

Repair manual

**BMW 320/323 i
6-cyl.**

Vol. 1

Bayerische Motoren Werke AG München

01 51 9 599 271



Introduction

This workshop manual is intended to ensure that the necessary maintenance and repair work is done in the correct manner. The manual should be used by workshop managers and mechanics to supplement the practical and theoretical knowledge they have acquired at our service training school.

Specifications are provided at the beginning of each main group.

The specifications apply to standard cars that have not been involved in an accident or modified after leaving the factory.

The group system applied in this manual is taken from our flat rate manual. For example, page 32-21/6 means:

32 main group

-21 sub-group

/6 page in sub-group

The special tools required for proper repair work are listed on our special tool microfilm - Order No. 01999699422. How the special tools must be used can be seen from the pictures.

Removal/disassembly is always described for each operation. If installation/assembly is not possible in the reverse order, a "when installing" note has been provided.

Supplements will be issued with both alterations and additions. If the word "alteration" has been printed on the sheet, take out the sheet already provided and insert the new one in its place. Sheets marked "addition" must be added to the existing manual without removing any old sheets.

Apart from the improvements announced by regular bulletins, we recommend that the spare parts lists (microfilms) - which have clear illustrations - are used as an additional source of information.

**BAYERISCHE MOTOREN WERKE AG
SERVICE DEPARTMENT**

Published by Bayerische Motoren Werke AG, 8 Munich 40, West Germany, Service Department.

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16	Kraftstoffbehälter und -leitungen	Fuel tank and lines	Réservoir à essence et conduites	Serbatoio carburante e condutture
17	Kühler	Radiator	Radiateur	Radiatore
18 21	Auspuff Kupplung	Exhaust system Clutch	Dispositif d'échappement Embrayage	Impianto di scarico Frizione
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99	Lackierung	Paintwork	Peinture	Verniciatura

Wartung und allgemeine Hinweise

Maintenance and general hints

Entretien et généralités

Manutenzione e informazioni generali

Entretienimiento e informes generales

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Onderhoud en algemene aanwijzingen

00 Maintenance

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**Conversion table for
official units of measurement**

**see pages 00-0/4 and
00-0/5**

Conversion table for official units of measurement

Value	Unit symbol		Conversion	
	old	new		
Length	m	m	1 m = 1000 mm	1 km = 1000 m
Area	m ²	m ²	1 m ² = 10 ⁶ mm ²	1 mm ² = 0.01 cm ²
Volume	m ³	m ³	1 m ³ = 10 ⁶ cm ³	1 dm ³ = 0.001 m ³
	l	l	1 l = 1 dm ³	
Angle	°	°, rad	1 rad = 1 m/m ≈ 57°	1° = π/180 rad
	(°) ²	sr	1 sr = 1 m ² /m ²	(1°) ² = (π/180) ² sr
Mass	kg	kg	1 kg = 1000 g	1 g = 1000 mg
	kg/m ³	kg/m ³	1 kg/m ³ = 0.001 kg/dm ³	1 t = 1 Mg = 1000 kg
Density	kg/m ³	kg/m ³	1 kg/m ³ = 0.001 kg/dm ³	1 kg/dm ³ = 1 kg/l
Imbalance	kgm	kgm	1 kgm = 1000 000 gmm	
Time	sec s	s	1 min = 60 s	1 h = 60 min
Speed of rotation	rev/sec rev/min (r.p.m.)	1/s 1/min	1 U/min = 1/min	1/min = 1/(60 s)
Speed	m/s	m/s	1 m/s = 3.6 km/h	
Acceleration	m/s ²	m/s ²		

Conversion table for official units of measurement (continued)

Value	Unit symbol		Conversion
	old	new	
Force	kp	N	1 N = 1 kgm/s ² 1 kp = 9.81 N
Pressure (gas, fluids)	at	N/m ²	1 at = 1 kp/cm ² = 0.981 bar = 98 066.5 Pa
	kp/cm ²	Pa	1 m WS = 9 806.65 Pa = 9 806.65 N/m ²
	mWS	bar	1 Torr = 1.333 224 mbar
	Torr mmHg		1 mm Hg = 133.322 Pa = 133.322 N/m ²
Mechanical load, stress	kp/mm ²	N/m ² Pa N/mm ²	1 N/m ² = 1 Pa 1 kp/mm ² = 9.81 N/mm ²
Energy, work, heat volume	kpm PSh cal	J kWh	1 J = 1 Nm 1 kWh = 3.6 MJ 1 kpm = 9.81 J 1 cal = 4.1868 J
Torque	kpm	Nm	1 kpm = 9.81 Nm
Power	PS	kW	1 kW = 1000 W 1 W = 1 Nm/s = 1 J/s
	kpm/s kcal/h	Nm/s	1 PS = 736 W = 75 kpm/s = 632 kcal/h 1 kW = 1.36 PS = 102 kpm/s = 860 kcal/h = 0.239 kcal/s
Viscosity	dynamic kinematic	Pas m ² /s	1 Pas = 1 Ns/m ² 1 P = 0.1 Pas = 1 g/cms 1 m ² /s = 1 Pas m ³ /kg 1 St = 1 cm ² /s = 0.0001 m ² /s
Temperature	°C °K	°C K	0 °C ≙ 273.15 K °K = 1 K = 1 °C (temperature differential)

Conversion table for official units of measurement (continued)

Value	Unit symbol		Conversion
	old	new	
Elec. current	A	A	1 mA = 0.001 A 1 kA = 1000 A
Elec. potential/voltage	V	V	1 V = 1 W/A 1 mV = 0.001 V 1 MV = 10 ⁶ V
Elec. resistance	Ω	Ω	1 Ω = 1 V/A = 1/S
Magnetic flux	M	Wb, Vs	1 Wb = 1 Vs 1 M = 10 ⁻⁸ Wb
Magn. flux density	G	T	1 T = Wb/m ² 1 G = 10 ⁻⁴ T
Magn. field strength	Oe	A/m	1 A/m = 1 N/Wb 1 Oe = 10 ^{3/4} T A/m
Light intensity, luminosity	HK	cd	1 cd = 1.107 HK 1 HK = 0.903 342 cd
Brightness, luminance	sb	cd/m ²	1 sb = 10 ⁴ cd/m ²
Light density	ph	lx	1 ph = 10 ⁻⁴ lx

Specifications

Maintenance and general instructions

Model	a) 320/6 b) 320/6 A	a) 323 i b) 323 i A *)
Dimensions and weights		
Overall length	mm (in)	4355 (171.4)
Overall width	mm (in)	1610 (63.4)
Overall height, unladen	mm (in)	1380 (54.3)
Ground clearance, laden (at perm. gross weight limit)	mm (in)	145 (5.7)
Front overhang (at perm. axle load)	mm (in)	781 (30.7)
Rear overhang (at perm. axle load)	mm (in)	1011 (39.8)
Overhang angle (at perm. axle load)	front ° rear °	23°20' 12°
Wheelbase (at perm. axle load)	mm (in)	2563 (100.9)
Min. turning circle (wheels)	left m (ft) right m (ft)	9.40 (30.8) 9.60 (31.5)
Min. turning circle (overall)	left m (ft) right m (ft)	10.20 (33.5) 10.40 (34.1)

*) Version for Sweden

Specifications

Maintenance and general instructions

Model		a) 320/6 b) 320/6 A	a) 323 i b) 323 i A *)
Unladen weight, empty (ready for road, tank full)	kg (lb)	a) 1115 (2458) b) 1130 (2491)	a) 1135 (2502) b) ()
Permissible gross weight	kg (lb)	1550 (3417)	1570 (3461)
Permissible axle load	front rear	780 (1720) 840 (1852)	790 (1742) 850 (1873)
Dimensions and weights (continued)			
Permissible trailer load. unbraked	kg (lb)	500 (1102)	
braked, max. gradient 16 % (1 in 6.25)	kg (lb)	a) 1000 (2205) b) 650 (1433)	a) 1000 (2205) b) 650 (1433)
braked, max. gradient 12 % (1 in 8.33)	kg (lb)	a) 1200 (2646) b) 1000 (2205)	a) 1200 (2646) b) 1000 (2205)
Towbar downthrust, max.	kg (lb)	50 (110)	
Permissible load on roof (when fully laden, max. angle loads must not be exceeded)	kg (lb)	75 (165)	

*) Version for Sweden

Specifications

Maintenance and general instructions

Model		a) 320/6 b) 320/6 A	a) 323 i b) 323 i A *)
Performance Max. gradient	in 1st gear % (1 in)	a) 58 (1.72) b)	a) 58 (1.72) b)
	in 2nd gear % (1 in)	a) 27 (3.70) b)	a) 30 (3.33) b)
	in 3rd gear % (1 in)	a) 14 (7.14) b)	a) 16 (6.25) b)
	in 4th gear % (1 in)	a) 9 (11.11) b)	a) 10 (10.0) b)
Acceleration	km/h (mile/h)	0 ... 50 (0 ... 31)	
	1st – 2nd gears s	a) 3.4 b) 5.2	a) 2.8 b)
	km/h (mile/h)	0 ... 80 (0 ... 50)	
1st – 2nd gears s		a) 7.2 b) 9.5	a) 6.4 b)
	km/h (mile/h)	0 ... 100 (0 ... 62)	
1st – 3rd gears s		a) 10.7 b) 13.6	a) 9.5 b)

*) Version for Sweden

Maintenance and general instructions

Specifications

Model	a) 320/6 b) 320/6 A	a) 323 i b) 323 i A *)
1st – 3rd gears	km/h (mile/h) s	0 ... 120 (0 ... 75)
	a) 15.8 b) 19.3	a) 13.6 b)
1st – 4th gears	km/h (mile/h) s	0 ... 140 (0 ... 87)
	a) 22.7 b) 29.3	a) 18.5 b)
1st – 4th gears	km/h (mile/h) s	0 ... 160 (0 ... 99)
	a) 36.0 b) 45.4	a) 27.3 b)
Standing-start kilometer (3281 ft) in	s	a) 30.9 b)
Maximum speed	km/h (mile/h)	a) 190 (118) b)

*) Version for Sweden

0000009 Free Delivery Check

1. Checking coolant level and concentration/adding coolant
2. Tightening hose clips
3. Checking engine oil level/adding oil
4. Checking steering gear oil level
5. Checking tightness of wire connections
6. Checking and correcting V-belt tension
7. Checking and correcting battery acid level
8. Checking and correcting brake fluid level
9. Checking and correcting windshield washer fluid level
10. Checking and correcting transmission oil level
11. Checking and correcting final drive oil level
12. Checking steering wheel straight-ahead position, adjusting steering wheel
13. Checking tightness of wheel bolts
14. Checking pressure of all tires (including spare wheel)
15. Checking and adjusting headlight beams
16. Checking lights
17. Checking interior equipment, chrome-plated parts and paint, doors, engine hood and trunk lid, door windows, sliding roof, seat belts
18. Tools
19. Test drive with function check
20. Leak inspection after test drive
21. Engine idle speed adjustment, exhaust emissions test

1. Checking coolant level

Add coolant until level is up to a maximum of 2 cm ($\frac{3}{4}$ in) below cap.

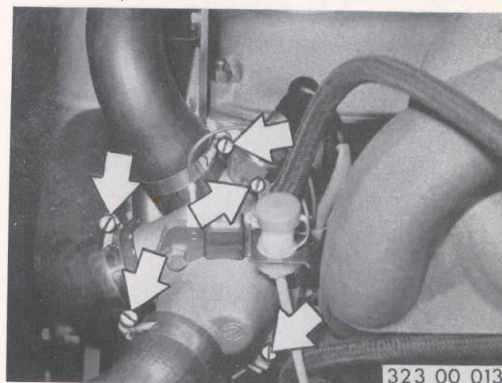


Check antifreeze concentration.
All-year antifreeze protection to -25°C (-13°F).
Add approved long-term antifreeze and corrosion inhibitor: see Service Information Gr. 17.



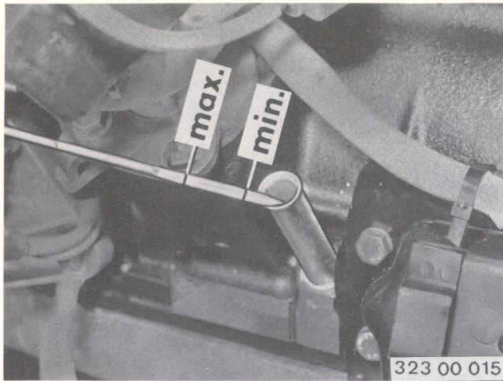
2. Tightening hose clips

Tighten all hose clips on engine.



Tighten all hose clips on radiator and expansion tank.



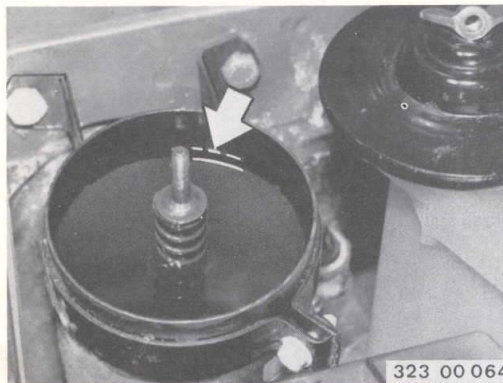


3. Checking/correcting engine oil level

Add oil until level is up to max. mark at the most.

Quantity of oil between min. and max. marks = 1.5 liters (1.5 US quarts, 2.6 Imp. pints).

For approved oil grades, see Service Information Group 11.

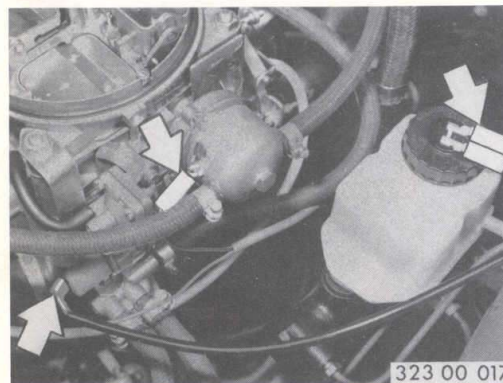


4. Checking/correcting power steering oil level

With engine stopped, remove wing nut and take off tank cover.

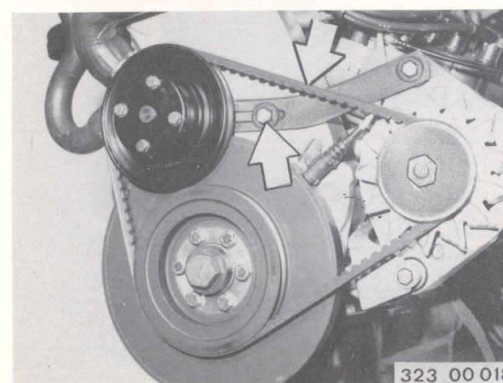
Oil level must be approx. 5 mm (0.2 in) above mark on tank wall.

Start engine and if necessary add oil until level reaches mark.



5. Checking tightness of wire connections

Check tightness of all wire plugs, bending them with pliers if necessary.



6. Checking and tightening belts

A tight belt must give under thumb pressure by 5 to 10 mm (0.2 to 0.4 in) at a point midway between two pulleys. Tighten belt for alternator and, if applicable, vane pump. Loosen alternator and, if applicable, vane pump, swing outward and tighten bolts again.

7. Checking/correcting battery acid level

Lift off battery cover and unscrew plugs. Acid level approx. 5 mm (0.2 in) above plate upper edges in each cell or up to level mark visible in opening. Add distilled water when level is too low. Keep upper section of battery dry and clean.

Important! Be careful not to spill any acid or wipe any lead oxide from the pole connections on clothes. Never work with an open flame near a battery – danger of explosion.



8. Checking/correcting brake fluid level

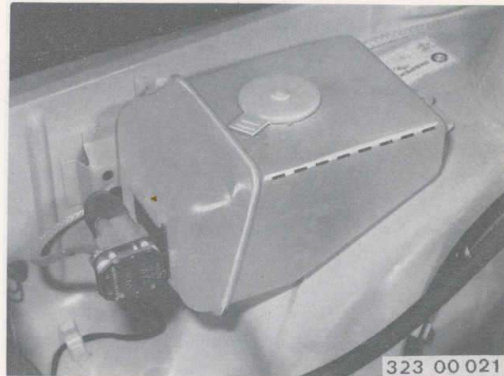
Brake fluid level in transparent tank for brake system between min. and max. marks.

Correct level only up to max. mark. Refer to Service Information Gr.34 for approved brake fluids.



9. Checking/correcting windshield washer fluid level

The windshield washer and headlight cleaner systems will always be ready for use by adding 40% household spirit for temperatures down to -20°C (-4°F).



10. Checking/correcting transmission oil level

a) Manual gearbox

Unscrew oil filler plug with a 17 mm socket wrench.

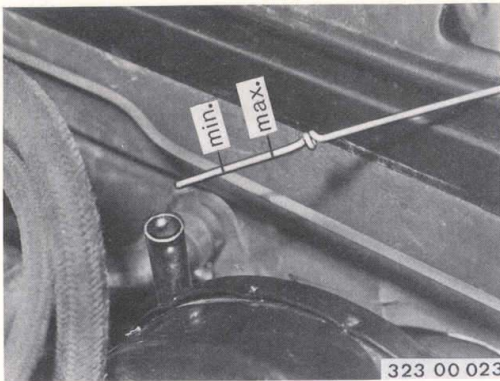
Oil level up to lower edge of filler opening.

Use only brand name SAE 80 gear oils.

Specification MIL-L-2105 or

API-GL-4





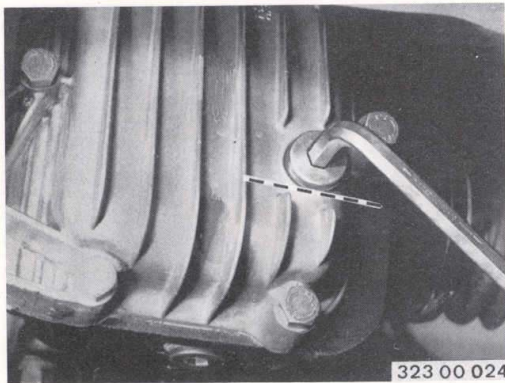
b) Automatic transmission

Requirement: Car on level ground, transmission at operating temperature, selector lever at "P" and engine running at idle speed.

Oil level must be between min. and max. marks.

Quantity of oil between min. and max. marks = 0.4 liter (0.7 Imp. pin, 0.42 US quart).

Important: Do not wipe oil dipstick with a fluffy cloth. Refer to Service Information Gr.24 for approved automatic transmission fluids.



11. Checking/correcting final drive oil level

Unscrew oil filler plug with a 10 mm socket wrench.

Oil level up to lower edge of filler opening.

Use only brand name hypoid SAE 90 gear oils. Refer to Service Information Gr.33 for approved final drive oil grades.



12. Checking steering wheel straight ahead position and steering wheel fastening

Check straight ahead position of steering wheel during a test drive. Lift off BMW emblem to adjust the steering wheel. Unscrew nut, take off steering wheel and put it on in straight ahead position. Use a new self-locking nut. Torque¹⁾



13. Checking tightness of wheel bolts

Check tightness of wheel bolts with a torque wrench.

Torque¹⁾

¹⁾ See Specifications

14. Checking pressure of tires (including spare wheel)

(Filling pressure¹⁾)



15. Checking and aiming headlight beams

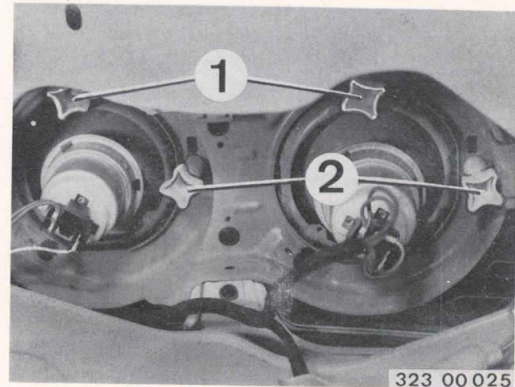
Requirement: Correct tire pressures, car on level ground and rear seat loaded at center by one person or 70 kg (154 lb).

Check low and high beams with optical testing equipment.

Take off covers. Correct beams with adjusting screws.

(1) Vertical adjustment

(2) Lateral adjustment



16. Checking lights

Check function of parking lights, high and low beam headlights, tail lights, stop lights, backup lights, tail fog light, license plate light, turn signals, hazard lights, horns, windshield wipers and windshield washer.

Adjust windshield washer jets. Check function of heater blower, interior lamp, glove box lamp, trunk and engine compartment lamps, instrument lights and all indicator and warning lamps, and the cigar lighter.

17. Check interior equipment, chrome-plated parts, paint, doors, engine hood, trunk lid, door windows, steel-panel sliding roof and seat belts

Check headliner, trim and carpets for correct installation, damage or dirt.

Check chrome-plated parts for damage or defects. Check painted parts for scratches, dust inclusions or silicone pits. Check function and alignment of doors, engine hood, trunk lid, door windows and steel sliding roof, correcting if necessary. Check function of seat belts.

¹⁾ See Specifications



18. Tools

Check whether all tools are present.



Spare key, owner's handbook, service booklet,
list of dealers and warranty card.
Car jack and wheel wrench.
Check whether these items are in car.

19. Test drive with function check

Check function of engine, cooling system, transmission, final drive, steering and brakes during a test drive. Check items affecting road safety. Bed down the handbrake by applying to 4 notches at lever and driving app. 400 m (1300 ft.).
Check instrument readings.

20. Leak test after test drive

Check (visual inspection) engine, cooling system, transmission, final drive, fuel, clutch and brake systems for leaks after a test drive.

21. Adjusting engine idle speed – exhaust emissions test

1) Idle speed

Requirement: correct ignition timing.

Engine at operating temperature.

Oil temperature at least 60°C (140°F).

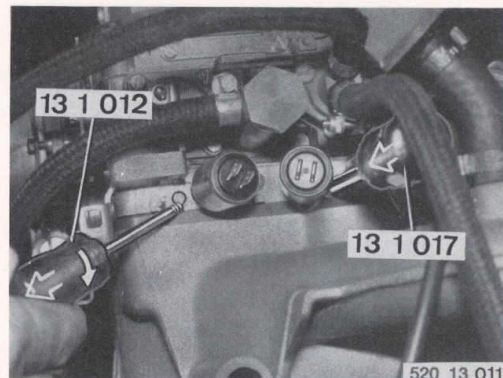
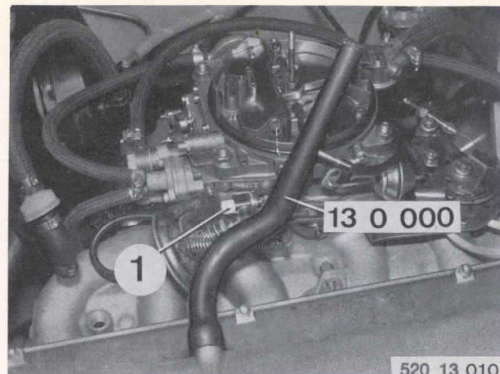
Remove air cleaner – 13 71 000.

Connect air cleaner simulator 13 0 000, using the hose between the air cleaner and the rocker cover.

Connect BMW digital tester.

Adjust engine idle speed with screw (1).¹⁾

Important: remove existing locks on adjusting screws with 13 1 012 puller. After adjusting idle speed, install new locks (color blue) with tool 13 1 017.



2) CO level in % by volume

Remove plugs from exhaust manifold and insert test probes 13 0 020.

Connect CO level tester.

Measure CO level separately at front and rear exhaust manifolds.

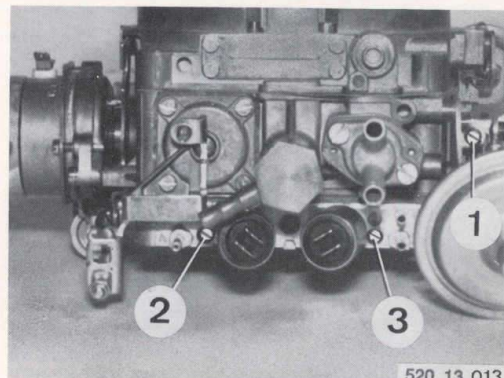


Adjust CO level with the mixture control screws (2 and 3).¹⁾

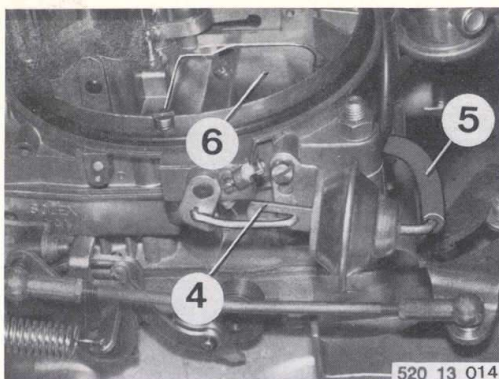
Screw (2) – rear exhaust manifold

Screw (3) – front exhaust manifold

Correct any change in idle speed with screw (1).



¹⁾ See Specifications



3) Checking function of stage II damper
Check easy movement of air flap and closing of throttle butterfly.

Run engine at idle speed.

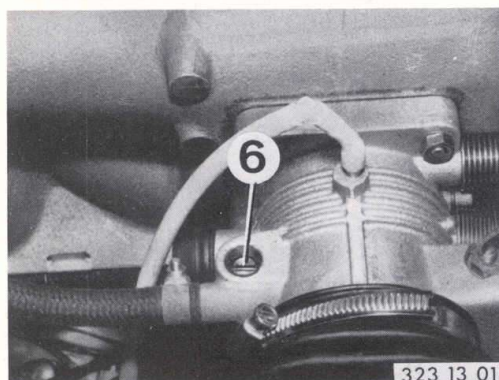
Lever (4) must be pulled against the stop by the diaphragm.

Pinch hose (5) with a Matra clamp or other means.

Operate air flap (6) several times.

The diaphragm is in working order when the lever always returns to the final stop.

Important: attach actuating rod with kink facing down, or accelerator linkage may jam.

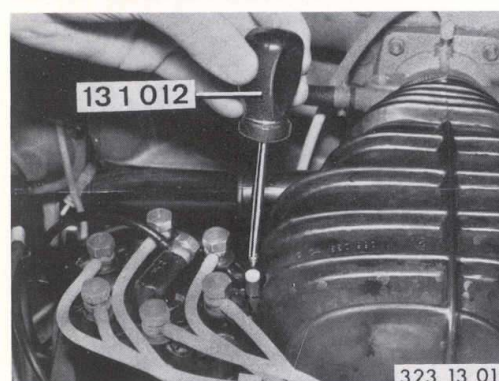


B) Fuel injection engine

– Engine at normal operating temperature –

1) Idle speed

Turn screw (6) to adjust idle speed.¹⁾



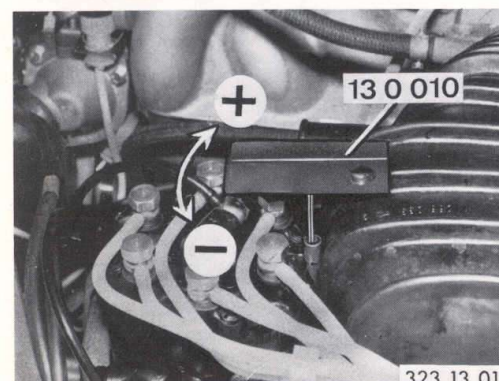
2) Adjusting CO level in % by volume

Remove screw plugs from exhaust manifolds and insert test probes 13 0 020.

Connect exhaust emissions tester.

Measure CO value at front and rear exhaust manifolds separately.

Important: remove screw lock with puller 13 1 012. After adjusting idle speed, attach new lock.



Use adjusting wrench 13 0 010 to set CO value.¹⁾

¹⁾ See Specifications

0000079 Extra work during BMW Inspection
– every 30000 km (20000 miles)

1. Transmission oil change
2. Final drive oil change
3. Checking installed clutch for wear
4. Checking and aiming headlight beams
5. Cleaning fuel strainers or renewing fuel filter

00 00 079 Extra work during BMW Inspection – every 30 000 km (20 000 miles)

1. Transmission oil change

a) Manual gearbox

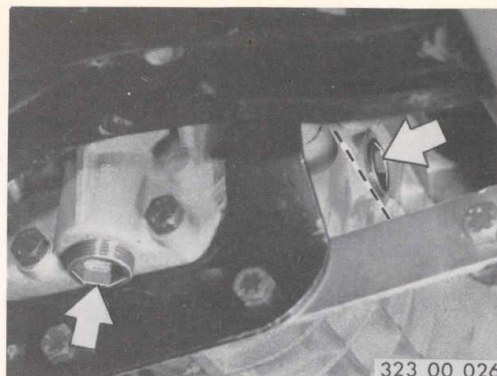
Transmission at operating temperature.

Unscrew oil drain plug and filler plug with a 17 mm Allen socket wrench. Remove, clean and insert oil drain plug.¹⁾

Add brand name SAE 80 gear oil.

Oil level up to lower edge of filler opening.¹⁾

Specifications MIL-L-2105 or API-GL-4.



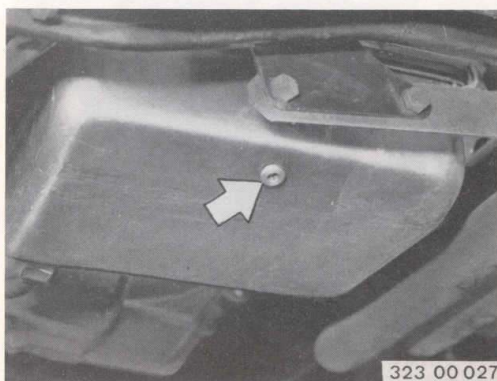
b) Automatic transmission

Transmission at operating temperature.

Unscrew oil drain plug with a 5 mm Allen socket wrench.

When installing: Check gasket and renew if necessary.

Pull out oil dipstick and add 2.0 liters (3.5 Imp. pints, 2.1 US quarts) of ATF. Refer to Service Information Gr.24 for approved ATF grades.



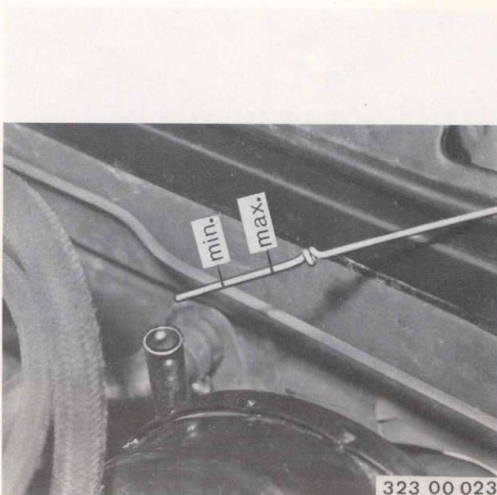
Check oil level.

Requirement: Car on level ground, transmission at operating temperature, selector lever at "P" and engine running at idle speed.

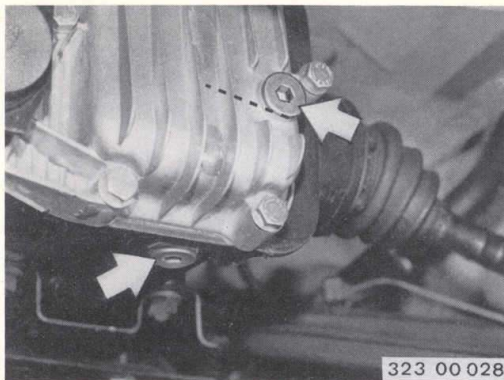
Oil level must be between min. and max. marks.

Quantity of oil between min. and max. marks = 0.4 liter (0.7 Imp. pint, 0.42 US quart).

Important! Never wipe off oil dipstick with a fluffy cloth.



¹⁾ See Specifications



2. Final drive oil change

Final drive at operating temperature.

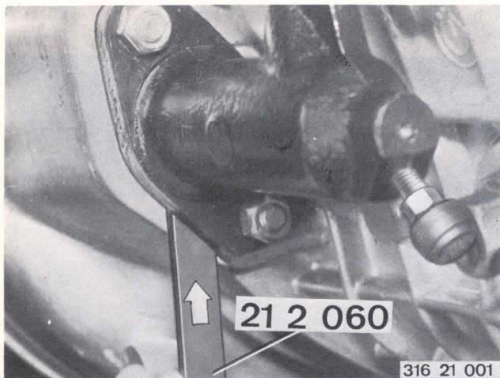
Unscrew oil drain plug and filler plug with a 10 mm Allen socket wrench.

Clean oil drain plug. Check seal and insert drain plug.

Add brand name hypoid SAE 90 gear oil.¹⁾

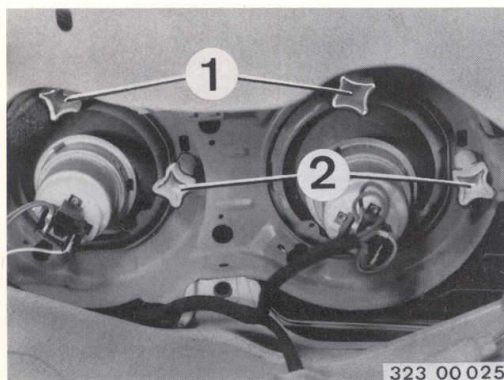
Oil level up to lower edge of filler opening.

Refer to Service Information Gr.33 for approved oils.



3. Checking installed clutch for wear

Clutch linings are good as long as gauge 21 2 060 can be inserted into the opening of the slave cylinder up to the stop. When there is a gap of 5 mm (0.2 in) between the gauge 21 2 060 and slave cylinder, the drive plate is worn and must be replaced.



4. Checking and aiming headlight beams

Requirement: Correct tire pressures, car on level ground and rear seat loaded at center by one person or 70 kg (154 lb) of weight.

Check low and high beams with an optical tester. Lift off covers. Adjust beams with the adjusting screws.

(1) Vertical adjustment.

(2) Lateral adjustment.

¹⁾ See Specifications

5. Cleaning fuel strainers or renewing fuel filter

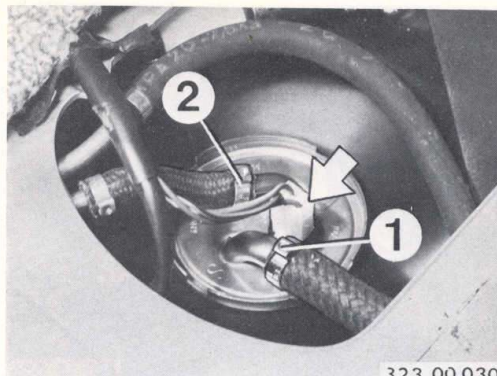
Remove rear seat.

Take off cover plate.

Detach hoses and cables from suction head.

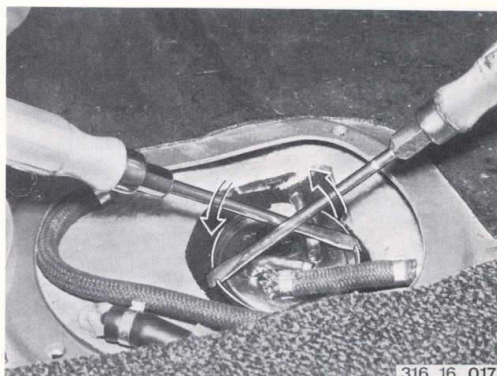
When installing: **1. Suction line**

2. Return line



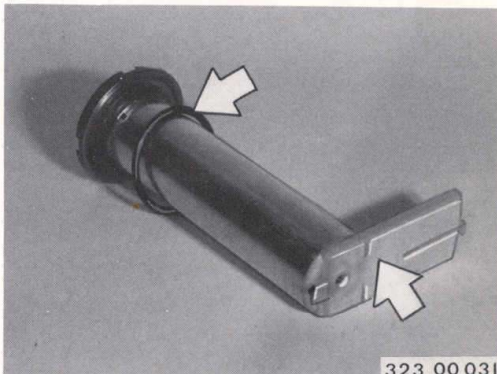
323 00 030

Unscrew fuel suction device by applying two crossed screwdrivers and turning counter-clockwise.



316 16 017

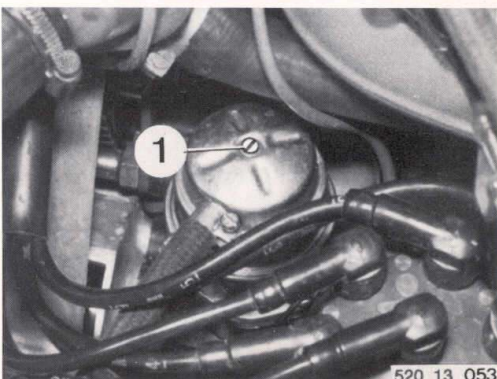
When installing: **clean fuel strainer. The round cord seal swells when in contact with gasoline and in this manner provides a perfect seal. Check round cord seal and renew if necessary.**



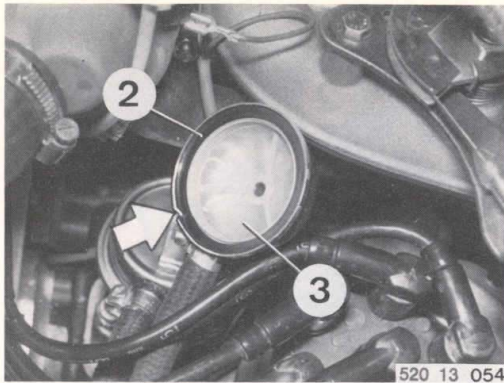
323 00 031

Carburetor engine:

Clean strainer in fuel pump. Loosen screw (1).



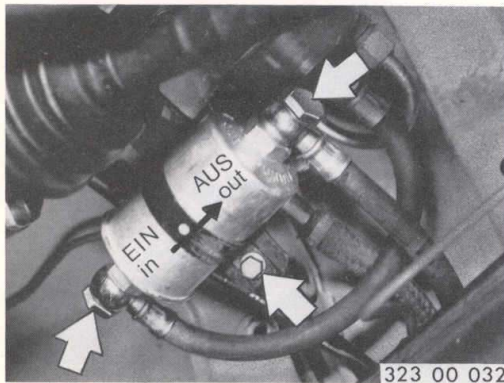
520 13 053



Remove cover with sealing ring (2) and strainer (3).

Clean strainer.

When installing: lug must engage in pump housing.



Fuel injection engine:

Detach hose unions and clip.

When installing: note correct direction of flow.

0000090 Extra work during BMW Inspection
– every 60000 km (40000 miles)

- 1. Checking high pressure pump and function of power steering (special equipment)**
- 2. Renewing power steering filter**
- 3. Checking/adjusting front wheel bearing play**
- 4. Checking handbrake linings (in rear disc brakes)**

00 00 090 Extra work during BMW Inspection – very 60 000 km (40 000 miles) –

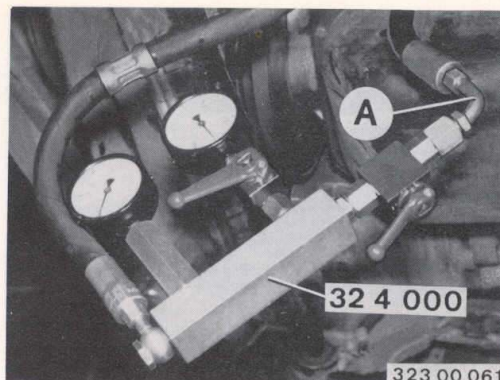
1. Checking vane pump and function of power steering (special equipment)

A) Vane pump

Always check delivery pressure of vane pump first.

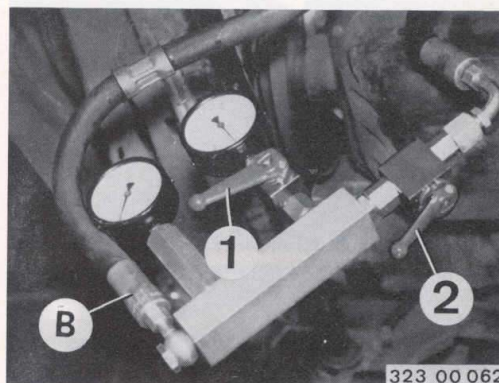
Detach pressure line (A) at vane pump and connect it to pressure tester 32 4 000.

Important! Never re-use oil which has run out.



Connect pressure line (B) from pressure tester to vane pump. Close cut-off valve (1). Open cut-off valve (2) and bleed hydraulic system while engine is running at idle speed – 32 13 006. Engine must be at operating temperature for this. After bleeding has been completed, close cut-off valve (2) for max. 10 seconds and read the pressure. The pressure¹⁾ given on the vane pump's data plate must not drop by more than 10%.

Important: shutoff valve (1) must remain closed for all high pressure measurements.



B) Power steering

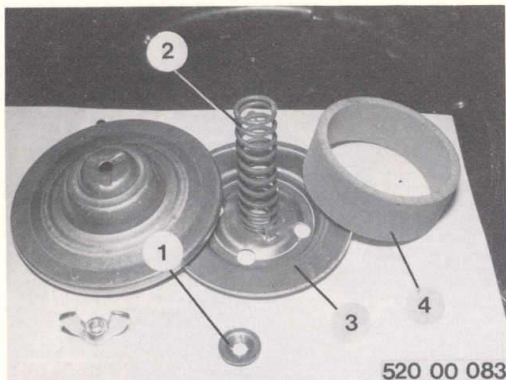
Let engine run.

Pull steering wheel against lock stop with a force of 100 N (22 lb) for approx. 5 seconds. Read pressure from pressure tester 32 4 000. Repeat same test at right lock.

The pressure¹⁾ quoted on the vane type pump data plate must not drop by more than 10%.



¹⁾ See Specifications



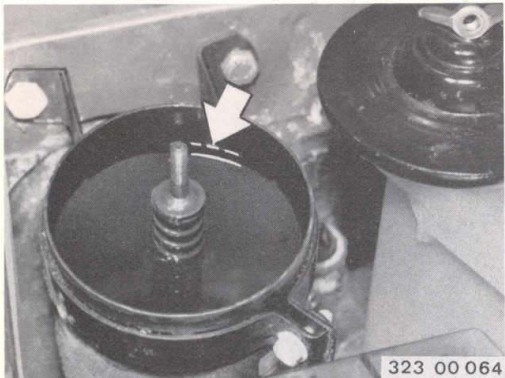
2. Renewing power steering filter

Unscrew cover.

Take out keeper (1).

Remove spring (2), washer (3) and filter (4).

When installing: renew keeper (1). Locate filter in its detent.

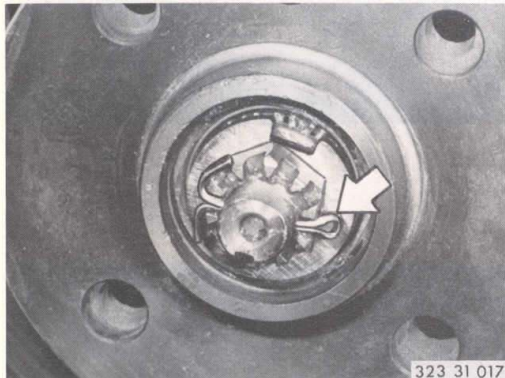


Checking power steering oil level:

Stop engine. Remove wing nut and tank lid.

Oil level must be app. 5 mm (0.2 in) above mark on inside of tank.

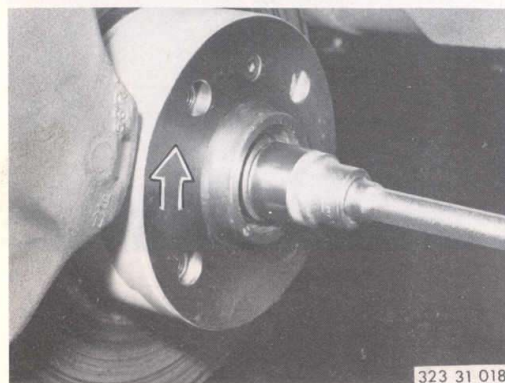
Start engine. Add oil if necessary until level is correct.



3. Checking/adjusting front wheel bearing play

Remove and install cap – 31 21 050.

Remove cotter pin and unscrew castle nut.



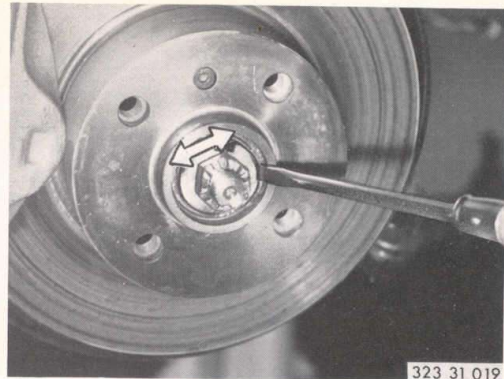
Tighten castle nut to 30... 33 Nm (22... 24 ft. lb) while constantly turning the wheel.

This will line up the taper rollers and bearing inner races. It will also force out the grease causing play. Turn tightened bearing assembly by at least 2 more turns.

When doing this, the castle nut must not be loosened nor tightened.

Loosen castle nut until there is axial play, whereby the hub must turn again. Tighten castle nut to max. 3 Nm (2 ft. lb) and lock with a cotter pin.

Checking axial bearing play: It must be possible to move tabbed disc (1) quickly and without any noticeable resistance.



4. Check handbrake linings

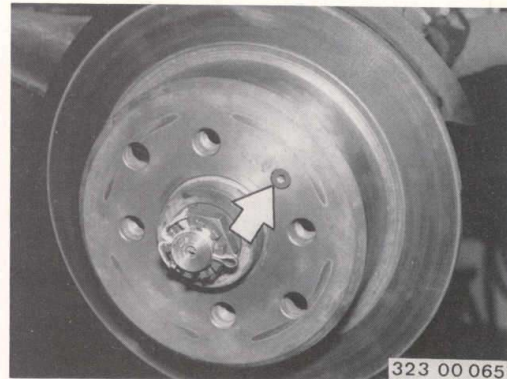
Detach and attach rear wheel – 36 10 320.

Remove fixed caliper. Brake pipe remains attached.

Remove 4 mm Allen screw.

Detach brake disc from axle shaft.

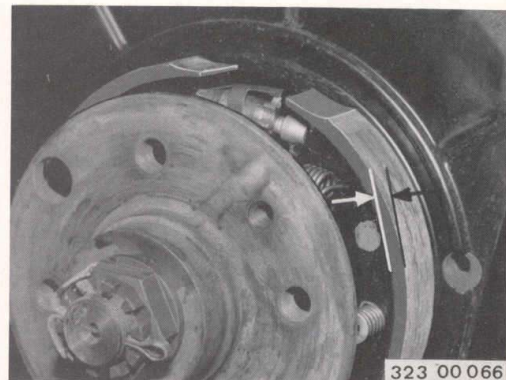
When installing: note relative positions of holes in brake disc and axle shaft flange.



Check minimum thickness and condition of linings.

Brake linings must be at least 1.5 mm (0.06 in) thick at the thinnest point.

When the minimum thickness of 1.5 mm is reached, renew the handbrake shoes.



0000219 1st BMW Inspection
– at 1000 km/600 miles –

1. Engine oil change and oil filter renewal
2. Manual gearbox oil change
3. Final drive oil change
4. Half-shafts
5. Power steering oil level check
6. Cooling system
7. Brakes
8. Fuel pump mounting
9. Carburetor nounting
10. Fuel injection system
11. Checking/tensioning V-belts
12. Tightening nuts and bolts on engine
13. Valve clearances – adjusting
14. Tightening nuts and bolts
15. Checking foot brake/handbrake
16. Checking tire pressures, including spare wheel
17. Checking/correcting toe of front wheels
18. Checking/correcting headlight beams
19. Checking lights
20. BMW program test/digital tester – diagnosis
21. Final inspection

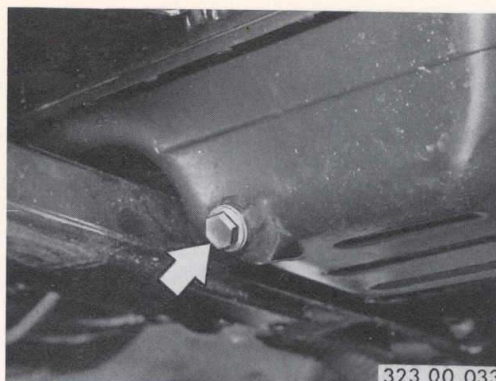
00 00 219 1st BMW Inspection
– at 1 000 km / 600 miles –

1. Engine oil change and oil filter renewed

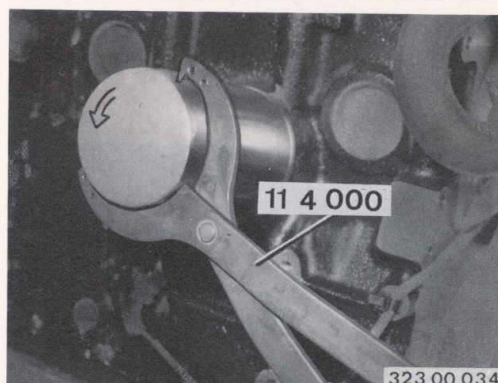
Engine at operating temperature.

Unscrew oil drain plug (19 mm/ $\frac{3}{4}$ " wrench) at bottom right of oil pan. After oil has drained, install and tighten plug. Torque¹⁾.

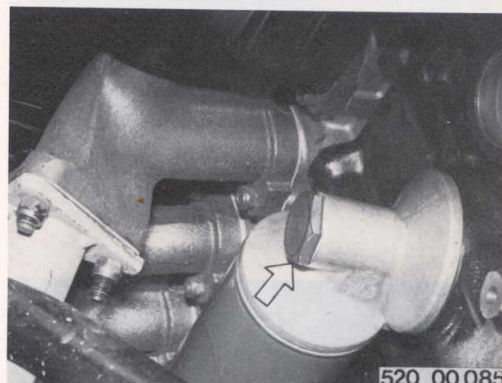
When installing: Check oil drain plug and seal; renew if necessary.



Unscrew oil filter with special tool 11 4 000.



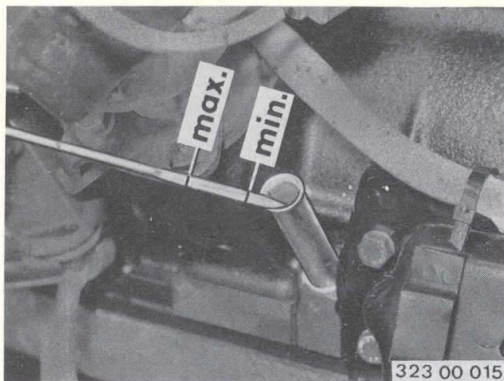
For cars with air conditioning:
Unscrew adaptor with a 32 mm ($1\frac{1}{4}$ in) wrench and separate filter from adaptor.



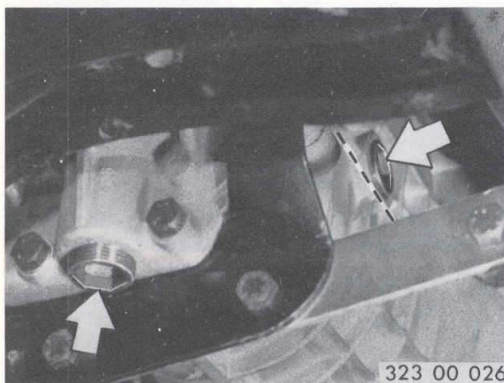
When installing: insert adaptor in lock. Renew the aluminum seal. Tightening torque¹⁾.



¹⁾ See Specifications



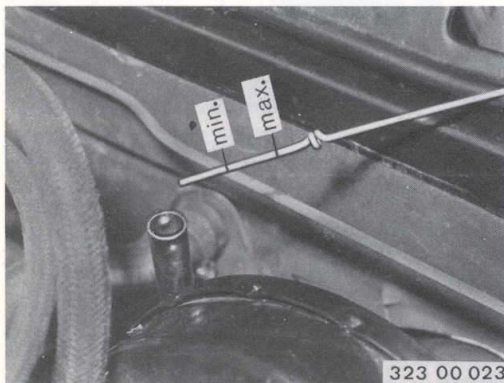
Add brand name engine oil. Quantity¹⁾.
Oil level not higher than max. mark.
Quantity of oil between min. and max. marks
= 1.5 liters (1.6 US quarts, 2.6 Imp. pints).
For approved oil grades, see Service Information Group 11.



2. Oil change only for manual gearbox

Transmission at operating temperature.
Unscrew oil drain plug and filler plug with a
17 mm wrench. Clean and install oil drain plug,
tightening torque¹⁾. brand name SAE 80 gear
tightening torque¹⁾. Add brand name SAE 80
gear oil.

Oil level¹⁾ up to lower edge of filler opening.
Specifications MIL-L-2105 or
API-GL-4



Automatic transmission – checking oil level

Requirement: car on flat, level surface. Trans-
mission at normal operating temperature,
selector lever at P, engine idling.

Oil level must be between max. and min.
marks.

Quantity of oil between marks: 0.4 liter (0.42 US
quart, 0.7 Imp. pint).

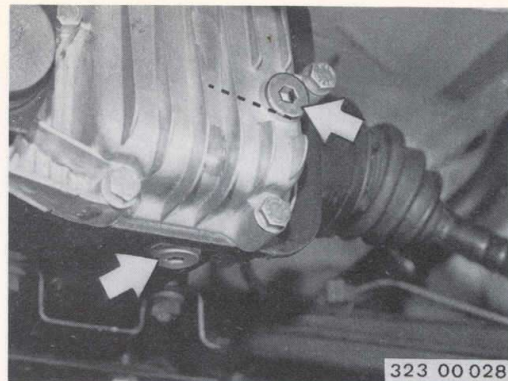
Important: do not clean oil dipstick with a fluffy
cloth.

For approved grades of ATF, see Service In-
formation Group 24.

¹⁾ See Specifications

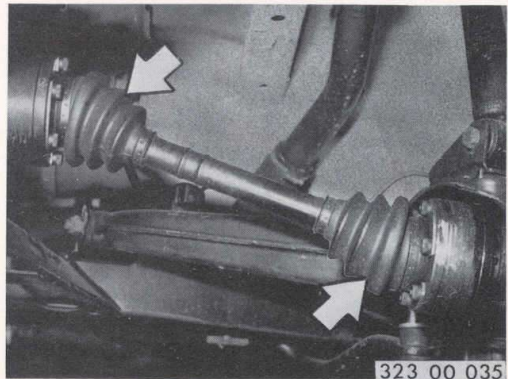
3. Final drive oil change

Final drive at operating temperature. Unscrew oil drain plug and filler plug with a 10 mm Allen socket wrench. Clean oil drain plug, check seal and install drain plug. Torque¹⁾. Add brand name SAE 90 hypoid gear oil. Oil level up to mark. Quantity¹⁾. Refer to Service Information Gr.33 for approved oils.



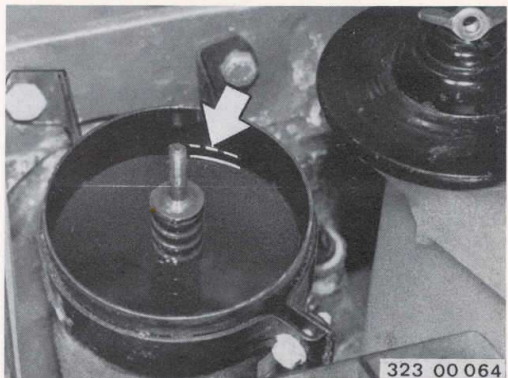
4. Output shafts

Check dust covers for leaks. Tighten mounting bolts. Torque¹⁾.



5. Checking power steering oil level

Stop engine. Unscrew wing nut on oil tank cover and remove cover. Oil level must be app. 5 mm (0.2 in) above mark on tank wall. Start engine. Add oil if necessary up to correct level.



6. Cooling system

Check coolant level. Add coolant until level is not more than 2 cm (0.8 in) below radiator cap.

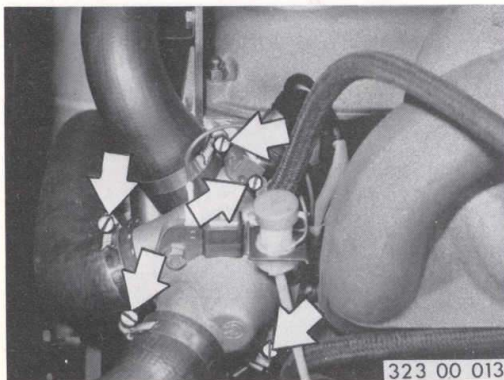


¹⁾ See Specifications



323 00 012

Check antifreeze concentration.
All-year antifreeze protection: -25°C (-13°F).
Refer to Service Information Gr. 17 for approved long-term antifreeze and corrosion inhibitors.



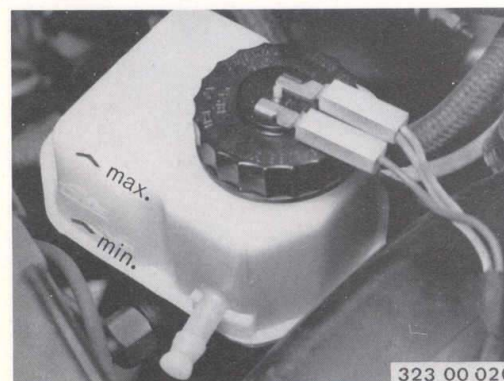
323 00 013

Tighten all hose clips on engine.



323 00 014

Tighten all hose clips on radiator and expansion tank.



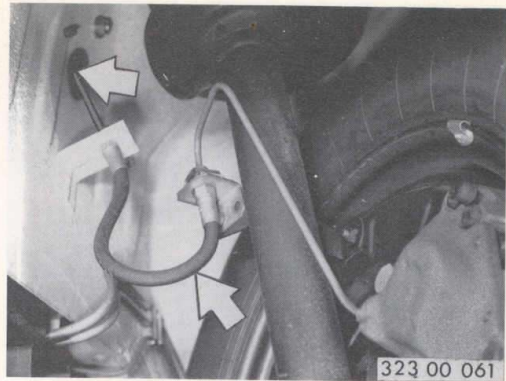
323 00 020

7. Brakes

Brake fluid level in transparent reservoir for braking system must be between min. and max. marks.

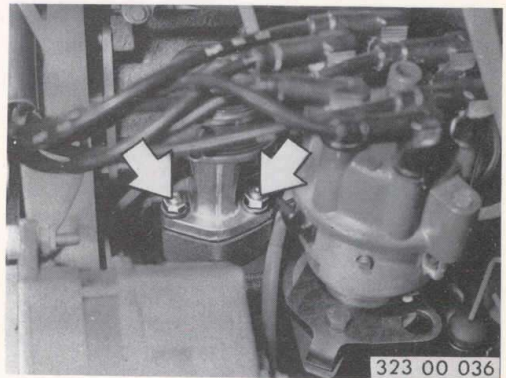
Add fluid only up to max. mark. Refer to Service Information Gr. 34 for approved brake fluids.
Important! Change brake fluid annually.

Check brake lines, brake hoses, connections and parking brake cables for correct routing, tightness and leaks.



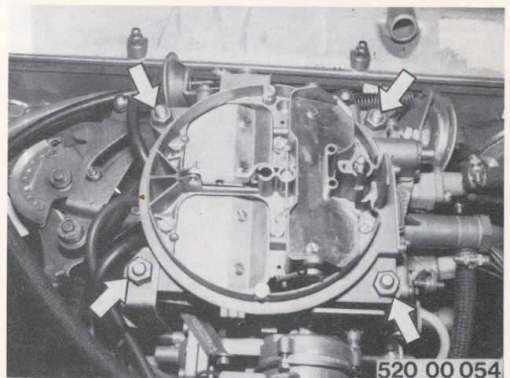
8. Fuel pump mounting

Tighten nuts of fuel pump. Torque¹⁾.
Check (visual inspection) fuel pump and connections for leaks.



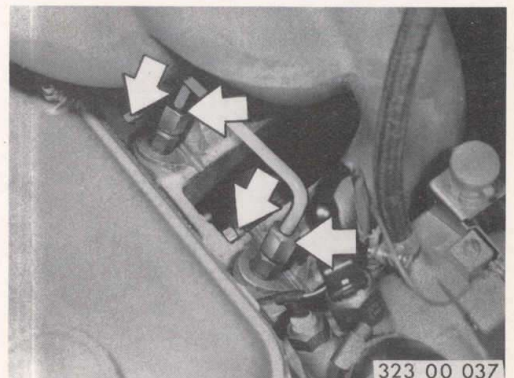
9. Carburetor mounting

Take off air cleaner.
Check tightness of carburetor nuts. Torque¹⁾.

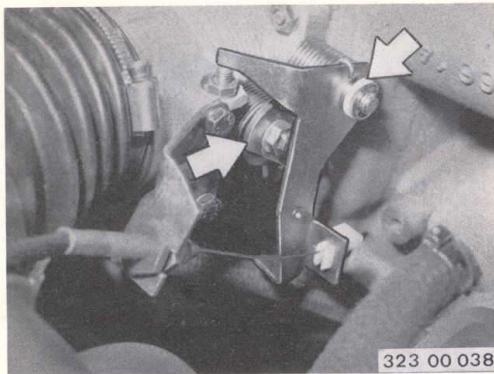


10. Fuel injection system

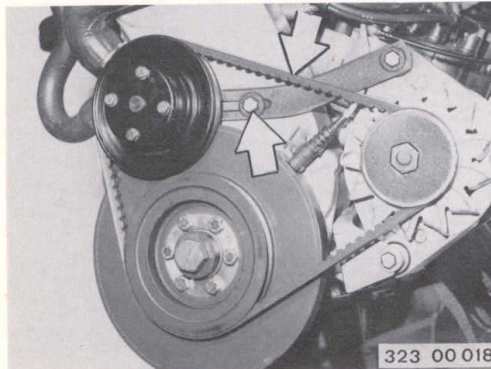
Take up any slack at injector pipe collar nuts and intake pipe retaining nuts. Check pipes for correct seating and leakage.



¹⁾ See Specifications



Oil pivots of throttle butterfly arm.



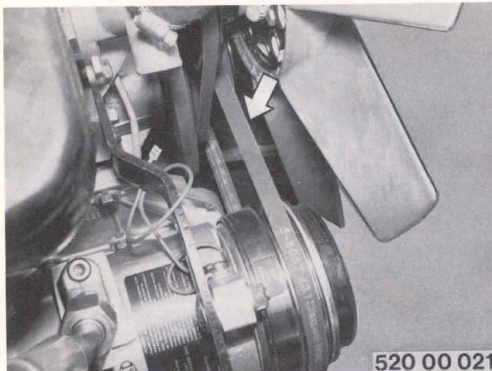
11. Checking/tensioning V-belts¹⁾.

The V-belts when tightened correctly must yield under thumb pressure by 5 to 10 mm (0.2 to 0.4 in) at a point midway between two pulleys. Tighten V-belt for alternator and, if applicable, vane pump. Loosen alternator and, if applicable, vane pump, swing outward and re-tighten the bolts.

Tighten V-belt for compressor (air conditioning).

Loosen compressor at holder and press downward.

Tighten the mounting bolts.



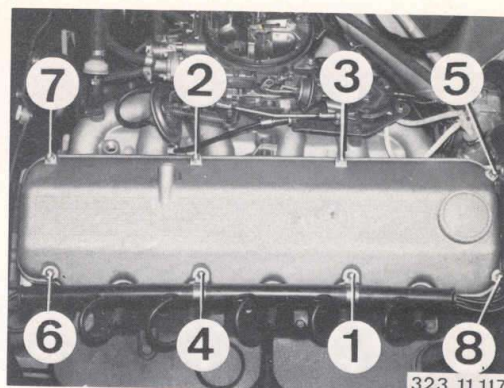
12. Tightening nuts and bolts on engine

Tighten left and right engine rubber mounts, engine mounting stirrup, toothed belt cover mounting bolts, intake/exhaust manifolds and oil pan mounting bolts.

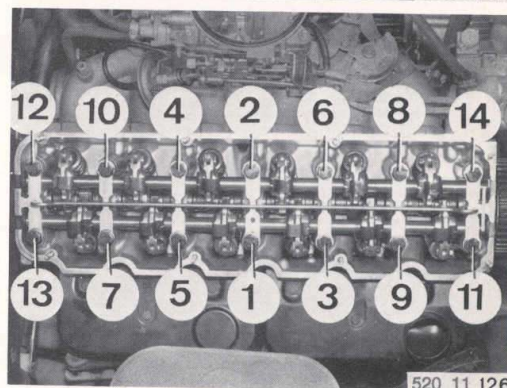
¹⁾ See Specifications

Tighten cylinder head bolts. For this purpose remove the air cleaner (carburetor engine). Take off cylinder head cover.

Installation Note! Tighten nuts in sequence of 1...8.



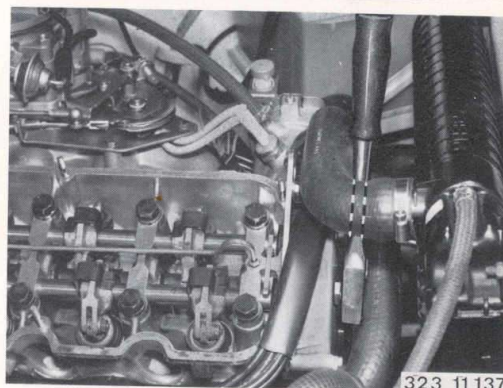
Max. engine temperature: +35°C (95°F). Tighten cylinder head bolts one after the other in the sequence 1...14, in two stages:



13. Valve clearances – adjusting

Important: take out spark plugs before turning over engine.

Turn engine over with a 1/2-inch ratchet head.

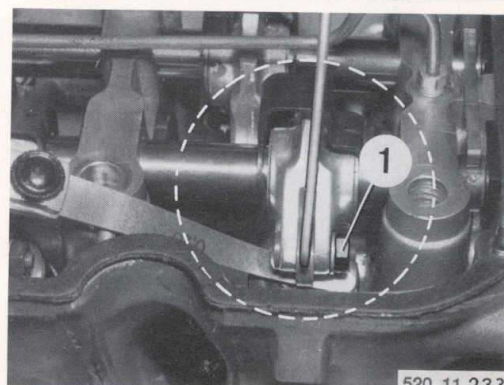


Adjust valves in same sequence as firing order (1-5-3-6-2-4), at compression to dead center (TDC).

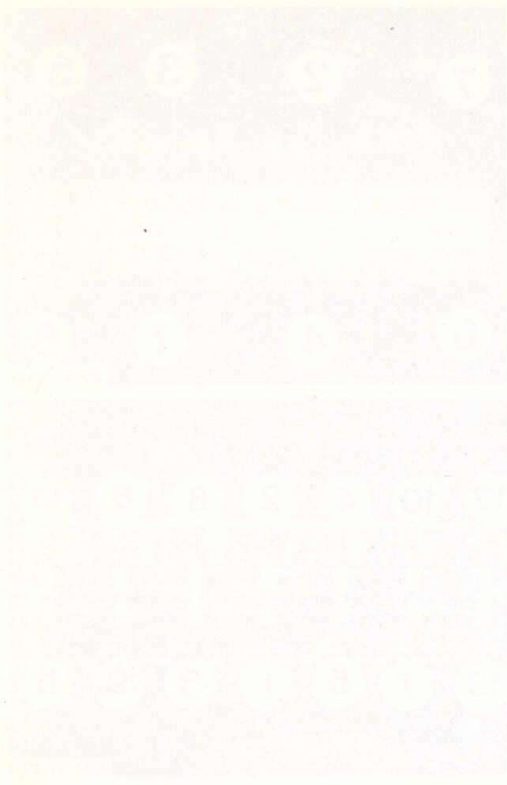
Adjust valve clearance between valve and eccentric after loosening nut (1).

Tighten nut (1) with special ring spanner 11 1 150 and torque wrench 00 2 050.

Note correct tightening torques¹⁾.

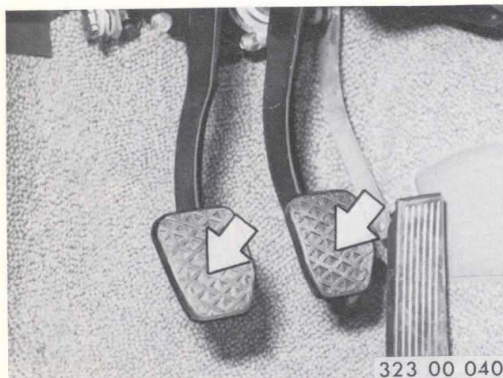


¹⁾ See specifications



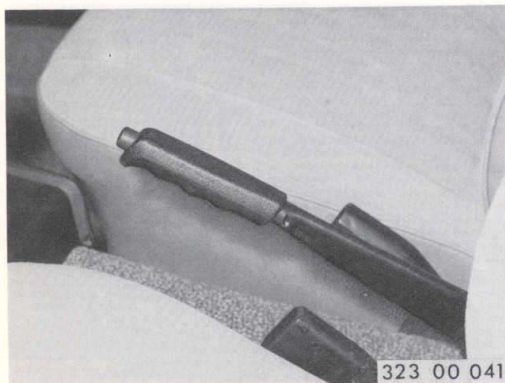
14. Tightening nuts and bolts¹⁾

Front axle beam to body
 Wishbone to front axle beam
 Steering gear to front axle beam
 Track rod clamping bolts
 Transmission to engine
 Bearing mount to transmission
 Rubber mount to cross member
 Cross member to body
 Exhaust pipes to exhaust manifold
 Exhaust (all exhaust holders) to front exhaust pipes
 Propeller shaft (manual gearbox), front
 Propeller shaft (automatic transmission), front
 Center bearing to body
 Propeller shaft to final drive
 Front brake calipers
 Wheel bolts



15. Checking foot brake and handbrake

Check pedal action during test drive.
 Check that brakes do not pull to one side or judder.



Check handbrake adjustment.
 Apply handbrake lever by 5 notches.
 Wheels should just turn by hand without local stiffness. If necessary, adjust brakes and handbrake cables.

¹⁾ See Specifications

16. Checking tire pressures, including spare wheel

Check filling pressure¹⁾ with cold tires.
Check valves for tightness.



17. Checking/adjusting toe of front wheels

Vehicle in normal-load position:¹⁾
Position steering at 0 and check toe with optical testing equipment.¹⁾
If necessary, adjust toe at track rods.

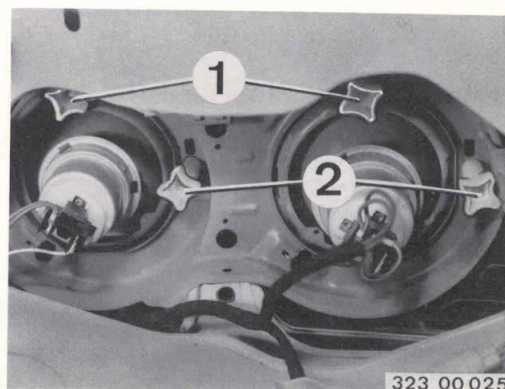


18. Checking/aiming headlight beams

Requirement: Correct tire pressures, car on level ground and rear seat loaded at center by one person or 70 kg (154 lb) weight.
Check low and high beams with optical testing equipment.

Remove covers. Make corrections with adjusting screws.

- (1) Vertical adjustment
- (2) Lateral adjustment



¹⁾ See Specifications

19. Checking lights

Check function of parking lights, high and low beam headlights, tail lights, stop lights, backup lights, tail fog light, license plate light, turn signals, hazard warning lights, horns, windshield wipers and windshield washer. The windshield washing and headlight cleaning system can be kept ready for use all year around down to temperatures of -20°C (-4°F) by adding 40% household spirit. Adjust windshield washer jets. Check function of heater blower, interior lights, glove box lamp, trunk and engine compartment lamps, instrument lights and all indicator lamps and cigar lighter.

20. Diagnosis with BMW program tester / digital tester

See 11 00 005.

21. Final inspection

Test drive to check road safety and function of engine, cooling system, transmission, rear axle, steering and brakes. After test drive check engine, cooling system, transmission, rear axle, steering and brakes for leaks.

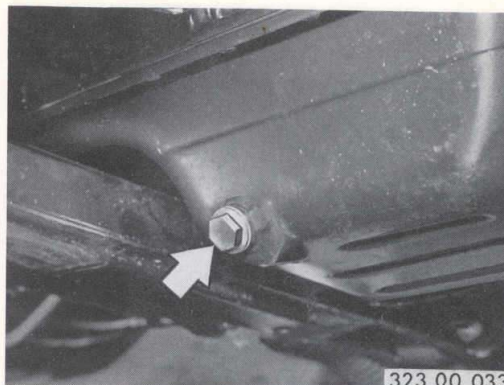
00 00 229 1st BMW Oil Service
– at 7500 km (5000 miles) –

1. Engine oil change and oil filter renewal

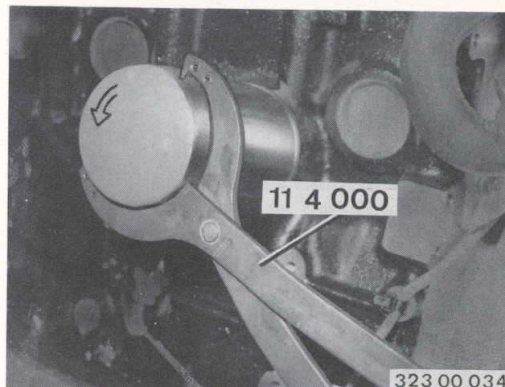
Engine at operating temperature.

Unscrew oil drain plug (19 mm / $\frac{3}{4}$ in wrench) on bottom of oil pan, right-hand side. After oil has drained install and tighten plug.¹⁾

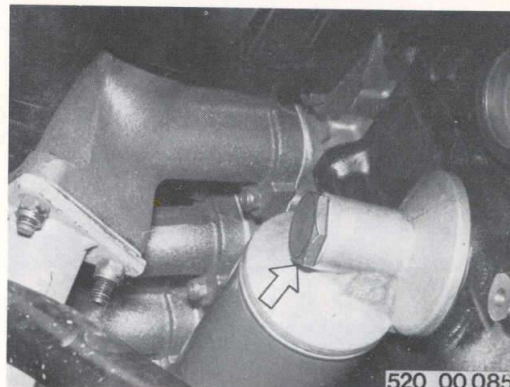
When installing: Check oil drain plug and seal and renew if necessary.



Unscrew oil filter with special tool 11 4 000.



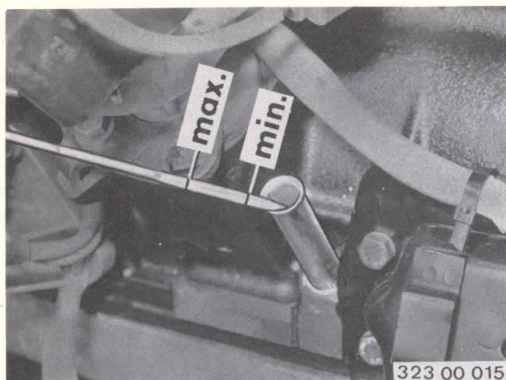
For version with air conditioning:
Unscrew adaptor with 32 mm ($1\frac{1}{4}$ in) wrench and separate filter from adaptor.



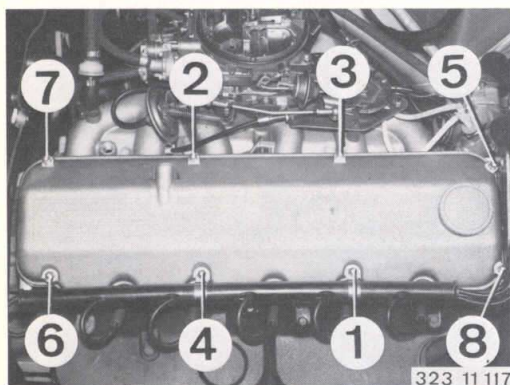
When installing: Insert adaptor in lock.
Renew aluminum seal.
Tightening torque:¹⁾



¹⁾ See Specifications

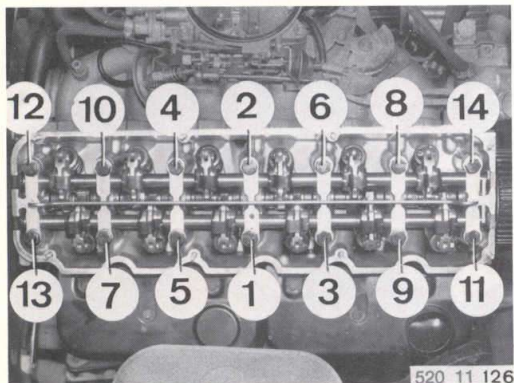


Add brand name engine oil.
 Oil level at most up to max. mark only.
 Quantity of oil between min. and max. marks
 = 1.5 liters (1.6 US quarts, 2.6 Imp. pints).



2. Tightening cylinder head bolts at
 7500 km (5000 miles); this job is not part of
 any later Oil Service

Remove air cleaner housing.
 Take off cylinder head cover.
 When installing: Tighten nuts in sequence of
 1... 8.¹⁾



Max. engine temperature: +35°C (+95°F).
 Tighten cylinder head bolts one after the other
 in sequence 1... 14, in 2 stages:¹⁾

¹⁾ See Specifications

**0000239 BMW Inspection (starting at 15000 km/10000 miles
and then every 15000 km/10000 miles)**

1. Engine oil change and oil filter renewal
2. Checking/correcting transmission oil level
3. Checking/correcting final drive oil level
4. Half-shafts
5. Power steering oil level check
6. Cooling system
7. Checking/correcting battery acid level
8. Checking/correcting brake fluid level
9. Checking/correcting belt tightness
10. Lubricating carburetor linkage or throttle butterfly controls with oil or grease
11. Tightening nuts and bolts on engine
12. Checking/adjusting valve clearances
13. Replacing spark plugs
14. Replacing contact breaker points
15. Replacing air cleaner element
16. Checking steering
17. Checking propeller shaft
18. Tightening nuts and bolts
19. Checking exhaust system
20. Checking brake linings
21. Checking condition of braking systems/adjusting parking brake
22. Checking hinges and locks
23. Checking lights
24. Checking seat belts
25. Diagnosis with BMW program tester/digital tester
26. Final inspection

00 00 239 BMW Inspection

– starting at 15 000 km (10 000 miles) and then every 15 000 km (10 000 miles) –

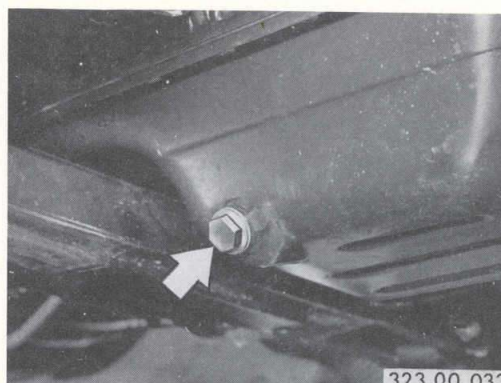
1. Engine oil change and oil filter renewal

Engine at operating temperature.

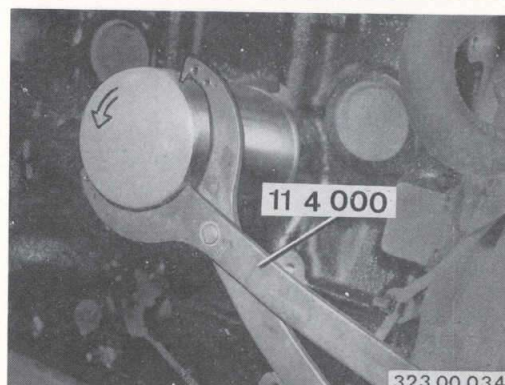
Unscrew oil drain plug (19 mm ($\frac{3}{4}$ " wrench) from bottom of oil pan on right-hand side. After oil has drained, install and tighten plug. Torque¹⁾.

When installing: Check oil drain plug and seal, and renew if necessary.

Unscrew oil filter with special tool 11 4 000.



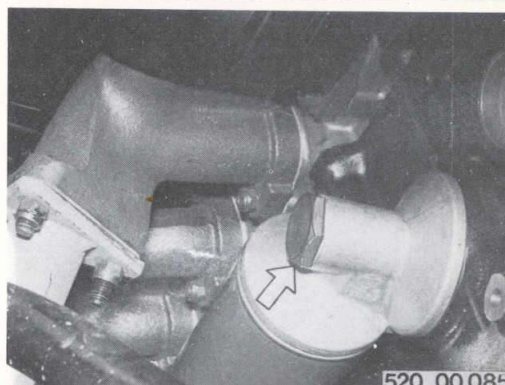
323 00 033



323 00 034

For version with air conditioning:

Unscrew adaptor with a 32 mm ($1\frac{1}{4}$ in) wrench and separate filter from adaptor.



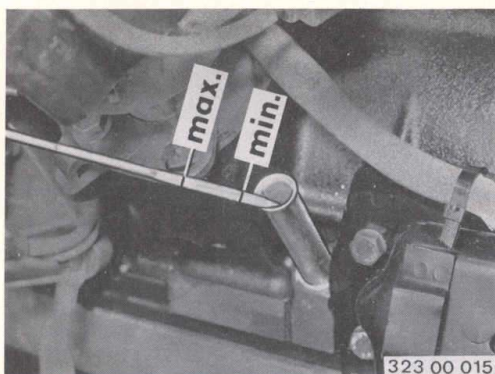
520 00 085

When installing: Place adaptor in lock. Renew aluminum seal. Tightening torque:¹⁾



520 00 086

¹⁾ See Specifications



Add brand name engine oil.
Oil level up to max. mark, not higher.
Quantity of oil between min. and max. marks
= 1.5 liters (1.6 US quarts, 2.6 Imp. pints).
For approved grades of oil, see Service Information Group 11.

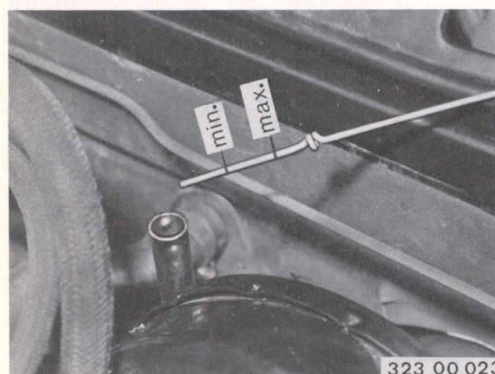


2. Checking/correcting transmission oil level

a) Manual gearbox.

Unscrew oil filler plug with a 17 mm socket wrench.

Oil level up to lower edge of filler opening.
Use only brand name SAE 80 gear oil.
Specifications MIL-L-2105 or API-GL-4.

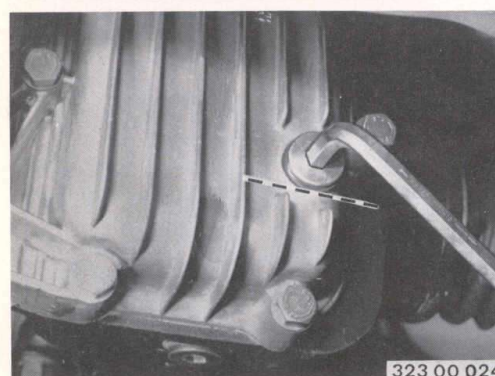


b) Automatic transmission:

Requirement: Car on level ground, transmission at operating temperature, selector lever at "P" and engine running at idle speed.
Oil level must be between min. and max. marks.

Quantity of oil between min. and max. marks
= 0.4 liter (0.42 US quart, 0.7 Imp. pint).

Important! Never wipe oil dipstick with a fluffy cloth. Refer to Service Information Gr.24 for approved automatic transmission fluids.



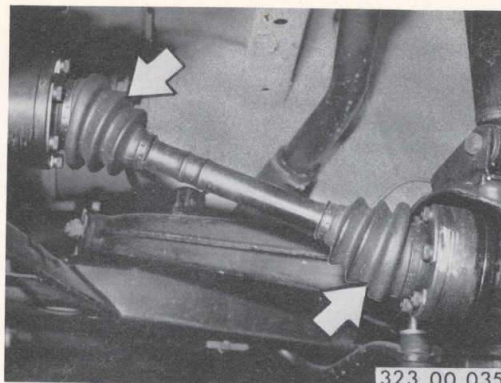
3. Checking/correcting final drive oil level

Unscrew oil filler plug with 10 mm socket wrench.

Oil level up to lower edge of filler opening.
Use only brand name hypoid SAE 90 gear oils.
Refer to Service Information Gr.33 for approved oils.

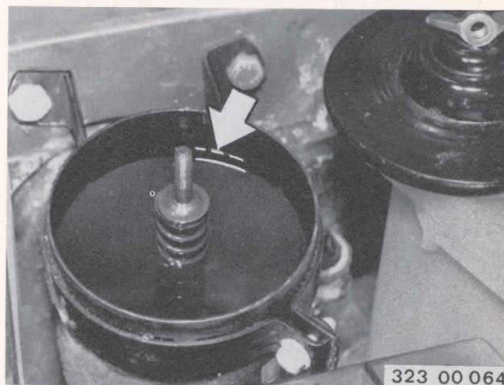
4. Half-shafts

Check flexible gaiters for leakage.
Take up any slack at the attachment bolts;
tightening torque¹⁾).



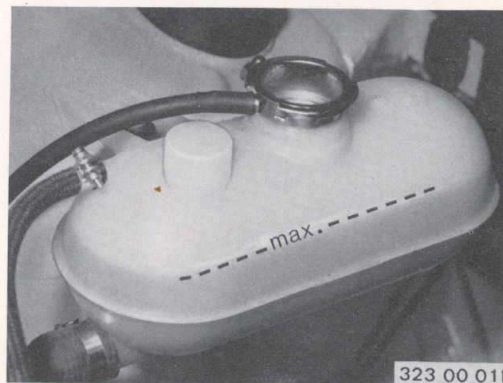
5. Checking oil level in power steering

With engine stopped, unscrew wingnut from fluid reservoir and take off lid.
The oil level must be approx. 5 mm (0.2 in) above the mark on the tank wall.
Start the engine and add fluid if necessary until the oil level agrees with the mark.



6. Cooling system

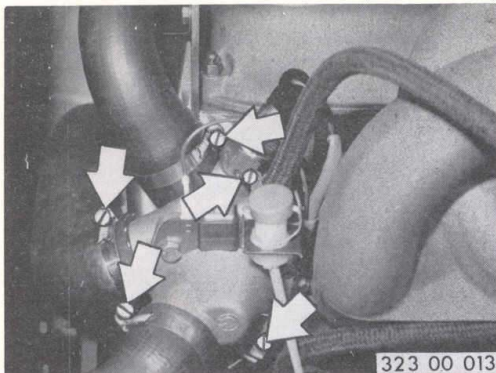
Check coolant level.
Add water if necessary to not higher than 2 cm (0.8 in) below the filler cap.



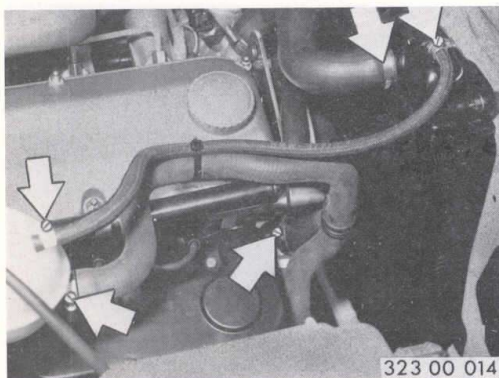
Check antifreeze concentration.
Antifreeze protection level: down to -25°C (-13°F) all the year round. For approved long-term antifreeze and corrosion inhibiting additives, see Service Information, Group 17.



¹⁾ See Specifications



Take up slack at all hose clips on the engine.



Take up slack at all hose clips on radiator and coolant expansion tank.



7. Checking battery acid level/adding distilled water if necessary

Take off the battery cover and unscrew the cell plugs.

Battery acid level should be approx. 5 mm (0.2 in) above the plates in each cell, or up to the mark visible in each cell opening.

Add distilled water if the level has dropped. Keep the upper part of the battery dry and clean.

Important: do not allow acid or lead oxide from the terminal posts to reach the clothing. Do not bring a naked light near the battery or an explosion may occur.



8. Brake fluid level – checking/restoring

The brake fluid level in the translucent reservoir for the brake system should be between the 'MIN' and 'MAX' marks.

Add fluid up to the 'MAX' mark if necessary. For approved grades of brake fluid, see Service Information, Group 34.

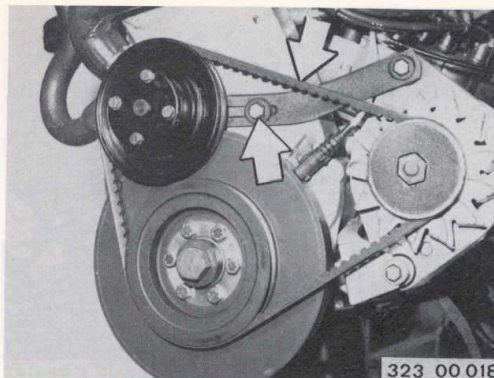
Important: brake fluid must be renewed at least once a year.

9. V-belt – checking condition, correcting tension

It should be possible to depress V-belts by 5 to 10 mm (0.2 to 0.4 in) at the centre of their runs if correctly tensioned.

Adjust the tension of the V-belts for the alternator and the power steering pump (if installed) if necessary.

Loosen the alternator (and the power steering pump if installed) at top and bottom, swing out and retighten bolts.



Correct tension of the compressor V-belt for the air conditioning (if installed).

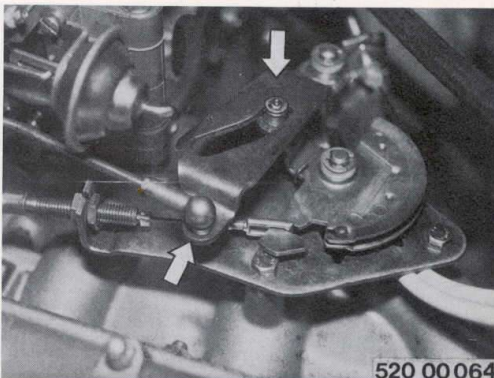
Slacken off the compressor at its mounting and press down.

Tighten the retaining bolts again.



10. Oil/grease the carburetor linkage or throttle butterfly actuating mechanism

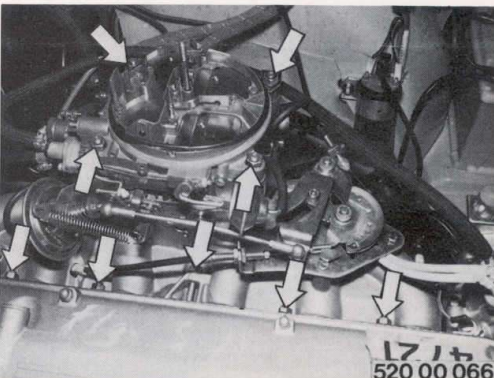
Oil or grease the pivots, bearing points and gate of the carburetor linkage or throttle butterfly actuating mechanism as appropriate.



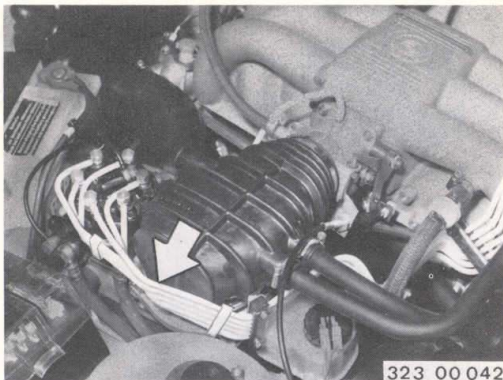
11. Take up slack at nuts and bolts on engine

Detach the air cleaner.

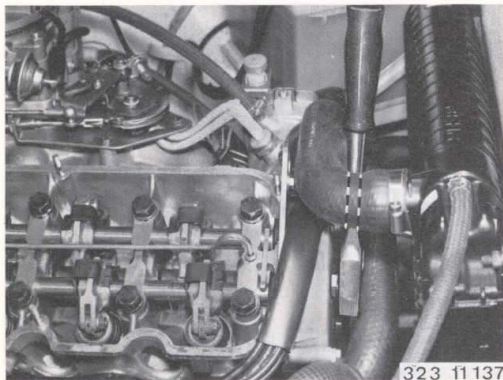
Tighten nuts on exhaust manifold, carburetor retaining nuts and fuel pump retaining nuts.¹⁾



¹⁾ See Specifications



Check fuel lines at carburetors or fuel injection system for correct location, general condition and freedom from leaks.

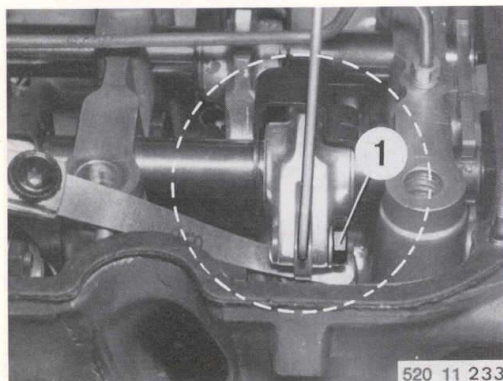


12. Valve operating clearances – checking/adjusting

Take off the rocker cover – 11 12 000.

Important: remove spark plugs before turning over engine.

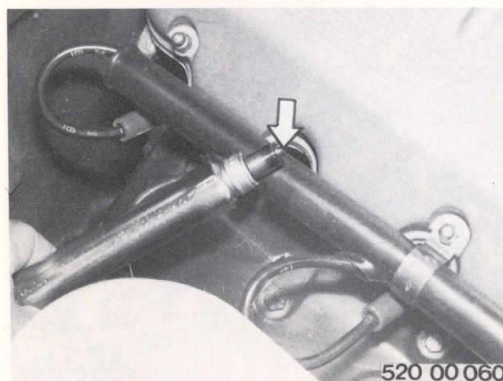
Turn the engine at the adapter with a $\frac{1}{2}$ " ratchet.



The order of adjustment is the same as the firing order: 1-5-3-6-2-4, and is carried out at top dead center (TDC) on the compression stroke. Adjust valve clearance between the valve and the eccentric after slackening off nut (1).

Tighten nut (1) with special ring spanner 11 1 150 used in conjunction with torque wrench 00 2 050.

Note correct tightening torque¹⁾.



13. Spark plugs – renewing

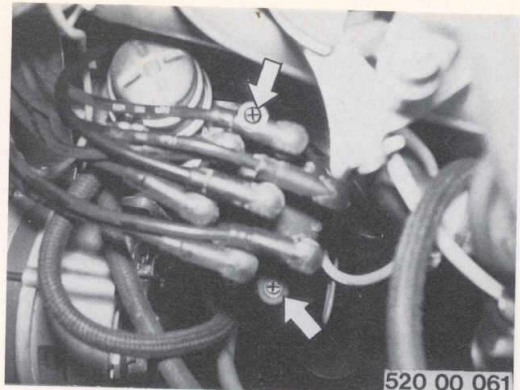
Before screwing in the new spark plugs, check their electrode gaps¹⁾

Correct if necessary by bending the earth (ground) electrode.

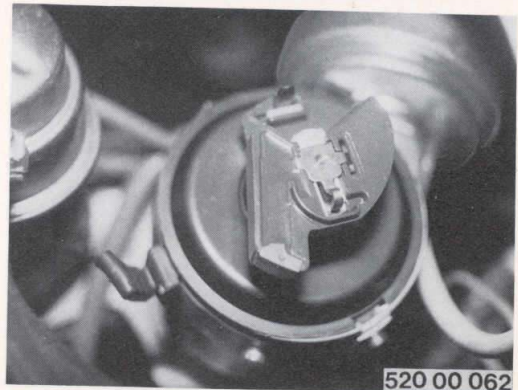
¹⁾ See specifications

14. Breaker points – renewing

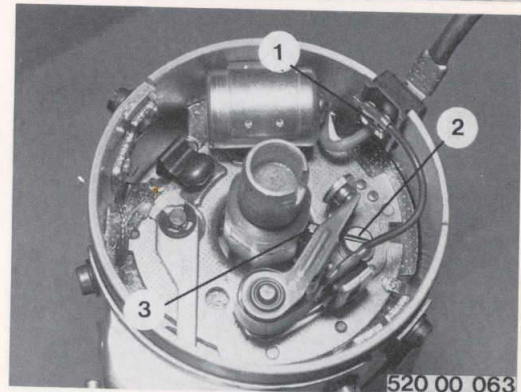
After overcoming the spring loading, turn the catch to the left and remove the distributor cap.
When installing: Make sure that the distributor cap locks into position and the catches are correctly seated.



Remove the distributor rotor and dust cover.



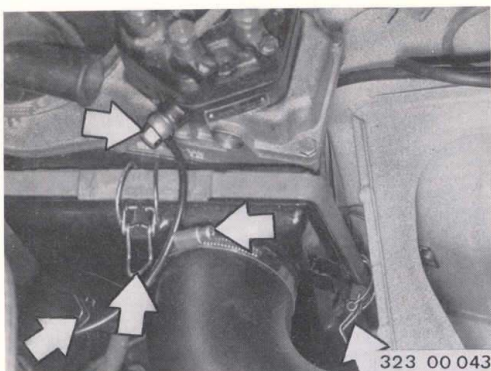
Pull off the flat pin plug (1).
Remove screw (2).
Pull out the breaker points assembly.
When installing: clean new breaker points to remove grease.
Apply Bosch Ft 1 v 4 grease to the cam and ramp (3) of the breaker arm.
Adjust dwell angle and ignition timing – 12 11 004.



15. Air cleaner element – renewing

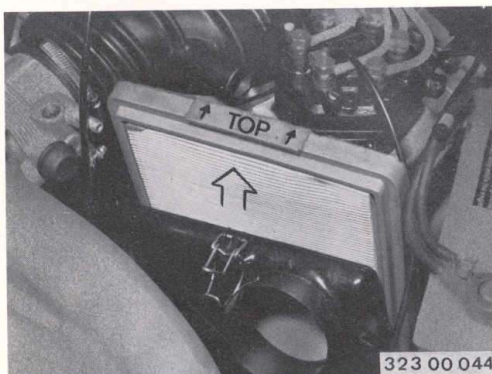
Carburetor engine:
Loosen nut and snap catch.
Take out and renew element.
When installing: rubberized inner ring faces up.
Arrows on intake pipe and air cleaner cover must be aligned.





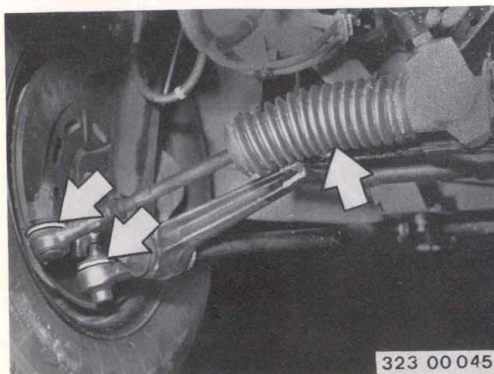
Fuel injection engine:
 Unscrew the pipe.
 Detach air inlet trumpet.
 Release snap fasteners.

323 00 043



Take the air cleaner out upwards.
 When installing: note "Top" inscription on element.
 Arrows must point towards flow distributor.

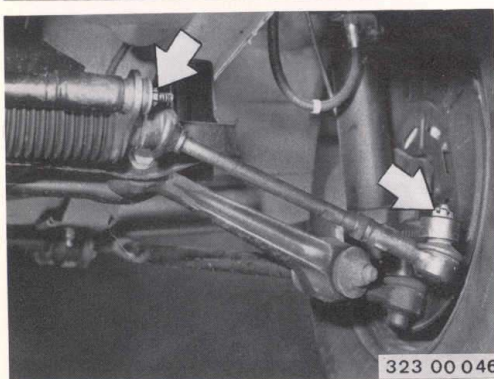
323 00 044



16. Checking steering

Check front suspension and steering joints for freedom from wear and damage, and absence of play.
 Check condition of flexible gaiters and sealing sleeves.

323 00 045



Detach left and right track rods.
 Detach the steering damper.
 When installing: note correct tightening torque¹⁾.

323 00 046

¹⁾ See specifications

Lift out the BMW badge and install BMW friction gauge 00 2 000.

Using the friction gauge, turn the steering spindle from full left to right lock, and check for local stiffness or partial seizure.

To determine the friction coefficient, move the steering rack to a central position and read off the friction value.¹⁾

If necessary, remove the rack and pinion steering gear and repeat the measurement. See 32 10 004.



17. Propeller shaft – checking

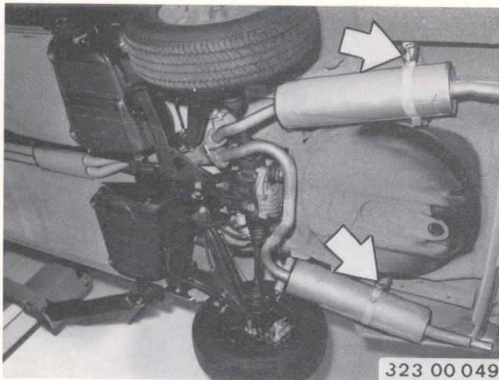
Inspect the propeller shaft, rubber coupling, universal joints and center bearing for signs of damage and absence of play.



18. Take up slack at nuts and bolts¹⁾

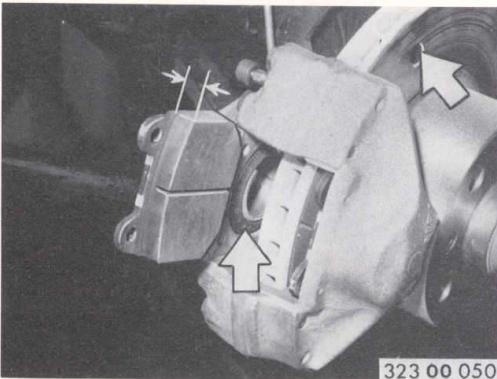
Front axle beam to body
Wishbone to front axle beam
Steering gear to front axle beam
Track rod clamp bolts
Gearbox to engine
Pivot mount to gearbox
Rubber mounting to cross-member
Cross-member to body
Exhaust pipes to exhaust manifold
Exhaust system to front exhaust pipes
(all exhaust system mountings)
Propeller shaft (manual gearbox), front
Propeller shaft (automatic transmission), front
Center bearing to body
Propeller shaft to final drive
Front brake calipers

¹⁾ See Specifications



19. Exhaust system – checking

Check condition, path, mountings and freedom from leaks of exhaust system.



20. Brake linings – checking

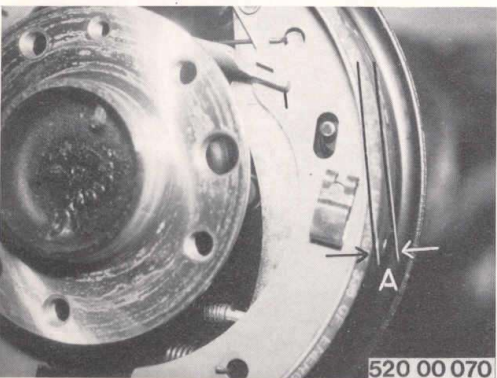
Detach the wheels.

Remove brake pads at front (and at rear if appropriate).

Renew brake pads if lining thickness (without backing plate) is only 2.0 mm (0.08 in).

Inspect the surfaces of the brake discs.

Clean out the brake calipers and check condition of sealing sleeves.



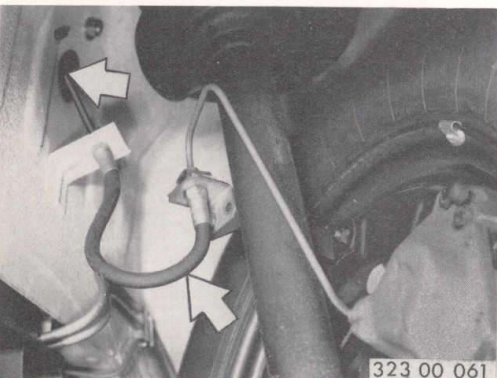
Rear drum brakes:

Remove screw and take off brake drum.

Check lining thickness. Renew brake linings if thickness (A) is only 2.0 mm (0.08 in).

Inspect the rubbed surfaces in the brake drums.

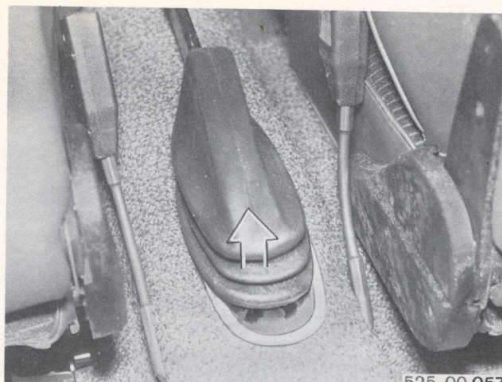
Clean out the brake drums.



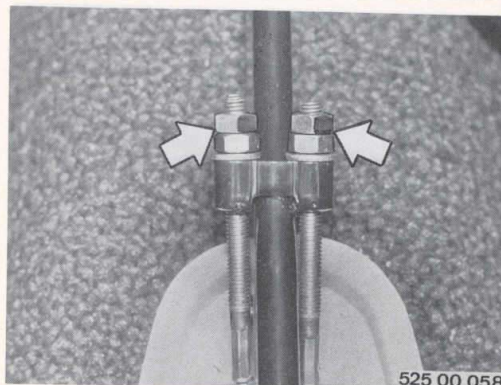
21. Checking condition of brake system/adjusting handbrake

Check that unions and pipes on the brake system are tight and correctly located. Check that the handbrake cables move freely.

Adjusting handbrake:
pull off the rubber cover.



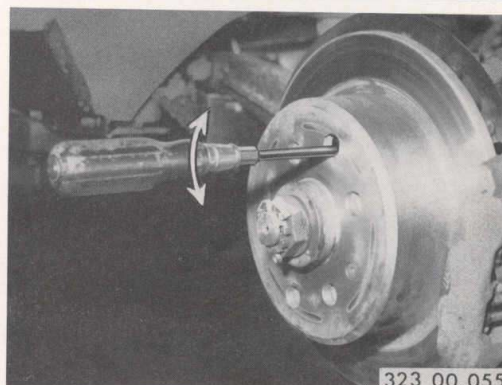
Unscrew the handbrake cable nuts until the cables are no longer taut.

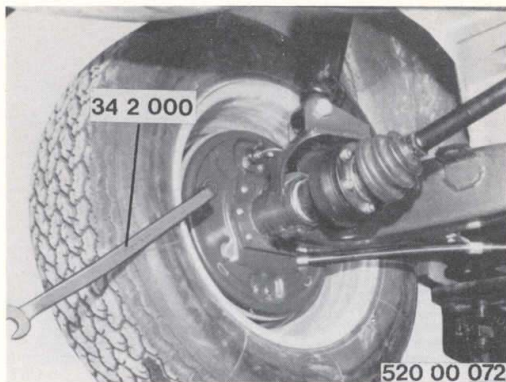


Rear disc brakes:
Take off the rear wheels.
Turn the left rear brake disc until the large inspection hole is approx. 10° behind vertical at the top.
On the right brake disc the large inspection hole should be app. 10° ahead of vertical at the top. In these positions, the adjusting nut can be seen through the inspection hole.



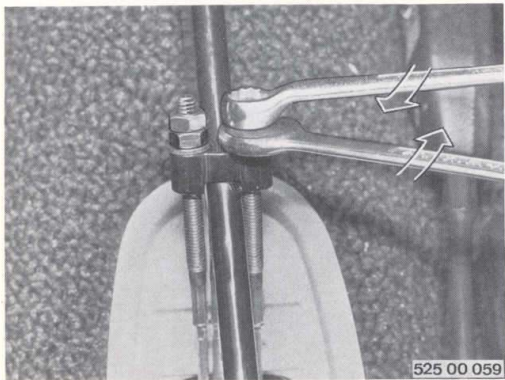
Insert a screwdriver and engage with the teeth on the adjusting nut.
Turn the adjusting nut with the screwdriver blade to move the handbrake shoes up to the drum so that the brake disc can no longer be turned. Then slacken the adjusting nut off by 4-6 teeth.
To lock the handbrake, turn the screwdriver downwards.
To release the handbrake, turn the screwdriver upwards.
Attach the wheels again.





Rear drum brakes:

Using adjusting wrench 34 2 000, turn adjusting eccentric anti-clockwise on left and clockwise on right of car until the road wheel, which should be turned continuously, is locked. After this, slacken the eccentric screw by $\frac{1}{8}$ turn so that the road wheel just turns freely.

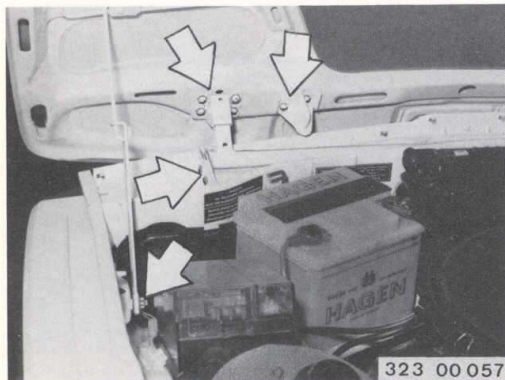


Adjust the handbrake cables.

Apply the handbrake lever by 4 notches and take up slack at the handbrake cables until the left and right rear wheels can just be turned without local stiffness.

Release the handbrake lever and check that the road wheels can now rotate freely.

Tighten the locknuts.



22. Check hinges, catches and locks

Take up slack at all retaining bolts for door and lid hinges which can easily be reached.

Grease or oil the hinges.

Check settings and correct operation of doors and lids.

23. Check lighting equipment

Check operation of sidelights, low and high beam headlights, reversing (backup) lights, brake lights, rear lights, rear fog light, license plate lights, flashing turn indicators, hazard warning flashers, horns, wipers and windshield washer. Position windshield washer jets correctly. To keep the windshield and headlight washer unit operational at temperatures down to -20°C (-4°F), add 40% domestic spirit to the reservoir. Check operation of the heater blower, interior light, glove box light, luggage compartment and engine compartment lights, instrument lighting and all warning and telltale lamps and the cigar lighter.

24. Check seat belts

Check condition and correct operation of seat belts.

25. Diagnosis with BMW Program tester/digital tester

See 11 00 005.

26. Final inspection

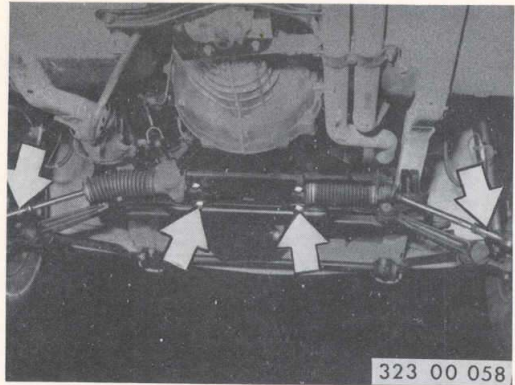
Test drive: check road safety and operation of engine, cooling system, transmission, rear axle, steering and brakes. Check handbrake. After test drive, inspect engine, transmission, cooling system, rear axle, steering and brakes for signs of leakage.

0000259 BMW Safety Test

- 1. Check steering**
- 2. Check brakes**
- 3. Check tires and tire pressures**
- 4. Check lighting**
- 5. Check warning equipment**
- 6. Check wipers and washer system**
- 7. Check seat belts**
- 8. Exhaust emissions test**

1. Checking steering

Check steering gear mountings, track rods and track rod pivots and steering column joints for correct attachment or play.

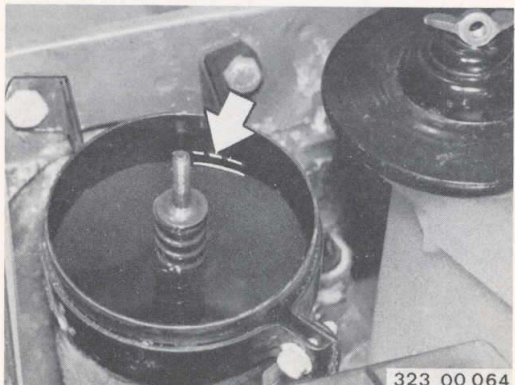


Power steering:

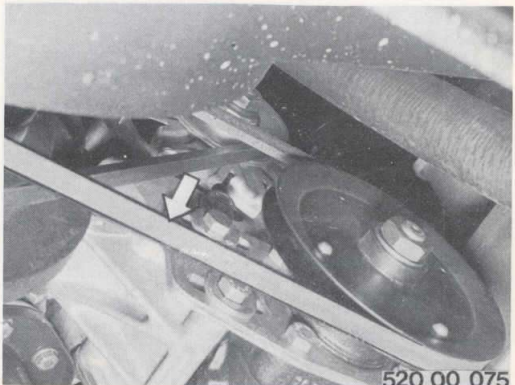
Inspect steering gear and hose connections for leaks.

To check oil level stop the engine, unscrew the wing nut from the fluid tank and take off the lid. The oil level must be approx. 5 mm (0.2 in) above the mark on the wall of the tank.

Start the engine and add oil if necessary until the level is at the mark.



Checking power steering pump V-belt:
when correctly tensioned, it should be possible to depress the center of the belt run by 5 to 10 mm (0.2 to 0.4 in).



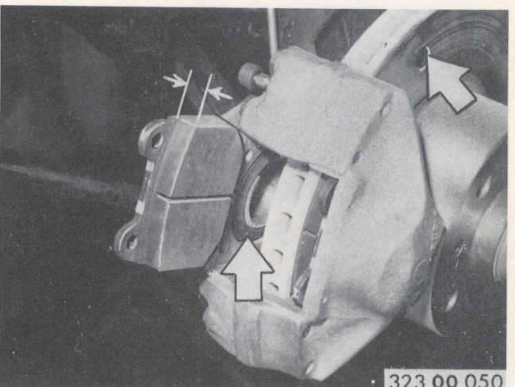
2. Checking brakes

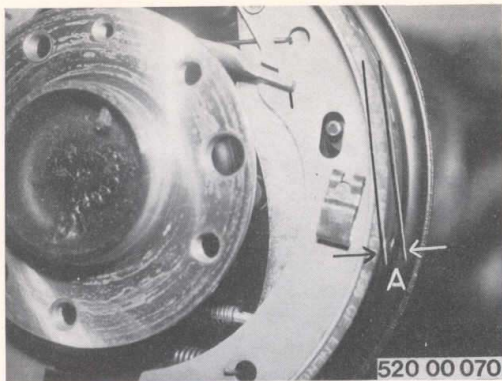
Take off the wheels.

Remove the front brake pads (and the rear pads if installed).

Renew the brake pads if the minimum thickness of 2.0 mm (0.08 in) is reached (lining material without backing plate).

Inspect the rubbed surfaces of the brake discs. Clean out the brake calipers and inspect the sealing sleeves.



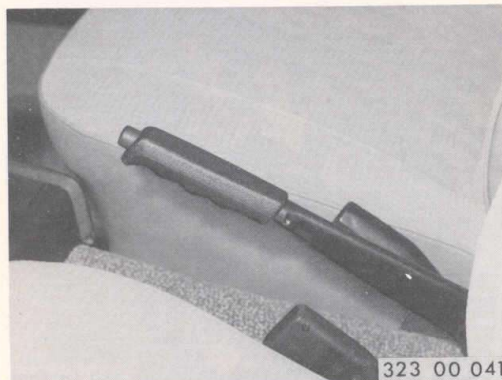


Rear drum brakes:

Remove the screw and take off the brake drum. Check brake lining thickness. Renew linings if the minimum thickness (A) has reached 2 mm (0.08 in).

Inspect the rubbed surfaces in the brake drums.

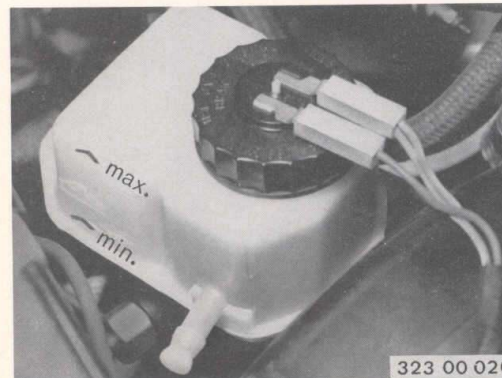
Clean the drum brakes.



Check handbrake setting.

Apply the handbrake by 5 notches.

It should just be possible to turn the wheels smoothly by hand.

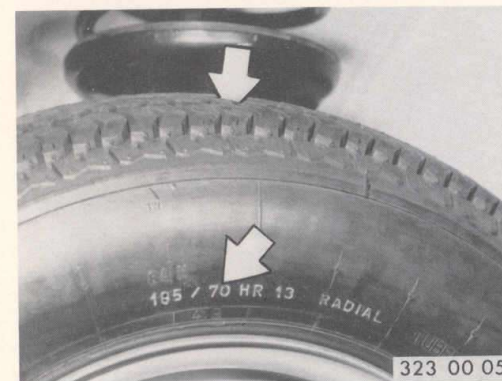


Check brake pipes, hoses, unions and the handbrake cables for correct location, strength and freedom from leaks.

The brake fluid level in the translucent reservoir for the brake system should be between the 'MIN' and 'MAX' markings.

Restore the level to the 'MAX' mark if necessary. For approved grades of brake fluid, see Service Information, Group 34.

Important: brake fluid must be renewed once a year.



3. Tires and tire pressures – checking

Although the law may permit tires to be used with only 1 mm (0.04 in) of tread depth, the car's tires should not be allowed to drop below 3 mm (0.12 in) depth of tread for safety reasons. Failing this, there is a severe risk of 'aquaplaning' at high speeds even when the road is covered only with a thin film of water. Inspect tires and rims for damage and make sure that they are of the correct size.

Checking tire pressures including spare wheel¹⁾.



4. Checking lights

Check function of headlights and auxiliary driving lights, and adjust beam settings with an optical alignment device. Check operation of side (parking) lights, rear lights, reversing (backup) lights, license plate lighting, instrument and inscription lighting, telltale and warning lights.

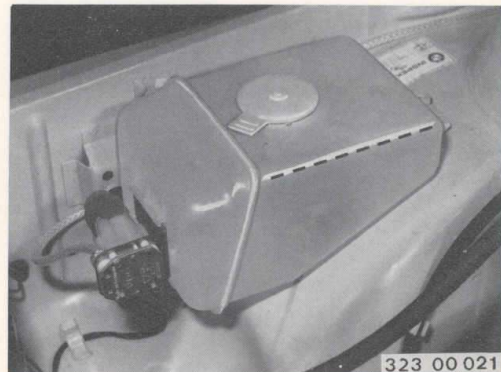
5. Checking warning equipment

Check operation of horn, turn indicators, hazard warning system, brake lights, headlight flasher and rear fog light.

6. Checking wipers/washer

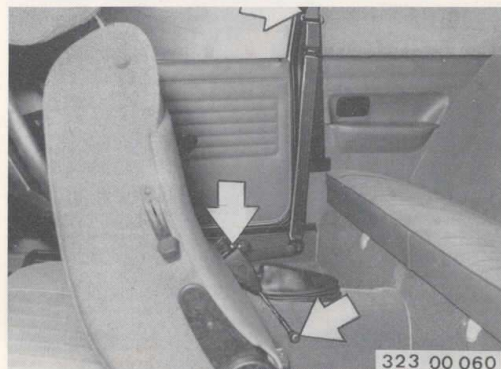
Check wiper blades, washer system (windshield and headlights if installed) and spray jets.

To keep the windshield washer and headlight cleaning systems operational at temperatures down to -20°C (-4°F), add 40% domestic spirit to the reservoir.



7. Checking seat belts

Check seat belts for correct function, general condition and correct attachment.



¹⁾ See Specifications



8. Exhaust emissions test

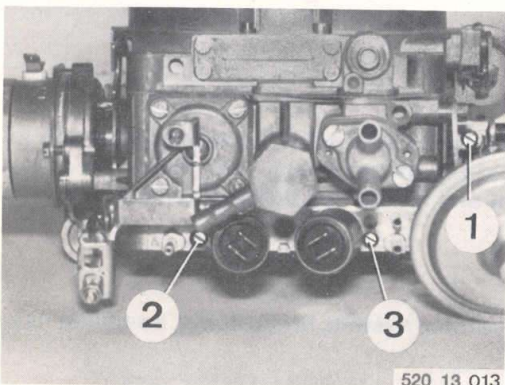
Run the engine at idle speed and at normal operating temperature.

A) Carburetor engine

Remove the screw plugs from the exhaust manifolds and insert 13 0 020 measuring probes.

Connect the exhaust emissions tester.

Take a separate CO value reading from the front and rear exhaust manifolds.



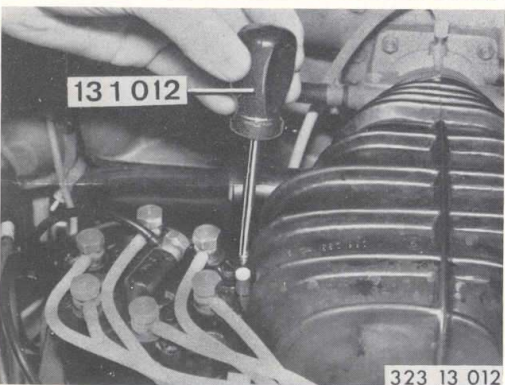
With mixture regulating screws (2 and 3), adjust the CO level in the exhaust¹⁾.

Screw (2) = rear exhaust manifold

Screw (3) = front exhaust manifold

If the idle speed varies, correct at screw (1).

After adjusting engine idle speed and exhaust emissions, install new anti-tampering devices.



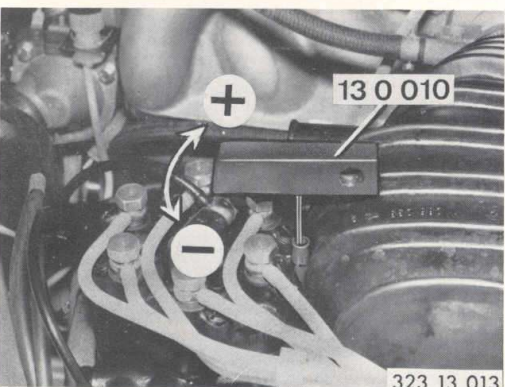
B) Fuel injection engine

Remove the screw plugs from the exhaust manifolds and insert measuring probes 13 0 020.

Connect the exhaust emissions tester.

Take separate readings for the CO level at the front and rear exhaust manifolds.

Important: remove the anti-tampering device with extractor 13 1 012. After adjusting engine idle speed and exhaust emissions, install a new anti-tampering device.



Adjust the CO value¹⁾ with adjusting wrench 13 0 010.

¹⁾ See Specifications

Motor

Engine
Moteur
Motore
Motor
Motor
Motor

11 Engine

Specifications	Page 11-0/3
1100005 Diagnosis with BMW program /digital tester	00/1
039 Checking compression of all cylinders	00/23
050 Removing and installing engine	00/23
1111160 Renew distributor shaft bearings	11/1
1112000 Removing and installing cylinder head cover	12/1
100 Removing and installing cylinder head	12/1
101 Renewing cylinder head gasket	12/7
240 Renewing radial seal in timing case cover	12/7
561 Renewing one valve guide	12/8
607 Machining valve seats and valves	12/9
719 Grinding cylinder head mating surface	12/9
729 Cylinder head water leak test	12/9
1113000 Removing and installing oil sump	13/1
1114175 Removing and installing front end cover	14/1
180 Renewing radial seals in end cover	14/3
611 Renewing radial seal in end cover (clutch end)	14/3
1121000 Removing and installing crankshaft	21/1
501 Renewing crankshaft	21/2
571 Renewing needle sleeve in crankshaft	21/3
1122000 Removing and installing flywheel	22/1
051 Renewing torque converter drive plate	22/1
541 Renewing starter gear ring	22/2
1124521 Renewing all connecting rods	24/1
1125000 Removing and installing all pistons	25/1
651 Renewing rings of one piston	25/3
1131000 Removing and installing camshaft	31/1
100 Tightening toothed belt	31/1
110 Removing and installing toothed belt	31/2
1133020 Removing and installing rocker arm shafts	33/1
031 Renewing all rocker arms	33/2
1134004 Adjusting valve clearance	34/1
509 Checking all valves for leaks	34/1
550 Removing and installing valves	34/1
1135020 Removing and installing intermediate distributor shaft	35/1
1141000 Removing and installing oil pump	41/1
110 Removing and installing safety valve	41/1
1151000 Removing and installing water pump	51/1
502 Disassembling and assembling water pump	51/2
1153000 Removing and installing coolant thermostat	53/1
081 Renewing temperature transmitter	53/1
1161000 Removing and installing/sealing intake line and carburetor	61/1
050 Removing and installing intake air collector	61/3
051 Renewing intake air collector	61/5
1174051 Renewing thermo valve	74/1

Engine Specifications

Engine		Specifications	
Model		a) 320/6 b) 320/6 A	a) 323 i b) 323 i A *
11 00 ... Engine, general			
Bore	mm (in)	80 (3.15)	80 (3.15)
Stroke	mm (in)	66 (2.60)	76.8 (3.02)
Stroke/bore ratio		0.825	0.96
Displacement, fiscal	cm ³ (in ³)	1977 (120.64)	2291 (139.81)
effective	cm ³ (in ³)	1990 (121.44)	2316 (141.33)
Compression ratio		9.2 : 1	9.5 : 1
Max. effective output	kW (bhp)	90 (122.4) ¹⁾	105 (142.8)
at engine speed	1/min	6000	5800
Governor cutout speed	1/min	6600 ± 150	6600 ± 150
Max. permitted engine speed	1/min	6400	6400
Max. continuous engine speed	1/min	6000	6000
Max. torque	Nm (kpm, lb. ft)	160 (16.3, 118.0)	190 (19.4, 140.1)
at engine speed	1/min	4000	4500

*) Version for Sweden

1) 88.2 kW (120 bhp) on Austrian Version

Specifications

Engine

Model		320/6 320/6 A	323 i 323 i A *)
1100 ... Engine – general (continued)			
Power/weight ratio ready for road, tank full (at unladen weight)	kg/kW (kg/bhp)	a) 12.4 9.1 (111.7)	b) 12.5 9.2 (110.4)
	(bhp/ton)		a) 10.8 7.9 (128.6)
fully loaded, incl. luggage (at permissible gross weight)	kg/kW kg/bhp	a) 17.2 12.7 (80.0)	b) 14.9 11.0 (92.3)
	(bhp/ton)		
Mean piston speed at engine speed	m/s (ft/min) 1/min	13.2 (2598) 6000	14.8 (2913) 5800
Compression pressure (gauge) – test procedure: measure with a suitable compression tester; battery fully charged, engine at normal operating temperature, throttle fully open, engine turned over at starting speed Compression:			
good above	bar (lb/in ²)	11.0 (156.5)	
normal	bar (lb/in ²)	10.0 ... 11.0 (142.2 ... 156.5)	
poor below	bar (lb/in ²)	10.0 (142.2)	

*) Version for Sweden

Specifications

Engine

Model	a) 320/6 b) 320/6 A		a) 323 i b) 323 i A *)
11 00 . . . Engine – general (continued)			
Fuel consumption by DIN 70030 standard test method ¹⁾	l/100 km Imp. mile/gal US mile/gal	a) 9.5 b) 10.4 29.7 27.2 24.8 22.6	a) 9.2 b) . . . 30.7 25.6
11 11 . . . Engine block			
Cylinders			
Bore – standard size	mm (in)	80.015 ± 0.005 (3.1502 ± 0.0002)	
Bore – intermediate oversize	mm (in)	80.095 ± 0.005 (3.1533 ± 0.0002)	
Bore – 1st rebore oversize	mm (in)	80.265 ± 0.005 (3.1600 ± 0.0002)	
Bore – 2nd rebore oversize	mm (in)	80.515 ± 0.005 (3.1699 ± 0.0002)	
Surface roughness	μ	3 . . . 4	
Permissible out-of-roundness of cylinder bore	mm (in)	0.01 . . . 0.02 (0.0004 . . . 0.0008)	
Permissible cylinder bore conicity	mm (in)	0.01 (0.0004)	
Permissible angular deviation of cylinder centerline from a line perpendicular to bearing bore	deg.	0° 0.5'	
Permissible total wear allowance at piston and cylinder	mm (in)	0.10 . . . 0.15 (0.004 . . . 0.006)	

*) Version for Sweden

¹⁾ See Page 11–0/39

Specifications

Engine		Specifications	
Model		320/6 320/6 A	323 i 323 i A *)
11 12 ... Cylinder head			
Rocker shaft bore dia.	mm (in)	17.5 + 0.043 0 (0.6890 + 0.0017)	
Rocker shaft installed clearance	mm (in)	0.016 ... 0.077 (0.0006 ... 0.0030)	
Valve guide bore dia.	mm (in)	13 + 0.018 0 (0.5118 + 0.0007)	
Oversizes	mm (in)	13.1/13.2/13.3 (0.5157/0.5197/0.5236)	
Shrink fit for valve guide	mm (in)	0.015 ... 0.044 (0.0006 ... 0.0017)	
Temperature to which cylinder head must be heated	°C (°F)	220 ... 250 (428 ... 482)	
Bore for valve seat ring ¹⁾			
Inlet	mm (in)	42.00 + 0.025 0 (1.6535 + 0.0010)	
Exhaust	mm (in)	37.50 + 0.025 0 (1.4764 + 0.0010)	
Shrink fit ²⁾ for valve seat ring	mm (in)	0.10 ... 0.15 (0.004 ... 0.006)	

*) Version for Sweden

1) Note shrink fit dimension for oversize bore in cylinder head

2) With cylinder head heated to 220 ... 250 °C (428 ... 482 °F). Chill valve seat ring to app. -70 °C (-94 °F)

Specifications

Engine

Model	320/6 320/6 A		323 i 323 i A *)	
11 12 . . . Valve seat rings				
External diameter	Inlet	mm (in)	42.15 – 0.009 (1.6594 – 0.0004) – 0.025 – 0.0010)	
	Exhaust	mm (in)	37.65 – 0.009 (1.4828 – 0.0004) – 0.025 – 0.0010)	
Oversizes ¹⁾	Inlet	mm (in)	42.35 – 0.009 (1.6673 – 0.0004) – 0.025 – 0.0010)	
	Exhaust	mm (in)	42.55 – 0.009 (1.6752 – 0.0010) – 0.025 – 0.0010)	
Valve seat angle	Inlet	deg.	45°	
	Exhaust	deg.	45°	
Extl. correction angle	Inlet	mm (in)	1.5 (0.059)	
	Exhaust	mm (in)	1.65 (0.065)	

*) Version for Sweden

¹⁾ Note shrink fit dimension for oversize bore in cylinder head

Specifications

Engine		320/6 320/6 A	323 i 323 i A *)
11 12 . . . Valve guide			
Overall length	mm (in)	45 (1.772)	
External diameter	mm (in)	13.0 + 0.044 + 0.033 (0.5118 + 0.0017 + 0.0013)	
Valve guide intl. dia. (in cylinder head)	mm (in)	7 + 0.015 0 (0.2756 + 0.0006 0)	
Oversizes	mm (in)	13.1/13.2/13.3 (0.5157/0.5197/0.5236)	
Valve guide projection in (cylinder head)	mm (in)	14.5 ± 0.5 (0.5709 ± 0.0197)	
11 21 . . . Crankshaft with bearings			
Crankshaft			
Bearing bore dia. in crankcase	mm (in)	65 + 0.010 0 (2.5591 + 0.0004 0)	
	blue	65 + 0.019 + 0.010 (2.5591 + 0.0007 + 0.0004)	

*) Version for Sweden

Engine Specifications

Model	320/6 320/6 A	323 i 323 i A *)
1121 . . . Crankshaft with bearings (continued)		
Regrind stages – main bearing journals	mm (in)	
Standard		
red	60 – 0.010 (2.3622 – 0.0004)	
blue	60 – 0.020 (2.3622 – 0.0008)	
1st regrind	mm (in)	
red	59.75 – 0.010 (2.3524 – 0.0004)	
blue	59.75 – 0.020 (2.3524 – 0.0008)	
2nd regrind	mm (in)	
red	59.50 – 0.010 (2.3425 – 0.0004)	
blue	59.50 – 0.020 (2.3425 – 0.0008)	
Bearing shell thicknesses	mm (in)	
Standard		
red	2.50 – 0.010 (0.0984 – 0.0004)	
blue	2.51 – 0.010 (0.0988 – 0.0004)	

*) Version for Sweden

Specifications

Engine		320/6 320/6 A		323 i 323 i A *)
Model				
11 21 . . . Crankshaft with bearings (continued)				
1st oversize	red	mm (in)	2.625 – 0.010 – 0.020 (0.1033 – 0.0008)	
	blue	mm (in)	2.635 – 0.010 – 0.020 (0.1037 – 0.0008)	
2nd oversize	red	mm (in)	2.750 – 0.010 – 0.020 (0.1083 – 0.0008)	
	blue	mm	2.760 – 0.010 – 0.020 (0.1087 – 0.0008)	
Bearing play, radial	red	mm (in)	0.030 . . . 0.070 (0.0012 . . . 0.0028)	
	blue	mm (in)	0.030 . . . 0.068 (0.0012 . . . 0.0027)	
Regrind stages – crankshaft guide bearing width				
Standard	mm (in)		25.00 + 0.053 + 0.020 (0.9843 – 0.0021)	
	1st oversize	mm (in)	25.20 + 0.053 + 0.020 (0.9221 – 0.0008)	
	2nd oversize	mm (in)	25.40 + 0.053 + 0.020 (1.0000 – 0.0021)	

*) Version for Sweden

Specifications

Engine

Model	320/6 320/6 A	323 i 323 i A *)
1121 . . . Crankshaft with bearings (continued)		
Regrind stages – big end bearing journal diameter		
Standard	mm (in)	45.00 – 0.009 (1.7717 – 0.0004) 45.00 – 0.025 (1.7717 – 0.0010)
1st undersize	mm (in)	44.75 – 0.009 (1.7618 – 0.0004) 44.75 – 0.025 (1.7618 – 0.0010)
2nd undersize	mm (in)	44.50 – 0.009 (1.7520 – 0.0004) 44.50 – 0.025 (1.7520 – 0.0010)
Max. permissible crankshaft imbalance in each measuring plane (dynamic, without flywheel)		
	gcm	25
Crankshaft endplay	mm (in)	0.080 . . . 0.163 (0.0031 – 0.0064)
Max. permissible runout at center main bearing journal (with crankshaft supported at outermost bearing journal)		
		0.15 (0.0059)
Crank pin throw	mm (in)	66 ± 0.1 (2.5984 – 0.0039)
Max. permissible bearing journal surface roughness	μ	76.8 ± 0.1 (3.0236 ± 0.0039)
*) Version for Sweden		1,5

Specifications

Engine			
Model		a) 320/6 b) 320/6 A	a) 323 i b) 323 i A *)
11 21 ... Toothed belt sprocket on crankshaft			
Identification No. (on end face)		1 264 531.3	
Number of teeth		21	
11 22 ... Flywheel			
Max. dynamic imbalance	gcm	a) 15	
Max. static imbalance	gcm	—	
Max. lateral runout, measured at: 90 mm (3.54 in) dia.	mm (in)	a) 0.02 (0.0008)	
92 mm (3.62 in) dia.	mm (in)	b) 0.02 (0.0008)	
223 mm (8.78 in) dia.	mm (in)	a) 0.1 (0.0039)	
Max. machining limit at contact face	mm (in)	a) 0.4 + 0.1 (0.016 + 0.0039)	

*) Version for Sweden

Specifications

Engine

Model	320/6 320/6 A	323 i 323 i A *)
1123 . . . Vibration damper		
V-belt pulley dia.	mm (in)	146 (5,75)
Max. imbalance at 1000 min ⁻¹	gcm	8
Max. radial runout at 200 mm (7.87 in) dia.	mm (in)	0.2 (0.0008)
at 235 mm (9.25 in) dia.	mm (in)	—
Max. axial runout at app. 200 mm (7.87 in) dia.	mm (in)	0.2 (0.008)
at app. 235 mm (9.25 in) dia.	mm (in)	—
1124 . . . Connecting rod and bearings	—	0.3 (0.012)
Connecting rod		0.3 (0.012)
Length from center of big end to center of small end	mm (in)	130 ± 0.1 (5.118 ± 0.004)
Connecting rod bores – small end dia.	mm (in)	24 + 0.021 0 (0.9449 + 0.0008)
big end dia.	mm (in)	48 + 0.01 0 (1.8897 + 0.0004)
Small end bearing bushing – extl. dia.	mm (in)	24.060 . . . 24.100 (0.9472 . . . 0.9488)
intl. dia.	mm (in)	22 + 0.010 0.005 (0.8661 + 0.0004 + 0.0002)

*) Version for Sweden

Specifications

Engine

Model	320/6 320/6 A	323 i 323 i A*)
11 24 . . . Connecting rod with bearings (continued)		
Regrind stages		
Bearing shell thickness – Mfr. Glyco – Standard	1.481 . . . 1.493 (0.0583 . . . 0.0588)	
Stage 1 oversize	1.606 . . . 1.618 (0.0632 . . . 0.0637)	
Stage 2 oversize		
Bearing play, radial	0.029 . . . 0.079 (0.0011 . . . 0.0031)	
Regrind stages		
Bearing shell thickness – Mfr. KS – Standard	1.484 . . . 1.494 (0.0584 . . . 0.0588)	
Stage 1 oversize	1.609 . . . 1.619 (0.0633 . . . 0.0637)	
Stage 2 oversize		
Bearing play, radial	0.021 . . . 0.067 (0.0008 . . . 0.0026)	
Max. deviation from parallel of connecting rod bearing bores with bearing shells, at 150 mm (5.9 in) spacing mm (in)	≤ 0.04 (0.0016)	
Max. permissible twist to one side	0° 30'	

*) Version for Sweden

Specifications

Engine

Model	320/6 320/6 A	323 i 323 iA*)
11 24 . . . Connecting rod with bearings (continued)		
Max. weight variation among the 6 connecting rods of an engine (without bearing shells)	g (oz)	± 4 (0.141)
– at big end	g (oz)	± 2 (0.071)
– at small end	g (oz)	± 2 (0.071)
11 25 . . . Piston ¹⁾		
Weight group (punched or stamped on)		+ or –
Identification on piston (engine type/compression) ²⁾	2,0/9,2	2,3/9,5
Piston diameter – standard	mm (in)	79.98 ± 0.009 (3.14881 ± 0.00035)
Intermediate oversize	mm (in)	80.06 ± 0.009 (3.15196 ± 0.00035)
1st rebore oversize (+0.25 mm/0.0010 in)	mm (in)	80.23 ± 0.009 (3.15866 ± 0.00035)
2nd rebore oversize (+0.50 mm/0.0020 in)	mm (in)	80.48 ± 0.009 (3.16859 ± 0.00035)
Piston installed clearance	mm (in)	0.035 ± 0.010 (0.00137 ± 0.00039)

^{*)} Version for Sweden

¹⁾ Always renew piston and piston (gudgeon) pin together, and note compression and piston pattern even if piston diameters are identical. Piston and pins are matched in pairs

²⁾ In addition, piston barrel diameter is shown, e.g. 79.98 (mm), and an arrow indicates direction of installation

Specifications

Engine

Model	320/6 320/6 A	323 i 323 i A *)
1125 . . . Piston (continued)		
Permissible difference in weight between the complete pistons of an engine ¹⁾	g (oz)	10 (0.35)
Piston pin bore	mm (in)	$22 + 0.004_0$ (0.86614 + 0.00016)
Piston pin bore offset	mm (in)	0.7 (0.276)
1125 . . . Piston rings		
1st groove (rectangular-section ring) Height	mm (in)	$1.50 - 0.010_0$ (0.0591 - 0.0004)
End gap	mm (in)	0.3 . . . 0.5 (0.012 . . . 0.020)
Vertical clearance in groove Mahle pistons	mm (in)	0.060 . . . 0.092 (0.0024 . . . 0.0036)
KS pistons	mm (in)	0.050 . . . 0.082 (0.0020 . . . 0.0032)
2nd groove (micro-chamfer ring) ²⁾ Height	mm (in)	$2.00 - 0.010_0$ (0.0787 - 0.0004)
End gap	mm (in)	0.3 . . . 0.5 (0.012 . . . 0.020)
Vertical clearance in groove Mahle pistons	mm (in)	0.030 . . . 0.062 (0.0012 . . . 0.0024)
KS pistons	mm (in)	0.040 . . . 0.072 (0.0016 . . . 0.0028)

*) Version for Sweden

1) Install only pistons from the same weight group (+ or -)

2) Not to DIN standard - special BMW pattern

Specifications

Engine

Model	320/6 320/6 A	323 i 323 i A *)
11 25 . . . Piston rings (continued)		
3rd groove (slotted oil scraper ring with tubular spring) ¹⁾		
Height	mm (in)	3.50 -0.010 -0.022 (0.1378 -0.0004 -0.0009)
End gap	mm (in)	0.25 . . . 0.50 (0.0089 . . . 0.0197)
Vertical clearance in groove		
Mahle pistons	mm (in)	0.020 . . . 0.052 (0.0008 . . . 0.0020)
KS pistons	mm (in)	0.030 . . . 0.062 (0.0012 . . . 0.0024)
11 25 . . . Piston pin ²⁾		
External diameter	mm (in)	22 -0 -0.004 (0.86614 -0 -0.00016)
Piston pin clearance in piston ²⁾		
Mahle pistons	mm (in)	0.001 . . . 0.005 (0.00004 . . . 0.00020)
KS pistons	mm (in)	0.002 . . . 0.006 (0.00008 . . . 0.00024)

*) Version for Sweden

¹⁾ Not to DIN standard – special BMW pattern

²⁾ Always renew piston and piston pin together (piston pin and piston are a matched pair)

*) Version for Sweden

Specifications

Engine		320/6 320/6 A	323 i 323 i A*)
1131 . . . Camshaft (continued)			
Bore dia. in cylinder head (continued)	mm (in)	45.0 + 0.034 (1.7717 + 0.0013) 45.5 + 0.034 (1.7913 + 0.0013) 46.0 + 0.034 (1.8110 + 0.0013)	+ 0.0004 + 0.0004 + 0.0004
Running clearance	radial mm (in)	0.059 . . . 0.1 (0.0023 . . . 0.0039)	
	axial mm (in)	0.2 (0.0079)	
Cam base circle dia.	mm (in)	27.9898 (1.102)	
Cam lift	mm (in)	6.5809 ± 0.080 (0.2591 ± 0.0031)	
1131 . . . Toothed belt			
Number of teeth		111	
Belt width	mm (in)	25.4 (1.0)	
1131 . . . Toothed belt sprocket on camshaft			
Identification number (on endface)		1 264 532	
Number of teeth		42	

*) Version for Sweden

Specifications

Engine			
Model		320/6 320/6 A	323 i 323 i A *)
1131 . . . Toothed belt sprocket on intermediate shaft			
Identification number on endface		1 265 458	
Number of teeth		28	
1131 . . . Tensioner pulley with tensioning device (for toothed belt)			
Make		FAG/INA/SKF	
Axial runout (on running surface, at 52 mm (2.05 in) dia. on side guide)	mm (in)	0.3 (0.0118)	
Radial runout	mm (in)	0.2 (0.0079)	
1133 . . . Rockers with pivots			
Rocker bore without bushing	mm (in)	20 + 0.021 + 0 (0.7874 + 0)	
Rocker bushing bore dia. in rocker	mm (in)	17.5 + 0.018 + 0 (0.6890 + 0.0007)	
Rocker shaft dia.	mm (in)	17.5 - 0.016 - 0.034 (0.6890 - 0.0006 + 0.0013)	
Rocker running clearance	mm (in)	0.016 . . . 0.052 (0.0006 . . . 0.0020)	

*) Version for Sweden

Engine Specifications

Model	320/6 320/6 A	323 i 323 i A *)
1134 . . . Valves		
Valve actuation		
Valve clearances		by light alloy rockers ¹⁾
Inlet and exhaust (at max. coolant temperature 35°C/95°F) mm (in)		0.25 (0.0098) ²⁾
Valve clearance adjustment		by eccentrics in rockers
Order of adjustment Cylinder at top dead center on compression stroke		1 5 3 6 2 4
Valve overlap in cylinder		6 2 4 1 5 3

*) Version for Sweden

1) with chill-cast pads and single overhead camshaft

2) at operating temperature (thermostat at limit of travel): 0.3 mm (0.0118 in)

Specifications

Engine

Model	320/6 320/6 A	323 i 323 i A *)
1134 ... Valves (continued)		
Valve timing (with 0.5 mm (0.002 in) clearance between cam base circle and rocker contact face)		
Inlet opens before TDC	°CS	11°
Inlet closes after BDC	°CS	47°
Exhaust opens before BDC	°CS	51°
Exhaust closes after TDC	°CS	7°
Inlet phase	°CS	238°
Exhaust phase	°CS	238°
Valve timing (at 0.30 mm (0.012 in) clearance between cam base circle and rocker contact face) ¹⁾		
Inlet opens before TDC	°CS	22°
Inlet closes after BDC	°CS	58°
Exhaust opens before BDC	°CS	62°
Exhaust closes after TDC	°CS	18°
Inlet phase	°CS	260°
Exhaust phase	°CS	260°

*) Version for Sweden

1) Overlap: Inlet = 1.179

Exhaust=0.813

Engine Specifications

Model	320/6 A 320/6 A		323 i 323 i A*)
11 34 . . . Valves (continued)			
Valves Overall length	Inlet	mm (in)	102.5 ± 0.2 (4.035 ± 0.008)
	Exhaust	mm (in)	102.5 ± 0.2 (4.035 ± 0.008)
Head diameter	Inlet	mm (in)	40 ⁰ _{-0.016} (1.5748 ^{0.0006} _{-0.0006})
	Exhaust	mm (in)	34 ⁰ _{-0.016} (1.3386 ⁰ _{-0.0006})
Stem diameter	Inlet	mm (in)	6.975 ⁰ _{-0.015} (0.2746 ⁰ _{-0.0006})
	Exhaust	mm (in)	6.960 ⁰ _{-0.015} (0.2740 ⁰ _{-0.0006})
Edge thickness of valve head in new condition	Inlet	mm (in)	1.5 ± 0.15 (0.0591 ± 0.0059)
	Exhaust	mm (in)	1.5 ± 0.15 (0.0591 ± 0.0059)
Min. edge thickness of valve head after machining	Inlet	mm (in)	1.2 (0.047)
	Exhaust	mm (in)	1.2 (0.047)
*) Version for Sweden			

Specifications

Engine

Model	320/6 A 320/6 A		323 i 323 i A*)
11 34 . . . Valves (continued)			
Valve seat angle	Inlet	deg.	44° 30' – 20'
	Exhaust	deg.	44° 30' – 20'
Permissible runout, valve seat/stem	Inlet	mm (in)	0.02 (0.0008)
	Exhaust	mm (in)	0.02 (0.0008)
Valve operating clearance (radial)	Inlet	mm (in)	0.025 . . . 0.055 (0.0010 . . . 0.0022)
	Exhaust	mm (in)	0.040 . . . 0.070 (0.0016 . . . 0.0028)
Max. clearance at wear limit	mm (in)		0.1 (0.0039)
11 34 . . . Valve springs			
Identification (at bottom in installed position) – color (according to make)			green white yellow
Wire thickness	mm (in)		4.25 (0.167)
Extl. dia. of spring	mm (in)		31.90 ± 0.2 (1.256 ± 0.008)
Relaxed length of spring, according to make	mm (in)		43.5 (1.713)
	mm (in)		46.0 (1.811)

*) Version for Sweden

Engine Specifications

Model	320/6 320/6 A	323 i 323 i A *)
11 34 . . . Valve springs (continued)		
Spring force/test length (valid for valve springs color coded green, yellow or white)	N/mm lb.f/in kp/mm	284.5 ± 11.8/37.6 63.9 ± 2.7/1.481 29 ± 1.2/37.6
	N/mm lb.f/in kp/mm	686.7 ± 27.5/28.5 154.3 ± 6.2/1.122 70 ± 2.8/28.5
11 35 . . . Intermediate timing shaft		
Bearing seat dia.	mm (in)	38 - 0.009 - 0.025 (1.4961 - 0.0004) 36.5 - 0.009 (1.4370 - 0.0004) - 0.0010
Extl. dia. for gearwheel	mm (in)	+ 0.048 18 + 0.035 (0.7087 + 0.0019) + 0.0014
Gearwheel (for intermediate shaft)		
Number of teeth		12
Bore diameter	mm (in)	18 - 0.005 (0.7087 - 0.0002) - 0.0009

*) Version for Sweden

Specifications

Engine

Model	320/6 320/6 A	323 i 323 i A *)
11 40 . . . Oil supply (engine lubrication), general		
Lubrication system		Pressure oil circuit ¹⁾
Fullflow oil filter and element		see Item 1142 . . .
Oil pressure warning lamp comes on below (gauge pressure) bar (lb/in ²)		0.2 . . . 0.5 (2.84 . . . 7.11)
Oil content – without filter change l (Imp. pints, US quarts)		4.5 (7.9, 4.8)
– with filter change l (Imp. pints, US quarts)		4.75 (8.4, 5.0)
Oil grade	Brand-name HD oil for spark-ignition engines	
Viscosity at outside temperatures: mostly above + 30 °C (+ 86 °F) Multigrade oils	SAE 20 W 50	
Single grade oils	SAE 40	
from – 10 °C (+14 °F) to + 30 °C (+86 °F) Multigrade oils	SAE 20 W 50	
Single grade oils	SAE 30	
from + 10 °C (+50 °F) to – 30 °C (–22 °F) Multigrade oils	SAE 10 W 30 SAE 10 W 40 SAE 10 W 50	
Single grade oils	SAE 20	

*) Version for Sweden

1) Pressure regulating valve in filtered oil circuit

Specifications

Engine

Model	320/6 A 320/6 A	323 i 323 i A*)
11 40 . . . Oil supply – (continued)		
all the year round above –10 °C (+14 °F) Multigrade oils		
Single grade oils	SAE 20 W 50	–
all the year round above –20 °C (–4 °F) Multigrade oils		
Single grade oils	SAE 15 W 50	–
all the year round below –10 °C (+14 °F) Multigrade oils		
Single grade oils	SAE 5 W 20 SAE 5 W 30	–
Max. oil consumption ¹⁾	l/100 km (mile/imp. pint, mile/US quart)	0.15 (235, 392)

*) Version for Sweden

1) see also page 11-0/38

Specifications

Engine		Specifications	
Model		320/6 320/6 A	323 i 323 i A *)
1141 . . . Oil pump			
Oil pump pattern		Gear type	
Oil pressure at idle speed (gauge)	bar (lb/in ²)	0.5 . . . 1.0 (7.1 . . . 14.2)	
Oil pressure at maximum speed (gauge)	bar (lb/in ²)	5.0 . . . 6.0 (71 . . . 85)	
Opening pressure of relief valve in oil pump cover (gauge)	bar (lb/in ²)	8 . . . 9 (114 . . . 128)	
Length of helical spring in oil pump cover	mm (in)	44 ± 0.2 (1.732 ± 0.008)	
Drive shaft/camshaft diameter	mm (in)	15 ⁰ _{-0.011} (0.5906 ⁻⁰ _{-0.0004})	
Bore for drive shaft/camshaft in housing	mm (in)	15 ⁺ _{+0.016} 0.043 (0.5906 ⁺ _{+0.0017} + 0.0006)	
Radial clearance at oil pump gearwheels (driveshaft and auxiliary shaft)	mm (in)	0.016 . . . 0.054 (0.0006 . . . 0.0021)	

*) Version for Sweden

Specifications

Engine				Specifications	
Model		320/6 320/6 A		323 i 323 i A *	
1141 . . . Oil pump – (continued)					
Depth of housing for oil pump gearwheels	mm (in)		19.2 + 0.06 + 0.03 (0.7559 + 0.0024, + 0.0012)		
Height of oil pump gearwheels	mm (in)		19.2 – 0.020 – 0.041 (0.7559 – 0.0008, – 0.0016)		
Max. endplay of oil pump gears	mm (in)		0.11 (0.0043)		
Permissible oil pump gearwheel backlash	mm (in)		0.2436 (0.0096)		
Drive system		By helical gear from intermediate timing shaft, via extension of distributor shaft			
1142 . . . Oil filter and lines					
Fullflow oil filter					
Pressure relief valve opening pressure (gauge)	bar (lb/in ²)		2.2 ± 0.3 (31.3 ± 4.3)		
Length of coil spring for pressure relief valve – relaxed	mm (in)		68 (2.677)		
– as installed	mm (in)		66.5 (2.618)		
Length of pressure relief valve plunger	mm (in)		35 (1.378)		
Oil filter element (replaceable fullflow oil filter)		One-way (throwaway) element			

*) Version for Sweden

Specifications

Engine

Model	320/6 320/6 A	323 i 323 i A *)
11 51 ... Water pump		
Gap between cover ring in housing and impeller wheel	mm (in)	0.6 ± 0.2 (0.024 ± 0.008)
11 53 ... Thermostat (for coolant)		
Opening movement starts	°C (°F)	80 ± 1.5 (176 ± app. 2)
Working stroke (at zero pressure)	mm (in)	8 (0.32)
11 74 ... Heat-sensitive (thermo-) valve (for exhaust emission reduction system)		
Make	Texas Instruments or Pierburg	
Type	23 VT 51 AB-12	
	Pierburg PE 20 286	
Color of top section	blue	
	yellow	
Switching point "Open"	Texas Instruments	20 (68)
	Pierburg	20 (68)
	Texas Instruments	13 (55)
	Pierburg	13 (55)

*) Version for Sweden

Specifications

Engine

Specifications

Model	320/6 320/6 A	323 i 323 i A *)
Tightening torques		
11 11 ... Engine block (cylinder block and crankcase)		
Main bearing caps	Nm kpm lb.ft	58.9 ... 65.7 6.0 ... 6.7 43.4 ... 48.4
Front engine block end cover	M 6 Nm kpm lb.ft	8.8 ... 10.8 0.9 ... 1.1 6.5 ... 8.0
	M 8 Nm kpm lb.ft	21.6 ... 23.5 2.2 ... 2.4 15.9 ... 17.3
Rear engine block end cover	M 6 Nm kpm lb.ft	8.8 ... 10.8 0.9 ... 1.1 6.5 ... 8.0
	M 8 Nm kpm lb.ft	21.6 ... 23.5 2.2 ... 2.4 15.9 ... 23.5
Tensioning pulley at engine block	M 8 Nm kpm lb.ft	21.6 ... 23.5 2.2 ... 2.4 15.9 ... 23.5

*) Version for Sweden

*) Version for Sweden

Specifications

Engine

Model	320/6 A 320/6 A	323 i 323 i A*)
Tightening torques (continued)		
1112... Cylinder head		
Cylinder head bolts (in crosswise pattern, starting from center and working outwards in two tightening stages)	Stage 1	Nm kpm lb.ft
	Stage 2	Nm kpm lb.ft
Cover on cylinder head M 6		Nm kpm lb.ft
Guide cover on cylinder head M 6		Nm kpm lb.ft
Rocker cover to cylinder head		Nm kpm lb.ft
Guard cover on cylinder head and front end cover		Nm kpm lb.ft
	M 8	Nm kpm lb.ft

*) Version for Sweden

1) with engine cold (max. 35° C (95° F) coolant temperature)

Specifications

Engine

Model	320/6 320/6 A	323 i 323 i A *)
Tightening torques (continued)		
11 13 ... Sump		
Oil drain plug	Nm kpm lb.ft	58.9 ... 63.8 6.0 ... 6.5 43 ... 47
Sump to engine block (crankcase)	Nm kpm lb.ft	8.8 ... 10.8 0.9 ... 1.1 6.5 ... 8.0
11 22 ... Flywheel		
Flywheel to crankshaft ¹⁾	Nm kpm lb.ft	98.1 ... 112.8 10.0 ... 11.5 72 ... 83
11 23 ... Vibration damper		
V-belt pulley with vibration damper to hub M 8	Nm kpm lb.ft	21.6 ... 23.5 2.2 ... 2.4 15.9 ... 17.3
Vibration damper with hub to crankshaft (with M 18 × 1.5 mm hex bolt)	Nm kpm lb.ft	392.3 ... 432.1 40.0 ... 44.0 298 ... 319

*) Version for Sweden

1) install with Loctite No. 270

Specifications

Engine

Model	320/6 320/6 A	323 i 323 i A *)
Tightening torques (continued)		
1124 ... Connecting rod with bearings		
Big end bolts	Nm kpm lb.ft	20 ¹⁾ 2.0 14.7
1131 ... Camshaft		
Toothed belt sprocket to camshaft M 10	Nm kpm lb.ft	54.9 ... 64.7 5.6 ... 6.6 40.5 ... 47.7
Adapter to disc M 6	Nm kpm lb.ft	8.8 ... 9.8 0.9 ... 1.0 6.5 ... 7.2
1133 ... Rockers with bearings		
Clamp bolt on rocker	Nm kpm lb.ft	8.8 ... 10.8 0.9 ... 1.1 6.5 ... 8.0
1135 ... Intermediate timing shaft		
Toothed belt sprocket to intermediate shaft M 10	Nm kpm lb.ft	39.3 ... 43.2 4.0 ... 4.4 29 ... 32

*) Version for Sweden

1) Tighten bolts by hand to 20 Nm (14.7 lb.ft) plus = 70° angle of rotation or turn the bolts through a further 70° with special tool 11 2 110 (when repairing always replace the bolts, use bolts only once).

Engine Specifications

Model	320/6 A 320/6 A	323 i 323 i A*)
Tightening torques (continued)		
1141 . . . Oil pump		
Screw plug for pressure relief valve, M 18 × 1.5 mm	Nm kpm lb.ft	24.5 . . . 29.4 2.5 . . . 3.0 18 . . . 22
Oil pump cover, oil strainer and screen plate at oil pump housing M 6	Nm kpm lb.ft	8.8 . . . 9.8 0.9 . . . 1.0 6.5 . . . 7.2
Oil pump to engine block M 8	Nm kpm lb.ft	21.6 . . . 23.5 2.2 . . . 2.4 15.9 . . . 17.3
1142 . . . Oil filter and lines		
Pressure relief valve or valve housing, M 20 × 1.5 mm	Nm kpm lb.ft	37.2 . . . 41.2 3.8 . . . 4.2 27 . . . 30
Fullflow oil filter (replaceable throwaway element) – with engine cold –	Nm kpm lb.ft	23.6 . . . 25.5 2.4 . . . 2.6 17.4 . . . 18.8
Collar screws for oil pipe, camshaft lubrication (M 8 × 1 mm)	Nm kpm lb.ft	5.9 . . . 7.85 0.6 . . . 0.8 4.4 . . . 5.9

*) Version for Sweden

Specifications

Engine			
Model		320/6 320/6 A	323 i 323 i A *)
Tightening torques (continued)			
1151 ... Water pump with drive			
Water pump with engine block M 8	Nm kpm lb.ft	21.6 ... 23.5 2.2 ... 2.4 15.9 ... 17.3	
Belt pulley to water pump M 6	Nm kpm lb.ft	8.8 ... 9.8 0.9 ... 1.0 6.5 ... 7.2	
1153 ... Thermostat and connections			
Cover to thermostat housing M 6	Nm kpm lb.ft	8.8 ... 9.8 0.9 ... 1.0 6.5 ... 7.2	
1153 ... Coolant temperature sensor			
Coolant temperature sensor	Nm kpm lb.ft	24.5 ... 27.5 2.5 ... 2.8 18.1 ... 20.3	
1162 ... Exhaust manifold			
Hex nut for exhaust manifold at cylinder head	Nm kpm lb.ft	29.4 ... 32.4 3.0 ... 3.3 21.7 ... 23.9	

*) Version for Sweden

Engine Specifications

Model	320/6 320/6 A	323 i 323 i A *)
Tightening torques (continued)		
1174 ... Heat-sensitive (thermo-) valve for exhaust emission control		
Heat-sensitive valve Mfr. Texas Instruments, max.	Nm kpm lb.ft	24.5 ... 27.5 2.5 ... 2.8 18.1 ... 20.3
Mfr. Pierburg	Nm kpm lb.ft	24.5 ... 27.5 2.5 ... 2.8 18.1 ... 20.3
1181 ... Engine mountings		
Left and right engine mountings (rubber bushings) at front axle beam (M 10)	Nm kpm lb.ft	49 ... 54 5.0 ... 5.5 36 ... 40
Left and right engine mountings (rubber bushings) to support bracket (M 10)	Nm kpm lb.ft	49 ... 54 5.0 ... 5.5 36 ... 40
Left support bracket on engine (M 8)	Nm kpm lb.ft	22 ... 24 2.2 ... 2.4 16 ... 18
Right support bracket on engine (M 8)	Nm kpm lb.ft	22 ... 24 2.2 ... 2.4 16 ... 18

*) Version for Sweden

Specifications

Engine		
Model	320/6 320/6 A	323 i 323 i A *)

Determining oil consumption

Oil consumption can be measured after the vehicle has covered about 7 500 km (5 000 miles). Until then, the oil consumption will not have stabilized at a constant figure.

The engine must be free from oil leaks.

Permissible oil consumption is not exceeding 0.15 l/100 km (235 miles/imp. pint, 392 miles/US quart).

The exact oil consumption must be determined by weighing.

Drain the engine oil while it is at normal operating temperature.

Draining time is 5 minutes. Weigh and fill with prescribed oil quantity¹⁾ – use new engine oil.

Drive vehicle for 1000 km/600 miles. Drain the engine oil while it is at normal operating temperature and weigh. Draining time is 5 minutes. Specific gravity of engine oil at ambient temperature is app. 0.9.

Example: Filled-in oil quantity – drained oil quantity

$$\begin{array}{r} 4500 \text{ g} \\ 900 - \text{Sp. Gr. } 0.9 = 1000 \text{ cm}^3 = 1 \text{ litre per } 1000 \text{ km} \end{array} \quad \begin{array}{r} - \\ 3600 \text{ g} = 900 \text{ g} \end{array}$$

Possible causes of excessive oil consumption:

1. Running in not yet complete.
2. Damaged sealing caps on valve stems.
3. Piston seizure.
4. Piston rings incorrectly installed, broken or worn.
5. Excessive running clearance between valve stem and valve guide.

*) Version for Sweden

Specifications

Engine

Model	320/6 320/6 A	323 i 323 i A*)
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Determining fuel consumption by DIN 70 030 standard test method

The vehicle's engine settings (ignition timing, fuel supply system etc.) must be to standard specification¹⁾.

The tire size must be as shown in the registration documents.

Tire pressures must be adjusted until as specified.

The brakes must be fully released.

The engine should have already covered at least 7 500 km (5 000 miles), and be at normal operating temperature.

During fuel consumption measurements, the vehicle should be laden to a point halfway between the permissible gross weight and the unladen weight.

Speed over the entire test course should be as uniform as possible, and three-quarters of the previously determined maximum speed, but not more than 110 km/h (68.5 mile/h).

The test route should be as smooth and flat as possible, and approx. 10 km (6.3 miles) in length. It should be covered in both directions. Rising and falling gradients of up to 1.5 % are permitted.

The air temperature should be between + 10 and + 30°C (50 ... 86°F) and the wind speed not more than 3 m/s (590 ft/min).

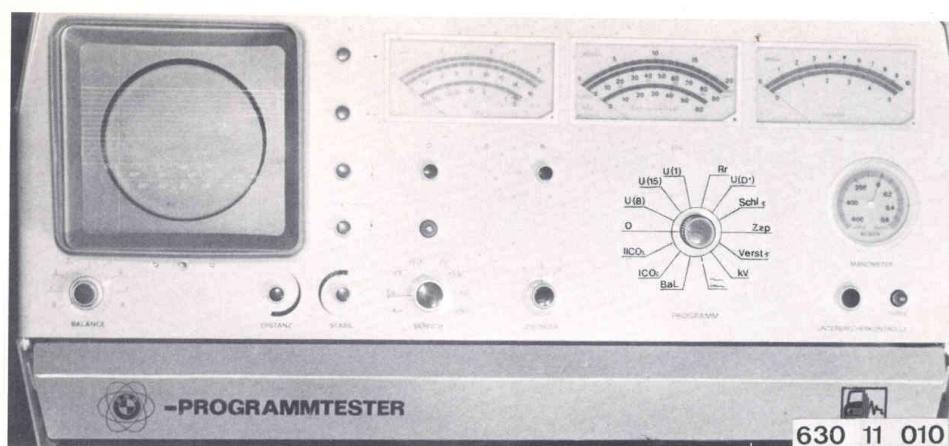
The vehicle's tank should be filled with a standard commercially-available grade of fuel (as specified by the manufacturer).

Fuel consumption is to be determined with a commercial meter or by means of the following formula, with a 10 % additional allowance for unfavorable circumstances.

$$\frac{\text{Fuel consumed} \times 100}{\text{Distance covered in km}} = \text{Fuel consumption by standard test method}$$

*) Version for Sweden

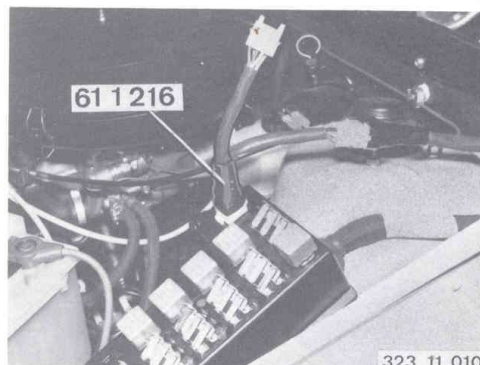
1) See specifications



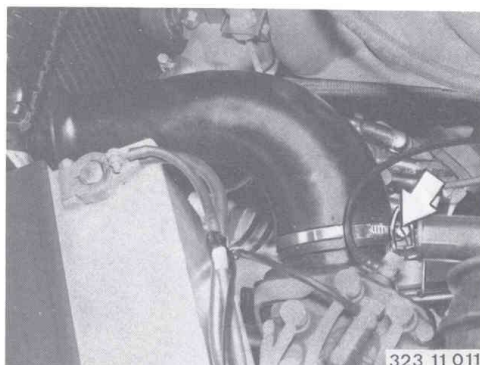
11 00 005 Diagnosis with BMW program tester/BMW digital tester

Switch position	Item tested	Page
	Connecting program tester	11-00/3
U (B +)	Battery voltage without power consumers	00/5
U (15)	Voltage at ignition coil terminal 15	00/5
	a) Ignition coil static current	
	b) When starting	
U (1)	Voltage drop at contact breakers and plugs	00/6
Rr	Capacitor-distributor	00/7
U (D +)	Alternator and regulator	00/8
Schl	Dwell angle	00/10
KV	Oscillograph display adjustments (basic trace)	00/10
	Cam displacement-distributor	00/11
	Contact breaker points	00/12
	Ignition coil polarity	00/12
	Capacitor-distributor	00/12
Digital tester	Ignition timing	00/13
Digital tester	Centrifugal ignition control	00/14
Digital tester	Vacuum ignition control	00/14
	Ignition voltage	00/16
	Ignition voltage/high tension insulation	00/17
	Comparative display of cylinders	00/20
Bal	Balancing cylinder display	00/21
Test values		00/23
Additional test		00/25
Additional test values		00/27

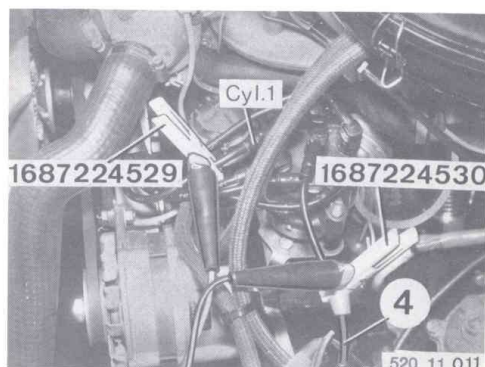
Connect BMW program tester to 220 volt power supply.
 Connect test leads and manual remote control on program tester.
 Plug adaptor cable No. 61 1 216 into diagnosis socket on car and connect with program test cable.



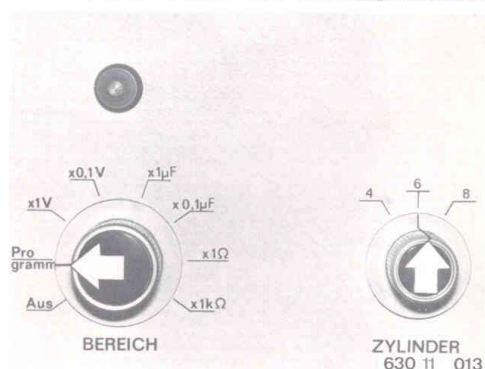
On 323i:
 Remove air tube.

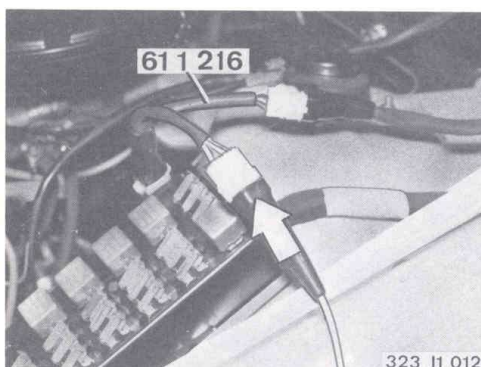


Connect detector clip 1 687 224 529 to cylinder 1 lead and detector clip 1 687 224 530 to ignition coil/distributor lead 4.



Set range switch to program.
 Tester is ready for use when yellow indicator lamp is on.
 If not, check 1 ampere fuse above main power supply cord.
 Set cylinder selector switch to 6.

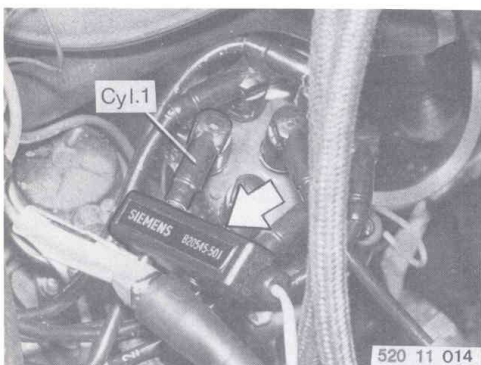




Connect BMW digital tester.
Connect test cable with adaptor cable No.
61 1 216.



Connect cable for TDC transmitter.



Connect trigger clip to cylinder 1 lead as close
as possible to the distributor.



Switch position U (B +)

16 volt scale.

**Check battery voltage¹⁾ with consumers off.
Engine stopped, ignition turned off.**



Switch position U (15)
16 volt scale

Version with breaker points:

Turn on ignition at ignition switch. Do not turn on ignition with manual remote control.

a) Measur-
minal 15).

b) Start engine at ignition switch.

Check voltage¹⁾ at ignition coil while operating starter motor.

Version with contactless transistorized coil ignition:

Important: Never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off.

Danger of electric shock!

Switch on the ignition at the ignition key.

Measure voltage¹⁾ at coil terminal 1.



1) See test values



1.6 volt scale

Green indicator lamp must be on. If not, operate starter motor until green lamp comes on (contact closes).

Read voltage drop¹⁾.

If maximum specifications are exceeded, check contact breaker points and plugs.

1) See test values.

Diagram illustrating the pinout of a 16-bit microcontroller. The pins are labeled as follows:

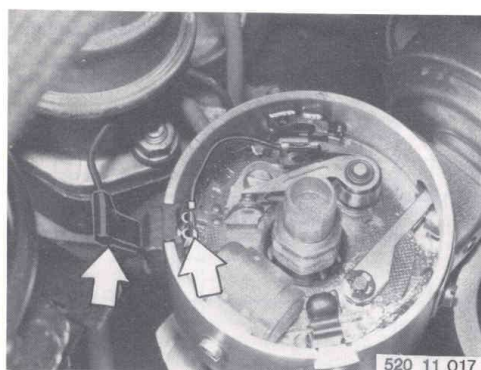
- Pin 1: UK1
- Pin 2: U1S
- Pin 3: U1B
- Pin 4: 0
- Pin 5: IC0
- Pin 6: IC0
- Pin 7: Bat
- Pin 8: Ry
- Pin 9: UKD
- Pin 10: SchL
- Pin 11: Zzp
- Pin 12: Vinst
- Pin 13: KV
- Pin 14: Vp
- Pin 15: Vm
- Pin 16: Programm

The diagram shows the face of a Bosch MZ 1000 multimeter. It features several scales and symbols:

- Top Scale:** A semi-circular scale with markings for 1, 2, and 3.
- Second Scale:** A scale for resistance (Ω) with markings for 0, 2, 4, 6, 8, 10, 12, 14, and 16. A red arrow points to the 16 mark.
- Third Scale:** A scale for capacitance (μF) with markings for 0, 2, 4, 6, 8, 10, 12, 14, and 16.
- Bottom Scale:** A scale for inductance (mH) with markings for 0, 2, 4, 6, 8, 10, 12, 14, and 16.
- Labels:** The brand name "BOSCH" is at the top. Symbols for AC voltage (V~), DC voltage (V-), AC current (A~), and DC current (A-) are shown. The unit "mV" is also indicated.
- Buttons:** There are four buttons on the left side of the face, each with a symbol: a circle with a dot, a circle with a cross, a circle with a plus sign, and a circle with a minus sign.

Remove distributor cap.

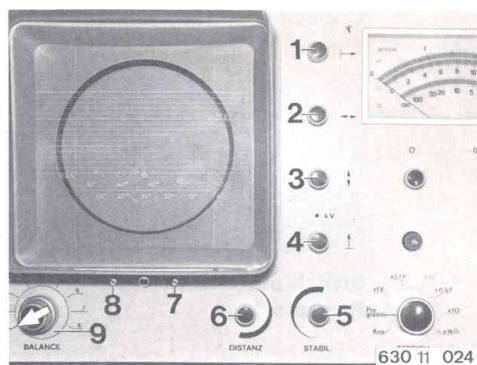
The capacitor is in working order if the reading is within the wide range.
Install distributor cap.



2.78



Switch position U (D+) 2000 min^{-1} scale



Set balance switch (9) to 0.

Turn distance rotary switch knob (6) to left stop.

Adjust image width between 0 and 100% with rotary switch knobs $\leftrightarrow$ (2) and $\rightarrow$ (1).

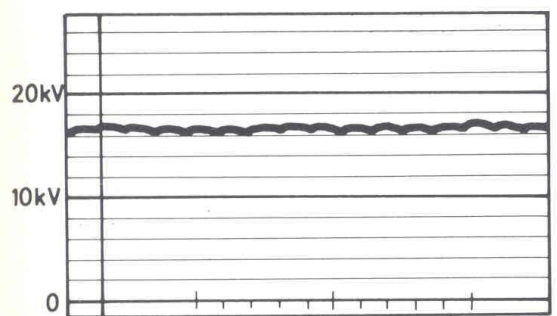
Adjust image to zero line with knob $\downarrow$ (3).

Start engine with remote control.

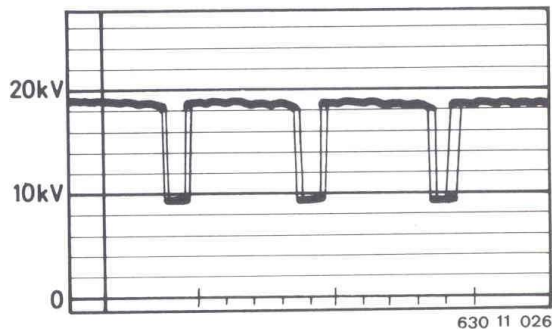
Switch on high beam headlights and other electrical consumers if necessary to prevent superimposition of the oscillograph images. Adjust stable rotary switch knob (5) with engine running at speed of 900 min^{-1} until the upper harmonic waves remain constant.

Turn rotary switch knob $\uparrow$ (4) until the upper harmonic wave is about 5 mm (0.2 in).

Important! Only adjust the image focus (8) and image brightness (7) when absolutely necessary.



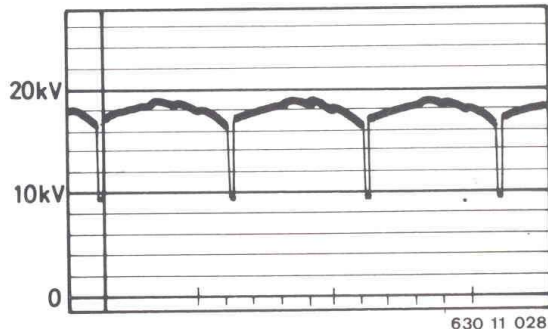
Alternator in proper working order.



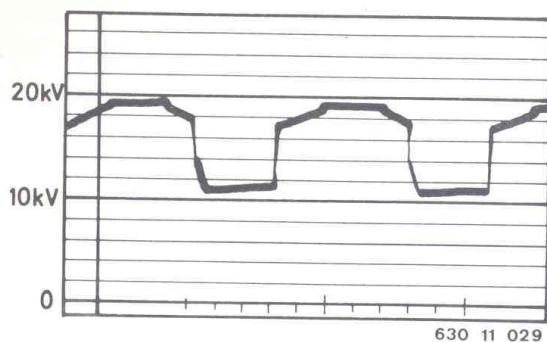
Break at one positive diode.



Break at one exciter diode.



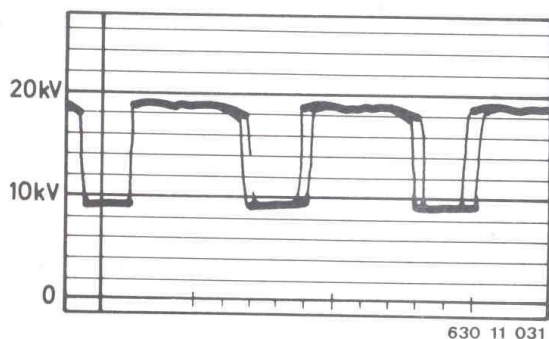
Break at one negative diode.



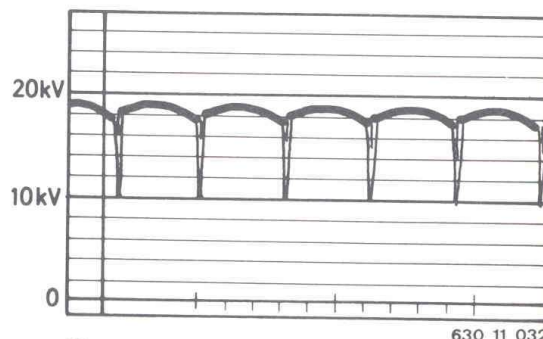
Short circuit at one exciter diode.



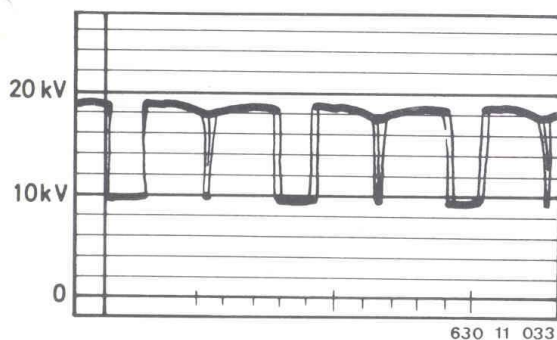
Short circuit at one positive diode.



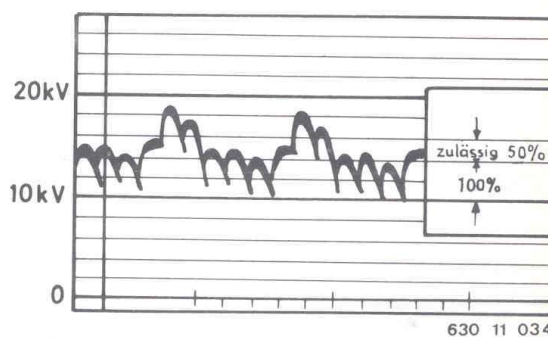
Short circuit at one negative diode.



Phase error.



Phase error and short-circuited negative diode.



Diodes with altered characteristic.
Important! Deviations below 50% are still acceptable. If deviations are greater than this, the defective diode must be replaced.



Switch position: dwell angle
Engine speed 2000 min^{-1}
60° dwell angle scale

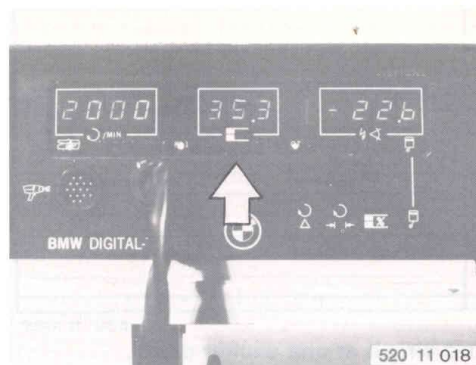
Version with contactless transistorized coil ignition:

Note: dwell angle is a fixed design feature and cannot be varied.

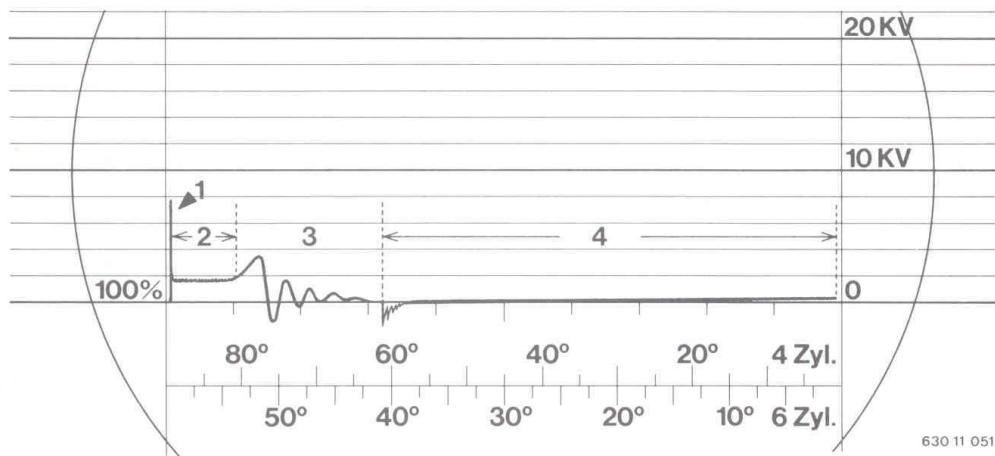
Check dwell angle

at $1500 \text{ min}^{-1} = 42^\circ \pm 10^\circ$

at $4500 \text{ min}^{-1} = 52^\circ \pm 5^\circ$



Read off dwell angle at digital tester.



Basic image EXTERNAL

This oscillograph shows the ignition voltage pattern for one cylinder; if the ignition system is in good working order the ignition voltage peak (1) actually appears on the right screen edge-basic image internal. It is produced at the moment when the contact breaker points open.

Combustion voltage line (2) shows the further progress of the ignition spark, which continues to glow for a brief period.

Dying out phase (3) shows how the ignition spark is broken off and dies away.

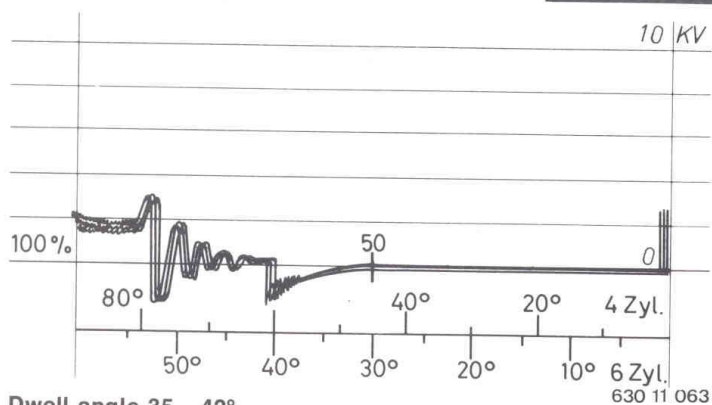
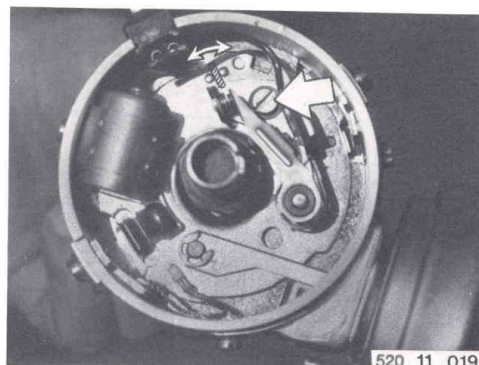
Closing period (4) = dwell angle.

The contact breaker points are shut. This is the closed period.

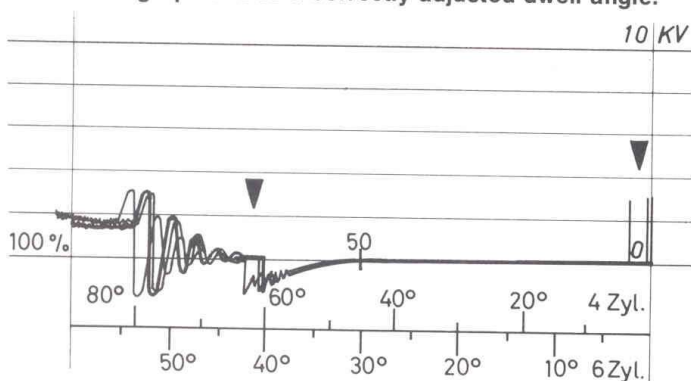
All deviations from the basic image mean faults in ignition system.

Version with breaker points:

Adjusting dwell angle
Switch off engine.
Remove distributor cap, rotor and dust cap.
Run engine with starter.
Adjust dwell angle to 35... 41° by turning the point carrier.
Strive for the smallest value.
The value can be read off directly at the digital tester during the adjustment, at starter speed.



Dwell angle 35...42°.
Adjust dwell angle to smallest value.
This oscillograph shows a correctly adjusted dwell angle.

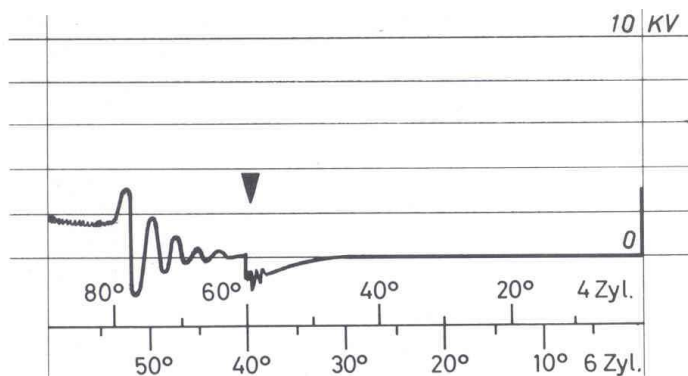


Distributor cam displacement

The ignition patterns of all cylinders are superimposed.
The distributor cam's accuracy will determine the regularity of the successive ignition patterns.

The amount of cam displacement¹⁾ can be read off at the scale in degrees.
Worn cams, a worn distributor shaft or a loose contact breaker plate will cause alterations in dwell angle and ignition timing intervals.
Renew distributor – 12 11 060.

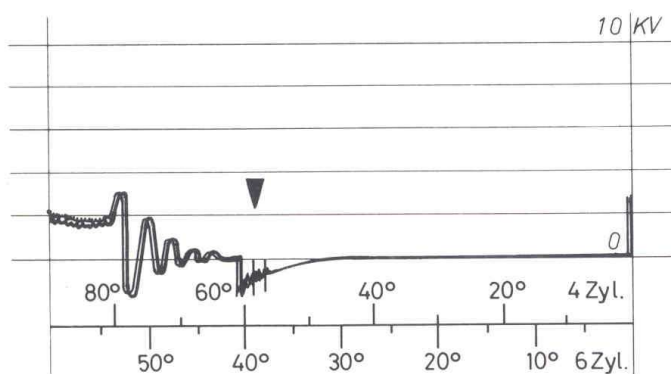
¹⁾ See test values



630 11 038

Dirty and burnt contact breaker points

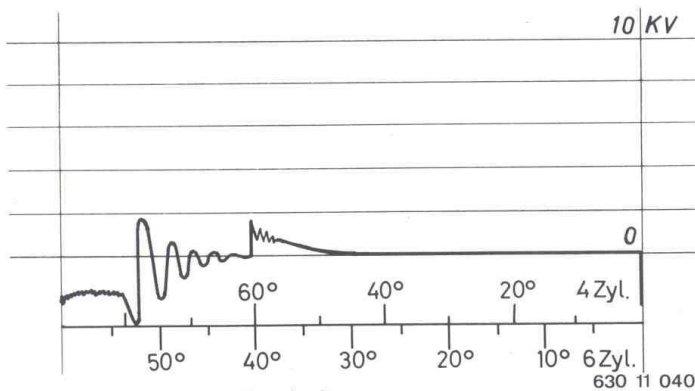
The oscillograph shows this fault by a deformation of the initial dwell phase.
Renew contact breaker points.



630 11 039

Contact chatter

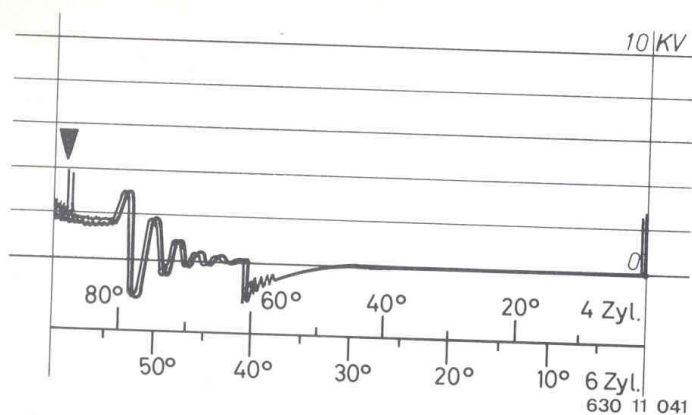
The contact breaker arm bounces after closing and thus produces another break. Renew contact breaker points.



630 11 040

Incorrect ignition coil polarity

Wires have been confused at ignition coil terminals 15 (+) and 1 (-). Correct the wire connections. This refers to the car's wiring and not to the test leads.



Capacitor series resistance

Capacitor series resistance will cause arcing at the contact breaker points, which turn blue, and the erosion of metal from one contact breaker point to the other.

Important: Capacitor series resistance will retard the ignition timing. It is essential to correct this defect before adjusting the ignition timing. Renew capacitor and contact breaker points.

Checking and adjusting ignition timing

Requirements for exact ignition timing adjustment:

- Perfect contact breaker points
- Correct dwell angle

Detach vacuum hoses at distributor.
Start engine.

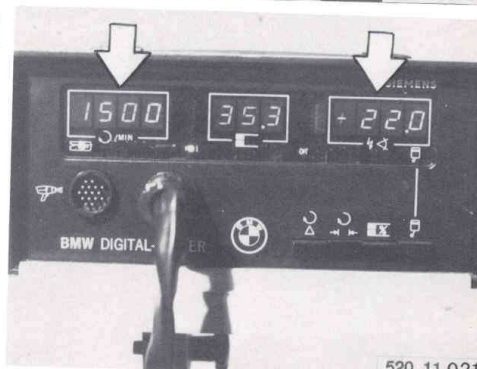
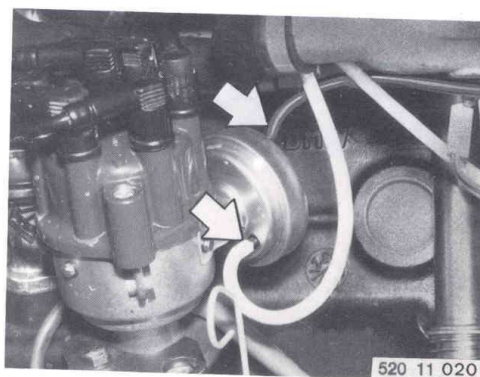
Set BMW digital tester to 1500 min^{-1} with the speed control button $\rightarrow \leftarrow$.

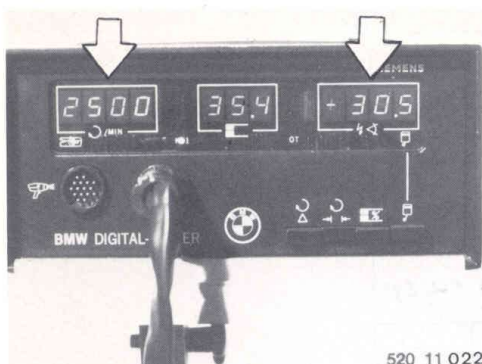
Refer also to BMW digital tester operating instructions.

Accelerate engine to at least 1500 min^{-1} .

Read advance ($22^\circ \pm 0.5'$) on digital tester.

Correction: Loosen distributor mounting screw and correct ignition timing by turning distributor.



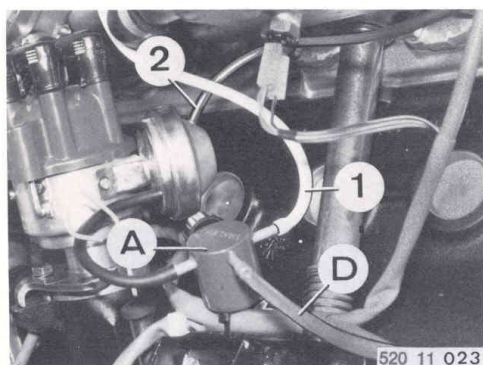


Centrifugal ignition control¹⁾

(engine at operating temperature)

Detach vacuum hoses for advance and retard control. Set BMW digital tester for different speeds (see pages 11-00/19 and 20), and take measurements.

Renew distributor if there is serious deviation from specifications.



Vacuum ignition control

a) Retard control: Install control valve (A) between vacuum box and hose (1). Connect the control valve connection (D) with vacuum gauge (in program tester). Detach hose (2). Start engine.

Open control valve slowly – vacuum drops. Watch digital tester and read vacuum¹⁾ from gauge as soon as the advance angle reading increases. The value shown on the digital tester is the end of the vacuum control, e.g. 38°. Open valve further until no vacuum is shown. Watch digital tester and shut control valve slowly. Read value from vacuum gauge as soon as the advance angle drops. The value shown on the digital tester is the beginning of vacuum control, e.g. 24°.

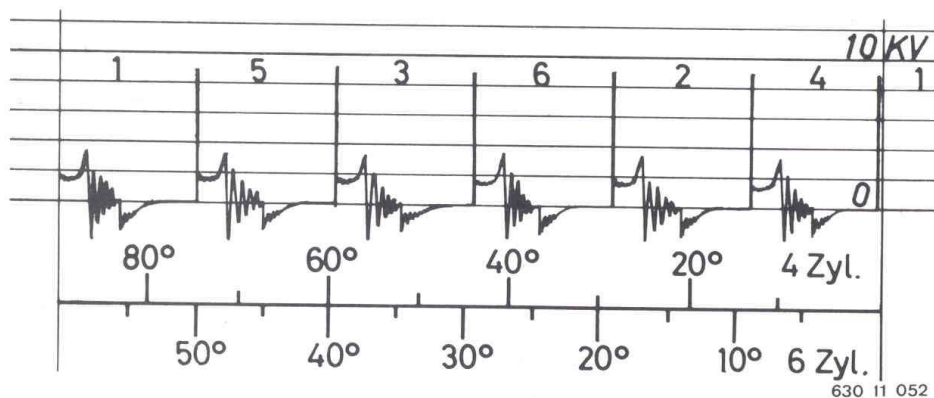
b) Advance control: Install control valve (A) between vacuum box and hose (2). Make measurement as in point a).

c) Control angle:

Measured at end of control	38°
– measured at beginning of control	– 24°
	14°

¹⁾ See test values

Switch position KV
Engine speed
9000 min⁻¹ scale
1200...1400 min⁻¹



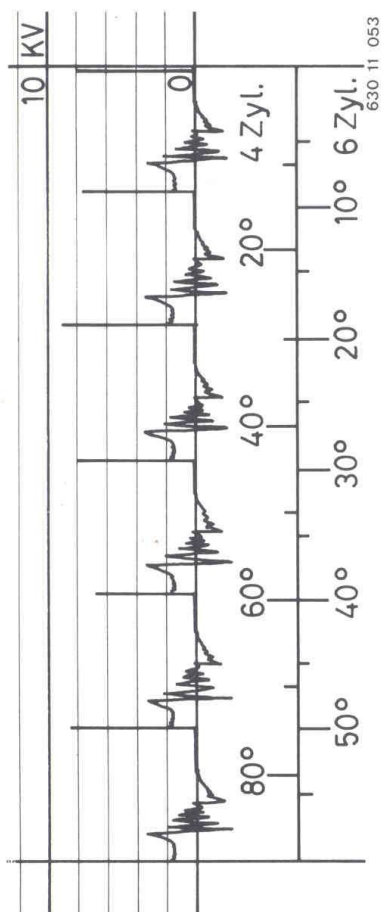
Turn KV rotary switch knob to left stop.
General view of an ignition system in good condition.
Cylinders are shown on the screen in firing order.
Only ignition voltage peak of cylinder number 1 is at far right.

11-00/15

2.73

11-00/15

11-00/15

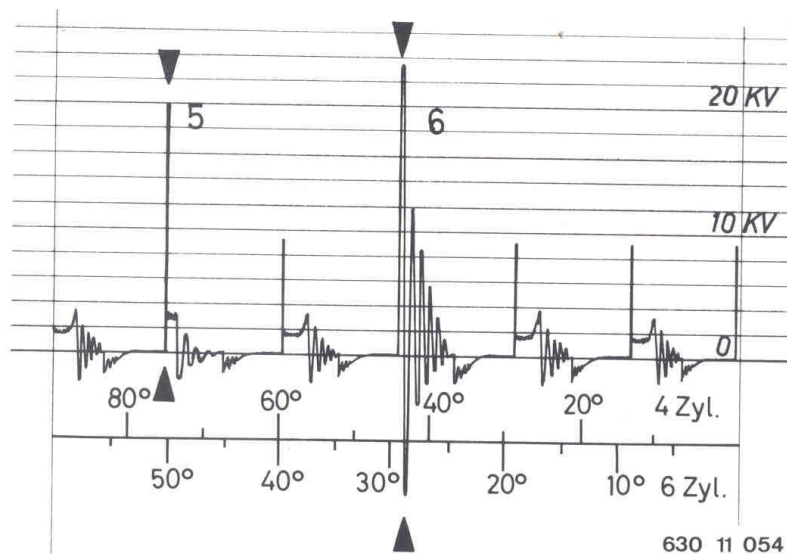


Ignition voltage is measured in KV with an oscilloscope.
 More important than the amount of ignition voltage is the uniformity for all cylinders. Differences up to 3 KV are acceptable.
 If differences are greater than this, check the following:

- a) Fuel/air mixture setting of carburetor.

Factors affecting ignition	Ignition voltage too	
	high Cause	low Cause
b) Electrode gap ¹⁾	Large	Small
c) Compression	High	Low
d) Fuel/air mixture	Lean	Correct
e) Ignition spark polarity	Incorrect	Correct (negative ignition pulse)
f) Electrode (engine) temperature	Low	High
g) Electrode material ¹⁾	Unsuitable alloys	Special alloys
h) Electrode shape ¹⁾	Round	Sharp-edged
i) Electrode condition ¹⁾	Burnt	New
k) Ignition timing	Retarded	Advanced
l) Ignition cable	Break	-
m) Spark gap in distributor	Large	-

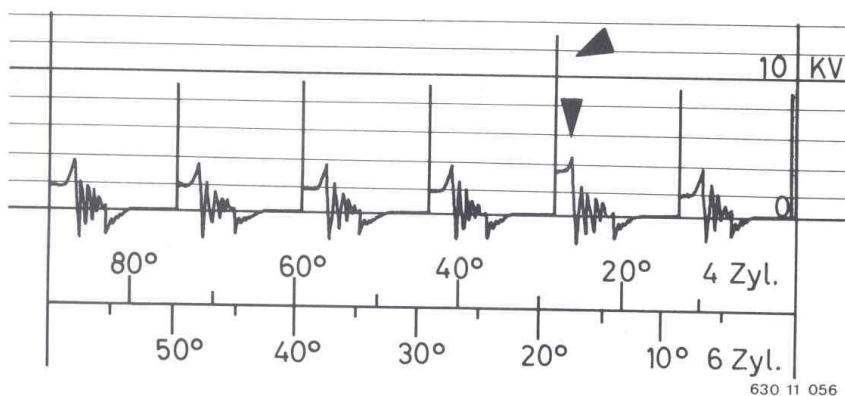
¹⁾ Determined by spark pulgs



Critical insulation test²⁾

This requires pulling off each spark plug connector one after the other.

Cylinder 6 insulation is in good condition.
Cylinder 5 insulation defective.



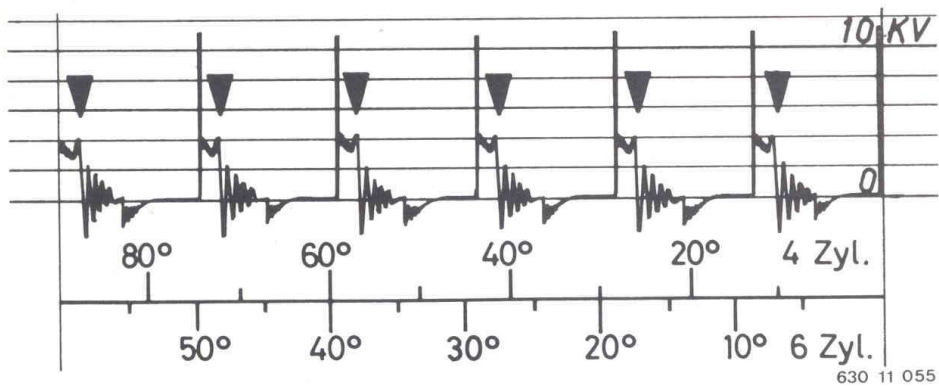
Faults on all cylinders

Suppressor resistors between ignition coil¹⁾, distributor or distributor rotor¹⁾ with too much resistance. Combustion voltage line is at an angle and narrower than usual.

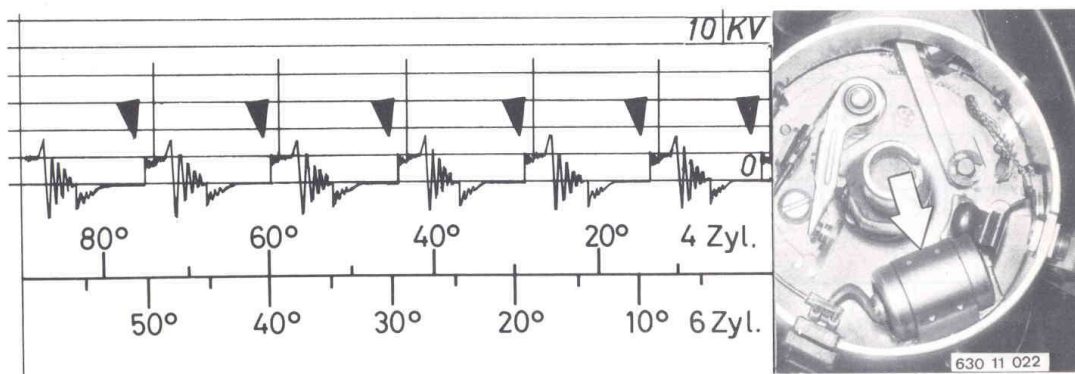
Excessive resistance will be noticed when driving the car by way of poor acceleration and inadequate engine power.

¹⁾ See test values

²⁾ Warning: Never work on contactless transistorized coil ignition system unless engine is stopped and ignition switched off. Danger of fatal electric shock.



Fault on one ignition cable, spark plug connector or suppressor cap.

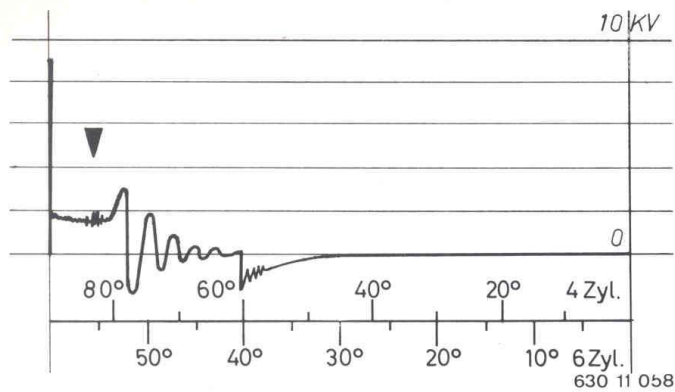


Capacitor series resistance

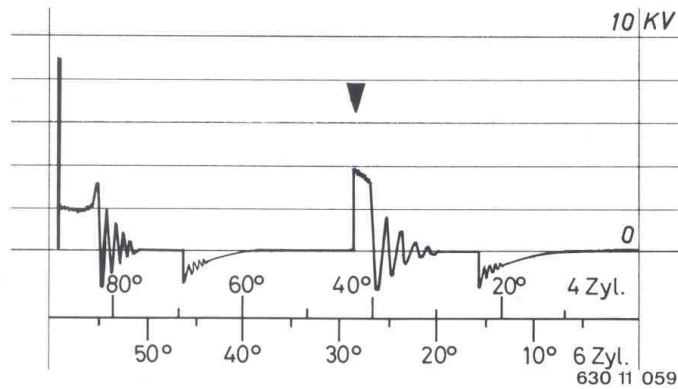
Important! Capacitor series resistance will retard the ignition timing. This fault must be found and corrected before timing the ignition.

Turn rotary switch knob → to the right until basic image for cylinder 1 appears separately on the screen.

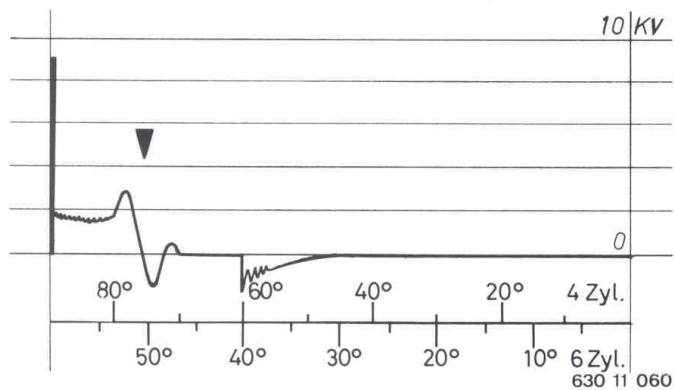
Now turn rotary switch knob ↔ to the left slowly and check the images in the sequence of the firing order (1-5-3-6-2-4).



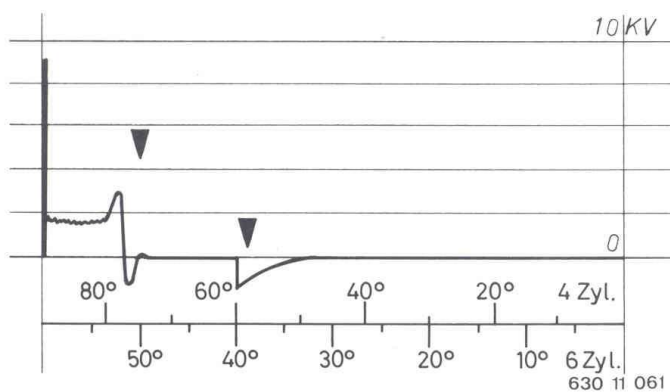
If spark plugs are heavily contaminated, the combustion voltage line will appear thicker than usual and will be superimposed by oscillations.



If spark plugs are severely leaded, the ignition current will stray via the electrically conductive lead deposits when the engine is warm. This in turn will cause misfiring.



Distributor capacitor is shorted to ground if insulation resistance is below 2 K Ohms. Engine will stop running if there is a complete short to ground.

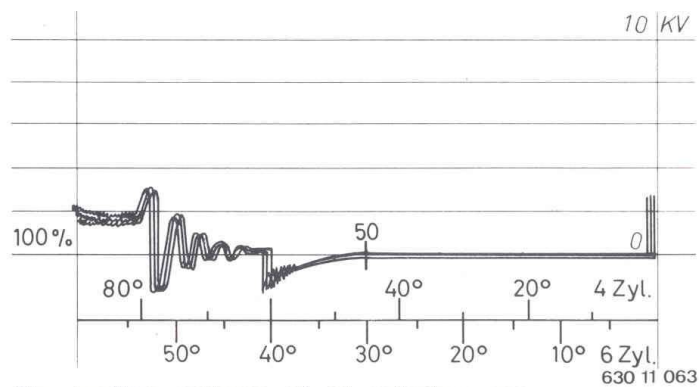


Short in ignition coil primary winding

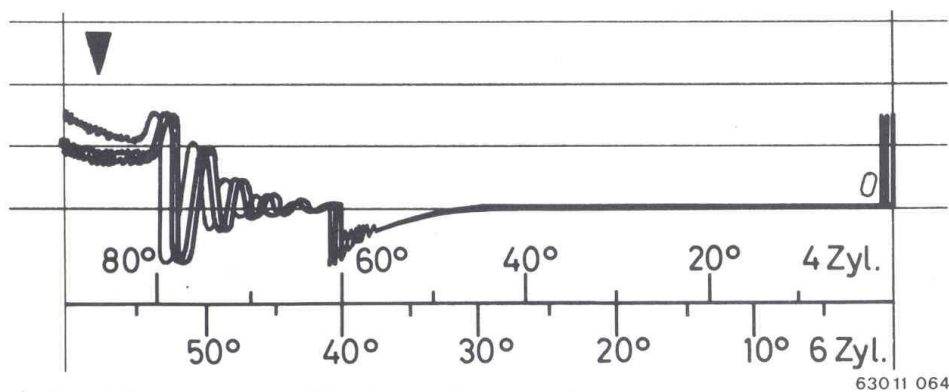
Turn back rotary switch knobs → and → to their initial positions (cylinders 1...6 between 0 and 60°).



9000 min⁻¹ scale
Engine speed approx.
1200...1400 min⁻¹

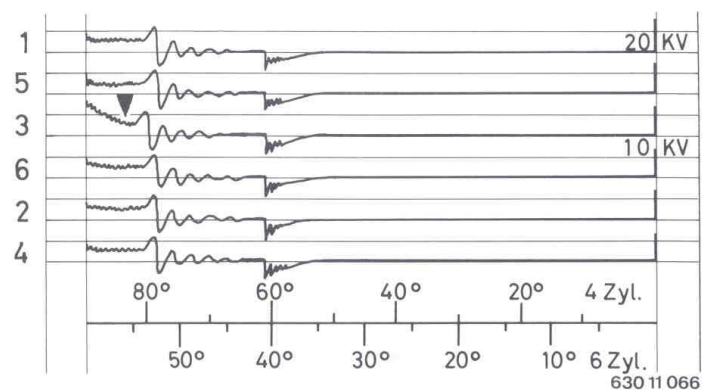
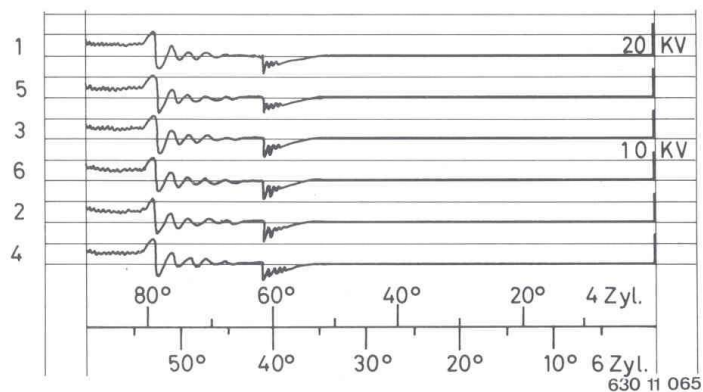


The ignition patterns of all cylinders are superimposed for comparison with each other.



This oscillograph shows that a suppressor resistor for one cylinder is defective.

Set balance switch to O.
 Turn distance rotary switch knob to the right until all
 cylinders appear on the screen.
 The cylinder patterns are superimposed in sequence of firing
 order to permit comparisons.



Excessive suppressor resistance at cylinder 3.



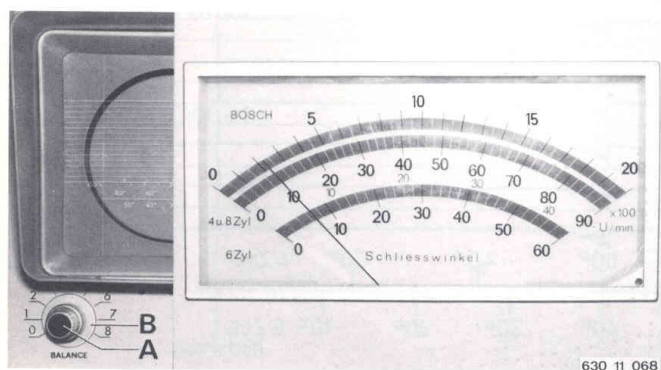
Switch position balance
2000 min⁻¹ scale
Engine speed 1500 min⁻¹

Power output comparison of cylinders

Important! This test requires perfect carburetor, ignition timing and valve clearance settings.

Adjust cylinders with selector switch (B) one after the other in sequence of firing order, and short circuit each cylinder by pressing button (A). Read speed drop on scale. Speed drops should be as uniform as possible and about 100 min⁻¹ per cylinder.

Check compression if speed drop is lower than this.



Switch position	Item tested	Specification
U (B +)	Battery voltage without power consumers	min. 11.8 volts
U (15)	Voltage at ignition coil terminal 15	min. 10.8 volts
	a) At ignition coil static current	min. 9.0 volts
	b) While starting	max. 0.3 volts
U (1)	Voltage drop at contact breakers and plug	within Rr range
Rr	Capacitor series resistance	13.5 ... 14.6 volts
U (D +)	Alternator	see page 11-00/7
	a) Voltage at D +	35 ... 41° ≥ 0.35 mm (0.014 in)
Schl. ✕	b) Checked with oscillograph at 900 min ⁻¹	max. 3°
	Dwell angle	
	Contact opening	
	Cam displacement, checked with oscilloscope at 2 000 min ⁻¹	
Digital Tester	Ignition timing without vacuum control at 1 500 min ⁻¹ (both hoses detached)	22 + 1° BTDC
	Centrifugal control without vacuum control	Degrees BTDC on crankshaft
		min ⁻¹
		1 000
		1 500
		2 000
		2 500
		3 000
		3 500
Verst. ✕	Aimed at TDC mark	
Digital Tester	Distributor No.: 0 231 309 007	
Digital Tester	Vacuum control	Begins Advance 110 ... 140
	mm/Hg	Ends Advance 175 ... 185
	Control range at crankshaft	Advance 8° ... 12°
	Retard control at idle speed	
	Speed boost with hose detached	
	Ignition voltage at 1 200 ... 1 400 min ⁻¹	150–200 min ⁻¹
	Difference in ignition voltage of individual cylinders	8 ... 14 KV
	Increase when accelerating	2 ... 3 KV
	Ignition coil idle voltage (plugs off)	2 ... 3 KV
	Output comparison of cylinders at 1 000 min ⁻¹	min. 18 KV
Bal.		Engine speed must be as constant as possible
I CO %	Exhaust test at 850 ± 50 min ⁻¹	1 ± 0.5% by volume
	Fuel pump pressure	0.20 ... 0.30 kp/cm ² (2.8 ... 4.2 lb/in ²)

Program test – BMW 323 i

Switch position	Item tested	Desired value
U (B +)	Battery voltage without consumers	min. 11.8 V
U (15)	Voltage at coil terminal 15 a) off-load coil current b) during starting	min. 10.8 V min. 9.0 V
U (1)	Voltage at coil terminal 1 or control unit terminal 16	below 2.0 V
U (D +)	Alternator a) Voltage at D + b) Oscilloscope test at 900 min ⁻¹	13.5 – 14.6 V see page 11-00/7
Digital tester	Dwell angle	at min ⁻¹ 1500 4500
Digital tester	Ignition at 1500 min ⁻¹ without vacuum control	22° bTDC
Verst. ✕	Centrifugal ignition control (without vacuum ignition control)	min ⁻¹
Digital tester		°CS bTDC 11° ... 17° 22° 27° ... 33° (End) 26° ... 32°
Digital tester	Distributor No. 0 237 302 006	
	Vacuum ignition control	advance 170 ... 230 advance 310 ... 320 advance 12 ... 16
kV	Ignition voltage at 1200 ... 1400 min ⁻¹ Variation in ignition voltage between cylinders Increase when throttle is opened	retard 140 ... 290 mbar retard 450 ... 540 mbar retard 14 ... 18 6 ... 11 kV 2 ... 3 kV 2 ... 3 kV
Bal.	Coil off-load voltage (spark plug caps detached) ¹⁾ Comparison of cylinder power output at 1000 min ⁻¹	min. 18 V Running speeds must be as uniform as possible
I CO %	Exhaust emissions test at 900 ± 50 min ⁻¹ Fuel pump pressure (vacuum hose to pressure regulator detached)	1.5 ± 0.5% CO by volume 0.20 – 0.30 kp/cm ² (2.8 ... 4.2 lb/in ²)

1) Warning: no work to be done on contactless transistorized coil ignition system unless engine is stopped and ignition switched off.
Danger of fatal electric shock.

Additional test

Voltage resistance and capacitance tests can also be made with the test lead via the range switch. These tests can be made at any program switch position; this will not impede the other programs – except the voltmeter.

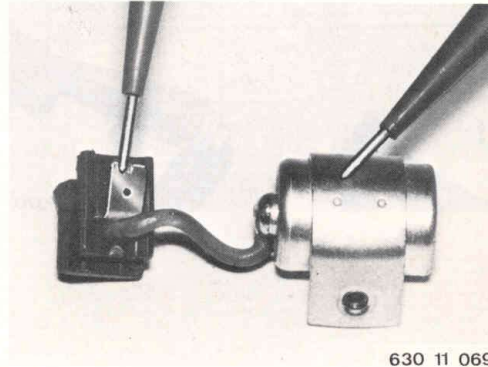
Voltage test

Set range switch to X 1 V or X 0.1 V depending on test range.

Test lead connections: red clip to +
black clip to –

Capacitance test

Set range switch at X 1 μ F or X 0.1 μ F depending on test range.



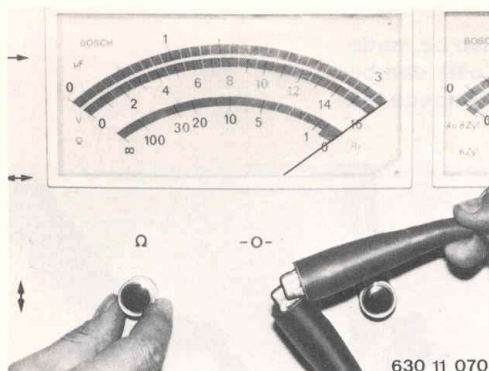
630 11 069

Important! For capacitance tests never short circuit or supply voltage to test terminals. Built-in capacitors must be disconnected before testing.

Connect capacitor between clips of test lead. Read test value¹⁾ on instrument.

Note! Capacitors which were not used for a long time or are new must be charged and discharged before testing. Otherwise the series resistance shown will be too high, but will disappear immediately after being put in operation.

¹⁾ See test values.



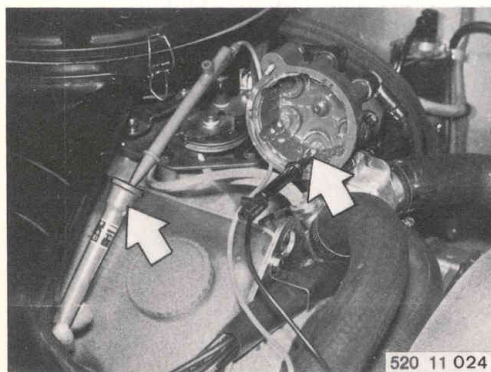
Resistance test

Set range switch at X 1 Ohm or X 1 KOhm depending on test range.

Calibrate the applied test range before each test.

Short circuit test terminals.

Set needle of instrument at 0 (bottom scale) with rotary switch knob for Ohms (Ω).



Connect resistor¹⁾ between clips of test lead and read amount of resistance.

The degree of insulation is better, the higher the insulation resistance. Normally the instrument needle in test range X 1 KOhm will deflect completely when insulation is perfect, i.e. infinite resistance.

Important!

Never supply voltage to test terminals.

0.25 ampere fuse on front of tester, right-hand side.

¹⁾ See test values

11-00/26

¹⁾ See test values

Test values for additional test

Charge condition	Acid density g/cm ³	Idle speed voltage per cell in volts	At least 12.2 volts
Charge condition			Battery voltage without power consumers in volts
Full	1.28	2.12 ... 2.13	12.72 ... 12.78
Half	1.20	2.05	12.3
Dead	1.12	1.97 ... 1.98	11.82 ... 11.88
Voltage at ignition coil terminal 15 or at input to series resistor			at least 11.0 Volts
a) At ignition coil static current			at least 9.0 Volts
b) While starting			
Voltage drop at contact breakers and plugs			max. 0.3 Volts
Voltage at alternator D +			13.5 ... 14.6 Volts
Voltage B + to starter 30			max. 0.5 Volts
B + to ignition coil 15 or series resistor input			max. 0.4 Volts
B - to engine ground			max. 0.5 Volts
Suppressor resistance ¹⁾			5 KOhm $\pm$ 25%
Distributor rotor			1 KOhm $\pm$ 25%
Suppressor cap in distributor cap			1.4 KOhm $\pm$ 25%
Plug connectors			
Distributor capacitor ¹⁾ at TSZ No. 1 237 330 303			0.18 ... 0.22 μ F
Insulation resistance			at least 200 KOhm
Ignition coil ¹⁾ Bosch No. 0221 119 017 KW 12 V			1.7 ... 2.152 Ohm
0221 122 010 at TSZ (= transistorized coil ignition)			0.4 Ohm
Cable series resistance			0.9 Ohm
			0.4 Ohm and 0.6 Ohm

¹⁾ Values at ... 20°C (... 68°F).

11 00 039 Compression test on all cylinders

On 323i only:

To prevent the cylinders from becoming flooded with fuel by the injectors delivering fuel continuously as the starter is run, the fuel pump relay (1) or diode relay (2) must be removed.

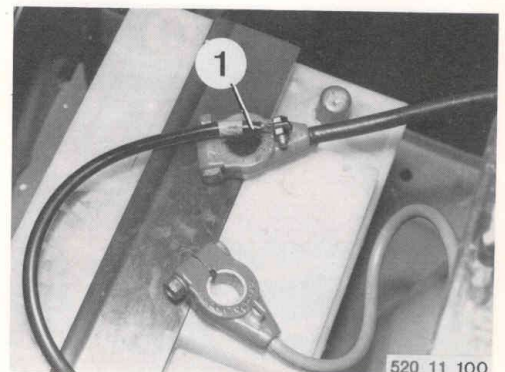
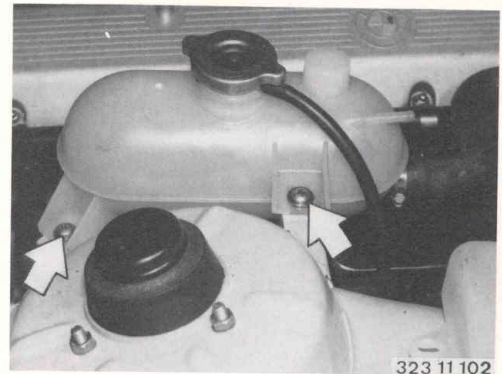
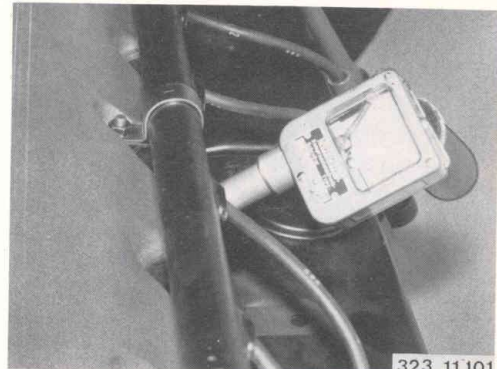
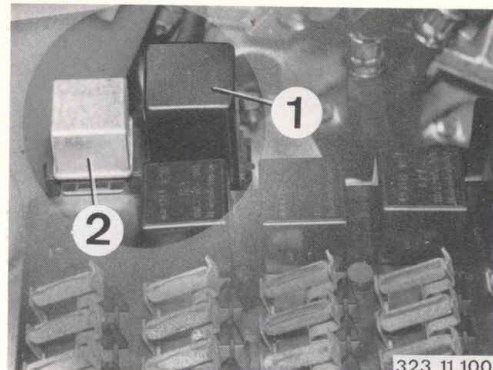
Remove the spark plugs.
Check compression¹⁾.

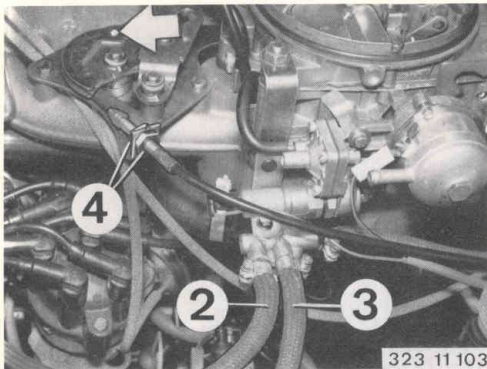
11 00 050 Engine – removing and installing

Remove gearbox – 23 00 020
or automatic transmission – 24 00 020.
Take off the engine compartment lid – 41 61 000.
Remove the air cleaner – 13 71 000.
Remove the radiator – 17 11 000.
Remove the coolant equalizing tank.

Detach the positive and negative leads from the battery.
Take off cable (1).

¹⁾ See specifications





Carburetor engine:

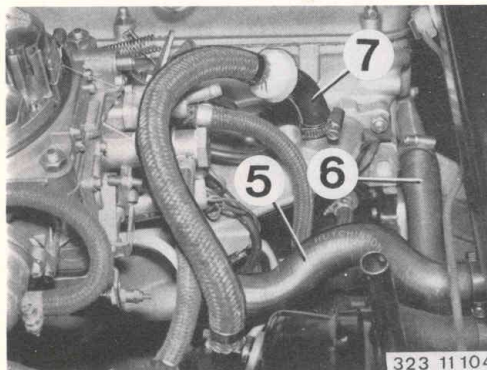
Detach fuel hoses (2) and (3).

When installing: do not accidentally confuse these hoses.

Hose (2): fuel supply; hose (3): fuel return.

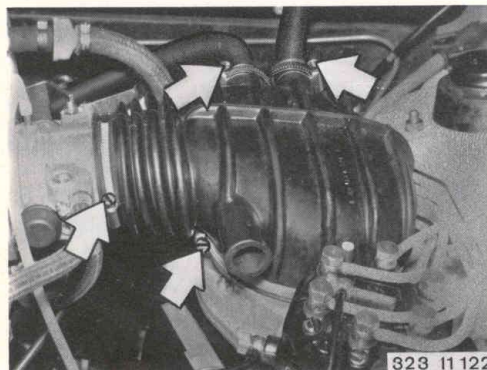
Unscrew nuts (4) and disconnect the accelerator cable.

When installing: adjust the accelerator cable – see 35 41 421.



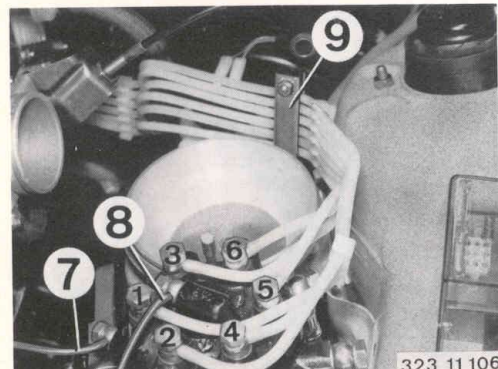
Detach coolant hoses (5) and (6).

Disconnect vacuum hose (7).



Fuel injection engine:

Take off the intake air scoop.



Detach injector lines (1... 6).

Detach fuel lines (7) and (8).

When installing: do not accidentally confuse these lines.

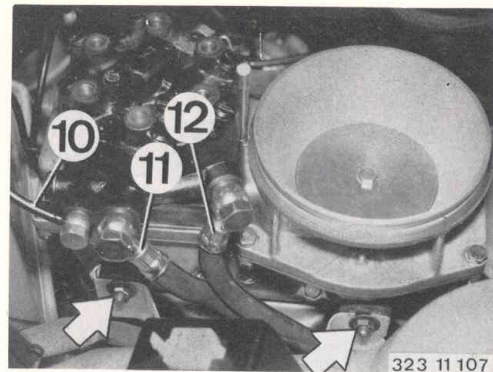
Line (7) to cold-start valve, line (8) to warming-up sensor.

Check condition of sealing rings and renew if necessary.

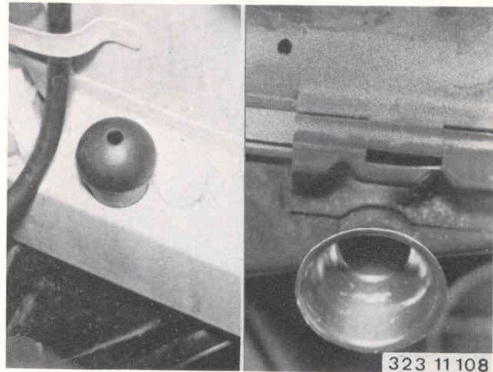
Release holder (9).

Detach fuel lines (10 ... 12).

When installing: line (10) to warming-up sensor, line (11): fuel supply, line (12): fuel return. Loosen nuts and take the mixture regulator with air cleaner housing out upwards.

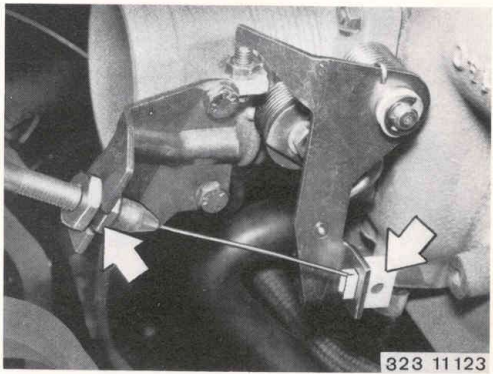


When installing: the rubber underlay must be in the funnel on the air cleaner housing.

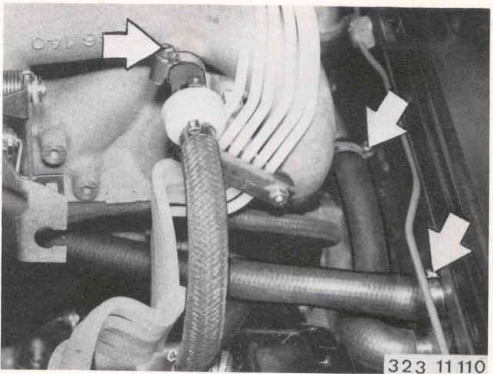


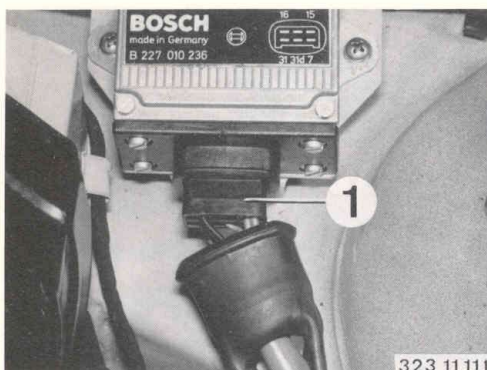
Detach the accelerator cable and remove it from the reaction bearing.

When installing: adjust accelerator cable – see 35 41 421.

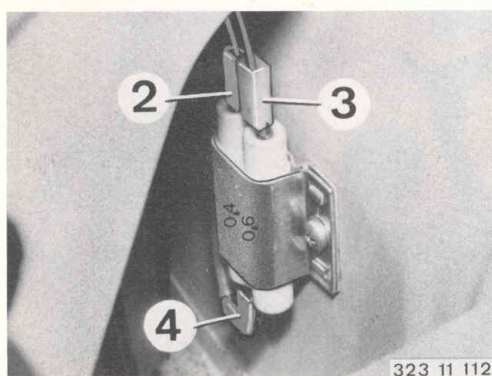


Detach coolant hoses and vacuum hose.

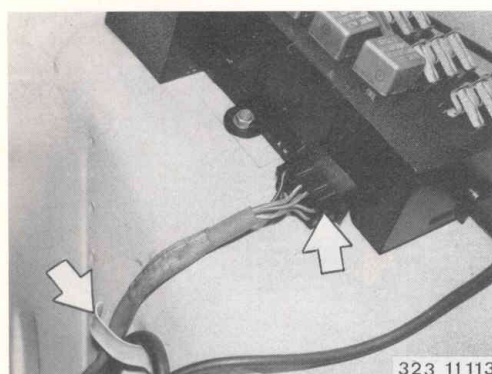




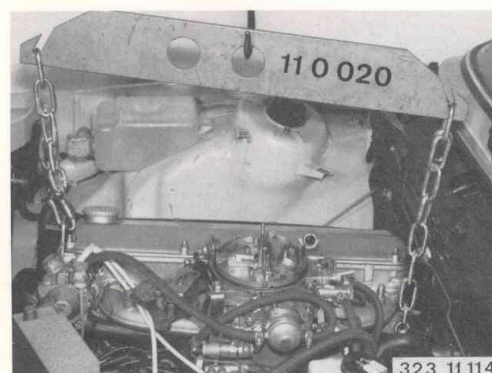
**Pull off the protective cap.
Pull out plug (1).**



Pull off leads (2...4).
When installing: **black/red and green to 0.4 Ohm**
black/red to 0.6 Ohm



**Detach the multi-pin plug.
Lift the wiring harness out of its clip on the wheel arch.**

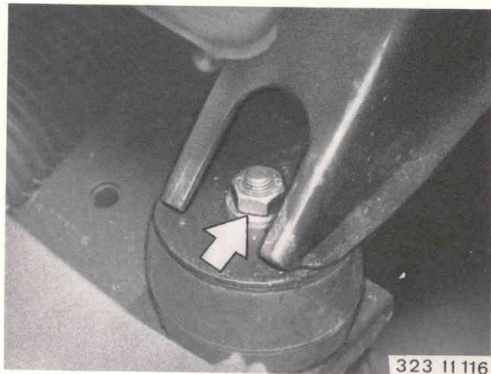


**Suspend the engine from engine lifting beam
11 0 020 at front and rear.**

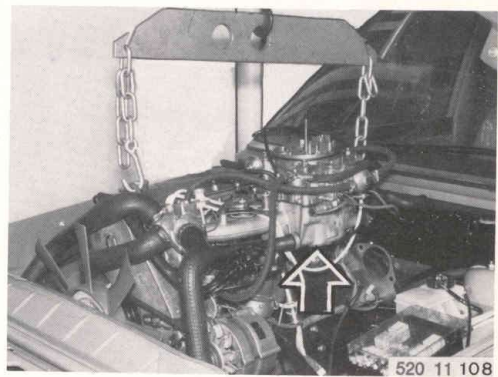
Detach earth (ground) strap (5) and left engine mounting.



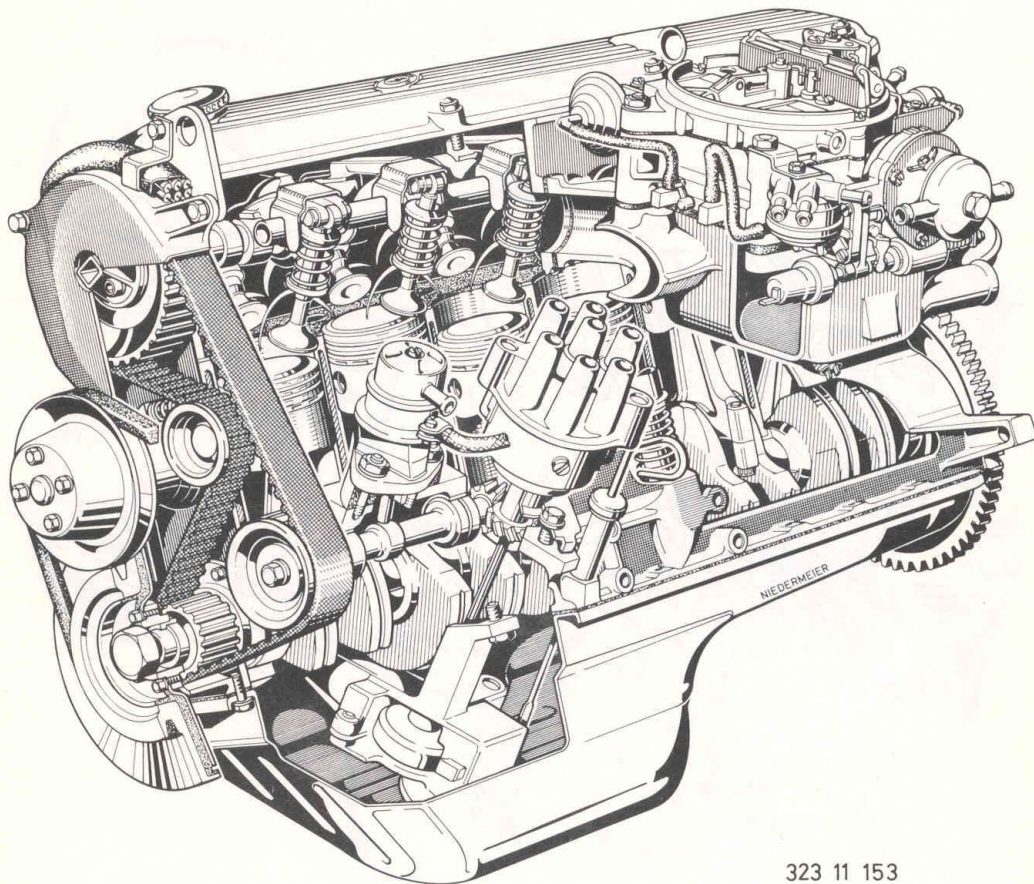
Detach right engine mounting.



Raise the engine and lift out towards the front.

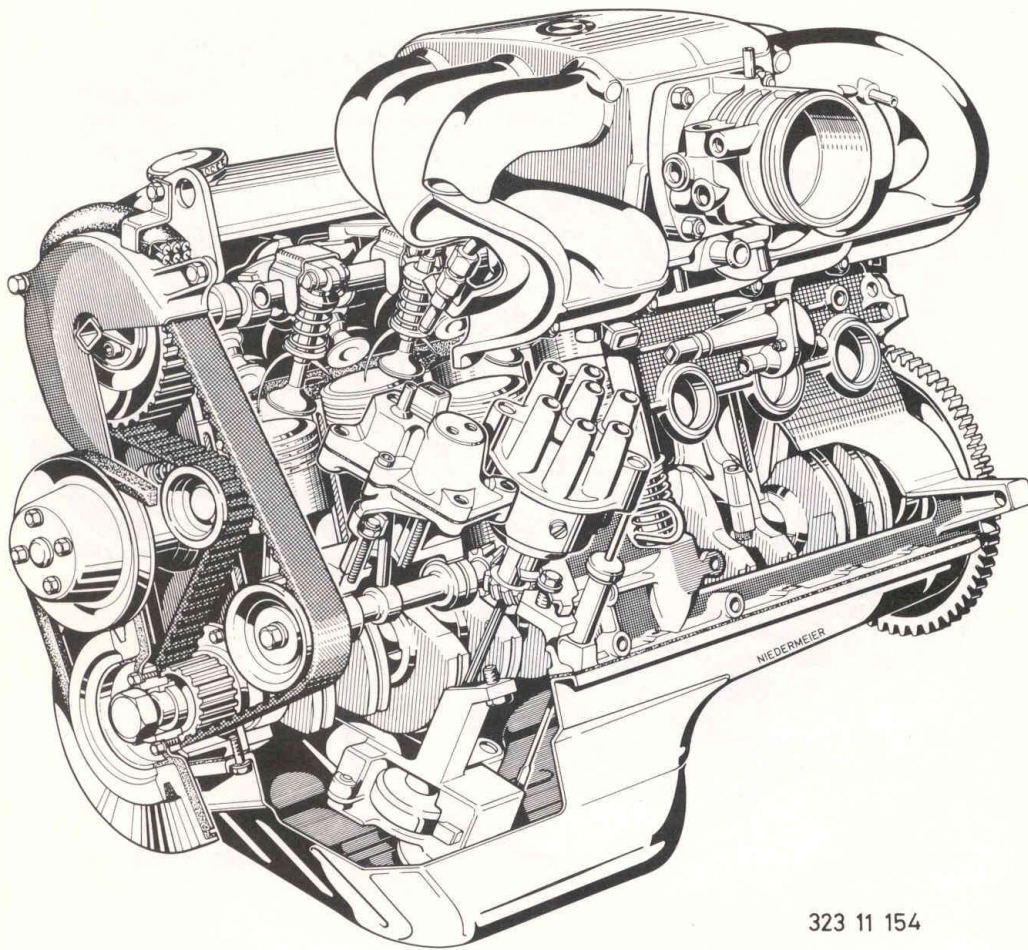


Sectional view of carburetor engine



323 11 153

Sectional view of fuel injection engine



323 11 154

**11 11 160 Distributor shaft bearing – re-
newing**

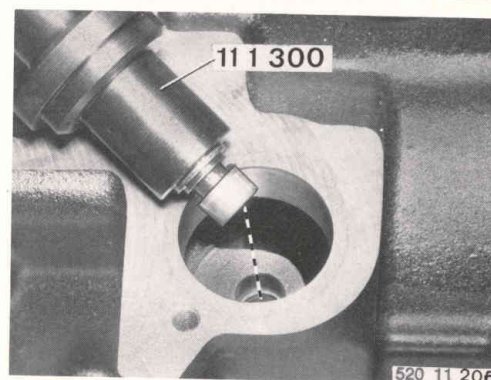
Remove oil pump – 11 41 000.

Remove distributor – 12 11 060.

**Remove needle bearing by driving it out from
bottom to top with special tool 11 1 310.**



**When installing: Lubricate needle bearing.
Drive in needle bearing up to stop with special
tool 11 1 300.**



11 12 000 Rocker cover – removing and installing

Remove the air cleaner – 13 71 000.

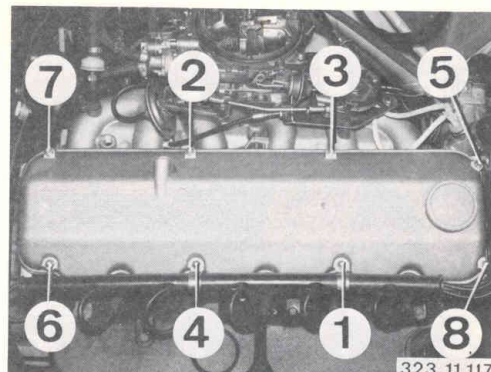
Slacken nuts (1 ... 8).

Warning: take off spring washers.

Take off the rocker cover.

When installing: tighten nuts in the order 1 to 8 as shown.

Check condition of gasket and renew if necessary.



11 12 100 Cylinder head – removing and installing

Detach exhaust pipes from exhaust manifolds.
Detach the exhaust pipe support.

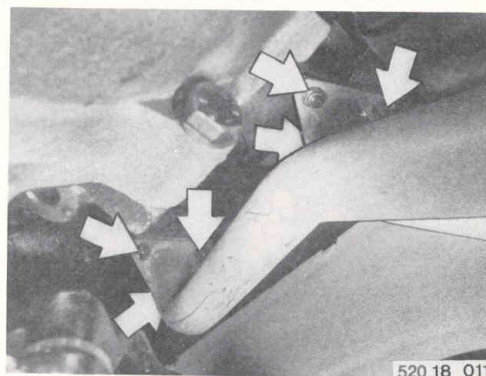
When installing: install exhaust pipe support without trapped stresses.

Remove rocker cover – 11 12 000.

Drain the coolant.

When installing: bleed the cooling system – 17 00 039.

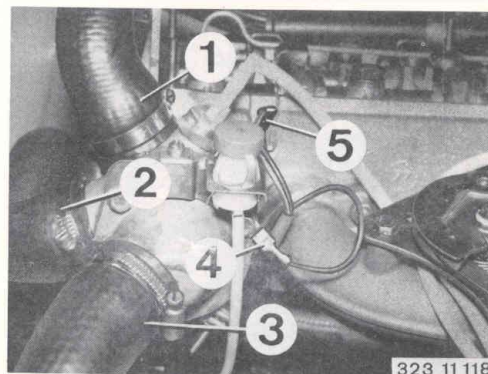
Disconnect the negative lead from the battery.



Carburetor engine:

Detach coolant hoses (1 ... 3).

Detach leads (4) and (5).



Detach fuel hoses (6) and (7).

When installing: do not accidentally confuse these hoses.

Hose (6): from fuel pump

Hose (7): to tank

Detach leads (8) and (9).

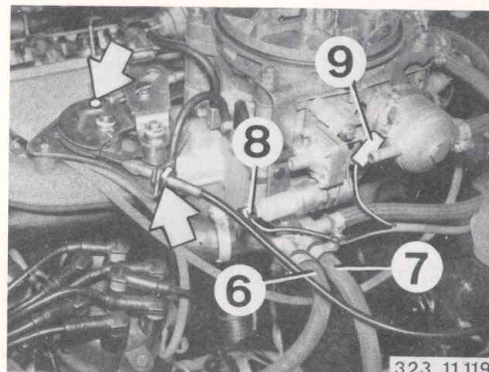
When installing:

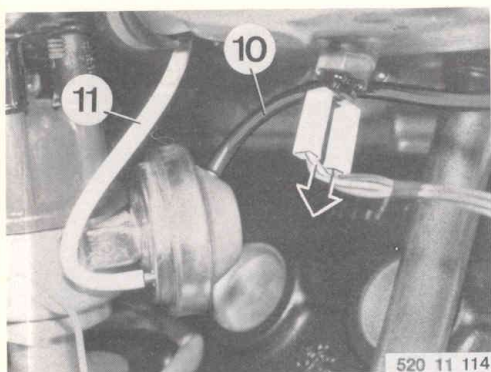
green/violet lead to servo motor

green/black lead to choke housing

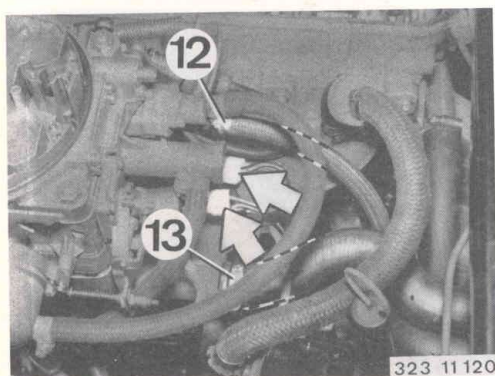
Disconnect the accelerator cable and remove from reaction bearing.

When installing: adjust accelerator cable – 35 41 421.

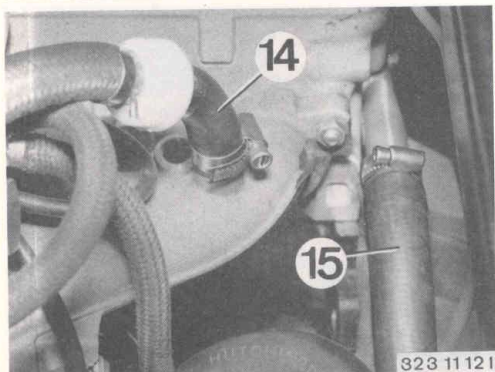




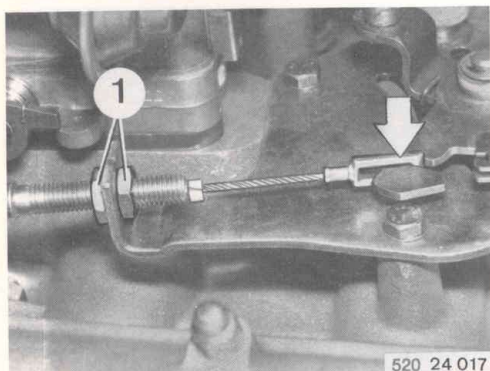
**Pull off vacuum hoses (10 and 11).
Detach lead from heat-sensitive switch.**



**Detach coolant hoses (12 and 13).
Detach the plugs from the idle shutoff valves.**

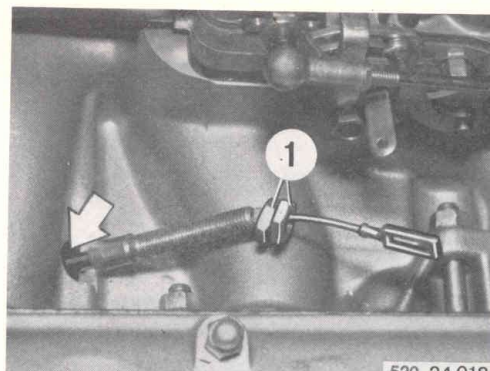


Detach the vacuum hose (14) and coolant hose (15).



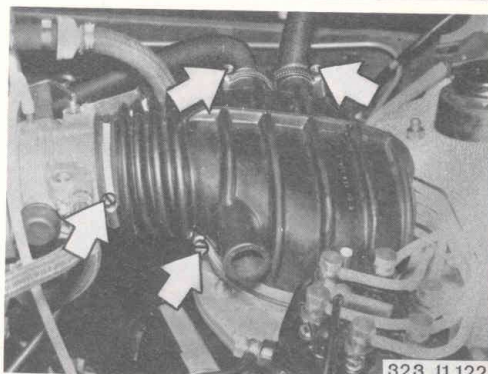
**Unscrew nuts (1).
Disconnect the throttle position cable.
When installing: adjust the throttle position cable – see 24 00 004.**

Unscrew nuts (1) and pull throttle cable out downwards through the hole in the intake pipe.



Fuel injection engine:

Take off the air intake scoop.



Disconnect the accelerator cable and remove from its reaction bearing.

When installing: adjust the accelerator cable – 35 41 421.

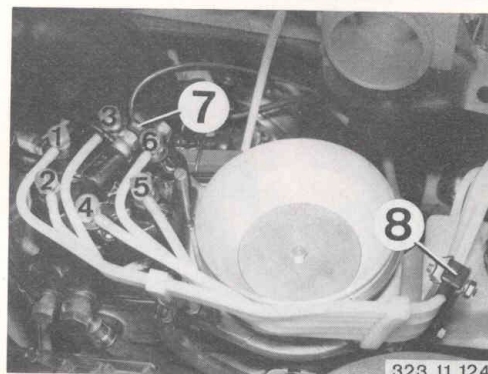


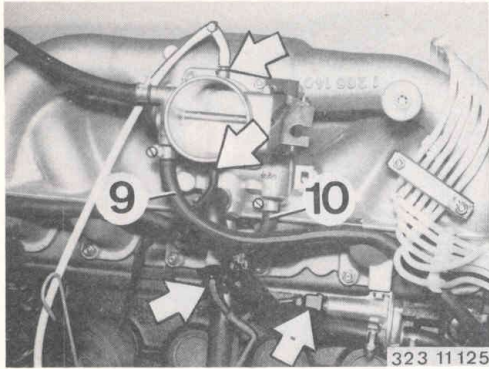
Detach injector pipes 1 ... 6 from the mixture regulator.

Check condition of sealing rings and renew if necessary.

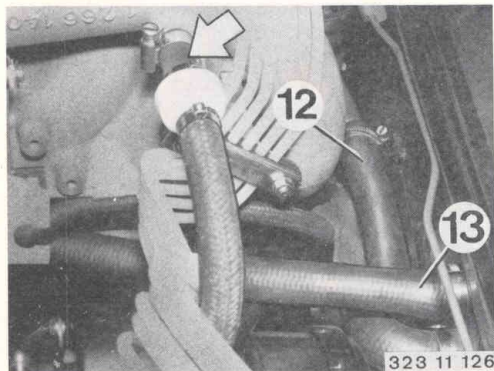
Detach fuel line (7).

Take off holder (8).

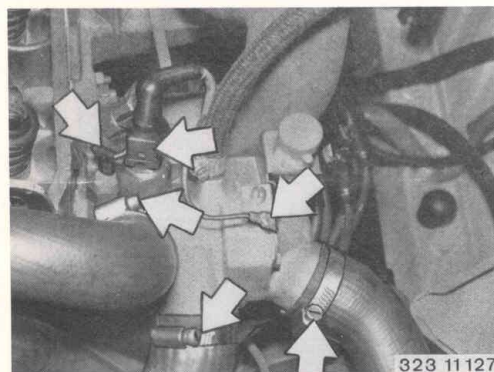




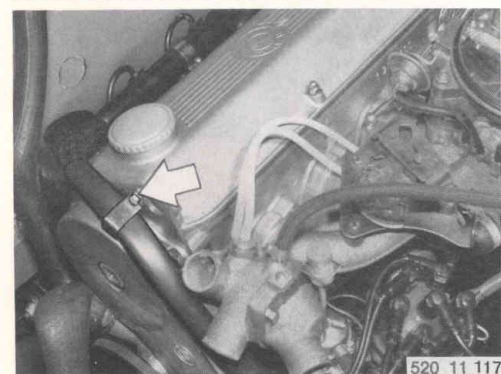
Detach hoses (9) and (10).
Lift hoses away from clips.
Pull off vacuum hoses.
Pull plug away from cold-start valve and from additional air slide.



Detach coolant hoses (12) and (13).
Detach vacuum hose from air collector.



Detach coolant hoses from branch flange.
Pull off plug and lead.



Detach the spark plug caps.
Take off the distributor cap.
Detach the ignition lead.

Remove bolt (1).

Take off belt pulley.

Take off V-belt.

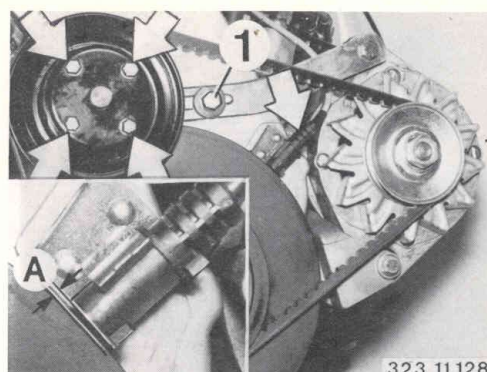
When installing: adjust V-belt to correct tension.

It should be possible to depress the V-belt by 5 ... 10 mm (0.2 ... 0.4 in) at the center of its run. Lift the position indicator out of its clip.

When installing: check that position indicator is correctly located.

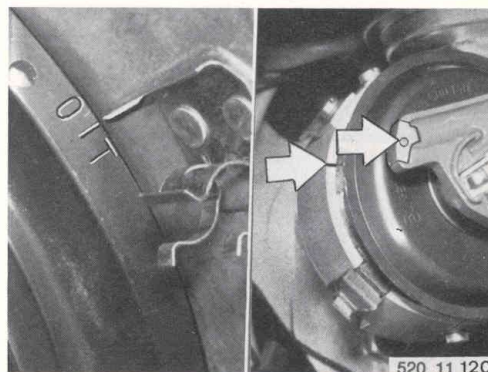
Gap between position indicator and vibration A = 0.2 ... 2.0 mm (0.008 ... 0.08 in).

Detach the vibration damper from its hub.



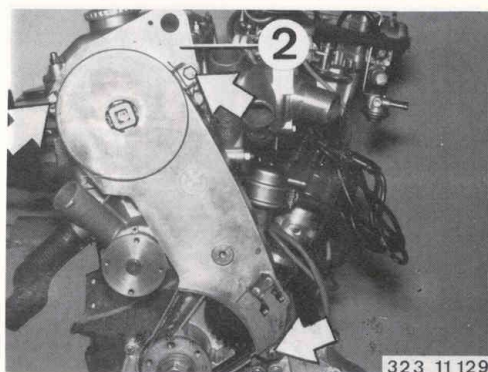
Warning: engine must not be turned over at the adapter unless the spark plugs have been removed.

Set the piston in cylinder 1 to TDC, so that the engine speed governor is aligned with the notch in the distributor body.

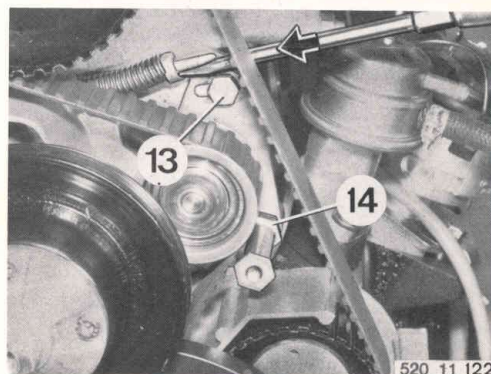


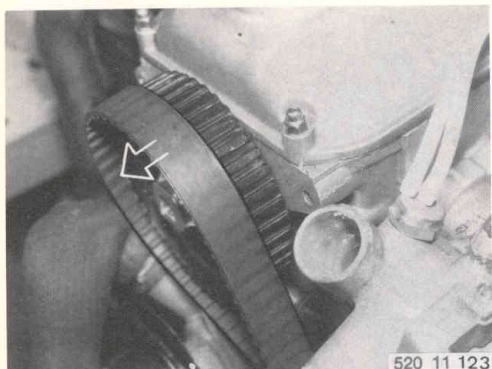
Remove the protective cover.

When installing: attach the suspension eye (2) at the same time.



Loosen bolts (13) and (14).
Press the tensioning pulley inwards.
Tighten bolt (13).





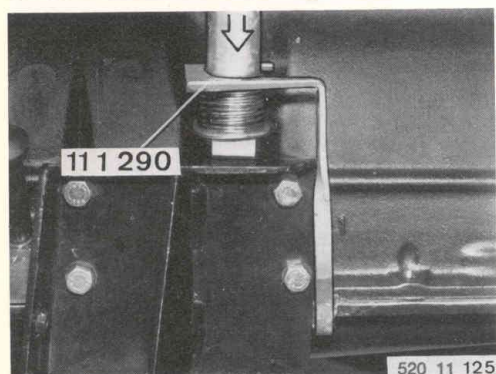
Take toothed belt off camshaft sprocket.

Important: Engine must not be turned without the toothed belt.

When installing: Check TDC position of crankshaft, camshaft and position of distributor.

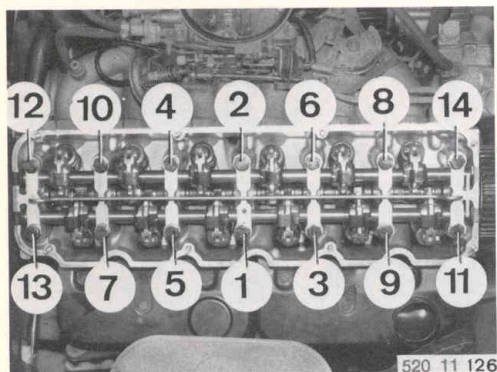
Tighten toothed belt – 11 31 100.

Check toothed belt and renew if necessary – 11 31 110.



Press down balance tube and lock with special tool 11 1 290.

When installing: Check seals and renew if necessary.



Take off cylinder head.

When installing: Tighten bolts in sequence 1... 14 one after the other in three steps¹⁾.

Run engine to operating temperature. After test run, let engine cool down to 35°C (95°F).

Tighten cylinder head bolts to final torque.

After driving a distance of 1000 km (600 miles) the cylinder head bolts have to be retightened.

Important! There must not be any oil in the cavities, since otherwise the bolts will not give full pressure on the cylinder head in spite of being tightened to the proper torque. Furthermore the crankcase could crack.

When installing: Clean cylinder head bolts and lubricate threads lightly with oil. The cylinder head gasket must always be renewed.

Adjust valve clearance – 11 34 004.

Adjust engine idle speed/test CO level – 13 00 054.

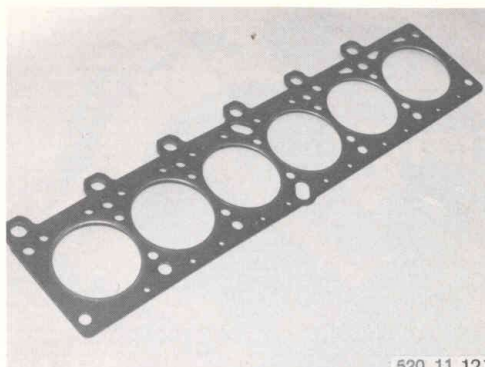
¹⁾ See specifications

11 12 101 Cylinder head gasket – renewing

Remove cylinder head – 11 12 100.
Clean sealing surfaces on cylinder head and crankcase thoroughly.

When installing: Use only original cylinder head gaskets since the coolant openings have to be exact.

When installing: If necessary, grind cylinder head sealing surface – 11 12 719.

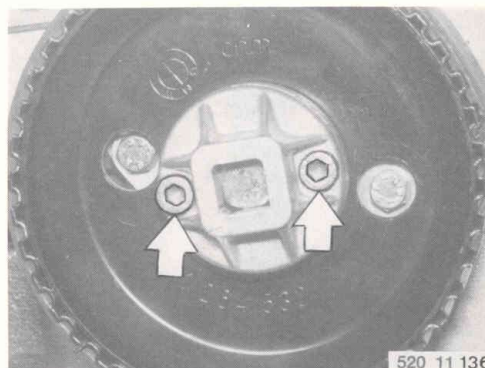


520 11 127

11 12 240 Radial seal in timing case cover – renewing

Remove toothed belt – 11 31 110.

Take off adaptor.

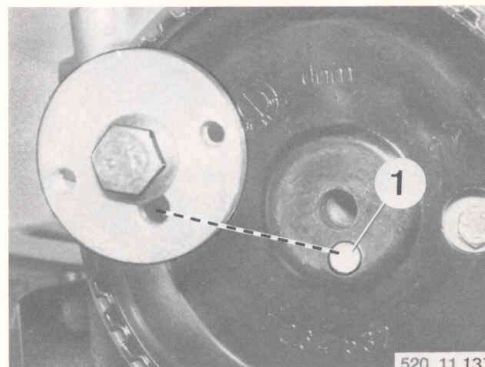


520 11 136

Take toothed belt wheel off camshaft.

When installing: Cylindrical pin (1) must fit in hole in toothed belt wheel.

Note correct tightening torque¹⁾.



520 11 137

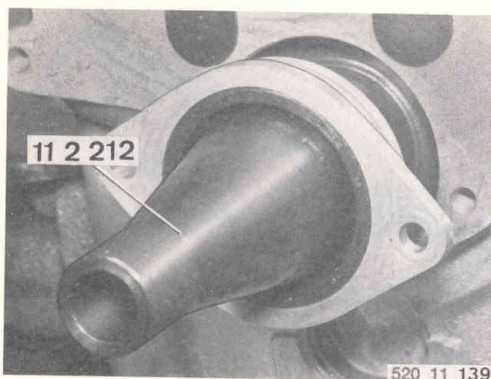
Take off guide cover.

Replace radial seal and round cord seal.

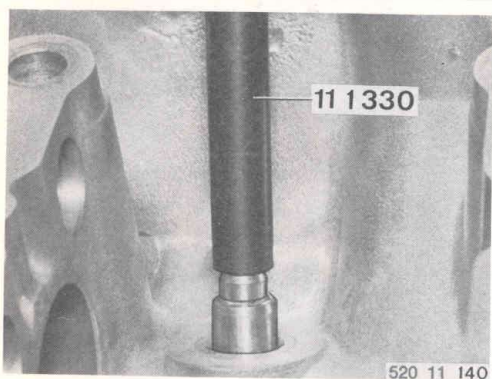


520 11 138

¹⁾ See specifications

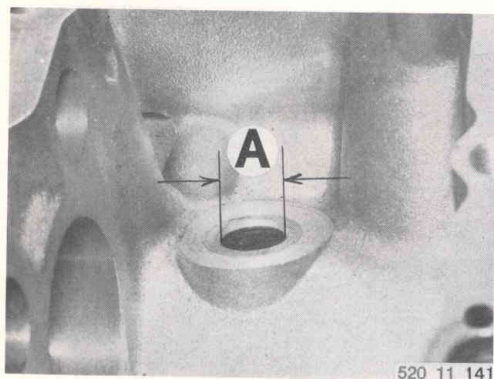


When installing: Use special tool 11 2 212 to install the guide cover.

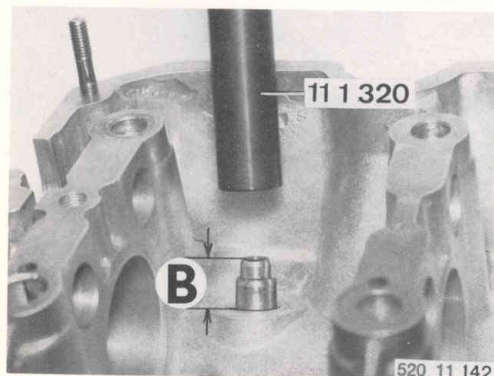


11 12 561 One valve guide – renewing – valve removed –

Drive out valve guide in cold state with special tool 11 1 330 into combustion chamber.



Check bore in cylinder head. If max. permissible diameter A has been exceeded, ream out the bore and install an oversize¹⁾ valve guide. Heat cylinder head¹⁾.



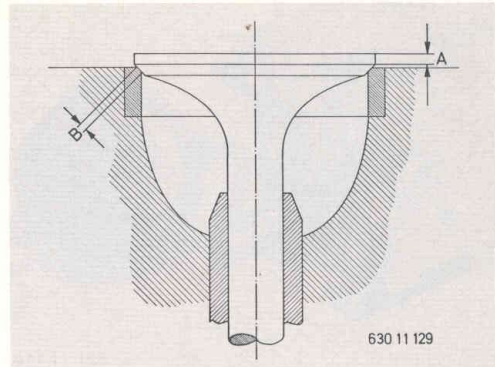
Drive valve guide into combustion chamber from camshaft end with special tool 11 1 320. Stepped end of valve guide faces camshaft.

Important: Bore in special tool determines the installed depth B of 14.5 ± 0.5 mm (0.571 ± 0.020 in). Ream out valve guide to diameter 7H7.

¹⁾ See specifications

11 12 607 Valve seats and valves – machining – cylinder head disassembled –

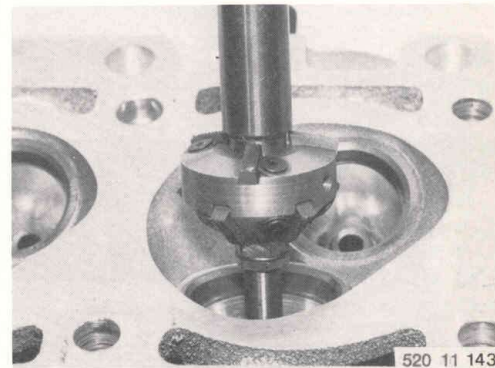
Note minimum edge thickness A¹⁾ and valve seat angle B. Valve must be replaced when edge thickness is below specification.



Machined valve seats must not have chatter marks.

Bed in valves with grinding paste.

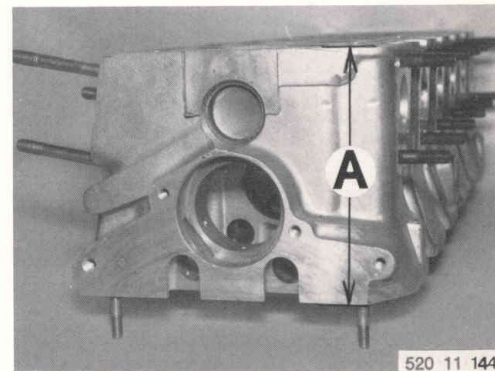
When installing: Check valves for leaks – 11 34 509.



11 12 719 Cylinder head sealing surface – refacing – cylinder head disassembled –

When machining the cylinder head sealing surface not more than 0.3 mm (0.012 in) must be removed from the total cylinder head original thickness A of 125.1 ± 0.1 mm (4.925 ± 0.004 in).

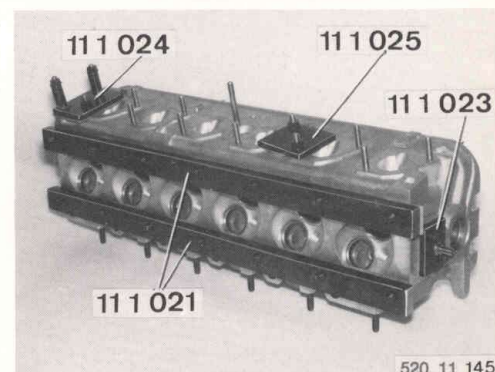
Important: Use stronger sealing at refaced cylinder head.



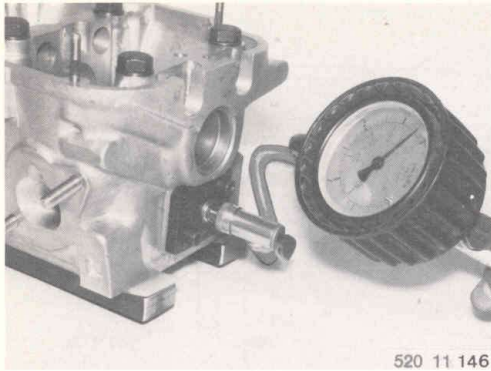
11 12 729 Cylinder head water leak test – cylinder head disassembled –

Bolt rails 11 1 021 on to cylinder head (use cylinder head bolts).

Plug water circuit on cylinder head with sealing plates 11 1 023, 11 1 024 and 11 1 025.



¹⁾ See specifications



**Pump compressed air into cylinder head.
Test pressure 1.5 bar (21 lb/in²). Place cylinder
head in a water bath and check for cracks.**

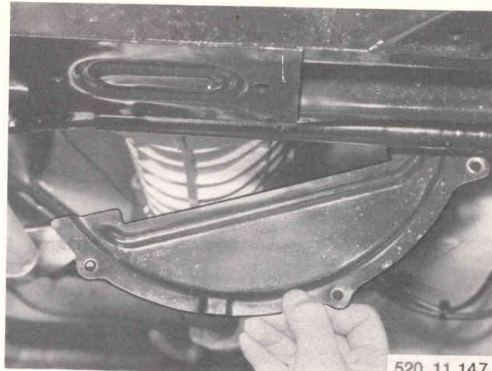
520 11 146

11-12/10

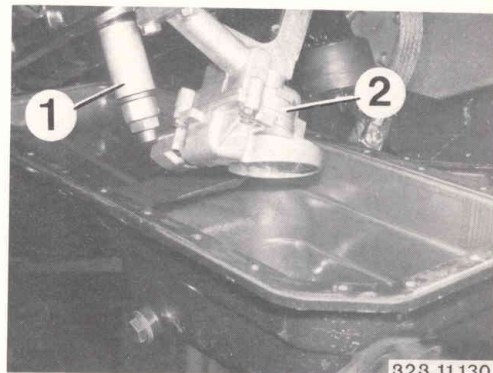
11-12/10

11 13 000 Oil sump – removing and installing

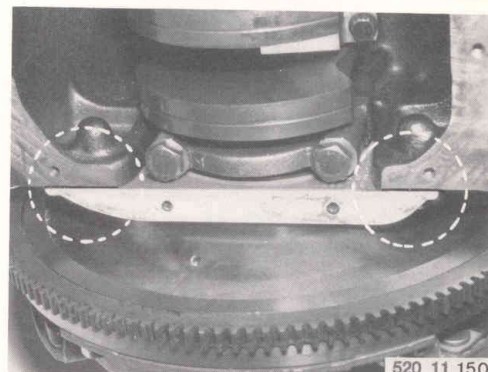
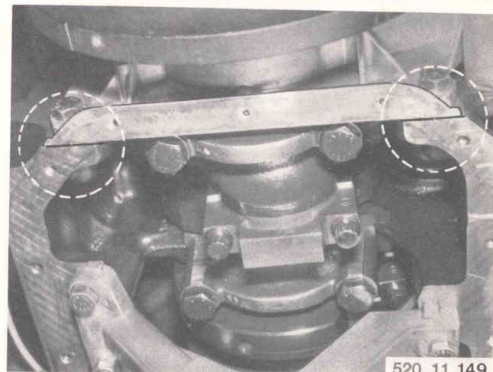
**Remove guard.
Drain oil.
Take off sump.**



**Tilt down sump.
Remove pressure relief valve (1) and oil pump (2).
Remove oil sump towards front.
When installing: use a new gasket.**



**When installing: Clean sealing surfaces.
Coat mating surfaces on timing case cover and
end cover with Atmosit or Curil K 2.**



11 14 175 Front end cover – removing and installing

Remove radiator – 17 11 000.

Remove bolt (1).

Detach V-belt pulley.

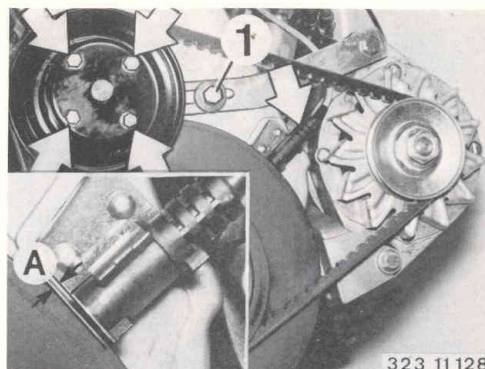
Remove V-belt.

When installing: tension V-belt correctly.

The V-belt must yield by 5 ... 10 mm (0.2 ... 0.4 in) when pressed in at the center of its run.

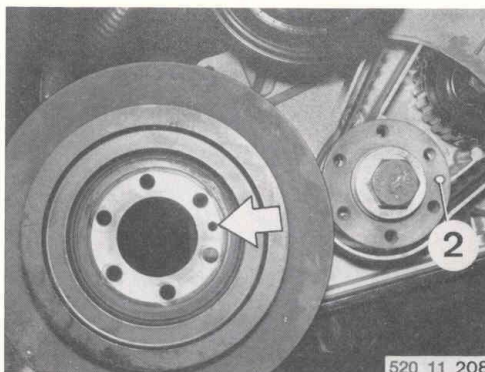
Extract the position indicator from its clip.

When installing: check that position indicator is correctly located. Gap between position indicator and vibration damper A = 0.2 ... 2.0 mm (0.008 ... 0.08 in).



Detach vibration damper from hub.

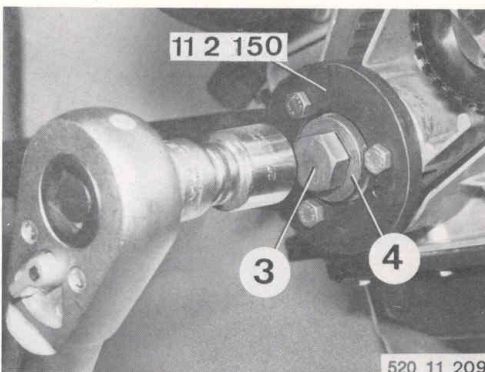
When installing: centering pin (2) must be in hole on vibration damper.



Prevent hub from turning with retainer 11 2 150.

Unscrew bolt (3)¹⁾.

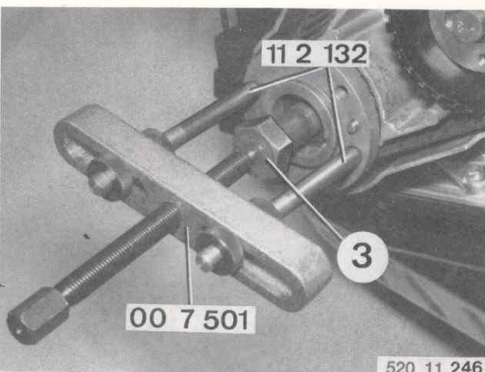
Take off shouldered disc (4).



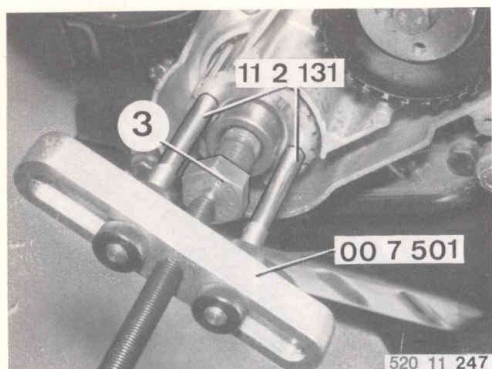
Insert bolt (3) by approx. 3 turns.

Pull off hub with Kukko puller 00 7 501 and threaded spindles 11 2 132 from crankshaft.

Remove bolt (3).



¹⁾ For correct tightening torque, see Specifications.



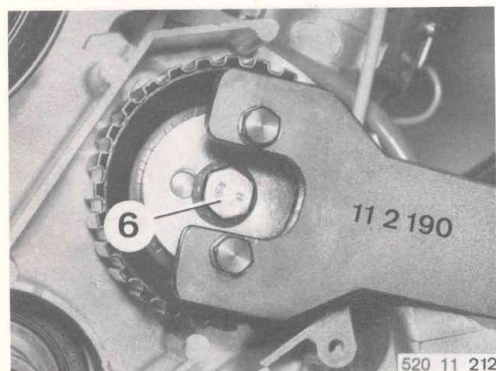
Take off the toothed belt – 11 31 110.

Insert bolt (3) again.

Detach sprocket from crankshaft with Kukko puller 00 7 501 used in conjunction with threaded spindle 11 2 131.

Important: note shaft key.

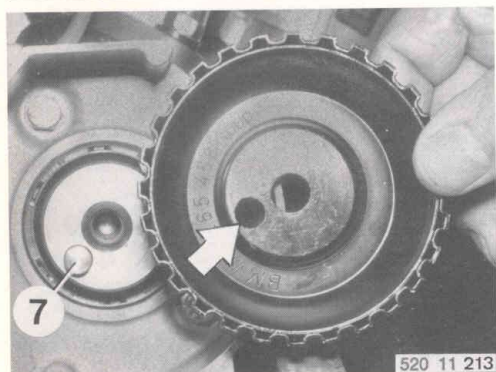
When installing: mount the sprocket with the tapped holes facing out.



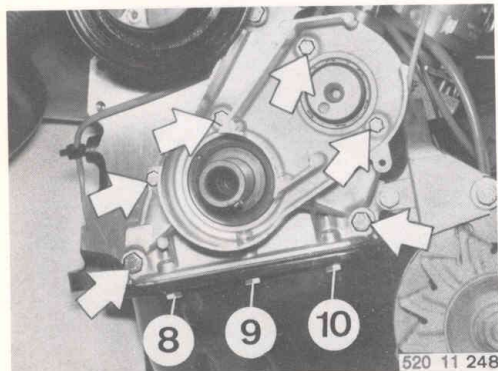
Use special tool 11 2 190 to prevent the intermediate shaft sprocket from turning.

Remove bolt (6)¹⁾.

Take off the washer and the sprocket.



When installing: the centering pin (7) must enter the hole on the intermediate shaft.



Remove bolts (8 ... 10).

The remaining oil sump bolts should only be slackened.

Take off the cover.

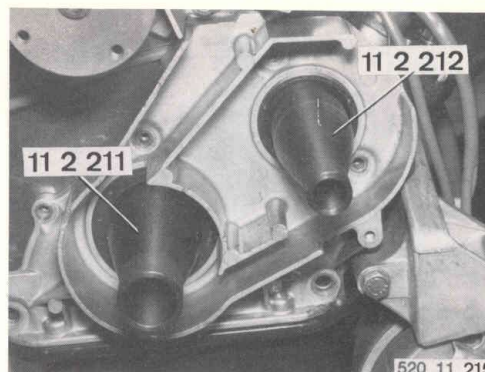
When installing: use a new gasket.

If the oil sump gasket becomes damaged, detach the sump and renew the gasket – 11 13 000.

¹⁾ For tightening torque, see Specifications

Check condition of radial sealing rings and renew if necessary.

Warning: install only with sleeves 11 2 211 for crankshaft and 11 2 212 for intermediate shaft.

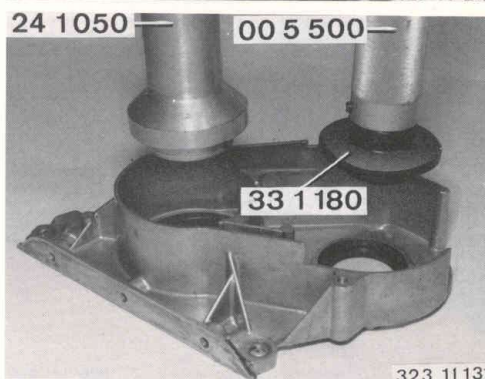


11 14 180 Radial sealing rings in end cover – renewing

Remove the end cover – 11 14 175.

Press the radial sealing rings out of the cover. Drive in radial sealing rings with sleeve 24 1 050 for crankshaft or drift 33 1 180 and handle 00 5 500 for intermediate shaft.

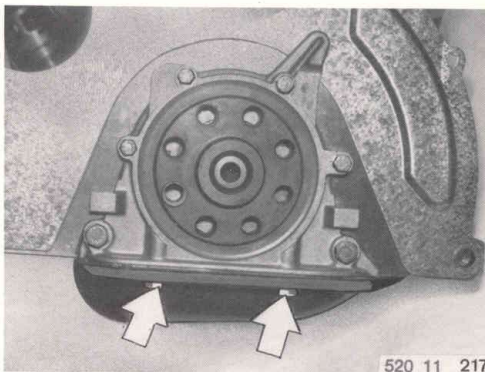
Sealing rings must be driven in until flush. Pack sealing lips with grease.



11 14 611 Radial sealing ring in clutch end cover – renewing – flywheel removed –

Remove the bolts at the oil sump – end cover. Only slacken the remaining oil sump bolts. Detach the end cover.

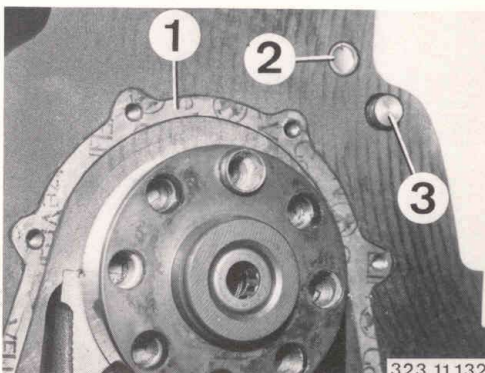
If the oil sump gasket is damaged, detach the oil sump – 11 13 000.

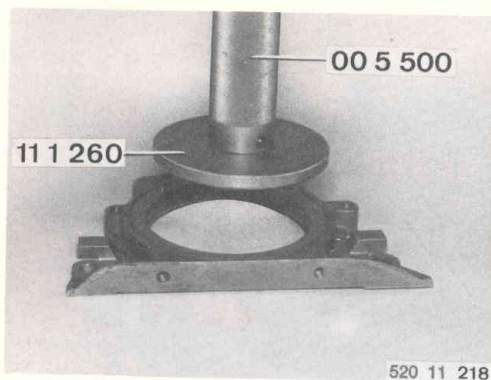


Renew gasket (1).

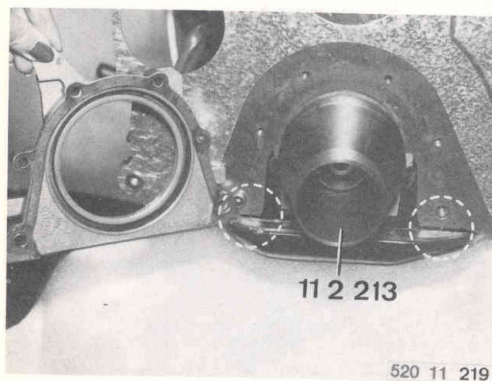
Warning: check that the sealing cover (2) for the main oil passage is not leaking, and renew sealing plug (3) if necessary.

Apply Loctite No.270 to sealing plug before inserting.





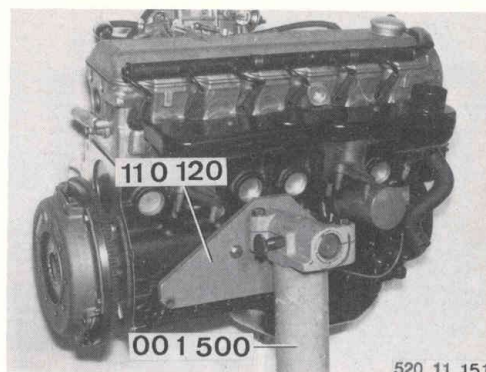
Press in the radial sealing ring with driving sleeve 11 1 260 in conjunction with handle 00 5 500.
Pack the sealing lips with grease.



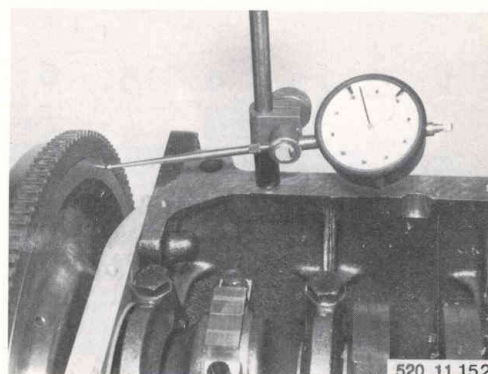
Coat the joint line between the end cover and oil sump with 'Atmosit' or 'Curil K 2'.
To prevent damage to the radial sealing ring, use slipover bushing 11 2 213.

11 21 000 Crankshaft – removing and installing

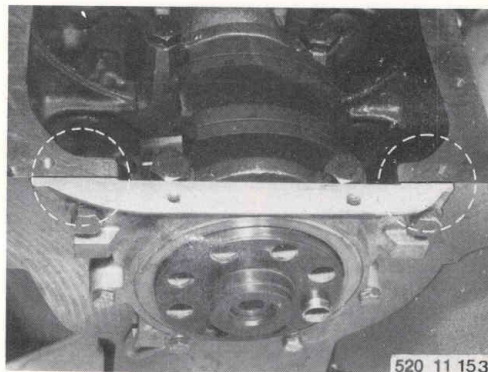
Remove engine – 11 00 050.
Secure crankcase to assembly stand 00 1 500 with assembly plate 11 0 120.



Detach the clutch – 21 21 000.
Detach the cylinder head – 11 12 100.
Remove the front end cover – 11 14 175.
Detach the oil pump – 11 41 000.
Before removing the crankshaft, determine its endplay (axial play)¹⁾.
If maximum endplay is exceeded, check the locating bearing.

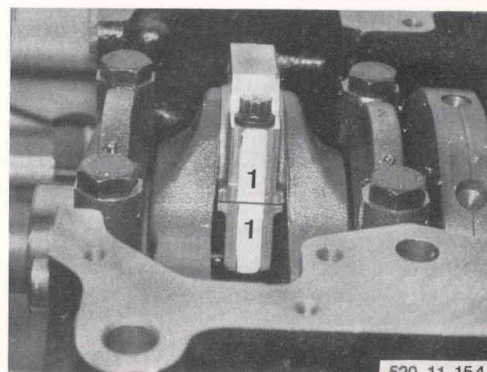


Remove the flywheel – 11 22 000.
Detach the end cover.
When installing: Apply a coat of 'Atmosit' or 'Curil K 2' to the joint line where the end cover meets the oil sump.

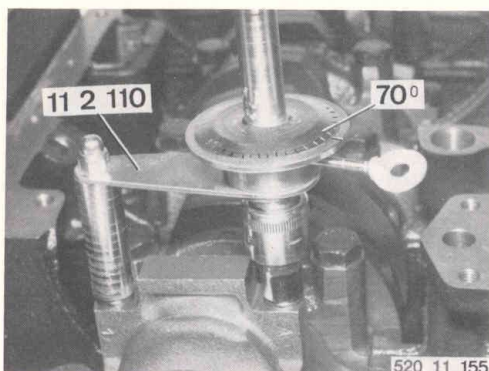


Install the big end bearing caps in the bottom dead center position.

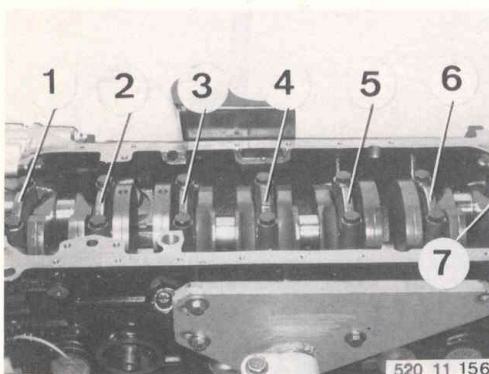
When installing: the connecting rod and bearing cap for each cylinder are marked. Connecting rod 1 is at the toothed belt end. The cylinder reference numbers must all be on the same side.



¹⁾ See specifications



Note when installing: do not re-use old big end bolts. Tighten the bolts to the specified torque¹⁾. After this, turn the bolts through a further 70° with special tool 11 2 110.



Take off the main bearing caps.

Lift out the crankshaft.

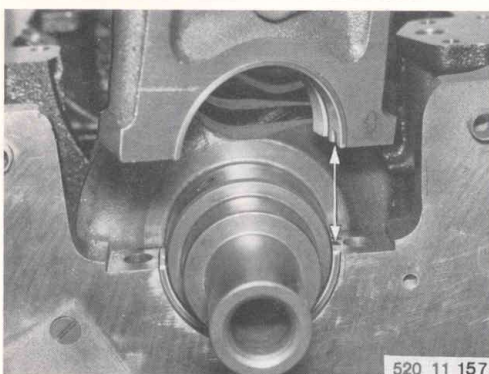
When installing: do not accidentally confuse the bearing caps.

Bearing cap 1 is at the toothed belt end.

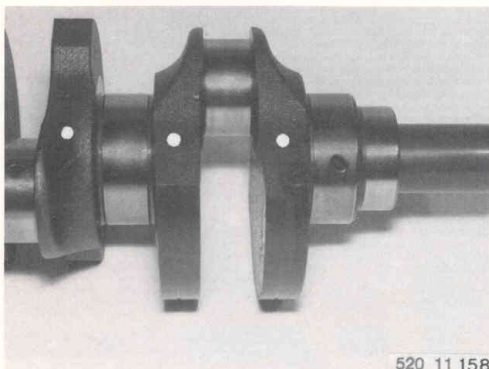
Bearing cap 6 is the locating bearing.

If the crankcase has a different color code from the crankshaft, use one red and one blue bearing shell for each bearing journal.

Make sure that all blue or all red bearing shells are either at the top or the bottom.



When installing: the grooves in the main bearing caps must coincide.



11 21 501 Crankshaft – renewing – crankshaft removed –

Transfer the needle roller race to the new crankshaft – 11 21 571.

Crankshaft identification:

Standard grinding dimensions: one red or blue paint spot at side of counterweights.

¹⁾ See specifications

Reground crankshafts are marked with paint stripes.

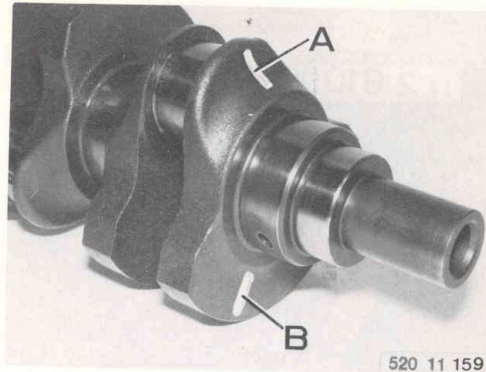
Big end bearing journal (A)

- 1 paint stripe: undersize 1¹⁾
- 2 paint stripes: undersize 2¹⁾

Main bearing journal (B)

- 1 paint stripe: undersize 1¹⁾
- 2 paint stripes: undersize 2¹⁾

Warning: the crankshaft is 'Tenifer' treated and can only be reground at the factory.



520 11 159

Install the correct bearing shells to suit the bearing journal diameters now in use; the same red or blue color codes must appear on the bearing shells as on the crankshaft.

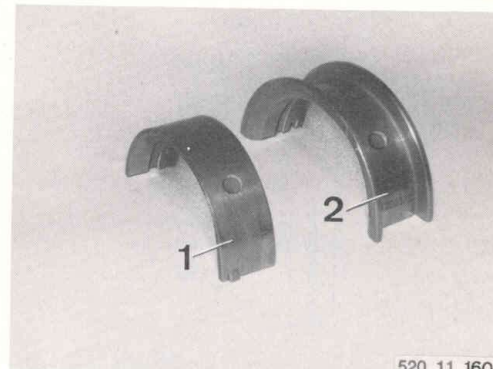
If the crankcase has a different color coding from the crankshaft, use one red and one blue bearing shell per bearing journal.

Red and blue bearing shells are supplied with replacement crankshafts.

When installing: make sure that either all blue or all red bearing shells are installed at the top or at the bottom.

1 Main bearing shell

2 Locating bearing shell



520 11 160

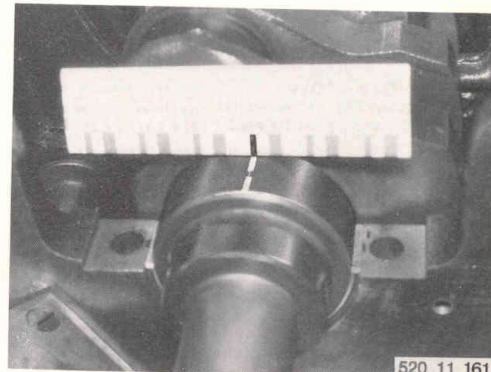
Check bearing play¹⁾ with 'Plastigage' Type PG 1.

- a) Measure each bearing separately.
- b) Bearing surfaces must be oil-dry.
- c) Measure with crankshaft at top dead center.
- d) Tighten bearing cap to specified torque¹⁾.
- e) Do not turn the crankshaft during the measuring procedure.
- f) Read off bearing play¹⁾ by comparing the width of the compressed area of plastic strip with the scale.

'Plastigage' is supplied in three different diameters.

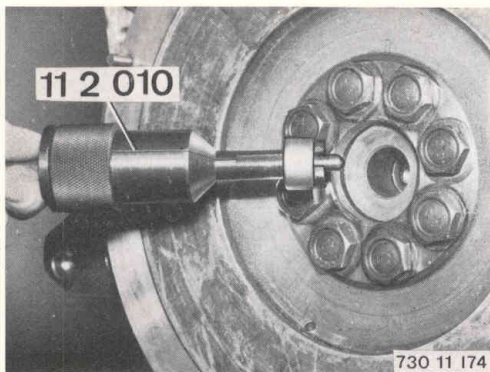
'Plastigage' supplier:

ERN Co., Schinkelstr. 46–48, 4000 Düsseldorf.



520 11 161

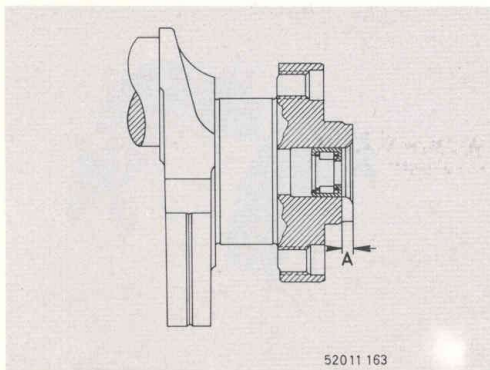
¹⁾ See specifications



**11 21 571 Needle roller race in crankshaft
– renewing – clutch removed –**

**Remove needle roller bearing from crankshaft
with puller 11 2 010.**

When installing: inscription on needle roller
bearing should face out.



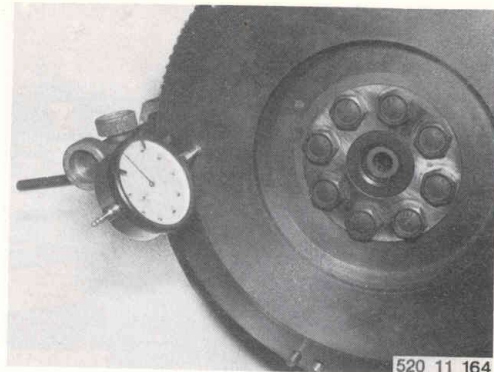
**Drive in the needle roller race with a suitable
arbor.**

Keep to dimension A = 5 mm (0.2 in).

**Pack the needle roller race with a brand-name
multipurpose grease.**

11 22 000 Flywheel – removing and installing

Remove the clutch – 21 21 000.
Check the flywheel for axial runout¹⁾.

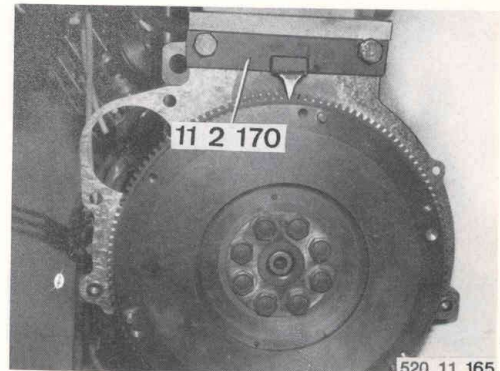


Prevent the flywheel from turning with holder 11 2 170.

Remove the expansion bolts.

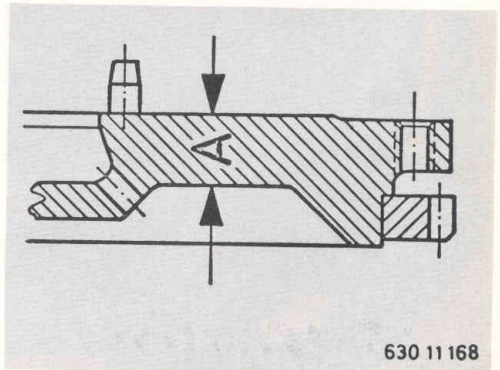
Important: when installing, use new expansion bolts and apply Loctite No.270 to them before inserting.

Take off the flywheel.



When installing: the clutch friction surface may be skimmed if not flat¹⁾.

However, the wall thickness within the rubbed area must not drop below 13.5 mm (0.531 in) – A.



11 22 051 Torque converter driving plate – renewing

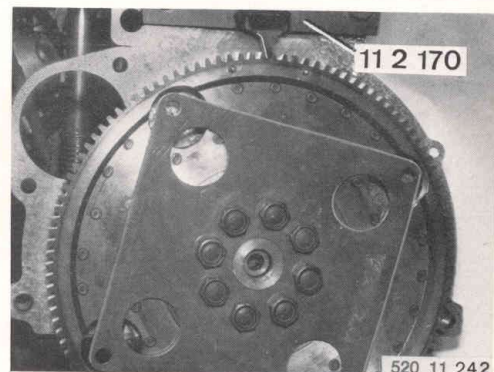
Remove the transmission – 24 00 020.

Prevent the flywheel from turning with holder 11 2 170.

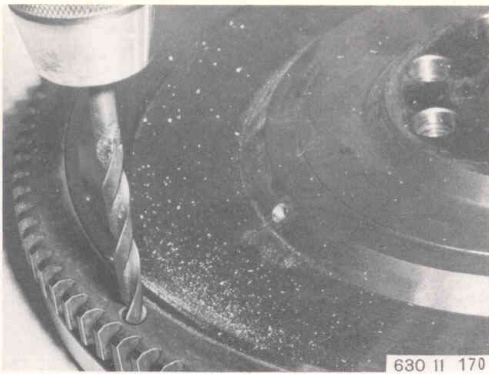
Remove the expansion bolts.

Important: when installing, use new expansion bolts and apply Loctite No.270 to them before inserting.

Renew the driving plate.

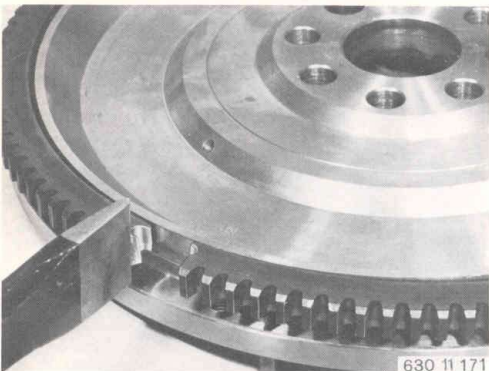


¹⁾ See specifications

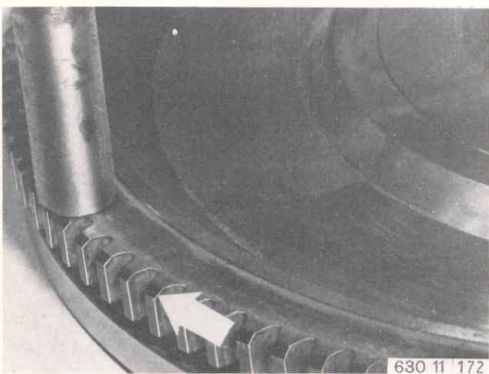


11 22 541 Starter gear ring – renewing

To simplify removal of the gear ring, drill into it below a tooth gap for a depth of app. 8 mm (0.31 in) with a 6 mm bit.



Split the gear ring by striking with a cold chisel in the tooth gap above the drilled hole.



When installing: heat the new starter gear ring to 200 ... 230°C (392 ... 445°F), using a thermo-chrome pin. The chamfered side of the gear teeth faces the engine. Drive the gear ring fully home with a brass drift.

11 24 521 All connecting rods – renewing – pistons detached –

Warning: the connecting rods in any engine must all be of the same weight group, with a total weight tolerance of ± 4 g (0.141 oz) without the bearing shells.

The weight group is shown by a color code. If no color code is visible, a second connecting rod must be removed and the weights compared.

Warning: connecting rods must not be refaced:

The piston pin¹⁾ should slide through the small-end bearing bushing when only light pressure is applied.

Check connecting rod for deviation from parallel (A) and permissible maximum twist (B), and re-align if necessary.

A 150 -0.04 mm (5.9055 -0.0016 in)

B 0° $-30'$

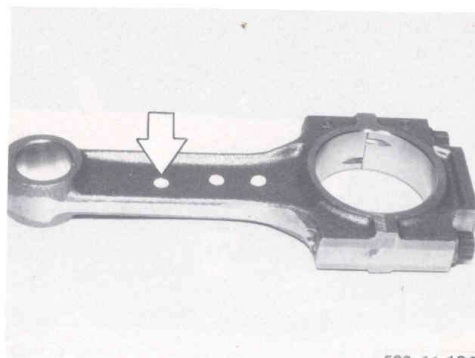
Install big end bearing shells in connecting rod.

Place 'Plastigage PG 1' on oil-free big end bearing journal.

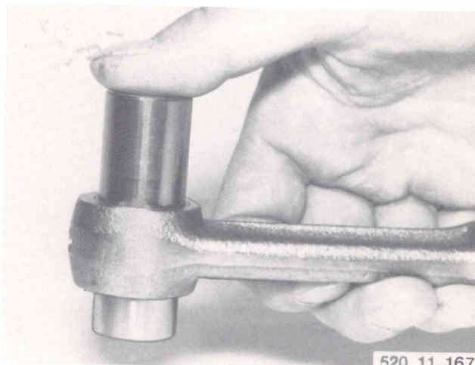
Attach connection rod to crankshaft.

Note identification marks used to match connecting rod and big end bearing cap.

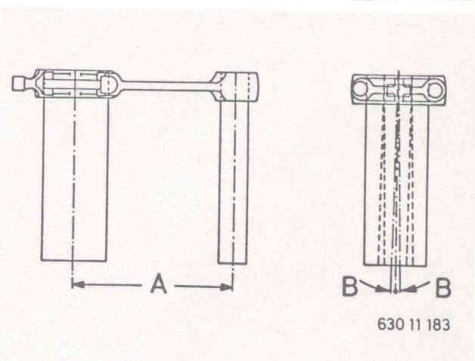
¹⁾ For piston pin running clearance, see Specifications.



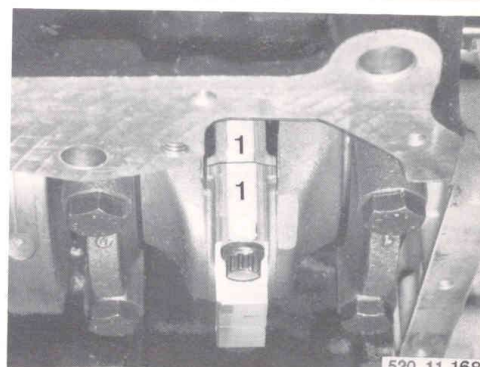
520 11 166



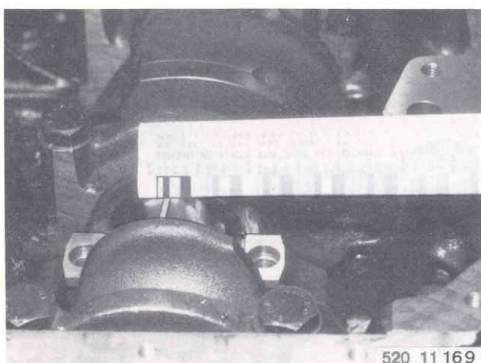
520 11 167



630 11 183



520 11 168



To measure bearing play, use old big end bearing bolts.

Tighten the bearing cap to the specified torque¹⁾.

Warning: do not twist the connecting rod or the crankshaft.

Take off the bearing cap.

Compare the width of the compressed plastic strip with the calibrated scale to establish bearing play¹⁾.

'Plastigage' supplier:

ERN Company, Schinkelstr. 46-48, 4000 Düsseldorf, Federal Republic of Germany.

¹⁾ See specifications

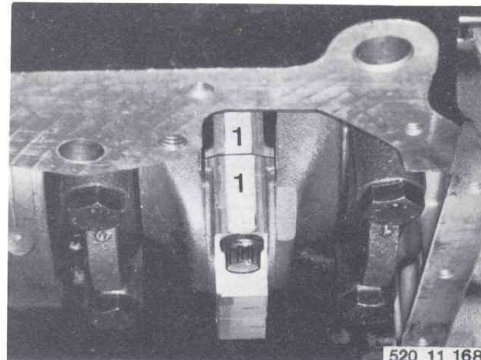
11 25 000 All pistons – removing and installing

Detach cylinder head – 11 12 100.

Remove oil pump – 11 41 000.

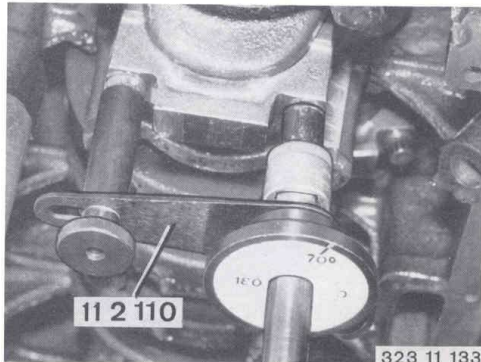
Detach big end bearing caps in bottom dead center position.

When installing: the connecting rod and bearing cap for each cylinder are marked. Connecting rod 1 is at the toothed belt end. The cylinder reference numbers must always be on the same side when installed.



Important: use new big end bolts when installing.

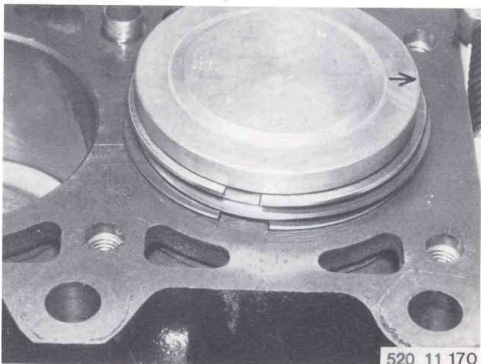
Tighten bolts to specified torque¹⁾. After this, tighten bolts by a further 70° with special tool 11 2 110.



Press the piston and connecting rod out upwards.

When installing: stagger the piston ring gaps by 120°.

The arrow on the piston crown must face the toothed belt.



Mark the correct relative positions of connecting rod and piston.

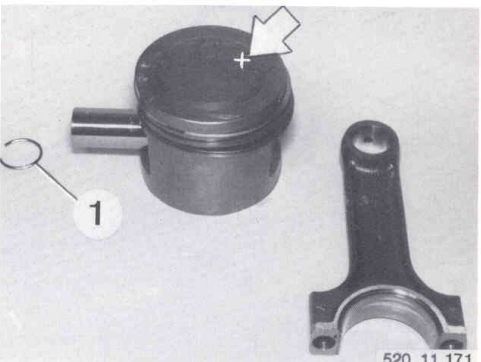
Extract snap ring (1).

Remove piston pin.

When installing: piston pin and piston are matched and must not be interchanged.

Warning: install only pistons of the same make and weight group in the engine.

The weight group is indicated by a + or – stamped on the piston crown.

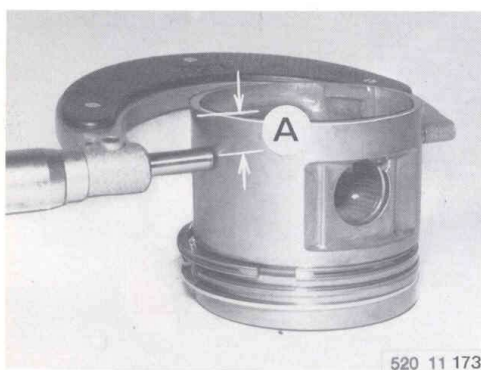


¹⁾ See specifications



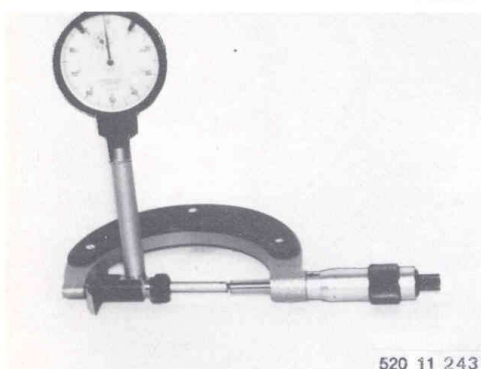
Distinguishing features of pistons:

BMW model	Piston diameter	Piston crown H =	Identification mark on piston crown
320	80 mm (3.150 in)	2.1 mm (0.827 in)	2.0/9.2
323 i	80 mm (3.150 in)	flat	2.3/9.5

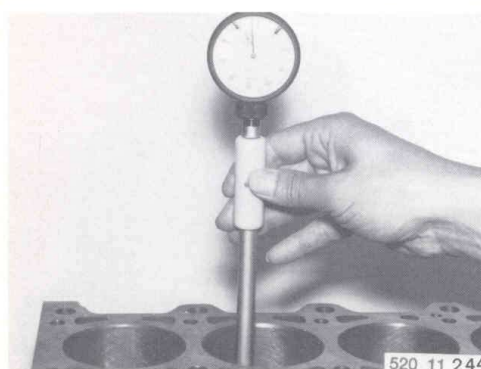


Check piston installed clearance¹⁾.

BMW model	Piston make	Measuring point A =
320	Mahle KS	9 mm (0.354 in) 25.95 mm (1.022 in)
323 i	Mahle KS	12 mm (0.472 in) 28.05 mm (1.104 in)



Set internal dial gauge to zero with the micrometer at the measured piston diameter.



Measure the cylinder bore at 3 points across the center with the internal dial gauge. Determine piston installed clearance¹⁾.

¹⁾ See specifications

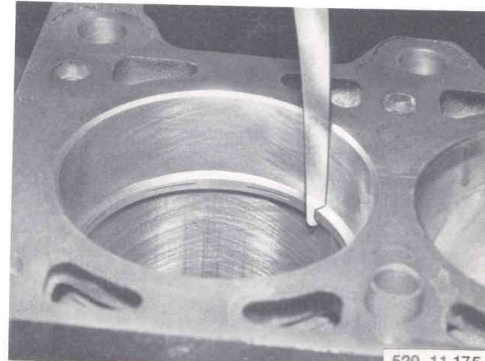
**11 25 651 Piston rings for one piston – re-
newing – piston removed –**

Measure clearance¹⁾ at ring flanks.



520 11 174

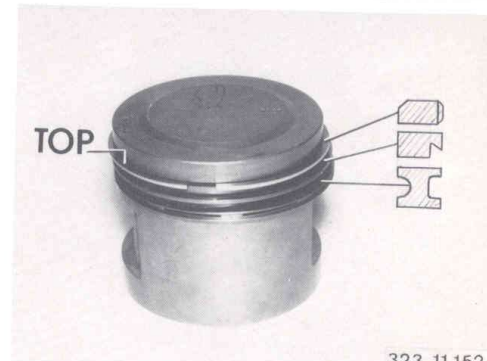
Remove piston rings and measure end gap¹⁾.



520 11 175

*When installing: 'TOP' marking must be
nearest piston crown when piston ring is in-
stalled.*

- 1 Rectangular-section ring**
- 2 Micro-chamfer ring**
- 3 Slotted oil-control ring with tubular spring**



323 11 152

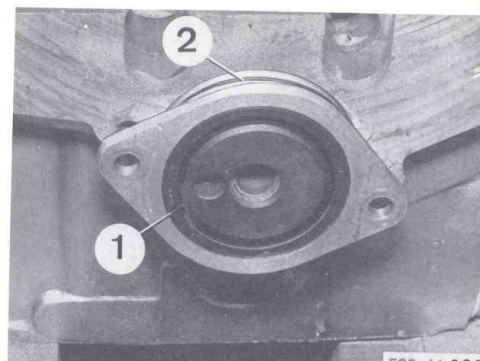
¹⁾ See specifications

11 31 000 Camshaft – removing and installing

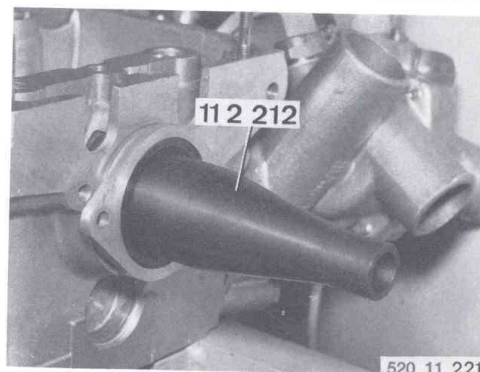
Remove rocker shafts – 11 33 020.

Take off locating cover.

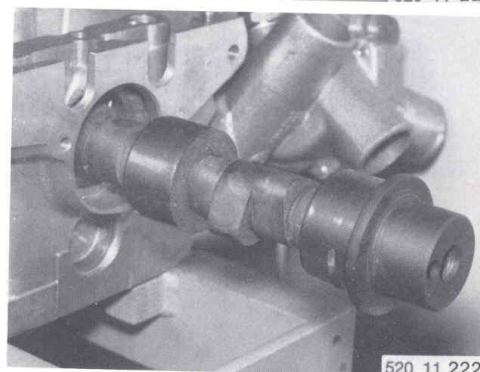
When installing: check condition of radial sealing ring (1) and cord ring seal (2), and renew if necessary.



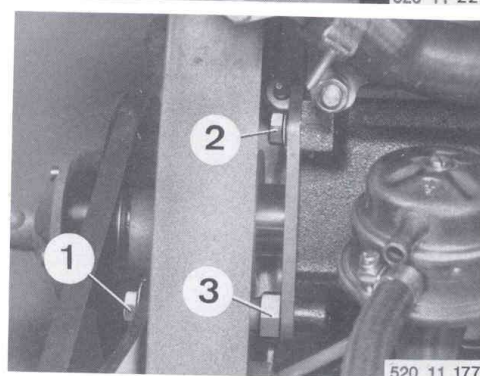
When installing: use bushing 11 2 212 to install locating cover.

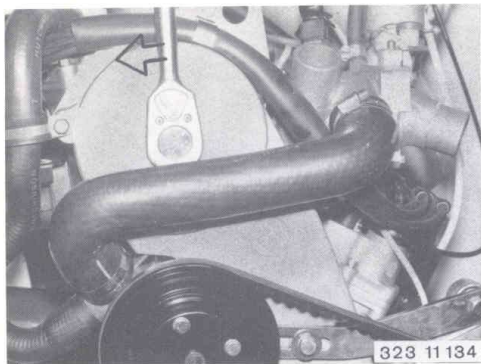


Pull out the camshaft.



11 31 100 Toothead belt – tensioning
Unscrew bolts (1) to (3).



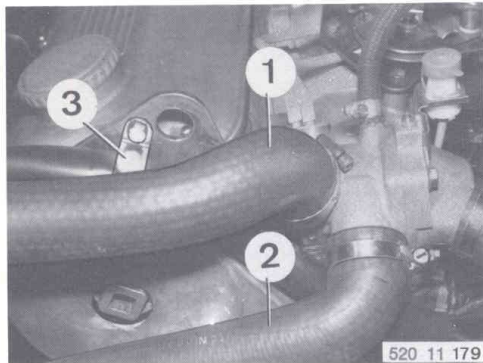


Warning: do not turn the engine over at the adapter unless the spark plugs have been removed.

Using a $\frac{1}{2}$ " ratchet, turn the engine through 1... 2 turns at the adapter, in the opposite direction to normal rotation.

This will tension the toothed belt.

In this position, retighten bolts (2, 3 and 1).



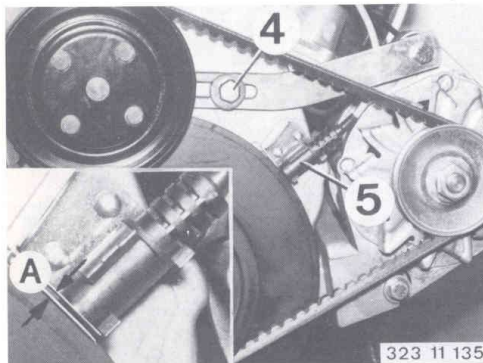
11 31 110 Toothed belt – removing and installing

Drain the cooling system.

When installing: bleed the cooling system – 17 00 039.

Detach the hot water hoses (1 and 2).

Detach holder (3).



Take out bolt (4).

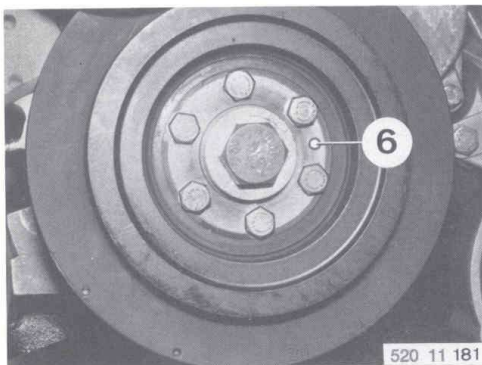
Take off the belt pulley.

Take off the V-belt.

When installing: adjust V-belt to correct tension.

It should be possible to depress the V-belt by 5... 10 mm (0.2... 0.4 in) at the center of its run. Lift position indicator (5) out of its clip.

When installing: make sure that the position indicator is correctly located. Gap between position indicator and vibration damper A = 0.2... 2.0 mm (0.008... 0.08 in).

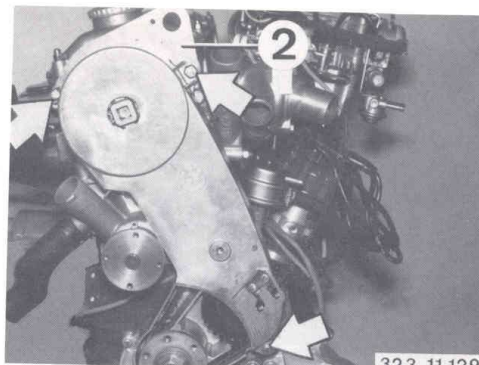


Detach the vibration damper from its hub.

When installing: centering pin (6) must locate in the hole on the vibration damper.

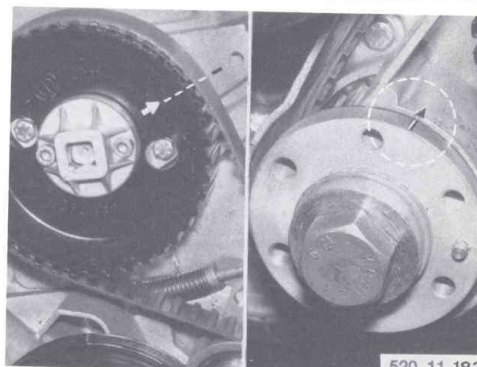
Detach protective cover.

When installing: do not forget to attach lug plate (2).



Warning: the engine must only be turned over at the adapter after the spark plugs have been removed.

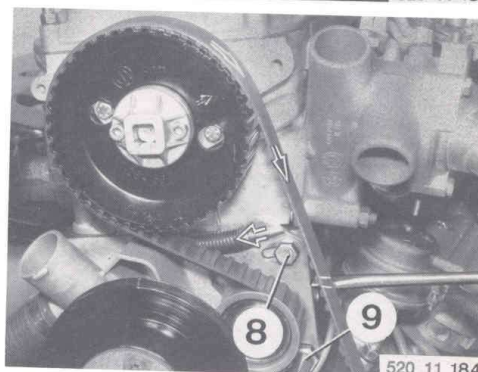
Set the piston in cylinder 1 to top dead center. The arrow on the camshaft sprocket must be aligned with the mark on the cylinder head; the mark on the crankshaft hub must be aligned with the mark on the end cover.



Mark the running direction of the toothed belt. Remove bolts (8) and (9).

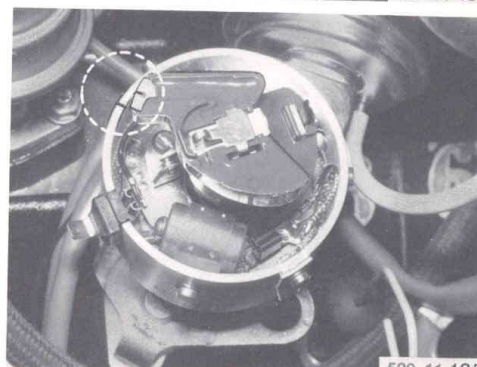
Press the tensioning pulley inwards. Tighten bolt (8) in this position. Take off the toothed belt.

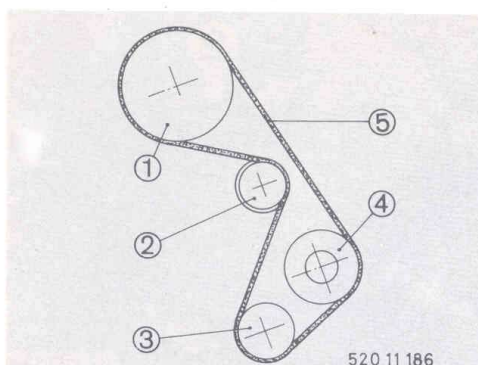
Warning: the engine must not be turned over at all when the toothed belt has been removed.



When installing: before placing the toothed belt on its sprockets, check the setting at the distributor housing. Take off the distributor cap.

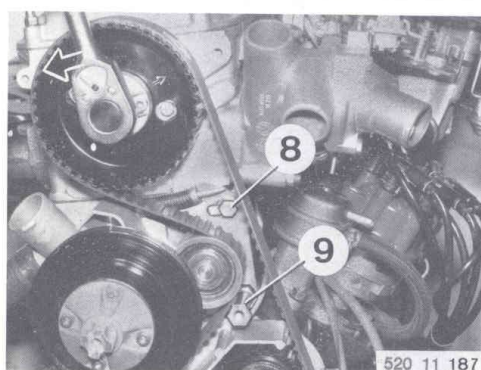
The notch in the distributor housing must be aligned with the center of the engine speed governor.





Arrangement of toothed belt:

- 1 Camshaft sprocket
- 2 Tensioning pulley
- 3 Crankshaft sprocket
- 4 Intermediate shaft sprocket
- 5 Toothed belt



Examine the toothed belt for signs of damage, and renew if necessary.

Starting at the crankshaft sprocket and working in the opposite direction to engine rotation, place the toothed belt over all its sprockets.

Release bolt (8) again.

Turn the engine by means of a $\frac{1}{2}$ inch ratchet head at the adapter for 1...2 turns in the opposite direction to normal rotation. This will tension the toothed belt correctly.

In this position, tighten bolts (8) and (9).

Check the alignment of the crankshaft and camshaft marks again.

Retime the ignition – 12 11 004.

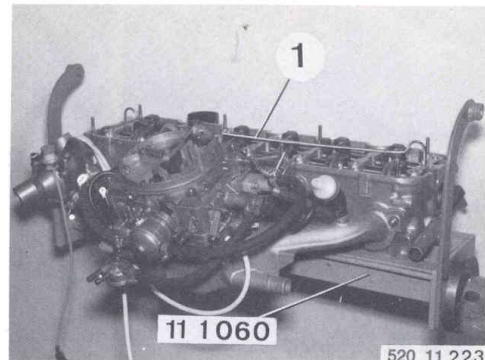
11 33 020 Rocker shafts – removing and installing

Remove cylinder head – 11 12 100.

Mount cylinder head on assembly fixture 11 1060 and secure with one cylinder head bolt.

Detach oil line (1).

Take off the toothed belt.

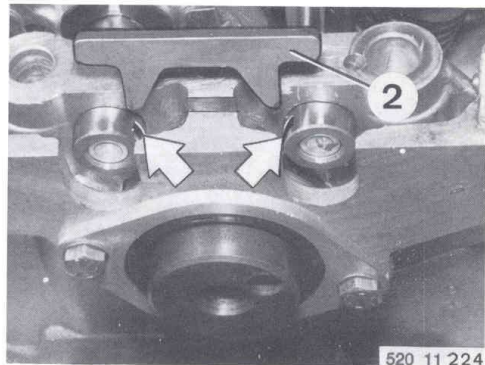


Set valve clearances for all cylinders to maximum.

Extract sealing plug.

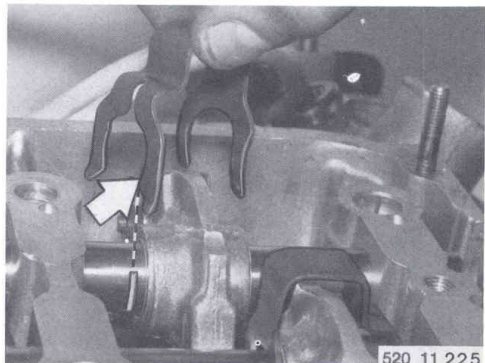
Remove locating plate (2).

When installing: locating plate (2) must be in the grooves of the rocker shafts.

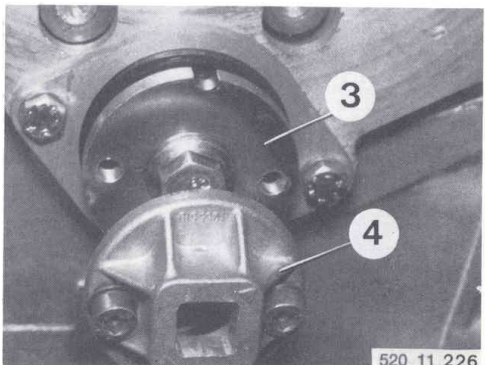


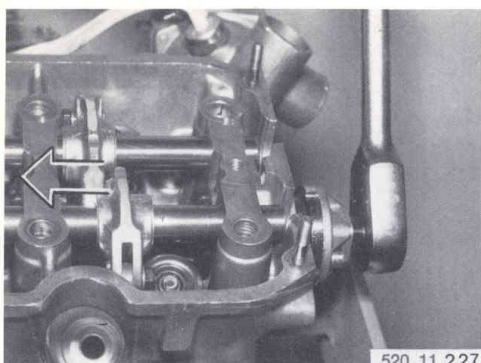
Remove the spring clips.

When installing: the straight face on the spring clip must be in the groove on the rocker shaft.



To turn the camshaft, attach washer (3) and adapter (4) to it.



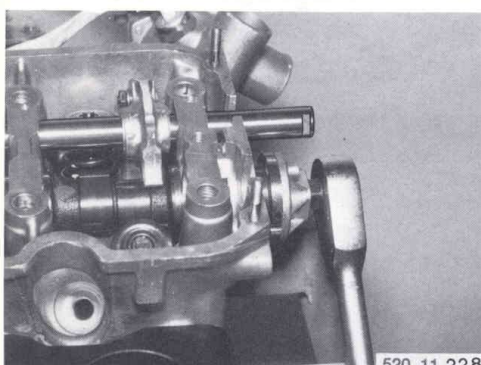


520 11 227

Remove the rocker shafts.

a) Exhaust side

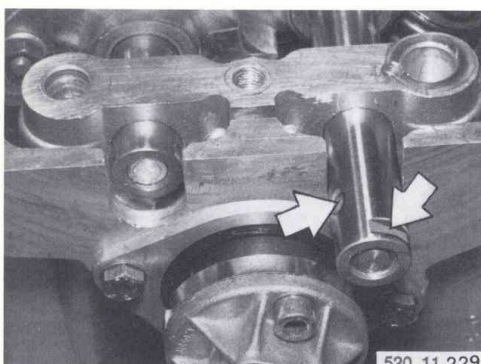
Cylinder 6 must have the valves on overlap. Push the rocker for the first cylinder inwards. Turn the camshaft at the adapter towards the inlet side until all the rockers are no longer under spring pressure. Pull out the rocker shaft.



520 11 228

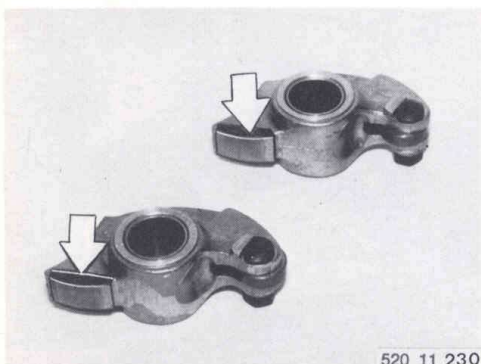
b) Inlet side

Turn the camshaft at the adapter towards the exhaust side until all rockers are relaxed. Pull out the rocker shaft. Renew rocker shafts and rockers if worn or scored.



520 11 229

When installing: the large oil holes on the rocker shafts must face the valve guide and the grooves for the locating plate must face inwards.



520 11 230

11 33 031 All rockers – renewing

Remove rocker shafts – 11 33 020.

Renew rockers which are worn, scored or have loose pads.

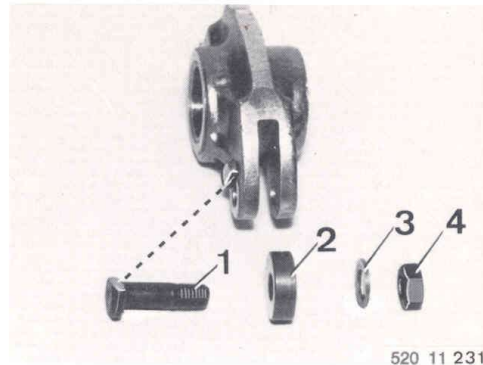
Loose pads will be audible in the form of excessive valve gear noise.

Transfer setscrew (1), eccentric (2), washer (3) and nut (4) to new rocker arm.

Replace worn eccentrics.

Important: Setscrew and nut have M 6 × 0.75 mm fine threads.

Hole faces outward and thick side downward. Bevelled side of setscrew faces tab on rocker arm.



11-33/3

2.7E

2.7E

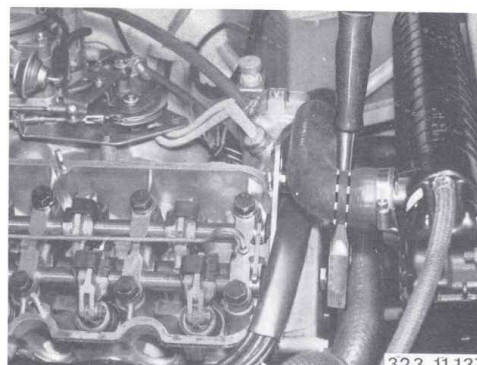
11-33/3

11 34 004 Valve clearances – adjusting

Remove cylinder head cover – 11 12 000.

Warning: engine must only be turned over at adaptor after removing spark plugs.

Turn engine with a $\frac{1}{2}$ " ratchet applied to adaptor.

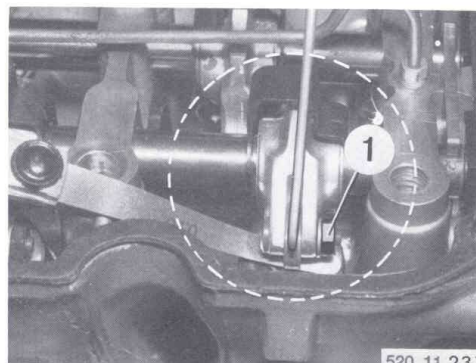


Adjusting sequence is same as firing order (1-5-3-6-2-4) at compression to dead center (TDC).

Adjust valve clearance¹⁾ between valve and eccentric after loosening nut (1).

Tighten nut (1) with special ring spanner 11 1 150 and torque wrench 00 2 050.

Note correct torque¹⁾.

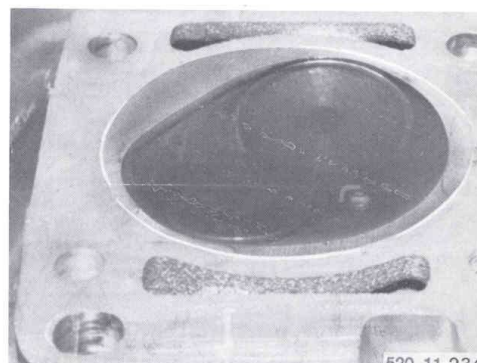


11 34 509 All valves – checking for leaks – camshaft removed –

Spark plugs remain installed.

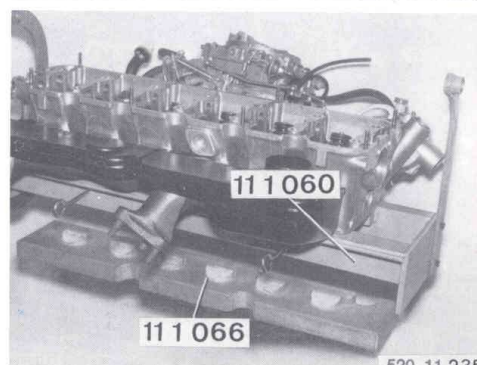
Fill combustion chamber with gasoline.

Valves have to be machined when gasoline runs past valve head (see 11 12 607).

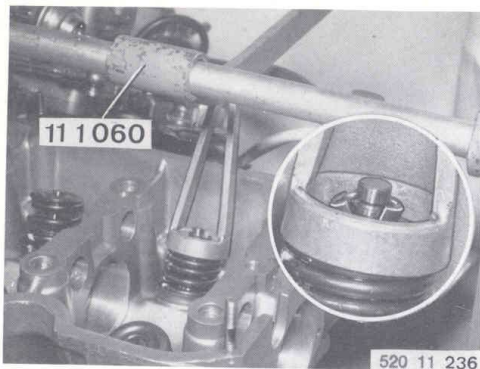


11 34 550 Valves – removing and installing – rocker shafts removed –

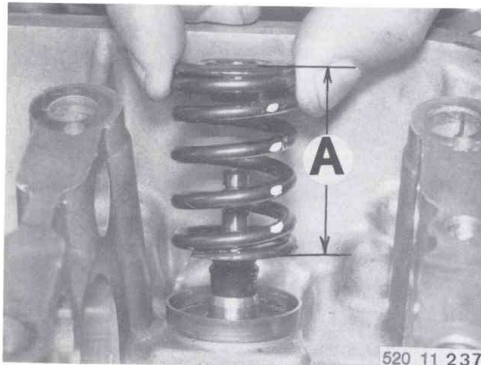
Place tray 11 1066 in assembly stand 11 1 060.



¹⁾ See specifications



Press down valve springs with special tool 11 1 060 and remove valve collets.



Remove upper spring retainer, spring and lower retainer.

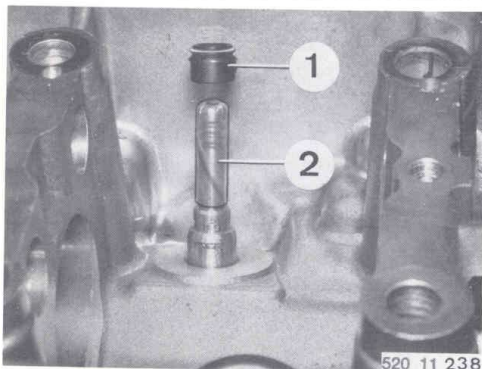
When installing: Relaxed spring length A¹⁾.

Important: Valve spring is wound progressively.

End with tight winding (paint mark) faces cylinder head.

Pull out valve.

When installing: Lubricate valve guide and valve stem with oil.



Pull off valve seal.

Replace valve seal (1).

Install valve.

Always use assembly sleeve (2) to prevent damage to valve seal.

Lubricate and install valve seal.

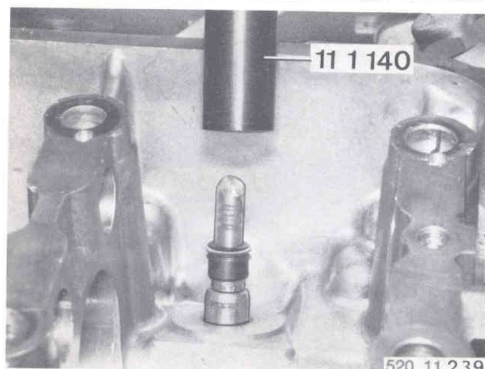
Supply source for assembly sleeves:

Cartool

Unterer Grasweg 88

D-8070 Ingolstadt

West Germany

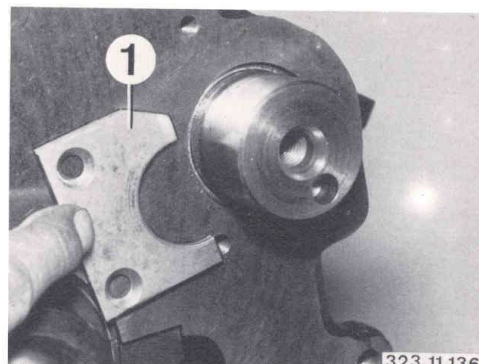


Press on valve seal with special tool 11 1 140 until a tight fit.

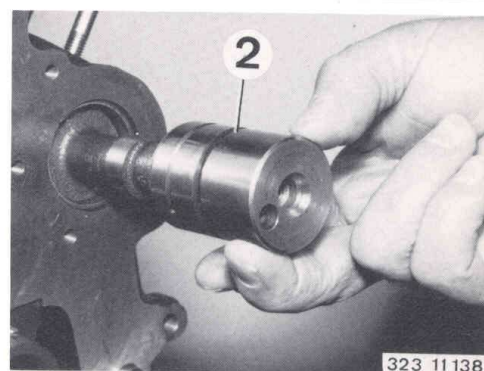
¹⁾ See specifications

**11 35 020 Distributor intermediate shaft –
removing and installing**

**Remove front end cover – 11 14 175.
Detach guide plate (1).**

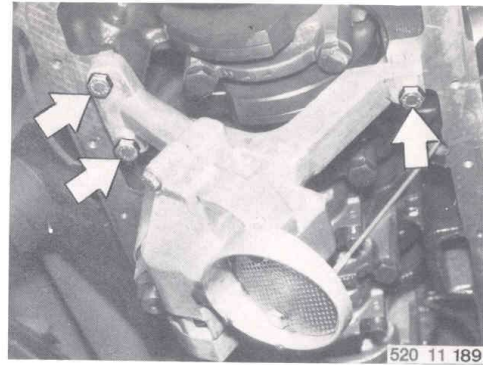


Pull out intermediate shaft (2).

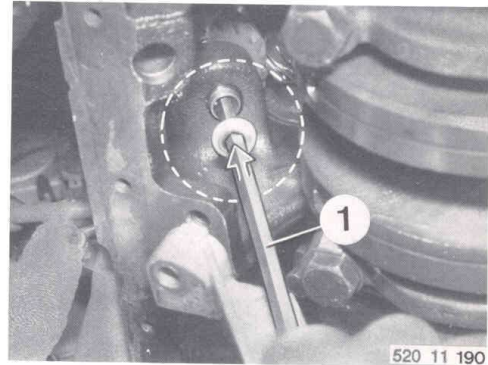


11 41 000 Oil pump – removing and installing

Remove oil sump – 11 13 000.
Take off oil pump.

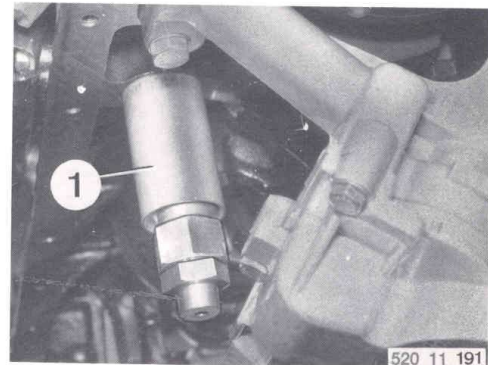


When installing: Guide input shaft (1) into distributor shaft.

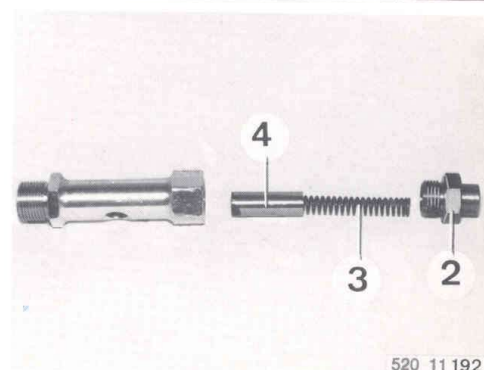


11 41 110 Pressure relief valve – removing and installing

Remove oil sump – 11 13 000.
Unscrew pressure relief valve.
Remove outer tube (1).



Unscrew plug (2).
Remove spring (3) and piston (4).
Important! Relaxed spring length¹⁾ must not be altered.



¹⁾ See specifications

11 51 000 Water pump – removing and installing

Drain coolant.

When installing: bleed cooling system – 17 00 039.

Detach belt pulley.

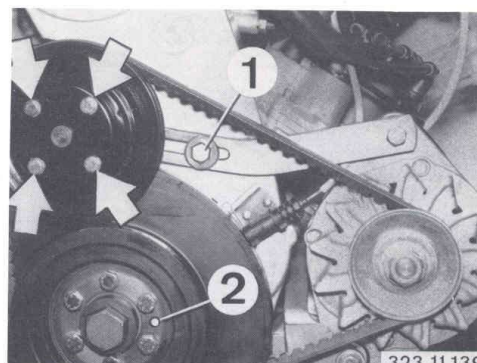
Unscrew bolt (1).

Take off V-belt.

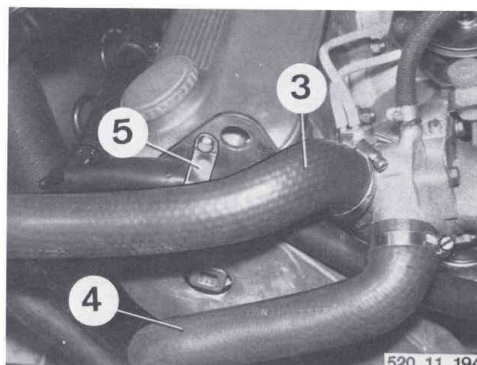
When installing: Tension V-belt.

Take vibration damper off hub.

When installing: centering pin (2) must be in hole in vibration damper.



Loosen warm water hose (3), remove hose (4) and take off holder (5).

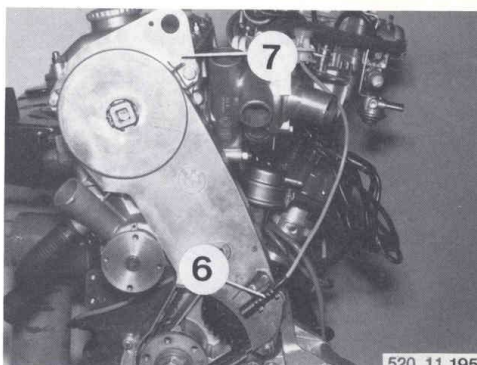


Remove position indicator (6) from mounting.

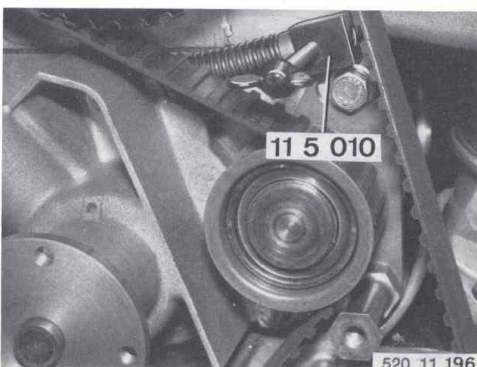
When installing: correct seating of position indicator. Gap between indicator and vibration damper must be 0.2... 2.0 mm (0.008... 0.08 in).

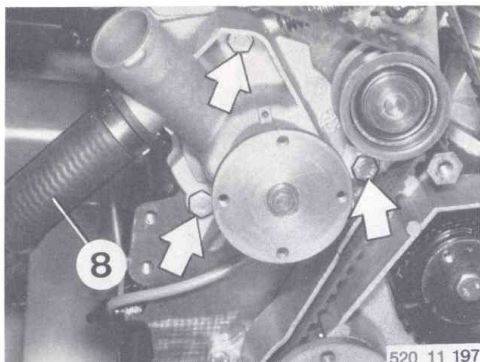
Remove cover.

When installing: Also attach suspension eye (7).

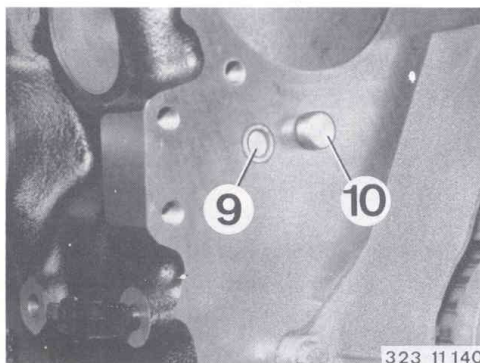


Hold clamping pin with special tool 11 5 010. Strong spring pressure!

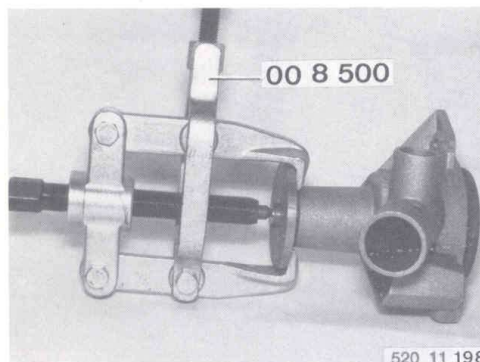




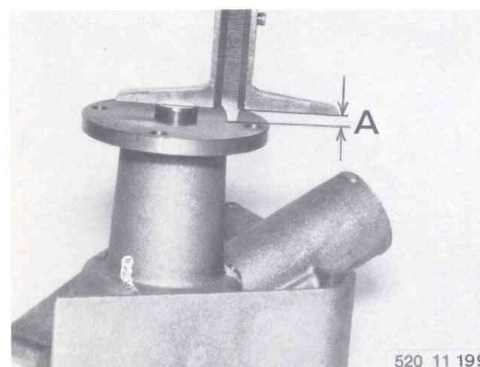
**Loosen warm water hose (8).
Take off water pump.
When installing: use a new gasket.**



**Important: check that end cover (9) of main oil passage is not leaking; install a new plug (10) if necessary.
Insert plug with Loctite Ref. No. 270.**

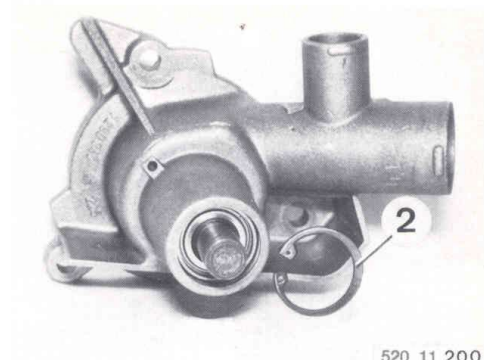


**11 51 502 Water pump – stripping and assembling – water pump removed –
Pull off hub with special tool 00 8 500 (Kukko).**



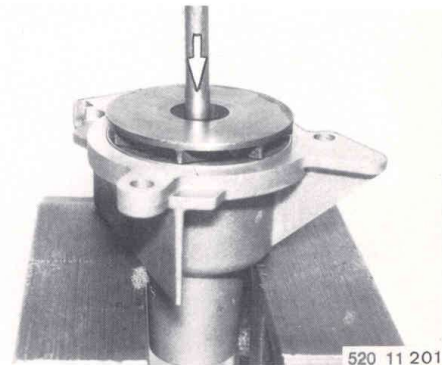
**When installing: Distance A = 4.1 + 0.3 mm
(0.161 + 0.012 in).**

Remove circlip (2).



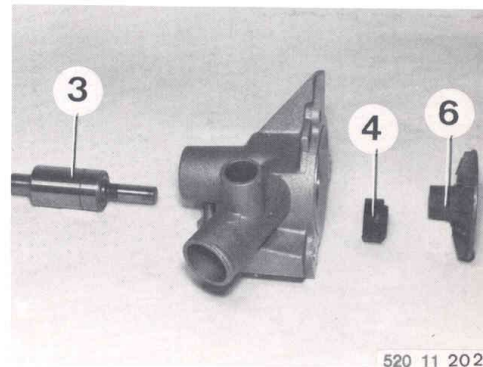
520 11 200

Press impeller off shaft and water pump bearing out of body.



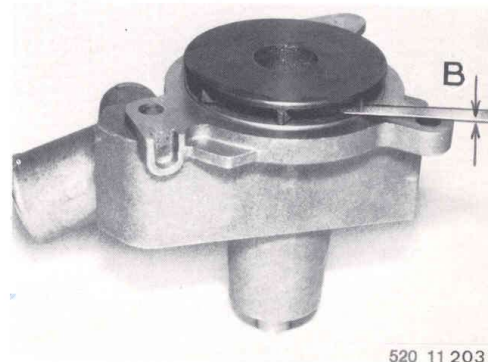
520 11 201

**Renew bearing (3) and seal (4).
Check impeller (6) and renew if necessary.
When installing: Long shaft of bearing (3) faces impeller.**

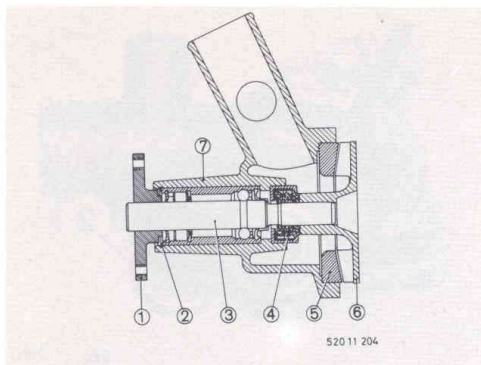


520 11 202

**When installing: Press on impeller.
Distance B = 0.6 : 0.2 mm (0.024 ± 0.008 in)
must be observed. Press-in force approx.
440 kp (970 lb); for new parts 500 kp (1100 lb).**



520 11 203



Water pump layout

- 1 Hub**
- 2 Circlip**
- 3 Pump bearing**
- 4 Seal**
- 5 Cover ring**
- 6 Impeller**
- 7 Body**

11 53 000 Coolant thermostat – removing and installing

Partially drain coolant.

When installing: bleed cooling system – 17 00 39.

Take off cover.

Remove thermostat.

Check beginning of thermostat opening¹⁾ in a hot water bath.

When installing: bracket on thermostat faces out.



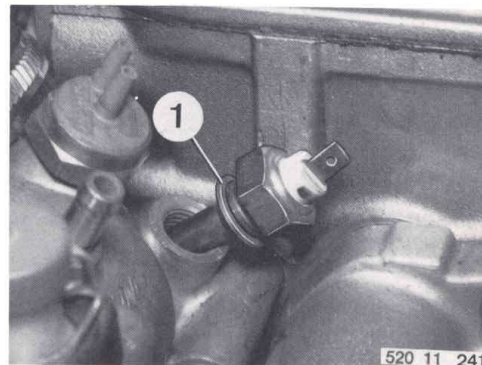
11 53 081 Temperature sensor – renewing

Disconnect wire from sensor.

Unscrew sensor.

Replace seal (1).

When installing: bleed cooling system – 17 00 039.



¹⁾ See specifications

2.73

11-53/1

¹⁾ See specifications

2.73

11-53/1

11 61 000 Intake pipe and carburetor – removing and installing/sealing

Disconnect negative lead at battery.

Detach air cleaner – 13 71 000.

Drain coolant.

When installing: bleed cooling system – 17 00 039.

Detach supply (1) and return (2) fuel lines.

Detach preheating hose (3).

Disconnect cables (4) and (5).

When installing:

green/violet cable to control motor

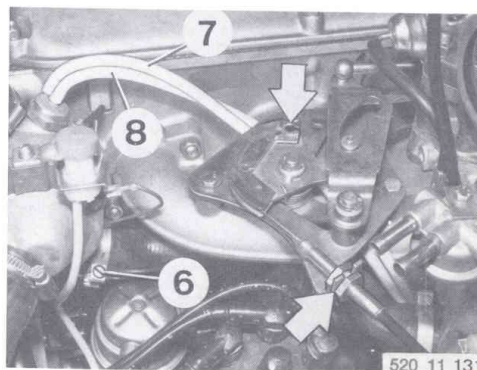
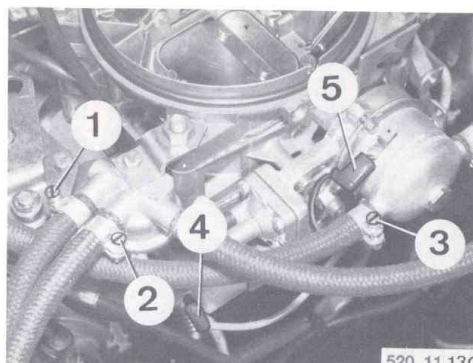
green/black cable to cold-start housing

Detach carburetor controls.

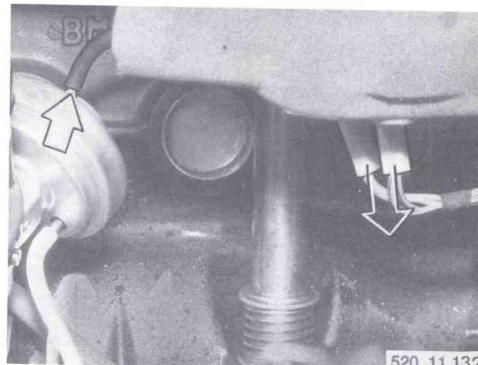
Detach water hose (6).

Detach hoses (7) and (8) and remove by pulling down.

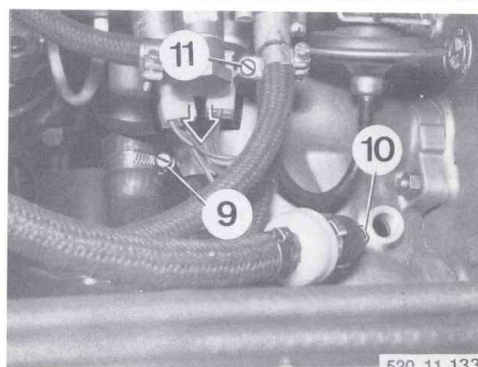
When installing: adjust accelerator cable – 35 41 421.

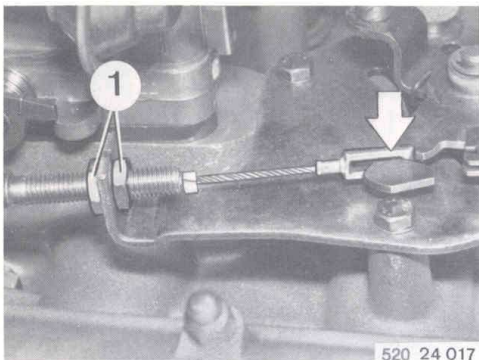


Detach black vacuum hose at distributor and wires at thermo switch.

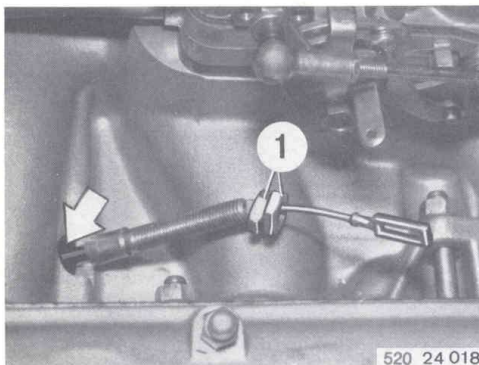


Pull off plug for idle cut-off valves.
Detach hoses (9 to 11).

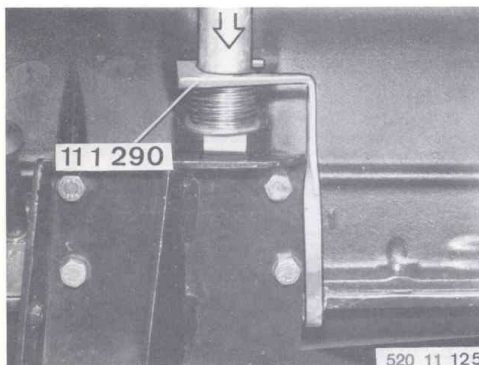




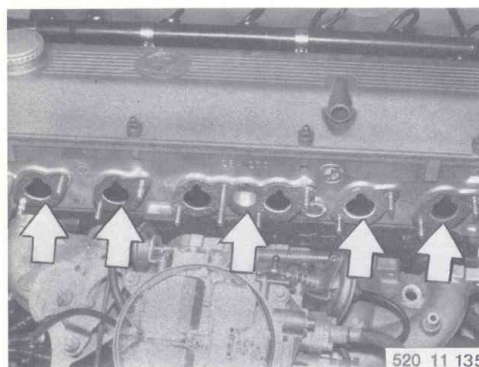
On automatic transmission cars:
 Unscrew nuts (1).
 Disconnect accelerator cable.
When installing: adjust accelerator cable (see 24 00 004).



Unscrew nuts (1) and pull accelerator cable out downwards through hole in intake manifold.



Press down balance tube and lock with special tool 11 1 290.



Detach intake manifold at cylinder head.
When installing: use new gaskets. Note installed position of gaskets.

11 61 050 Intake air collector – removing and installing

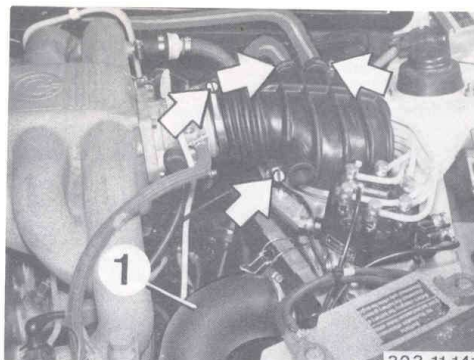
Disconnect negative lead at battery.

Drain the cooling system.

When installing: bleed the cooling system – 17 00 039.

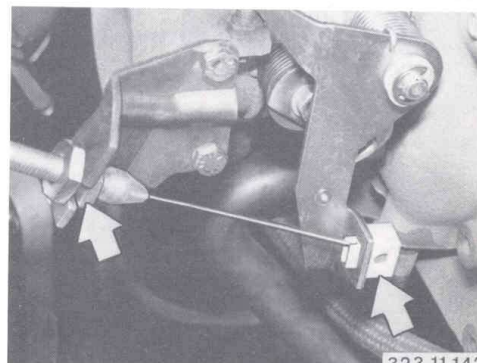
Disconnect intake cowl.

Disconnect manifold (1).

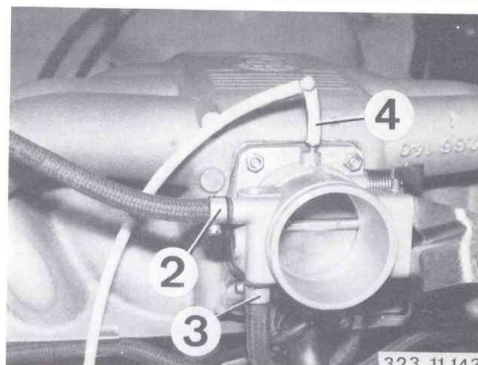


Detach accelerator cable and remove from reaction bearing.

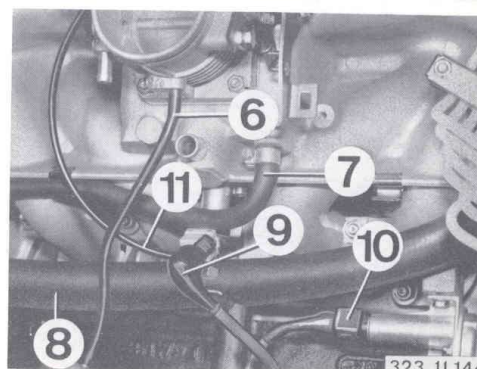
When installing: adjust accelerator cable – 35 41 421.

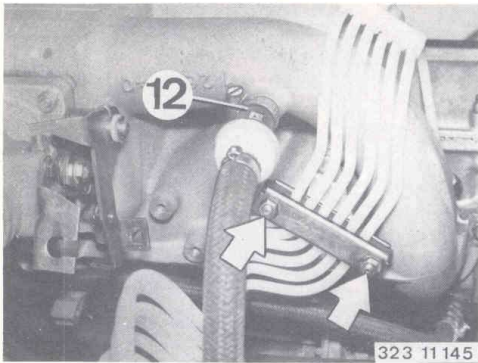


Detach hoses (2 and 3).
Pull off vacuum hose (4).

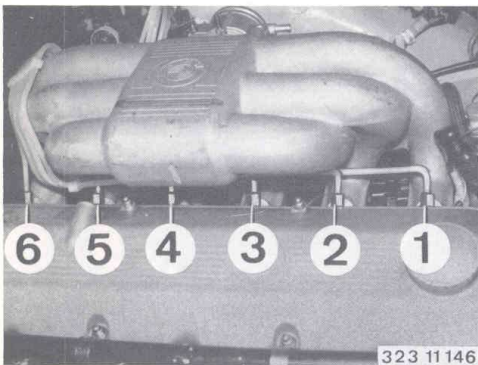


Pull off vacuum hose (6).
Detach hose (7).
Detach hose (8) at branch flange.
Pull off plugs (9) and (10).
Detach fuel line (11).

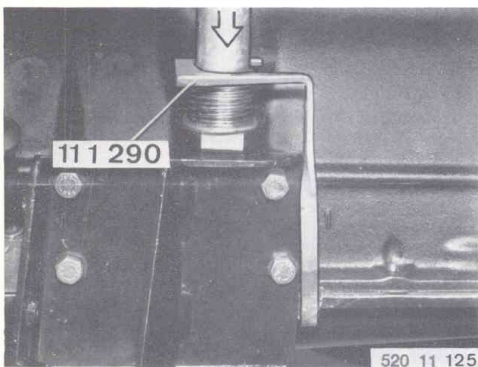




Take off vacuum hose (12).
Detach holder at air collector.



Detach injector pipes (1... 6).

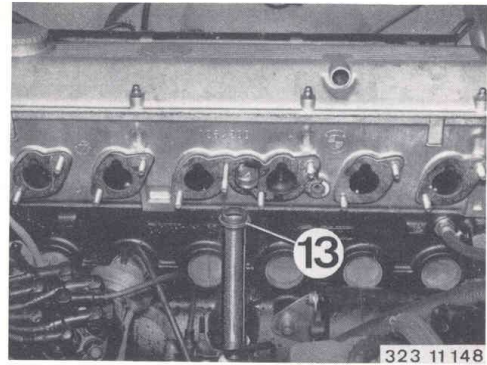


Press equalizing pipe down and hold with special tool 11 1 290.



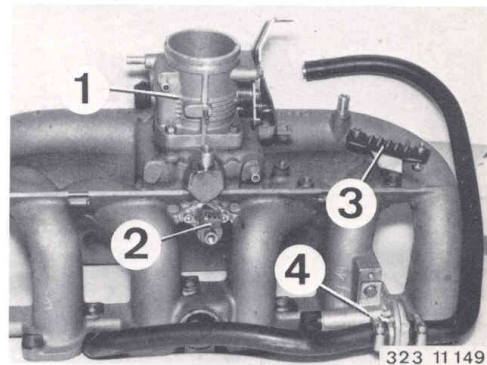
Detach air collector from cylinder head.

When installing: renew gaskets and ensure they are correctly positioned.
Renew sealing ring (13).

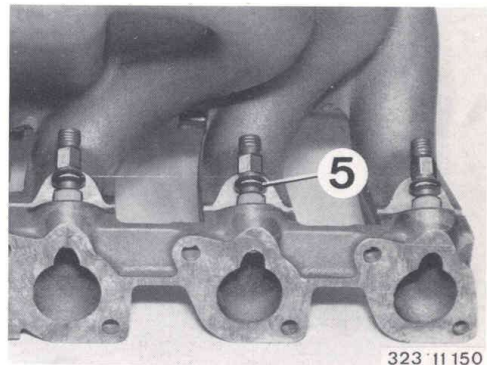


11 61 051 Intake air collector – renewing

Remove the air collector – 11 61 050.
Transfer the throttle butterfly stub pipe (1),
cold-start valve (2), holder (3) and additional
air slide (4) to the new air collector.



Transfer injectors 1 ... 6.
Renew sealing rings (5) and coat with Vaseline
or similar before installing.



11 74 051 Thermo valve – renewing

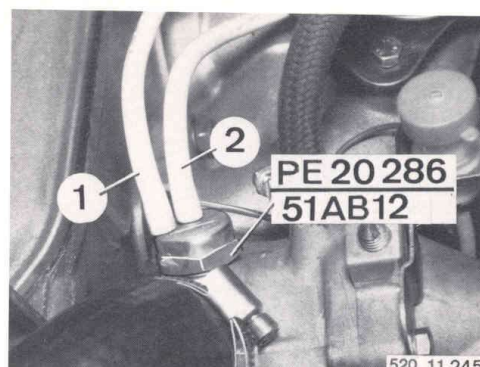
Test: Detach hose (1) at thermo valve.
Detach hose (2) at distributor and blow through it.

Thermo valve must be closed at coolant temperatures up to $+13 \pm 3^{\circ}\text{C}$ ($55 \pm 6^{\circ}\text{F}$) and open from $+20 \pm 3^{\circ}\text{C}$ ($+68^{\circ} \pm 6^{\circ}\text{F}$).

Unscrew thermo valve.

Add coolant.

Important: Only install thermo valves with designation PE 20 286 yellow or 51 AB 12 blue with a yellow spot.



Motor-Elektrik

Engine-Electrical
Moteur-électricité
Motore-Impianto elettrico
Motor-equipio eléctrico
Motor – Elsystem
Motor-elektrisch

12 Engine – Electrical System

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Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
12 11 . . . Distributor		
Manufacturer	Bosch	
Type	PFUD 6	PGFUD 6
Bosch No.	0 231 309 007	0 237 302 006 1)
BMW part number	12 11 1 360 659	12 11 1 266 723
Distributor rotor with speed governor		
Cutout speed (crankshaft)	1/min	6600 ± 150
Cutout speed (camshaft)	1/min	3300 ± 75
12 11 . . . Distributor rotor with speed governor		
Manufacturer	Bosch	
Bosch No.	1 234 332 196	
Suppressor resistor	kΩ	5

*) Version for Sweden

1) with inductive (contactless) transmitter. *Warning:* never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A*)
12 11 . . . Condenser		
Manufacturer	Bosch	–
Bosch No.	1 237 330 303	–
Capacitance	μF 0.18 . . . 0.22	–
Insulation resistance	$\text{k}\Omega$ min. 200	–
12 11 . . . Position indicator		
Manufacturer	Bosch	
Bosch No.	0 335 541 010	
Resistance measured between leads at temperature	Ω at $^{\circ}\text{C}$ ($^{\circ}\text{F}$) 80 $\pm$ 10 25 (77)	
Air gap between position indicator and vibration damper	mm (in)	0.2 . . . 2.0 (0.008 . . . 0.8)

*) Version for Sweden

Engine – electrical system

Specifications

Model	320/6 320/6 A	323 i 323 i A *)
12 11 ... Ignition timing		
Distributor – Bosch No.	0 231 309 007	0 237 302 006
Dwell angle	35 ... 41	
	deg.	
	%	
at 4500/min	58 ... 68	52 ... 57
	deg.	
	%	86.7 ... 95.0
Breaker points gap	mm (in)	–
	≤ 0.35 (0.014)	
Spark plug electrode gap	mm (in)	see 12 12 ... Spark plugs
Firing order		1 – 5 – 3 – 6 – 2 – 4
Static ignition timing 1) with engine cold		10° before TDC
Dynamic ignition timing 2) with engine running at normal operating temperature (vacuum ignition control out of action, dwell angle tester switched off)		–
– at engine speed	°CS 1/min	22° before TDC 1500

*) Version for Sweden

1) Guide value only. Always time the ignition dynamically.

2) With BMW digital tester, using TDC position indicator installed on engine or if necessary marks or vibration damper (V-belt pulley) or ball mark on flywheel, illuminated with stroboscopic lamp. On automatic transmission cars, TDC = short pin, ignition timing mark = long pin

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
12 11 ... Ignition timing (continued)		
Centrifugal ignition advance (measured with vacuum ignition control out of action and engine at normal operating temperature, using BMW digital or dwell angle tester ¹⁾)	°CS before TDC	
1000 /min	10 ... 14°	11° ... 17°
1500 /min	22°	22°
2000 /min	23 ... 29°	
2400 /min		27 ... 33° (ends)
2500 /min	25 ... 31°	
3000 /min	27 ... 33°	
3500 /min	30 ... 36° (ends)	
Max. ignition advance (without vacuum advance)	°CS	30 ± 3

*) Version for Sweden

1) If necessary, illuminate TDC mark with strobe lamp

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
12 11 . . . Ignition timing (continued)		
Vacuum ignition control Bosch distributor number	0 231 309 007	
Vacuum control direction	advance	retard
Start:	150 . . . 190 (153 . . . 180) ¹⁾	140 . . . 280 (73 . . . 113) ¹⁾
Torr (mm Hg)	112 . . . 142 (115 . . . 135) ¹⁾	105 . . . 210 (55 . . . 85) ¹⁾
in Hg	4.41 . . . 5.59 (4.53 . . . 5.31) ¹⁾	4.13 . . . 8.27 (2.17 . . . 3.35) ¹⁾
End:	240 . . . 260 (233 . . . 247) ¹⁾	340 . . . 420 (120 . . . 247) ¹⁾
mm Hg	180 . . . 195 (175 . . . 185) ¹⁾	255 . . . 315 (90 . . . 105) ¹⁾
in Hg	7.09 . . . 7.68 (6.89 . . . 7.28) ²⁾	10.04 . . . 12.40 (3.54 . . . 4.13) ¹⁾
Range of control	°CS	°CS
	10	10
		14
		16

*) Version for Sweden

1) Previous values (until 8/77)

Specifications

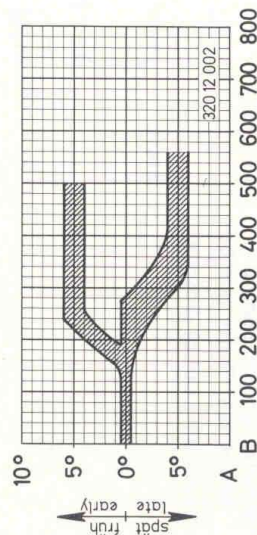
Engine – electrical system

Model	320/6 320/6 A	323 i 323 i *
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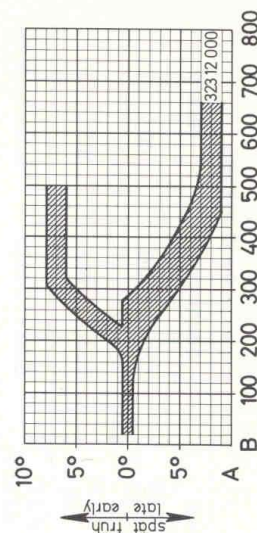
Vacuum ignition control graphs

A = Distributor shaft movements in degrees

B = Vacuum in mbar



Bosch distributor number 0 231 309 007



Bosch distributor number 0 237 302 006

*) Version for Sweden

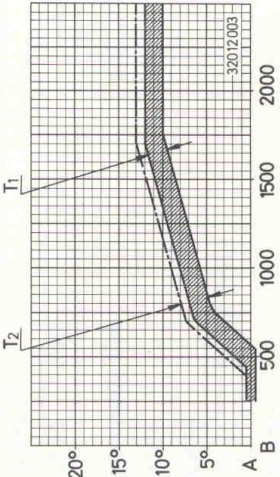
Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
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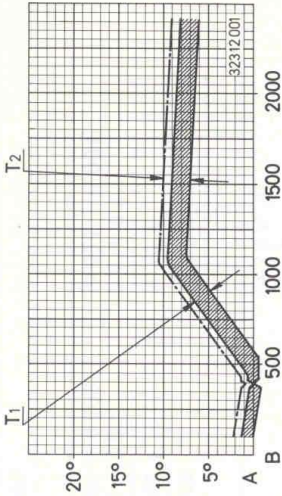
Centrifugal advance graphs – ignition control values for distributor test bench measurement

- A = Distributor shaft movement in degrees
- B = Distributor shaft speed in 1/min
- T₁ = Tolerance band with distributor in new condition
- T₂ = Tolerance band when distributor has been run



Bosch distributor number 0 231 309 007

*) Version for Sweden



Bosch distributor number 0 237 302 006

Engine – electrical system Specifications

Model	320/6 320/6 A	323 i 323 i A *)
12 12 . . . Spark plugs		
Make	Beru	Bosch
Type	145/14/3 A	W 145 T 30
Electrode gap	mm (in)	N 10 Y
	0.6 + 0.1 (0.024 + 0.004)	0.65 + 0.05 (0.026 + 0.002)
12 13 . . . Coil		0.6 + 0.1 (0.024 + 0.004)
Make		Bosch
Bosch-Nr.	0 221 119 017 ¹⁾	0 221 122 010
Type	KW 12 V	KW 12 V
Primary winding resistance Ω	1.7 . . . 2.1	0.4
12 13 . . . Line resistor		
Make	¹⁾	Bosch
Bosch No.	¹⁾	0 227 900 101
Nominal resistance Ω	¹⁾	0.4 und 0.6

*) Version for Sweden

¹⁾ Coil 0 221 119 017 only in conjunction with line resistor rated $0.9 \pm 0.05 \Omega$. (Resistor lead in engine wiring harness).

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
1214 . . . Control unit for transistorized coil ignition		
Make	–	Bosch
Bosch No.	–	0 227 100 025
Nominal voltage V	–	12
Operating voltage V	–	6 . . . 15
1231 . . . Alternator with attached regulator		
Make	Bosch	
Bosch No.	0 120 489 688	0 120 489 718
Nominal alternator output voltage V	14	14
Max. current A	65	65
Max. output W	910	910
Max. running speed 1/min	15 000	15 000
Charging commences at 1/min	1 060	1 060
2/3 of full current at 1/min	2 100	2 100
Max. current at 1/min	6 000	6 000

*) Version for Sweden

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
1231 . . . Alternator with attached regulator (continued)		
Min. slipping diameter	mm (in)	31.5 (1.24)
Min. projection	mm (in)	2.5 (0.10)
1231 . . . V-belt		
Narrow-section V-belt		9.5 × 950 LA
1232 . . . Regulator (attached to alternator)		
Make		Bosch
Bosch No.		0 192 052 006
Type		Bosch EE 14 V 3
Cut-in voltage	V	14.1 + 0.2
Controlled voltage range	V	13.7 . . . 14.5

*) Version for Sweden

Engine – electrical system

Specifications

Model	320/6 320/6 A	323 i 323 i A *)
12 14 . . . Control unit for transistorized coil ignition		
12 41 . . . Starter		
Make		Bosch
Bosch number		0 001 311 125
Type		GF → 12 V 1.1 kW
Direction of rotation		clockwise
Number of teeth on pinion		9
Armature axial play	mm (in)	0.05 . . . 0.3 (0.002 . . . 0.012)
Min. length of carbon brushes	mm (in)	11 (0.433)
Operating voltage	V	6 . . . 12
Test voltage	V	13 ± 0.26
Test temperature	°C (° F)	+ 20° (+ 68)
12 41 . . . Solenoid switch		
Current consumption (with nominal voltage at terminal 50)		
Engagement and hold-in windings A		40
Hold-in winding	A	7.5

*) Version for Sweden

Engine – electrical system

Specifications

Model		320/6 320/6 A	323 i 323 i A *)
Tightening torques			
12 11 ... Distributor			
Distributor to crankcase (M 8)	Nm kpm lb.ft	19.6 ... 21.6 2.0 ... 2.2 14.5 ... 15.9	
12 12 ... Spark plug			
Spark plug threads (M 14 × 1.25 mm)	Nm kpm lb.ft	24.0 ... 29 2.5 ... 3.0 18 ... 21	
12 31 ... Alternator			
Belt pulley	Nm kpm lb.ft	34.4 ... 44.2 3.5 ... 4.5 25 ... 32	
Alternator to pivot mount (M 8)	Nm kpm lb.ft	21.6 ... 23.5 2.2 ... 2.4 15.9 ... 17.3	
Pivot mount to crankcase (M 8)	Nm kpm lb.ft	21.6 ... 23.5 2.2 ... 2.4 15.9 ... 17.3	

*) Version for Sweden

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
12 31 . . . Alternator (continued)		
Tightening torques		
Alternator tensioning strap at protective cover (M 8)	Nm kpm lb.ft	21.6 . . . 23.5 2.2 . . . 2.4 15.9 . . . 17.3
Alternator to tensioning strap	Nm kpm lb.ft	21.6 . . . 23.5 2.2 . . . 2.4 15.9 . . . 17.3
12 41 . . . Starter		
Retaining bolts (M 10)	Nm kpm lb.ft	47.5 4.75 35.0

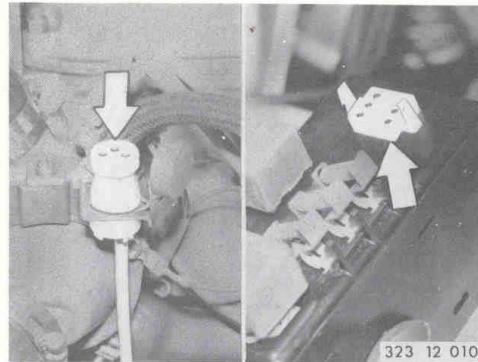
*) Version for Sweden

12 11 004 Timing ignition

– engine at normal operating temperature –

The following items must be correct before the ignition can be timed accurately:

- a) breaker points in good condition
 - b) dwell angle correct
 - c) TDC position indicator correctly located.
- Connect the BMW digital tester to the round-pin plug and the current distributor for the TDC position indicator.

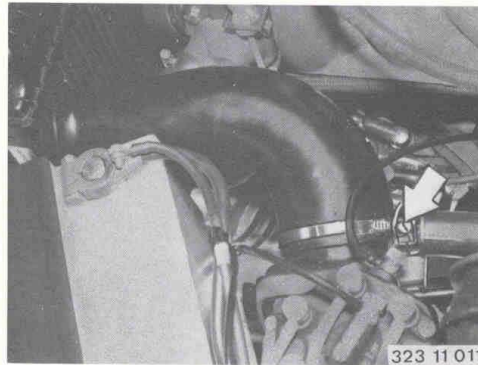


Version with contactless transistorized coil ignition:

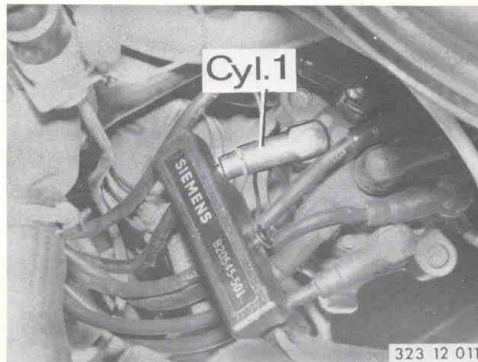
Warning: the dwell angle is a fixed feature and cannot be varied.

Dwell angle at 1500/min = $42^\circ \pm 10^\circ$
at 4500/min = $52^\circ \pm 5^\circ$

– check these settings.
Detach the tube.



Connect the detector clip to the ignition lead for cylinder 1, as close as possible to the distributor.

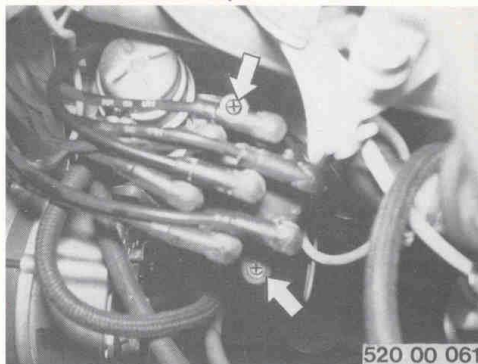


Version with breaker points:

Adjust dwell angle:

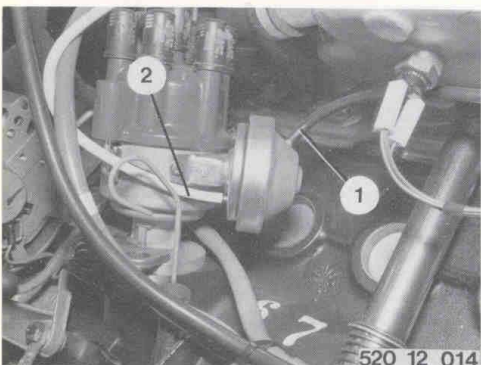
Overcome the spring-loading and turn the catch to the left to remove the distributor cap. Take out the distributor rotor and dust cover.

When installing: make sure that the dust cover and distributor cap are properly secured and the catches correctly seated.





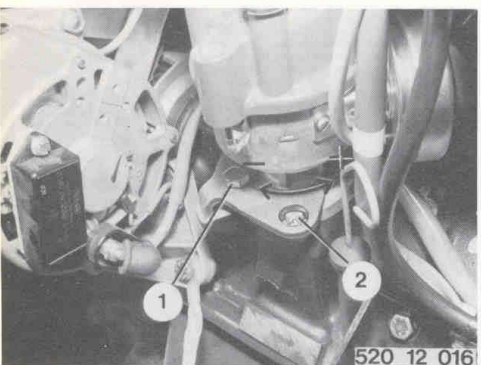
Turn the engine over with the starter.
Turn the breaker points carrier until the dwell angle is $35^{\circ} \dots 41^{\circ}$.
Aim for the lower value.



Detach the vacuum hoses for ignition advance (1) and retard (2).
Vacuum advance = black hose
Vacuum retard = white hose



Start the engine.
Program the BMW digital tester to 1500 ± 50 min at the speed control $\rightarrow \curvearrowleft$.
See also operating instructions for BMW digital tester.
Accelerate until engine speed is at least 1500/min.
Read off the ignition control angle ($22^{\circ} \pm 1^{\circ}$) at the digital tester.



To correct: loosen the distributor retaining bolt (1) and turn the distributor body at gear teeth (2) until ignition timing is correct.
+ = advance
- = retard

12 11 031 TDC position indicator – renewing

Pull the round-pin plug downwards out of the holder.

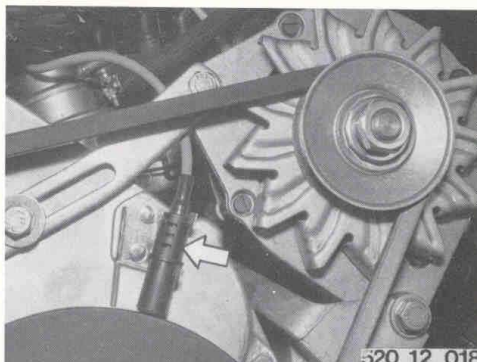
Detach the cap from the plug.



520 12 017

Lift the position indicator out of its clip.

When installing: make sure that the position indicator is correctly seated. The gap between the position indicator and the vibration damper should be 0.2 ... 2.0 mm (0.008 ... 0.08 in).



520 12 018

12 11 060 Distributor – removing and installing

Take off the distributor cap.

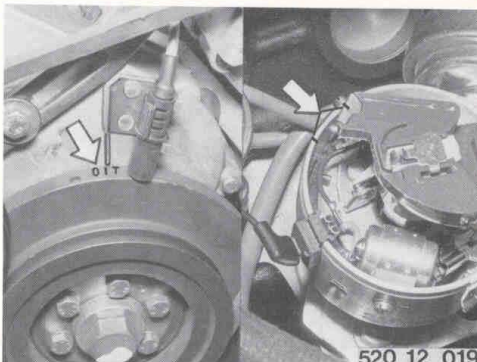
Detach lead from terminal 1 and pull off vacuum hoses.

Take out distributor rotor and dust cover.

Install the distributor rotor again.

Move the piston in cylinder 1 to TDC – the distributor rotor must be aligned with the notch in the distributor body.

When installing: black vacuum hose = ignition advance.



520 12 019

Remove bolt (1).

Take off retaining plate.

Pull out the distributor.



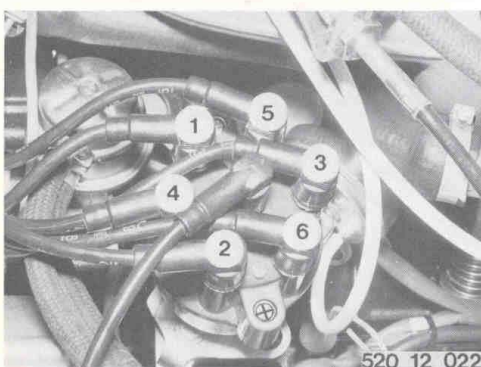
520 12 020



When installing: turn the distributor rotor approx. 25 mm (1 in) clockwise (A) away from the notch on the distributor body.

Carefully insert the distributor drive peg into the intermediate shaft.

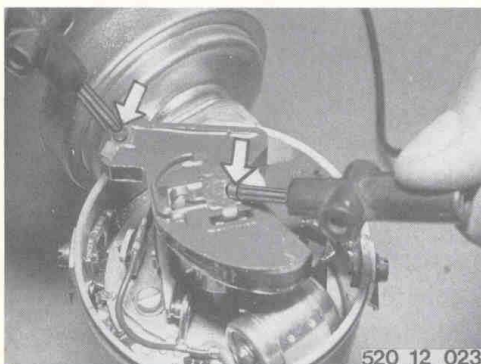
When installing: time the ignition – 12 11 004.



12 11 091 Distributor cap – renewing

Pull off the ignition leads. Take off the distributor cap and attach the new cap.

When installing: note correct order of ignition leads (firing order): 1-5-3-6-2-4.



12 11 111 Distributor rotor – renewing

Take off the distributor cap.

Pull out the distributor rotor.

Resistance of suppressed rotor¹⁾.

Important: the cutout speed¹⁾ of the distributor rotor is stamped underneath.



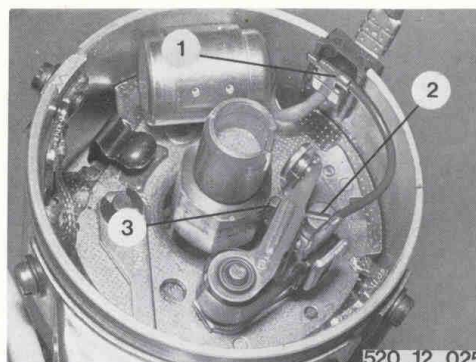
12 11 141 Breaker points – renewing

Take off the distributor cap.

Remove the distributor rotor and dust cap.

¹⁾ See specifications

Pull off flat pin plug (1).
 Remove screw (2).
 Pull out the breaker points assembly.
When installing: clean new points to remove grease.
 Apply Bosch Ft 1 v 4 grease to cam and lift section (3) of breaker arm.
 Adjust dwell angle and ignition timing – 12 11 004.



12 11 151 Pulse transmitter in distributor – checking/renewing

Important: no work is to be performed on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.
 The pulse transmitter delivers an AC signal varying between app. 0.3 and 100 V according to running speed. This is used as a control signal to interrupt the ignition spark.

a) Testing

Disconnect the transmitter lead at the plug between the distributor and the control unit.

Connect the Program tester.

Test lead red to terminal 7, black to terminal 31d.

Set range switch to x0.1 V.

Operate the starter.

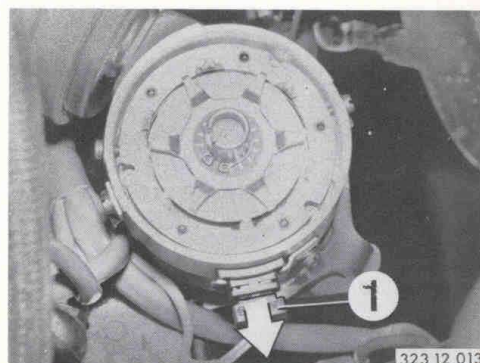
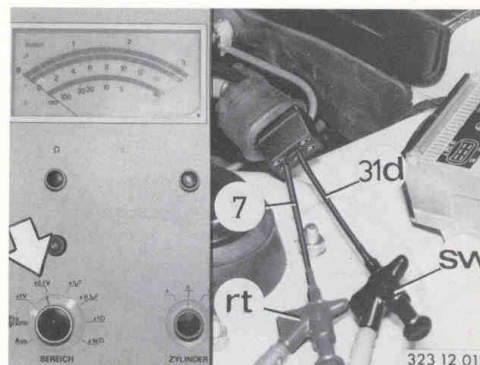
If a reading of at least 0.05 V is obtained, the pulse transmitter is in good working order.

If not, the fault is in the control unit.

b) Renewing

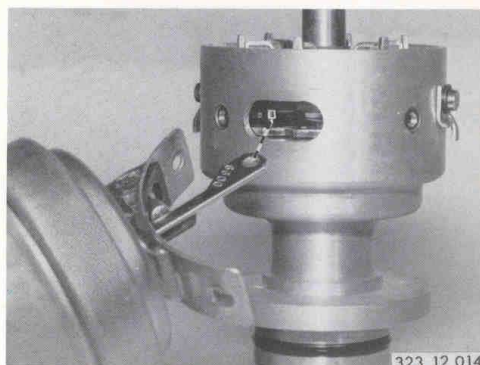
Pull out plug (1).

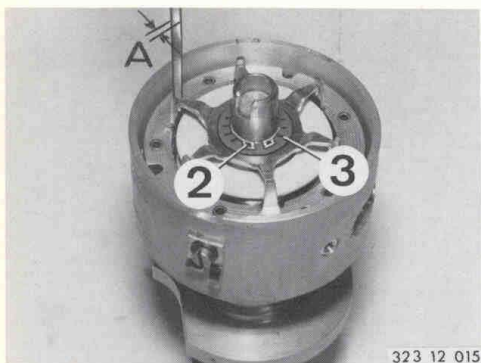
Remove the distributor – 12 11 060.



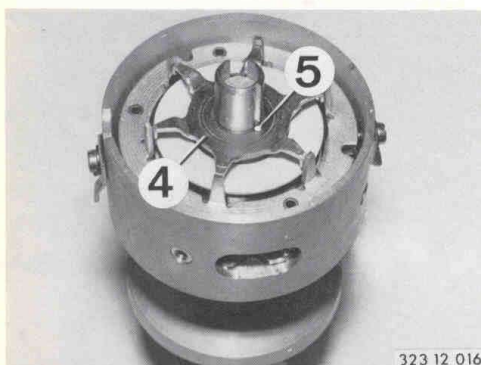
Loosen the retaining screws and disconnect the vacuum ignition control device (press the connecting link down).

When installing: attach the connecting link to its journal, and grease the linkage.

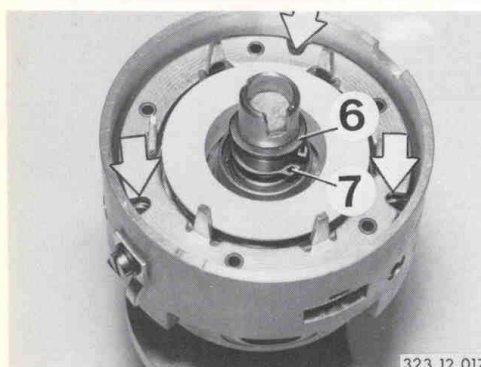




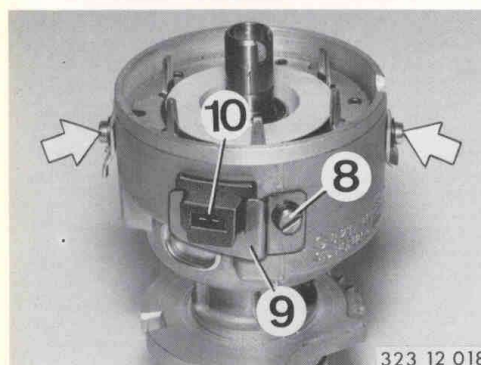
Lift out Seeger circlips (2).
Remove cup spring (3).
When installing: check gap between pulse transmitter wheel and pulse transmitter.
 $A = 0.35 \dots 0.70 \text{ mm} (0.014 \dots 0.028 \text{ in})$.



Carefully press up the pulse transmitter wheel (4) with two screwdriver blades on opposite sides.
Note: locating pin (5).
When installing: cutout in pulse transmitter wheel must engage in groove on distributor shaft.

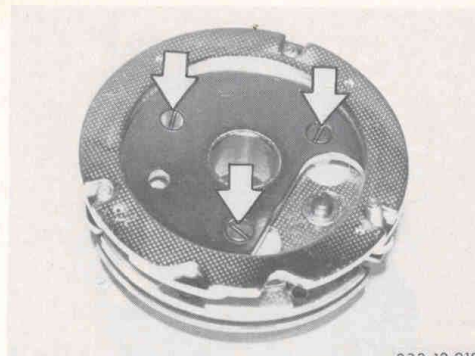


Take out thrust washer (6).
Remove the three retaining screws with a 3 mm Allen key.
Remove Seeger circlip (7).



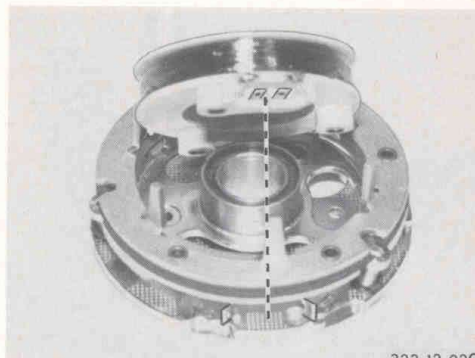
Remove screw (8) and take off retaining plate (9).
Pull out plug (10).
Loosen screws for mounting and take off carrier plate.

Unscrew pulse transmitter from carrier plate.



323 12 019

When installing: lugs face cutout for plug-in section.



323 12 020

12 11 171 Condenser – renewing

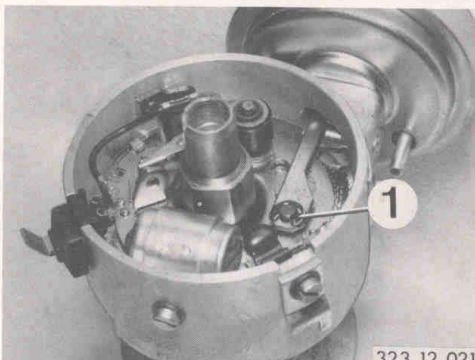
**Take off the distributor cap.
Remove the distributor rotor and dust cap.
Detach cable 1 and the lead from the breaker points.
Lift cable connecting block out of distributor.
Remove screw holding condenser.
Remove the condenser.
When installing: use only condenser with part number 1 237 330 303.**



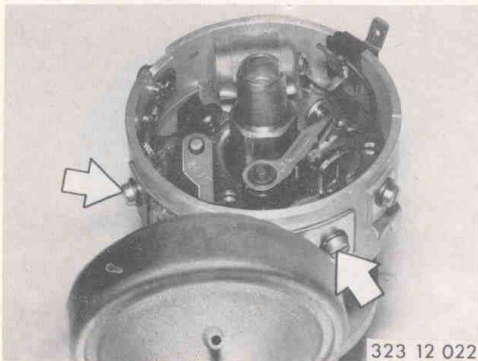
520 12 026

12 11 201 Vacuum control unit for distributor – renewing

**Remove the distributor – 12 11 060.
Remove the distributor rotor and the dust cover.
Extract circlip (1).**

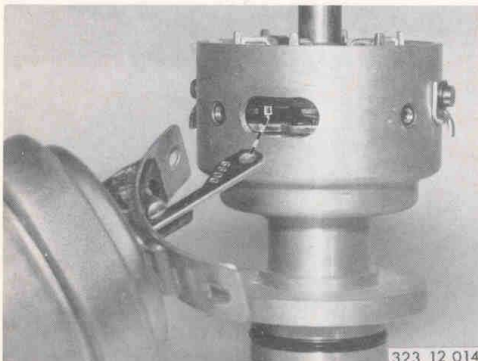


323 12 021



323 12 022

Remove the retaining screws and lift out the vacuum control unit.



323 12 014

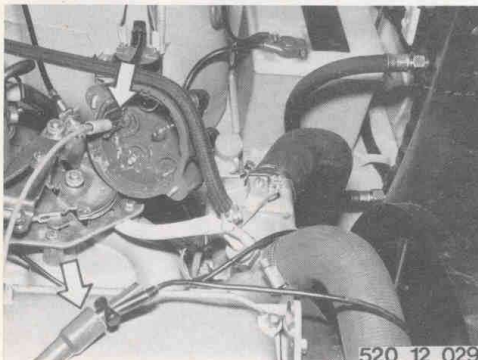
Version with contactless transistorized coil ignition:

Warning: never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Danger of fatal electric shock.

Remove the distributor – 12 11 060.

Take out the retaining screws and disconnect the vacuum control unit (press connecting link down).

When installing: grease the connecting link and connect to journal.



520 12 029

12 11 209 Distributor cap/ignition leads – checking

Detach the distributor cap and the ignition lead plugs.

Check condition of lead plugs.

Measure resistance¹⁾.

The better the insulation, the higher the resistance value which will be measured.

¹⁾ See specifications

Trouble shooting – distributor (with contact breaker)

Fault	Cause ¹⁾	Remedy
Engine will not start, or misfires and stops	Burned or dirty breaker points	Renew breaker points
Engine runs erratically and misfires	Stray currents across distributor cap	Clean distributor cap, renew if necessary
Engine misfires under part load	Defective suppressor resistor in distributor rotor	Renew distributor rotor
Engine power output drops	Dwell angle incorrect. Contact gap not identical at all lobes of cam – uneven cam wear	Adjust dwell angle. Renew distributor
Engine backfiring – noise developed	Contact breaker plate for vacuum ignition control is worn or loose	Renew distributor
Engine will not accelerate	No centrifugal ignition control – cam seized or rusted to shaft	Free distributor cam on shaft (oil): if necessary, renew distributor
Engine starts, but cuts out immediately	Open or short circuit at condenser	Renew condenser
Engine misfires – fuel consumption too high	Defective ignition lead Defective spark plug cap Defective suppressor resistors	Renew ignition lead Renew spark plug cap Renew suppressor resistors

¹⁾ Determine with BMW Program tester 1100 005

12 13 011 Coil – renewing

Warning: never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.

Check the coil – 11 00 009.

Detach the leads.

Detach the coil from its retaining plate.

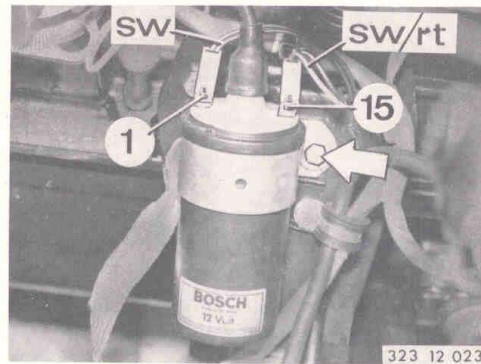
When installing: black/red lead to terminal 15
black lead to terminal 1

Warning: do not accidentally confuse the coil for the standard ignition system (with breaker points) and the coil for the TSZ transistorized contactless coil ignition system.

Bosch number 0 221 119 017 for coil with breaker points system

Bosch number 0 221 122 010 for contactless transistorized system

If these items are confused, there will be severe erosion at the breaker points even after only a short distance has been covered, and misfiring and poor cold starting will occur.



12 13 051 Line resistor for coil – renewing

Warning: never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.

Version without breaker points

Remove the battery.

Detach the leads.

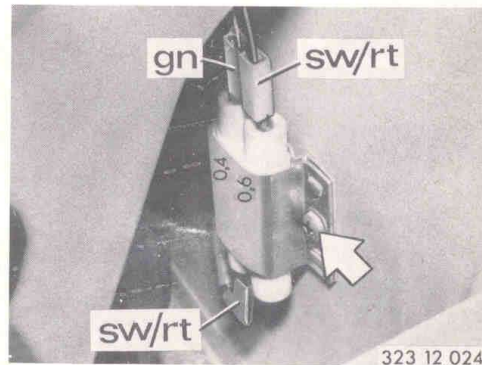
Detach the line resistor from the retaining plate.

When installing:

black/red lead to 0.6 Ohm resistor

green lead to 0.4 Ohm resistor

black/red lead to 0.4 Ohm resistor.



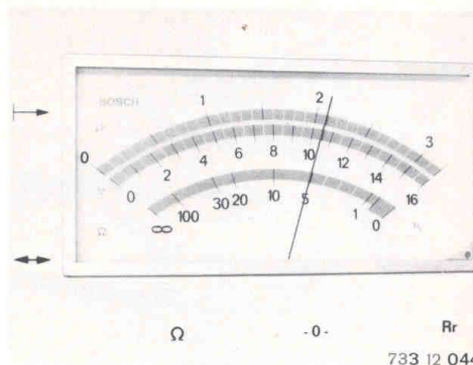
12 14 009 Control unit for transistorized ignition – checking

Warning: never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.

A) Connect the Program tester
Switch position U 1.



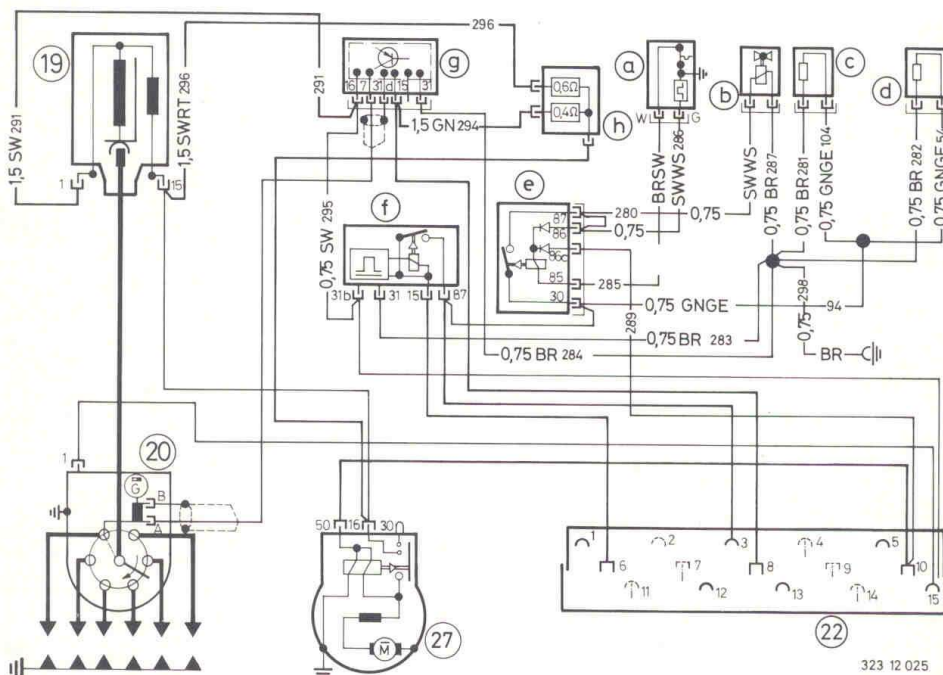
Switch position U (1)
Scale 1.6 V



With the ignition switched on, the reading must be below 2.0 V.

If more than 2.0 V are shown, the control unit has a fault.

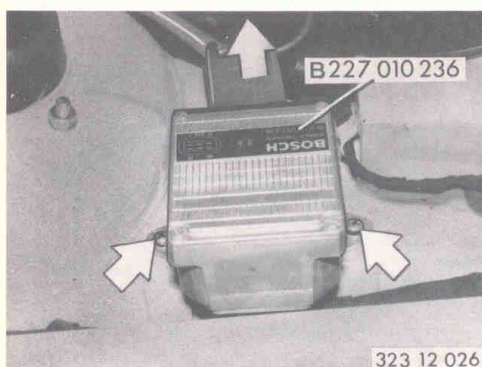
If no dwell angle reading is shown, test the pulse transmitter – 12 11 151.



Circuit diagram for transistorized ignition – K-Jetronic

- | | | | |
|----|--------------------|---|--|
| 19 | Coil | c | Warming-up regulator |
| 20 | Distributor | d | Additional air slide |
| 22 | Engine plug | e | Diode relay |
| 27 | Starter | f | Fuel pump relay |
| a | Thermo-time switch | g | Transistorized ignition (TSZ) control unit |
| b | Starting valve | h | Resistors |

SW = black
RT = red
GN = green
BR = brown



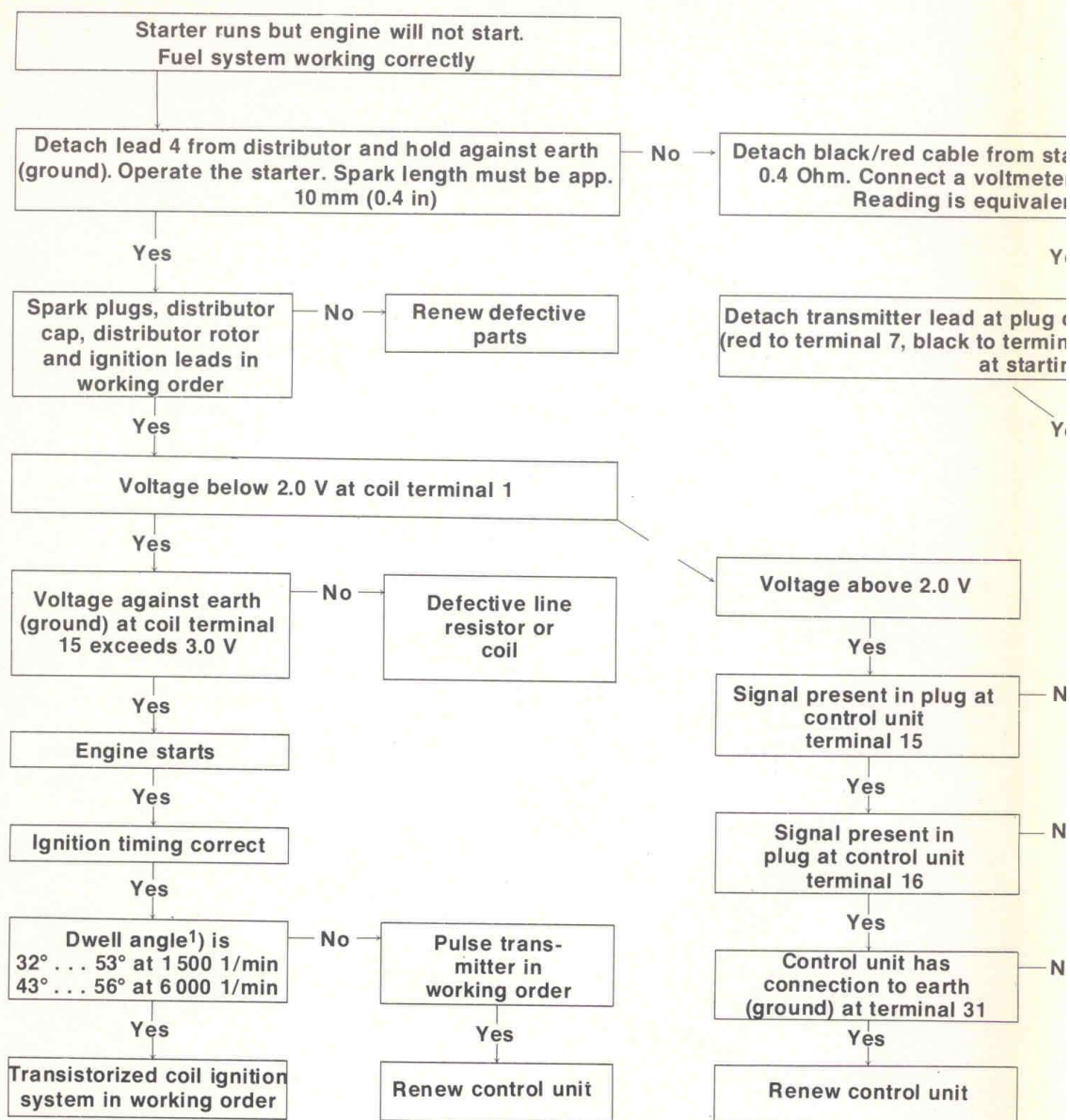
12 14 010 Control unit for transistorized ignition – renewing

Warning: Never work on the contactless transistorized ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.

Pull out plug.

Detach control unit from wheel arch.

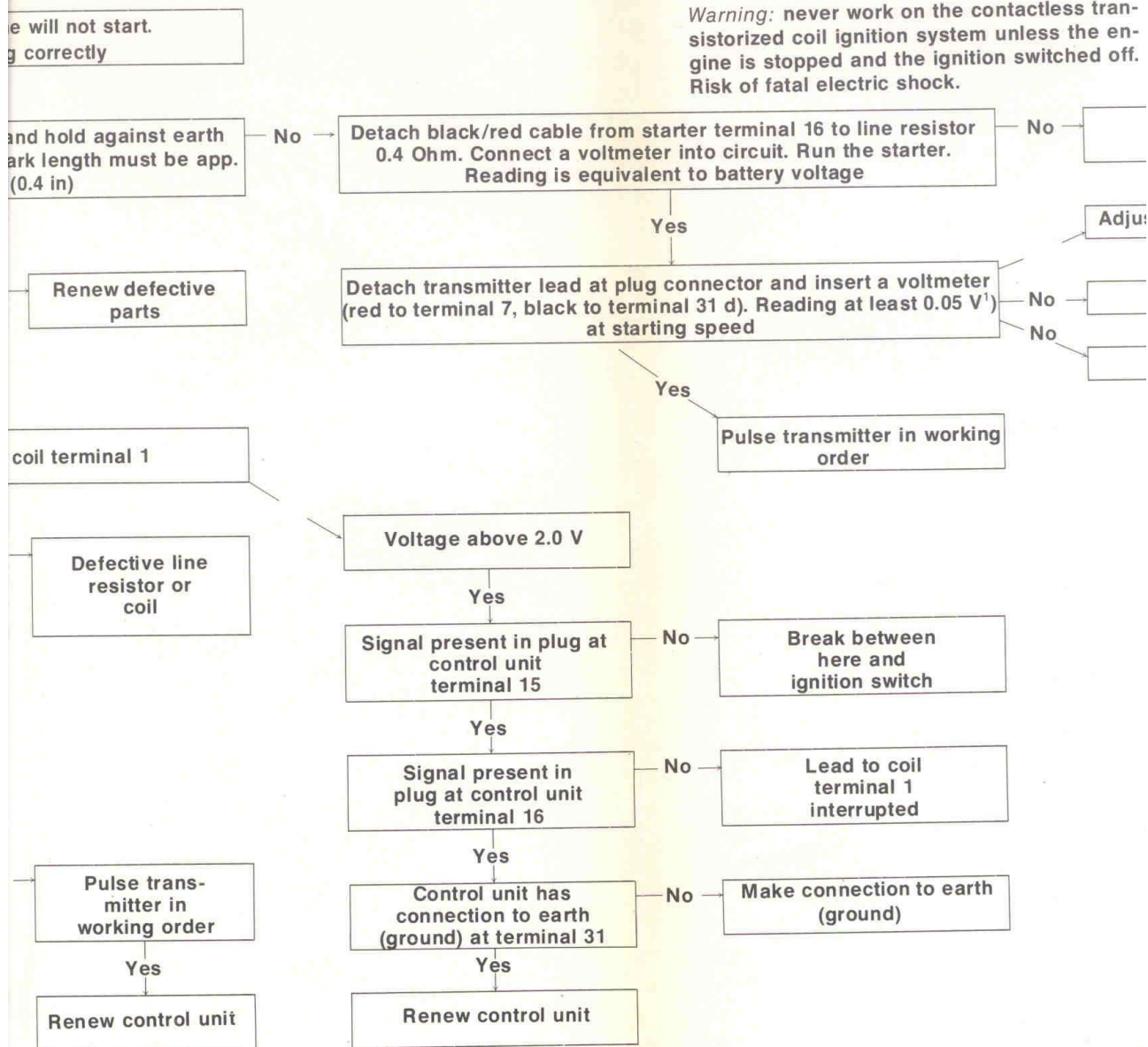
Install only control unit with Bosch number B 227 010 236.



¹⁾ measured with BMW Program tester

Trouble shooting – contactless transistorized

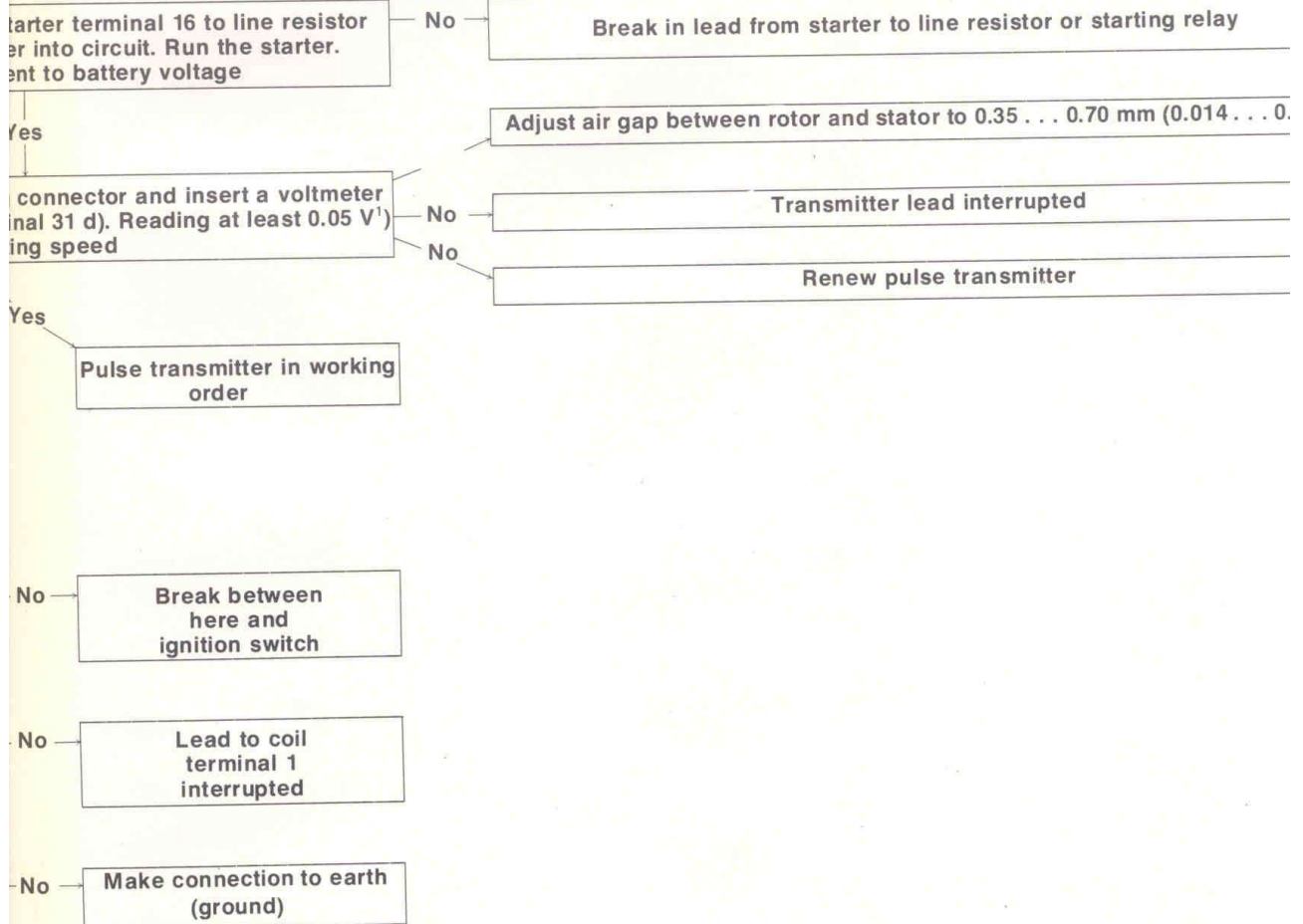
Warning: never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.



tester

ble shooting – contactless transistorized ignition

Warning: never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off.
Risk of fatal electric shock.



transistorized ignition

actless tran-
less the en-
switched off.

No

Break in lead from starter to line resistor or starting relay

Adjust air gap between rotor and stator to 0.35 . . . 0.70 mm (0.014 . . . 0.028 in)

No

Transmitter lead interrupted

No

Renew pulse transmitter

12 31 009 Alternator and regulator – checking

For test procedure, see Program Test 11 00 005.

12 31 020 Alternator – removing and installing

Warning: Do not disconnect the leads between the battery and the alternator unless the engine is stopped.

If the battery is recharged without removing it from the vehicle, the positive and negative battery leads must be disconnected.

When arc welding on the vehicle, the ground (earth) terminals of the welding equipment should be attached directly to the vehicle component being welded.

Disconnect the negative lead at the battery. Detach the leads at the alternator.

B + Red

D + Blue

Remove the bolt holding the alternator at the tensioning strap.

Loosen the upper mounting and lift out the alternator.

When installing: It should be possible to press in the V-belt by 5–10 mm (0.2–0.4 in).

12 31 101 Belt pulley/cooling fan – renewing

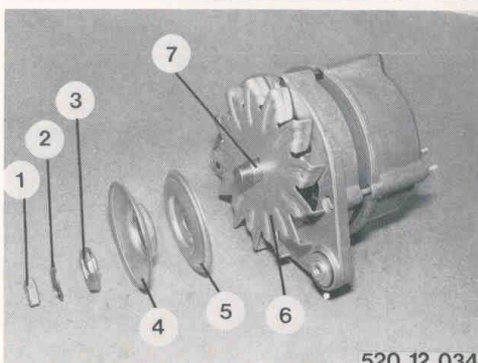
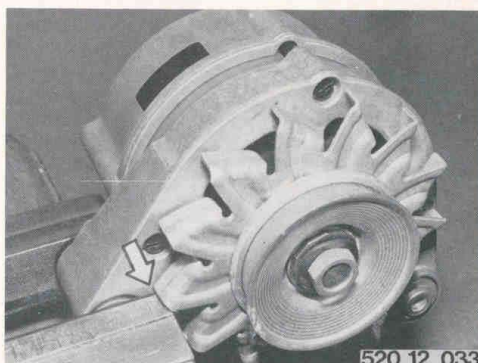
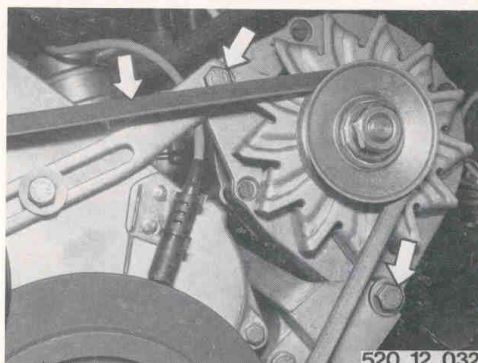
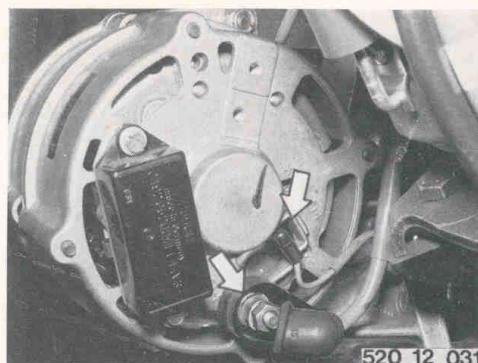
Remove the alternator – 12 31 020.

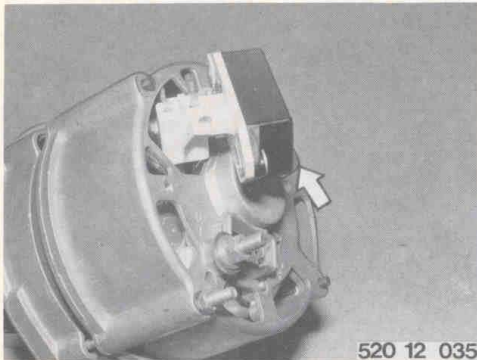
Prevent the cooling fan from turning, and detach it.

When installing: note correct tightening torque¹⁾.

Installation order: nut (1), corrugated washer (2), washer (3), belt pulley (4 + 5), cooling fan (6), key (7).

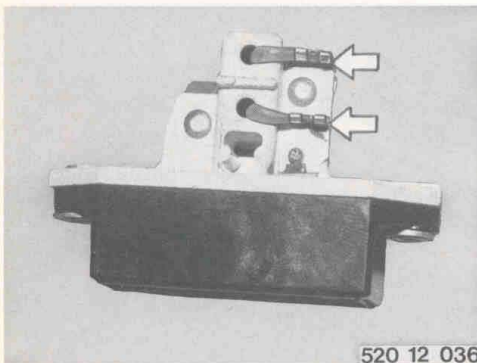
¹⁾ See specifications



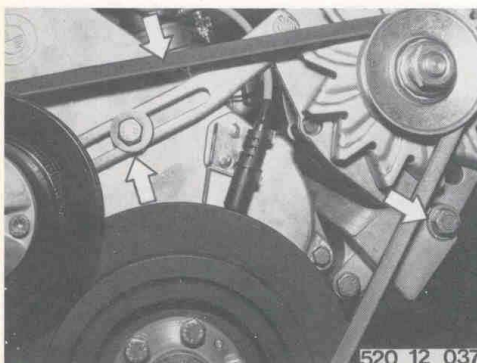


12 31 201 Carbon brushes – renewing

Take off the regulator and remove complete with carbon brush holder.

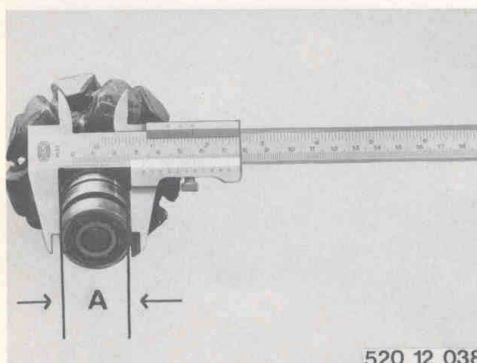


Unsolder the carbon brushes and solder in the new brushes.



12 31 301 V-belt – renewing

Loosen the alternator at the tensioning strap and the upper mounting. Take off the V-belt¹⁾. When installing: It should be possible to press in the V-belt by 5 ... 10 mm (0.2 ... 0.4 in).



12 31 569 Sliprings – skimming – alternator stripped –

To skim the sliprings, tailstock spindle EFAW 75 or GDF 85 R 3 must be used.

Remove only enough material to smooth out the scored areas.

Warning: Minimum slipring diameter 31.5 mm (1.24 in).

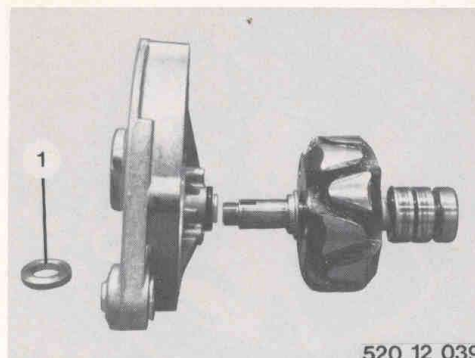
After skimming, check that sliprings still run true. Max. permissible runout 0.03 mm (0.0012 in).

¹⁾ See specifications.

**12 31 571 Rotor – renewing
– alternator stripped –**

Press the rotor out of the bearing plate.

When installing: The collar on disc (1) faces the ball bearing.

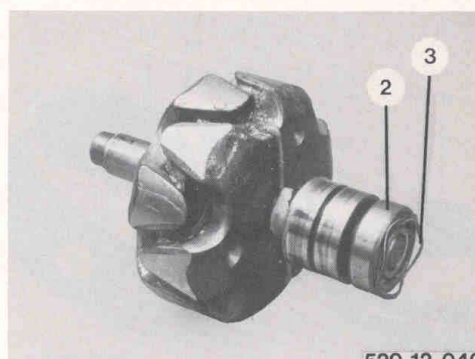


520 12 039

Pull the ball bearing (2) away from the rotor.
When installing: Grease the bearing with Ft 1 v 34 grease.

The open side of the bearing faces the housing.

Place the corrugated washer (3) into the housing before installing the ball bearing.



520 12 040

**12 31 581 Both ball bearings – renewing
– alternator stripped –**

Take off the retaining plate (2).

Press the ball bearing (3) out of the bearing plate.

When installing: The open side of the bearing faces the rotor.

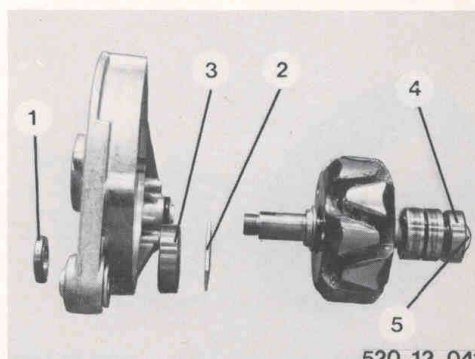
The shoulder on disc (1) faces the ball bearing.

Pull the ball bearing (4) away from the rotor.

Use only C 3 bearings.

The open side of the bearing faces the rotor.

Insert corrugated washer (5) into the housing before installing the ball bearing.



520 12 041

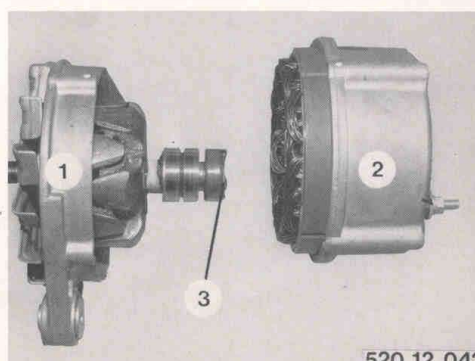
12 31 691 Diode board – renewing

Detach the regulator.

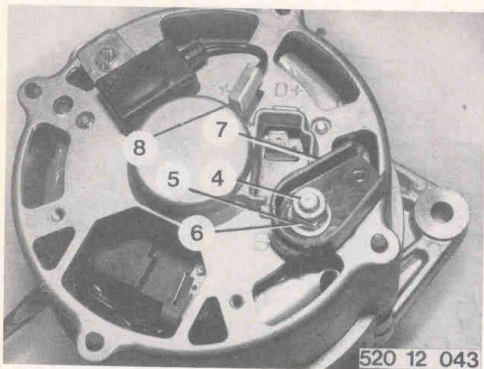
Mark the correct installed position of the housing (1) in relation to the slipring bearing (2).

Detach the housing (1) from the slipring bearing (2).

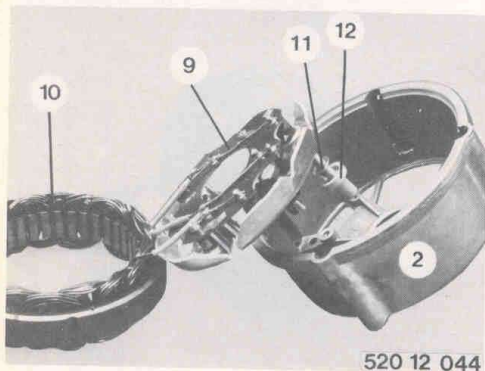
When installing: Attach corrugated washer (3) with Ft 1 v 34 grease before installing the ball bearing.



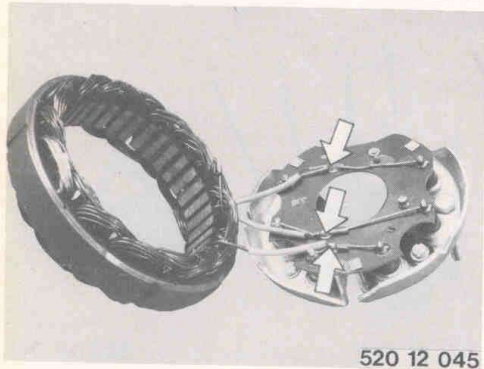
520 12 042



Remove nut (4) and spring washer (5), washer (6) and insulating washer (7). Pull off the plug (8) for the suppressor.



Detach diode board (9) and stator (10) from slipping mount (2). Note correct installed position of washer (11) and insulating bushing (12).



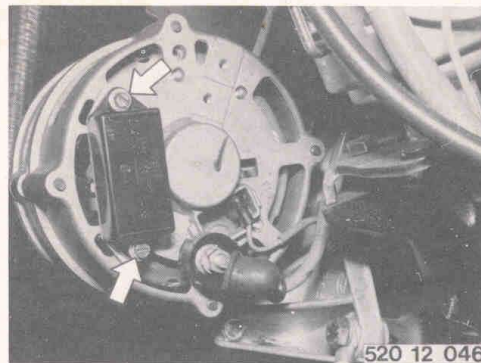
Unsolder the diode board from the stator winding.

12 32 001 Regulator – renewing

The regulator can only be renewed together with the carbon brush holder.

Remove and install the regulator.

When installing: use only Bosch regulator 0 192 052 004.

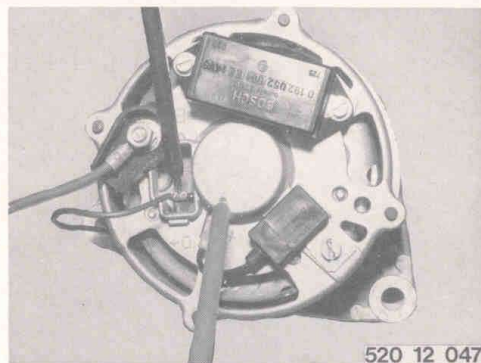


If Program tester is not available:

A. Full battery voltage must be available¹⁾. Connect a voltmeter between D+ and ground (earth).

At 2000 min⁻¹, a reading of 13.5–14.6 V must be obtained.

The regulator is defective if the reading exceeds 14.6 V.



¹⁾ See test values

2.73

¹⁾ See test values

12-32/1

12-32/1

Trouble-shooting – alternator

Fault	Cause	Remedy
Noise from alternator	Defective ball bearing Defective V-belt Belt pulley loose	Renew ball bearing Renew V-belt Tighten belt pulley nuts
Telltale lamp burns at half intensity when engine is running	V-belt slack Poor contact at cable connectors Regulator defective Defective carbon brushes Rectifier diode defective or has short to ground (earth) Short to ground (earth) at stator Partial short to ground (earth) at rotor	Correct V-belt tension Check cable connectors and cables Renew regulator Renew carbon brushes Renew rectifier diode Renew stator Renew rotor
Severe gas formation at battery	Poor contact between regulator and alternator Regulator defective	Check cable connections at regulator and alternator Renew regulator
Telltale lamp burns at half or full intensity when engine is running	Slack V-belt Defective regulator Open or short circuit in supply leads Defective carbon brushes Defective rotor winding Exciter current circuit broken Diodes or diode board defective	Retension V-belt Renew regulator Check cable connections and leads Renew carbon brushes Renew rotor Check cable connections Check diodes or diode board and renew if necessary Rectify short circuit or renew lead
Telltale lamp does not come on at all when engine is started	Telltale lamp bulb blown Lead 61 open circuit	Install a 4 Watt bulb Repair lead
Telltale lamp does not come on when ignition is switched on before engine is started	Telltale lamp bulb blown Battery run down Battery flat Lead detached or defective Defective regulator Positive diode short circuited in alternator	Install a new 4 Watt bulb Recharge battery Renew battery Renew lead or tighten connections Renew regulator Detach charge lead immediately to prevent battery discharge when engine is stopped; have alternator repaired Renew carbon brushes Have alternator repaired
Telltale lamp remains on when ignition is turned off	Defective diodes	Renew diode board

12 41 009 Starter – checking without removal from vehicle

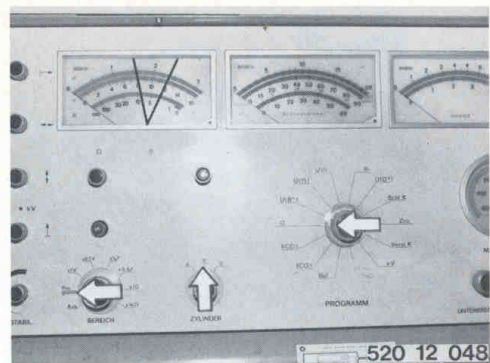
The battery must be fully charged¹⁾ before this test is made.

On cars with automatic transmission, the starter must be removed and checked on a starter test bench.

Engage a gear and hold the car with the foot brake.

Run the starter for 2–3 seconds.

Starting voltage must not drop below 8 V¹⁾.



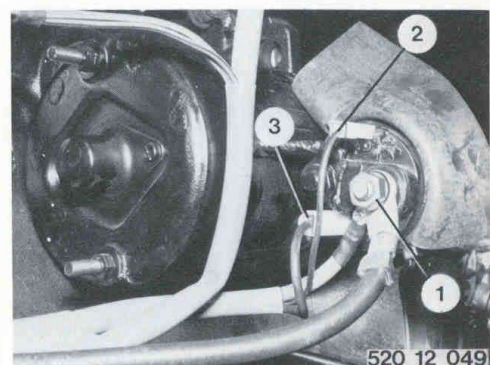
12 41 020 Starter – removing and installing

Disconnect the negative lead from the battery. Detach and attach the air cleaner – 13 71 000. Detach leads from starter.

(1) 30 to battery and alternator

(2) 50 black/yellow

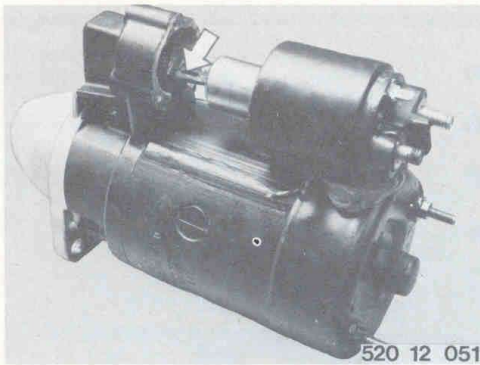
(3) 16 black/red



Remove the bolts retaining the starter and take out the starter.



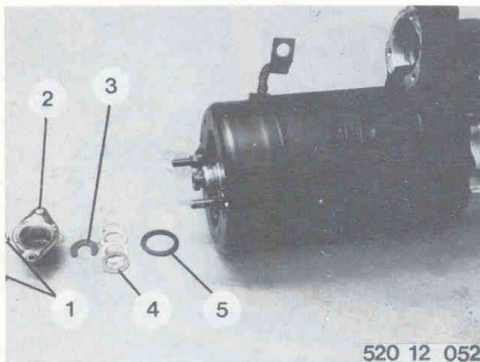
¹⁾ See test values



520 12 051

12 41 511 Solenoid switch – renewing – starter removed –

Unscrew the lead from the exciter winding.
Remove the bolts holding the solenoid switch.
Disconnect the engagement lever.

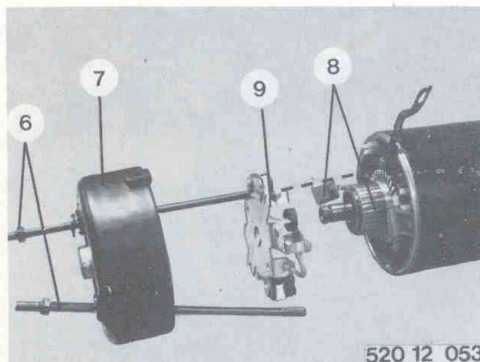


520 12 052

12 41 513 Starter – stripping and assembling

Remove the solenoid switch – 12 41 511.
Take out the retaining screws (1).
Take off the dust cap (2).
Remove the lock washer (3), shims (4) and seal (5).

When installing: use shims to adjust armature endplay to 0.10 ... 0.15 mm (0.004 ... 0.006 in) (4).

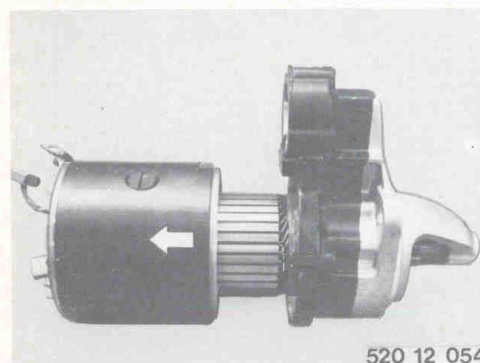


520 12 053

Remove the pole housing screws (6) and pull off cap (7).

Lift out the positive brushes (8) and detach the brush holder board (9).

When installing: note correct installed position of brush holder board (9). Pole housing screws (6) must be inserted through the locating slots in the brush holder board (9). Pass the exciter winding lead through the rubber seal. Check condition of commutator bearings.



520 12 054

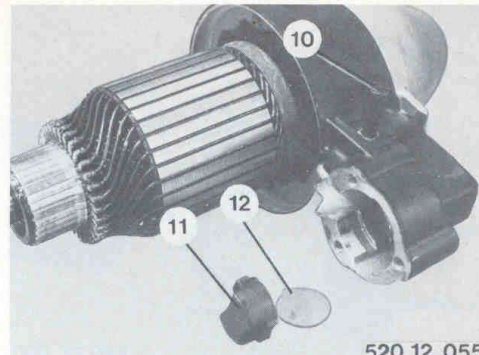
Separate the pole housing from the input side bearing.

When installing: note correct installed position of pole housing. The slot in the pole housing faces the rubber projection.

Remove pivot screw (10) for engagement lever.

Extract rubber seal (11) and washer (12).

When installing: lug on washer (12) and rubber seal (11) face towards armature.

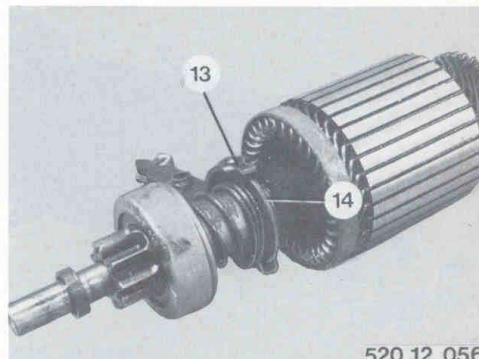


520 12 055

Pull the armature out of the input side bearing. Remove the engagement lever (13).

When installing: insert the engagement lever (13) so that the engagement ring (14) rests between the projections on the engagement lever.

Grease the engagement lever with Bosch Ft 2 v 3 silicone grease.



520 12 056

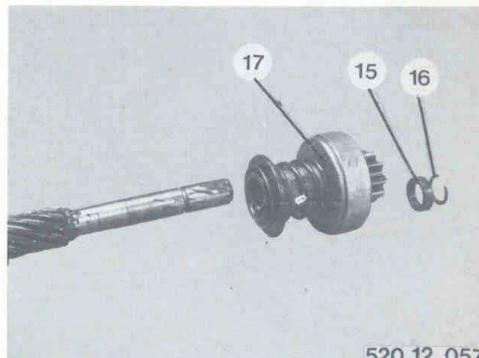
Press the thrust ring (15) back.

Lift out the circlip (16).

Pull off the starter gear (17).

When installing: apply Bosch Ft 2 v 3 silicone grease to spiral thread, engagement ring and intermediate bearing.

Pull thrust ring (15) over circlip (16).



520 12 057

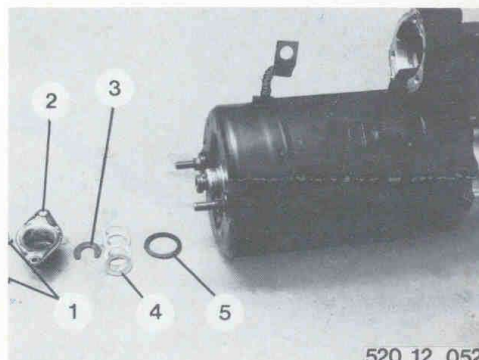
12 41 551 Carbon brushes – renewing – starter removed –

Take out the retaining screws (1).

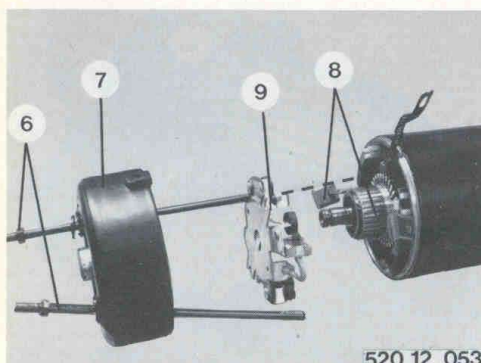
Take off the dust cap (2).

Remove the lock washer (3), shims (4) and seal (5).

When installing: adjust armature endplay with shims (4) to 0.10 ... 0.15 mm (0.004 ... 0.006 in).



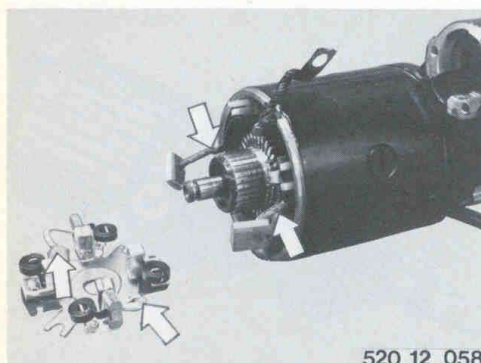
520 12 052



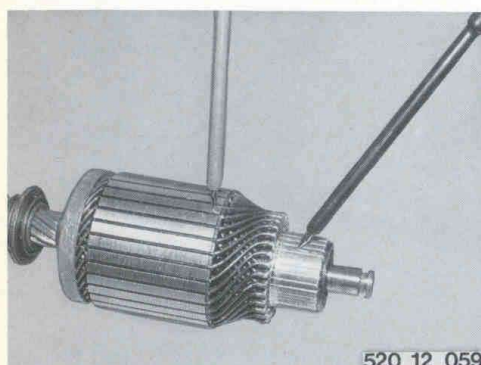
Remove the pole housing screws (6) and pull off the cap (7).

Lift out the positive brushes (8) and take off the brush holder plate (9).

When installing: note correct position of brush holder board (9). The pole housing screws (6) must be placed through the retaining slots in the brush holder board (9). Insert the exciter winding lead into the rubber seal. Check the commutator bearing.



Unsolder and resolder the carbon brushes to the exciter winding and the brush holder board.

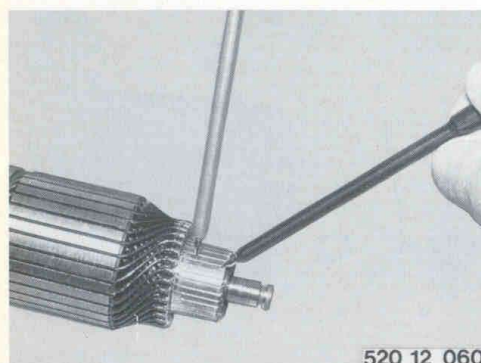


12 41 602 Starter – reconditioning – starter stripped down –

Check armature and field windings with 220 V test lamp.

Check the commutator and laminations with probes.

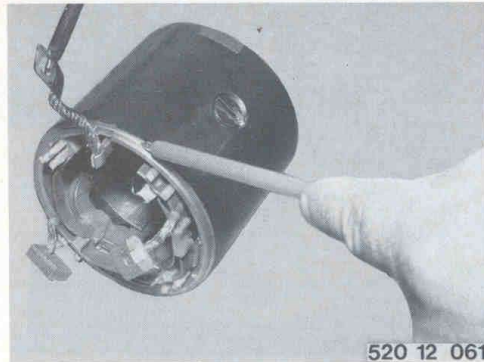
If there is a short to earth (ground), the lamp will light up. In this case, renew the armature.



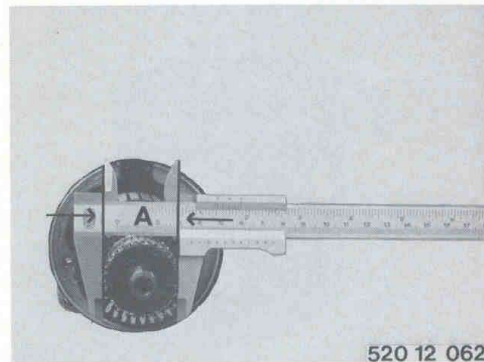
Introduce an ammeter with 60 A measuring range into the current circuit, and test each lamination of the commutator in turn by touching briefly with the test probe. Test voltage 2 ... 4 V. The needle deflection on the meter should be the same between all laminations.

Severe fluctuations indicate an open circuit. Renew armature if an open circuit is found.

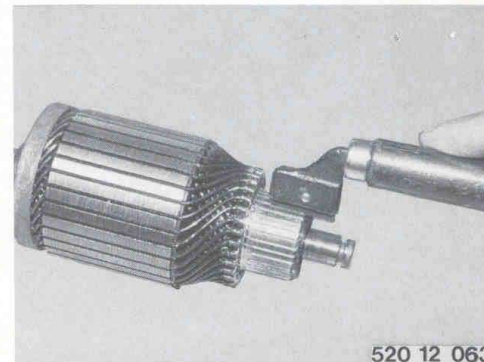
Check the exciter winding for short to earth (ground).
Carry out a visual inspection.
Renew burned or otherwise overheated windings.



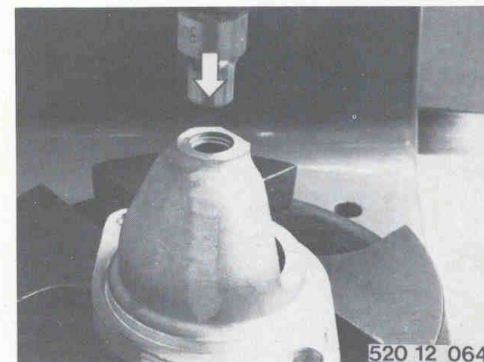
Skim the commutator surface to a fine finish. However, do not skim below the minimum commutator diameter (A) of 33 mm (1.3 in).

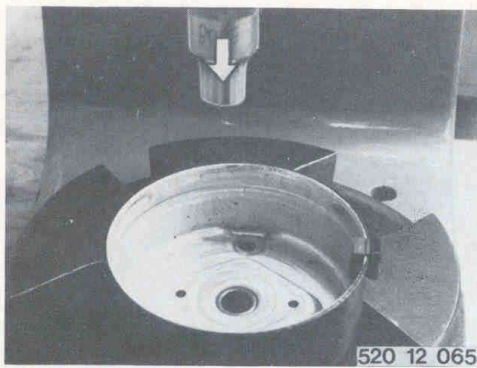


Cut back the insulation between the commutator plates.
The insulation should be 0.5 mm (0.02 in) below the surface of the plates.



Press out bushing if worn.
When installing: before inserting new bushing, soak it for at least half an hour in engine oil, then press in until flush.

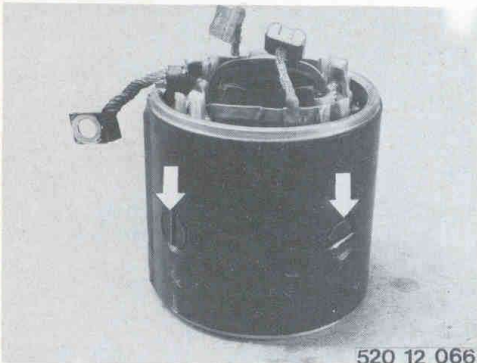




520 12 065

Press the bushing out of the intermediate bearing cap if worn.

When installing: soak the new bushing for at least half an hour in engine oil, then press in until flush.



520 12 066

12 41 701 Exciter winding – renewing – starter stripped down –

Mark the positions of the pole shoes so that they can be installed again in the same positions as before. Take out the four pole shoe screws and remove the pole shoes and the exciter winding from the pole housing.

When installing: before finally tightening the pole shoe screws after insertion, align the pole shoes exactly parallel with the longitudinal axis.

Kraftstoffaufbereitung und -regelung

Fuel supply and adjustments

Alimentation et réglage au carburant

Alimentazione di carburante e

regolazione

Alimentación de combustible y reglaje

Bränslesystem

Benzinetoevoer en afstelling

13 Fuel Supply

Specifications	Page 13-0/3
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1311009 Carburetor—cleaning	11/1
044 Automatic choke—adjusting	11/3
054 Quantity of fuel injected by accelerator pump—checking/adjusting	11/4
065 Heat-sensitive bypass (TN) starting system—checking/renewing	11/6
100 Carburetor—removing and installing	11/6
111 Insulating flange—renewing	11/7
171 Carburetor cover gasket—renewing	11/7
241 Float needle valve—renewing	11/8
278 Bedplate gasket—renewing	11/9
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391 Idle valve—renewing	11/10
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1331009 Fuel pump pressure/float needle valve—checking	31/1
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1353100 Injectors—removing and installing	53/1
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1372001 Air cleaner element—renewing	72/1
1373004 Warm air regulating flap valve—adjusting	73/1

Specifications

Fuel supply and regulation

Model	320/6 320/6 A
13 00 . . . Carburetor, general	
Make	DVG (Solex)
Type	Two-stage
Reference	4 A 1
Auxiliary system	TN (heat-sensitive bypass) starting system
Float chamber ventilation	interior vented
DVG number	E 17 603
BMW identification number on type plate	1 266 255
Type plate	rectangular, flat
Color	blue
13 00 . . . Engine idling	
Idle speed	1/min 800 . . . 900
CO content of exhaust at idle speed	% by vol. 0.5 . . . 1.5

Fuel supply and regulation Specifications

Model	320/6 320/6 A	
13 11 . . . Carburetor settings (4 A 1) carburetor No. 1 266 255		
Gap at throttle arm and idle stop – setting of throttle butterfly adjuster –	Stage I	mm (in)
	Stage II	mm (in)
	2.9 ± 0.2 (0.114 ± 0.008)	
Spring length with vacuum can in rest position	Stage I	mm (in)
	Stage II	mm (in)
	23 ± 0.3 (0.906 ± 0.012)	
Choke butterfly gap	Stage I	mm (in)
	Stage II	mm (in)
	1.2/4.0 ± 0.2 (0.047/0.157 ± 0.008)	
Air butterfly gap	Stage I	mm (in)
	Stage II	mm (in)
	0.3 . . . 0.8 (0.012 . . . 0.032)	
Fuel level (measured at center)	mm (in)	7 ± 1 (0.276 ± 0.039)
Quantity injected per stroke	cm ³ (fl.oz)	0.5 ± 0.15 (0.176 ± 0.053)
TN (heat-sensitive bypass) starting system at 20° C (68° F) coolant temperature Gap A	mm (in)	2.0 . . . 2.2 (0.079 . . . 0.087)

Specifications

Fuel supply and regulation

Model	320/6 320/6 A	
13 11 . . . Carburetor jets and fittings		
Air venturi diameter	Stage I	mm (in)
	Stage II	mm (in)
Main jet	Stage I	20 (0.79)
	Stage II	—
Air correction jet	Stage I	× 97.5
	Stage II	B 5 ¹⁾
Idle jet	Stage I	90
	Stage II	—
Idle air jet	Stage I	42.5
	Stage II	—
Additional air jet (TM starting system)	Stage I	110
	Stage II	—
Additional fuel jet (TM starting system)	Stage I	100
	Stage II	—
Jet needle	Stage I	57.5
	Stage II	—

Specifications

Fuel supply and regulation

Model		320/6 320/6 A
13 11 . . . Carburetor settings (4 A 1) continued (carburetor number 1266 255)		
Float needle valve diameter	mm (in)	2.5 (0.098)
Choke cover identification number		171
Float weight	g (oz)	6.8 ± 0.35 (0.240 ± 0.012)
13 11 . . . Idle shutoff valve		
Make		Pierburg
No./jet size		PE 20 273/2.5 ± 0.05
Nominal voltage	V	12
Max. permissible voltage	V	16.5
Max. current consumption at 12 V	A	0.25 ± 0.02
13 11 . . . Vacuum regulator		
Make		Pierburg
Type (No.)		PE 20 464

Specifications

Fuel supply and regulation

Model	320/6 320/6 A
1331 . . . Mechanical fuel pump	
Make	Pierburg
Type (No.)	PE
Delivery pressure (gauge)	bar (lb/in ²)
– at intermediate shaft speed	1/min 0.21 . . . 0.30 (2.99 . . . 4.27)
– at engine speed	1/min 3 000 4 000
Minimum delivery flow	l (Imp. pints, US quarts)/h 55 (97, 58)
– at intermediate shaft speed	1/min 3 000
– at engine speed	1/min 4 000
Length of pump plunger	mm (in) 36 (1.42)
Insulating flange with gasket	mm (in) 20 ± 0.15 (0.787 ± 0.006)
1331 . . . Fuel return valve	
Make	Pierburg
Type (No.)	20 439

Specifications

Fuel supply and regulation

Model	320/6 320/6 A	
Tightening torques		
13 11 . . . Carburetor		
Carburetor to intake pipe	Nm kpm lb.ft	5.9 . . . 7.85 0.6 . . . 0.8 4.4 . . . 5.8
Idle shutoff valve, max.	Nm kpm lb.ft	4.2 0.43 3.1
13 31 . . . Fuel pump		
Fuel pump to cylinder head	Nm kpm lb.ft	5.9 . . . 7.85 0.6 . . . 0.8 4.4 . . . 5.8

Specifications

Fuel supply and regulation

Model	323 i 323 i A *)
1300 . . . Fuel injection system/engine idling	
Bosch fuel injection system	K-Jetronic
Idle speed	1/min 850 . . . 950 . . . *)
CO content of exhaust at idle speed	% by vol. 1.0 . . . 2.0 . . . *)
1351 . . . Mixture regulator (with airflow meter and flow distributor)	
Make	Bosch
Bosch number	0 438 060 025
Airflow meter Make	Bosch
Bosch number	0 438 120 086
Color code	yellow/violet
Flow distributor Make	Bosch
Bosch number	0 438 100 028
Color code	black/red

*) Version for Sweden

Fuel supply and regulation

Specifications

Model	323 i 323 i A *)
13 53 . . . Injectors	
Make	Bosch
Type and Bosch number	EPILKE 6/0 437 502 006
Opening pressure (gauge)	bar (lb/in ²) 3.3 (46.9)
Spray angle	deg. app. 35
13 62 . . . Temperature/time switch	
Make	Bosch
Bosch number	0280 130 220
Nominal voltage	V 12
Switching point	°C (°F) + 35 (+ 95)
13 63 . . . Warming-up regulator (with full-load enrichment)	
Make	Bosch
Bosch number	0 438 140 005
Nominal voltage	V 12
Max. permissible voltage	V 20 (for brief periods)
Operating voltage	V 7 . . . 15

*) Version for Sweden

Specifications

Fuel supply and regulation

Model		323 i 323 i A *)
1363 . . . Additional air slide		
Make		Bosch
Bosch number		0280 140 118
Nominal voltage	V	12
Max. permissible voltage (for short periods)	V	
Operating voltage	V	7 . . . 15
1364 . . . Electric starting valve		
Make		Bosch
Bosch number		0280 170 411
Nominal voltage	V	12
Operating voltage	V	7 . . . 15
Current consumption	W	app. 37
Spraying angle	deg.	app. 80
Operating pressure	bar (lb/in ²)	app. 4.5 (64)

*) Version for Sweden

Fuel supply and regulation

Specifications

Model	323 i 323 i A *)	
Tightening torques		
13 53 . . . Injectors		
Injector collar nut	Nm kpm lb.ft	25 2.5 14.47
13 62 . . . Temperature/time switch		
Temperature/time switch, max.	Nm kpm lb.ft	30 3.0 22.1

*) Version for Sweden

13 00 054 Engine idling – adjusting/ checking exhaust emissions

A) Carburetor engine

1) Idle speed

Before performing the work, check that ignition timing is correct and the engine is at normal operating temperature.

Oil temperature should be at least 60°C (140°F).

Take off the air cleaner – 13 71 000.

Attach the air cleaner simulator 13 0 000, using the hose between the air cleaner and the rocker cover.

Connect the BMW digital tester.

Turn screw (1) to adjust engine idle speed to $850 \pm 50/\text{min}$.

Warning: remove the safety keepers (to prevent unauthorized tampering with the settings) using puller 13 1 012. After adjusting idle speed, install new keepers (color blue) with press tool 13 1 017.

2) Exhaust emissions (% CO by volume)

Remove the screw plugs on the exhaust manifolds and insert measuring probes 13 0 020. Connect the exhaust emissions tester to the probes.

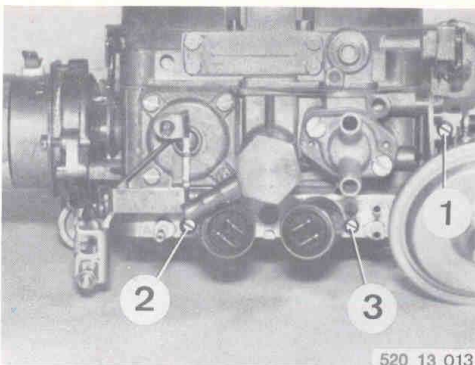
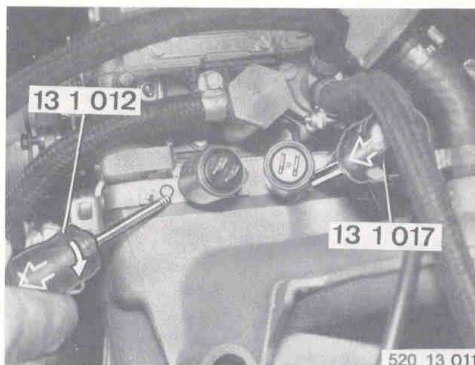
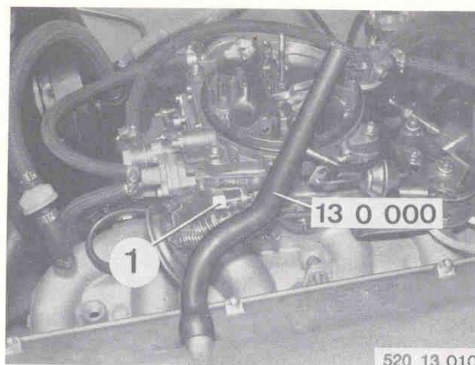
The CO value is measured separately for the front and rear exhaust manifolds.

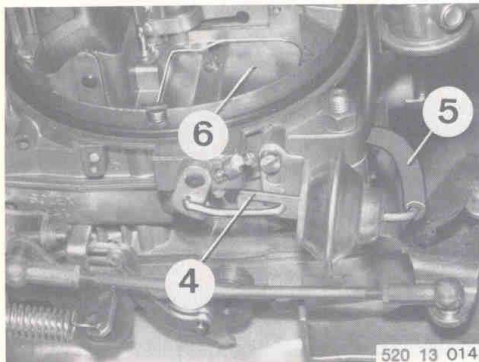
Turn the mixture regulating screws (2 and 3) to adjust the CO content of the exhaust to $1 \pm 0.5\%$ by volume.

Screw (2) = rear exhaust manifold

Screw (3) = front exhaust manifold

If the idle speed changes, correct again at screw (1).





3) Checking operation of stage II damper
Check that the air butterfly moves freely and the throttle butterfly closes correctly.
Run the engine at idle speed.

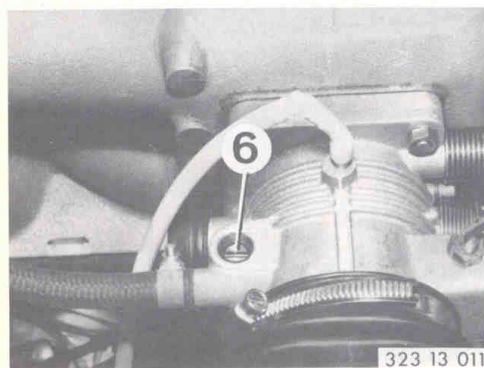
Lever (4) must be pulled against its stop by the diaphragm.

Detach hose (5) ('Matra' clip or similar).

Operate the air butterfly (6) several times.

The diaphragm is in good working order if the lever (4) always returns to the end stop.

Warning: attach the actuating rod with the bend pointing down, or else the accelerator linkage may stick.

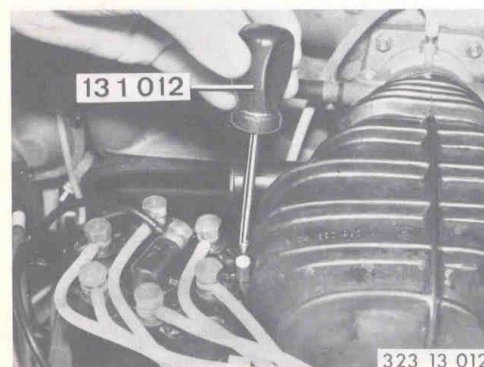


B) Fuel injection engine

– engine at normal operating temperature –

1) Idle speed

Turn screw (6) to adjust engine idle speed to $900 \pm 50/\text{min}$.



2) Adjusting CO content of exhaust

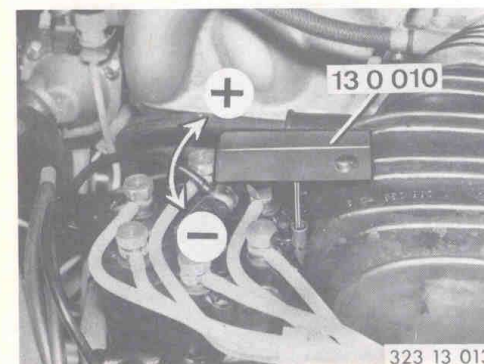
Remove the screw plugs from the exhaust manifolds and insert measuring probes 13 0 020.

Connect the exhaust emissions tester.

Measure the CO content of the exhaust separately at the front and rear manifolds.

Warning: remove the safety keeper (designed to prevent unauthorized tampering with the settings) using puller 13 1 012.

After adjusting engine idling and the CO content of the exhaust, a new keeper must be installed. Use socket head 13 1 018 for this purpose.



Use adjusting wrench 13 0 010 to set the CO value of the exhaust emissions to $1 \pm 0.5\%$.

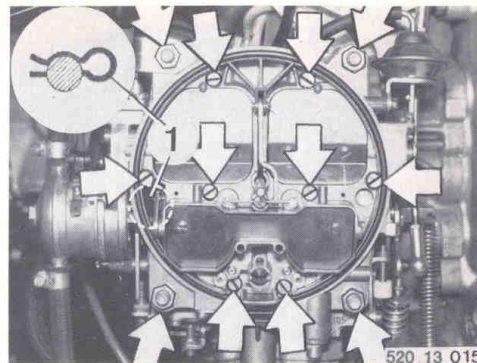
After adjustment, remove the wrench and accelerate briefly.

13 11 009 Carburetor – cleaning

Detach the air cleaner – 13 71 000.

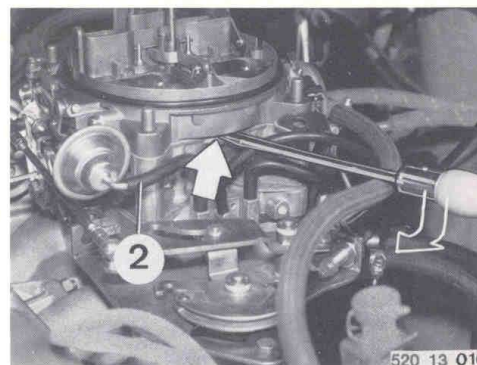
Remove keeper (1) and detach the connecting rod. Unscrew the four nuts and the eight machine screws.

When installing: place the holder with the return valve on the pin, and tighten the nuts in a cross-wise sequence to 8 ... 10 Nm (5.9 ... 7.3 ft.lb) torque.



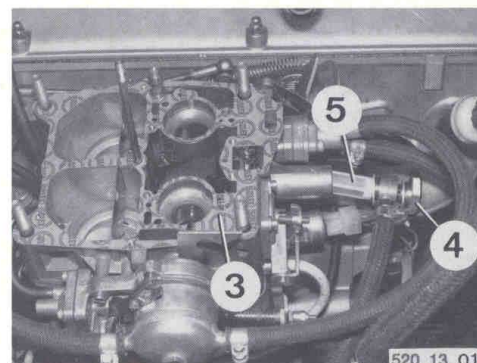
Detach the vacuum hose (2) from the stage II damper.

Press off the carburetor cover with a screwdriver at the point provided.



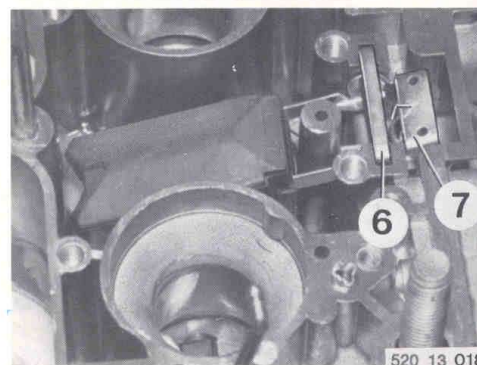
When installing: use a new gasket (3).

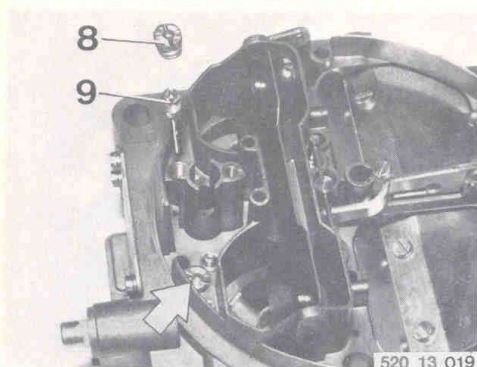
Remove hollow screw (4) with filter (5), and clean the filter.



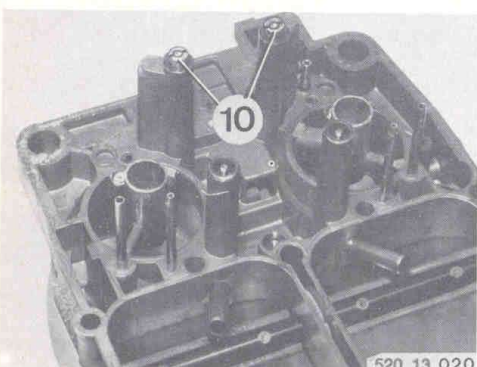
Take out retainer (6), float and float needle valve.

Warning: connect the retaining spring (7) for the float needle valve from the float side.

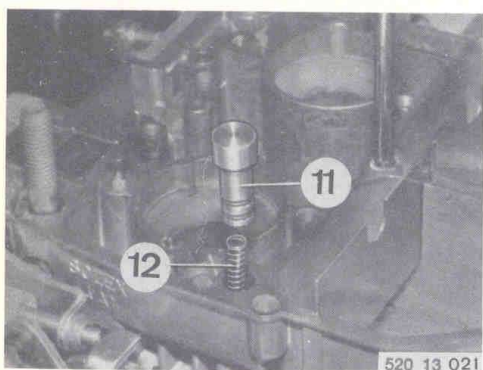




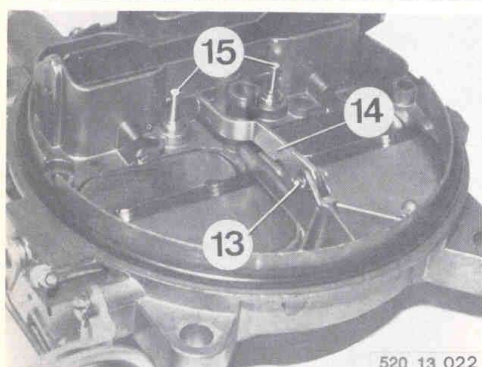
Unscrew and remove idle air jets (8) and idle jets (9).



Clean the two main jets (10).



Lift out plunger (11) and spring (12).



Remove the keeper from pivot (13). Remove pin, lever (14), jet needles (15) for stage II air correction and the plungers.

Warning: mark the correct installed positions of the jet needles.

Blow through all passages and jets with compressed air.

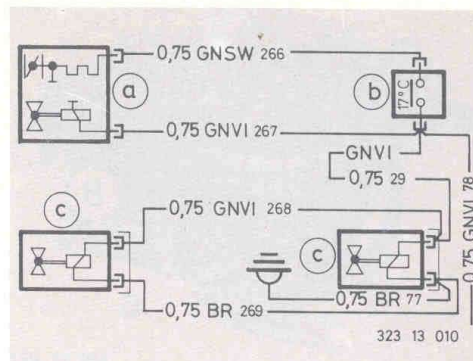
13 11 044 Automatic choke – adjusting

Circuit diagram for cold-start system

a) Automatic choke

b) Coolant temperature switch, 17°C (63°F)

c) Idle cut-off valves

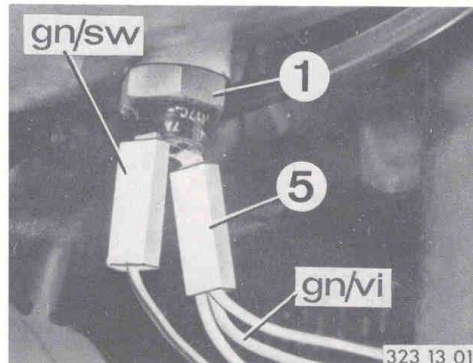


17°C (63°F) heat-sensitive switch

The heat-sensitive switch (1) controls the current supply to the spiral heating element in the choke cover, which is operated when coolant temperature exceeds +17°C (+63°F).

When the ignition is switched on, the green/violet leads (5) must be live.

Heat-sensitive switch (1) is in good working order if the terminal for the green/black leads is not live below a coolant temperature of +17°C (+63°F).



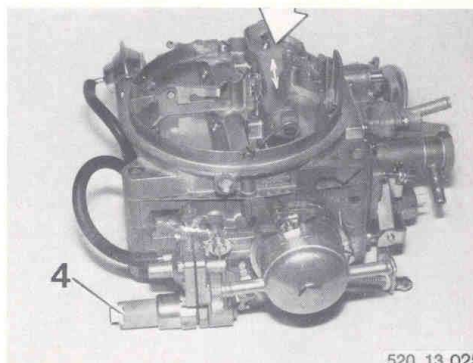
Choke butterfly pulldown

1. Adjust choke butterfly gap 'S 1'.

The ignition should be switched off.

Warning: choke butterfly gap 'S 1' can only be adjusted at temperatures not exceeding +20°C (+68°F). At temperatures above +20°C (+68°F): the servo motor (4) must be cooled.

Check that the choke butterflies can move freely.



Detach the choke cover – 13 11 360.

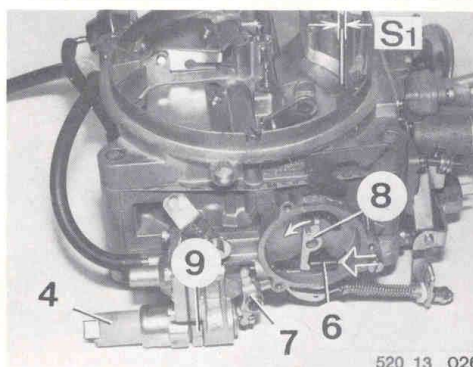
Push the pulldown rod (6) to the left until it is against intermediate lever (7).

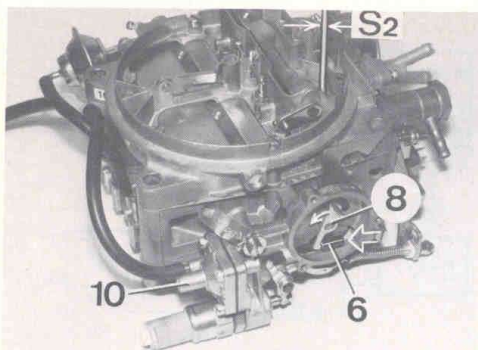
Move lever (8) at the pulldown rod (6) up to its stop.

With a 1.2 mm (0.047 in) twist drill or rod, check choke butterfly gap 'S 1' at the lobe of the butterfly which moves downwards.

The gap should be 1.2 ± 0.1 mm (0.047 ± 0.004 in).

Correct by slackening nut (9) and turning the servo motor (4).





520 13 027

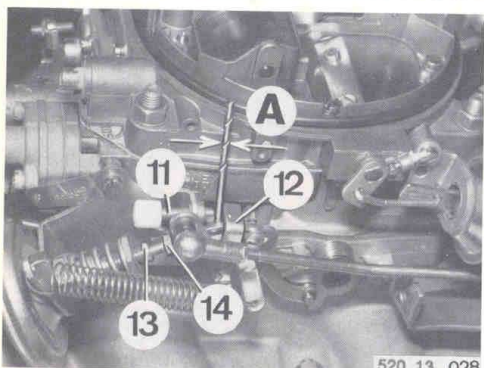
2. Adjust choke butterfly gap 'S2'.

Switch on the ignition.

After approx. 150 s have elapsed, press the pulldown rod (6) to the left until against its stop. Move the lever (8) on the pulldown rod (6) against its stop.

With a 4.2 mm (0.165 in) twist drill or rod, check, choke butterfly gap (S2) at the lobe which moves downwards. The gap must be 4.2 ± 0.1 mm (0.165 $\pm$ 0.004 in).

Correct at screw (10).

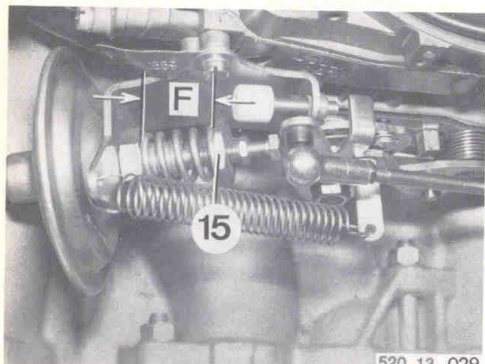


520 13 028

Adjusting the throttle butterfly actuator

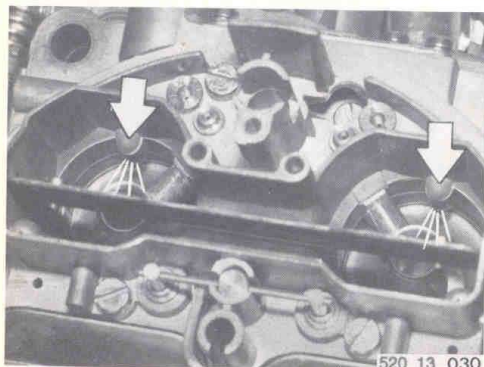
Check gap (A) between screw (11) and throttle lever (12). It should be 3.0–0.2 mm (0.118–0.008 in).

To correct, slacken locknut (13) and turn screw (14).



520 13 029

Check spring length (F) = 23 mm (0.91 in) between the nuts, and adjust if necessary at nut (15).



520 13 030

13 11 054 Quantity of fuel injected – checking/adjusting

Take off the air cleaner – 13 71 000.

Actuate the throttle butterfly lever several times.

A spray of fuel should be seen to emerge from the two fuel outlets.

If no fuel is injected:

a) check that the jets at the fuel outlet points are not blocked, and clean the jets if necessary.

b) take off the pump cover.

Check condition of diaphragm and renew if necessary.

Blow through the suction and discharge passages.

When installing: the smaller diameter of the conical spring faces the diaphragm.

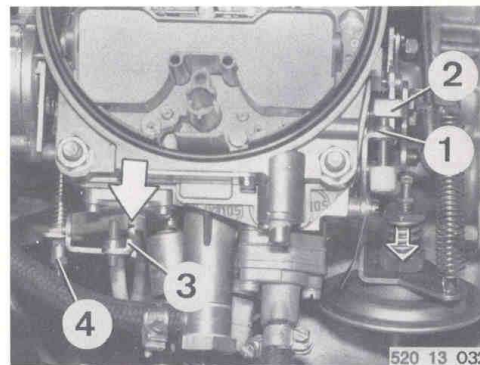


Move the throttle butterfly actuator back until the idle speed stop screw (1) touches lever (2).

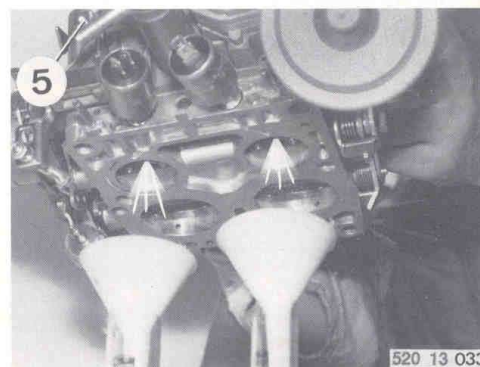
For cars with automatic transmission: obtain a gap of 1 mm (0.04 in) between idle stop screw (1) and lever (2).

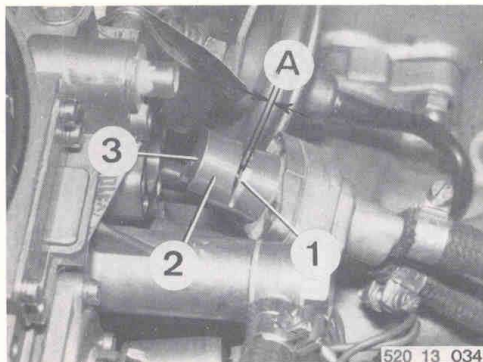
Lever (3) should then just touch the diaphragm plunger.

Correct at nut (4).



To measure the quantity of fuel injected by the accelerator pump, detach the carburetor – 13 11 100. Attach a vessel containing fuel 2 m (6 ft 6 in) above the carburetor, connect it to the carburetor and fill it with the correct grade of fuel. Operate the throttle butterfly lever several times slowly through its full range of movement. Trap the emerging fuel with a funnel and measuring flask. Per stroke and per side, the quantity of fuel should be $0.5 \pm 0.1 \text{ cm}^3$ ($0.176 \pm 0.035 \text{ fl. oz.}$). Adjust the quantity at the stroke limiting screw (5). Tighten screw (5) to reduce the quantity of fuel injected.





13 11 065 Heat-sensitive bypass (TM) starting system – checking/renewing

A) Checking

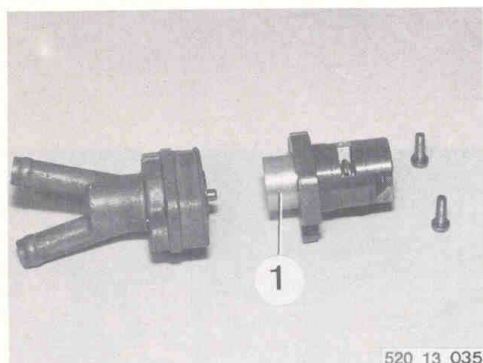
Remove the TM starter assembly.

At a coolant temperature of +20°C (+68°F), there must be a gap (A) = 2.2 ± 0.2 mm (0.087 ± 0.008 in) between plunger (1) and housing (2).

At normal operating temperature, plunger (1) should just have closed the gap.

To check and adjust the TM starting system, cool it to +20°C (+68°F) with water, and adjust the gap (A) with screw (3).

When installing: note correct position, with slot facing up.



B) Renewing TM starter system

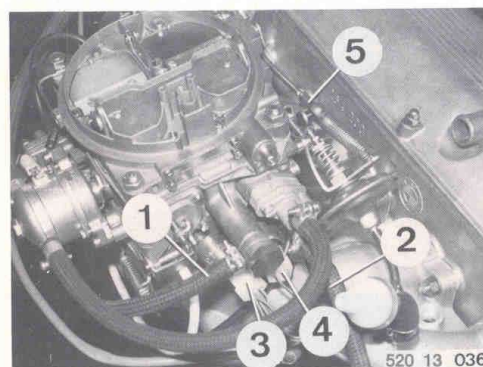
Trouble-shooting:

Engine warm

Plunger (1) sticking – gap remains open
= CO content of exhaust (in % by vol.) very high
= Engine runs on after ignition has been switched off.

Engine cold

Plunger (1) sticking – no air gap
= Engine will not idle



13 11 100 Carburetor – removing and installing

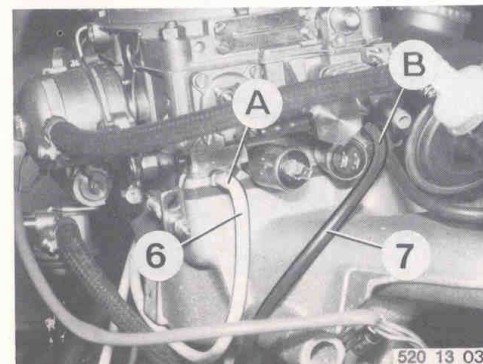
Remove the air cleaner – 13 71 000.

Partly drain the coolant.

Detach fuel hose (1), coolant hose (2), both plugs from idle shutoff valves (3 and 4) and accelerator linkage (5).

When installing: add coolant.

Bleed the cooling system – 17 00 039.



Detach white vacuum hose (6) from connection A and black vacuum hose (7) from connection B.

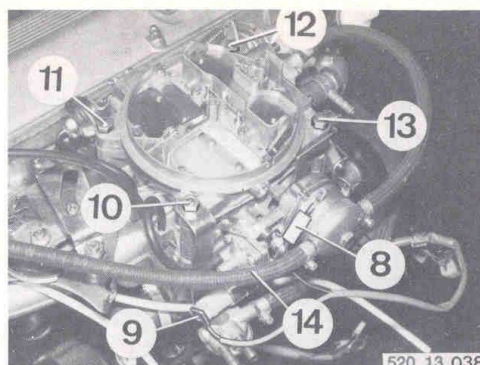
Detach green/black lead (8) from choke body, green/violet lead (9) from servo motor and loosen nuts (10 ... 13).

Take off coolant hose (14).

Take off carburetor.

When installing: tighten nuts (10 ... 13) in a crosswise sequence to 8 ... 10 Nm (5.9 ... 7.3 lb.ft) torque.

Secure retaining bracket for return valve with nut (10).

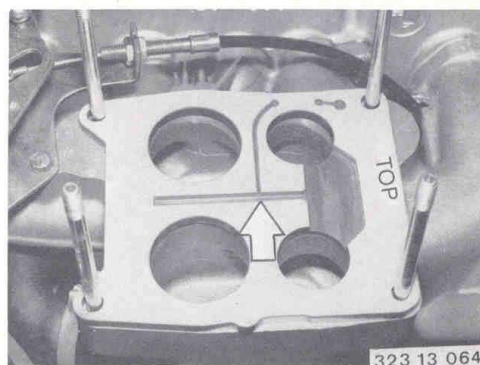


13 11 111 Insulating flange – renewing

Remove carburetor – 13 11 100.

Take off the insulating flange.

When installing: the milled channels face the carburetor.



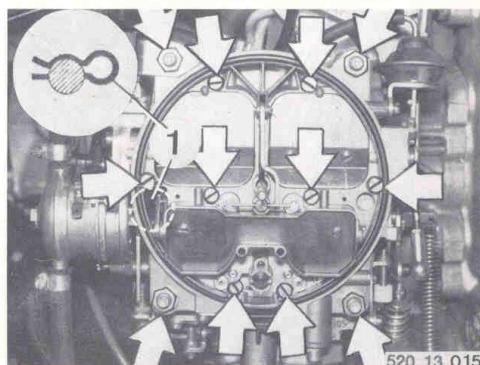
13 11 171 Carburetor cover gasket – renewing

Detach the air cleaner – 13 71 000.

Remove keeper (1) and detach connecting rod.

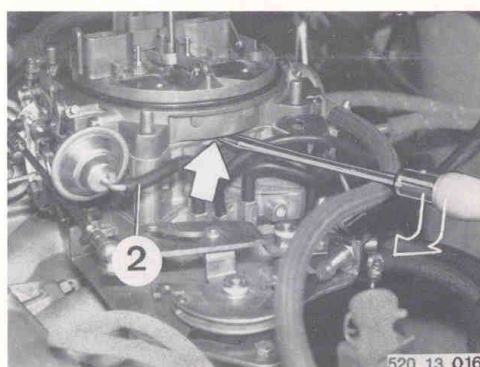
Loosen the 4 nuts and 8 machine screws.

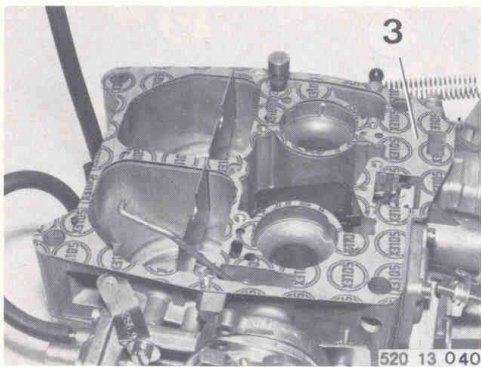
When installing: place holder with return valve on to pin and tighten nuts in a crosswise sequence to 8 ... 10 Nm (5.9 ... 7.3 lb.ft) torque.



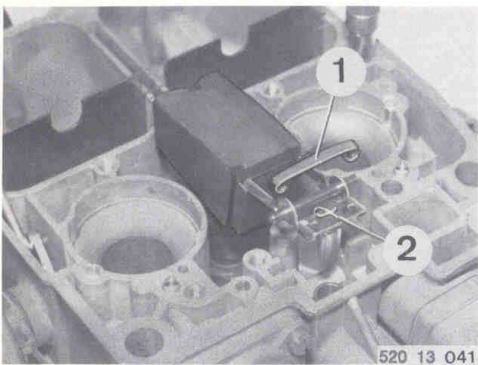
Detach vacuum hose (2) from the stage II damper.

Lever off the carburetor cover at the prescribed point with a screwdriver blade.





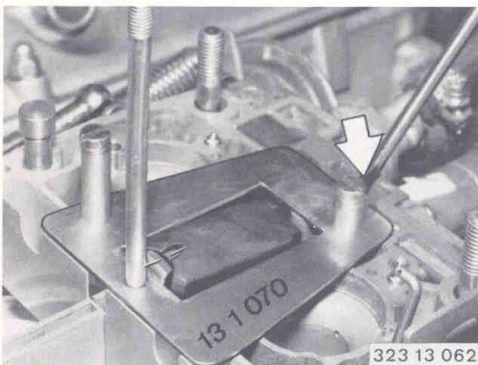
Renew gasket (3).



13 11 241 Float needle valve – renewing

Remove the carburetor cover – 13 11 171.
Lift out the retainer and take out the float with float needle valve.

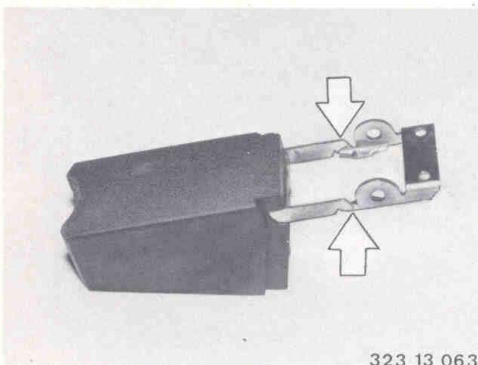
When installing: attach the retaining spring (2) from the float side.



Check fuel level and float setting with gauge 13 1 070.

Screw on the gauge. The float with float needle valve and retainer must be installed. Raise the float until resistance is encountered (float needle cannot move any further).

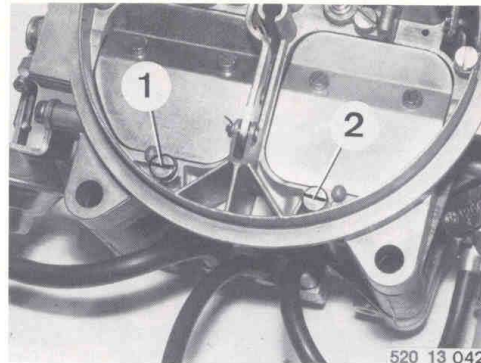
The projection on the gauge should then be in line with the top of the cutout in the float.



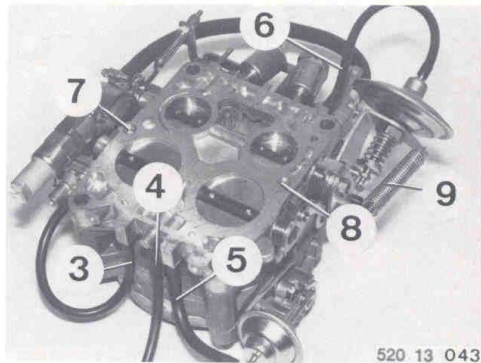
Correct float position by bending at the prescribed point (3).

13 11 278 Bedplate gasket – renewing

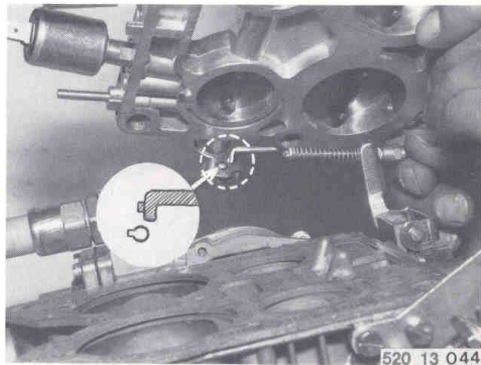
Remove the carburetor – 13 11 100.
Take out machine screws (1) and (2).



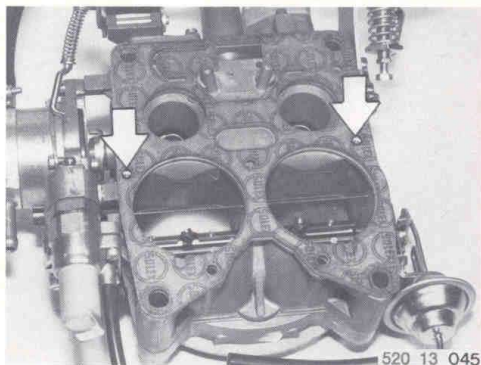
Pull off vacuum hoses (3 ... 6).
Remove screws (7) and (8).
Disconnect spring (9).

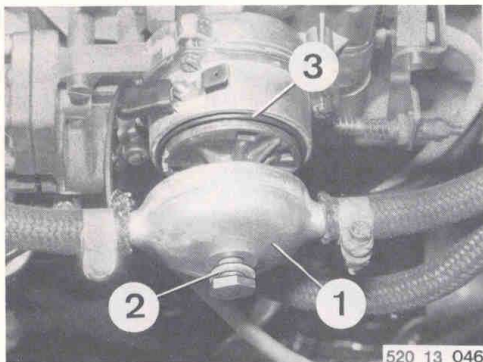


Raise the throttle butterfly section and turn through 180 degrees. Disconnect the accelerator pump linkage.



Renew the gasket.
When installing: the holes must be aligned with the tapped holes.





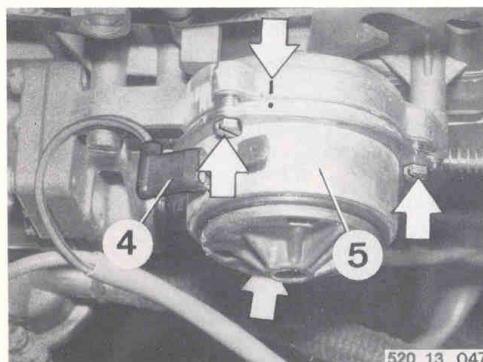
13 11 360 Choke cover/spiral heating element – renewing

Partly drain the coolant.

Detach the water stub pipe (1).

When installing: check condition of sealing washer (2) and O-ring (3) and renew if necessary.

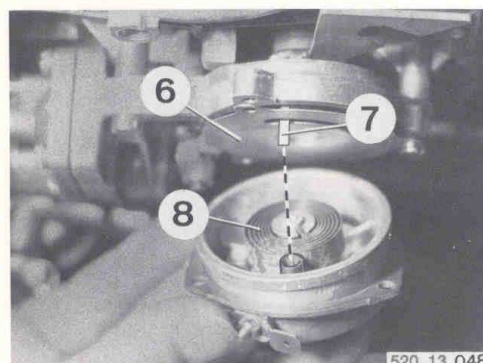
Add coolant and bleed the cooling system – 17 00 039.



Detach lead (4).

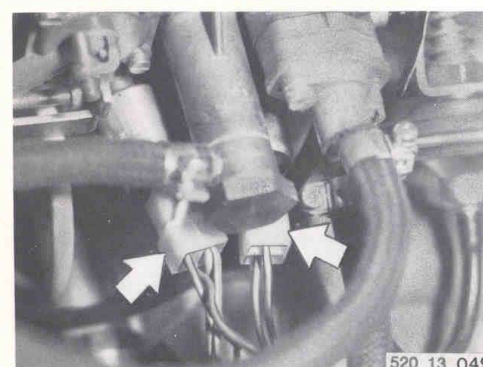
Take off the choke cover (5).

When installing: the marks on the choke cover and the choke body must be opposite each other.



When installing: the raised side of the depression in the intermediate plate (6) faces the carburetor.

Connect the actuating lever (7) and bimetallic spring (8).



13 11 391 Idle valve – renewing

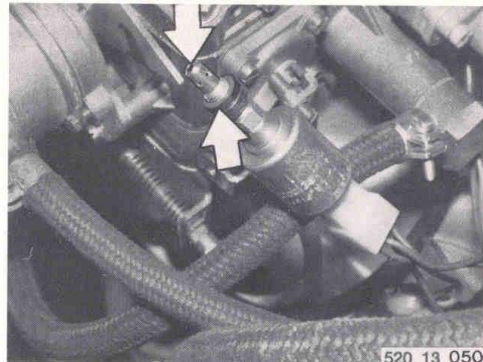
With the ignition switched on, the plugs for the green/yellow leads must be live.

Brown lead = earth (ground).

Pull off the plugs, then re-attach.

The idle valve is in good working order if a clicking sound can be heard.

Unscrew and remove the idle valve.
Warning: do not damage the conical sealing face.
A loose idle valve will cause misfiring and running on.
Check the gasket and renew if necessary.



520 13 050

2.73

13-11/11

2.74

13-11/11

Trouble-shooting – Solex 4 A 1 carburetor

The following conditions must be fulfilled before this trouble-shooting table can be used:

1. Normal compression in all cylinders
2. Valve clearances adjusted to specified values
3. Dwell angle and ignition timing to specification
4. All ignition system components in good working order

Fault	Cause	Remedy
Poor cold starting	Choke butterfly not closing	Free or adjust choke butterfly Servo motor sticking: renew
	Defective bimetallic spring in choke cover	Renew choke cover
	Choke cover out of adjustment	Adjust choke cover correctly
	Throttle butterfly not advanced sufficiently	Adjust throttle butterfly positioner
	Cold start mixture enrichment supply blocked	Clean carburetor
	Vacuum retard can operating	Renew thermo-valve (heat-sensitive valve)
	Choke butterfly setting incorrect	Adjust choke butterfly correctly
	Throttle butterfly positioner defective	Renew throttle butterfly positioner
Engine starts when cold but will not run	Choke butterfly does not move to 'S 2'	No power supply to servo motor Defective servo motor: renew
	TN (heat-sensitive bypass) starting system not working	Blow through air connection jet via TN starting system with compressed air Adjust TN gap to 2.0 ... 2.4 mm (0.079 ... 0.094 in) at 20 °C (68 °F)
	Pulldown diaphragm leaking	Renew pulldown diaphragm or seal housing
	Automatic choke jammed or incorrectly adjusted	Adjust automatic choke
	Vacuum hoses porous/leaking	Renew vacuum hoses

Fault	Cause	Remedy
Extremely irregular running or stalling during warming-up	Choke butterfly gap 'S 2' too large	Set 'S 2' to 4.2 mm (0.165 in)
1. Fuel-air mixture too weak	Preload at choke butterfly absent or too low	Set choke cover to mark, or renew
	Temperature switch in intake pipe defective (circuit closed below 17°C/63°F)	Renew temperature switch
	TN starting system not supplying any mixture	Blow through the TN fuel jet
	TN starting system supplying too little mixture	Check plunger setting and adjust if necessary at 20°C (68°F) to 2.0 . . . 2.4 mm (0.08 . . . 0.09 in)
	Ignition retarded below +17°C (+63°F) – coolant temperature switch operating	Renew thermo-valve (heat-sensitive valve)
2. Fuel-air mixture too rich	Basic idle setting too lean	Set idle mixture for both groups of cylinders to 1 ± 0.5% CO by volume (with engine at normal operating temperature)
	Intake air system leaking	Seal intake system
	Choke butterflies sticking	Free choke butterflies
	Choke butterfly gap too small at idle speed	Adjust choke butterfly gap 'S 1' to 1.2 mm (0.047 in)
	Pulldown diaphragm leaking	Renew pulldown diaphragm or seal housing
	Pulldown mechanism or choke butterfly system sticking	Free these items
	Choke butterfly gap 'S 2' too small	Adjust 'S 2' to 4.2 mm (0.165 in)
	Defective automatic choke heating	Check power supply, renew choke cover if necessary
	Temperature switch in intake pipe not opening circuit above 17°C (+63°F)	Renew temperature switch in intake pipe
	Basic idle settings differ too widely	Set idle speed CO content of exhaust to 1 ± 0.5% by volume at both cylinder groups (engine at normal operating temperature)

Fault	Cause	Remedy
Poor idling	Idle shutoff valve defective or inoperative	Repair supply lead
	Electric lead defective	
	Internal fault in idle shutoff valve	Renew idle shutoff valve
	Idle fuel jets blocked	Clean idle fuel jets with compressed air from the top, through the idle air jets
	Leaks at vacuum cans	Check spray, trace and remedy leaks
	Leak at intake pipe vacuum connections	
	Leak at carburetor gasket	
	Leak at intake pipe	
	Blocked TN (heat-sensitive bypass) starting system jets	Blow through TN system with compressed air from front and below
	Float needle valve dirty or defective	Clean valve, renew if necessary Check set of seals, renew if necessary
Idle speed too high	Choke butterfly sticking	Free choke butterfly
	Spiral heating element burnt out	Renew choke cover
	Defective temperature switch	Renew temperature switch
	Actuating linkage or throttle butterfly lever stiff to move	Free linkage or lever
	Throttle butterfly opened too far by positioner	Adjust positioner to 3.0 mm (0.118 in)
	Excessive spring preload at butterfly positioning spring	Adjust length of butterfly positioning spring to 23.0 mm (0.91 in)
	Vacuum hoses leaking	Check for leaks by spray test, and remedy
	TN (heat-sensitive bypass) starting system not cutting out	Remove TN starting system housing when hot and check that plunger covers control slot.
	Control plunger not completely covering control slot	Adjust TN plunger at +20°C (+68°F) to 2.0 ... 2.4 mm (0.08 ... 0.09 in); renew TN starting system if necessary
	No hot water preheating at TN (heat-sensitive bypass) starting system (passage blocked)	Clean water passage
	Stage II throttle butterfly not closing Linkage stiff to move	Free linkage
	Carburetor and insulating flange not correctly centered	Align carburetor and insulating flange centrally

Fault	Cause	Remedy
Poor transition from idle to stage I part load	Accelerator pump injection volume not adjusted correctly Fuel passages blocked Diaphragm defective Severe difference in basic idle mixture settings, or settings too rich Uncontrolled air entry from pre-atomizer Fuel level too low	Adjust injected volume Blow through passages with compressed air Renew diaphragm Set idle speed CO content for both cylinder groups to $1.0 \pm 0.5\%$ by volume (engine at normal operating temperature) Seal the pre-atomizer Adjust fuel level
Poor transition from part load to full throttle	Leak at stage II vacuum can damper Air butterfly for stage II sticking Stage II jet needles sticking Transition passages blocked Broken torsion spring for stage II air butterfly	Check vacuum can for leaks and renew if necessary Free butterfly Free levers and needles Blow through passages from the top with compressed air Renew torsion spring
High fuel consumption	Choke butterfly sticking Transfer linkage stiff Heating element burned out Temperature switch defective Stage II air butterfly sticking Broken stage II air butterfly torsion spring Intake air preheat control flap sticking in warm-air position Defective thermo-element	Free choke butterfly Free transfer linkage Renew choke cover Renew temperature switch Free butterfly Renew torsion spring Free control flap Renew thermo-element
Engine 'hunts' (irregular idle speed)	Butterfly positioner out of adjustment Idle mixture setting too weak Leaks on intake side	Adjust butterfly positioner Adjust to richer idle mixture Trace leaks by spray test and eliminate

Fault	Cause	Remedy
Lack of power at full throttle	Throttle butterflies stiff Stage II throttle butterfly release not working	Free throttle butterflies Release is controlled by automatic choke. Check operation and renew any defective parts Blow through fuel supply with compressed air
	Fuel supply blocked	
	Fuel supply leaking Fuel pump defective	Renew defective hoses and unions Renew defective parts; install an exchange pump if necessary
	Fuel tank vent blocked	Blow through vent line with compressed air

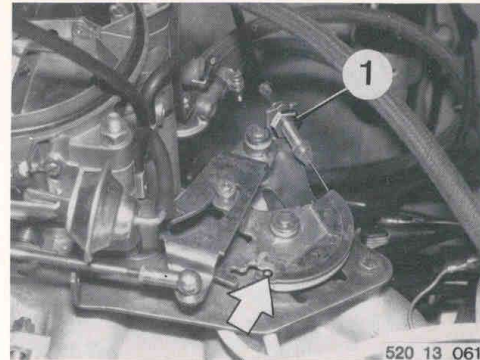
13 21 065 Torsion spring for throttle actuating linkage – renewing

Unscrew nut (1) for accelerator cable, and detach cable.

When installing: adjust accelerator cable – 35 41 421.

On cars with automatic transmission: remove the throttle position cable.

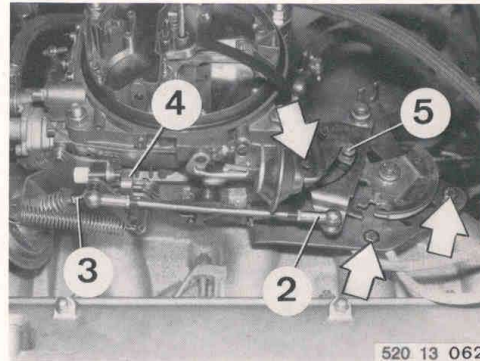
When installing: adjust throttle position cable – 24 00 004.



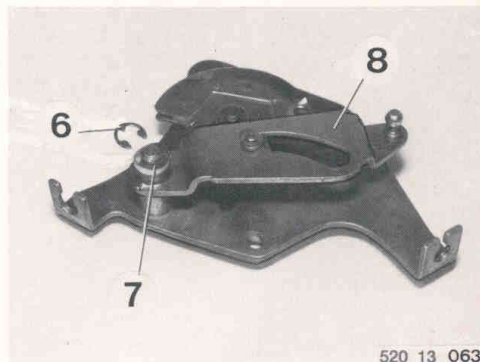
Detach the connecting rod (2). Unscrew the retaining bolts and take out the throttle actuating mechanism.

When installing: press back the throttle butterfly positioner (3) until the throttle lever (4) is touching the stop bolt.

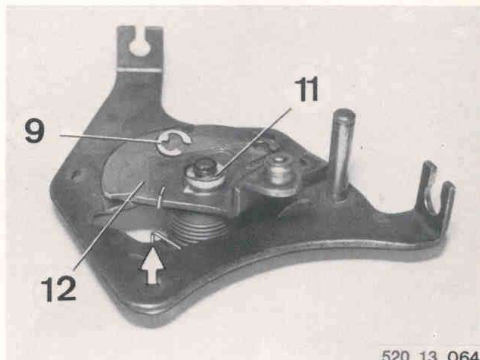
With the connecting rod (2) re-attached, move the throttle actuating mechanism along its slots until roller (5) is touching the contact face of the gate. In this position, tighten the retaining bolts.

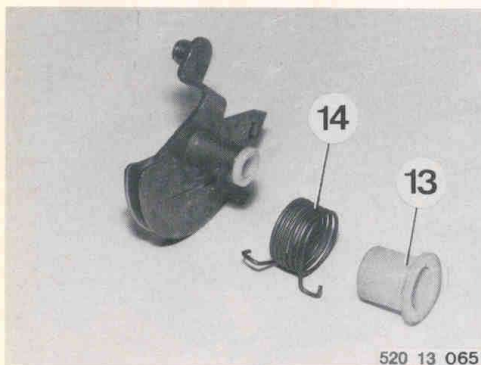


Remove keeper (6) and take off corrugated washer (7) and lever (8).



Take out keeper (9). Disconnect the spring at the bottom. Take off corrugated washer (11) and lever (12).





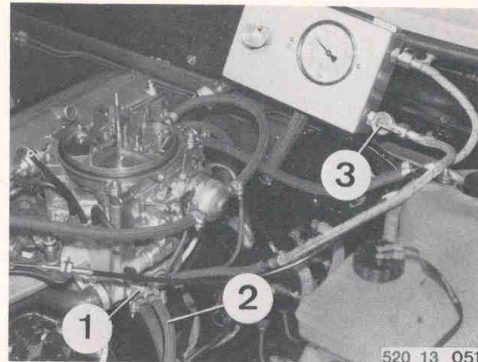
Take off bushing (13) and spring (14).

13 31 009 Fuel pump pressure/float needle valve – checking

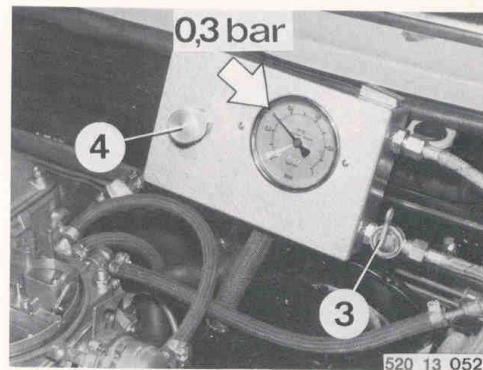
Connect the tester between the fuel return valve (1) and the carburetor.

Disconnect the return line (2) with a 'Matra' clip or similar. Open the shutoff tap (3).

The fuel pump is in good working order if max. pump pressure at 3000/min is 0.29 bar (4.1 lb/in²).

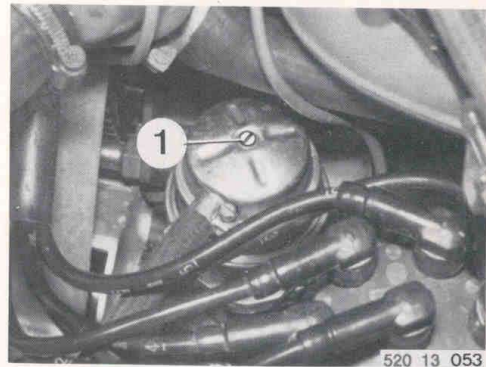


Run the engine briefly, then switch off. Close shutoff tap (3) and increase fuel pressure to 0.3 bar (4.27 lb/in²) at rotary knob (4). The float needle valve is in good working order if the pressure does not drop.



13 31 019 Fuel pump – cleaning

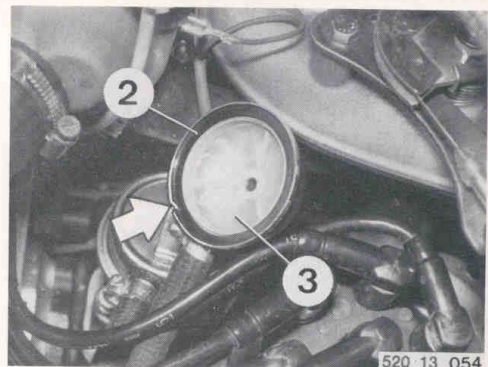
Take out screw (1).

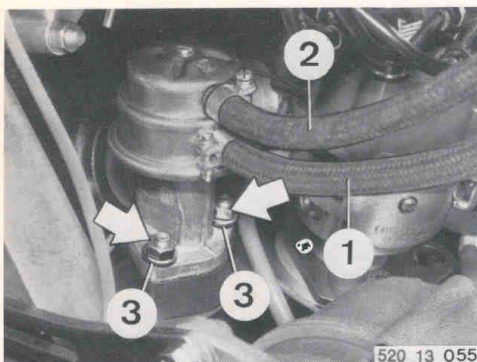


Remove cover with sealing ring (2) and strainer (3).

Clean the strainer.

When installing: the projection must locate in the pump body.





13 31 030 Fuel pump – renewing A) Carburetor engine

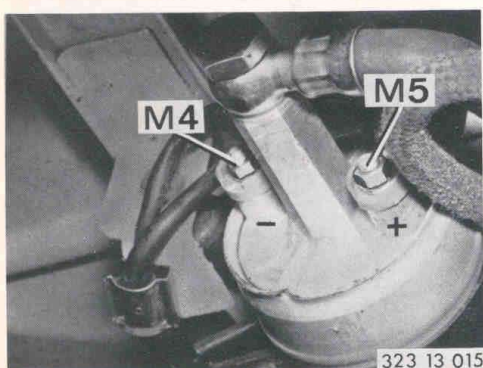
Take off fuel hoses (1) and (2).

1 Hose to return valve

2 Hose to fuel tank

Unscrew the fuel pump.

Transfer the insulating bushings (3) to the new pump.



B) Fuel injection engine

Unscrew the electric leads.

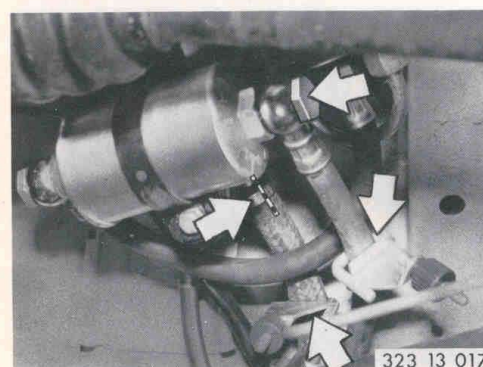
When installing:

+ connection = M 4 nut, green/yellow lead

- connection – M 5 nut, brown lead



Remove the three retaining nuts.



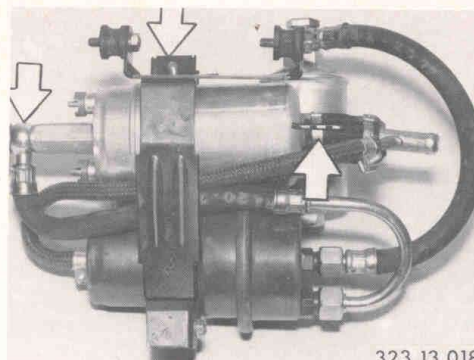
Close off the feed and return hoses with suitable clips.

Cut open the hose clip or unscrew the hose.

When installing: use new hose clip.

Take out the pump with mounting.

Detach pump from mounting plate.
When installing: use new crimp-pattern hose clip.

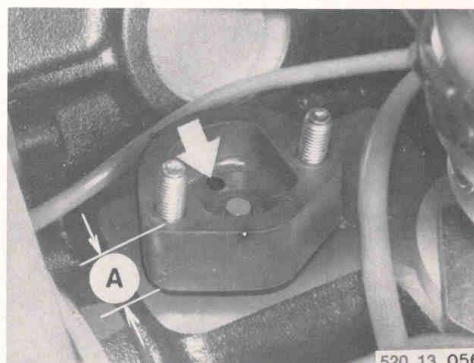


323 13 018

13 31 041 Insulating flange – renewing

Remove the fuel pump – 13 31 030.
Do not alter the thickness (A)¹⁾ of the insulating flange.

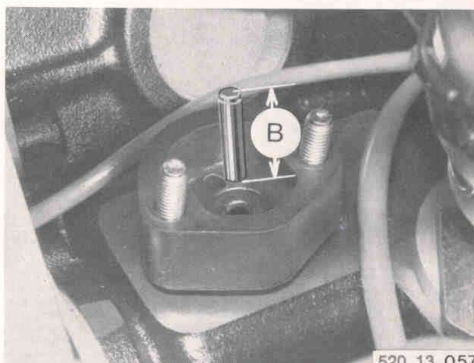
When installing: the oil return hole faces the crankcase.



520 13 056

13 31 051 Pump plunger – renewing

Remove the fuel pump – 13 31 030.
Note correct length (B)¹⁾ of pump plunger.
Any change in pump plunger length will alter the fuel pump pressure¹⁾.

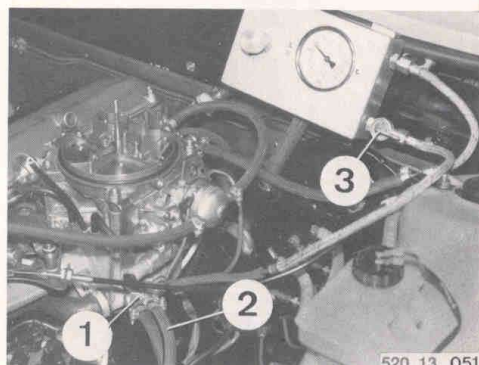


520 13 057

13 31 071 Fuel return valve – checking

Connect the tester between the fuel return valve (1) and the carburetor.
Detach the return line (2) and hold a vessel under the union to trap escaping fuel.
The shutoff tap (3) must be open.
Start the engine.

The fuel return valve is in good working order if fuel emerges from the union (2) from a pressure of 0.2 bar (2.84 lb/in²) upwards.



520 13 051

¹⁾ See specifications

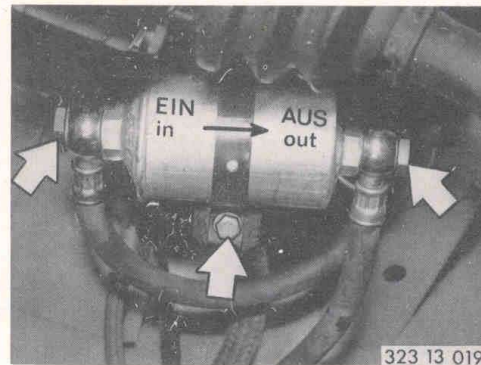
13 32 051 Fuel filter – renewing

Renew the fuel filter every 30 000 km (approx. 20 000 miles).

Detach the hose unions and clip.

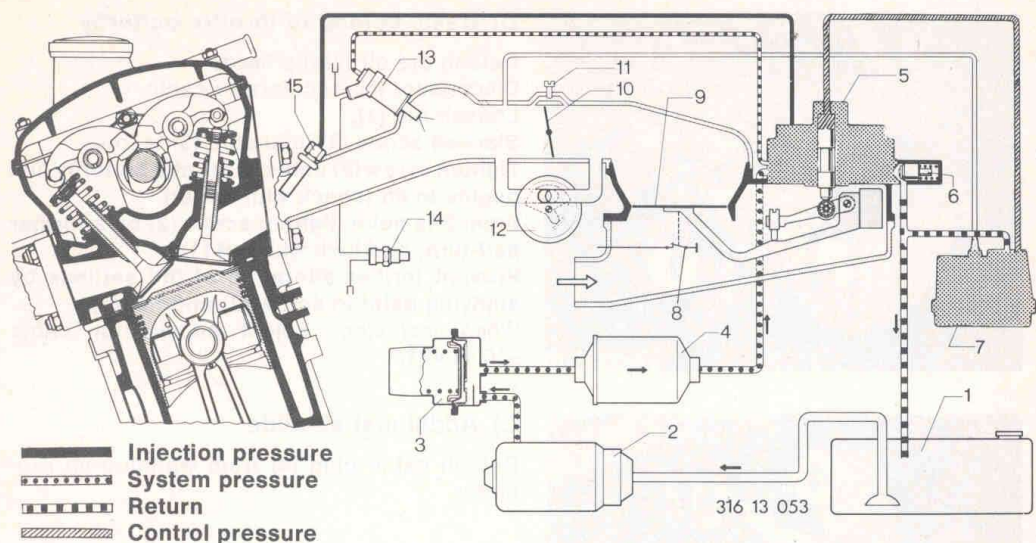
When installing: Note correct direction of flow (union at right is for outlet flow).

Use only genuine spare parts. In addition to the paper element, the filter housing contains a fluff trap.



Circuit diagram for transistorized ignition and K-Jetronic fuel injection

- | | | | |
|----|----------------------------|---|---|
| 19 | Coil | c | Warming-up regulator |
| 20 | Distributor | d | Additional air slide |
| 22 | Engine plug | e | Diode relay |
| 27 | Starter | f | Fuel pump relay |
| a | Heat-sensitive time switch | g | Transistorized coil ignition (TSZ) control unit |
| b | Starting valve | h | Resistors |

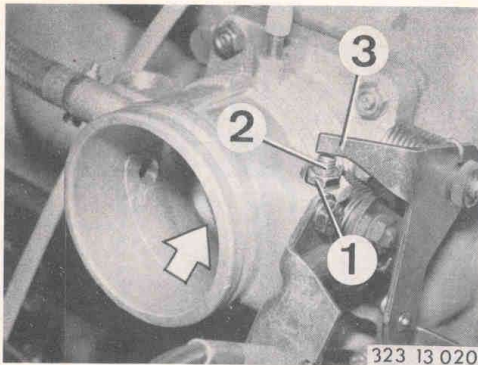


- | | | |
|-----------------------------|-------------------------|-------------------------------|
| 1 Fuel tank | 7 Warming-up regulator | 13 Starting valve |
| 2 Fuel delivery pump | 8 Safety switch | 14 Heat-sensitive time switch |
| 3 Pressure reservoir | 9 Baffle plate | 15 Injectors |
| 4 Fuel filter | 10 Throttle butterfly | |
| 5 Fuel flow distributor | 11 Idle adjusting screw | |
| 6 System pressure regulator | 12 Additional air slide | |

13 50 009 Fuel injection system – checking operation

A) Visual inspection with engine stopped

Rectify visible leaks on the fuel system by renewing or sealing the parts concerned. Inspect the vacuum system for loose or porous hoses and unions, good condition of starting valve, injector and intake pipe seals and gaskets, and rectify any faults detected. Any uncontrolled air source drawn into the engine will not be measured by the airflow meter. As a result, the mixture will be weakened and the engine will not idle smoothly.



B) Basic setting of throttle butterfly

Detach the air intake hood.

Disconnect the accelerator cable.

Loosen nut (1).

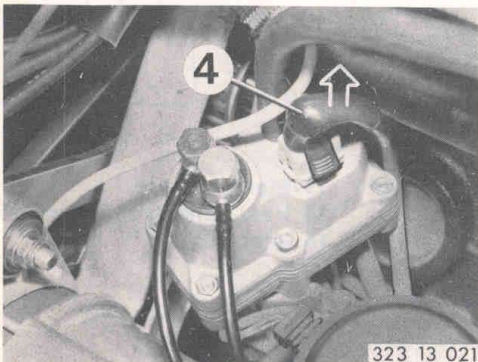
Slacken screw (2) until stop (3) is free.

Tighten screw (2) until the throttle butterfly just begins to lift (check with finger).

From this point, tighten screw (2) by a further half-turn, and lock with nut (1).

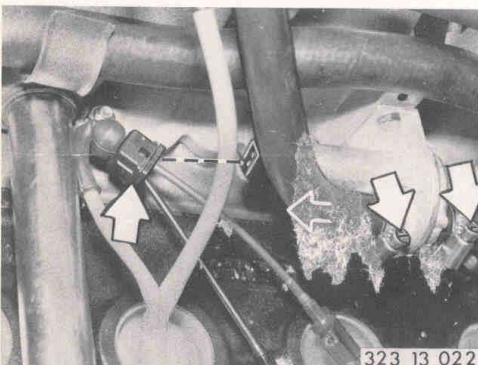
Prevent further alteration of the settings by applying paint to screw (2) and nut (1).

When installing: adjust accelerator cable -35 41 421.



C) Additional air slide

Detach cable plug (4) from warming-up regulator.



Detach both hoses from the additional air slide.

When the engine is cold – at approx. +20°C (68°F) – the shutoff slide will have half-opened the air passage.

Switch on the ignition and operate the starter. Power should be present at the green/yellow lead in plug (5).

Connect plug (5).

Attach both hoses to the additional air slide.

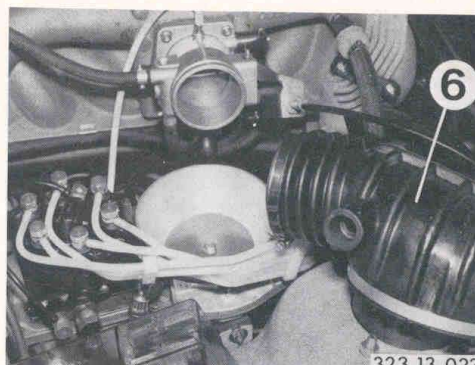
Connect the plug to the warming-up regulator.

With the engine running, the shutoff slide should have completely closed the air passage after approx. 5 minutes.

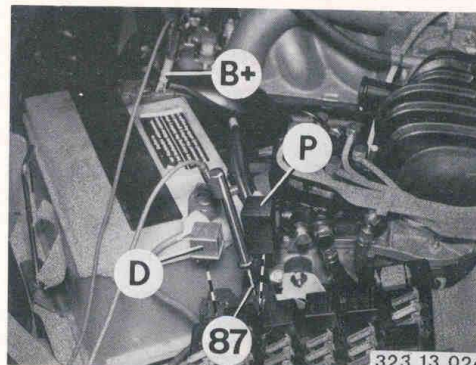
If the air passage remains open even after the valve has been tapped lightly, the additional air slide must be renewed.

D) Mixture regulator

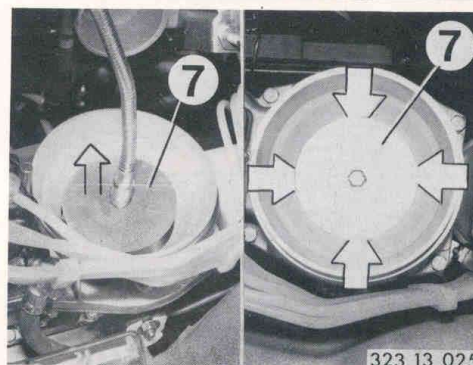
Detach the intake air scoop (6) from the mixture regulator and the throttle butterfly section.



Pull out the diode relay (D) and pump relay (P). Connect contact 87 from the pump relay base to B+ (the fuel pump will run).



With the fuel pump still running, raise the baffle plate (7) by hand or with a magnet slowly. The resistance must be the same over the entire range of movement. Slowly lower the baffle plate again and then pull up immediately a second time. The resistance should be felt immediately. If any free travel is detected, the plunger must be sticking. There should be no resistance when the baffle plate is lowered rapidly.



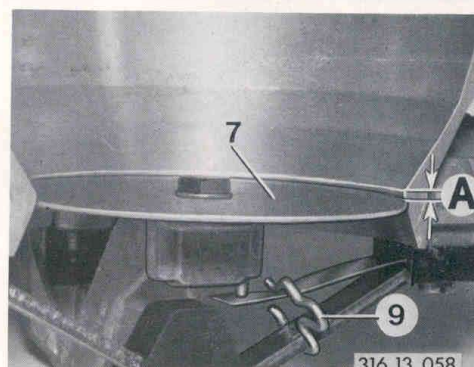
The baffle plate (7) should be flush with the start of the tapered section of the air venturi, or max. 0.5 mm (0.02 in) deeper.

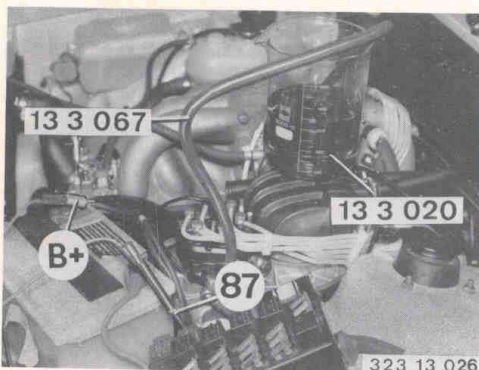
To correct, detach mixture regulator from intermediate housing and bend the shaped spring (9) accordingly.

Baffle plate (7)

too high – engine will run on

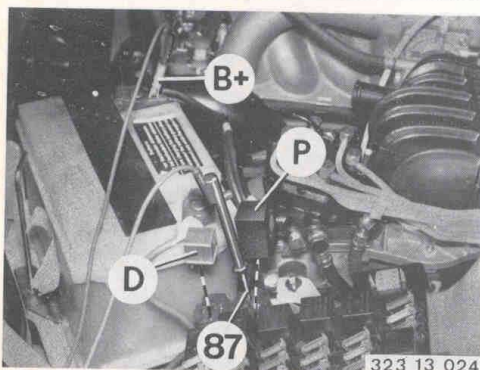
too deep – poor cold or warm starting



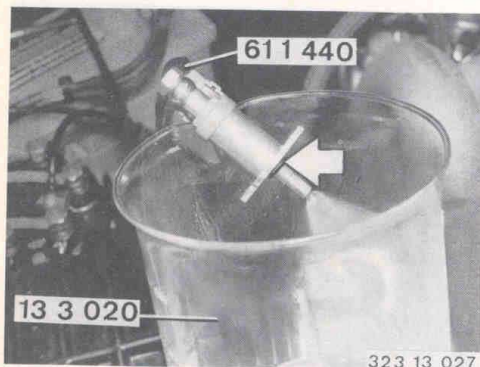


E) Checking electric fuel pump delivery volume

Detach the return line from the flow distributor. Connect hose 13 3 067 and place in measuring flask 13 3 020.

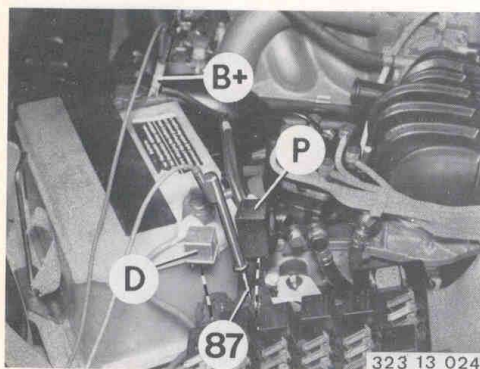


Pull out diode relay (D) and pump relay (P). Connect contact 87 on the pump relay base with B+ (the fuel pump will run). The pump should deliver approx. 750 cm³ (264 fl. oz) within 30 s. Tank must be filled to half capacity at least.



F) Checking operating and leakage of starting valve

Remove the starting valve. The fuel line remains attached. Hold the starting valve in measuring flask 13 3 020. Connect lead 61 1 440 to the starting valve and to B+ and earth (ground). When installing: check condition of O-ring and renew if necessary.

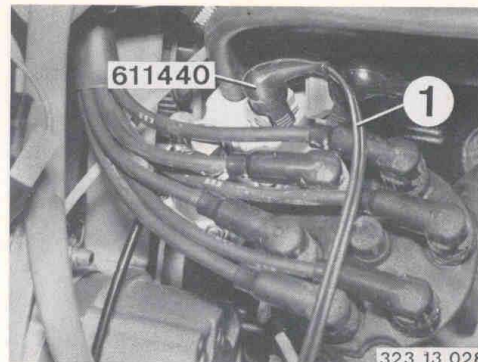


Take out diode relay (D) and pump relay (P). Connect contact 87 on pump relay base with B+ (the fuel pump will run). The cold start valve must deliver a fuel spray. Detach the plug from the cold start valve and dry its jet. No fuel must drip from the cold start valve within 1 minute.

G) Checking electrical operation of warming-up regulator

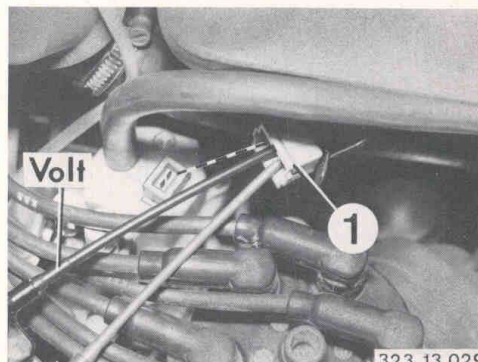
Detach plug (1) from warming-up regulator, and connect lead 61 1 440.

Connect an ohmmeter to the terminals of the heater winding, and check for open circuit in the heater element.



Connect a voltmeter to the warming-up regulator plug (1).

With the engine running, the minimum voltage should be 11.5 V.

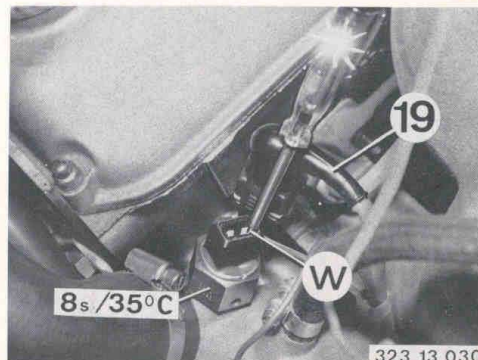


H) Checking temperature-time switch

The thermo-time switch controls the opening time of the cold start valve in relation to coolant temperature.

The opening time of max. 8 s and the cutout temperature of 35°C (95°F) are stamped on the hexagon of the valve.

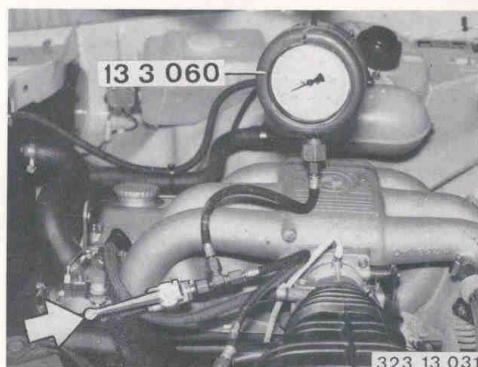
Detach cable plug (19). Connect the test lamp to battery + and to connection W in the thermo-time switch. The test lamp must burn brightly at coolant temperatures below +35°C (+95°F). The test lamp should remain out at temperatures above +35°F).

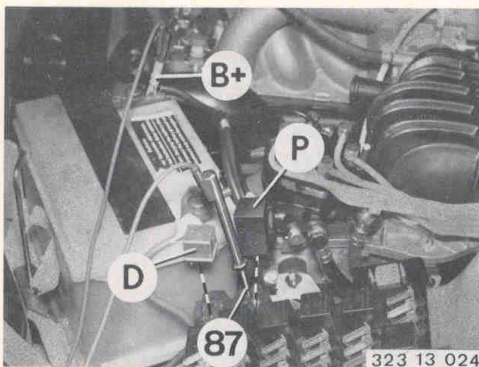


I) Control pressure (engine cold)

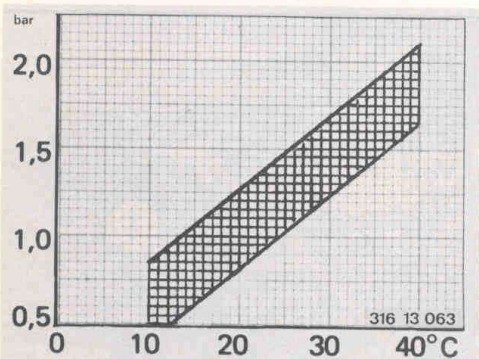
Test if cold or warm starting present difficulties.

Install pressure gauge 13 3 060 between the control pressure line and the flow distributor. Use adapters 13 3 065 and 13 3 066. Open the two-way valve.

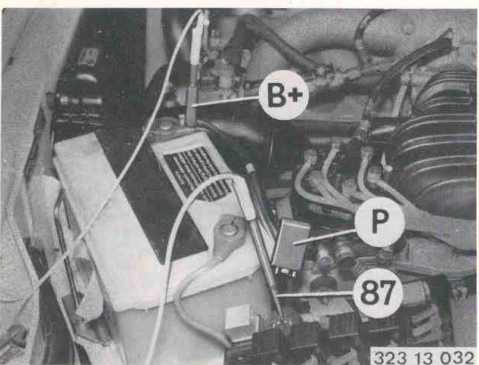




Take out diode relay (D) and pump relay (P). Connect contact 87 from the pump relay base with B+ (the fuel pump will run). Read off the control pressure at gauge 13 3 060.



The control pressure depends on coolant temperature, and can be seen on the graph. Desired value too low – warming-up regulator defective. Desired value too high – inadequate fuel return flow – warming-up regulator defective. Deviations: renew warming-up regulator. Check fuel return line for blockage.



K) Control pressure (engine warm)

Detach pump relay (P). Connect terminal 87 at pump relay base to B+ (fuel pump runs, warming-up regulator operational).



The two-way is open. Read off the control pressure (warm engine) at pressure gauge 13 3 060.

Start the engine and read off pressure at idle speed.

Engine stopped = 2.7... 3.1 bar (38.4... 44.1 lb/in²)

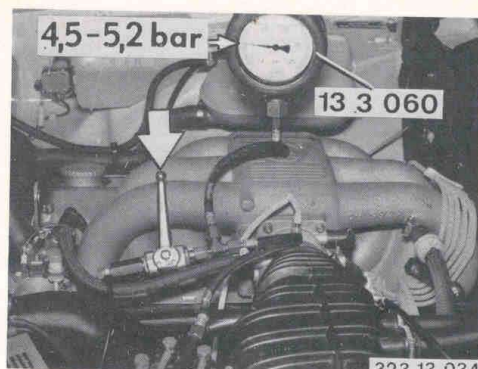
Engine idling = 3.4... 3.8 bar (48.4... 54.0 lb/in²).

If these values are not obtained, install an exchange warming-up regulator. Check the vacuum hose between the warming-up regulator and the intake pipe.

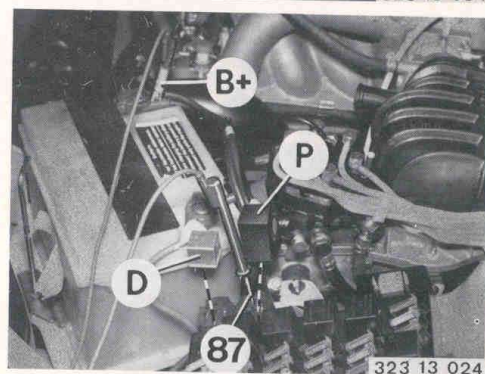
L) System pressure – engine warm or cold –

Before testing: fuel pump and filter must be in good working order.

Pressure gauge 13 3 060 is connected and the two-way valve closed.



Pull out diode relay (D) and pump relay (P). Connect terminal 87 at the pump relay base with B+ (the fuel pump will run). Desired value for system pressure: 4.5... 5.2 bar (64.0... 74.0 lb/in²).



System pressure too low

- leaking fuel lines/unions
- fuel filter severely blocked
- engine running on
- fuel pump¹⁾ delivery rate inadequate
- system pressure incorrectly adjusted

Alteration in pressure (bar, lb/in²)

0.06 (0.85)

0.3 (4.27)

shim washer thickness (10)

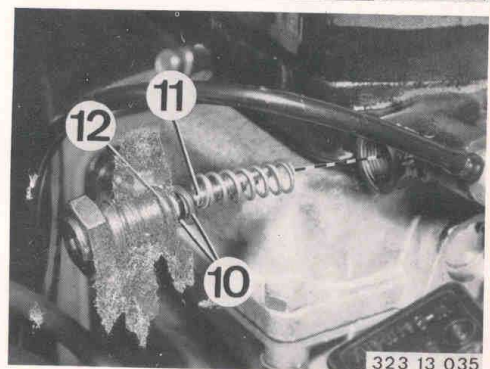
0.1 mm (0.004 in)

0.5 mm (0.020 in)

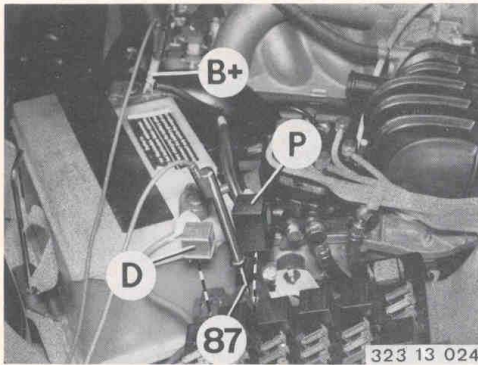
System pressure too high

- inadequate fuel return flow
- system pressure regulator incorrectly adjusted
- plunger (11) sticking

Adjust system pressure to 4.7... 4.9 bar.

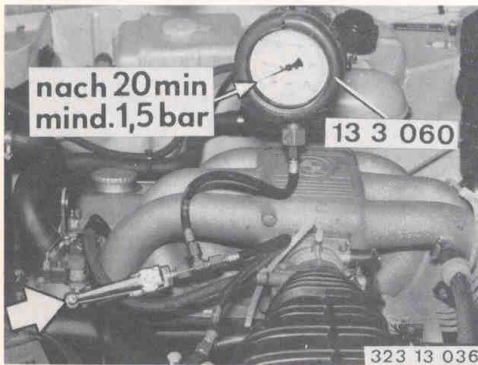


¹⁾ See specifications



M) Shutoff pressure/leakage test –
engine allowed to cool for at least 30 minutes –

Pull out diode relay (D) and pump relay (P).
Connect contact 87 at the pump relay base with
B+ until pressure does not rise any further.
Pressure gauge 13 3 060 is in circuit.



Two-way valve is open.
Shutoff pressure must not drop below 1.5 bar
(21.3 lb/in²) within 20 minutes.

Premature pressure drop:

- leak at rubber sealing ring (12) in system pressure regulator
- leak at warming-up regulator or supply line
- leaking check (non-return) valve in fuel pump
- leak at pressure reservoir.

Remove pressure gauge 13 3 060.

Adjust engine idling and check CO content of
exhaust – 13 00 054.

הוועדה הלאומית למעקב אחר המצב הכלכלי – דוח מס' 10

1. Engine does not start when cold
2. Engine does not start when warm

4. Poor warm starting
5. Erratic idling – vibration during warm-up phase
6. Erratic idling – vibration when engine is warm
7. Engine backfires
8. Engine detonates in exhaust system
9. Engine misfires when car is being driven
10. Engine power output low
11. Engine runs on
12. Fuel consumption too high
13. CO content of exhaust too high at idle speed
14. CO content of exhaust too low at idle speed
15. Idle speed too high, cannot be adjusted

Use of this trouble shooting chart assumes:

- 1) Normal compression in all cylinders
- 2) Valve clearances correctly adjusted
- 3) Dwell angle and ignition timing correct
- 4) All ignition system components in good working order
- 5) Safety circuit (see circuit diagram, page 13-32/2) working correctly

Cause:													For remedy, see:												
X	X												1. Electric fuel pump not running	13 50 009	Section E										
X	X	X	X	X	X								2. Poor contact at electric fuel pump	13 50 009	Section E										
X		X		X					X				3. Control pressure (cold) out of tolerance	13 50 009	Section I										
					X				X	X			4. Control pressure (warm) too high (cutout point)	13 50 009	Section K										
			X		X		X						5. Control pressure (warm) too low (cutout point)	13 50 009	Section K										
													6. Additional air valve not closing												
					X		X					X	7. Additional air valve not opening	13 50 009	Section C										
X		X			X								8. Starting valve not opening (below 35°C, 95°F)												
X	X	X											9. Starting valve leaking	13 50 009	Section F										
X	X	X	X	X	X		X	X		X	X		10. System pressure out of tolerance	13 50 009	Section L										
					X	X						X	11. Baffle plate stop out of adjustment												
X	X	X	X	X	X		X	X	X		X		12. Baffle plate or control plunger stiff	13 50 009	Section D										
					X	X							13. Vacuum system leaking	13 50 009	Section A										
X	X	X	X	X	X		X		X	X	X	X	14. Complete fuel system leaking	13 50 009	Section M										
X	X	X	X	X	X		X		X		X		15. Injector(s) leaking, opening pressure too low	13 53 700											
					X		X			X	X		16. Idle mixture (basic setting) too rich	13 00 054											
					X							X	17. Idle mixture (basic setting) too lean												
													18. Throttle butterfly not opening fully	13 50 009	Section B										
X	X	X	X	X							X		19. Heat/time switch not closing												
	X	X	X	X							X		20. Heat/time switch remains closed too long	13 50 009	Section H										
X		X											21. Plunger in full-load setting	13 50 009	Section D										
X	X	X	X	X					X				22. Defective diode relay		For circuit diagram,										

Trouble shooting chart – BMW 323i with K-Jetronic fuel injection system

1. Engine does not start when cold
2. Engine does not start when warm
3. Poor cold starting
4. Poor warm starting
5. Erratic idling – vibration during warm-up phase
6. Erratic idling – vibration when engine is warm
7. Engine backfires
8. Engine detonates in exhaust system
9. Engine misfires when car is being driven
10. Engine power output low
11. Engine runs on
12. Fuel consumption too high
13. CO content of exhaust too high at idle speed
14. CO content of exhaust too low at idle speed
15. Idle speed too high, cannot be adjusted

Cause:															
x	x														1. Electric fuel pump not running
x	x	x	x	x	x			x							2. Poor contact at electric fuel pump
x		x		x											3. Control pressure (cold) too low
					x	x		x	x					x	4. Control pressure (warm) too low
			x		x		x				x	x			5. Control pressure (warm) too high
														x	6. Additional air valve not closed
x		x		x											7. Additional air valve not closed
x		x													8. Starting valve not opening
x	x	x	x	x	x		x		x		x	x			9. Starting valve leaking
					x	x	x	x			x	x	x		10. System pressure out of tolerance
					x	x								x	11. Baffle plate stop out of adjustment
x	x	x	x	x	x			x	x	x		x			12. Baffle plate or control plate defective
					x	x	x					x	x		13. Vacuum system leaking
x	x	x	x	x	x			x	x			x	x	x	14. Complete fuel system leakage
		x	x	x	x						x				15. Injector(s) leaking, opening too late
					x		x				x	x			16. Idle mixture (basic setting) too rich
					x	x								x	17. Idle mixture (basic setting) too lean
									x						18. Throttle butterfly not opened
x	x	x	x									x			19. Heat/time switch not closed
		x	x	x								x			20. Heat/time switch remains open
x		x													21. Plunger in full-load setting
x	x	x	x					x							22. Defective diode relay

fuel injection system

Use of this trouble shooting chart assumes:

- 1) Normal compression in all cylinders
- 2) Valve clearances correctly adjusted
- 3) Dwell angle and ignition timing correct
- 4) All ignition system components in good working order
- 5) Safety circuit (see circuit diagram, page 13-32/2) is working correctly

se
warm

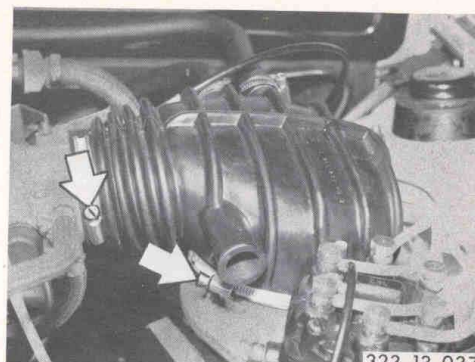
stem
s being driven
ow

otion too high
nt of exhaust too high at idle speed
content of exhaust too low at idle speed
Idle speed too high, cannot be adjusted

		For remedy, see:	
1.	Electric fuel pump not running	13 50 009	Section E
2.	Poor contact at electric fuel pump		
3.	Control pressure (cold) out of tolerance	13 50 009	Section I
4.	Control pressure (warm) too high (cutout point)	13 50 009	Section K
5.	Control pressure (warm) too low (cutout point)		
6.	Additional air valve not closing	13 50 009	Section C
7.	Additional air valve not opening		
8.	Starting valve not opening (below 35°C, 95°F)	13 50 009	Section F
9.	Starting valve leaking		
10.	System pressure out of tolerance	13 50 009	Section L
11.	Baffle plate stop out of adjustment	13 50 009	Section D
12.	Baffle plate or control plunger stiff		
13.	Vacuum system leaking	13 50 009	Section A
14.	Complete fuel system leaking	13 50 009	Section M
15.	Injector(s) leaking, opening pressure too low	13 53 700	
16.	Idle mixture (basic setting) too rich	13 00 054	
17.	Idle mixture (basic setting) too lean		
18.	Throttle butterfly not opening fully	13 50 009	Section B
19.	Heat/time switch not closing	13 50 009	Section H
20.	Heat/time switch remains closed too long		
21.	Plunger in full-load setting	13 50 009	Section D
22.	Defective diode relay	For circuit diagram, see page 13-32/2	

13 51 011 Mixture regulator – renewing

Take off the intake air scoop.



323 13 037

Detach the connections at the fuel flow distributor.

1–6 to injectors

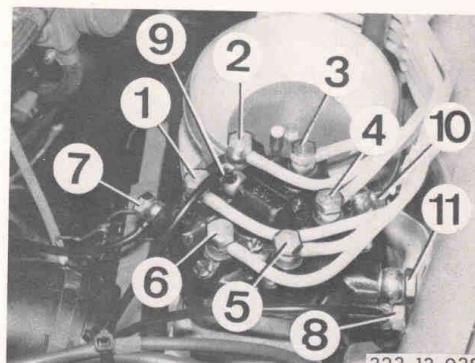
7 to cold start valve

8 and 9 to warming-up regulator sensor

10 to fuel filter (feed)

11 Return

When installing: use new sealing washers.

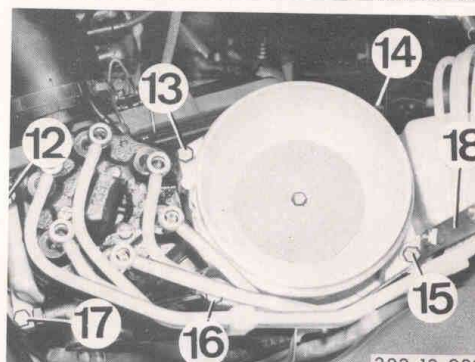


323 13 038

Remove bolts (12... 17).

Bolts (12) and (13) have no nuts.

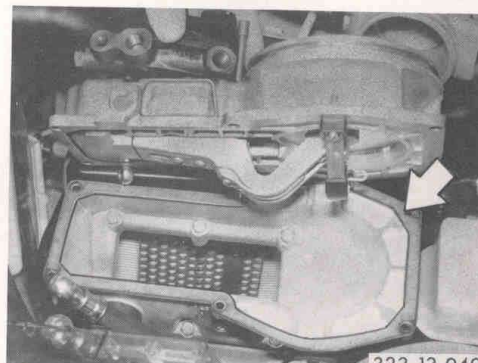
When installing: secure holder (18) with bolt (15).



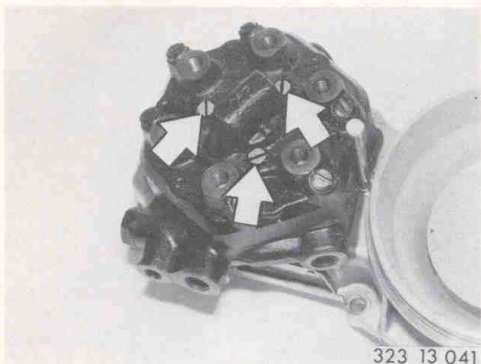
323 13 039

Take out the mixture regulator.

When installing: renew gasket.



323 13 040

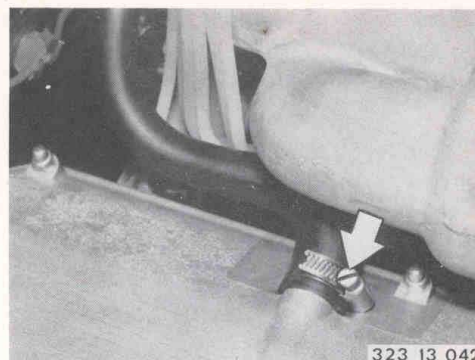


The volumetric fuel flow distributor (19) is secured to the mixture regulator by three machine screws.
Adjust engine idling – 13 00 054.

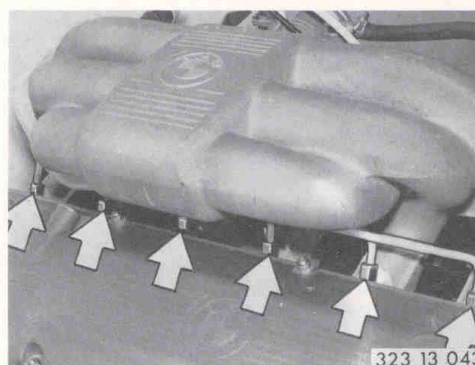


13 53 100 Injectors – removing and installing

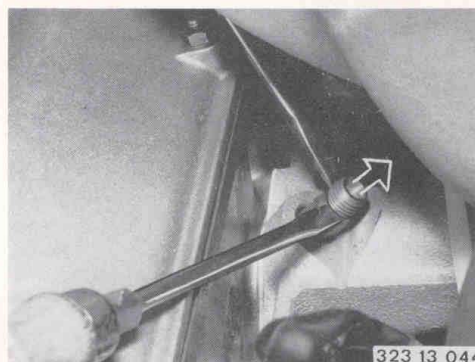
Detach the breather hose.



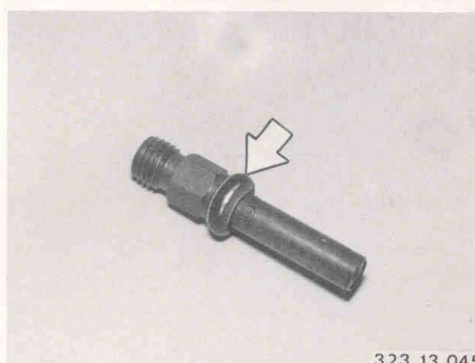
Detach the injector pipes.

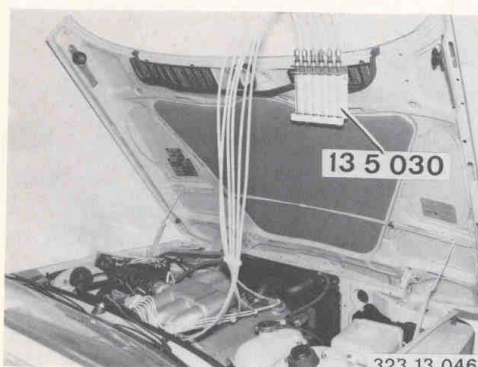


Unscrew the injectors. If necessary, lever out with two screwdrivers.



When installing: renew the rubber rings and coat with 'Vaseline' or similar before inserting.





13 53 700 Injected quantity differences – checking

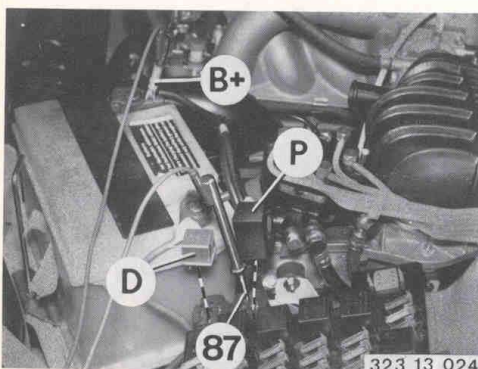
This test should only be performed if the compression in all cylinders is satisfactory, but the engine still runs very irregularly.

Remove the injectors – 13 53 100.

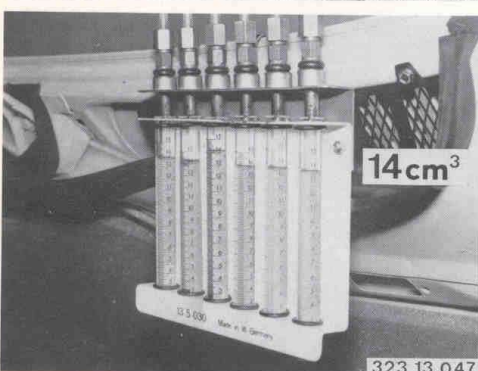
Connect the injectors pipes and the lines to the 13 5 030 tester with threaded adapters 13 5 012.

Suspend the tester from the engine compartment lid.

Attach the injectors to the lines and insert into the measuring flasks.



Pull out diode relay (D) and pump relay (P). Connect contact 87 from the pump relay base with B+ (the fuel pump will run).



Take off the air intake scoop.

Raise the baffle plate until the measuring flasks are full.

Empty the measuring flasks.

Next, raise the baffle plate until the 14 cm³ mark is reached in one measuring flask.

The difference between the flows to each cylinder must not exceed 15%.

If the difference is greater than 15%:

interchange a normal-delivery injector with the one having the worst delivery rate.

If the quantity delivered through the injector which was previously normal now also drops severely, the mixture regulator (fuel flow distributor) must be causing the fault.

If, however, the previously normal injector still delivers the correct quantity of fuel, and the suspect injector remains faulty, the injector should be renewed.

13 54 051 Throttle butterfly return springs – renewing

Disconnect the accelerator cable.

When installing: adjust the accelerator cable – 35 41 421.

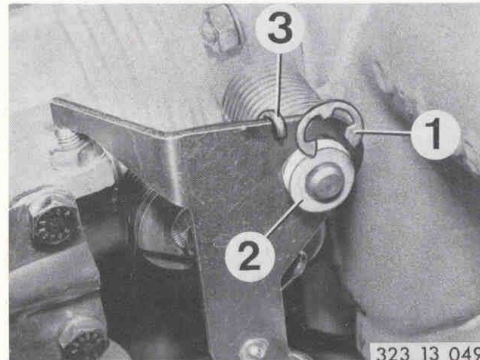
Remove keeper (1).
Take off corrugated washer (2).
Disconnect spring (3).
When installing: Pull up spring (3) with a hook or similar, and attach.

Take off lever (4) with bushing (5).
When installing: attach the linkage (6). Grease the pivots with 'Longterm'.

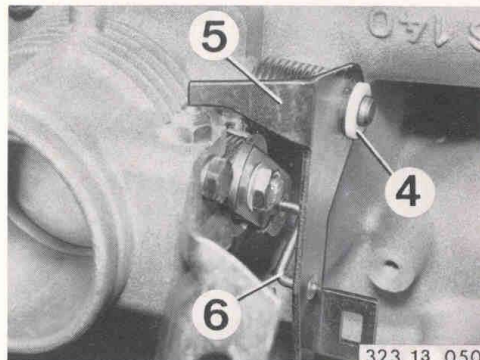
Take off spring (3).
Unscrew nut (7).
Detach spring (8).
When installing: pull up spring (8) with a hook or similar, and attach.



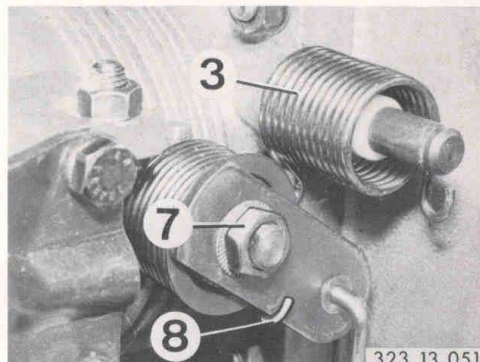
323 13 048



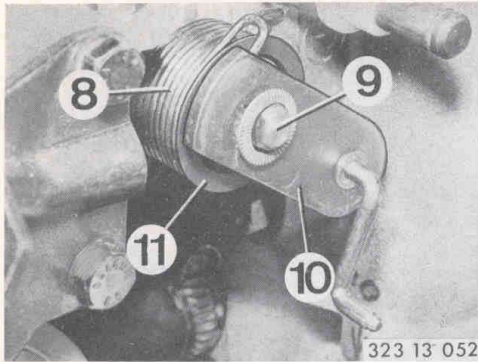
323 13 049



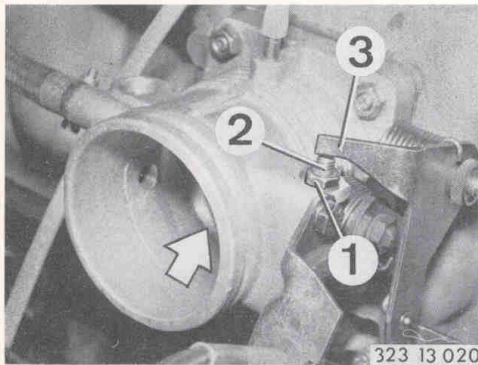
323 13 050



323 13 051



Take off serrated washer (9), lever (10), sleeve (11) and spring (8).



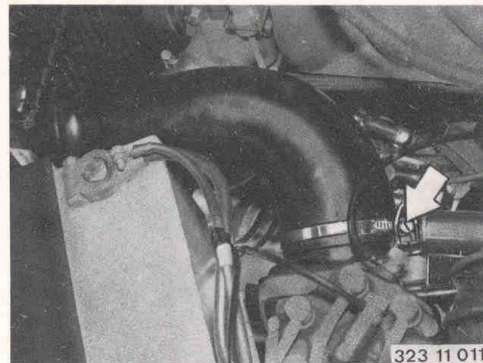
Adjust throttle butterfly.

Take off the intake air scoop. Disconnect the accelerator cable. Loosen nut (1). Unscrew bolt (2) until it is clear of stop (3). Then tighten bolt (2) until the throttle butterfly just begins to lift (check movement with finger). From this point, tighten bolt (2) by a further half-turn, and lock with nut (1). Prevent subsequent movement of bolt (2) and nut (1) with paint.

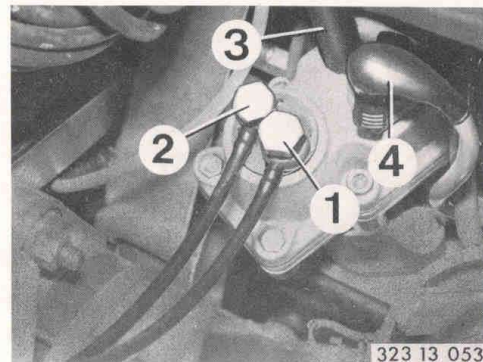
When installing: adjust engine idling and check exhaust emissions – 13 00 054.

13 63 050 Warming-up regulator – removing and installing

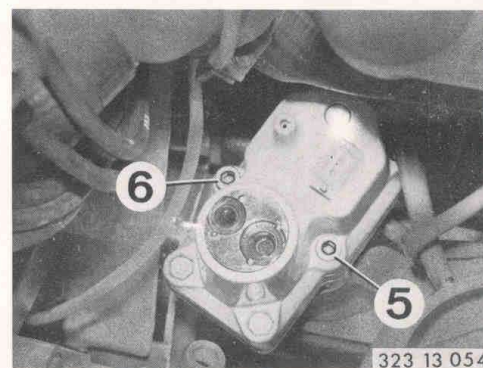
Remove projecting tube.



**Take off distributor cap.
Detach line (1) – feed and line (2) – return.
Pull off vacuum hose (3) and plug (4).**

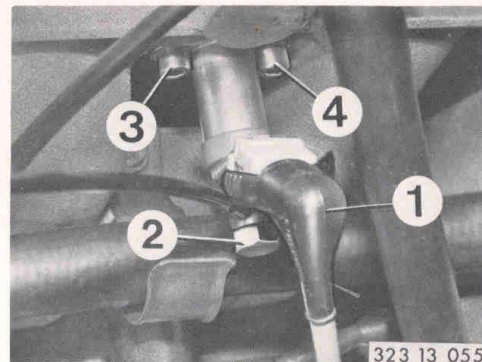


**Unscrew retaining bolts (5) and (6).
Take out the warming-up regulator.**

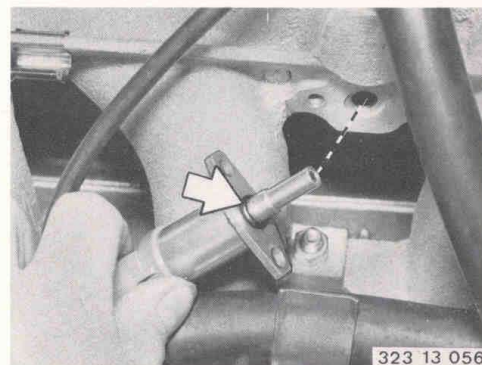


13 64 030 Starting valve – removing and installing

**Pull off plug (1).
Detach fuel line (2).
Remove retaining bolts (3) and (4).**



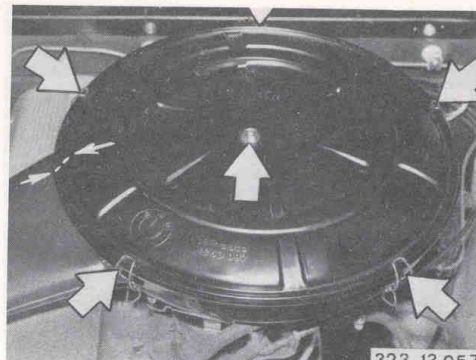
**When installing: renew O-ring.
For operating and leakage check, see
13 50 009 Section F.**



13 72 001 Air cleaner element – renewing

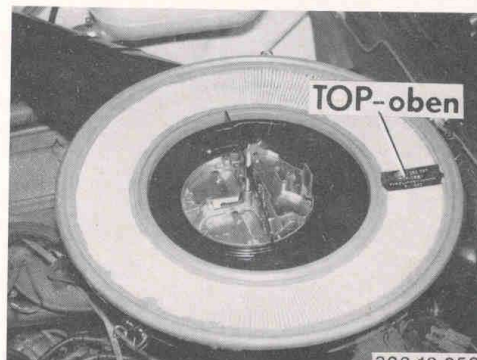
A) Carburetor engine

Open the snap fasteners and unscrew the nut.
When installing: the arrows on the cover and on the housing must coincide.



323 13 057

Take out the air cleaner element.
The air cleaner element must be renewed every 15 000 km (app. 10 000 miles).



323 13 058

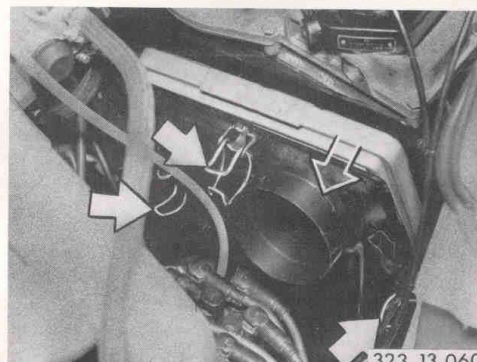
B) Fuel injection engine

Detach the projecting tube.
Detach the fuel line to the cold start valve.

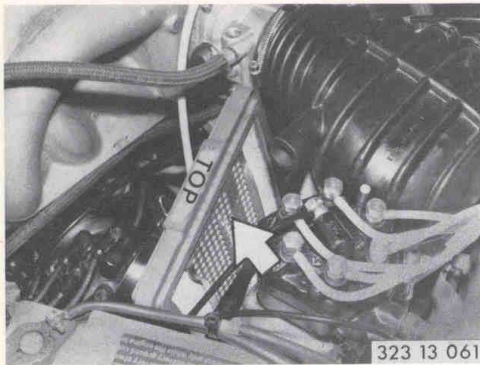


323 13 059

Open the snap fasteners.
Hinge up the air cleaner cover towards the engine.



323 13 060



Pull the air cleaner element out upwards.
When installing: note correct position. The 'TOP' marking should be uppermost and the perforated plate side facing the mixture regulator.

The air cleaner element must be renewed every 15 000 km (app. 10 000 miles).

13 73 004 Intake air preheat flap valve – adjusting

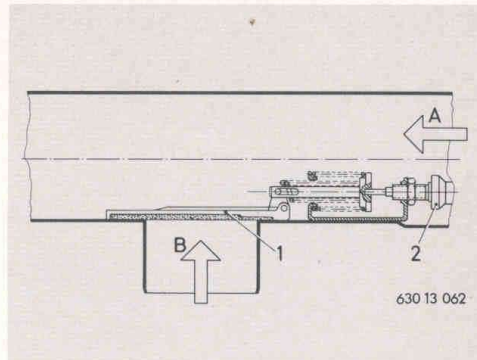
The intake air preheat system is controlled automatically by element (2).

To check and adjust the flap valve, the air cleaner must be removed – 13 71 000.

Place the cold air stub pipe with actuating element in a water bath at $+15^{\circ}\text{C}$ ($+59^{\circ}\text{F}$) for approx. 5 minutes.

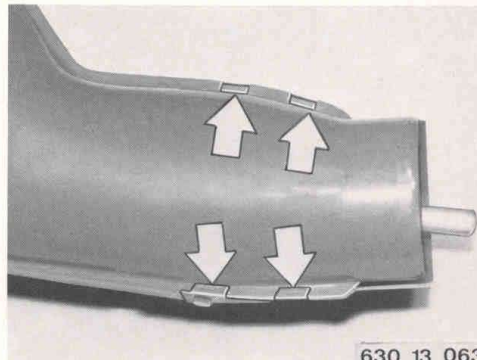
At $+15^{\circ}\text{C}$ ($+59^{\circ}\text{F}$), the flap valve (1) should just close the pre-heated air supply (B).

Below $+8^{\circ}\text{C} \pm 1^{\circ}\text{C}$ ($+46^{\circ}\text{F} \pm \text{approx. } 2^{\circ}\text{F}$), the flap valve (1) must completely close the cold air intake (A).



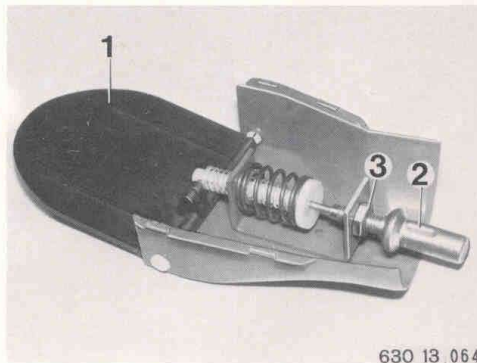
To adjust the flap valve, the lower cold air entry stub pipe with actuating element must be removed.

Bend up the sheet metal lugs.



Loosen nut (3) and adjust the actuating element (2) as shown in Fig. 1.

Check that flap valve (1) moves freely; grease and free the pivot points if necessary.



Kraftstoffbehälter und -leitungen

Fuel tank and lines

Réservoir à essence et conduites

Serbatio carburante e conduttore

Depósito de carburante y tubería

Bränsletank och ledningar

Benzinetank en leidingen

16 Fuel Tank and Lines

Specifications	Page 16-0/3
1611030 Fuel tanks (both) – removing and installing	11/1
1612000 Fuel suction unit – removing and installing	12/1
040 Pressure storage unit – removing and installing	12/1

16-0/1

270

16-0/1

16-0/1

Specifications

Fuel tank and lines

Model		320/6 320/6 A	323 i 323 i A *)
16 11 ... Fuel tank			
Total capacity	I (Imp., gal, US gal)	58 (12.75, 15.3)	
Filler cap		non-vented	
16 12 ... Electrical fuel pump (for mechanical fuel pump, see Group 13)			
Make		—	Bosch
Bosch number		—	0 580 254 982
Pattern ¹⁾		—	roller cell pump
Operating pressure (gauge)	bar (lb/in ²)	—	5 (71.1)
Delivery rate	I (Imp. pints, US quarts)/h	—	100 (176, 105)
Operating voltage	V	—	7 ... 15
Current consumption, max.	A	—	4.7
Tightening torques			
16 11 ... Fuel tank			
Fuel tank mountings	Nm kpm lb.ft	20 ... 22 2.0 ... 2.2 15 ... 16	

*) Version for Sweden

1) with permanent-magnet motor excitation

16 11 030 Fuel tanks (both) – removing and installing

Warning: The fuel tank is not provided with a drain plug.

Note fuel level and if necessary siphon off the fuel.

Remove the rear seat.

Remove the cover plate.

Detach the hoses and leads from the suction unit.

When installing:

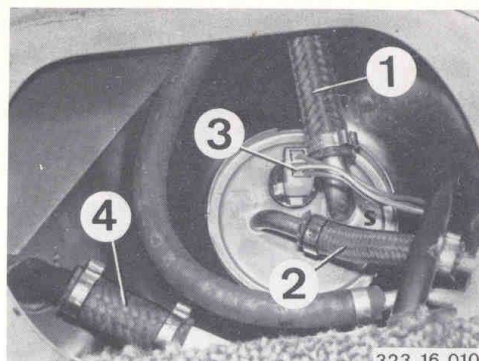
1 Suction line

2 Return line

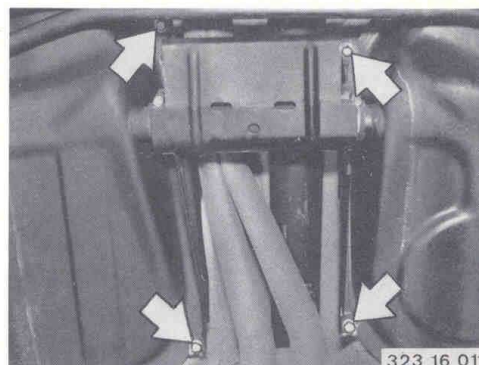
3 Cable plug

4 Tank vent pipe

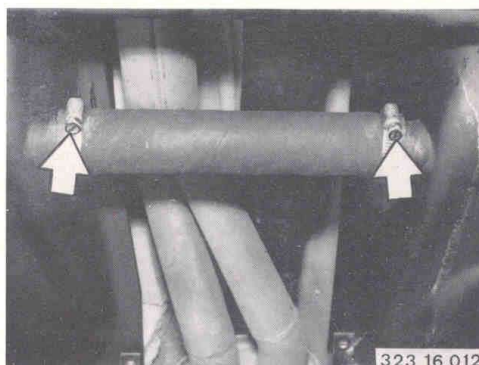
Do not re-use the old crimped hose clips.



Detach guard plate.



Detach connecting hose.



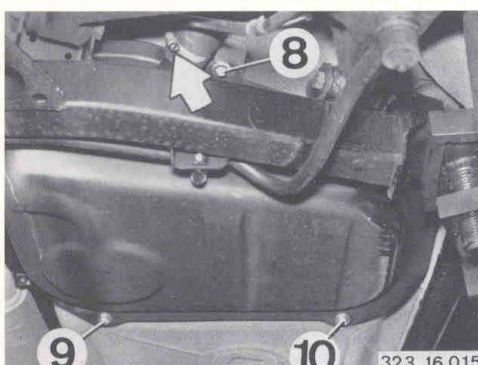
Detach left half of fuel tank:
Loosen bolt (5) and take out bolts (6) and (7).
Carefully lower tank. Note vent hose.





323 16 014

Detach connecting hose for vent.
When installing: use new crimp-pattern hose clips.



323 16 015

Remove right half of tank:
Detach hose clip for filler tube.
Loosen screw (8) and take out screws (9) and (10).
Take out the tank.

16 12 000 Fuel suction unit—removing and installing

Note: Fuel tank has no drain plug. Check fuel level and siphon off fuel if necessary.

Remove the rear seat.

Remove the cover plate.

Detach hoses and leads from suction unit.

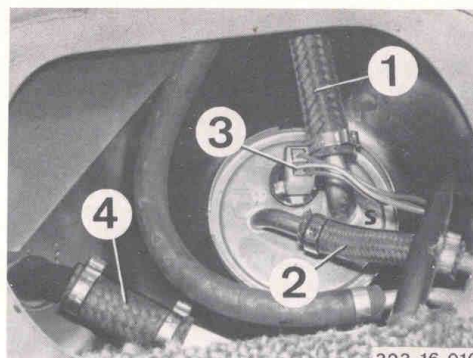
When installing:

1 Suction line

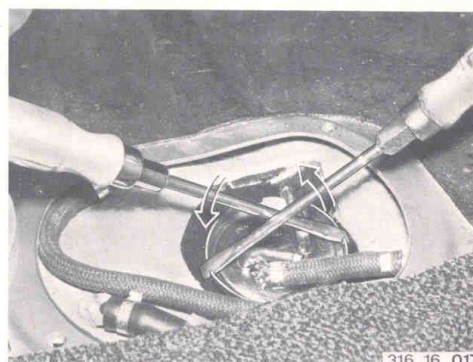
2 Return line

3 Cable plug

4 Tank vent pipe



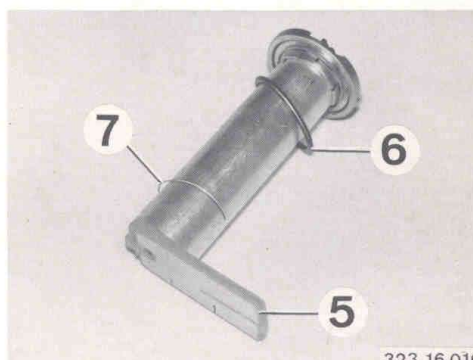
Remove the suction unit by unscrewing anti-clockwise with two crossed screwdrivers.



When installing: Clean the mesh filter (5).

The cord ring seal (6) will swell in contact with gasoline, and must therefore be renewed whenever the unit is removed.

Only when renewing the suction unit: remove the transit keeper (7).



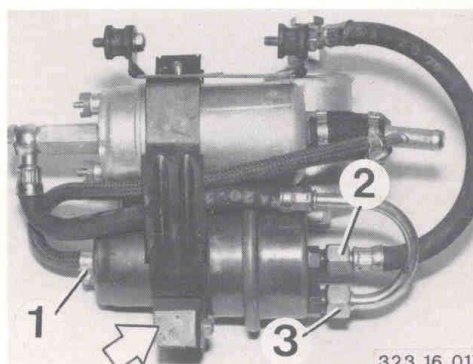
16 12 040 Pressure storage unit – removing and installing

Apart from reducing noise and smoothing out pressure peaks, the pressure storage unit maintains a given-load pressure in the system in conjunction with the pump check valve when the engine and the fuel pump are not running.

Remove fuel pump – 13 31 030.

Detach fuel lines (1 to 3) from pressure storage unit.

Detach pressure storage unit from retaining plate.



Kühler

Radiator
Radiateur
Radiatore
Radiador
Kylsystem
Radiateur

17 Radiator

Specifications	Page 17-0/3
1700009 Cooling system—checking for leaks	00/1
039 Cooling system—bleeding	00/1
1711000 Radiator—removing and installing or renewing	11/1
1711100 Radiator header (level compensation) tank—removing and installing	11/2
1722080 Oil cooler feed and return lines—removing and installing	22/1
1740000 Auxiliary fan—removing and installing or renewing	40/1

2.70

17-0/1

17-0/1

17-0/1

Specifications

Radiator

Model	a) 320/6 b) 320/6 A		a) 323 i b) 323 i A *)
17 10 . . . Coolant			
Quantity of coolant incl. heater circuit app.	I (Imp. pints, US quarts)	12 (21.1, 12.7)	
Antifreeze ^{1,2)} Mixing ratio water : antifreeze)	%	60 : 40	
Version for Nordic countries	%	50 : 50	
17 11 . . . Radiator cap			
Pressure relief valve opens	bar (lb/in ²)	1.0 $\pm$ 0.15 (14.2 $\pm$ 2.1) - 0.10 - 1.4)	
Vacuum relief valve opens	bar (lb/in ²)	0.9 (12.8)	
17 11 . . . Radiator (without transmission oil cooler) – standard version			
BMW number (on top of radiator)	a) 1 112 064		
Number of radiator fins per dm (Behr radiator)	a) 60		
Test pressure (gauge)	bar (lb/in ²)	1.5 (21.3)	

*) Version for Sweden

1) Renew every 2 years

2) For approved long-term antifreezes and corrosion inhibitors, see Service Information

Specifications

Radiator

Model	a) 320/6 b) 320/6 A	a) 323 i b) 323 i A *)
17 11 . . . Radiator (with transmission oil cooler) – standard version		
BMW number (on top of radiator)	b) 1 120 001	
Number of fins per dm (Behr radiator)	60	
Test pressure (gauge) bar (lb/in ²)	1.5 (21.3)	
Transmission oil cooler Test pressure (gauge) bar (lb/in ²)	b) 12	
Operating pressure (gauge), max. bar (lb/in ²)	b) 8	
17 40 . . . Auxiliary electric fan – for standard version and as special equipment		
Make	Bosch	
Bosch number	0 130 703 . . .	
Type	IPL 12 V	
Pattern	5-bladed	
Fan diameter mm (in)	366 (14.4)	

*) Version for Sweden

Specifications

Radiator

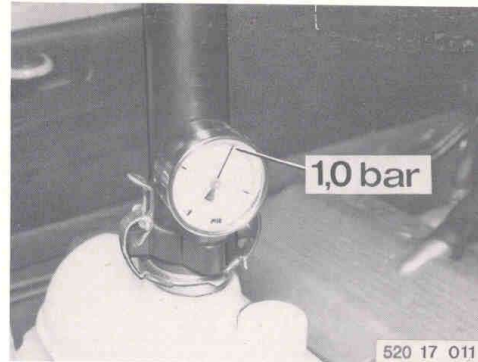
Model	a) 320/6 b) 320/6 A		a) 323 i b) 323 i A*)
Tightening torques			
17 11 . . . Radiator (with or without transmission oil cooler) incl. special equipment			
Radiator mountings (M 6)	Nm kpm lb.ft	8 . . . 9 0.8 . . . 0.9 5.9 . . . 6.6	
Oil cooler pipes (feed and return) at transmission oil cooler	Nm kpm lb.ft	b) 12 . . . 15 b) 1.2 . . . 1.5 b) 8.8 . . . 11.1	
Oil cooler pipes (feed and return) at transmission	Nm kpm lb.ft	b) 40 . . . 45 b) 4.0 . . . 4.5 b) 28.9 . . . 32.5	

*) Version for Sweden

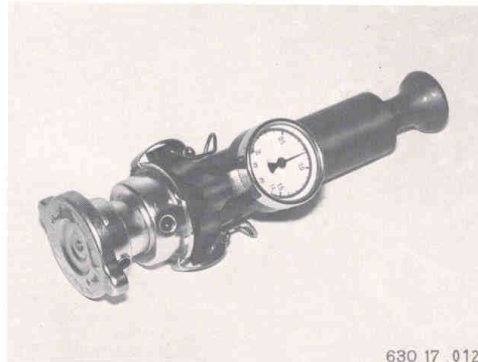
1700 009 Cooling system – checking for leaks

Attach tester 17 0 000 to header (compensating) tank.

Build up a pressure of app. 1 bar (14.2 lb/in²) in the cooling system with the hand pump. The cooling system has no leaks if pressure remains constant for 1... 2 minutes.



Attach the radiator cap and the tester to the connecting piece, and build up pressure with the hand pump.



The opening pressure must agree with the value stated in the Specifications.



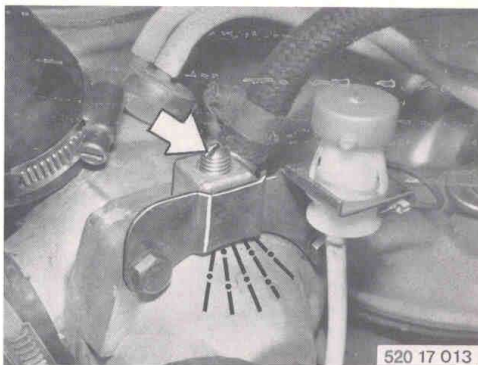
17 00 039 Cooling system – bleeding

Set the rotary heater control to "Warm".

With the engine at its normal operating temperature, loosen the bleed screw.

Run the engine at a fast idle speed until the water emerges free from air bubbles.

During bleeding, top up the coolant level in the header tank whenever it tends to drop.



17 11 000 Radiator – removing and installing or renewing

Remove the radiator cap from the header (compensating) tank.

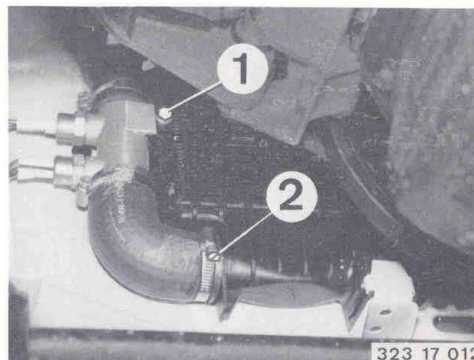
Take out screw (1).

Take off the radiator hose (2) and drain the coolant.

When installing: add coolant to correct level.

Bleed cooling system – 17 00 039.

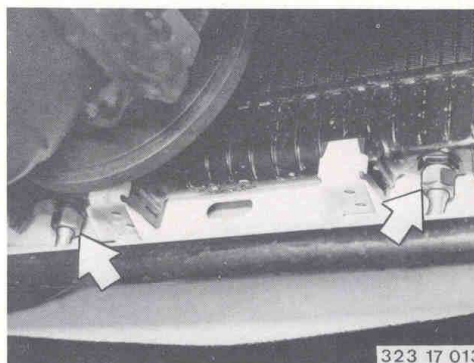
Note correct tightening torque¹⁾.



On automatic transmission cars:
unscrew and detach the oil lines:

When installing: if the transmission has failed or suffered damage, remove the radiator and immediately blow through the oil cooler in the lower water chamber of the radiator with compressed air, then flush out twice with ATF (automatic transmission fluid).

Note correct tightening torque¹⁾.



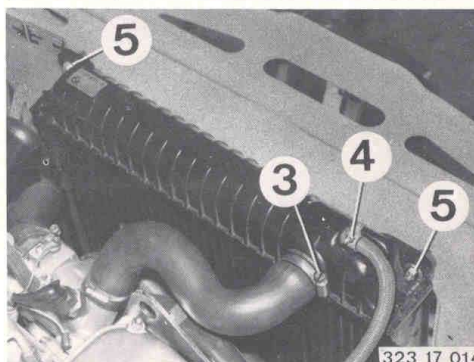
Detach hoses (3) and (4).

Unscrew the radiator mountings (5).

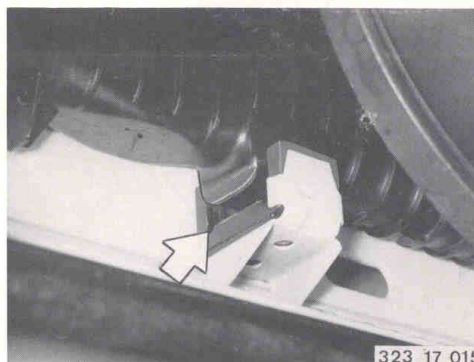
Lift out the radiator.

Warning: pull off the bleed line (4) carefully.

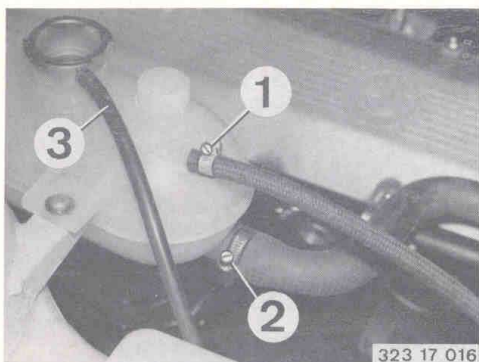
When installing: check radiator mountings and renew if necessary.



When installing: check condition of rubber underlay pads and renew if necessary. The rubber underlay is located between the webs of the radiator.



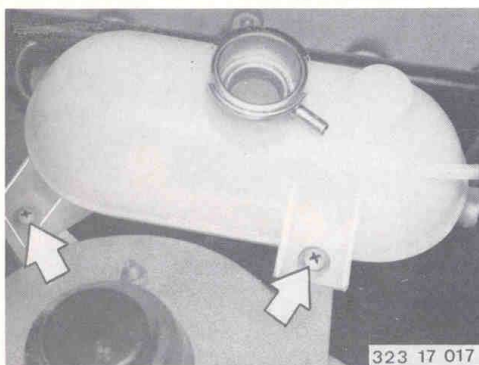
¹⁾ See specifications



17 11 100 Coolant header (compensating) tank – removing and installing or renewing

Partly drain the coolant.

Detach hose (1), pipe elbow (2) and overflow hose (3).



Remove screws and take out header tank.

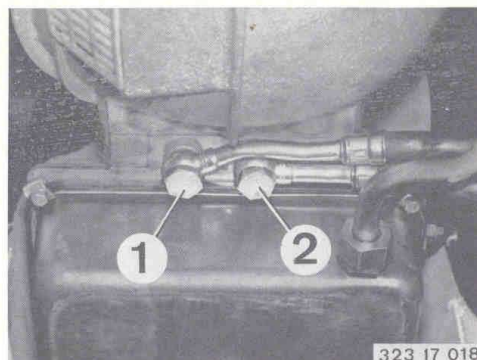
When installing: add coolant.

Bleed cooling system – 17 00 039.

17 22 080 Oil cooler feed and return lines – removing and installing

Detach feed (1) and return (2) pipes from transmission.

When installing: note correct tightening torque¹⁾.

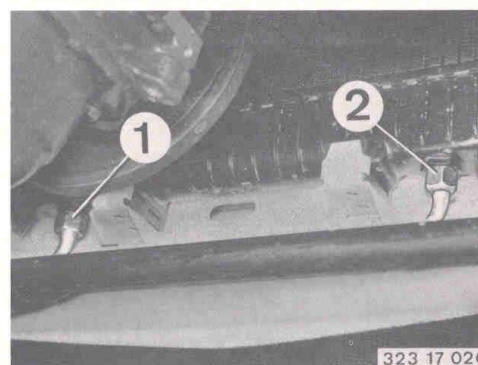


Take off clips.

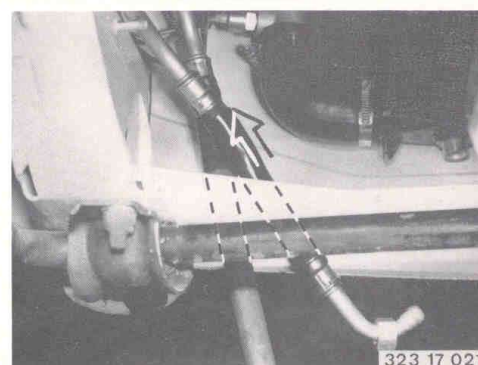


Unscrew feed (1) and return (2) from radiator.
Warning: hold union with open-ended wrench to prevent movement.

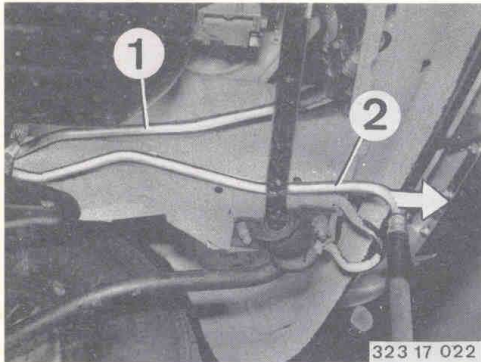
When installing: note correct tightening torque¹⁾.



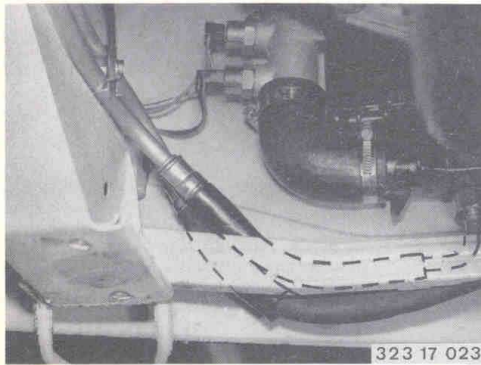
Pull hoses out of apron.



¹⁾ See specifications



First push the return line (2) – top – out forwards, then lift the feed line (1) – bottom – over the threaded rod of the rear clip and pull out forwards.



When installing: note correct positions of pipes, hoses and protective sleeves.
Feed line at bottom (shorter hose)
Return line at top (longer hose).

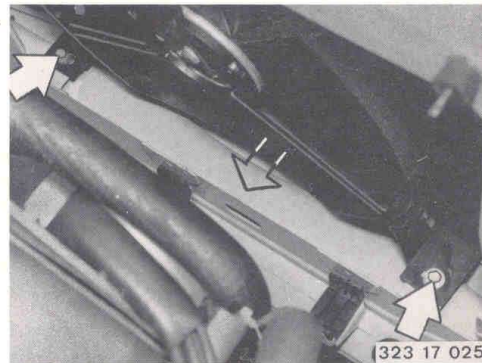
17 40 000 Auxiliary fan – removing and installing or renewing

Remove radiator – 17 11 000.

Unscrew nut and take screw out downwards.

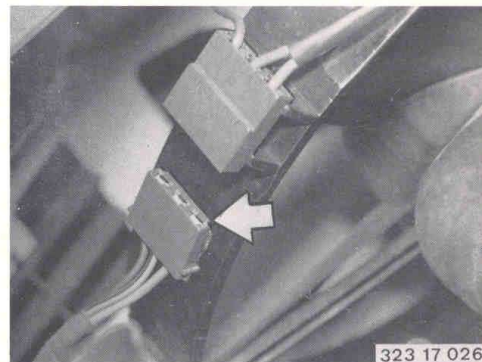


Remove screws and pull fan out downwards.

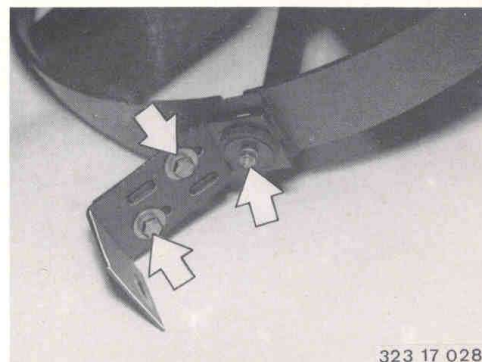


**Detach plug connector.
Lift fan out.**

When installing: cutouts on plug face fan.



**When renewing auxiliary fan:
transfer resistor and retaining bracket.
Do not tighten the screws for the retaining
bracket until the fan has been installed.**



Auspuff

Exhaust system
Dispositif d'échappement
Impianto di scarico
Dispositivo de escape
Avgassystem
Uitlaatinstallatie

Kupplung

Clutch
Embrayage
Frizione
Embrague
Koppling
Koppeling

18 Exhaust System

Specifications	Page 18-0/3
1800020 Complete exhaust system—removing and installing	00/1
1812030 Secondary muffler(silencer)—removing and installing or renewing	12/1

18-0/1

2.73

18-0/1

18-0/1

Specifications

Exhaust system

Model	320/6 320/6 A	323 i 323 i A*)	Tightening torques
18 11 ... Exhaust pipe			
Exhaust pipe to exhaust manifold – when renewing exhaust pipe	Nm kpm lb.ft	60 ... 67 6.0 ... 6.7 44 ... 49	
– when taking up slack	Nm kpm lb.ft	43 ... 48 4.3 ... 4.8 32 ... 35	
Exhaust pipe to triangular flange	Nm kpm lb.ft	22 ... 24 2.2 ... 2.4 16 ... 18	
18 21 ... Exhaust system fastenings			
Exhaust pipe carrier to retaining plate	Nm kpm lb.ft	22 ... 24 2.2 ... 2.4 16 ... 18	
Exhaust pipe carrier to exhaust pipe	Nm kpm lb.ft	22 ... 24 2.2 ... 2.4 16 ... 18	

*) Version for Sweden

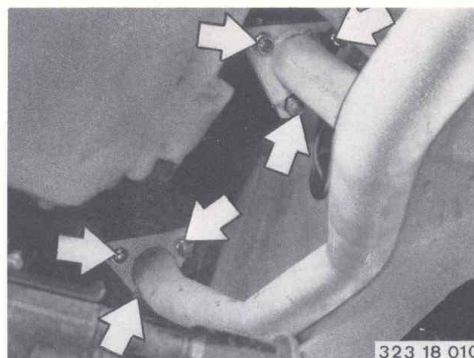
**18 00 020 Complete exhaust system
– removing and installing**

Detach the front exhaust pipes from the exhaust manifolds.

When installing: Note correct tightening torque¹⁾

Coat the studs with "Molykote" G paste.

Use new gaskets.

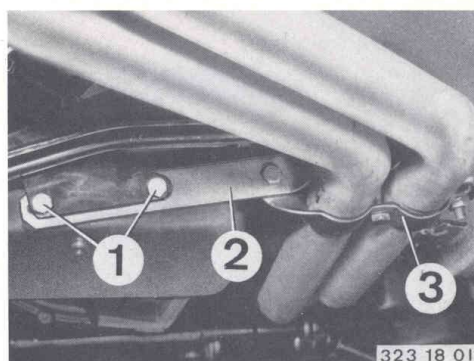


Detach the exhaust pipe carrier.

When installing: Loosen bolts (1). Press the exhaust pipe carrier (2) against the exhaust pipe until free from stress. Secure the retaining plate (2) to the transmission and the exhaust pipe carrier.

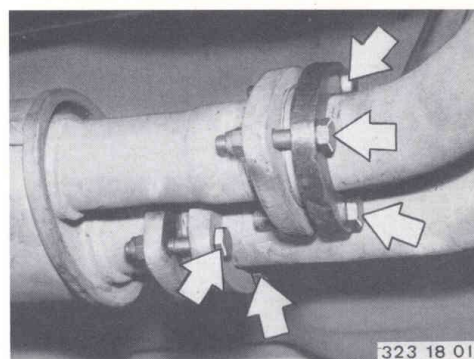
Finally, tighten bracket (3).

If any other installing sequence is used, severe drumming noises may result.



Detach front exhaust pipes from primary muffler.

When installing: Check condition of sealing rings and renew if necessary. Install primary muffler at exhaust pipes so that no stresses are trapped.

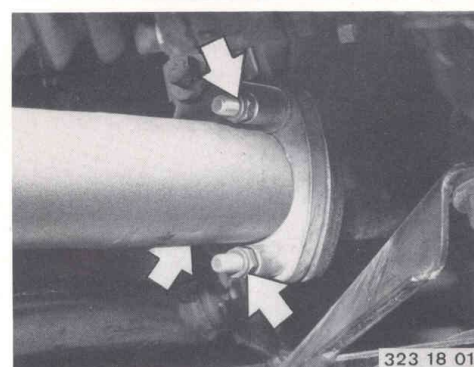


Separate the secondary muffler (silencer) at the flange.

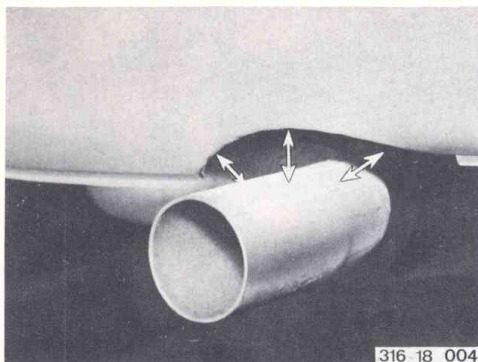
When installing: Install mounting. Before attaching the secondary muffler, align the pipe so that it does not make contact with the vehicle at any point.

Check condition of sealing ring and renew if necessary.

To prevent the secondary muffler from becoming loose when heat causes expansion, use long bolts with spacing sleeves.



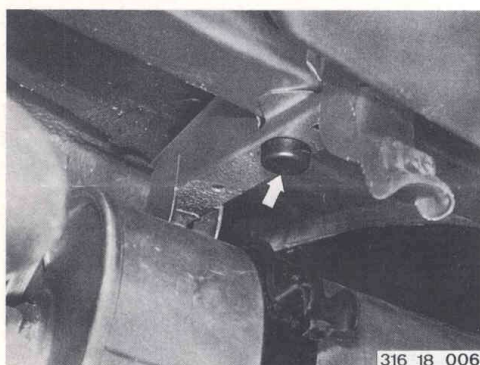
¹⁾ See specifications



Align the tail pipe with the cutout in the body tail panel.



Detach and remove the secondary muffler. Remove the front exhaust pipe with primary muffler.
When installing: Renew rubber rings if porous or torn.



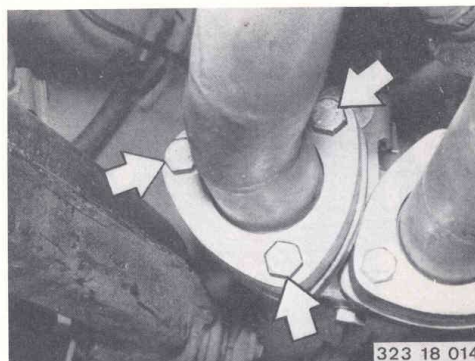
When installing: Check condition of rubber stop.

18 12 030 Secondary muffler (silencer) – removing and installing or renewing

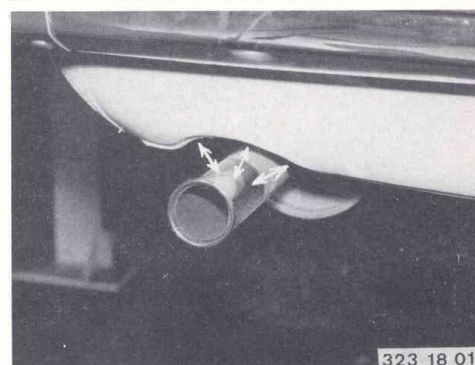
Left secondary muffler:

detach secondary muffler at flange.

When installing: before attaching the secondary muffler, align the pipe so that it cannot strike the body at any point.

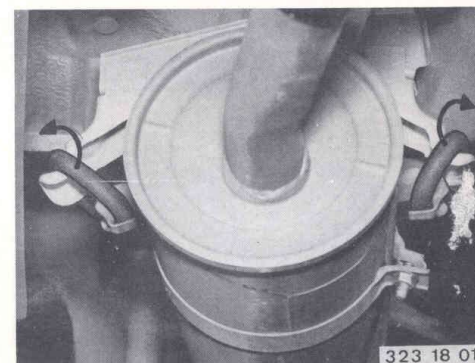


**Align the tailpipe with the cutout in the body end panel.
Renew the tailpipe trim.**

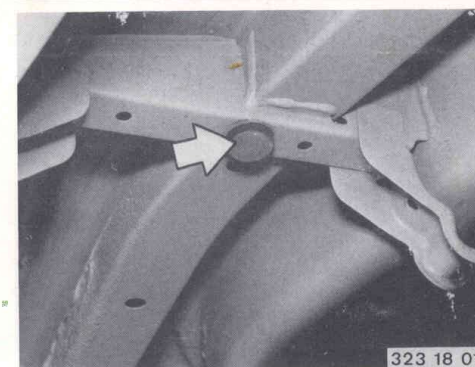


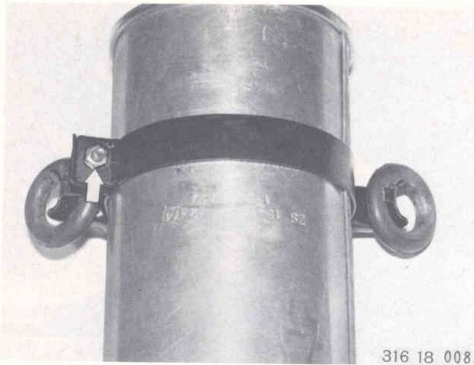
Disconnect the secondary muffler and remove it.

When installing: renew porous, cracked or torn rubber rings.

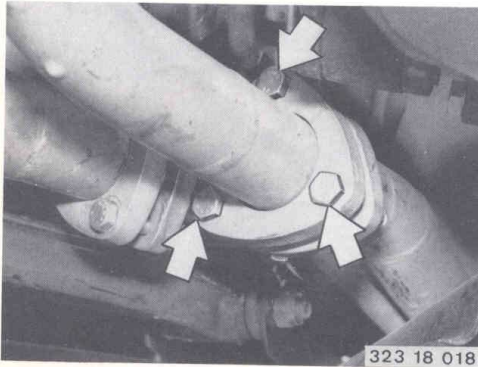


When installing: check rubber stop pad.



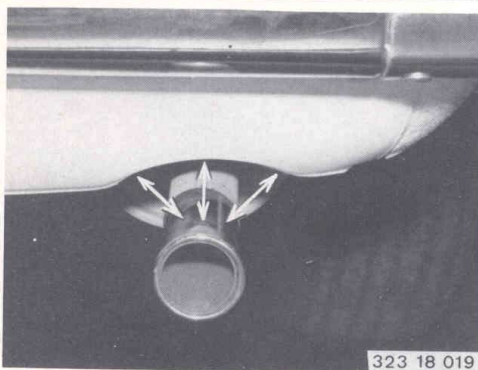


Transfer holder from old secondary muffler.



Right secondary muffler:
detach muffler at flange.

When installing: before securing the secondary muffler, align the pipe so that it does not strike the body at any point.



Align the tailpipe with the cutout in the body end panel.

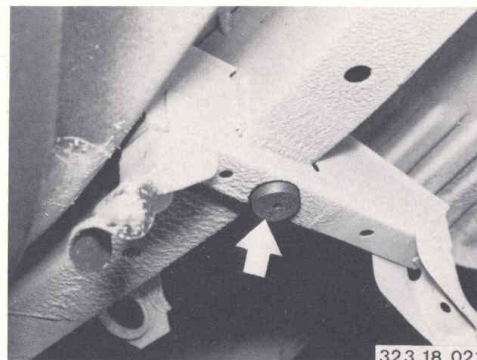
Renew the tailpipe trim.



Disconnect the secondary muffler and take it out.

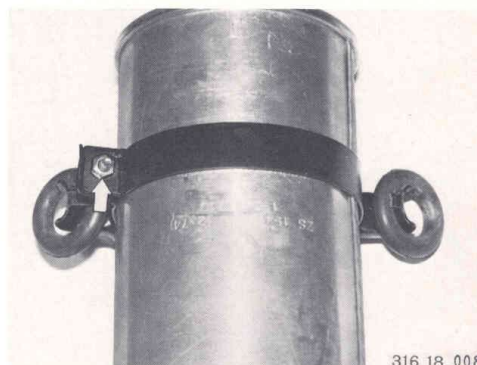
When installing: renew porous, cracked or torn rubber rings.

When installing: Check condition of rubber stop.



323 18 021

Transfer holder from secondary muffler (silencer) to new unit.



316 18 008

21 Clutch

Specifications	Page 21-0/3
2100006 Clutch hydraulic system—bleeding	00/1
2121000 Clutch—removing and installing	21/1
2151000 Clutch release mechanism—removing and installing	51/1
001 Clutch release mechanism—renewing	51/1
2152000 Clutch master cylinder—removing and installing	52/1
010 Clutch slave cylinder—removing and installing	52/2
502 Clutch master cylinder—reconditioning	52/2
512 Clutch slave cylinder—reconditioning	52/2
Trouble-shooting—clutch	52/3

Specifications

Clutch

Model	320/6		323 i
21 00 . . . General information			
Clutch type	Hydraulically operated single dry plate, with diaphragm spring, torsional vibration damper and automatic lining wear compensation		
Hydraulic fluid (brake fluid) ¹⁾ designation	BMW Brake Fluid DOT 4 ATE-DOT 4 "SL" Pentosin Super DOT 4 Castrol Disc Brake Fluid DOT 4		
21 21 . . . Clutch			
Make/Type	F & S/MF 228 K Sph		
Color code	yellow		brown
Contact pressure,	min.	N (kp, lb.f) 4412 (450, 991)	5300 (540, 1191)
	max.	N (kp, lb.f) 5099 (520, 1146)	6003 (612, 1349)
Withdrawal force,	min.	N (kp, lb.f) 1176 (120, 264)	1400 (143, 315)
	max.	N (kp, lb.f) 1372 (140, 308)	1550 (158, 348)
Max. imbalance	gcm		20
Max. deviation from plane (vertical runout) of diaphragm spring outer ends	mm (in)		0.6 (0.024)
¹⁾ Must be renewed once a year			

¹⁾ Must be renewed once a year

Specifications

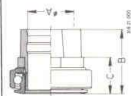
Clutch

Model	320/6	323 i
2121 ... Driving plate (with torsional vibration damper)		
Make/Type	F & S/228 PSD	F & S/228 TD
Color code	white	silver
External diameter	mm (in)	228 ± 1 (8.98 ± 0.04)
Internal diameter	mm (in)	150 ± 1 (5.91 ± 0.04)
Overall thickness (removed, incl. lining)	mm (in)	10.45 ± 0.4 (0.411 ± 0.016)
compressed at 4800 N (480 kp, 1079 lb.f)	mm (in)	9.3 ± 0.25 (0.366 ± 0.010)
Minimum thickness (removed, incl. lining)	mm (in)	9.35 (0.368)
(compressed at 4800 N (480 kp, 1079 lb.f)	mm (in)	8.20 (0.323)
Max. runout	mm (in)	0.6 (0.024)
– measured at plate dia.	mm (in)	220 (8.66)
Max. imbalance	gcm	10

Specifications

Clutch

Model	320/6	323 i
2121 . . . Driving plate (with torsional vibration damper) (continued)		
Permissible deviation from parallel of the two lining faces	mm (in)	0.15 (0.006)
Clutch lining designation		Textar 50 s/17
– engine side/gearbox side		
Lining thickness	mm (in)	3.9 (0.154)
– engine side/gearbox side		
Minimum thickness	mm (in)	3.2 (0.126)
– engine side/gearbox side		
2151 . . . Clutch withdrawal mechanism (self-centering ball thrust bearing)		
Withdrawal bearing internal dia. A	mm (in)	38 + 0.112 + 0.0044 + 0.050 (1.4961 + 0.0020)
Height B	mm (in)	52.5 ± 0.4 (2.067 ± 0.016)
Height C	mm (in)	30.5 ± 0.25 (1.201 ± 0.010)



Specifications

Clutch

Model	320/6	323 i
2152 . . . Hydraulic clutch operation		
Clutch master cylinder Make ¹⁾		Kugelfischer or Teves
Bore	mm (in)	19.05 (0.75)
Stroke	mm (in)	32.00 (1.26)
Clutch slave cylinder Make		Kugelfischer or Teves
Bore	mm (in)	20.64 (0.8125)
Stroke	mm (in)	23.00 (0.906)

¹⁾ On RHD cars, Kugelfischer only

Specifications

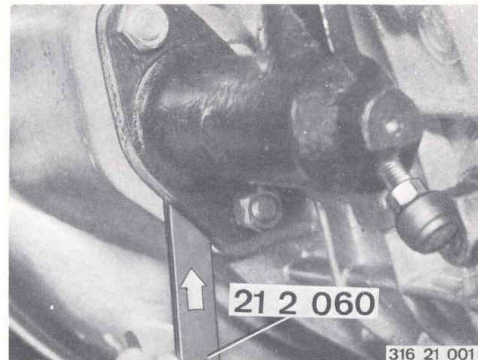
Clutch		Specifications	
Model		320/6	323 i
Tightening torques			
21 11 ... Clutch housing			
Clutch (gearbox) housing to crankcase	M 12 × 60 mm	Nm kpm lb.ft	78 ... 86 8 ... 8.8 58 ... 64
	M 12 × 45 mm	Nm kpm lb.ft	78 ... 86 8 ... 8.8 58 ... 64
Cover plate and gearbox cover plate at gearbox (M 6)		Nm kpm lb.ft	9 ... 10 0.9 ... 1.0 6.6 ... 7.4
21 21 ... Clutch with driving plate			
Clutch to flywheel (M 8)		Nm kpm lb.ft	22 ... 24 2.2 ... 2.4 16 ... 18

Specifications

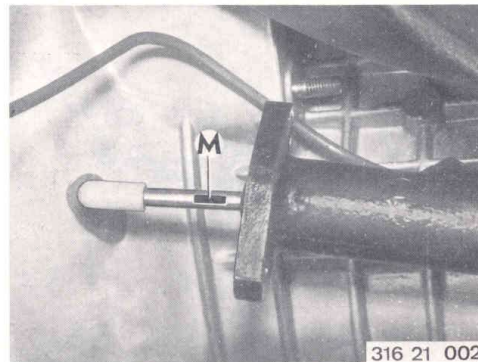
Specifications			
Clutch	320/6		323 i
Model	Tightening torques		
21 52 . . . Clutch operating mechanism (hydraulic)			
Master cylinder to mount (M 8)	Nm	22 . . . 24	
	kpm	2.2 . . . 2.4	
	lb.ft	16 . . . 18	
– to clutch pedal (M 10)	Nm	32 . . . 36	
	kpm	3.3 . . . 3.7	
	lb.ft	24 . . . 27	
Slave cylinder to clutch housing (gearbox) – M 8	Nm	25 . . . 28	
	kpm	2.5 . . . 2.9	
	lb.ft	18.4 . . . 20.6	
Collar screws for clutch line (master and slave cylinders)	Nm	13 . . . 16	
	kpm	1.3 . . . 1.6	
	lb.ft	9.6 . . . 11.8	

21 00 006 Clutch hydraulic system – bleeding

Determining release trouble:
Insert feeler gauge 21 2 060 into the cutout provided, and push up as far as the piston rod.

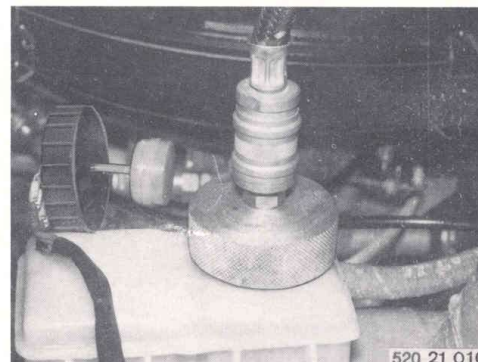


Depress the clutch pedal fully. Detach the slave cylinder and measure the line marked by the feeler gauge (M).
If the release travel (indicated by the line) is less than 20 mm (0.8 in), there may be air in the hydraulic system or a sleeve may be defective.

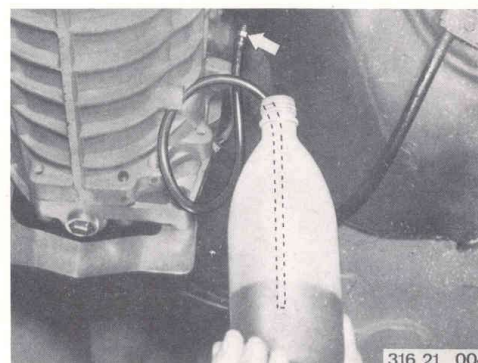


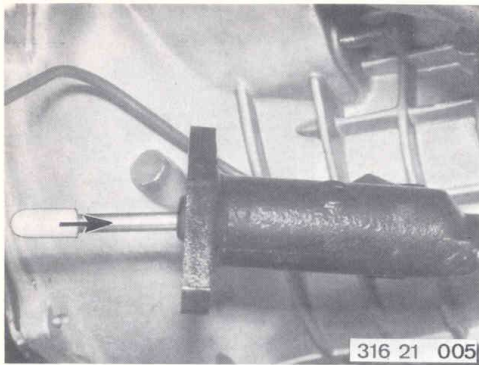
A) With bleeding device

Unscrew the threaded union on the fluid reservoir.
Connect the bleeding device.

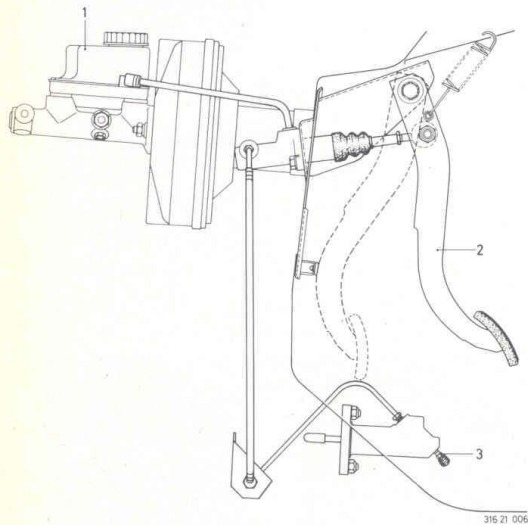


Keep the bleed screw on the clutch slave cylinder open until no further air bubbles emerge, and at the same time depress the clutch pedal fully several times.





Detach the slave cylinder from the gearbox. Press the thrust rod in until it makes contact inside the slave cylinder, then release slowly. This will expel any remaining air in the fluid reservoir and ensure that the maximum release travel is available. Never depress the clutch pedal when the slave cylinder is removed.



B) Without bleeding device

Fill the fluid reservoir (1). Connect the bleed hose to the bleed screw (3). The end of the bleed hose must be immersed in a vessel containing brake fluid, so that no air is drawn into the system during bleeding. Depress the clutch pedal (2) fully approx. 10 times, then hold down in this position. Open the bleed screw (3). When no further air bubbles emerge, close the screw. Release the clutch pedal and depress again approx. 10 times. Repeat these operations until no further air bubbles emerge from the hydraulic system. *Warning:* Top up the level of fluid in the reservoir (1) during the above procedure.

21 21 000 Clutch – removing and installing

Inspect clutch for wear before removing:

If the feeler gauge 21 2 060 can be inserted as far as its handle into the opening on the slave cylinder, the clutch plates are still in good working order.

If a gap approx. 5 mm (0.2 in) wide is formed between the handle of test gauge 21 2 060 and the slave cylinder, the clutch lining is worn and should be renewed.

Remove the gearbox 23 00 020.

Check runout at ends of diaphragm spring¹⁾. Prevent the flywheel from turning with special tool 11 2 170.

Loosen all retaining bolts by 1 to 1½ turns in succession until the clutch spring pressure has been released.

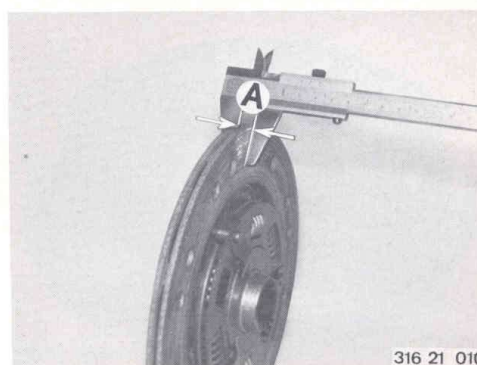
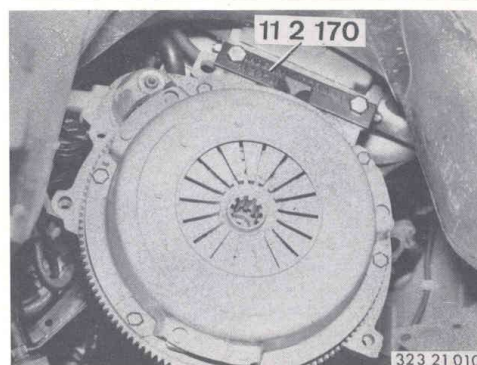
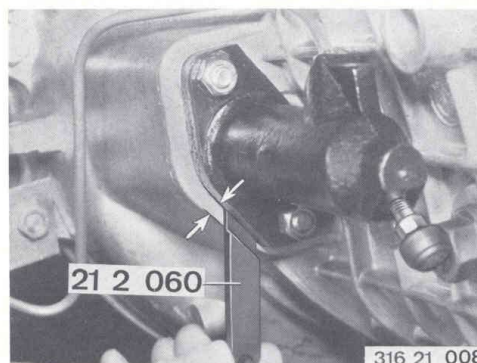
Remove the retaining bolts and take off the clutch and driving plate.

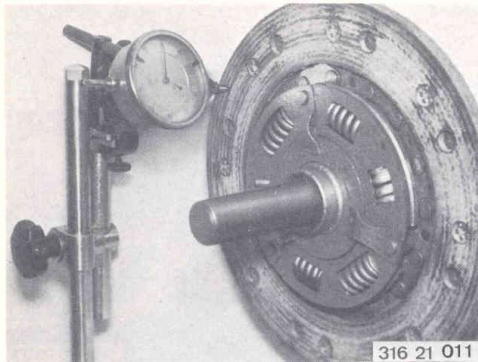
Important: Never throw or drop clutch. Improper handling of the clutch could snap off the three tangential leaf springs holding the clutch in its direction of rotation. The diaphragm spring will then permit the release stroke, but the weak leaf springs cannot lift the pressure ring sufficiently and the drive plate will not be released.

Check the driving plate¹⁾ (A) for signs of cracking, and ensure that the spring elements of the vibration damper are firmly seated.

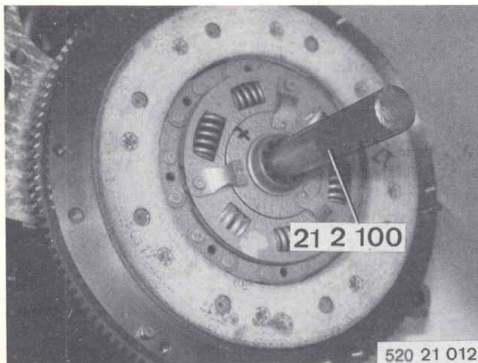
When installing: Note correct side of clutch.

¹⁾ See specifications





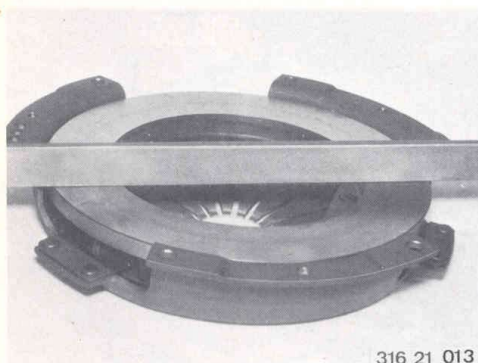
Check the driving plate with lining for lateral runout¹⁾.



When installing: Check free movement of needle roller bearing in crankshaft and renew if necessary.

Check flywheel for score marks.

Center the driving plate in the flywheel with centering arbor 21 2 100.



Inspect the clutch for signs of cracking, wear or localized burns.

The pressure face must be absolutely flat.



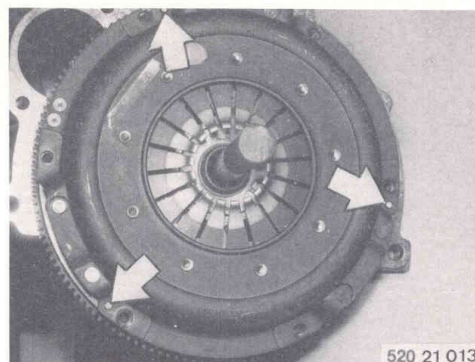
Inspect the riveted joints for wear and firm grip. Renew the clutch if the rivet heads are loose or worn.

¹⁾ See specifications

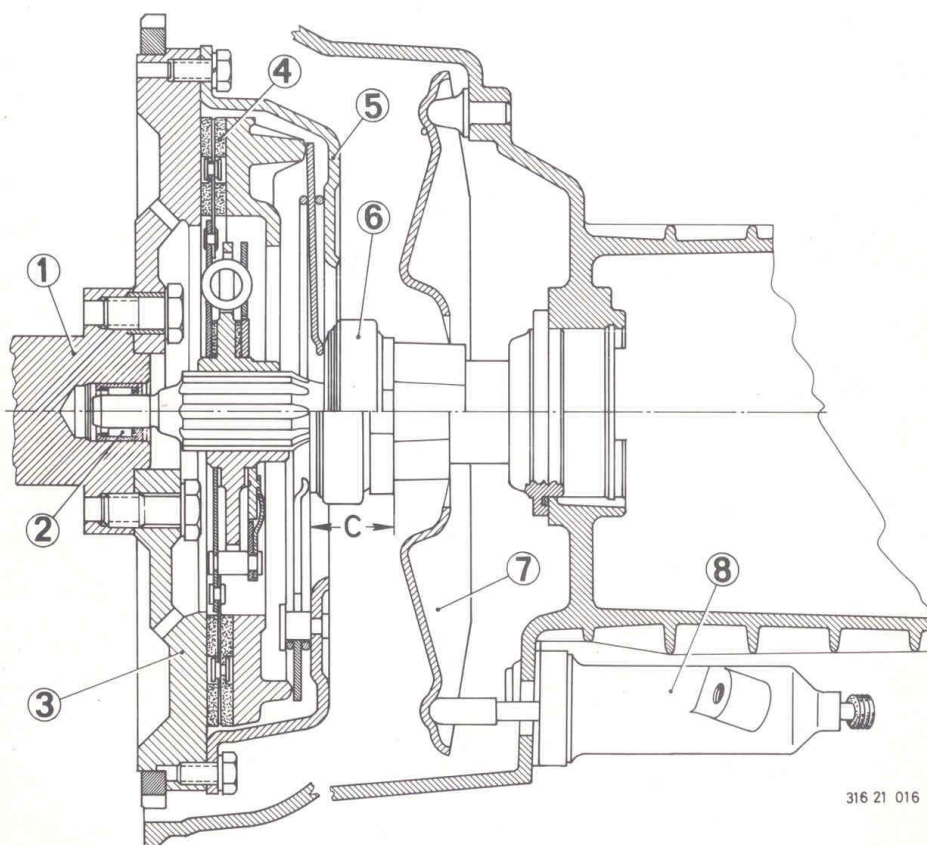
Place the clutch on the locating pins.
Tighten the retaining bolts uniformly in sequence until the specified torque¹⁾ is reached.
When installing: Apply a small amount of "Molykote Longterm 2" grease to the gearbox input shaft splines.

Clutch – general arrangement

- 1 Crankshaft
- 2 Needle roller bearing
- 3 Flywheel
- 4 Driving plate¹⁾
- 5 Pressure plate¹⁾
- 6 Release mechanism¹⁾
- 7 Release lever
- 8 Slave cylinder



520 21 013



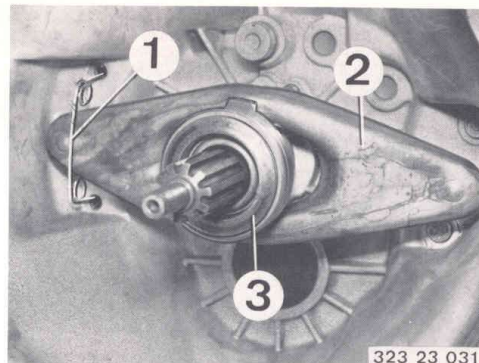
316 21 016

¹⁾ See specifications

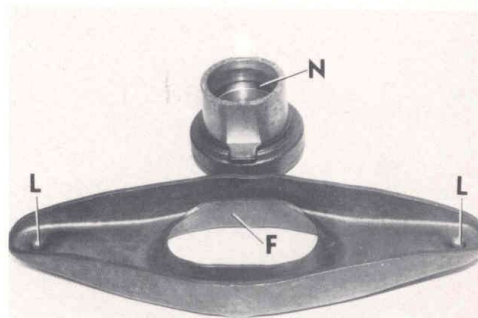
21 51 000 Clutch release mechanism – removing and installing

Remove the gearbox 23 00 020.

Take out spring (1) and release lever (2) with release unit (3).



When installing: Pack the lubricating groove (N) with "Molykote Longterm 2". Coat the guides (F) and support points (L) with "Molykote Longterm 2". If this precaution is neglected, the bearing may seize on the guide sleeve.



316 23 025

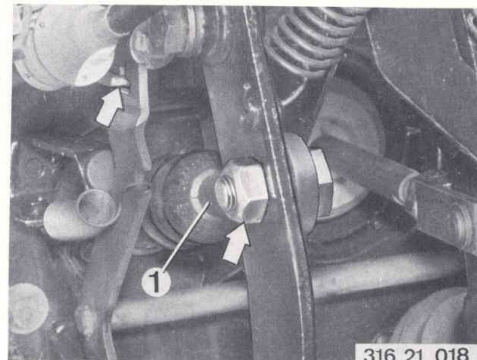
Note correct release unit heights B and C¹⁾.
BMW 320/323i Fichtel & Sachs No. 3151 047 001.
Grease the lubricating groove with "Molykote Longterm 2".



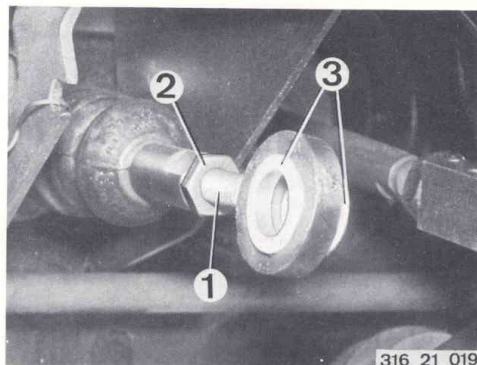
¹⁾ See specifications

21 52 000 Clutch master cylinder – removing and installing

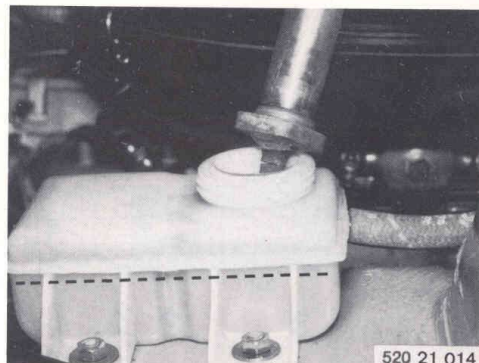
Detach the thrust rod (1) from the clutch pedal lever.



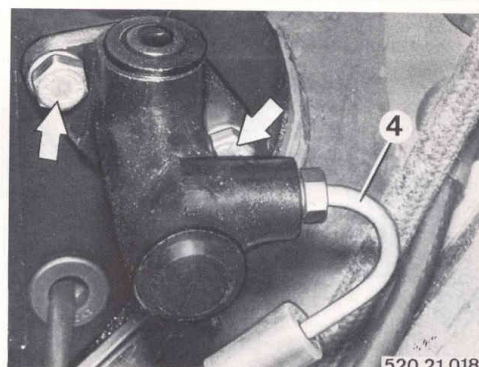
Loosen nut (2) and unscrew piston rod (1).
When installing: Use piston rod (1) to adjust clutch pedal travel¹⁾.
Warning: Note presence of bushings (3).
Coat the bushings and pin with "Molykote Longterm 2".



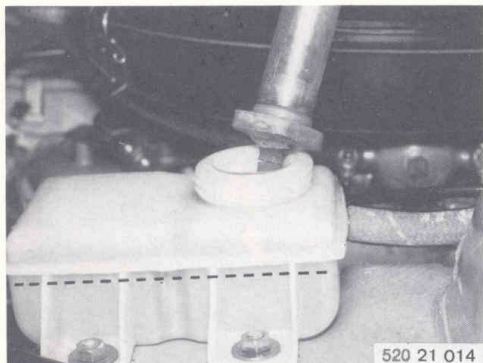
Siphon off the brake fluid from the reservoir until the level drops below the refill line outlet.



Disconnect brake pipe from engine bulkhead and bend up.
Pull out the refill line.
Detach line (4) to the slave cylinder.
Detach the master cylinder from the engine bulkhead and remove forwards.
Bleed the clutch hydraulic system – 21 00 006.

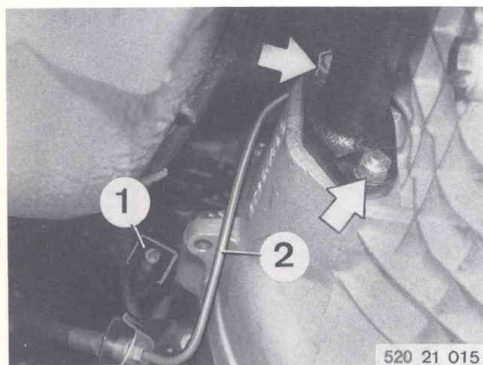


¹⁾ See specifications



21 52 010 Clutch slave cylinder – removing and installing

Siphon off the brake fluid from the reservoir down to the refill line connection.



Detach the slave cylinder from the gearbox. Take off the slave cylinder.

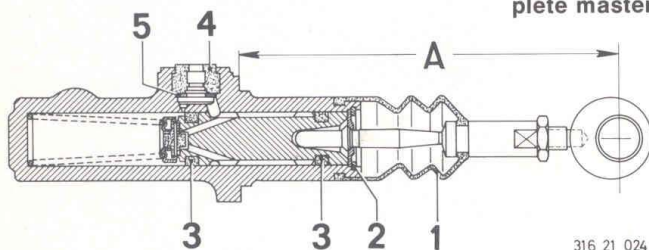
Detach pipe (1).

When installing: The bleed screw points down. Coat the thrust rod at the front with Molykote Longterm 2.

Bleed the clutch hydraulic circuit – 21 00 006.

21 52 502 Clutch master cylinder – reconditioning (removed)

Clean the master cylinder and interior components with cleaning spirit. If the cylinder bore is scored or locally corroded, renew the complete master cylinder.



Install the repair kit.

Components:

Dust cap 1

Circlip 2

Slotted rings 3

Sealing plug 4

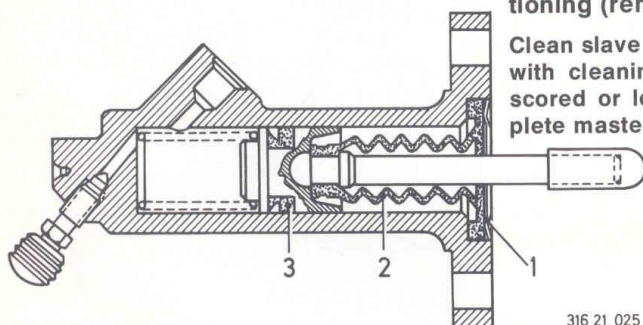
Washer 5

Installed dimension

A 140 ± 0.5 mm (5.512 ± 0.020 in)

21 52 512 Clutch slave cylinder – reconditioning (removed)

Clean slave cylinder and interior components with cleaning spirit. If the cylinder bore is scored or locally corroded, renew the complete master cylinder.



Install the repair kit.

Components:

1 Serrated ring

2 Dust cap

3 Slotted sleeve

Trouble shooting – Clutch

Fault	Cause	Remedy
Clutch slipping	a) Clutch contact pressure¹⁾ too low b) Clutch lining¹⁾ severely worn c) Oil on lining – gearbox – or crankshaft sealing ring defective d) Clutch has been running too hot e) Clutch was not a genuine BMW component	a) Renew clutch b) Renew driving plate c) Renew defective seal and clutch driving plate d) Renew clutch e) Install genuine BMW component
Clutch juddering	a) Lining¹⁾ not to specification b) Oil on lining c) Release mechanism exerting pressure to one side d) Pressure plate acting at an angle e) Crankshaft not aligned with gearbox input shaft f) Defective engine and transmission mounting g) Driving plate is not a genuine BMW component	a) Renew driving plate b) Renew driving plate c) Check withdrawal arm d) Renew pressure plate e) Check centering faces at engine and transmission f) Renew engine and transmission mounting g) Install a genuine BMW component
Clutch will not release	a) Driving plate out of alignment or lining fractured b) Driving plate lateral runoff¹⁾ c) Lining rusted to flywheel d) Driving plate sticking on gearbox input shaft e) Defective gearbox input shaft bearing in crankshaft f) Air in clutch hydraulic system g) Tangential leaf springs in clutch snapped off	a) Renew driving plate b) Straighten or renew c) Clean flywheel, roughen lining with emery paper d) Free driving plate on gearbox input shaft or renew damaged components e) Renew crankshaft bearing f) Bleed clutch hydraulic system g) Renew clutch
Noise from clutch	a) Clutch and driving plate severely out of balance¹⁾ b) Defective vibration damper c) Defective clutch release mechanism d) Defective gearbox input shaft bearing in crankshaft e) Loose rivets in clutch	a) Renew clutch or driving plate b) Renew driving plate c) Renew clutch return mechanism d) Renew crankshaft bearing e) Renew clutch

¹⁾ See specifications

Getriebe mechanisch

Transmission – manual

Boîte à vitesses – mécanique

Cambio

Caja de cambio

Växellåda, mekanisk

Versnellingsbak, mechanisch

23 Manual shift gearbox

Specifications	Page 23-0/3
2300020 Gearbox—removing and installing	00/1
2311000 Gearbox housing—detaching and attaching/sealing	11/1
101 Backup (reversing) light switch—renewing	11/3
590 Guide sleeve for clutch release unit—removing and installing	11/3
591 Guide sleeve for clutch release unit—renewing	11/4
2312051 Output flange radial seal—renewing	12/1
081 Selector shaft radial seal—renewing	12/2
131 Cord ring seal for speedometer shaft bushing—renewing	12/2
521 Input shaft radial seal—renewing	12/2
2321500 Input and output shafts—removing and installing	21/1
551 Output shaft—renewing	21/8
701 All ball bearings—renewing	21/8
2333100 Speedometer drive pinion—removing and installing	22/1
551 3rd and 4th gear clusters—renewing	22/1
2323503 Synchromesh rings—renewing	23/1
2331501 1st/2nd and 3rd/4th gear selector forks—renewing	31/1
721 All sliding blocks—renewing	31/1

Specifications

Manual gearbox

Model	320/6	323 i
2300 ... Gearbox, general (4-speed manual shift)		
Make	Getrag	
Type	242/7.50	
Type of synchromesh	Borg-Warner (limited slip)	
Gear shift	Central floor-mounted lever	
Oil grade	SAE 80 ¹⁾	
Oil content	1 (Imp. pints, US quarts)	
Gear ratios	1.0 (1.76, 1.05)	
	Ratio	
	3.7643 : 1	
1st	Ratio	
	31 · 34	
	20 · 14	
2nd	Ratio	
	2.043 : 1	
	Ratio	
	31 · 29	
3rd	Ratio	
	20 · 22	
	Ratio	
	1.320 : 1	
4th	Ratio	
	31 · 23	
	Ratio	
	20 · 27	

¹⁾ Use a brand-name gear oil to MIL-L-2105 or API-GL 4 specification, not a hypoid oil. In a emergency, use a brand-name HD single-range or multigrade engine oil for spark-ignition engines as specified for the car's engine (see Service Information).

Specifications

Manual gearbox

Model	320/6	323 i
23 00 . . . Gearbox, general (4-speed manual shift) – (continued)		
Gear ratios (continued) 4th	Ratio	1.0 : 1
	Ratio	4.0964 : 1
Reverse	Number of teeth	$31 \cdot 17 \cdot 37$
		$20 \cdot 14 \cdot 17$
Speedometer drive	Ratio	2.5 : 1
	Number of teeth	$\frac{10}{4}$
23 11 . . . Gearbox housing with cover		
Heating temperature for bearing installation	°C (°F)	80 (176)
23 12 . . . Bearing in gearbox		
Output shaft bearings		Optional: FAG 6306 C3 700 672 or SKF 6306 C3 VB – 005
Input shaft bearings		Optional: FAG 6206/E. TNH C3 or SKF 6206 C3/361 781
Layshaft bearings,	front	Optional: FAG 6304 TNH C3/139 677 or SKF 6304 C3/361 153 A
	rear	Optional: FAG roller bearing NJ 304 C3 DIN 5412 or SKF NJ 304

Specifications

Manual gearbox

Model	320/6		323 i
23 21 . . . Gearbox shafts			
Endplay of output/ input shafts	mm (in)	Output shaft 0.14 . . . 0.2 mm (0.0055 . . . 0.0079 in) ¹⁾ Input shaft 0.12 . . . 0.18mm (0.0047 . . . 0.0071 in) ¹⁾	
Output shaft endplay (between reverse gear pinion and speedometer drive worm)	mm (in)	0 . . . 0.09 (0 . . . 0.0035)	
Layshaft endplay	mm (in)	0.1 . . . 0.2 (0.0039 . . . 0.0079)	
Radial runout at output shaft journal	mm (in)	0.07 (0.0028)	
Installed output flange – radial runout	mm (in)	0.07 (0.0028)	
– face runout	mm (in)	0.1 (0.0039)	
23 22 . . . Gearwheels			
Pressure for removing gearwheels N	kp lb.f	app. 98 100 app. 10 000 app. 22 045	
Pressure for installing gearwheels N	kp lb.f	max. 58 860 max. 6 000 max. 13 225	
Temperature to which gearwheels must be heated	°C (°F)	120 . . . 150 (248 . . . 302)	

¹⁾ Axial bearing play

Manual gearbox

Specifications

Model	320/6	323 i
23 23 ... Synchronmesh		
Synchronmesh ring		
Space between synchro-mesh ring and clutch body – when new	mm (in)	1.0 (0.039)
– wear limit	mm (in)	0.8 (0.031)
23 31 ... Internal shift mechanism components		
Width of selector fork guide web, 1st ... 4th gear	mm (in)	5 – 0.030 (0.1968 – 0.0012) – 0.078 – 0.0031)
Selector lever guide width, reverse gear	mm (in)	13.95 ⁰ – 0.1 (0.5492 – 0.0039)

Manual gearbox

Specifications

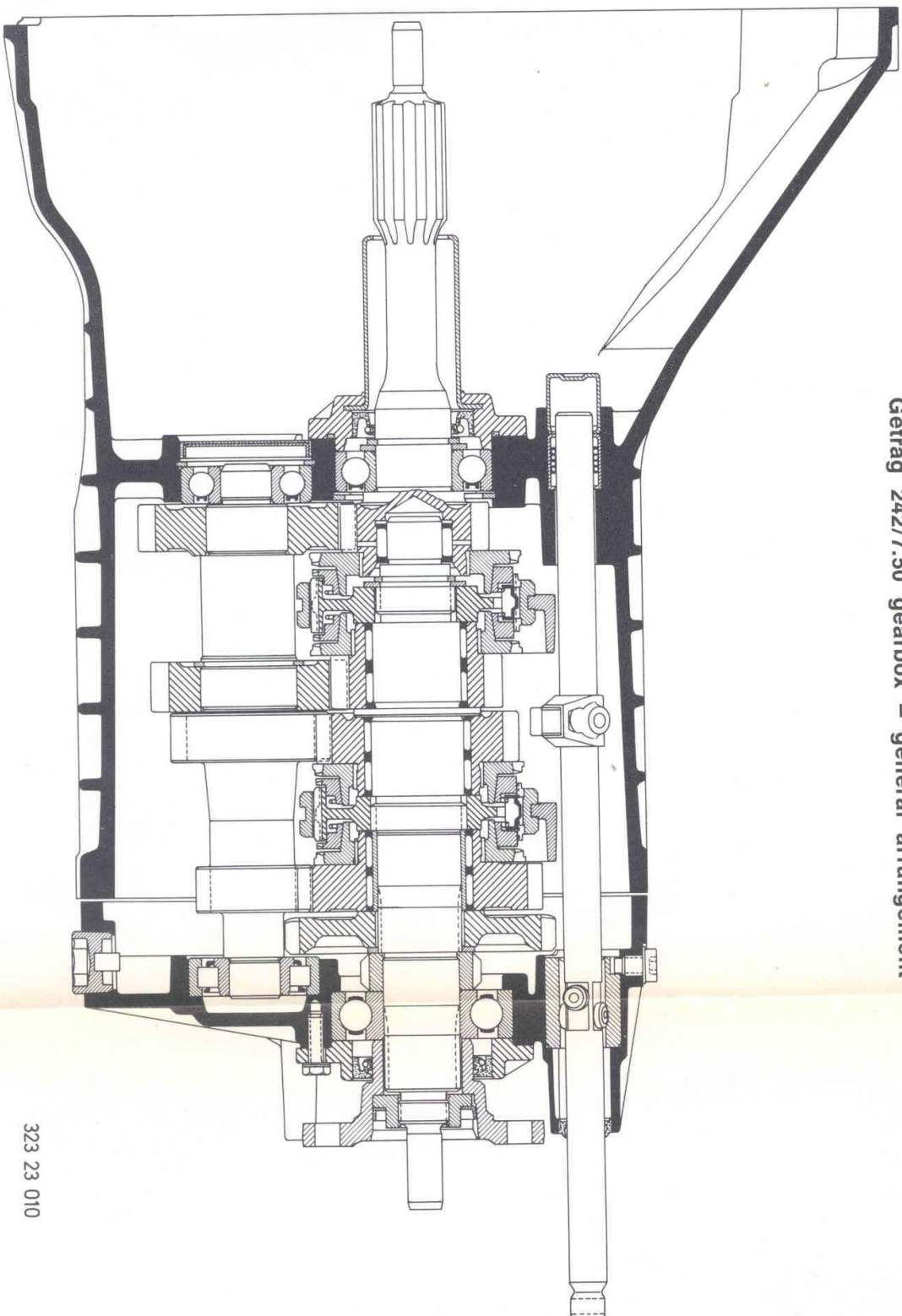
Model		320/6	323 i
Tightening torques			
23 00 . . . Gearbox, general			
Four-speed gearbox to engine M 12 × 60 mm	Nm	78 . . . 86	
	kpm lb.ft	8.0 . . . 8.8 58 . . . 63	
M 12 × 45 mm	Nm	78 . . . 86	
	kpm lb.ft	8.0 . . . 8.8 58 . . . 63	
Screw plugs M 24 × 1.5 mm (oil filter) M 24 × 1.5 mm (oil drain)	Nm	39 . . . 59	
	kpm lb.ft	4.0 . . . 6.0 29 . . . 44	
23 11 . . . Housing with cover			
Gearbox housing cover/ housing (M 8)	Nm	25	
	kpm lb.ft	2.5 18	
Cover with guide sleeve/ housing (M 6)	Nm	10	
	kpm lb.ft	1.0 7.4	
Bearing cap (support ring) – M 6	Nm	10	
	kpm lb.ft	1 7.4	
Reverse gear pin (M 10)	Nm	39 . . . 49	
	kpm lb.ft	4.0 . . . 5.0 29 . . . 44	

Specifications

Manual gearbox

Model	320/6		323 i
Tightening torques – continued			
23 21 . . . Gearbox shafts			
Output flange (shouldered nut, M 20 × 1.5 mm)	Nm kpm lb.ft	98 10 72	
23 71 . . . Gearbox mounting			
Rubber mounting to cross-member (M 10)	Nm kpm lb.ft	43 . . . 48 4.4 . . . 4.9 32 . . . 35	
Rubber mounting to gearbox (M 10)	Nm kpm lb.ft	43 . . . 48 4.4 . . . 4.9 32 . . . 35	
Cross-member to body (M 8)	Nm kpm lb.ft	22 . . . 24 2.2 . . . 2.4 16 . . . 18	

Getrag 242/7.50 gearbox – general arrangement

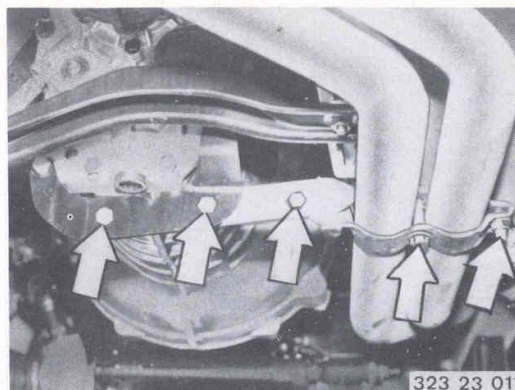


323 23 010

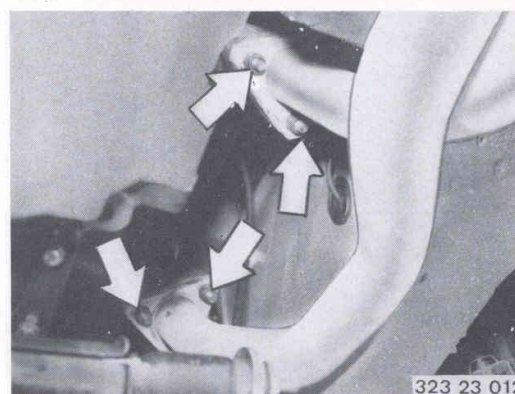
23 00 020 Gearbox – removing and installing

Detach exhaust pipe support.

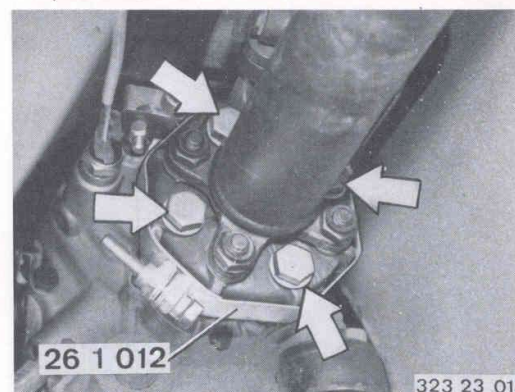
When installing: exhaust pipe support must be free from trapped stresses.



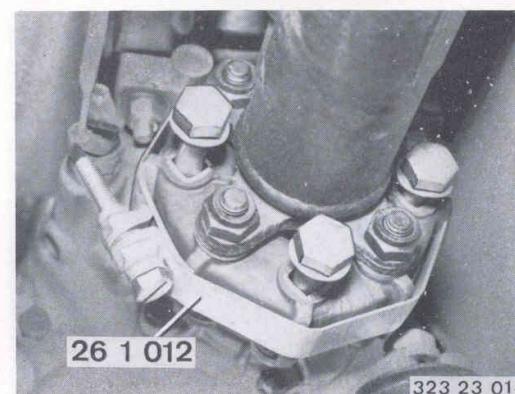
Detach exhaust pipes from exhaust manifold.
When installing: check gaskets and renew if necessary.

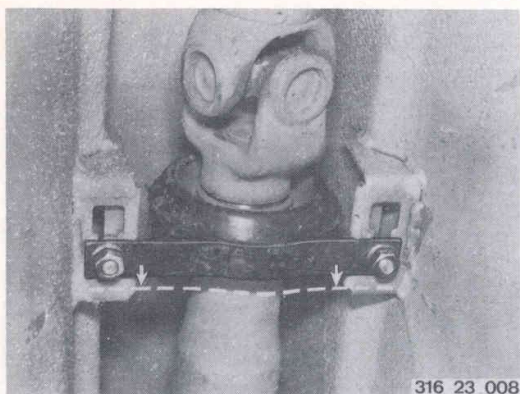


Attach clamp strap 26 1 012.
Unscrew bolts.
Do not re-use the stop nuts.

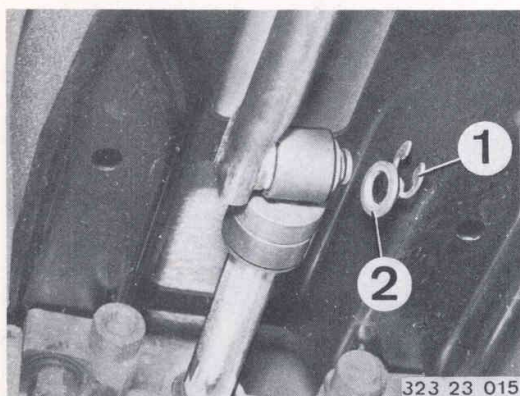


Tighten clamp strap 26 1 012 until the bolts can be taken out.
When installing: to prevent distortion of the 'Giubo' coupling, only tighten the nuts. Do not remove the clamp strap until the nuts have been tightened.

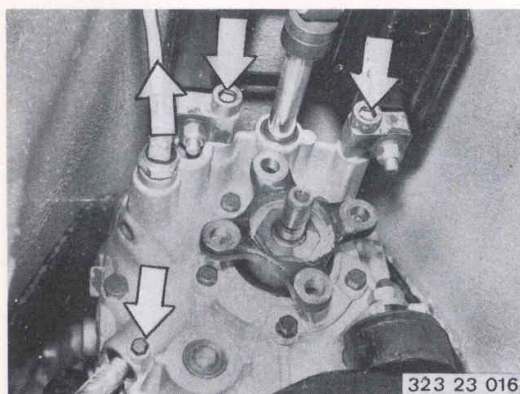




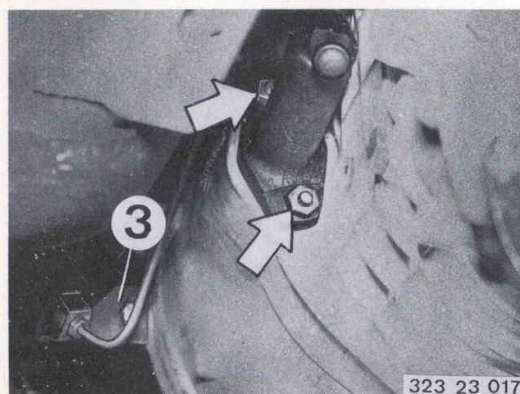
Take off the center bearing.
When installing: preload the center bearing by 2 mm (0.08 in) towards the front of the car.
 Hinge the propeller shaft down and pull off the centering journal.



Select reverse gear.
 Take out lock washer (1) and take off washer (2). Pull out the selector rod.

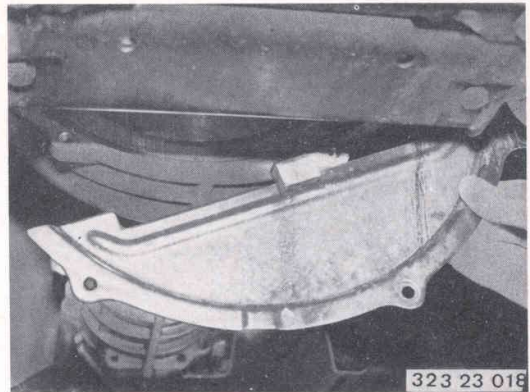


Detach the selector bracket from the gearbox.
 Remove the speedometer drive shaft.
 Detach the lead from the reversing (backup) light switch.



Remove the clutch slave cylinder.
 Take off holder (3).

Remove cover plate.

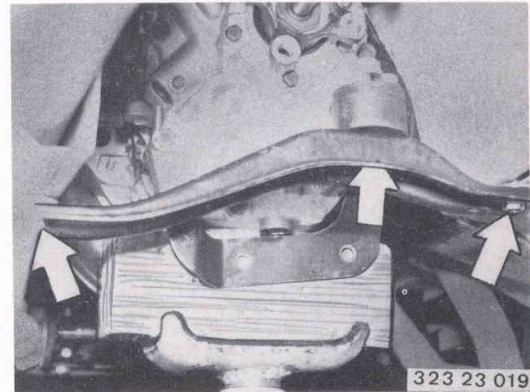


Support the gearbox.

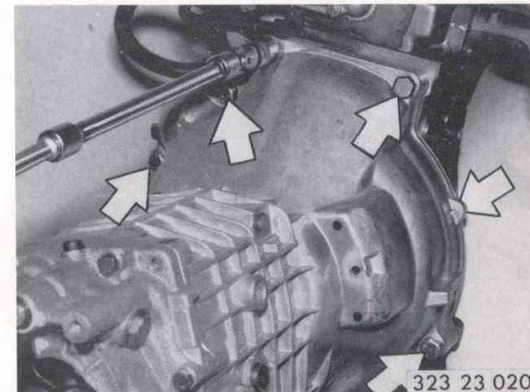
Remove the cross-member.

Warning: if there are shim washers between the cross-member and the body, they must be inserted when re-assembling.

Lower the gearbox as far as the front axle beam.

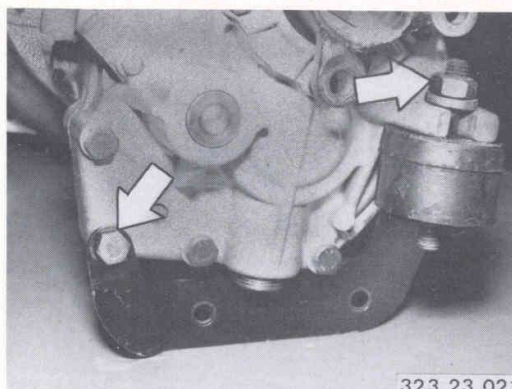


Remove all retaining bolts at the gearbox.
Use an extension wrench as necessary.
Remove the gearbox to the rear.

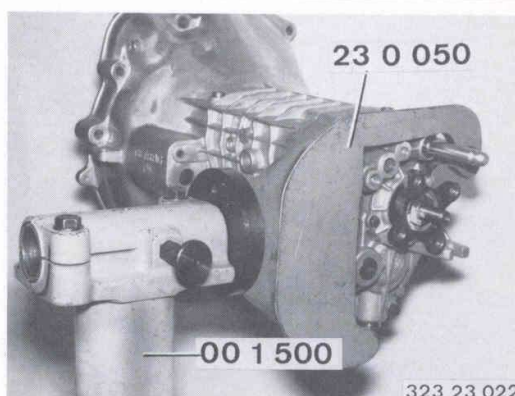


23 11 000 Gearbox housing – detaching and attaching/sealing

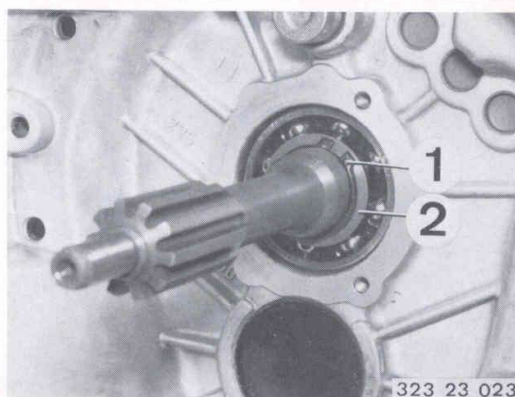
Remove the gearbox – 23 00 020.
Detach the cross member and rubber mounting.



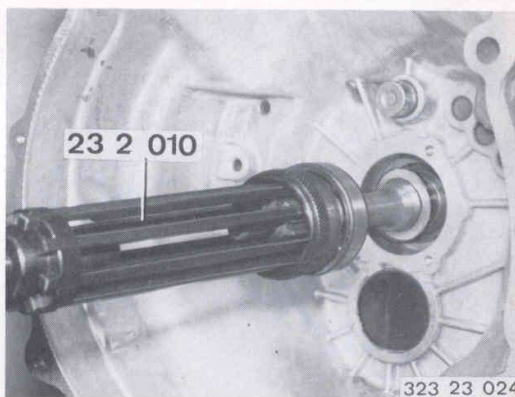
Attach the gearbox to mounting plate 23 0 050
and to repair stand 00 1 500.
Drain the oil.

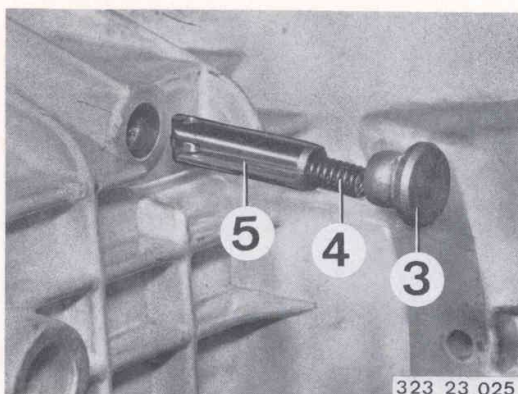


Remove the guide sleeve – 23 11 590.
Extract the circlip (1).
Remove the thrust washer (2).

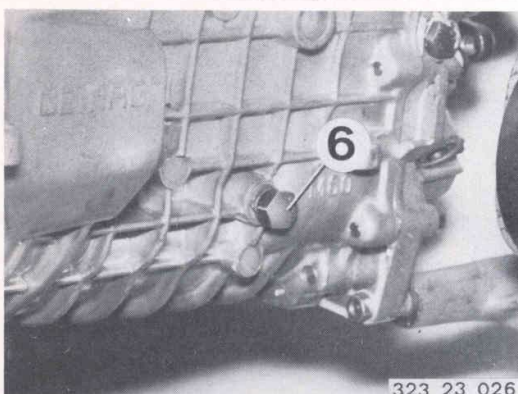


Extract ball bearing with Rillex puller 23 3 010.
Note: shim.

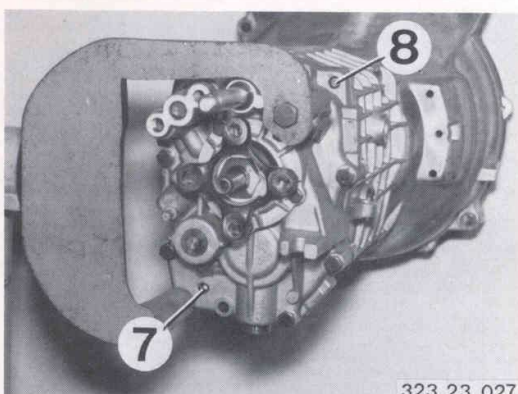




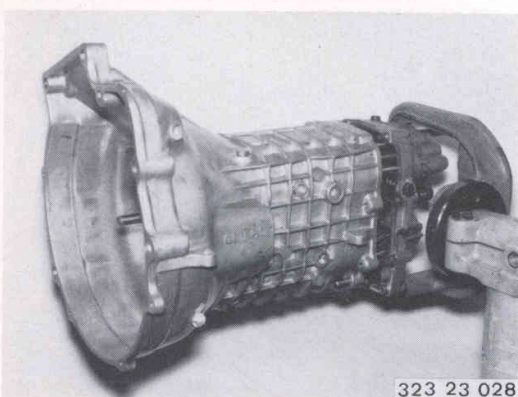
Lift out cover (3).
Remove spring (4) and locking pin (5).



Remove bolt (6).
When installing: coat bolt with Loctite Ref. No.270.

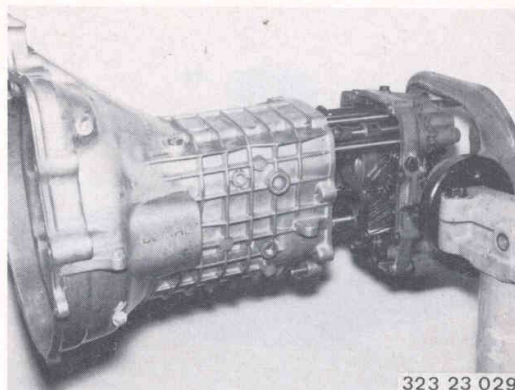


Remove the bolts holding the gearbox cover.
Drive locating pins (7) and (8) out of the cover.

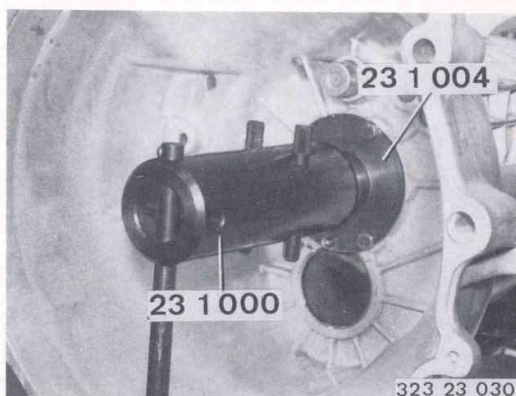


Pull off the gearbox housing.
When installing: use a new gasket.
Warning: note shims on input shaft and layshaft.

Install input shaft ball bearing in gearbox housing.
Press gearbox housing over gear cluster.

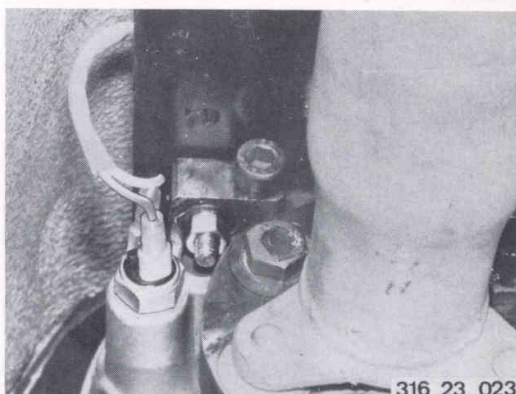


Using thrust piece 23 1 004 with installing tool 23 1 000 press the input shaft into the ball bearing and the housing on to the cover.
Secure the gearbox housing.
Install locking pins, shims and circlip.



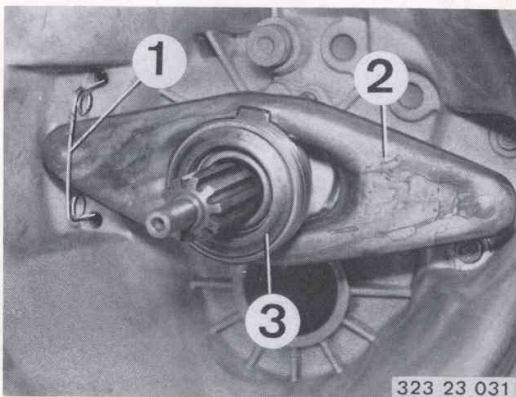
23 11 101 Switch for backup (reversing) light – renewing

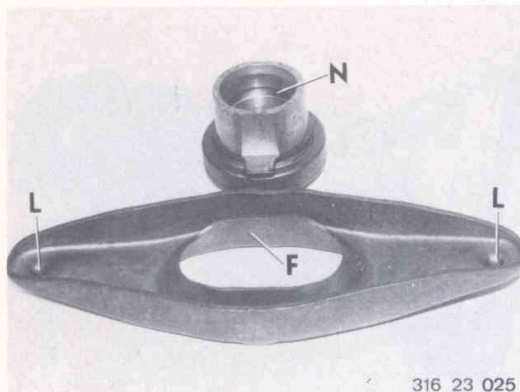
Detach lead from switch.
Unscrew and remove switch.
Renew gasket.



23 11 590 Guide sleeve for clutch withdrawal rod – removing and installing – gearbox removed –

Extract spring (1) and remove withdrawal arm (2) with thrust bearing (3).

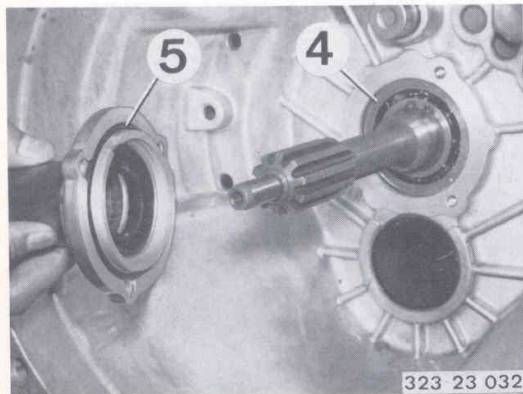




316 23 025

When installing: Pack lubricating groove (N) with 'Molykote Longterm 2'. Coat guides (F) and bearing points (L) with 'Molykote Longterm 2'.

If these precautions are neglected, the withdrawal bearing may seize on the guide sleeve.

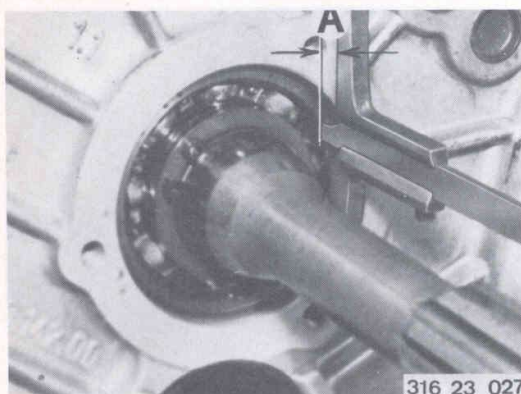


323 23 032

Detach the guide sleeve.

Warning: note shims (4)

When installing: use a new O-ring (5).

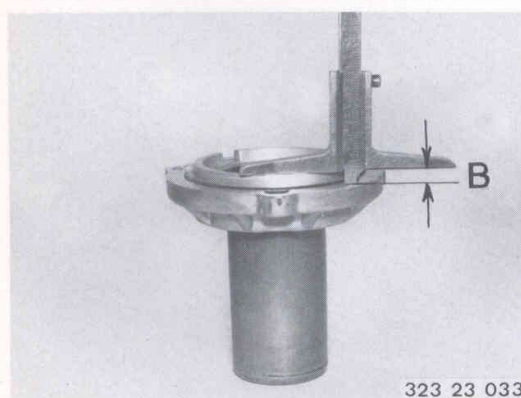


316 23 027

23 11 591 Guide sleeve for clutch withdrawal rod – renewing

Remove the guide sleeve – 23 11 590.

When installing: measure distance A from housing to ball bearing.



323 23 033

Determine height of shoulder B on guide sleeve. Shim to eliminate any play.

Example:

A 5.0 mm (0.197 in)

-B 4.7 mm (0.185 in)

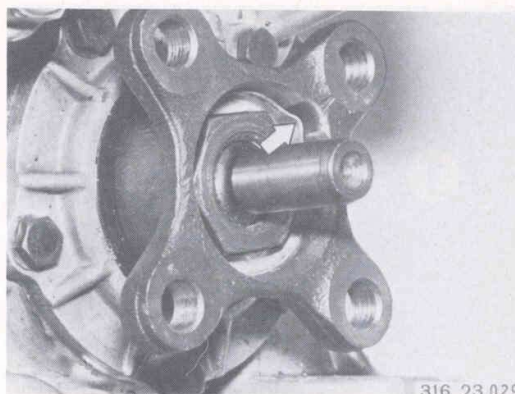
0.3 mm (0.012 in) – shim thickness

**23 12 051 Output flange radial seal – re-
newing**

Detach front propeller shaft and center bearing – 26 11 000.

Lift out the keeper plate.

When installing: Drive the keeper plate into the groove.



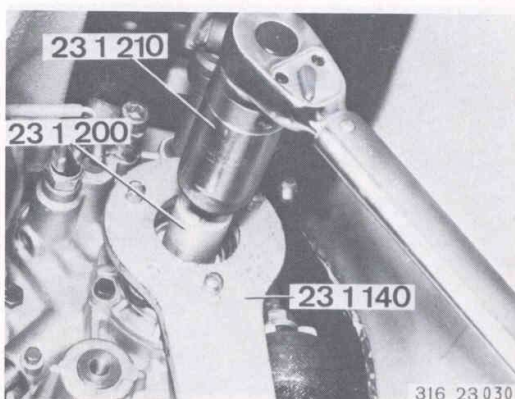
Install guide bushing 23 1 200.

Prevent the output flange from moving with wrench 23 1 140.

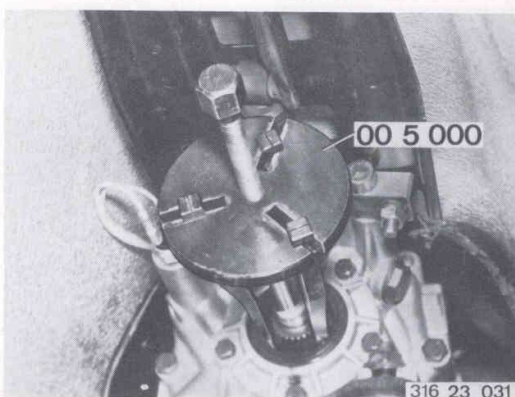
Loosen shouldered nut¹⁾ with socket wrench insert 23 1 210.

Pull off the output flange.

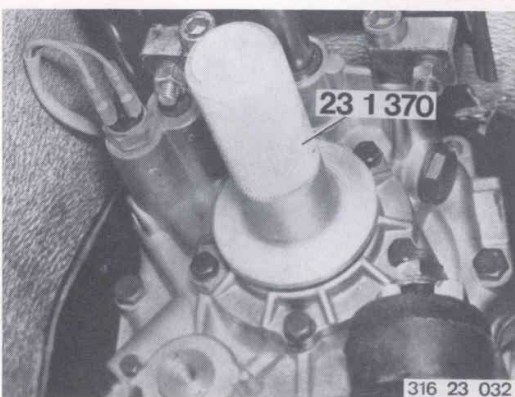
**If difficult to move, use “Kukko” 00 8 500 pul-
ler.**



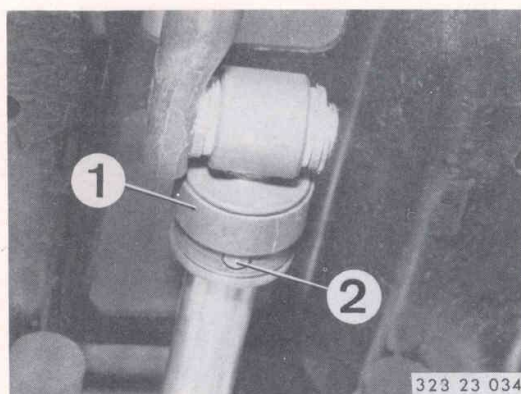
Extract the radial seal with puller 00 5 000.



When installing: Pack the sealing with grease.
Drive in the radial seal with tubular drift 23 1 370.



¹⁾ For tightening torque, see specifications

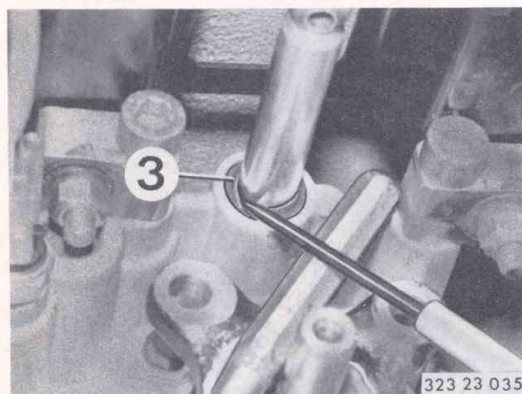


23 12 081 Selector shaft radial seal – re-newing

Remove the front propeller shaft and center bearing 26 11 000.

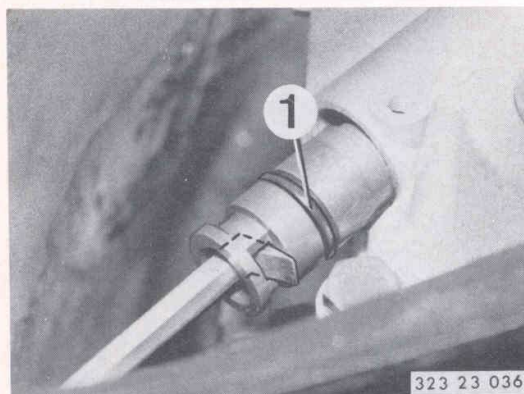
Extract the locating sleeve (1).

Drive pin (2) out upwards.



Extract the radial seal (3).

When installing: Pack the sealing lips with grease and drive the radial seal in until flush with a suitable length of tube.



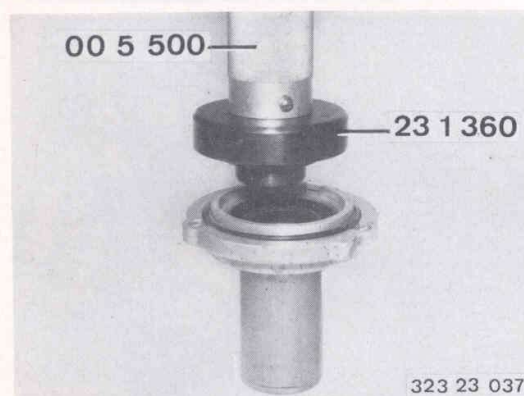
23 12 131 Cord ring seal for speedometer drive pinion socket bushing – re-newing

Take off the speedometer drive shaft.

Drive or pull out the socket bushing with an angled screwdriver.

Install the new cord ring seal (1).

If oil is leaking from the radial seal, the socket bushing must be renewed.



23 12 521 Input shaft radial seal – re-newing – Guide sleeve removed –

Extract the radial seal.

Drive the radial seal in with sleeve 23 1 360 and handgrip 00 5 500.

The open side faces the gearbox housing.

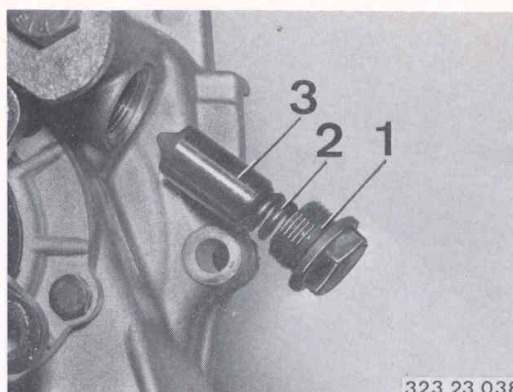
Pack the sealing lips with grease.

Use a new gasket.

23 21 500 Input and output shafts – removing and installing – Gearbox casing removed –

Unscrew the screw plug (1).

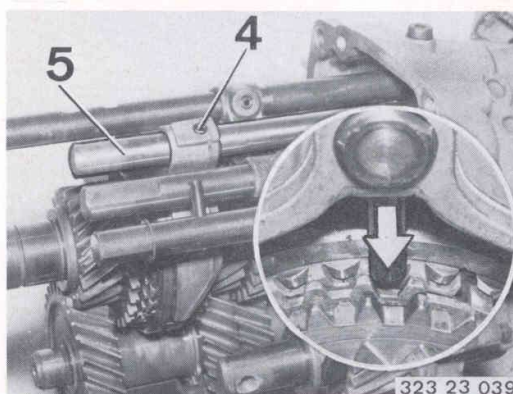
Take out the spring (2) and locking pin (3).



Drive the locating pin (4) carefully downwards until the selector rod (5) can be pulled out.

If necessary, raise the selector rod slightly.

Warning: Drive the locating pin between the teeth of the synchromesh unit. The locating pin remains in the lower part of the selector fork. Note the presence of loose balls.

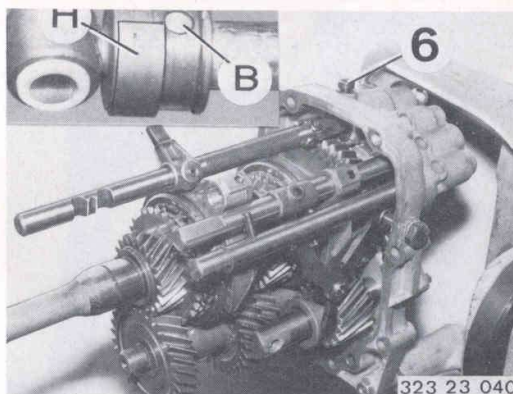


Extract the locking sleeve (H).

Drive out the pin (B).

Slacken bolt (6) until selector shaft can be turned. Selector finger must point upwards. Press the selector fork firmly into the selector sleeve, and pull the selector shaft out forwards.

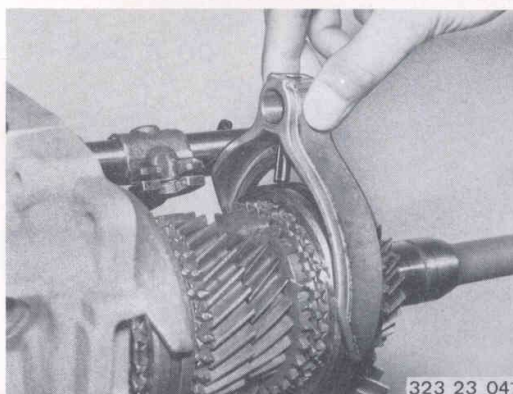
Note: rollers.



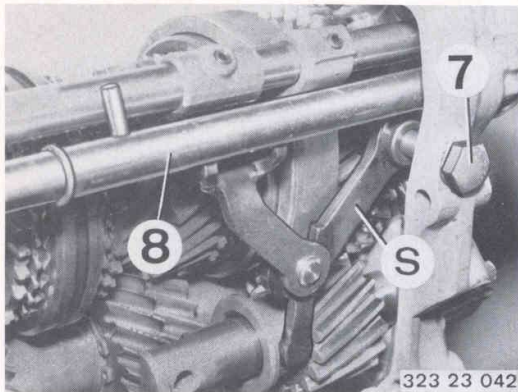
Take off the selector fork.

Drive the locating pin out of the selector fork.

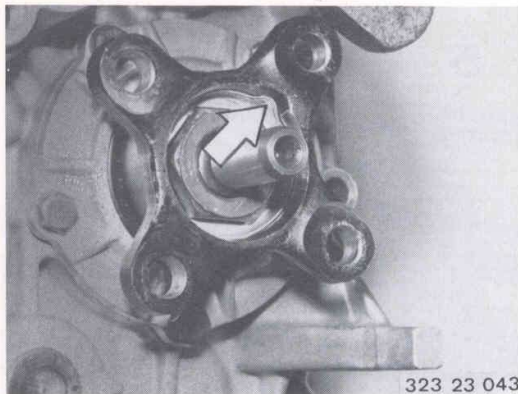
When installing: Check selector fork for wear¹⁾ – 23 31 501.



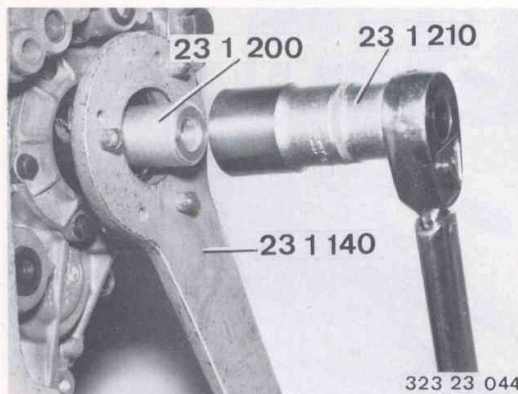
¹⁾ See specifications



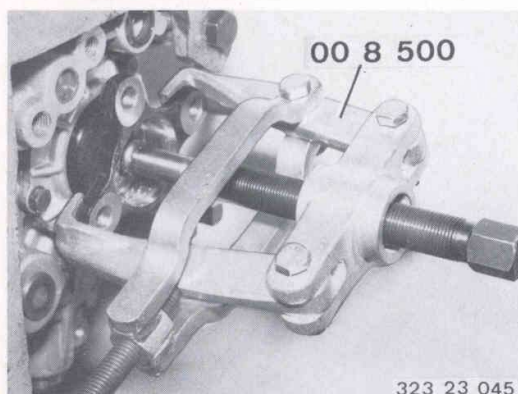
Loosen bolt (7) until reverse gear selector lever (S) can be taken out.
Pull out selector rod (8).
Note that balls may escape.



Remove the keeper plate.
When installing: Drive keeper plate into groove.



Attach guide bushing 23 1 200.
Prevent the output flange from turning with locking wrench 23 1 140.
Loosen the shouldered nut¹⁾ with socket wrench insert 23 1 210.

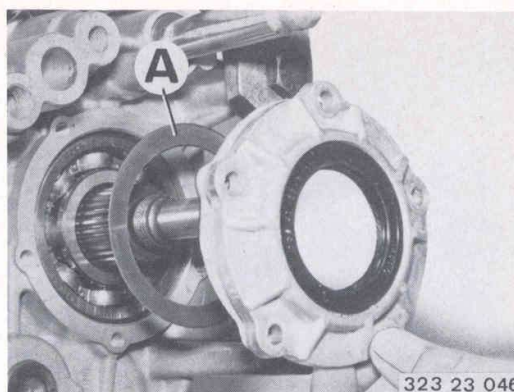


Pull off the output flange.
If flange is difficult to remove, use "Kukko" 00 8 500 puller.

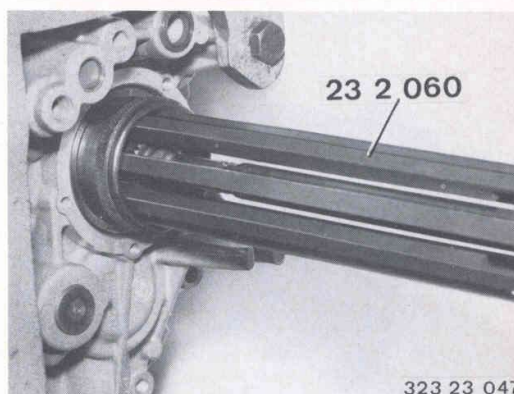
¹⁾ See specifications

Take off the thrust ring.

Warning: Note presence of shims A.
When installing: Use a new gasket.

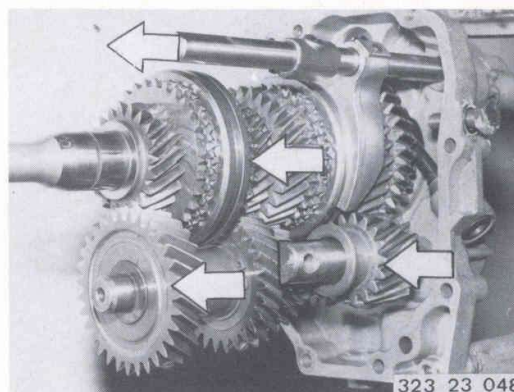


Using the Rillex 23 2 060 puller, remove the ball bearing from the output shaft and extract from the gearbox cover.



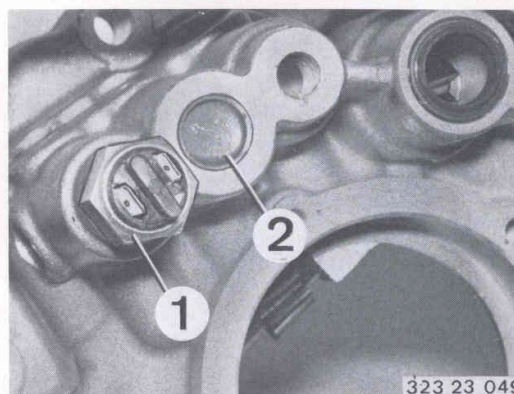
Pull the input and output shafts with selector rod and 1st/2nd gear selector fork, layshaft and reverse gear wheel out of the gearbox cover.

Warning: Note escaping balls.
When installing: Check selector fork for wear¹⁾ – 23 31 501.

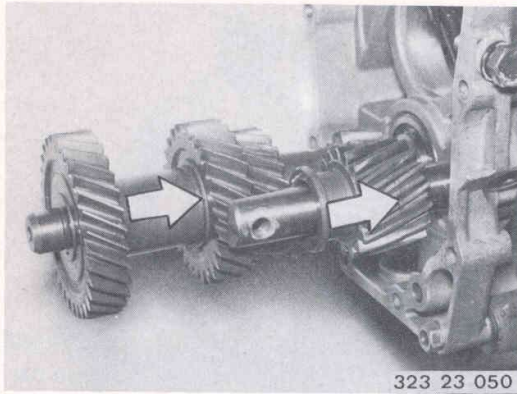


Remove backup (reversing) light switch (1) and end cap (2).

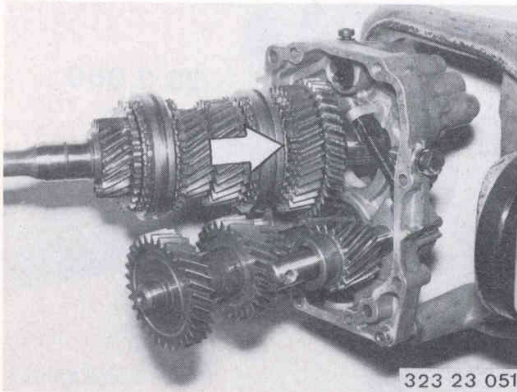
When installing: Press the locking balls down with a screwdriver inserted through the open holes.



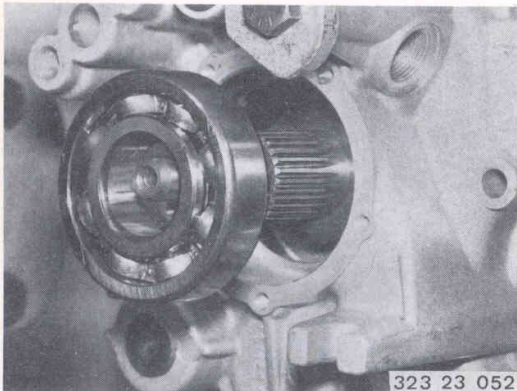
¹⁾ See specifications



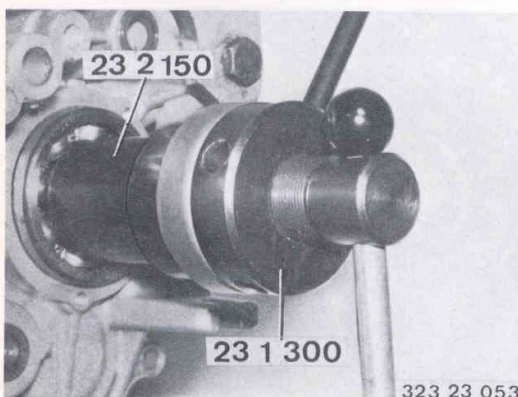
Install layshaft with reverse gear wheel.



Insert the input and output shafts into the gearbox cover.

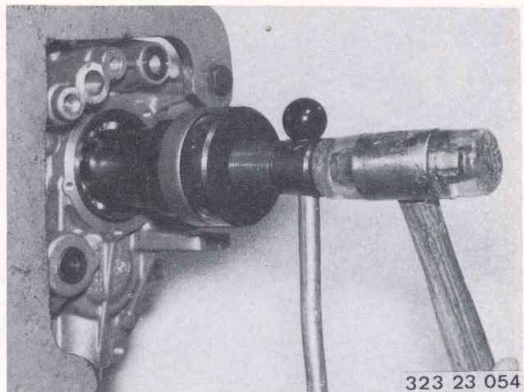


Insert the ball bearing into the gearbox cover, but do not press in.

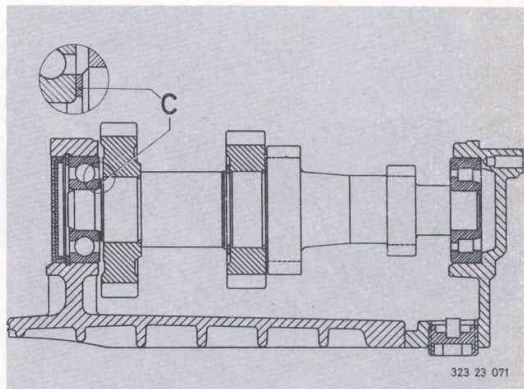


Using bushing 23 2 150 together with installation tool 23 1 300, press the ball bearing on to the output shaft.

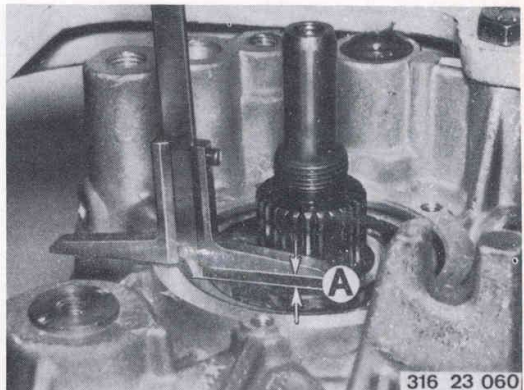
Drive the ball bearing firmly against its seat with light hammer blows.



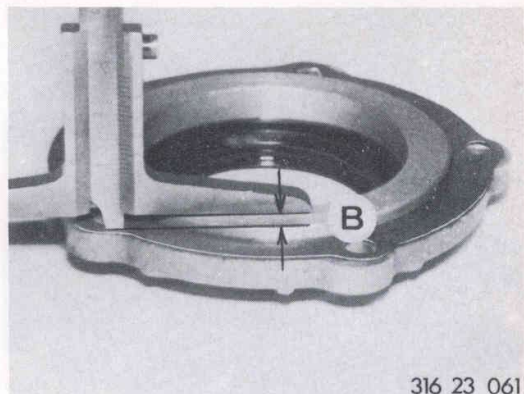
Check tooth engagement: this can be adjusted by means of shims C. Install the speedometer drive bushing and drive shaft.

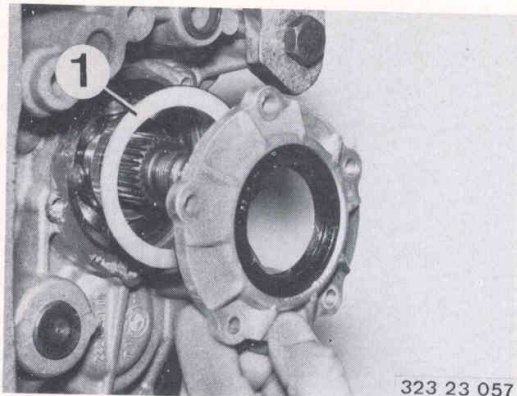


Determine distance A from the gearbox cover to the ball bearing.



Measure shoulder height B of sealing cover with gasket in position.





Warning: There must be no play between the outer race of the ball bearing and the sealing cover.

If play is present, eliminate with the aid of shims (1).

Example:

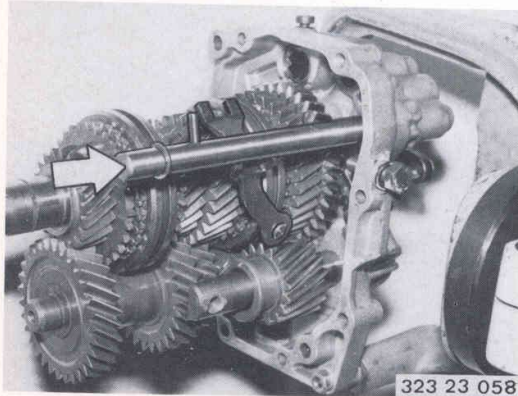
A 3.0 mm (0.118 in)

–B 2.8 mm (0.110 in)

0.2 mm (0.008 in) = shim thickness

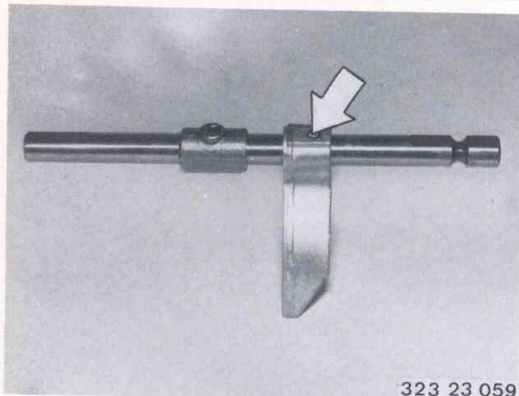
Attach the sealing cover.

Attach and secure the output flange.



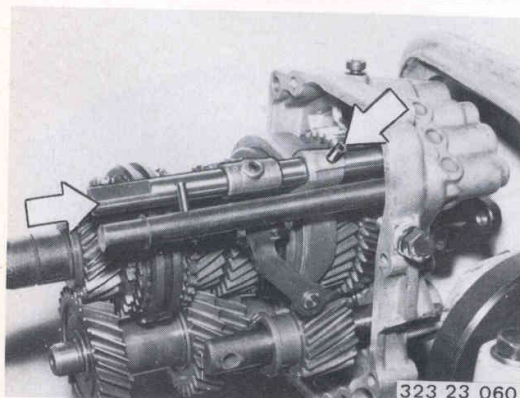
Insert the locking ball.

Install the reverse gear selector rod.



Drive out the locking pin.

Pull the selector fork away from the selector rod.



Insert the 1st/2nd gear selector fork into the selector sleeve.

Insert the locking and locating ball.

Install the selector rod.

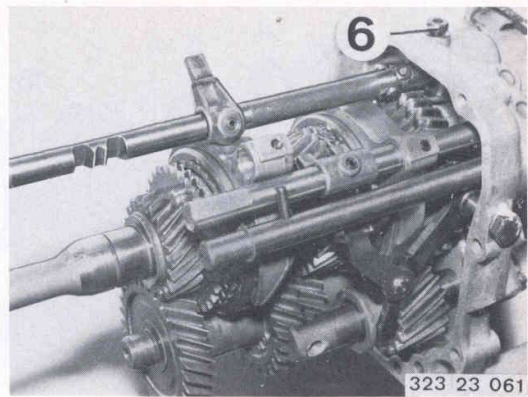
Secure the selector fork with the locating pin.

Insert the 3rd/4th gear selector fork into the selector sleeve.

Install the selector shaft. Swing the selector finger down.

Warning: Note position of taper bushing.

Insert and tighten bolt (6).



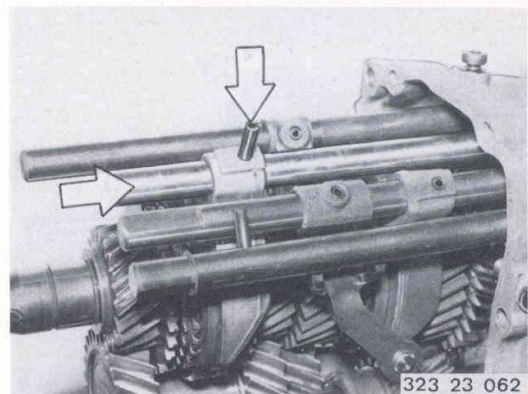
Insert the locking and locating balls.

Install the 3rd/4th gear selector rod.

Secure selector fork with locating peg.

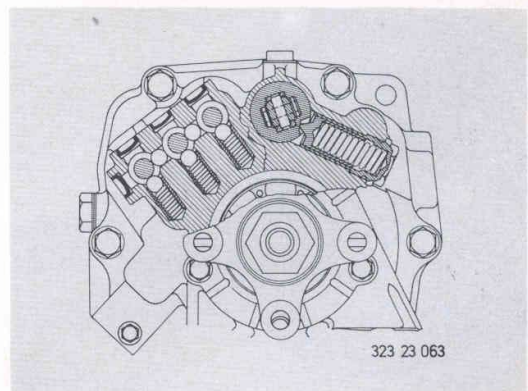
Install end cap and reversing (backup) light switch.

Install the locking pin.



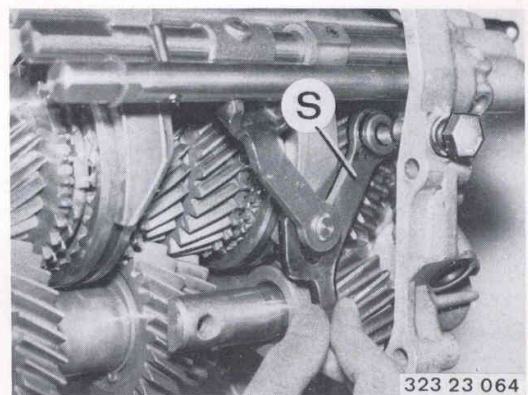
Note installed position of locking pin in taper bushing.

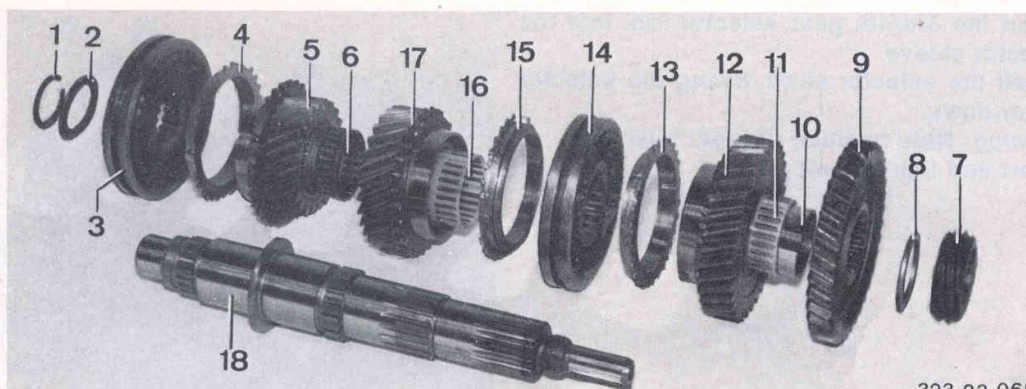
Note correct position of locating and locking balls.



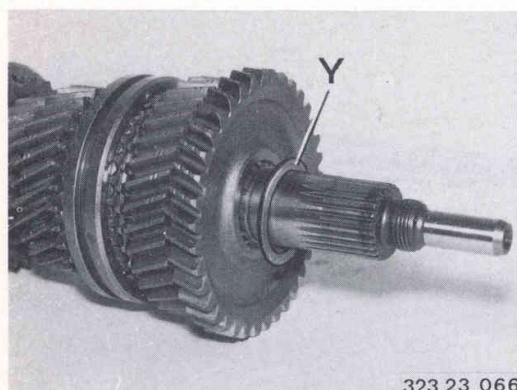
Install selector lever (S) for reverse gear.

Warning: do not offer up the selector lever at an angle.





323 23 065



323 23 066

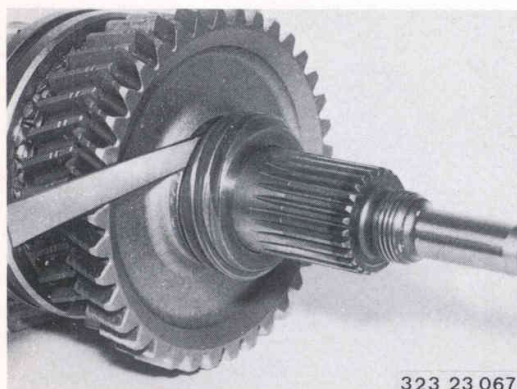
23 21 551 Output shaft – renewing – Output shaft removed –

Remove the circlip (1). Pull off the thrust washer (2), synchromesh unit with sliding sleeve (3), synchromesh ring (4), 3rd gear wheel (5) and needle roller cage (6) from the output shaft. Press the speedometer drive worm (7), washer (8), reverse gear wheel (9), spacing bushing (10), needle roller cage (11), 1st gear wheel (12), synchromesh ring (13), synchromesh unit with sliding sleeve (14), synchromesh ring (15), needle roller cage (16) and 2nd gear wheel (17) off the output shaft (18).

Assembly the output shaft.

Warning: Using shim Y, adjust end play to 0...0.09 mm (0... 0.0035 in).

Insert shim Y ahead of reverse gear wheel. Press the speedometer drive gear on as far as the shoulder on the output shaft. Determine end play.



323 23 067

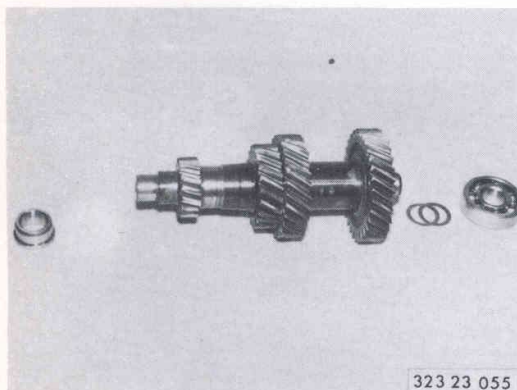
23 21 701 All ball bearings – renewing – gearbox removed –

Remove and install the input and output shafts – 23 21 500.

A) Layshaft

Pull off ball bearing and inner race of roller bearing.

Note: shims



323 23 055

Pull the roller bearing out of the gearbox cover; heat the gearbox cover if necessary.

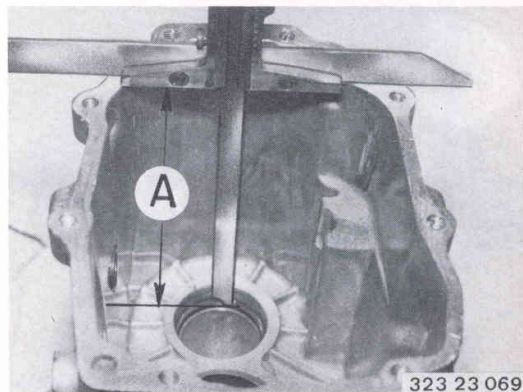
Warning: Note shims.

When installing: The smaller diameter on the roller cage faces towards the gearbox cover.



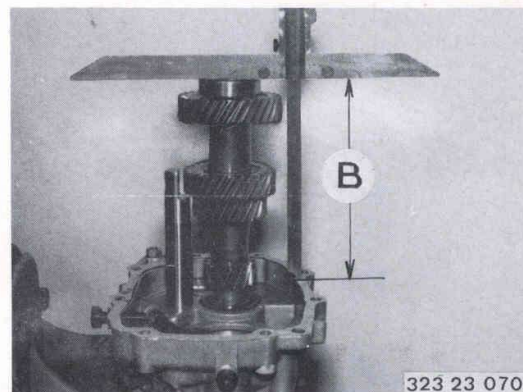
323 23 068

Determine distance A from housing joint face to circlip.



323 23 069

**Install layshaft in gearbox cover.
Measure height B of layshaft with gasket in position.
Remove layshaft.**



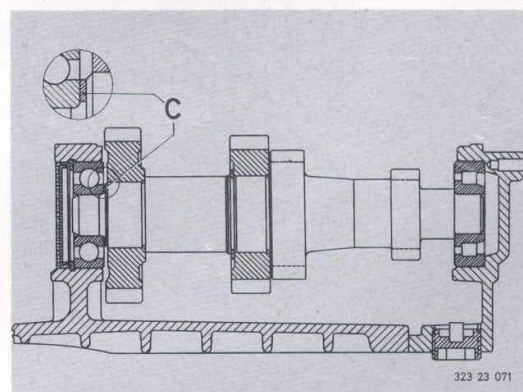
323 23 070

Determine thickness of shims C.

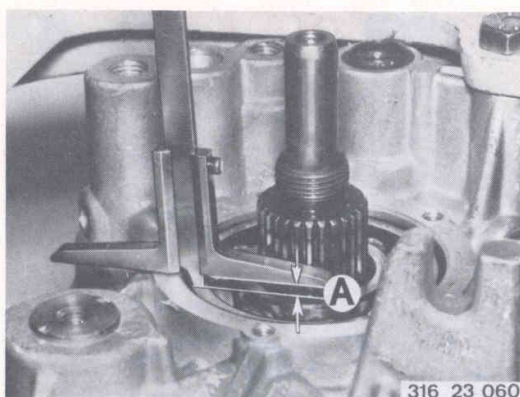
Example:

A	165.3 mm (6.5079 in)
- B	165.0 mm (6.4961 in)
C	0.3 mm (0,0118 in)

Shims C can be used to adjust tooth engagement.

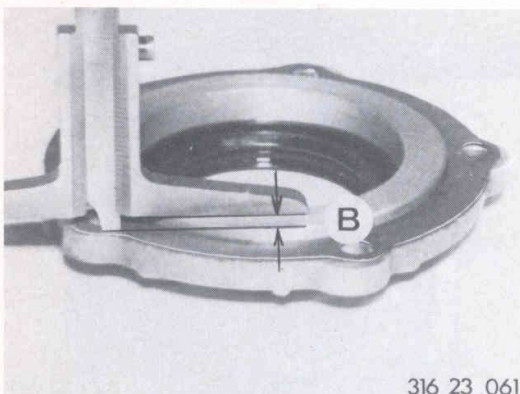


323 23 071



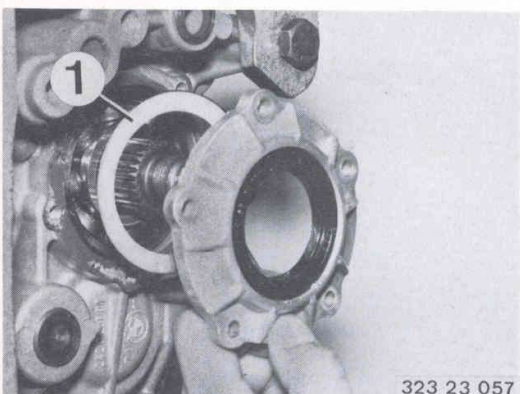
316 23 060

B) Output shaft
Determine distance A from housing cover to ball bearing.



316 23 061

Measure height of shoulder B on sealing cover with gasket in place.



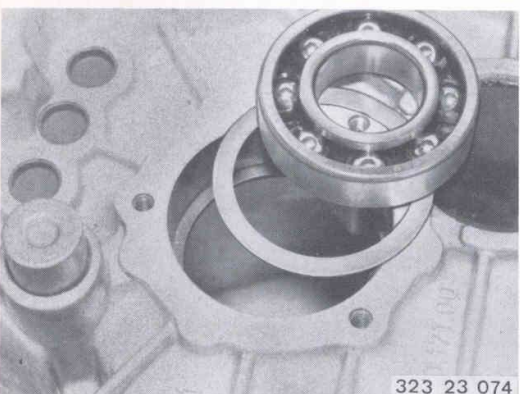
323 23 057

Warning: There must be no play between the ball bearing outer race and the sealing cover. Any play must be shimmed to zero (1).

Example:

A 3.0 mm (0.118 in)
-B 2.8 mm (0.110 in)
0.2 mm (0.008 in) = shim thickness

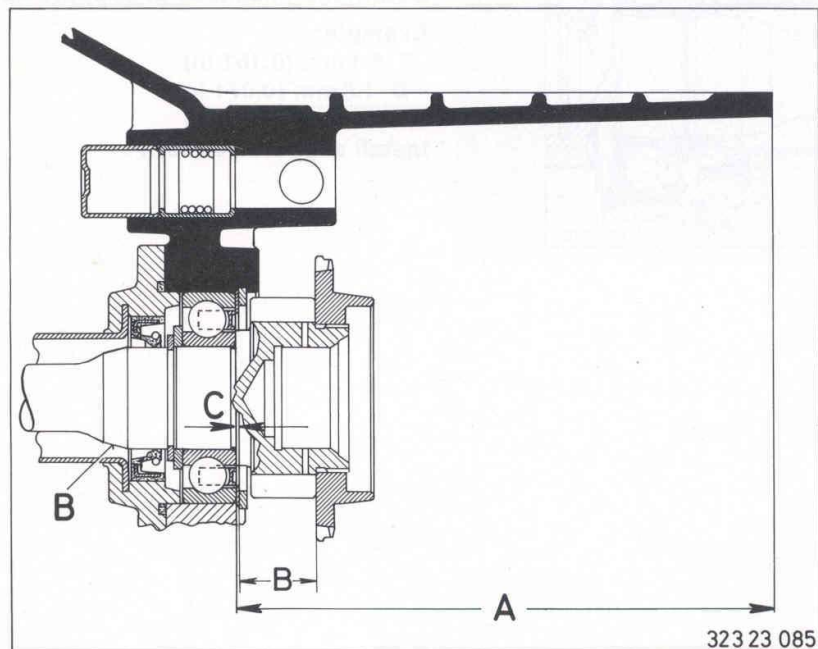
Attach the sealing cover.
Attach and secure the output flange.



323 23 074

C) Input shaft
Install a 1 mm (0.04 in) shim and the ball bearing in the housing.

A from sealing face on housing to deep-groove ball bearing
 Actual dimension B is engraved on input shaft
 C = shim thickness required.

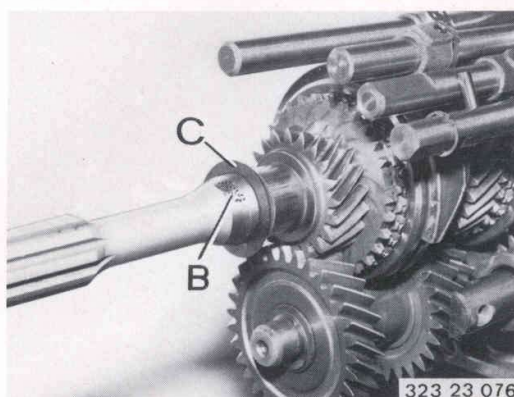
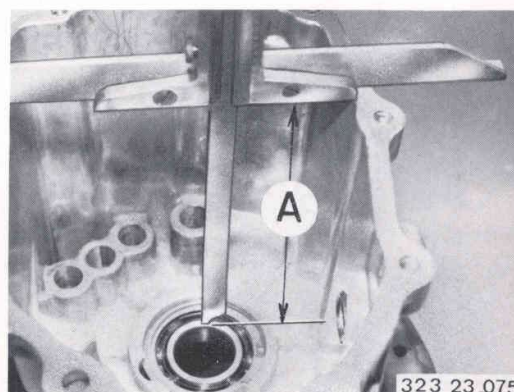


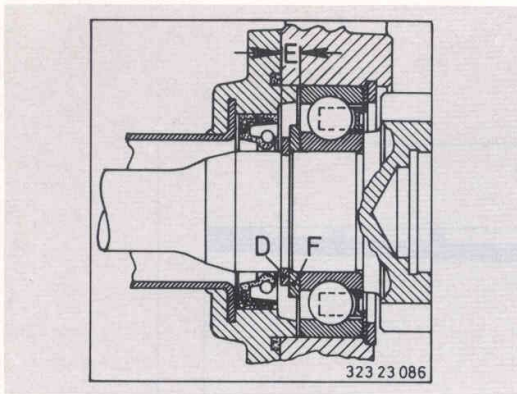
A – determine from housing joint face to ball bearing.

After establishing the actual values for A and B, the thickness of shim C can be taken from column C in the table below.

A mm (in)	mm (in)	B	C mm (in)
159.9 (6.295)	23.5 (0.925) 23.4 (0.921)	100 90	0.5 (0.020) 0.6 (0.024)
159.8 (6.291)	23.5 (0.925) 23.4 (0.921)	100 90	0.4 (0.016) 0.5 (0.020)
159.7 (6.287)	23.5 (0.925) 23.4 (0.921)	100 90	0.3 (0.012) 0.4 (0.016)
159.6 (6.283)	23.5 (0.925) 23.4 (0.921)	100 90	0.3 (0.012) 0.3 (0.012)

Place the correct shim C on the input shaft.





D – measure thickness of Seeger circlip.
 Install Seeger circlip in slot on input shaft.
 E – measure distance from Seeger circlip to
 ball bearing.
 Determine thickness of support washer.

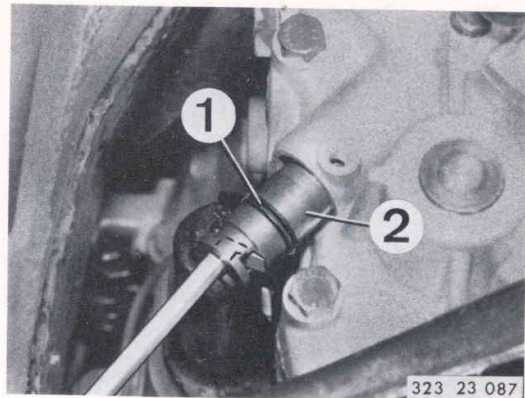
Example:

E 4.1 mm (0.161 in)
 –D 1.8 mm (0.071 in)
 F 2.3 mm (0.091 in)
 Install support washer F.

23 22 100 Speedometer drive pinion – removing and installing

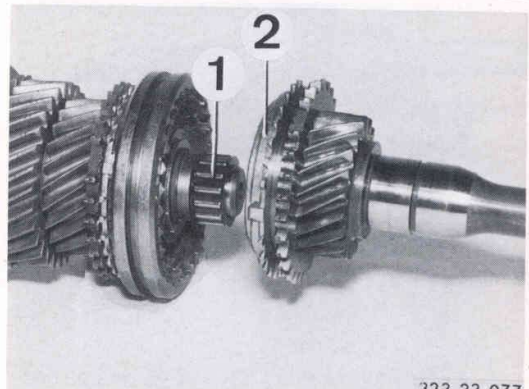
Take off the speedometer drive shaft.
Carefully pull or drive out the speedometer drive shaft bushing with an angled screwdriver.

Renew cord ring seal (1). If the radial seal is defective, the bushing (2) must be renewed.

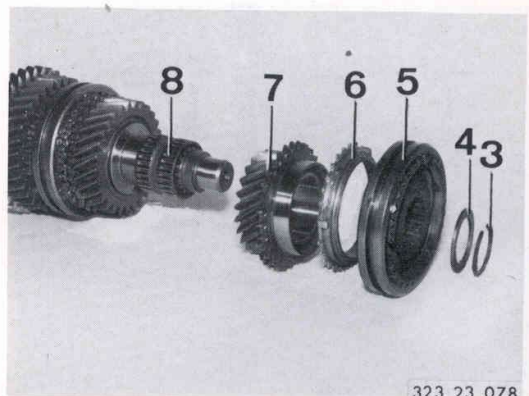


23 22 551 3rd and 4th gear clusters – renewing – Output shaft removed –

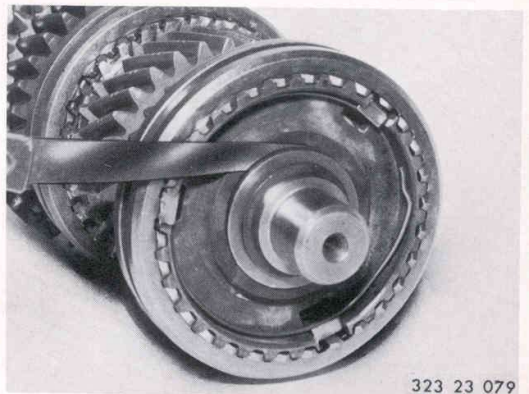
Pull the input shaft with needle roller cage (1) and synchromesh ring (2) away from the output shaft.

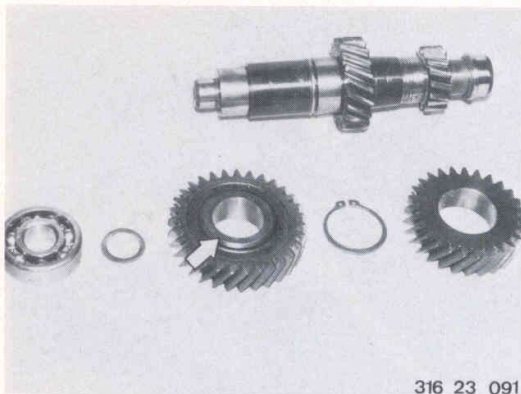


Remove the snap ring (3).
Pull off the thrust washer (4), guide sleeve (5), synchromesh ring (6) and 3rd gear wheel (7) with needle roller cage (8).



When installing: If the needle roller bearing with spacing bushing is also renewed, any play which develops must be eliminated again with shims.





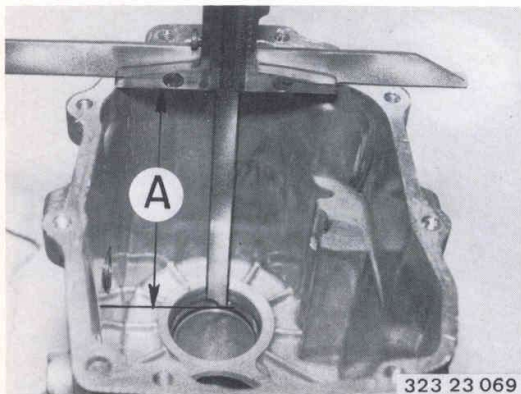
Press off the 4th gear wheel with ball bearing from the layshaft.

Warning: Note shims

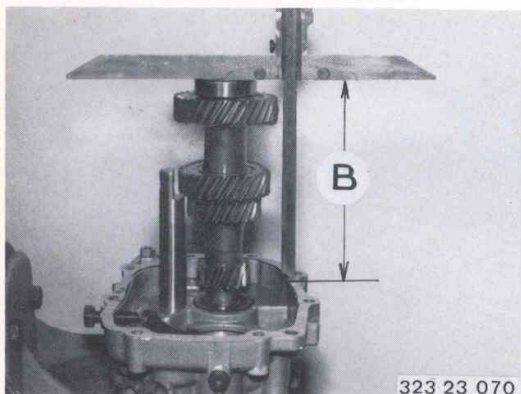
Extract the circlip and press off the 3rd gear wheel. Removal pressure approx. 10 t, installation pressure approx. 7t.

When installing: Heat gear wheels to 120... 150°C (250... 300°F).

Warning: The raised shoulder on the 3rd and 4th gear wheel bore must face towards the 2nd gear wheel.



Determine distance A from housing joint face to circlip.



Install the layshaft in the gearbox cover.

Measure height B of layshaft with gasket in position.

Remove the layshaft.

Determine thickness of shims.

Example

A 165.3 mm (6.5079 in)

—B 165.0 mm (6.4961 in)

Shim thickness

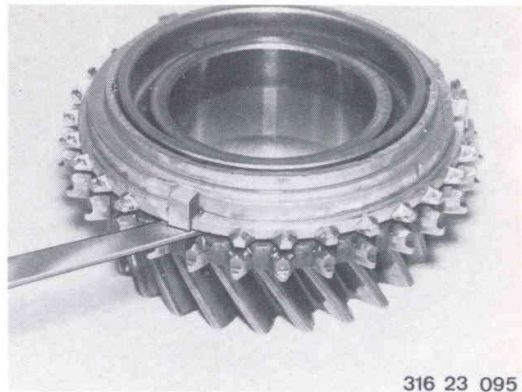
0.3 mm (0.0118 in)

23 23 503 Synchromesh rings – renewing

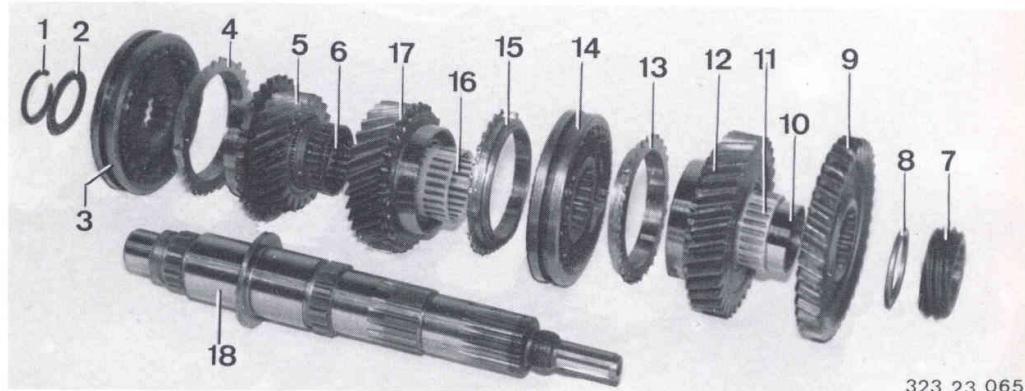
Remove input and output shafts – 23 21 500. The synchromesh rings must be renewed when the gap between the ring and the clutch body is less than 0.8 mm (0.031 in).

Warning: Measure the gap next to the stop blocks.

When the synchromesh rings are new, the gap should be 1.0 mm (0.039 in).



316 23 095



323 23 065

Extract circlip (1).

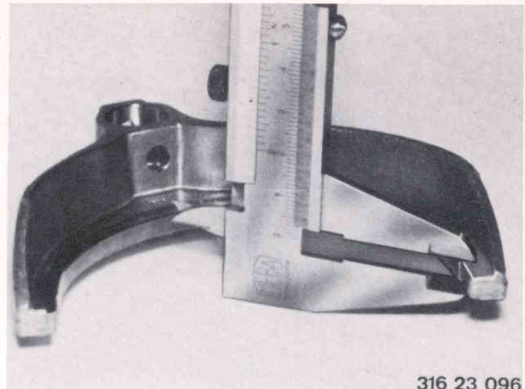
Pull off the thrust washer (2), synchromesh unit with sliding sleeve (3), synchromesh ring (4), and needle roller cage (6) from the output shaft.

Press off the speedometer drive worm (7), washer (8), reverse gear wheel (9), spacing bush (10), needle roller cage (11), 1st gear wheel (12), synchromesh ring (13), synchromesh unit with sliding sleeve (14), synchromesh ring (15), needle roller cage (16) and 2nd gear wheel (17) from the output shaft (18).

23 31 501 1st/2nd and 3rd/4th gear selector forks – renewing

Remove and install the input and output shafts – 23 21 500.

Measure wear¹⁾ at the selector fork.



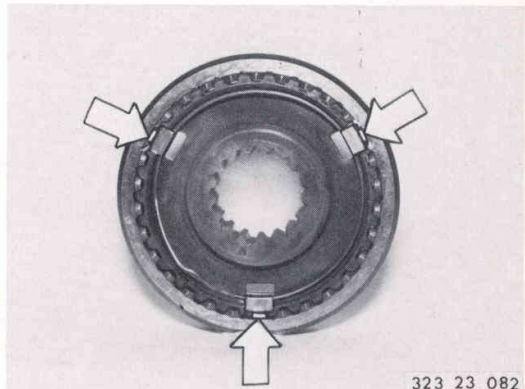
23 31 721 All sliding pads –renewing

Remove input and output shafts – 23 21 500.

Strip the output shaft – 23 23 503.

Press the sliding sleeve away from the synchromesh unit.

When installing: Push the flat teeth on the sliding sleeve over the pressure pads.



Engage the hooked ends of the synchromesh springs in a longitudinal groove.

Attach the pressure pads to the synchromesh springs.



¹⁾ See specifications

Getriebe automatisch

Transmission – automatic

Boîte à vitesses – automatique

Cambio automatico

Caja de cambio automático

Växellåda – automatisk

Transmissie, automatische

24 Automatic Transmission ZF 3 HP – 22

Specifications	Page 24-0/3
2400004 Selector lever, throttle cable and transmission cable-adjusting	00/1
009 Hydraulic pressure values – checking	00/3
020 Transmission – removing and installing	00/4
040 Exchange transmission – installing	00/8
080 Automatic transmission – stripping and assembling	00/9
2411000 Transmission oil pan – removing and installing	11/1
050 Transmission cover – removing and installing/sealing	11/1
2412001 Oil seal for torque converter – renewing	12/1
011 Radial seal for output flange – renewing	11/3
031 O-ring for speedometer drive bush – renewing	12/3
101 Radial seal for manual selection valve shaft – renewing	12/3
2423020 Plate clutches and brakes – renewing	23/1
2430000 Control unit – removing and installing	30/1
001 Control unit – renewing	30/1
2431000 Primary pump – removing and installing	31/1
150 Oil mesh filter on control unit – detaching and attaching	31/2
2432000 Centrifugal governor – removing and installing	32/1
503 Centrifugal governor – stripping and assembling	32/1
2434000 Parking lock pawl – removing and installing	34/1
101 Throttle cable – replacing	34/1
701 Torsion spring for throttle cable – renewing	34/2
730 Torsion spring for parking lock cam – renewing	34/4
2440000 Torque converter – removing and installing	40/1
001 Torque converter – renewing	40/2
2471001 Rubber mounting for transmission – renewing	71/1
Trouble-shooting – automatic transmission	71/3

Automatic transmission

Specifications

Model	320/6 A	323 i A *)
2400 . . . Transmission, general		
Make/designation		ZF/3 HP - 22
Transmission number	1 043 000 058	1 043 000 059
Code letter on type plate	C	D
Mechanical ratios -		
1st		2.478 : 1
2nd		1.478 : 1
3rd		1.000 : 1
Reverse		2.090 : 1
Speedometer drive		2.500 : 1
Oil grade	For approved grades of automatic transmission fluid (ATF), see Service Information Group 24 (automatic transmission)	
Total oil content of new or exchange transmission (including oil cooler)	1 (Imp. pints, US quarts)	5.7 + 0.4 (10.0 + 0.7, 6.0 + 0.42)
Initial content of new or exchange transmission	1 (Imp. pints, US quarts)	2.4 (4.2, 2.5)

*) Version for Sweden

Specifications

Automatic transmission

Model	320/6 A	323 i A *)
2400 . . . Transmission, general – (continued)		
Quantity to be added during oil changes (transmission at normal operating temperature, handbrake applied, selector lever in 'P' position, engine stopped). Add 1 liter (1.75 Imp. pints, 1.05 US quarts), then run engine at idle speed and continue to add oil until two-thirds up the space between the two dipstick marks)	1 (Imp. pints, US quarts)	2.0 (3.5, 2.1)
Quantity of oil represented by space between dipstick marks	1 (Imp. pints, US quarts)	app. 0.4 (0.7, 0.42)
Towing away		
– up to a distance of	km (miles)	50 (31)
– permissible max. speed	km/h (mile/h)	50 (31)
distances above 50 km (30 miles)		¹⁾

*) Version for Sweden

¹⁾ Add 1 liter (1.75 Imp. pints, 1.05 US quarts) of ATF to the specified content of the transmission, or else detach and tie up the propeller shaft at the final drive. After the vehicle has been repaired, do not forget to reduce the ATF content of the transmission to the correct level.

Specifications

Automatic transmission

Model	320/6 A		323 i A *)
24 00 ... Upward shift points ¹⁾			
Selector lever position 'D':			
1st – 2nd gear			
Full-throttle accelerator position			
Shift point at:			
Engine speed	1/min	4300 ± 380	4260 ± 380
Road speed	km/h (mile/h)	49 ± 5 (30.4 ± 3.1)	51 ± 5 (31.7 ± 3.1)
Selector lever position 'D':			
1st – 2nd gear			
Kickdown accelerator position			
Shift point at:			
Engine speed	1/min	5850 ± 330	5820 ± 330
Road speed	km/h (mile/h)	68 ± 4 (42.3 ± 2.5)	72 ± 4 (44.7 ± 2.5)
Selector lever position 'D':			
2nd – 3rd gear			
Full-throttle accelerator position			
Shift point at:			
Engine speed	1/min	5240 ± 230	5220 ± 230
Road speed	km/h (mile/h)	101 ± 5 (62.8 ± 3.1)	107 ± 5 (66.5 ± 3.1)

*) Version for Sweden

1) Check on a flat, level surface; speed data disregard speedometer error

Specifications

Automatic transmission

Model	320/6 A	323 i A *)
24 00 . . . Upward shift points ¹⁾ (continued)		
Selector lever position 'D'		
2nd – 3rd gear		
Kickdown accelerator position		
Shift point at:		
Engine speed	1/min	5830 ± 220
Road speed	km/h (mile/h)	120 ± 5 (74.6 ± 3.1)
24 00 . . . Downshift points ²⁾		
Selector lever position 'D'		
(3rd – 2nd gear)		
Full-throttle accelerator position		
Shift point at:		
Engine speed	1/min	3130 ± 140
Road speed	km/h (mile/h)	85 ± 6 (52.8 ± 3.7)
Selector lever position 'D'		
(3rd – 2nd gear)		
Kickdown accelerator position		
Shift point at:		
Engine speed	1/min	3900 ± 150
Road speed	km/h (mile/h)	115 ± 5 (71.5 ± 3.1)

*) Version for Sweden

¹⁾ Check on flat, level road; speed data disregard speedometer error

²⁾ Downshift point cannot be exceeded

Specifications

Automatic transmission

Model	320/6 A		323 i A *)
24 00 ... Downshift points ¹⁾ (continued)			
Selector lever position 'D'			
(2nd – 1st gear)			
Kickdown accelerator position			
Shift point at:			
Engine speed	1/min	3490 ± 190	3430 ± 190
Road speed	km/h (mile/h)	62 ± 5 (38.5 ± 3.1)	66 ± 5 (41.0 ± 3.1)
Downshift point from 3rd to 2nd gear			
– manual lever movement –			
Shift point at:			
Engine speed	1/min	3500 ... 4000	116 ... 129 (72.1 ... 80.2)
Road speed	km/h (mile/h)	110 ... 122 (68.4 ... 75.8)	
Downshift point from 2nd to 1st gear			
– manual lever movement –			
Shift point at:			
Engine speed	1/min	2800 ... 3450	64 ... 76 (39.8 ... 47.2)
Road speed	km/h (mile/h)	61 ... 72 (37.9 ... 44.7)	

*) Version for Sweden

¹⁾ Downshift point cannot be exceeded

Automatic transmission		Specifications	
Model		320/6 A	323 i A *)
24 00 ... Main pressures			
Main pressure (gauge) in selector lever position 'R'			
Idle speed	bar (lb/in ²)		
Kickdown	bar (lb/in ²)	17.3 ... 19.4 (246 ... 276)	12.5 ... 14.5 (178 ... 206)
in selector lever positions D, 2, 1, P and N			
Idle speed	bar (lb/in ²)		16.5 ... 18.3 (235 ... 260)
Kickdown	bar (lb/in ²)	7.6 ... 8.5 (108 ... 121)	5.5 ... 6.4 (78 ... 91)
24 30 ... Control unit			
Adjustment setting between control unit housing and needle on throttle pressure plunger	mm (in)		11,5 (0.45)
24 40 ... Torque converter			
Torque converter diameter	mm (in)		240 (9.44)
Color code (paint spot)		blue	yellow
Stall speed	1/min	2270	2060
Starting ratio		2.36	2.06

*) Version for Sweden

Specifications

Automatic transmission

Modul	320/6 A		323 i A *)
Tightening torques			
2400 . . . Transmission, general			
Transmission to engine. M 12 × 60 mm	Nm kpm lb.ft	78 ... 86 8 ... 8.8 58 ... 63	
2411 . . . Transmission housing with cover			
Transmission extension to main transmission housing (M 8)	Nm kpm lb.ft	23 ... 26 2.3 ... 2.6 17.0 ... 19.2	
Cover plate at converter dome, M 6 × 16 mm	Nm kpm lb.ft	8 ... 9 0.8 ... 0.9 5.9 ... 6.6	
Converter dome to transmission (M 8)	Nm kpm lb.ft	23 ... 26 2.3 ... 2.6 17.0 ... 19.2	
Screw plug at intermediate plate M 10 × 1 mm	Nm kpm lb.ft	15 ... 17 1.5 ... 1.7 11.1 ... 12.5	
Oil pan to transmission (M 6)	Nm kpm lb.ft	8 ... 9 0.8 ... 0.9 5.9 ... 6.6	

*) Version for Sweden

Automatic transmission

Specifications

Model	320/6 A	323 i A *)
Tightening torques (continued)		
24 11 ... Transmission housing with cover (continued)		
Oil drain plug in oil pan, M 10 × 1 mm	Nm kpm lb.ft	15 ... 17 1.5 ... 1.7 11.1 ... 12.5
Oil filler tube at oil pan	Nm kpm lb.ft	100 ... 115 10.2 ... 11.7 74 ... 85
Oil filler tube at converter dome, M 6 × 16 mm	Nm kpm lb.ft	8 ... 9 0.8 ... 0.9 5.9 ... 6.6
Screw plug at transmission, M 18 × 1.5 mm	Nm kpm lb.ft	40 ... 46 4.1 ... 4.7 29 ... 34
24 12 ... Speedometer drive bushing		
Hex bolt for speedometer bushing	Nm kpm lb.ft	10 ... 11 1.0 ... 1.1 7.4 ... 8.1
24 21 ... Transmission shafts		
Shouldered nut for output shaft/ output flange	Nm kpm lb.ft	100 ... 115 10.2 ... 11.7 74 ... 85

*) Version for Sweden

Specifications

Automatic transmission

Model	320/6 A		323 i A *)
Tightening torques (continued)			
24 30 . . . Control unit			
Machine screw (Torx screw), M 5, on control unit	Nm kpm lb.ft	6 . . . 7 0.6 . . . 0.7 4.4 . . . 5.2	
Control unit to transmission (M 6)	Nm kpm lb.ft	10 . . . 11 1.0 . . . 1.1 7.4 . . . 8.1	
24 31 . . . Oil pump			
Oil pump attachment (M 6)	Nm kpm lb.ft	10 . . . 11 1.0 . . . 1.1 7.4 . . . 8.1	
24 32 . . . Speed-controlled governor			
Governor flange to transmission housing (M 8)	Nm kpm lb.ft	15 . . . 17 1.5 . . . 1.7 11.1 . . . 12.5	
Threaded rod at centrifugal governor (M 6)	Nm kpm lb.ft	3 . . . 3.5 0.3 . . . 0.36 2.2 . . . 2.6	
Hex nut at threaded rod	Nm kpm lb.ft	9 . . . 10 0.9 . . . 1.0 6.6 . . . 7.4	
Hex bolt on centrifugal governor (M 6)	Nm kpm lb.ft	10 . . . 11 1.0 . . . 1.1 7.4 . . . 8.1	

*) Version for Sweden

Specifications

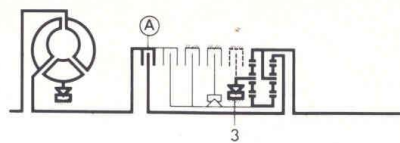
Automatic transmission

Model	320/6 A		323 i A *)
Tightening torques (continued)			
24 40 . . . Torque converter			
Torque converter to driving disc, M 8 × 12 mm	Nm kpm lb.ft	25 . . . 27 2.5 . . . 2.7 18.4 . . . 19.9	
24 51 . . . External shift mechanism components			
Selector lever to transmission, M 8 × 1 mm	Nm kpm lb.ft	8 . . . 10 0.8 . . . 1.0 5.9 . . . 7.4	
24 71 . . . Transmission mountings			
Cross-member to body (M 8)	Nm kpm lb.ft	22 . . . 24 2.2 . . . 2.4 16.2 . . . 17.7	
Rubber mountings to cross-member (M 10)	Nm kpm lb.ft	43 . . . 48 4.4 . . . 4.9 32 . . . 35	
Rubber mounting to transmission (M 10)	Nm kpm lb.ft	43 . . . 48 4.4 . . . 4.9 32 . . . 35	

*) Version for Sweden

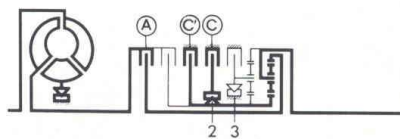
Power flow diagram – 3 HP 22 1st gear

Clutch A is engaged. On traction the planetary gear carrier bears against freewheel 3; on the overrun it turns freely on the freewheel. With the selector lever in position 1, clutch D is also engaged to permit engine braking.



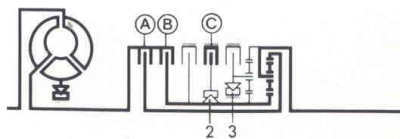
2nd gear

Clutches A, C' and C are engaged. Freewheel 3 is overrun. The hollow shaft with sun wheel is blocked.



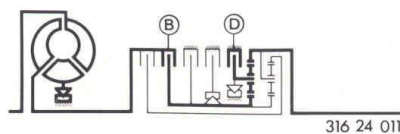
3rd gear

Clutches A, B and C are engaged. Freewheels 2 and 3 are overrun. The complete planetary gear set turns as a unit in the ratio 1:1.

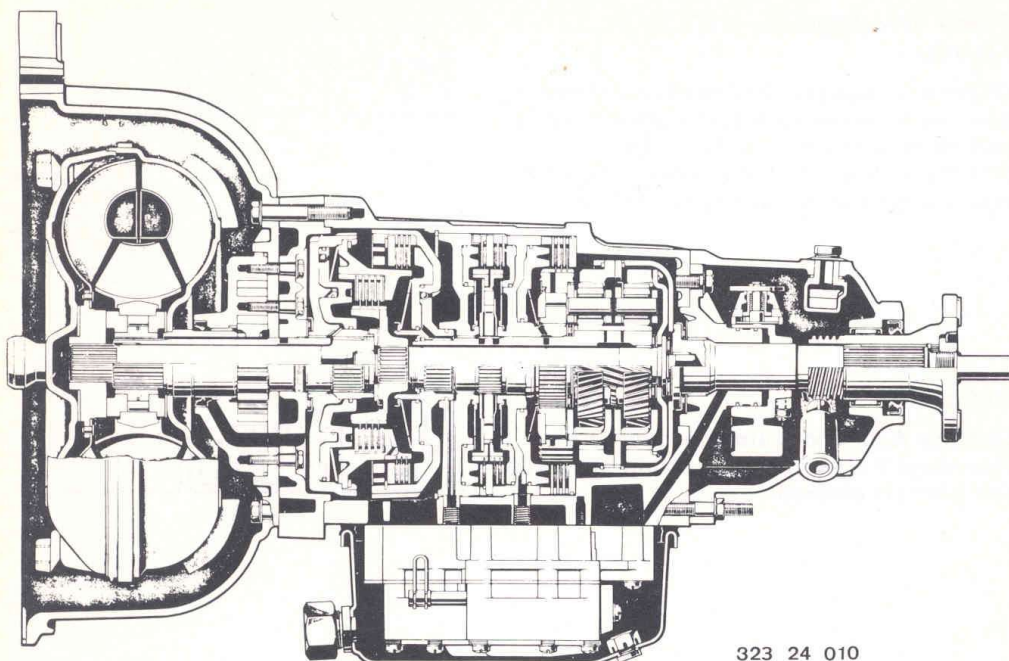


Reverse gear

Clutches B and D are engaged. By locking the planetary gear carrier, the direction of rotation of the output shaft is reversed.



316 24 011



323 24 010



323 24 019

The 3 HP-22 transmission is fully automatic. It has a torque converter and Simpson planetary gear train.

P Neutral

R Reverse

N Neutral

D 1st, 2nd and 3rd gears

2 1st and 2nd gears – 3rd gear locked out

1 1st gear – 2nd and 3rd gears locked out

In selector lever position P the transmission output shaft is locked mechanically by the parking pawl.

R = Reverse gear

The engine must be started with the selector lever in position N or P. No power is transmitted to the rear wheels.

The lever should remain in position D under normal driving conditions in order to obtain the best possible fuel consumption.

The transmission can be made to change down early by operating the kickdown control with the accelerator pedal.

Selector lever position 2 prevents undesirable upward changes from 2nd to 3rd gear on hills. In addition, engine braking is improved.

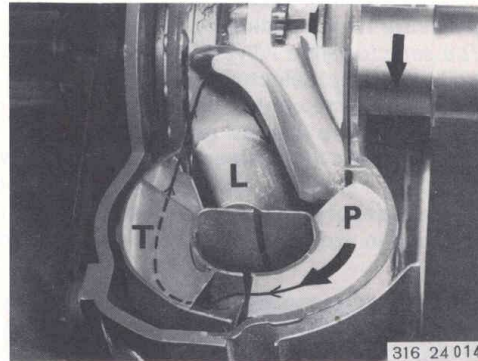
Selector position 1 is particularly suitable for continuous engine braking effect on severe gradients.

The selector lever may be moved to position 1 or 2 at any road speed. The transmission will then no longer change up into the next higher gear.

The torque converter operates as a fluid coupling and a means of multiplying output torque. The pump wheel or impeller P turns at the same speed as the engine and directs the oil clockwise into turbine wheel (T). When a gear is engaged the turbine wheel with the input shaft is connected by way of the clutches to the planetary gear train. As engine speed increases, the shape of the turbine wheel blades causes the oil to be diverted in an anti-clockwise direction from the turbine wheel into the rotor (L), which is prevented from turning against the direction of engine rotation by a freewheel. From here the oil is conducted with a minimum of disturbance back to the pump wheel. The back pressure caused by changing the direction of flow produces an increase in torque. Maximum torque multiplication occurs when the vehicle is standing still, the pump wheel is driven by the engine at full throttle and the oil is attempting to bring the stationary turbine wheel into motion.

As road speed increases, the difference in speeds of rotation between the pump and turbine wheels falls, until the so-called lock-up point is reached at a ratio of 1:1. At this point the rotor ceases to be locked against the freewheel and begins to run forwards in the oil flow and the vehicle begins to overrun and attempts to turn the engine. The torque converter functions as a straightforward fluid coupling. On the overrun this means that the braking effect of the engine can be partially exploited.

The primary pump is driven from the torque converter at engine speed. Its function is to supply oil to the converter, the control unit and the clutches.



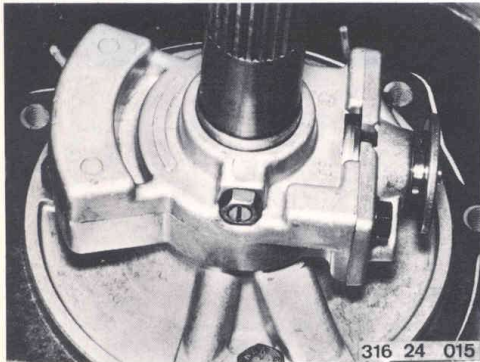
Key to hydraulic control circuit diagram

The main pressure valve determines the pressure level in the control unit. As soon as the control unit is filled with oil, the oil supply passage to the converter is opened. As the flow rate increases, excess oil is returned to the intake passage of the primary pump.

The converter pressure valve prevents excess pressure from building up in the converter.

The selector slide valve is operated mechanically from the selector lever. It directs the oil pressure in the control unit to the appropriate circuits for the desired gear ratios.

The regulator determines the shift points with the shift valves in accordance with throttle valve pressure. The regulator pressure is developed in proportion to output shaft speed of rotation.



Neither upward nor downward shifts can take place if the regulator plunger or bushing is blocked or seizes. Clean the regulator (see 24 32 503).

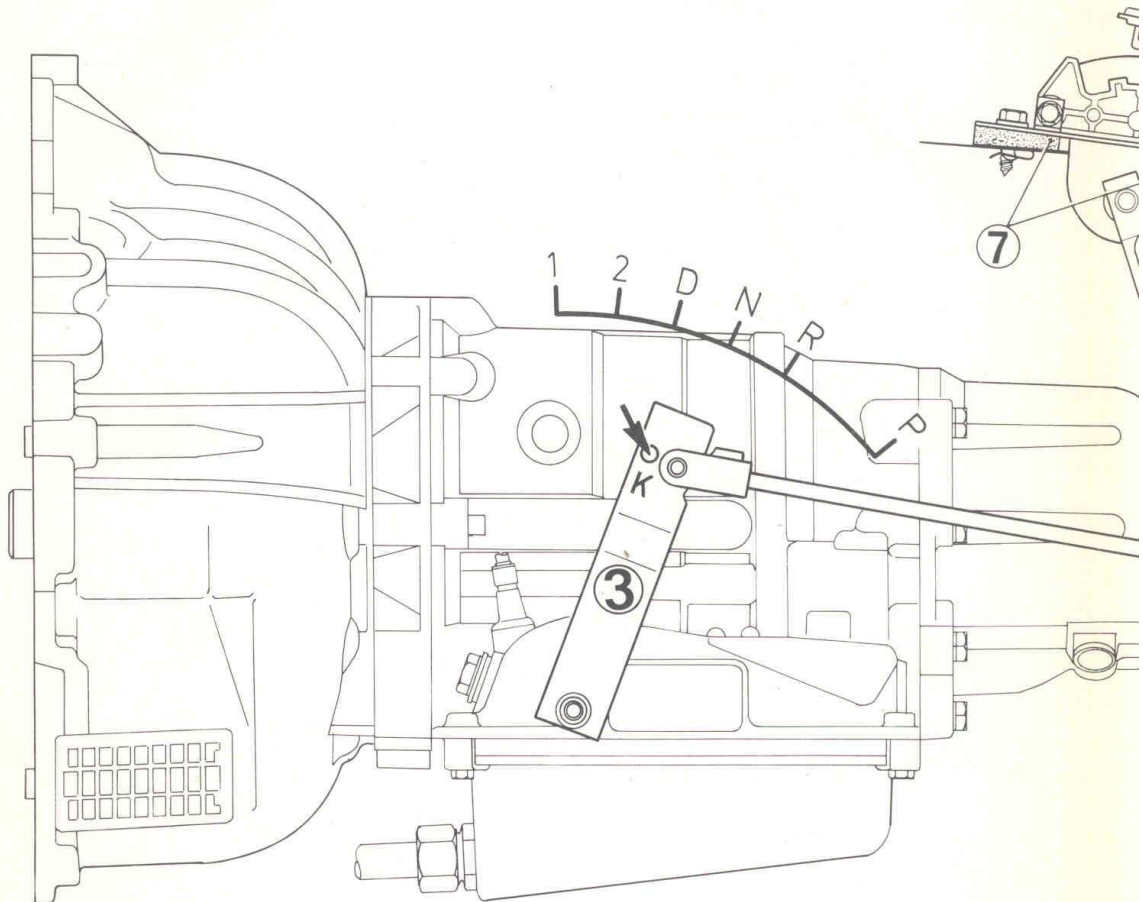
The throttle pressure valve is connected to the throttle cable and determines the shift points, depending on the position of the throttle butterflies.

The shut-off valves initiate down-shifts through the gears, independently of throttle butterfly position. In addition, the shut-off valves prevent further automatic gear shifts when the selector lever is in position 1 or 2.

The selector valves determine the gear selected. As soon as spring pressure in the selector valve is overcome by regulator pressure, the oil supply can reach the clutch valves and engage the relevant clutches. When the kick-down mechanism is operated, spring pressure is reinforced by throttle pressure. This means that the engine must reach a higher speed before the regulator pressure can overcome the combined spring and throttle pressure.

The clutch valves and dampers are intended to make gear shifts as smooth as possible.

**24 00 004 Floor selector lever, throttle linkage and
throttle cable – adjusting**



A) Adjusting gear shift

Before adjusting, check firm seating of pivot mount.

The selector rod (1) must be connected to the unmarked hole in selector lever (3).

Detach the shift rod (1) from the shift lever lower section (2).

Engage the selector lever (3) on the transmission in position N.

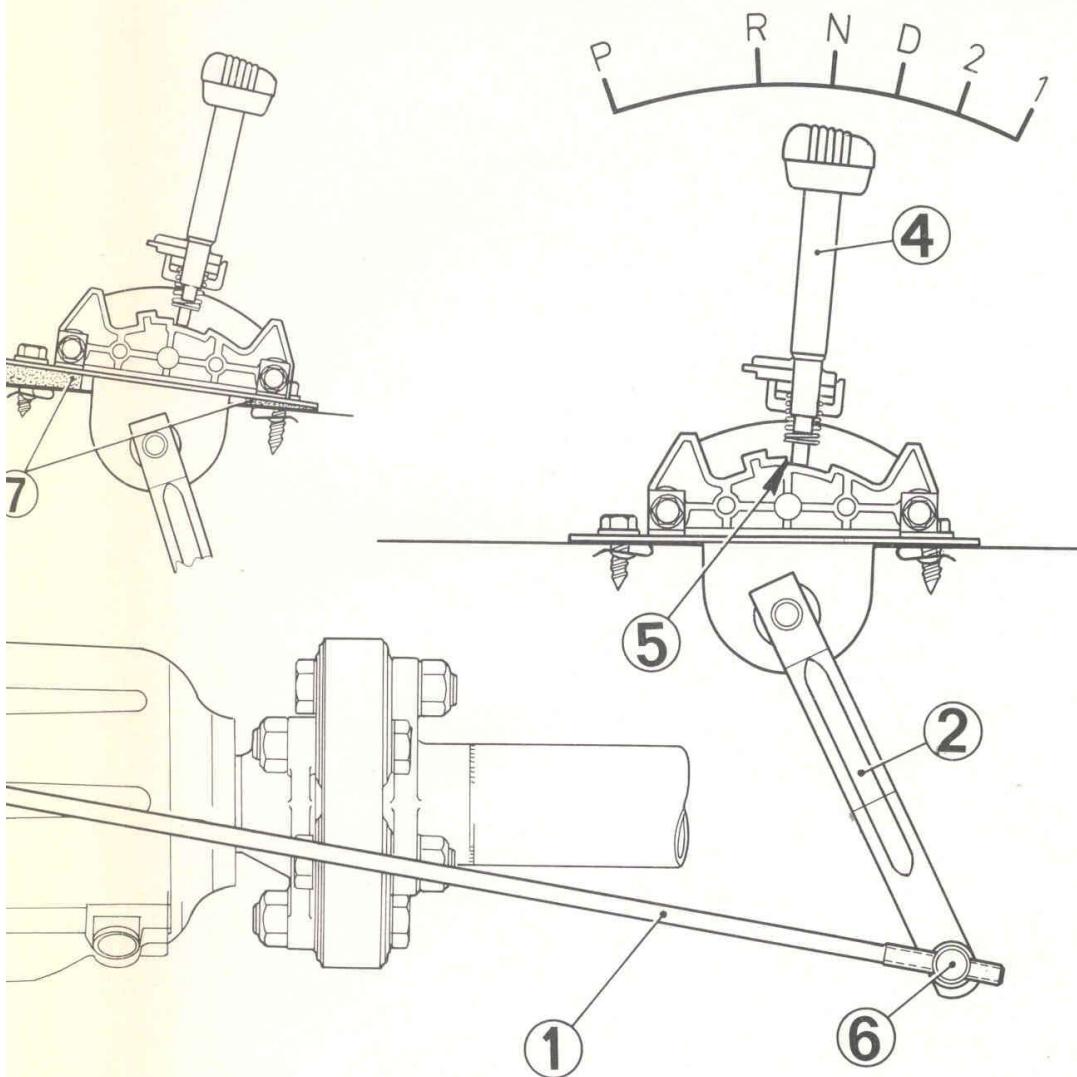
Press shift lever (4) against stop (5) on the gate.

Alter the length of the shift rod (1) until pin (6) is aligned with the hole in the lower part of the shift rod (2).

Now shorten the shift rod (6) by 1 to 2 turns at pin (6).

Attach shift rod and secure.

Note: If car has air conditioning, underlay blocks (7) must be installed between the pivot mount and the floor plate, and shift rod (1) must be connected to hole K in selector lever (3).

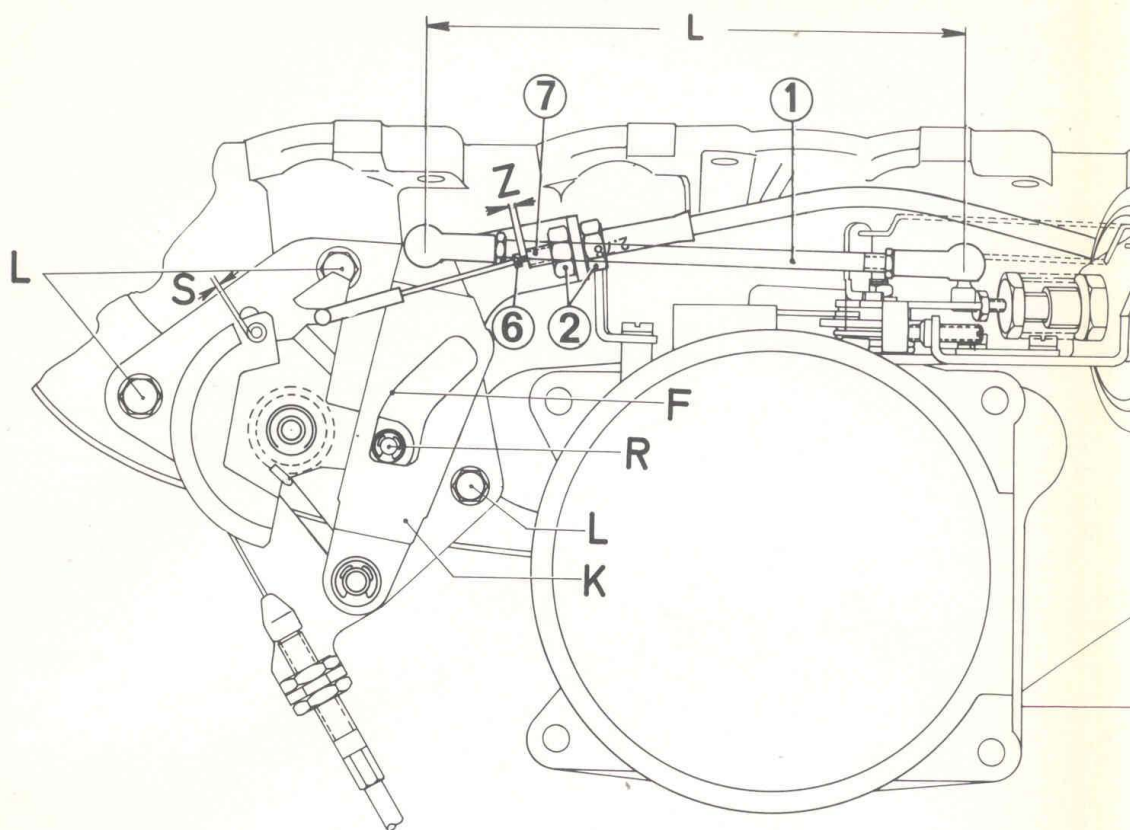


323 24 011

the

ivot
(3).

ZF 3 HP-22



B) Adjusting the throttle cable

Check length of pull rod (1). $L = 165.5 \pm 0.5 \text{ mm}$ ($6.516 \pm 0.020 \text{ in}$).

Check throttle operation: roller (R) on the accelerator cable lever must be touching the running surface (F) of the gate lever (K). Free travel before the throttle butterfly lever is moved must not exceed 1.5 mm (0.06 in).

If this is not the case, move the throttle actuating mechanism along in its slots (L).

The throttle cable must be free from stresses in the idle position.

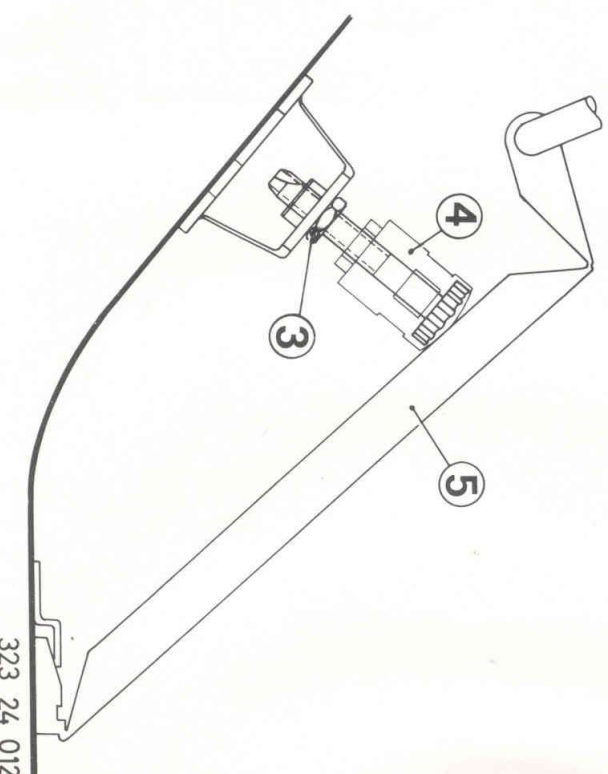
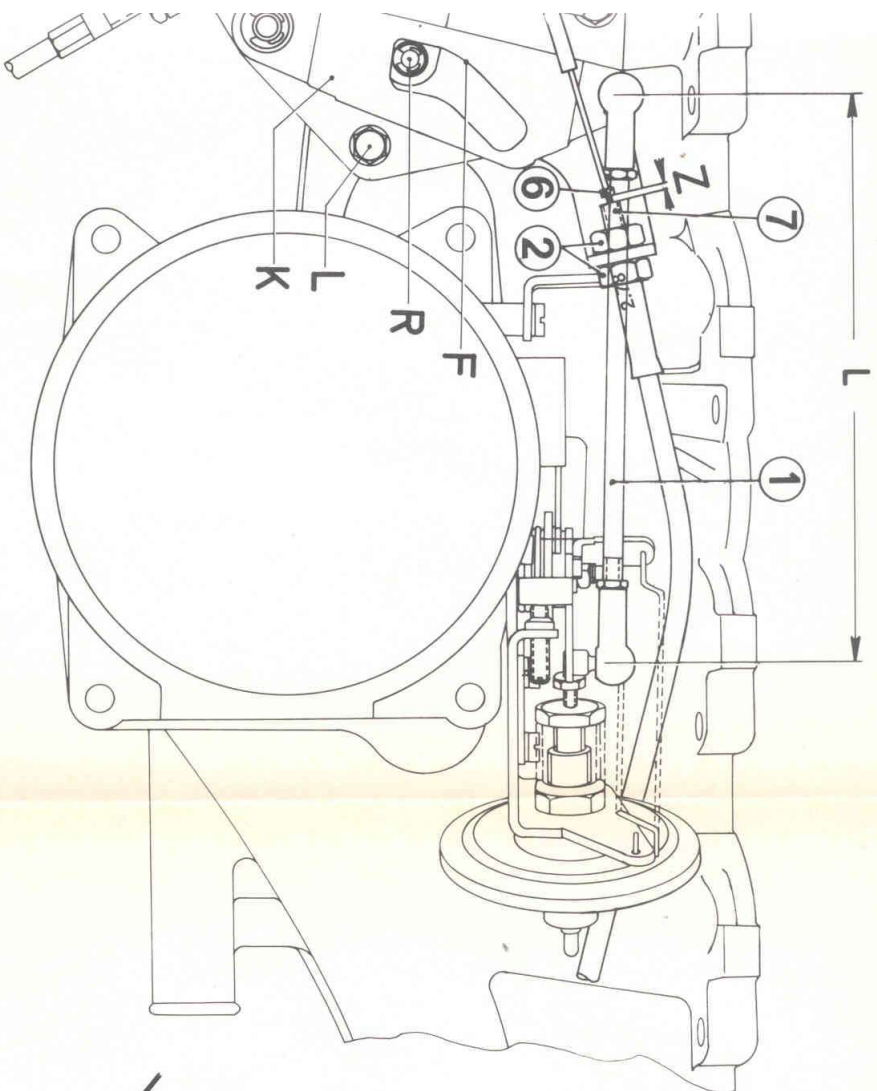
Play at nipple 'S' = 0.5 mm (0.02 in).

With the engine idling (throttle butterfly lifter raised), adjust play (Z) to 0.25...0.75 mm (0.010...0.030 in) with nuts (2). The cable must not hang down slack when this is done.

Slacken nut (3). Screw in the kickdown stop (4).

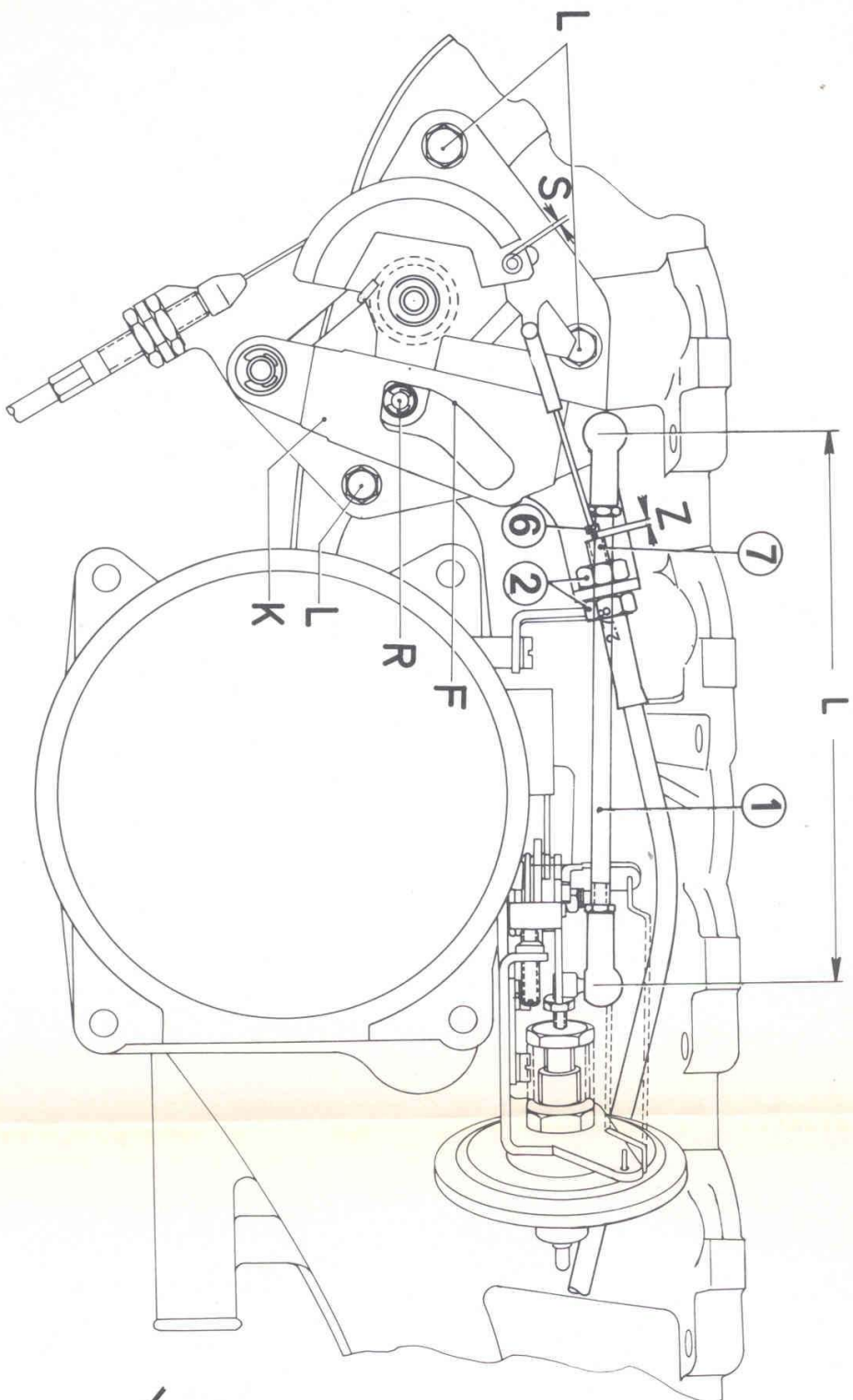
Depress the accelerator pedal (5) until the full-throttle position is obtained (pressure point at transmission). In this position, unscrew the kickdown stop until it is touching the accelerator pedal.

Depress the accelerator pedal (5) fully, to the kickdown position. The distance (Z) from the lead block (6) to the end of the wire cable outer sheath (7) must now be at least 45 mm (1.77 in).



323 24 012

^e = 165.5 ± 0.5 mm (6.516 ± 0.020 in).
 r (R) on the accelerator cable lever must be touching the run-
 ner (K). Free travel before the throttle butterfly lever is moved
 in).
 he throttle actuating mechanism along in its slots (L).
 he from stresses in the idle position.
 .02 in).
 the butterfly lifter raised), adjust play (Z) to $0.25 \dots 0.75$ mm

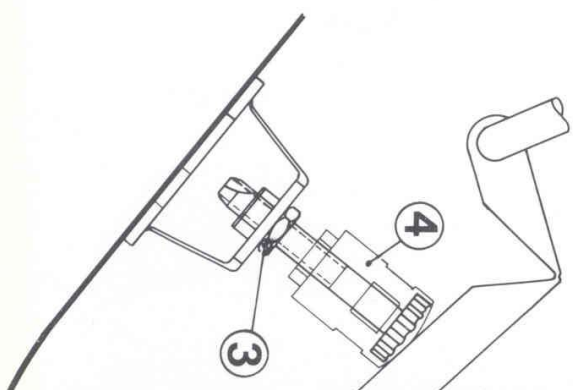


B) Adjusting the throttle cable

Check length of pull rod (1). $L = 165.5 \pm 0.5 \text{ mm}$ ($6.516 \pm 0.020 \text{ in.}$).

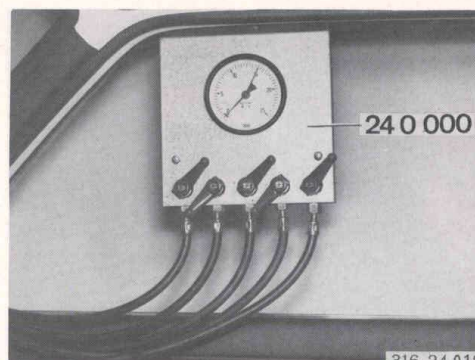
Check throttle operation: roller (R) on the accelerator cable lever must be touching the run-

travel before the throttle butterfly lever is moved



24 00 009 Hydraulic pressures – checking

Attach the 24 0 000 tester or 13 3 061 together with hose 24 0 021 to the door window.

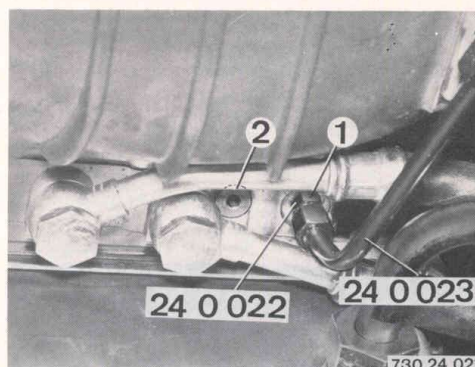


Connect tester 24 0 000 or 13 3 061 in conjunction with hose 24 0 021, and check pressure values.

1 Main pressure:

adapter 24 0 022 and elbow 24 0 023

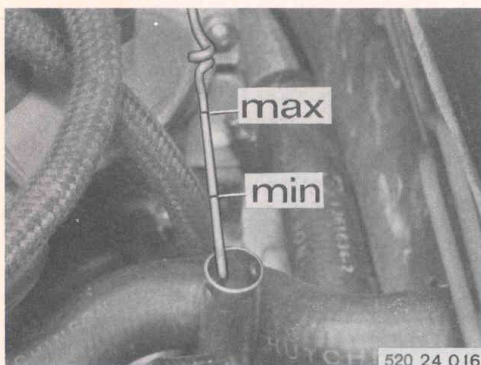
2 Clutch A:



Test:

Disconnect accelerator cable, engine speed 1500 min ⁻¹	Selector lever position	Accelerator cable position
Main pressure ¹⁾ (gauge)	R	Brake pedal applied, handbrake on 1. Idle speed 2. Kickdown
Main pressure ¹⁾	D, 2, 1, P, N	Brake pedal applied, handbrake on 1. Idle speed 2. Kickdown

¹⁾ See specifications



520 24 016

When installing: Restore automatic transmission fluid level with the transmission at normal operating temperature, the selector lever in position P and the engine running at idle speed.

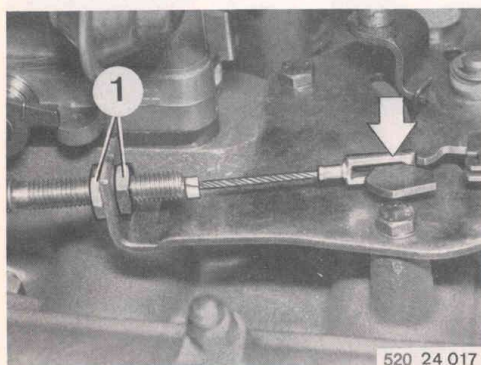
The car should stand on a flat, level surface. If the transmission is at normal operating temperature, the oil level must be between the two dipstick marks.

The quantity of oil represented by the space between the MIN and MAX marks is approx. 0.4 liter (0.42 US quart, 0.7 Imp. pint).

Wipe the dipstick with a non-fluffy cloth.

Warning: If automatic transmission fluid level is too high, serious foaming and splash losses will occur and the transmission will overheat when the car is driven fast.

If the fluid level is too low, the valves will chatter, foaming will occur and the engine will overspeed when the car is cornered.



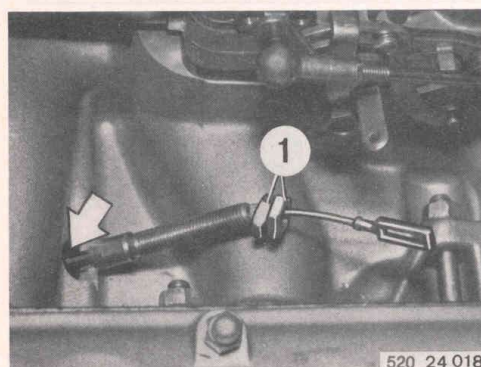
520 24 017

24 00 020 Transmission – removing and installing

Loosen nuts (1).

Disconnect the throttle cable.

When installing: Adjust throttle cable – see 24 00 004.



520 24 018

Unscrew nuts (1). Pull throttle cable down through hole on intake manifold.

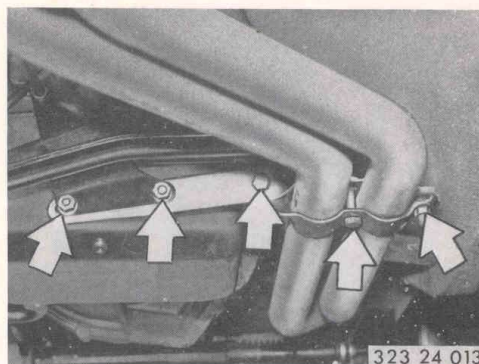
Drain the oil.

Warning: Do not re-use old oil.

When installing: If the oil has a burnt smell and is discolored black, the transmission must be stripped. If the oil has a metallic grey tinge, it contains either aluminium or iron abraded particles. Aluminium, unlike iron, is not trapped by the magnetic drain plug.

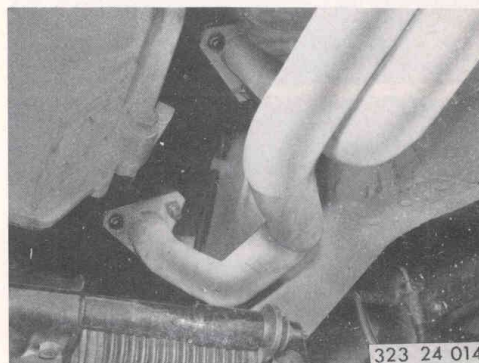
Warning: If the transmission is defective in this way, blow through the oil cooler and pipes with compressed air and flush out twice with ATF. Detach the exhaust pipe holder.

When installing: relieve stresses in exhaust pipe holder.

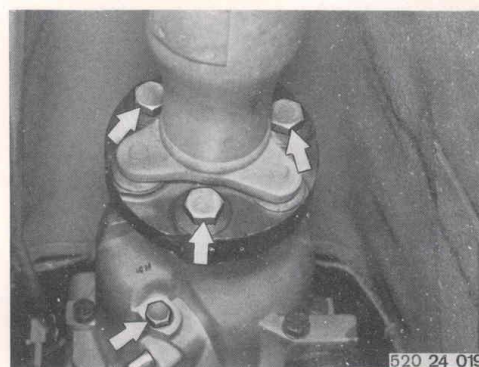


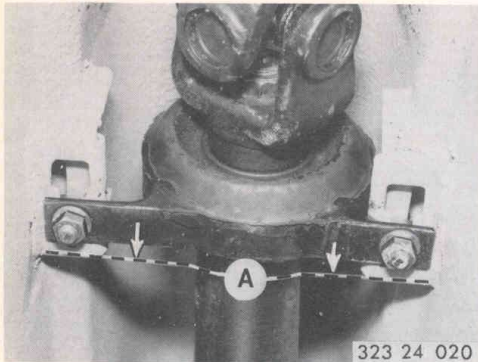
Detach exhaust pipe from exhaust manifolds.

When installing: Check gaskets and renew if necessary.



**Detach propeller shaft from transmission.
Remove speedometer shaft.**





Detach center bearing.

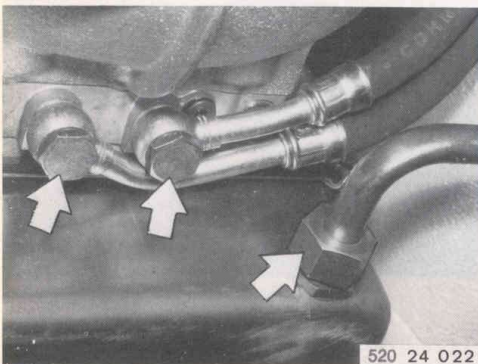
When installing: **Preload center bearing 2 mm (0.08 in) forwards (A).**



Compress propeller shaft halves at sliding joint, hinge down and pull away from centering journal.

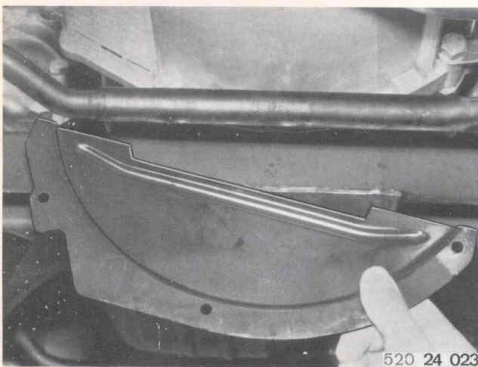
Detach shift rod (3) from selector lever.

When installing: **adjust selector lever – 24 00 004.**



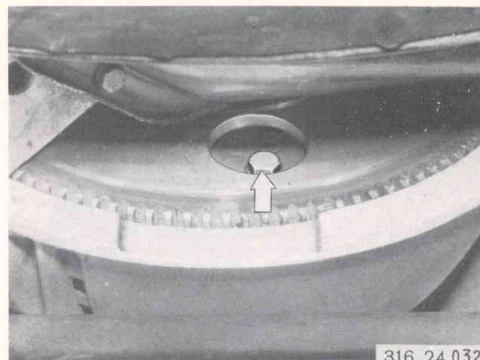
Detach oil filler pipe.

Detach oil cooler lines at transmission.



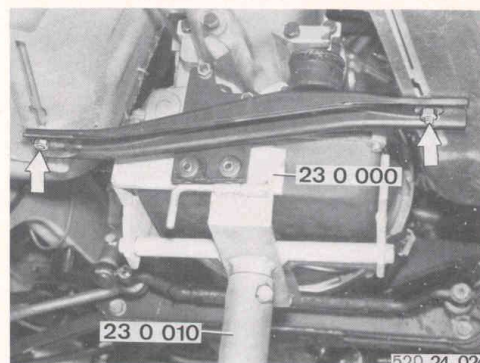
Remove cover plate.

Detach the torque converter from the driving disc at four points.
Turn the engine over while doing this.



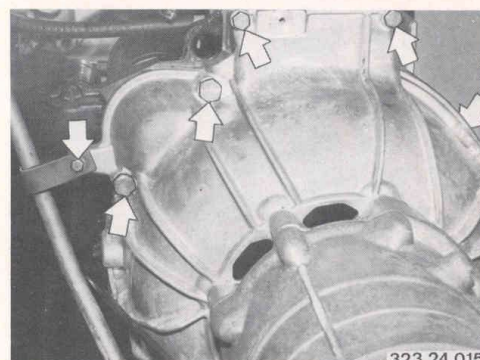
316 24 032

Support transmission with adapter 23 0 000 in conjunction with support tube 23 0 010.
Detach cross-member from body.



520 24 024

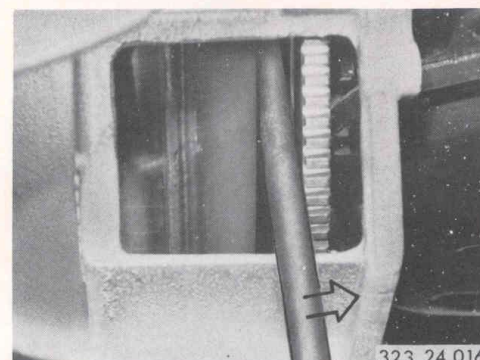
Lower transmission as far as front axle beam.
Remove retaining bolts at transmission.



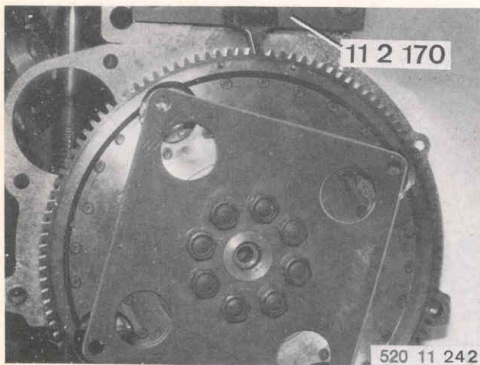
323 24 015

Lift out the protective grille.
Pull the transmission away from the engine, pressing the torque converter off at the same time.

Warning: Before installing, check correct position of torque converter.



323 24 016

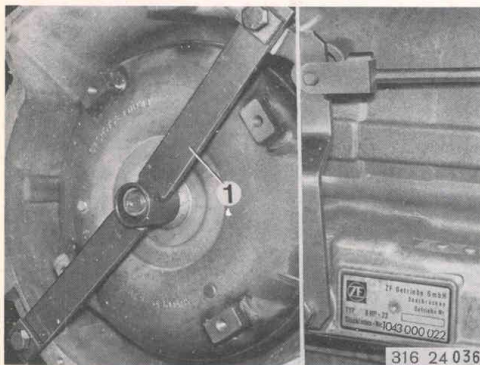


When installing: Examine driving disc for fractures or cracking, and renew if necessary. Prevent flywheel from turning with holder 11 2 170.

Remove the expansion bolts.

Warning: Never re-use expansion bolts; install new bolts with Loctite Ref. No. 270.

Make sure the tapped holes are absolutely clean.



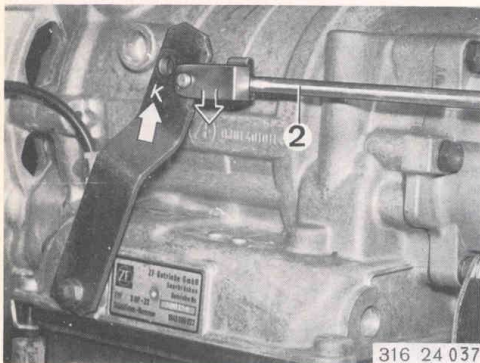
24 00 040 Exchange transmission – installing

Remove the transmission – 24 00 020.

Warning: Before installing an exchange transmission, always blow through the oil cooler and pipes with compressed air and flush out twice with ATF.

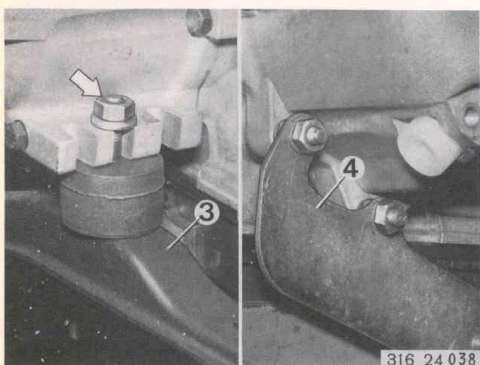
Note transmission code¹⁾ on type plate.

Detach the transit bar (1).



Transfer selector rod (2) to new transmission.

When installing: Connect selector rod (2) to unmarked hole (no code letter) on selector lever. Insert clamp spring from the top downwards.



Transfer cross-member (3) and exhaust pipe holder (4) to new transmission.

¹⁾ See specifications

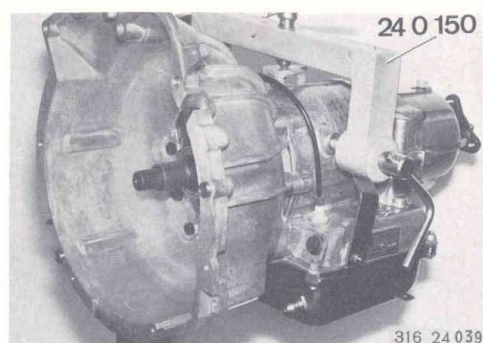
24 00 080 Transmission – stripping and assembling

Remove the transmission – 24 00 020.

Remove the torque converter – 24 40 000.

Attach transmission to hanger 24 0 150 in conjunction with assembly stand.

Warning: Do not overtighten clamp bolts or transmission casing will be distorted.

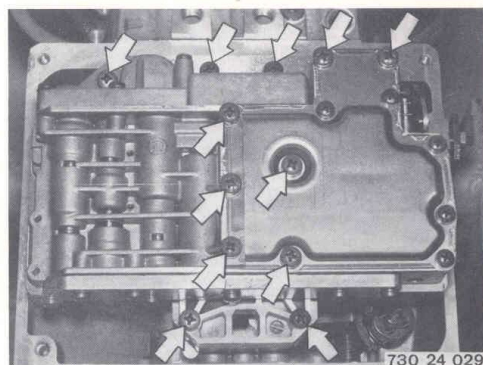


A) Stripping

Detach the oil pan.

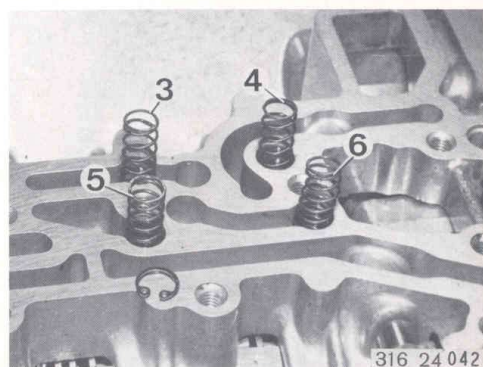


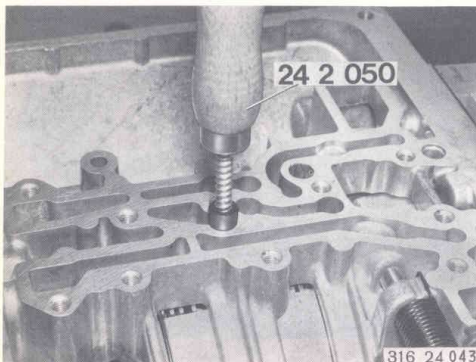
Remove the control unit.



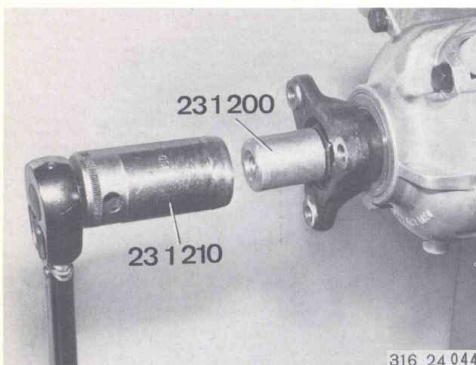
Extract the circlips.

Remove coil springs (3 to 6).

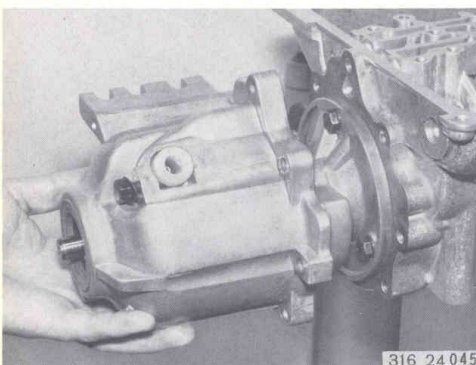




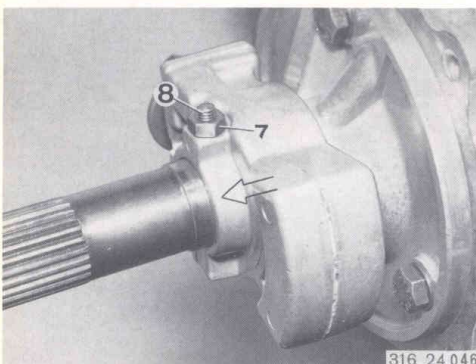
Extract the sealing sleeves with special tool 24 2 050.



Engage the parking lock.
Mount guide bushing 23 1 200.
Remove shouldered nut with socket head 23 1 210.
Pull off the output flange.



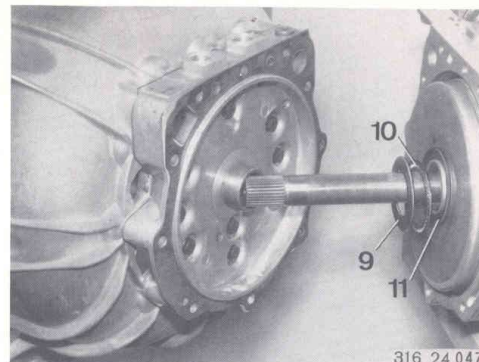
Detach the exhaust pipe support.
Detach the transmission extension.



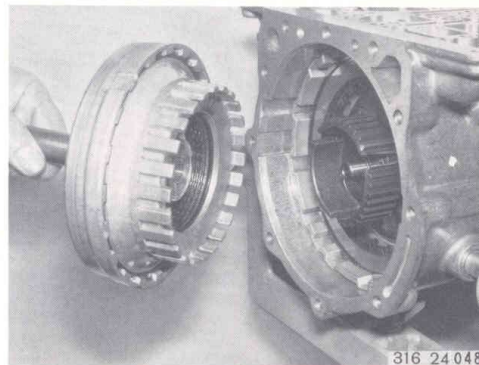
Loosen nut (7) and unscrew stud (8) by approx. 3 turns.
Pull off the governor.

Detach converter dome with intermediate plate.

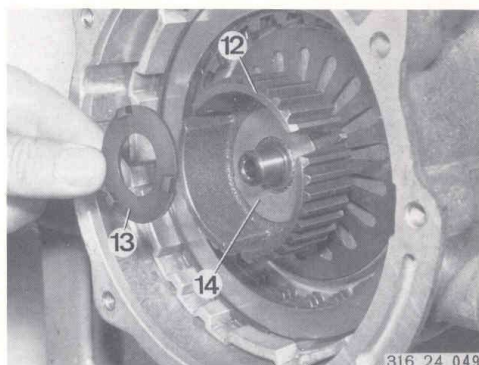
Warning: Note thrust washer (9), needle roller bearing (10) and angled disc (11).



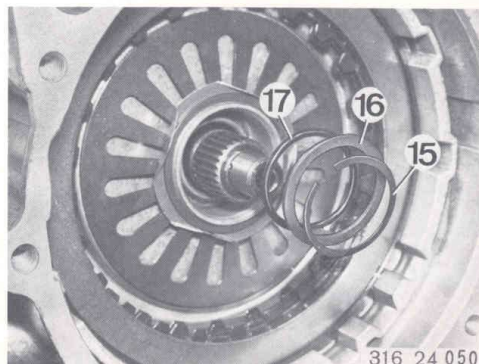
Remove input shaft with clutch A.

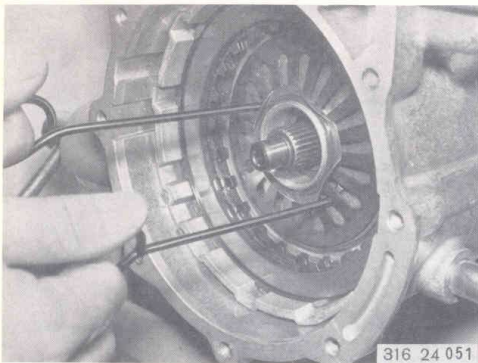


Remove plate carrier (12) for clutch A, with thrust washer (13) – plastic – and thrust washer (14) – metal.

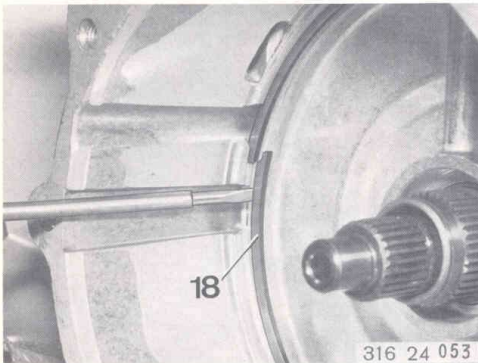
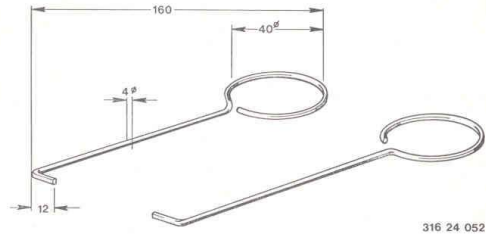


Extract circlip (15).
When clutch B is removed, cover disc (16) and sealing ring (17) will also be pulled out.

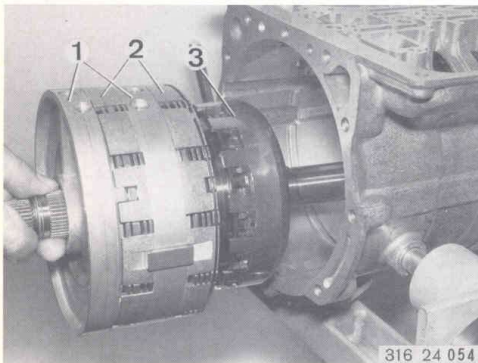




Pull out clutch B with two wire hooks made up in your own workshop.
Sketch for making up hooks (dimensions in millimeters):



Extract snap ring (18).

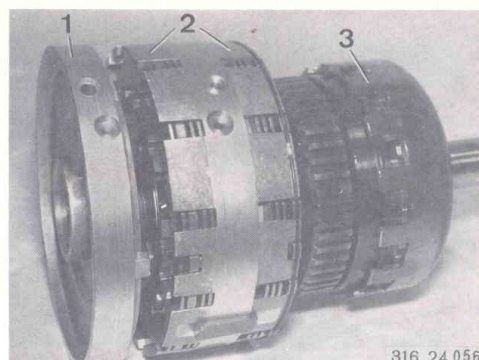


Pull out the complete cluster:
centering plates (1), clutches C', C and D (2) and planetary gear set with output shaft (3).



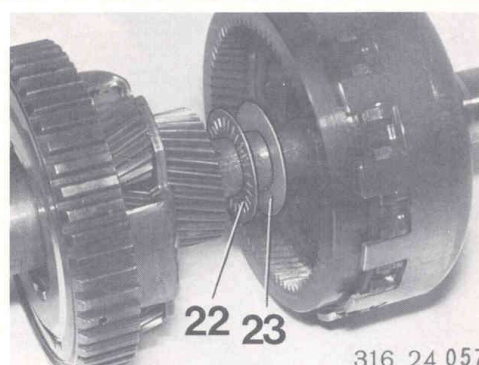
Warning: Note thrust washer (19), needle roller bearing (20) and angled disc (21).

Pull off centering plate (1) and clutch cluster (2) with clutches C', C and D from output shaft (3).

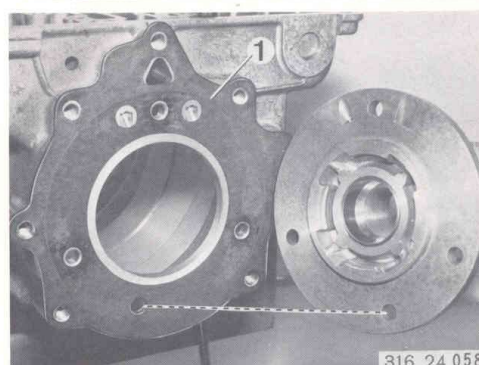


Remove planetary gear set with sun wheel shaft.

Warning: Note needle roller bearing (22) and thrust washer (23).

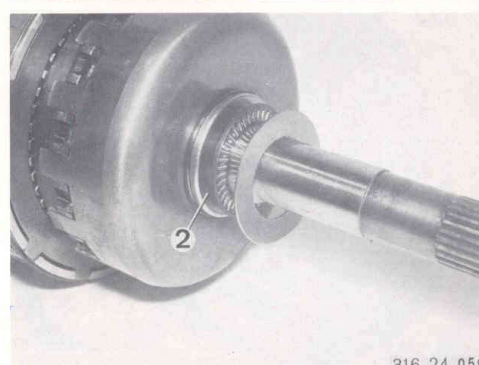


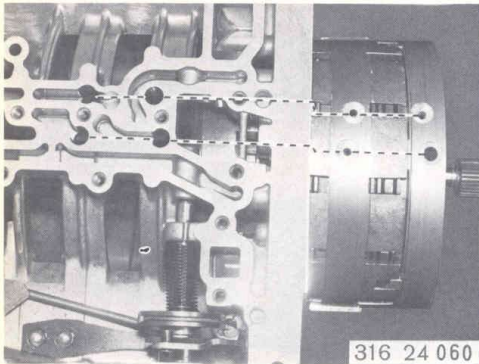
B) Assembling
Detach the governor flange.
Use a new gasket (1).



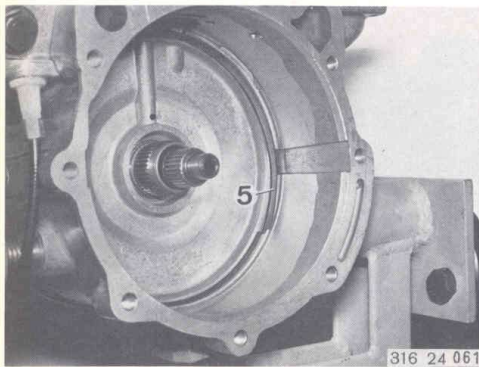
Attach the angled disc (2) with grease, so that the angled-away side is against the output shaft.

Place the needle roller bearing and the thrust washer on the output shaft.

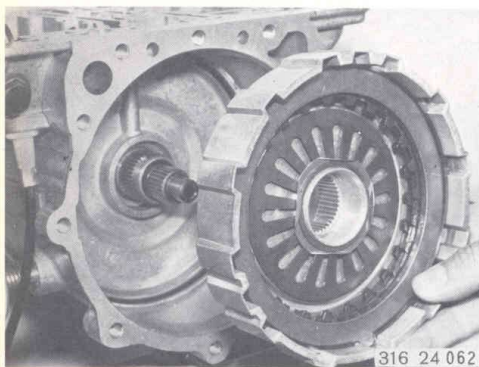




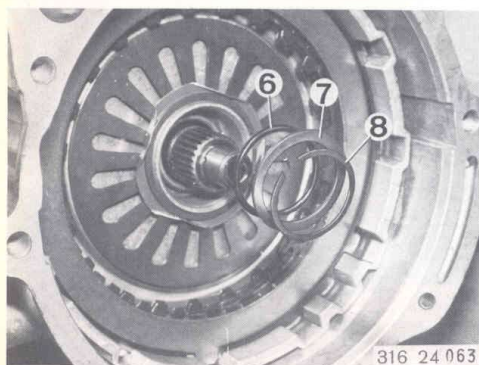
Note: The keys must be in the center of the slot in the cylinder. The parking lock pawl must not be engaged. Insert the complete output side cluster into the transmission housing so that the 4 oil holes coincide with the holes in the underside of the transmission housing.



Insert the snap ring (5).

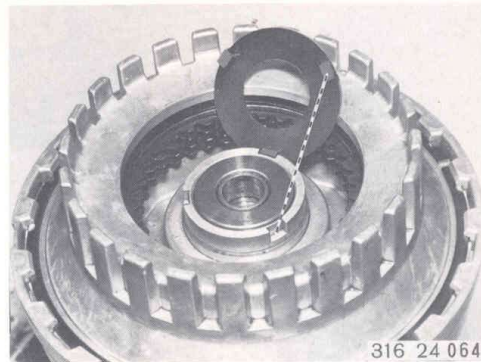


Install clutch B.

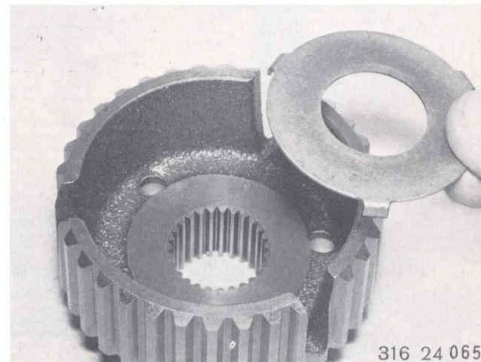


**Insert sealing ring (6) and press in fully with thrust washer (7).
Insert circlip (8).**

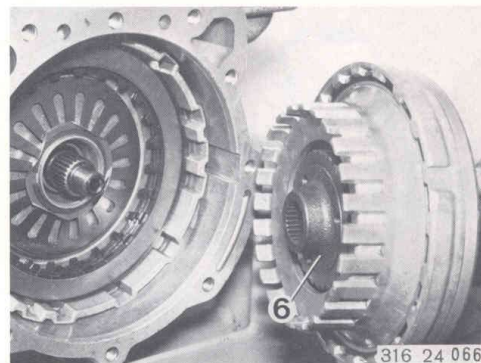
Attach the plastic thrust washer with grease so that the lugs engage in the cutouts on cylinder A.



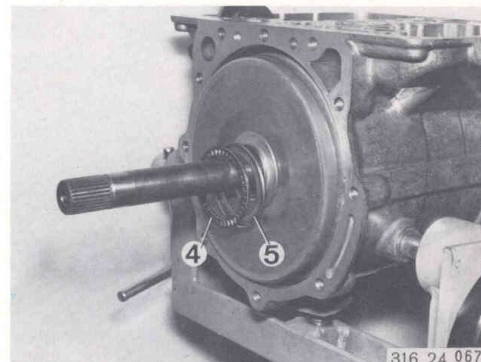
Attach the metal thrust washer with grease inside the plate carrier.

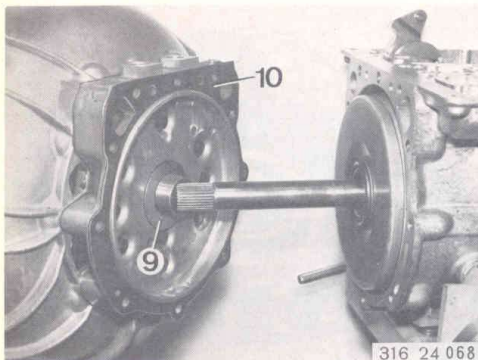


Install the plate carrier (6) in clutch A, turning it backwards and forwards slightly while inserting. Insert clutch A in the transmission housing.

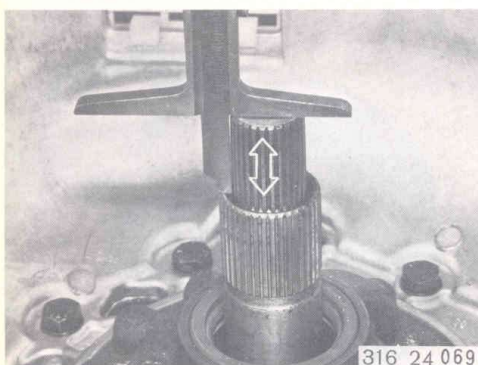


Attach angled disc (5) to the input shaft with the shoulder towards needle roller bearing (4).

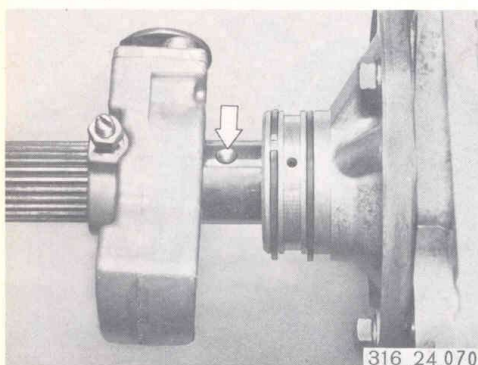




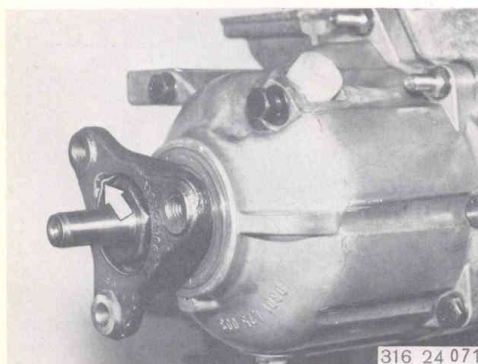
Attach thrust washer (9) and gasket (10) to converter dome with a little grease. Push the converter dome on to the input shaft, and secure.



Check input shaft endplay.
Desired value: 0.3 ... 1.5 mm (0.0012 ... 0.060 in).



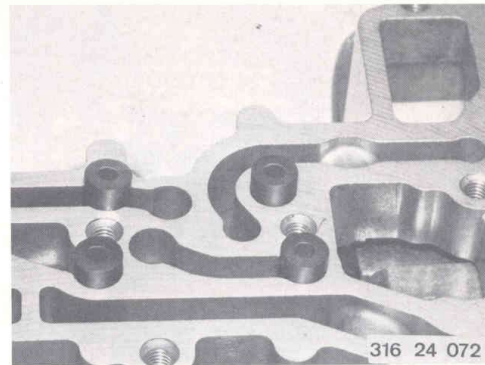
Compress piston rings slightly and at the same time push the governor on to the governor flange.
Unscrew the setscrew to simplify location of the recess in the output shaft.
Secure governor with setscrew in recess on output shaft and prevent from moving with a centerpunch mark.



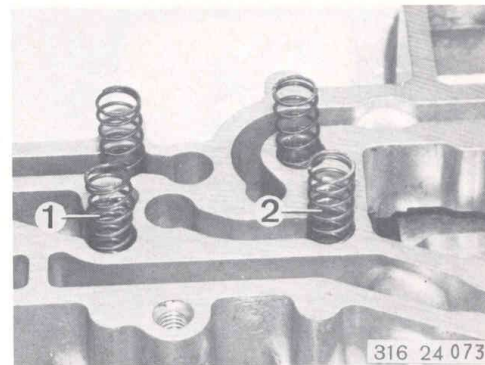
Pack the radial sealing ring lips with grease. Attach the transmission extension and output flange. Coat the shouldered nut with Curil K2 or Loctite 572 before installing. Engage the parking lock and tighten the nut¹⁾. Place keeper plate on nut and secure in groove on output flange.

¹⁾ See specifications

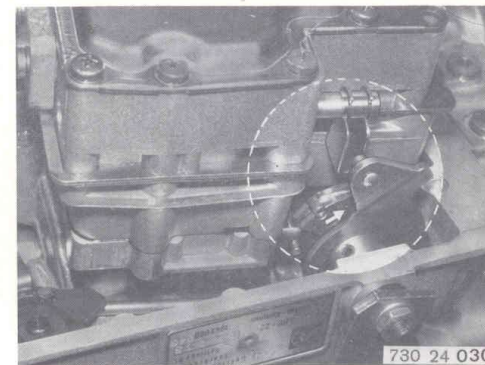
Drive the 4 sealing sleeves fully in with a suitable drift.



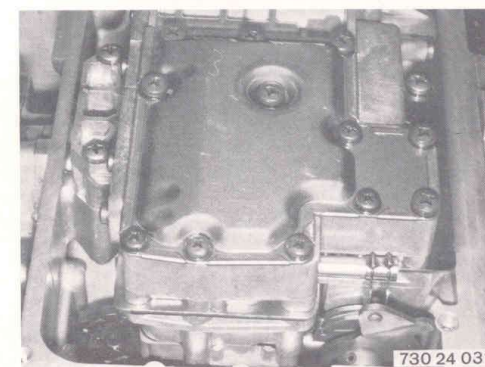
Insert and secure the coil springs. The two shorter springs (1 and 2) are at the selector lever side.

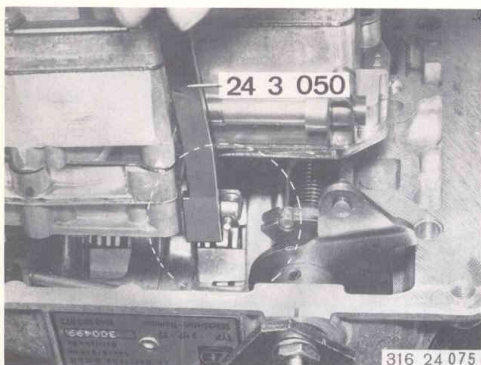


Attach the control unit so that the clip on the selector slide valve can be engaged with the actuating finger of the pawl. To do this, pull up the wire cable slightly so that the throttle cam stays clear of the throttle pressure valve.



Screw on the control unit without tightening.

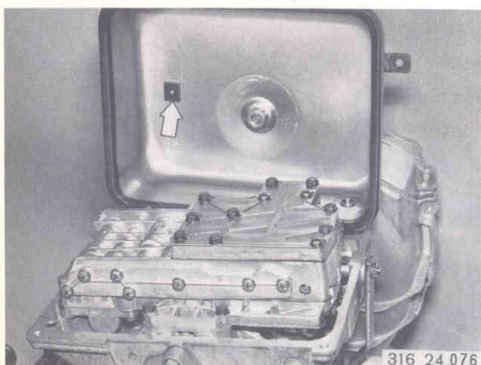




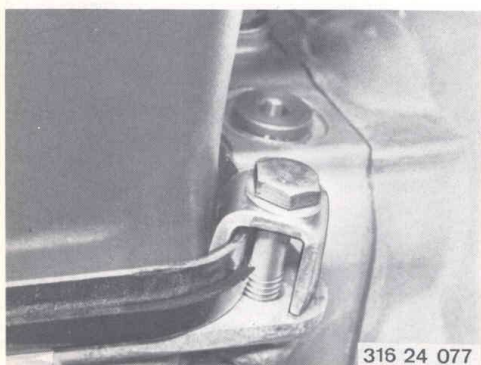
Align the control unit with gauge 24 3 050. If no gauge is available, the distance from the control unit casing to the peg in the throttle pressure plunger must be 11.5 mm (0.453 in). Tighten the control unit in this position.

With 'Torx' screws:

Tighten them with insert 002 100 and torque wrench 002 050.¹⁾



Place the gasket on the oil pan joint face. Insert the magnetic disc. Installed position: next to oil strainer.



Bolt down the oil pan with its retaining brackets. The shorter arm of the retaining bracket presses against the oil pan.

¹⁾ torque see Specifications

24 11 000 Oil pan – removing and installing

Drain the oil (ATF).

Warning: Do not re-use old oil.

When installing: If the old oil smells burnt or is discolored black, the transmission must be stripped and inspected. If the oil has a metallic gray tinge, it contains abraded aluminum or ferrous particles. Note that unlike iron or steel, aluminum is not trapped by the magnet.

Place the car on a flat, level surface.

Restore fluid level with selector lever at P, transmission at normal operating temperature and engine idling.

With the engine at normal operating temperature, the oil level must be between the two marks on the dipstick.

The quantity of oil between the minimum and maximum marks on the dipstick is app. 0.4 liter (0.71 Imp. pint, 0.42 US quart).

If the oil level is too high, severe foaming will result, oil will be lost through agitation and the temperature will rise excessively when driving fast.

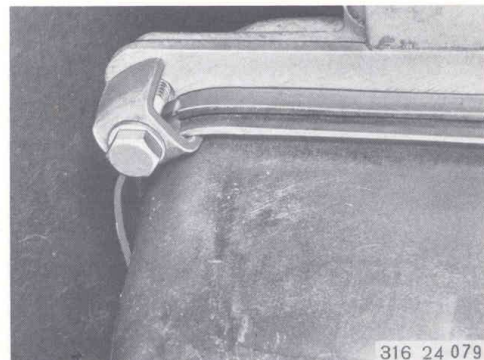
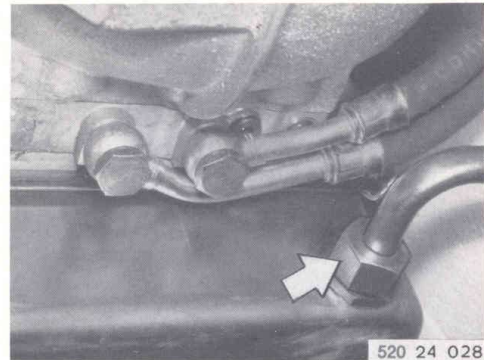
If the oil level is too low, the valves will chatter in the transmission, foaming will occur and the engine will overspeed.

Detach the oil filler pipe from the oil pan.

Detach the oil pan.

When installing: Secure oil pan with retaining brackets; the shorter arm of the brackets presses against the oil pan.

Warning: Insert the magnetic disc (1) next to the oil strainer in the oil pan. Attach gasket (2).



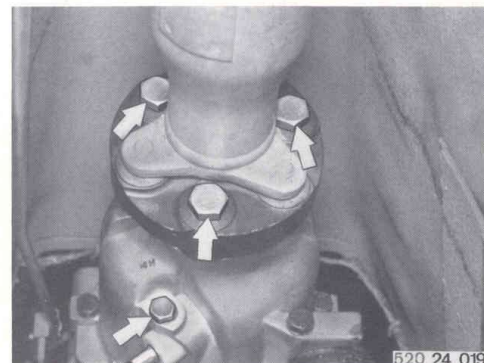
24 11 050 Transmission cover – removing and installing/sealing

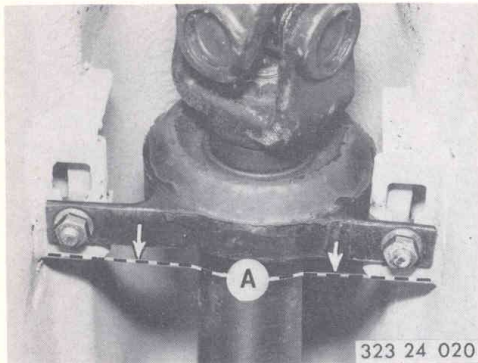
Detach the exhaust pipe support and the exhaust pipes at the exhaust manifolds.

When installing: Attach exhaust pipe support so that no stresses are trapped.

Detach propeller shaft from gearbox.

Remove speedometer shaft.



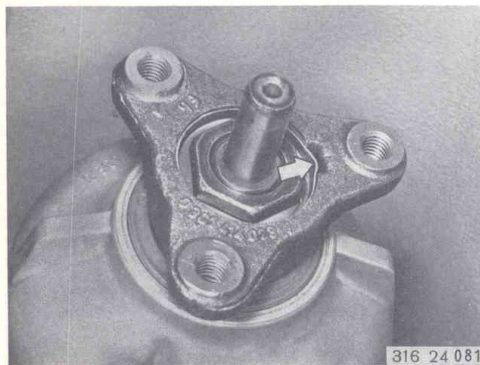


Detach center bearing.

When installing: Preload center bearing forwards (A) by 2 mm (0,08 in).

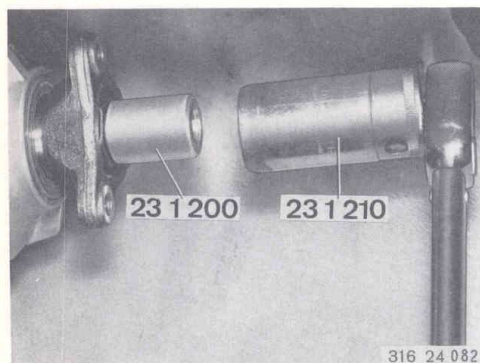


Compress propeller shaft sections together at sliding joint, hinge down and pull away from centering journal.



Lift out keeper plate.

When installing: Drive keeper plate into groove on output flange.



Engage the parking lock.

Mount guide bushing 23 1 200.

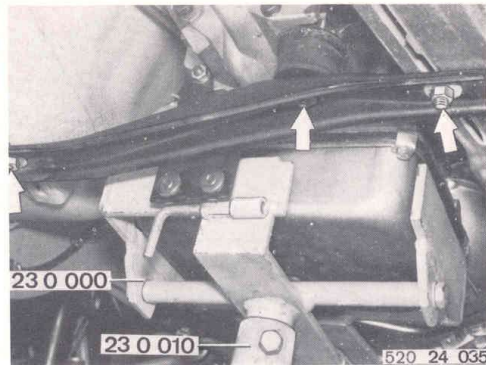
Remove shouldered nut¹⁾ with socket head adapter 23 1 210.

Pull off output flange.

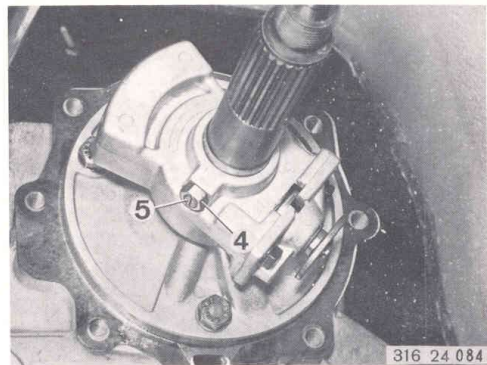
When installing: apply Curil K 2 or Loctite 572 to shouldered nut.

¹⁾ See specifications

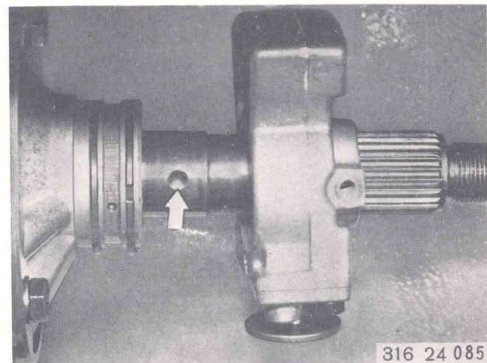
Support transmission with adapter 23 0 000 in conjunction with tube 23 0 010.
Remove cross-member.
Lower transmission.
Take off transmission cover.



Loosen nut (4) and unscrew threaded stud (5) by 3 turns.
Pull off the governor.

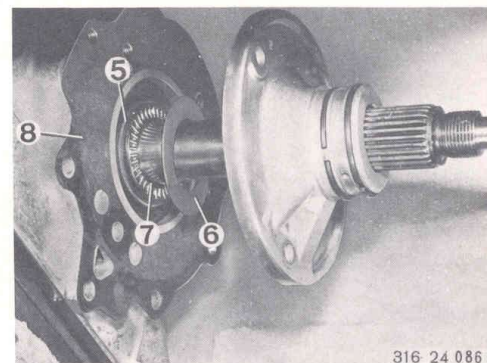


When installing: Compress the piston rings slightly, and at the same time push the governor on to the governor flange. To help in locating the recess in the output shaft, remove the stud. Secure the governor in the recess on the output shaft with the threaded stud, and prevent from moving with a centerpunch mark.



Detach the bearing flange.

Note: angled disc (5), thrust washer (6) and needle roller bearing (7). Renew gasket (8).



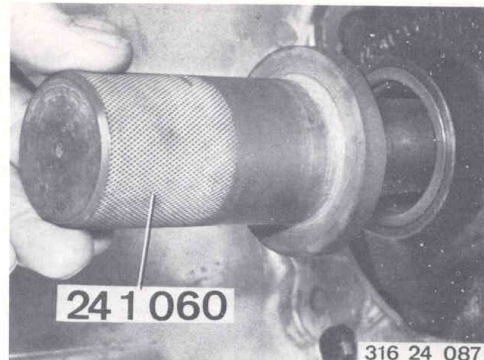
24 12 001 Radial sealing ring for torque converter – renewing

Remove (install) the torque converter – 24 40 000.

Extract the radial sealing ring.

When installing: Pack the cavity between the sealing lips with grease.

Drive the radial sealing ring in until firmly seated with drift 24 1 060.

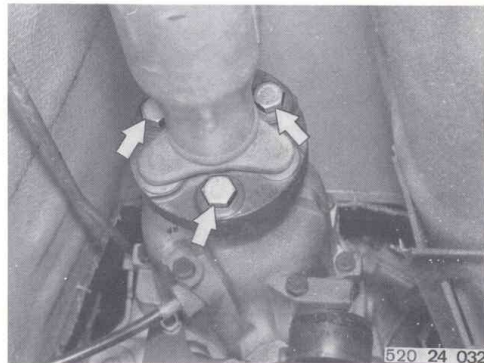


24 12 011 Output flange radial sealing ring – renewing

Detach exhaust pipe support and exhaust pipes from exhaust manifold.

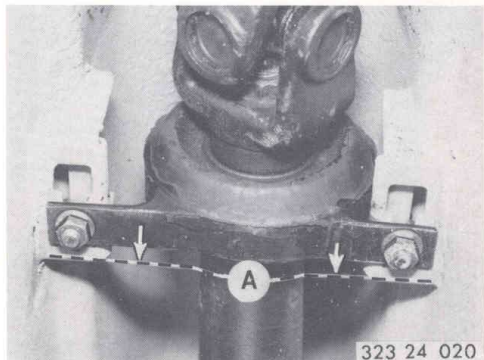
When installing: relieve trapped stresses in exhaust pipe support.

Detach propeller shaft from transmission.



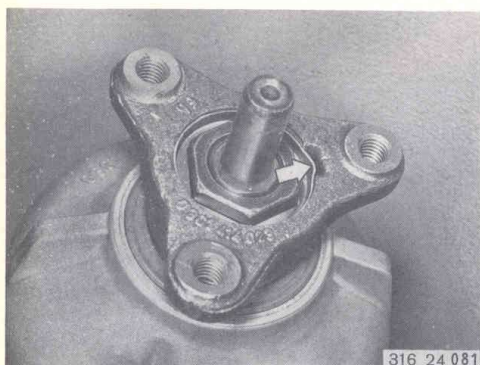
Detach center bearing.

When installing: Preload the center bearing forwards (A) by 2 mm (0.08 in).



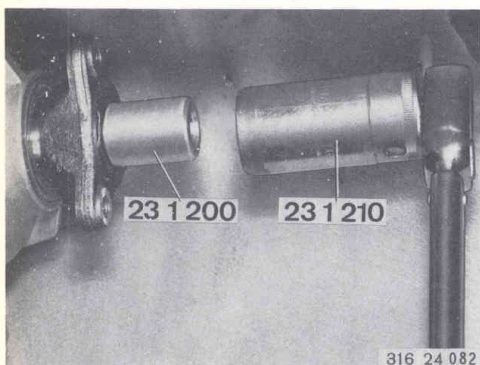
Compress the propeller shaft together at the sliding joint, hinge down and pull away from centering journal.





Extract the keeper.

When installing: Drive keeper into groove on output flange.



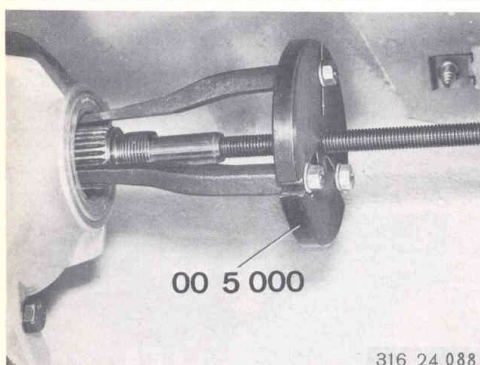
Engage the parking lock.

Mount guide bushing 23 1 200.

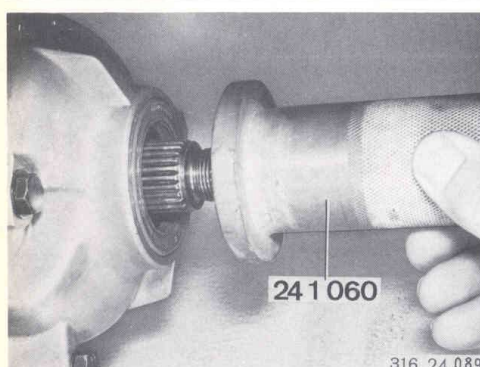
Remove shouldered nut¹⁾ with socket head 23 1 210.

Pull off the output flange.

When installing: Coat shouldered nut with Curil K 2 or Loctite 572.



Remove the radial sealing ring with extractor 00 5 000.

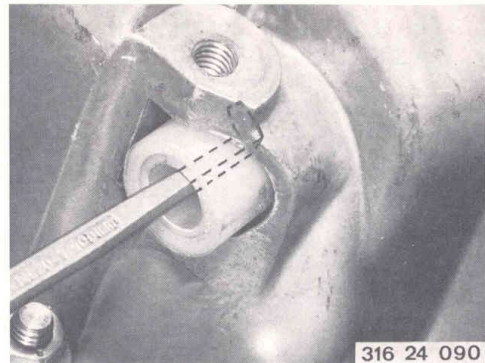


When installing: Pack the cavity between the sealing lips with grease. Drive in the radial sealing ring until firmly seated with drift 24 1 060.

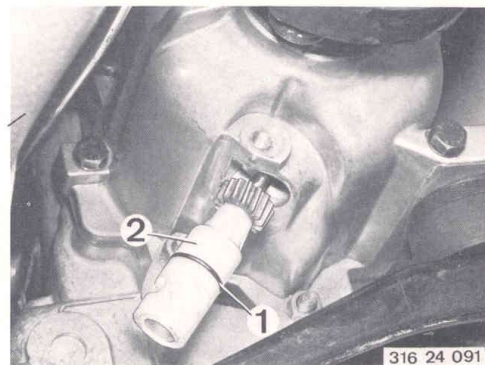
¹⁾ See specifications

24 12 031 O-ring for speedometer drive shaft bushing – renewing

Detach the speedometer drive shaft.
Pull out the speedometer shaft bushing with an angled screwdriver.



Renew the O-ring (1).
If the radial sealing ring is leaking, the speedometer shaft bushing (2) must be renewed.

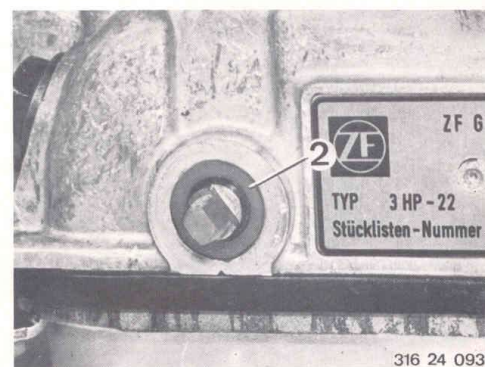


24 12 101 Radial sealing ring for manual shift valve shaft – renewing

Detach selector lever (1) from transmission.



Extract the radial sealing ring (2).
When installing: Drive the radial sealing ring in until flush.



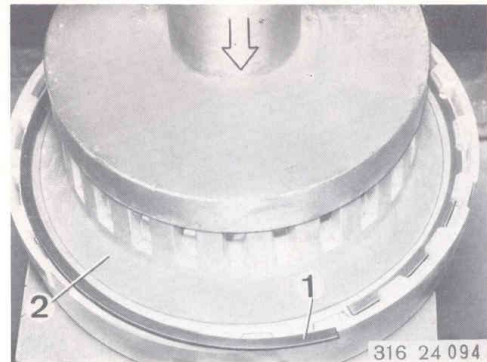
24 23 020 Plate clutches and disc brakes – renewing

Strip the transmission – 24 00 080.

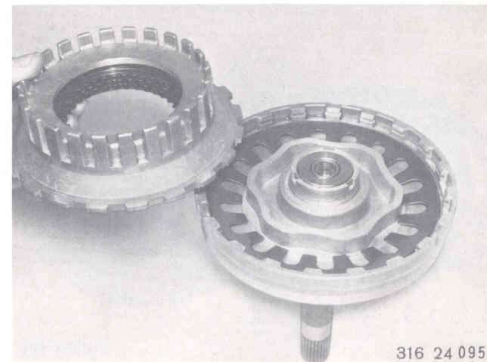
Clutch A

Compress the clutch plates and extract snap ring (1).

Take off plate carrier (2).



Lift out the plate cluster and the diaphragm spring.



Installation order:

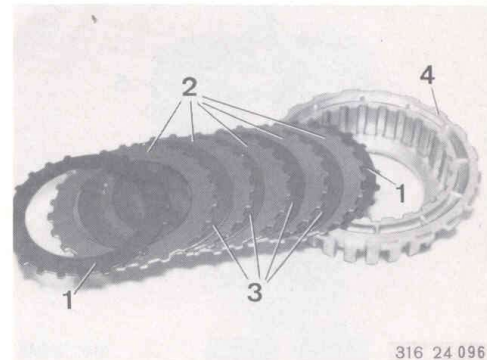
1 Corrugated outer plates

2 Outer plates

3 Lined plates

4 Plate carrier

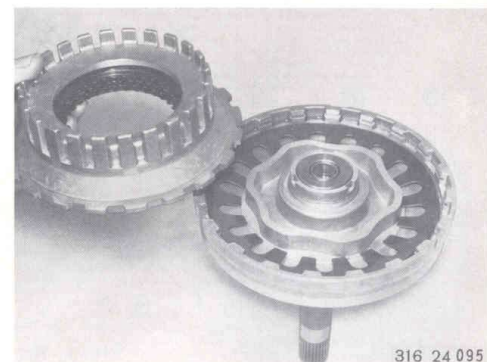
When installing: Place new lined plates in ATF at 70°C for approx. 20 minutes.

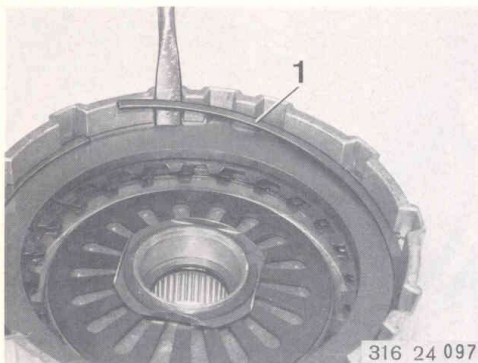


Place diaphragm spring in input shaft housing with convex side down.

Insert plate cluster with plate carrier.

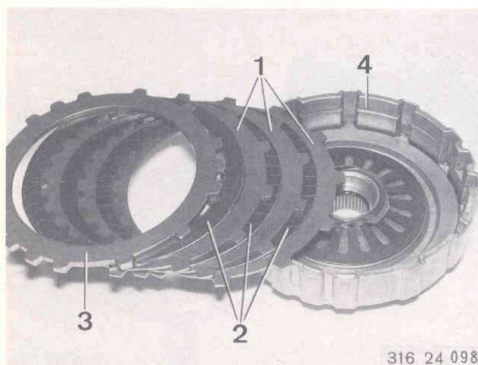
Compress the clutch plates and insert the snap ring.





Clutch B

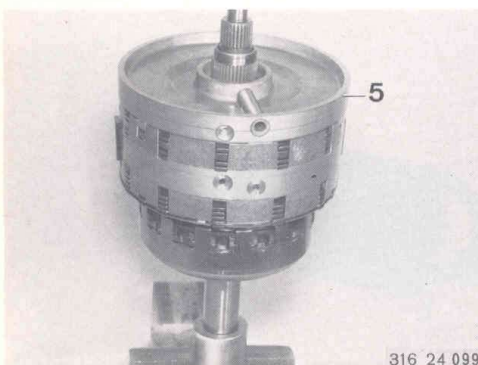
Extract the snap ring (1).
Remove outer and lined plates.



Installation order:

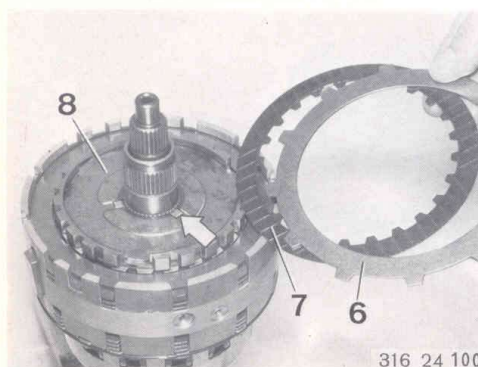
- 1 1.8 mm (0.071 in) outer plates – 3
- 2 Lining plates – 3
- 3 4.5 mm (0.177 in) outer plate – 1
- 4 Housing

When installing: Place new lined plates in ATF at 70°C for approx. 20 minutes.



Clutch C'

To simplify assembly, place the complete cluster in a pipe of 29 mm (1.14 in) inside diameter, and clamp into vise.
Take off centering plate (5).



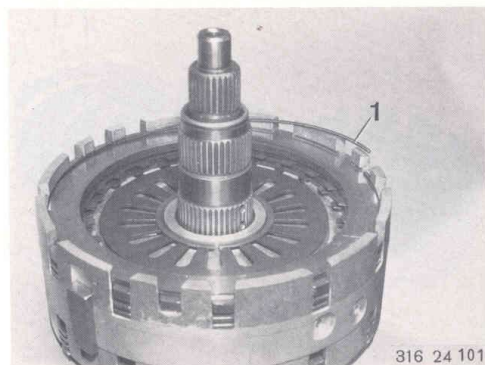
Remove outer plate (6), lining plate (7) and freewheel (8) for 2nd speed range.

When installing: Install freewheel (8) with the bent-over lugs of the retaining plate visible on top.

Place new lined plates in ATF at 70°C for approx. 20 minutes.

Clutch C

Extract the snap ring (1).



Remove the plates.

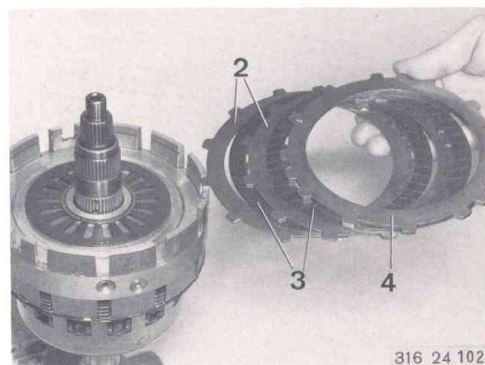
Installation order:

2 1.8 mm (0.071 in) outer plates – 2

3 Lining plates – 2

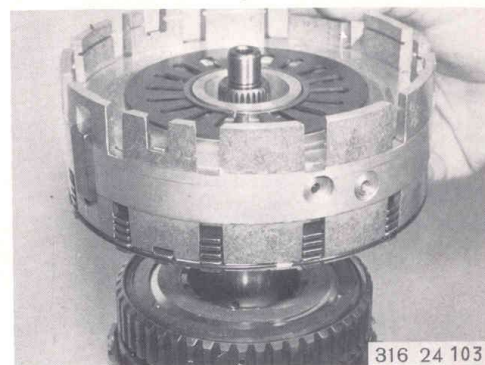
4 4.5 mm (0.177 in) outer plate – 1

When installing: Place new lined plates in ATF heated to 70°C for approx. 20 minutes.

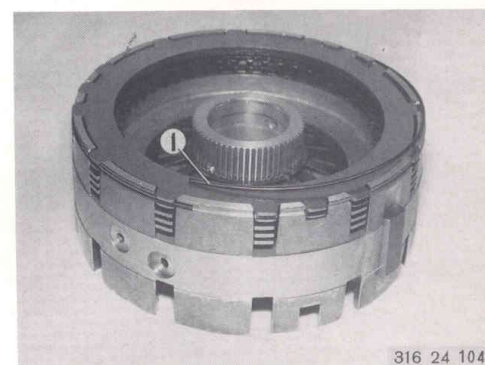


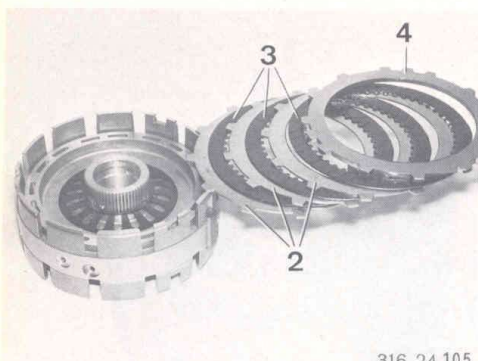
Clutch D

Separate clutch body with clutch D from planetary gear set.



Extract the snap ring (1).





316 24 105

Lift out the plate cluster.

Installation order:

2 1.8 mm (0.071 in) outer plates – 3

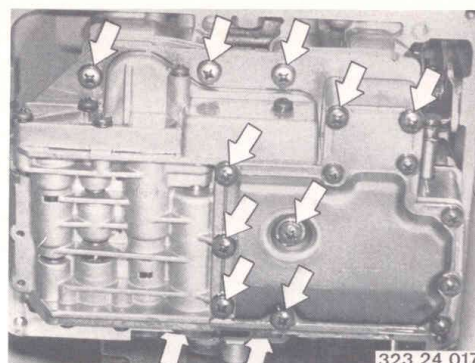
3 Lining plates – 3

4 4.5 mm (0.177 in) outer plate – 1

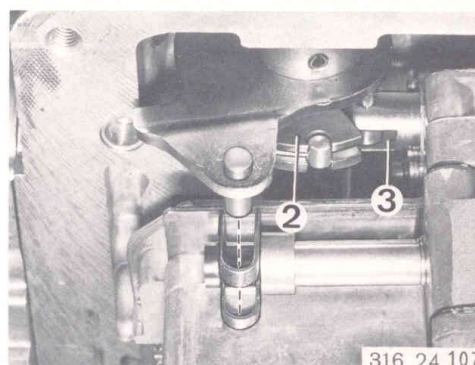
When installing: Place new lined plates in ATF heated to 70°C for approx. 20 minutes.

24 30 000 Control unit – removing and installing

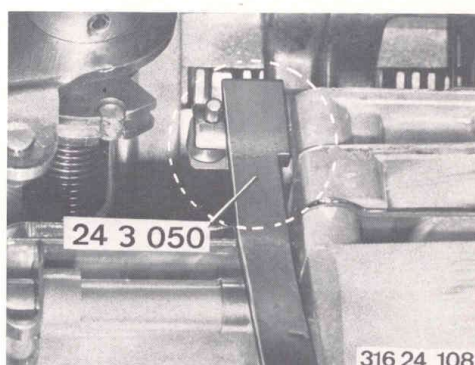
Take off the oil pan – 24 11 000.
Remove the control unit.



When installing: Attach the control unit so that the clip on the selector slide valve can be engaged in the actuating finger of the pawl. To do this, pull up the transmission Bowden cable slightly so that the throttle cam (2) is clear of the throttle pressure valve (3).



Screw on the control unit but do not tighten. Align control unit with gauge 24 3 050. If no gauge is available, the distance from the control unit casing to the peg in the throttle pressure plunger must be 11.5 mm (0.453 in). Tighten the control unit down in this position. With 'Torx' screws: Tighten them with insert 002 100 and torque wrench 002 050.¹⁾



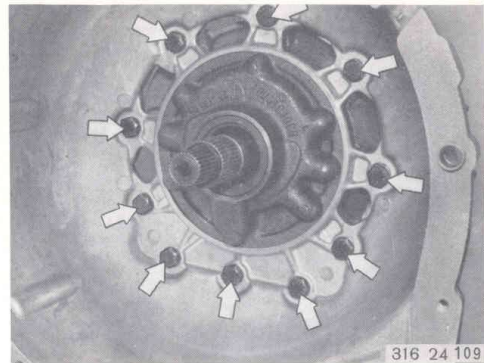
24 30 001 Control unit – renewing

Work stages are identical with "Control unit – renewing and installing" – 24 30 000.

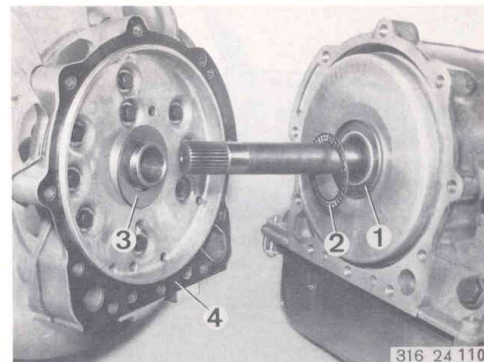
¹⁾ torque see Specifications

24 31 000 Primary pump – removing and installing

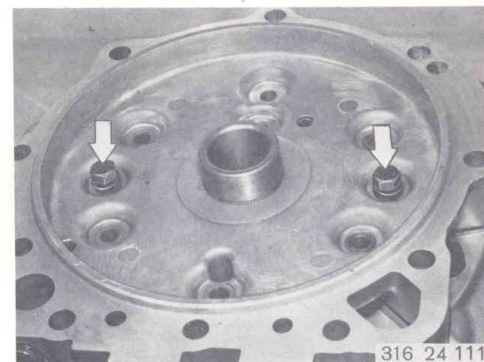
Remove torque converter – 24 40 000.
Detach converter dome with intermediate plate.



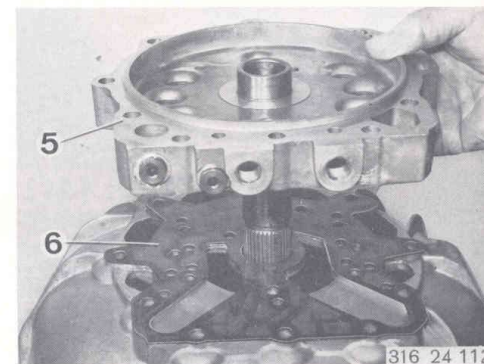
When installing: Place angled disc (1) on input shaft with shoulder towards needle roller bearing (2).
Attach thrust washer (3) to converter dome with grease.
Renew gasket (4).

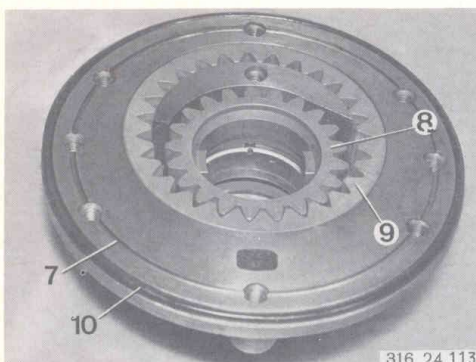


Detach intermediate plate from converter dome.
Loosen two bolts on opposite sides by a few turns only.
Strike the primary pump lightly to dislodge it from the converter dome.
Remove the bolts and take off the primary pump.



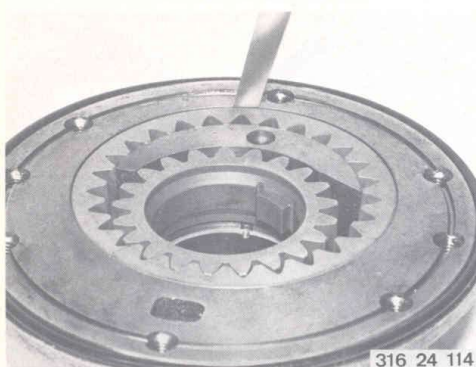
Take off the intermediate plate (5).
When installing: Renew gasket (6).



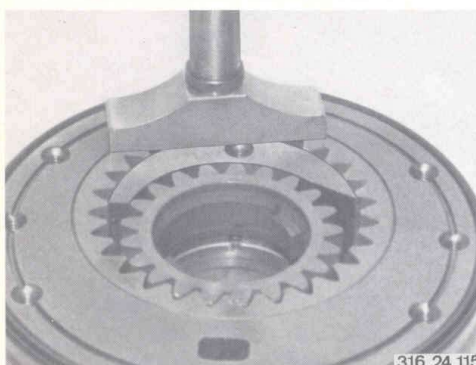


When installing: The primary pump, consisting of the pump housing (7), annulus (8) and pump impeller (9), can only be renewed as a complete unit.

Check O-ring (10) and renew if necessary.



Check radial clearance¹⁾ between driven gearwheel and pump housing, turning the gearwheel through 360° while doing so.



Check endplay¹⁾ of both gears in relation to end face, using a depth gauge.



With driving flange 24 3 140, check primary pump for smooth free running. Repeat this test after attaching the intermediate plate.

¹⁾ See specifications

24 31 150 Oil strainer on control unit – detaching and attaching

Remove oil pan – 24 11 000.

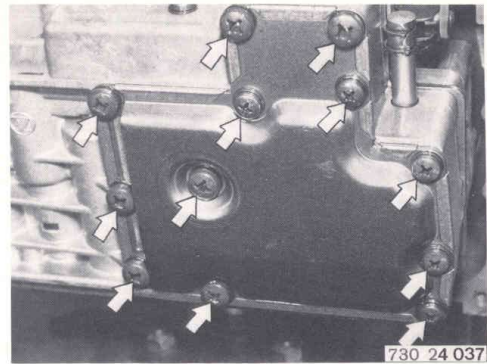
Detach oil strainer.

When installing: Clean oil strainer.

Renew oil strainer if signs of resin deposits are detected (brownish, burned-on deposits).

With 'Torx' screws:

Tighten them with insert 002 100 and torque wrench 00 20 50.1)



1) torque see Specifications

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2.7B

1) torque see Specifications

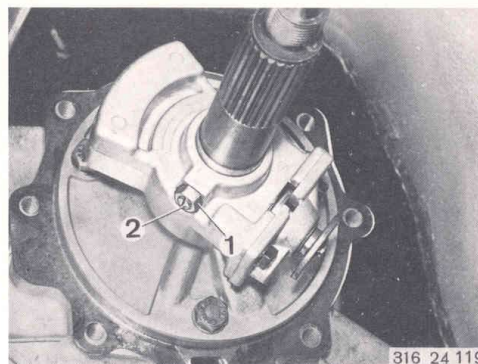
2.7B

ZF 3 HP-22

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24 32 000 Centrifugal governor – removing and installing

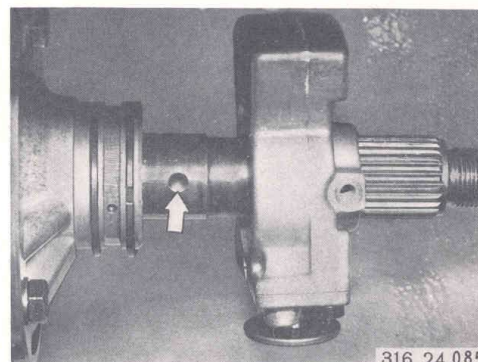
Remove transmission cover – 24 11 050.
Loosen nut (1) and unscrew threaded stud (2) by approx. 3 turns.
Pull off the governor.



316 24 119

When installing: Compress the piston rings slightly and at the same time push the governor on to its flange.

To assist in locating the recess in the output shaft, unscrew the threaded stud. Secure the governor in the recess with the stud and prevent from moving with a centerpunch mark.

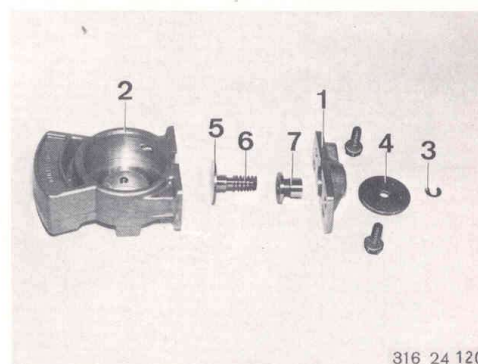


316 24 085

24 32 503 Centrifugal governor – stripping and assembling – Governor removed –

Detach cover (1) from housing (2).
Extract the circlip (3) and take off washer (4).
Remove governor piston (5), spring (6) and bushing (7).

When installing: Governor piston must slide easily in the bushing.



316 24 120

24 34 000 Parking lock pawl – removing and installing

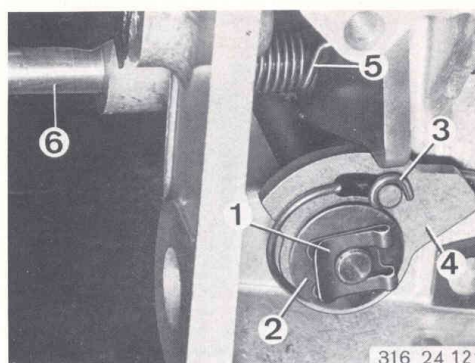
Remove the control unit – 24 30 000.

Take off the transmission cover – 24 11 050.

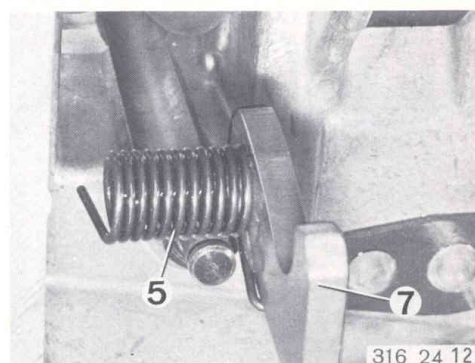
Extract the keeper (1) and take off the washer (2).

Disconnect spring (3) and pull off the parking lock cam (4).

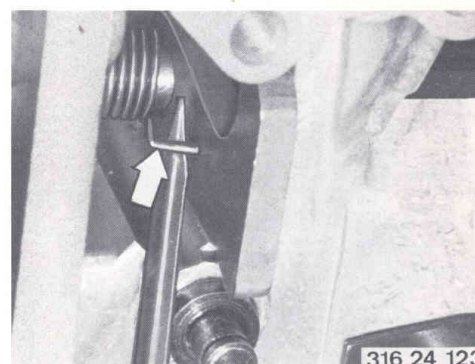
Disconnect torsion spring (5) and press out pin (6) from the inside with a screwdriver, or pull out.



When installing: Press in the pin and at the same time push torsion spring (5) with pawl (7) on to the pin. The straight end of the spring must point upwards, towards the transmission housing. The front end of the spring should be at the left, behind the pawl.



Place the front end of the spring round the right side of the pawl.



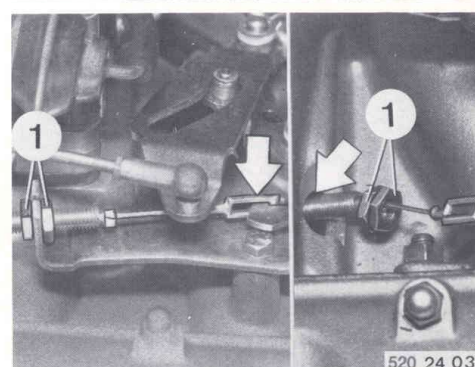
24 34 101 Accelerator (throttle position) cable – renewing

Detach the accelerator cable and remove from thrust mount.

Slacken nuts (1).

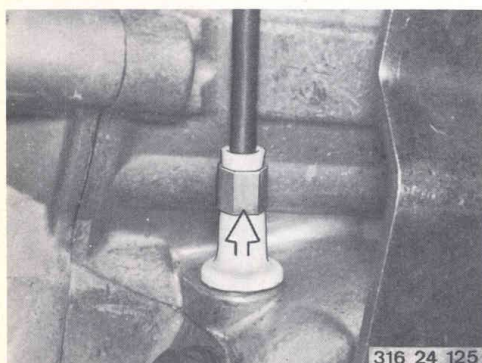
Lift out wire cable.

Unscrew nuts (1) and pull cable down through hole on intake manifold.

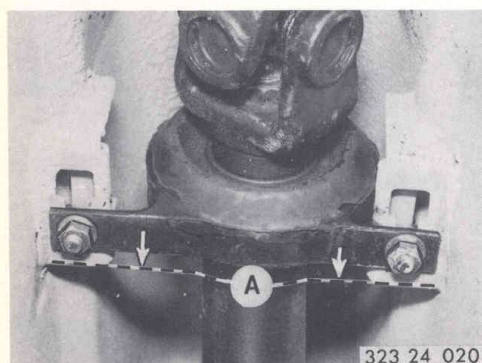




Detach the oil pan – 24 11 000.
Move selector lever to N.
Press accelerator cam forwards and detach cable from cam.

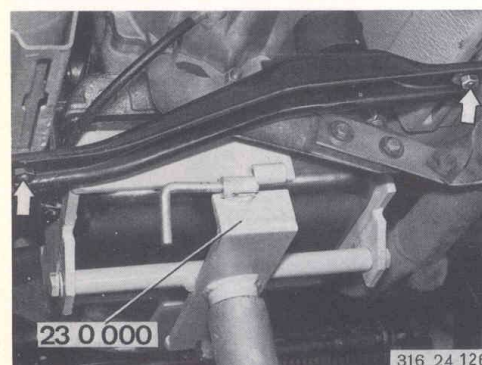


Press the accelerator cable forwards out of the housing.
When installing: Adjust the accelerator cable (see 24 00 004).



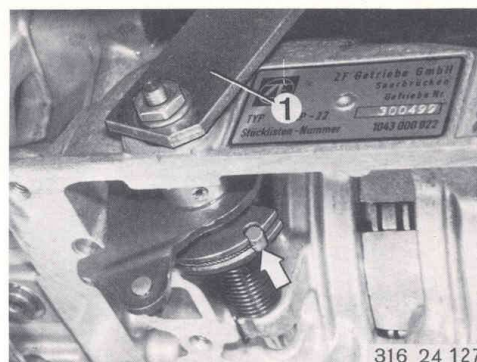
24 34 701 Torsion spring for throttle position cable – renewing

Detach the propeller shaft center bearing.
When installing: Preload by 2 mm (0.08 in) towards front of car.

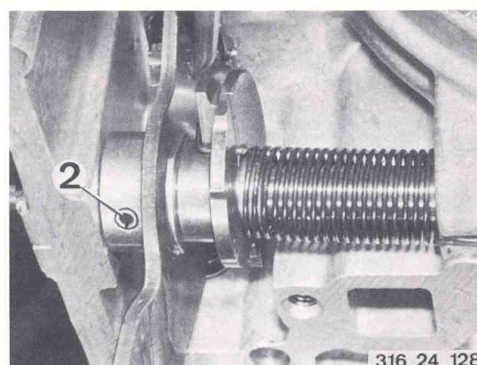


Support transmission with adapter 23 0 000.
Detach cross-member from body.
Lower transmission as far as front axle beam.

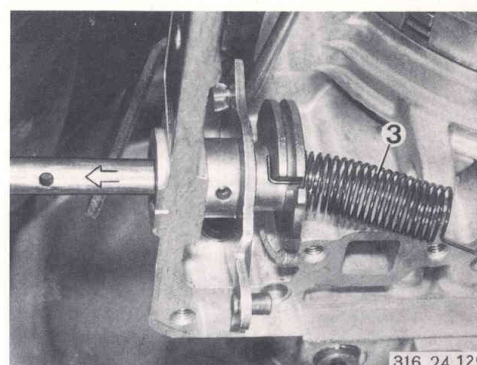
Remove the control unit – 24 30 000.
 Detach the selector lever (1) from the transmission.
 Disconnect the throttle position cable.



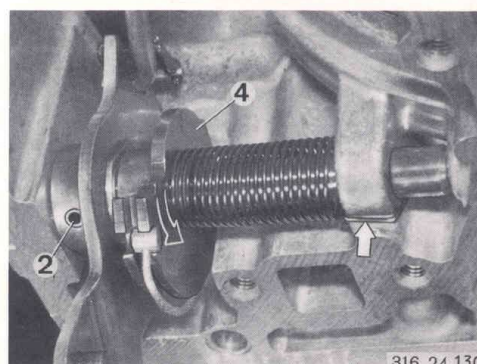
Drive out locking collet (2) in position N.

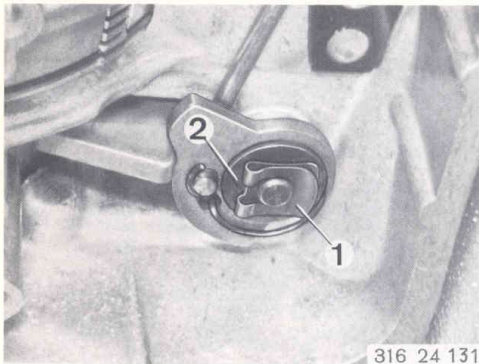


Pull the selector shaft out until the torsion spring (3) can be removed.



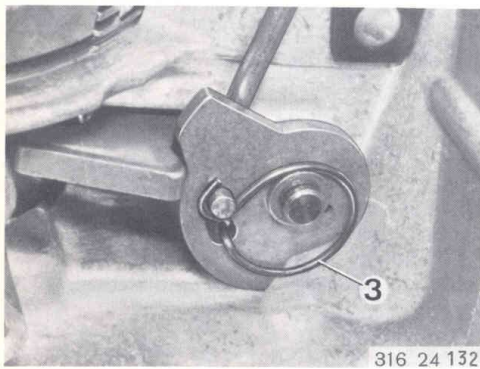
When installing: Attach the shorter arm of the spring to throttle cam (4).
 Place the longer arm of the spring in the slot in the housing.
 Install the selector lever.
 With throttle cam (4), preload the torsion spring by one turn anticlockwise.
 Connect the throttle position cable and secure the detent pawl with locking collet (2).





24 34 730 Torsion spring for parking lock cam – renewing

**Remove the control unit – 24 30 000.
Extract the keeper (1) and take off washer (2).**



Remove the torsion spring (3).

24 40 000 Torque converter – removing and installing

Remove and install transmission – 24 00 020. Using handgrips 24 4 000, carefully pull the torque converter out of the primary pump.

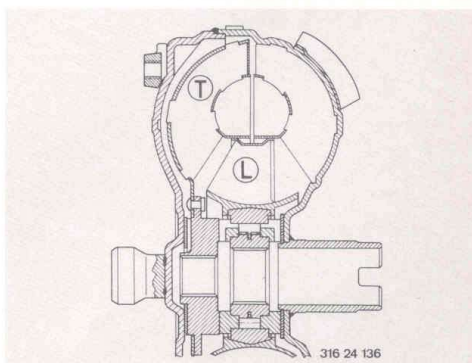
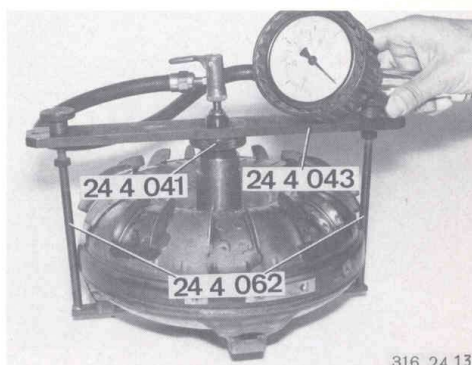
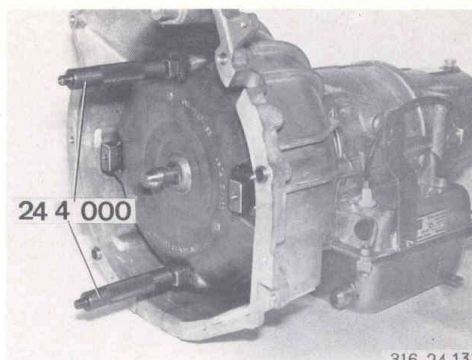
Warning: Automatic transmission fluid will escape.

When installing: Check torque converter for leaks with device 24 4 041 in conjunction with retaining bracket 24 4 043 and retaining bolts 24 4 062. Test pressure 0.5 atmg (7.1 lb/in²).

Warning: this operation is dangerous unless the retaining bracket is used.

If the running surface on the converter shaft is damaged, the torque converter must be renewed.

If the guide wheel (L) or turbine wheel (T) cannot be rotated by hand, the torque converter must be renewed – 24 40 001.

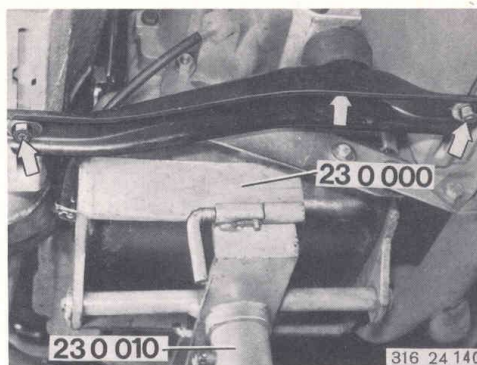


24 71 001 Rubber mounting for automatic transmission – renewing

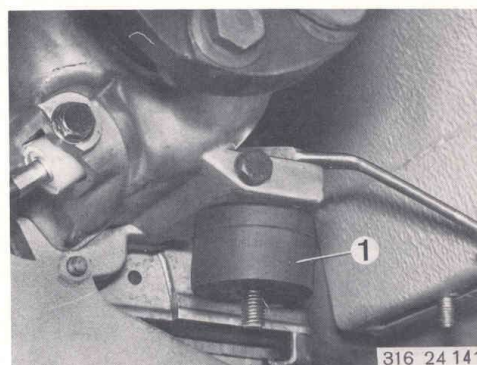
Support transmission with adapter 23 0 000 and tube 23 0 010.

Remove the cross-member.

Lower the transmission.



Detach the rubber mounting (1) with a slightly cranked open-ended wrench.



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2.78

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ZF 3 HP-22

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Trouble-shooting – 3 HP-22 automatic transmission

Fault	Cause	Remedy
Shift points ¹⁾ are too high	a) Accelerator cable setting incorrect b) Governor bushing sticking c) Governor piston rings failed or worn d) Throttle pressure valve not operating correctly e) Shift valves sticking	a) Adjust accelerator cable b) Clean or renew governor c) Renew piston rings d) Exchange control unit e) Exchange control unit
Shift points ¹⁾ are too low	a) Accelerator cable setting incorrect b) Governor bushing sticking c) Throttle pressure valve not operating correctly d) Leaking plastic balls in channel plate	a) Adjust accelerator cable b) Clean or renew governor c) Exchange control unit d) Exchange control unit
Shift points too high or too low, shift action too slow and too 'soft'	a) Clutch C + C' damaged during 1st-2nd gear shift b) Clutch B damaged during 2nd-3rd gear shift	a) Renew clutches C + C' b) Renew clutch B
Kickdown inoperative	a) Accelerator cable setting incorrect b) Control unit setting incorrect c) Throttle pressure valve sticking d) Plastic balls in channel plate leaking	a) Adjust accelerator cable b) Adjust control unit c) Exchange control unit d) Exchange control unit
Selector lever will not move to P position	a) Selector linkage out of adjustment b) Parking lock pawl mechanism defective	a) Adjustment selector linkage b) Repair pawl mechanism
Selector jams in P position	a) Parking lock pawl jammed in teeth on output boss b) Excessive friction in parking lock mechanism	a) Renew parking lock pawl b) Repair parking lock mechanism

Trouble-shooting – 3 HP-22 automatic transmission

Fault	Cause	Remedy
Transmission will not remain in P position (slips out)	a) Selector rod out of adjustment	a) Adjust selector rod
Car will not move forward or in reverse	a) Too little ATF in transmission b) Pump drive failed c) Driving disc broken d) Parking lock pawl sticking e) Clutches A and B defective	a) Restore correct oil level b) Exchange converter and pump c) Renew driving disc d) Renew pawl e) Strip and recondition transmission
Car will not move forwards	a) Selector linkage out of adjustment b) Clutch A failed or oil losses in feed line	a) Adjust selector linkage b) Renew clutch A
Car will not move in reverse	a) Selector linkage out of adjustment b) Clutch B or D failed c) Clutch valve and damper B not working correctly d) Fluid level too low, pump priming	a) Adjust selector linkage b) Strip the transmission c) Exchange control unit d) Restore correct fluid level
Slipping or judder when starting in R position	a) Clutch B or D damaged b) Severe leakage of oil in B or D feed lines	a) Strip transmission b) Strip transmission
Car does not move in R or 2 selector positions	a) Shift valve stuck in 3rd gear position	a) Renew control unit; strip transmission if abraded particles are noted in oil pan
Violent jolt or distinct double jerk when R is selected	a) Damper B failed, gate incorrectly laid out	a) Renew control unit
Car cannot be started with lever at 0	a) Switch on transmission has failed	a) Renew transmission switch
Car creeps forward or moves off in 0 position	a) Selector linkage out of adjustment b) Clutch A exhausts too slowly c) Clutch A failed (fused together)	a) Adjust selector linkage b) Strip transmission c) Strip transmission
Car stays in 1st gear when D is selected	a) Shift valve 1–2 sticking b) Governor bushing sticking	a) Exchange control unit b) Clean or renew governor
Car remains in 1st or 2nd gear when D is selected	a) Shift valve 2–3 sticking	a) Exchange control unit
Car can only be driven in 2nd gear	a) Shift valves 1–2 and 2–3 are sticking	a) Exchange control unit
Car can only be driven in 3rd gear	a) Shift valves 1–2 and 2–3 sticking b) Governor bushing sticking	a) Exchange control unit b) Clean or renew governor

Trouble-shooting – 3 HP-22 automatic transmission

Fault		Cause	Remedy
Drag when shifting from one gear to the next		a) Accelerator cable has become detached or is out of adjustment	a) Reconnect or adjust cable
		b) Oil level too low	b) Restore correct oil level
Drag during shift from 1st to 2nd gear		c) Throttle pressure valve sticking	c) Exchange control unit
		d) Clutch A defective	d) Strip transmission
Drag when shifting from 2nd to 3rd gear		a) Slipping clutches C and C' working	a) Strip transmission
		b) Clutch valve and damper C not working	b) Strip transmission
3rd gear slipping		c) Accelerator cable has become detached or is out of adjustment	c) Reconnect or adjust cable
		d) Oil level too low	d) Restore correct oil level
Stall speed ¹⁾ too high		e) Throttle pressure valve sticking	e) Exchange control unit
		f) Freewheel F failed	f) Strip transmission
Stall speed ¹⁾ too low		a) Clutch B slipping	a) Renew clutch B
		b) Accelerator cable has become disconnected or is out of adjustment	b) Reconnect or adjust cable
Transmission up or down shifts are too violent		c) Oil level too low	c) Restore correct oil level
		d) Throttle pressure valve sticking	d) Strip the transmission
Transmission judders when car is driven away briskly from a standstill		e) Freewheel E failed	e) Exchange control unit
		f) Freewheel F failed	f) Strip the transmission
Transmission up or down shifts are too violent		a) Clutch B slipping	a) Strip the transmission
		b) Accelerator cable detached or out of adjustment	b) Reconnect or adjust cable
Transmission up or down shifts are too violent		c) Oil level too low	c) Restore correct oil level
		d) Oil pressure too low	d) Strip the transmission
Transmission up or down shifts are too violent		e) Throttle pressure valve sticking	e) Exchange control unit
		f) Freewheel F failed	f) Strip the transmission
Transmission up or down shifts are too violent		a) Clutch A failed	a) Renew clutch A
		b) Center propeller shaft bearing failed	b) Renew center bearing
Transmission up or down shifts are too violent		c) Freewheel F or G failed	c) Strip transmission
		d) Accelerator cable setting is incorrect	d) Adjust cable
Transmission up or down shifts are too violent		e) Clutch A failed	e) Strip transmission
		f) Clutch A failed	f) Strip transmission

Trouble-shooting – 3 HP-22 automatic transmission

Fault	Cause	Remedy
Car moves in position N	a) Selector linkage out of adjustment b) Clutch A (forward) is rused together c) Clutch B (reverse) is fused together	a) Adjust selector linkage b) Strip transmission c) Strip transmission
No 1st gear braking action in positions 2 or 1	a) Clutch valve and damper C failed b) Clutch D failed	a) Exchange control unit b) Renew clutch D
No 2nd gear braking action in positions 2 or 1	a) Clutch C' failed	a) Renew clutch C'
Transmission can be down-shifted from 2 to 1 manually too early (above 80 km/h = 50 mile/h)	a) Inhibit valve pressure too high b) Pressure losses in governor and shift valves	a) Renew control unit b) Strip transmission
Transmission shifts down from 2 to 1 manually too late (below 40 km/h = 25 mile/h)	a) Inhibit valve pressure too low b) Governor pressure too high	a) Renew control unit b) Strip transmission
Stall speed in forward gear ¹⁾ too high	a) Clutch A or 1st gear free-wheel slipping	a) Strip transmission
Stall speed in forward gear ¹⁾ too low	a) Engine not developing rated power output b) Converter freewheel failed	a) Check engine settings b) Renew converter
Screaching sound, varies with speed and load reversal	a) Propeller shaft center bearing failed	a) Renew center bearing
Clattering sound at idle speed	a) Broken driving plate b) Torn weld lugs on converter	a) Renew driving plate b) Renew converter
Rattling sound at idle speed; disappears when accelerator is depressed in 0 position	a) Valve chatter in control unit b) Oil pump priming	a) Restore correct oil level b) Tighten bolts securing control unit, check gasket
Oil leaks on converter bell housing	a) Shaft sealing ring failed b) O-ring at primary pump housing failed c) Converter leaking at weld seams d) Plugs leaking	a) Renew shaft sealing ring b) Renew O-ring c) Renew converter d) Renew sealing ring
Output flange covered in oil	a) Shaft sealing ring failed	a) Renew shaft sealing ring

Schaltung

Gear shift mechanism

Dispositif de changement des vitesses

Impianto cambio marcia

Dispositivo cambio de velocidades

Växlingsmekanism

Schakelmechanisme

25 Gear shift

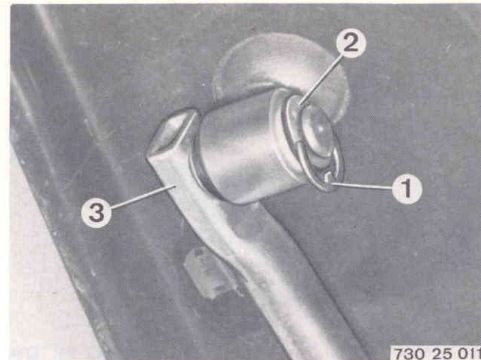
2511000	Gear lever—removing and installing	Page 25-11/1
011	Rubber rings in gear lever—renewing	11/1
041	Gear lever ball sockets—renewing	11/2
081	Flexible gaiter for gear lever—renewing	11/2
111	Selector rod pivot—renewing	11/3
200	Gear lever mounting bracket—removing and installing	11/3

25 Selector lever ZF 3 HP – 22

2516050	Removing and installing selector lever and base	Page 25-16/1
061	Renewing selector lever handle	16/2
075	Renewing pull rod in selector lever	16/2
080	Removing and installing selector lever	16/2
211	Renewing pivot bushing for selector rod	16/4
551	Renewing selector lever bearing sleeves	16/4
581	Renewing shift gate	16/5

25 11 000 Gear lever – removing and installing

Simplify installation by engaging reverse gear.
Remove the circlip (1).
Take off the washer (2).
Pull out the selector rod (3).

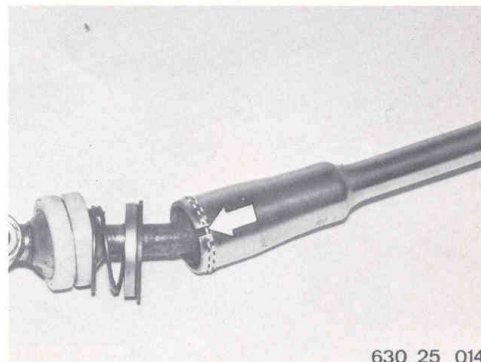


Push the flexible gaiter up.
Remove the circlip (4).
Lift out the gear lever.
When installing: Apply "Longterm 2" grease to the ball sockets.

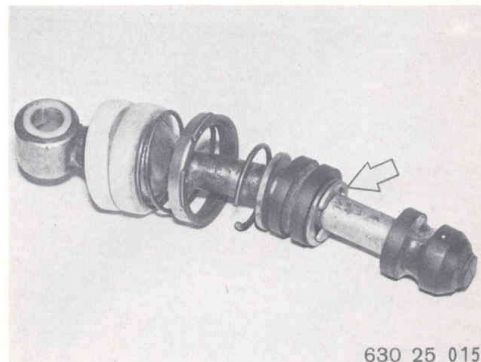


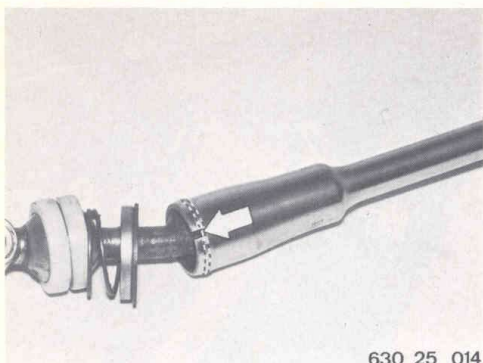
25 11 011 Rubber rings in gear lever – renewing

Remove gear lever – 25 11 000.
Remove the wire snap ring.



Detach the gear lever from the gear lever base.
Remove the lock washer.
Take out the rubber rings.





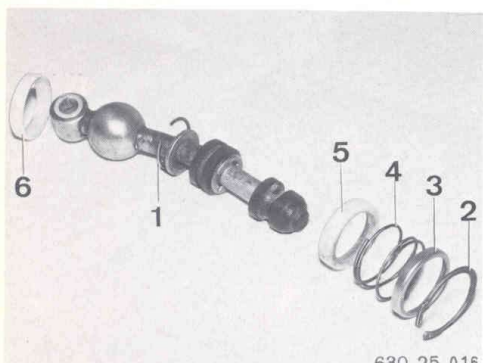
630 25 014

25 11 041 Gear lever ball sockets – renewing

Remove the gear lever – 25 11 000.

Remove the wire snap ring.

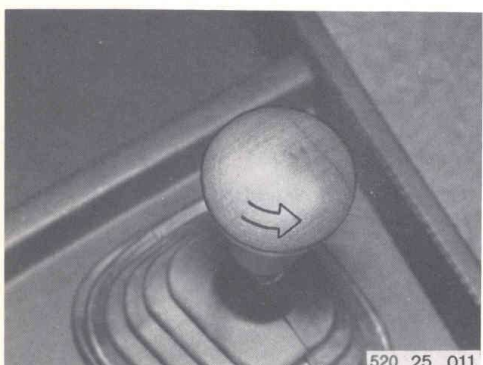
Pull off the upper section of the gear lever.



630 25 016

Components: wire snap ring (1), circlip (2), spring cup (3), spring (4), ball sockets (5 and 6).

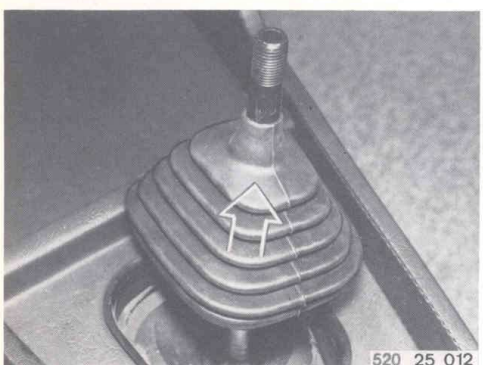
When installing: Apply "Longterm 2" grease to the ball sockets.



520 25 011

25 11 081 Flexible gaiter for gear lever – renewing

Unscrew the gear lever knob.



520 25 012

Take off the flexible gaiter.

25 11 111 Selector rod pivot – renewing

Detach exhaust pipe support and exhaust pipes from exhaust manifolds.

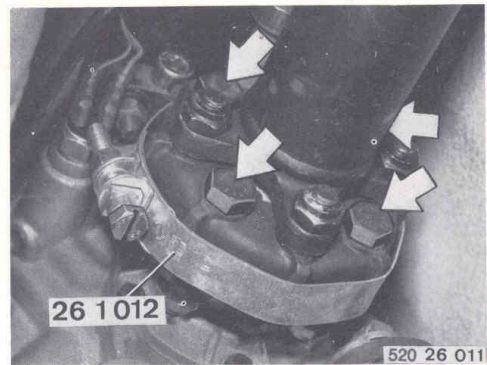
When installing: make sure that no stresses are trapped in the exhaust pipe support.

Attach clamp strap 26 1 012.

Unscrew the bolts.

Warning: to prevent damage to the threads, turn the nuts only.

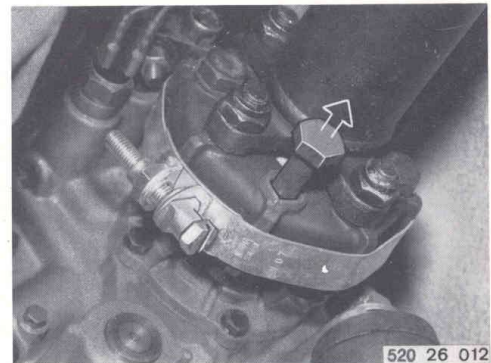
When installing: do not re-use stop nuts.



Tighten clamp strap 26 1 012 until the bolts can be removed by hand.

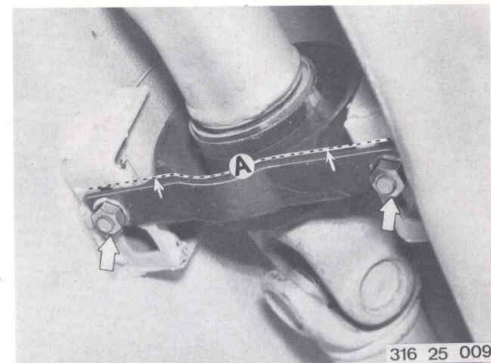
When installing: to prevent distortion in the 'Giubo' coupling, always tighten the nuts, never the bolts.

Warning: remove the clamp strap after the nuts have been tightened.



Detach the center bearing.

When installing: preload the center bearing towards the front of the car by app. 2 mm (0.08 in) (A).

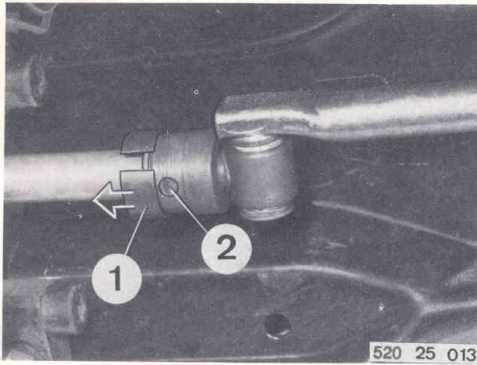


Hinge the propeller shaft down and pull it out of the centering journal on the transmission.

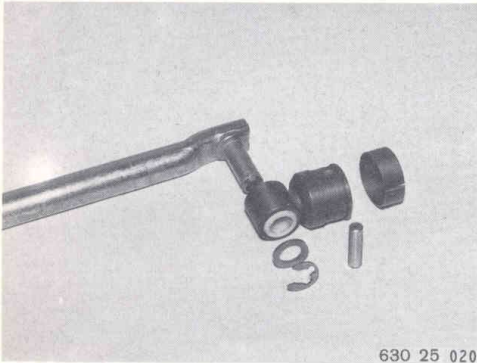
When installing: check centering assembly and grease if necessary with 'Longterm 2'. Renew centering assembly if damaged.



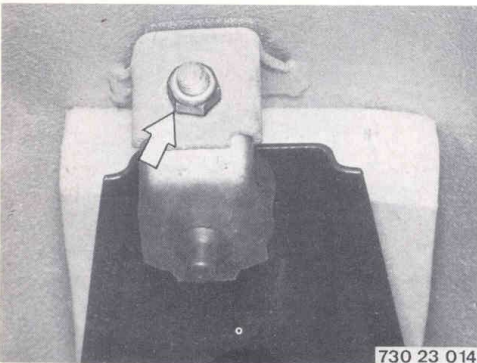
¹⁾ See specifications



Push back sleeve (1).
Drive out locking pin (2).

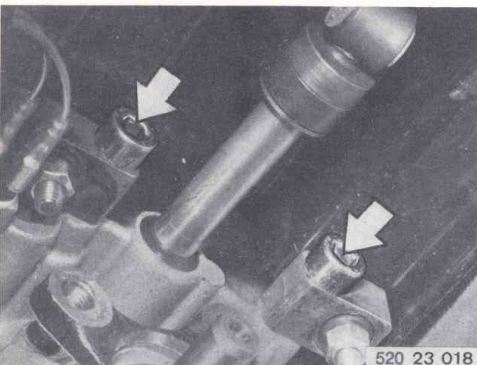


Detach the selector rod.
Check condition of pivot and bearing bushings,
and renew if necessary.



**25 11 200 Bracket for gear lever mount –
removing and installing**

Remove gear lever – 25 11 000.
Detach retaining bracket.



Detach bracket from gearbox and remove from
vehicle.

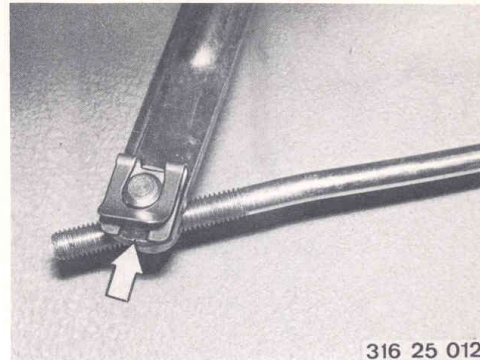
When installing: check rubber mounting for
wear and renew if necessary.

25 16 050 Selector lever with pivot mount – removing and installing

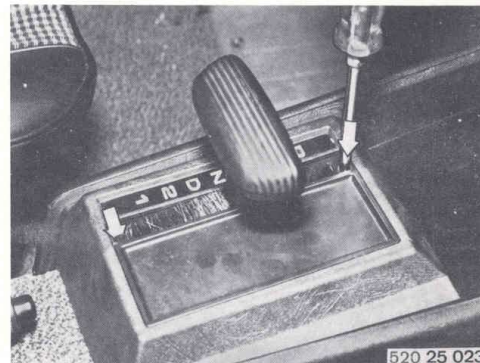
Remove the keeper.

Detach the selector rod.

When installing: **Adjust selector rod – 24 00 004.**



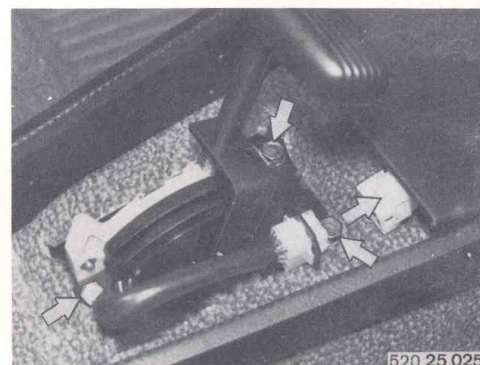
Unscrew and remove the screws holding the sealing brush and cover, and remove the cover with sealing brush.

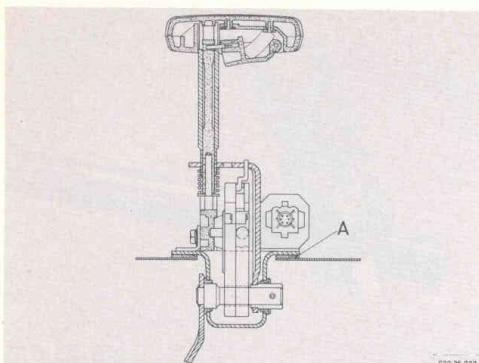


Remove the selector lever screen panel.



**Detach the transmission switch plug.
Remove the bolts holding the pivot mount and take out the pivot mount.**



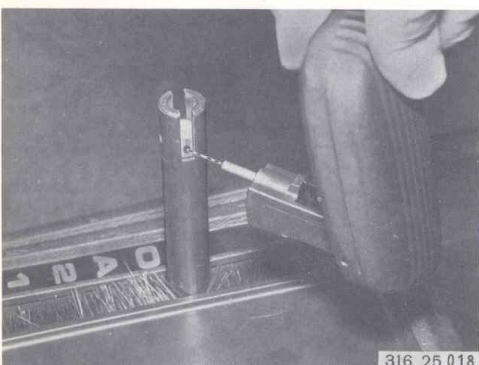


When installing: Note sealing plate (A).

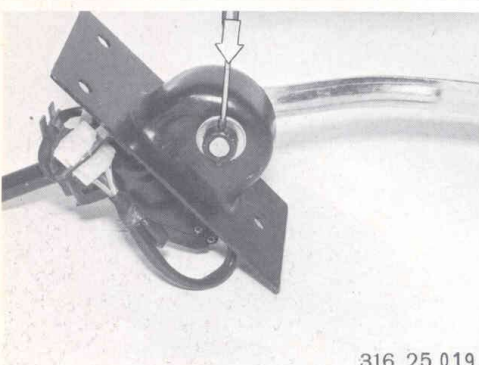


25 26 061 Selector lever handle – renewing

Set the selector lever to 'R'.
Remove the grub screw.
Take off the handle.



When installing: Insert the release catch peg in the hole on the pull rod.



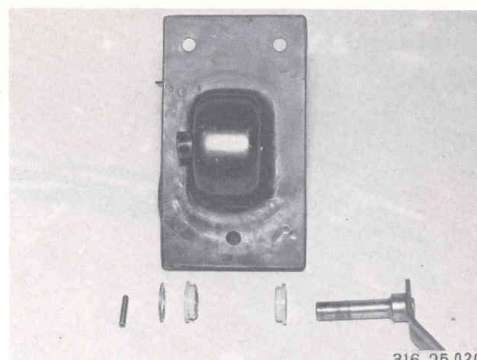
25 16 075 Pull rod in selector lever – renewing

25 16 080 Selector lever – renewing

Remove selector lever with pivot mount – 25 16 050.
Remove selector lever handle – 25 16 061.
Drive out clamp pin.

Pull out the lower section of the selector lever and take off the washer and pivot bushing.

When installing: Grease pivot bushings with Longterm 2.

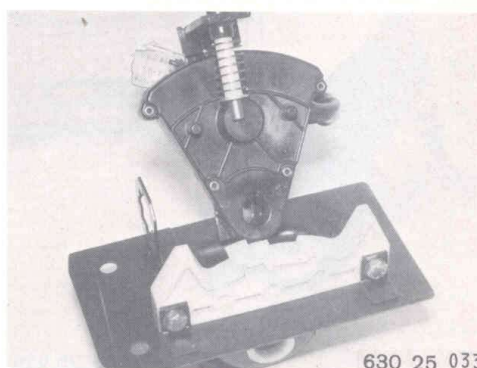


Pull the lead out of the upper section of the selector lever and detach the plug at the pivot mount.



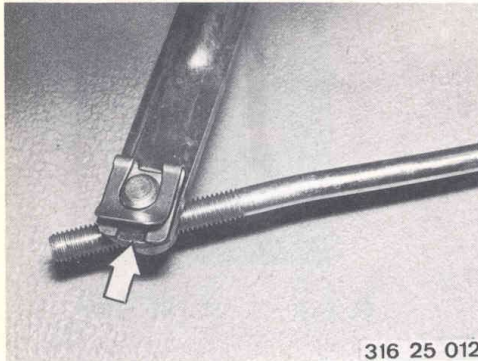
Remove the screw holding the transmission switch and extract the switch complete with the upper section of the selector lever from the pivot mount.

When installing: Note correct position of transmission switch actuating arm.



Remove the selector rod with spring from the upper section of the selector lever.





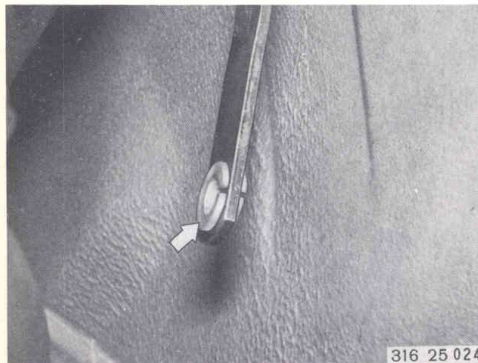
25 16 211 Selector rod pivot bushing – renewing

Remove the keeper.

Disconnect the selector rod.

When installing: **Adjust selector rod – 24 00 004.**

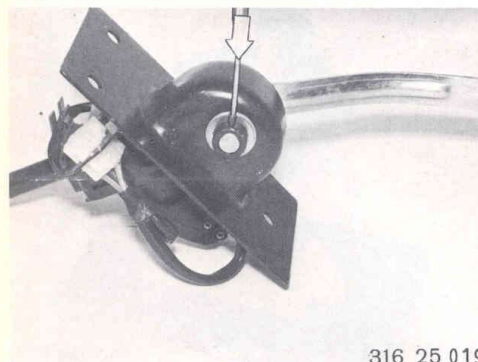
316 25 012



Extract pivot bushing from lower section of selector lever.

When installing: **Grease the bushing with Longterm 2.**

316 25 024

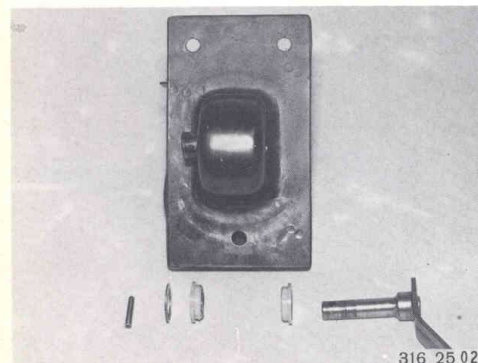


25 16 551 Selector lever pivot bushings – renewing

– Selector lever with pivot mount removed –

Drive out the clamp pin.

316 25 019



Pull out the lower section of the selector lever and remove the washer and pivot bushings.

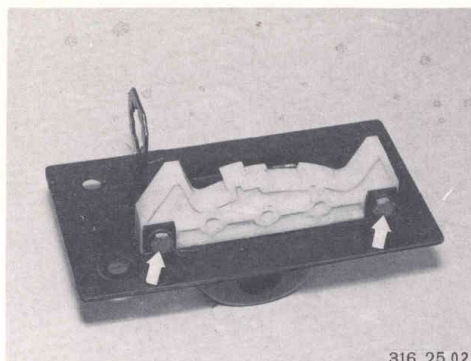
When installing: **Grease pivot bushings with Longterm 2.**

316 25 020

**25 16 581 Selector lever gate – renewing
– Selector lever with pivot mount
removed –**

Remove selector lever upper and lower sections – 25 16 080.

Remove bolts holding selector gate and detach gate from pivot mount.



316 25 025

Gelenkwelle

Drive shaft

Arbre de transmission

Albero di trasmissione

Arbol articulado

Kardanaxel

Cardanas

26 Propeller shaft

Specifications	Page 26-0/3
2611000 Propeller shaft—removing and installing	11/1
001 Complete shaft—renewing	11/2
051 Joint disc—renewing	11/2
501 Centering assembly—renewing	11/3
2612001 Center bearing—removing and installing	12/1
511 Ball bearing in center bearing—renewing	12/1
Trouble-shooting—propeller shaft	12/3

Specifications

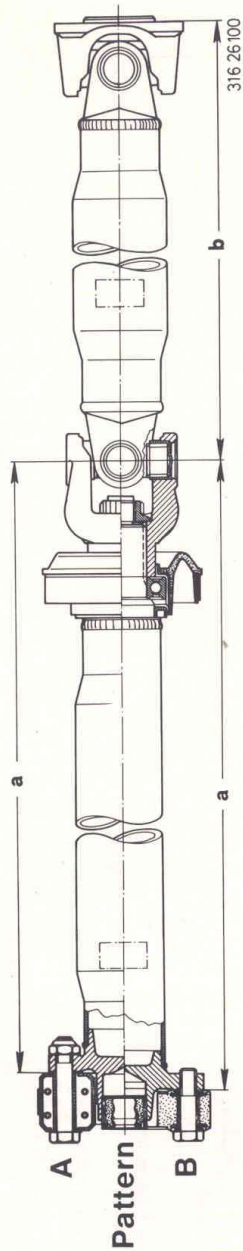
Propeller shaft

Model	320/6 323 i	320/6 A 323 i A *)
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26 11 . . . Propeller shaft (standard version)

2-piece propeller shaft, front section with	'Giubo' coupling	'Jurid' joint disc
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Propeller shaft pattern 'A' = with 'Giubo' coupling
pattern 'B' = with 'Jurid' joint disc



Length, front section 'a'	mm (in)	635.5 ± 1 (25.06 ± 0.04)	510.5 ± 1 (20.10 ± 0.04)
Length, rear section 'b'	mm (in)	916.5 ± 1 (36.08 ± 0.04)	
Max. imbalance per side (with pickup points at outer ends) at test speed 3250 1/min	gcm	15	

*) Version for Sweden

Specifications

Propeller shaft

Model	320/6 323 i	320/6 A 323 i A *)
26 11 . . . Propeller shaft (standard version) – (continued)		
Max. imbalance at center (pickup point at center) at test speed 3250 1/min	gcm	10
Permissible bending moment at universal joints	Ncm (kpcm)	20 . . . 70 (2 . . . 7)
26 12 . . . Center bearing		
Center bearing preload in forward direction	mm (in)	2 (0.08)
Deep-groove ball bearing for center bearing		
– make	FAG/Kugelfischer	INA/Fafnir
– designation	6006.2 RS.795 008 or 6006.2 RSR.795 008	6006-2 RS AH 01
		6006-2 RS1 TN/C4 PLT 41

*) Version for Sweden

Specifications

Propeller shaft

Model	320/6 323 i	320/6 A 323 i A *)
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Tightening torques

26 11 . . . Propeller shaft

'Giubo' coupling to propeller shaft
and to gearbox output flange
(M 10)

Nm	68 . . . 76
kpm	6.9 . . . 7.7
lb.ft	50 . . . 56

Joint disc to propeller shaft
and to transmission output
flange (M 10)

Nm	43 . . . 48
kpm	4.4 . . . 4.9
lb.ft	32 . . . 35

Propeller shaft to final
drive input flange (M 10)

Nm	68 . . . 76
kpm	6.9 . . . 7.7
lb.ft	50 . . . 56

Fork piece to bearing
journal (M 12 × 1.5)¹⁾

Nm	95 . . . 105
kpm	9.7 . . . 10.7
lb.ft	70 . . . 77

26 12 . . . Center bearing

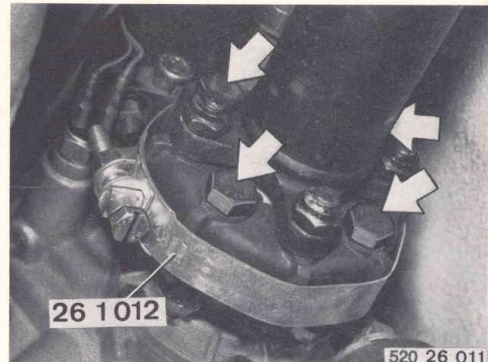
Center bearing to body (M 8)

Nm	22 . . . 24
kpm	2.2 . . . 2.4
lb.ft	16 . . . 18

*) Version for Sweden
1) with Loctite 270

26 11 000 Propeller shaft – removing and installing

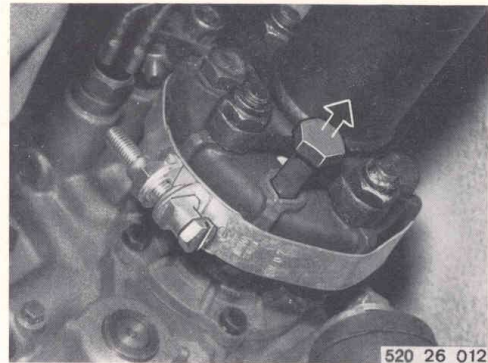
Take off the primary muffler (silencer).
Attach clamp strap 26 1 012.
Remove the bolts.
Do not re-use the stop nuts.



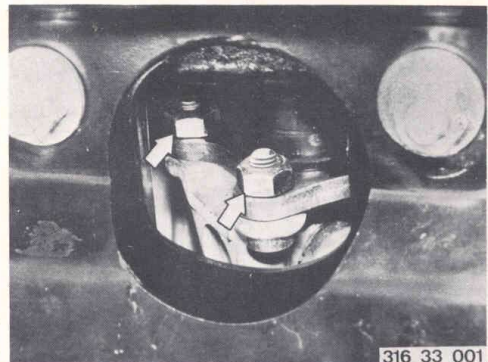
Tighten clamp strap 26 1 012 until the bolts can be taken out by hand.

When installing: to prevent distortion of the 'Giubo' coupling, always tighten the nuts, never the bolts.

Warning: the clamp strap must be removed after tightening the nuts.

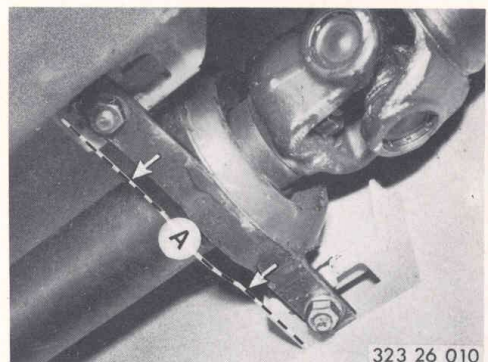


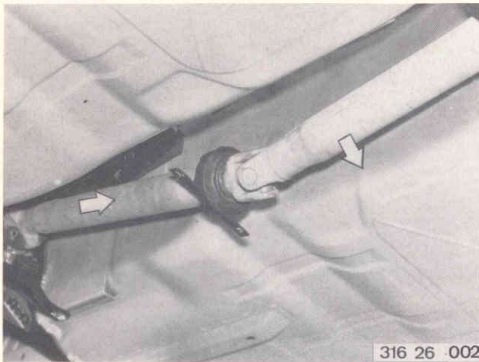
Detach propeller shaft from final drive.
Do not re-use the stop nuts.



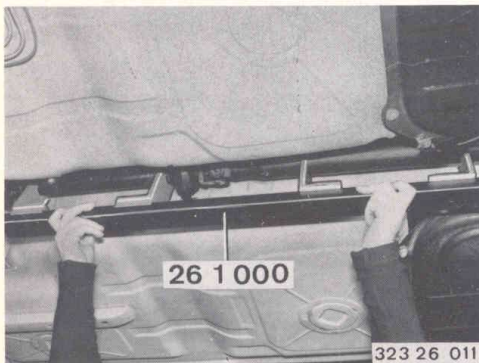
Detach the center bearing.

When installing: preload the center bearing forwards by 2 mm (0.08 in) (A).





Hinge the propeller shaft down and withdraw it from the centering journal on the gearbox.
When installing: check condition of centering assembly and grease with 'Longterm 2'. Renew centering assembly if damaged.



26 11 001 Complete propeller shaft – renewing

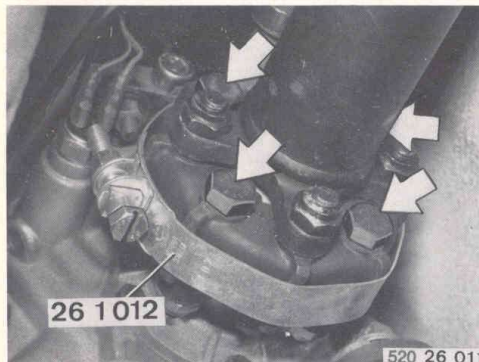
Remove the propeller shaft – 26 11 000.

The propeller shaft is balanced as a complete unit, and must therefore be renewed complete.

When installing: grease the centering assembly with 'Longterm 2'. Align the propeller shaft with special fixture 26 1 000 or a template made up in your own workshop:

- a) by moving the center bearing to one side
- b) by placing shim plates under the center bearing.

If the propeller shaft is not properly aligned, this can be a frequent cause of vibration or drumming.



26 11 051 Rubber coupling for front of propeller shaft – renewing

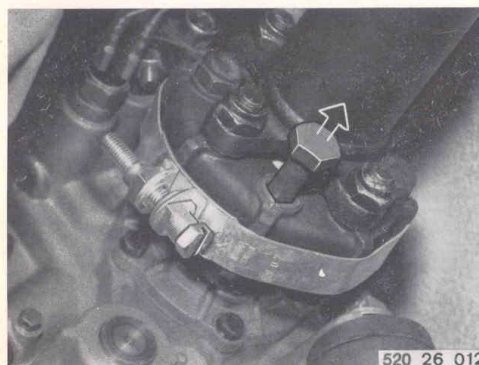
Detach exhaust pipe support, and exhaust pipes at manifolds.

When installing: make sure there are no trapped stresses in the exhaust pipe support.

Attach clamp strap 26 1 012.

Unscrew the bolts.

Do not re-use the stop nuts.



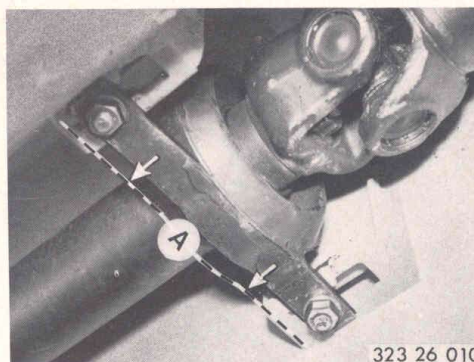
Tighten clamp strap 26 1 012 until the bolts can be taken out by hand.

When installing: to prevent distortion in the 'Giubo' coupling, always tighten the nuts, never the bolts.

Warning: remove the clamp strap after the nuts have been tightened.

Detach the center bearing.

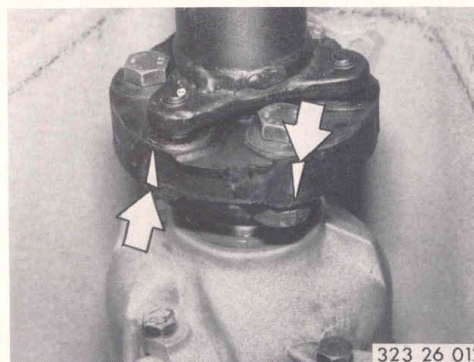
When installing: preload the center bearing forwards by approx. 2 mm (0.08 in) (A).
Hinge the propeller shaft down and withdraw from the centering journal on the gearbox.
Detach the 'Giubo' coupling or joint disc.



Automatic transmission version:

Install the joint disc with the arrowheads pointing to the flange arms of the propeller shaft and the output flange.

If this is neglected, noise and premature wear of the joint disc may result.

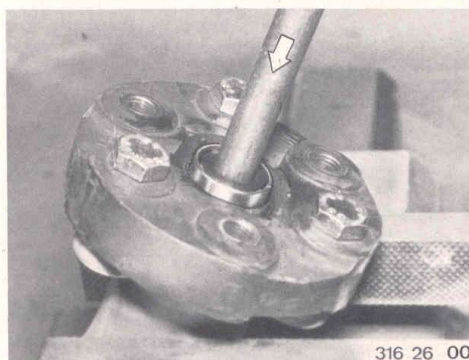


26 11 501 Centering assembly for front of propeller shaft – renewing – propeller shaft removed –

Pack the centering assembly with high-viscosity grease.

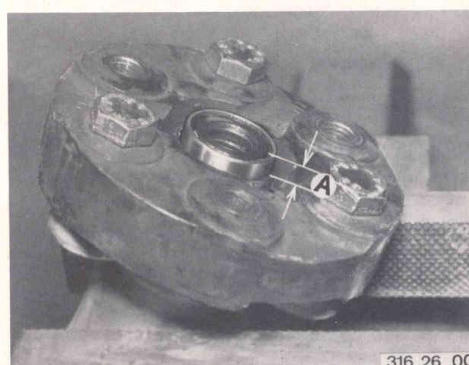
Insert a 14 mm (0.55 in) diameter drift.

Strike the drift with a hammer to exert pressure and force out the centering assembly.



When installing: apply app. 6 g (0.21 oz) of Molykote 'Longterm 2' grease to the centering assembly, and drive in.

Projection A = 5 mm (0.2 in); oil seal ring side faces out.



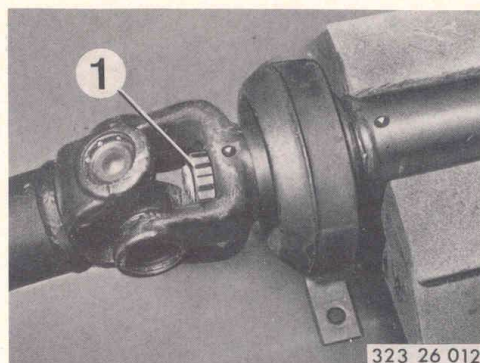
**26 12 501 Complete propeller shaft center bearing – renewing
– propeller shaft removed –**

Mark the relative positions of the propeller shaft halves and the joints.

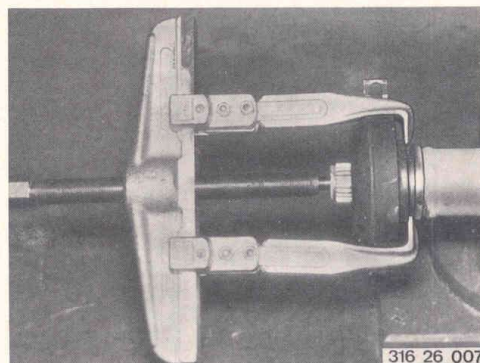
Unscrew nut (1).

Pull out the propeller shaft half.

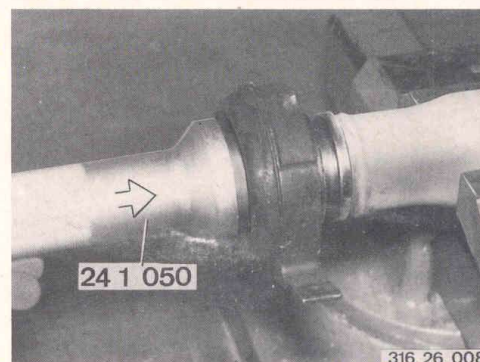
When installing: apply Loctite 270 to thread when tightening nut.



Pull off the center bearing without the dust cover, using a Kukko B 150 puller (available from the trade).

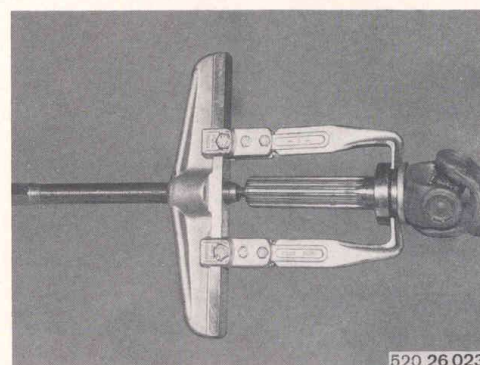


When installing: drive the center bearing on to the propeller shaft with sleeve 24 1 050. Coat the ball bearing pickup surface with water.



**26 12 511 Ball bearing in center bearing – renewing
– center bearing removed –**

Pull the ball bearing off the shaft with a Kukko B 150 puller (available from the trade).



Trouble-shooting – propeller shaft

Fault	Cause	Remedy
Vibration or drumming	a) Propeller shaft not properly balanced b) Centering bearing seized or defective c) Runout at centering journal or flange d) Center bearing defective, rubber split e) Balancing plate torn off by bottoming car or similar f) Universal joints worn or too tight g) Giubo coupling distorted h) Giubo coupling or joint disc defective; rubber split i) Bending angle between gearbox and propeller shaft	a) Align the propeller shaft with fixture 26 1 000 by pushing center bearing to side and placing shim plates under center bearing b) Free centering bearing or renew; grease with Molykote Longterm 2 c) Check centering journal and flange for runout with dial gauge. Reposition or renew flange d) Renew center bearing e) Renew propeller shaft f) Check bending moment; if play or bending moment are too great (crushed needle rollers), renew propeller shaft g) Attach clamp strap 26 1 012. Unscrew bolts and tighten at nuts only. Renew defective bolts. h) Renew Giubo coupling or joint disc i) Place shim plates between body and cross-member. Min. distance between cross-member upper surface and gearbox lower surface = 28 mm (1.1 in). Check rubber mountings and renew if necessary.
Center bearing whines when starting	a) Center bearing not at right angle to propeller shaft b) Center bearing not preloaded, or preloaded at an angle c) Bearing seat conical	a) Align center bearing at a right angle to propeller shaft b) Preloaded center bearing by 2 mm (0.08 in) forwards and perpendicular to propeller shaft c) Measure bearing seat with dial micrometer – conicity 0.03 ... 0.04 mm (0.0012 ... 0.0016 in).
Propeller shaft rattles and bangs at center bearing	a) Center bearing defective b) Bending angle between front propeller shaft and rear section at center bearing excessive c) Propeller shaft compressed in installed position	a) Renew center bearing b) Insert shims between body and center bearing. Align with special tool 26 1 000 c) Relieve axial tension on propeller shaft at engine/transmission and at final drive
Heterodyning (variable-intensity drumming) at app. 110–140 km/h (68–87 mile/h) with automatic transmission	a) Axial play at output flange	a) Renew output flange