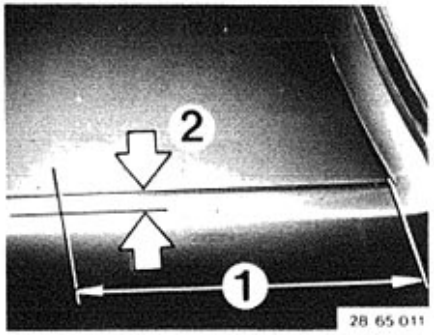
Route antenna lead from radio installation point to antenna installation point along standard wire harnesses.
Explanations of Routing Plan:
1 = Antenna
2 = Radio antenna jack



Connect antenna lead (1).
Route wire harness between trim panel and side panel.

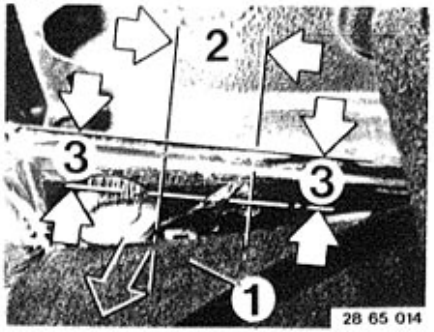


Plug antenna lead (arrow) in jack of radio.
Reinstall all removed parts.

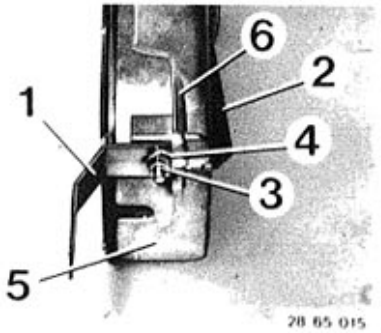


65 22 005 INSTALLING AUTOMATIC ANTENNA

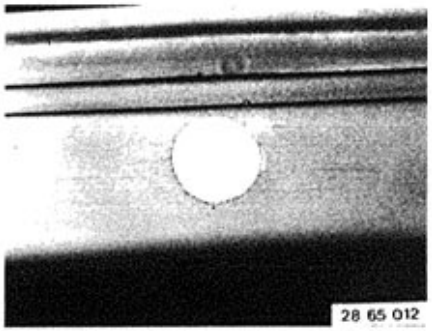
Disconnect battery ground wire.
Use tape in area of hole to avoid damaging paint finish with burrs from drilling and to provide a better method of marking the location of the hole.
Mark location of hole.
Distance 1 = 427 mm (16.811")
Distance 2 = 15 mm (0.591")



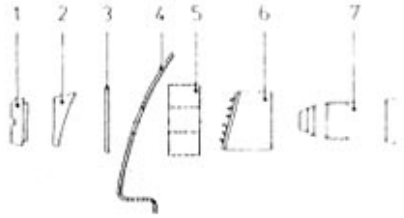
Pull off trim (1).
Mark position of and drill a 6.5 mm (0.256") dia. hole.
Coat edges of hole with zinc dust paint.
Remove burrs from floor of trunk to prevent rust
Distance 2 = 50 mm (1.968")
Distance 3 = 30 mm (1.181")



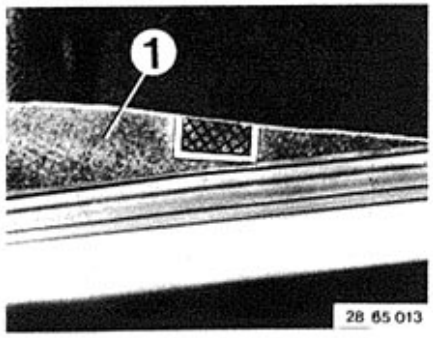
Mount bracket (1) and ground wire (2) on antenna (5) with nut (3) and lock washer (4).
Mount bracket (1) flush with cast rib (6) of automatic antenna.



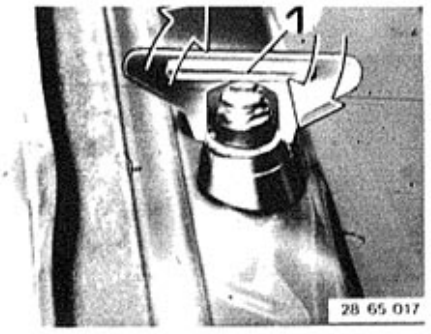
Punch mark point of intersection and drill a 22 mm (0.866") dia. hole.
Remove tape.
Deburr hole and coat edges of hole with zinc dust paint.
Remove burrs from trunk floor to prevent rust.



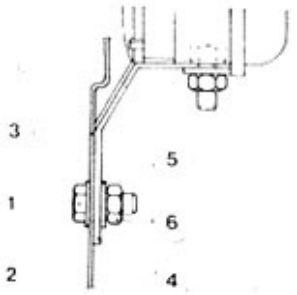
Install antenna.
Installed Order of Parts:
1 = Nut
2 = Shim
3 = Insulator
4 = Side panel, rear, right
5 = Seal
6 = Brass ring
7 = Antenna



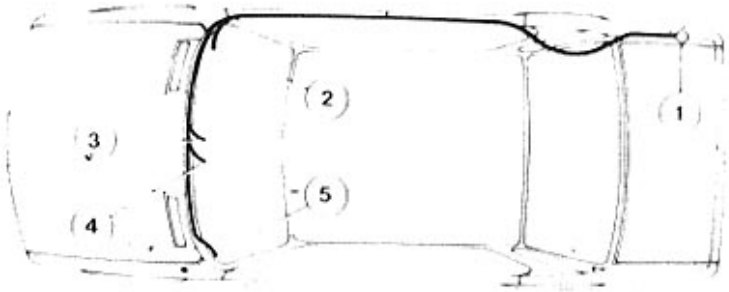
Cut out trim in area of bore.



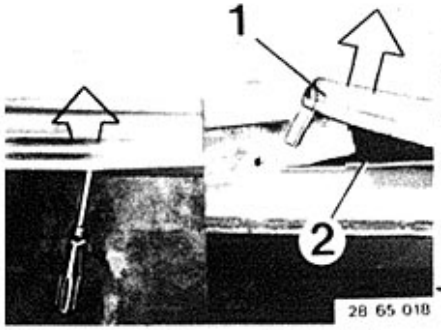
Tighten nut with wrench (1).



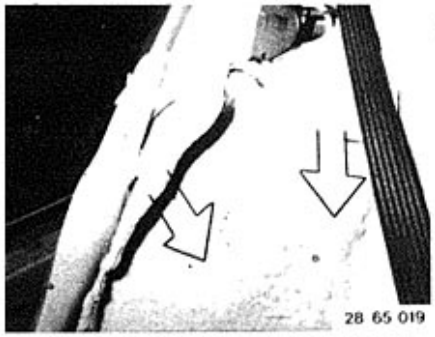
Mount antenna holder on partition wall.
1 = Screw M 6 x 16
2 = Lock washer
3 = Partition wall
4 = Antenna holder
5 = Washer
6 = Nut



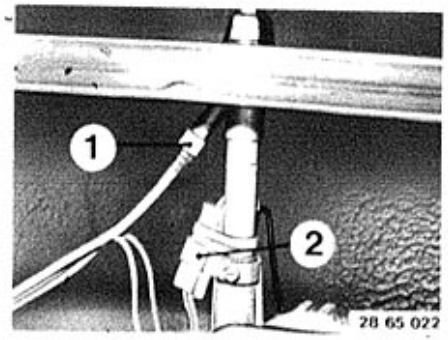
See sketch for routing of antenna wiring.
1 = Automatic antenna
2 = Extra equipment conn. for RHD (red wire)
3 = Antenna jack conn.
4 = Radio conn. (white wire)
5 = Extra equipment conn. for LHD (red wire)



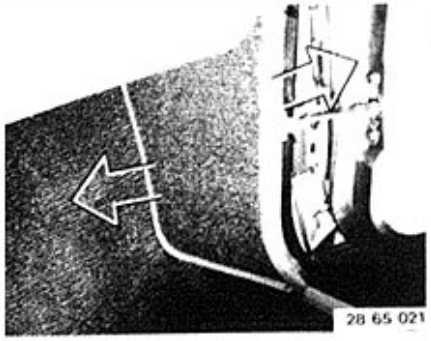
Remove rear seat cushion/backrest 52 20 000.
Lift off door sill covers on right side, front and rear.
Press carpet and insulation sheet away from door sill.



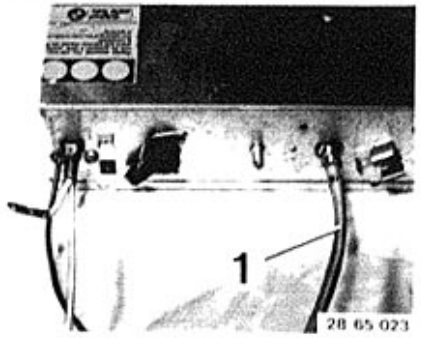
Pull insulation sheet off of wheel house.



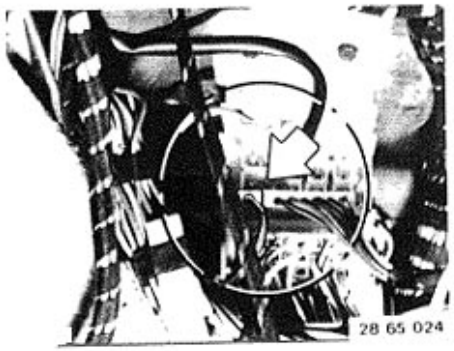
Connect antenna wire (1) and plug (2) on antenna.
Route wire harness between trim panel and side wall.



Remove footwell trim.

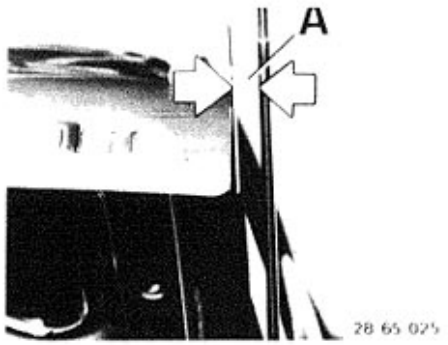


Connect white wire on "automatic antenna" connection as well as antenna wire (1) on "antenna jack".


28 65 024

Connect red wire in "SA" (optional equipment) connection.

Checking Function:
Antenna should run out when turning on the radio.
Antenna should run in when turning off the radio.
Note
Radio cannot be turned on when the ignition key is positioned at "0"

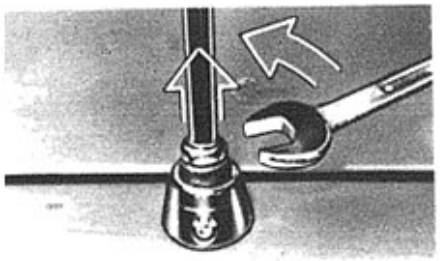


28 65 025

Check distance A = 18 mm (0.709") with the antenna run out and trunk lid raised.
Distance A can be corrected by moving antenna on the bracket.

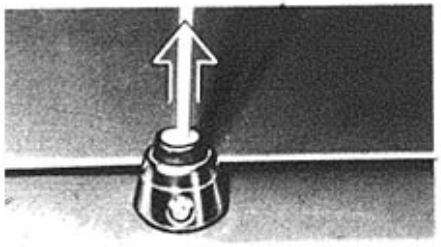
65 22 040 REPLACING TELESCOPE FOR AUTOMATIC ANTENNA

The automatic antenna remains installed in car when replacing the telescope.



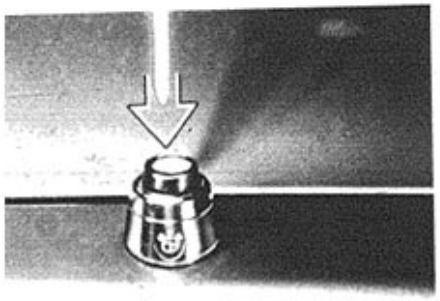
28 65 026

Turn on radio to run out the telescope as far as possible.
Unscrew threaded bush.



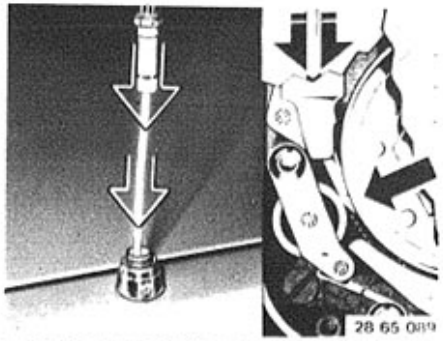
28 65 027

Remove telescope and plastic sleeve.
This could require pulling firmly, especially when, for example, a bent telescope cannot be run out fully.



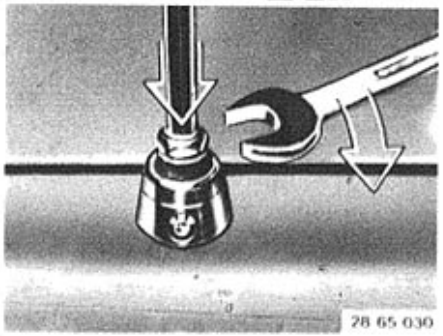
28 65 028

Push the straight, pointed plastic end of the spare telescope into the antenna adapter until resistance is felt from the pressure roller.



28 65 029

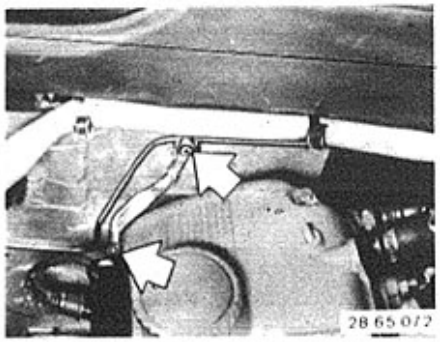
Turn off radio to run in the antenna.
Push in cable briefly until it is taken in automatically by the drive.
In so doing guide in the plastic sleeve and telescope by hand.



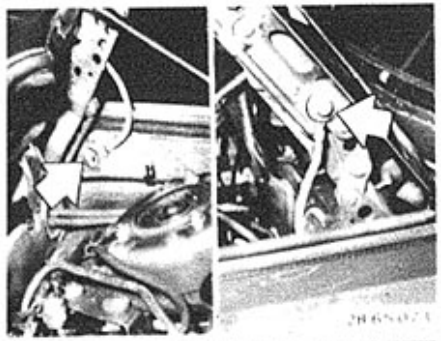
28 65 030

Screw in threaded bush tight and run telescope out and in fully several times.

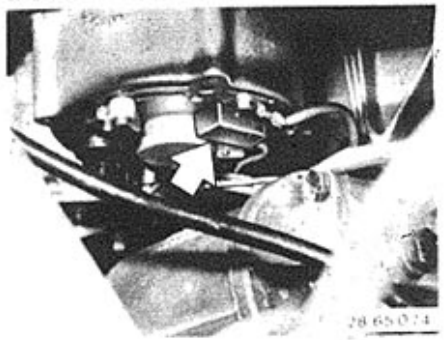
65 31 000 INSTALLING SHIELDING FOR RADIO



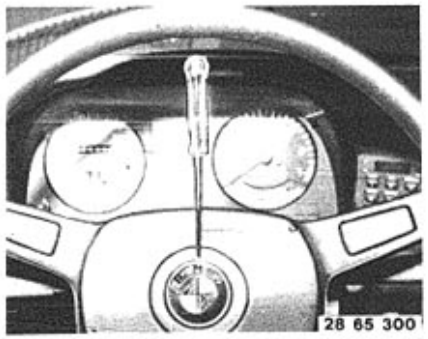
Install ground strap on cylinder head cover and brake line mounting point.



Install ground strap on wheel house and engine hood.

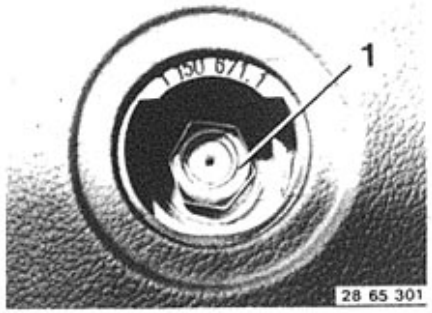


Install shielded capacitor for alternator.

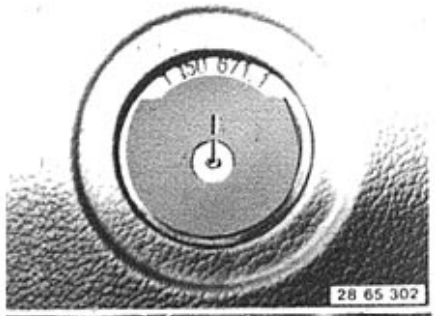


65 71 000 SERVICE INSTALLING CRUISE CONTROL

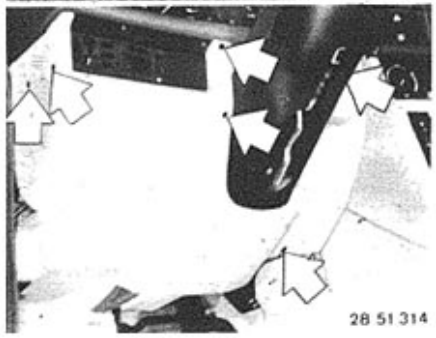
Disconnect battery ground lead.
Lift off BMW emblem carefully with a small screwdriver.



Unscrew nut.
Take off nut and corrugated washer.
Installation:
Tightening torque*.
Replace self-locking nut.

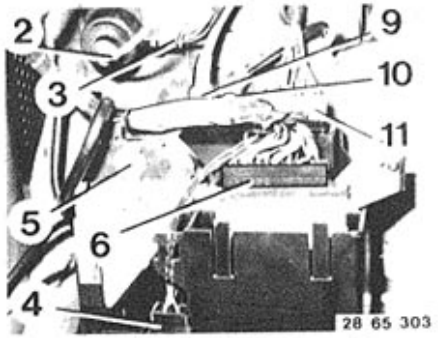


Mark, e.g. punch, position of steering wheel to steering column.[1]

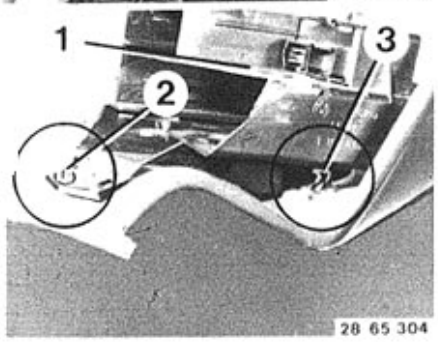


Unscrew bolts.

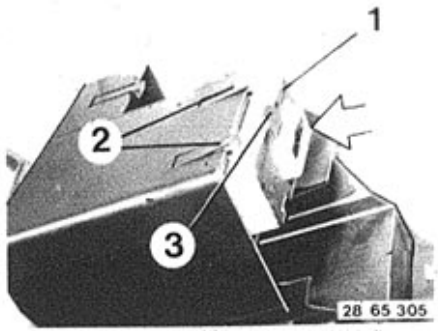
* See Specifications



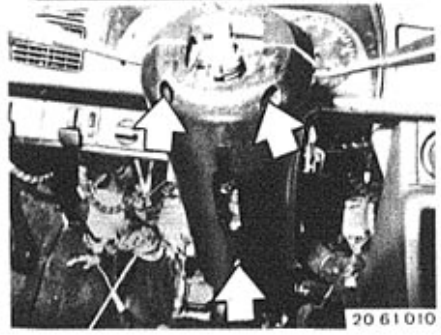
Disconnect those plugs, which are applicable.
- = Automatic cutout for electric windows
2 = Vacuum line,for passenger compartment temperature sensor
3 = Plug for passenger compartment temp. sensor
4 = Electronic gong
5 = On-board computer
6 = On-board computer
9 = Burglar alarm
10 = Burglar alarm
11 = Burglar alarm



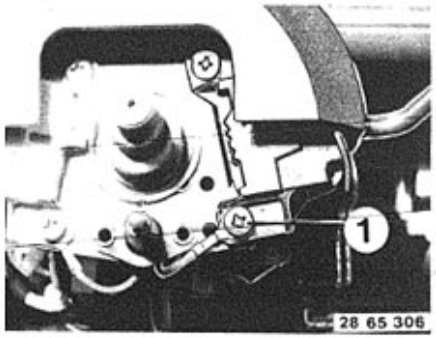
If an equipment carrier (1) has not yet been installed, mount carrier (1) on trim panel with self-tapping screw (2) and clamps (3) (left and right sides).



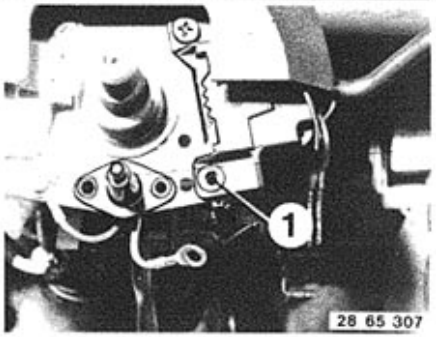
Insert control unit in slot until retaining clamps (1 and 2) engage.
Tab (3) prevents the control unit from being pushed through.



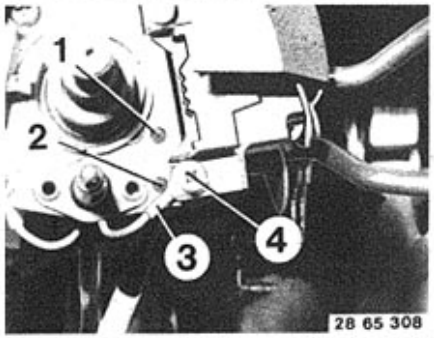
Unscrew bolts and take off steering column casing.



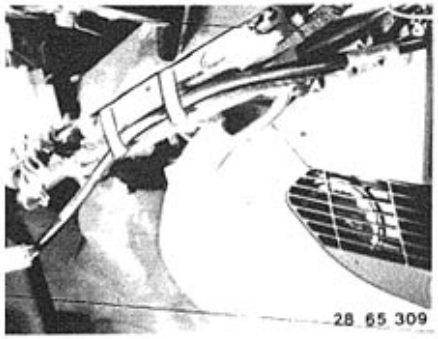
Unscrew bolt (1).



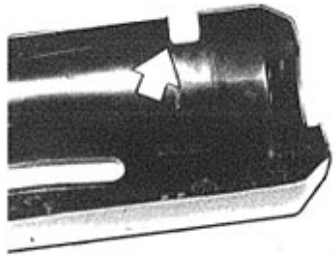
Open up tapped bore to 5.5 mm (0.216") diameter.



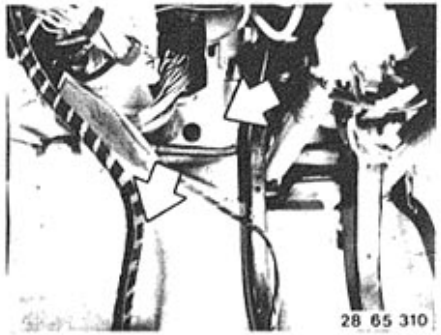
Mount selector switch with M 5 x 15 screw (4).
Also mount ground wire (3).
Both tabs on switch must protrude into bores (1 and 2).



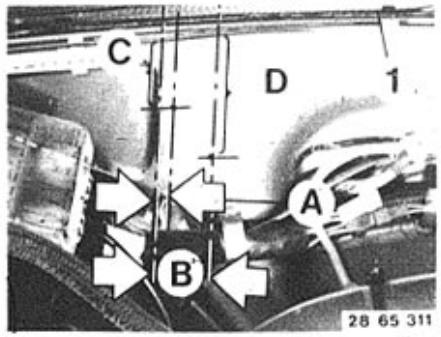
Route wire harness along standard wire harnesses.



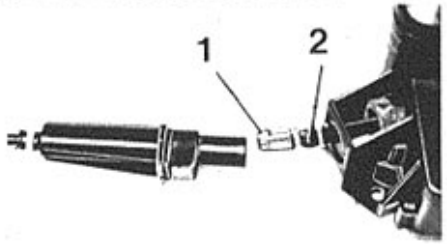
Cut out marked opening in steering column casing.
Reinstall steering column casing.



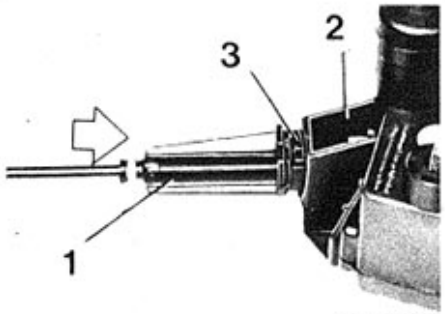
Fold back carpet and knock out punched hole.
Coat edges of hole with zinc dust paint.



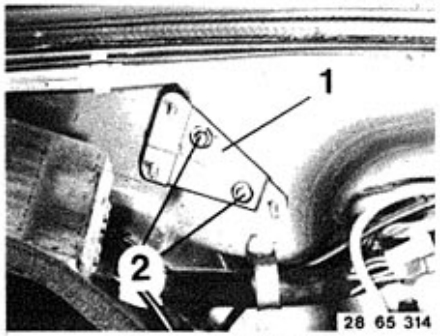
Mark location of bores as shown and drill 6 mm (0.236") dia. holes.
A = 10 mm (0.394")
B = 40 mm (1.575")
C = 60 mm (2.362")
D = 100 mm (3.937")



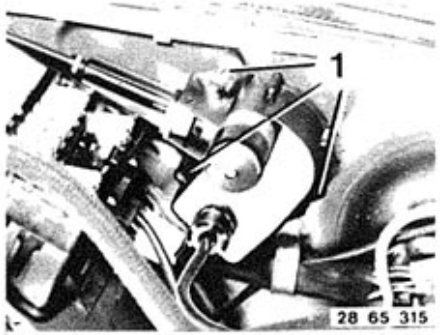
Connect cable (1) in pull rod (2) of operating motor.



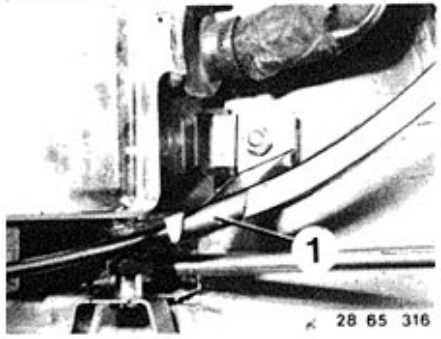
Insert cable (1) in holder (2) until spring clip (3) engages.
Note:
Pull rod is guided in cable.



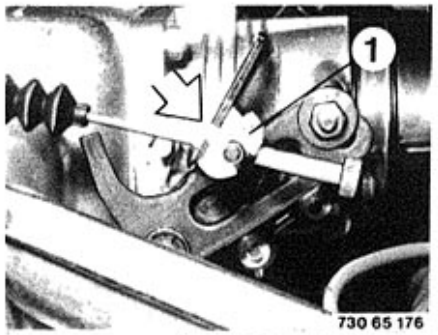
Mount holder (1) with screws, washers and nuts.
Tightening torque = 5 to 6 Nm (3.6 to 4.3 ft. lbs.).



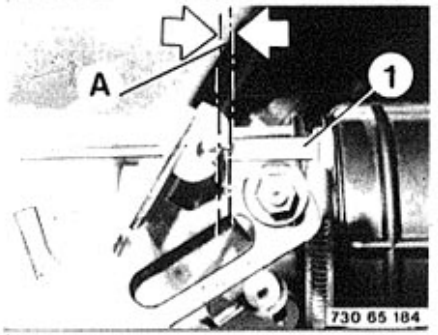
Mount operating motor on holder with nuts and washers.



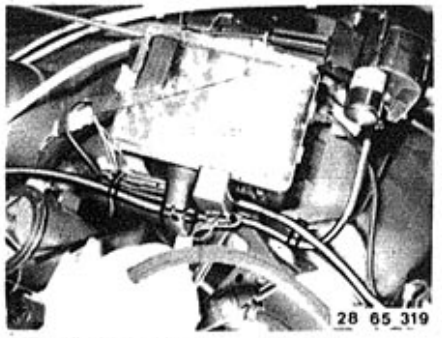
Mount cable holder (1) with "central electric board" mounting bolt.
Connect cable in holder.



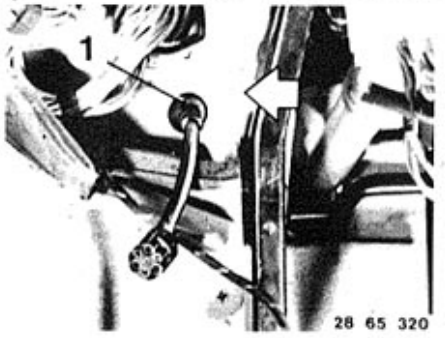
Connect cable with adapter (1).



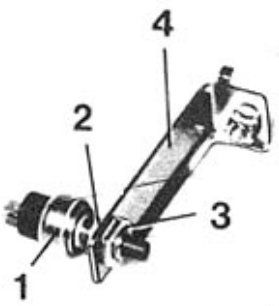
Adjust gap (A) to 1 — 2 mm (0.039 to 0.079") on knurled nut (1) with the throttle closed and operating motor unactivated.



Route and secure wire harness along standard wire harnesses up to underneath the instrument panel.

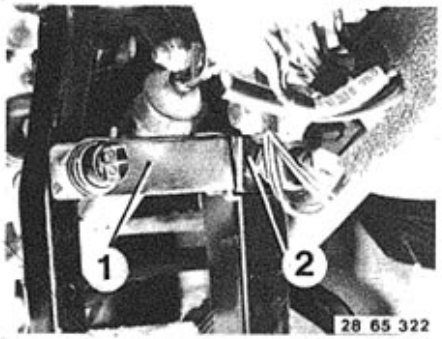


Make sure rubber grommet fits correctly.

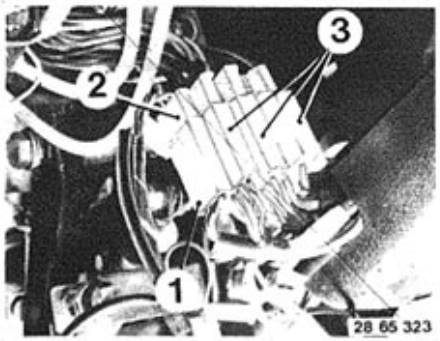


28 65 321

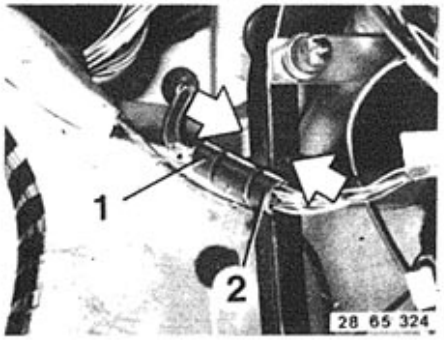
Only Cars with Manual Transmission:
Mount clutch switch (1) in holder (4) with nuts (2 and 3).



Only Cars with Manual Transmission:
Mount holder (1) with clutch pedal switch on bracket (2) with a bolt.
Mount holder (1) that clutch pedal switch is pressed in.
Make adjustments with nuts (3 and 4).



Install extra wire harness (also refer to wire harness drawing).
Connect plug (1) of selector switch with multiple pin plug (2) and secure on plug connections (3).

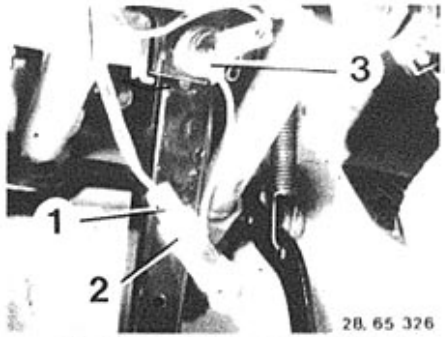


Connect seven pin round male plug (1) on operating motor wire harness plug (2).

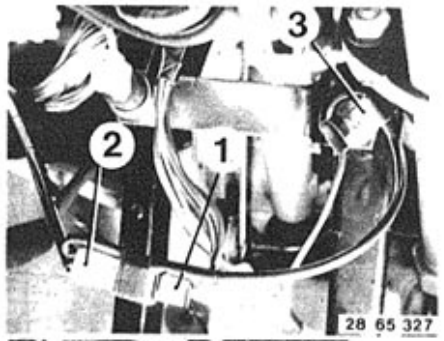
Connect both extra wire harnesses together with plugs (1 and 2).



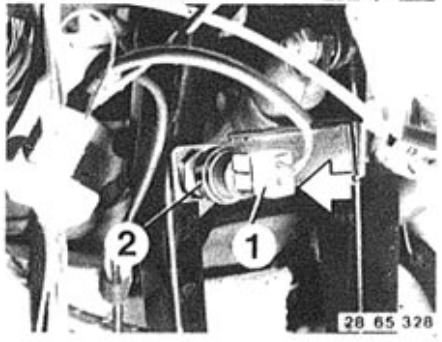
28 65 325



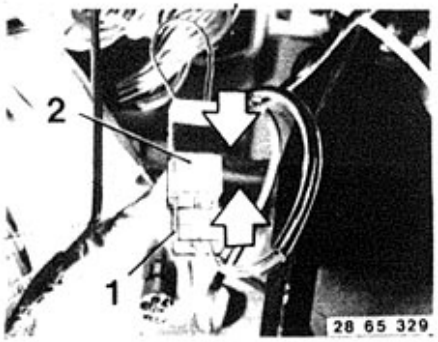
Pull off plug (1) on brake pedal switch and connect with jack (2).
Connect plug (3) on brake pedal switch.
Note:
Make sure wire colors match on plug connection (1 and 2).



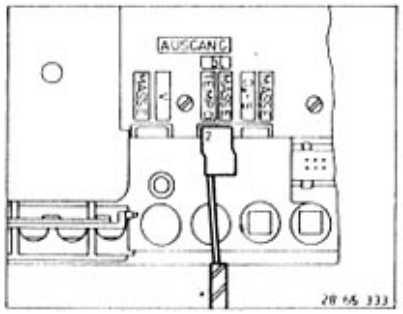
Pull off plug (1) on brake pedal switch and connect with jack (2).
Connect plug (3) on brake pedal switch.
Note:
Make sure wire colors match on plug connection (1 and 2).



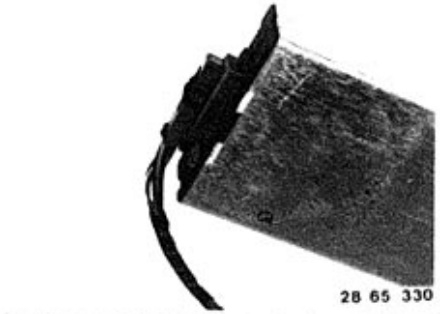
Only Cars with Manual Transmission:
Connect plug (1) on clutch pedal switch (2).



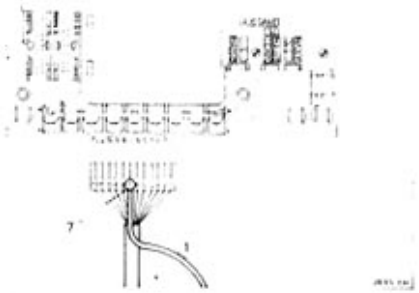
Only Cars with Automatic Transmission:
Connect plug (1) with plug (2).



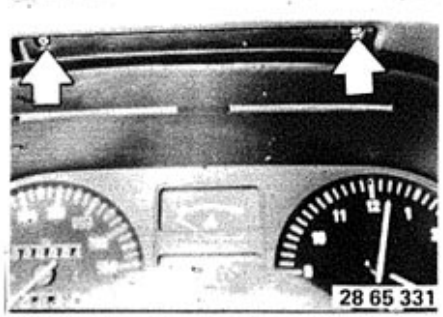
Only Cars with Automatic Transmission:
Connect plug (1) on speedometer connection.



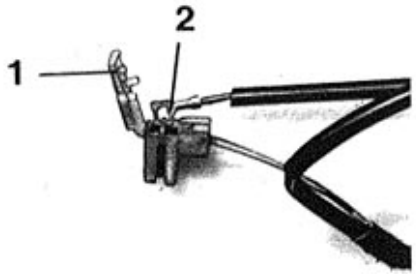
Connect multiple pin plug on control unit.



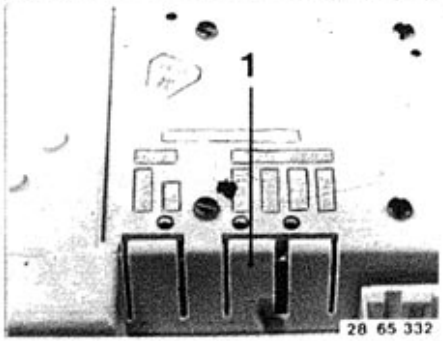
Only Cars with Automatic Transmission:
Plug blue/yellow wire (1) in plug chamber (7) of plug receptacle for range indicator.



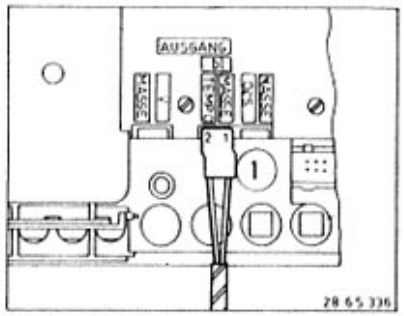
Unscrew bolts and pull instrument cluster forward.
Pull off plugs and remove instrument cluster.



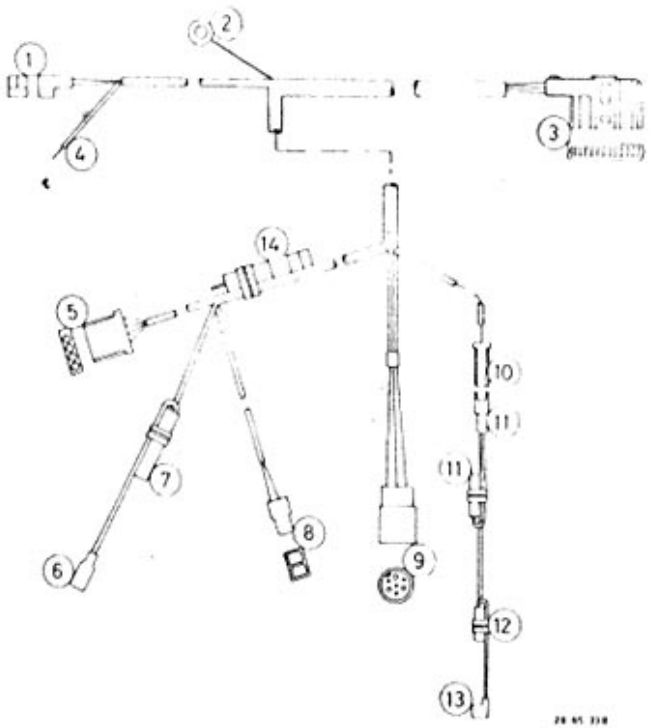
Only Cars with Manual Transmission:
Fold up lid (1) on plug.
Insert spring fork in plug chamber (2).
Close lid (1).



Break out housing bar (1).



Only Cars with Manual Transmission:
Connect plug (1) on speedometer connection.
Reinstall instrument cluster.
Install steering wheel.
Install bottom instrument panel trim.
Connect battery.
Check operation.



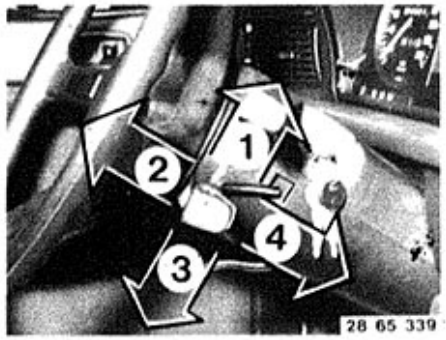
1 Plug for instrument cluster
2 Ground connection
3 Control unit plug
4 Range indicator conn. (autom. transm.)
4 Instrument cluster conn. (manual transm.)
5 Selector lever plug
6 Brake pedal switch
7 Brake pedal switch wire
8 Clutch pedal switch (manual transm.)
8 Plug for wire bridge (14) (autom. transm.)
9 Operating motor plug conn.
10 Connecting plug
11 Connecting plug
12 Power supply for brake pedal switch
13 Brake pedal switch
14 Plug with wire bridge (autom. transm.)

Description

The electronic cruise control operates in a range from about 35 km/h (22 mph) to almost maximum road speed. The system regulates the road speed to a road speed stored in the memory with a tolerance of about ± 2 km/h (1 mph).

The system switches off automatically when the actual road speed drops below the set road speed by approx. 15 %. This measure will protect the engine from being overloaded, for example when hauling a trailer uphill.

When the road speed picks up by 6 to 8 km/h (4 to 5 mph) more than the set road speed, the fast separating clutch opens and the throttle goes into idle position. If the road speed goes back to the set value, the clutch will close again.



Brief Tipping on CONSTANT (4)

The present road speed will be maintained and stored in the memory.

Holding on CONSTANT (4)

Car accelerated until desired road speed is reached. Then release selector switch. Present road speed will be maintained and stored in the memory.

Pulling to CALL (2)

A previously stored road speed is called by operating the selector lever in direction of CALL automatically.

Up – Down OFF (1/3)

Cruise control is switched off. The memory value is cancelled only after turning off the ignition.

TROUBLESHOOTING CRUISE CONTROL

Test Requirement:
Battery charged – battery voltage okay.
Specified multimeter functions (e.g. M 01) are in reference to the BMW SERVICE TEST. The following multimeter functions are required: 01/06/14. The following test procedures do not include sources of defect, which are outside of the electronic cruise control system.

Check fuse no. 12 and contact of fuse. —— no → Replace fuse.
Fuse and contact okay? Clean and bend fuse holder.

yes

Check bulbs of stop lights and their contact. —— no → Replace light bulbs.
Bulbs and contact okay? Clean and bend contacts.

yes

Check cable adjustment. —— no → Adjust cable.
Cable adjustment okay? Replace cable, see 65 71 040 in Repair Manual.

yes

Check cable and strap of operating motor for —— no → Replace cable or operating motor.
damage and easy movement. Cable and strap okay?

yes

Check adjustment of brake and clutch pedal switch. — no → Adjust brake and clutch pedal switch.
Adjustment okay? See Group 35 of Repair Manual.

yes

Check all plugs (see wiring diagram) and wires for —— no → Repair or replace plugs and wires.
tight fit and damage.
Plugs and wires okay?

yes

yes

Connect ohmmeter (M 06) between ground and wire (23) on disconnected control unit plug.
Ohmmeter should display approx. "0" ohm.
Resistance value okay?
— no → Correct ground connection according to wiring diagram.

yes

Pull off plug on control unit.
Connect voltmeter (M 01) between ground and wire (1) on disconnected control unit plug.
Turn on ignition.
Voltmeter should display operating voltage* for control unit.
Voltage value okay?
— no → Correct power supply according to wiring diagram.

yes

Connect voltmeter (M 01) between ground and wire (2) on disconnected control unit plug.
Turn on ignition.
Voltmeter should display operating voltage* for control unit.
Selector lever switch pressed in "off" direction – voltmeter should display approx. 0 volt.
Voltage values okay?
— no → Check and repair "selector lever switch - control unit" plug and wires.
Replace selector lever switch.

yes

Connect voltmeter (M 01) between ground and wire (4) on disconnected control unit plug.
Turn on ignition.
Voltmeter should display approx. 0 volt.
Selector lever pressed in "constant" direction – voltmeter should display battery voltage.
Voltage values okay?
— no → Check and repair "selector lever switch - control unit" plug and wires.
Replace selector lever switch.

yes

* See Specifications

Connect voltmeter (M 01) between ground and wire (5) on disconnected control unit plug.
Turn on ignition.
Voltmeter should display about 0 volt.
Press selector lever switch in direction "call".
Voltmeter should display operating voltage*.
Voltage values okay?

no → Check and repair "selector lever switch - control unit" plug and wires.
Replace selector lever switch.

yes ↓

Connect voltmeter (M 01) between ground and wire (9) on disconnected control unit plug.
Turn on ignition.
Voltmeter should display approx. 0 volt.
Voltage values okay?

no → Replace brake pedal switch.
See Group 35 of Repair Manual.

yes ↓

Connect voltmeter (M 01) between ground and wire (9) on disconnected control unit plug.
Turn on ignition.
Operate brake pedal.
Voltmeter should display control unit operating voltage*
Voltage value okay?

no → Check stop light switch.
Pull off both plugs on stop light switch.
Connect ohmmeter (M 06) on stop light switch.
Operate brake pedal.
Ohmmeter should display approx. 0 ohm.

no → Replace stop light switch.

yes ↓

Check clutch switch.
Pull off both plugs on clutch switch.
Connect ohmmeter (M 06) on clutch switch.
Ohmmeter should display approx. 0 ohm.
Operate clutch pedal.
Ohmmeter should display 0 ohm.
Values okay?

no → Replace clutch switch.

yes ↓

Check wires, repairing if necessary.

* See Specifications

Connect frequency meter (M 14) on wires 3 and 6 on disconnected control unit plug.
Lift car.
Start engine.
Run briefly to speed of about 50 km/h (30 mph)
Frequency meter should display frequency*
Okay?

— no → Check speed transmitter for speedometer, see Group 62 of Repair Manual.

— no → Check wires, repairing if necessary.

yes

Connect control unit plug again.
Following tests are made on 7-pin plug for "control unit - motor".
Connect voltmeter on connection (4) and on connection (3).
Turn on ignition.
Voltmeter should display about 8 volts.
Voltage value okay?

— no → Replace control unit.

yes

Connect voltmeter on connection (3) and connection (7).
Turn on ignition.
Voltmeter should display voltage.
Voltage value okay?

— no → Replace motor.

yes

* See Specifications

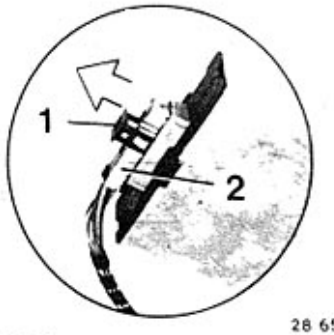
Disconnect "control unit - motor" 7-pin plug. —— no → Replace motor.
Connect connection (1, white) on ground.
Connect connection (6, green) on B + (12 V).
Clutch must be heard to switch.
Clutch switching?

yes

Connect ground on connection (2, blue) and —— no → Replace motor.
B + on connection (5, black) of 7-pin plug on motor.
Motor must be heard to run.
Motor running?

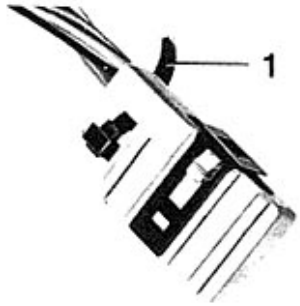
yes

Replace control unit.



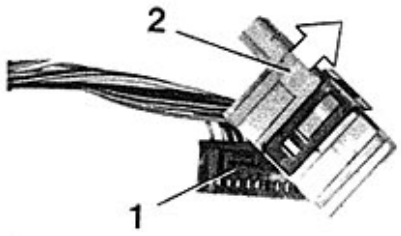
28 65 181

Important Information for 26 Pin Central Electric Plug:
Pull back clamp (1).
Pull off central electric plug (2).



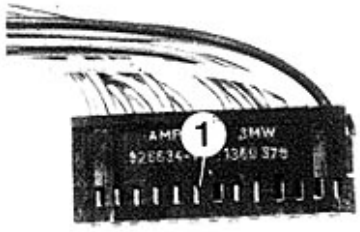
28 65 182

Cut off strap (1).



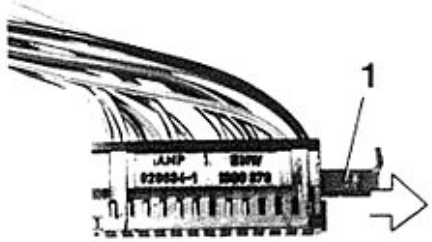
28 65 183

Pull plug member (1) out of housing (2).



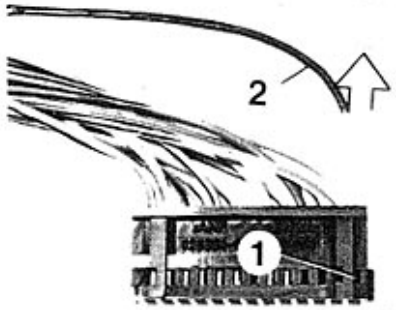
28 65 184

Tests on disconnected central electric plug, e.g. for troubleshooting, can be made with test clips on windows (1).



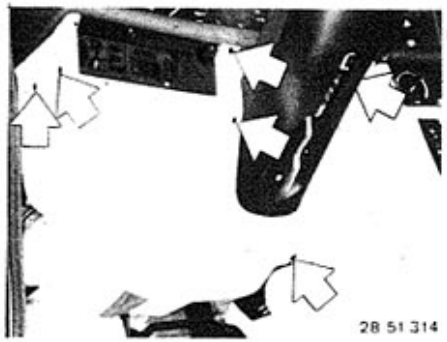
28 65 185

Pull out lock (1).



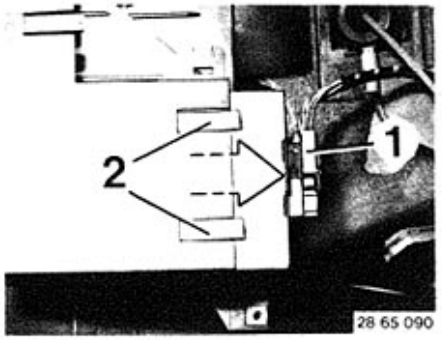
28 65 186

Use a screwdriver to press on each wire window and pull wire (2) out of plug receptacle.



65 71 010 REMOVING AND INSTALLING CONTROL UNIT FOR CRUISE CONTROL

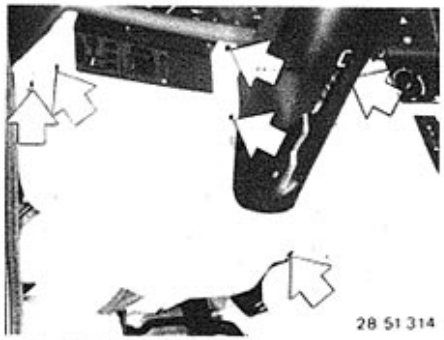
Unscrew bolts.
Lay trim aside in the footwell.



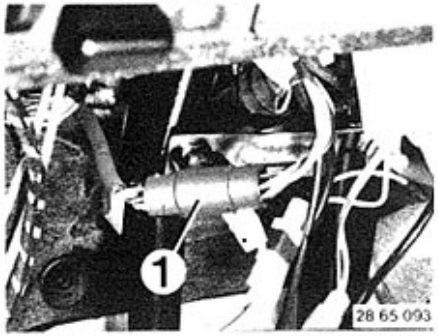
Pull off multiple-pin plug (1).
Push back clamps (2) and slide control unit out of the holders.

Since 1985 Models:
Push back the arrest and slide out the control unit.

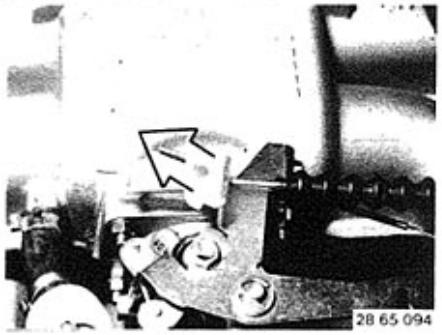
65 71 020 REMOVING AND INSTALLING OPERATOR



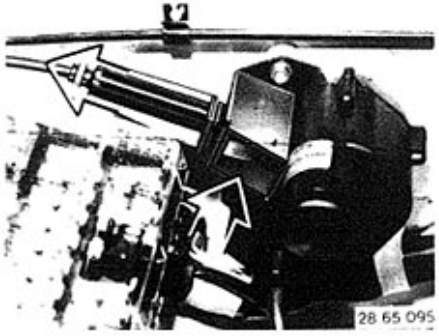
Unscrew bolts.
Lay trim aside in the footwell.



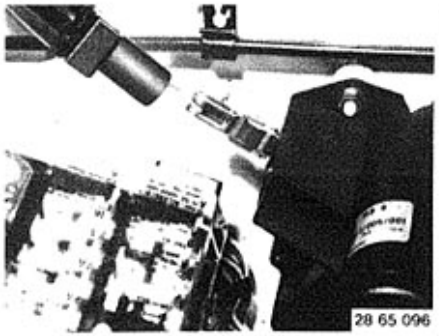
Disconnect multiple-pin plug (1) and pull wiring into the engine compartment.



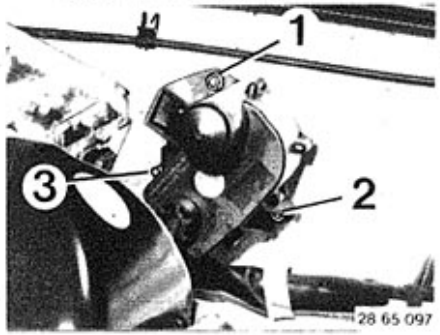
Disconnect cable.



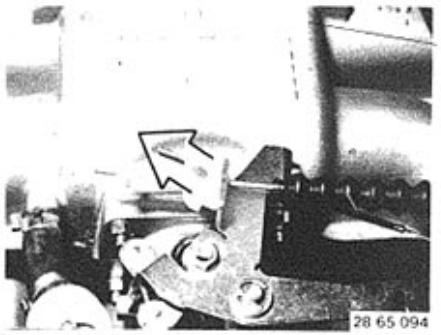
Press in holding clamp and pull cable out of the holders.



Disconnect cable.

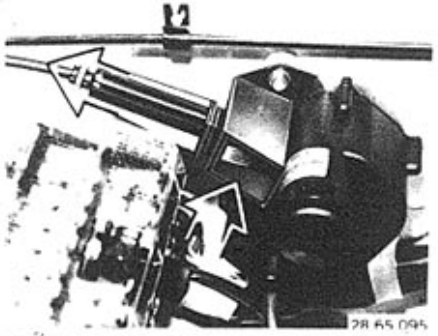


Unscrew nuts (1 ... 3).
Remove operator.



65 71 040 REPLACING ACCELERATOR CABLE

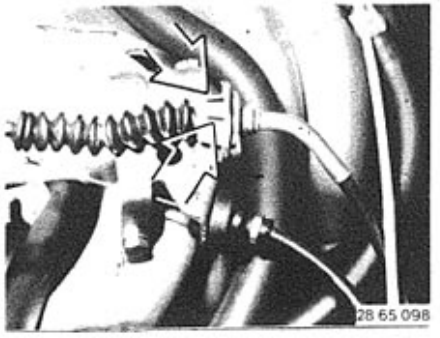
Disconnect cable.



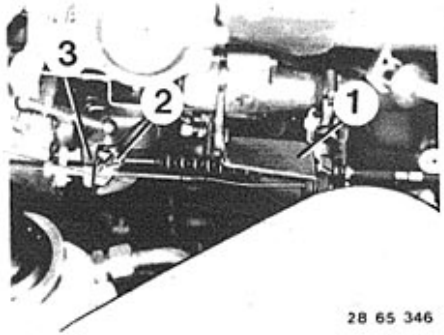
Press in holding clamp.
Pull cable out of the holders.



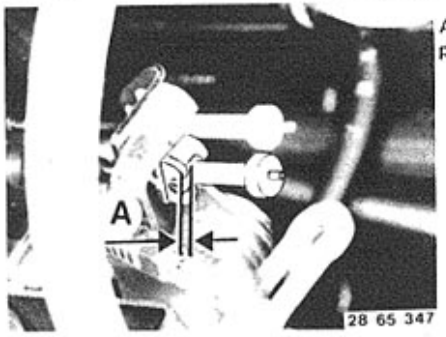
Disconnect cable.



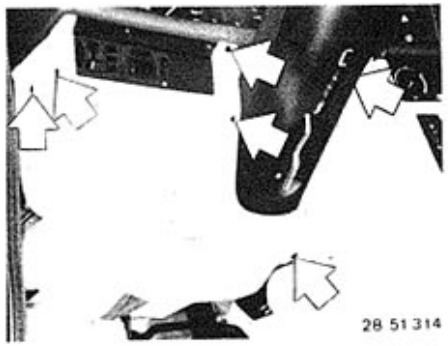
Compress holding clamp and pull cable out of the holders.
Installation:
Adjust the accelerator cable.



Diesels:
Guide cable through holder (1) and connect it on adapter (2) in lever (3).

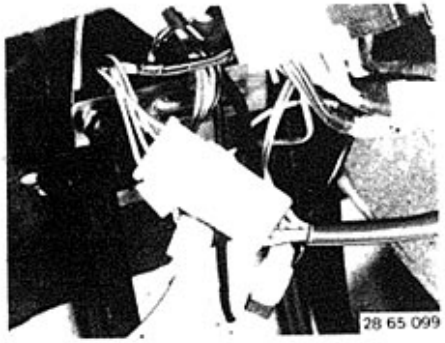


Adjust cable with knurled nut (1) until there is play (A) = 1 to 2 mm (0.039 to 0.079").

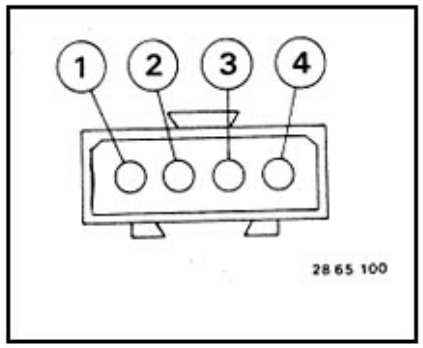

28 51 314

65 71 ... REMOVING AND INSTALLING CONTROL SWITCH

Remove steering wheel 32 33 000.
Unscrew bolts.
Lay trim aside in footwell.
Remove lower steering column casing 32 31 020.

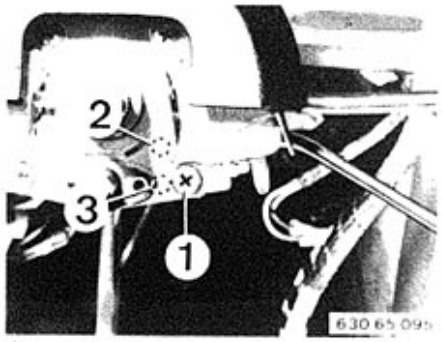

28 65 099

Disconnect plug.



28 65 100

Connections on multiple-pin plug:
Wire Color:
1 = yellow
2 = blue
3 = green
4 = green/white



630 65 095

Unscrew bolt (1) and remove control switch.
Installation:
Both tabs on control switch must engage in covered bores (2 and 3).

TROUBLESHOOTING ON-BOARD COMPUTER

Troubleshooting the on-board computer (BC) requires checking all functions first. Proceed in the sequence specified in operating instructions. If a function is not okay, correct the cause before continuing with the remaining functions.

Important!

Testing instructions in this chart refer to the "BMW SERVICE TEST" and the pertinent multimeter functions (M). Make connections acc. to operating instructions of BMW service test unit.

Function "UHR" okay? — no → Check power supply to control unit: — no → Check power flow in wire. Provide power supply. (see wiring diagram)

Connect voltmeter (M 01) between ground and wire 25 on disconnected black central electric plug of control unit.
Voltmeter should display battery voltage.
Voltage value okay?

yes

Check power supply to control panel: — no → Replace control unit.

Pull off yellow plug on control unit.
Connect voltmeter (M 01) between ground and wire 12 or 25 on yellow outlet of control unit.
Voltmeter should display 5 volts for wire (12) or 8 volts for wire (25).
Power supply okay?

yes

Check ground of control unit: — no → Provide ground connection (see wiring diagram)

Connect ohmmeter (M 06) between ground and wire 13 on disconnected black central electric plug of control unit.
Ohmmeter should display approx. 0 ohm.
Ground okay?

yes

Check ground of control panel: — no → Replace control unit.

Pull off yellow plug on control unit.
Connect ohmmeter (M 06) between ground and wire 1 on yellow outlet of control unit.
Ohmmeter should display approx. 0 ohm.
Ground okay?

yes

Control wire from control unit to control panel okay? — no → Check power flow of all wires in control line. Replace control line.

yes

Control unit okay? Control panel okay? (exchange control unit or panel for testing) — no → Replace control unit and/or control panel.

Function "LOCK" okay?

yes

Function "KORR" okay?

yes

Function "START" okay?

yes

Function "STOP" okay?

yes

Function "TEMP" okay? — no →

Control unit okay? Control panel okay? (exchange control unit or panel for testing) — no → Replace control unit and/or control panel.

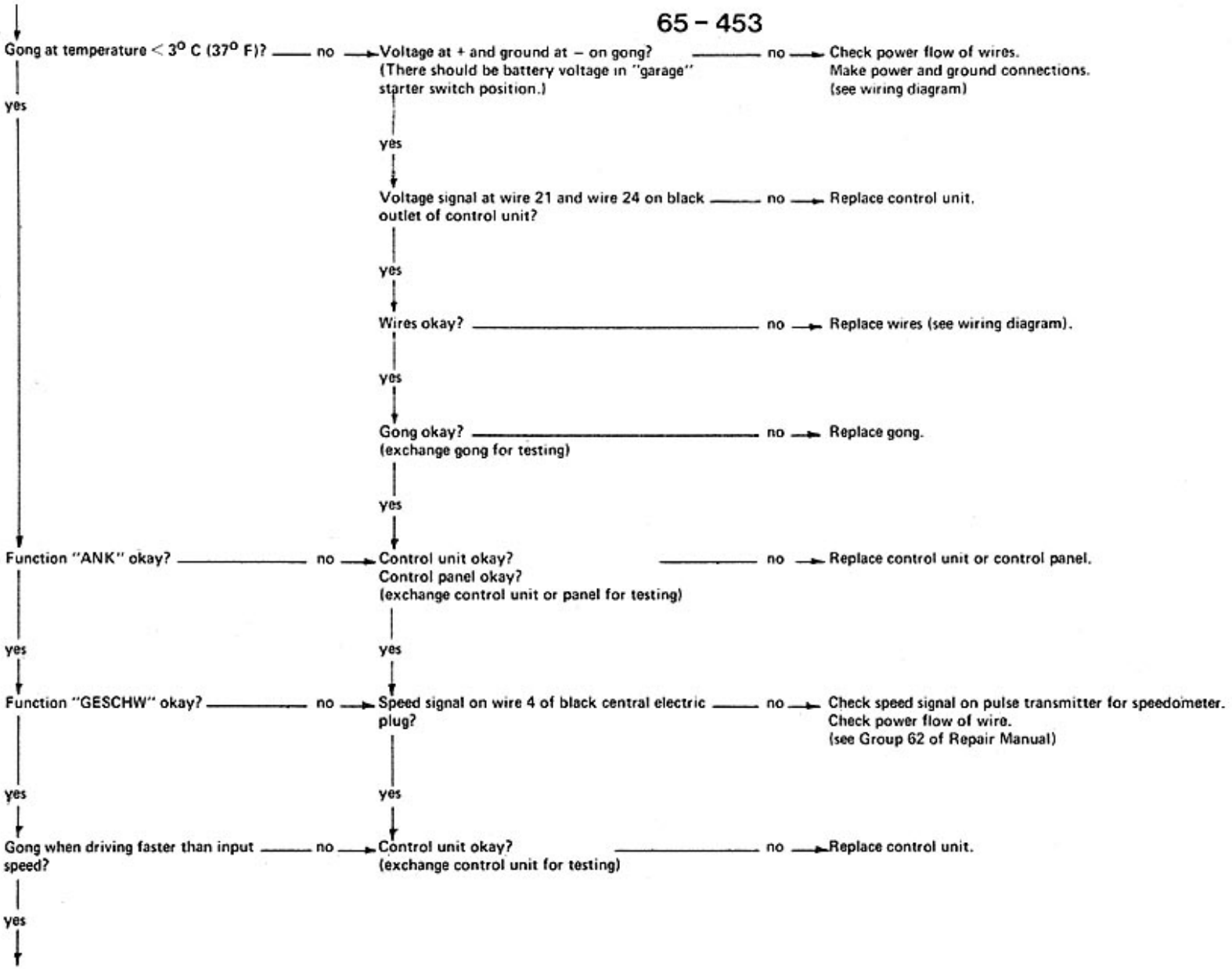
Function "TEMP" okay? — no → Pull off black plug on control unit. Connect ohmmeter (M 06) between wire 7 and wire 19 on black central electric plug. — no → Check power flow of wires. Check temperature sensor. Replace temperature sensor. (see wiring diagram)

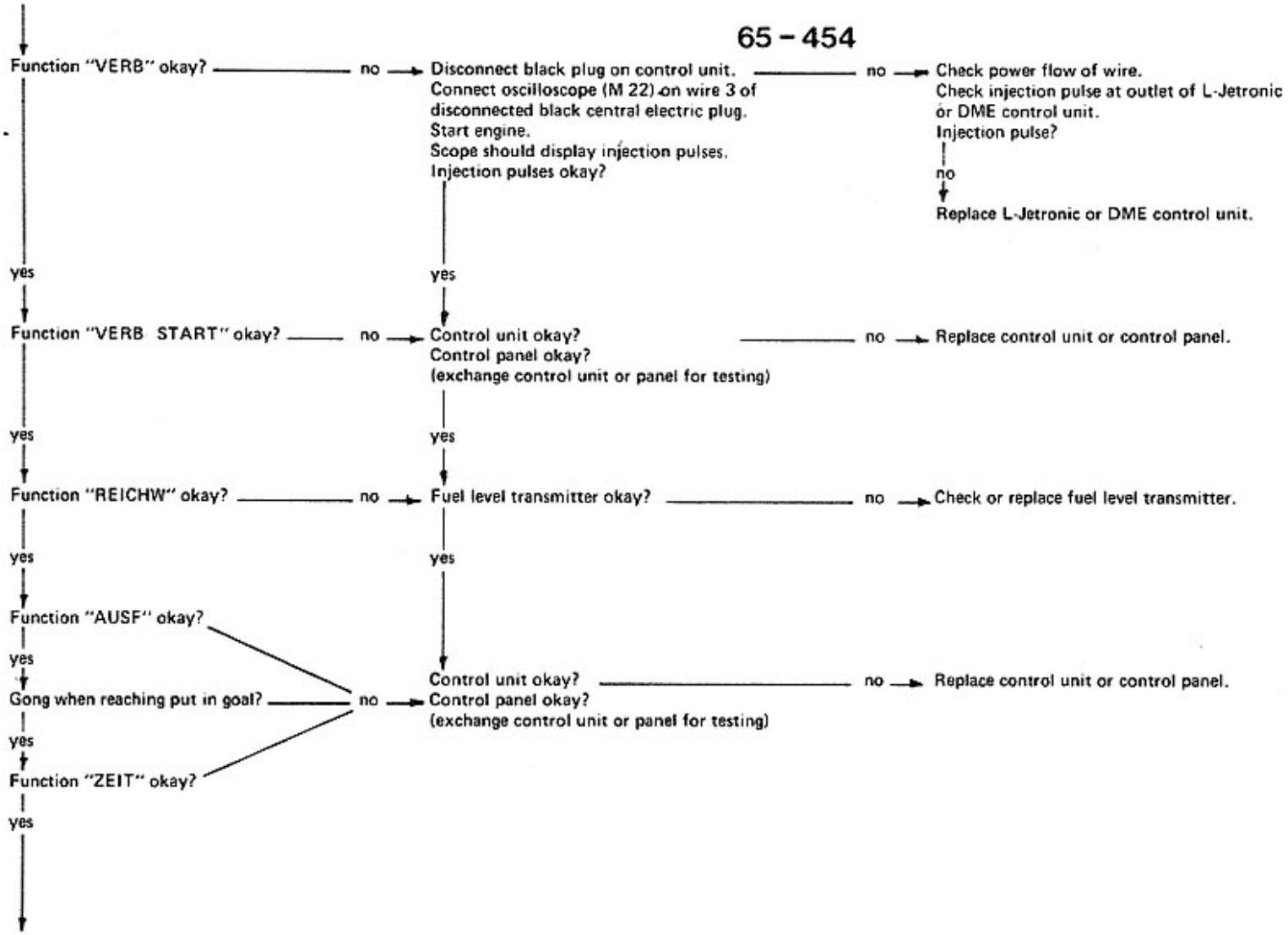
Display:

0° C	10° C	20° C	30° C	40° C
32° F	50° F	68° F	86° F	104° F
16.5	10.0	6.2	4.0	2.65 k-ohms

yes

Control unit okay? Control panel okay? (exchange control unit or panel for testing) — no → Replace control unit or control panel.


Gong at temperature < 3° C (37° F)?
no
Voltage at + and ground at – on gong?
(There should be battery voltage in "garage" starter switch position.)
no
Check power flow of wires.
Make power and ground connections.
(see wiring diagram)
yes
yes
Voltage signal at wire 21 and wire 24 on black outlet of control unit?
no
Replace control unit.
yes
Wires okay?
no
Replace wires (see wiring diagram).
yes
Gong okay?
(exchange gong for testing)
no
Replace gong.
yes
Function "ANK" okay?
no
Control unit okay?
Control panel okay?
(exchange control unit or panel for testing)
no
Replace control unit or control panel.
yes
yes
Function "GESCHW" okay?
no
Speed signal on wire 4 of black central electric plug?
no
Check speed signal on pulse transmitter for speedometer.
Check power flow of wire.
(see Group 62 of Repair Manual)
yes
yes
Gong when driving faster than input speed?
no
Control unit okay?
(exchange control unit for testing)
no
Replace control unit.
yes


Function "VERB" okay?
no
Disconnect black plug on control unit.
Connect oscilloscope (M 22) on wire 3 of disconnected black central electric plug.
Start engine.
Scope should display injection pulses.
Injection pulses okay?
no
Check power flow of wire.
Check injection pulse at outlet of L-Jetronic or DME control unit.
Injection pulse?
no
Replace L-Jetronic or DME control unit.
yes
yes
Function "VERB START" okay?
no
Control unit okay?
Control panel okay?
(exchange control unit or panel for testing)
no
Replace control unit or control panel.
yes
yes
Function "REICHW" okay?
no
Fuel level transmitter okay?
no
Check or replace fuel level transmitter.
yes
yes
Function "AUSF" okay?
yes
Gong when reaching put in goal?
no
Control unit okay?
Control panel okay?
(exchange control unit or panel for testing)
no
Replace control unit or control panel.
yes
Function "ZEIT" okay?
yes

Function "DIST" okay? — no → Control unit okay? — no → Replace control unit or control panel.
Control panel okay?
(exchange control unit or panel for testing)

yes

Function "CODE" okay? — no → Pull off black central electric plug on control unit, connect voltmeter (M 01) between ground and wire 15 on disconnected black central electric plug. — no → Make power supply connection. (see wiring diagram)

yes

System okay!

Turn on ignition.
Voltmeter should display battery voltage.
Voltage value okay?

yes

No code put in. — no → Replace control unit.
There should be battery voltage on yellow outlet of computer wire 14 with ignition turned on.

yes

Code put in. — no → Replace control unit.
There should be no voltage on yellow outlet of control unit wire 14 when starting.
Engine must not start.

Replace control panel in the case of partial or complete failure of the on-board computer display.
Also replace control panel in case of partial failure of diodes (LEDs).
If only one LED fails, light bulb in control panel could be faulty.

TESTING INSTRUCTIONS FOR ON-BOARD COMPUTER (GENERATION II)

These testing instructions are compiled in logical sequence, but the test steps could also be taken separately. The specified pin numbers must be used – danger of short circuits!

- Testing Requirements: The on-board computer II calling and storing in memory are according to operating instructions (chapter 2).
- Testers Required: Universal adapter with connecting lead as well as BMW service test unit (multimeter tests).
- Data stored in on-board computer II is cancelled with the connecting switch of the test adapter (between BC II wire harness plug and BC II).
- Functions in ignition lock pos.
  - 0: No display background lighting, not possible to operate buttons.
  - R: Display board illuminated, operation possible, code function free.
  - 15: Same as R, however also distance/time/consumption functions, code function locked.
  - 50: Same as 15, but in this case the starting interlock must only function 6 seconds after taking away the term. 50 signal.
- Universal adapter HWB No. 81 12 9 425 091
  Conn. lead wire harness 26-pin 096
  Conn. lead control unit 26-pin 097

Note: The type of coding plug* can be called in ignition lock position 15 by pressing buttons 1 and 100 simultaneously. If calling is not possible, check power supply between pins 10 (= B –) and 7 (= term. 15).

Malfunction Operation	Possible Defect	Test / Specification	Not As Specified Sources of Defect / Information
1. PPPP appears in display	– in coding plug* on back	Coding test	– Replace coding plug, disconnect power supply, reconnect, perform coding test.
	– on its plug pins – or on BC II		– Replace BC II. After replacing BC II check coding and compensate reserve volume: If the tank volume does not equal reserve range, pull the fuel level transmitter out of tank far enough that float is on bottom stop. Remove anti-tamper lock on BG II (left side next to button 1000). Ignition lock in position 15. Correct the displayed liter value* with a screwdriver after pressing buttons 1 and 1000 simultaneously. Reinstall anti-tamper lock.
Note: The driving range display could be changed after calling the tank volume.			
2. AAAA appears in display	Internal BC II defect		Replace BC II; also refer to point 1.
3. No display	Power supply missing	Between pin 10 (= B–) and pin 6 (= B+). Specification: U ≥ 10 V.	Wires to and from instrument cluster; plug connections.
4. Weak time display, but no other operations are possible in ignition lock position R	– No voltage on term. R	Between pin 10 (= B–) and pin 5 (= term. R). Specification: U ≥ 10 V.	Wires to and from instrument cluster; plug connections.
	– BC II defective (e.g. buttons)		Replace BC II (see point 1).

* See Specifications

Malfunction Operation	Possible Defect	Test / Specification	Not as Specified Sources of Defect / Information
5. Ignition lock from position R display board background button lighting (with lights on) not working	– Term. 31 g, term. R, term. 58 power supply missing	– Between pin 10 (= term. 31) and pin 5 (= term. R). Specification: 10 V (button board lighting only works with lights on)	– Break in wire
	– Lights in BC II defective		– Replace light bulbs; depending on defect pull out light slider with a small pliers (check printed voltage data when testing externally) or light bulb for button lighting (12 V, 1.2 W).
		– Between pin 9 (= term. 31 g) and pin 8 (= term. 58 k). Specification: U = U battery, depending on switch position.	
6. None or wrong SPEED display	– Wrong coding plug* in BC II	– See point 1	
	Speed signal missing	– Simulate speed signal on speed transmitter wire plug connection with BMW service test unit.	– Follow signal up to BC II.
	– Defect in input signal	– With simulation of 256 Hz, ignition on (engine not running), on BC II button SPEED and button SET-RES Displayed value see coding plug table*.	
	– BC II defective		– Replace BC II (see point 1).
7. None or wrong CONSUMPTION display	– Wrong coding plug* in BC II	– See point 1	
	– Defect in input signal	– With engine running there must consumption signal on pin 17 and pin 10 (≒ B–).	– Check signal from L-Jetronic control unit pin 12 or wire 11 from 2BE control unit with BMW service test unit. Scope test or BMW digital tester II: ms-test, possibly compare with signal of cyl. 1 or 2.
	– BC II defective		– Replace BC II (see point 1).

* See Specifications

Malfunction Operation	Possible Defect	Test / Specification	Not As Specified Sources of Defect / Information
8. TEMP function Considerable difference in temperature display between pos. R and 15 Displays: – 30° C	– Fuel level transmitter or its wires		– Fuel level transmitter/connections – Short circuit in wire – Break in wire
	– Temperature sensor or its wires	– Measure resistance* between pin 16 and pin 10 (= B–) (BC II not connected) and compare with actual temp..	– Wires – Temperature sensor
Wrong TEMP function	– Temp. sensor defective	– See Specifications* for value	– Replace temperature sensor
	– BC II defective		– Replace BC II (see point 1).
9. Gong not working	– Defect in gong signal transmitter/wires	Turn ignition lock to pos. R or 15, connect pin 10 and pin 2 – gong must gong	No Gong: – Defect in wires – Defect in gong (check gong externally) Gong:
	– BC II defective		– Replace BC II (see point 1).
10. No activation of parked car heating Note: parked car heating being prepared for E 30.	– Relay for parked car heating defective/wires	Connect pin 14 with pin 6 (= B+); relay must switch.	Measure resistance between pin 14 and pin 10, BC II not connected, ignition lock in position 0; specification: between 80 and 120 (see wiring diagram). – Relay defective – Defect in wiring
	– BC II		– BC II defective (see point 1)
11. No activation of horn relay	– Relay box for horn activation defective – Wires	Connect pin 1 and pin 10 (= B–). Horn relay must be activated and horn must sound.	– Defect in relay box, wiring, horn. Horn function okay:
	– BC II		– Replace BC II (see point 1).

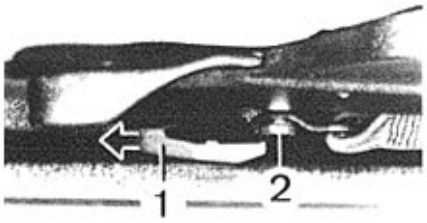
* See Specifications

Malfunction Operation	Possible Defect	Test / Specification	Not As Specified Sources of Defect / Information
12. No activation of starter interlocking relay	– Defect in relay box, activation of interlock defective – Wires	Connect pin 11 and pin 10 (= B–) and turn ignition lock to R or 15: relay in relay box must operate.	See point 10, but between pin 6 and pin 11.
	– BC II		Replace BC II (see point 1).
13. No function of remote control	– Steering column switch defective – Wires	Ignition lock in R or 15. Pin 10 (= B–) connected briefly with pin 4 several times: Information in display must change each time.	– Defect in steering column switch (check without BC II) – Wiring
	– BC II		– Replace BC II (see point 1).
14. Driving range function wrong	– Coding plug – Reserve volume balance – Speed signal – Consumption signal – Fuel level transmitter / reserve contact	– See point 1 – See point 6 – See point 7 – Fuel gauge display in instrument cluster correct	– Connection from instrument cluster to BC II – Wires to instrument cluster

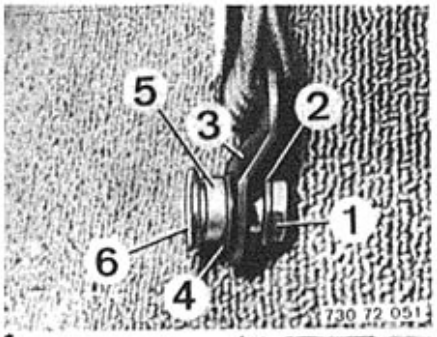
72 Equipment and accessories for body

72 11 030	Seat belts, front – remove and install or replace	72- 1
100	Seat belts, rear, left or right – replace	72- 2
	Automatic seat belts – check	72- 3
	Checklist for automatic seat belts	72- 5

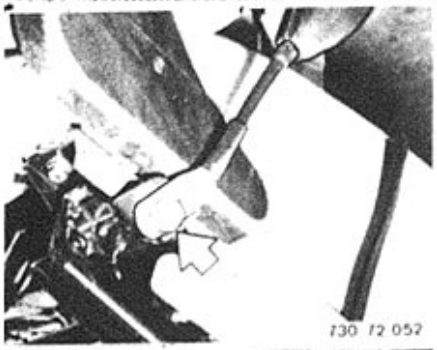
72 11 030 REMOVING AND INSTALLING/ REPLACING FRONT SEAT BELT



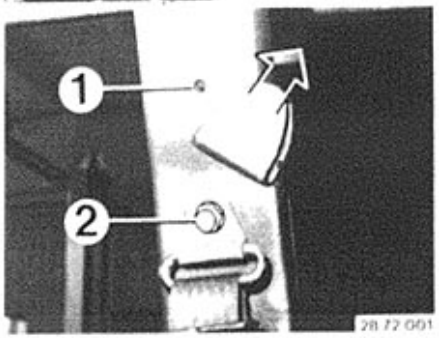
Pull off cap (1) toward front.
Unscrew bolt (2).
Remove seat see 52 10 000



Installation:
Check installed order and tightening torque*
1 Bolt
2 Plastic washer
3 Belt anchor
4 Plastic washer
5 Spacer
6 Circlip
Belt anchor must still move after tightening bolt.

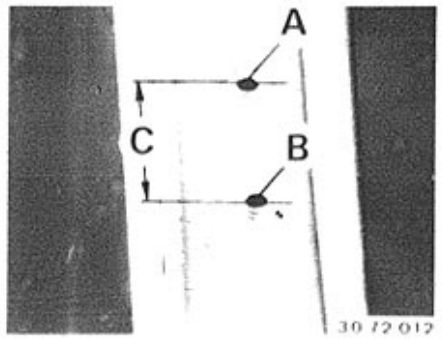


Unscrew bolt of bottom strap.
Installation:
Tightening torque*

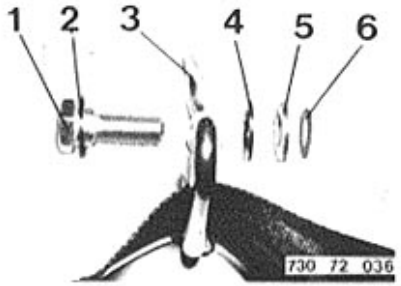


Pull off cap.
Unscrew bolts (1 and 2).

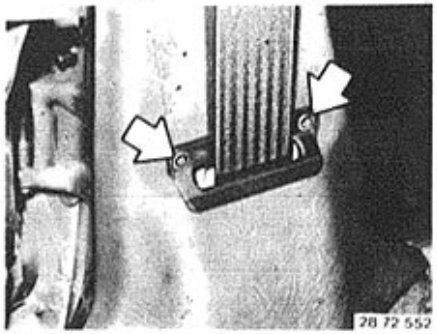
* See Specifications



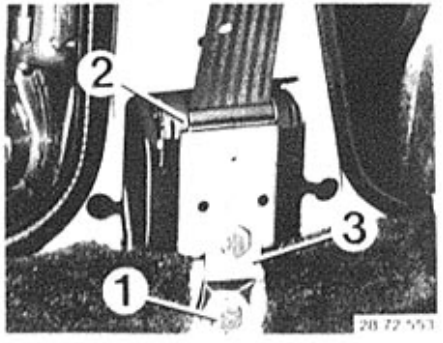
The belt reversing holder can be mounted either in bore A or B, depending on size of person.
Cut out B pillar trim for bore B.
C = approx. 50 mm (2")



Installed Order:
1 Bolt
2 Plastic washer
3 Holder
4 Plastic washer
5 Washer
6 Lock washer
Holder must still move after tightening bolt,
Tightening torque*.



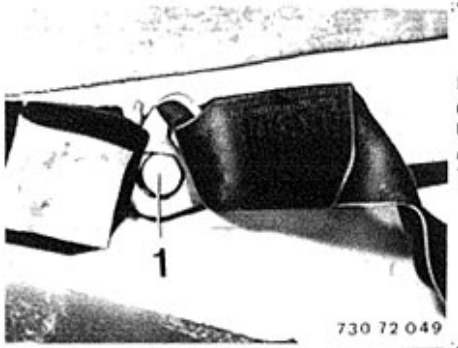
Unscrew bolts and remove trim.



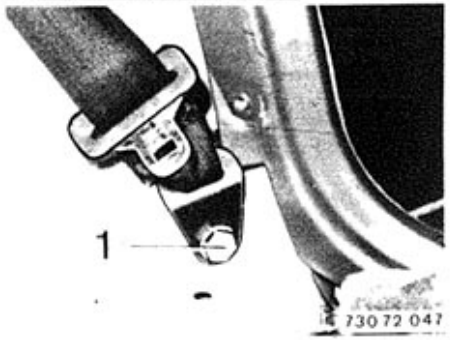
Unscrew bolt (1).
Remove automatic reel (2) and transfer bracket (3).
Installation:
Tightening torque*.

* See Specifications

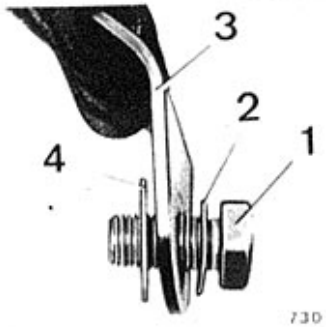
72 11 100 REPLACING LEFT OR RIGHT REAR SEAT BELT



Remove and install rear seat cushion and backrest 52 20 000.
Unscrew bolt (1) of lower belt.
Installation:
Tightening torque[1].

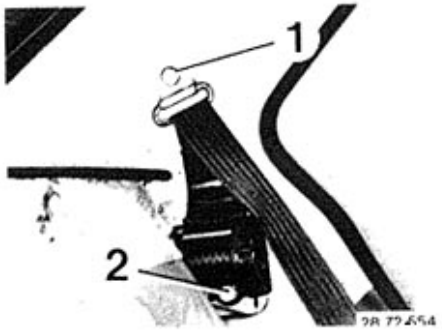


Unscrew bolt (1) of bottom anchorage point.
Installation:
Tightening torque[1].



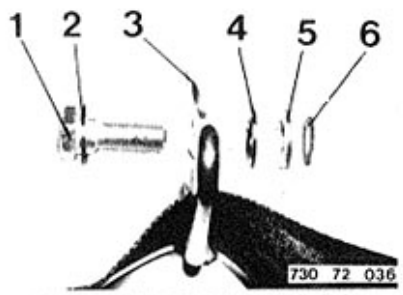
730 72 048

Installed Order:
1 = Bolt
2 = Spring washer
3 = Mounting bar
4 = Cardboard ring

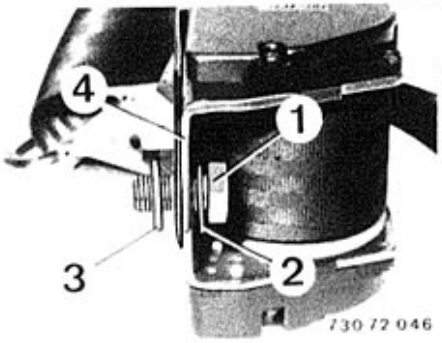


Lift off trim cap on stirrup.
Unscrew bolt (1) of stirrup and bolt (2) of automatic reel.
Installation:
Stirrup must still move after tightening bolt.
Tightening torque[1].

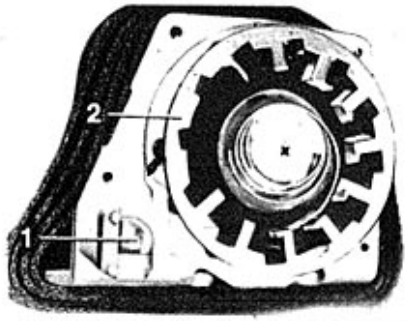
[1] See Specifications



Installed Order (Stirrup):
1 = Bolt
2 = Plastic washer
3 = Stirrup
4 = Plastic washer
5 = Washer
6 = Spring washer



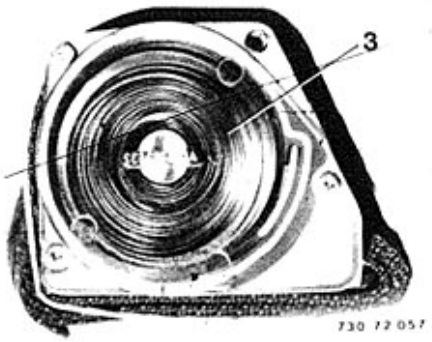
Installed Order (Automatic Reel):
1 = Bolt
2 = Spring washer
3 = Washer
4 = Automatic reel



730 72 058

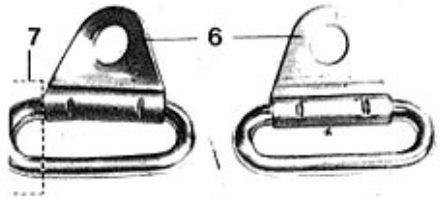
Checking Automatic Seat Belts

The automatic reel has two independent activating systems for the locking effect.
The first activating system should lock the reel when driving fast in curves, driving in tight curves, when car rolls over, during sharp braking or by impact. This activation is accomplished with a ball (1). To check, seat must be set upright and both hands placed on steering wheel in supporting position. The apply brakes fully while driving at a road speed equal to twice walking speed (road must be dry). The seat belt should lock.
The second activating system is for additional safety and is controlled by inertia mass (2). If reel locks when pulling out belt suddenly, this system is also okay.



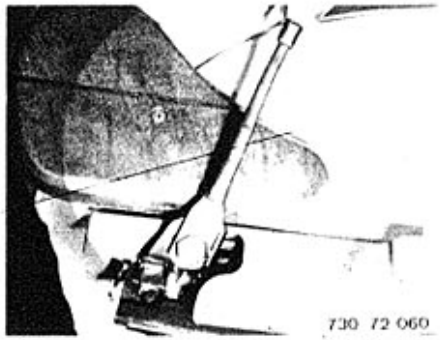
730 72 057

The belt should retract automatically as far as possible when released.
It could happen that the last section of the belt will have to be guided to the door beam by hand. If this last section is not wound, there could be a weak or broken return spring (3) and/or excessive friction in the belt guides.
An unusable seat belt or a seat belt worn in a serious accident should be destroyed immediately after removal to guarantee that it will not be used again.
The automatic reel does not require servicing and must not be opened.

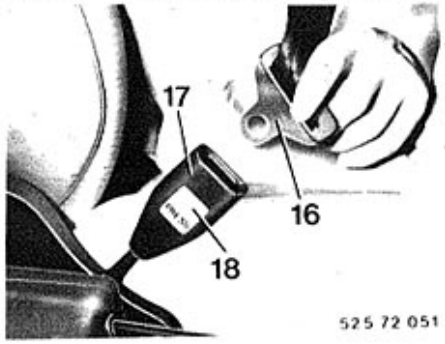


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The automatic seat belt has to be replaced when the mounting bar (6) is bent or the stirrup is distorted in area (7).
The stirrup must still pivot after mounting bolt has been tightened.

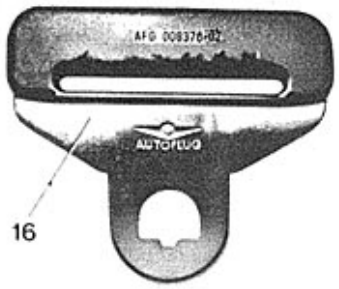

730 72 060

When replacing a seat belt also replace the lower strap.
In the case of belts integrated in seats an impact could deform the lower strap stop on the seat rail.
Never attempt to straighten the seat or seat rail. Straightened lower straps must be replaced.



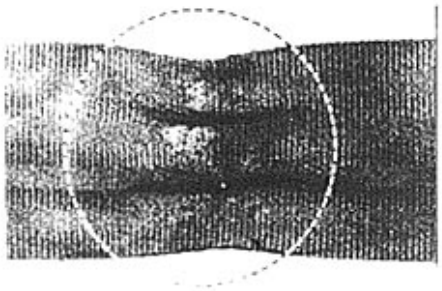
525 72 051

To fasten a belt the tongue (16) should insert easily and with a loud click in lock (17).
When pushing in "PRESS" button (18) the belt tongue (16) should be ejected from lock (17) by spring pressure.
Replace a seat belt when lock trim is missing or damaged.



If the plastic cover in the opening for the belt above the anchorage bar (16) has traces of wear, the seat belt must be replaced.

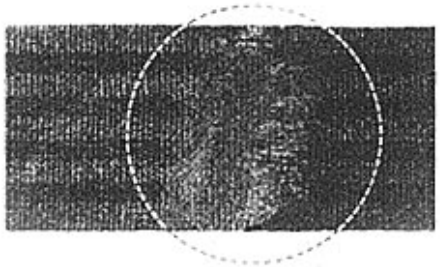
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Belt Straps

Only clean belt straps in a luke-warm soap solution or a commercial fine laundry detergent. Never clean belts chemically or dye belts. An automatic seat belt must be replaced when there is

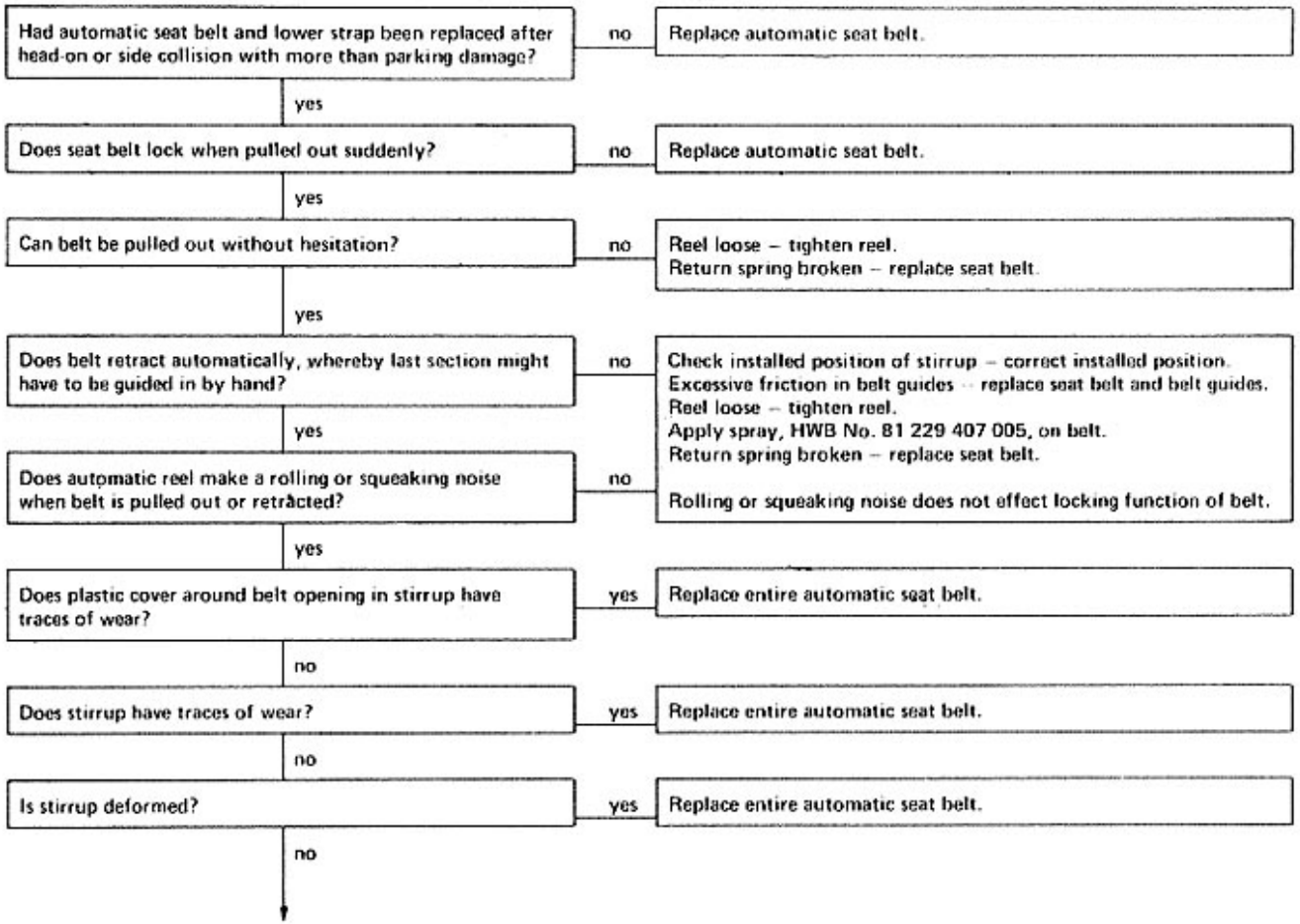
- creasing (see picture),
- unravelling,
- pinch damage,



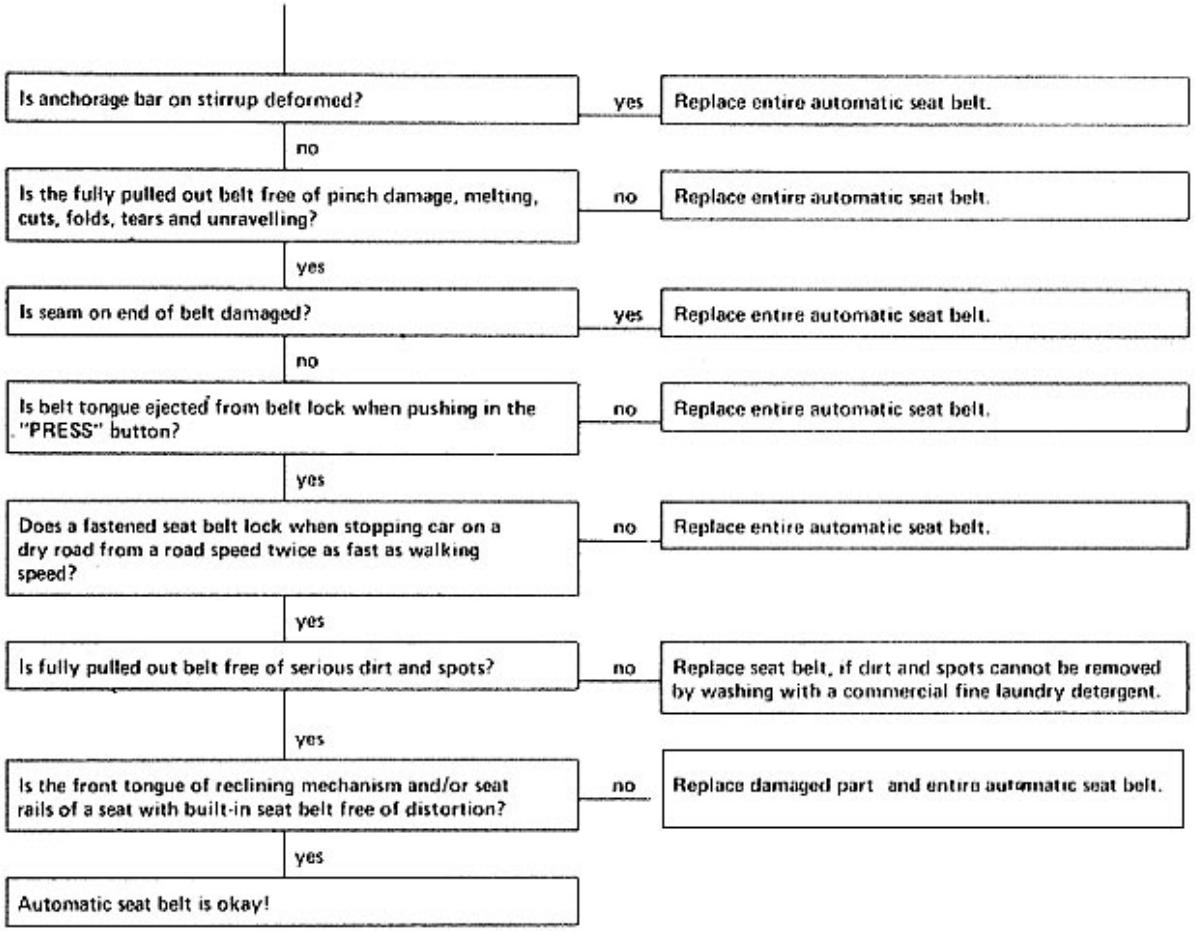
- tearing and/or cutting,
- melting (see picture), or
- damaged seam on end of belt in area of holding or pivoting part.

To improve belt retraction the belt can be sprayed with a universal belt spray, HWB No. 8122 947 005, which will reduce friction, especially on the stirrup.

CHECKLIST FOR AUTOMATIC SEAT BELTS



CHECKLIST FOR AUTOMATIC SEAT BELTS



97 Body cavity sealing and undercoating

97 00 010 Body cavity sealing for entire car 97- 1

97-1

BODY CAVITY SEALING – '5' E 28 SERIES

Sealing Preparations

- Underside of car must be clean and dry.
- If applicable, damaged PVC on underside including wheel housings and side panels must be repaired and treated with Tectyl.

  The thickness of undercoating should not exceed 250 µm (0.25 mm / 0.010").
- Check car for paint finish damage and damage from flying stones and, if applicable, repair after consulting the customer.
  - Sealing compounds and the car itself should have room temperature (approx. 20° C / 68° F).
  - Check spray pattern of guns and nozzles.
  - When drilling holes, dip the stepped drill bit in sealing compound to trap burrs.
  - Remove sealing compound drippings.
  - Insert plugs dipped in Tectyl in all drilled holes after finishing sealing.
  - Spray engine sealing compound on engine and engine compartment to cover completely.
  - When repairing body parts damaged in an accident or replacing the car body, body cavity sealing must be carried out immediately after painting and before installation of attachments, equipment, trim, etc.. If repair welding seams and joints are only accessible from one side, the side which produces a cavity has to be treated with wax! The same is applicable for the rear side panels, above the wheel housings up to the roof joint, as well as doors especially in the upper corner areas.

Body cavity sealing performed after body repairs must be confirmed on the annual inspection sheets (Owner's Manual)!

Sealing Procedures on Lifting Platform (wheels protected with covers available from HWB)

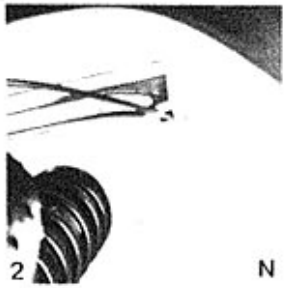
1.	Front cross member from underneath through side openings.	N or RS
2.	Front wheel house reinforcements through provided openings.	N or RS
3.	Front side panels on end plate from underneath through provided openings.	N or RS
4.	Engine carrier from underneath and from engine compartment.	N or RS
5.	Door member from underneath in middle.	N or RS
6.	Doors twice each through provided openings with both nozzles.	T+N or F+RS
7.	Rear side panel to member joint – wheel house side.	H or F
8.	Left and right rear spring strut mounts through provided openings.	N or RS
9.	Side and cross members underneath trunk through provided holes.	N or RS

Sealing Procedures Without Lifting Platform

10.	Front side panel in area of front panel.	H or F
11.	Engine hood braces through provided openings.	H or F
12.	Side wheel house reinforcements through provided holes (heater wall/firewall) underneath cowl panel from heater duct.	H+N or F+RS
13.	'A' pillars – remove door contact switches (also remove speakers in cars with a radio).	N or RS
14.	Rear side panel end plate – remove door contact switch.	N or RS
15.	Rear side panels and wheel houses from trunk.	N or RS
16.	Trunk lid braces through provided openings.	H or F

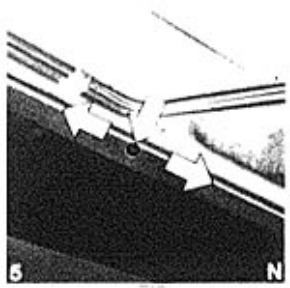
H = Hook-type probe
N = Nylon probe
T = Door probe
RS = Round spray pattern slotted nozzle
F = Flat spray pattern nozzle

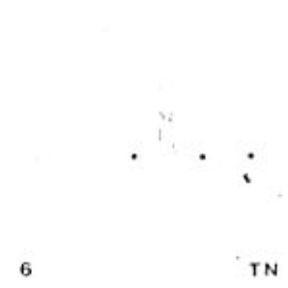



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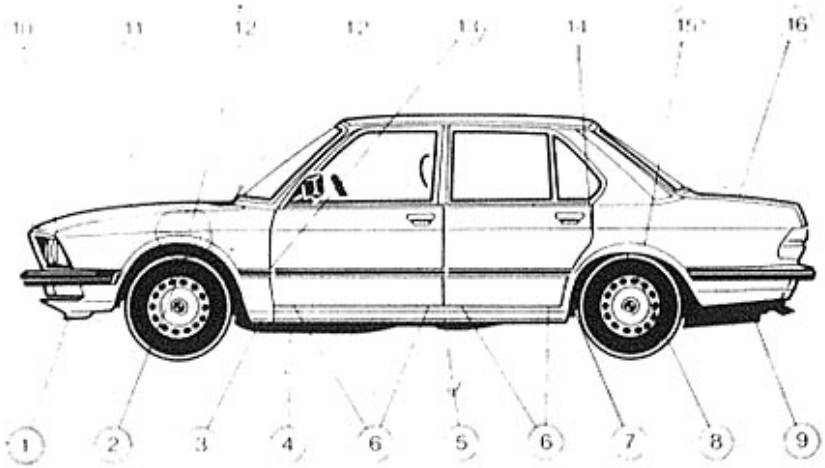

3
N


N

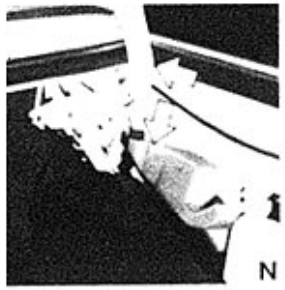

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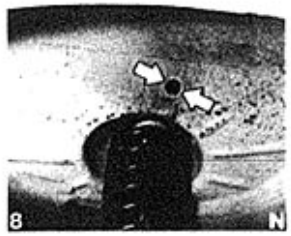

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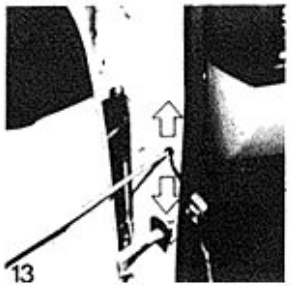

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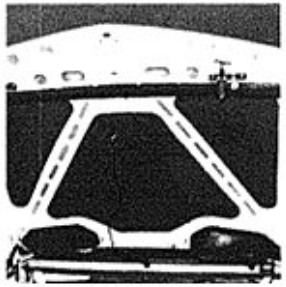

N


8
N


14


13






10
H

