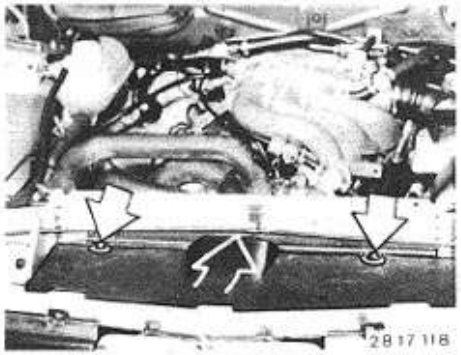
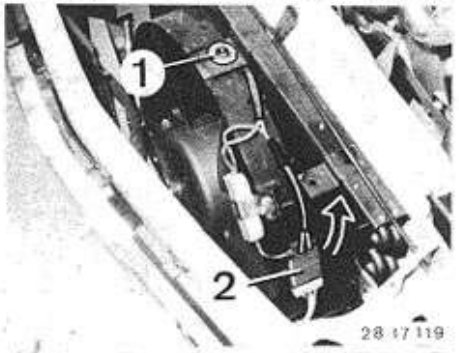
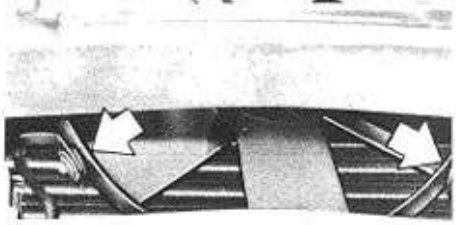
17 40 000 REMOVING AND INSTALLING EXTRA FAN ASSEMBLY



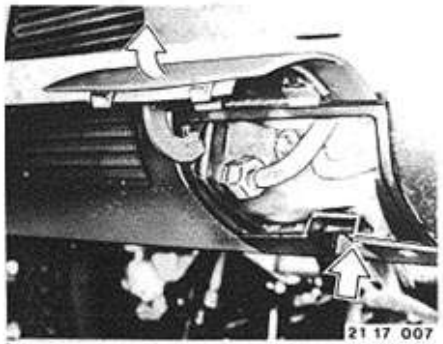
Pull out retainers from above and remove trim panel.



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

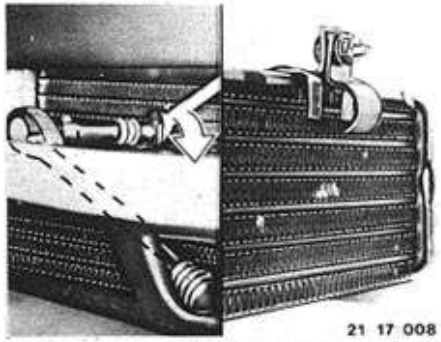


Unscrew nuts.
Remove extra fan from above.

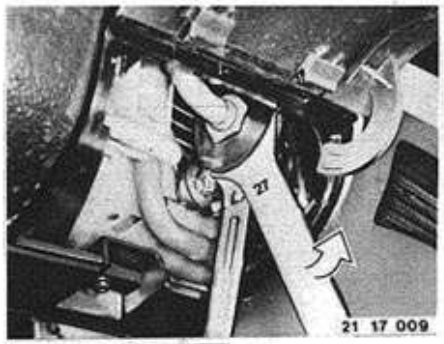


17 11 150 REMOVING AND INSTALLING ENGINE OIL COOLER

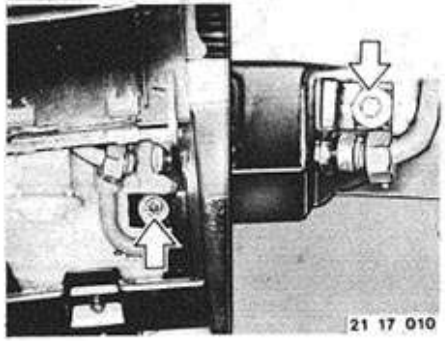
BMW 524 td
Fold open both covers.
Unscrew trim panel on left side.



Unscrew line holder.

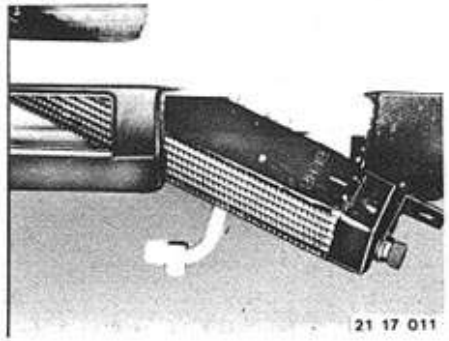


Unscrew coupling nuts (size 27 mm wrench).
Hold on hexagon of oil cooler with a 22 mm open-ended wrench.
Catch escaping oil (approx. 0.5 ltr./1 pint).
Installation:
Tightening torque*.
Only add same amount of oil which had run out during removal.



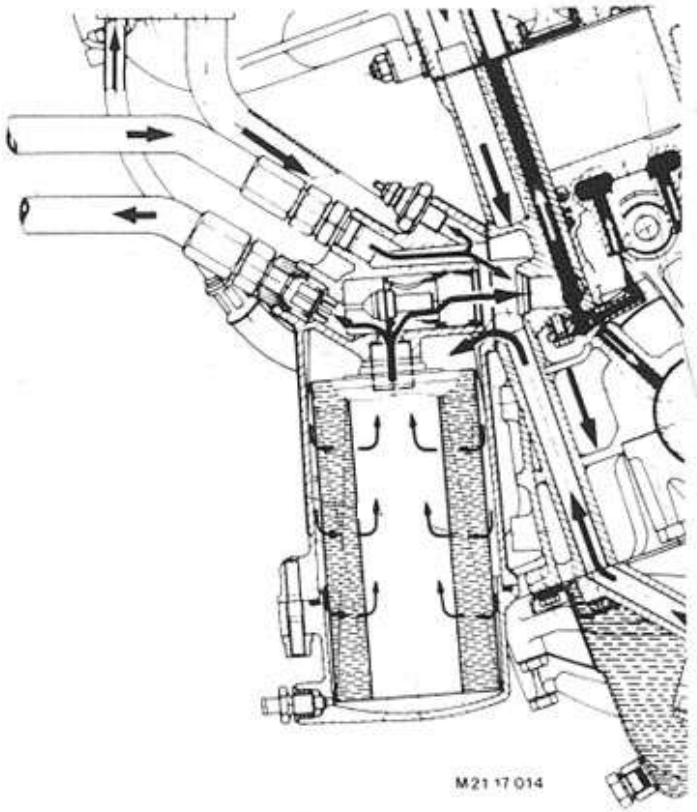
Unscrew bolts (1 and 2).
Installation:
Tightening torque*.

* See Specifications



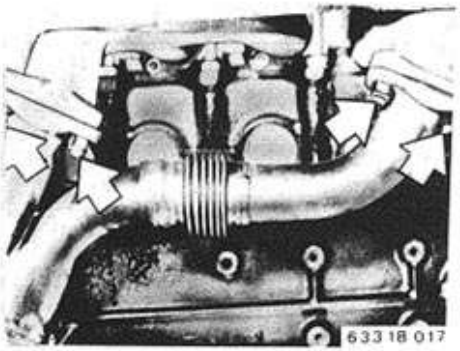
Lift out oil cooler.

The system is bled automatically.
The oil cooler is switched into the engine oil circuit at oil temperature of approx. 95° C (203° F). Volume of engine oil cooler incl. hoses is approx. 0.75 ltr. (1.5 pints).

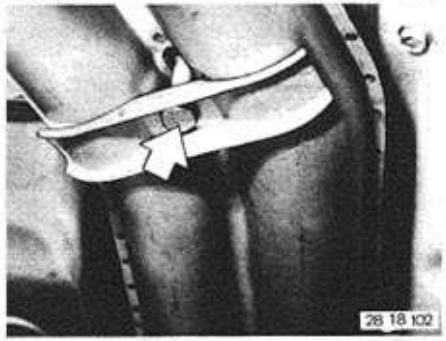


18 Exhaust system

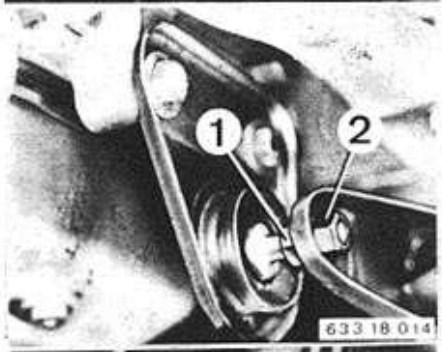
18 00 020 REMOVING AND INSTALLING EXHAUST ASSEMBLY



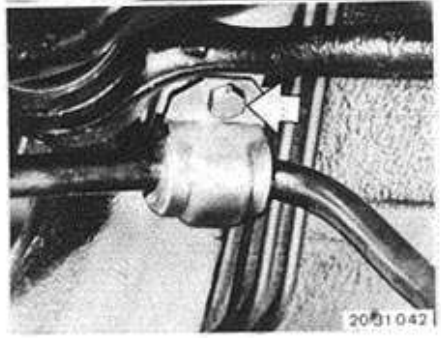
Remove oxygen sensor (see 11 78 510) to avoid damage on same.
Unscrew front exhaust pipes on exhaust manifolds.
Installation:
Check gaskets, replacing if necessary.
Coat studs with CRC** copper paste.
Replace self-locking nuts.
Tightening torque*.



Unscrew pipe clamp.

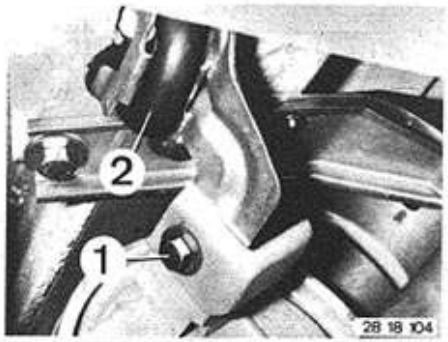


Since 1984 Models:
Unscrew nut (2).
Installation:
Mount exhaust assembly without tension by adjusting nut (1).
Tighten nut (2).

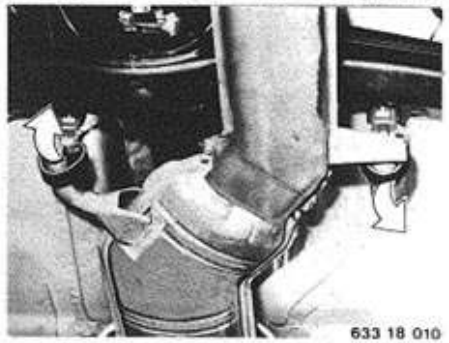


Since 1984 Models with Automatic Transm.:
Unscrew stabilizer on body at left and right sides.
Installation:
Tightening torque*.

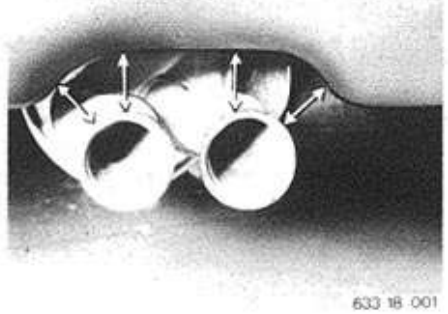
* See Specifications
** Source: HWB



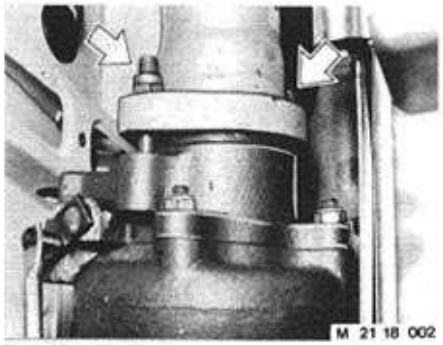
Unscrew bolt (1).
Remove exhaust assembly.
Installation:
Check rubber ring (2), replacing if necessary.



Disconnect rubber rings.
Take off exhaust assembly.
Installation:
Replace rubber rings if necessary.

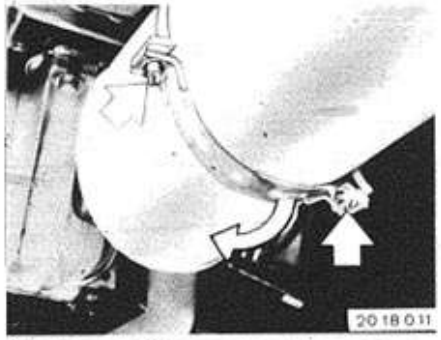


If necessary, correct distance between tailpipes and body by adjusting holders.

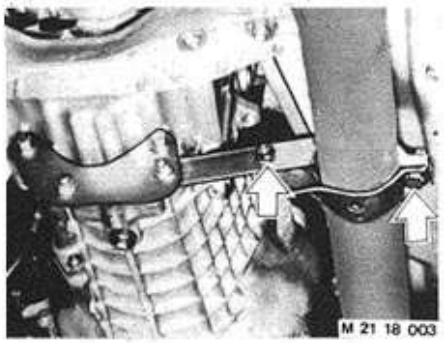


18 00 020 REMOVING AND INSTALLING EXHAUST ASSEMBLY

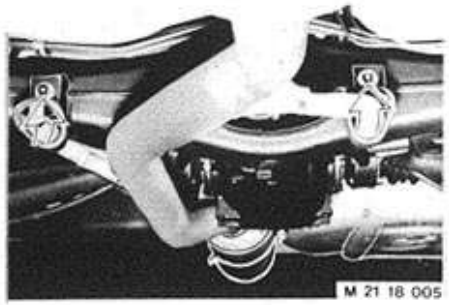
BMW 524 td:
Unscrew exhaust pipe on turbocharger.
Installation:
Coat threads with copper paste "CRC"**.
Tightening torque*.



Unscrew and swing away clamp on muffler.
Installation:
Check rubber ring, replacing if necessary.
Tightening torque*.

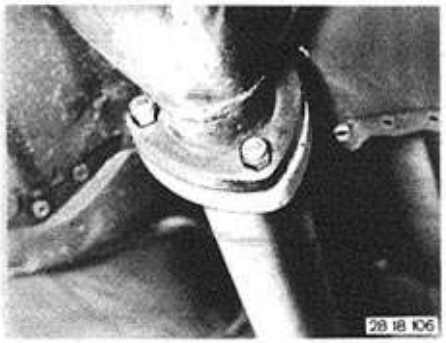


Unscrew holder for exhaust pipe.



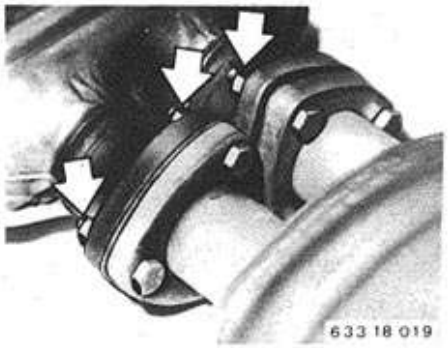
Disconnect rubber rings.
Take off exhaust assembly.
Installation:
Check rubber rings, replacing if necessary.
Keep distance to rear axle and body, correcting if necessary.

* See Specifications

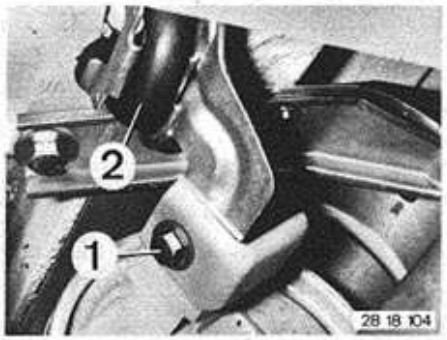


18 12 011 REPLACING MUFFLER ASSY (INTERMEDIATE AND FINAL MUFFLERS)

BMW 528 e:
Unscrew bolts on triangular flange.
Installation:
Replace self-locking nuts.
Check gasket, replacing if necessary.
Tightening torque*.

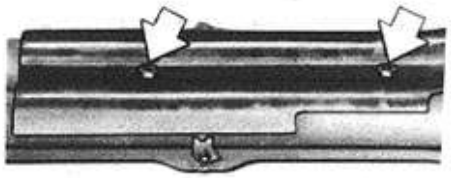


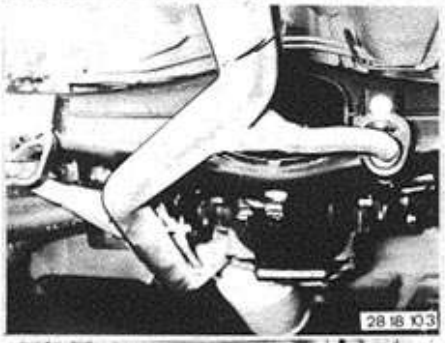
Unscrew nuts.
Installation:
Replace seals.
Replace self-locking nuts.
Tightening torque*.



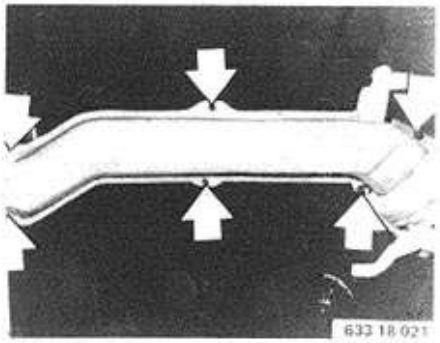
Unscrew bolt (1).
Installation:
Check rubber ring (2), replacing if necessary.

Transfer upper heat shield.

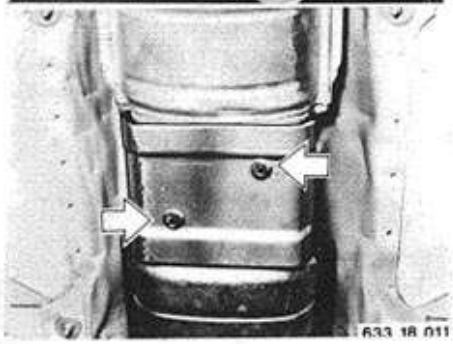




Disconnect rubber rings.
Remove exhaust assembly.
Transfer heat shield.
Installation:
Replace rubber rings if necessary.
Correct distance between tailpipe and body by adjusting holders.



Transfer lower heat shield.

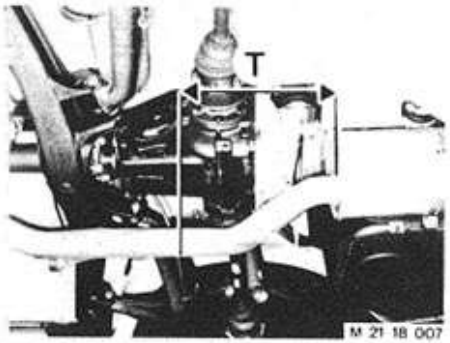


BMW 533 i:
Remove and install exhaust assembly 18 00 020.
Unscrew bolts.

* See Specifications

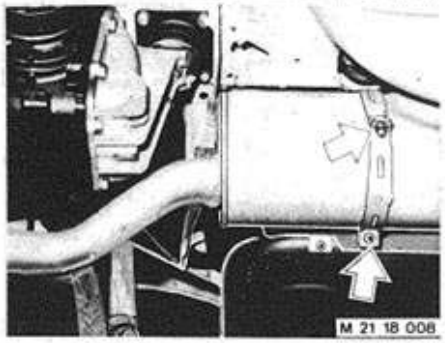
* See Specifications

18 12 031 REPLACING FINAL MUFFLER



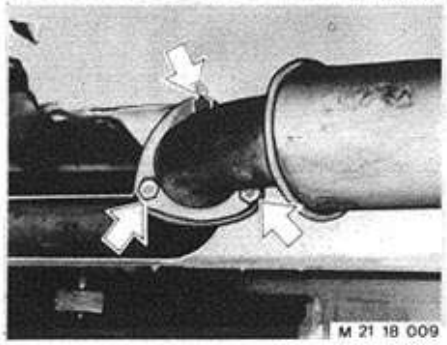
BMW 524 td:
Mark cutting point "T" and cut exhaust pipe with Special Tool 00 2 200.
Deburr cut edges.

T = 400 mm (15.748")



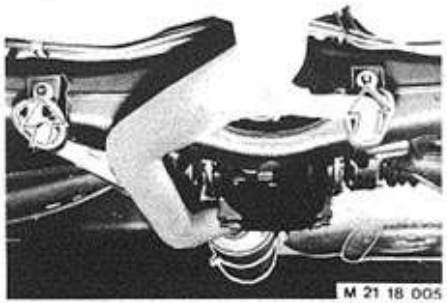
Unscrew clamp and take off muffler.
Installation:
Check rubber ring, replacing if necessary.
Tightening torque*.

Install new final muffler and move to correct installed position.
Slide on sleeve and tack weld on both ends.

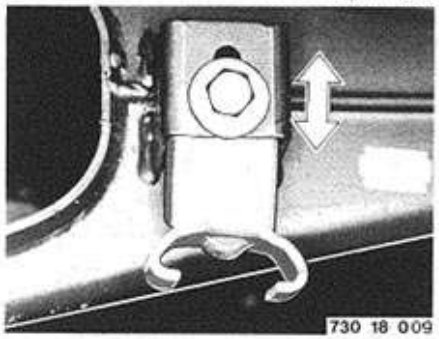


Remove muffler assembly again.
Installation:
Replace self-locking nuts.
Check seal, replacing if necessary.
Tightening torque*.

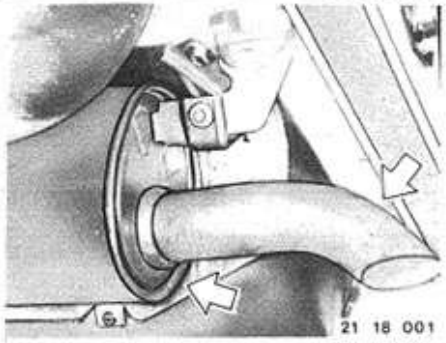
* See Specifications



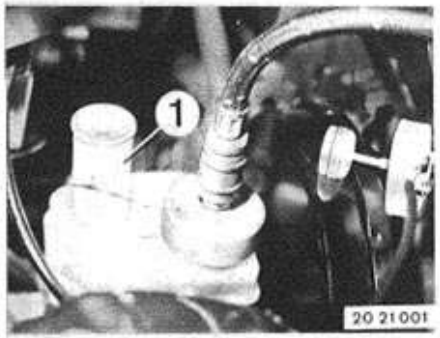
Disconnect and remove muffler assembly.
Weld sleeve all around.
Installation:
Check rubber rings, replacing if necessary.



Installation:
Check installed position and distance to rear axle and body, correcting on holder if necessary.

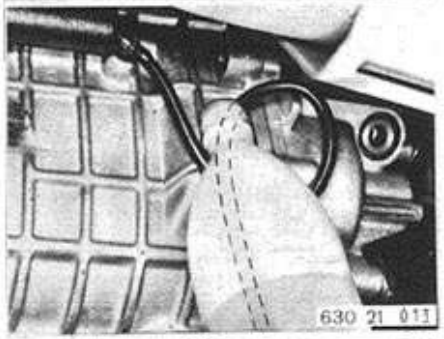


21 Clutch

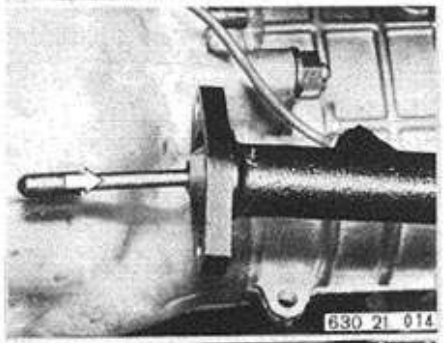


21 00 006 BLEEDING HYDRAULIC CLUTCH SYSTEM

A) With Bleeder
Unscrew cap on expansion tank.
Remove float container (1).
Connect bleeder.



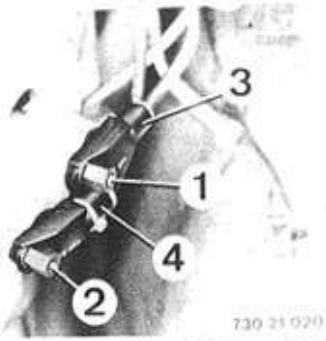
Open bleeder screw on clutch slave cylinder so long until escaping fluid is without air bubbles.
Operate clutch pedal several times during this step.



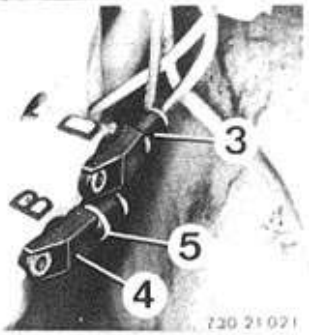
If there is still air in hydraulic system after repeating bleeding procedures several times, unscrew slave cylinder on transmission.
Press push rod into slave cylinder against stop and release slowly.
This will force back residual air into supply tank and guarantee maximum release travel.

21 11 000 REMOVING AND INSTALLING CLUTCH HOUSING

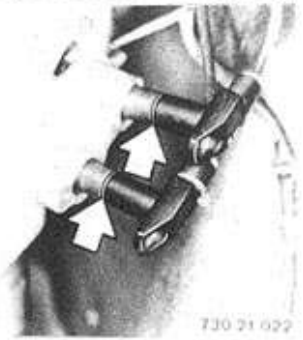
Remove and install transmission 23 00 022.
Cars with Cover:
Remove cover.



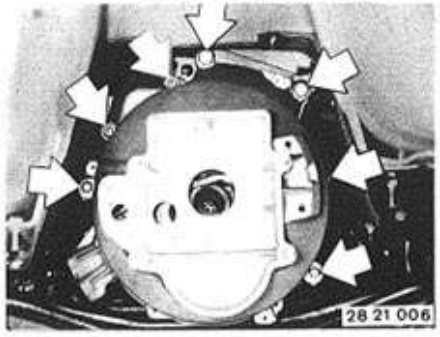
Cars with DME:
Unscrew heat shield.
Unscrew bolts (1 and 2).
Pull out speed sensor (3) and reference mark sensor (4).



Important!
Installation:
Check installed position.
Don't mix up plugs.
Install speed sensor (3) in bore (D) and reference mark sensor (4) with ring (5) in bore (B).
Engine cannot be started if mixed up.

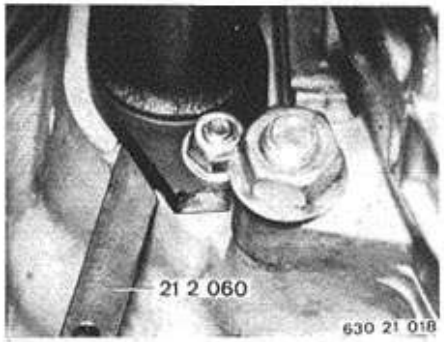


Installation:
Check O-rings.
Install sensors with Molykote Longterm 2.
Important!
Keep grease and dirt off of face of sensors for DME.



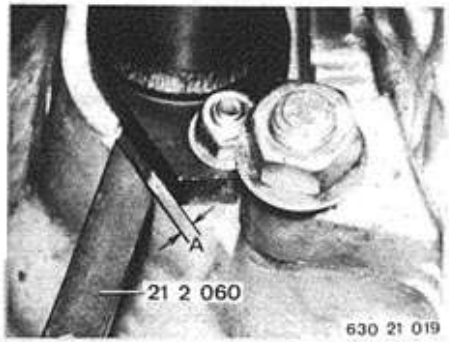
Unscrew clutch housing.
Unscrew Torx bolts with a Torx socket**
Important!
Installation:
Washers must be used for version with Torx bolts to avoid an increase in breaking loose torque.
Tightening torque*.

* See Specifications
** Source: HWB

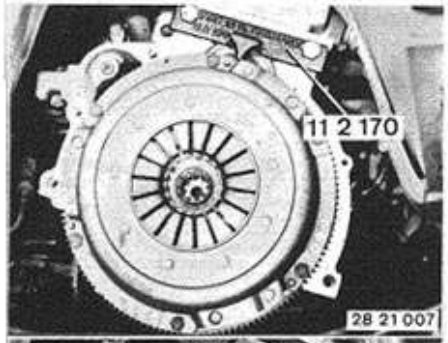


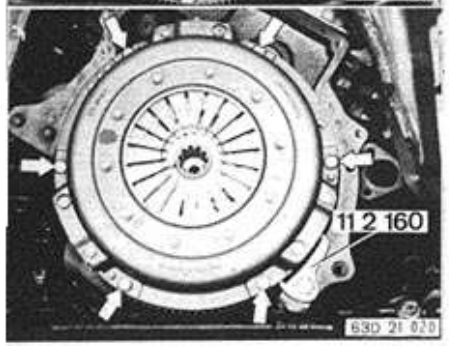
21 21 000 REMOVING AND INSTALLING CLUTCH DISC

Check clutch for wear without removing from the car.
If Special Tool 21 2 060 can be inserted in opening of slave cylinder against stop liners are still good.



With a gap (A) of 5 mm (0.197") between gage 21 2 060 and the slave cylinder, the drive plate is worn and must be replaced.



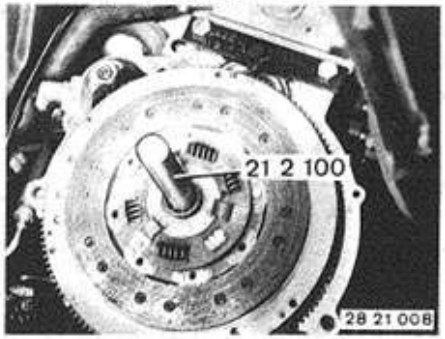


Remove the transmission – see 23 00 022.
Cars with 265/6 Transmission:
Remove the clutch housing – see 21 11 000.
Check the diaphragm spring tip deviation*.
BMW 528 e/524 td:
Hold the flywheel with Special Tool 11 2 170.
Loosen the mounting nuts one after the other by 1 to 1 1/2 turns until the clutch is relaxed.
Remove the mounting bolts, clutch disc and drive plate.
Important!
Don't throw or let the clutch fall.
Improper handling could cause the tangential leaf springs, holding the clutch in direction of turning, to be bent off.
The diaphragm spring will still initiate lift off, but because of the weak leaf springs the pressure ring would not lift off far enough and the drive plate will not be cleared.

BMW 533 i / 535 i:
Hold the flywheel with Special Tool 11 2 160.

* See Specifications

Check the drive plate for wear (A)*, cracks and the torsional damper for tight fit of the spring elements.
Installation:
Note clutch side.
Important! – Installation:
Note the transmission end mark on the drive plate.
Version with Double Mass Flywheel:
The drive plate is designed rigid with a damper.
The torsional damper is integrated in the flywheel.

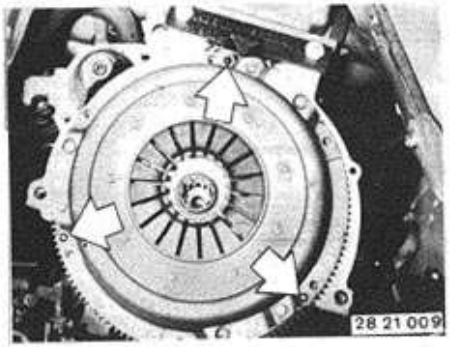


Installation:
Check the grooved ball bearing in the crankshaft for easy movement, replacing if necessary.
Check the flywheel for scoring.
Center the drive plate in the flywheel with Special Tool 21 2 100.

Visually inspect the clutch for cracks, wear and burnt spots.
The pressure contact surface must be level.

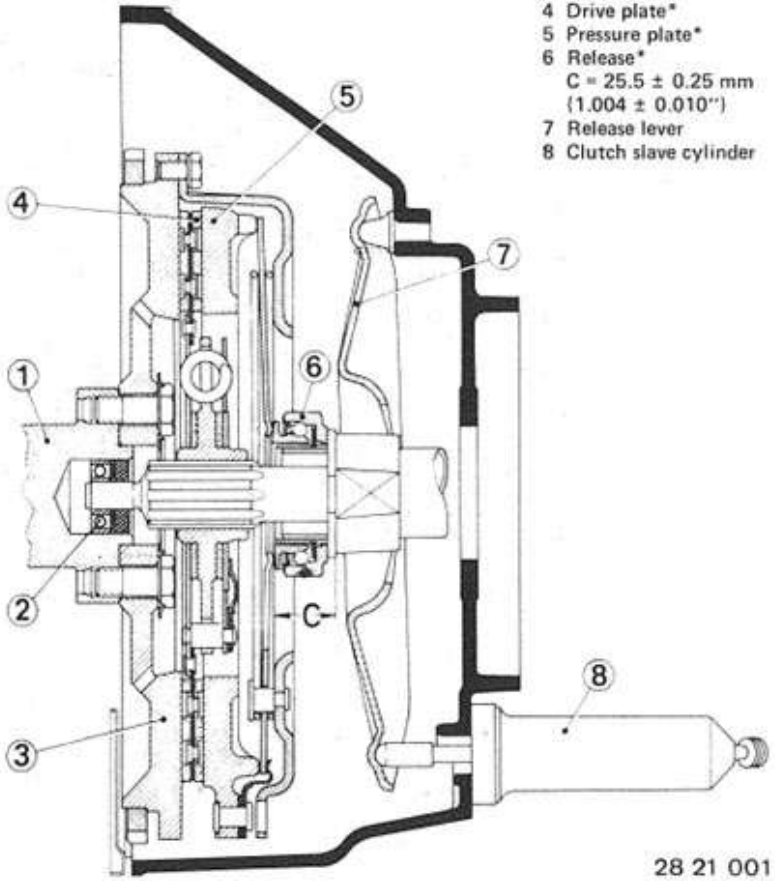
Check rivets for wear and tight fit visually.
Replace a clutch with loose or worn rivet heads.
Important!
Remove all corrosion inhibiting compound when installing a new clutch disc.
Version with Double Mass Flywheel:
The clutch is lower in height.

* See Specifications



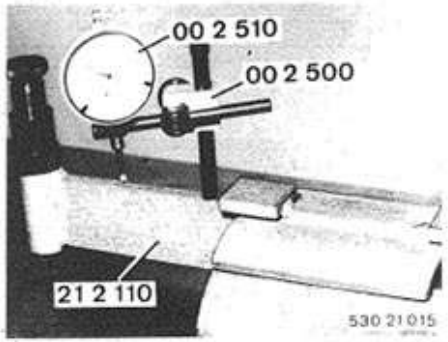
Install the clutch on the dowel pins.
Tighten the mounting bolts uniformly in specified order and torque*.
Installation:
Give keyways of the transmission input shaft a light coat of Molykote Longterm 2.
Important!
Version with Double Mass Flywheel:
Lubricate the keyways lightly with Microlube 261**.

Clutch Assembly:
1 Crankshaft
2 Grooved ball bearing
3 Flywheel
4 Drive plate*
5 Pressure plate*
6 Release*
C = 25.5 ± 0.25 mm
(1.004 ± 0.010")
7 Release lever
8 Clutch slave cylinder



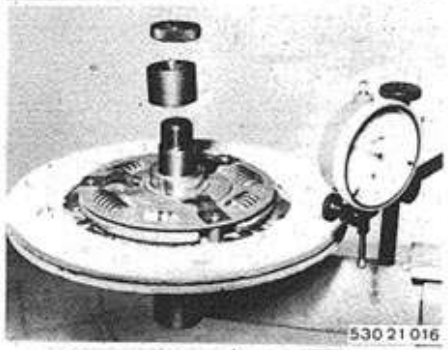
28 21 001

* See Specifications
** Source: HWB

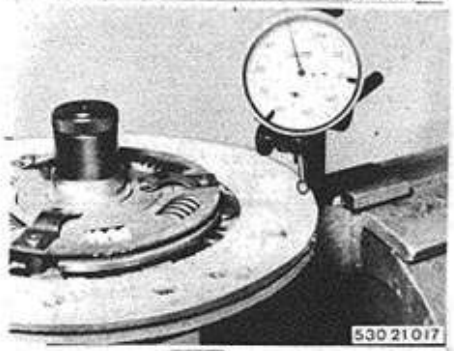


21 21 565 CHECKING LATERAL RUNOUT OF DRIVE PLATE
– Drive Plate Removed –

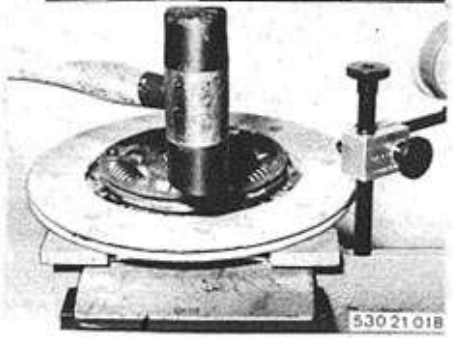
Clamp Special Tool 21 2 110 in a vise.
Mount Special Tools 00 2 510 and 00 2 500.



Clamp the drive plate on the fixture and clean the liners with emery cloth.

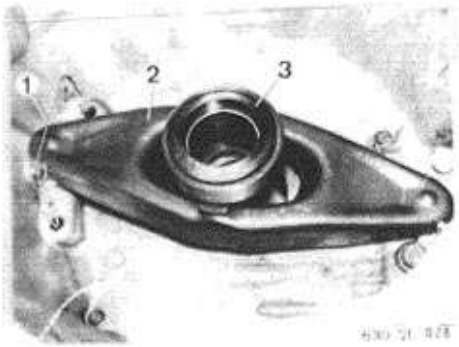


Apply the dial gage about 3 mm (0.118") from the outer edge.
Turn the drive plate and read the lateral runout*.



Straighten the drive plate with a plastic hammer applied on the take-up points of the fixture.
Repeat the test.

* See Specifications



630 21 028

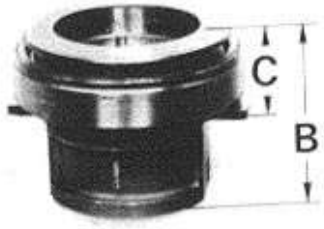
21 51 000 REMOVING AND INSTALLING OR REPLACING CLUTCH RELEASE

Remove the clutch housing – 21 11 000.
Remove spring (1) and release lever (2) with release (3).

630 21 029

Installation:
Pack lubricating groove (N) with Molykote Longterm 2.
Give the guides and bearings a light coat of Molykote Longterm 2.
Important!
Version with Double Mass Flywheel:
Use Microlube 261**.
Non-conformance could cause the bearings to seize on the guide sleeve.

Check the specified height of release B and C*.

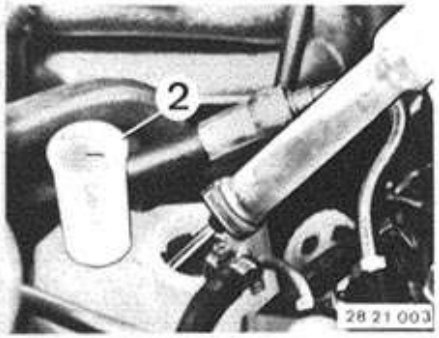


28 21 011

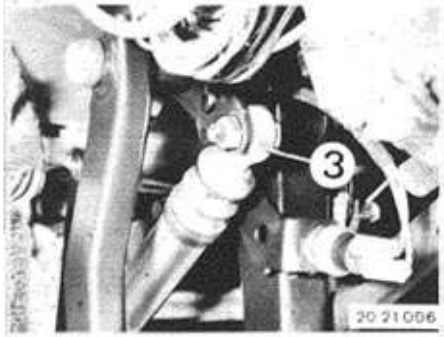
* See Specifications
** Source: HWB

21 52 000 REMOVING AND INSTALLING CLUTCH MASTER CYLINDER

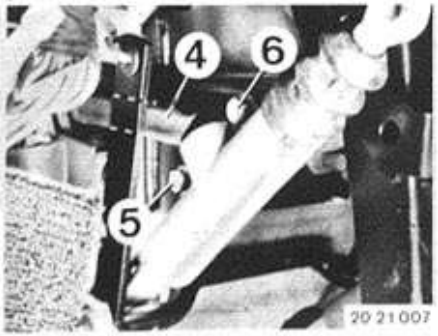
Disconnect line (1) to slave cylinder.



Unscrew cap on expansion tank.
Remove float container (2).
Draw off brake fluid in tank to lower level to connection for filling line.

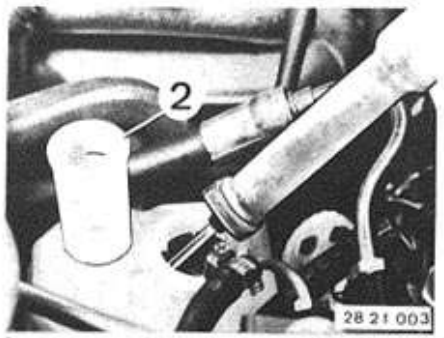


Detach instrument panel trim at bottom left.
Detach piston rod (3) on clutch pedal.
Installation:
Adjust clutch pedal with eccentricbolt (see 35 11 000).

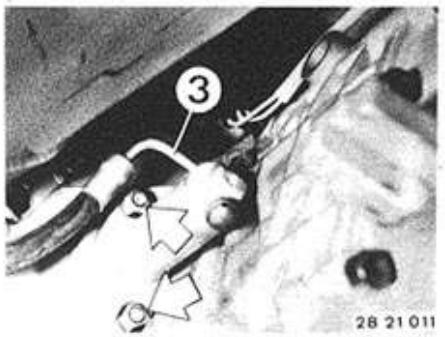


Pull out filling line (4).
Unscrew bolts (5 and 6).
Remove master cylinder.
Installation:
Bleed clutch 21 00 006.

21 52 010 REMOVING AND INSTALLING CLUTCH SLAVE CYLINDER



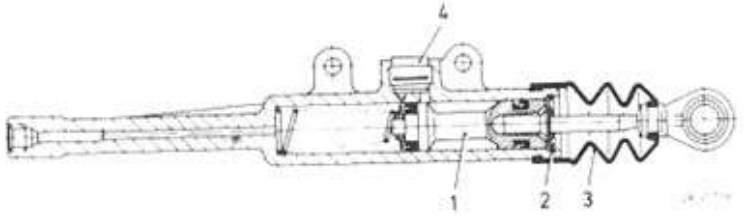
Unscrew cap on expansion tank.
Remove float container (2).
Draw off brake fluid in tank to lower level to connection for filling line.



Detach slave cylinder at transmission.
Remove slave cylinder.
Disconnect line (3).
Installation:
Bleeder screw faces down.
Install front push rod with Molykote Longterm 2.
Bleed clutch 21 00 006.

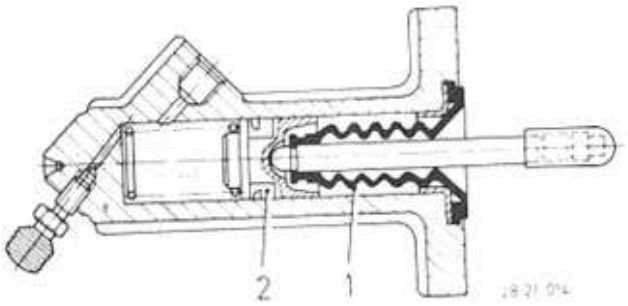
21 52 502 OVERHAULING CLUTCH MASTER CYLINDER (REMOVED)

Clean master cylinder and inside parts with alcohol.
Replace entire master cylinder, if cylinder bore has scoring or corrosion.
Install repair kit, consisting of:
1 Piston assy.
2 Circlip
3 Protective cap
4 Sealing plug
Apply a light coat of ATE* brake cylinder paste on cylinder bore walls and slotted rings.



21 52 512 OVERHAULING CLUTCH SLAVE CYLINDER (REMOVED)

Clean slave cylinder and inside parts with alcohol.
Replace entire slave cylinder, if cylinder bore has scoring or corrosion.
Install repair kit, consisting of:
1 Protective cap
2 Slotted dust cover
Apply a light coat of ATE* brake cylinder paste on cylinder bore wall and slotted dust cover.



* Source: HWB

TROUBLESHOOTING CLUTCH

Condition	Cause	Correction
Clutch slips	a) Clutch contact pressure[1] insufficient	a) Replace clutch 21 21 000
	b) Liner[1] seriously worn	b) Replace drive plate 21 21 000
	c) Liner splattered with oil – transmission or crankshaft seal defective	c) Replace defective seal and drive plate
	d) Clutch was overheated	d) Replace clutch 21 21 000
	e) Clutch not an original BMW part	e) Install original BMW parts
Clutch grabs	a) Liner[1] not as specified	a) Replace drive plate 21 21 000
	b) Liner splattered with oil	b) Replace drive plate 21 21 000
	c) Release pressure one-sided	c) Check release lever
	d) Pressure plate pressing crooked	d) Replace pressure plate 21 21 000
	e) Crankshaft not aligned with transmission input shaft	e) Check centering surfaces of engine and transmission
	f) Engine and transmission suspension defective	f) Replace engine and transmission suspension
	g) Drive plate not an original BMW part	g) Install original BMW parts
Clutch does not release	a) Drive plate wrenched excessively or liner broken	a) Replace drive plate 21 21 000
	b) Drive plate has excessive lateral runout[1]	b) Straighten or replace drive plate 21 21 565
	c) Liner rusted on flywheel	c) Clean flywheel, roughen liner surface with emery cloth
	d) Drive plate seized on transmission input shaft	d) Service drive plate on transmission input shaft, replacing damaged parts if necessary
	e) Bearing in crankshaft for transmission input shaft defective	e) Replace bearing in crankshaft 11 21 571
	f) Air in clutch hydraulic system	f) Bleed clutch 21 00 006
	g) Tangential leaf springs of clutch bent off	g) Replace clutch 21 21 000
Clutch noise	a) Unbalance[1] of clutch and drive plate excessive	a) Replace clutch and/or drive plate 21 21 000
	b) Torsional damper defective	b) Replace drive plate 21 21 000
	c) Clutch release defective	c) Replace clutch release
	d) Bearing in crankshaft for transmission input shaft defective	d) Replace bearing in crankshaft 11 21 571
	e) Clutch rivets loose	e) Replace clutch 21 21 000

[1] See Specifications

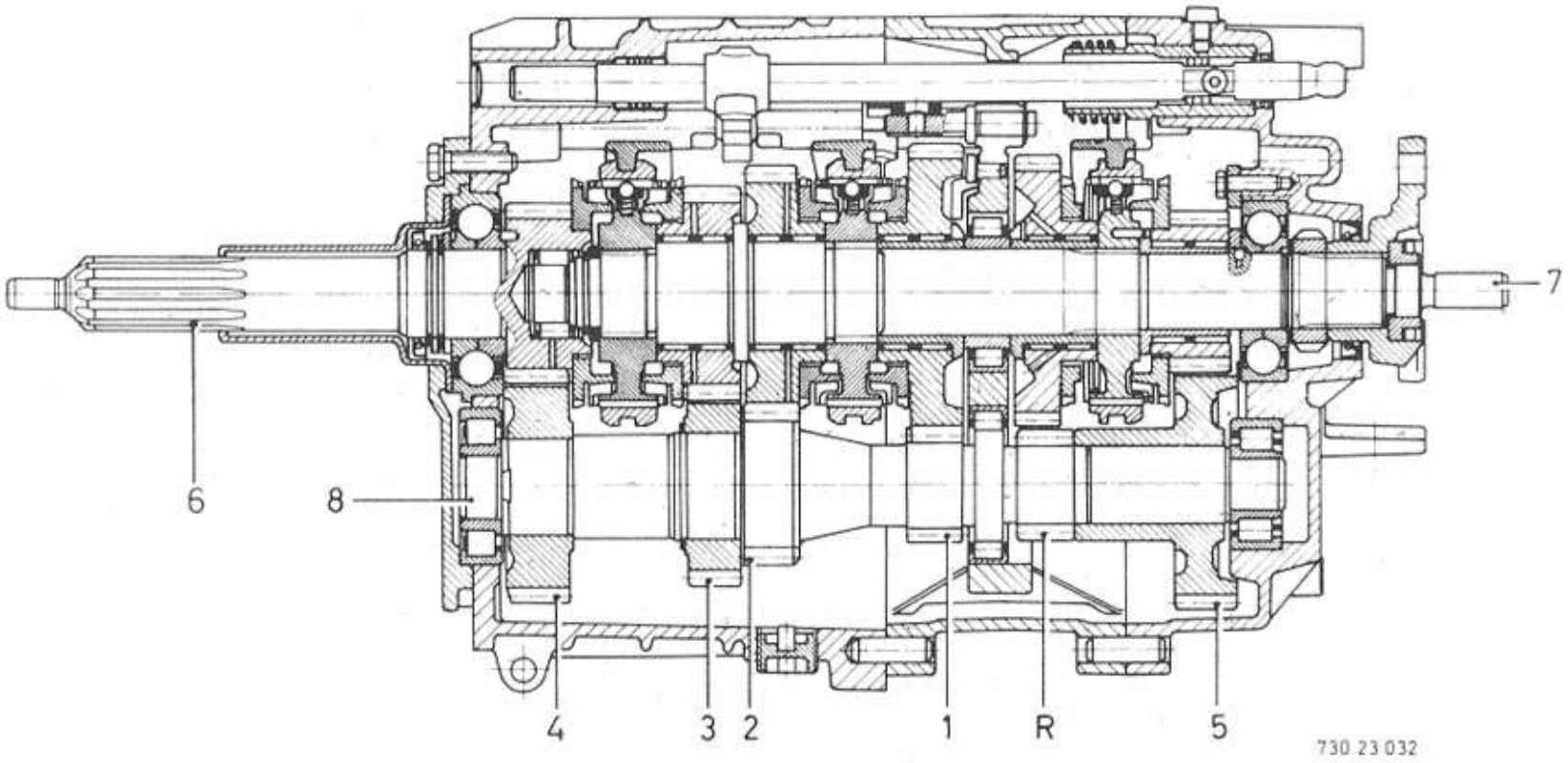
23 Manual transmission

Getrag 265/6 five speed manual transmission (overdrive)

Getrag 260 five speed manual transmission with overdrive

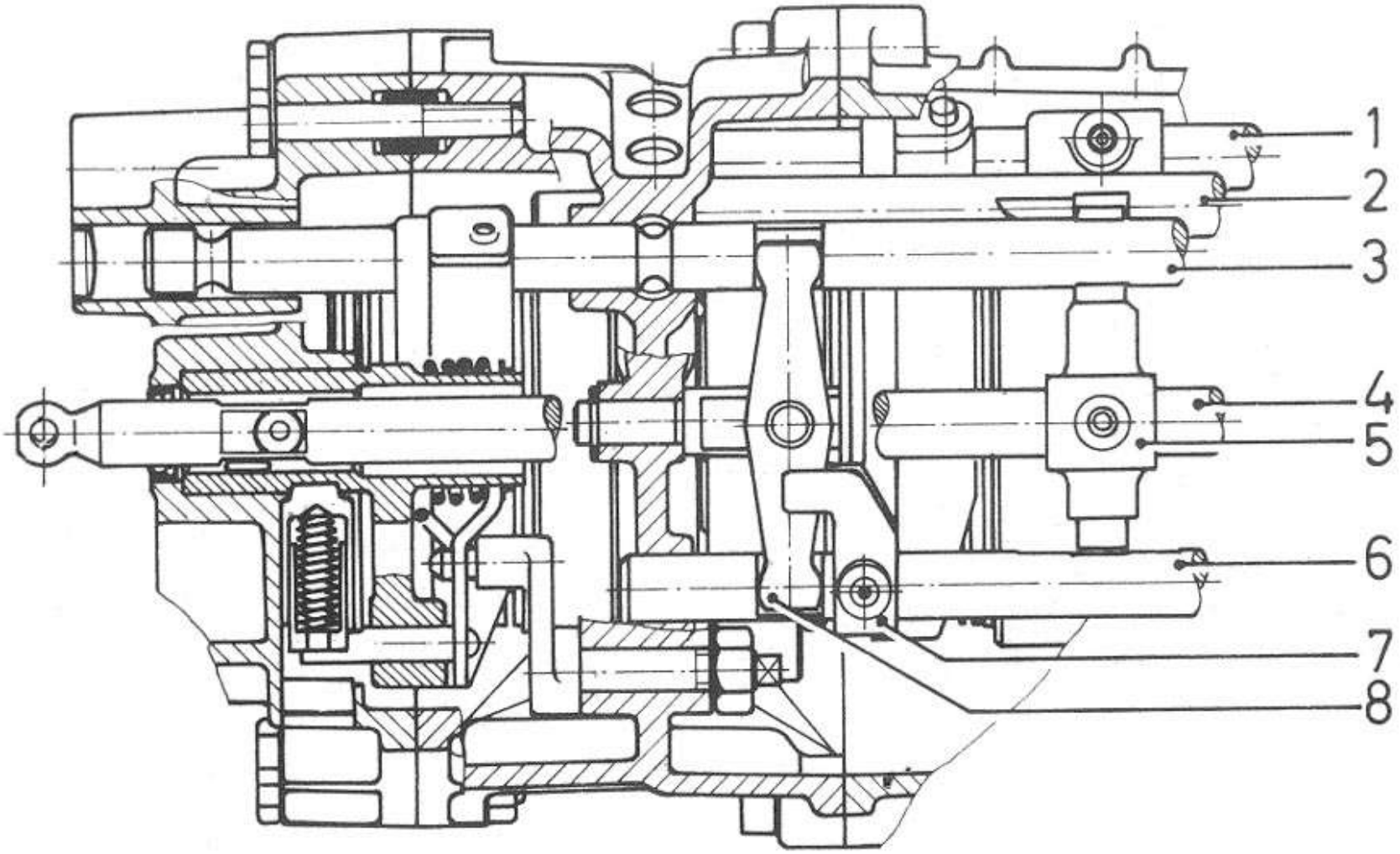
23 – 1

LAYOUT DRAWING OF GETRAG 265/6 OVERDRIVE TRANSMISSION



1 1st gear
2 2nd gear
3 3rd gear
4 4th gear
5 5th gear
R Reverse gear
6 Input shaft
7 Output shaft
8 Layshaft

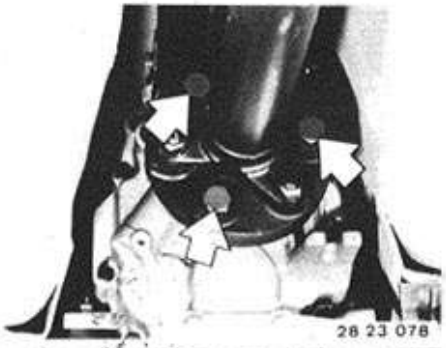
LAYOUT DRAWING OF SHIFT PARTS FOR GETRAG 265/6 OVERDRIVE TRANSMISSION



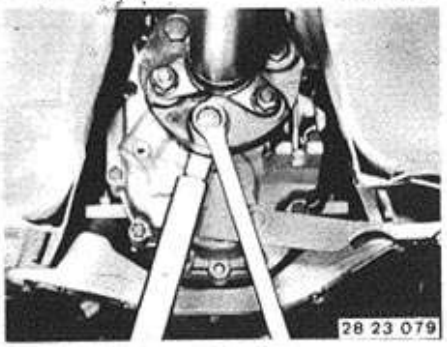
730 23 033

1 Selector rod, 1st/2nd gear
2 Selector rod, 3rd/4th gear
3 Selector rod, 5th/reverse gear
4 Selector shaft
5 Selector arm
6 Selector rail
7 Dog
8 Reversing lever

23 00 022 REMOVING AND INSTALLING TRANSMISSION

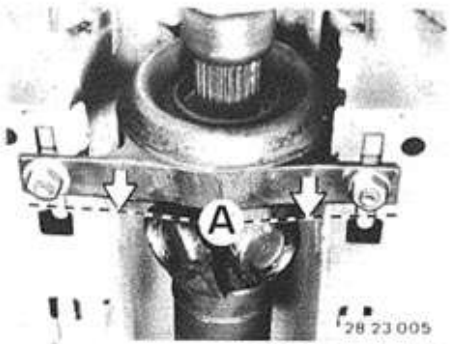


Remove exhaust assembly 18 00 020.
Unscrew heat shield.
Unscrew joint disc on transmission.

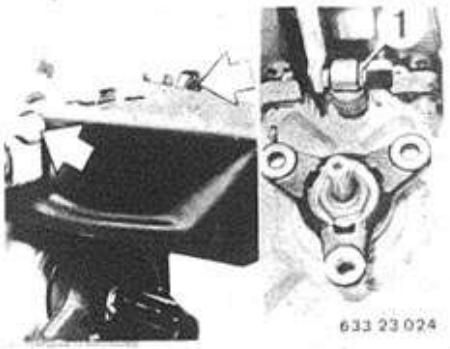


Installation:
Always replace stop nuts.
Tighten nuts with a standard 12 mm socket and torque wrench.
Tightening torque*.
Important!
Only tighten nuts (never bolts) to avoid stress in joint disc.

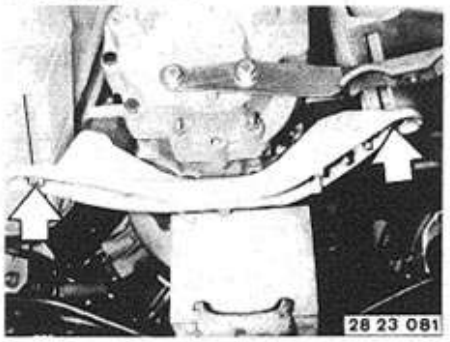
Loosen threaded ring (1) several turns.
Installation:
After finishing installation, tighten threaded ring (1) with Special Tool 26 1 040.
Tightening torque*.



Unscrew center mount.
Installation:
Preload center mount forward by distance (A) = 2 to 4 mm (0.079 to 0.157").
Tightening torque*.
Bend propeller shaft down and pull off of centering pin.
Important!
Suspend propeller shaft from car on a piece of wire.

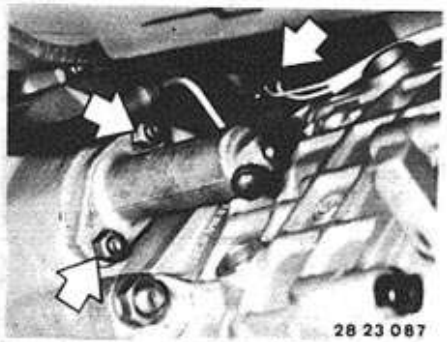


Unscrew console on transmission.
Lift out retainer (1).
Take off washer.
Pull out shift rod.
Installation:
Tightening torque*



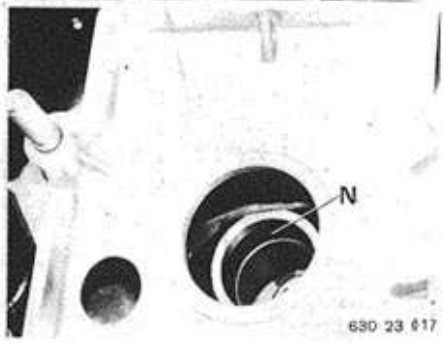
Support transmission.
Unscrew cross member on body.
Lower transmission.
Installation:
Tightening torque*

* See Specifications



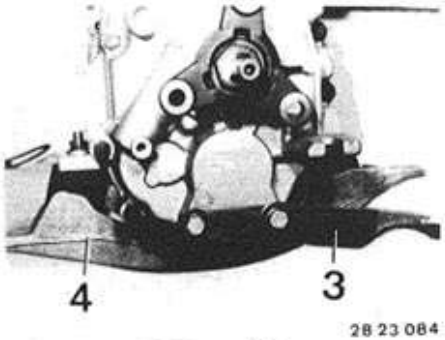
Unscrew clutch slave cylinder.
Line remains connected.
Installation:
Pull off wires on reverse gear switch.
Lift wire harness out of holders.

Unscrew transmission on clutch housing and remove toward rear.
Use special ring wrench** to loosen and tighten nuts at top left.



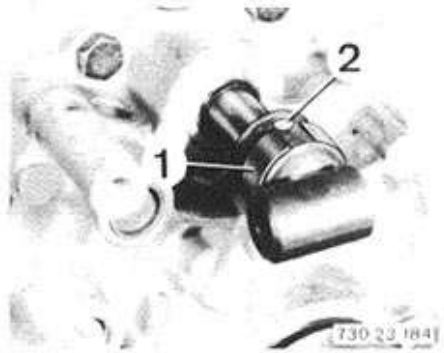
Installation:
Position release lever with the clutch slave cylinder.
Align clutch release bearing.
Pack groove (N) with Molykote Longterm 2.
Non-conformance could cause bearing to seize on guide sleeve.
Engage gear before connecting transmission.
Insert guide sleeve of transmission in bearing carefully.
Turn output flange until input shaft slides into drive plate.
Remove clutch slave cylinder again.
Mount transmission.

** Source: HWB

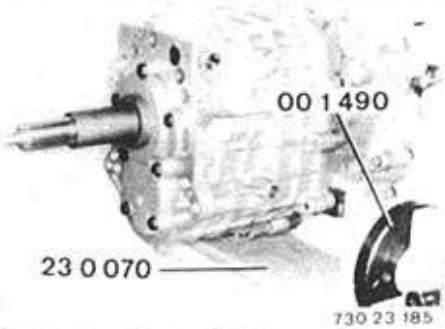


23 11 013 REMOVING AND INSTALLING/ SEALING TRANSMISSION CASE FRONT SECTION

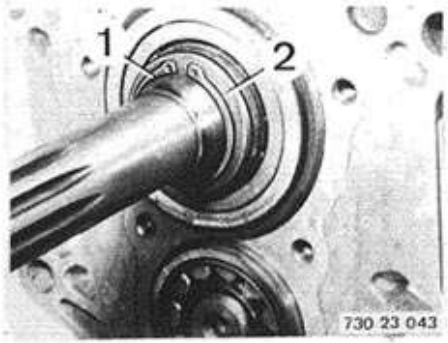
Remove transmission 23 00 022.
Unscrew exhaust bracket (3) and cross member (4) with rubber mount.



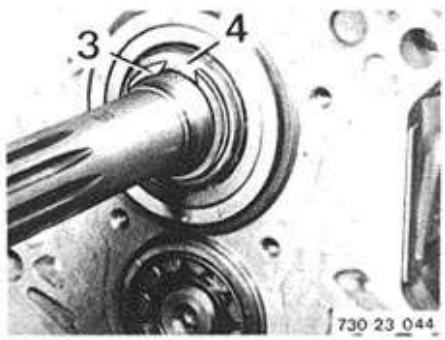
Engage 3rd gear.
Push back spring sleeve (1).
Drive out cylindrical pin (2).
Pull off selector rod.
Pull off selector rod joint.
Note:
Mount selector rod joint with offset side on left when locking in forward direction.



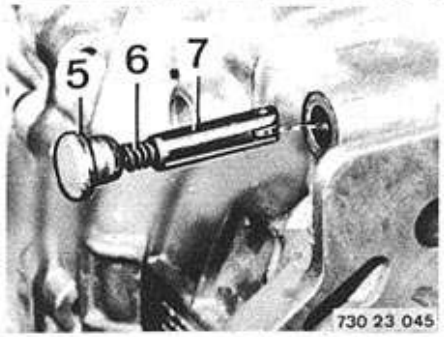
Mount transmission on Special Tool 23 0 070 in conjunction with Special Tool 00 1 490.
Drain oil.



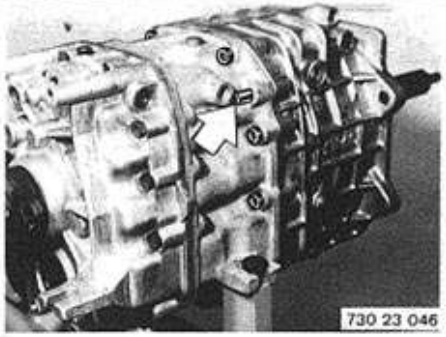
Remove guide flange 23 11 623.
Lift out circlip (1).
Take off grooved washer (2).
Installation:
Position grooved washer that groove faces the circlip.



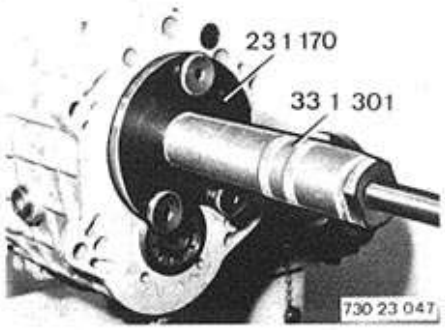
Lift out circlip (3).
Remove washer (4).
Installation:
Always replace circlip.



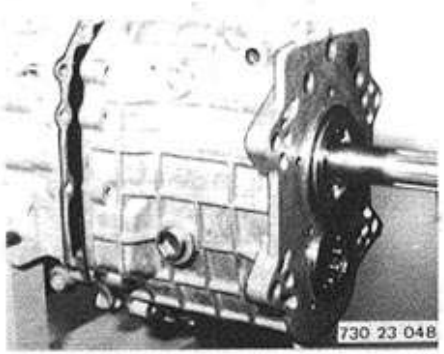
Lift out end cap (5).
Remove spring (6) and lockpin (7).
Installation:
Check installed position.
Remove backup light switch.



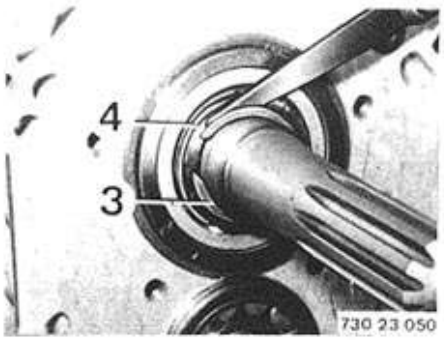
Drive out cylindrical pin.
Unscrew bolts.



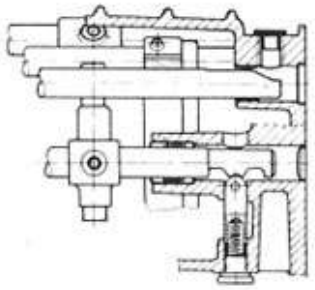
Pull off transmission case front section with Special Tools 23 1 170 and 33 1 301.



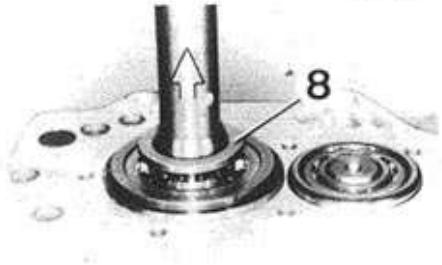
Coat sealing surfaces with Loctite No. 573.
Sealing surfaces must be cleaned thoroughly and dried of oil.
Mount transmission case front section.
Tightening torque*.



Adjust play between washer (4) and circlip (3) to 0 ... 0.09 mm (0 to 0.0035").
Circlips (3) are available from Parts in various thicknesses.
Install grooved washer and circlip.

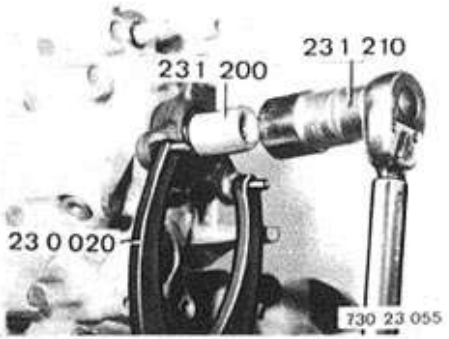


Install lockpin and backup light switch.
Note arrangement of lockpin.



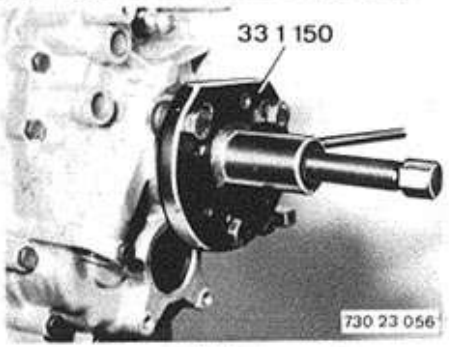
Heat ball bearing inner race (8) to about 80° C (175° F) with a hot air blower and slide on to input shaft.
Pull out input shaft for this purpose.

* See Specifications

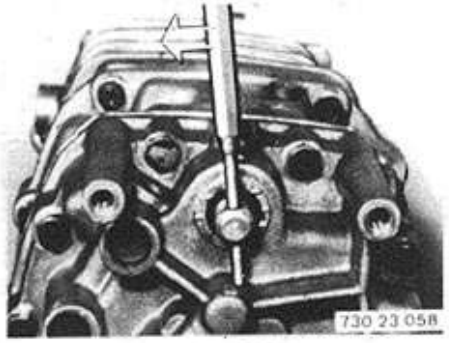


23 11 022 REMOVING AND INSTALLING/ SEALING TRANSMISSION CASE REAR SECTION

Lift out lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.
Installation:
Tightening torque*.



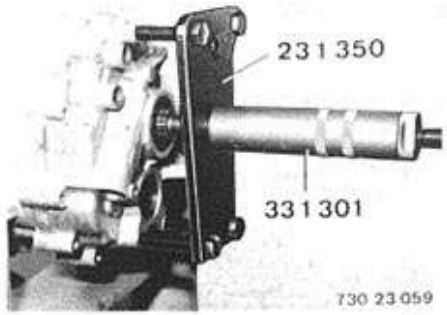
Pull off output flange with Special Tool 33 1 150 if necessary.



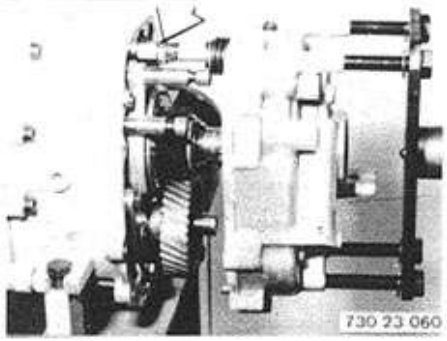
Caution!
Make sure 2nd gear is engaged before pulling off cover.
Swing selector shaft to the left against stop and slide forward.

Unscrew rear case section mounting bolts.

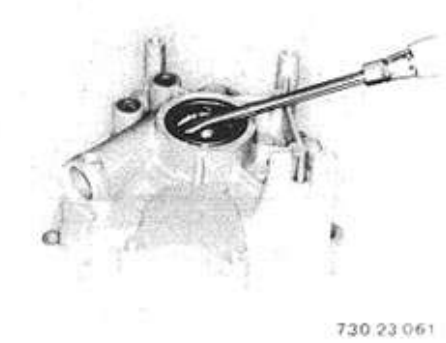
* See Specifications



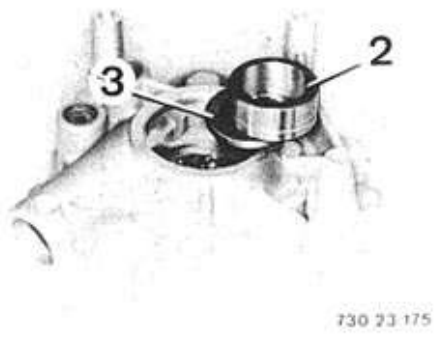
Knock back centering pin.
Pull off transmission case rear section with Special Tool 23 1 350 used in conjunction with Special Tool 33 1 301.



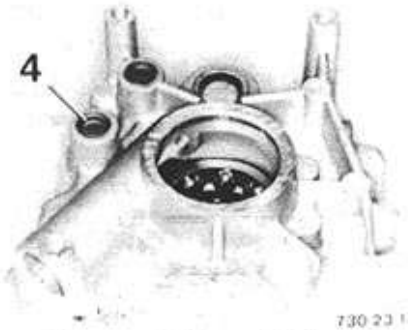
Take off rear section.
Important!
Rollers on selector shaft.



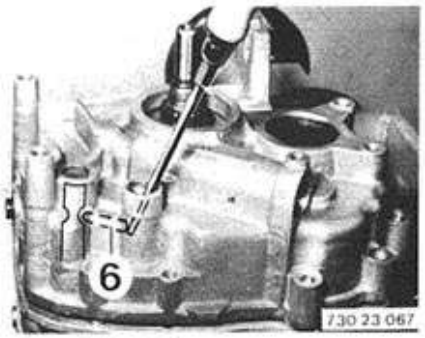
Lift out radial oil seal.
Installation:
Replace radial oil seal.



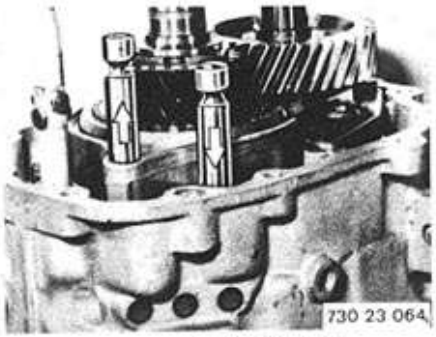
Remove spacer (2) and ball bearing inner race (3).



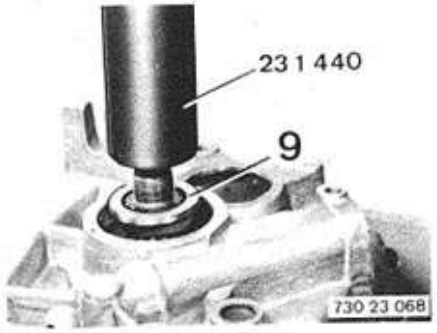
Knock out end cap (4).
Installation:
Replace and install end cap with Loctite No. 573.



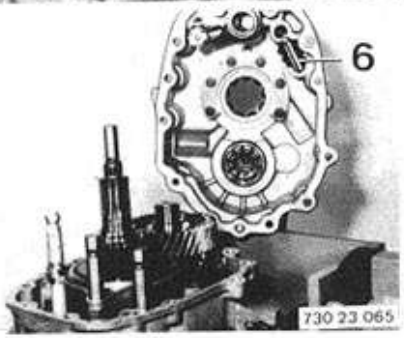
Press lockpin (6) into opening of 1st/2nd gear selector rod.
Push on and bolt down transmission case rear section.
Tightening torque*.
Drive in centering pin.
Install end cap (4).



Position output shaft upright.
Second gear is engaged.
Adjust reverse/5th gear selector rod until opening of 5th gear selector rod is aligned with end of 1st/2nd gear selector rod.

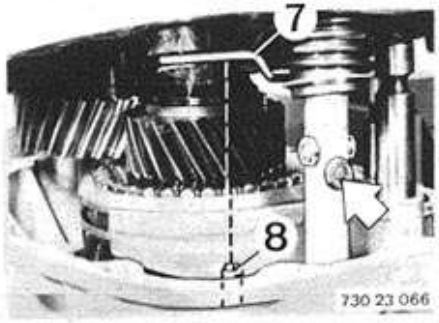


Heat bearing inner race (9) to about 80° C (175° F) with a hot air blower and slide on to output shaft, if necessary knocking on against ball bearing with Special Tool 23 1 440.

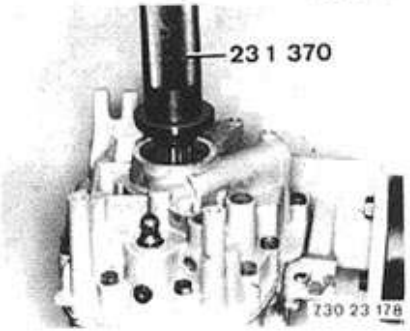


Coat sealing surfaces with Loctite No. 573.
Sealing surfaces must be cleaned thoroughly and dried of oil.
Important!
Lockpin (6) must move easily and face down.

Install spacer (2).

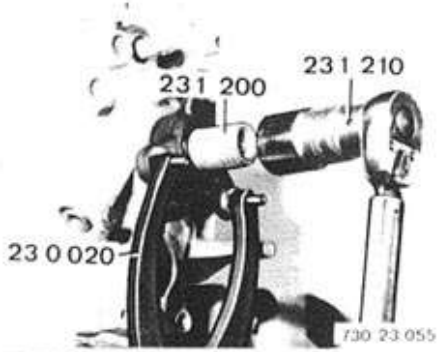


Hold rollers in position with grease.
Mount transmission case rear section.
Make sure spring (7) of selector arm engages on lever (8).

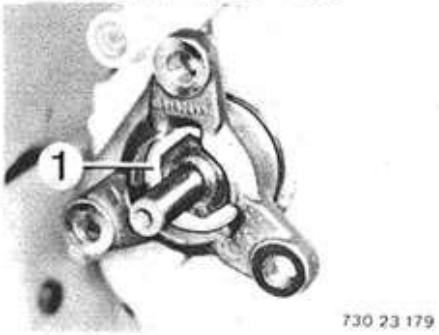


Drive in radial oil seal flush with Special Tool 23 1 370.

* See Specifications

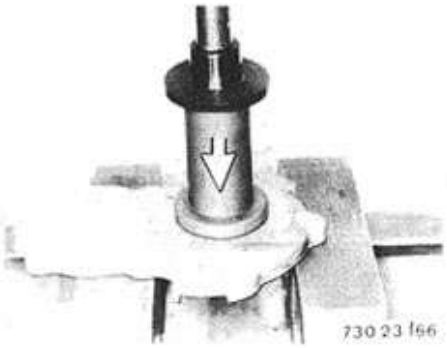


Mount output flange.
Install collar nut with Loctite No. 270.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Tighten collar nut with Special Tool 23 1 210.
Tightening torque*.



Install lockplate (1).

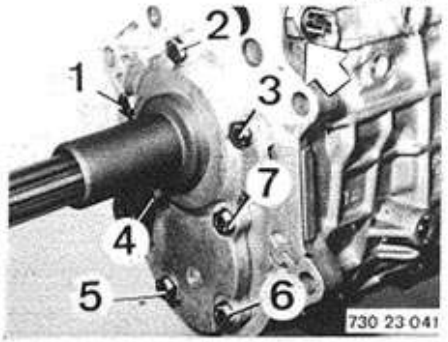
* See Specifications



23 11 610 REPLACING CLUTCH RELEASE GUIDE TUBE
– Transmission Removed –

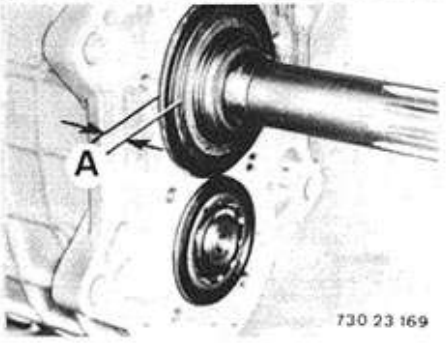
Remove guide flange, see 23 11 623.
Press out guide tube.

Heat guide flange to about 80° C (175° F) with a hot air blower.
Install guide tube.
Note:
Check turning lock (1).
Install radial oil seal.

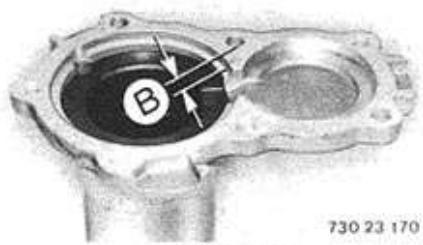


23 11 623 REMOVING AND INSTALLING/ SEALING COVER WITH GUIDE TUBE FOR CLUTCH RELEASE

Unscrew cover.
Important!
Spacers.
Important! – Installation:
Check length of bolts.
Bolts (1 ... 3) = 8 x 30 mm.
Bolts (4 ... 7) = 8 x 22 mm.

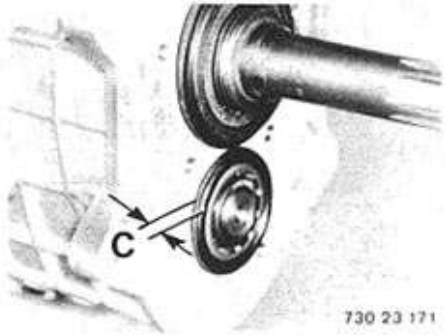


Adjust ball bearing between input shaft and guide flange to 0 ... 0.09 mm (0 to 0.0035").
Measure distance (A) from case to ball bearing.

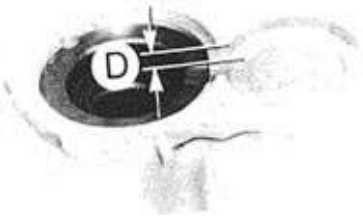


Measure distance (B).
Example:

B	8.1 mm (0.319")
– A	7.8 mm (0.307")
	0.3 mm (0.012") spacer thickness

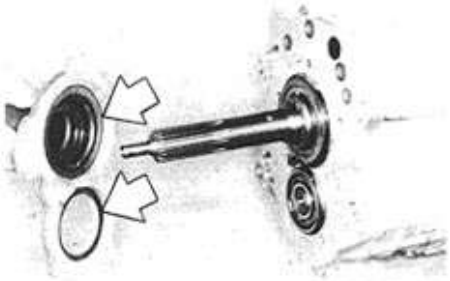


Adjust roller bearing play between layshaft and guide flange.
Measure distance (C) from case to roller bearing outer race.



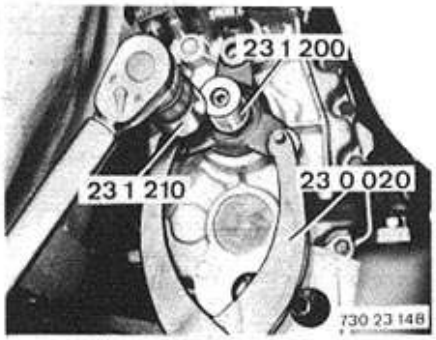
Measure distance (D).
Example:

D	4.8 mm (0.189")
– C	4.3 mm (0.169")
	0.5 mm (0.020")
– 0.1 ... 0.2 mm (0.004 ... 0.008")	axial play
	0.3 mm (0.012") spacer thickness



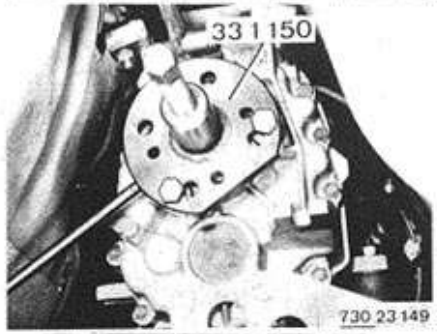
Coat sealing surfaces with Loctite No. 573.
Sealing surfaces must be cleaned thoroughly and dried of oil.
Hold spacers of calculated thickness in position with grease.
Mount cover.
Install bolts with Loctite No. 573.
Tightening torque*.
Threads cleaned to remove old cement.

* See Specifications

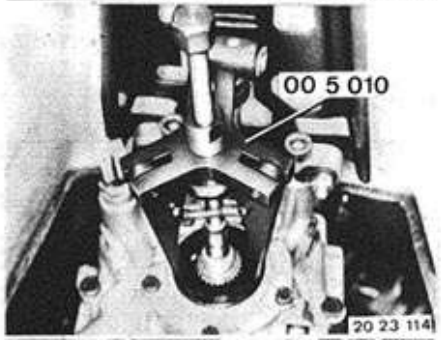


23 12 053 REPLACING RADIAL OIL SEAL FOR OUTPUT FLANGE

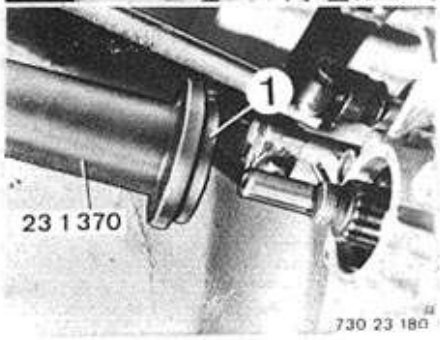
Unscrew exhaust pipes on manifold (see 18 00 020).
Unscrew propeller shaft (see 23 00 022).
Lift out lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.



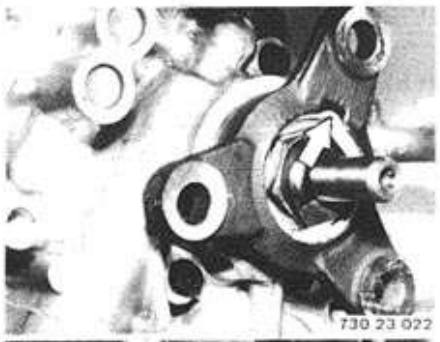
If too difficult, pull off output flange with Special Tool 33 1 150.



Pull out radial oil seal with Special Tool 00 5 010.



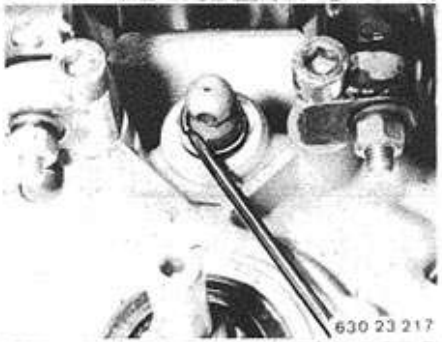
Lift out radial oil seal.
Drive in radial oil seal (1) flush with Special Tool 23 1 370.
Installation:
Lubricate sealing lip with oil.



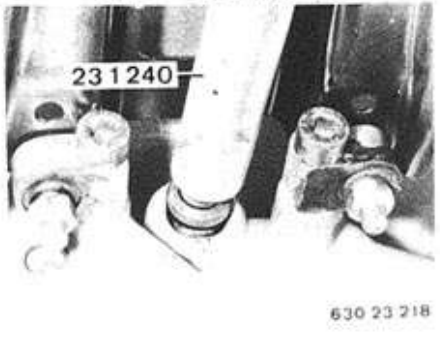
Mount output flange.
Tightening torque*.
Install collar nut with Loctite No. 270.
Install lockplate.

23 12 083 REPLACING RADIAL OIL SEAL FOR SELECTOR SHAFT

Unscrew exhaust pipes on manifold (see 18 00 020).
Unscrew propeller shaft (see 23 00 022).
Unscrew output flange (see 23 12 053).
Engage 3rd gear.
Push away locking sleeve (1) and drive out cylindrical pin (2).

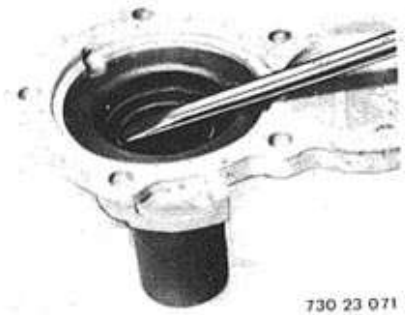


Lift out radial oil seal.



Lubricate sealing lip of radial oil seal with oil.
Drive in radial oil seal with Special Tool 23 1 240.

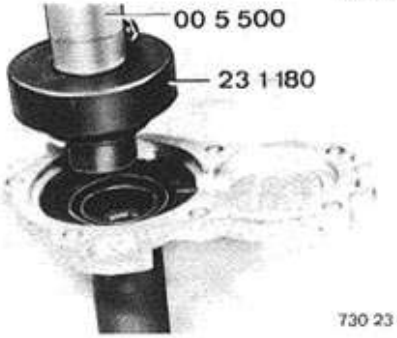
* See Specifications



730 23 071

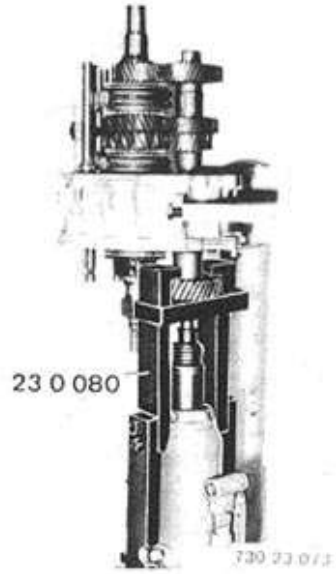
23 12 503 REPLACING RADIAL OIL SEAL FOR INPUT SHAFT
– Transmission Removed –

Remove cover with guide tube, see 23 11 623.
Lift out radial oil seal.



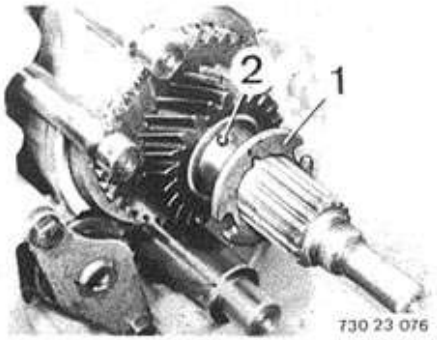
730 23 072

Drive in radial oil seal against stop with Special Tool 23 1 180 used in conjunction with Special Tool 00 5 500.
Open end faces transmission:
Lubricate sealing lip with oil.

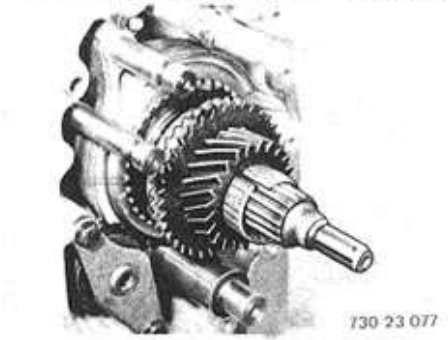


23 21 503 REMOVING AND INSTALLING INPUT AND OUTPUT SHAFT ASSEMBLY
– Front and Rear Transmission Case Sections Removed –

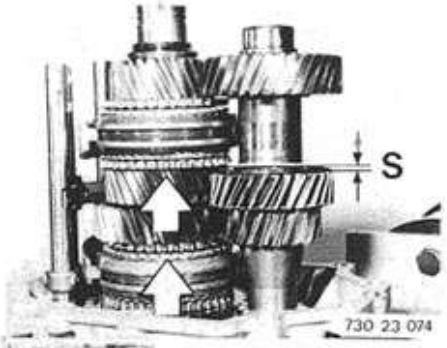
Swing down output shaft.
Pull 5th gear wheel off of layshaft with Special Tool 23 0 080.
This also pulls off the bearing inner race.
Pressing off force*
Caution!
Prevent pulling off tool from falling down.



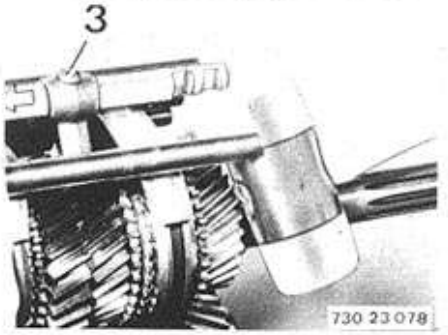
Take off washer (1) and ball (2).



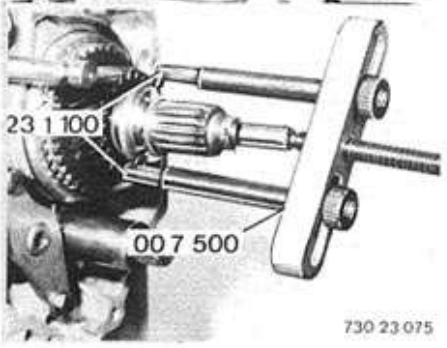
Pull off 5th gear wheel with synchromesh ring and split needle bearing.



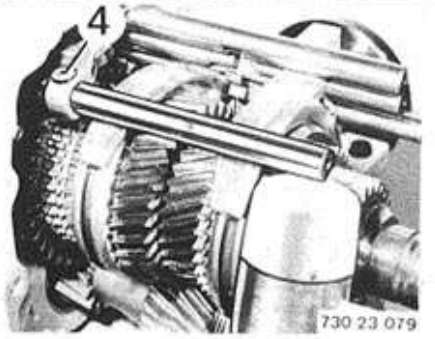
Important!
When installing 5th gear always remember to provide play (S) between 3rd gear and layshaft, to avoid damaging the 3rd gear wheel.
Push up output shaft if necessary.



Remove needles on selector shaft.
Drive out pin (3) in selector shaft, while counterholding.
Pull out selector shaft toward rear.
Remove selector arm.
Installation:
Replace pin.

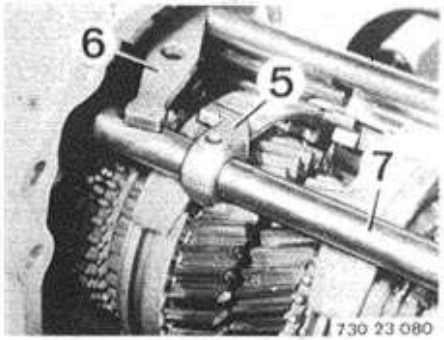


Pull bearing inner race off of output shaft with Special Tools 23 1 100 and 00 7 500.

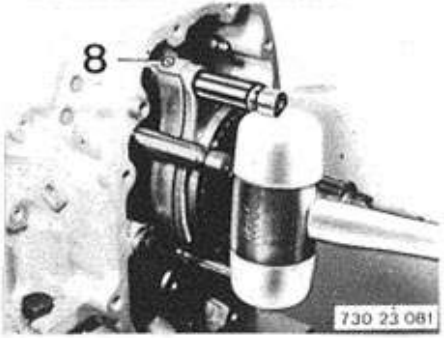


Engage 2nd gear.
Drive out pin (4), while counterholding.
Installation:
Replace pin.

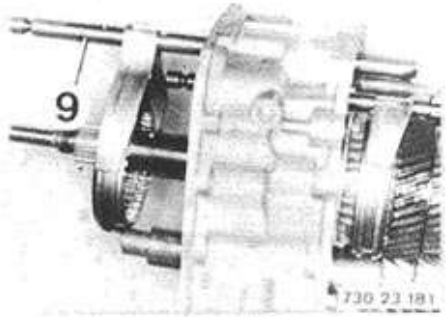
* See Specifications



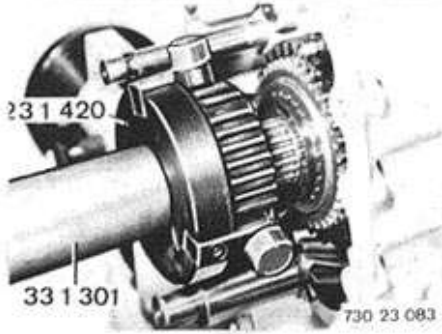
Pull or take off turning lock (5) and reversing lever (6)
Pull out selector rail (7) forward.
Disengage second gear.



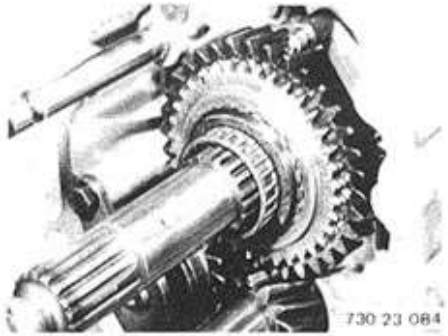
Pull out 5th gear selector rod with selector fork and operating sleeve toward rear far enough, that pin (8) can be driven out while counterholding.
Important!
Loose balls, springs and slides.
Installation:
Replace pin.



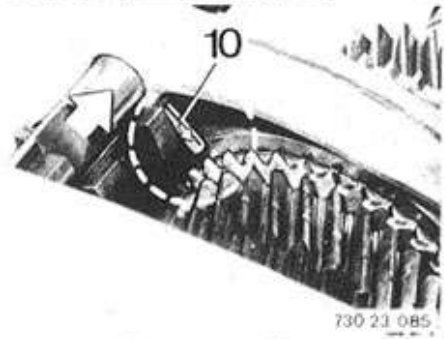
Pull off operating sleeve and fifth gear selector fork.
Pull out selector rod (9) forward.
Important!
Loose balls.



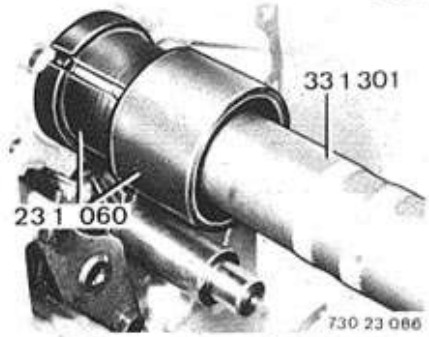
Pull guide sleeve and bearing inner race off of output shaft with Special Tools 23 1 420 and 33 1 301.
Important!
Hold knurled head bolts in recesses of guide sleeve with a pliers.



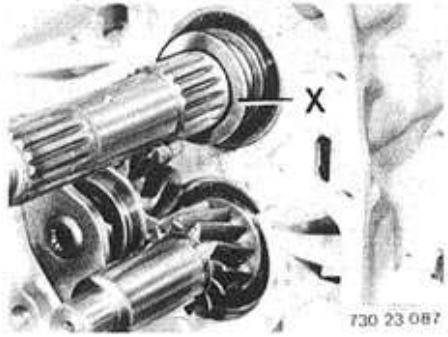
Pull off reverse gear and needle bearing.



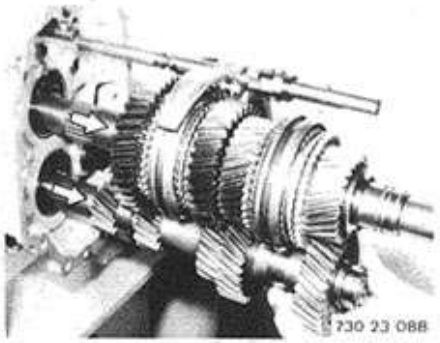
Engage third gear.
Drive out pin (10).
Important!
Drive in pin on to tooth of 3rd gear wheel until selector rod can be pulled out forward.
Remove 3rd/4th gear selector fork.
Loose balls.
Installation:
Replace pin.



Pull out output shaft toward rear far enough, that bearing inner race can be pulled off with Special Tools 23 1 060 and 33 1 301.

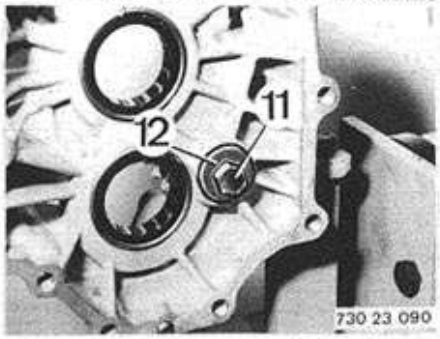


Remove shim X.
Installation:
Determine thickness of shim X (see 23 21 554).

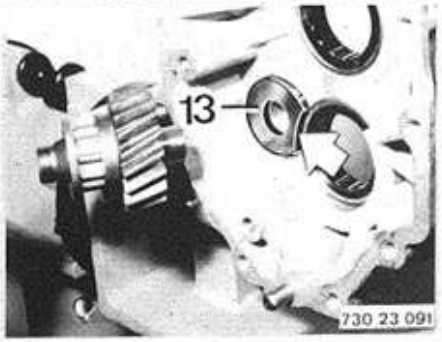


Pull out input and output shaft assembly with layshaft and 1st/2nd gear selector rod in intermediate case.
Important!
Loose balls.

Detach holder.



Unscrew bolt (11), while counterholding on front of shaft.
Installation:
Install bolt with Loctite No. 270.
Tightening torque*.
Remove washer (12).

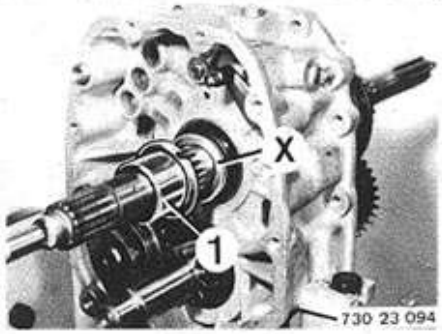


Knock out reverse gear shaft.
Installation:
Check installed position of thrust washer (13).
Check needle bearing, replacing if necessary.
Check condition of all bearings, replacing if necessary (see 23 21 703).

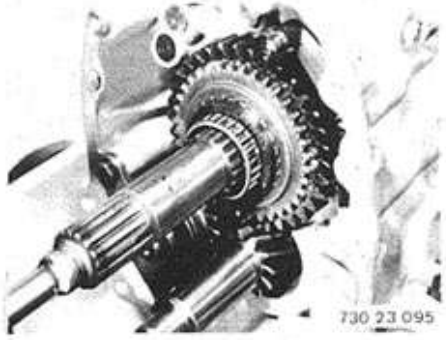
* See Specifications

Installation:
Install and mount reverse gear.
Stepped collar of reverse gear faces out.
Tightening torque*.

Install input shaft, ouput shaft and layshaft in intermediate case.

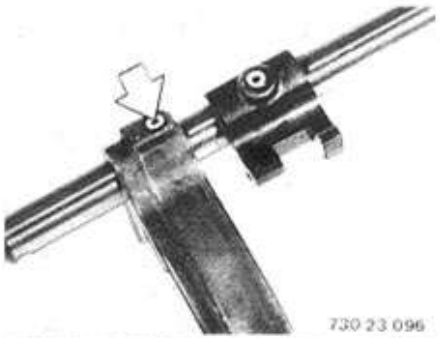


Install shim X.
Heat bearing sleeve (1) to approx. 80° C (175°F) and install on output shaft.
Heat with a hot air blower.

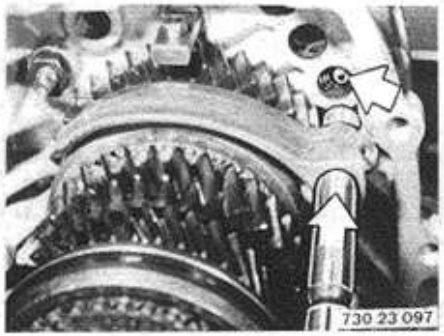


Install needle bearing and reverse gear.
Install synchromesh ring.

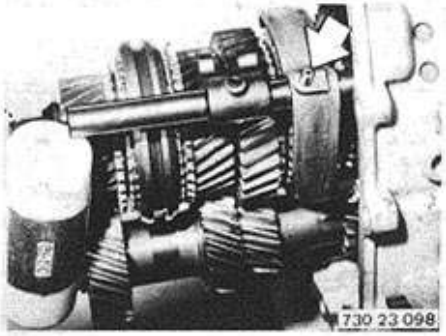
* See Specifications



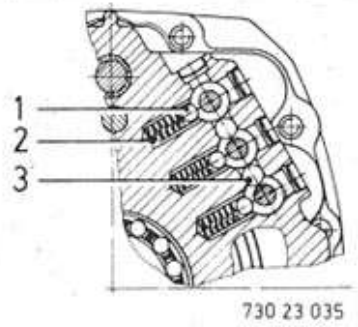
Drive pin out of 1st/2nd gear selector rod.
Installation:
Replace pin.



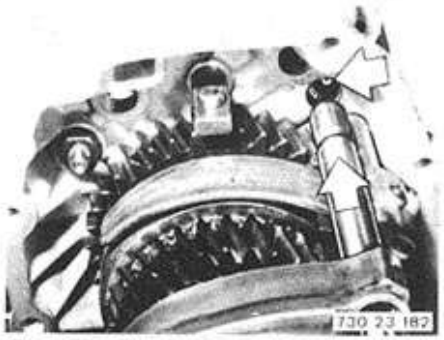
Mount 1st/2nd gear selector fork.
Push in 1st/2nd gear selector rod up to spring.
Insert locking balls and press down.
Push in selector rod against arrest in this position.



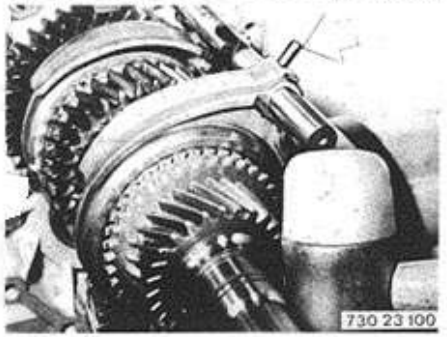
Drive in 6 x 32 mm pin, while counterholding.



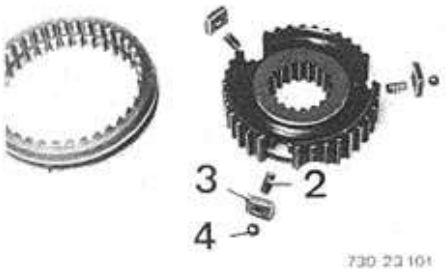
Layout of Selector Arrest:
1 Locking ball
2 Spring
3 Detent ball



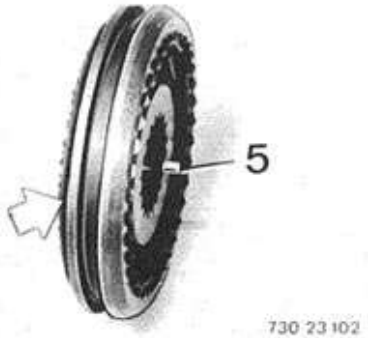
Mount 3rd/4th gear selector fork.
Insert detent ball.
Push in selector rod up to spring.
Insert locking balls and press down.
Push in selector rod against arrest in this position.



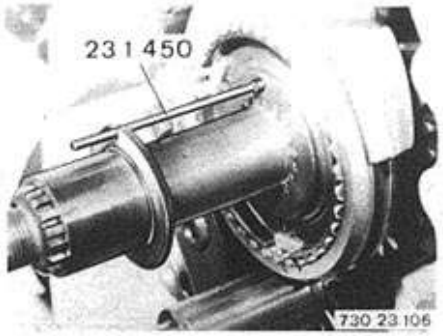
Drive in 6 x 26 mm pin, while counterholding.



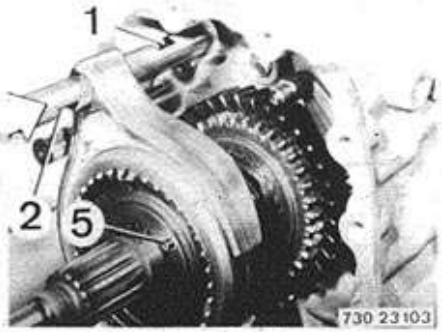
Assemble synchronizer.
Installed Order:
Springs (2), thrust parts (3) and balls (4).
Curved surface of thrust parts (3) faces operating sleeve.



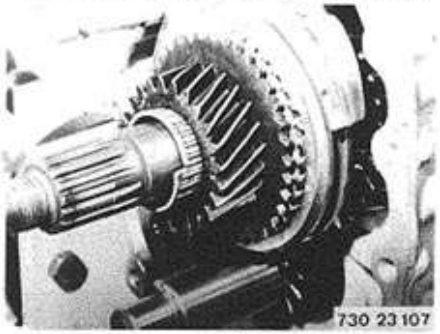
Important!
Stepped end of sliding sleeve must be opposite centering pin (5).



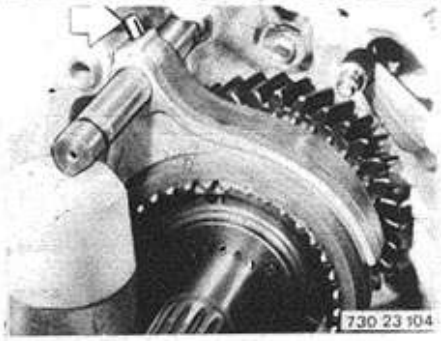
Place Special Tool 23 1 450 in centering pin.
Heat bearing sleeve to approx. 80° C (175° F) with a hot air blower and push on to output shaft.



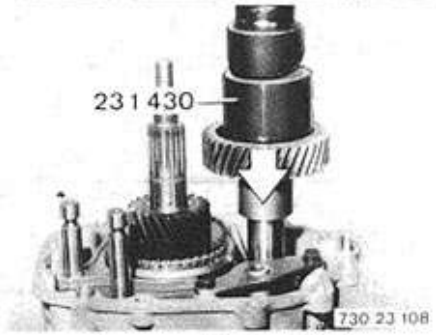
Install guide sleeve.
Centering pin (5) faces 5th gear.
Install 5th/reverse gear selector fork.
Install detent ball.
Push in selector rod up to spring.
Insert locking balls and press down.
Push in and turn selector rod that openings (1 and 2) are always opposite locking balls.



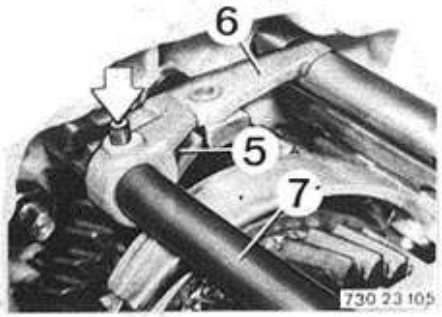
Install split needle bearing, synchromesh ring and fifth gear.



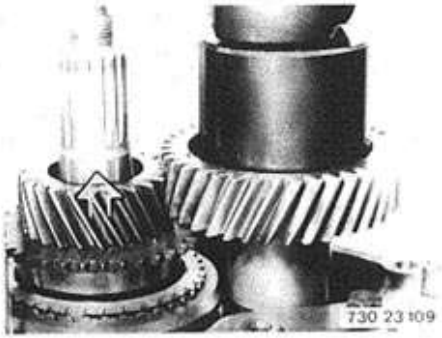
Push in selector rod far enough that 6 x 26 mm pin can be driven in, while counterholding.
Push in selector rod and guide sleeve against arrest.



Detach intermediate case on mounting bracket and set up on a press.
Lubricate pressing surface of layshaft with oil.
Heat 5th gear uniformly to correct temperature* with a hot air blower.
Press on 5th gear to fit tight with Special Tool 23 1 430.
Pressing on force*.

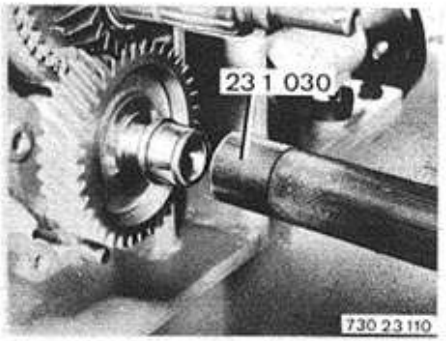


Install reversing lever (6).
Smooth side faces down.
Insert selector rail (7).
Push on turning lock (5).
Lock with 6 x 26 mm pin.

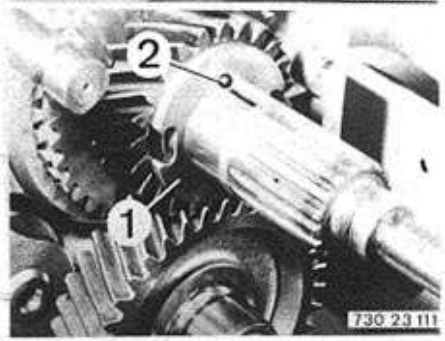


Important!
Lift and turn 5th gear until teeth mesh.

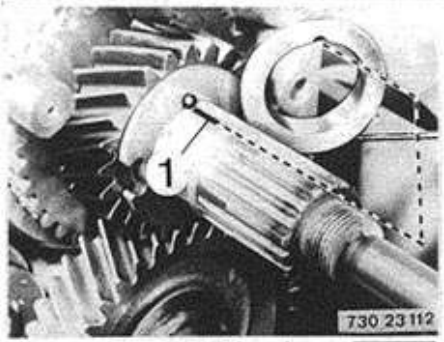
* See Specifications



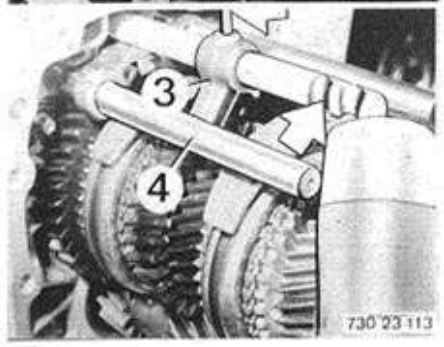
Heat bearing inner race to approx. 80° C (175° F) with a hot air blower and install on layshaft.
If necessary, drive on with Special Tool 23 1 030.
Collar of bearing race faces gear.



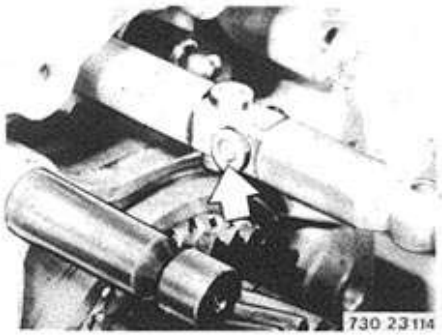
Insert ball (2) with grease.
Push on washer (1).



Installation:
Heat ball bearing inner races to approx. 80° C (175° F) with a hot air blower and install on output shaft.
Important!
Turning lock.
Opening in bearing inner race must engage in ball.
Draw line (1) to make installation of bearing race easier.

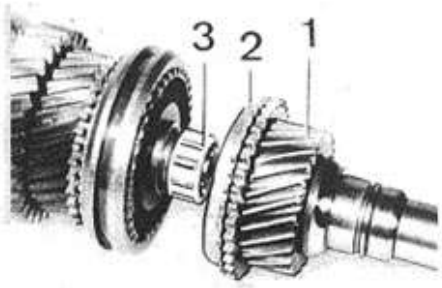


Install selector shaft, while pushing on selector arm (3) with long finger facing 3rd/4th gear selector rod.
Important!
Arrest on selector shaft faces selector rail (4).
Drive in 6 x 32 mm pin, while counterholding.



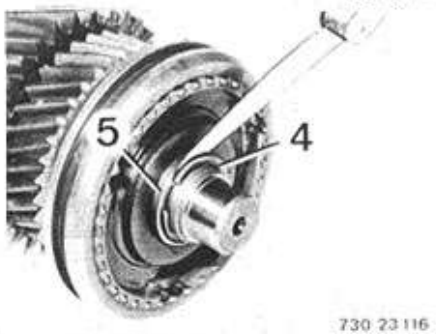
Hold four rollers in position on selector shaft with grease.

23 21 554 REPLACING OUTPUT SHAFT
– Output Shaft Removed –



730 23 115

Pull off input shaft (1), synchromesh ring (2) and needle bearing (3).

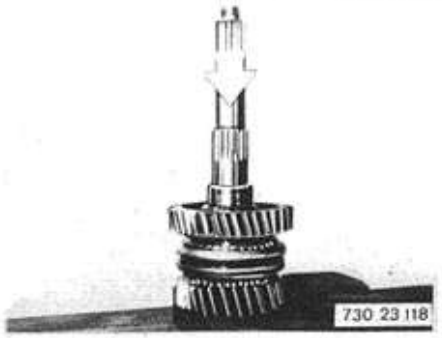


730 23 116

Remove snap ring (4).
Remove washer (5).
Installation:
Adjust play between snap ring and guide sleeve to 0 ... 0.09 mm (0 to 0.0035").
Always replace snap ring.


730 23 117

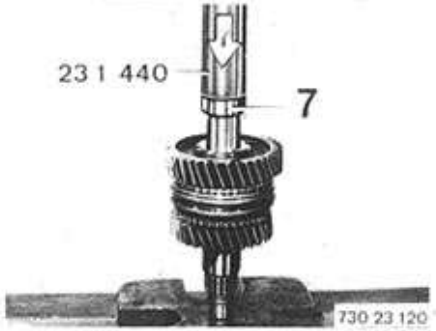
Pull off guide sleeve, synchromesh ring, 3rd gear and needle bearing.


730 23 118

Press 2nd gear, needle bearing, synchromesh ring, guide sleeve, synchromesh ring, 1st gear, needle bearing with bearing sleeve and bearing inner race off of output shaft.
Check condition of all bearings, replacing if necessary.
Check synchromesh rings (see 23 23 505).


730 23 119

Install needle bearing, 2nd gear, synchromesh ring and guide sleeve with offset groove facing 1st gear.
Install bearing sleeve and needle bearing in 1st gear.
Install synchromesh ring.
Press in output shaft.
Important!
Guide in synchromesh ring with tabs in sliding sleeve.

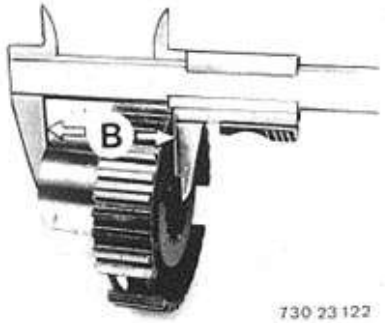


730 23 120

Heat bearing inner race (7) to approx. 80° C (175° F) with a hot air blower and install on output shaft, pressing on with Special Tool 23 1 440 if necessary.

730 23 121

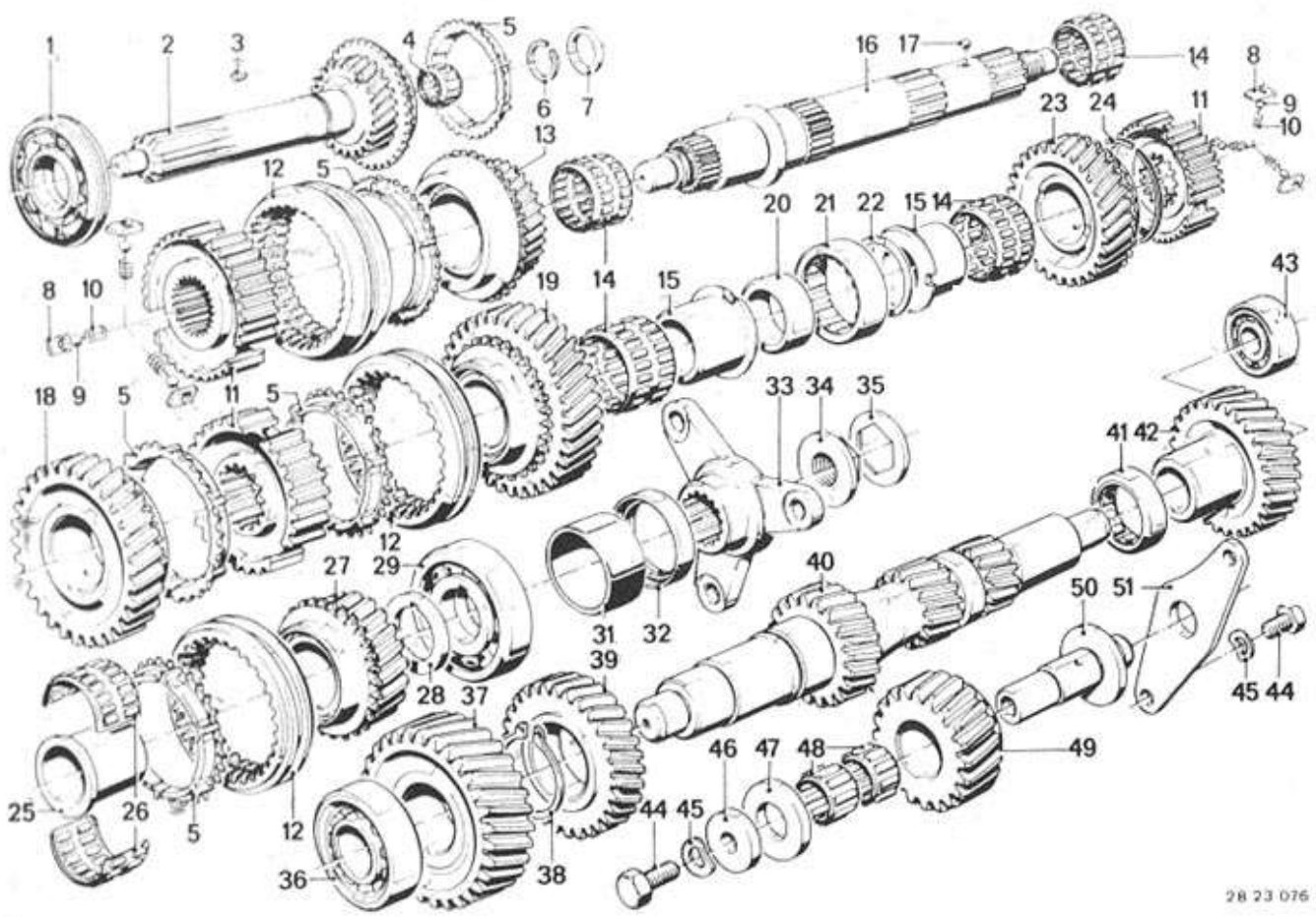
Determine thickness of shim X.
Measure distance (A) from collar of output shaft to bearing inner race.



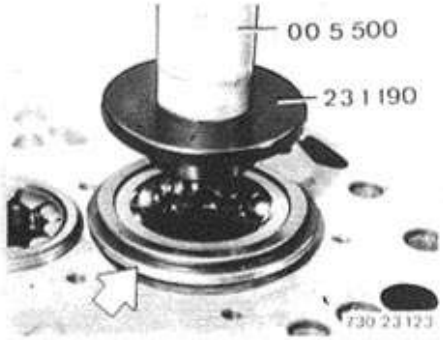
730 23 122

Place bearing sleeve for reverse gear in guide sleeve.
Measure distance (B) from collar of guide sleeve to bearing sleeve.
Example:

	A	52.2 mm (2.056")
–	B	52,0 mm (2.047")
	X	0.2 mm (0.008") shim thickness



1 Ball bearing
2 Input shaft with 4th gear
3 Turning lock
4 Needle bearing
5 Synchromesh ring
6 Snap ring
7 Washer
8 Thrust part
9 Ball
10 Spring
11 Guide sleeve
12 Sliding sleeve
13 3rd gear
14 Needle bearing
15 Bearing sleeve
16 Output shaft
17 Ball
18 2nd gear
19 1st gear
20 Bearing race
21 Roller bearing
22 Shim X
23 Reverse gear
24 Circlip or synchromesh ring
25 Bearing sleeve
26 Split needle bearing
27 5th gear
28 Washer
29 Ball bearing
30 Washer
31 Speedometer drive gear
32 Radial oil seal
33 Output flange
34 Collar nut
35 Lockplate
36 Roller bearing
37 4th gear
38 Circlip
39 3rd gear
40 Layshaft
41 Roller bearing
42 5th gear
43 Roller bearing
44 Bolt
45 Washer
46 Washer
47 Thrust washer
48 Needle bearing
49 Reverse gear
50 Bearing shaft
51 Bearing holder

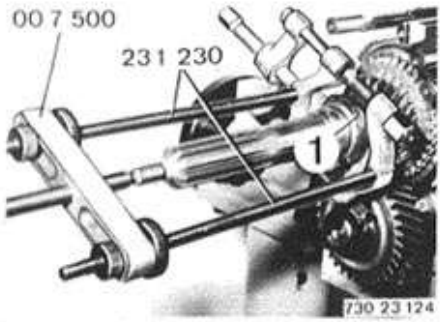


23 21 703 REPLACING BEARINGS OF ALL TRANSMISSION SHAFTS

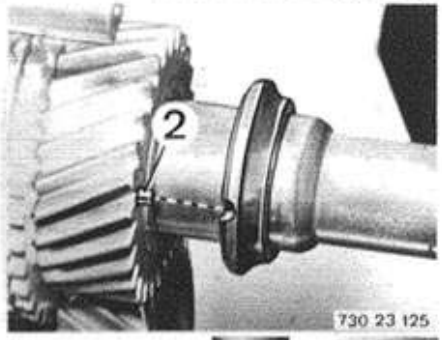
– Transmission Removed –

A) Input Shaft, Layshaft in Case Front Section:

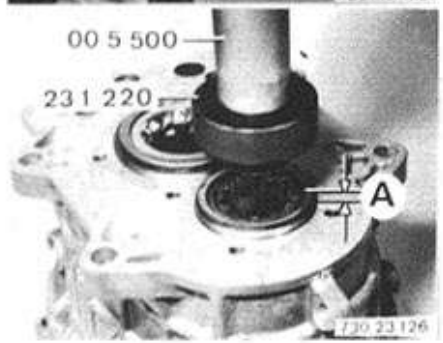
Remove case front section 23 11 013.
Drive ball bearing out of and into case with Special Tools 23 1 190 and 00 5 500.
Important!
Install ball bearing that collar faces out.



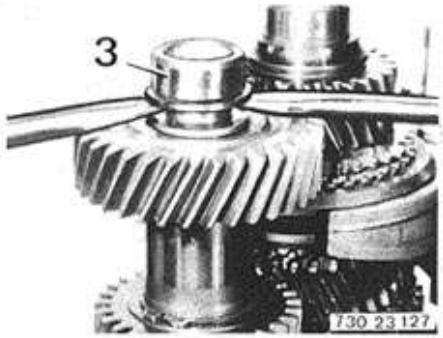
Pull bearing inner race (1) off of input shaft with Special Tools 23 1 230 and 00 7 500.



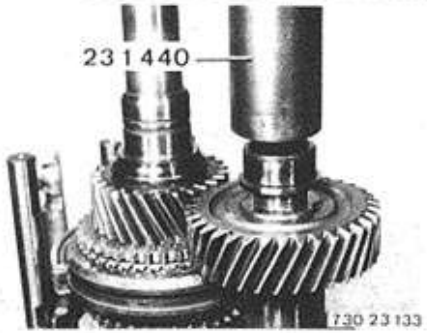
Installation:
Heat bearing inner race to approx. 80° C (175° F) with a hot air blower and install on input shaft.
Important!
Turning lock.
Pin (2) must be in opening of bearing inner race.



Drive layshaft roller bearing out and in with Special Tools 23 1 220 and 00 5 500.
Protrusion A = approx. 5 mm (0.197").
Install roller bearing that open end faces in.



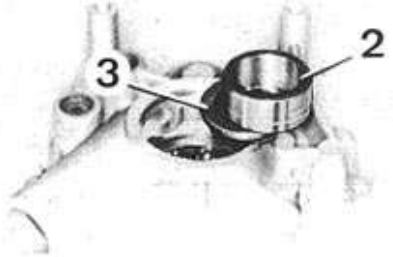
Press bearing inner race (3) off of layshaft with a screwdriver.

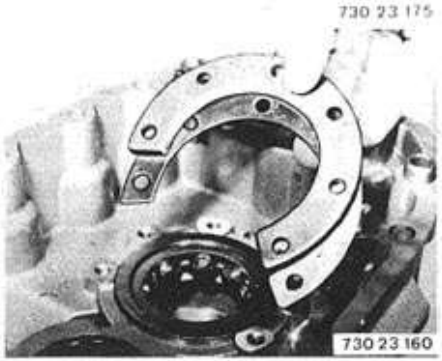


Installation:
Heat bearing inner race to approx. 80° C (175° F) and install on layshaft, driving on to fit tight with Special Tool 23 1 440 if necessary.
Collar of bearing inner race faces gear.

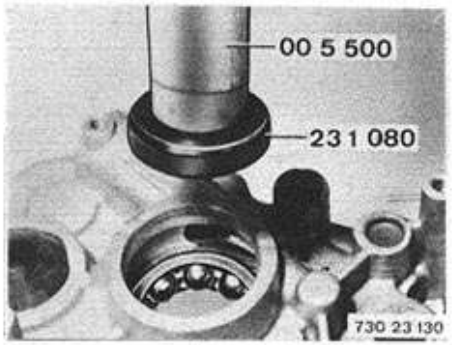
B) Output Shaft, Layshaft in Case Rear Section:

Remove case rear section 23 11 022.
Lift out radial oil seal.
Remove spacer (2) and bearing inner race (3).

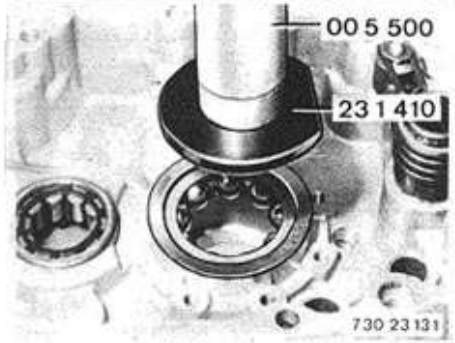




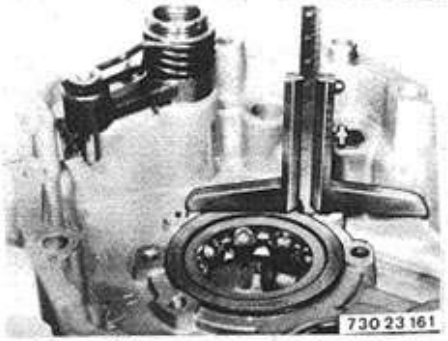
Unscrew bolts.
Remove bearing holder.



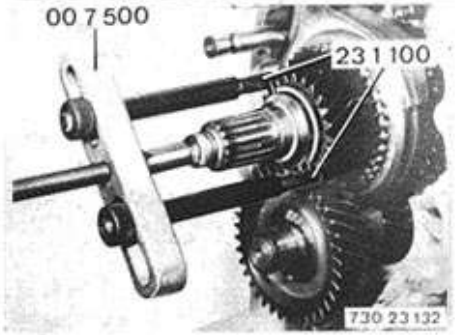
Drive out ball bearing with Special Tools 23 1 080 and 00 5 500.



Drive in ball bearing with Special Tools 23 1 410 and 00 5 500.

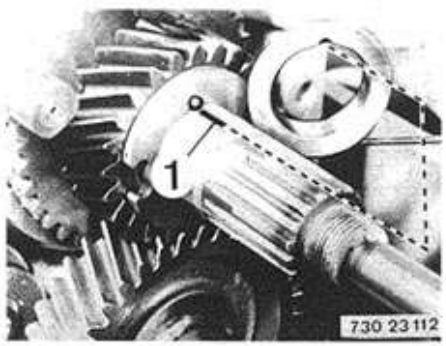


Adjust play between bearing holder and case rear section with shims.
Mount bearing holder.
Tightening torque*.

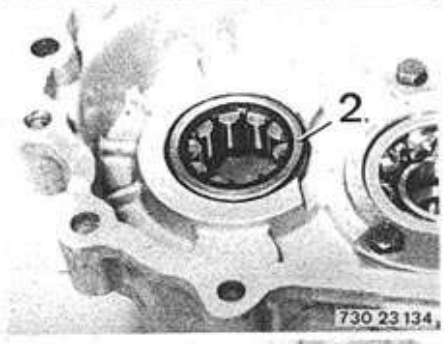


Pull ball bearing inner race off of output shaft with Special Tools 23 1 100 and 00 7 500.

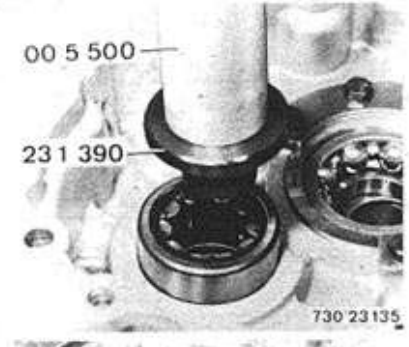
* See Specifications



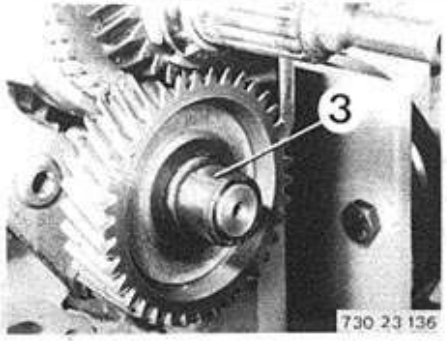
Installation:
Heat ball bearing inner race to approx. 80° C (175° F) with a hot air blower and slide on to output shaft.
Important!
Opening in bearing inner race must engage in ball.
Draw line (1) to make installation of bearing race easier.



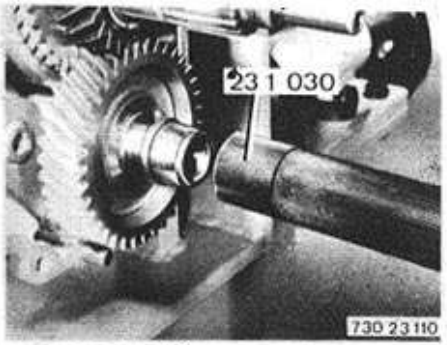
Heat case rear section to approx. 80° C (175° F) with a hot air blower.
Lift out roller bearing (2).
Installation:
Inert bearing that large diameter end of plastic cage faces up.



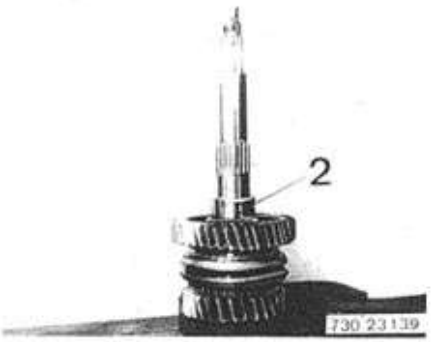
Heat case rear section to approx. 80° C (175° F) with a hot air blower.
Install roller bearing, driving in with Special Tools 23 1 390 and 00 5 500.



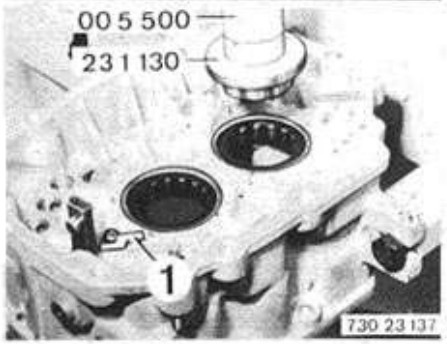
Bearing inner race (3) can only be pulled off together with the 5th gear (see 23 21 503).



Heat new bearing inner race to approx. 80° C (175° F) with a hot air blower and install on layshaft, driving on with Special Tool 23 1 030 if necessary.
Collar of bearing race faces gear.

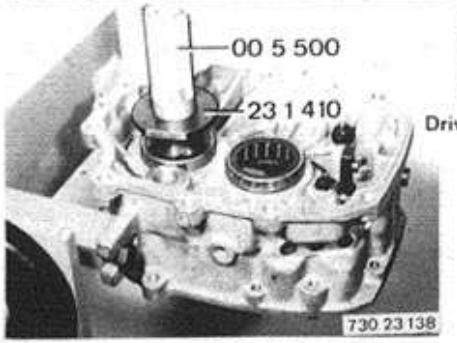


Check condition of bearing inner race (2) on output shaft, replacing if necessary.
If replacement is necessary, press gear set off of output shaft (see 23 21 554).



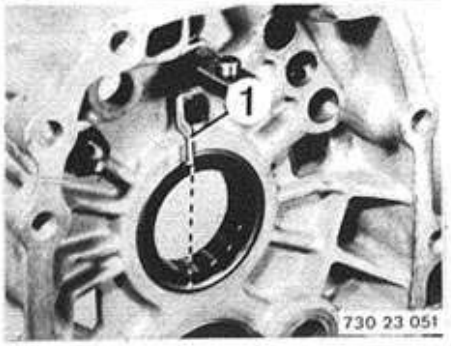
C) Output Shaft, Layshaft in Intermediate Case:

Remove input and output shaft assembly 23 21 503.
Drive roller bearings for input shaft and layshaft out of intermediate case with Special Tools 23 1 130 and 00 5 500.
Important!
Unscrew and turn oil plate (1) in case of roller bearing for output shaft.

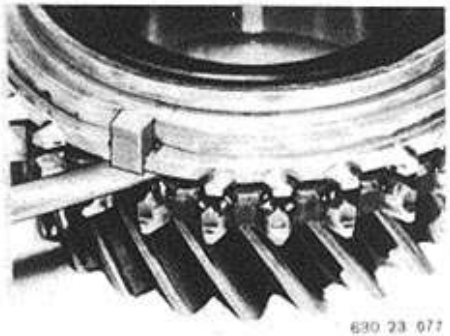


Drive roller bearings for output shaft and layshaft into intermediate case with Special Tools 23 1 410 and 00 5 500.
Drive in roller bearings flush.

Drive



Bolt down oil plate (1) in vertical installed position.



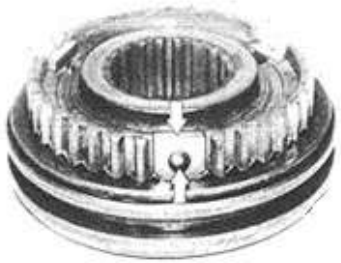
630 23 677

23 23 505 DISASSEMBLING/ASSEMBLING COMPLETE SYNCHRONIZATION
– Output Shaft Removed –

Disassemble output shaft (see 23 21 554).
All synchromesh rings are identical and coated with molybdenum on the inside.
Check distance* between synchromesh ring and clutch.
Measure in area of stops.
Synchromesh rings should bear uniformly all around.

635 23 137

Disassemble synchronization.
Pressure piece (1)
Soring (2)
Ball (3)
Installation:
Bore (4) in operating sleeve must be aligned with ball (3).



630 23 575

Installation:
Install all springs, pressure pieces and balls.
Important!
Curved surface of pressure pieces faces th operating sleeve.
Install guide sleeve that half of it is in the operating sleeve.
Press in balls far enough until the guide sleeve can be pressed into the operating sleeve.

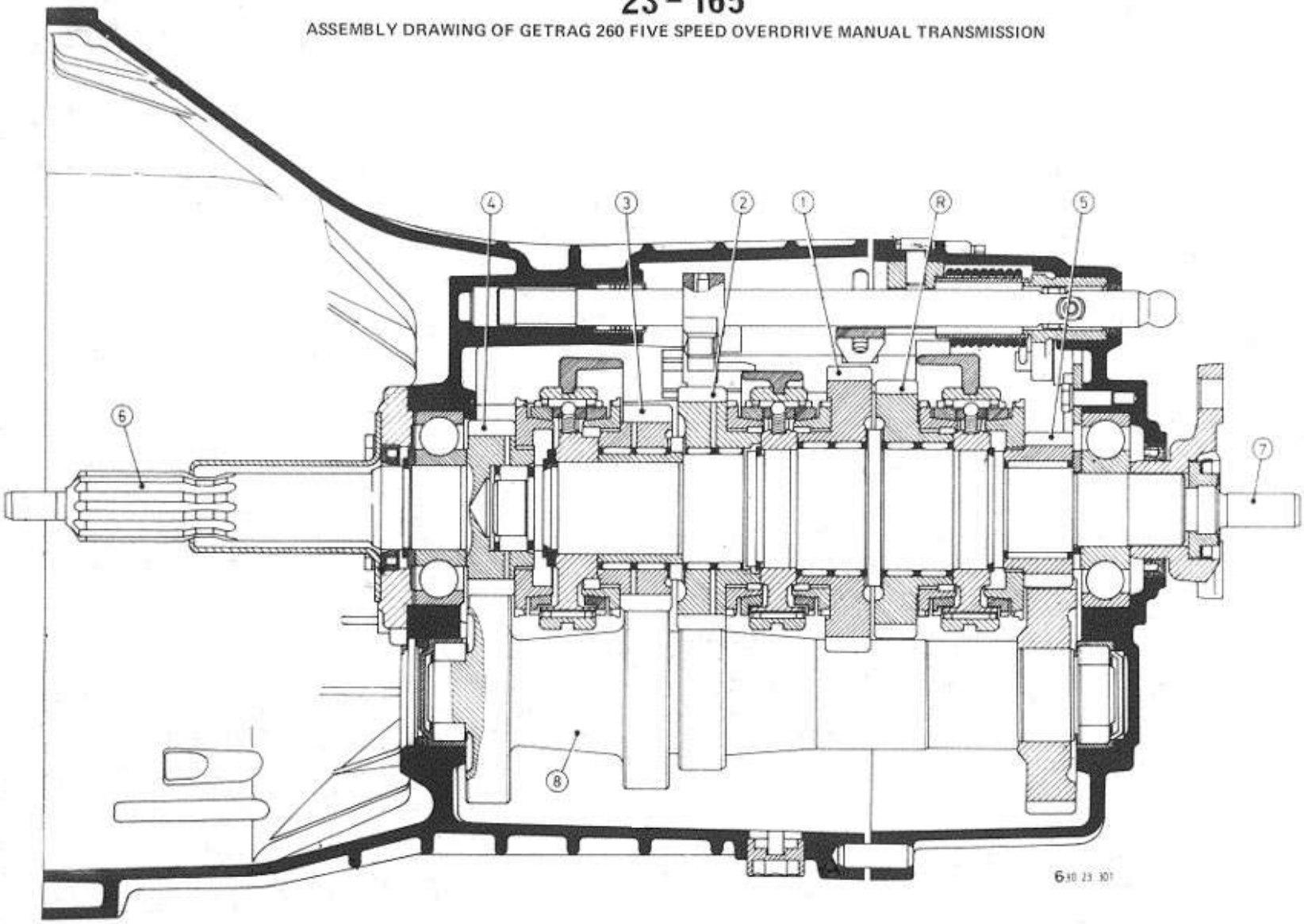
* See Specifications

Condition	Cause	Correction
Oil on clutch housing	a) Guide flange leaks b) Radial oil seal for input shaft leaks c) Gasket on end cover (crankcase) leaks d) Radial oil seal for crankshaft leaks	a) Seal guide flange b) Replace radial oil seal 23 12 503 c) Replace gasket d) Replace radial oil seal 11 14 605
Oil on output flange	a) Radial oil seal for output shaft leaks b) Radial oil seal for selector shaft leaks	a) Replace radial oil seal 23 12 053 b) Replace radial oil seal 23 12 083
Transmission leaks between front and rear sections	a) Gasket defective	a) Replace gasket
Oil on vent	a) Oil level too high b) Wrong oil (excessive foaming)	a) Correct oil level b) Replace oil
Gear does not hold - jumps out	a) Worn sliding sleeve, defective slides, broken springs b) Inversely installed sliding sleeve (1st/2nd gear) c) Shift console loose d) Selector fork worn e) Output flange loose	a) Replace damaged parts 23 23 505 b) Install sliding sleeve correctly 23 21 554 c) Tighten shift console d) Replace selector fork e) Tighten output flange

TROUBLESHOOTING MANUAL TRANSMISSION

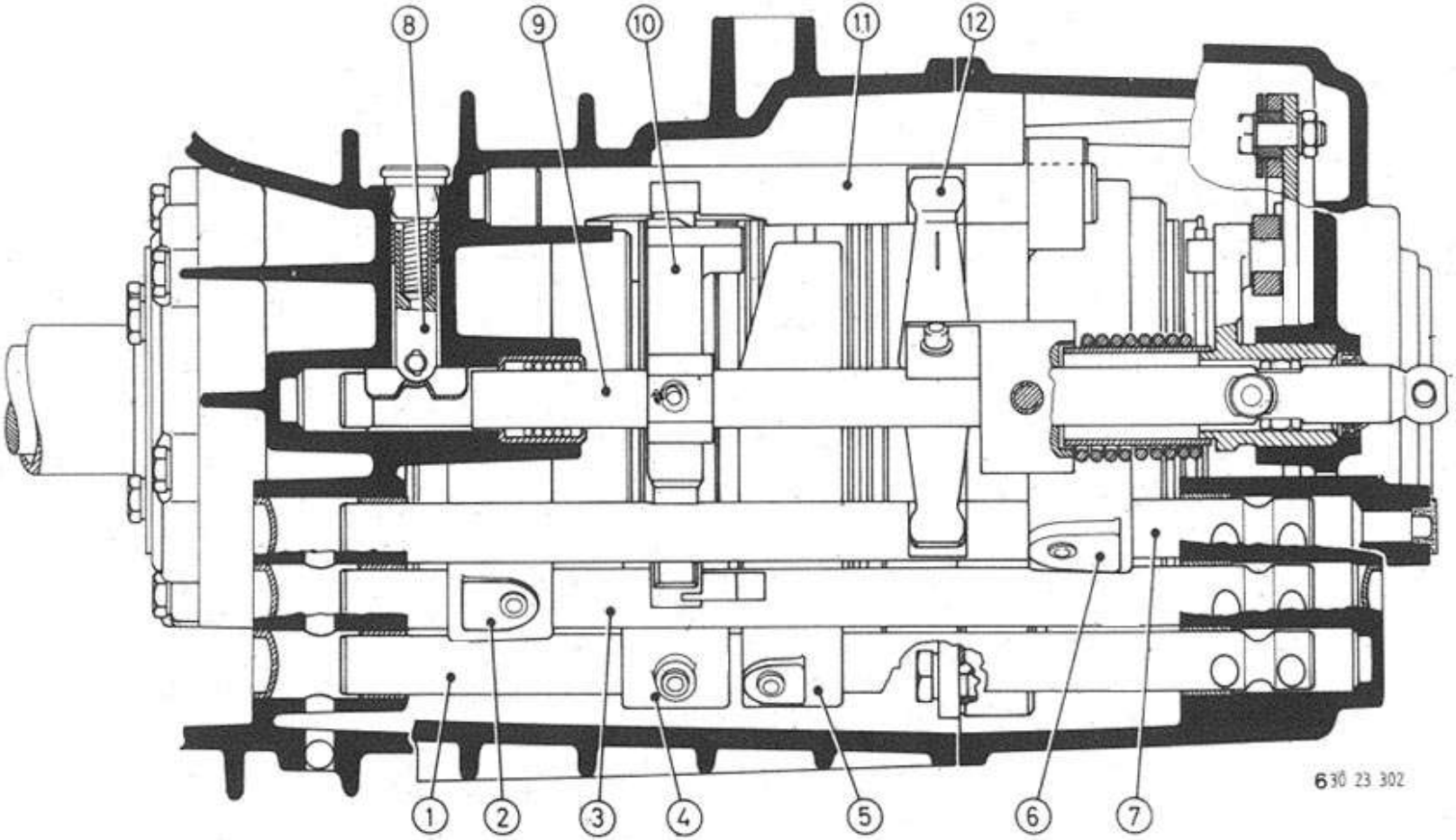
Condition	Cause	Correction
Hard moving, sticking (scratching) shifts	a) Clutch disengagment insufficient 1. Pedal travel insufficient 2. Drive plate worn 3. Liner stuck on flywheel 4. Drive plate seized on transmission input shaft 5. Bearing for transmission input shaft in crankshaft defective 6. Air in clutch hydraulic system b) Thick, viscous gear lube c) Excessive play in selector lever bearings d) Selector fork worn e) Sliding sleeve worn	a) 1 Check pedal travel, adjusting if necessary. Remove excessively thick mats. Floor clutch when shifting. 2. Replace drive plate 21 21 000 3. Clean flywheel, replace drive plate 4. Service or replace drive plate 21 21 000 5. Replace bearing in crankshaft 11 21 571 6. Bleed clutch 21 00 006 b) Use 10 W-50 engine oil in cold climates or sticking on cold transmission c) Check selector lever bearings (shift console mounting), replacing worn ball plates if necessary 25 11 041 d) Replace selector fork e) Replace sliding sleeve 23 23 505
Transmission scratches when shifting	a) Clutch disengagement insufficient b) Synchromesh rings worn, sliding sleeve worn c) Reverse gear: 3 sec. shift pause not made	a) See above b) Check synchronization, replace damaged parts 23 23 505 c) Make shift pause
Transmission loud	a) Oil level too low b) Transmission shaft bearings defective c) Damaged gears d) Needle bearings of output and input shafts defective e) Bearing for transmission input shaft in crankshaft defective	a) Correct oil level b) Replace all bearings 23 23 703 c) Replace gear wheel set or gear assembly d) Replace needle bearings e) Replace bearing in crankshaft 11 21 571

ASSEMBLY DRAWING OF GETRAG 260 FIVE SPEED OVERDRIVE MANUAL TRANSMISSION

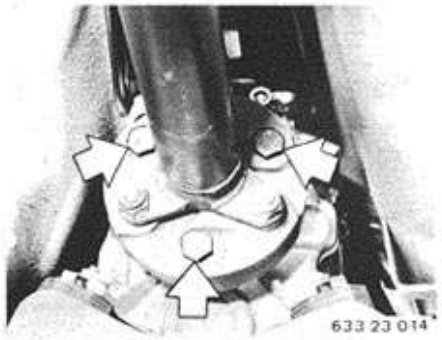


1 First gear
2 Second gear
3 Third gear
4 Fourth gear
5 Fifth gear
6 Reverse gear
6 Input shaft
7 Output shaft
8 Layshaft

ASSEMBLY DRAWING OF SHIFT PARTS FOR GETRAG 260 FIVE SPEED OVERDRIVE MANUAL TRANSMISSION

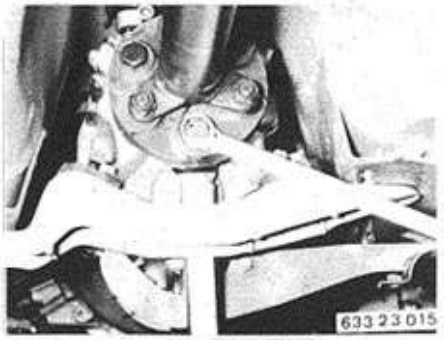


1 Selector rod – 1st/2nd gear
2 Selector fork – 3rd/4th gear
3 Selector rod – 3rd/4th gear
4 Dog
5 Selector fork – 1st/2nd gear
6 Selector fork – reverse/5th gear
7 Selector rod – reverse/5th gear
8 Lockpin
9 Selector shaft
10 Selector arm
11 Selector rail
12 Operating lever

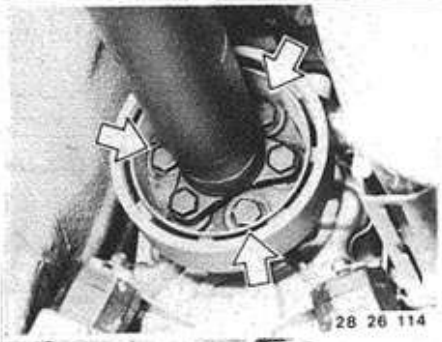


23 00 022 REMOVING AND INSTALLING TRANSMISSION

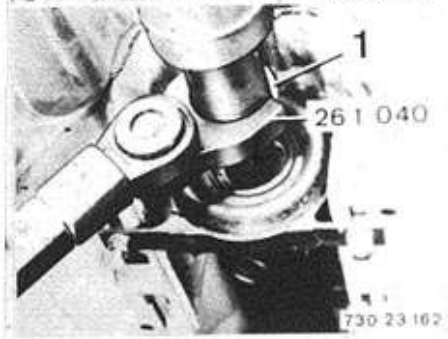
Remove exhaust assembly – 18 00 020.
Remove the heat shield.
Unscrew coupling on the transmission.



Installation:
Replace stop nuts.
Tighten nuts with a standard 19 mm socket and a torque wrench.
Tightening torque*.
Important!
Only tighten the nuts (never the bolts) to avoid stress in the coupling.

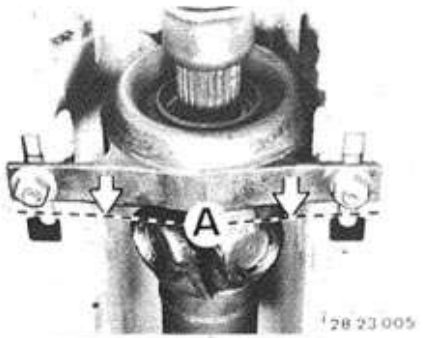


Version with Vibration Damper:
The vibration damper is mounted in the drive flange together with the coupling mounting bolts.
Turn the vibration damper and pull it back over the output flange before pulling the propeller shaft off of the guide pin.
The vibration damper is pulled off together with the propeller shaft.

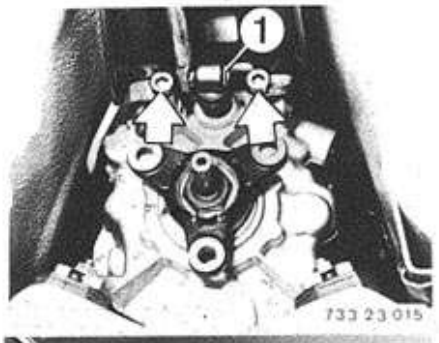


Version with Screw-On Ring:
Loosen the screw-on ring (1) several turns.
Installation:
Tighten the screw-on ring (1) with Special Tool 26 1 040 after finishing installation.
Tightening torque*.

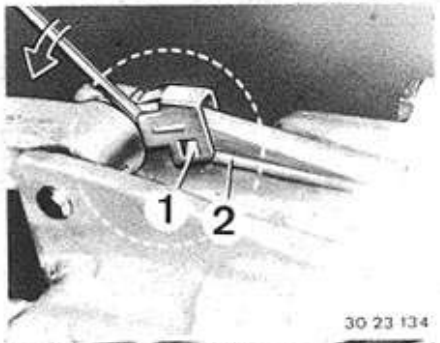
* See Specifications



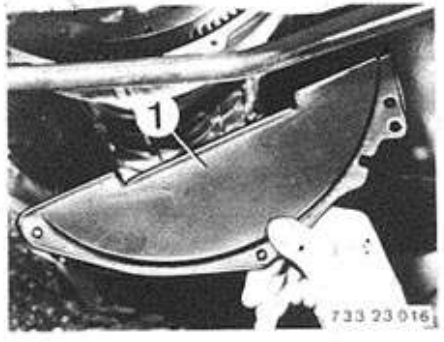
Unscrew the center mount.
Installation:
Preload the center mount forward by distance A = 4 to 6 mm (0.157 to 0.236").
Tightening torque*.
Bend the propeller shaft down and pull it off of the centering pin.
Important!
Suspend the propeller shaft from the car on a piece of wire.



Pull off wires on the reverse gear switch.
Unscrew the shift console on the transmission.
Important!
Self-locking bolts – these bolts will be hard to unscrew.
Installation:
Always replace the self-locking bolts.
When tightening, make sure that brackets are horizontal to the shift console (shift lever noise).
Tightening torque*.
Lift out retainer (1).
Remove the washer.
Pull out the selector rod.

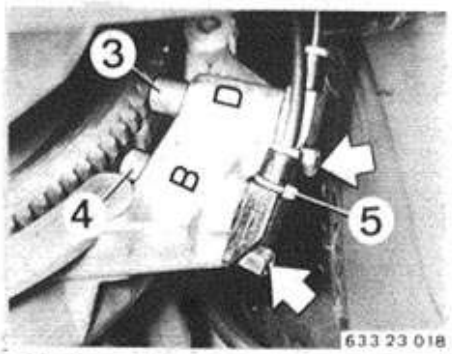


Version with Selector Arm:
Lift out spring (1) from tab (2) on the case with a screwdriver and swing it up.
Pull out the shaft pin.
Installation:
Lubricate the shaft pin lightly with Molykote Longterm 2.

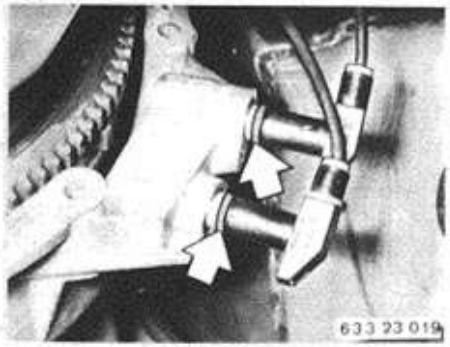


Only for Version with Cover:
Unscrew cover (1).

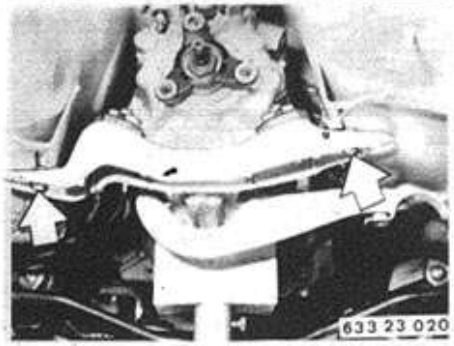
* See Specifications



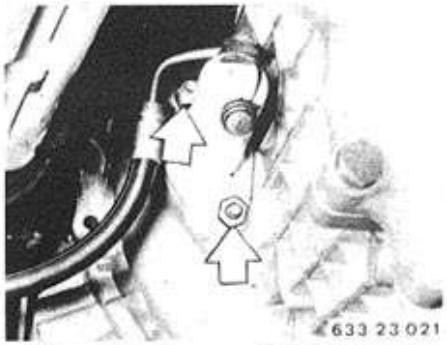
Version with DME:
Unscrew the bolts.
Pull out speed sensor (3) and reference mark sensor (4).
Important! – Installation:
Check the installed position.
Plugs must not be mixed up.
Install speed sensor (3) in bore (D) and reference mark sensor (4) with ring (5) in bore (B).
The engine cannot,be started, if plugs are mixed up.



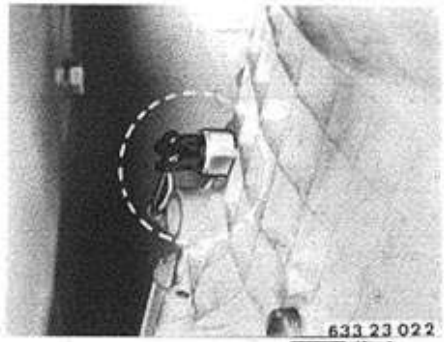
Installation:
Check the O-ring.
Install sensors with Molykote Longterm 2.
Important!
Face of DME sensors must be free of grease and dirt.



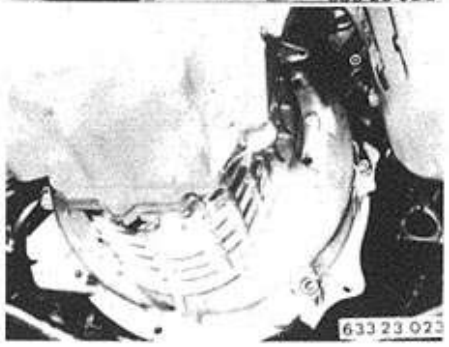
Unscrew the cross member on the body.
Installation:
Tightening torque*.



Unscrew the clutch slave cylinder.
The line remains connected.
The bleeder screw faces down.



Pull off wires on the reverse gear switch.
Lift wires out of the holders.



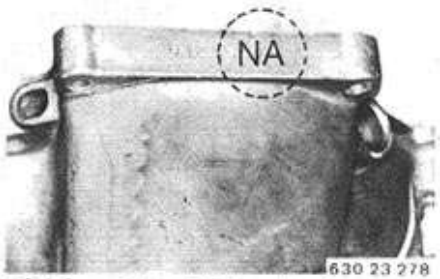
Unscrew the transmission on the engine.
Use Torx socket for the Torx bolts.
Important! – Installation:
Use washers on version with Torx bolts to avoid any increase in the breaking-loose torque.
Tightening torque*.
Remove the transmission toward the rear.
Check the oil level.

* See Specifications

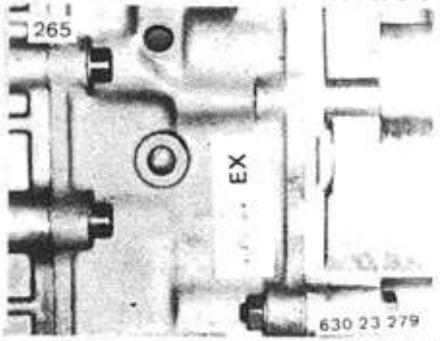
* See Specifications

242/240/260

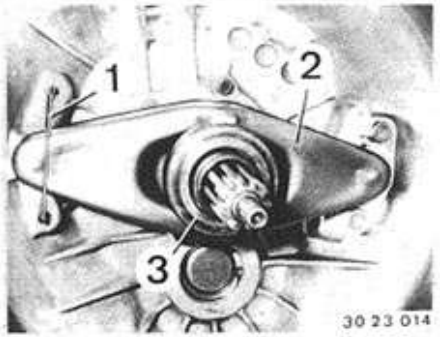
23 00 032 INSTALLING EXCHANGE TRANSMISSION



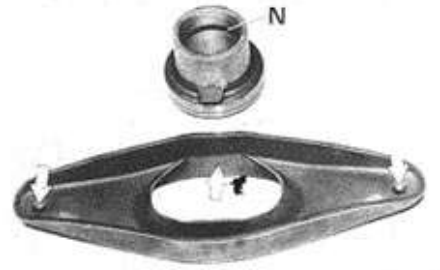
Remove transmission 23 00 022.
Transmission Identification:
BMW code* on front case section.
Transmission Type 260.



BMW code* on intermediate case section.
Transmission Type 265/Overdrive.

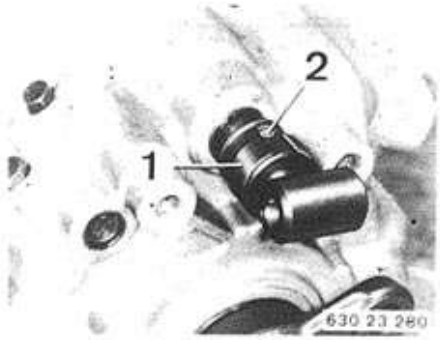


Transfer spring (1) and release lever (2) with release (3).

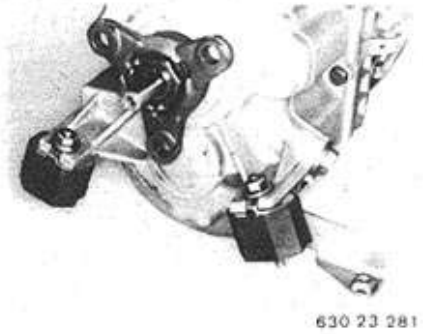


Installation:
Fill lubricating groove (N) with Molykote Longterm 2.
Lubricate guides (F) and bearings (L) with a light coat of Molykote Longterm 2.
Non-conformance could cause bearing to seize on the guide sleeve.

* See Spare Part Microfiche

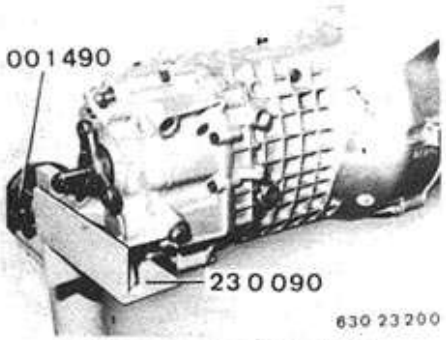


Transfer selector rod joint.
Push back locking sleeve (1)
Drive out dowel pin (2).
Note:
Check installed position of the selector rod joint.
The offset end of the selector rod joint of a Type 260 transmission is installed on the right side as seen looking forward in car, while the offset end of the selector rod joint of a Type 265 transmission is installed on the left side.



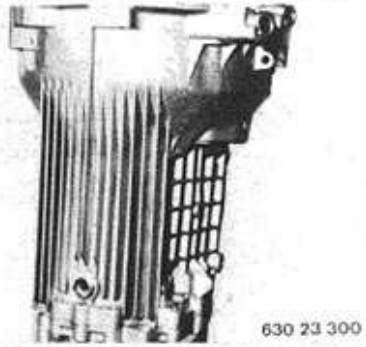
Transfer rubber mounts, exhaust carrier and backup light switch.
After Installation of Transmission:
Fill transmission with oil.
Oil volume*.

* See Specifications

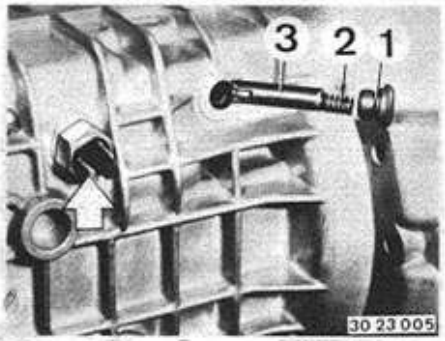


23 11 013 REMOVING AND INSTALLING/ SEALING TRANSMISSION CASE FRONT SECTION

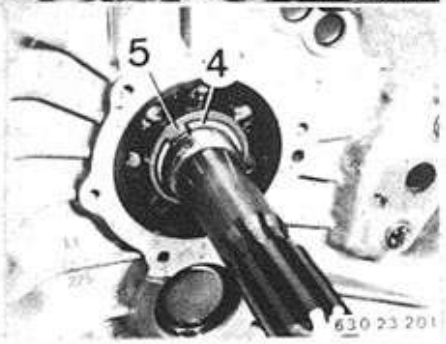
Remove transmission 23 00 022.
Mount Special Tool 23 0 090 on Special Tool 00 1 490.
Mount transmission on special tool assembly.
Drain oil.



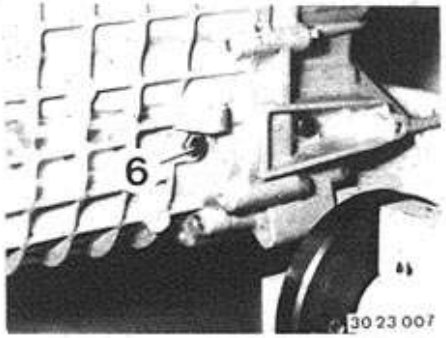
General Information:
A stronger five speed overdrive manual transmission, Type 260/6, is installed since 9.85 in cars with a 3.2 or 3.4 liter M 30 engine.
It can be identified on the additional cooling ribs on the bottom of the case.
The 260/6 overdrive transmission has been included in the following description for the formerly installed Type 260/5 overdrive transmission.



Remove guide sleeve 23 11 623.
Unscrew backup light switch.
Remove cap (1).
Pull out spring (2) and lockpin (3).
Check installed position!

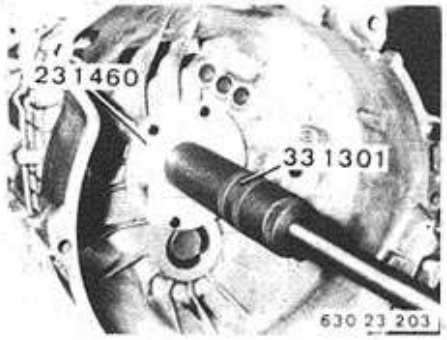


Remove snap ring (4).
Remove washer (5).
Installation:
Always replace snap ring.

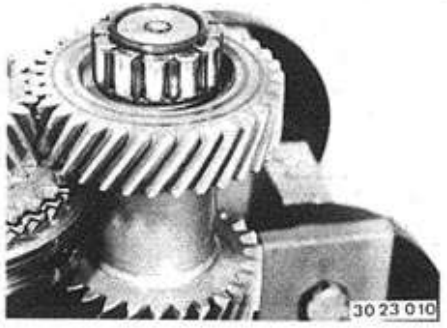


Unscrew bolt (6).
Installation:
Install bolt with Loctite No. 270.
Tightening torque*

Drive out cylindrical pins.
Unscrew bolts.
Installation:
Check length of bolts.
Bolt (1) = 8 x 60 mm.

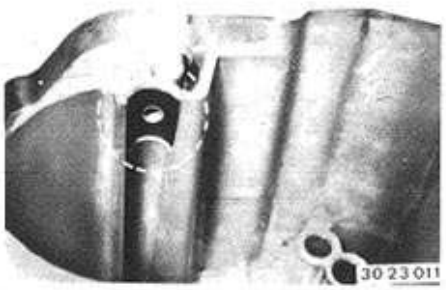


Pull off front case section with Special Tools 23 1 460 and 33 1 301.



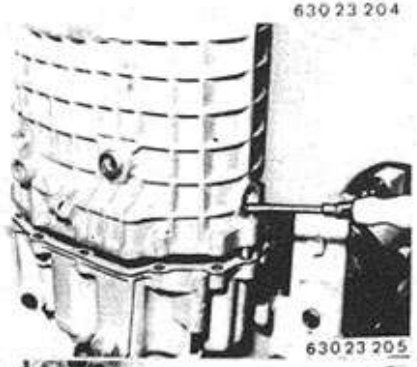
Install roller bearing on layshaft that small diameter end faces up.
Note:
Coat rollers with grease and press in, in order to avoid clamping of rollers when mounting the case front section.

* See Specifications

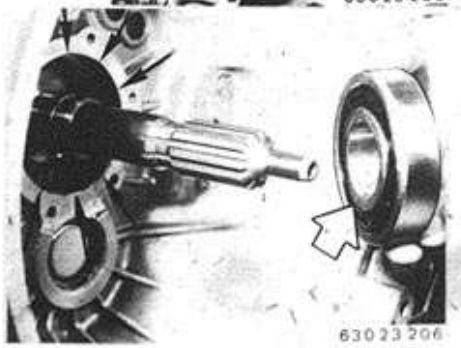


Coat case front section in area of reverse gear shaft with Loctite No. 573.
Surface must be thoroughly cleaned and dried of oil.

Remove grooved ball bearing for input shaft.
Important!
Inner race of grooved ball bearing has a protrusion.
Protrusion faces gear shaft.

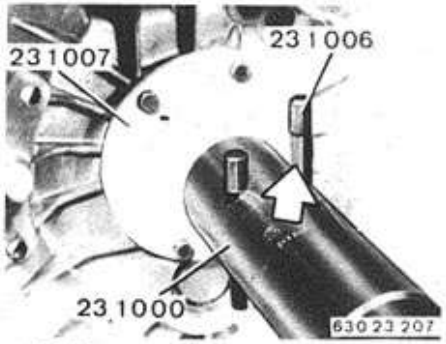


Unscrew oil drain plug.
Coat sealing surface with Loctite No. 573.
Sealing surface must be thoroughly cleaned and dried of oil.
Mount front case section.*
Align layshaft through bore for oil drain plug that roller bearing of layshaft slides into bearing shell.
Bolt front case section.
Tightening torque*.
Install lockpin and reverse gear switch.

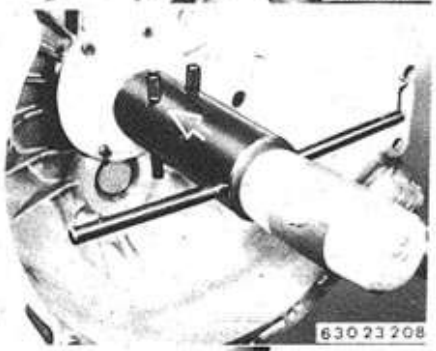


Heat* bearing inner race and front case section in area of grooved ball bearing with a hot air blower.
Push on grooved ball bearing as far as possible.
Inner race protrusion faces gear set.

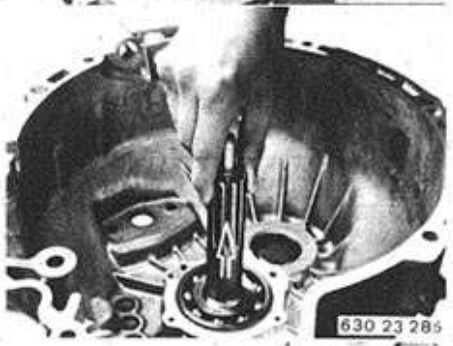
* See Specifications



Press grooved ball bearing on to input shaft and into front case section with Special Tools 23 1 007, 23 1 000 and 23 1 006.
Important!
Insert Special Tools 23 1 006 that flat sides face input shaft.



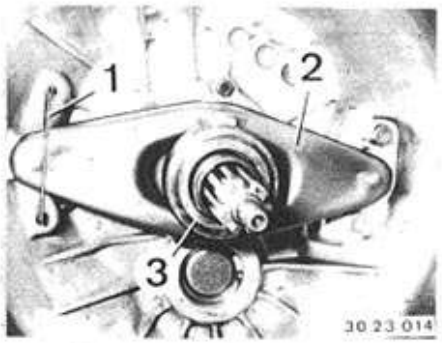
Keep driving on grooved ball bearing simultaneously with light hammer knocks.



Transmission 260/6:
The front case section cannot be pressed on, because of the uniform thickness of the input shaft.
A double bearing is installed in the front case section.
Heat bearing inner race to about 80° C (175° F) with a hot air blower.
Important!
Protect plastic cage against heat.
Mount front case section, pulling out the input shaft for this purpose.
Bolt front case section.
Tightening torque*.

Install spacer and circlip.
Adjust play between bearing inner race and circlip to 0 ... 0.09 mm (0 to 0.0035").

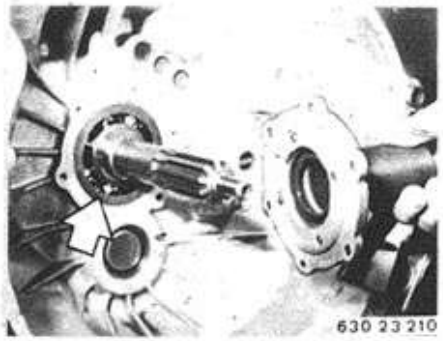
* See Specifications



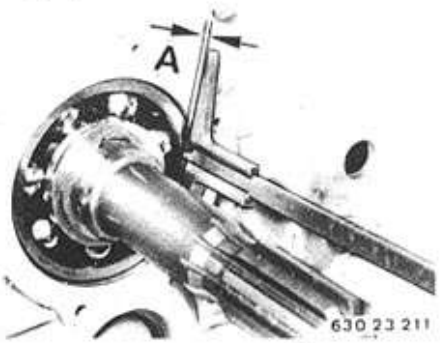
23 11 623 REMOVING AND INSTALLING GUIDE SLEEVE FOR CLUTCH RELEASE
– Transmission Removed –

Lift out spring (1) and remove release lever (2) with thrust bearing (3).

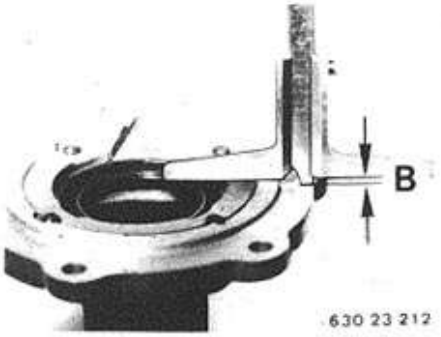
Installation:
Pack lubricating groove N with Molykote Longterm 2.
Coat guides F and bearings L with Molykote Longterm 2.
Non-conformance could cause release bearing to seize on guide sleeve.



Unscrew guide sleeve.
Important!
Spacer.
Installation:
Install guide sleeve and bolts with Loctite No. 573.
Sealing surface and bolts must be thoroughly cleaned and dried of oil.
Tightening torque*



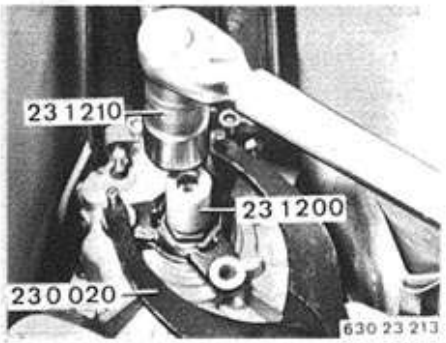
Installation:
Adjust play to 0 ... 0.09 mm (0 to 0.0035").
Determine thickness of spacer.
Measure distance (A).



Measure distance (B).
Example:

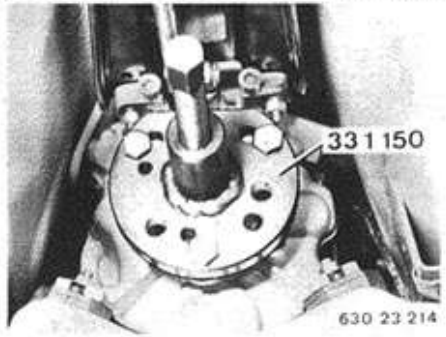
A	3.0 mm (0.118")
– B	2.6 mm (0.102")
	0.4 mm (0.016") spacer thickness

* See Specifications

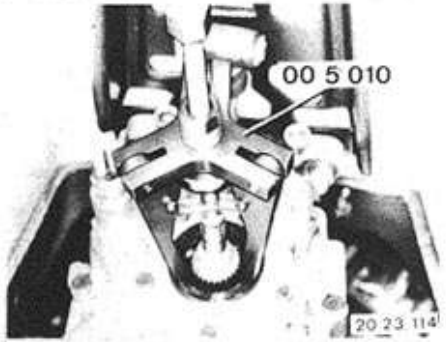


23 12 053 REPLACING RADIAL OIL SEAL FOR OUTPUT FLANGE

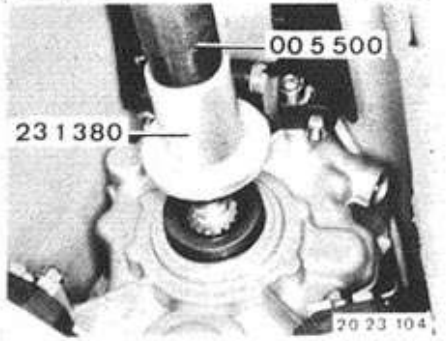
Unscrew propeller shaft – see 23 00 022.
Lift out lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.



If too difficult, pull off output flange with Special Tool 33 1 150.

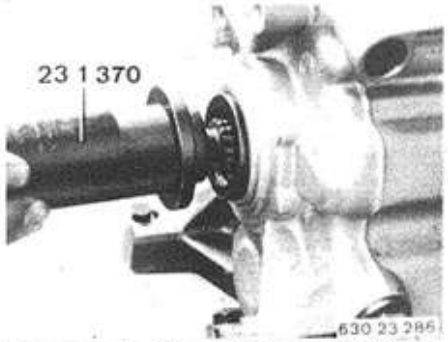


Pull out radial oil seal with Special Tool 00 5 010.

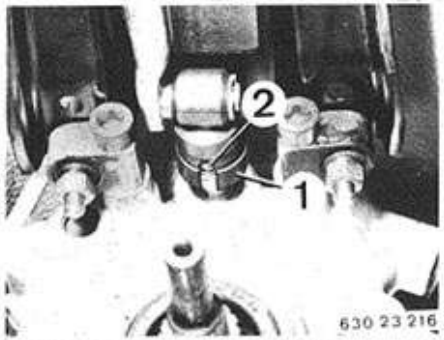


Lift out radial oil seal.
Drive in radial oil seal with Special Tools 23 1 380 and 00 5 500.
Installation:
Lubricate sealing lips with oil.
Bolt output flange.
Tightening torque*.
Install collar nut with Loctite No. 270.
Lock lockplate in groove of output flange.

* See Specifications

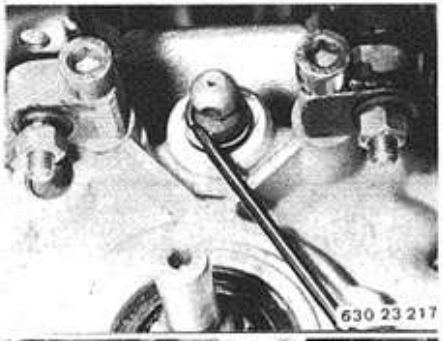


Transmission 260/6:
Drive in radial oil seal flush with Special Tool 23 1 370.

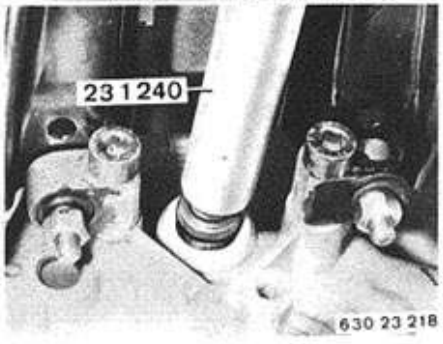


23 12 083 REPLACING RADIAL OIL SEAL FOR SELECTOR SHAFT

Unscrew propeller shaft – see 23 00 022.
Remove output flange – see 23 12 053.
Engage 3rd gear.
Push locking sleeve (1) aside and drive out pin (2).



Lift out radial oil seal.



Drive in radial oil seal with Special Tool 23 1 240.

23 12 503 REPLACING RADIAL OIL SEAL FOR INPUT SHAFT

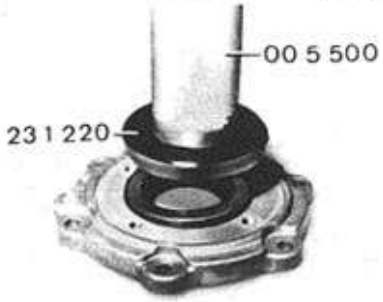
– Transmission Removed –

630 23 219

Remove guide sleeve 23 11 623.
Unscrew guide tube.
Installation:
Install guide tube and bolts with Loctite No. 573
Sealing surface and bolts must be thoroughly cleaned and dried of oil.
Tightening torque*.

630 23 220

Important!
Collar on inside surface of flange.
Drive out radial oil seal in direction of guide tube with Special Tool 24 1 040.



630 23 221

Drive in radial oil seal with Special Tools 23 1 220 and 00 5 500.
Lubricate sealing lips of radial oil seal with oil.

635 23 027

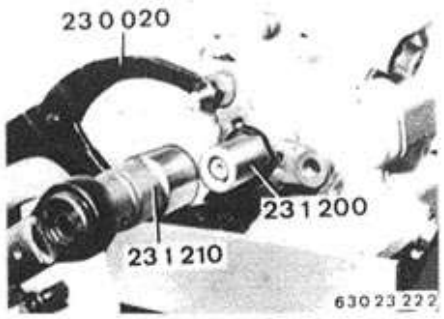
Transmission 260/6:-
Lift out radial oil seal.

635 23 028

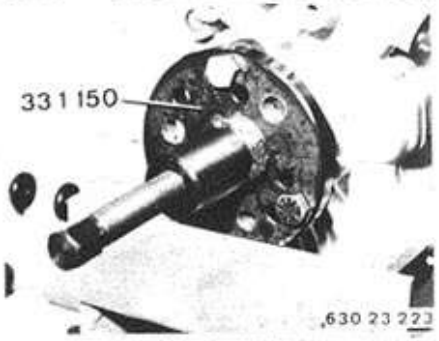
Drive in radial oil seal against stop with Special Tools 23 1 180 and 00 5 500.
Open end faces up.
Lubricate sealing lip with oil.

* See Specifications

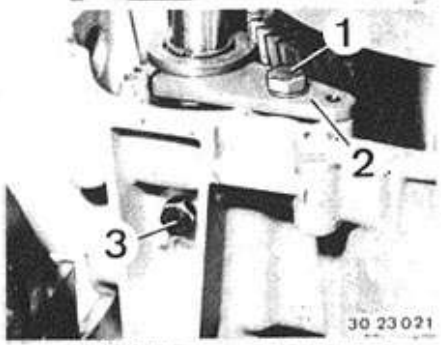
23 21 503 REMOVING AND INSTALLING INPUT AND OUTPUT SHAFT ASSEMBLY
–TRANSMISSION REMOVED–



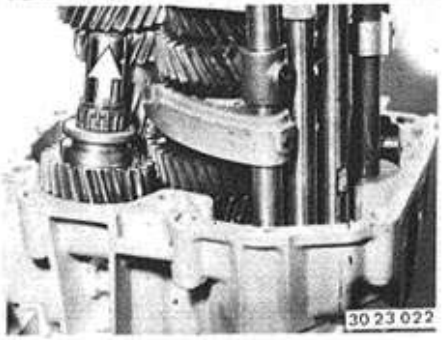
Remove transmission case front section 23 11 013.
Remove lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.



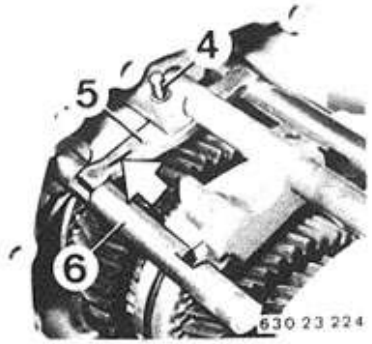
Pull off output flange with Special Tool 33 1 150.



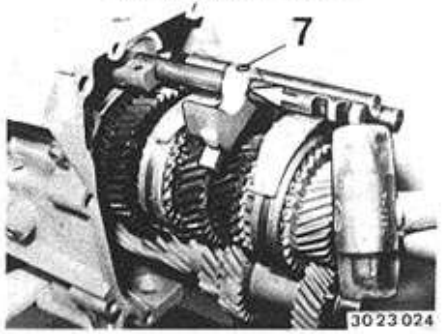
Unscrew bolt (1).
Remove holder (2).
Unscrew bolt (3).



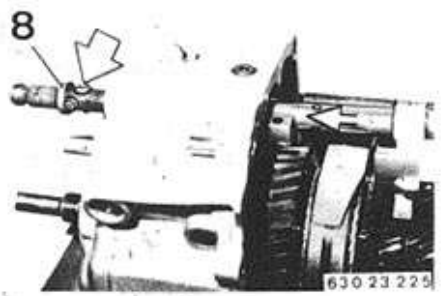
Remove shaft with reverse gear and needle bearing.



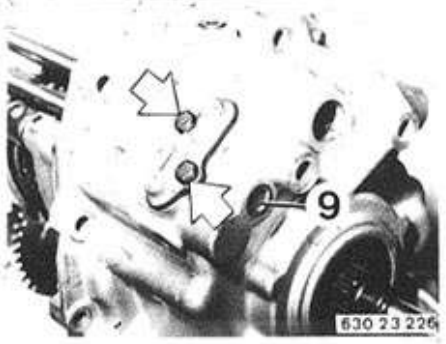
Pull out pin (4) for operating lever (5).
Pull out selector rail (6).
Remove operating lever (5).
Installation:
Install operating lever that notch faces up and in direction of selector rail.



Engage 4th gear.
Drive in pin (7), while counterholding.
Important!
Only drive in pin (7) far enough that selector shaft can be pulled back and out.

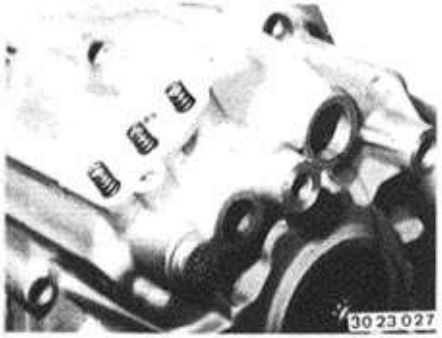


Radial oil seal (8) will also be pulled out.
Important!
Rollers on selector shaft.
Installation:
Replace radial oil seal.
Remove selector arm.

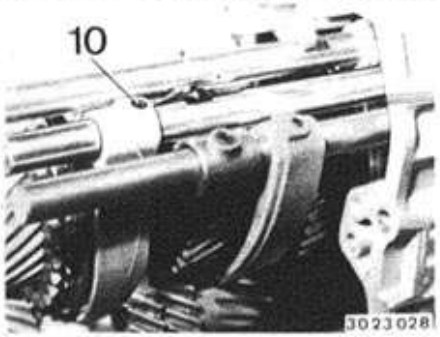


Unscrew end plate.
Installation:
Install end plate with Loctite No. 573*.
Sealing surface must be thoroughly clean and dried of oil.
Remove plug (9).
Installation:
Replace plug.

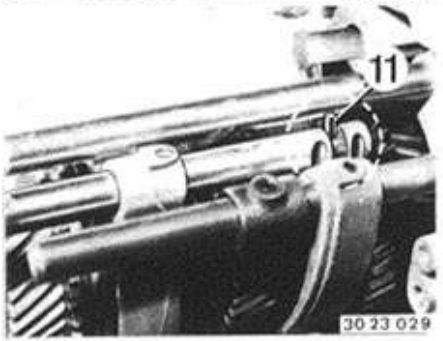
* Source: HWB



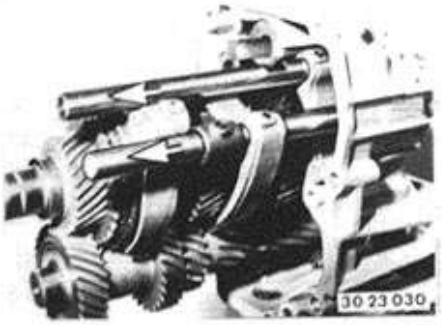
Remove 3 springs and 3 balls.
Note:
Length of springs differs (see installation).



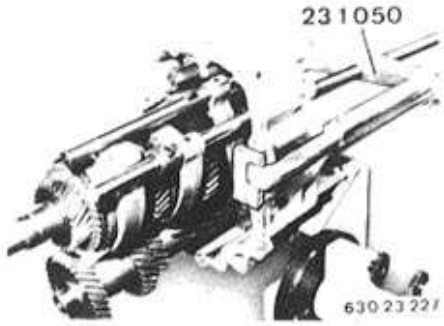
Drive out pin (10) in 3rd/4th gear selector fork.
Installation:
Replace pin.



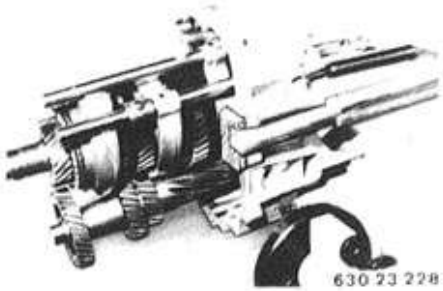
Knock out 3rd/4th gear selector rod forward.
Important!
Lockpin (11) in selector rod.



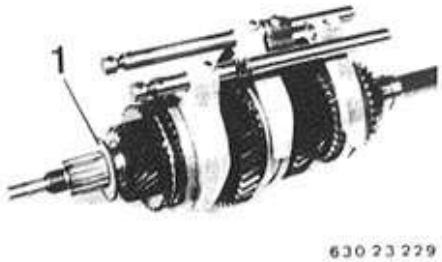
Engage 2nd and reverse gears by pushing 1st/2nd and 5th/reverse gear selector rods forward.



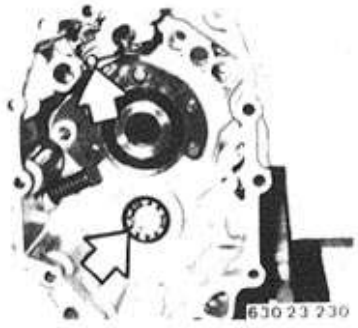
Press input shaft, output shaft and layshaft out of rear case section with Special Tool 23 1 050.
Important!
To avoid sealing surface damage, use a piece of wood, aluminum or similar material between claws and sealing surface.



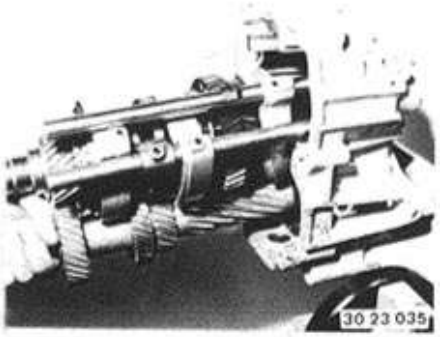
Important!
Be careful not to clamp selector rods and layshaft while pressing out parts.
Installation:
Check condition of all bearings, replacing if necessary.



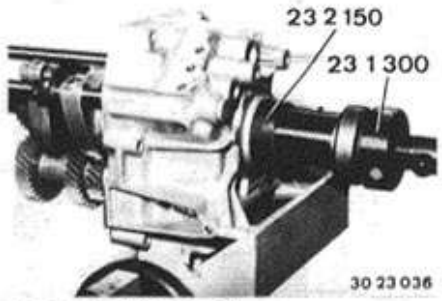
Installing:
Install 3rd/4th gear selector fork and 1st/2nd as well as 5th/reverse gear selector rods with selector forks.
Only 260/5:
Check thrust washer (1).



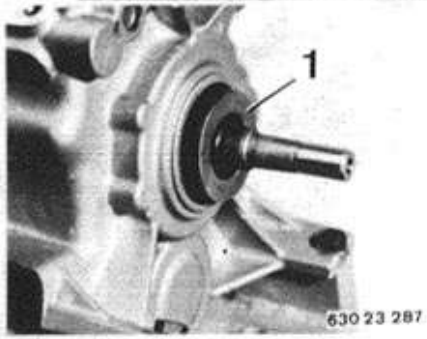
Remove all detent and locking balls in rear case section.
Install roller bearings with large diameter end facing out.
Lubricate lockpin and locking lever with oil.
Transmission 260/6:
The output flange radial oil seal and ball bearing inner race have to be removed prior to installing the input shaft and output shaft.



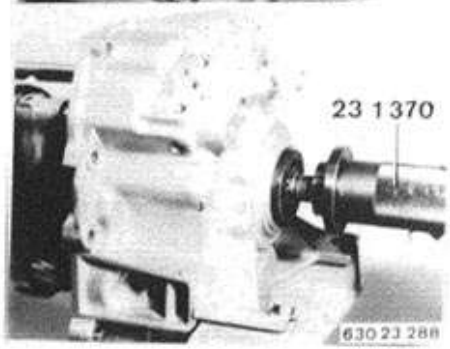
Heat grooved ball bearing inner race in rear case section to about 80° C (175° F) with a hot air blower.
Second and reverse gears are engaged.
Insert input shaft, output shaft and layshaft in case rear section.
Align selector rods.



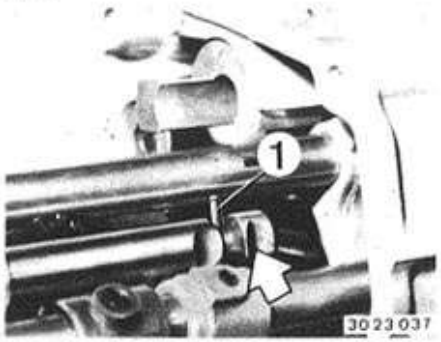
Pull input shaft, output shaft and layshaft into rear case section with Special Tools 23 1 300 and 23 2 150.
Important!
Make sure selector rods and layshaft are not clamped while pulling in parts.



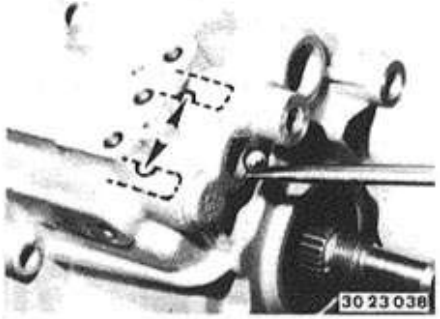
Transmission 260/6:
Place input shaft and output shaft with 3rd/4th gear selector forks and 5th/reverse gear plus 1st/2nd gear selector rods as well as layshaft in the rear case section.
Heat bearing inner race (1) to about 80° C (175° F) with a hot air blower and slide on to the output shaft, pressing on with Special Tool 23 1 160 if necessary.



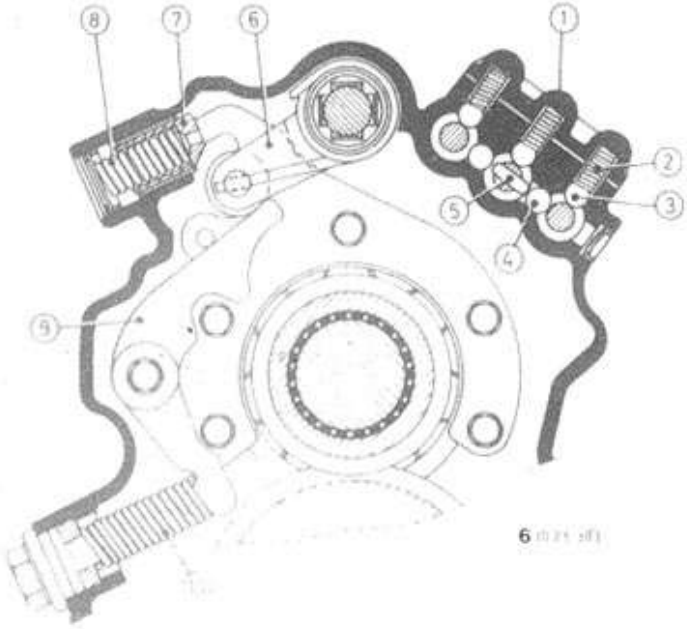
Transmission 260/6:
Drive in radial oil seal flush with Special Tool 23 1 370.
Lubricate sealing lip with oil.



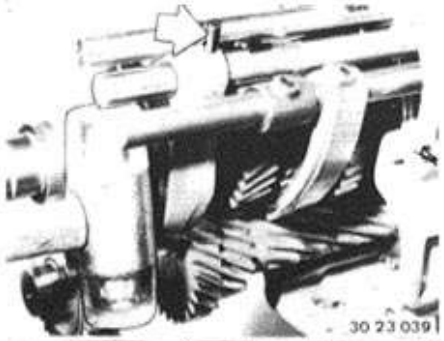
Move selector rods to neutral position.
Slide 3rd/4th gear selector rod through selector forks.
Install lockpin (1) in selector rod with grease.
Push in selector rod up to bore.
Opening in selector rod faces up.



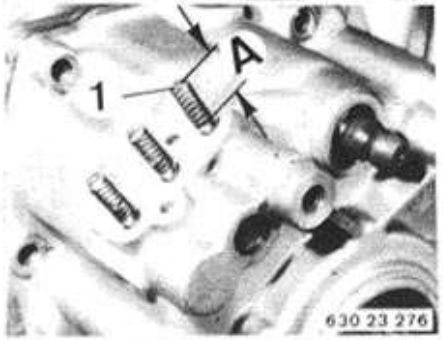
Install two detent balls with grease.
Push in 3rd/4th gear selector rod against lock.



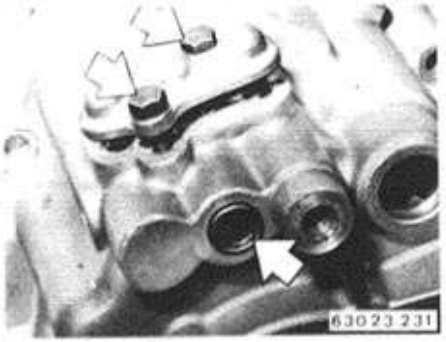
Arrest Assembly:
1 End cap
2 Spring
3 Locking ball
4 Detent ball
5 Lockpin
6 Selector arm
7 Lockpin
8 Spring
9 Locking lever
10 Spring



Drive 6 x 26 mm pin into 3rd/4th gear selector fork (counterhold).

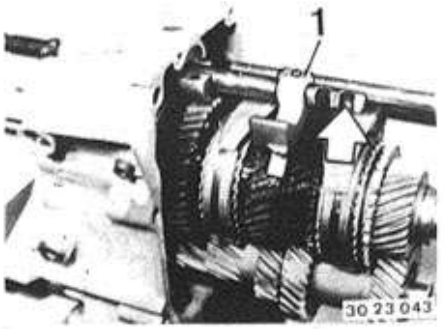


Install 3 locking balls and 3 springs.
Important!
Version with Different Length Springs:
Install the shorter spring (1) with a relaxed length (A) of 15.9 mm (0.626") for the 5th/ reverse gear selector rod.

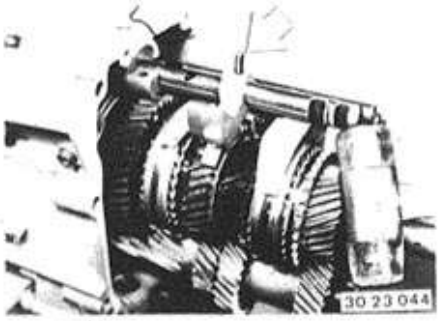


Install end cap after coating with Loctite No. 573.
Install end cover with Loctite No. 573.

Drive pin out of selector arm.

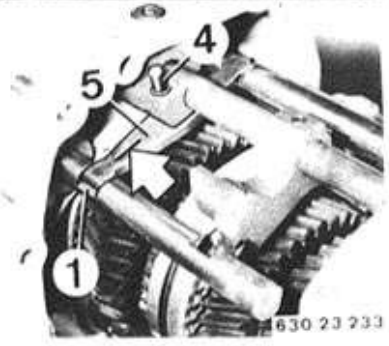


Hold four rollers in position with grease.
Slide in selector shaft and install selector arm (1) at same time.
Important!
Opening in selector shaft faces out.

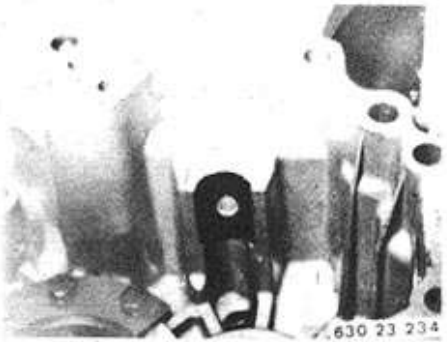


Drive in 6 x 26 mm pin (counterhold).

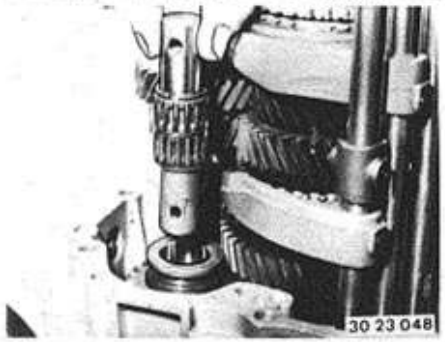
Lubricate sealing lips of radial oil seal with oil.
Drive in radial oil seal with Special Tool 23 1 240.



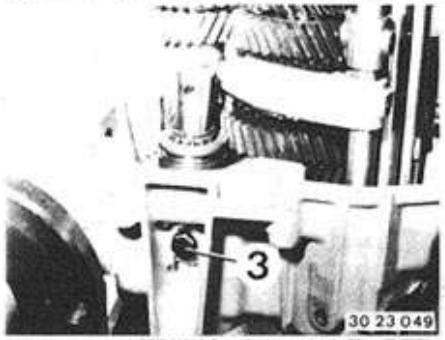
Install selector rail.
Groove (1) in selector rail faces up.
Install operating lever (5) with notch facing up and toward selector rail.
Install pin (4).



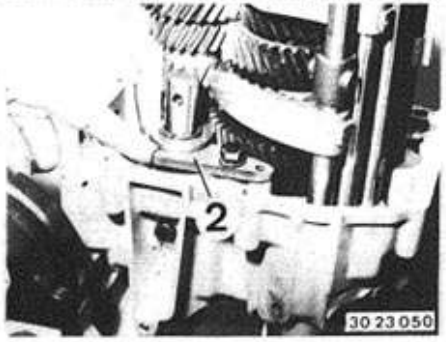
Coat case rear section in area of reverse gear shaft with Loctite No. 573.
Surface must be thoroughly cleaned and dried of oil.



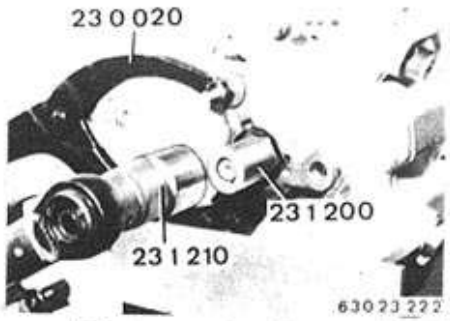
Install shaft with needle bearing and reverse gear.



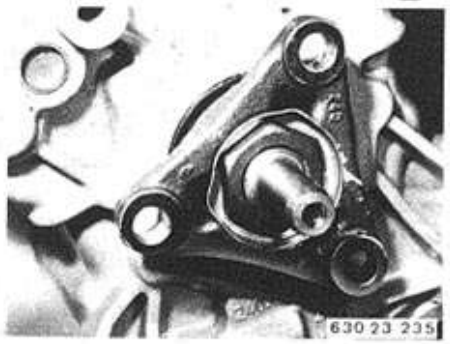
Mount shaft with bolt (3).
Install bolt with Loctite No. 270.



Insert holder (2), press out and secure in this position.

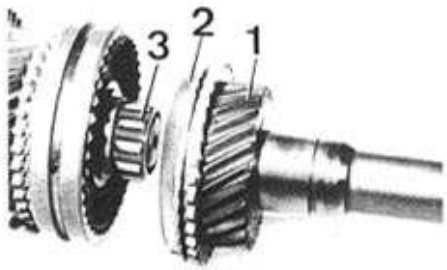


Install output flange.
Install collar nut with Loctite No. 270.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Tighten collar nut with Special Tool 23 1 210.
Tightening torque*.



Install and lock lockplate.

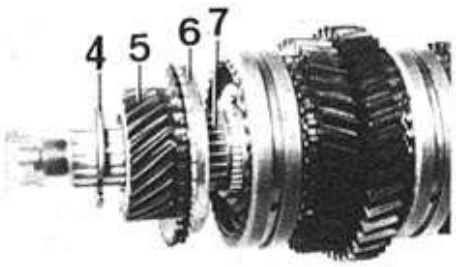
* See Specifications



630 23 236

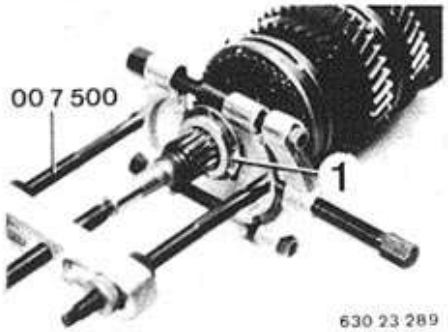
23 21 554 REPLACING OUTPUT SHAFT
– Output Shaft Removed –

Pull off input shaft (1), synchromesh ring (2) and needle bearing (3).
Note:
It is recommended to mark the synchromesh rings for a pertinent gear wheel when disassembling the output shaft, in order to avoid mixing up the synchromesh rings.



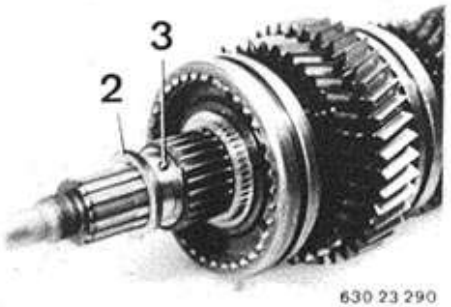
630 23 237

Pull off thrust washer (4), 5th gear (5), synchromesh ring (6) and needle bearing (7).



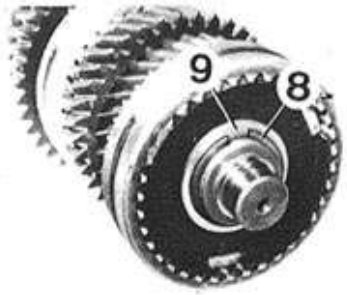
630 23 289

Transmission 260/6:
Pull off bearing inner race (1) on the output shaft with Special Tool 00 7 500.



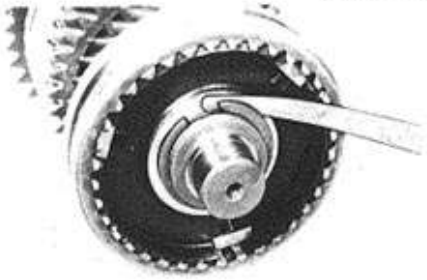
630 23 290

Transmission 260/6:
Pull off the 5th gear and synchromesh ring.
Take off thrust washer (2) and ball (3).
Pull off the needle bearing.



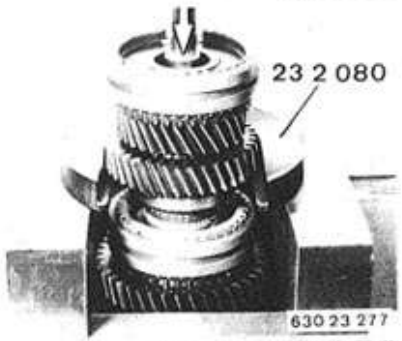
630 23 238

Lift out circlip (8).
Take off spacer (9).
Installation:
Always replace the circlip.



630 23 239

Installation:
Adjust play between the circlip and guide sleeve to 0 ... 0.09 mm (0 to 0.0035").



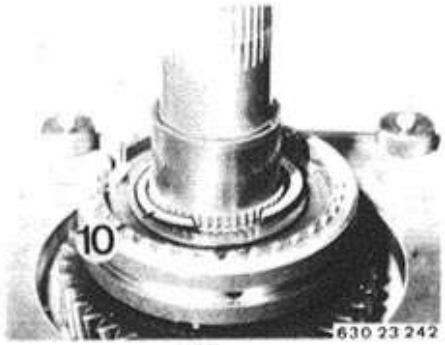
630 23 277

Press 2nd gear, bearing sleeve, 3rd gear, synchromesh ring and guide sleeve off of the output shaft with Special Tool 23 2 080.
Pressing-off force*.

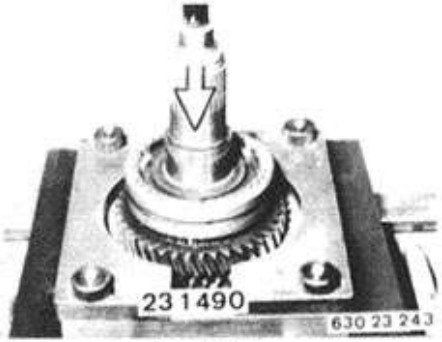
630 23 291

Transmission 260/6; 260/5**:
Note thrust washer (2) and ball (3) between the 2nd and 3rd gear wheels.

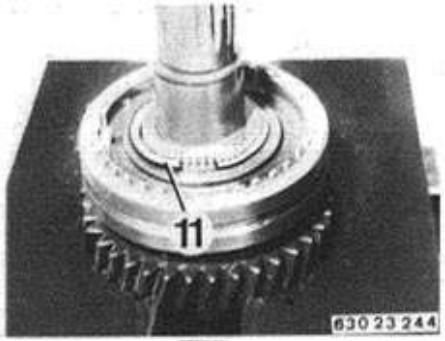
* See Specifications.
** Since 7.85



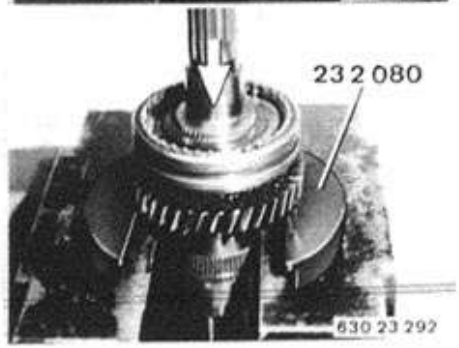
Important!
Circlip (10) has to be removed prior to pressing off the 1st gear wheel.
Installation:
Always replace the circlip.



Press off the 1st gear wheel with guide and operating sleeves with Special Tool 23 1 490.
Take off the needle bearing.
Pressing-off force*.



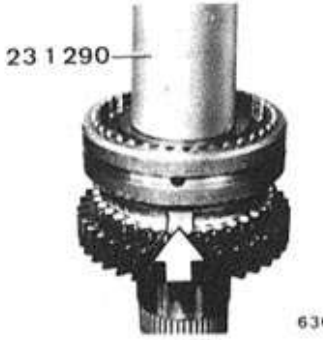
Important!
Circlip (11) has to be removed prior to pressing off the reverse gear wheel.
Installation:
Always replace the circlip.



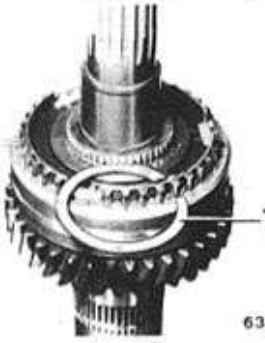
Press off the guide sleeve, operating sleeve and reverse gear wheel with Special Tool 23 2 080, the bottom end of which faces the gear wheel.
Take off the needle bearing.
Pressing-off force*.

* See Specifications

Assembling:
Note:
Check the synchromesh rings for wear (see 23 23 505) prior to assembling.
Install the needle bearing, reverse gear and synchromesh ring.
Install guide and operating sleeves on splines of the output shaft.
Transmission 260/6; 260/5**:*
The stepped end of the operating sleeve faces the reverse gear wheel



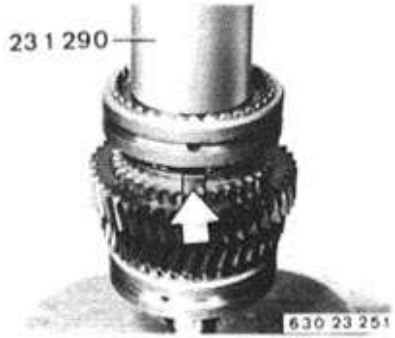
Press on the guide sleeve to fit tight with Special Tool 23 1 290.
Pressing-on force*.
Important!
Make sure that tabs on synchromesh ring are aligned with openings in the guide sleeve while pressing on.



Move operating sleeve in direction of the reverse gear wheel.
Adjust the guide sleeve to be without play with circlip (11).
Circlips are available in thicknesses from 1.7 to 2.0 mm (0.067 to 0.079") from Parts.
Install circlip (11).

Install the needle bearing, 1st gear wheel and synchromesh ring.
Install guide and operating sleeves on splines of the output shaft.
Transmission 260/6; 260/5**:
The stepped end of the operating sleeve faces the 1st gear wheel.

* See Specifications
** Since 5.85



Press on guide sleeve to fit tight with Special Tool 23 1 290.
Pressing-on force*.
Important!
Make sure that tabs on synchromesh ring are aligned with openings in the guide sleeve while pressing on.

Move operating sleeve in direction of the 1st gear wheel.
Adjust the guide sleeve to remove play.
Circlips are available from Parts in different thicknesses from 1.7 to 2.0 mm (0.067 to 0.079").
Install circlip (10).

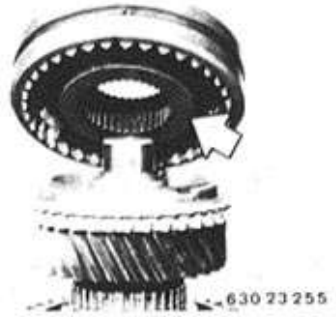
Install the needle bearing, synchromesh ring and 2nd gear wheel.
Important!
The collar for the bearing sleeve must protrude slightly on the output shaft.
If applicable, check the seating of circlip (10).

Heat the bearing sleeve to about 80° C (175° F) with a hot air blower and install on the output shaft.

* See Specifications

Transmission 260/6; 260/5**:
Install ball (3) and thrust washer (2) with opening facing ball (3).

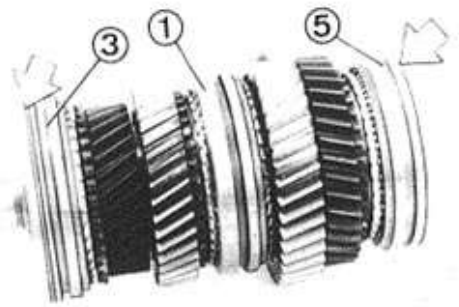
Transmission 260/6; 260/5**:
Heat bearing sleeve (4) without collar to about 80° C (175° F) with a hot air blower and install on the output shaft.



Install the needle bearing, 3rd gear wheel and synchromesh ring.
Install guide and operating sleeves on splines with the long collar facing the 3rd gear wheel.
Transmission 260/5 Since 5.85:
The stepped end of the operating sleeve faces the 3rd gear wheel.

Press on the guide sleeve to fit tight with Special Tool 23 1 290.
Important!
Make sure that tabs on the synchromesh ring are aligned with openings in the guide sleeve while pressing on.
Install the spacer and circlip.
Pressing-on force*.

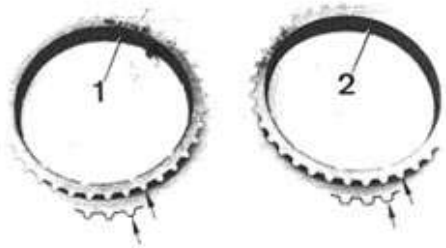
* See Specifications
** Since 7.85



630 23 282

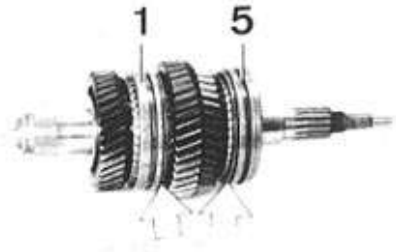
Transmission 260/5:

Important!
Modified operating sleeves, synchromesh rings and gear wheels since 5.85.
Check installed position of operating sleeves and synchromesh rings.
Operating sleeves have asymmetric teeth.
Install operating sleeve (1) without a groove that the stepped end faces 1st gear.
Install operating sleeve (3) with two grooves that the stepped end faces 3rd gear.
Install operating sleeve (5) with one groove that the stepped end faces reverse gear.



630 23 305

Identification of Synchromesh Rings:
Check the identification or tooth width to avoid mixing up the synchromesh rings.
Synchromesh ring (1) for 1st/reverse gears, Drawing No. 011.8.0241.00.
Idenification: narrow teeth.
Synchromesh ring (2) for 2nd, 3rd, 4th and 5th gears, Drawing No. 011.8.0161.00.
Identification: wide teeth.



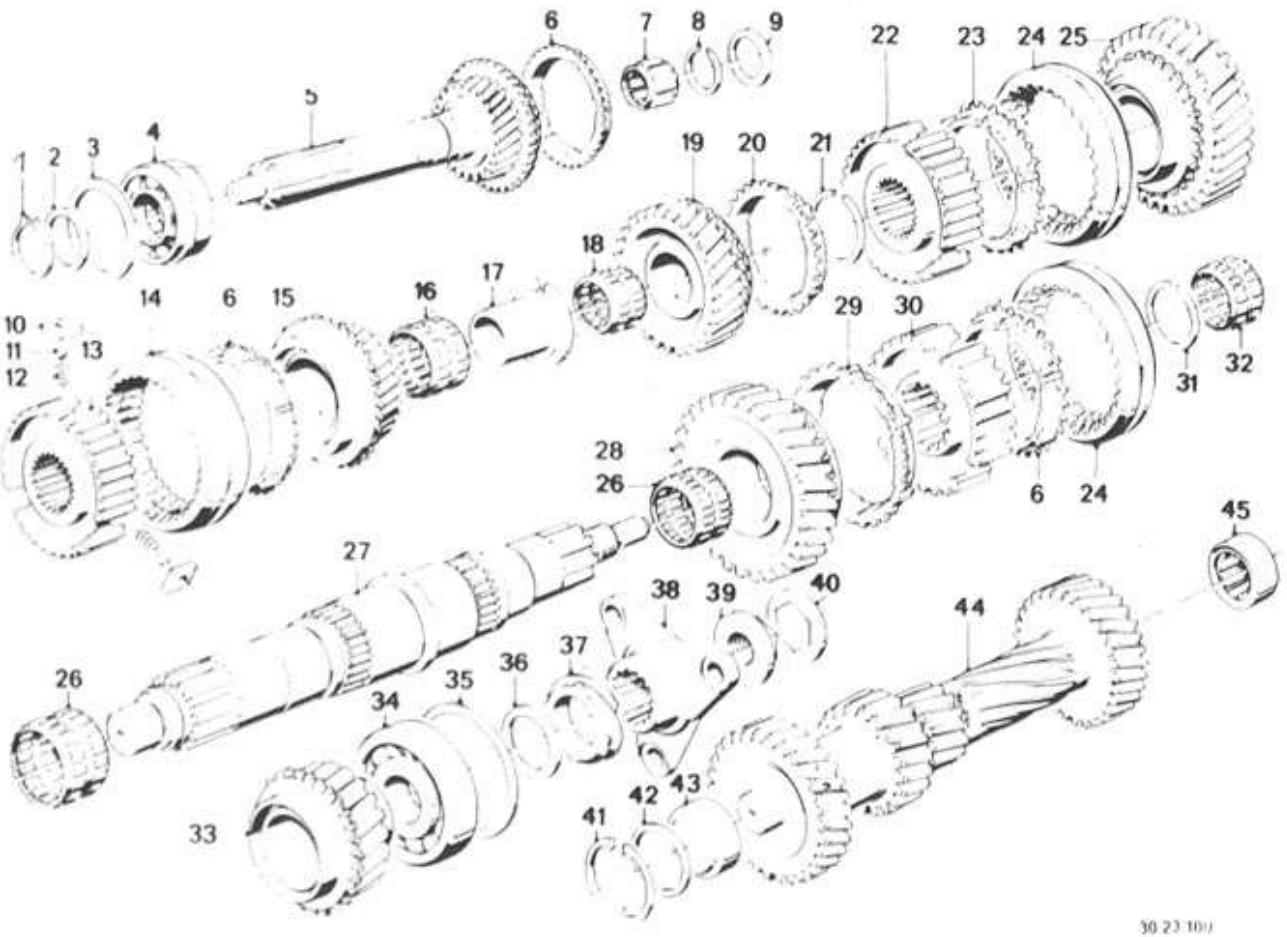
630 23 297

Transmission 260/6:
Installed position of operating sleeves/gear wheels:
Operating sleeve (1) – 1st/2nd gear.
Stepped end facing 1st gear.
Operating sleeve (5) – 5th/reverse gear.
Stepped end facing reverse gear.

630 23 299

Transmission 260/6:
Identification of Synchromesh Rings:
Check the identification or tooth width to avoid mixing up the synchromesh rings for 1st/2nd gears and 5th/reverse gears.
Synchromesh ring for 1st/reverse gear, Drawing No. 011.8.0241.00.
Identification: narrow teeth.
Synchromesh ring for 2nd/5th gear, Drawing No. 011.8.0161.00.
Identification: wide teeth.

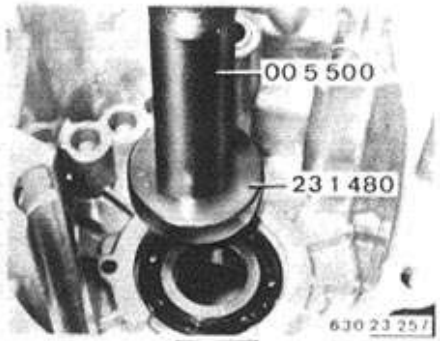
23-181b



30 23 100

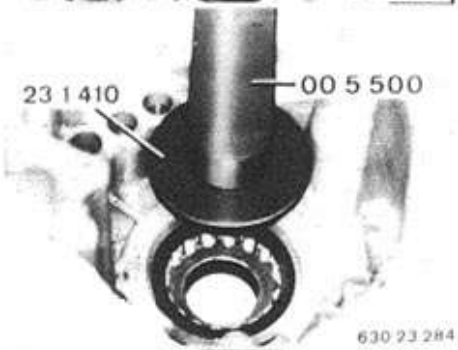
Layout Drawing of Gear Set with Bearings:

1 Circlip
2 Spacer
3 Spacer
4 Bearing
5 Input shaft with 4th gear
6 Synchromesh ring
7 Needle bearing
8 Circlip
9 Spacer
10 Drive dog
11 Ball
12 Spring
13 Guide sleeve
14 Operating sleeve
15 3rd gear
16 Needle bearing
17 Spacer
18 Needle bearing
19 2nd gear
20 Synchromesh ring
21 Circlip
22 Guide sleeve
23 Synchromesh ring
24 Operating sleeve
25 1st gear
26 Needle bearing
27 Output shaft
28 Reverse gear
29 Synchromesh ring
30 Guide sleeve
31 Circlip
32 Needle bearing
33 5th gear
34 Bearing
35 Spacer
36 Spacer
37 Speedometer drive gear
38 Output flange
39 Collar nut
40 Lockplate
41 Circlip
42 Spacer
43 Bearing
44 Layshaft
45 Bearing

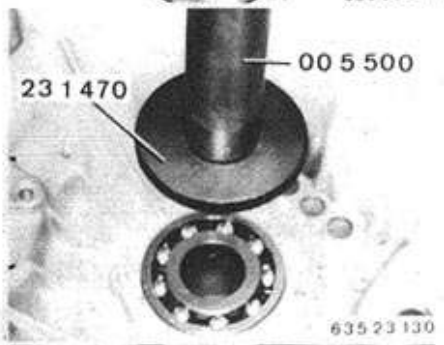


23 21 703 REPLACING BEARINGS OF ALL TRANSMISSION SHAFTS
– Transmission Removed –

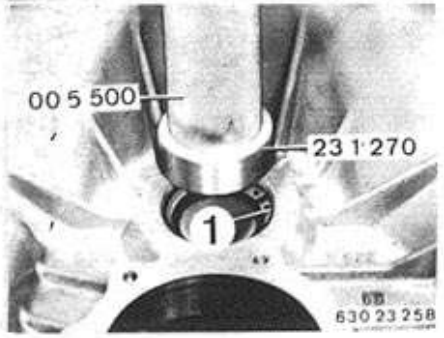
Remove input and output shaft assembly 23 21 503.
A) Input Shaft, Layshaft in Front Case Section:
Input Shaft:
Drive out grooved ball bearing with Special Tools 23 1 480 and 00 5 500.
Installation – see 23 11 013.



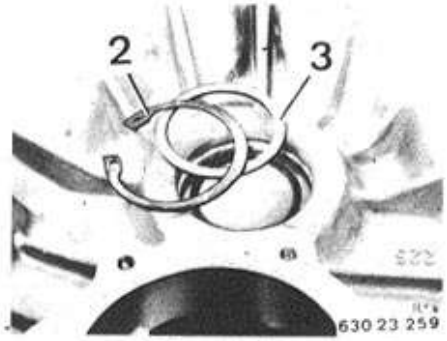
Transmission 260/6:
Drive out double bearing with Special Tools 23 1 410 and 00 5 500.



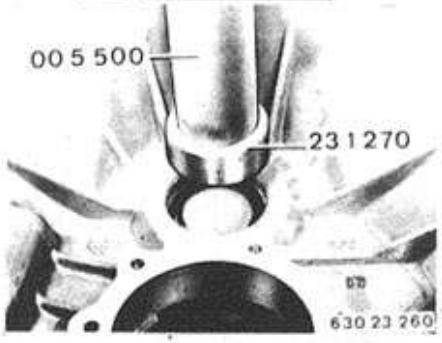
Transmission 260/6:
Heat front case section in area of bearing to about 80° C (175° F) with a hot air blower.
Important!
Install bearings with rollers facing gear set, driving in to fit tight with Special Tools 23 1 470 and 00 5 500 if necessary.



Layshaft:
Loosen circlip (1) with one knock from Special Tools 23 1 270 and 00 5 500.

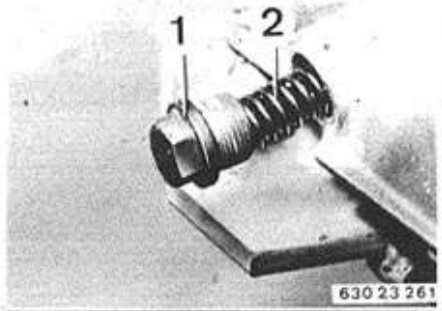


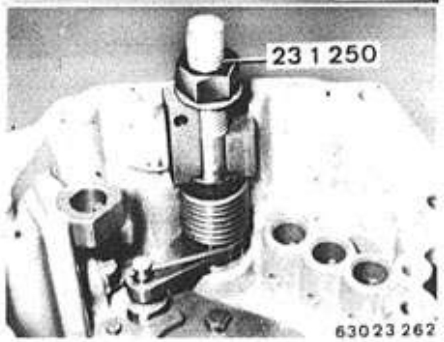
Lift out circlip (2).
Remove spacer (3).



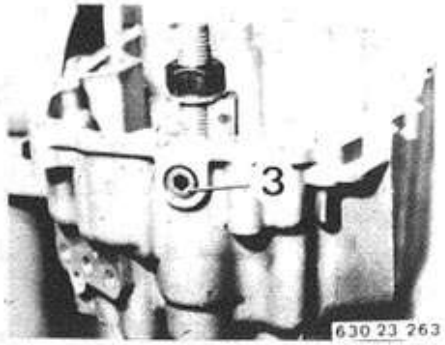
Drive out bearing shell with Special Tools 23 1 270 and 00 5 500.

B) Output Shaft, Layshaft in Rear Case Section:
Output Shaft:
Unscrew bolt (1).
Caution!
Spring force.
Remove spring (2)
Installation:
Install bolt with Loctite No. 270.

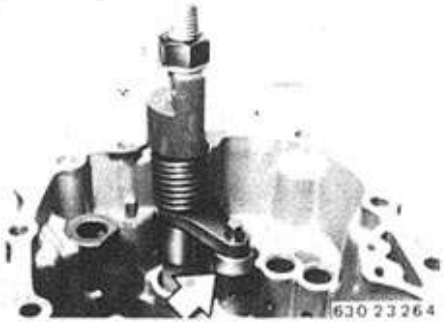




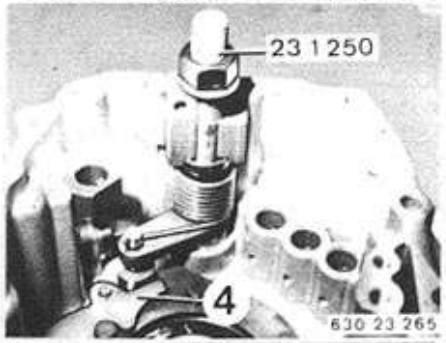
Install Special Tool 23 1 250 for removal of the selector arm.



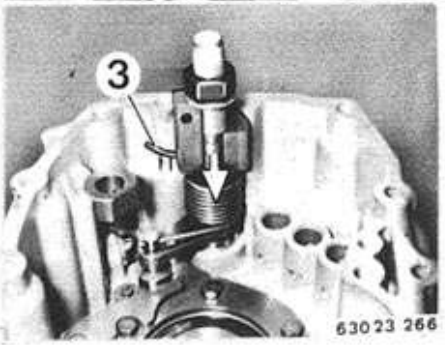
Remove socket head bolt (3).
Installation:
Install bolt with Loctite No. 270.
Tightening torque*.



Remove selector arm from above.
Important!
Roller.

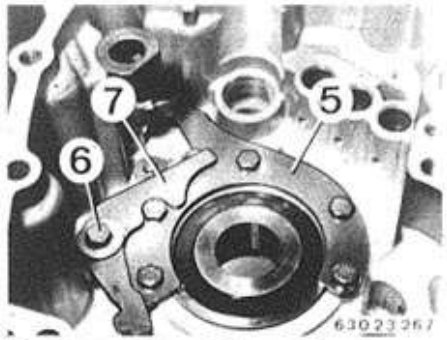


Installation:
Insert selector arm with Special Tool 23 1 250.
Swing out selector arm with roller over locking lever (4).

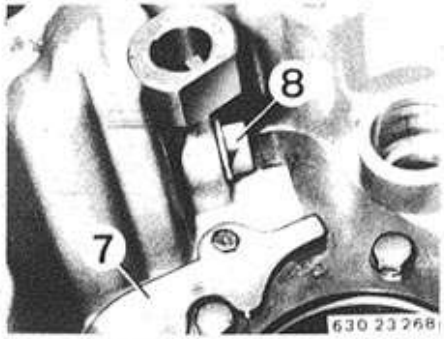


Position end of spring (3) above high spot.
Press (don't knock) down selector arm in this position.
Mount selector arm with socket head bolt before removing th special tool.
Install socket head bolt with Loctite No. 270.
Tightening torque*.

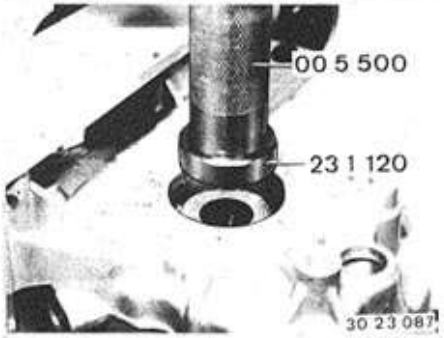
* See Specifications



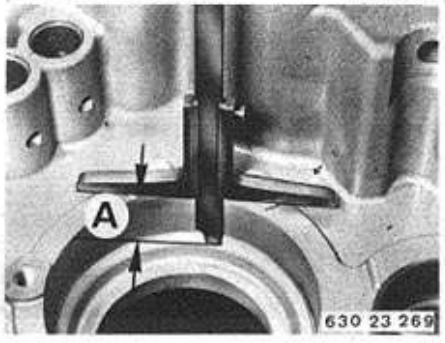
Remove bearing holder (5).
Important!
Don't unscrew bolt (6).
Locking lever (7) remains on bearing holder.



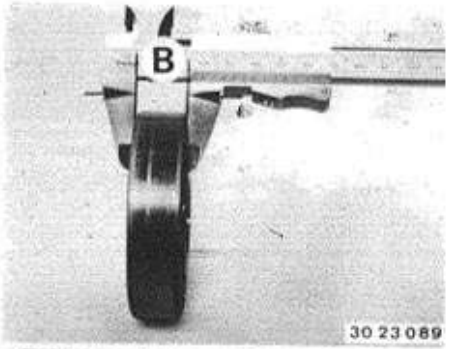
Installation:
Check installed position of locking lever (7) and thrust pin (8).



Lift out radial oil seal.
Drive out grooved ball bearing with Special Tools 23 1 120 and 00 5 500.
Important!
Spacer X.

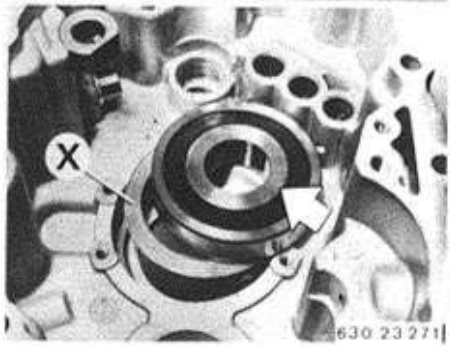


Determine thickness of spacer X.
Measure distance (A).



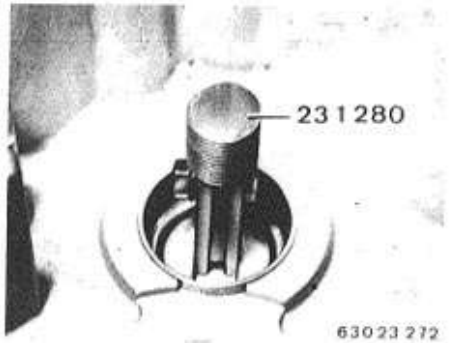
Measure distance (B).
Example:

A	20.3 mm (0.799")	
– B	20.0 mm (0.787")	
X	0.3 mm (0.012")	spacer thickness

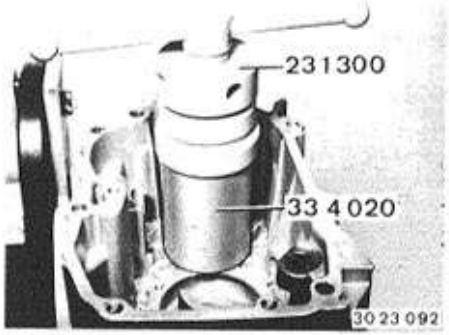


Heat rear case section in area of grooved ball bearing to about 80° C (175° F) with a hot air blower.
Install spacer X.
Install grooved ball bearing.
Important!
Inner race of grooved ball bearing has protrusion.
Install bearing race that this protrusion faces the gear set.
If necessary, drive in bearing against stop with Special Tool 23 1 470.

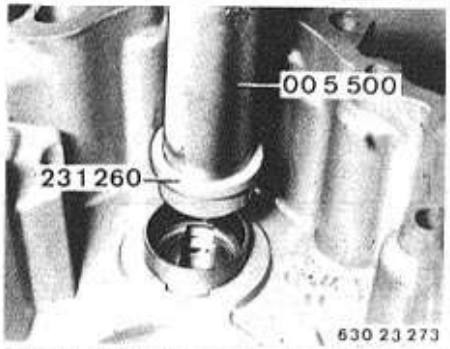
Transmission 260/6:
Split Bearing Inner Races:
The bearing inner race with an opening for the ball (turning lock) must be mounted on the output shaft (see "Replacing Output Shaft" – 23 21 554).



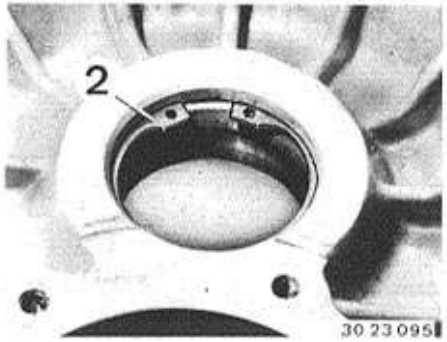
Layshaft:
Apply large end of Special Tool 23 1 280 in bearing shell.



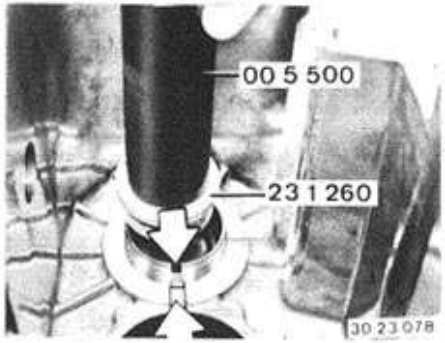
Apply Special Tool 33 4 020.
Screw on Special Tool 23 1 300.
Pull out bearing shell.



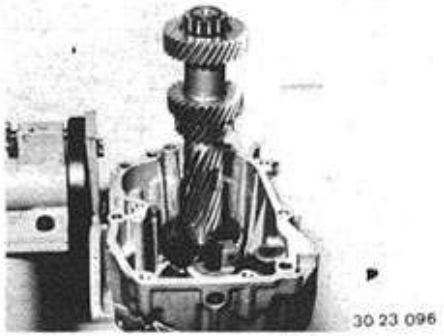
Drive in bearing shell with Special Tools 23 1 260 and 00 5 500.



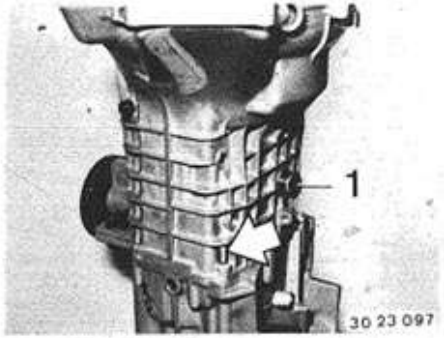
Check axial play of layshaft.
Install circlip (2).



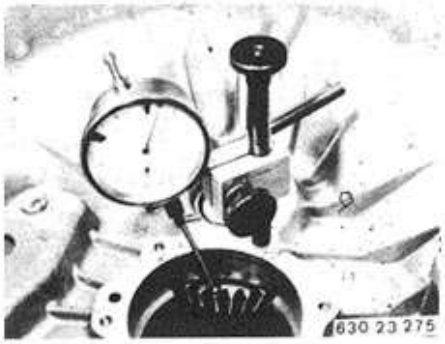
Install old spacers.
Drive in bearing shell to fit tight in front case section with Special Tools 23 1 260 and 00 5 500.
Important!
Oil groove must be aligned with groove in case.



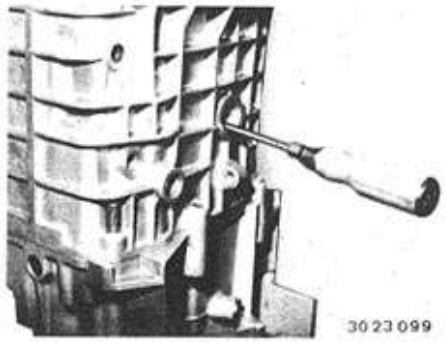
Place layshaft with roller bearings in rear case section.



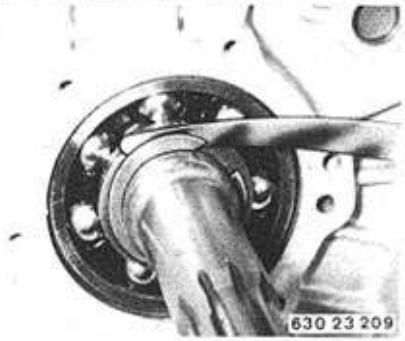
Install case front section and mount with two bolts opposite each other.
Center case front section with dowel pins slightly.
Unscrew oil filler plug (1).



Install dial gage with holder.
Tip of dial gage must bear on tooth of layshaft.



Check layshaft axial play through bore for oil filler plug.
Axial play = 0.13 to 0.23 mm (0.005 to 0.009").
If correction is necessary, bearing shell must be removed again and a spacer of different thickness installed.

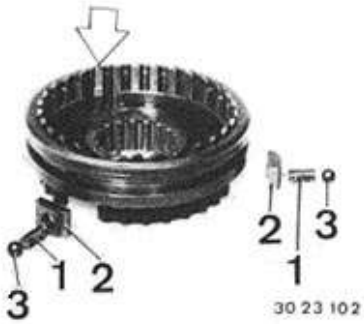


Install gear set.
Determine thickness of drive pinion shim.
Install old shim and circlip.
Adjust play to 0 ... 0.09 mm (0 to 0.0035").
Determine thickness of spacer for guide sleeve (see 23 11 623).

23 23 505 DISASSEMBLING/ASSEMBLING COMPLETE SYNCHRONIZATION
– Output Shaft Removed –

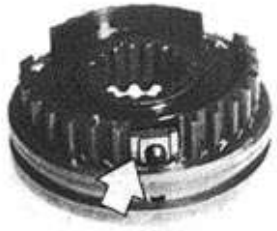
30 23 101

Disassemble output shaft (see 23 21 554).
3rd/4th gear synchromesh ring – brass.
1st/2nd gear synchromesh ring – brass, hard nickle plated.
Reverse gear synchromesh ring – brass with molybdenum coat.
Check distance between synchromesh ring and clutch*.
Measure in area of stops.
Note:
Only use molybdenum coated synchromesh rings for repairs.
Check distance* between synchromesh ring and clutch.
Measure in area of stops.
Synchromesh rings should bear uniformly all around.



30 23 102

Disassemble synchronization.
Spring (1), thrust piece (2) and ball (3).
Installation:
Flat teeth of sliding sleeve must be aligned with thrust pieces.



30 23 104

Install all springs, thrust pieces and balls.
Important!
Shouldered end of thrust pieces faces sliding sleeve.
Place guide sleeve halfways in sliding sleeve.
Push in balls far enough until guide sleeve can be pressed into sliding sleeve.

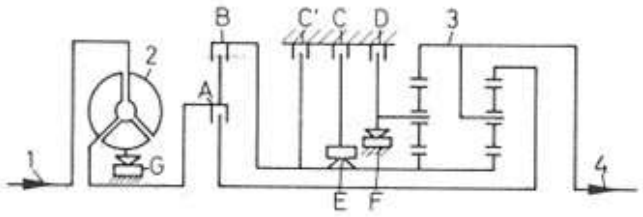
* See Specifications

24 Automatic transmission

3 HP-22

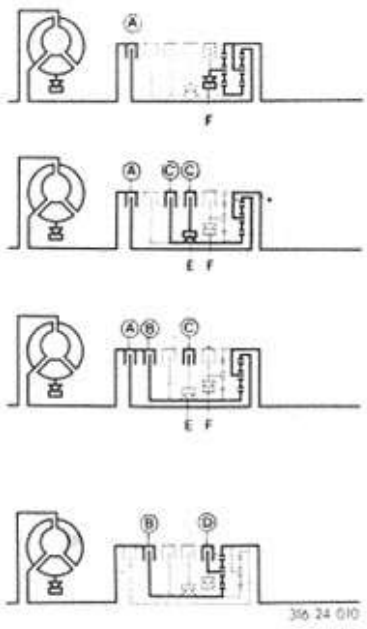
4 HP-22

Layout of Transmission 3 HP-22
1 Input
2 Torque converter
3 Planet gear set
4 Output



530 24 010

Power Flow Diagrams 3 HP-22



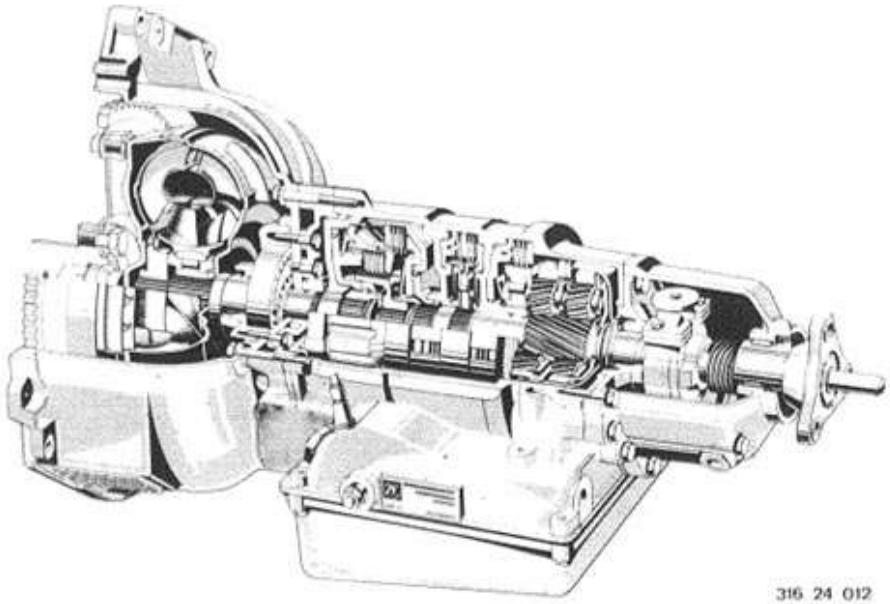
356 24 010

1st Gear
Clutch A is engaged.
Planet gear carrier bears on one-way clutch F during acceleration and is cancelled while coasting. With selector lever in position 1 clutch D also engages in 1st gear, so that engine braking force can be utilized.

2nd Gear
Clutches A, C' and C are engaged
One-way clutch F is cancelled.
Hollow shaft is fixed with sun gear.

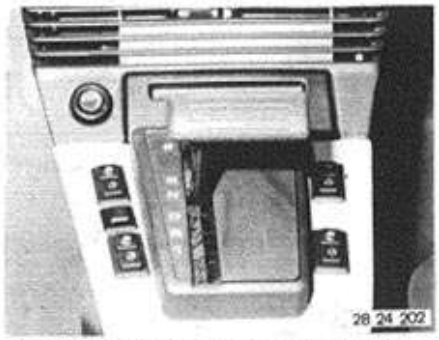
3rd Gear
Clutches A, B and C are engaged.
One-way clutches E and F are cancelled.
The entire set of planet gears turns as an unit at a ratio of 1 : 1.

Reverse Gear
Clutches B and D are engaged.
The output shaft's direction of rotation is reversed by way of the locked planet gear carrier.
Power flow 1st, 2nd, 3rd and reverse gears is by way of emphasized parts.



316 24 012

The torque converter functions as a fluid coupling and a torque booster. The impeller (P) turns at engine speed and directs the oil clockwise into turbine (T). When a range is selected the turbine and input shaft are connected with set of planet gears via the clutches. As the engine speed increases the oil due to shape of turbine blades will be slung anticlockwise out of the turbine into the supported stator (L) running opposite the engine direction of rotation and thus it is conducted back to impeller with as little disturbance as possible. The back pressure caused by diverting direction will boost the torque. The maximum torque boost occurs on a stationary car when an impeller driven at full throttle is forced to drive a stopped turbine.
As the road speed picks up the difference in speed between impeller and turbine drops until ratio is 1 : 1. At this point the stator is released by the one-way clutch and turns in oil flow direction of impeller and turbine. As road speed increases further or when car is coasting the torque converter acts as a fluid coupling. Consequently when coasting the engine's braking force can be exploited.
The primary pump is driven at engine speed by the torque converter. It has the task of supplying oil to the torque converter, the valve body and the clutches.



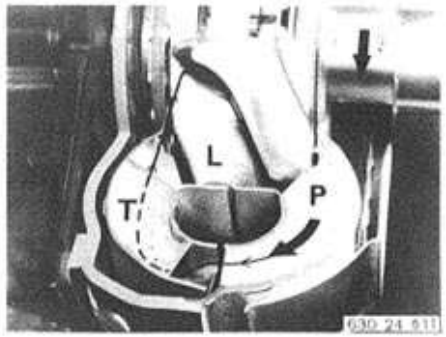
28 24 202

The fully automatic transmission 3 HP-22 is equipped with a torque converter and Simpson planet gear set.

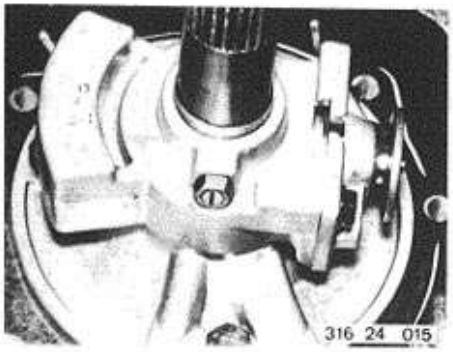
Selector Lever Positions:
P Parking
R Reverse
N Neutral
D 1st, 2nd and 3rd gears = Drive
2 1st and 2nd gears; 3rd gear blocked
1 1st gear; 2nd and 3rd gears blocked

The engine is started with the selector lever at N or P.
In these positions power is not transmitted to the rear wheels.
With the selector lever at P a locking pawl will lock the transmission's output shaft mechanically.
R – Reverse gear
The selector lever is moved to D for normal driving conditions for lower fuel consumption.
Early downshifts are possible with kickdown.
Selector lever position 2 is for driving in mountainous regions to avoid unwanted shifts from 2nd to 3rd gear.
Besides engine's braking effect will be better.
Range 1 is for driving downhill where engine brake is required continuously.

Ranges 1 and 2 can be engaged at any road speed.
If driving too fast, it will merely mean shifting up to the next higher gear automatically.



630 24 611



Explanation of Hydraulic Valve Body

The main pressure valve controls the pressure level in the valve body. As soon as the control unit is filled with oil, the supply of oil to the torque converter is released. If the delivery rate increases, any excessive oil is returned to the primary pump via the intake port.

The converter pressure valve has been given the task of preventing excessive pressures in the torque converter.

The selector slide valve is operated mechanically by the selector lever. This valve directs the oil pressure in the valve body to the desired driving range.

The governor determines in conjunction with the shift valves the shift points depending on the throttle pressure. The governor pressure is produced in accordance with the output shaft's speed.

If the governor piston or governor bushing seize due to dirt, there will be neither upshifts nor downshifts. Clean governor (see 24 32 503).

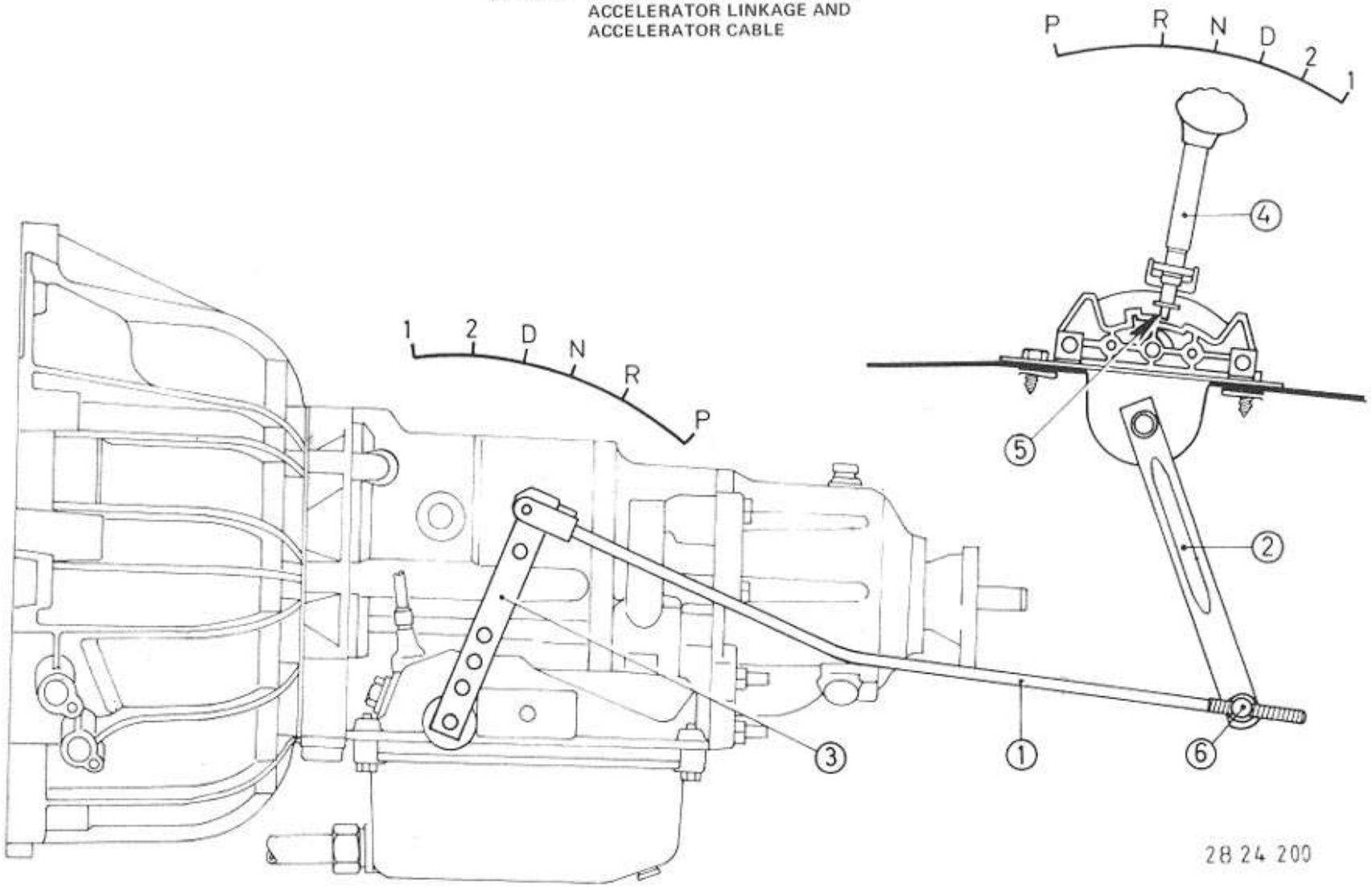
The throttle pressure valve is connected with the accelerator cable and determines with the governor the shift points depending on the throttle valve position.

The locking valves have the task of initiating the downshifts into the different gears regardless of the throttle valve position. Further the locking valves will prevent that other gears are engaged automatically when selector lever is moved to 1 or 2.

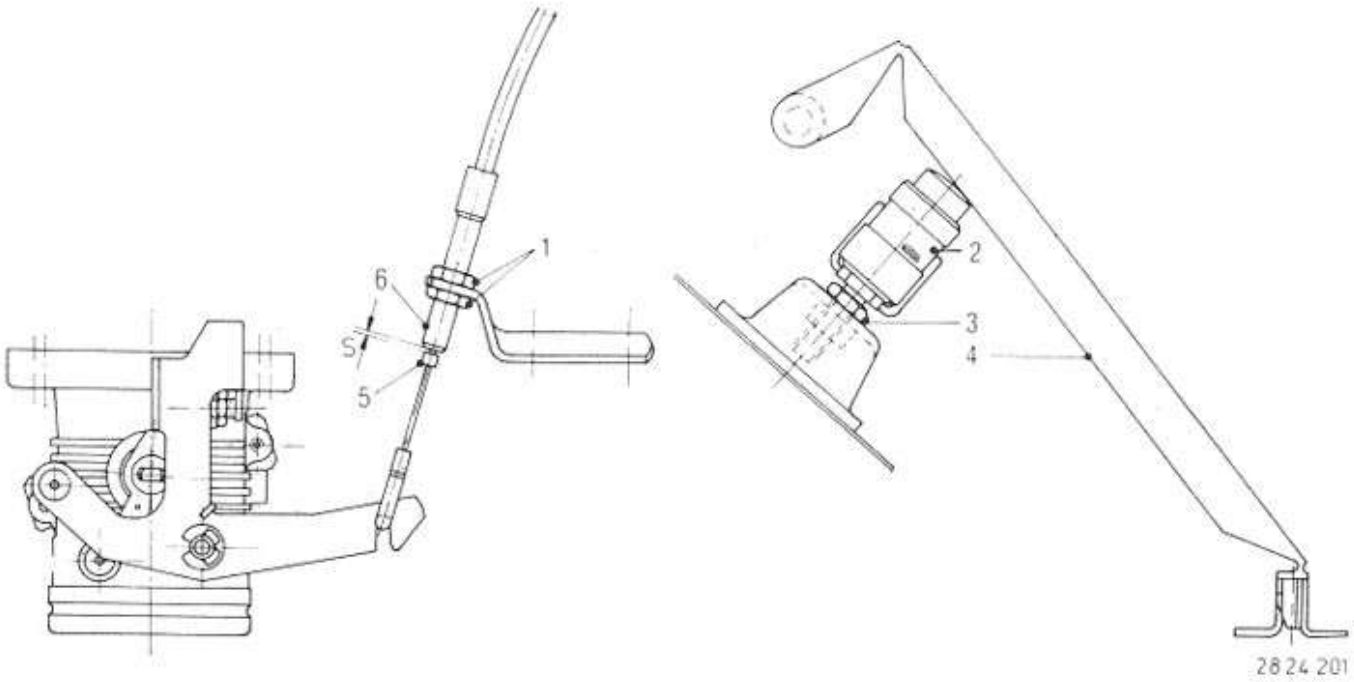
The shift valves determine which gear is engaged. If the spring pressure in a shift valve is overcome by governor pressure, the oil pressure goes to the clutch valves and shuts the pertinent clutches. When kickdown is operated, the spring pressure receives more support from the throttle pressure. Because of this the engine speed must pick up, so that the governor pressure can overcome the spring force and throttle pressure.

The clutch valves and dampers are meant to make gear shifts as smooth as possible.

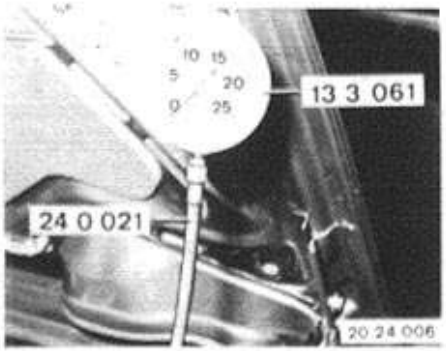
24 00 004 ADJUSTING SELECTOR LEVER, ACCELERATOR LINKAGE AND ACCELERATOR CABLE

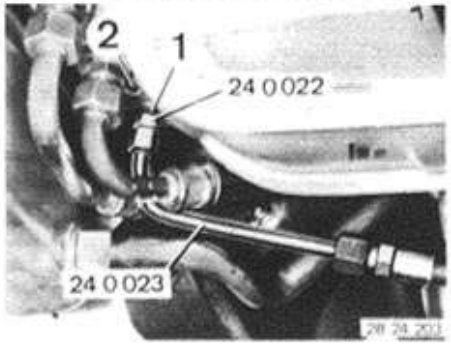


A) Adjusting Selector Lever
Check tightness of bearing bracket before adjusting.
Selector rod (1) must be attached in bore of selector lever (3) without code letters.
Detach selector rod (1) at selector lever lower section (2).
Move selector lever (3) on transmission to position N.
Press selector lever (4) against stop (5) on shift gate.
Alter length of selector rod (1) until pin (6) aligns with bore in selector lever lower section (2).
Now shorten selector rod length by 1 to 2 turns with pin (6).
Attach and secure selector rod.



B) Adjusting Accelerator Cable
Requirement: full throttle setting correct.
In neutral position adjust play (S) to 0.50 ± 0.25 mm (0.020 ± 0.010") with nuts (1).
Check kickdown stop (2).
Unscrew locknut (3) and screw in kickdown stop (2).
Press down accelerator pedal (4) to transmission pressure point.
Unscrew kickdown stop in this position until accelerator pedal touches.
Press accelerator pedal (4) to kickdown (final position).
Now distance (S) from seal (5) to end of sleeve (6) must be at least 44 mm (1.732").





24 00 009 CHECKING HYDRAULIC PRESSURE VALUES

Mount pressure tester 13 3 061 on engine hood in conjunction with hose 24 0 021.

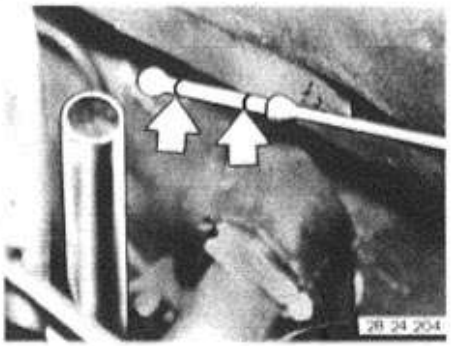
Connect tester on transmission.

1 Main Pressure
Adapter 24 0 022 and elbow pipe 24 0 023
2 Clutch A

Test:

Accelerator Cable Detached; engine speed 1300 rpm	Selector Lever Position	Accelerator Lever Pos.
Main pressure[1]	R	1. Idle 2. Pulled to kickdown
Main pressure[1]	D,2,1, P,N	Brake pedal pressed down Parking brake applied 1. Idle 2. Pulled to kickdown

[1] See Specifications



Installation:

Correct oil level with selector lever at P, transmission at operating temperature and engine running at idle speed.

Park car on level ground.

Oil level of a transmission having operating temperature should be between both marks.

Amount of oil between min. and max. marks: approx. 0.4 liter (0.8 pint).

Never wipe off dipstick with a cloth losing lint.

Important!

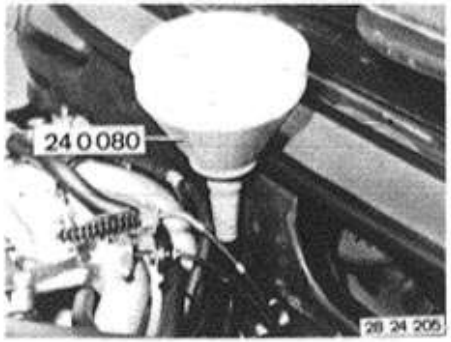
Oil Level Too High:

Excessive foam, oil lost by splashing, high temperature when driving fast, oil lost through vent.

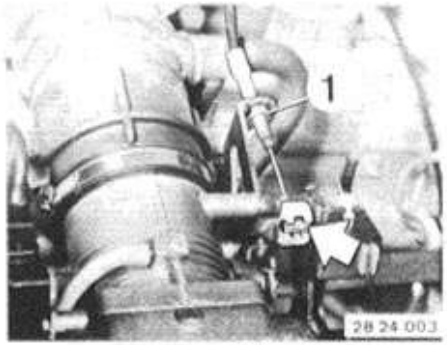
Oil Level Too Low:

Valves rattling, foam, engine slipping when driving in cuves.

General malfunctioning.

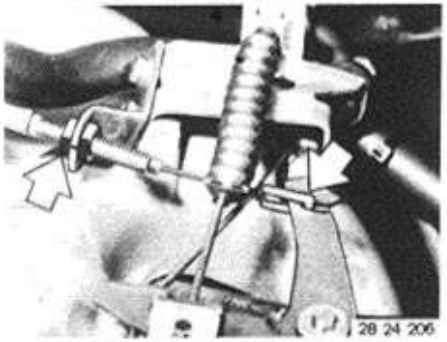


Always use funnel 24 0 080 to add ATF.

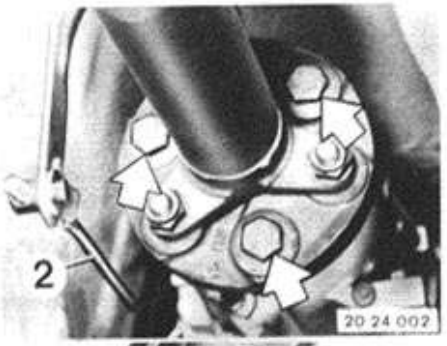


24 00 020 REMOVING AND INSTALLING TRANSMISSION

Disconnect battery ground wire.
Unscrew nut (1).
Disconnect accelerator cable.
Installation:
Adjust accelerator cable, see 24 00 004.



BMW 528e:

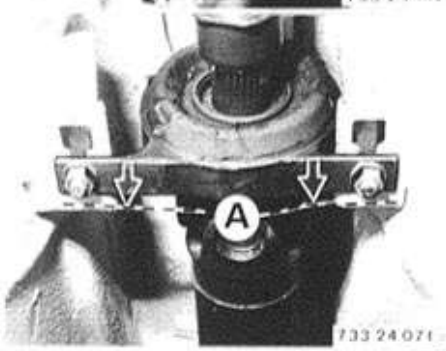


Remove exhaust assembly 18 00 020.
Remove heat shield.
Detach joint disc at transmission.
Disconnect selector rod (2).
Installation:
Tighten bolts to specified torque*
Adjust selector lever 24 00 004.

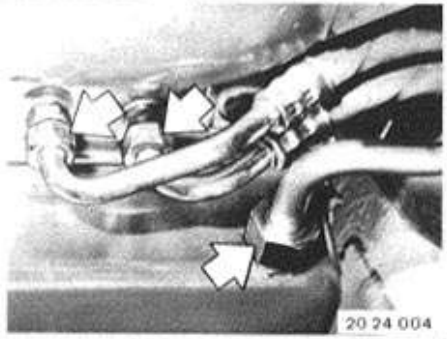
Installation:
Replace stop nuts.
Tighten nuts to specified torque* with a standard 19 mm socket and torque wrench.
Important!
Only tighten nuts (never bolts) to avoid stress in joint disc.

* See Specifications

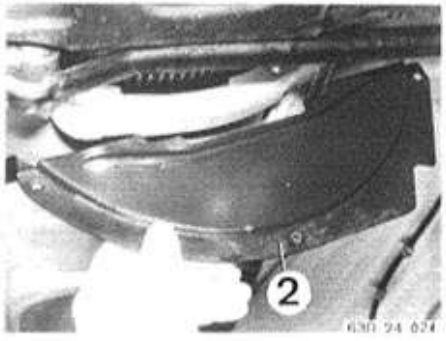
Loosen screw-on ring (1) several turns.
Installation:
Tighten screw-on ring with Special Tool 26 1 040 after finishing installation.
Tightening torque*.



Unscrew center mount.
Installation:
Preload center mount forward by distance A = 2 to 4 mm (0.079 to 0.157").
Tightening torque*.
Bend propeller shaft down and pull off of centering pin.
Important!
Suspend propeller shaft from car on piece of wire.

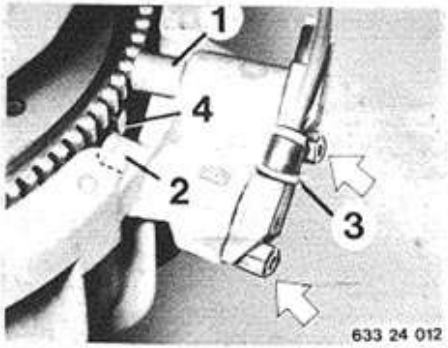


Drain oil.
Important!
Never reuse drained oil.
Installation:
Transmission will have to be disassembled if oil has a burnt odor and is black.
Important!
If transmission was defective, clean oil cooler and lines with compressed air and flush twice with ATF.
Remove oil filler tube.
Disconnect oil cooler lines on transmission.
Tightening torque*.

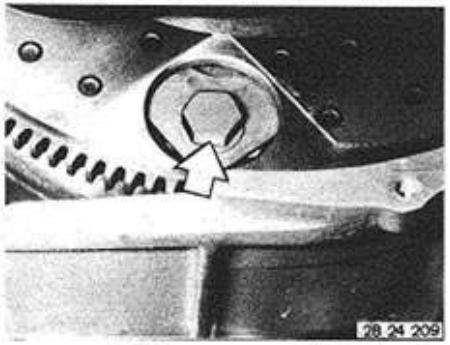


Remove cover (2).

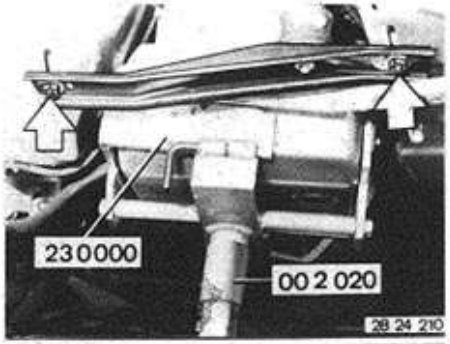
* See Specifications



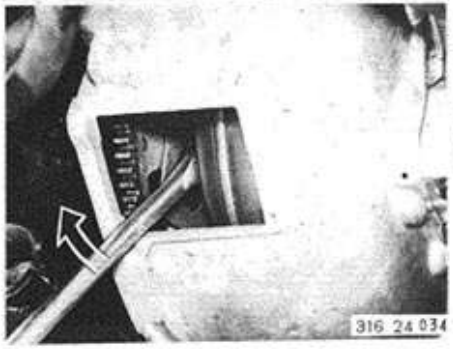
Detach heat shield.
Unscrew bolts.
Pull out speed transmitter (1) and reference mark transmitter (2).
Important!
Check installed position don't mix up plugs.
Install speed transmitter (1), black plug facing gear ring, and reference mark transmitter (2), plug with gray ring (3) facing pin (4).
If mixed up, engine cannot be started.
Engine will not start when plugs are mixed up.
Installation:
Check O-rings, replacing if necessary.
Insert transmitter with Molykote Longterm 2.



Remove grill.
Disconnect torque converter on drive plate at four points.

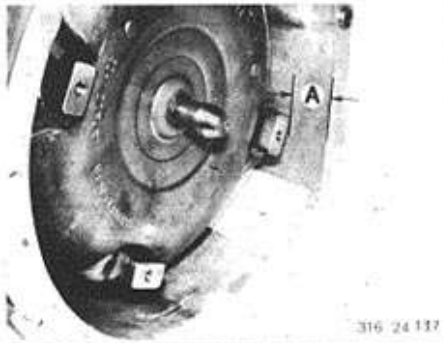


Support transmission with Special Tools 23 0 000 and 00 2 020.
Detach cross strut on body.
Lower transmission to front axle carrier.
Tightening torque*.

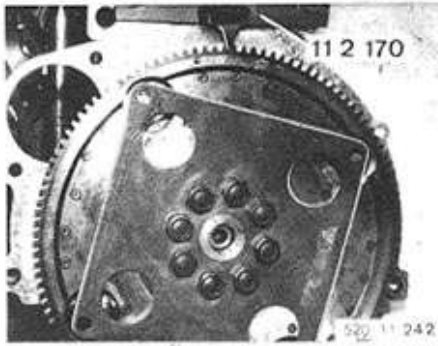


Detach transmission from engine.
Pull transmission off of engine, pressing off torque converter at same time.
Important!
With the transmission attached the lifting fixture may only be moved in completely lowered state.

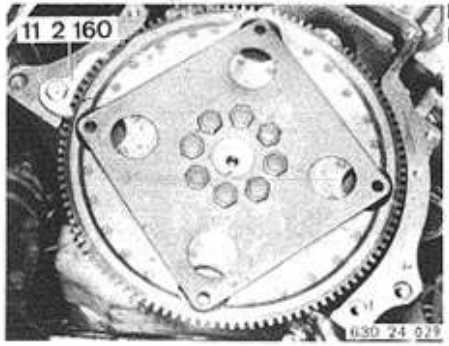
* See Specifications



Important!
Make sure torque converter is positioned correctly prior to installation of transmission.
Drive tabs must be below case edge by distance (A) = approx. 30.5 mm (1.201").

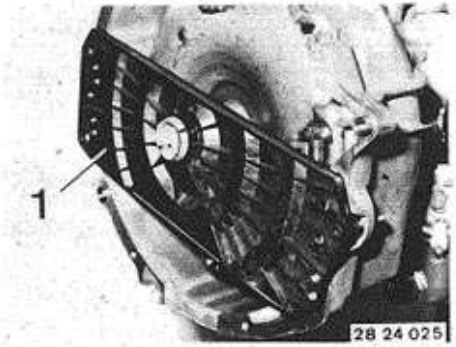


Installation:
Inspect drive plate for breaks and cracks, replacing if necessary.
BMW 528e:
Hold flywheel with Special Tool 11 2 170.
Unscrew expansion bolts.
Important!
Replace expansion bolts and install with Loctite No. 270.
Only coat threads.
Clean tapped bores thoroughly.
Tightening torque*.



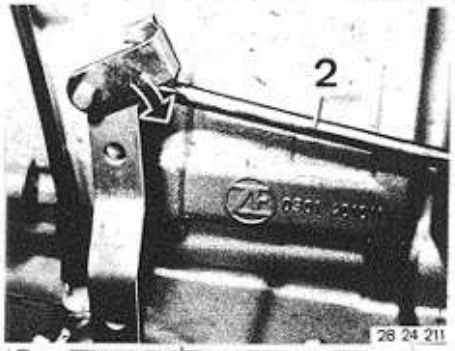
BMW 533i:
Hold flywheel with Special Tool 11 2 160.

* See Specifications

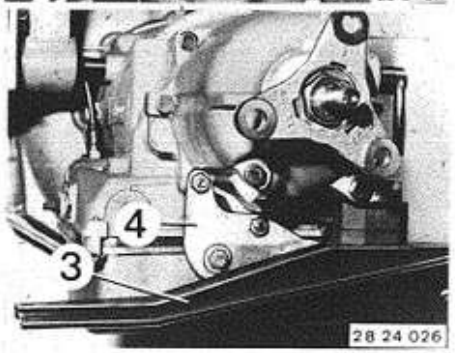


24 00 040 INSTALLING RECONDITIONED TRANSMISSION

Remove transmission 24 00 020.
Important!
Always clean oil cooler and lines with compressed air and flush twice with ATF prior to installing a reconditioned transmission.
Transmission code* on data plate.
Take off transport holder (1).

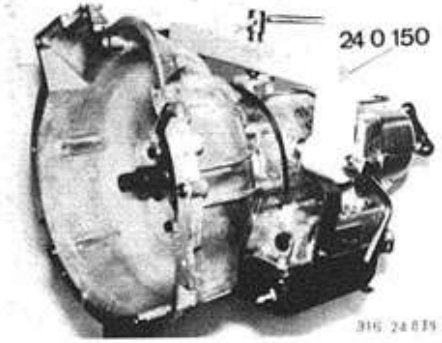


Transfer linkage (2).
Important!
Linkage (2) must be attached in bore without code letters of selector lever.
Mount spring clamp from top to bottom.
Note plastic sleeve.



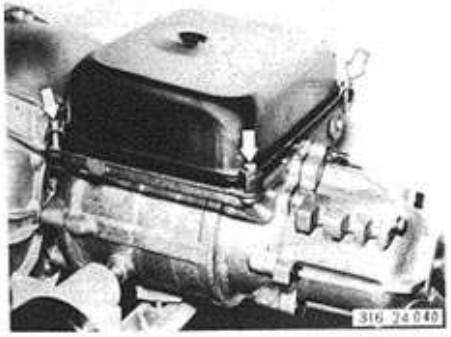
Transfer cross member (3) and exhaust carrier (4).

* See Specifications

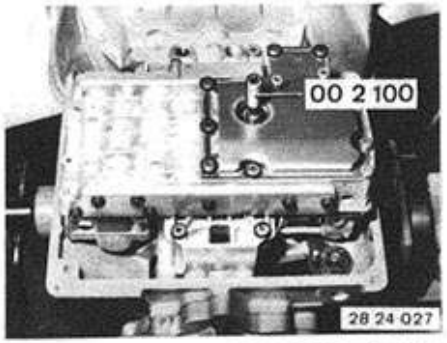


24 00 080 DISASSEMBLING / ASSEMBLING TRANSMISSION

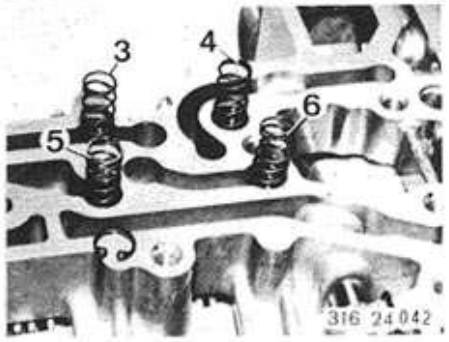
Remove transmission 24 00 020.
Remove torque converter 24 40 000.
Mount transmission on assembly stand in conjunction with Special Tool 24 0 150.
Important!
Tighten bolts only finger tight to prevent damage on transmission case.



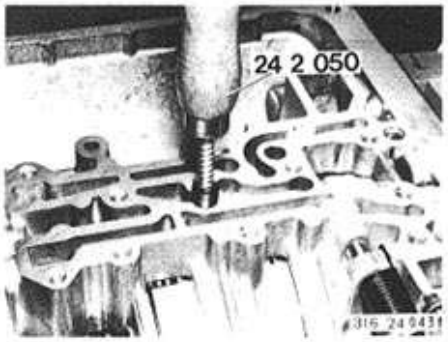
A) Disassembling
Detach oil sump.



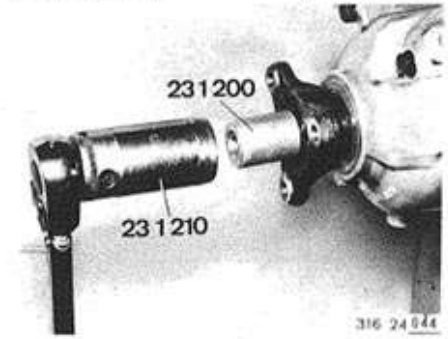
Detach valve body.
Unscrew Torx bolts with Special Tool 00 2 100.



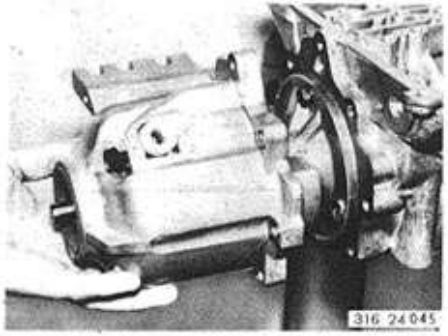
Remove circlips.
Remove springs (3 ... 6).



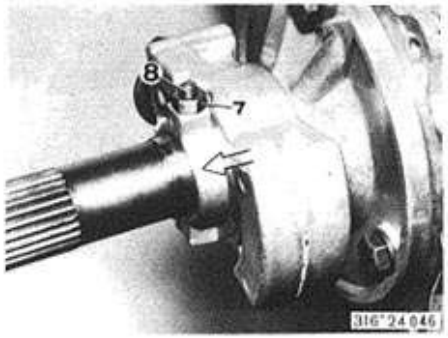
Pull out sealing sleeves with Special Tool 24 2 050.



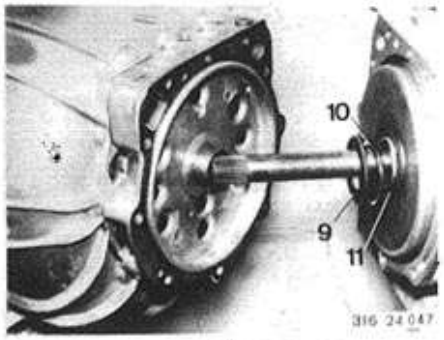
Engage parking lock.
Apply Special Tool 23 1 200.
Unscrew collar nut with Special Tool 23 1 210.
Pull off output flange.



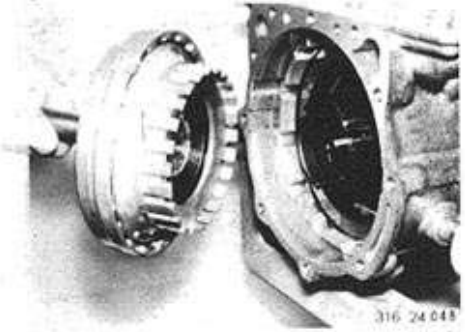
Disconnect exhaust brace.
Detach transmission extension.



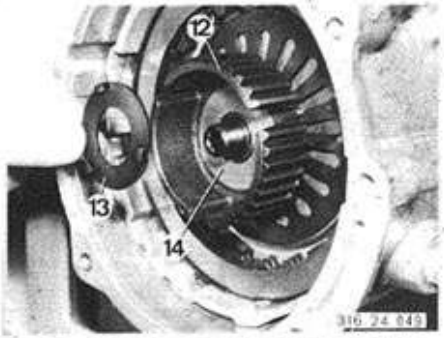
Loosen nut (7) and unscrew stud (8) by about 3 turns.
Pull off governor.



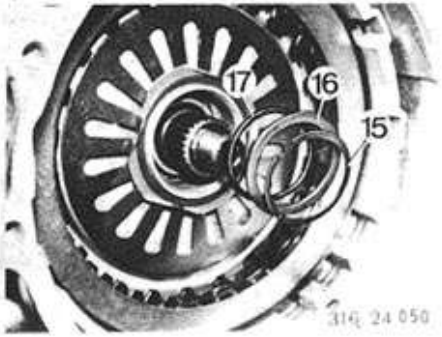
Detach converter bell housing with intermediate plate.
Important!
Thrust washer (9), needle bearing (10) and angled disc (11).



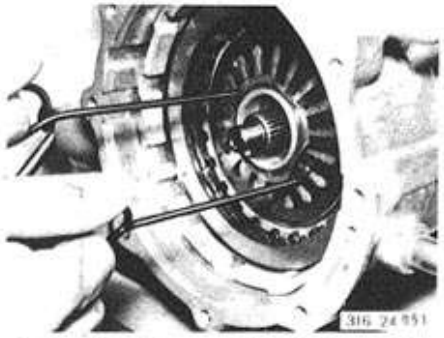
Remove input shaft with clutch A.



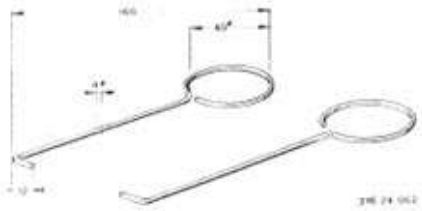
Remove plate carrier (12) for clutch A with plastic thrust washer (13) and metal thrust washer (14).

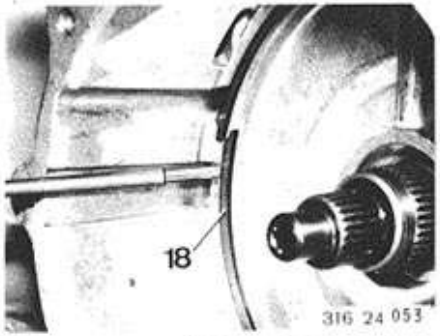


Remove circlip (15).
When removing clutch B, cover (16) and seal (17) will also be pulled out.

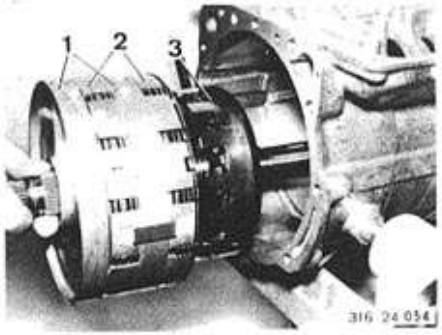


Pull out clutch B with two locally made hooks.
See sketch for local manufacture.
Dimensions in mm.

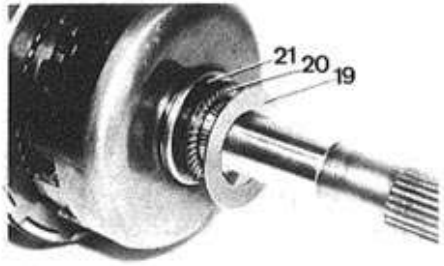




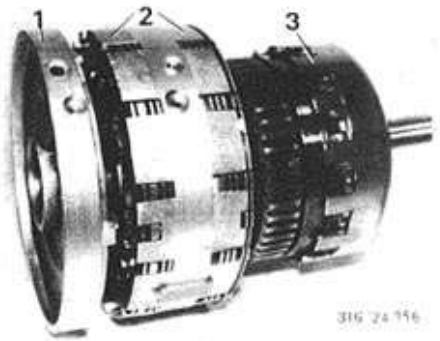
Remove circlip (18).



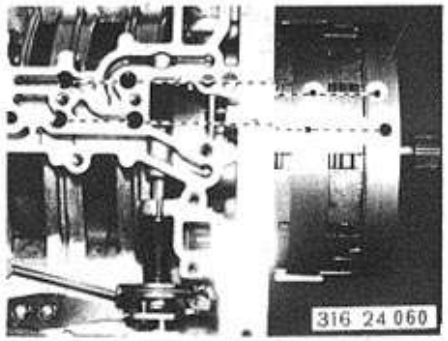
Pull out entire packet of parts.
Centering plates (1), clutches C', C and D (2), planet gear set with output shaft (3).
Important!
Parking lock must not be engaged.



Important!
Thrust washer (19), needle bearing (20) and angled disc (21).

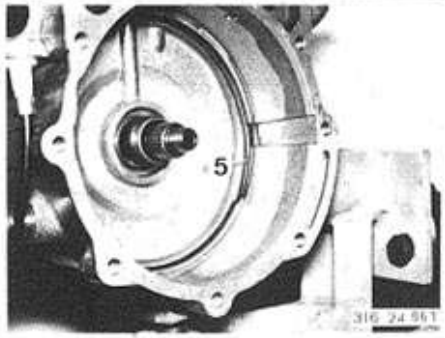


Pull centering plate (1), clutch packet (2) with clutches C , C and D off of output shaft (3).

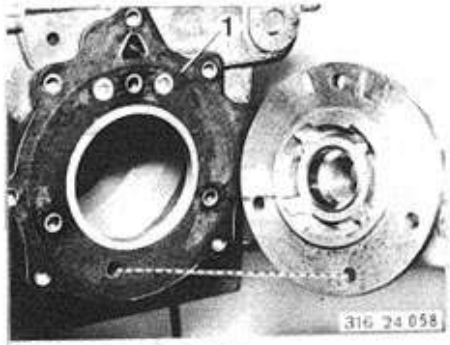


Important!
Keys must be centered in groove of cylinder.
Parking lock must not be engaged.
Insert entire output packet into transmission case that the 4 oil bores in output packet align with bores in underside of transmission case.

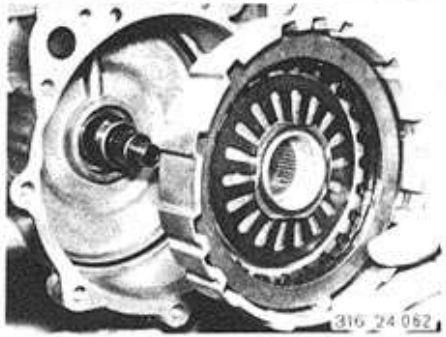
Remove set of planet gears with sun gear shaft.
Important!
Needle bearing (22) and thrust washer (23).



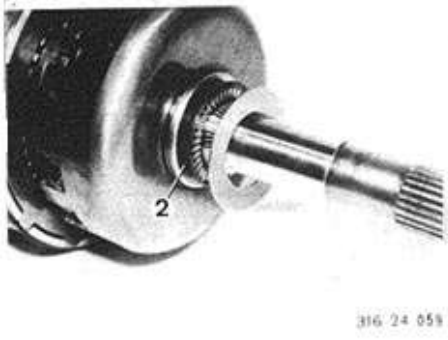
Insert circlip (5).



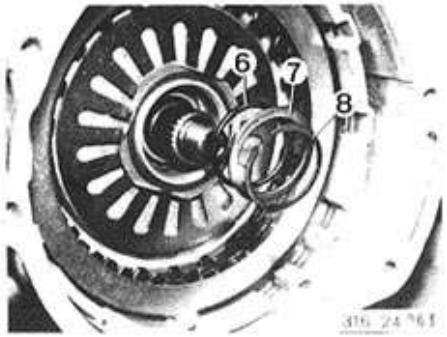
B) Assembling
Detach governor flange.
Replace gasket (1).



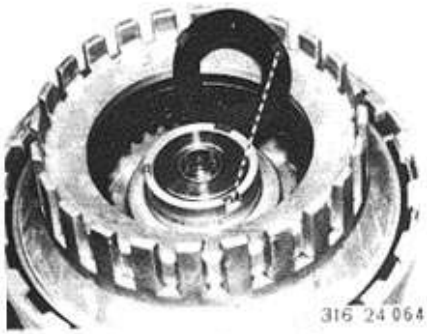
Install clutch B.



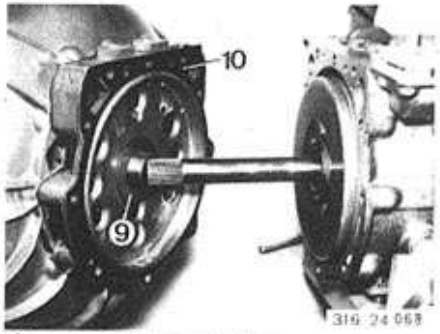
Install angled disc (2) with grease, angled side on output shaft.
Install needle bearing and thrust washer on output shaft.



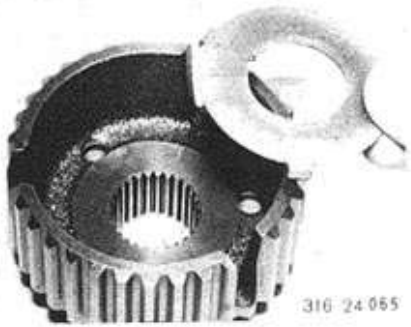
Install seal (6) and press in against stop with support disc (7).
Insert circlip (8).



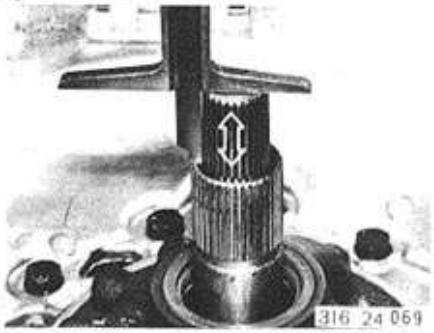
Install plastic thrust washer with grease so that tabs engage in openings of cylinder A.



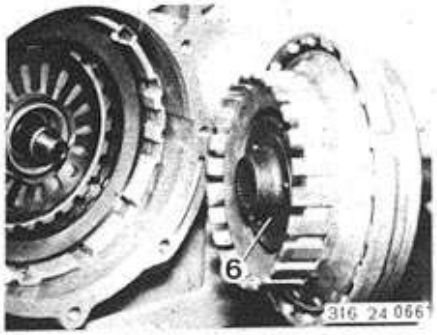
Stick thrust washer (9) and gasket (10) on converter bell housing.
Slide converter bell housing on to input shaft a secure.



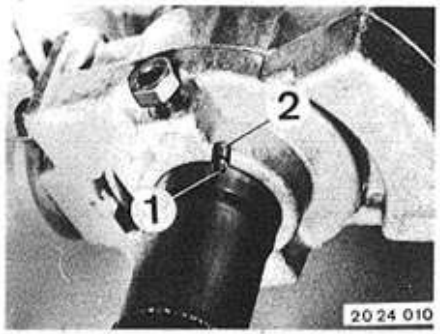
Stick metal thrust washer in plate carrier with grease.



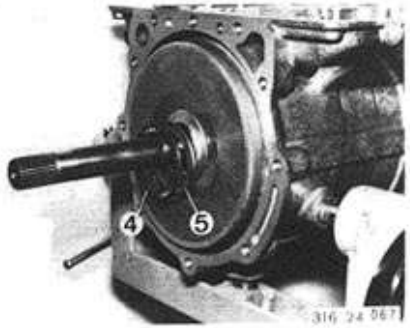
Check axial play of input shaft.
Specifications: 0.3 ... 1.5 mm (0.012 ... 0.059"



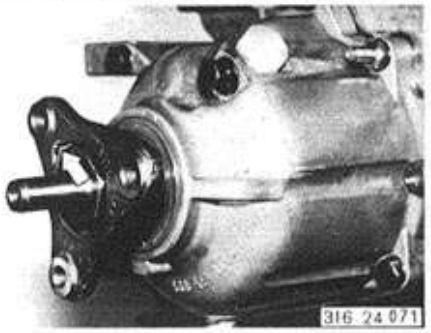
Install plate carrier (6) in clutch A by turning back and forth slightly.
Install clutch A in transmission case.



Compress piston rings slightly and then slide governor on to governor flange.
Important!
Punch mark (1) on output shaft must be aligned with opening (2) in governor hub.
Secure governor.

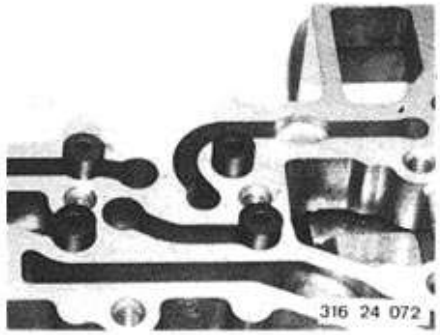


Mount angled disc (5) on input shaft with collar facing needle bearing (4).

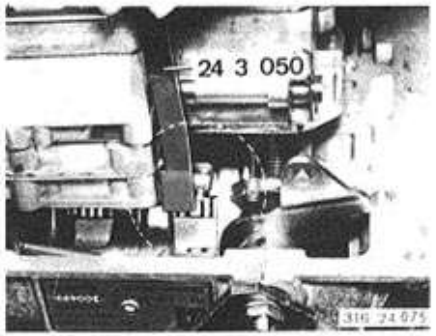


Lubricate sealing lip of radial oil seal with ATF.
Attach transmission extension and output flange.
Install collar nut with Curil K 2 or Loctite 572.
Tighten collar nut[1].
Place lockplate on nut and lock in groove of output flange.

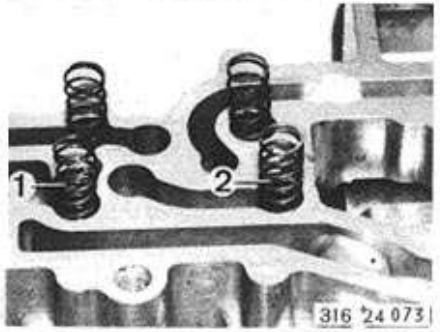
[1] See Specifications for tightening torque



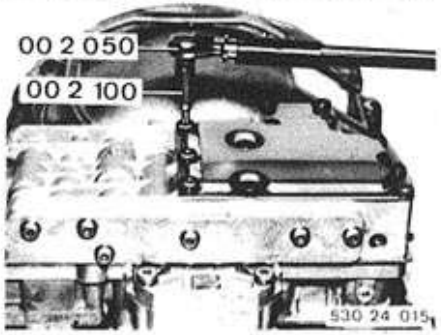
Press in 4 sealing sleeves against stop with a suitable mandrel.



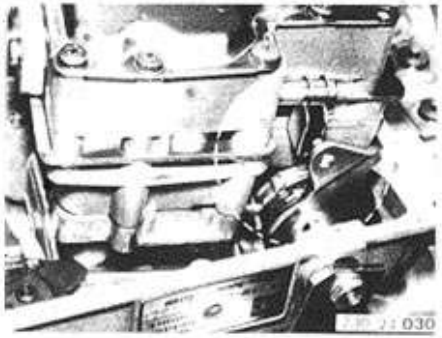
Align valve body with Special Tool 24 3 050. When special tool is not available, check that distance from valve body housing to pin in throttle pressure piston is 11.5 mm (0.453"). Tighten valve body bolts in this position.



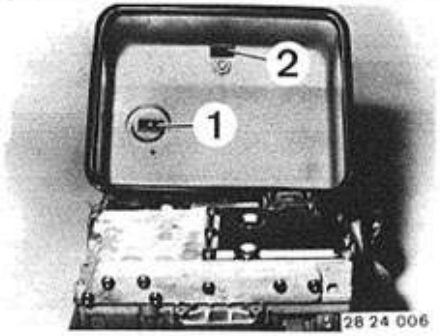
Install and secure springs.
Both short springs (1 and 2) will be on selector lever end.



Tighten[1] Torx bolts with Special Tools 00 2 100 and 00 2 050.

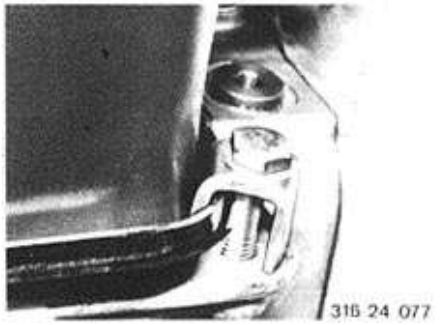


Install valve body that clip on selector sliding valve can be engaged in operating arm of pawl. This requires tightening transmission cable slightly so that throttle cam will not interfere with throttle pressure valve.



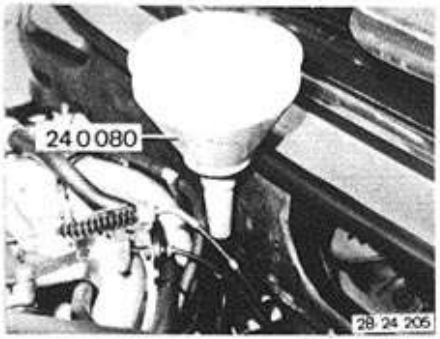
Place gasket on oil sump.
Install magnets (1 and 2).
Note installed position.

Tighten valve body bolts only finger tight.



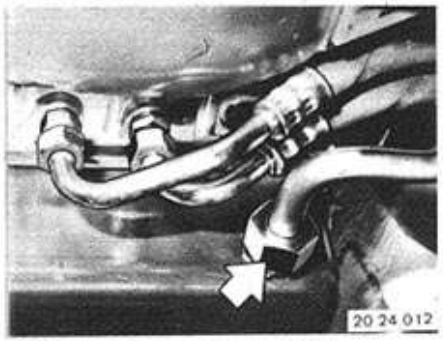
Tighten oil sump mounting bolts with brackets. Short leg of brackets presses down on oil sump.

[1] See Specifications for tightening torque

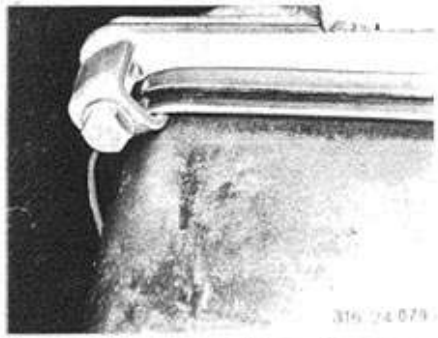


24 11 000 REMOVING AND INSTALLING OIL SUMP

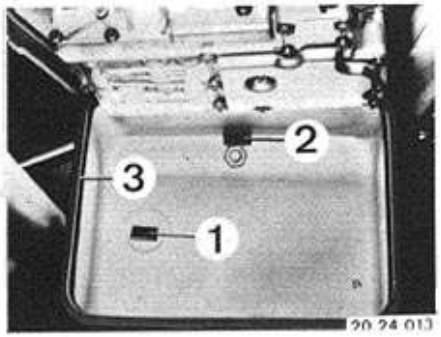
Drain oil.
Important!
Never reuse drained oil.
Installation:
If oil smells burnt and is black, the transmission will have to be disassembled.
Park car on level ground.
Correct oil level with selector lever at P, transmission at operating temperature and engine running at idle speed.
Oil level of transmission having operating temperature should be between both marks.
Amount of oil between min. and max. marks: approx. 0.4 liter (0.8 pint).
Oil Level Too High:
Serious foaming, oil lost by splashing out, high temperature when driving fast, oil lost through vent.
Oil Level Too Low:
Valves rattling, foam, engine slipping, general malfunctioning.
Always use funnel 24 0 080 to add ATF.



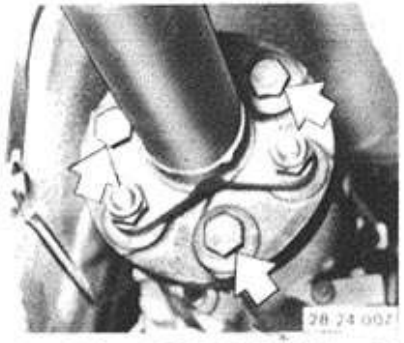
Disconnect oil filler tube on oil sump.
Detach oil sump.



Installation:
Mount oil sump with brackets in such a manner that short legs of brackets exert force on oi sump.

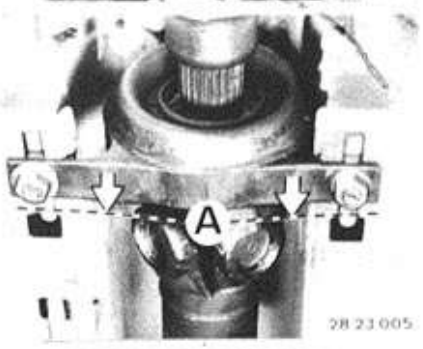


Important!
Place magnets (1 and 2) in oil sump.
Mount gasket (3).

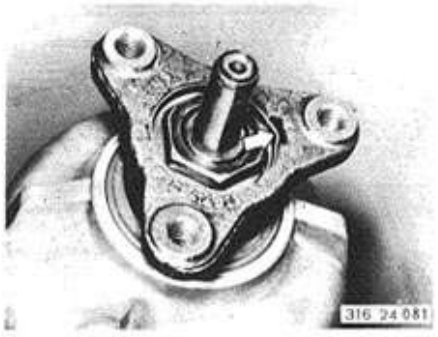


24 11 050 REMOVING AND INSTALLING/ SEALING TRANSMISSION EXTENSION

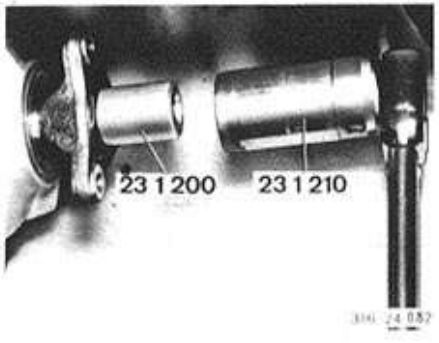
Remove exhaust assembly 18 00 020.
Remove heat shield.
Detach propeller shaft at transmission.
Installation:
Tighten bolts to specified torque[1].



Detach center bearing.
Installation:
Preload center bearing forward by distance (A) 2 mm (0.079").
Push propeller shaft together at slide, bend down and pull off of centering pin.
Installation:
Align propeller shaft with Special Tool 26 1 030 (see 26 11 000).

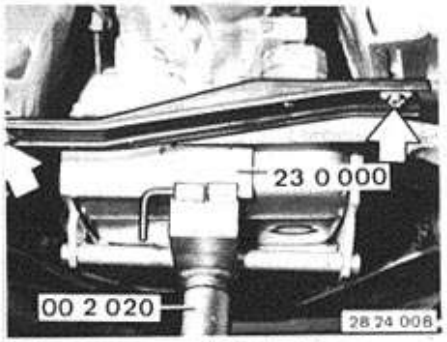


Remove lockplate.
Installation:
Lock lockplate in groove of output flange.

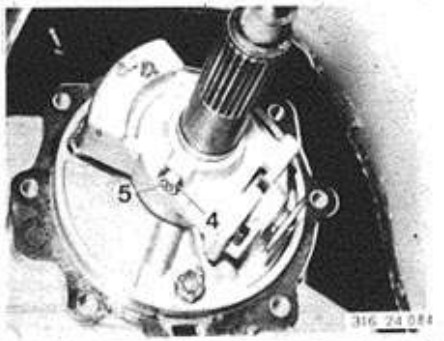


Engage parking lock.
Apply Special Tool 23 1 200.
Unscrew collar nut with Special Tool 23 1 210.
Pull off output flange.
Installation:
Install collar nut with Curil K 2 or Loctite No. 572.
Tightening torque[1].

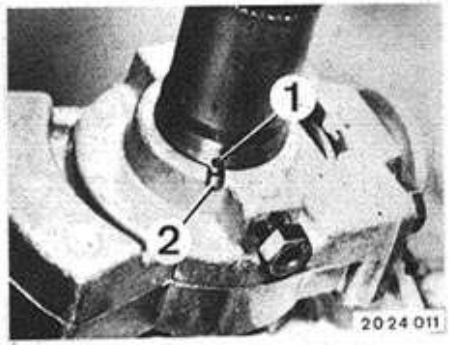
[1] See Specifications



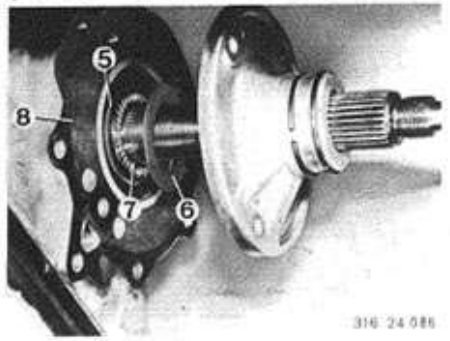
Support transmission with Special Tools 23 0 000 and 00 2 020.
Remove cross member.
Lower transmission.
Detach transmission extension.



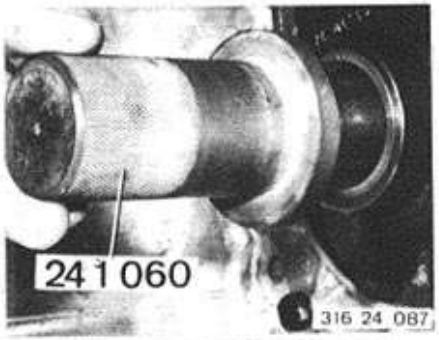
Loosen nut (4) and unscrew stud (5) by about 3 turns.
Pull off governor.



Installation:
Compress piston rings slightly and push governor on to governor flange.
Important!
Punch mark (1) on output shaft must be aligned with opening (2) in governor flange.
Mount governor.

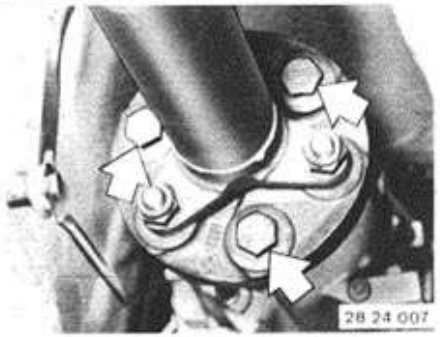


Detach bearing flange.
Important!
Angled disc (5), thrust washer (6) and needle bearing (7).
Replace gasket (8).



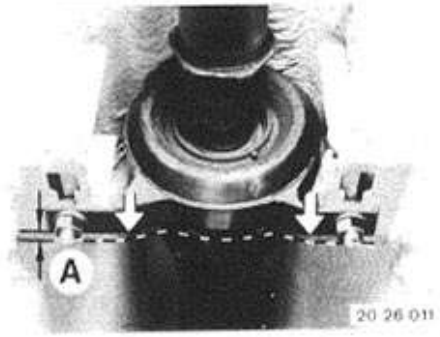
24 12 001 REPLACING RADIAL OIL SEAL FOR TORQUE CONVERTER

Remove and install torque converter 24 40 000.
Remove radial oil seal.
Installation:
Lubricate sealing lip with oil.
Knock in radial oil seal to fit tight with Special Tool 24 1 060.

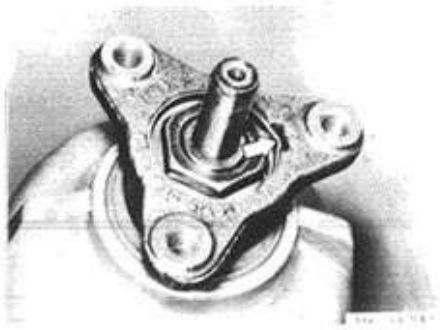


24 12 011 REPLACING RADIAL OIL SEAL FOR OUTPUT FLANGE

Remove exhaust assembly 18 00 020
Remove heat shield.
Detach propeller shaft at transmission.
Installation:
Tighten bolts to specified torque[1].

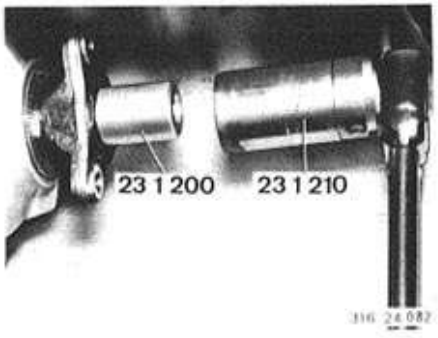


Detach center bearing.
Installation:
Preload center bearing forward by distance (A) = 2 mm (0.079").
Bend down propeller shaft and pull off of centering pin.
Installation:
Align propeller shaft with Special Tool 26 1 030 (see 26 11 000).

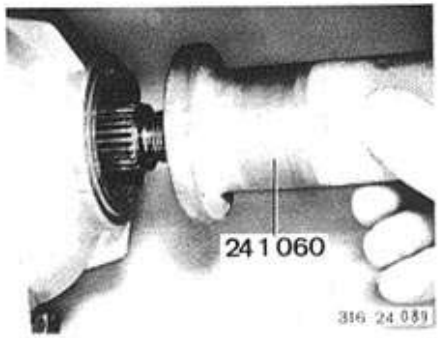


Remove lockplate.
Installation:
Lock lockplate in groove of output flange.

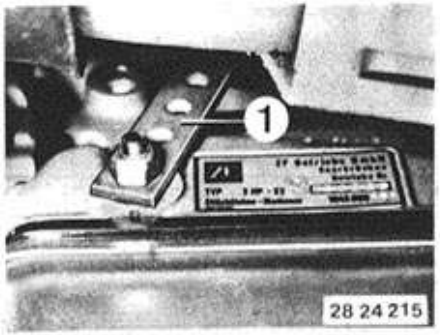
[1] See Specifications



Engage parking lock.
Apply Special Tool 23 1 200.
Unscrew collar nut with Special Tool 23 1 210.
Pull off output flange.
Installation:
Install collar nut with Curil K 2 or Loctite 572.
Tightening torque[1].

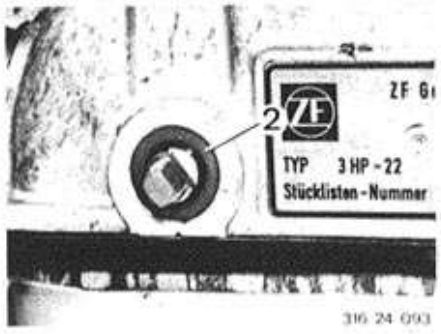


Remove radial oil seal.
Installation:
Lubricate sealing lip with ATF.
Knock in radial oil seal to fit tight with Special Tool 24 1 060.



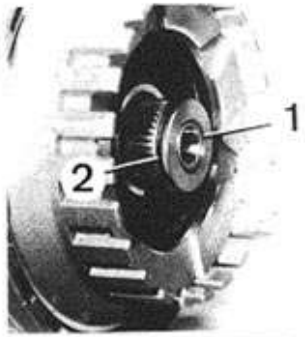
24 12 101 REPLACING RADIAL OIL SEAL FOR MANUAL SHIFT VALVE SHAFT

Detach selector lever (1) on transmission.



Remove radial oil seal (2).
Installation:
Lubricate sealing lip with ATF.
Knock in radial oil seal flush.

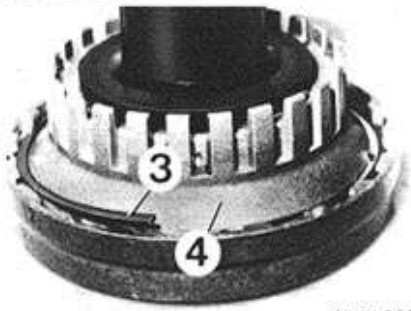
[1] See Specifications



28 24 035

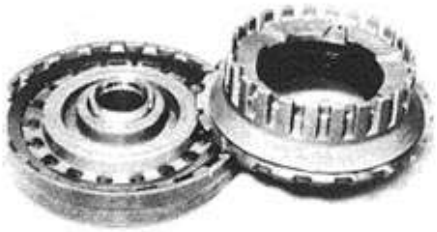
24 23 020 REPLACING PLATE CLUTCHES AND BRAKES

Disassemble transmission 24 00 080.
Clutch A:
Push out input shaft (1).
Check O ring (2), replacing if necessary.

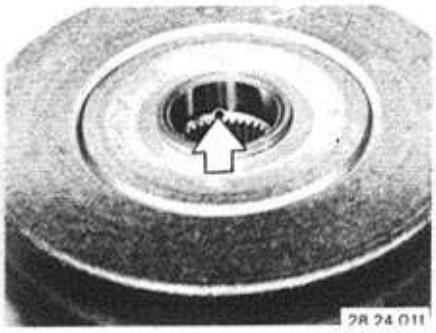


28 24 009

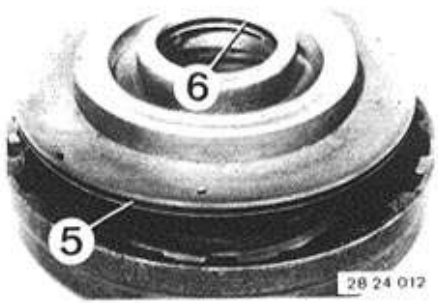
Compress clutch packet and remove circlip (3).
Take off plate carrier (4).


28 24 010

Lift out plate packet and diaphragm spring.

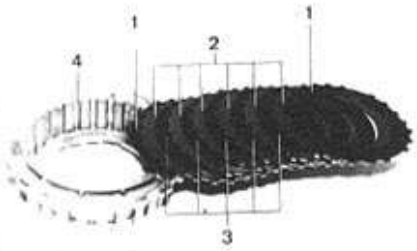


Press out piston for clutch A by applying compressed air at oil bore.



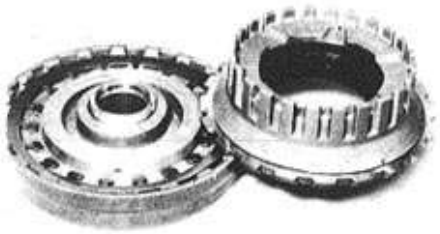
28 24 012

Installation:
Replace O rings (5 and 6).

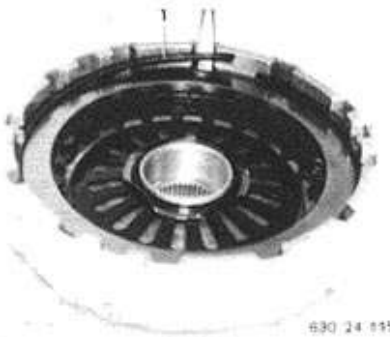


630 24 691

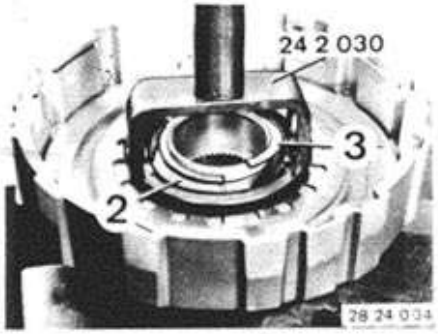
Remove plates.
Installed Order:
1 Spring plates (two)
2 Outer plates (six)
3 Lined plates (five)
4 Plate carrier
Installation:
Place new lined plates in ATF having temperatu of 70° C (158° F) for about 20 minutes.


28 24 010

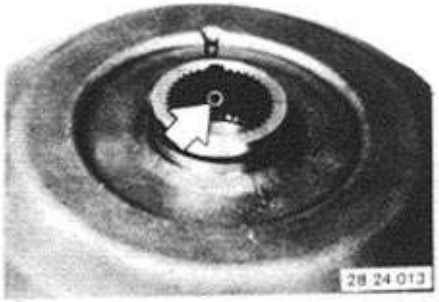
Place diaphragm spring in input shaft housing that curved surface faces down.
Insert plate packet with plate carrier.
Compress clutch packet and insert circlip.



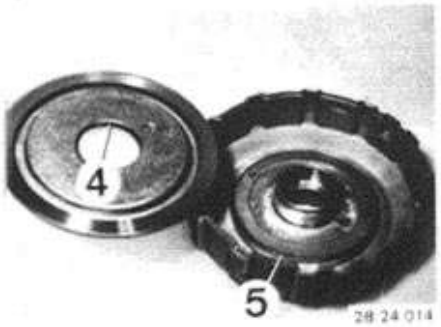
Clutch B:
Remove circlip (1).
Remove outer and lined plates.



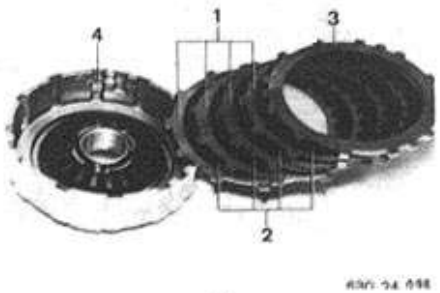
Bend open lockwasher (2).
Push down diaphragm spring with Special Tool 24 2 030 and remove circlip (3).
Installation:
Replace and lock lockwasher.
Insert diaphragm spring with curved surface facing up.



Press out piston for clutch B with compressed air applied in oil bore.

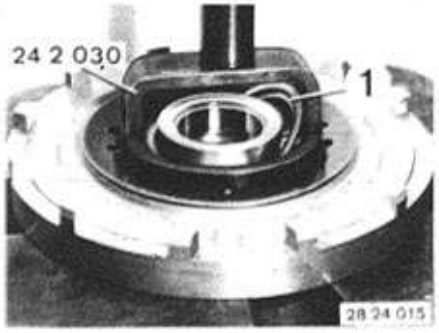


Installation
Check O-rings (4 and 5), replacing if necessary

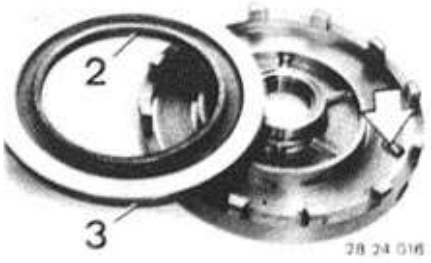


Installed Order:
1 Outer plates 1.8 mm (0.071") (four)
2 Lined plates (four)
3 End plate 4.5 mm (0.177") (one)
Important!
Insert end plate with ground side facing lined plate.
4 Housing
Installation
Place new lined plates in ATF having temperature of 70° C (158° F) for about 20 minutes.

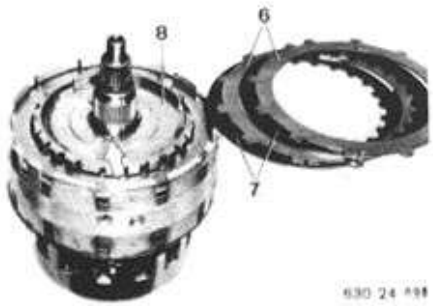
Clutch C:
To make installation easier, insert entire packet in a piece of pipe with an inside dia. of 29 mm and clamp in a vise (29 mm = 1.142").
Lift off centering plate (5).
Remove outer lined plates and one way clutch.



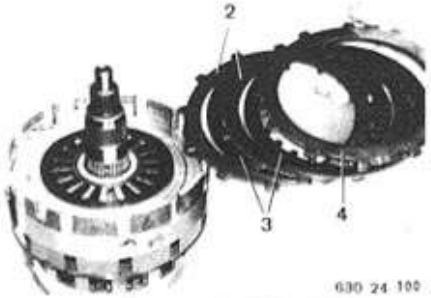
Push down diaphragm spring with Special Tool 24 2 030 and lift out split retaining ring (1).
Installation
Insert diaphragm spring with curved surface facing up.



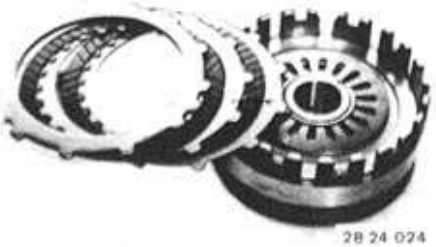
Press out piston for clutch C with compressed air applied in oil bore.
Installation
Check O-rings (2 and 3), replacing if necessary.



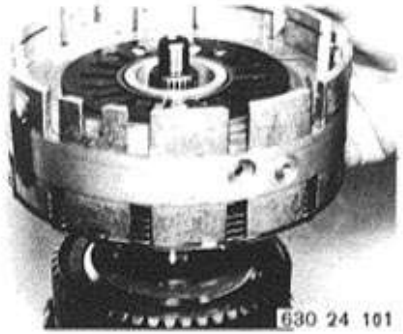
Installation:
Install one-way clutch (8) that bent over tabs of holder are visible from above.
Installed Order:
6 Outer plates (two)
7 Lined plates (two)
Place new lined plates in ATF having temperature of 70° C (158° F) for about 20 minutes.



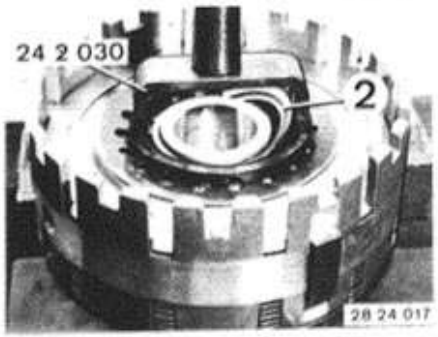
Installed Order:
2 Outer plates 1.8 mm (0.071") (two)
3 Lined plates (two)
4 End plate 4.5 mm (0.177") (one)
Important!
Install end plate with ground side facing lined plate.
Installation:
Place new lined plates in ATF having temperature of 70° C (158° F) for about 20 minutes.



Clutch C:
Remove outer and lined plates.

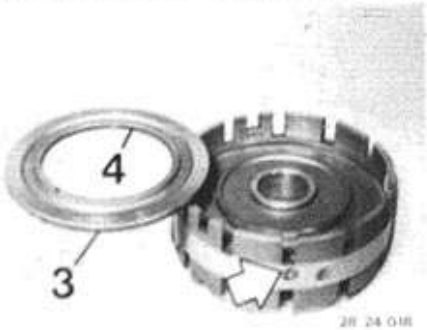


Clutch D:
Lift clutch unit with clutch D off of planet gear set.

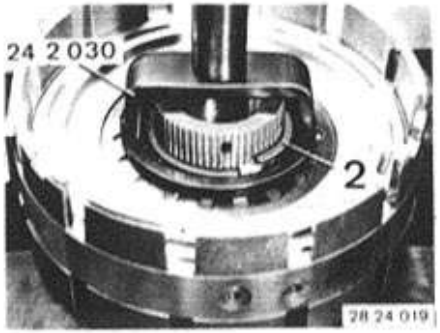


Push down diaphragm spring with Special Tool 24 2 030 and lift out split retaining ring (2).
Installation:
Install diaphragm spring with curved surface facing up.

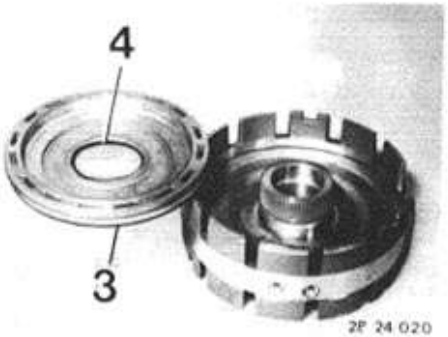
Remove circlip (1).
Remove outer and lined plates.



Press out piston for clutch C by applying compressed air in oil bore.
Installation:
Check O-rings (3 and 4), replacing if necessary.



Push down diaphragm spring with Special Tool 24 2 030 and remove circlip (2).
Installation:
Install diaphragm spring with curved surface facing up.

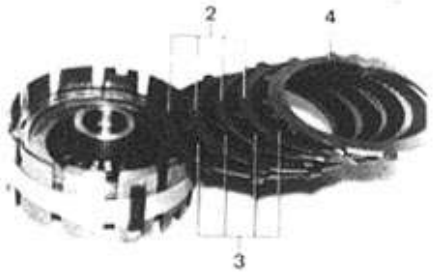


2F 24 020

Press out piston for clutch D by applying compressed air in oil bore.

Installation:

Check O rings (3 and 4), replacing if necessary.



630 24 161

Installed Order:

2 Outer plates 1.8 mm (0.071") (four)
3 Lined plates (four)
4 End plate 4.5 mm (0.177") (one)

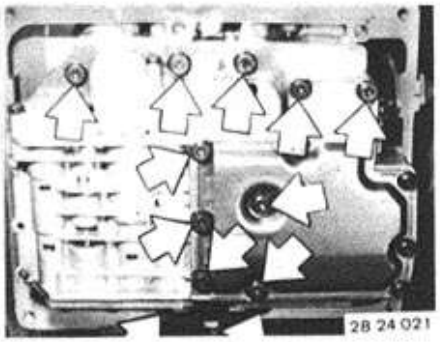
Important!

Install end plate with ground side facing lined plate.

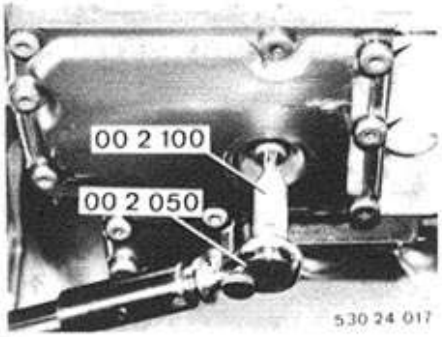
Installation:

Place new lined plates in ATF having temperature of 70° C (158° F) for about 20 minutes.

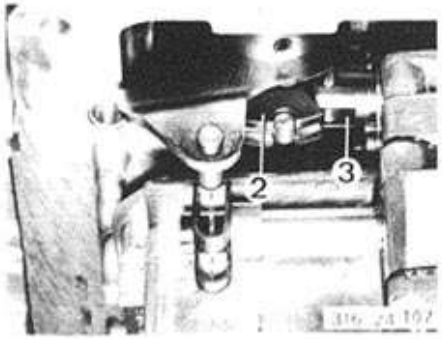
24 30 000 REMOVING AND INSTALLING VALVE BODY



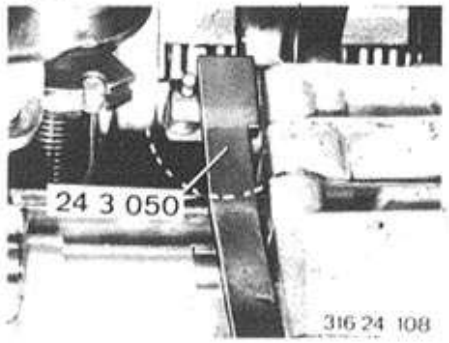
Remove oil sump 24 11 000.
Remove valve body.



Installation:
Tighten[1] Torx bolts with Special Tools 00 2 100 and 00 2 050.

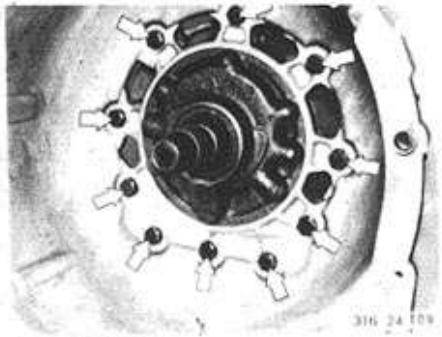


Installation:
Install valve body that clip on selector valve can be engaged in operating arm of pawl. This will require pulling the transmission cable slightly so that accelerator cam (2) cannot interfere with throttle pressure valve (3).



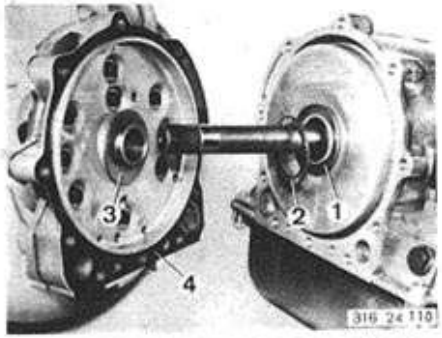
Tighten valve body bolts only finger tight. Align valve body with Special Tool 24 3 050 If this special tool is not available, check that distance from valve body housing to pin in throttle pressure piston is 11.5 mm (0.453"). Tighten valve body bolts.

[1] See Specifications



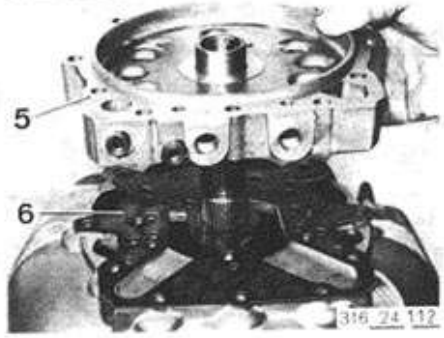
24 31 000 REMOVING AND INSTALLING PRIMARY PUMP

Remove torque converter 24 40 000.
Take off converter bell housing with intermedi ate plate.

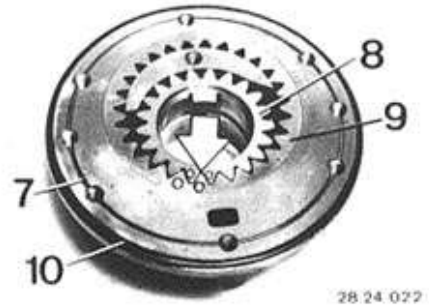


Installation:
Mount angled disc (1) on input shaft with collar facing needle bearing (2).
Hold thrust washer (3) on converter bell housing with grease.
Replace gasket (4).

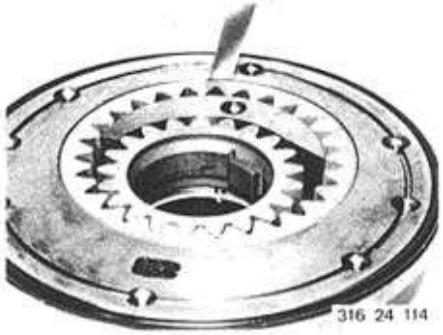
Detach intermediate plate on converter bell housing.
Loosen both opposite bolts by only several turns.
Disconnect primary pump on converter bell housing by applying several light knocks.
Unscrew bolts and take off primary pump.



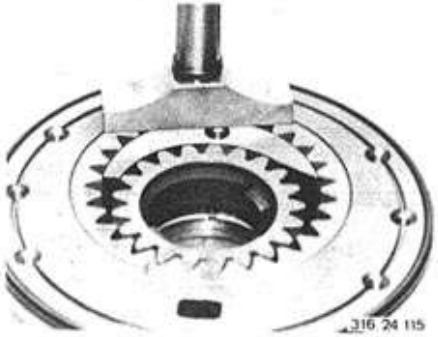
Installation:
Lift off intermediate plate (5).
Replace gasket (6).



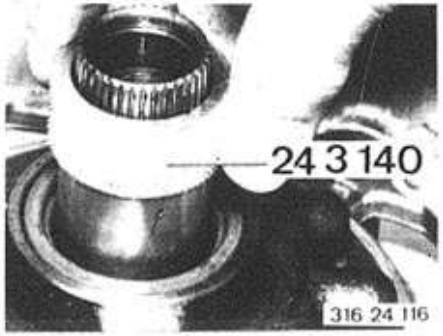
Installation:
The primary pump, consisting of pump body (7), hollow gear (8) and impeller (9), may only be replaced as an assembly.
Check O-ring (10), replacing if necessary.
Install hollow gear (8) and impeller (9), that punch mark faces up.



Check radial play[1] between driven gear and pump body.
Turn gear 360° for this purpose.

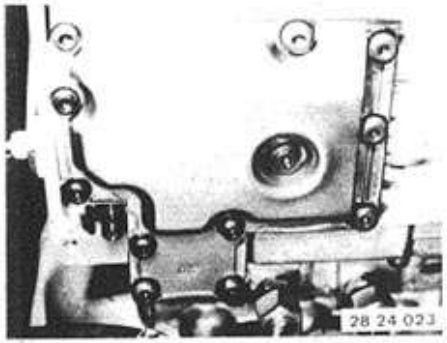


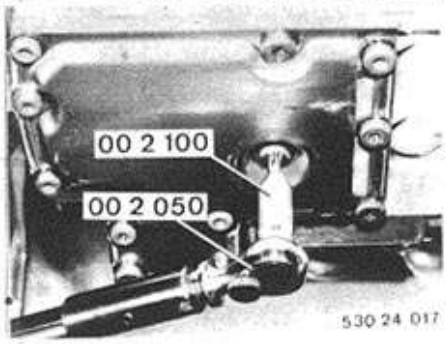
Check axial play[1] of both gears to face surface with a depth micrpmeter.



Check primary pump for perfect light running with Special Tool 24 3 140.
This test must be repeated after installation of intermediate plate.

[1] See Specifications

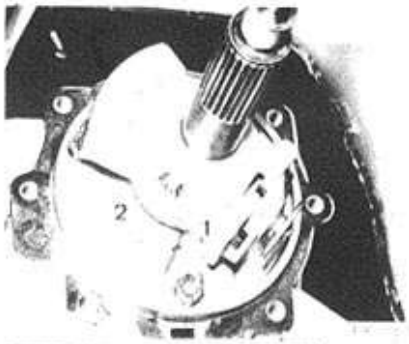


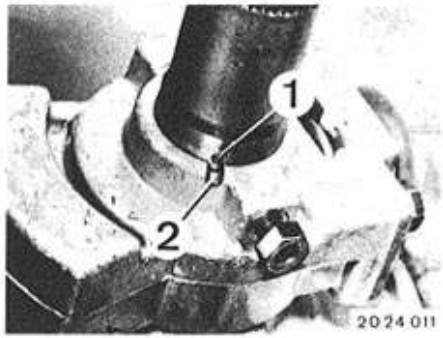


24 31 150 REMOVING AND INSTALLING OIL FILTER SCREEN ON VALVE BODY

Remove oil sump 24 11 000.
Detach oil filter screen.
Installation:
Clean oil filter screen.
Replace oil filter screen which is starting to gum up with a burnt brown resin.
Tightening torque[1].

Installation:
Tighten[1] Torx bolts with Special Tools 00 2 100 and 00 2 050.
Replace oil filter screen (see Group 00).





24 32 000 REMOVING AND INSTALLING CENTRIFUGAL GOVERNOR

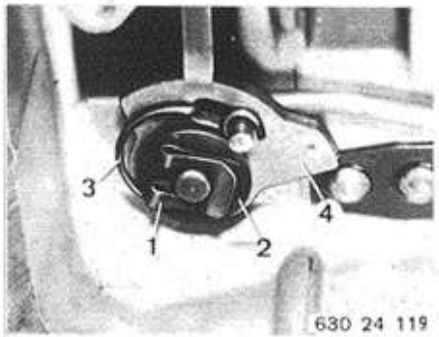
Remove transmission cover 24 11 050.
Unscrew nut (1) and stud (2) by about 3 turns.
Pull off governor.

Installation:
Compress piston rings lightly and then slide governor on to governor flange.
Important!
Punch mark (1) on output shaft must align with opening (2) in governor flange.
Secure governor.

24 32 503 DISASSEMBLING / ASSEMBLING CENTRIFUGAL GOVERNOR GOVERNOR REMOVED

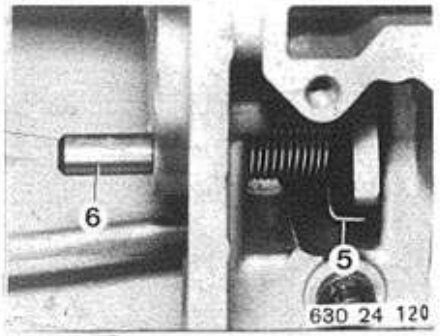
Take off cover (1) from housing (2).
Lift off circlip (3) and remove washer (4).
Remove governor piston (5), spring (6) and governor bush (7).
Installation:
Governor piston must slide in governor bush easily.
Replace circlip (3).

[1] See Specifications

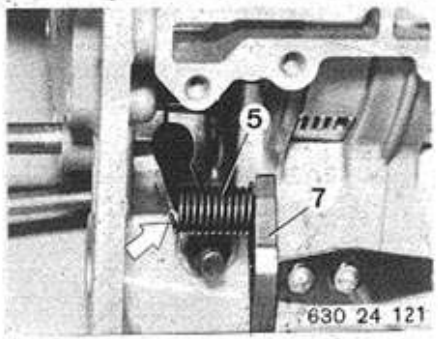


24 34 000 REMOVING AND INSTALLING PARKING LOCK PAWL

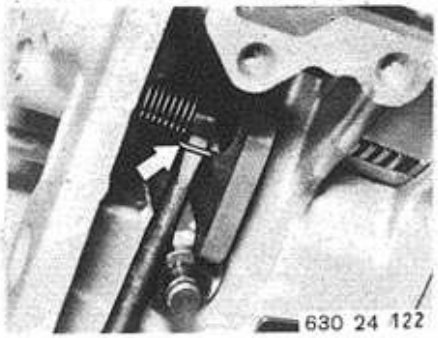
Remove valve body 24 30 000.
Remove transmission cover 24 11 050.
Lift off circlip and remove washer (2).
Disengage spring (3) and pull off parking lock cam (4).



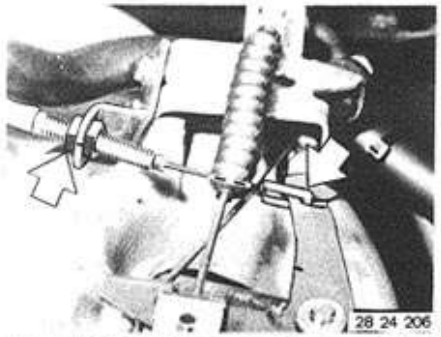
Disconnect spring (5) and push out pin (6) from inside to outside or pull out.



Installation:
Press in pin, pushing spring (5) and pawl (7) on to pin.
Straight end of spring faces up on transmission case.
Front end of spring is behind pawl at left.

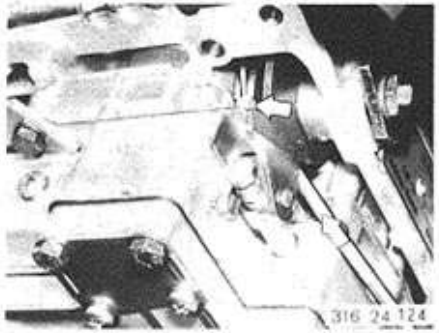


Attach front end of spring on right pawl side.

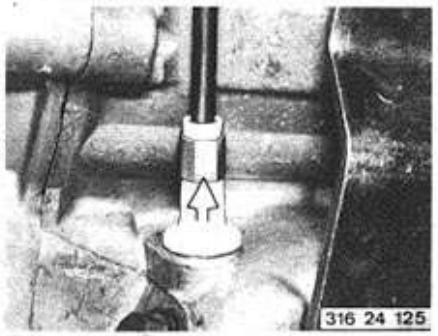


24 34 100 REPLACING ACCELERATOR CABLE

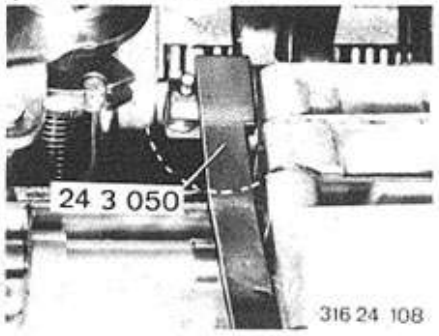
Disconnect accelerator cable and detach on holder.



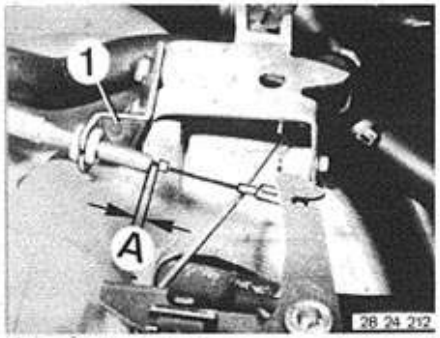
Remove oil sump 24 11 000.
Set selector lever to N.
Push accelerator cam forward and disconnect cable on cam.



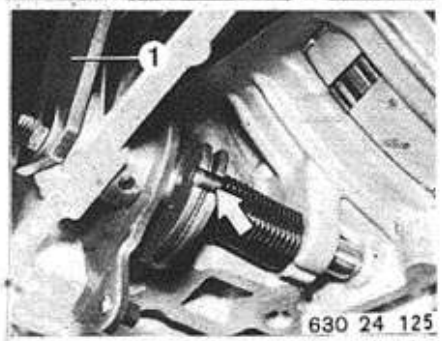
Push out accelerator cable from housing upward



Press new accelerator cable into case until retaining tabs engage.
Connect nipple on accelerator cam.
Apply Special Tool 24 3 050 between valve body housing and throttle pressure switch.
Push accelerator cam against throttle pressure valve.

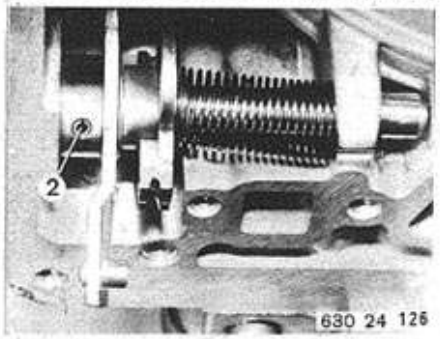


Move accelerator cable to installed position and attach on holder (1).
Tighten cable.
Squeeze loose lead seal on cable firmly at distance (A) = 0.25 ... 0.50 mm (0.010 ... 0.020").
Adjust accelerator cable 24 00 004.

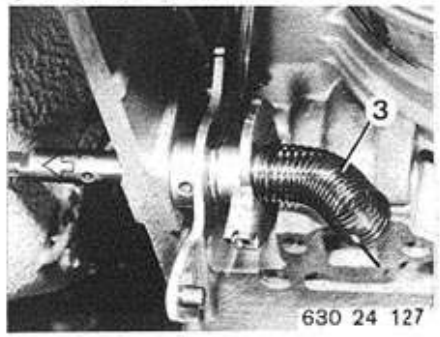


24 34 701 REPLACING ACCELERATOR CABLE SPRING
VALVE BODY REMOVED

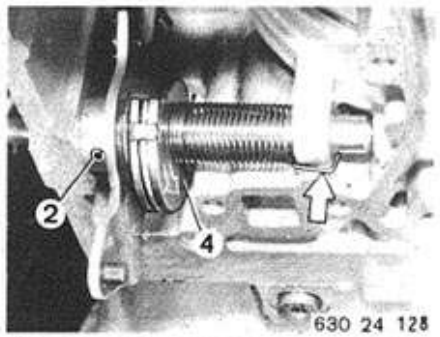
Detach selector lever (1) on transmission.
Disconnect accelerator cable.



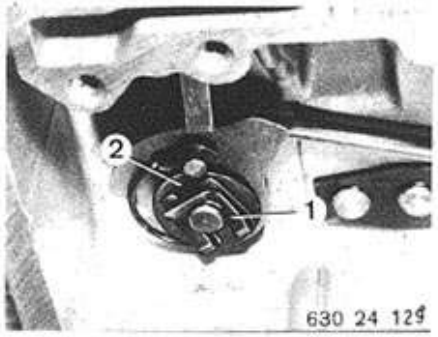
Knock out pin (2) in position N,



Pull out selector shaft far enough that spring (3) can be removed.

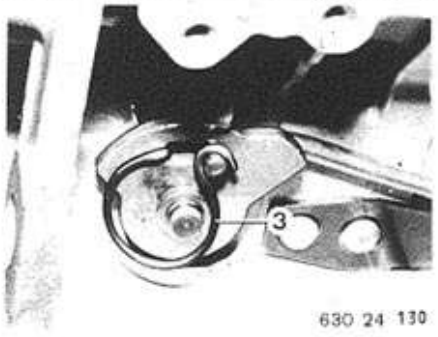


Installation:
Short leg of spring is connected on accelerator cam (4).
Place long leg of spring in groove on housing.
Install gear selector lever.
Preload spring with accelerator cam (4) by turni anticlockwise one turn.
Connect accelerator cable and lock pawl with pin (2).

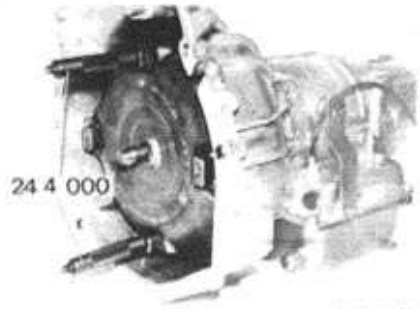


24 34 703 REPLACING SPRING FOR PARK ING LOCK CAM
VALVE BODY REMOVED

Lift off circlip (1) and remove washer (2).

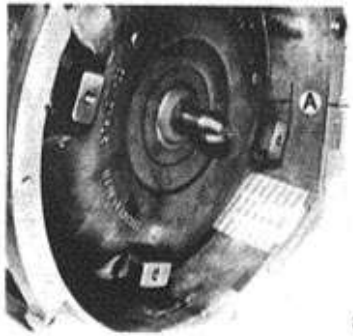


Remove spring (3).

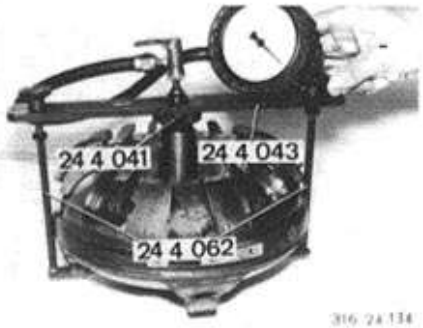


24 40 001 REMOVING AND INSTALLING TORQUE CONVERTER

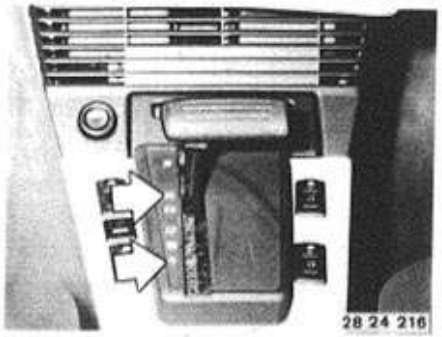
Remove and install transmission 24 00 020.
Pull torque converter out of primary pump carefully with Special Tool 24 4 000.
Important!
Escaping ATF.



Guide openings on converter into primary pump carefully under slight pressure, using Special Tool 24 4 000 to help.
Important!
Don't damage converter bearings and seal while guiding in.
Converter is in correct installed position when drive dogs (A) are below case edge by approx. 30.5 mm (1.201").



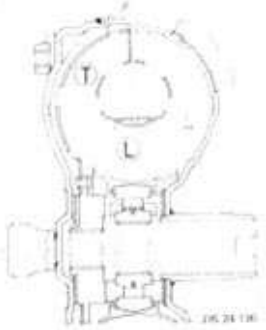
Installation:
Check torque converter for leaks with Special Tools 24 4 041, 24 4 043 and 24 4 062.
Testing pressure: 0.5 bar (7 psi).
Important!
Always use special tool holder to avoid accidents.



Check torque converter installed in car.
Engine and transmission oil must have operating temperature.
Engine must develope full power.
Start engine.
Apply parking brake and depress brake pedal firmly.
Move selector lever to R or 1.
Press to accelerator pedal to full throttle.
Read stall speed[1] on speedometer.

Replace torque converter, if bearing surface on converter shaft is damaged.

Important!
Don't test stall speed longer than 10 seconds to prevent damage from excessive heat.
Stall Speed Much Higher Than Specified[1]:
a) Insufficient oil in converter - correct oil level.
b) Slip in clutches - check clutches.
Stall Speed Much Lower Than Specified[1]:
a) Engine power insufficient - check engine.
b) Converter or pump defective - replace converter or check pump.

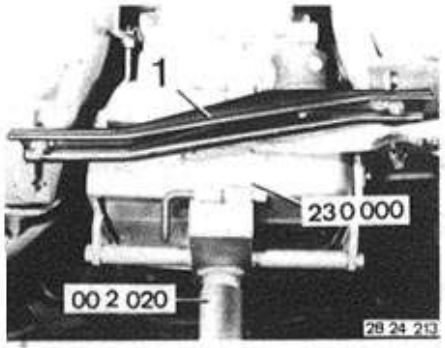


Replace torque converter, if stator (L) or turbine (T) cannot be turned by hand.

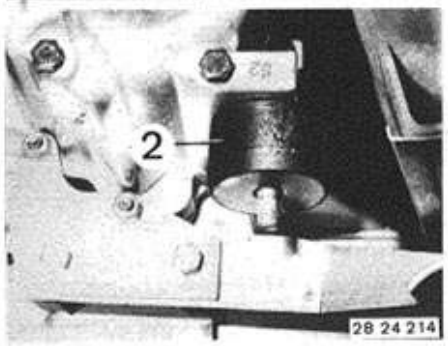
Torque converters cannot be cleaned with standard workshop equipment and must be replaced in the case of transmission damage or torn oil filter screens.
Converter code[1].

[1] See Specifications

24 71 001 REPLACING RUBBER MOUNTS FOR TRANSMISSION SUSPENSION



Support transmission with Special Tools 23 0 000 and 00 2 020.
Remove cross member (1).



Lower transmission and disconnect rubber mount (2).

TROUBLESHOOTING AUTOMATIC TRANSMISSION 3 HP-22

Condition	Cause	Correction
Shift points[1] too high	a) Accelerator cable maladjusted b) Governor bushing seized c) Governor piston rings defective or worn d) Throttle pressure valve malfunctions e) Shift valves jammed	a) Adjust accelerator cable 24 00 004 b) Clean or replace governor 24 32 000 c) Replace piston rings 24 32 000 d) Replace valve body 24 30 000 e) Replace valve body 24 30 000
Shift points[1] too low	a) Accelerator cable maladjusted b) Governor bushing seized c) Throttle pressure valve malfunctions d) Plastic balls in transfer plate leak	a) Adjust accelerator cable 24 00 004 b) Clean or replace governor 24 32 000 c) Replace valve body 24 30 000 d) Replace valve body 24 30 000
Shift points too high or too low and also shift movements too long and too soft	a) Clutches C and C' for 1 2 shift damaged b) Clutch B for 2–3 shift damaged	a) Replace clutches C and C 24 23 080 b) Replace clutch B 24 23 080
No kickdown shifts	a) Accelerator cable maladjusted b) Valve body maladjusted c) Throttle pressure valve stuck d) Plastic balls in transfer plate leak	a) Adjust accelerator cable 24 00 004 b) Adjust valve body 24 30 000 c) Replace valve body 24 30 000 d) Replace valve body 24 30 000
Selector lever cannot be moved to P	a) Selector linkage maladjusted b) Locking mechanism defective	a) Adjust selector linkage 24 00 004 b) Repair locking mechanism 24 34 000
Parking position cannot be taken out	a) Parking lock pawl caught in teeth of output shell b) Excessive friction in parking lock mechanism	a) Replace parking lock pawl 24 34 000 b) Repair parking lock mechanism 24 34 000
Parking position does not hold (slips)	a) Selector linkage maladjusted.	a) Adjust selector linkage 24-00 004
No forward or reverse drive	a) Oil volume insufficient b) Pump drive defective c) Drive plate broken d) Parking lock pawl stuck e) Clutches A and B defective	a) Correct oil level b) Replace converter and pump 24 31 000 c) Replace drive plate d) Replace pawl 24 34 000 e) Disassemble transmission 24 23 020
No forward drive	a) Selector linkage maladjusted b) Clutch A defective or oil loss in feed line	a) Adjust selector linkage 24 00 004 b) Replace clutch A 24 23 020
No reverse drive	a) Selector linkage maladjusted b) Clutch B or D defective c) Clutch valve and damper B malfunction d) Oil level insufficient; pump cannot draw in oil	a) Adjust selector linkage 24 00 004 b) Disassemble transmission 24 00 080. c) Replace valve body 24 30 000 d) Correct oil level

[1] See Specifications

TROUBLESHOOTING AUTOMATIC TRANSMISSION 3 HP 22

Condition	Cause	Correction
Slipping or shaking when moving off in reverse gear	a) Clutch B or D damaged b) Heavy oil loss in feed line to B or D	a) Disassemble transmission 24 00 080 b) Disassemble transmission 24 00 080
No drive in R and 2nd gear	a) Shift valve seized in 3rd gear position	a) Replace valve body 24 30 000; if oil pan has abrasion, disassemble transmission 24 00 080
Hard engagement jolt or definite double knock when engaging reverse	a) Damper B defective or wrong cover parts	a) Replace valve body 24 30 000
Car cannot be started in N	a) Transmission switch defective	a) Replace transmission switch 61 31 260
Car creeps or runs in N	a) Selector linkage maladjusted b) Clutch A discharges too slowly c) Clutch A defective (bonded)	a) Adjust selector linkage 24 00 004 b) Disassemble transmission 24 00 080 c) Disassemble transmission 24 00 080
Drive only in 1st gear when in D	a) Shift valve 1–2 jammed b) Governor bushing seized	a) Replace valve body 24 30 000 b) Clean or replace governor 24 32 503
Drive only in 1st and 2nd gear when in D	a) Shift valve 2–3 jammed	a) Replace valve body 24 30 000
Drive only in 2nd gear	a) Shift valves 1–2 and 2–3 jammed	a) Replace valve body 24 30 000
Drive only in 3rd gear	a) Shift valves 1–2 and 2–3 jammed b) Governor bushing seized	a) Replace valve body 24 30 000 b) Clean or replace governor 24 32 503
Drive in N	a) Selector linkage maladjusted b) Clutch A (forward) bonded c) Clutch B (reverse) bonded	a) Adjust selector linkage 24 00 004 b) Disassemble transmission 24 00 080 c) Disassemble transmission 24 00 080
No braking effect from 1st gear in 2 or 1	a) Clutch valve and damper D defective b) Clutch D defective	a) Replace valve body 24 30 000 b) Replace clutch D 24 23 020
No braking effect from 2nd gear in 2 or 1	a) Clutch C' defective	a) Replace clutch C' 24 23 020
Transmission shifts too early for manual downshift from 2 to 1 (above 80 km/h or 50 mph)	a) Locking valve pressure too high b) Pressure loss in governor pressure feed between governor and shift valves	a) Replace valve body 24 30 000 b) Disassemble transmission 24 00 080
Transmission shifts too late for manual downshift from 2 to 1 (below 40 km/h or 25 mph)	a) Locking valve pressure too low b) Governor pressure too high	a) Replace valve body 24 30 000 b) Disassemble transmission 24 00 080
Stall speed[1] too high in forward	a) Clutch A or 1st gear one-way clutch slips	a) Disassemble transmission 24 00 080
Stall speed[1] too low in forward	a) Engine power output insufficient b) Converter one-way clutch defective	a) Check engine tuning b) Replace converter 24 40 000

[1] See Specifications

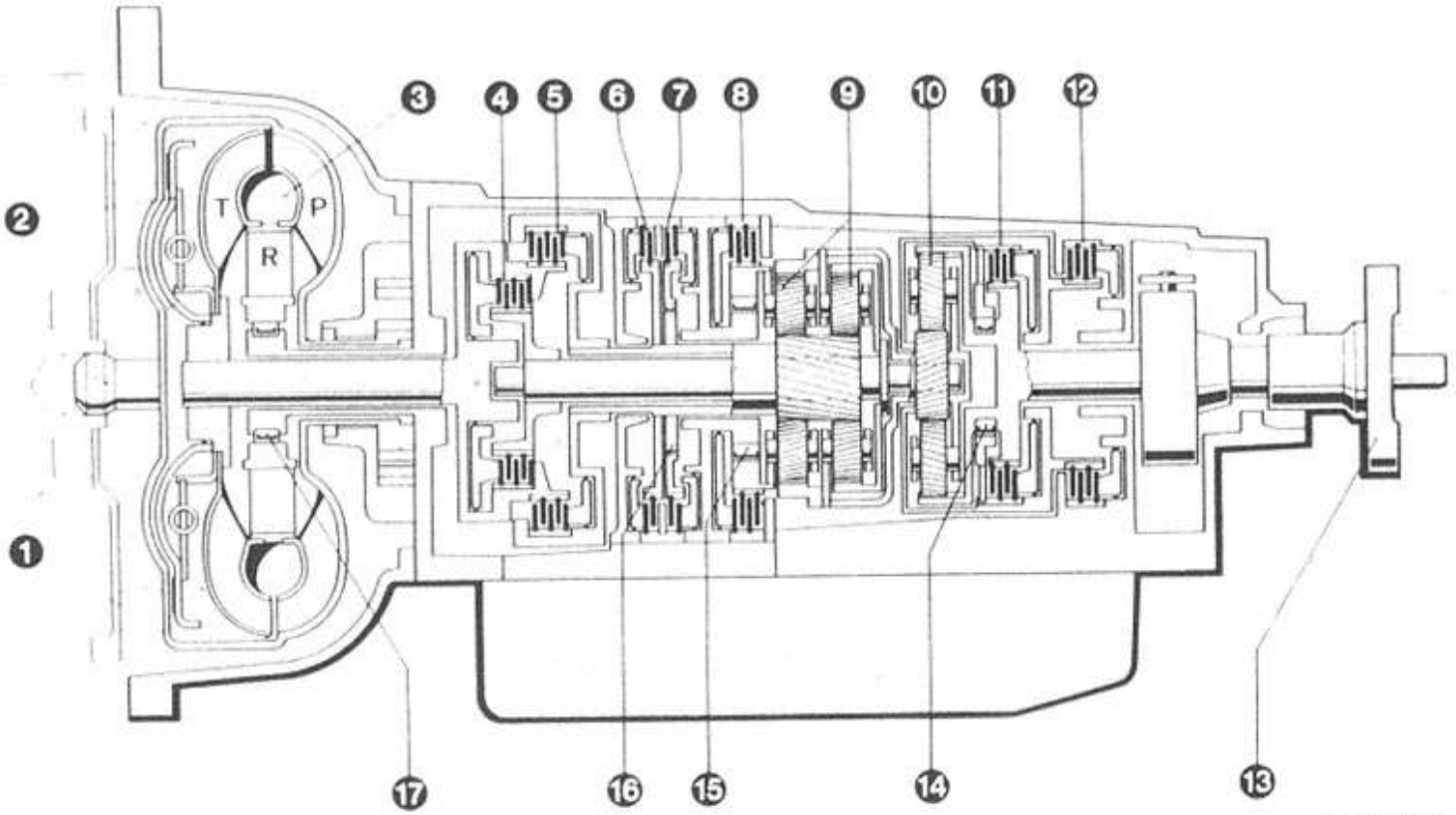
TROUBLESHOOTING AUTOMATIC TRANSMISSION 3 HP-22

Condition	Cause	Correction
Grinding shifts	a) Accelerator cable detached or maladjusted b) Oil volume insufficient c) Throttle pressure valve seized d) Clutch A defective	a) Attach or adjust accelerator cable 24 00 004 b) Correct oil volume c) Replace valve body 24 30 000 d) Disassemble transmission 24 00 080
Grinding shifts from 1st to 2nd gear	a) Clutches C and C' slip b) Clutch valve and damper C malfunction c) Accelerator cable detached or maladjusted d) Oil volume insufficient e) Throttle pressure valve seized f) One-way clutch F defective	a) Disassemble transmission 24 00 080 b) Disassemble transmission 24 00 080 c) Attach or adjust accelerator cable 24 00 004 d) Correct oil level e) Replace valve body 24 30 000 f) Disassemble transmission 24 00 080
Grinding shifts from 2nd to 3rd gear	a) Clutch B slips b) Accelerator cable detached or maladjusted c) Oil volume insufficient d) Oil pressure too low e) Throttle pressure valve seized f) One-way clutch E defective	a) Replace clutch B 24 23 080 b) Attach or adjust accelerator cable 24 00 004 c) Correct oil level d) Disassemble transmission 24 00 080 e) Replace valve body 24 30 000 f) Disassemble transmission 24 00 080
3rd gear slips	a) Clutch B slips b) Accelerator cable detached or maladjusted c) Oil volume insufficient d) Oil pressure too low e) Throttle pressure valve seized	a) Disassemble transmission 24 00 080 b) Attach or adjust accelerator cable 24 00 004 c) Correct oil level d) Disassemble transmission 24 00 080 e) Replace valve body 24 30 000
Stall speed[1] too high	a) Oil volume insufficient b) Engaged clutch slips c) One-way clutch F or G slips	a) Correct oil level b) Disassemble transmission 24 00 080 c) Disassemble transmission 24 00 080
Stall speed[1] too low	a) Torque converter defective b) Engine power output insufficient	a) Replace converter 24 40 000 b) Check engine tuning
Transmission vibrates when moving off quickly	a) Clutch A defective b) Propeller shaft center bearing defective c) One-way clutch F or G defective	a) Replace clutch A 24 23 020 b) Replace center bearing 26 12 501 c) Disassemble transmission 24 00 080
Transmission shifts hard or down	a) Accelerator cable maladjusted b) Clutch A defective	a) Adjust accelerator cable 24 00 004 b) Disassemble transmission 24 00 080

[1] See Specifications

Condition	Cause	Correction
Whining depending on speed and load	a) Propeller shaft center bearing defective b) Needle bearing in transmission extension defective	a) Replace center bearing 26 11 501 b) Replace transmission extension 24 11 050
Rattling noise in neutral	a) Drive plate broken b) Welded converter drive dogs broken off	a) Replace drive plate 11 22 051 b) Replace converter 24 40 000
Grinding noise in neutral, disappearing when accelerating in N	a) Valve chatter in valve body b) Oil pump taking in air	a) Correct oil level b) Tighten valve body mounting bolts. Check gasket 24 30 000
High pitch noise in all selector lever positions	a) Suction noise of oil pump b) Suction noise of valve body	a) Check tightness of valve body. Tightening torque[1)] b) Replace valve body 24 30 000
Oil on converter bell housing	a) Shaft seal defective b) O-ring in primary pump body defective c) Converter leaks at welded seams d) Plugs leak	a) Replace shaft seal 24 12 001 b) Replace O-ring 24 31 000 c) Replace converter 24 40 000 d) Replace seals
Scratching or chirping noise in all selector lever positions	a) Oil level too low b) Suction noise at valve body	a) Correct oil level b) Replace valve body 24 30 000
Oil on output flange	a) Shaft seal defective b) Output flange leaks at threads	a) Replace shaft seal 24 12 011 b) Install collar nut with Curil K 2 or Loctite No. 572
Breather leakage	a) Oil level too high b) Wrong type of oil (excessive foaming) c) Breather defective d) Breather mounted incorrectly e) O-ring in breather defective	a) Correct oil level b) Replace oil c) Replace breather d) Remove transmission extension. Position breather correctly (opening faces left when looking forward) e) Replace O-ring

1) See Specifications



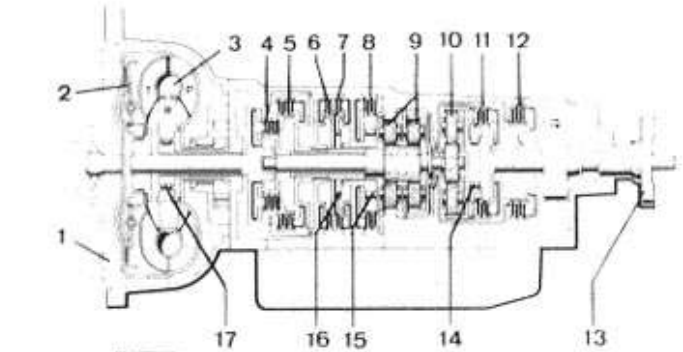
ZF 4 HP 22 Layout Drawing

1 Input
2 Converter lockup clutch
3 Hydrodynamic torque converter
P = Impeller
R = Stator
T = Turbine

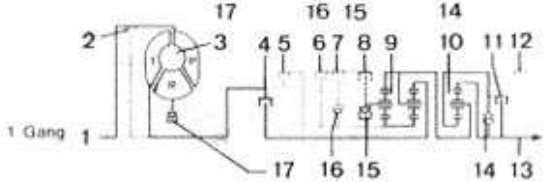
4 Clutch A
5 Clutch B
6 Clutch C'
7 Clutch C
8 Clutch D

9 Planet gear set
10 Planet gear set – 4th gear
11 Clutch E
12 Clutch F
13 Output

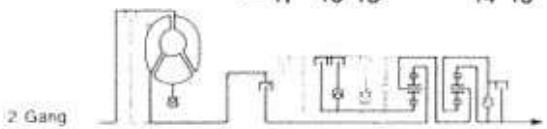
14 One-way clutch
15 One-way clutch
16 One-way clutch
17 One-way clutch



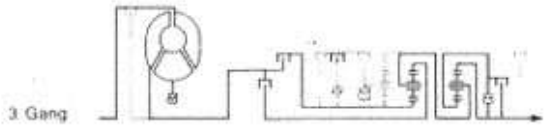
Clutches 4 and 11 are engaged.
Front planet gear carrier of gear set 9 supports on one-way clutch 15 during acceleration and is cancelled while coasting.
Planet gear set 10 rotates as a block.
In selector lever position 1 clutch 8 is also engaged in 1st gear, to have engine brake.



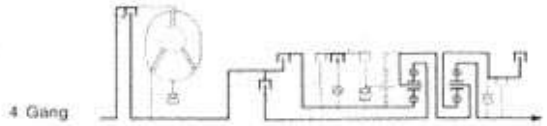
Clutches 4, 6, 7 and 11 are engaged.
One-way clutch 15 is cancelled.
Hollow shaft is fixed with sun gear of planet gear set 9.
Planet gear set 10 rotates as a block.



Clutches 4, 5, 7 and 11 are engaged.
One-way clutches 15 and 16 are cancelled.
Planet gear sets 9 and 10 rotate as a block at ratio of 1 to 1.



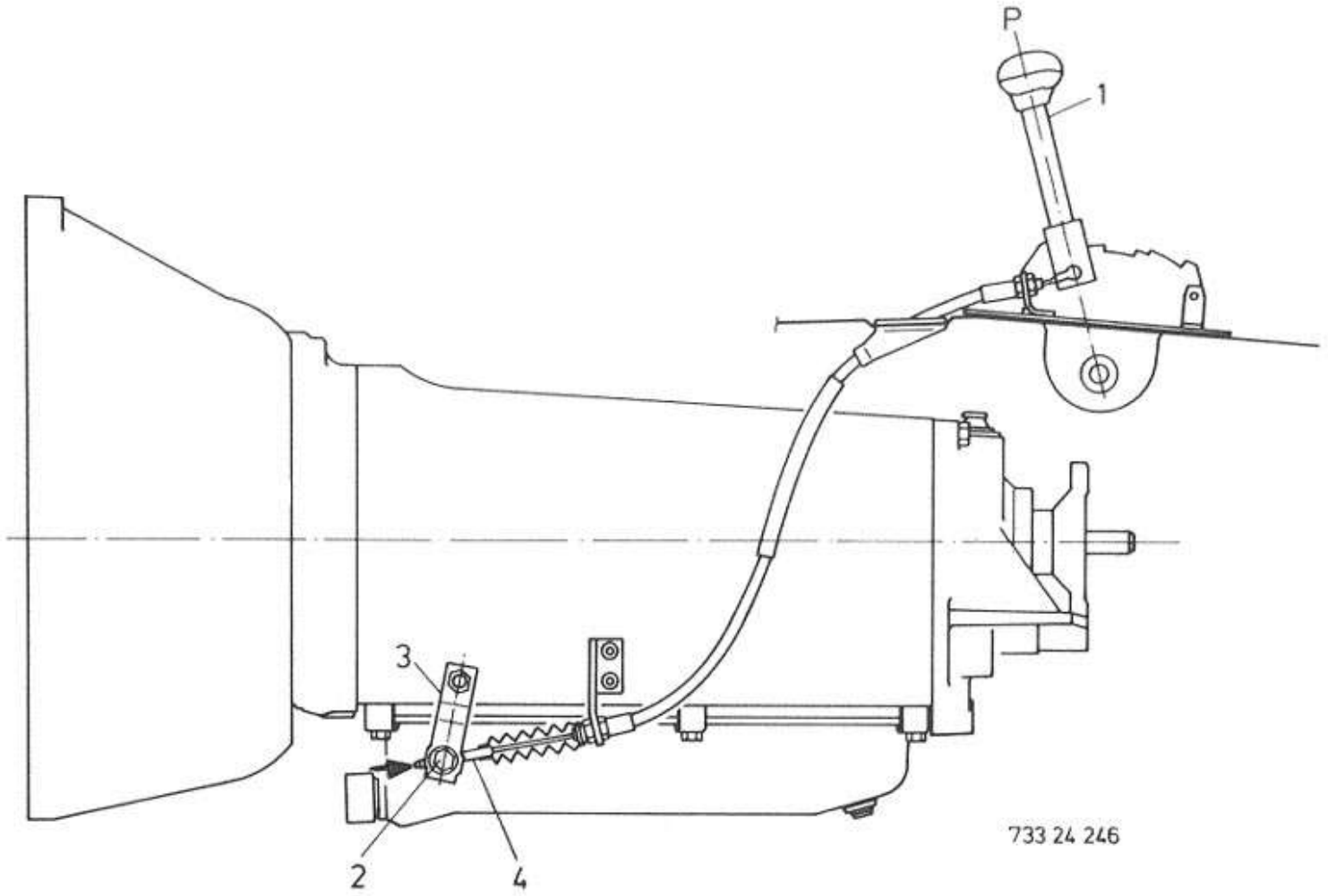
Clutches 4, 5, 7 and 12 are engaged.
One-way clutches 14, 15 and 16 are cancelled.
Planet gear set 9 rotates as a block.
Hollow shaft is fixed with sun gear of planet gear set 10.
Torque converter 3 is locked by clutch 2 as from a certain road speed.



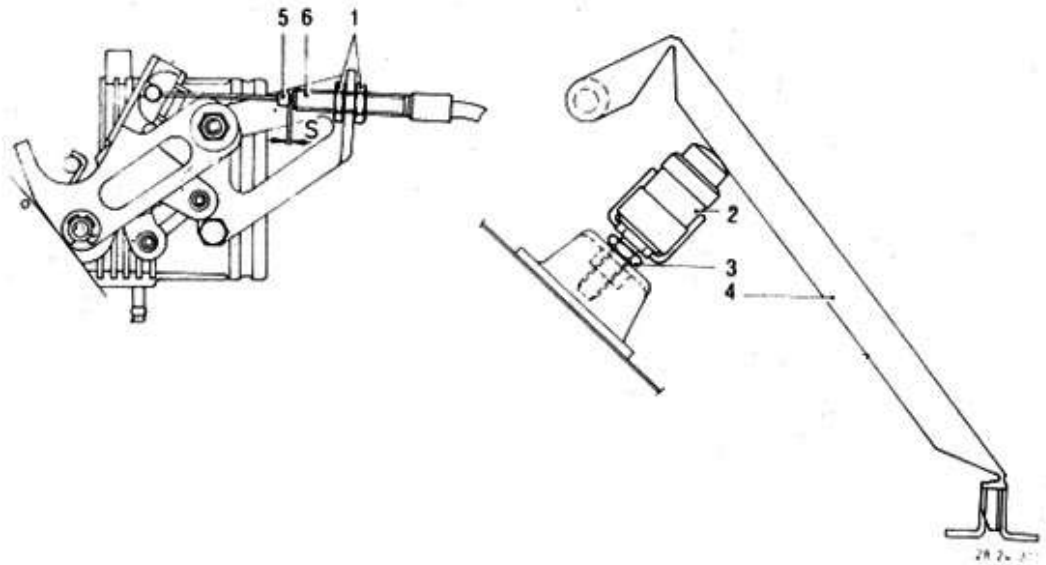
Clutches 5, 8 and 11 are engaged.
Output shaft's direction of rotation is reversed via the held front planet gear carrier of gear set 9.
Planet gear set 10 rotates as a block.

733 24 062

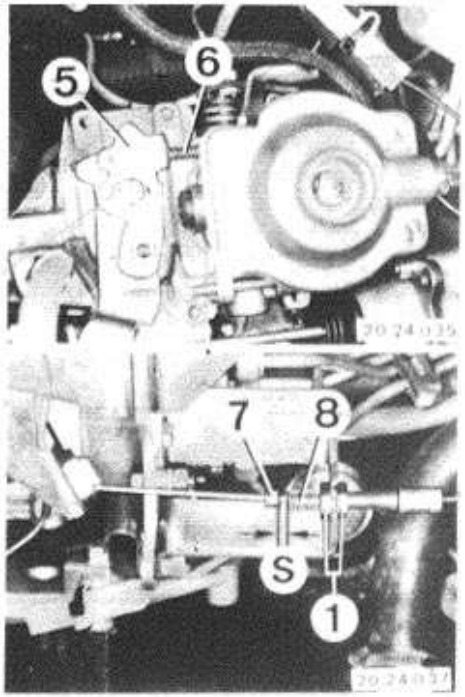
24 00 006 ADJUSTING SELECTOR LEVER, THROTTLE LINKAGE AND THROTTLE CABLE

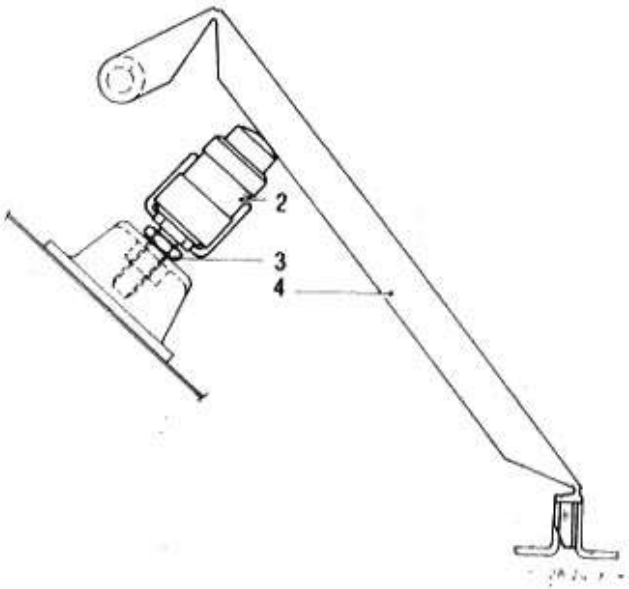


A) Adjusting Selector Lever:
Move selector lever (1) to "P".
Loosen nut (2).
Push lever (3) forward (park position).
Push cable rod (4) opposite forward direction.
Clamp cable rod (4) with nut (2).
Tightening torque: 10 to 12 Nm (7.0 to 8.5 ft. lbs.).



B) Adjusting Throttle Cable:
Requirement: full throttle adjustment correct.
Adjust play (S) to 0.50 ± 0.25 mm (0.020 ± 0.010") with nuts (1) in idle position.
Check kickdown stop (2).
Loosen lock nut (3) and screw in kickdown stop (2).
Push down accelerator pedal (4) to transmission pressure point.
Unscrew kickdown stop in this position, until it contacts the accelerator pedal.
Push down accelerator pedal (4) to kickdown (final position).
Now distance (S) from lead seal (5) to end of sleeve (6) must be at least 44 mm (1.732").



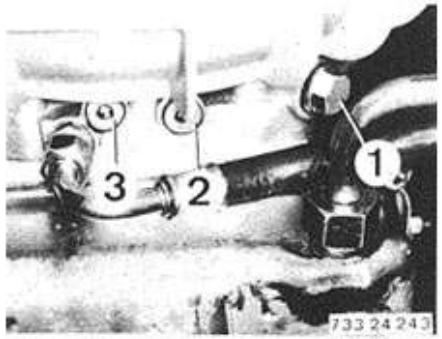


Type 524 td:
B) Adjusting Throttle Cable
Requirement: engine running adjustment correct.
If applicable, adjust engine running – see 13 00 050.
Temperature dependent idle speed boost activated.
This means: operating lever (5) must rest on idle stop (6).
Adjust play (S) to 0.50 ± 0.25 mm (0.020 ± 0.010") with nuts (1).
Check kickdown stop (2).
Loosen nut (3) and screw in the kickdown stop (2).
Press the accelerator pedal (4) to the transmission pressure point.
Unscrew the kickdown stop in this position until it touches the accelerator pedal.
Press the accelerator pedal (4) to kickdown (final position).
The distance (S) from lead seal (7) to adjusting screw (8) must now be at least 44 mm (1.732").

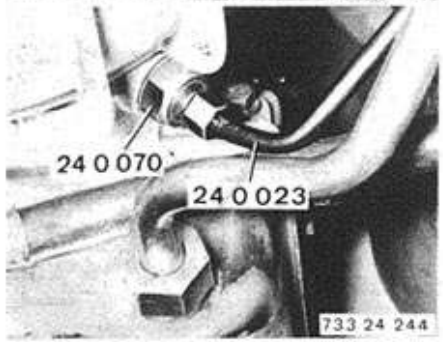
24 00 011 CHECKING HYDRAULIC PRESSURE VALUES

Connect hose 24 0 021 with pressure tester 13 3 061.

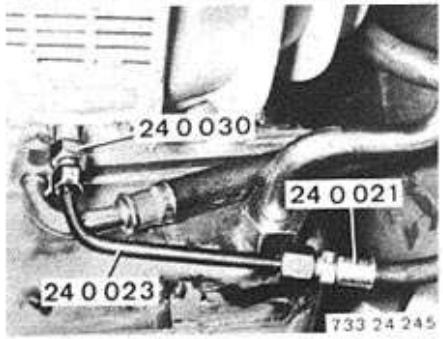
Test	Pos.	Gear	Speed (rpm)	Bar
Pump press.	D	1st	700...1000	6.0...7.5
		2nd/3rd and 4th	app. 4000	4.6...5.8
	R	reverse	700...1000	11 ... 13
Conv. press.	D	4th	converter locked	max. 0.7



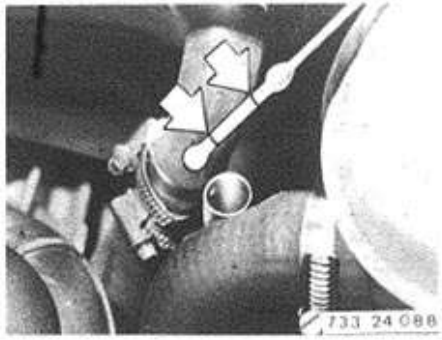
Remove pertinent plugs for testing.
1 Pump pressure
2 Clutch A
3 Converter pressure



A) Pump Pressure:
Install adapter 24 0 070 with seal on transmission.
Connect elbow pipe 24 0 023 in conjunction with hose 24 0 021.



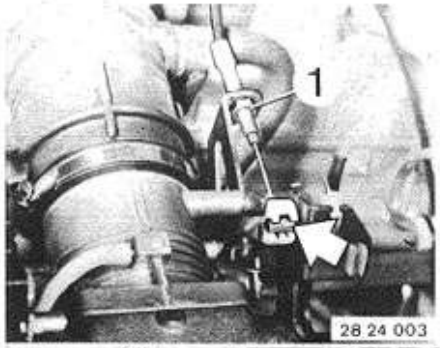
B) Converter Pressure:
Install adapter 24 0 030 on transmission.
Connect elbow pipe 24 0 023 in conjunction with hose 24 0 021.



Correct oil level in selector lever position P with transmission at operating temperature and engine running at idle speed.
Car parked on level floor.
The oil level of a transmission at operating temperature = approx. 80° C (175° F) must be between both marks.
Amount of oil between min. and max. marks = approx. 0.4 liters (0.8 pints).
Never wipe off oil dipstick with a cloth losing lint.

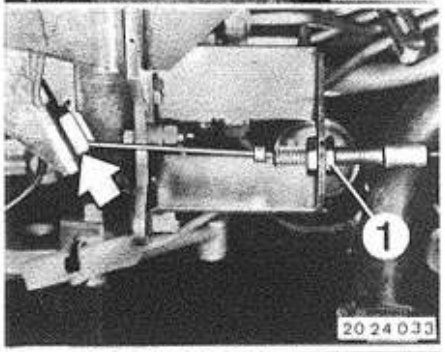
An oil dipstick with a longer measuring tip (1) is standard since 2.85.
This produces an earlier display of the oil level in the transmission.
The oil level should not be below ball (2) after a test drive and an oil temperature of approx. 40° C (105° F).
The oil level should be between the min. and max. marks at an oil temperature of approx. 80° C (175° F).
Correct oil level, if necessary.
Note:
The new oil dipstick can be installed retroactively.

Important!
Oil Level Too High:
Strong foaming, splash loss, high temperature when driving fast, oil lost via vent.
Oil Level Too Low:
Valves rattling, foaming, engine slipping when driving in curves, general operating disturbances.
Only pour in transmission oil with Special Tool 24 0 080 (funnel).

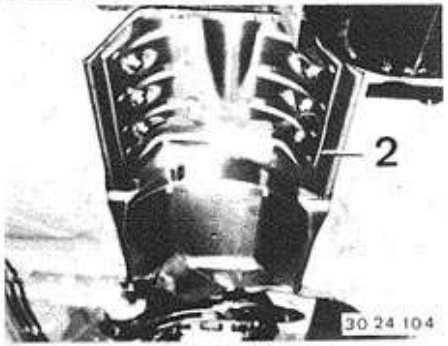


24 00 022 REMOVING AND INSTALLING TRANSMISSION

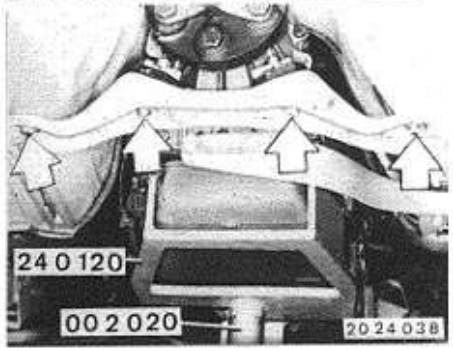
Disconnect the battery ground lead.
Unscrew nut (1).
Disconnect the throttle cable.
Installation:
Adjust throttle cable, see 24 00 006.



BMW 524 td:

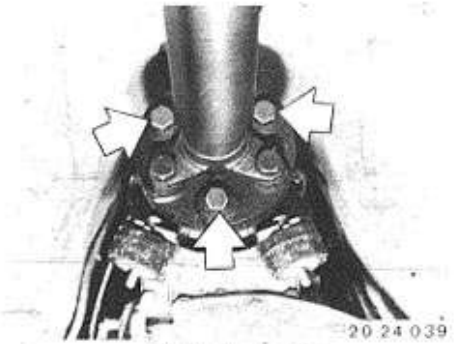


Remove the exhaust assembly – see 18 00 020.
Unscrew heat shield (2).

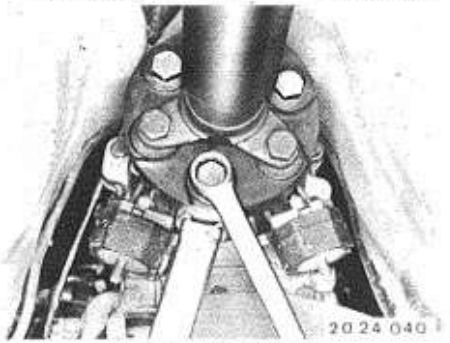


Support the transmission with Special Tools 24 0 120 and 00 2 020.
Remove the cross member.
Installation:
Tightening torque*.

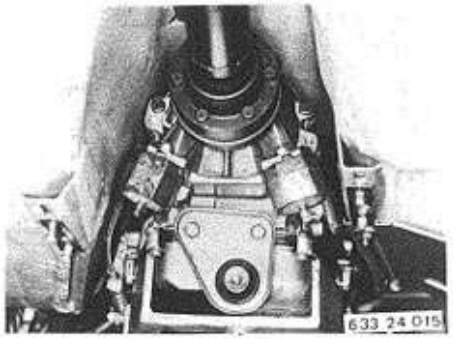
* See Specifications



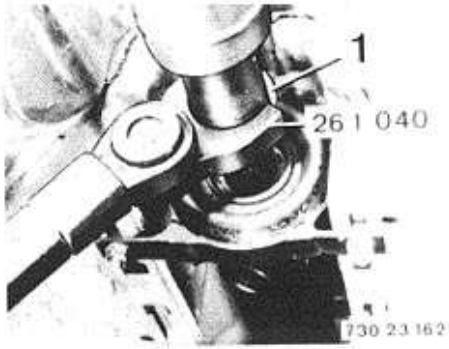
Unscrew propeller shaft on the transmission.



Installation:
Replace stop nuts.
Tighten nuts with a standard 19 mm socket and torque wrench.
Tightening torque*.
Important!
Only tighten the nuts (never bolts) to avoid stress in the coupling.

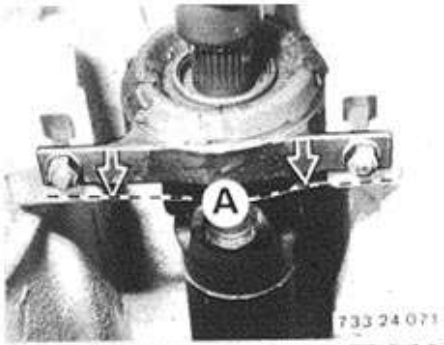


Version with Constant Velocity Joint.
Unscrew the constant velocity joint on the transmission.
Important!
Check the gasket between the constant velocity joint and drive flange.
Protect the constant velocity joint against dirt.

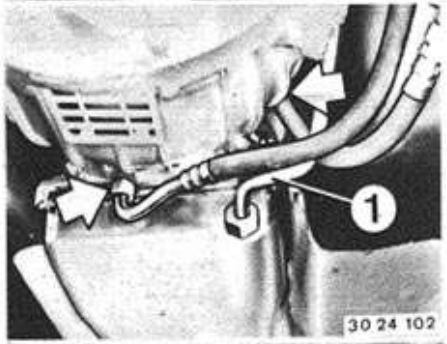


Loosen screw-on ring (1) several turns.
Installation:
Tighten the screw-on ring with Special Tool 26 1 040 after finishing installation.
Tightening torque*.

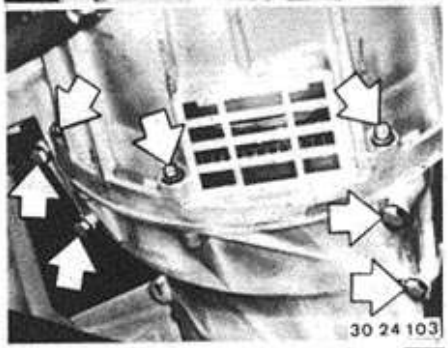
* See Specifications



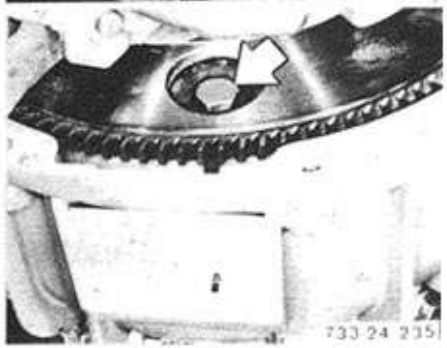
Unscrew the center mount.
Installation:
Preload the center mount forward by distance (A) = 4 to 6 mm (0.157 to 0.236").
Bend the propeller shaft down and pull it off of the centering pin.
Important!
Suspend the propeller shaft from the car on a piece of wire.



Drain oil.
Important!
Never reuse drained oil.
Installation:
The transmission will have to be disassembled, if oil has a burnt odor and is black.
Important!
If the transmission was defective, clean the oil cooler and lines with compressed air and flush twice with ATF.
Remove oil filler neck (1).
Unscrew oil cooler lines on the transmission and plug open connections with caps.
Installation:
Tightening torque*

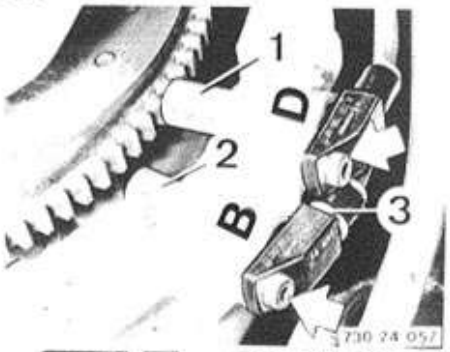


Remove the reinforcement plate.
Unscrew Torx bolts with a Torx socket.
Installation:
Tightening torque*.
Important! – Installation:
Use washers on the version with Torx bolts to avoid an increase in the breaking-loose torque.
Tightening torque*.

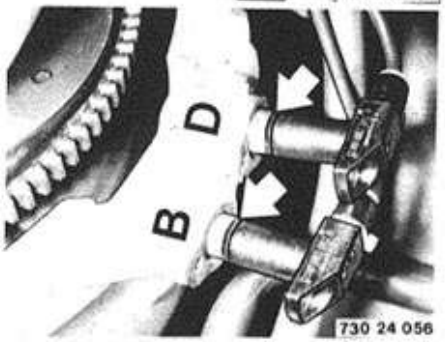


Unscrew the torque converter on the drive plate at three points.
Turn the flywheel away for this purpose.
Important! – Installation:
Tightening torque*.
Only use size M 10 x 16 mm bolts together with spring washer – non-conformance could lead to destruction of the transmission.

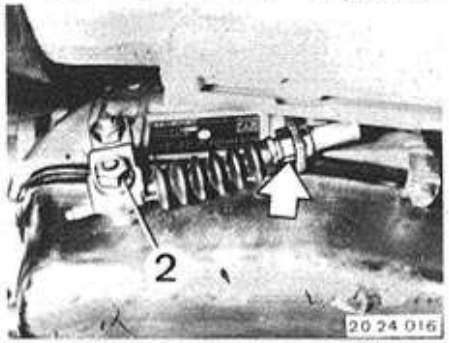
* See Specifications



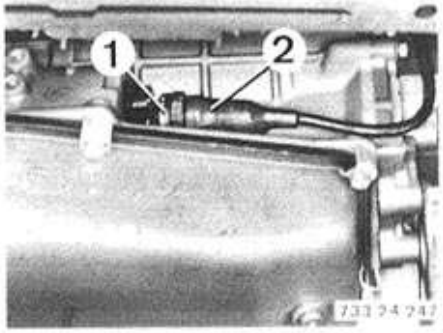
Unscrew the guard.
Unscrew the bolts.
Pull out speed sensor (1) and reference mark sensor (2).
BMW 524 td:
Only reference mark sensor (2).
Important! – Installation:
Check the installed position.
Don't mix up the plugs.
Install speed sensor (1) in bore (D) and reference mark sensor (2) with ring (3) in bore (B).
The engine cannot be started if plugs are mixed up.



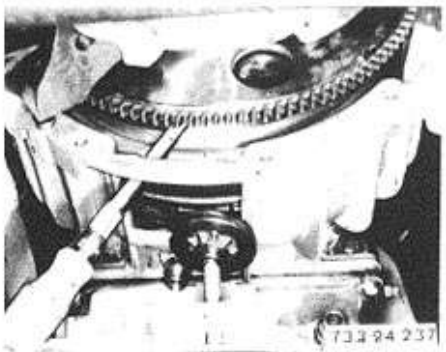
Installation:
Check the O-rings.
Install the sensors with Molykote Longterm 2.
Important!
Keep grease and dirt off of the face of DME sensors.



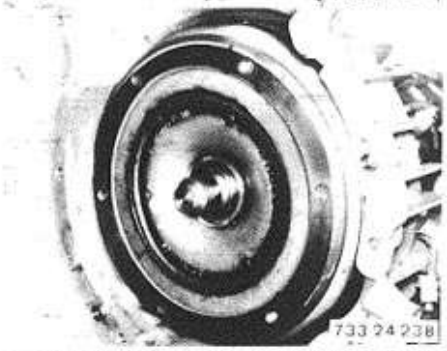
Unscrew nut (2).
Disconnect the cable on the holder.
Pull out the cable.
Installation:
Adjust the cable – see 24 00 006.



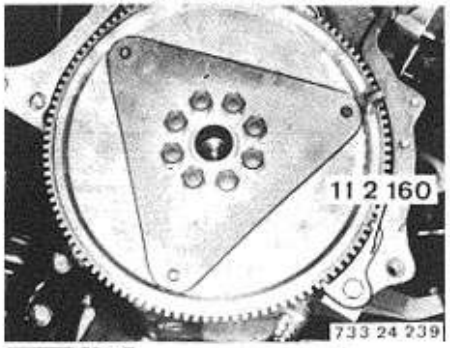
Only Version with EH Transmission:
Turn bayonet fastener (1) to the left.
Pull off plug (2).
Lift the wire harness out of holders.



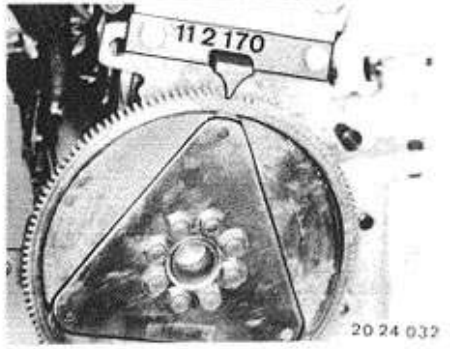
Lift off the grill.
Pull the transmission off of the engine, pressing off the torque converter at the same time.
Important!
When the lifting fixture is carrying the transmission, it may only be moved in the completely lowered position.



Important! – Installation:
Check the installed position of the torque converter – the drive ring must be located below the case edge.

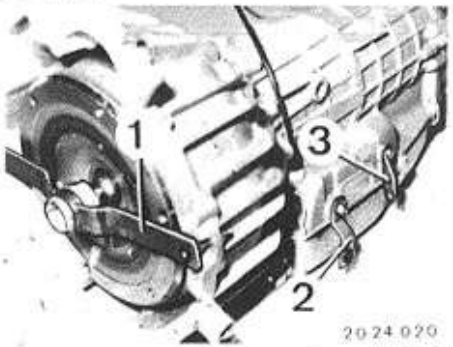


Installation:
Inspect the drive plate for breaks and cracks, replacing if necessary.
BMW 533 i, 535 i:
Hold the flywheel with Special Tool 11 2 160.
Unscrew the expansion bolts.
Important!
Replace and install the new expansion bolts with Loctite No. 270.
Only coat the threads.
Clean the tapped bores thoroughly.
Tightening torque*.



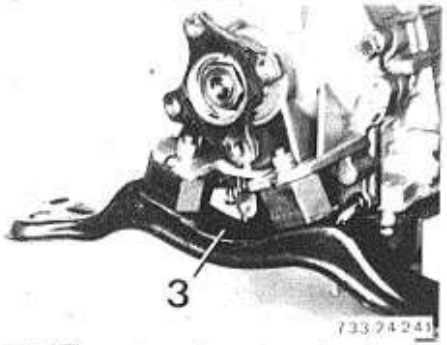
BMW 528 e, 524 td:
Hold the flywheel with Special Tool 11 2 170.

* See Specifications

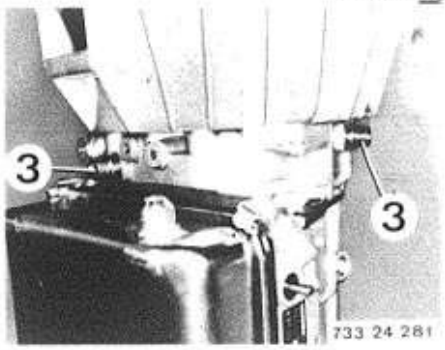


24 00 042 INSTALLING EXCHANGE TRANSMISSION

Remove the transmission – see 24 00 022.
Important!
Always clean the oil cooler and lines with compressed air and flush twice with ATF before installing an exchange transmission.
Check the transmission code* on the data plate.
Attach transport holder (1), lever (2) and bracket (3).

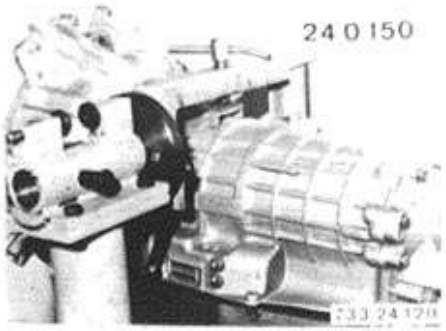


Transfer cross member (3) with rubber mounts and exhaust carrier.



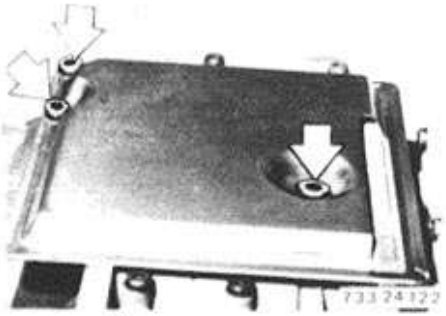
Transfer adapters (3).
Version with Multiple Tooth Socket:
Unscrew adapters with a 12 mm multiple tooth socket or T 55 Torx socket.
Replace seals.
Tightening torque*.

* See Specifications

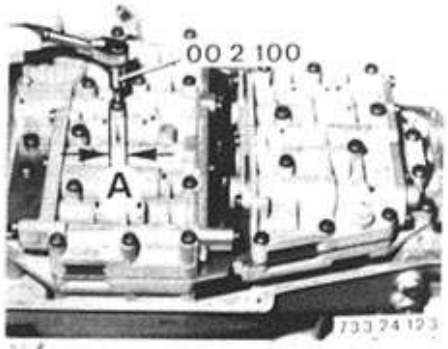


24 00 082 DISASSEMBLING/ASSEMBLING TRANSMISSION

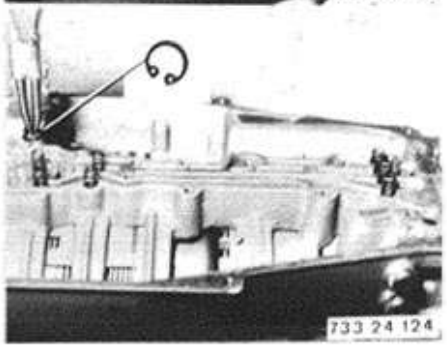
Remove transmission 24 00 022.
Remove torque converter 24 40 003.
Mount transmission on Special Tool 24 0 150 in conjunction with an assembly stand.
Important!
Screw in bolts only finger tight to prevent damaging transmission case.



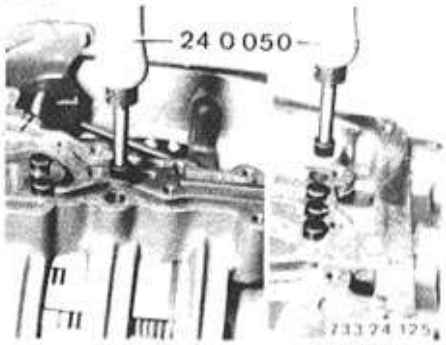
A) Disassembling:
Unscrew oil sump.
Remove oil filter screw.



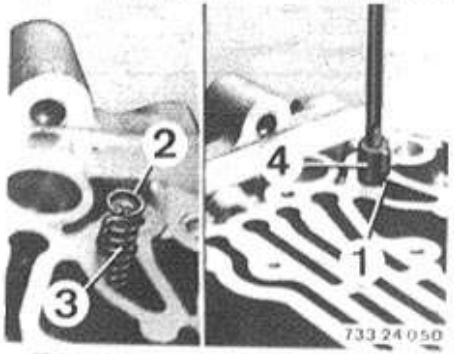
Take off valve body.
Unscrew Torx bolts with Special Tool 00 2 100.
Important!
Only unscrew bolts with 12 mm size head (A).



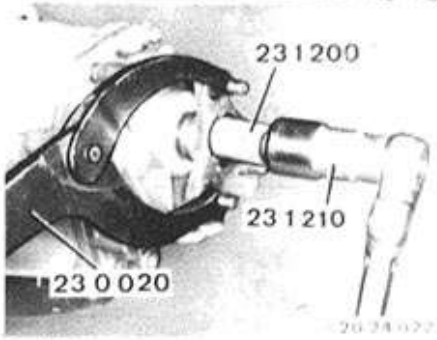
Lift out eight circlips.
Remove eight springs.
Installation:
Install longer springs facing output end.
EH Transmission:
Only remove two circlips and two springs from cylinder F (output end).



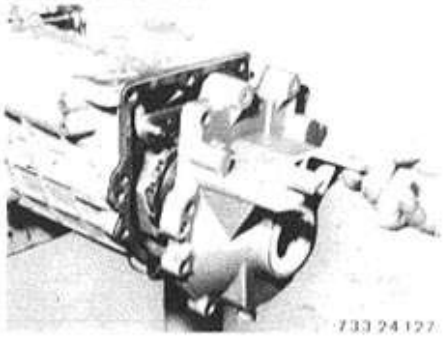
Pull out eight sealing sleeves with Special Tool 24 0 050.
EH Transmission:
Only remove two sealing sleeves from cylinder F (output end).



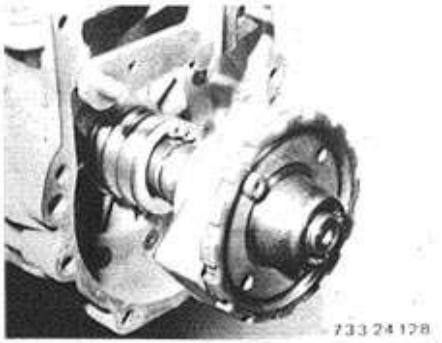
Important!
The lubricating oil feed to the cylinder F gear set was improved and introduced gradually since 7.85.
Circlip (2), spring (3) and sealing sleeve (4) must also be removed at bore (1).
Pull sealing sleeve (4) out of the bore with a M 6 x 65 screw.
Don't cant the screw.



Lift off lockplate.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.
Pull off output flange.

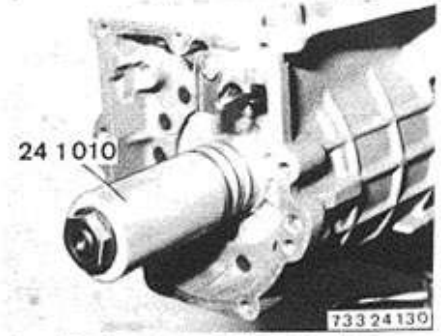


Unscrew transmission extension.
Installation:
Replace gasket.

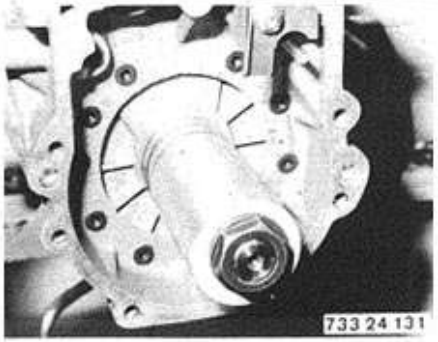


Pull off parking lock gear and governor.
Important!
Pull off parking lock gear with special tool, if necessary (see 24 32 002).

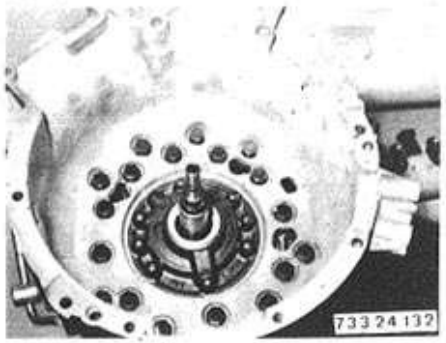
Remove parking lock pawl, spring and shaft.
Caution!
Spring force.



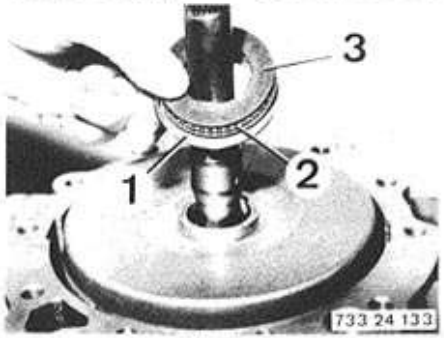
Apply Special Tool 24 1 010 on output shaft and secure with collar nut.



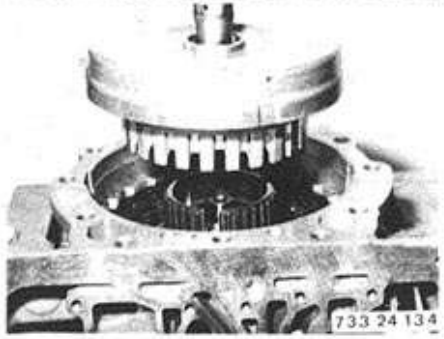
Unscrew Torx bolts with Special Tool 00 2 100.



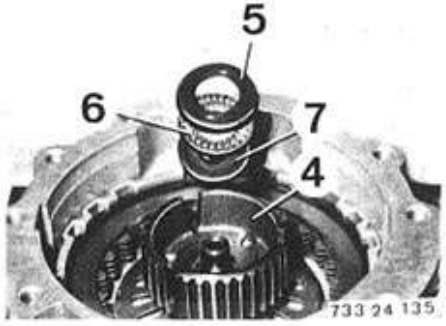
Set transmission upright.
Disconnect converter bell housing and connecting plate.



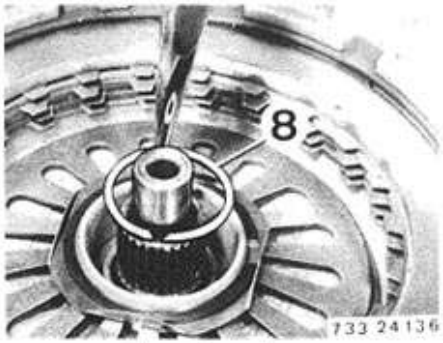
Take off angled washer (1), axial bearing (2) and thrust washer (3).



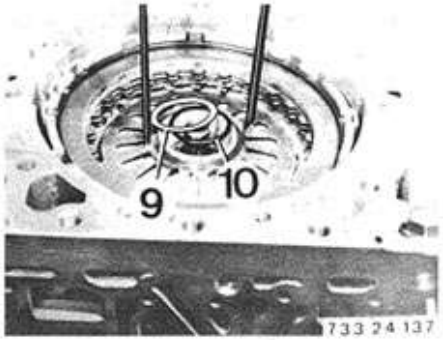
Remove input shaft with clutch A.



Remove plate carrier (4) for clutch A with angled washer (5), axial bearing (6) and thrust washer (7).

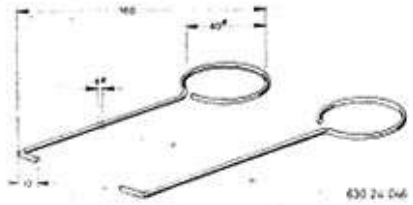


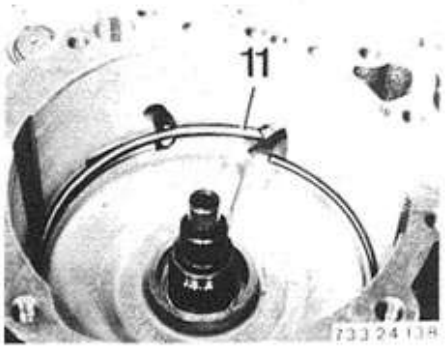
Remove snap ring (8) with help of two screwdrivers.
Installation:
Replace snap ring (8).



Pull out clutch B with two locally made hooks.
Installation:
Lift clutch until resistance is noticed and push back again.
Pull out clutch with one firm pull.
This will also pull out support (9) and seal (10).

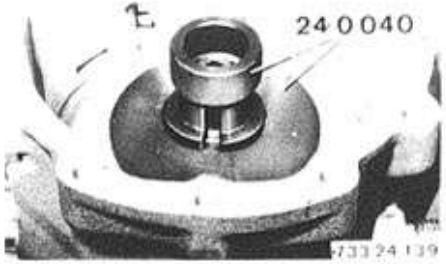
Sketch for local manufacture of hooks.
Dimensions in mm.



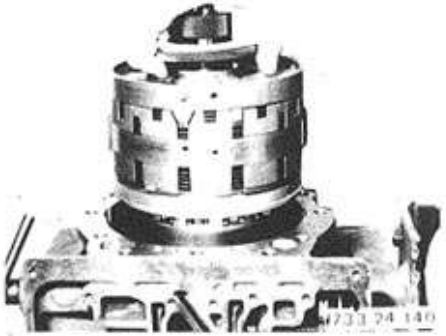


Lift out snap ring (11).

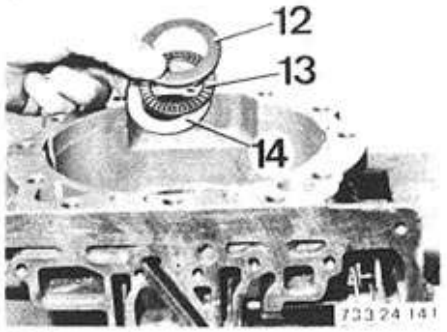
Apply Special Tool 24 0 040 on intermediate shaft.



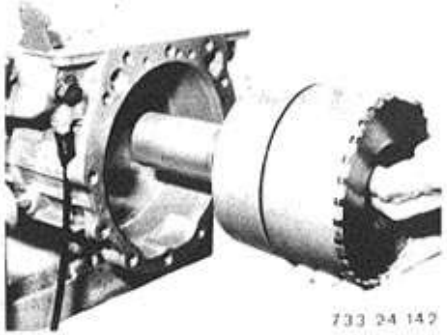
Pull out entire set.

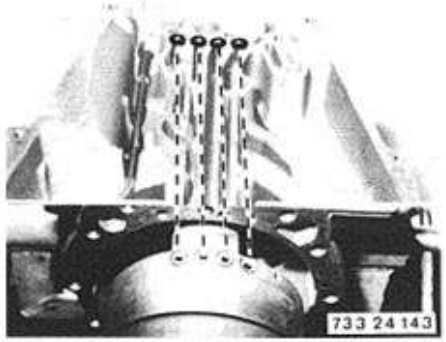


Remove angled washer (12), axial bearing (13) and thrust washer (14).

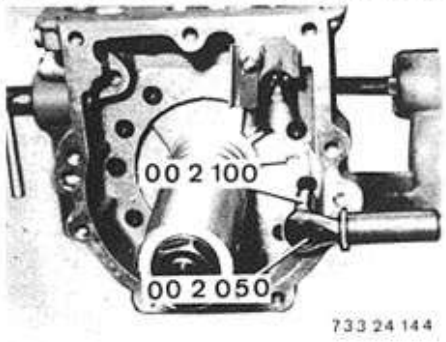


Remove 4th gear clutch set.

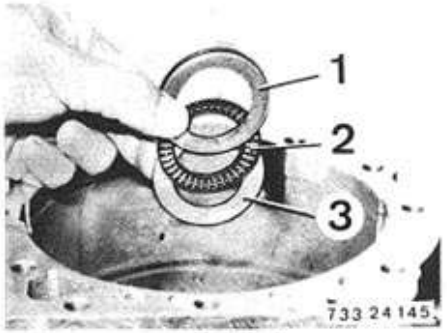




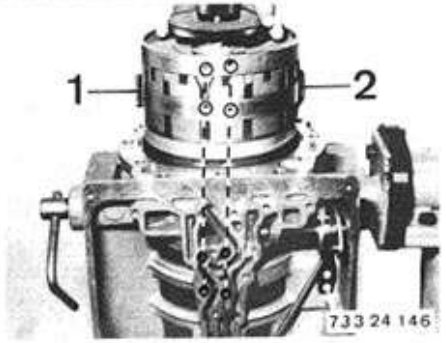
B) Assembling:
Install 4th gear clutch set.
Guide clutch set into transmission case that 4 oil feed bores are aligned with bores in case.



Bolt down clutch set with Special Tools 00 2 100 and 00 2 050.
Tightening torque*.

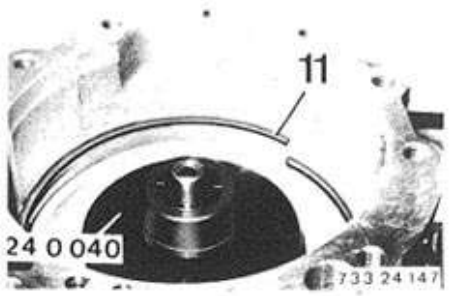


Set transmission upright.
Insert thrust washer (3), axial bearing (2) and angled washer (1) with collar facing up.

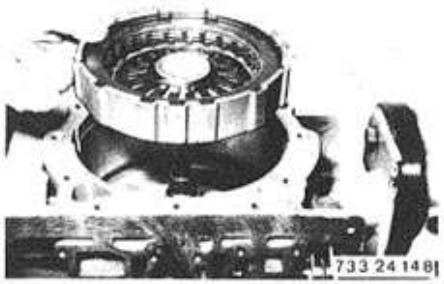


Place entire set in case.
Four oil feed bores must be aligned with bores in case.
Springs (1 and 2) must be in center of cylinder groove.

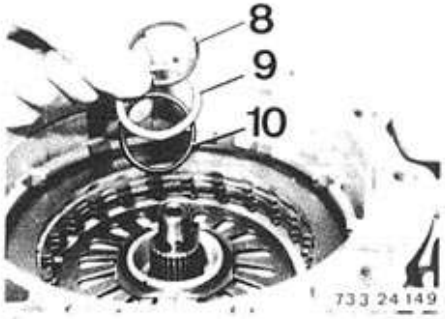
* See Specifications



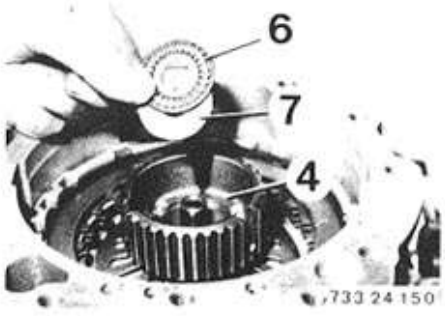
Insert snap ring (11).
Remove Special Tool 24 0 040.



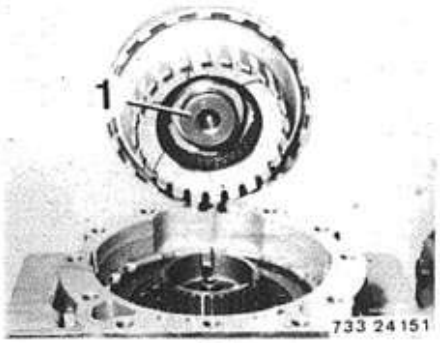
Insert and push clutch B against stop.



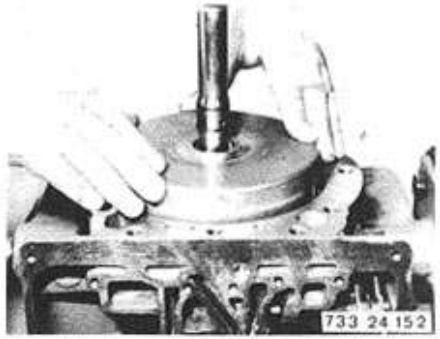
Install seal (10), support (9) and snap ring (8).



Insert plate carrier (4).
Install thrust washer (7) and axial bearing (6).

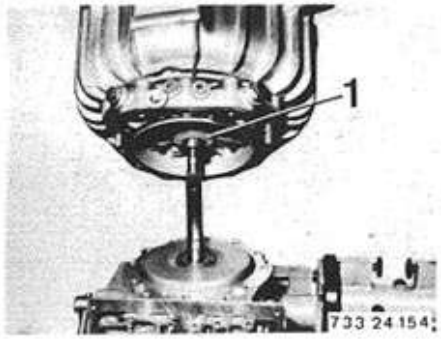


Paste angled washer (1) on cylinder A with grease (vaseline).

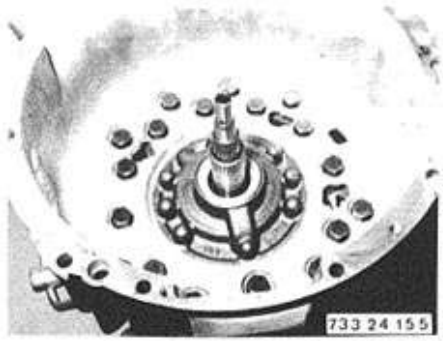


Insert clutch A and move it back and forth until splines of plate carrier and plates match.

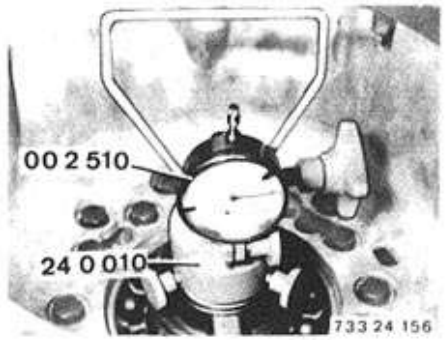
Install angled washer (3) with collar facing up and axial bearing (2).



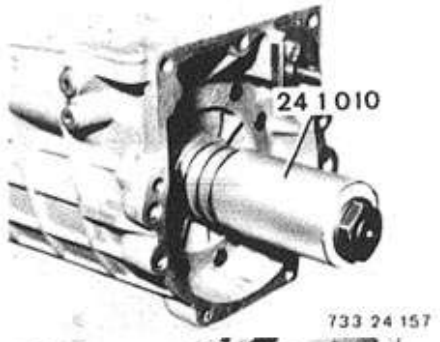
Paste on gasket and thrust washer (1) with grease (vaseline).



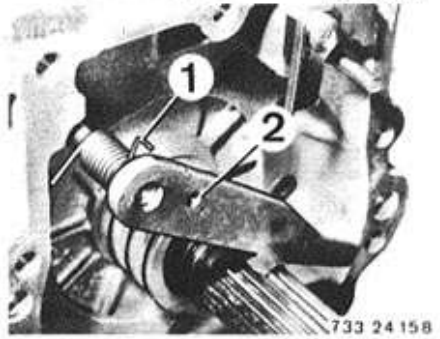
Install converter bell housing and tighten all bolts.
Tightening torque*.



Check axial play of input shaft.
Mount Special Tool 24 0 010 to hold input shaf
Apply Special Tool 00 2 510 (dial gauge).
Check axial play by pulling input shaft.
Specification: 0.2 to 0.4 mm (0.008 to 0.016").
If play deviates, take off converter bell housing again and replace thrust washer with a thicker or thinner one.
Recheck axial play.
Bolt down converter bell housing.
Tightening torque*.

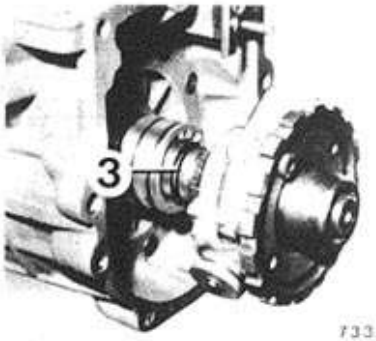


Remove Special Tool 24 1 010.

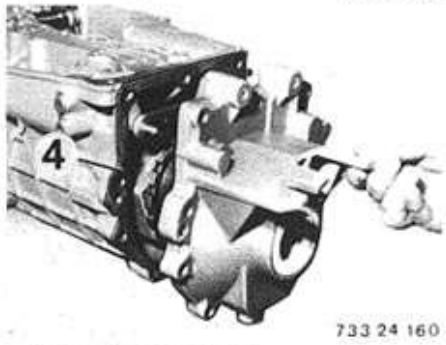


Install parking lock pawl.
Attach return spring (1) in bore (2) of pawl.

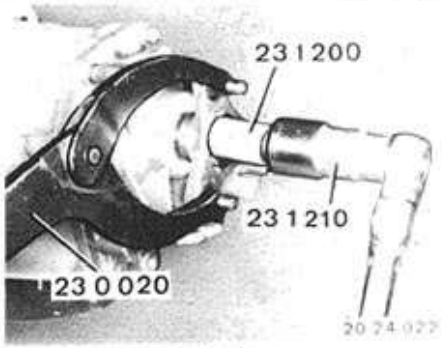
* See Specifications



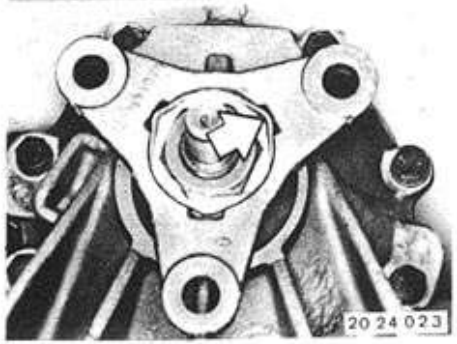
Lubricate O-ring (3) with ATF.
Push on parking lock gear and governor.



Hold gasket (4) in position with grease.
Bolt on transmission extension.
Tightening torque*.

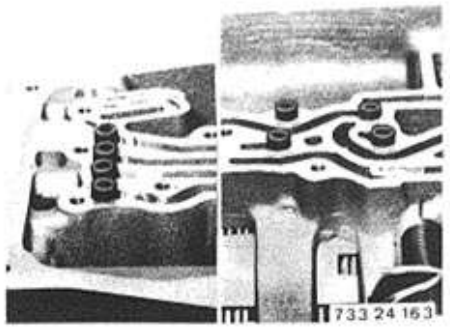


Install output flange.
Screw on collar nut.
Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Tighten collar nut with Special Tool 23 1 210.
Tightening torque*.

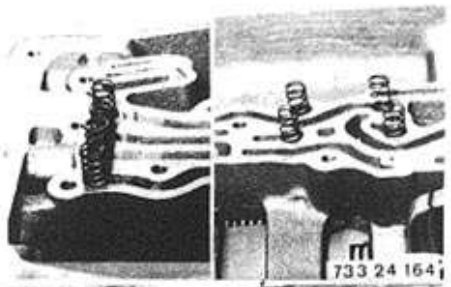


Install lockplate and lock in groove.

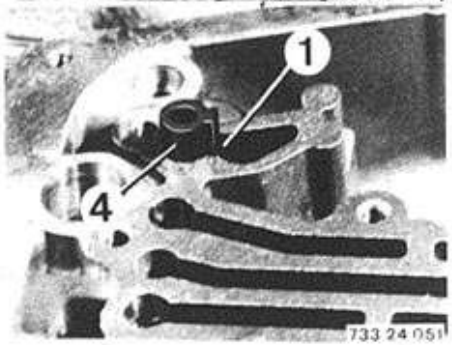
* See Specifications



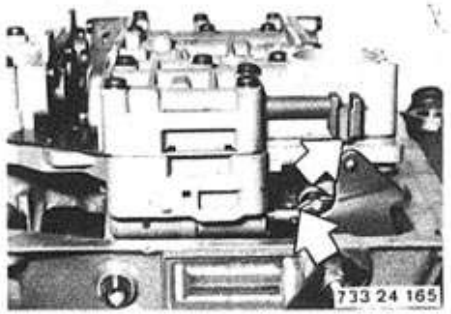
Install eight sealing sleeves.
Press in sealing sleeves against stop.
Be careful not to damage sealing sleeves.
EH Transmission:
Only install two sealing sleeves on cylinder F (output end).



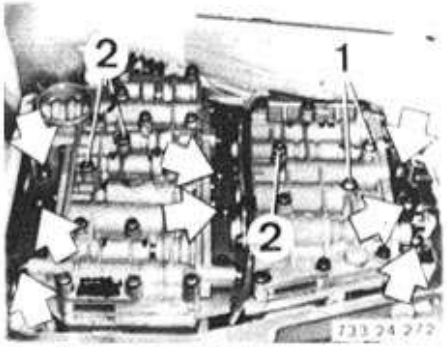
Install eight springs and eight circlips.
Important!
Install longer springs to face cylinder F (output end).
EH Transmission:
Install two springs only on cylinder F (output end).



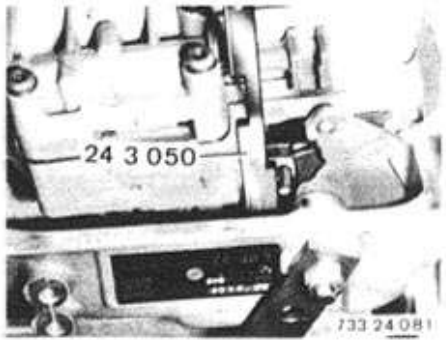
Note:
Version with Improved Lubrication for Cylinder F Gear Set:
Insert sealing sleeve (4) in bore (1) with tab facing oil bore.
Press in sealing sleeve against stop with a suitable mandrel.
Install spring and circlip.



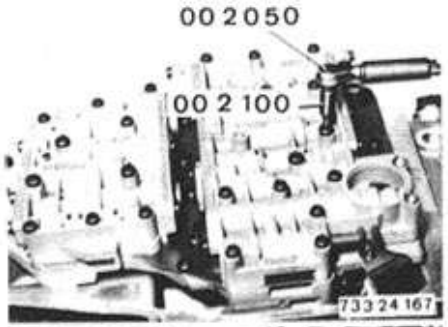
Mount valve body that selector valve can be connected in operating finger of pawl.
This requires pulling throttle cable slightly, so that accelerator cam does not clamp on throttle pressure valve.



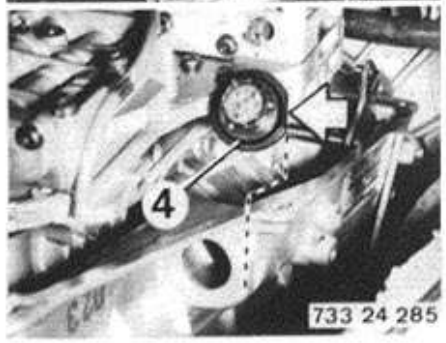
Screw in valve body mounting bolts.
Important!
Bolts differ in length.
Bolts (1) = 65 mm (2.559").
Bolts (2) = 60 mm (2.362").



Tighten valve body bolts only finger tight.
Align valve body with Special Tool 24 3 050.
Distance between valve body case and throttle pressure piston must be 11.5 mm (0.453").

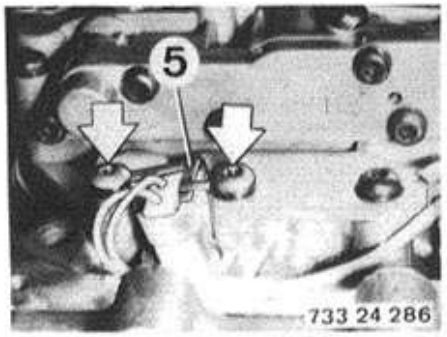


Tighten valve body bolts.
Tightening torque*.
Tighten bolts with Special Tools 00 2 100 and 00 2 050.

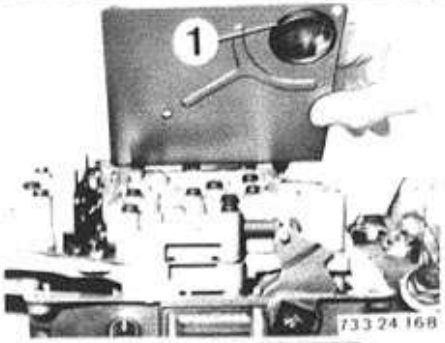


EH Transmission:
Check O-ring (4), replacing if necessary.
Install socket with the flat side facing out and bolt.
Tightening torque*.

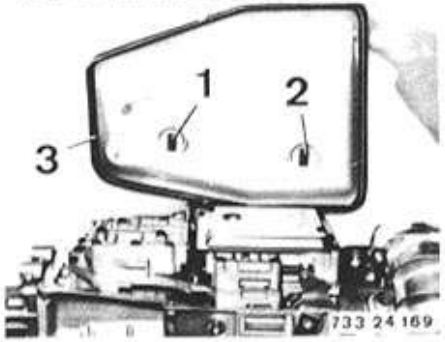
* See Specifications



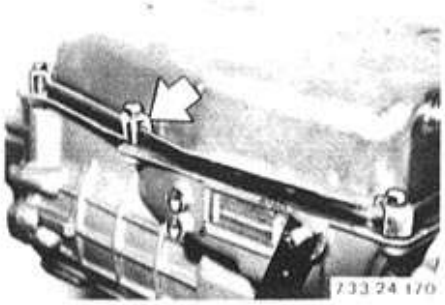
Note:
Also mount pulse transmitter on valve body.
Engage tabs of holder (5) in grooves of plug.



Install O-ring (1) between valve body and oil filter screen.
Install and bolt down oil filter screen.
Tightening torque*.
Check length of bolts.
Bolts with conical head = 65 mm long.

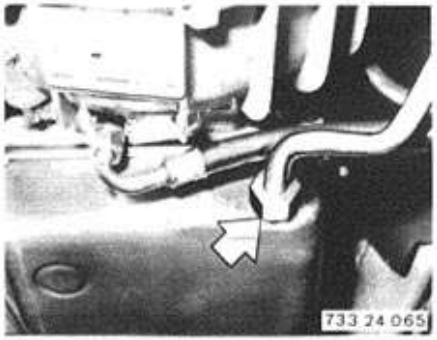


Place magnets (1 and 2) in oil sump.
Install gasket (3).



Install oil sump and tighten bolts with brackets.
Tightening torque*.
Important!
Both brackets with straight, short legs must be mounted on straight side of the oil sump.

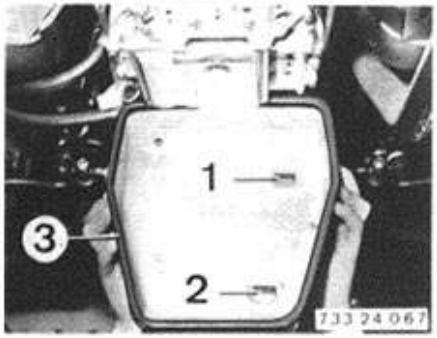
* See Specifications



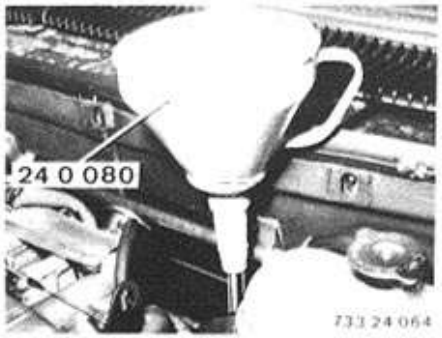
24 11 002 REMOVING AND INSTALLING OIL SUMP

Drain oil.
Important!
Never reuse drained oil.
Installation:
The transmission will have to be disassembled, if the oil smells burnt and is black.
Unscrew oil filler tube on oil sump.
Unscrew oil sump.

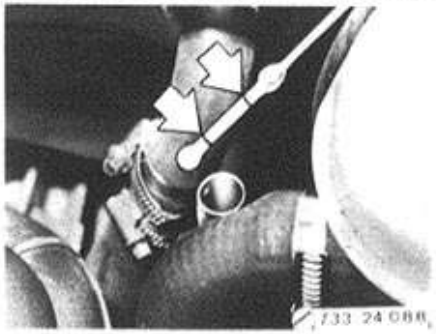
Installation:
Mount oil sump with brackets in such a manner, that short leg presses on oil sump.
Tightening torque*.
Important!
The two brackets with straight legs must be mounted on the sides.



Clean oil pan.
Important!
Place magnets (1 and 2) in oil sump.
Install gasket (3).



Pour in oil*.
Important!
Only pour in transmission oil with Special Tool 24 0 080 (funnel).

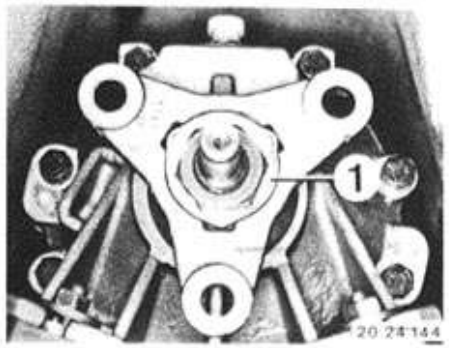


Test drive car.
Check oil level.
Park car on level floor or ground.
Correct oil level in selector lever position P with transmission at operating temperature and engine running at idle speed.
Oil level of transmission at operating temperature = aprrox. 80° C (175° F) must be between both marks.
Amount of oil between min. and max. marks = approx. 0.4 liter (0.8 pint).

An oil dipstick with a longer measuring tip (1) is standard since 2.85.
This produces an earlier display of the oil level in the tranmission.
The oil level must not be below ball (2) after a test drive and an oil temperature of approx. 40° C (105° F).
The oil level must be between min. and max. marks with an oil temperature of approx. 80° C (175° F).
Correct oil level, if necessary.
Note:
The new oil dipstick can be installed retroactively.
Oil Level Too High:
Strong foaming, splash loss, high temperature when driving fast, oil lost via vent.
Oil Level Too Low:
Valves rattling, foaming, engine slipping, general operating disturbances.

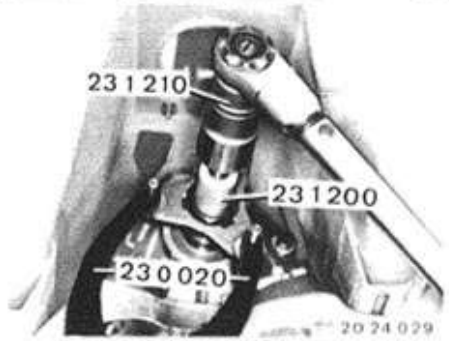
* See Specifications

* See Specifications

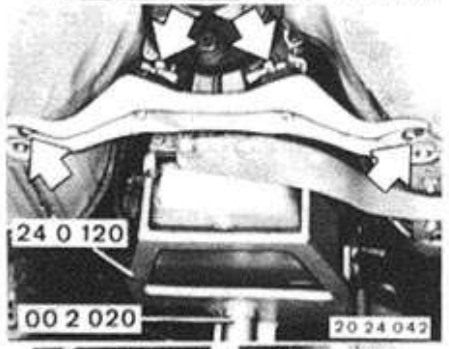


24 11 052 REMOVING AND INSTALLING/ SEALING TRANSMISSION EXTENSION

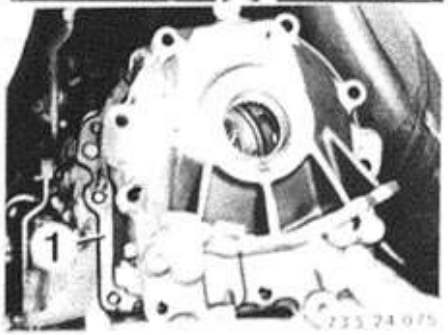
Unscrew propeller shaft – see 24 00 022.
Lift out lockplate (1).
Installation:
Replace lockplate.



Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.
Installation:
Tightening torque*.
Pull off output flange.



Support transmission with Special Tools 24 0 120 and 00 2 020.
Remove cross member with rubber mounts.
Lower transmission.



Unscrew transmission extension.
Installation:
Replace gasket (1).
Tightening torque*.

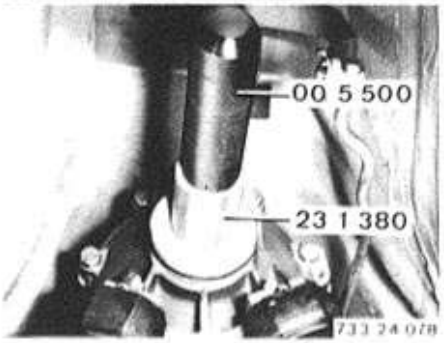
* See Specifications

24 12 003 REPLACING RADIAL OIL SEAL FOR TORQUE CONVERTER

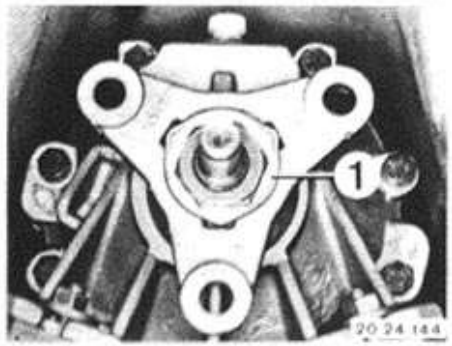
Remove torque converter 24 40 003.
Pull out radial oil seal with Special Tool 00 5 010.

Pull out radial oil seal with Special Tool 00 5 010.

Lubricate sealing lip with ATF.
Drive in radial oil seal to fit tight with Special Tool 24 0 090.

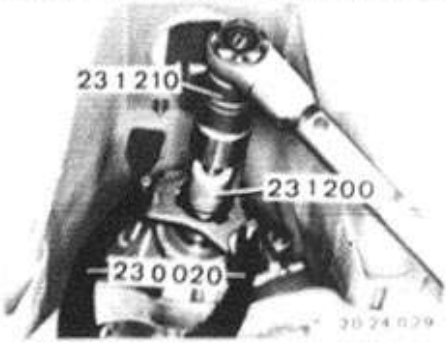


Lubricate sealing lip with ATF.
Drive in radial oil seal with Special Tools 23 1 380 and 00 5 500.



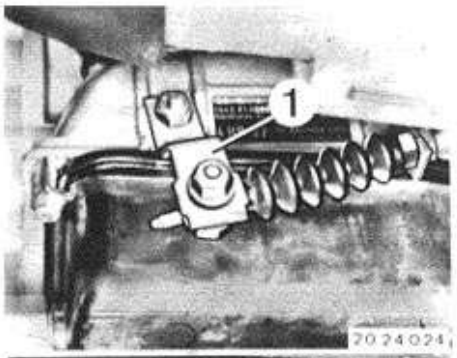
24 12 013 REPLACING RADIAL OIL SEAL FOR OUTPUT FLANGE

Unscrew propeller shaft – see 24 00 022.
Lift out lockplate (1).
Installation:
Replace lockplate.



Apply Special Tool 23 1 200.
Hold output flange with Special Tool 23 0 020.
Unscrew collar nut with Special Tool 23 1 210.
Installation:
Tightening torque*.
Pull off output flange.

* See Specifications



24 12 103 REPLACING RADIAL OIL SEAL FOR MANUAL SHIFT VALVE SHAFT

Detach selector lever (1) at transmission.

Remove radial oil seal (2).

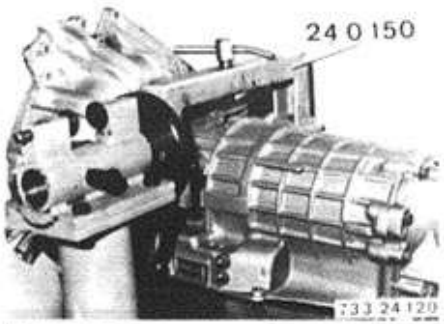
Installation:

Lubricate sealing lip with ATF.

Knock in radial oil seal.

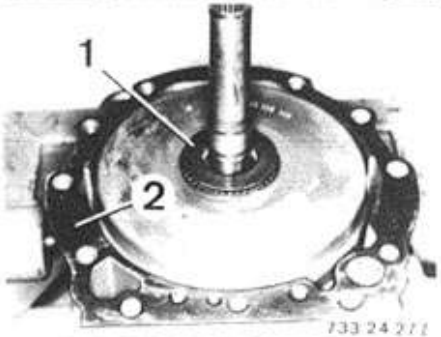
24 16 502 REPLACING TRANSFER PLATE

– Transmission Removed –

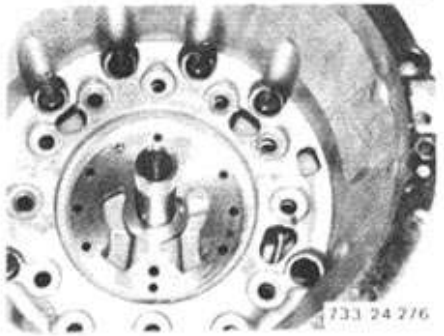


Remove torque converter – see 24 40 003.
Mount transmission on Special Tool 24 0 150 in conjunction with an assembly stand.
Caution!
Only bolt down finger tight to avoid deforming the transmission case.

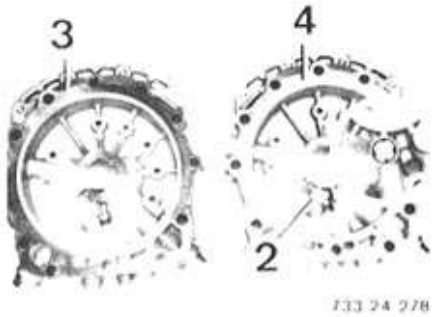
Unscrew converter bell housing with transfer plate.
Only remove the inner bolts for this purpose.
Only loosen the outer bolts.



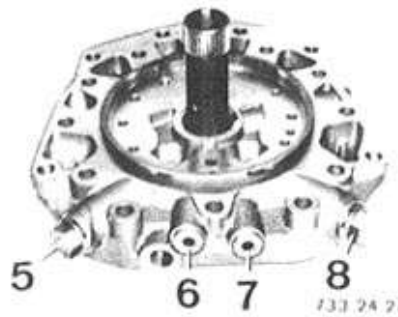
Lift off converter bell housing.
Installation:
Thrust washer (1), needle cage and angled washer.
Note:
The axial play of the input shaft can be adjusted with thrust washer (1).
Replace gasket (2).



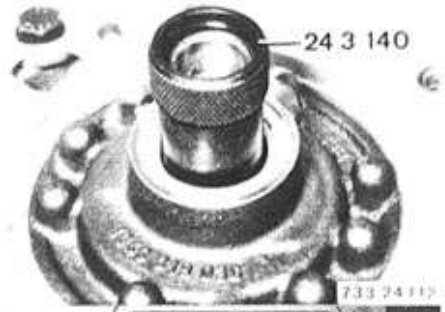
Remove primary pump (see 24 31 002).
Unscrew bolts.
Lift converter bell housing off of transfer plate.



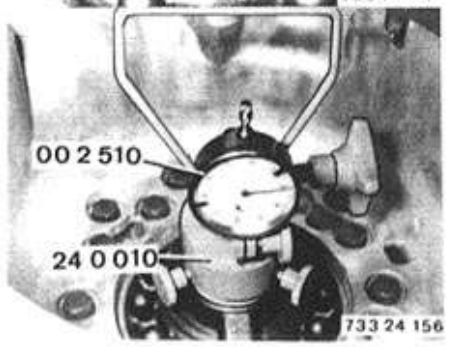
A transfer plate with venting valve (2) is installed since Transm. No. 170 195.
The venting valve provides faster pressure drop for clutch A.
Only use transfer plates with a venting valve for repairs.
Transfer plate (3) without venting valve.
Transfer plate (4) with venting valve.



Transfer plugs (5 ... 8).
Tightening torque*.
Check seals, replacing if necessary.



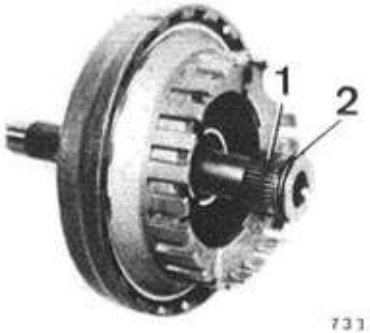
Bolt transfer plate on converter bell housing with outer bolts finger tight.
Align bores for inner bolts.
Install primary pump and check running with Special Tool 24 3 140.



Mount converter bell housing and tighten all bolts with correct torque*.
Check axial play of input shaft.
Build up Special Tool 24 0 010 to hold the input shaft.
Apply dial gage 00 2 510.
Check axial play by pulling the input shaft.
Specification: 0.2 to 0.4 mm (0.008 to 0.016").
Remove converter bell housing again in case of deviation and replace thrust washer with a thicker or thinner one.
Recheck axial play.
Tighten converter bell housing to correct torque*

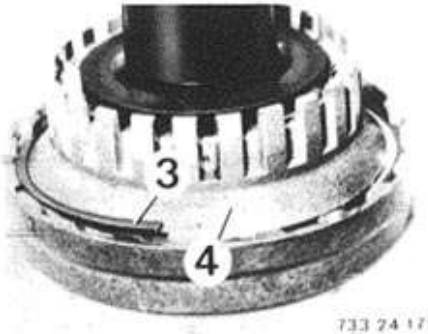
* See Specifications

24 23 022 REPLACING MULTIPLE DISC CLUTCHES AND BRAKES



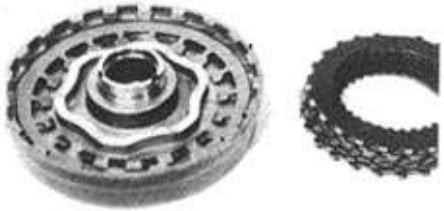
733 24 171

Disassemble transmission 24 00 082.
Important!
Check transfer plate for installation of a venting valve (see 24 16 502) when repairing clutch A.
If applicable, install a transfer plate with a venting valve.
Clutch A:
Press out input shaft (1).
Check O-ring (2), replacing if necessary.

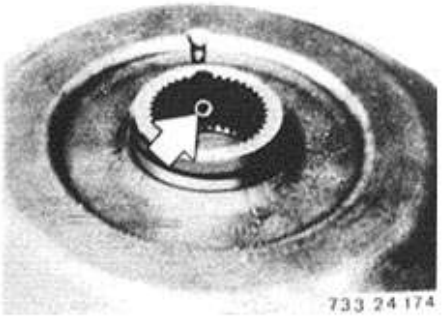


733 24 172

Compress clutch set and remove snap ring (3).
Remove plate carrier (4).

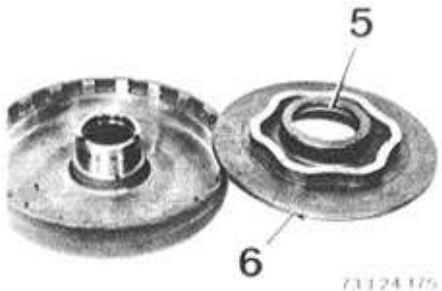

733 24 173

Lift out plate set and diaphragm spring.
Note:
Note number of steel and lined plates.



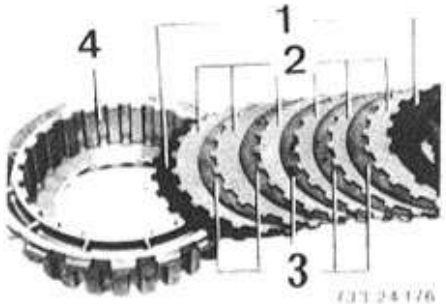
733 24 174

Press out clutch A piston with compressed air applied through bore.



733 24 175

Installation:
Replace O-rings (5 and 6).
Lubricate O-rings with light coat of ATF to make installation easier.

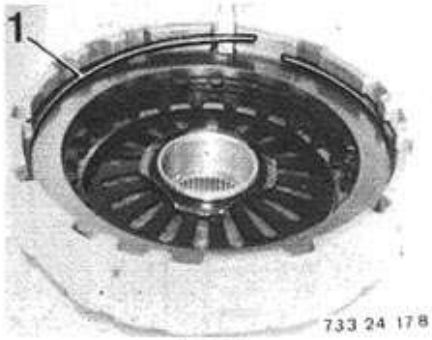


733 24 176

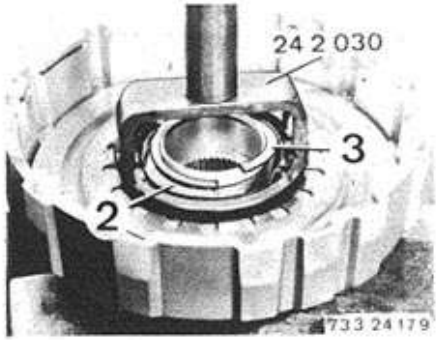
Installed Order of Plates:
Insert noted number of removed steel and lined plates alternately, beginning with a spring and steel plate.
1 Spring plates
2 Steel plates 1.8 mm
3 Lined plates
4 Plate carrier


733 24 177

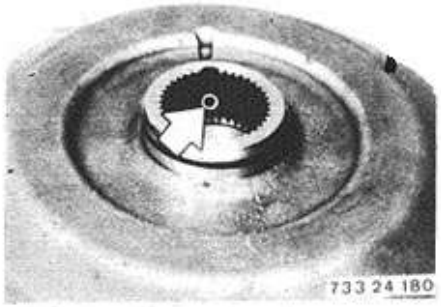
Place diaphragm spring in input shaft case with curved surface facing down.
Insert plate set with plate carrier.
Compress clutch set and insert snap ring.



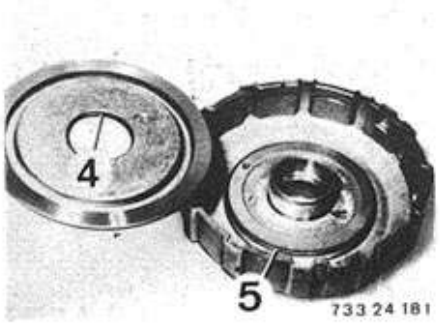
Clutch B:
Remove snap ring (1).
Remove steel and lined plates.
Note:
Note number of steel and lined plates.



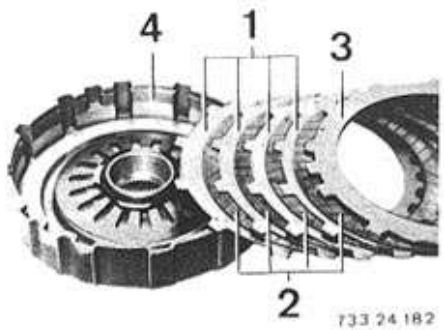
Bend open lockplate (2).
Press down on diaphragm spring with Special Tool 24 2 030 and remove snap ring (3).
Installation:
Replace and lock lockplate.
Insert diaphragm spring with curved surface facing up.



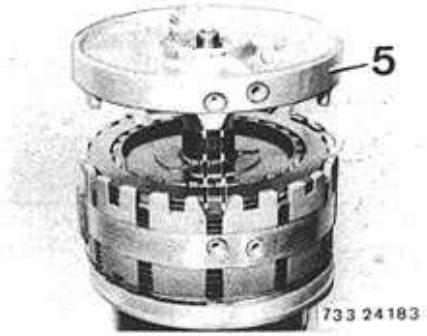
Press out clutch B piston with compressed air applied through oil bore.



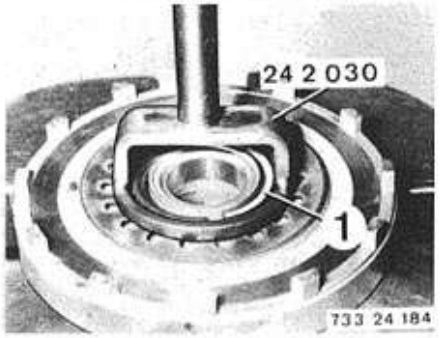
Installation:
Check O-rings (4 and 5), replacing if necessary.
Lubricate O-rings with a light coat of ATF to make installation easier.



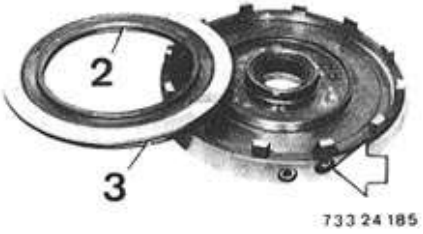
Installed Order of Plates:
Insert noted number of removed steel and lined plates alternately, beginning with a steel plate.
1 Steel plates 1.8 mm (.535 i = 2.1 mm)
2 Lined plates
3 End plate 4.5 mm
Important!
Insert end plate with ground side facing lined plate.
4 Housing



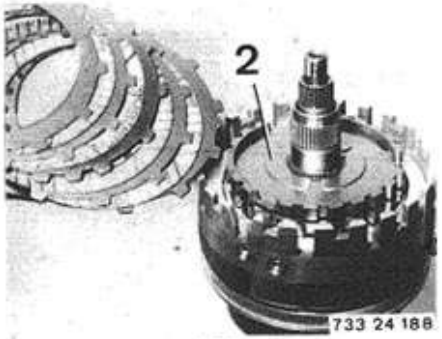
Clutch C' and C:
To make this step easier, place complete set in a pipe with an inside diameter of 29 mm (1.142") and clamp in a vise.
Remove Special Tool 24 0 040.
Lift off centering plate (5).
Installation:
Bevelled beads must engage in bevelled openings.



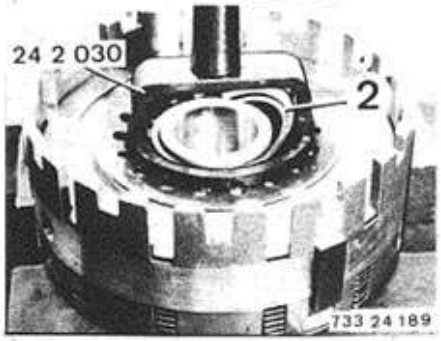
Press down on diaphragm spring with Special Tool 24 2 030 and lift out split retaining ring (1)
Installation:
Insert diaphragm spring with curved surface facing up.



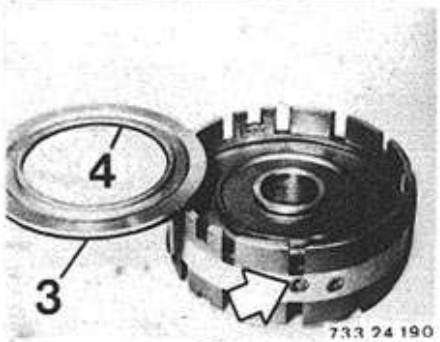
Press out clutch C' piston with compressed air applied through oil bore.
Installation:
Check O-rings (2 and 3), replacing if necessary.
Lubricate O-rings with light coat of ATF to make installation easier.



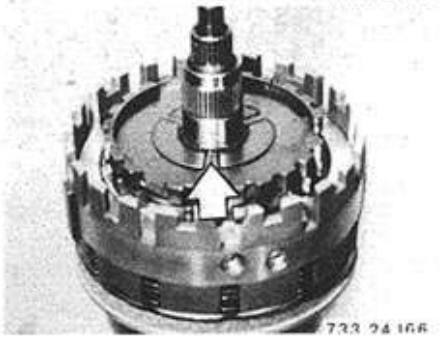
Remove all steel and lined plates.
Note:
Note number of steel and lined plates.
Pull out one-way clutch (2).



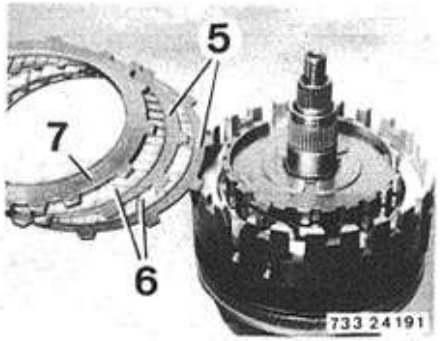
Press down diaphragm spring with Special Tool 24 2 030 and lift out split retaining ring (2).
Installation:
Insert diaphragm spring with curved surface facing up.



Press out clutch C piston with compressed air applied through oil bore.
Installation:
Check O-rings (3 and 4), replacing if necessary.
Lubricate O-rings with a light coat of ATF to make installation easier.

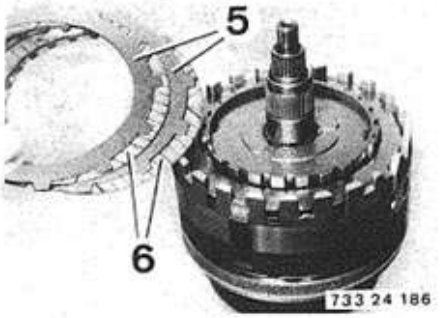


Install one-way clutch.
Important!
Bent over tabs or word "oben" must be seen.



C Installed Order:
Insert noted number of removed steel and lined plates alternately, beginning with a steel plate.
5 Steel plates 1.8 mm
Important!
Steel plates for a BMW 535i have different thicknesses (1.5 and 2.1 mm).
The thinner (1.5 mm) steel plate is installed on the piston end.
6 Lined plates
7 End plate 4.5 mm

Important!
Insert end plate that center tooth of three teeth group engages in opening of cylinder.



C' Installed Order:
Insert noted number of removed steel and lined plates alternately, beginning with a lined plate.
5 Steel plates 1.8 mm
Important!
Steel plates for a BMW 535 i have different thicknesses (1.5 and 2.1 mm).
The thinner (1.5 mm) steel plate is installed on the piston end.
6 Lined plates

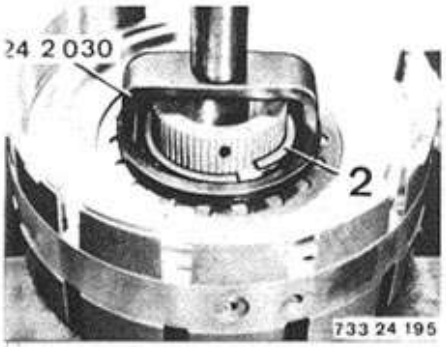
Important!
External splines of steel plates must not be placed in bevelled openings of cylinder.


733 24 192

Clutch D:
Clutches C' and C removed.
Lift clutch member with clutch D off of planet gear set.

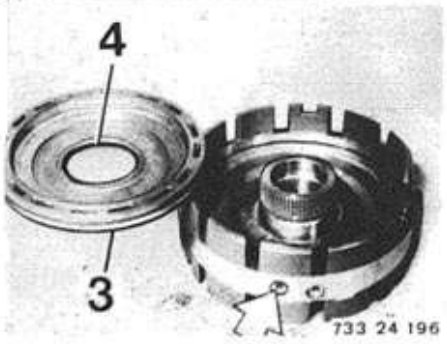
733 24 194

Remove snap ring (1).
Remove steel and lined plates.
Note:
Note number of steel and lined plates.



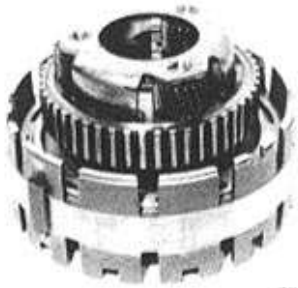
733 24 195

Press down on diaphragm spring with Special Tool 24 2 030 and lift out snap ring (2).
Installation:
Insert diaphragm spring with curved surface facing up.

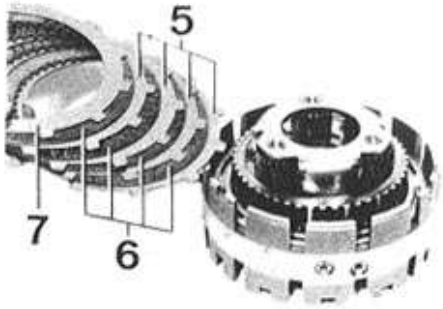


733 24 196

Press out clutch D piston with compressed air applied through oil bore.
Installation:
Check O-rings (3 and 4), replacing if necessary. Lubricate O-rings with a light coat of ATF to make installation easier.


733 24 197

Place planet plate with one-way clutch on hub of cylinder D.



733 24 198

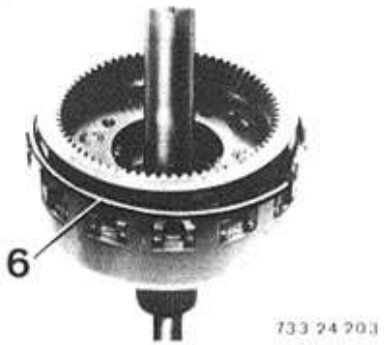
Installed Order of Plates:
Insert noted number of removed steel and lined plates alternately, beginning with a steel plate.
5 Steel plates 1.8 mm
6 Lined plates
7 End plate 1.2 mm

Disassemble planet gear set.
Remove support ring (1).
Installation:
Mount support ring with fins facing down.

Take off planet gear set (2).

Pull out sun gear shaft (3).

Remove axial bearing (4) and thrust washer (5).



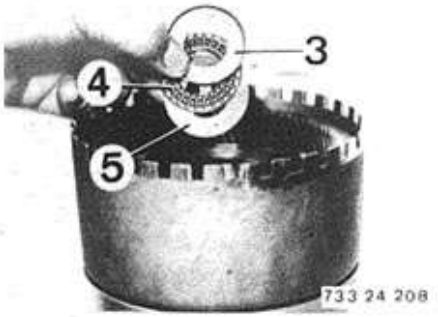
Lift out snap ring (6).

Remove hollow gear (7) and planet plate (8).

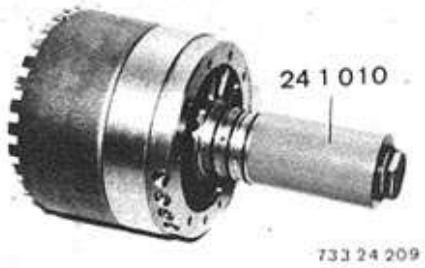
Remove thrust washers (9) and axial bearing (10
Take off spacer (11).

Lift out snap ring (12).
Take off hollow gear (13).

Clutches E and F:
Remove sun gear (1) and planet carrier (2).



Remove angled washer (3), axial bearing (4) and thrust washer (5).
Installation:
Install angled washer (3) with collar facing planet carrier.



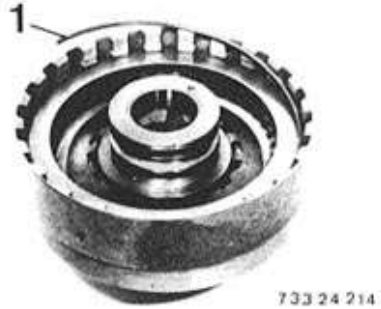
Take off Special Tool 24 1 010.

Lift cylinder F off of cylinder E.

Lift off cylinder E on output shell.

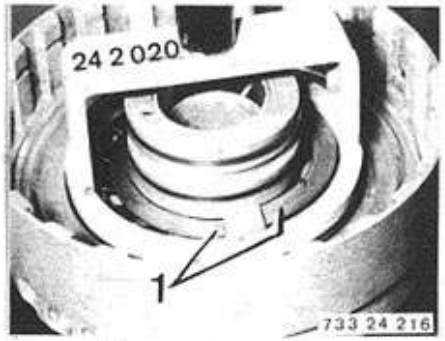
Take off thrust washer (6), axial bearing (7) and steel/copper angled washer (8).

Installation:
Mount cylinder E and turn until it rests on stop.
Cylinder must rest on copper angled washer.
When holding output shaft it must now be possible to turn cylinder E clockwise.
It should lock in opposite direction.

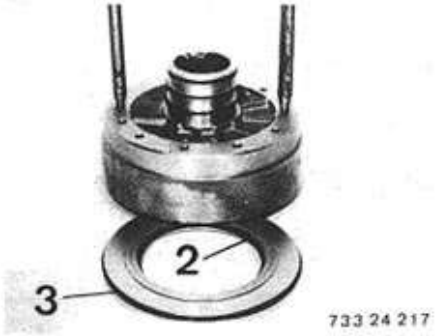


Clutch F:
Lift out snap ring (1).

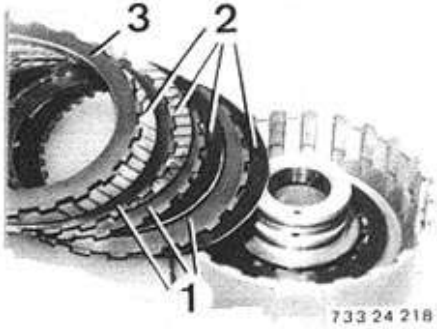
Remove plate set.
Note:
Note number of steel and lined plates.



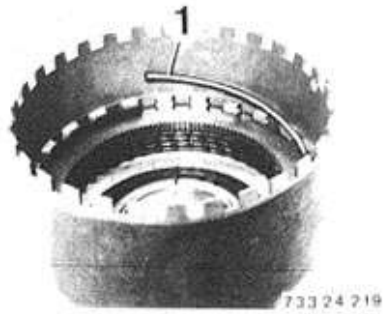
Remove piston for clutch F.
Press down on diaphragm spring with Special Tool 24 2 020, and lift out split retaining ring (1).
Installation:
Insert diaphragm spring with curved surface facing up.



Press out piston for clutch F with two suitable mandrels.
Installation:
Check O-rings (2 and 3), replacing if necessary. Lubricate O-rings with a light coat of ATF to make installation easier.

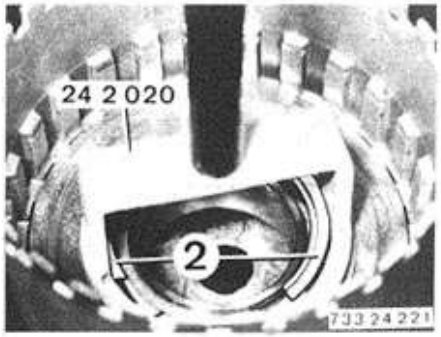


Installed Order of Plates:
Insert noted number of removed steel and lined plates alternately, beginning with a steel plate.
1 Steel plates 2.1 mm
2 Lined plates
3 End plate 4.5 mm

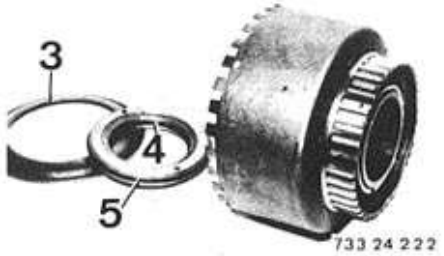


Clutch E:
Lift out snap ring (1).

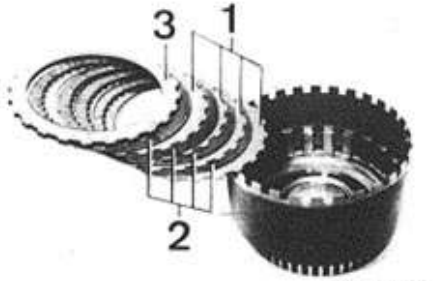
Remove plate set.
Note:
Note number of steel and lined plates.



Remove piston for clutch E.
Press down on diaphragm spring with Special Tool 24 2 020 and remove the split retaining ring (2).
Installation:
Insert diaphragm spring with curved surface facing up.

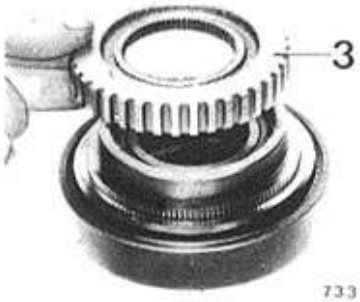


Lift off thrust cover (3).
Press out clutch E piston with compressed air applied through oil bore.
Installation:
Check O-rings (4 and 5), replacing if necessary. Lubricate O-rings with a light coat of ATF to make installation easier.



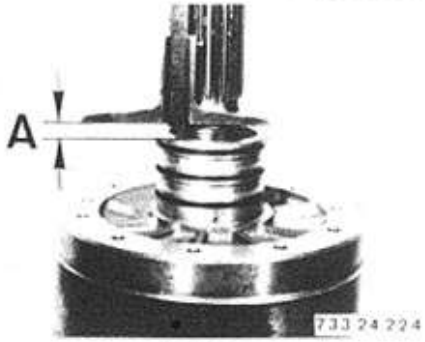
733 24 223

Installed Order of Plates:
Insert noted number of removed steel and lined plates alternately, beginning with a steel plate.
1 Steel plates 1.5 mm
2 Lined plates
3 End plate 4.5 mm



733 24 227

Lift off carrier (3).



733 24 224

Connect cylinders E and F by turning.
Collar on output shaft must protrude by distance A = approx. 10 mm (0.394").
Apply Special Tool 24 1 010.


733 24 228

Pull or press off one-way clutch.

733 24 225

Removing One-way Clutch:
Lift out snap ring (1).


733 24 229

Press one-way clutch cage out of outer race carefully.
Caution!!
Needles could jump out of cage.

733 24 226

Press out output shaft (2).


733 24 230

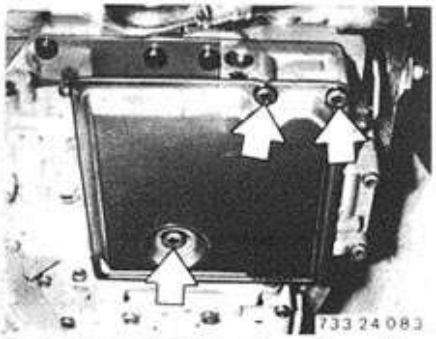
Installation:
Place one-way clutch cage on the outer race and align.
Press in one-way clutch cage against stop and then turn until metal edge engages in holding groove of outer race.

Use plate carrier (3) to turn one-way clutch outer race clockwise and mount race on inner race.

733 24 231

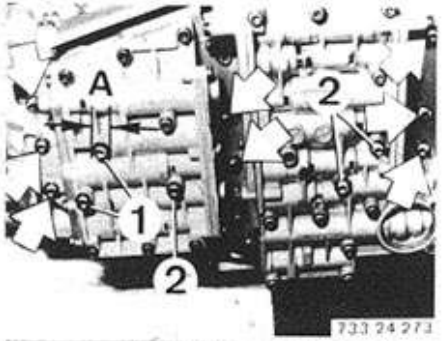
Clearance between one-way clutch inner race and outer race should be at least 0.1 mm (0.004").

733 24 232

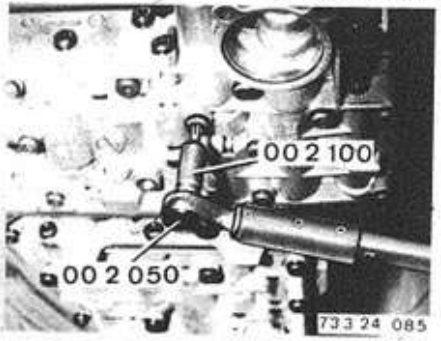


24 30 002 REMOVING AND INSTALLING VALVE BODY

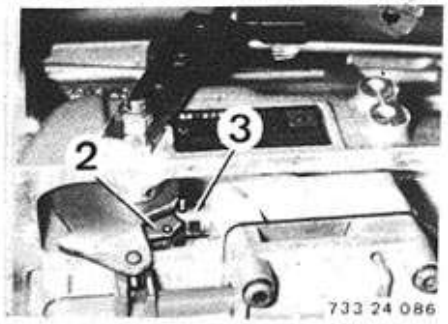
Remove oil sump 24 11 002.
Remove oil filter screen.
Installation:
Tightening torque*.
Check length of bolts.
Bolts with conical bolt head = 65 mm long.



Remove valve body.
Unscrew Torx bolts with Special Tool 00 2 100.
Important!
Only unscrew bolts with bolt head size A = 12 mm.
Installation:
Bolts differ in length.
Bolts (1) = 65 mm (2.559") long.
Bolts (2) = 60 mm (2.362") long.

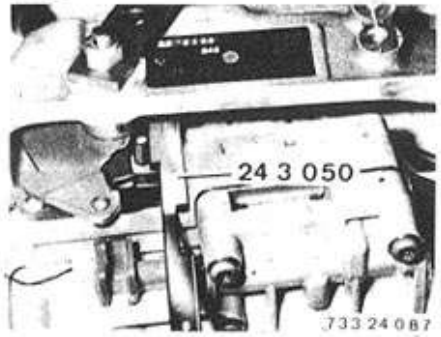


Installation:
Tighten Torx bolts with Special Tools 00 2 100 and 00 2 050.
Tightening torque*.

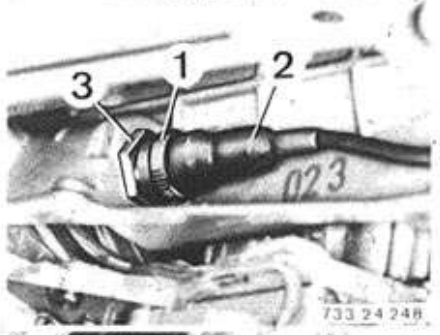


Installation:
Mount valve body that clamp on selector valve can be connected in operating finger of pawl. This requires pulling transmission cable slightly so that throttle cam (2) cannot clamp on throttle pressure valve (3).

* See Specifications

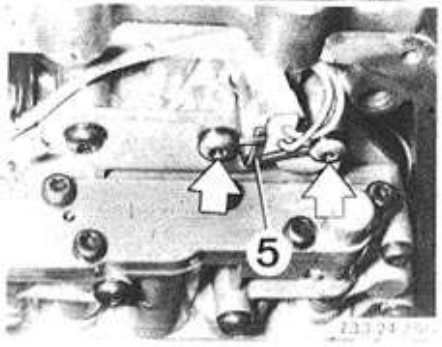


Install valve body and screw in bolts only finger tight.
Align valve body with Special Tool 24 3 050.
If special tool is not available, check that distance from valve body case to pin of throttle pressure piston is 11.5 mm (0.453").
Tighten valve body bolts.



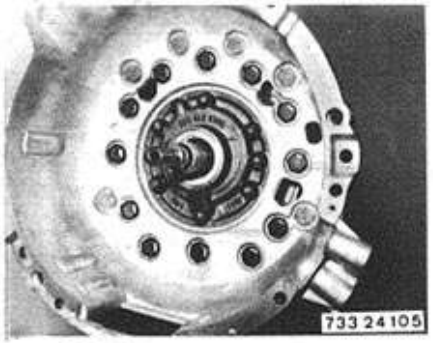
EH Transmission:
Turn bayonet fastener (1) to the left.
Pull off plug (2).
Unscrew nut (3).

Pull out socket toward inside.
Installation:
Check O-ring (4), replacing if necessary.
Plug in socket with flat side facing out.
Tightening torque*.



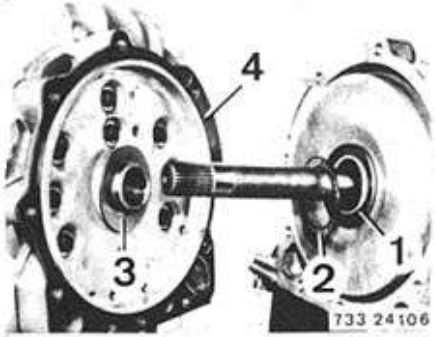
Note:
Also mount pulse transmitter on the valve body.
Tabs on holder (5) must engage in grooves of plug.

* See Specifications

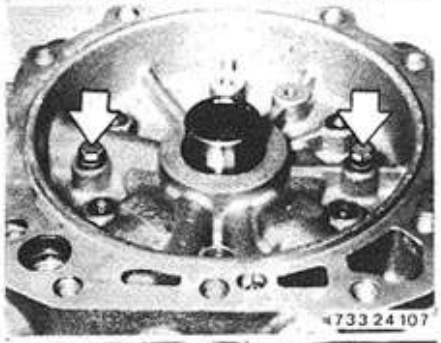


24 31 002 REMOVING AND INSTALLING PRIMARY PUMP

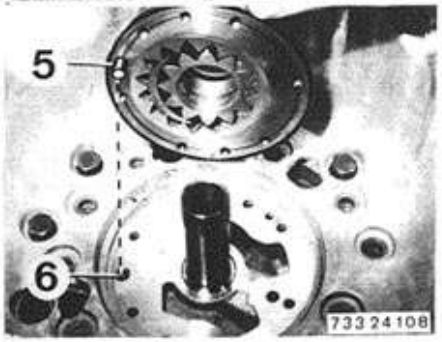
Remove torque converter 24 40 003.
Take off converter bell housing with connecting plate.
Installation:
Tightening torque*.



Installation:
Mount angled washer (1) with collar facing needle bearing (2) on input shaft.
Hold thrust washer (3) on converter bell housing with grease.
Replace gasket (4).

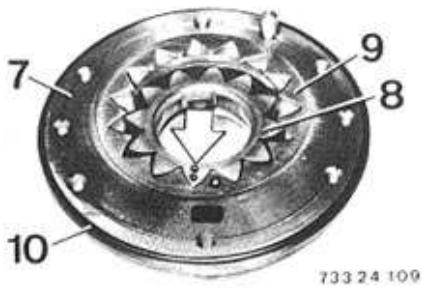


Unscrew primary pump on converter bell housing.
Loosen two bolts opposite each other by only several turns.
Loosen primary pump on converter bell housing with several light knocks.
Tightening torque*.



Remove primary pump.
Installation:
Centering pin (5) must engage in bore (6).

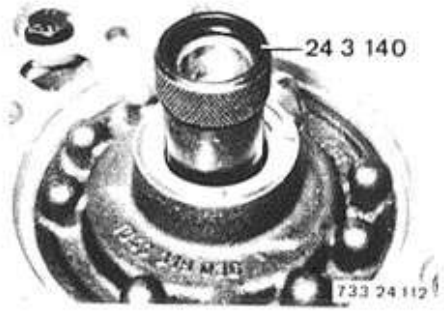
* See Specifications



Installation:
Primary pump, consisting of pump body (7), hollow gear (8) and impeller (9), may only be replaced as an assembly.
Check O-ring (10), replacing if necessary.
Important!
Install hollow gear (8) and impeller (9) that punch marks face up.

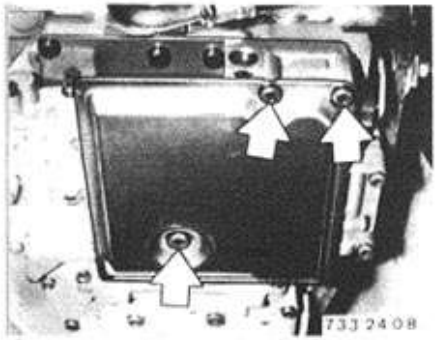
Check radial play* between driven gear and pump body, while turning gear 360°.

Check axial play* of both gears to face surface with a precision depth micrometer.



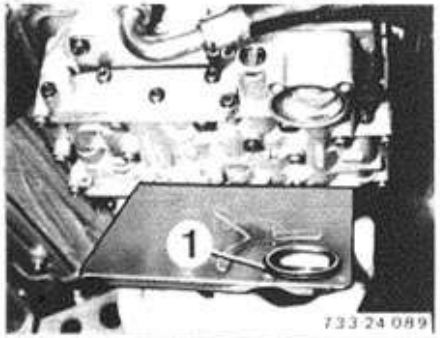
Check running of primary pump with Special Tool 24 3 140.

* See Specifications

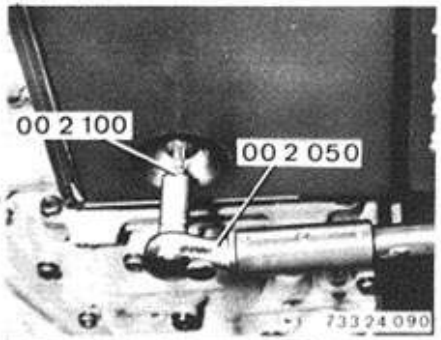


24 31 152 REMOVING AND INSTALLING OIL FILTER SCREEN ON VALVE BODY

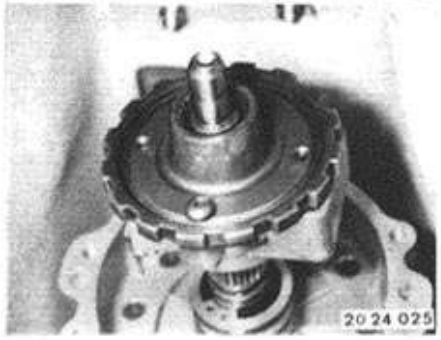
Remove oil sump 24 11 002.
Detach oil filter screen.
Installation:
Clean oil filter screen.
Replace an oil filter screen when it starts to gum up with a brown, burnt residue.
Tightening torque*.



Check rubber ring (1), replacing if necessary.



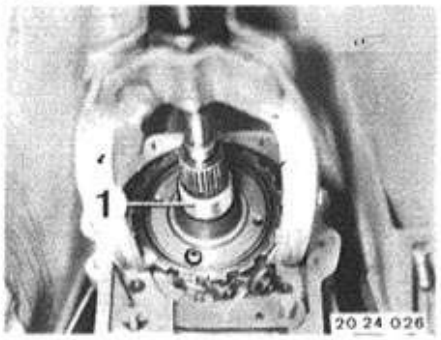
Installation:
Tighten Torx bolts with Special Tools 00 2 100 and 00 2 050.
Tightening torque*.
Replace oil filter screen (see Group 00).



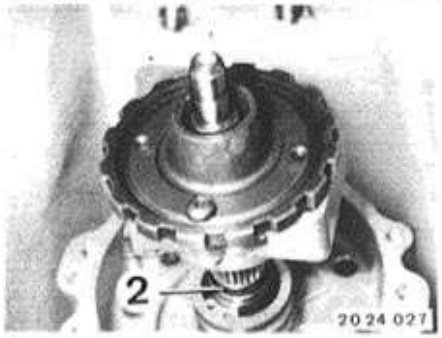
24 32 002 REMOVING AND INSTALLING CENTRIFUGAL GOVERNOR

Remove transmission extension 24 11 052.
Pull off parking lock gear with centrifugal governor.

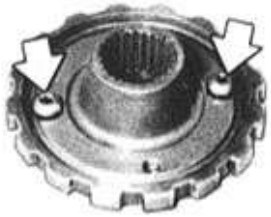
* See Specifications



Version with Bearing Race (1):
Pull off parking lock gear with a Kukko puller.
Installation:
Heat bearing race (1) to about 80° C (175° F) and slide on to output shaft.

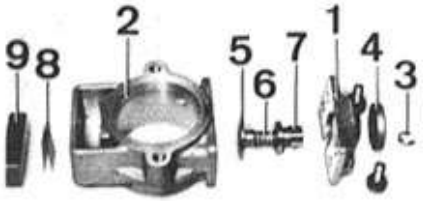


Replace seal (2).
Slide on parking lock gear with centrifugal governor.



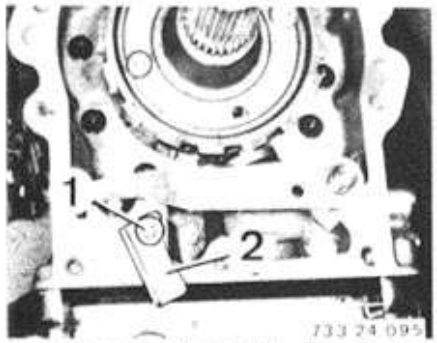
24 32 505 DISASSEMBLING/ASSEMBLING CENTRIFUGAL GOVERNOR
CENTRIFUGAL GOVERNOR REMOVED

Detach parking lock gear on centrifugal governor
Installation:
Tightening torque*.



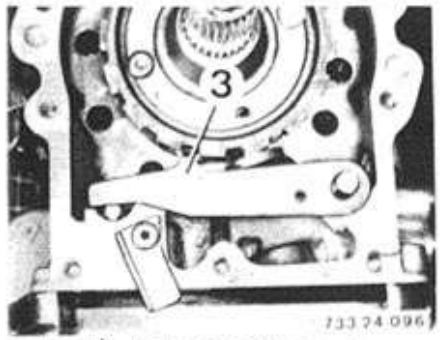
Take off cover (1) on case (2).
Lift out retainer (3) and remove washer (4).
Remove governor piston (5), spring (6) and governor bushing (7).
Installation:
Governor piston must slide easily in governor bushing.
Remove spring clip (8) and balance weight (9).

* See Specifications

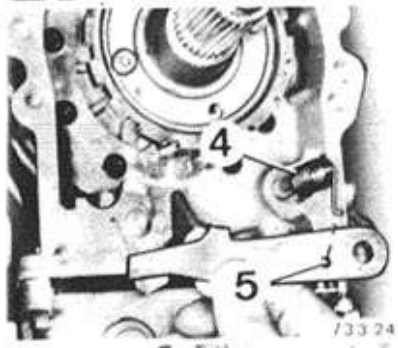


24 34 002 REMOVING AND INSTALLING PARKING LOCK PAWL

Remove transmission extension 24 11 052.
Loosen bolt (1).
Swing holder (2) down.



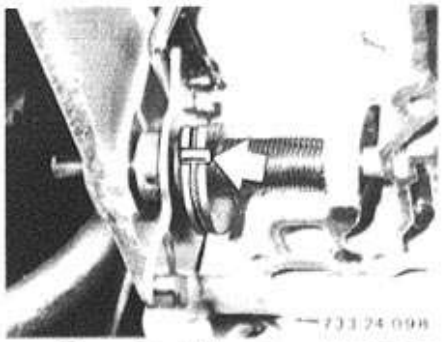
Pull off pawl (3).
Caution!
Spring force.



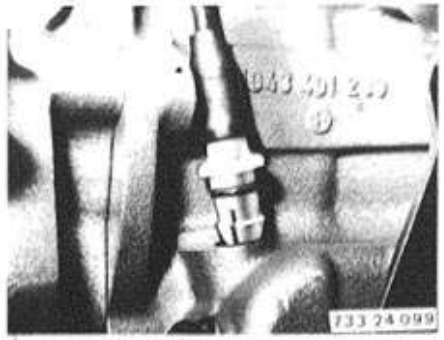
Installation:
Check installed position of spring (4).
It must be possible to connect end of spring (4) in bore (5) of pawl.

24 34 102 REPLACING THROTTLE CABLE

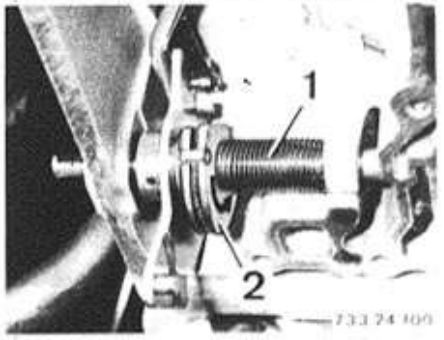
Unscrew nut (1) and disconnect throttle cable.



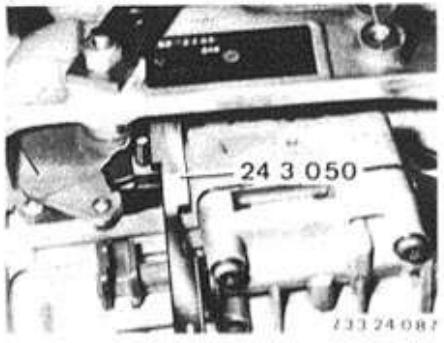
Remove valve body 24 30 002.
Disconnect throttle cable.



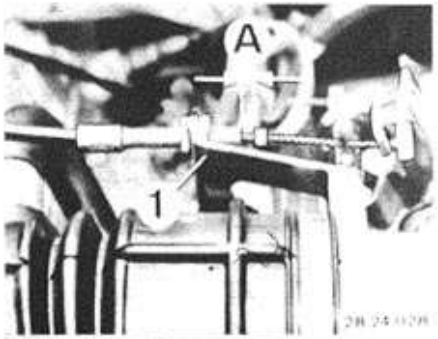
Press throttle cable out of case upwards.
Press new throttle cable into case until retaining tabs engage.



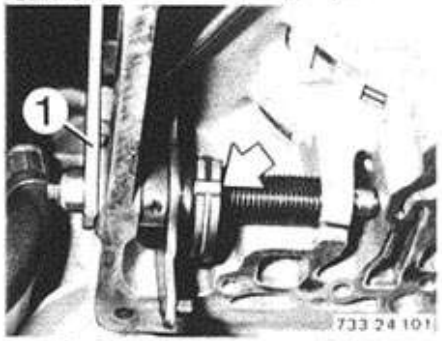
Preload spring (1) by one turn anticlockwise with throttle cam (2).
Connect nipple on throttle cam



Install valve body.
Insert Special Tool 24 3 050 between valve body case and throttle pressure valve.
Push throttle cam against throttle pressure valve

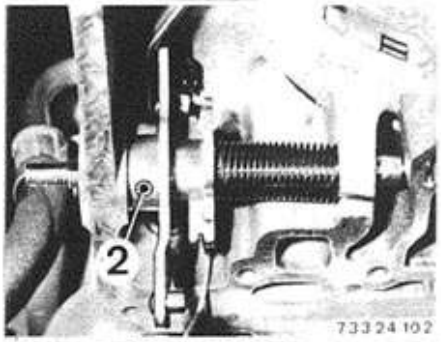


Connect throttle cable in suspension on transmission and holder (1).
Tighten cable.
Squeeze loose lead seal on cable at distance (A) = 0.25 to 0.50 mm (0.010 to 0.020").
Adjust throttle cable 24 00 006.

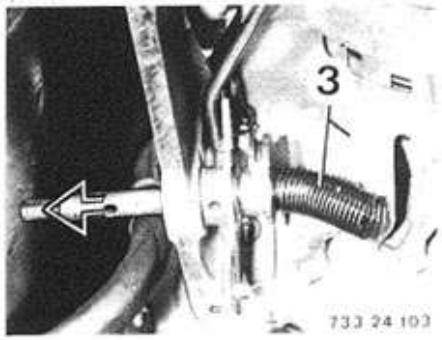


24 34 702 REPLACING SPRING FOR THROTTLE CABLE

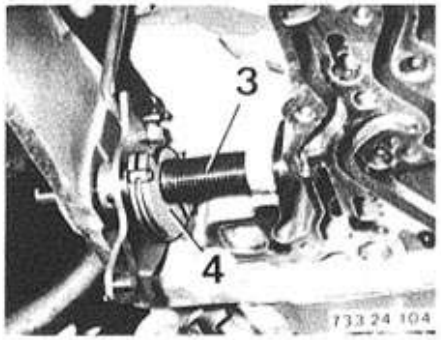
Remove valve body 24 30 002.
Disconnect selector lever (1) on transmission.
Disconnect throttle cable.



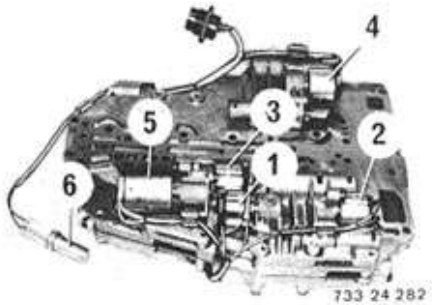
Drive out pin (2) in position N.



Pull out selector shaft far enough that spring (3) can be removed.

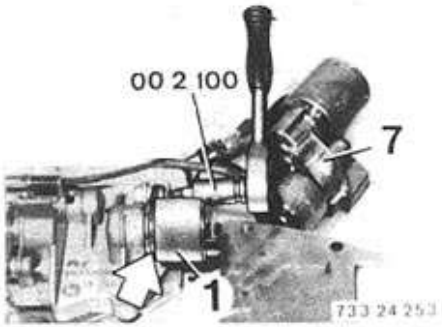


Installation:
Install selector shaft.
Preload spring (3) by one turn anticlockwise with throttle cam (4).
Connect nipple on throttle cam.

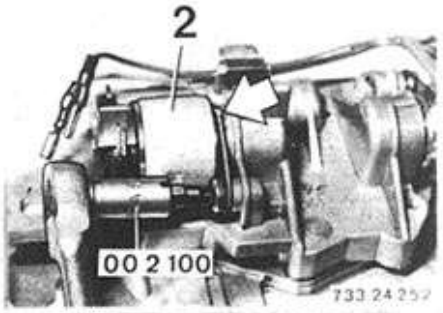


24 34 851 REPLACING ALL SOLENOIDS
– Valve Body Removed –

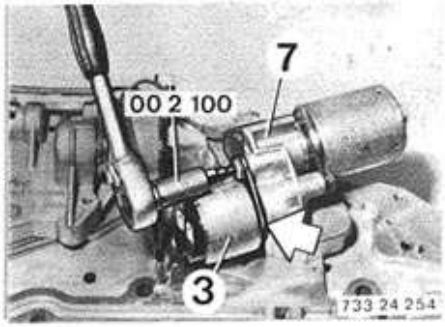
Arrangement:
1 Solenoid - 1st/2nd and 3rd/4th gears
2 Solenoid - 2nd/3rd gears
3 Solenoid - converter lockup clutch
4 Solenoid - reverse gear lock
5 Pressure regulator
6 Pulse transmitter



a) Solenoid (1) – 1st/2nd and 3rd/4th Gears:
Unscrew governor housing (7).
Pull off wire plug.
Unscrew Torx bolt with Special Tool 00 2 100.
Take off holder.
Pull out solenoid.
Installation:
Install holder with tabs facing collar on solenoid.
Tightening torque*.

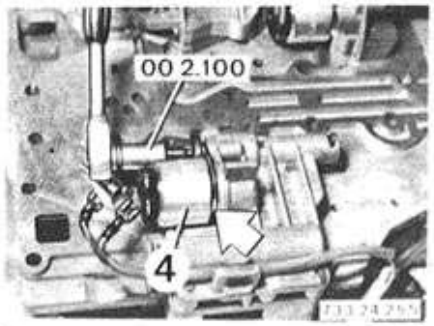


b) Solenoid (2) – 2nd/3rd Gears
Pull off wire plug.
Unscrew Torx bolt with Special Tool 00 2 100.
Take off holder.
Pull out solenoid.
Installation:
Install holder with tabs facing collar on solenoid.
Tightening torque*.

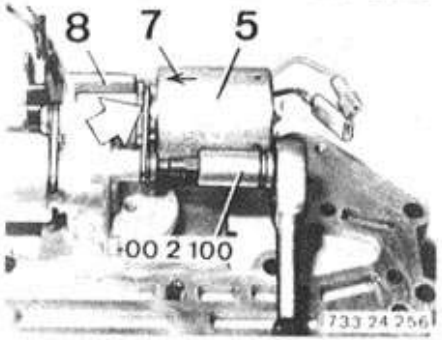


c) Solenoid (3) – Conv. Lockup Clutch:
Unscrew governor housing (7).
Pull off wire plug.
Unscrew Torx bolt with Special Tool 00 2 100.
Take off holder.
Pull out solenoid.
Installation:
Install holder with tabs facing collar on solenoid.
Tightening torque*.

* See Specifications

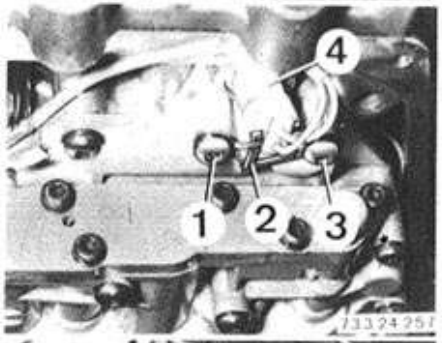


d) Solenoid (4) – Reverse Gear Lock:
Pull off wire plug.
Unscrew Torx bolt with Special Tool 00 2 100.
Take off holder.
Pull out solenoid.
Installation:
Install holder with tabs facing collar on solenoid.
Tightening torque*.



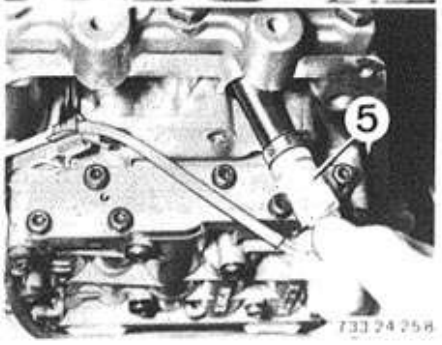
24 34 860 REPLACING PRESSURE REGULATOR
– Valve Body Removed –

Pull off wire plug.
Unscrew Torx bolt with Special Tool 00 2 100.
Take off holder.
Pull out pressure regulator (5).
Important! – Installation
Arrow (7) on pressure regulator must be aligned with rib (8).
Install holder with tabs facing collar on pressure regulator.
Tightening torque*.



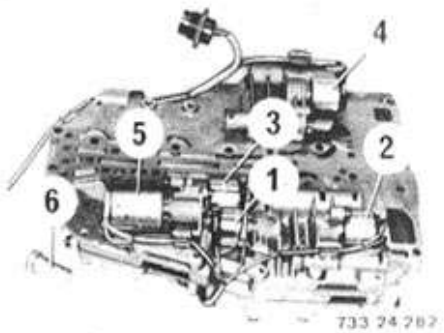
24 34 870 REPLACING PULSE TRANSMITTER
– Oil Sump Removed –

Unscrew Torx bolts (1 and 3) with Special Tool 00 2 100.
Take off holder (2).
Installation:
Engage tabs on holder (2) in grooves of plug (4).



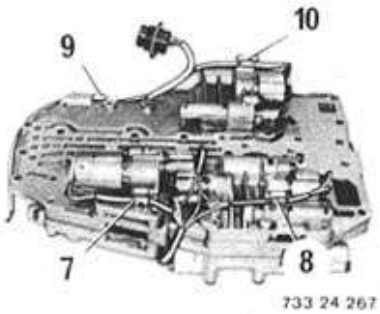
Pull out pulse transmitter.
Pull off plug (5).
Installation:
Tightening torque*.

* See Specifications

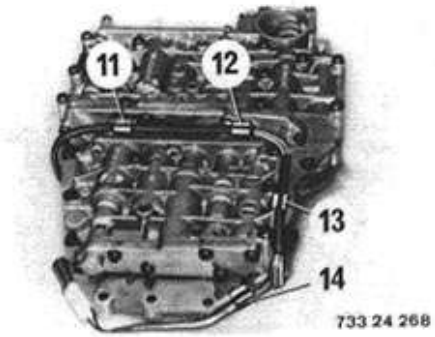


24 35 500 REPLACING WIRE HARNESS FOR AUTOMATIC TRANS MISSION

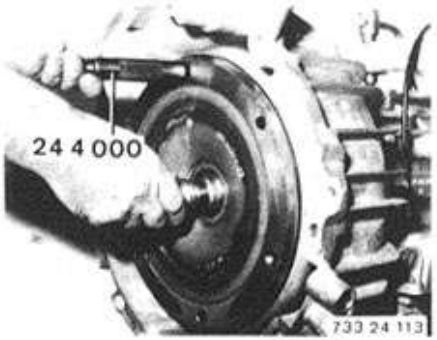
Remove valve body 24 30 002.
Pull off wire harness plugs on solenoids (1...4), pressure regulator (5) and pulse transmitter (6).
Lift wire harness out of holders.
Installation:
Check colors of wires.
Solenoid (1) – gray/violet
Solenoid (2) – green/violet
Solenoid (3) – red/violet
Solenoid (4) – orange/violet
Pressure regulator (5) – blue/violet
Pulse transmitter (6) – brown/brown
Push on plugs against stop and check for tight fit.



Route wire harness and clamp in holders (7 ... 10).

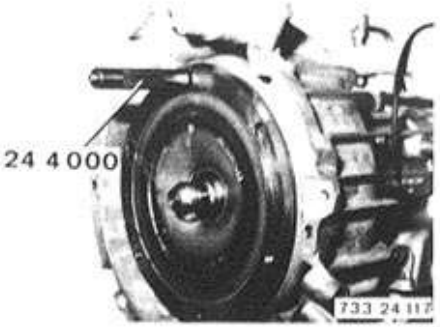


Turn valve body around.
Route wire harness and clamp in holders (11 ... 14).

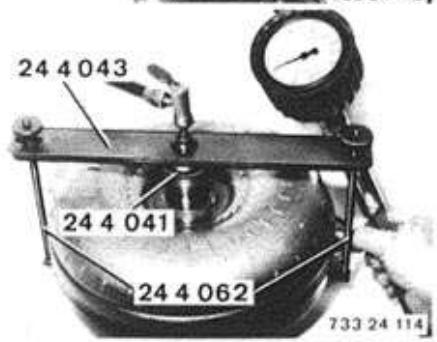


24 40 003 REMOVING AND INSTALLING TORQUE CONVERTER

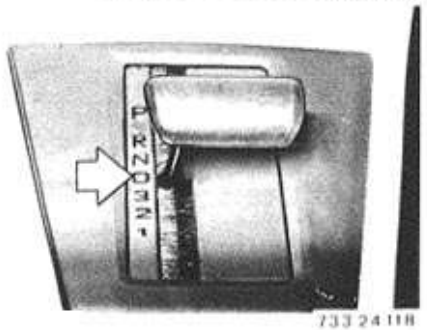
Remove and install transmission 24 00 022.
Pull torque converter out of primary pump carefully with Special Tool 24 4 000.
Important!
Escaping ATF!



Turn slightly to guide openings on converter into primary pump carefully, using Special Tool 24 4 000.
Important!
Be careful not to damage converter bearings and seal while guiding in.
Converter is in its correct installed position, if drive ring is below case edge.

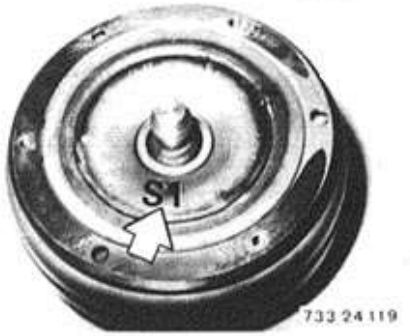


Installation:
Check torque converter for leaks with Special Tools 24 4 041, 24 4 043 and 24 4 062.
Test pressure: 0.5 bar (7 psi).
Important!
Always use Special Tool 24 4 043 to prevent injury.



Checking Installed Torque Converter:
Engine and transmission oil must have operating temperature.
Engine must produce full rated power.
Start engine.
Pull on parking brake and operate brake pedal firmly.
Move selector lever to D and press accelerator pedal to full throttle.
Read stall speed* from tachometer.

Torque converter must be replaced when bearing surface on converter shaft is damaged.



Important!
Never test stall speed longer than 10 seconds to prevent damage from excessive heat.
Stall Speed Much Above Specified Value*:
a) Converter oil volume insufficient – correct oil level.
b) Slip in clutches – check clutches.
Stall Speed Much Below Specified Value*:
a) Engine power insufficient – check engine.
b) Converter or pump defective – replace converter or check pump.

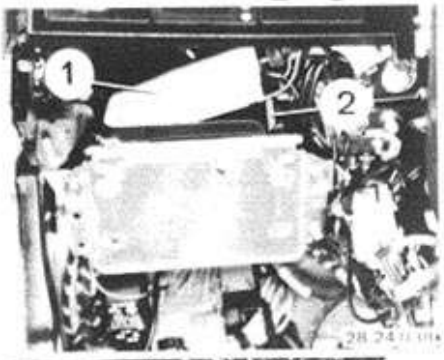
Torque converters cannot be cleaned with conventional workshop equipment and must be replaced when a transmission had been defective or an oil filter screen torn.
Converter identification*.

* See Specifications

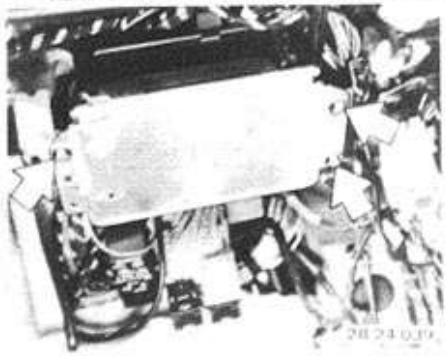
28 24 037

24 61 000 REMOVING AND INSTALLING OR REPLACING EH CONTROL UNIT

The AEGS control unit is located underneath the instrument panel on the left-hand side.
Remove the instrument panel trim at bottom left – see 51 45 180.
Unscrew the control unit holder.



Pull off plug (1) on the control unit after pushing back spring retainer (2).
Caution!
Plug (1) must only be disconnected or connected with the ignition turned off.



Remove the control unit.

735 24 016

Control Unit Identification:
535 i Bosch No. 0 260 002 007
Code F

Condition	Cause	Correction
Position P		
Park will not engage	Selector linkage or cable between selector lever and transmission maladjusted	Adjust selector lever 24 00 006
	Excessive friction in parking lock mechanism	Replace parking lock parts (connecting rod, pawl) 24 34 002
Park does not hold (slips out)	Selector linkage or cable between selector lever and transmission maladjusted	Adjust selector lever 24 00 006
Engine cannot be started in N or P	Transmission switch defective	Replace transmission switch 25 16 080
Position R		
No reverse gear	Selector linkage or cable between selector lever and transmission maladjusted	Adjust selector lever 24 00 006
	Oil filter screen dirty	Replace oil filter screen Replace transmission if liner bits are found in oil sump
	Clutch B destroyed – in this case also no 3rd gear	Disassemble clutches 24 23 022
	Brake D destroyed – in this case also no engine braking in 1st gear of position 1	Disassemble clutches 24 23 022
	Clutch E destroyed – in this case also no engine braking in 2nd and 3rd gears as well as 1st gear in position 1	Disassemble clutches 24 23 022
	Reverse gear arrest does not cancel	Replace valve body 24 30 002
Slipping or shaking when moving off	Clutch B or E or brake D damaged	Disassemble clutches 24 23 022
Hard engaging jolt P–R or N–R or definite double knock for P–R or N–R shifts (engine speed < 1500 rpm)	Damper B defective – in this case shift 2–3 also not correct	Replace valve body 24 30 002

Condition	Cause	Correction
Backup lights do not come on (electric system okay)	Transmission switch defective	Replace transmission switch 25 16 080
Car moves or crawls	Selector linkage or cable between selector lever and transmission maladjusted	Adjust selector lever 24 00 006
	Clutch A defective (bonded)	Replace clutch A 24 23 022
Position D		
No power flow	Oil filter screen dirty	Replace oil filter screen 24 31 152 Replace transmission if liner bits are found in oil sump
	Clutch A defective	Replace clutch A 24 23 022
	1st gear one-way clutch slips	Disassemble transmission 24 00 082
	Selector linkage or cable between selector lever and transmission maladjusted	Adjust selector lever 24 00 006
Slipping or shaking when moving off	Clutch A damaged	Replace clutch A 24 23 022
Hard engaging jolt N–D (engine speed < 1500 rpm)	Clutch A damaged	Replace clutch A 24 23 022
	Damper A defective	Replace valve body 24 30 002
No shift (warm or cold state)		
1–2/2–1 shifts	Governor dirty	Clean or replace governor 24 32 002
	Shift valve 1–2 seized	Replace valve body 24 30 002
1–2 shift	Brake C and/or C defective	Disassemble clutches 24 23 022
2–3/3–2 shifts	Governor dirty	Clean or replace governor 24 32 002
	Shift valve 2–3 seized	Replace valve body 24 30 002
2–3 shift	Clutch B defective	Replace clutch B 24 23 022
3–4/4–3 shifts	Governor dirty	Clean or replace governor 24 32 002
	Shift valve 3–4 seized	Replace valve body 24 30 002
3–4 shift	Brake F defective	Disassemble clutches 24 23 022

Condition	Cause	Correction
Car drives in 2nd gear	Governor bushing seized	Clean or replace governor 24 32 002
	Shift valve 1–2 seized	Replace valve body 24 30 002
Car drives in 3rd gear	Governor bushing seized	Clean or replace governor 24 32 002
	Shift valves 1–2 and 2–3 seized	Replace valve body 24 30 002
Car shifts 1–3	Shift valve 2–3 seized	Replace valve body 24 30 002
Shift points*		
Zero load shift not correct	Governor dirty	Clean or replace governor 24 32 002
	Shift valve sticks	Replace valve body 24 30 002
Full load shift points not correct	Throttle cable maladjusted	Adjust throttle cable 24 00 006
No kickdown shift		
1–2/2–1	Throttle cable maladjusted	Adjust throttle cable 24 00 006
2–3/3–2	Throttle cable maladjusted	Adjust throttle cable 24 00 006
4–3	4–3 kickdown valve seized	Replace valve body 24 30 002
Shift Transitions		
Zero load shifts too hard	Damper defective	Replace valve body 24 30 002
	Modulation pressure too high	Replace valve body 24 30 002
	Plates damaged	Disassemble transmission 24 00 082
Full load and kickdown shifts too long	Damper defective	Replace valve body 24 30 002
	Modulation pressure too low	Replace valve body 24 30 002
	Plates damaged	Disassemble transmission 24 00 082
Full load and kickdown shifts too hard	Modulation pressure deviates	Replace valve body 24 30 002
	Damper defective	Replace valve body 24 30 002

* See Specifications

Condition	Cause	Correction
Position 3 / 3rd Gear		
No engine braking effect	Clutch E damaged	Disassemble clutches 24 23 022
Position 2		
Manual downshift 3–2 not correct	Locking valve 2 sticks	Replace valve body 24 30 002
	Governor hesitates	Replace governor 24 32 002
No engine braking effect	Brakes C or clutch E damaged	Disassemble clutches 24 23 022
Position 1		
Manual downshift 2–1 not correct	Locking valve 1 sticks	Replace valve body 24 30 002
	Governor hesitates	Replace governor 24 32 002
No engine braking effect	Brake D or clutch E damaged	Disassemble clutches 24 23 022
Torque Converter		
Shift speed not correct	Converter hysteresis valve sticks	Replace valve body 24 30 002
	No 4th gear	Replace valve body 24 30 002
	Governor pressure not correct	Replace governor 24 32 002
Shift transition too hard	Converter damper defective	Replace valve body 24 30 002
	Converter not okay	Replace converter 24 40 003
No shift	Valve body not okay	Replace valve body 24 30 002
	Converter defective	Replace converter 24 40 003
	No 4th gear	Replace valve body 24 30 002

Condition	Cause	Correction
Throttle cable sticks	Nipple disconnected on throttle cam	Replace throttle cable 24 34 102
	Excessive friction in throttle cable sleeve	Replace throttle cable 24 34 102
Throttle pressure piston seized	Throttle pressure piston clamped	Replace valve body 24 30 002
Noise and power flow interruption after long drive	Oil filter screen on valve body dirty	Replace oil filter screen and, if burnt clutch liner bits are found in oil sump, also replace transmission
No forward or reverse drive, loud noise	Drive plate between converter and engine torn off	Replace drive plate or converter 11 22 051 or 24 40 003
Noises		
Loud noise in all positions, especially with cold oil. Oil pump intake noise.	Oil level too low	Correct oil level
	Valve body leaks	Replace valve body 24 30 002
Loud, screeching noise depending on speed in all positions, especially with warm oil; occurring after long drive, sometimes accompanied by breaks in power flow	Oil filter screen dirty	Replace oil filter screen and, if burnt clutch liner bits are found in oil sump, also replace transmission
Loud noise when converter closes	Torsion damper defective	Replace converter 24 40 003
Loud engine grumble when converter closes	Engine speed too low, converter shift point not correct	Replace valve body 24 30 002
Leaks		
Oil dripping out of converter bell housing	Seal in pump body damaged	Replace seal 24 31 002
	Pump body leaks	Replace pump assy. 24 31 002
	Converter leaks on welded seam	Replace converter 24 40 003
	Radial oil seal for converter leaks	Replace radial oil seal 24 12 003
Leak between transmission case and oil sump	Oil sump mounting bolts not tightened correctly	Tighten bolts to specified torque*
	Oil sump gasket damaged	Replace gasket 24 11 002
Leak between transfer plate and transmission case (especially in area of pump pressure bore)	Mounting bolts on converter bell housing loose	Tighten bolts to specified torque*
Oil lost through throttle cable connection	O-ring on connection damaged	Replace O-ring or, if necessary, entire throttle cable 24 34 102

* See Specifications

Condition	Cause	Correction
Oil loss on output	Radial oil seal for output flange damaged	Replace radial oil seal 24 12 013
Oil loss through or on vent	Oil level too high	Correct oil level
	Wrong oil (strong foaming)	Replace oil, if necessary remove transmission and drain completely with torque converter
	Vent cover missing	Mount cover or replace vent
	O-ring on vent damaged	Detach transmission extension and replace O-ring
	Lock washer preload insufficient	Replace lock washer
Oil loss on cooler line	Coupling loose	Tighten bolts to specified torque*
	Cooler line damaged	Replace cooler line
	Cooler leaks	Replace cooler 17 11 000
Oil loss on transfer plate	Plug on transfer plate leaks	Tighten plug to specified torque*
		Replace seal
Leak between transmission case and transmission extension	Mounting bolts loose	Tighten bolts to specified torque*
	Gasket damaged	Replace gasket 24 11 052

* See Specifications

TROUBLESHOOTING AUTOMATIC TRANSMISSION 4 HP 22 / EH

Conformance with the following points is necessary for troubleshooting.

a) Engine in perfect operating condition (valves, DME and idle speed okay).

b) Fault indicator, program indicator and range indicator okay.

c) Battery, plugs and ground point okay.

d) Transmission oil level okay.

Other important general tips to avoid damaging the engine, transmission or control units:

a) Never start engine without a correctly connected battery.

b) Avoid wrong power supply poles, e.g. battery connected wrong.

c) Never start the engine with a quick battery charger.

d) Disconnect battery before quick charging.

e) Never disconnect battery while engine is running.

f) Only start engine from outside source with help of starting leads and a second 12 volt battery.

g) Always turn off ignition before disconnecting or connecting plugs on control unit.

h) Only use high-ohmic testers (BMW service tester) for testing with the control unit connected.

TROUBLESHOOTING AUTOMATIC TRANSMISSION 4 HP 22 / EH

Condition	Cause	Correction
Position P		
Park will not engage	Selector linkage between selector lever and transmission maladjusted	Adjust selector linkage 24 00 006
	Excessive friction in parking lock mechanism	Replace parking lock parts (connecting rod, pawl) 24 34 002
Park does not hold (slips out)	Selector linkage between selector lever and transmission maladjusted	Adjust selector linkage 24 00 006
Engine cannot be started in N or P	Transmission switch defective	Replace transmission switch 25 16 080
Position R		
No reverse gear	Linkage between selector lever and transmission maladjusted	Adjust selector linkage 24 00 006
	Oil filter screen dirty	Replace oil filter screen Replace transmission if liner bits are found in oil sump
	Clutch B destroyed – in this case also no 3rd gear	Disassemble clutches 24 23 022
	Brake D destroyed – in this case also no engine braking in 1st gear of position 1	Disassemble clutches 24 23 022
	Clutch E destroyed – in this case also no engine braking in 2nd and 3rd gears as well as 1st gear in position 1	Disassemble clutches 24 23 022
	Reverse gear lock does not cancel	Check transmission electronics (see test plan) Replace valve body 24 30 002
Slipping or shaking when moving off	Clutch B or E or brake D damaged	Disassemble clutches 24 23 022
Hard engaging jolt P–R or N–R or definite double knock for P–R or N–R shifts (engine speed 1500 rpm)	Damper B defective – in this case shift 2–3 also not correct	Replace valve body 24 30 002 Check transmission electronics (see test plan)
Backup lights do not come on (electric system okay)	Transmission switch defective	Replace transmission switch 25 16 080
Car moves or crawls	Linkage between selector lever and transmission maladjusted	Adjust selector linkage 24 00 006
	Clutch A defective (bonded)	Replace clutch A 24 23 022

Condition	Cause	Correction
Position D		
No power flow	Oil filter screen dirty	Replace oil filter screen 24 31 152 Exchange transmission, if liner bits are found in oil sump
	Clutch A defective	Replace clutch A 24 23 022
	1st gear one-way clutch slips	Disassemble transmission 24 00 082
	Linkage between selector lever and transmission maladjusted	Adjust selector linkage 24 00 006
Slipping or shaking while moving off	Clutch A damaged	Replace clutch A 24 23 022
Hard engaging jolt N–D (engine speed 1500 rpm)	Clutch A damaged	Replace clutch A 24 23 022
	Damper A defective	Replace valve body 24 30 002
No shift (warm or cold state)	Kickdown switch defective (only kickdown shifts)	Replace kickdown switch
o Shift 1–2 / 2–1	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (1) defective (see test plan)	Replace solenoid 24 34 851
	Control valve 1–2 / 3–4 seized	Replace valve body 24 30 002
	Shift valve 1–2 seized	Replace valve body 24 30 002
o Shift 1–2	Brake C and/or C defective	Disassemble clutches 24 23 022
o Shift 2–3 / 3–2	Solenoid (2) defective (see test plan)	Replace solenoid 24 34 851
	Shift valve 2–3 seized	Replace valve body 24 30 002
o Shift 2–3	Clutch B defective	Replace clutch B 24 23 022
o Shift 3–4 / 4–3	Solenoid (1) defective (see test plan)	Replace solenoid 24 34 851
	Control valve 1–2 / 3–4 seized	Replace valve body 24 30 002
	Shift valve 3–4 seized	Replace valve body 24 30 002
o Shift 3–4	Brake F defective	Disassemble clutches 24 23 022
	Program switch defective (see test plan)	Replace program switch
o Shift 1–2 Engine speed does not go beyond stall speed in drive and full load	Pulse transmitter defective (see test plan)	Replace pulse transmitter 24 34 870

Condition	Cause	Correction
Car moves off in 2nd gear	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (1) defective (see test plan)	Replace solenoid valve 24 34 851
	Shift valve 1–2 seized	Replace valve body 24 30 002
Car moves off in 3rd gear	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (1 or 2) defective (see test plan)	Replace solenoid valve 24 34 851
	Shift valve 1–2 and 2–3 seized	Replace valve body 24 30 002
Car shifts 1–3	Shift valve 2–3 seized	Replace valve body 24 30 002
	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (2) defective (see test plan)	Replace solenoid valve 24 34 851
Shift Speeds		
– Zero load shift not okay	Control unit defective	Replace control unit 24 61 000
– Full load shift points not okay	No full load signal	Check throttle switch 13 63 544
– No kickdown shift	Kickdown switch defective	Check/replace switch (see test plan)
– Only zero load shifts	Zero load switch on engine defective	Check/replace zero load switch 13 66 554
– Only kickdown shifts	Kickdown switch defective	Check/replace switch (see test plan)
Shift Transitions		
– Zero load shifts too hard	Control unit defective	Replace control unit 24 61 000
	Damper defective	Replace valve body 24 30 002
	Modulation pressure too high	Replace valve body 24 30 002
	Plates damaged	Disassemble transmission 24 00 082
– Full load and kickdown shifts too long	Control unit defective	Replace control unit 24 61 000
	Damper defective	Replace valve body 24 30 002
	Modulation pressure too low	Replace valve body 24 30 002
	Plates damaged	Disassemble transmission 24 00 082

Condition	Cause	Correction
– Full load and kickdown shifts too hard	Modulation pressure not okay	Replace valve body 24 30 002
	Damper defective	Replace valve body 24 30 002
	Control unit defective	Replace control unit 24 61 000
Position 3 – 3rd Gear		
No engine braking effect	Clutch E damaged	Disassemble clutches 24 23 022
Position 2		
Manual downshift 3–2 not okay	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (2) defective (see test plan)	Replace solenoid valve 24 34 851
No engine braking effect	Brake C' or clutch E damaged	Disassemble clutches 24 23 022
Position 1		
Manual downshift 2–1 not okay	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (1) defective (see test plan)	Replace solenoid valve 24 34 851
No engine braking effect	Brake D or clutch E damaged	Disassemble clutches 24 23 022
Converter Clutch		
Shift speed not okay	Control unit defective	Replace control unit 24 61 000
Shift transition too hard	Converter clutch damper defective	Replace valve body 24 30 002
	Converter not okay	Replace converter 24 40 003
No shift	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (3) defective (see test plan)	Replace solenoid valve 24 34 851
	Converter defective	Replace converter 24 40 003
Converter clutch always locked (engine stops in drive position)	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (3) defective (see test plan)	Replace solenoid vlave 24 34 851

Condition	Cause	Correction
General		
Shifts only as positioned	Transmission electronics defective	Check transmission electronics (see test plan)
	Program switch defective (see test plan)	Replace program switch
Defect indicator lights up	Transmission electronics defective	Check transmission electronics (see test plan)
	Solenoid (2) defective (see test plan)	Replace solenoid valve 24 34 851
Defect indicator lights up while driving	Transmission electronics defective	Check transmission electronics (see test plan)
	Poor contact of plug on transmission	Check plug connection
Noise and finally interruption of power flow after long drive	Oil filter screen on valve body dirty	Only replace filter screen, if there are no burnt clutch liner bits in oil sump; otherwise exchange transmission
No power flow forward or reverse, loud noise	Drive plate between converter and engine torn off	Replace drive plate or converter 11 22 051 or 24 40 003
Noise		
High-pitched noise in all positions, especially when oil is cold, intake noise of oil pump	Oil level too low	Correct oil level
	Valve body leaks	Replace valve body 24 30 002
High-pitched, screeching, speed-dependent noise in all positions, especially when oil is warm, occurring after long drive, sometimes accompanied by interruptions in power flow	Oil filter screen dirty	Only replace filter screen, if there are no clutch liner bits in oil sump; otherwise replace complete transmission
Loud noise when converter clutch is locked	Torsion damper defective	Replace converter 24 40 003

Condition	Cause	Correction
Leakage		
Oil dripping out of converter bell housing	Seal in pump body damaged	Replace seal 24 31 002
	Pump body leaks	Replace complete pump 24 31 002
	Converter leaks on welded seam	Replace converter 24 40 003
	Radial oil seal for converter leaks	Replace radial oil seal 24 12 003
Leak between transmission case and oil sump	Oil sump mounting bolts not tightened to correct torque	Tighten bolts to correct torque*
	Oil sump gasket damaged	Replace gasket 24 11 002
Leak between transfer plate and transmission case (especially in area of pump pressure bore)	Converter bell housing mounting bolts loose	Tighten bolts to correct torque*
Oil loss on transmission plug	O-ring defective	Replace O-ring 24 30 002
Oil loss on output	Radial oil seal on output damaged	Replace radial oil seal 24 12 013
Oil loss through or on vent	Oil level too high	Correct oil level
	Wrong type of oil (strong foaming)	Replace oil, if necessary remove transmission and drain entire oil including converter
	Vent cover missing	Mount cover or replace vent
	O-ring on vent damaged	Unscrew transmission extension, replace O-ring
	Circlip pre-load insufficient	Replace circlip
Oil loss on cooler line	Loose connection	Tighten bolts to correct torque*
	Cooler line damaged	Replace cooler line
	Cooler leaks	Replace cooler 17 11 000
Oil loss on transfer plate	Plug on transfer plate leaks	Tighten plug to correct torque*
		Replace seal
Leak between transmission case and transmission extension	Mounting bolts loose	Tighten bolts to correct torque*
	Gasket damaged	Replace gasket 24 11 052

* See Specifications

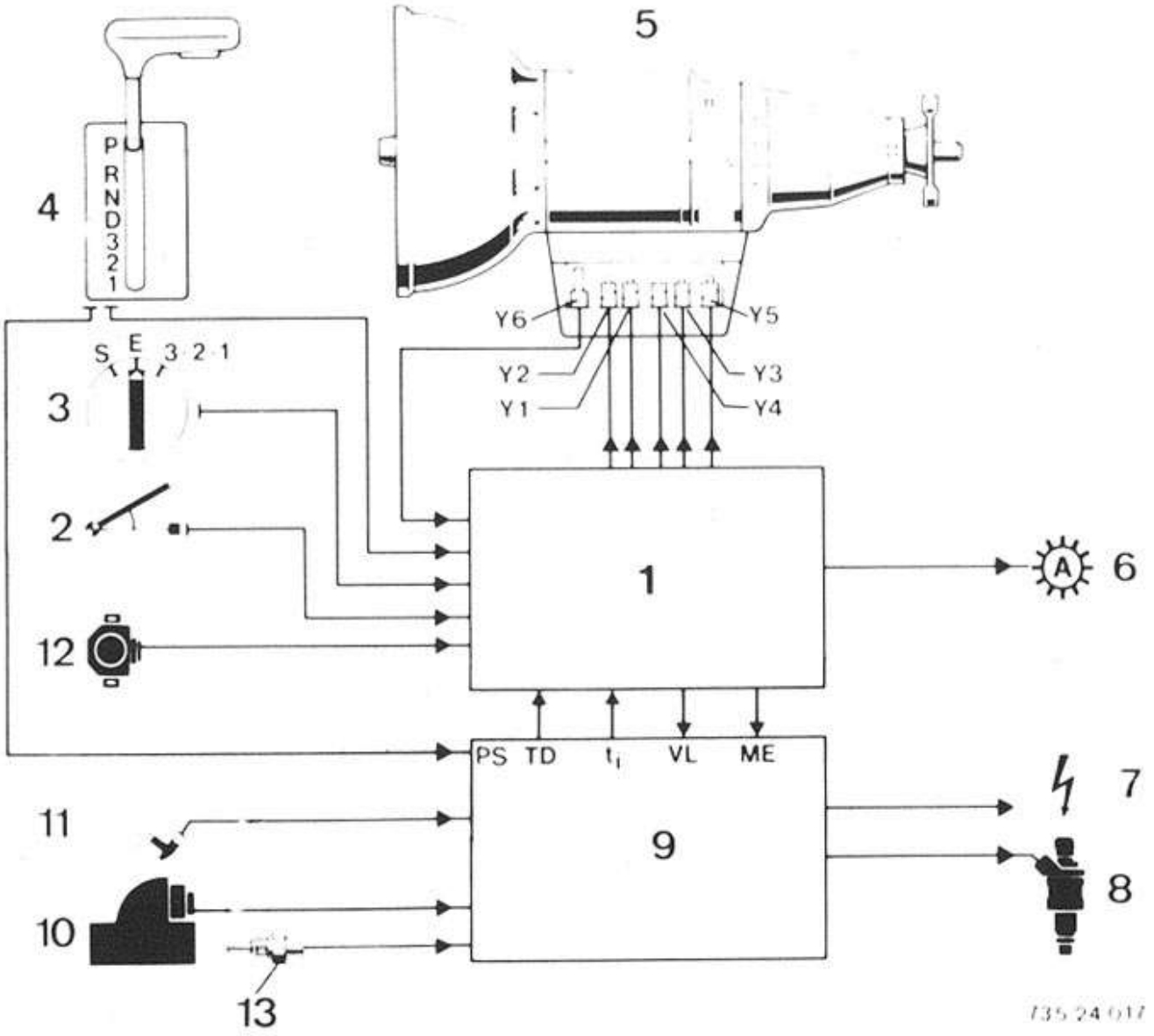
TROUBLESHOOTING VALVE BODY FOR 4 HP 22 / EH

Condition	Cause	Correction
Position R		
No reverse gear	Solenoid (4) defective (see test plan)	Replace solenoid valve 24 34 851
	Wire to solenoid (4) grounded out (see test plan)	Replace wire harness
	Reverse gear locking valve seized	Replace valve body 24 30 002
	Damper B malfunctions	Replace valve body 24 30 002
No reverse or forward gear	Main pressure valve seized, spring broken	Replace valve body 24 30 002
Insufficient power transmission	Pressure too low in clutch B or E, brake D	Replace valve body 24 30 002
Hard jolt when moving into position R	Damper B malfunctions	Replace valve body 24 30 002
	Modulation pressure too high	
Position D		
No forward gear	Main pressure valve seized, spring broken	Replace valve body 24 30 002
Insufficient power transmission	Pressure too low in clutch A	Replace valve body 24 30 002
No shift function	Pulse transmitter defective (see test plan)	Replace pulse transmitter 24 34 870
	Wire to pulse transmitter grounded out (see test plan)	Replace wire harness
No shift function 1–2 / 2–1	Solenoid (1) defective (see test plan)	Replace solenoid valve 24 34 851
	Wire to solenoid (1) grounded out (see test plan)	Replace wire harness
	Shift valve 1–2, control valve 1–2 / 3–4, pressure reducing valve 1 seized	Replace valve body 24 30 002

Condition	Cause	Correction
Position D		
No shift function 2–3 / 3–2	Solenoid (2) defective (see test plan)	Replace solenoid valve 24 34 851
	Wire to solenoid (2) grounded out (see test plan)	Replace wire harness
	Shift valve 2–3 seized	Replace valve body 24 30 002
No shift function 3–4 / 4–3	Solenoid (1) defective (see test plan)	Replace solenoid valve 24 34 851
	Control valve 1–2 / 3–4 seized	Replace valve body 24 30 002
Shifts 1–2 / 2–3 / 3–4 too long	Pressure regulator defective (see test plan)	Replace pressure regulator 24 34 860
	Wire to pressure regulator grounded out (see test plan)	Replace wire harness
	Damper defective	Replace valve body 24 30 002
	Modulation valve, pressure reducing valves 1 and 2 seized	Replace valve body 24 30 002
Upshifts 1–2 / 2–3 / 3–4 too hard	Pressure regulator defective (see test plan)	Replace pressure regulator 24 34 860
	Modulation valve sticks	Replace valve body 24 30 002
	Damper defective	Replace valve body 24 30 002
Downshift 4–3 too hard	Plate F dirty	Replace valve body 24 30 002
Manual downshifts 4–3 / 3–2 too hard	Damper E or C' defective	Replace valve body 24 30 002

Condition	Cause	Correction
Position 1		
Manual downshift 2–1 not okay	Pressure regulator defective (see test plan)	Replace pressure regulator 24 34 860
	Damper D defective	Replace valve body 24 30 002
	Modulation valve sticks	Replace valve body 24 30 002
Converter Lockup Clutch		
No converter clutch locking	Solenoid (3) defective (see test plan)	Replace solenoid valve 24 34 851
	Converter clutch damper defective	Replace solenoid valve 24 34 851
	Converter pressure valve seized	Replace valve body 24 30 002
	Pressure reducing valve 1 seized	Replace valve body 24 30 002
No converter clutch unlocking	Solenoid (3) defective (see test plan)	Replace solenoid valve 24 34 851
	Wire to solenoid (3) grounded out (see test plan)	Replace wire harness
Main pressure too high in all positions	Pressure regulator defective (see test plan)	Replace pressure regulator 24 34 860
	Main pressure valve seized	Replace valve body 24 30 002
	Modulation pressure too high	Replace valve body 24 30 002

24-149a

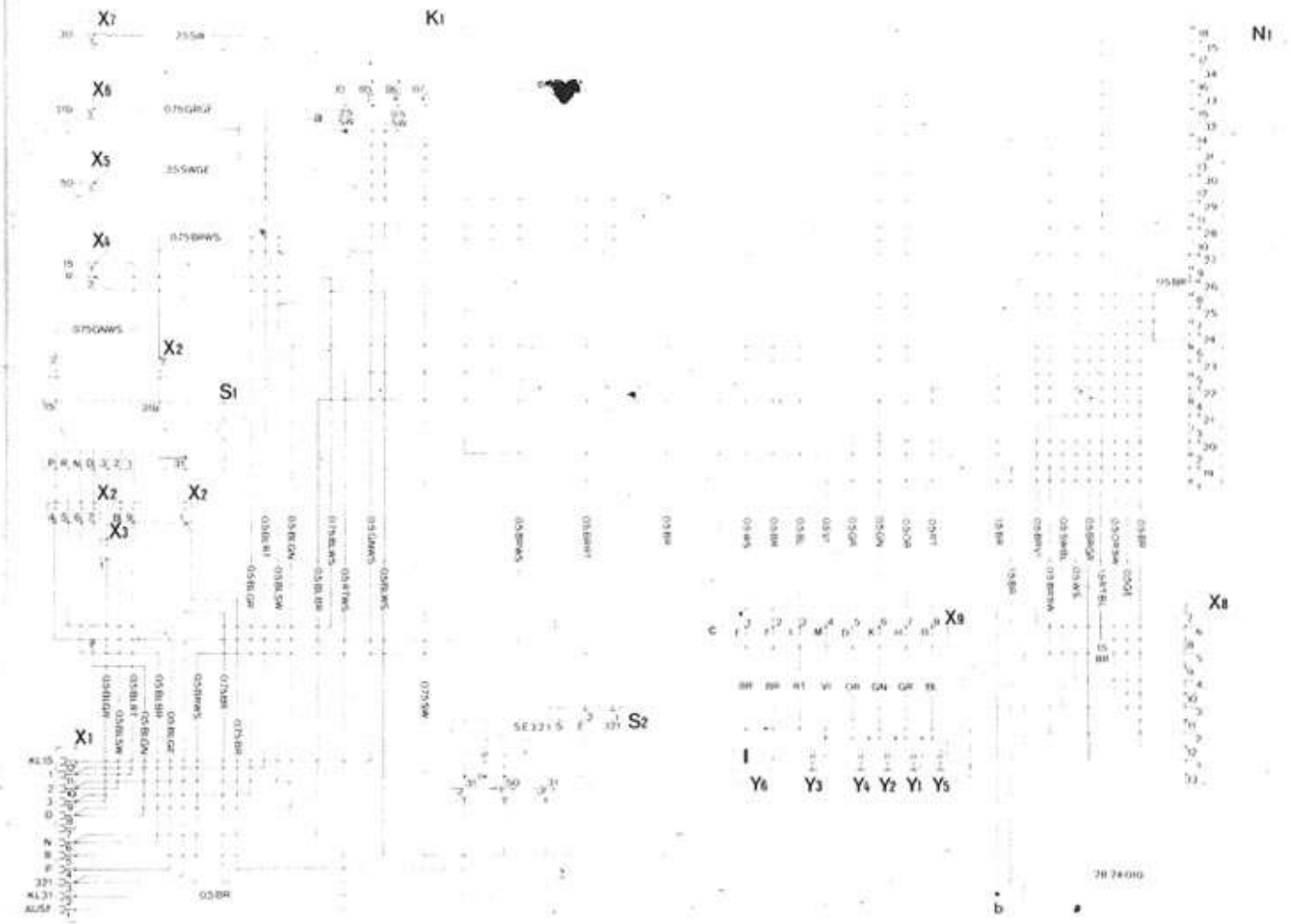


AEGS LAYOUT DRAWING

1	AEGS control unit
2	Kickdown switch
3	Program switch
4	Position switch
5	Transmission
6	Fault indicator
7	Ignition
8	Fuel injection
9	DME control unit
10	Air flow sensor
11	Engine speed sensor
12	Throttle valve sensor
13	Temperature sensor
Y1	Solenoid – 1st/2nd and 3rd/4th gears
Y2	Solenoid – 2nd/3rd gears
Y3	Solenoid – converter lockup clutch
Y4	Solenoid – reverse gear lock
Y5	Pressure regulator
Y6	Pulse transmitter
tD	Speed signal
ti	Load signal
VL	Full load
ME	Engine tap
PS	Position switch

24 –150

4 HP – 22 AEGS WIRING DIAGRAM



Plug Connections N 1

Pin 1 Solenoid +
Pin 2 Kickdown
Pin 4 Range indicator N
Pin 5 Ground
Pin 6 Throttle valve switch –
Pin 7 Load signal
Pin 8 Speed sensor
Pin 9 Throttle valve switch +
Pin 11 Injection signal
Pin 14 Program switch E
Pin 15 Range indicator 3 2 1
Pin 16 Solenoid 1
Pin 17 Solenoid 2
Pin 18 Range indicator 1
Pin 19 Ground
Pin 20 Solenoid - reverse gear
Pin 21 Signal / ignition
Pin 22 Pressure regulator
Pin 23 Shielding
Pin 24 Engine tap
Pin 25 Solenoid - conv. clutch lockup
Pin 26 Coding
Pin 27 Speed sensor
Pin 28 Range indicator 2
Pin 29 Range indicator 3
Pin 30 Range indicator D
Pin 31 Full load signal
Pin 33 Fault indicator
Pin 35 Battery +

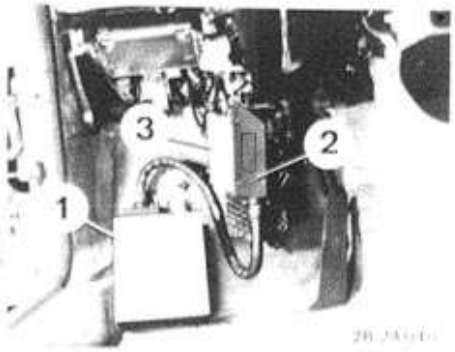
Plug Connections X 8
(installed in glove box at control unit for DME)

Pin 1 Engine tap
Pin 2 Full load signal
Pin 3 Signal/ignition
Pin 4 Injection signal
Pin 5 Battery –
Pin 6 Transm. switch P, N
Pin 8 DME +
Pin 10 Throttle valve switch +
Pin 11 Load signal
Pin 12 Throttle valve switch –
a Starting voltage conn.
b Electronics ground conn.
c Shielding

N 1 AEGS control unit
K 1 Starter interlocking relay
S 1 Transmission switch
S 2 Program switch
X 1 Range indicator conn.
X 2 Range indicator plug
X 3 Transmission switch plug
X 4 Wire harness conn. - rear section
X 5 Wire harness conn. - center section
X 6 Kickdown switch conn.
X 7 Ignition switch conn.
X 8 Engine wire harness conn.
X 9 Transmission plug
Y 1 Solenoid - 1st/2nd + 3rd/4th gears
Y 2 Solenoid - 2nd/3rd gears
Y 3 Solenoid - converter lockup,clutch
Y 4 Solenoid - reverse gear lock
Y 5 Pressure regulator
Y 6 Pulse transmitter

TEST PLAN FOR 4 HP – 22 / AEGS

The AEGS control unit is located underneath the instrument panel on the left-hand side.
Remove the instrument panel trim at bottom left – see 51 45 180.
Unscrew the control unit holder.
Caution!
Never disconnect or connect plug (3) with the ignition turned on.
Connect adapter (1), HWB No. 81 12 9 425 091, on plug (3) in conjunction with connecting lead (2), HWB No. 81 12 9 425 092, for all tests / periphery.
Install the connecting lead (HWB NO. 81 12 9 425 093) between the adapter and control unit for tests in conjunction with the AEGS control unit.
Only test with the BMW service tester.



Test Position 1

Requirement for all tests: ground wire okay. Check ground wires 5 and 19 for correct connection. —— no ——► Break in ground wire. Connection engine wire harness pin 5 to battery –. ——► Repair ground wire to wiring diagram. Make connection.

Throttle valve switch signal, see 13 63 544.

Explanations for Independent Electronic Transmission Control (AEGS):
There is a comprehensive test of the entire AEGS each time the engine is started.
Turn on ignition.
The yellow defect indicator lamp in the instrument panel will flash twice briefly, stay on while starting and go out at an engine speed above 450 rpm.

Test Position Defect Indicator	Cause	Correction
Defect indicator not on with ignition turned on	Check voltage between wires 5/19 and 33 with the ignition on. Nominal value: > 10 volts. Light bulb for defect indicator defective. Break in wire to range indicator on instrument carrier.	 Replace printed circuit board for range indicator 62 11 020. Repair wire.
Defect indicator does NOT flash and remains on after starting.	Break in ground wire 5/19. Check voltage between wires 5/19 and 24 with ignition on. Nominal value: 5 V. AEGS control unit defective	Repair wire to wiring diagram. Repair wire to wiring diagram. Replace control unit 24 61 000.
Defect indicator flashes, but remains on after starting.	Power supply to AEGS control unit insufficient. Check voltage between wires 5/19 and 35 with ignition on. Nominal value: > 10 volts. Wires to solenoid 1 (Y 1), 2 (Y 2), reverse gear (Y 4) or converter lockup clutch (Y 3) have a break or are grounded out. See test plan for checking. No TD signal from DME control unit. No ti signal from DMF control unit.	Repair wire to wiring diagram. Repair wires to wiring diagram. Check plug connection (X 8) and power supply lead to AEGS control unit.
Defect indicator comes on while driving.	Power supply between wires 5/19 and 35 insufficient (drops below 10 V). TD signal stops suddenly. Break in positive wires to solenoids.	Repair wires to wiring diagram. Repair wires to wiring diagram.

Test Position 2

Solenoid Valves

a) Solenoid valve (Y 1) – 1st/2nd and 3rd/4th gears. — no → Wire to solenoid valve damaged/shorted. → Repair wire to wiring diagram.
Resistance test (M 06). Solenoid valve defective. Replace solenoid valve 24 34 851.
Measure resistance between wires 1 and 16.
Nominal value: 25 ... 46 ohms.
N o t e: Specified resistance values for solenoid valves and pressure regulator should be measured with a transmission oil temperature of about 20° C (68° F).

↓

Insulation test (M 06). — no → Wire to solenoid valve damaged/grounded out. → Repair wire to wiring diagram.
Measure resistance between wires 5/19 and 1/16. Solenoid valve grounded out. Replace solenoid valve 24 34 851.
Nominal value: > 500 k ohms.

↓

b) Solenoid valve (Y 2) – 2nd/3rd gears. — no → Wire to solenoid valve damaged/shorted. → Repair wire to wiring diagram.
Resistance test (M 06). Solenoid valve defective. Replace solenoid valve 24 34 851.
Measure resistance between wires 1 and 17.
Nominal value: 25 ... 46 ohms.

↓

Insulation test (M 06). — no → Wire to solenoid valve damaged/grounded out. → Repair wire to wiring diagram.
Measure resistance between wires 5/19 and 1/17.
Nominal resistance: > 500 k-ohms.

↓

c) Solenoid valve (Y 4) – reverse gear lock. — no → Wire to solenoid valve damaged/shorted. → Repair wire to wiring diagram.
Resistance test (M 06). Solenoid valve defective. Replace solenoid valve 24 34 851.
Plug pulled off of control unit.
Measure resistance between wires 1 and 20.
Nominal value: 25 ... 46 ohms.

Solenoid valve (Y 4) – reverse gear lock. — no → Wire to solenoid valve damaged/grounded out. → Repair wire to wiring diagram.
Insulation test (M 06). Solenoid valve grounded out. Replace solenoid valve 24 34 851.
Measure resistance between wires 5/19 and 1/20.
Nominal value: > 500 k-ohms.

↓

d) Solenoid valve (Y 3) – conv. lockup clutch. — no → Wire to solenoid valve damaged/shorted. → Repair wire to wiring diagram.
Resistance test (M 06). Solenoid valve defective. Replace solenoid valve 24 34 851.
Measure resistance between wires 1 and 25.
Nominal value: approx. 25 ... 46 ohms.

↓

Insulation test (M 06). — no → Wire to solenoid valve damaged/grounded out. → Repair wire to wiring diagram.
Measure resistance between wires 5/19 and 1/25. Solenoid valve grounded out. Replace solenoid valve 24 34 851.
Nominal value: > 500 k-ohms.

Test Position 3

Pressure regulator (Y 5). — no → Wire to pressure regulator damaged/shorted. → Repair wire to wiring diagram.
Resistance test (M 06). Pressure regulator defective. Replace pressure regulator 24 34 860.
Measure resistance between wires 1 and 22.
Nominal value: 1.8 ... 4.6 ohms.

↓

Insulation test (M 06). — no → Wire to pressure regulator damaged/grounded → Repair wire to wiring diagram.
Measure resistance between wires 5/19 and 1/22. out.
Nominal value: > 500 k-ohms.

Test Position 4

Program switch (S 2). — no → Wire to program switch damaged/shorted. → Repair wire to wiring diagram.
A magnet returns the program switch to position E for each starting procedure. Program switch defective. Replace program switch 61 31 265.
Resistance test (M 06).
Measure resistance between wires 6 and 14.
Nominal values:
∞ ohms for switch pos. S or 3, 2, 1
0 ohms for switch pos. E

↓

Direct current voltage (M 01). — no → Wire damaged. → Repair wire to wiring diagram.
Measure voltage between black and brown wires (while starting).
Nominal value: > 8 V.

Test Position 5

Kickdown switch. — no → Wire to kickdown switch damaged/shorted. → Repair wire to wiring diagram.
Resistance test (M 06). Kickdown switch defective. Replace kickdown switch 35 41 480.
Measure resistance between wires 19 and 2.
R = ∞ ohms.
Accelerator pedal floored (kickdown).
R = approx. 0 ohm.

Test Position 6

Position switch (S 1). — no → Wire to position switch damaged/shorted. → Repair wire to wiring diagram.
Direct current voltage (M 01). Position switch defective Replace position switch.
Turn on ignition. Display unit defective. Replace display unit.
Switch off lights. Fuse no. 9 defective. Replace fuse.
Pertinent position lamp on. Battery voltage too low. Charge battery.
Measure voltage betw. wires 19 and 18 Pos. 1,
19 and 28 Pos. 2,
19 and 29 Pos. 3,
19 and 30 Pos. D,
19 and 4 Pos. N.
Nominal value in pertinent position: > 10 V.
All other positions: < 1 V.

Test Position 7

Pulse transmitter (Y 6).
Resistance test (M 06).
Measure resistance between wires 8 and 27.
Nominal value: 800 ohms ... 1.6 k-ohms.

no → Wire to pulse transmitter damaged/shorted. Pulse transmitter defective. → Repair wire to wiring diagram. Replace pulse transmitter 24 34 870.

↓

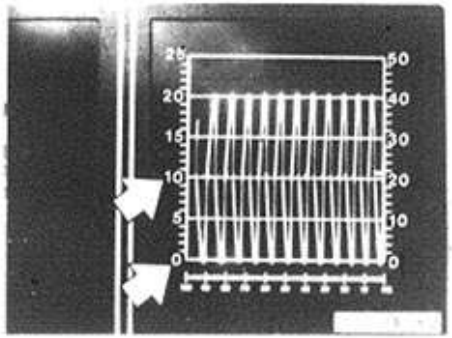
Insulation test (M 06).
Measure resistance between wires 5/19 and 8/27.
Nominal value: > 500 k-ohms.

no → Wire to pulse transmitter damaged/grounded out. Pulse transmitter grounded out. → Repair wire to wiring diagram. Replace pulse transmitter 24 34 870.

↓

Dynamic test (M 22).
Scope test.
Connect test lead between wires 8 and 27 (see operating instructions for BMW service tester).
Lift car.
It should be possible to turn rear wheels easily.
Start engine.
Select position D.
Speed approx. 30 km/h (25 mph).
All sine curves must be uniformly larger than 0 ... 10 (left screen scale).

no → Pulse transmitter defective. Wire to pulse transmitter damaged/grounded out. → Replace pulse transmitter 24 34 870. Repair wire to wiring diagram.



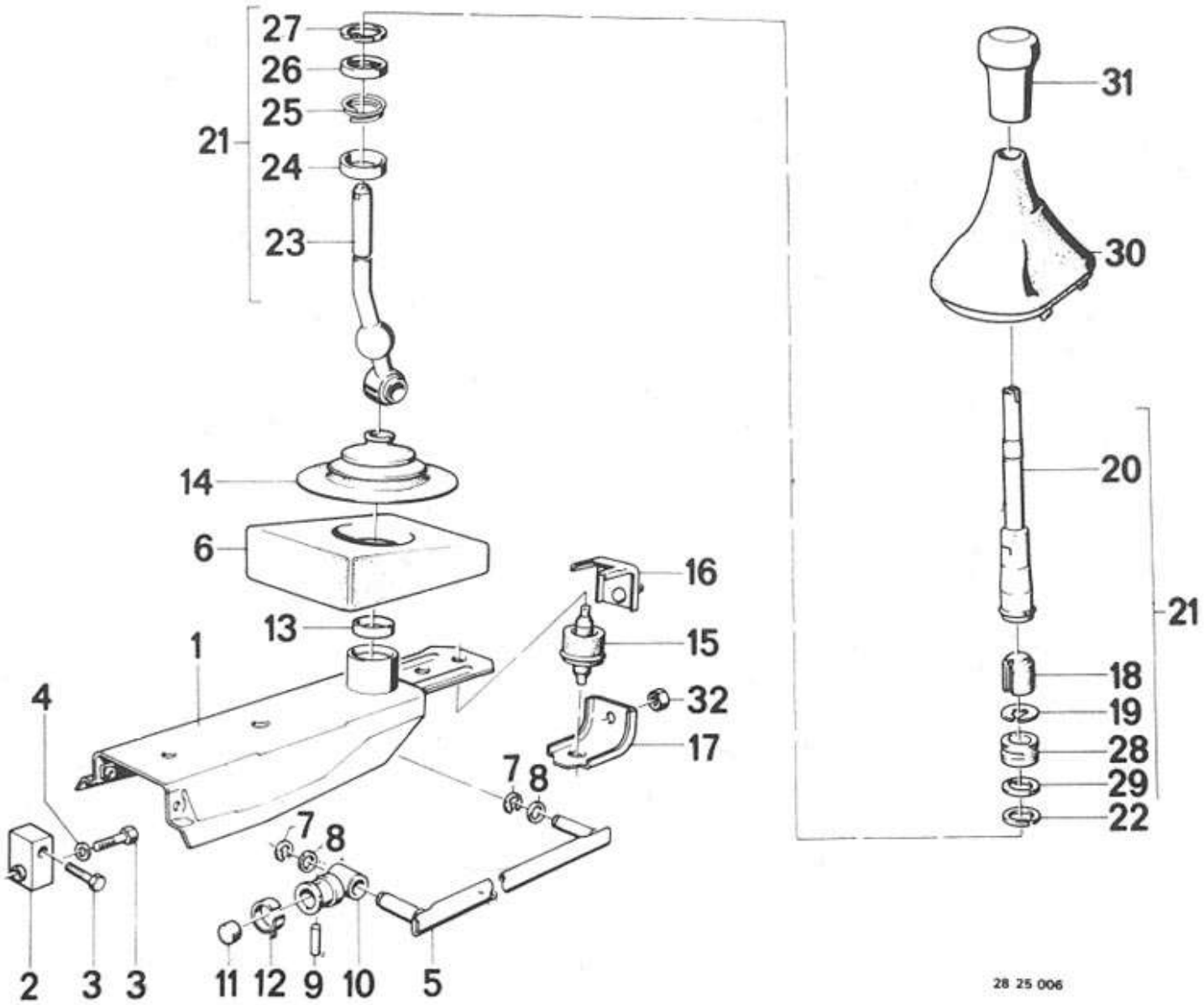
25 Gear shift mechanism

Shift layout – manual transmission

Shift layout – automatic transmission

25-1

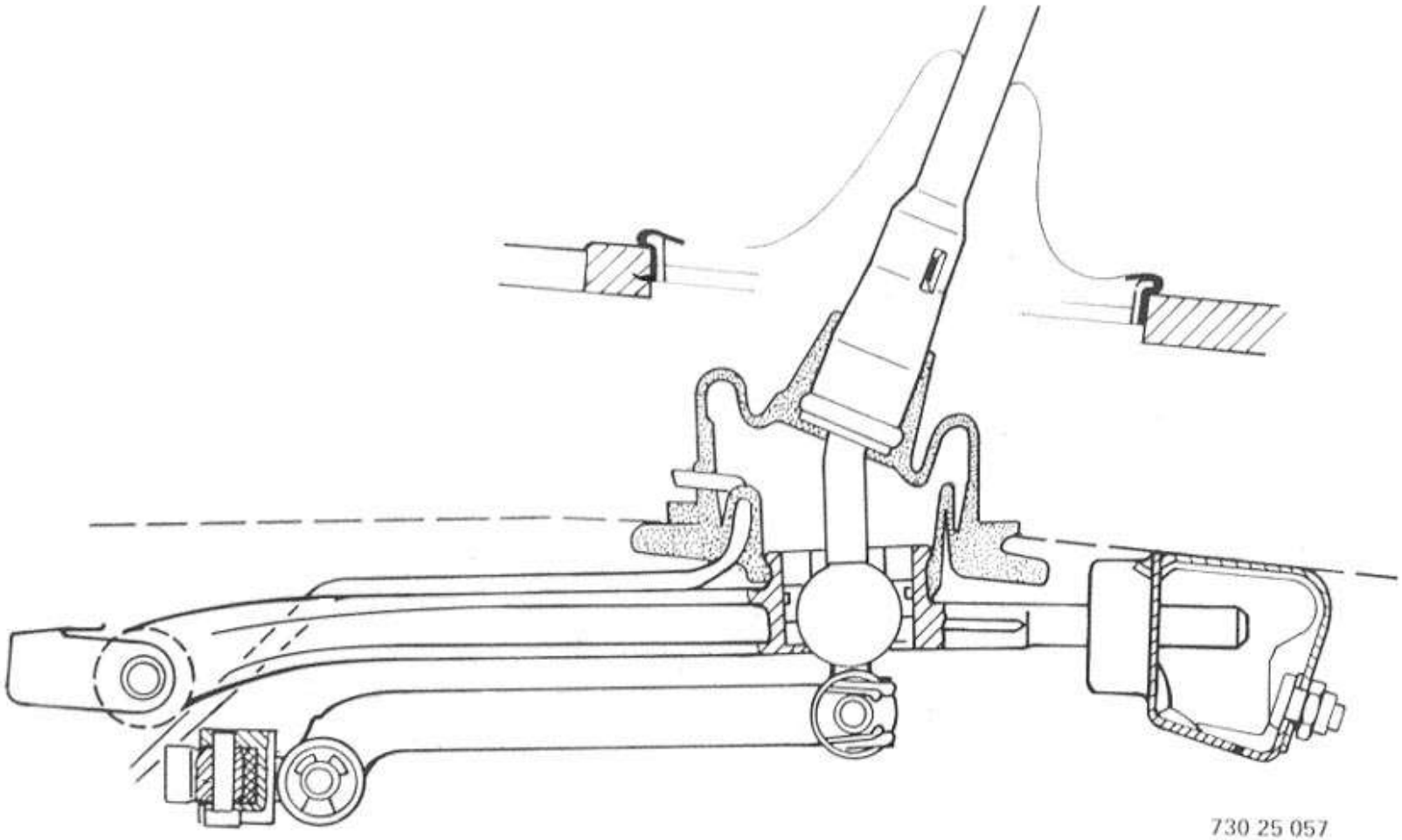
LAYOUT OF SHIFT FOR MANUAL TRANSMISSION
– Sheet Metal Shift Console –



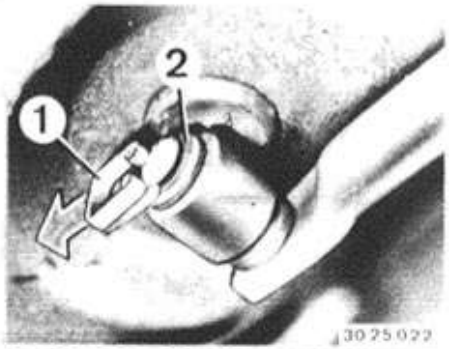
1 Shift arm
2 Console
3 Bolt
4 Washer
5 Selector rod
6 Damper
7 Circlip
8 Washer
9 Cylindrical pin
10 Selector rod joint
11 Lubricating felt
12 Spring sleeve
13 Lower ball plate
14 Rubber cover
15 Rubber mount
16 Holder
17 Holder
18 Cap
19 Lock washer
20 Shift lever upper section
21 Shift lever assembly
22 Circlip
23 Shift lever lower section
24 Upper ball plate
25 Spring
26 Spacer
27 Circlip
28 Rubber ring
29 Washer
30 Dust cover
31 Shift lever knob
32 Hexagon nut

25-2

LAYOUT OF SHIFT FOR MANUAL TRANSMISSION
– Aluminum Shift Console –



730 25 057

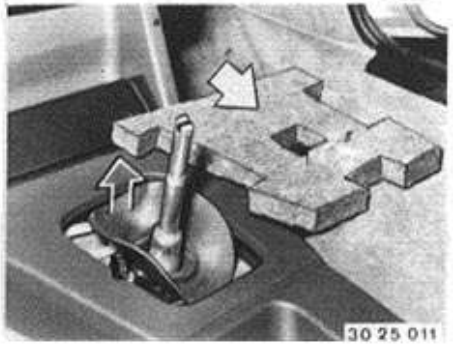


25 11 000 REMOVING AND INSTALLING SHIFT LEVER
– Sheet Metal Shift Console –

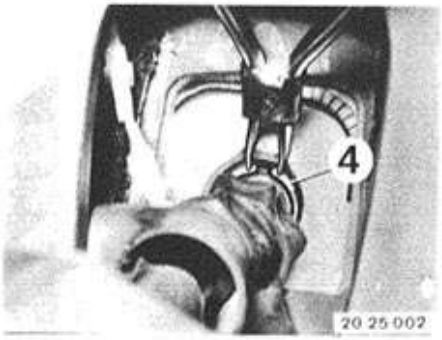
Lift out circlip (1).
Remove washer (2).
Pull out the shift rod.

Pull off the shift lever knob.

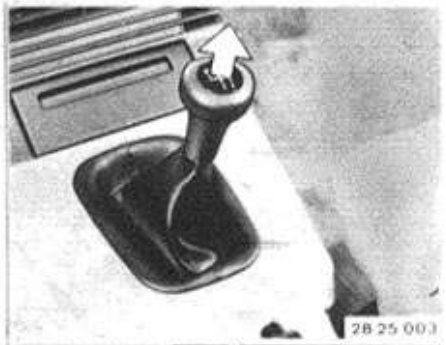
Lift off the dust cover.



Remove the felt insulation.
Pull out the sleeve between the body and shift console.



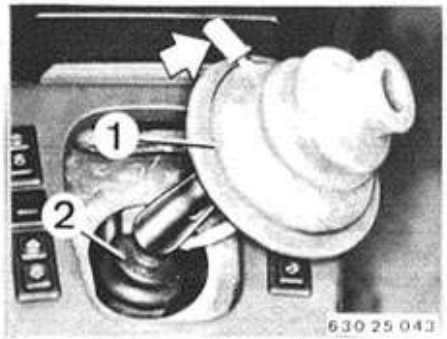
Lift out circlip (4)
Remove the shift lever.
Installation:
The shift lever is bent toward the rear.



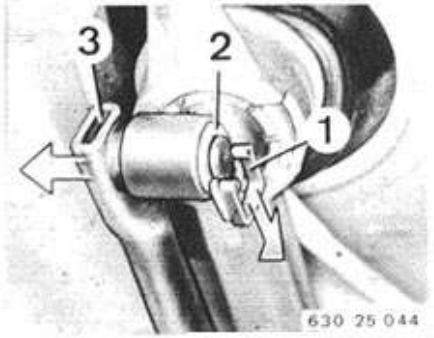
25 11 000 REMOVING AND INSTALLING SHIFT LEVER
– Aluminum Shift Console –

Pull off the shift lever knob.

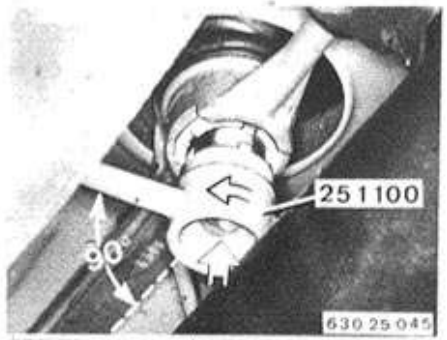
Lift out the dust cover.



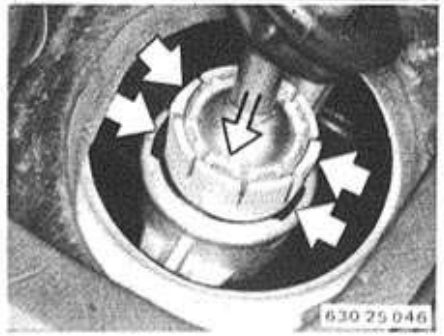
Remove the felt liner.
Disconnect the plug on the backup light lead.
Unsnap dust cover (1) on the body and pull it off of the shift lever.
Loosen dust cover (2) on the shift console.
Installation:
Check the dust covers and make sure of correct seating.



Lift out circlip (1).
Take off washer (2).
Pull out shift rod (3).

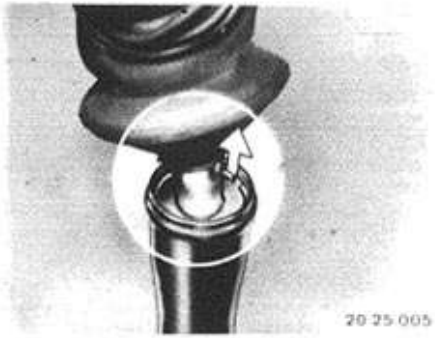


Apply Special Tool 25 1 100.
Turn it 90° anticlockwise.
Press the spherical plate upwards.
Remove the shift lever from above.

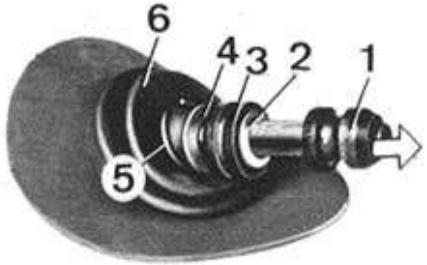


Installation:
Mount the spherical plate in such a manner that the tabs on the spherical plate are aligned with the openings in the shift console.
Press in the shift lever until the retaining tabs are heard to engage twice.

25 11 003 DISASSEMBLING AND ASSEMBLING SHIFT LEVER – Sheet Metal Shift Console –

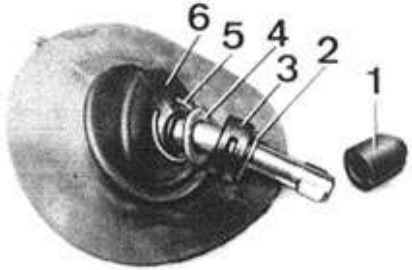

20 25 005

Remove the shift lever – see 25 11 000.
Lift out the snap ring.



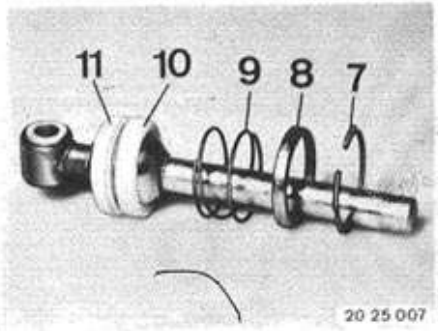
20 25 006

Pull off the upper shift lever section.
Installation:
Check the installed position.



28 25 002

Pull off cap (1).
Remove circlip (2).
Take off rubber ring (3), washer (4), snap ring (5) and rubber part (6).



20 25 007

Circlip (7), spring retainer (8), spring (9), upper spherical plate (10) and lower (ribbed) spherical plate (11).
Installation:
Lubricate the spherical plates with Molykote Longterm 2.

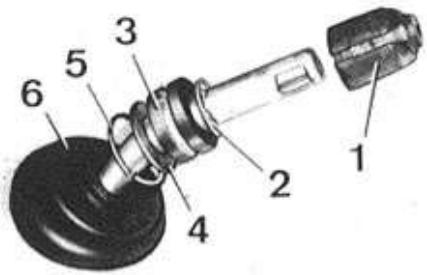
25 11 003 DISASSEMBLING AND ASSEMBLING SHIFT LEVER – Aluminum Shift Console –


630 25 039

Remove the shift lever – see 25 11 000.
Lift out the snap ring.

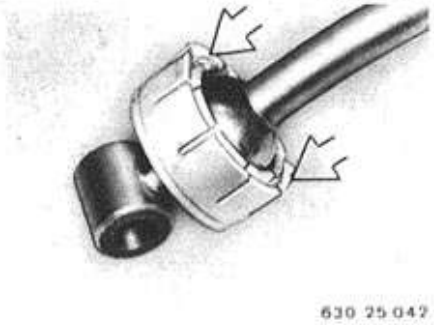

630 25 040

Pull off the upper shift lever section.
Installation:
Check the installed position.

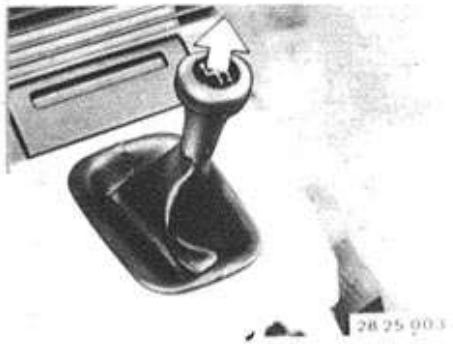


630 25 041

Pull off cap (1).
Remove circlip (2).
Take off rubber ring (3), washer (4), snap ring (5) and rubber part (6).

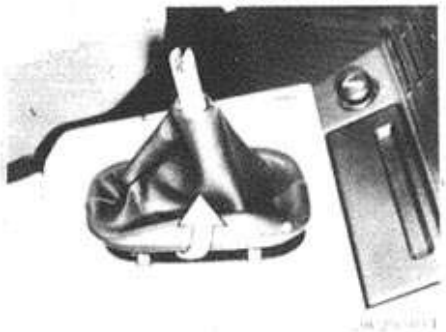

630 25 042

Press off the bearing shell downwards.
Installation:
Lubricate the bearing shell and ball with Molykote Longterm 2.

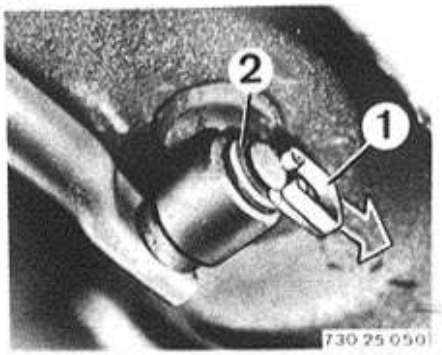


25 11 081 REPLACING DUST COVER FOR SHIFT LEVER

Pull off the shift lever knob.

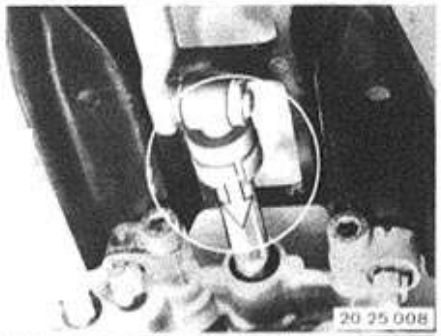


Lift out the dust cover.

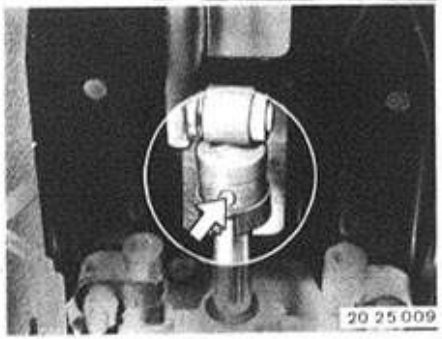


25 11 111 REPLACING SHIFT ROD JOINT

Transmission 260/5:
Unscrew the propeller shaft on the transmission – see 26 11 000:
Engage 5th gear.
Lift out circlip (1).
Take off washer (2).
Pull out shift rod (3).
Note:
Transmission 260/5 without Vibration Damper:
The shift rod is inserted from the left hand side as seen looking forward in car.
Transmission 260/5 with Vibration Damper or Transmission 265/5:
The shift rod is inserted from the right-hand side as seen looking forward in the car.

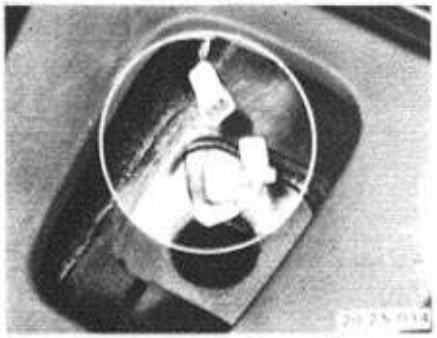


Push back the locking sleeve.



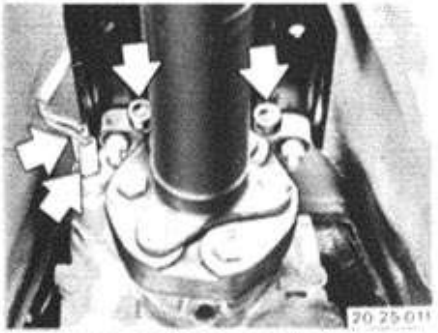
Drive out the pin.
Pull out the shift rod with joint.

Installation:
Lubricate the bearing sleeve and shift rod joint with Molykote Longterm 2.
Note:
Transmission 260/5:
The bearing sleeve is offset to the right as seen looking forward in car.
Transmission 265/5 or 260/5 with Vibration Damper:
The bearing sleeve is offset to the left as seen looking forward in the car.

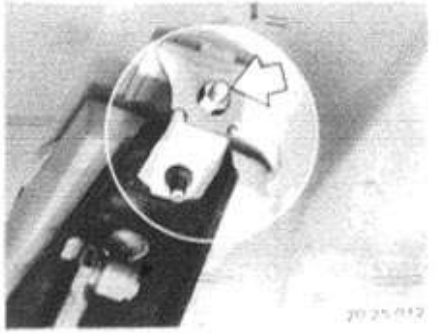


25 11 210 REMOVING AND INSTALLING SHIFT LEVER CONSOLE
– Sheet Metal Shift Console –

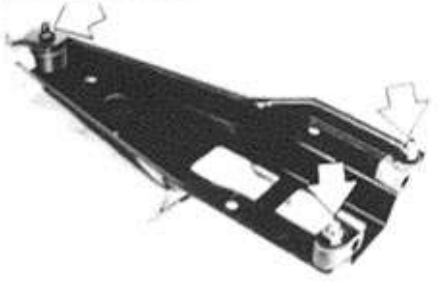
Remove the shift lever – see 25 11 000.
Disconnect the plug.



Pull off the backup light leads.
Unscrew the console mounting bolts.
Important!
Self-locking bolts – loosening these bolts will be difficult.
Installation:
Use new, micro-encased adhesive sealed bolts.
Tightening torque*.

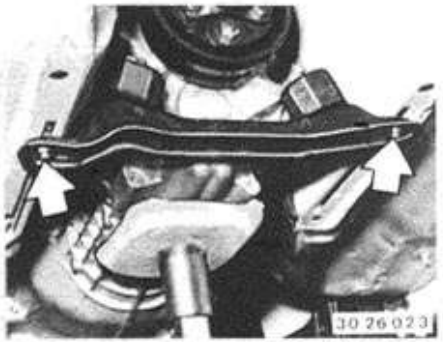


Unscrew the mounting bracket.
Installation:
First insert the shift lever to make installation of the rubber cover easier.



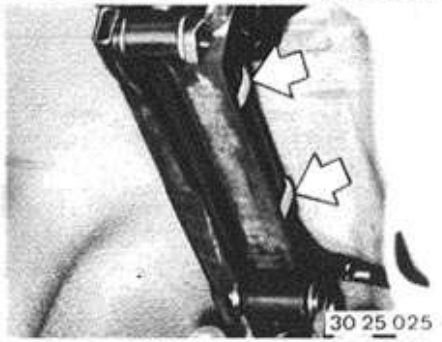
Remove the console.
Installation:
Check the rubber mounts, replacing if necessary.

* See Specifications

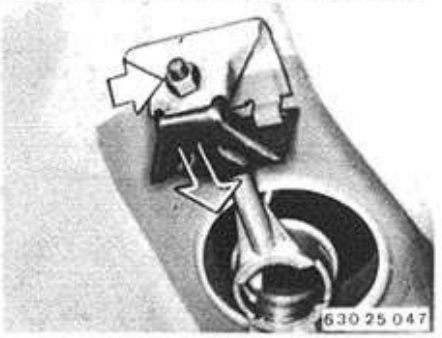


25 11 210 REMOVING AND INSTALLING SHIFT LEVER CONSOLE
– Aluminum Shift Console –

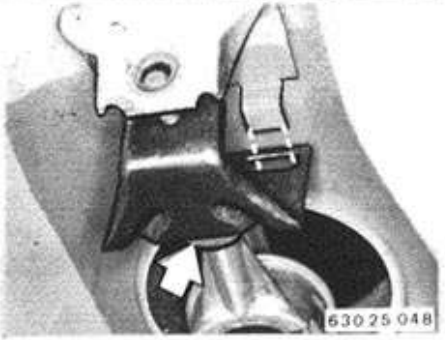
Unscrew the propeller shaft on the transmission see 26 11 000.
Remove the shift lever – see 25 11 000.
Support the transmission.
Unscrew the cross member.
Lower the transmission to the front axle carrier.



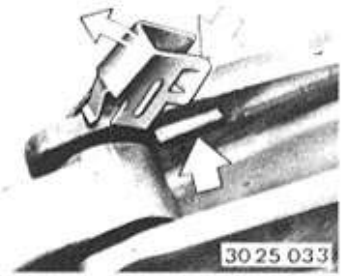
Take the backup light leads out of the holders.



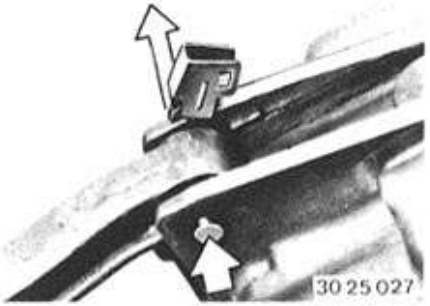
Unscrew the holder.



Installation:
Lubricate the support ring with Molykote Longterm 2.
Engage the holder in the retaining tabs.



Lift out the clip on the bearing shaft.
Note:
The clip is accessible with a screwdriver.
Turn to disengage the clip in the retaining tab and swing up.

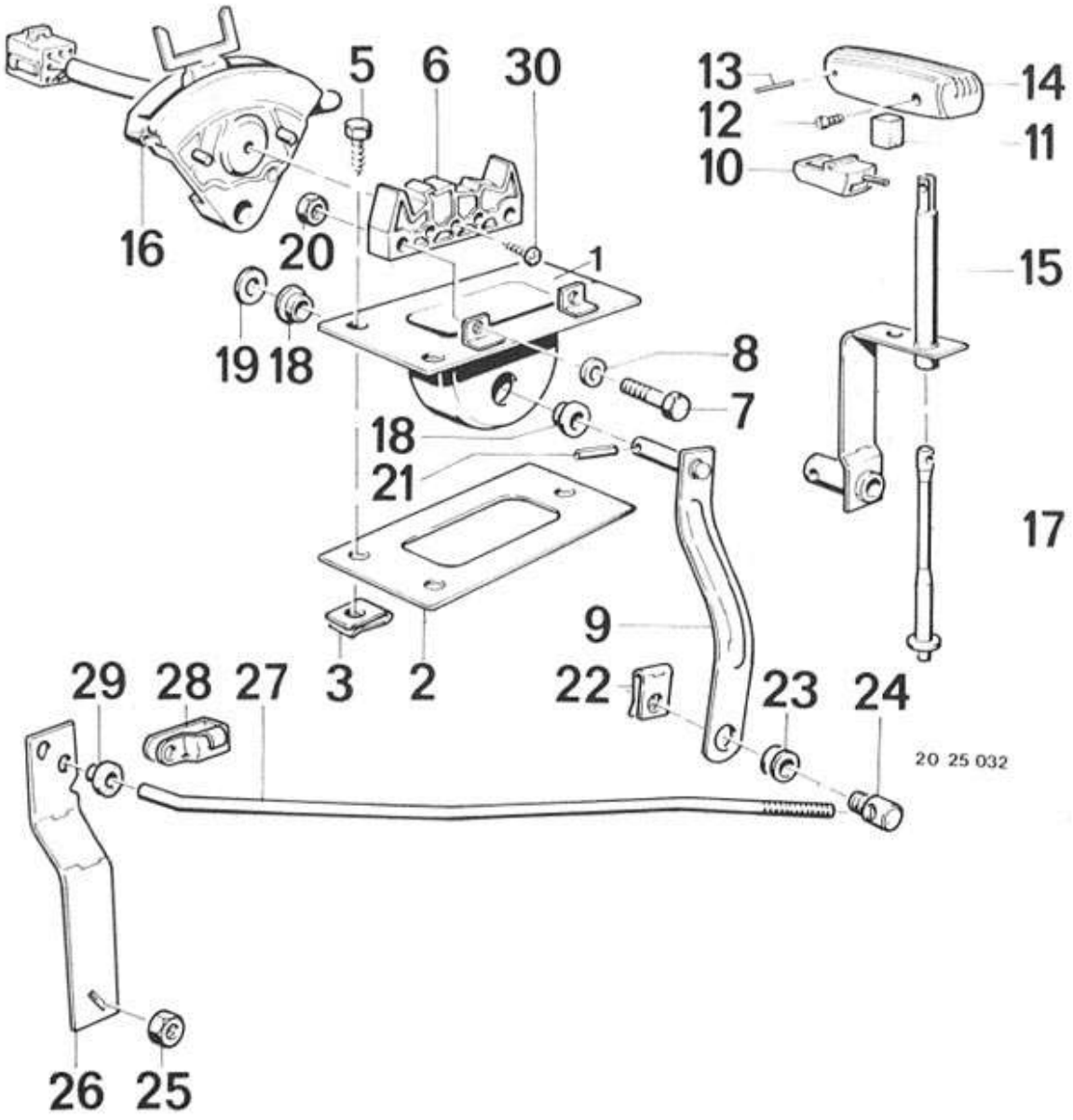


Pull out the bearing shaft.
Take off the shift console.

Lubricate the bearing sleeve with grease and press it into the new console.

25-9

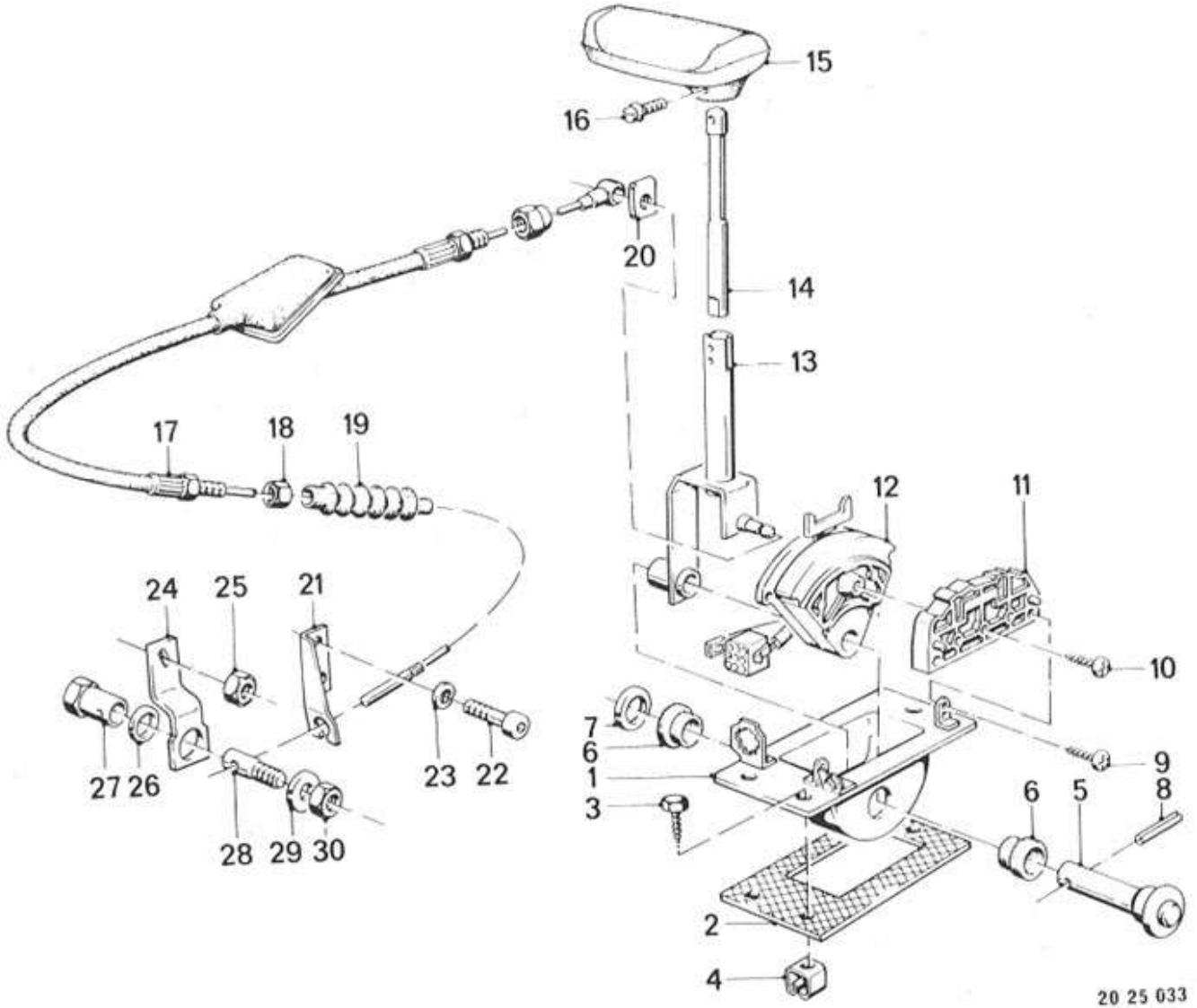
SHIFT LAYOUT DRAWING FOR AUTOMATIC TRANSMISSION
(Version with Selector Rod)



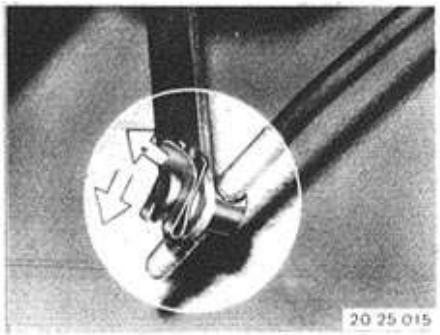
1 Base
2 Insulator
3 Self-tapping nut
5 Self-tapping screw
6 Shift gate
7 Bolt
8 Washer
9 Selector lever lower section
10 Push button
11 Spring element
12 Stud
13 Cyl. pin
14 Handle
15 Selector lever
16 Transmission switch
17 Pull rod
18 Bearing sleeve
19 Shim
20 Nut
21 Key
22 Retainer
23 Pivot sleeve
24 Shaft
25 Nut
26 Selector lever bar
27 Selector rod
28 Spring clip
29 Sleeve
30 Oval head screw

25 - 10

SHIFT LAYOUT DRAWING FOR AUTOMATIC TRANSMISSION
(Version with Cable)



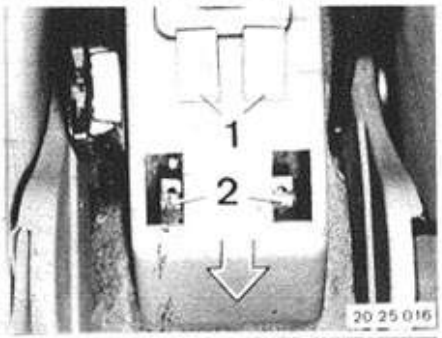
1 Base
2 Insulator
3 Self-tapping screw
4 Self-tapping nut
5 Shaft
6 Bearing sleeve
7 Shim
8 Pin
9 Self-tapping screw
10 Self-tapping screw
11 Shift gate
12 Transmission switch
13 Selector lever
14 Pull rod
15 Handle
16 Stud
17 Cable
18 Nut
19 Dust cover
20 Retainer
21 Bracket
22 Bolt
23 Washer
24 Transmission lever
25 Nut
26 Washer
27 Sleeve
28 Clamping bolt
29 Washer
30 Nut



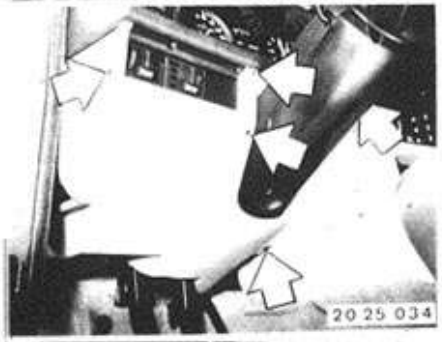
25 16 050 REMOVING AND INSTALLING SELECTOR LEVER COMPLETE WITH BASE

– Version with Shift Rod –

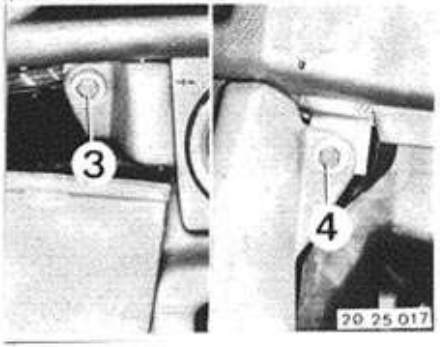
Disconnect the battery ground lead.
Lift out the retainer.
Disconnect the shift rod.
Installation:
Adjust the shift rod – see 24 00 004.



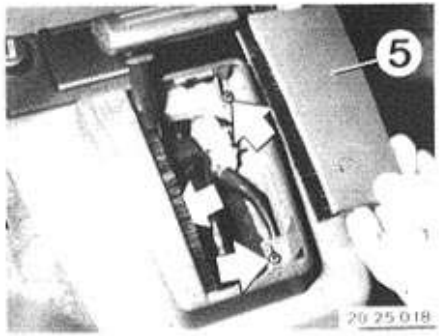
Lift out caps (1).
Loosen bolts (2) and push back the console.



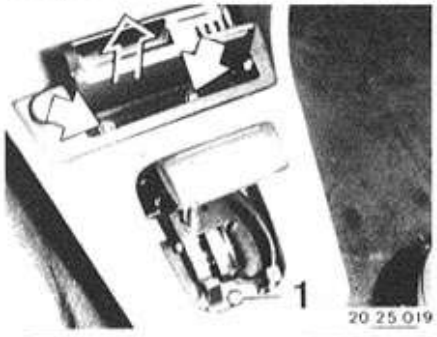
Unscrew the trim panel.



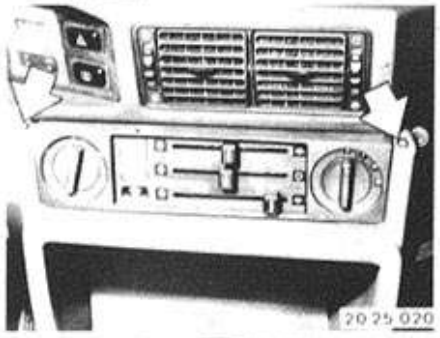
Unscrew the trim panel on the left side.
Remove bolt (3).
Open the glove box.
Remove bolt (4).



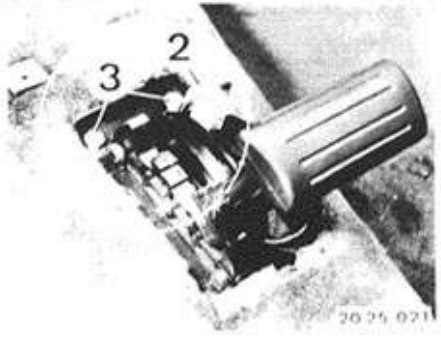
Lift out cover (5).
Take off the mask.



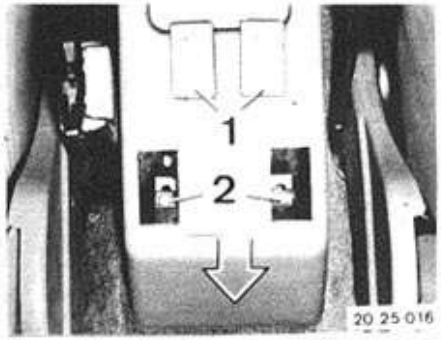
Lift out the ashtray.
Unscrew the ashtray insert.
Remove bolt (1).
Installation:
Connect the leads.



Pull back the console.
Unscrew the heater controls.
Remove the console completely.
Cars with Radio:
Pull off all plugs on the radio and speaker balance control.



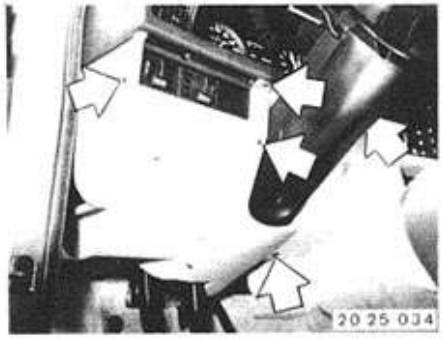
Disconnect plug (2).
Remove bolts (3).
Remove the base.
Installation:
Check the insulating plate between the body and base, replacing if necessary.



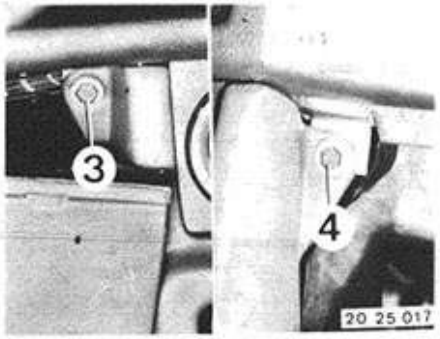
25 16 050 REMOVING AND INSTALLING SELECTOR LEVER COMPLETE WITH BASE

– Version with Cable –

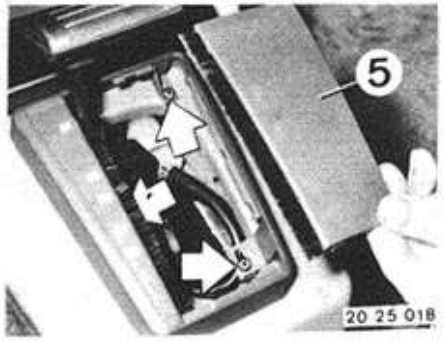
Disconnect the battery ground lead.
Lift out caps (1)
Loosen bolts (2) and push back the console.



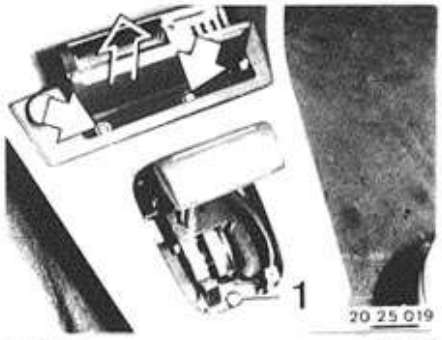
Unscrew the trim panel.



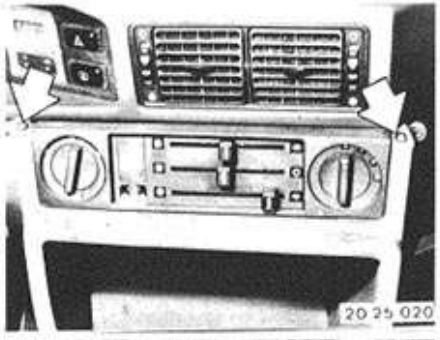
Unscrew the trim panel on the left side.
Remove bolt (3).
Open the glove box.
Remove bolt (4).



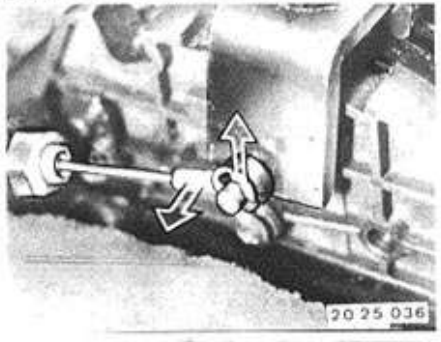
Lift out cover (5).
Take off the mask.



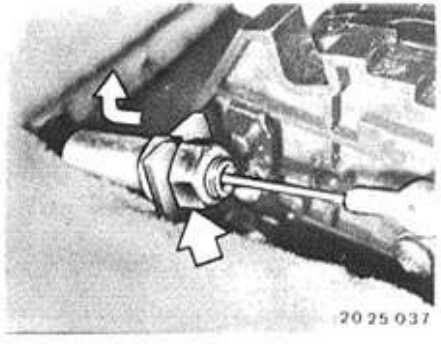
Lift out the ashtray.
Unscrew the ashtray insert.
Remove bolt (1).
Installation:
Connect the leads.



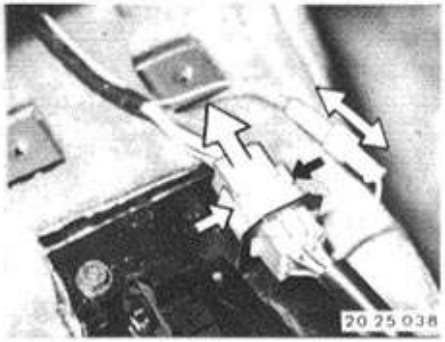
Pull back the console.
Unscrew the heater controls.
Remove the console completely.
Cars with Radio:
Pull off all plugs on the radio and speaker balance control.



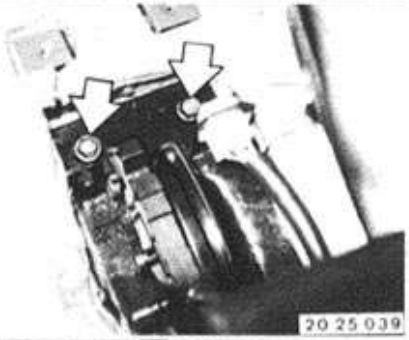
Lift out the retainer.
Unscrew the eye on the shaft.
Important!
Don't bend the steel cable.



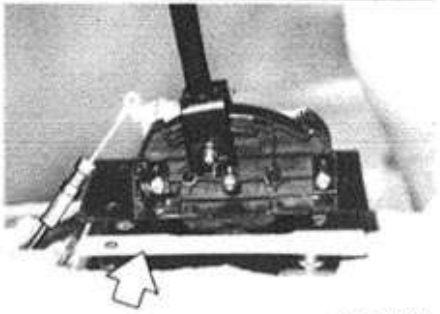
Unscrew the nut.
Disengage the cable sleeve in the holder.



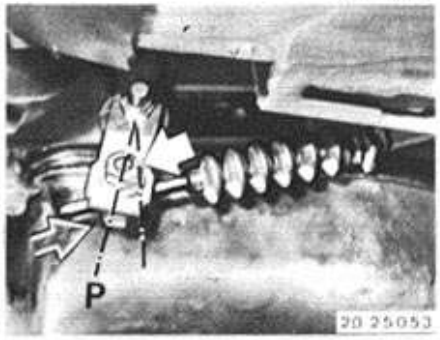
Disconnect plugs.



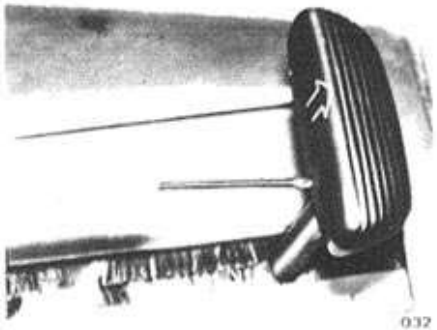
Unscrew the bolts.
Remove the base.



Installation:
Insert the insulating plate.



Installation:
Adjust the cable.
Selector lever in "P" (most forward position).
Transmission lever in "P" (most forward position).
Press the cable pull rod opposite the forward direction.
Clamp the cable pull rod without tension.
Important!
Torque: 10 to 12 Nm (7.5 to 8.5 ft. lbs.).
Don't bend the cable.



25 16 061 REPLACING HANDLE FOR SELECTOR LEVER

Move the selector lever to 1 or 2.
Unscrew clamping bolt.
Pull off the handle.

Installation:
Guide the pin of the button into the pull rod hole.

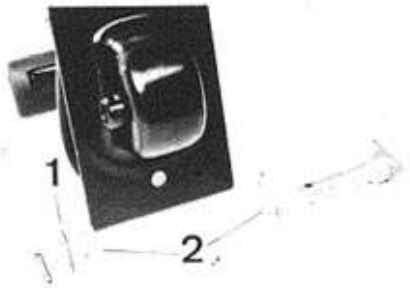
25 16 080 REMOVING AND INSTALLING SELECTOR LEVER

Version with Selector Rod:

Remove selector lever and base assembly 25 16 050.
Drive out pin.

20 25 023

Pull out selector lever lower section.
Remove washer (1) and bearing sleeves (2).
Installation:
Check bearing sleeves, replacing and installing with Molykote Longterm 2 if necessary.

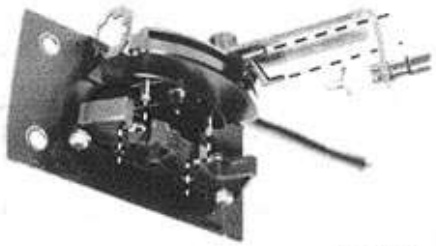


20 25 024

Pull off plug (3).
Unscrew screw (4).
Remove transmission switch together with selector lever upper section.

20 25 025

Installation:
Check installed position of transmission switch and drive dog.



20 25 026

20 25 027

Unscrew screw on handle.
Pull off handle.

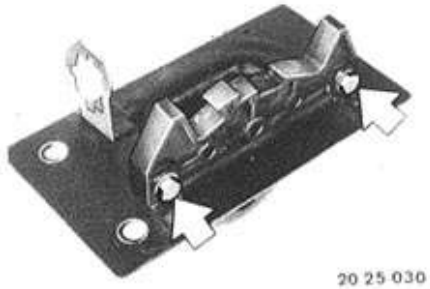
Installation:
Guide pin of button into pull rod hole.

20 25 028

Take pull rod out of selector lever upper section.

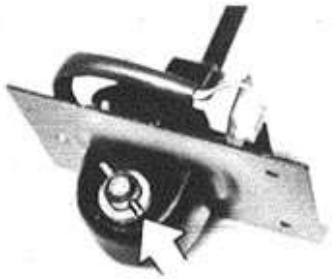
20 25 029

Installation:
Check shift gate, replacing if necessary.



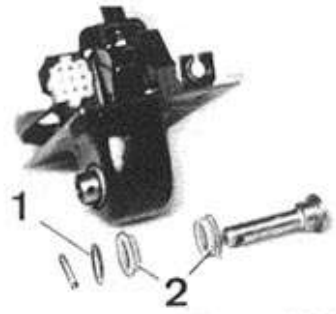
20 25 030

25 16 080 REMOVING AND INSTALLING SELECTOR LEVER
Version with Cable



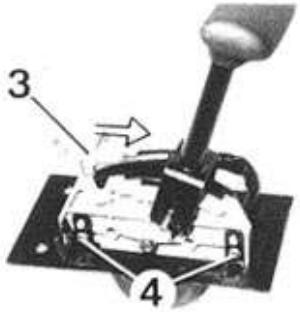
20 25 041

Remove the selector lever complete with base – see 25 16 050.
Drive out the pin.



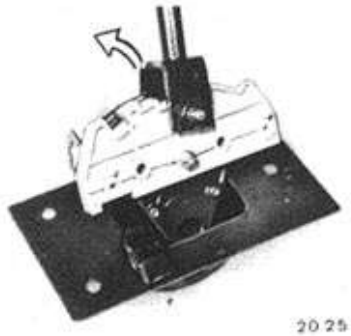
20 25 042

Pull out the shaft.
Take off washer (1).
Pull the bearing sleeves (2) out of the housing.
Installation:
Replace the bearing sleeves.



20 25 043

Pull off plug ( ).
Unscrew bolts (4).
Remove the transmission switch together with the upper selector lever section.



20 25 044

Tilt out the selector lever together with the transmission switch and shift gate.
Installation:
Pivot fork of the transmission switch engages over the selector lever.

20 25 045

Unscrew the shift gate on the transmission switch.
Installation:
Make sure that the pins on the transmission switch engage in the bores of the shift gate.

20 25 046

Unscrew screw on the handle.
Pull off the handle.
Installation:
Check position of the handle to the selector lever.

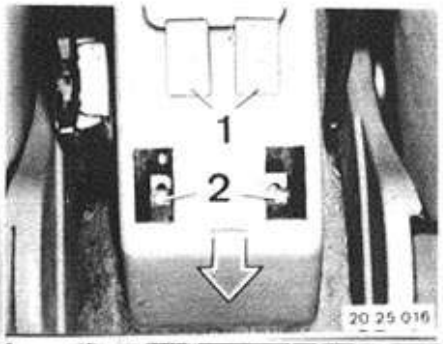
20 25 028

Installation:
Guide pin of button into the pull rod hole.

20 25 029

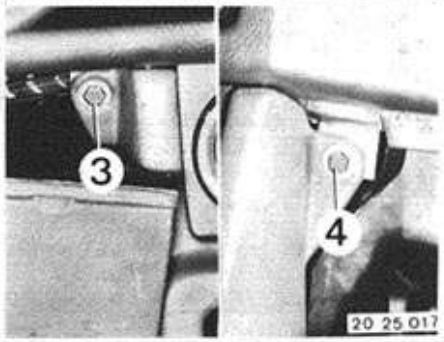
Take the pull rod out of the upper selector lever section.

25 16 202 REPLACING CABLE FOR GEAR RANGE SELECTOR LEVER

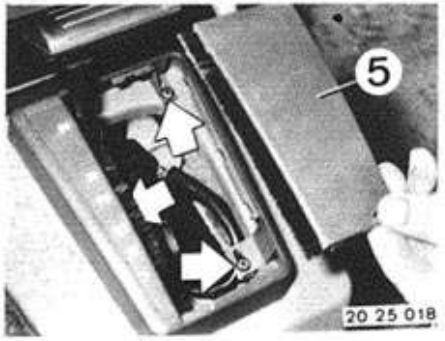


Disconnect battery ground lead.
Lift off caps (1).
Loosen screws (2) and push back console.

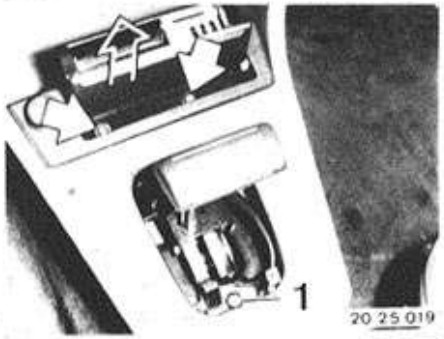
Unscrew trim panel.



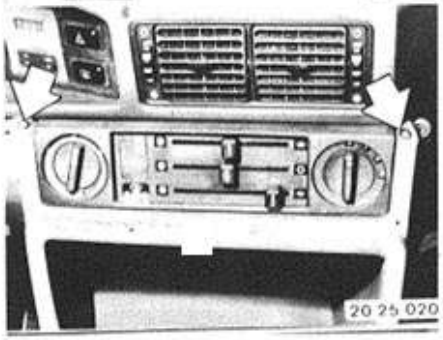
Unscrew left trim panel.
Remove screw (3).
Open glove box.
Remove screw (4).



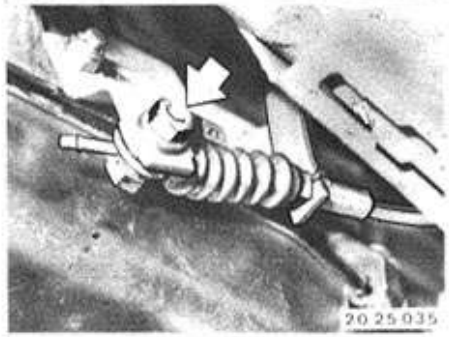
Take off cover (5).
Disconnect mask.



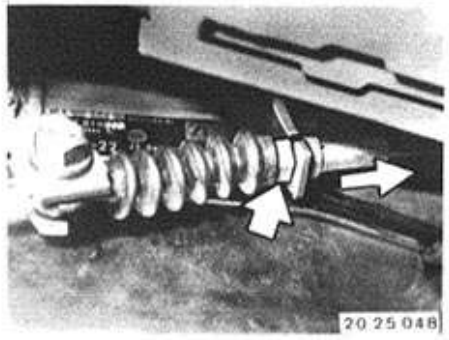
Lift out ashtray.
Unscrew ashtray insert.
Remove screw (1).
Installation:
Connect wire.



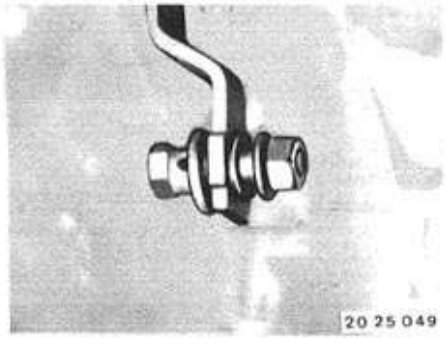
Pull back console.
Unscrew heater controls.
Take out console completely.
Cars with Radio:
Pull off all plugs on radio and speaker balance control.



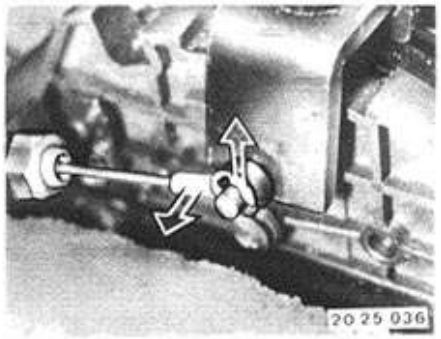
Loosen nut.
Important!
Don't bend the steel cable.



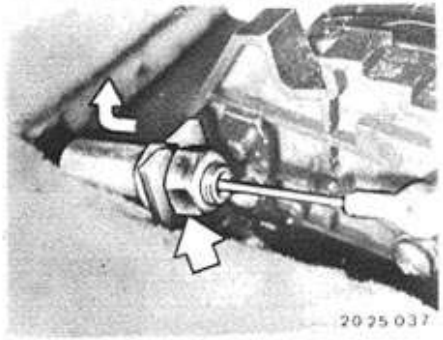
Unscrew nut.
Push back cable sleeve and disconnect in holder.
Pull cable out of operating lever.



Installation:
Check arrangement of washers.
Check rubber mount, replacing if necessary.

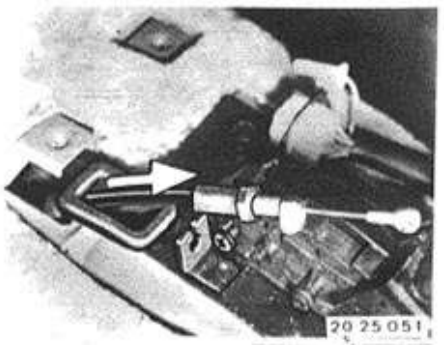


Lift out retainer.
Unscrew eye on pin.
Important!
Don't bend the steel cable.

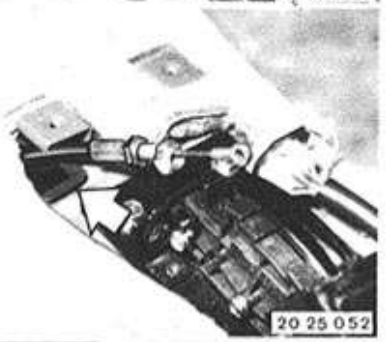


Unscrew nut.
Disconnect cable sleeve in bracket.

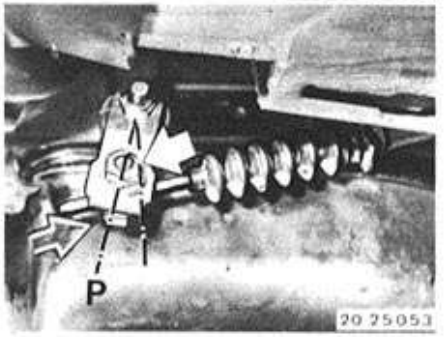
Cut and fold in carpet.



Pull out rubber grommet with cable.

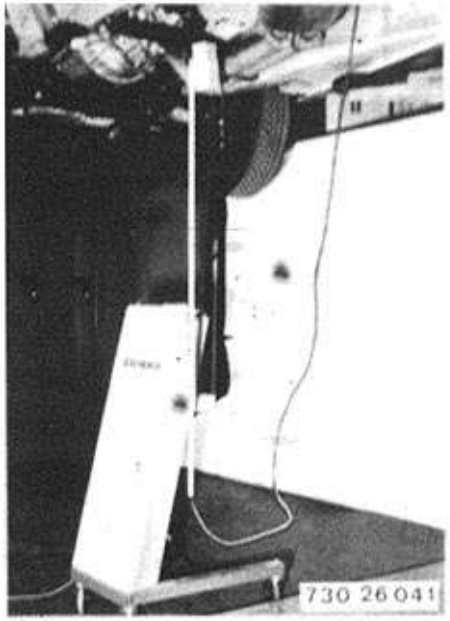


Installation:
Guide in cable from above.
Knock in rubber grommet.
Note:
Recheck seating of rubber grommet before final installation of cable.



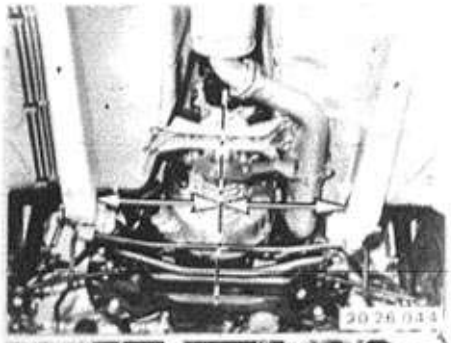
Installation:
Adjust cable.
Selector lever in "P" (far forward position).
Transm. lever in "P" (far forward position).
Push cable pull rod against forward direction.
Tighten cable pull rod without tension.
Important!
Tightening torque: 10 to 12 Nm (7 to 8.5 ft. lbs.).
Don't bend the steel cable.

26 Propeller shaft

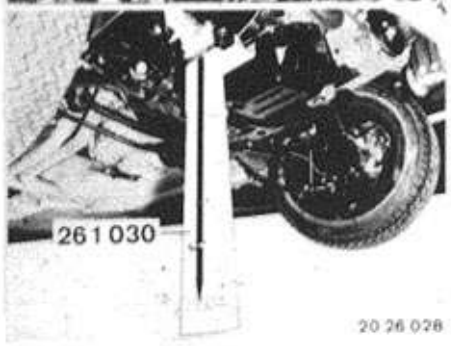


ELIMINATING PROPELLER SHAFT VIBRATION AND NOISE

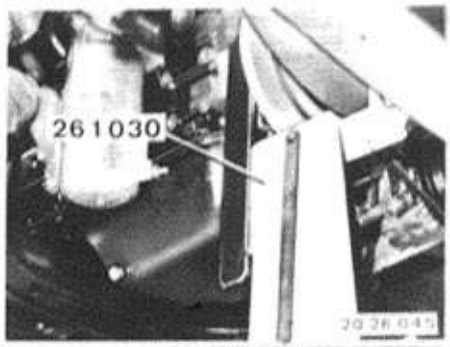
Vibration or Drumming:
Requirements:
Propeller shaft in perfect optical condition.
Balance propeller shaft, if balance plates are missing or there is suspicion of imbalance (see instructions supplied with balancing machine).



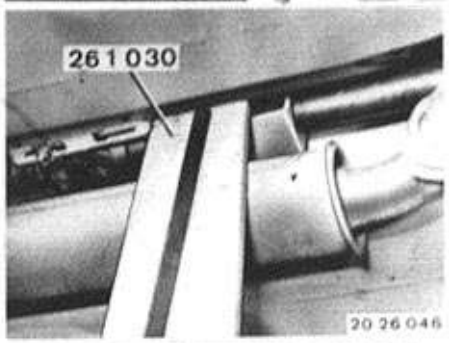
Aligning Propeller Shaft To Eliminate Vibration or Drumming:
Center transmission with measuring tape.



Checking/Correcting Deflection Angle of Joints:
Place Special Tool 26 1 030 on oil pan flange and measure angle of engine inclination.
Note:
When correcting deflection angle by installing shims, remember that this will change the deflection angle of neighboring joints.

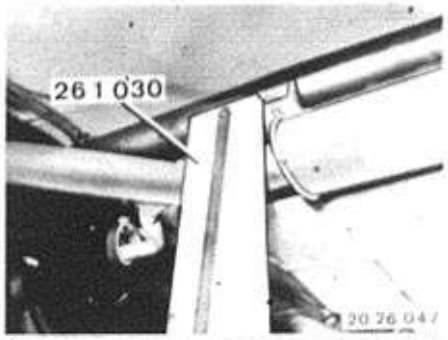


Oil Pan Flange Not Accessible:
Apply Special Tool 26 1 030 with a helping rail (steel ruler) and measure angle of engine inclination.
Note:
When correcting deflection angle by installing shims, remember that this will change the deflection angle of neighboring joints.

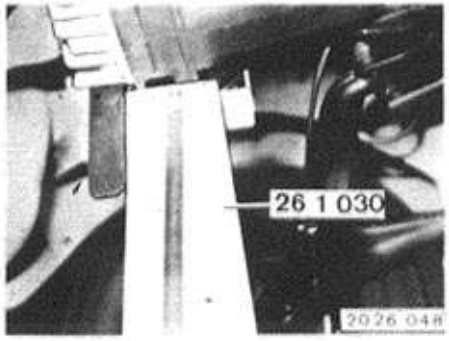


Place special tool gauge on propeller shaft front section and measure angle.
Determine deflection angle* of coupling and, if necessary, correct by installing max. 3 mm (0.118") thick shims on transmission suspension or on center mount.
Example:

Engine angle	2^{0} 16'
Propeller shaft angle	-2^{0} 06'
Coupling deflection angle	0^{0} 10'



Place gauge on propeller shaft rear section and measure angle.
Determine deflection angle* of center mount and correct by installing max. 3 mm (0.118") shims on transmission suspension or on center mount if necessary.

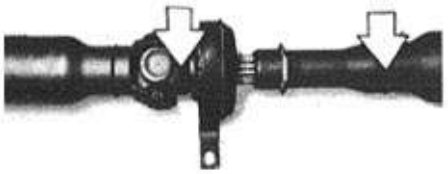


Place gauge on final drive together with helping rail (steel ruler) and measure angle.
Determine deflection angle* of universal joint and correct by installing max. 3 mm (0.118") shims on center mount if necessary.

* See Specifications

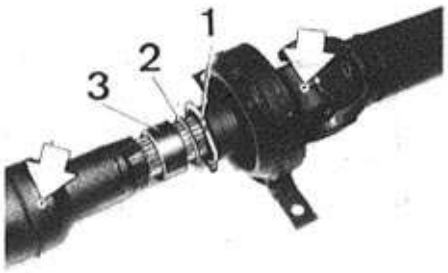
Hard Moving Slide:

Note:
The propeller shaft was balanced in assembled state and must not be turned in the slide.
Punch mark an unmarked propeller shaft.



730 26 031

Take off screw-on sleeve (1), washer (2) and rubber ring (3).
Inspect the rubber ring, replacing if necessary.
Disconnect the propeller shaft on the slide.
Clean the keyway and lubricate with Molykote Longterm 2**.
Assemble the propeller shaft that the punch marks are aligned.

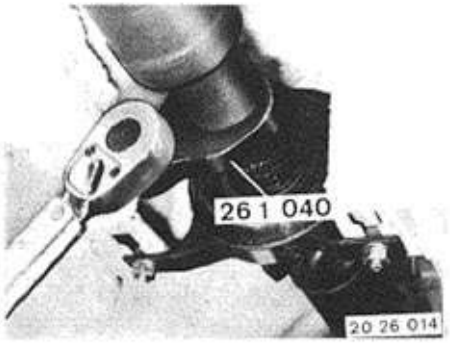


20 26 015

Note:
The propeller shaft sections are mounted in such a manner, that the universal joints are in one plane.
If the slide has been disassembled without marking, only 180° wrong installation is possible because of balancing.

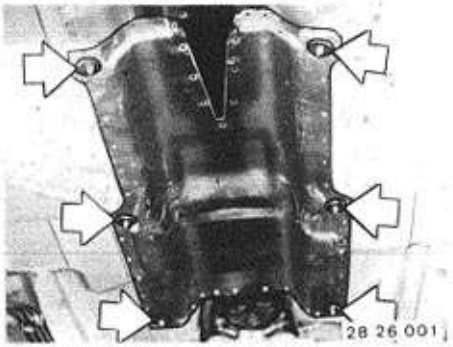
30 26 025

After Finishing Installation:
Tighten the screw-on sleeve with Special Tool 26 1 040.
Tightening torque*.



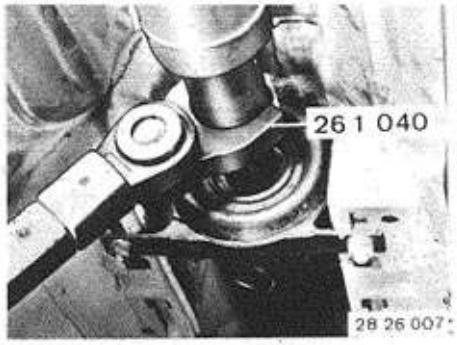
20 26 014

* See Specifications
** Source: HWB



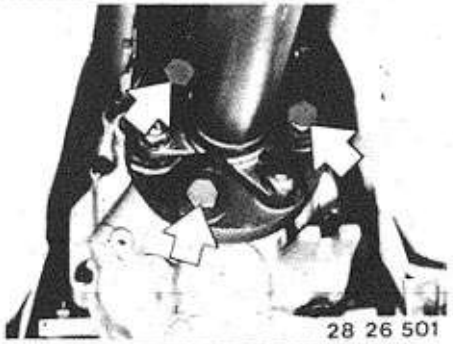
26 11 000 REMOVING AND INSTALLING PROPELLER SHAFT

Remove the exhaust assembly – see 18 00 020.
Unscrew the heat shield.

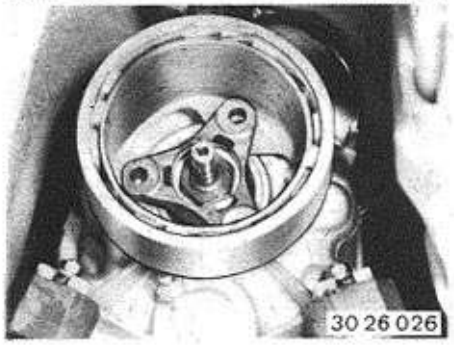


Version with Front Coupling or Universal Joint:

Loosen the screw-on sleeve several turns with Special Tool 26 1 040.
Installation:
Tighten the screw-on sleeve with Special Tool 26 1 040 after finishing installation.
Tightening torque*.



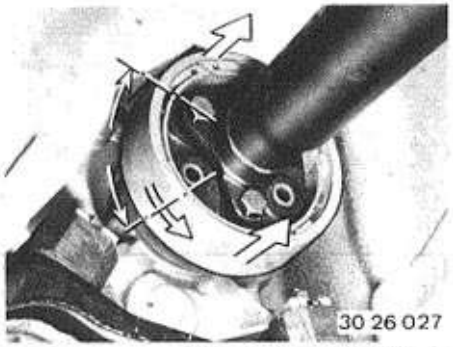
Unscrew the propeller shaft on the transmission.



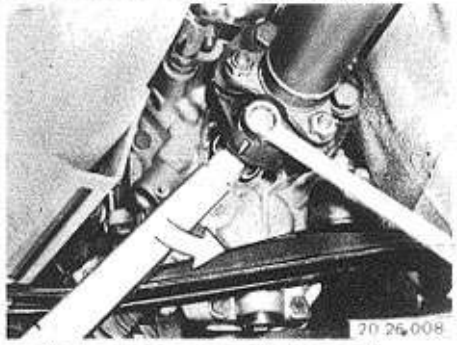
Version with Bolted Vibration Damper:

The vibration damper is mounted on the transmission end output flange.

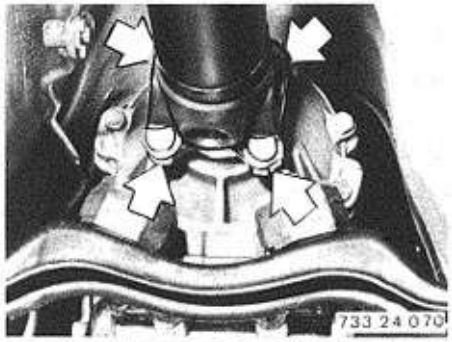
* See Specifications



Unscrew the propeller shaft on the transmission.
Turn the vibration damper 60° and place it on the rubber coupling.
The vibration damper is removed together with the propeller shaft.

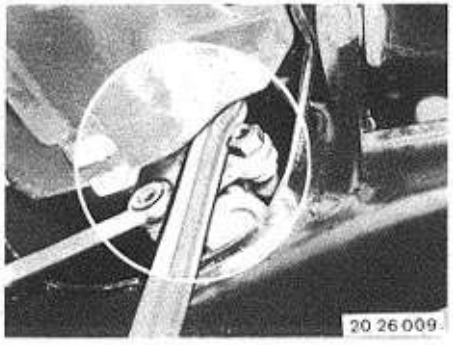


Installation:
Replace the stop nuts.
Tightening torque*.
Important!
Only tighten the nuts or bolts on the flange end to avoid tension in the coupling.
If necessary, loosen and adjust the cross member.



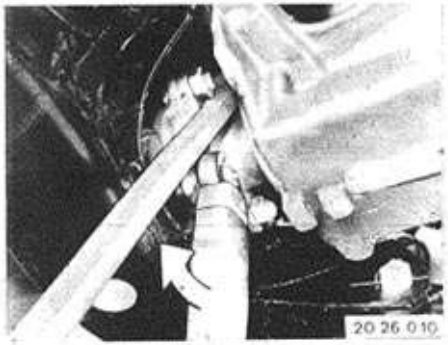
Version with Front Universal Joint:

Unscrew the propeller shaft on the transmission.
Installation:
Replace the stop nuts.
If necessary, adjust the cross member.
Tighten the nuts with a torque wrench.
Tightening torque*.

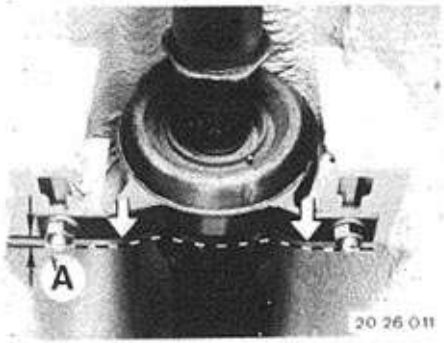


Unscrew the propeller shaft on the final drive.

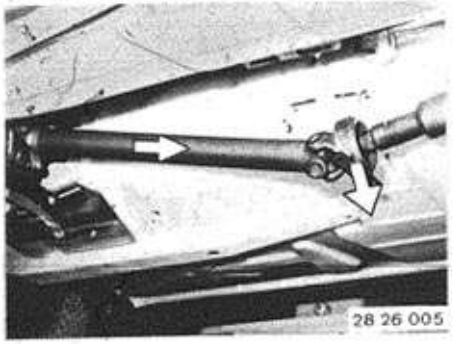
* See Specifications



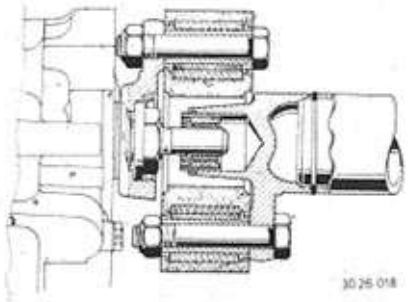
Installation:
Replace the stop nuts.
Tightening torque*.



Unscrew the center mount.
Installation:
Preload the center mount in forward direction
A = 4 to 6 mm (0.157 to 0.236").

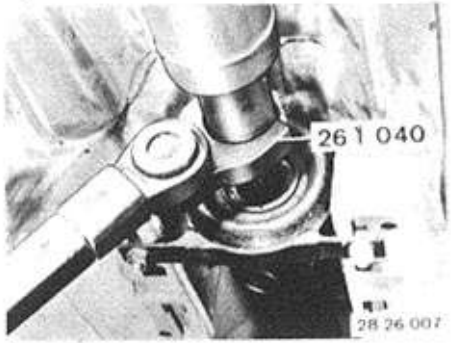


Bend down the propeller shaft and pull it out of the centering pin on the transmission.
Installation:
The propeller shaft was balanced in assembled state and may only be replaced complete.
Check center, lubricating with Molykote Longterm 2 if necessary.
Replace a damaged center.



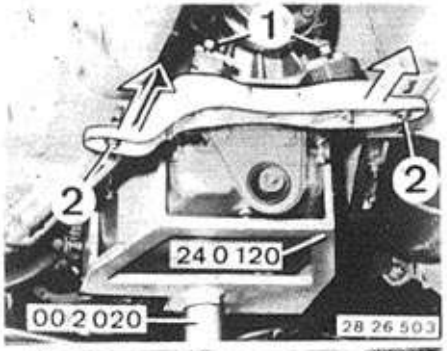
Installation:
Check the center, lubricating with Molykote Longterm 2 if necessary.
Replace a damaged center.

* See Specifications



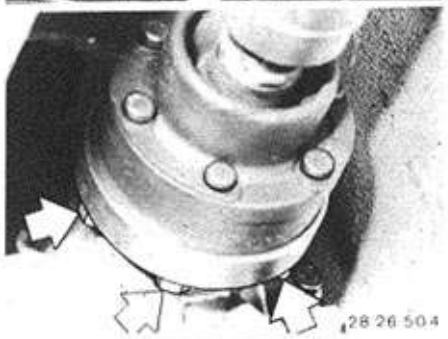
Installation:
Tighten the screw-on sleeve with Special Tool 26 1 040 after finishing installation.
Tightening torque*.

* See Specifications

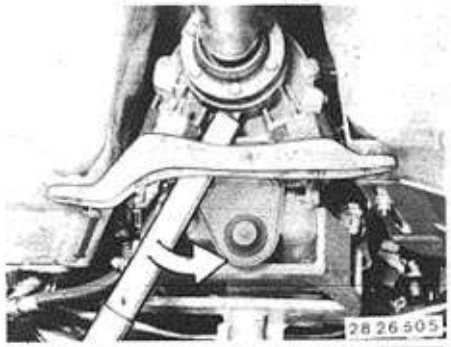


Version with Constant Velocity Joint:

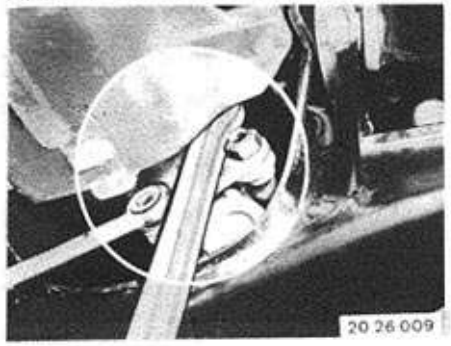
Support the transmission with Special Tools 24 0 120 and 00 2 020.
Remove the nuts and washer (1).
Loosen nuts (2).
Push back the transmission carrier.
Installation:
Tightening torque*.



Unscrew the nuts.

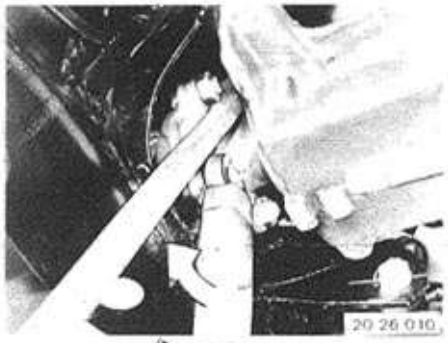


Installation:
Replace the stop nuts.
Tightening torque*.



Unscrew the propeller shaft on the final drive.

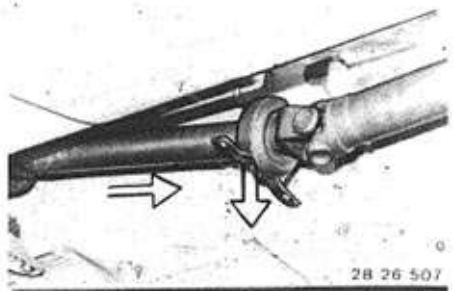
* See Specifications

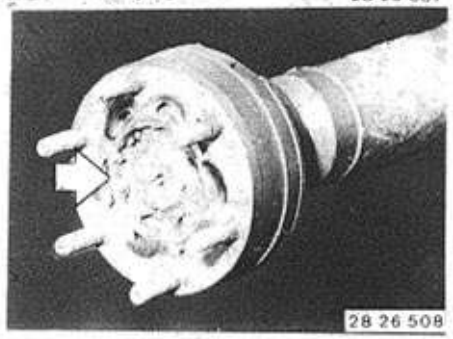


Installation:
Replace the stop nuts.
Tightening torque*.

Unscrew the center mount.
Installation:
Preload the center mount forward by distance A = 4 to 5 mm (0.157 to 0.197").

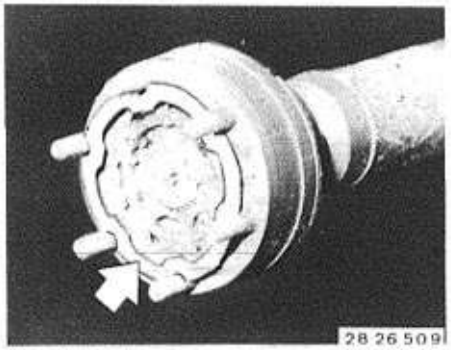
Bend the propeller shaft down and pull it out of the transmission flange.



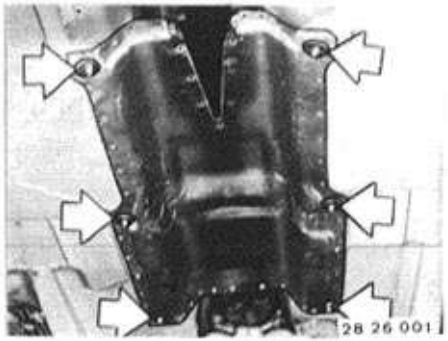


Important!
The constant velocity joint is not enclosed. Cover the constant velocity joint or use the transportation cap.

* See Specifications

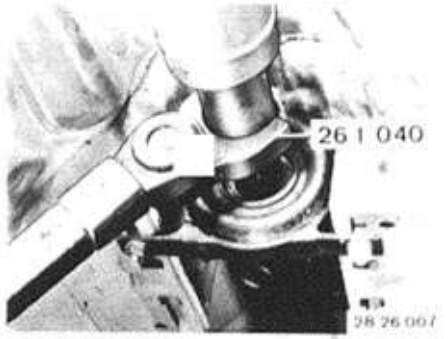


Installation:
Use the gasket between the constant velocity joint and transmission flange.

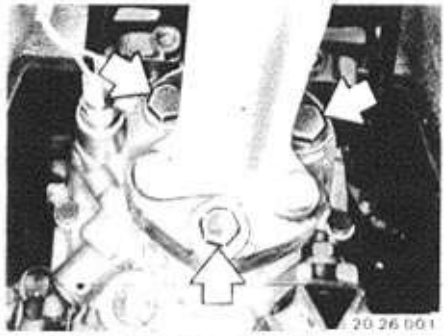


26 11 051 REPLACING FRONT RUBBER COUPLING FOR PROPELLER SHAFT

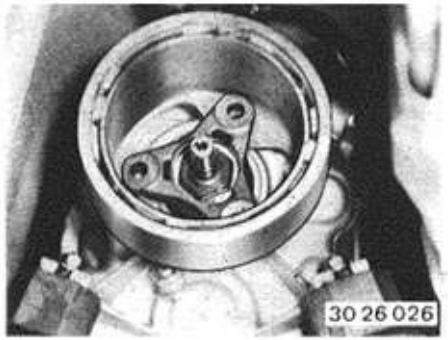
Remove the exhaust assembly – see 18 00 020.
If applicable, unscrew the heat shield.



Loosen the screw-on sleeve several turns with Special Tool 26 1 040.
Installation:
Tighten the screw-on sleeve with Special Tool 26 1 040 after finishing installation.
Tightening torque*.

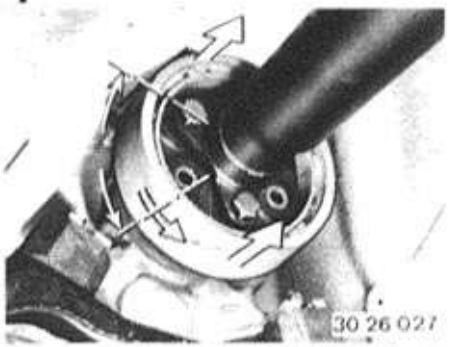


Unscrew the propeller shaft on the transmission.

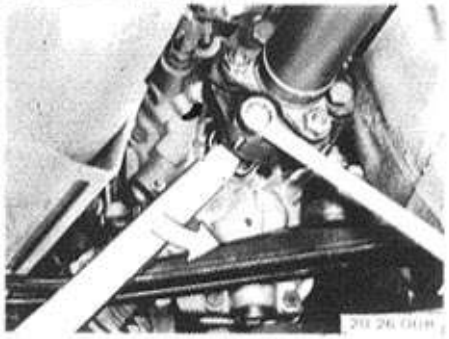


Version with Bolted Vibration Damper:
The vibration damper is mounted on the transmission end output flange.

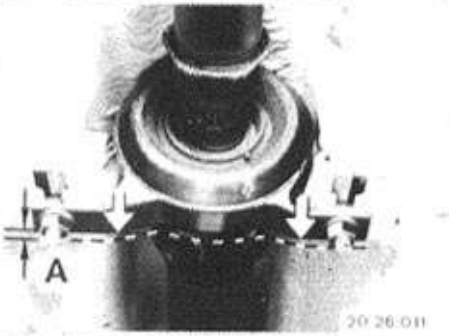
* See Specifications



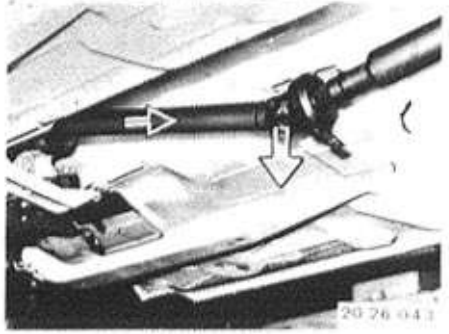
Unscrew the propeller shaft on the transmission.
Turn the vibration damper 60° and place it on the rubber coupling.
The vibration damper is taken off together with the propeller shaft.



Installation:
Replace the stop nuts.
Tightening torque*.
Important!
Only tighten the nuts or bolts on the flange end to avoid tension in the coupling.
Loosen and adjust the cross member, if necessary.

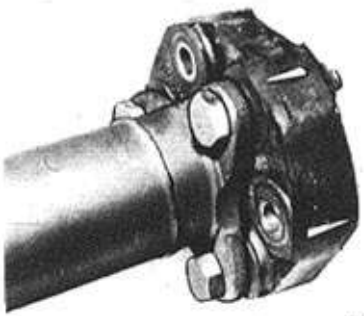


Unscrew the center mount.
Installation:
Preload the center mount forward by distance A = 2 to 4 mm (0.079 to 0.157").



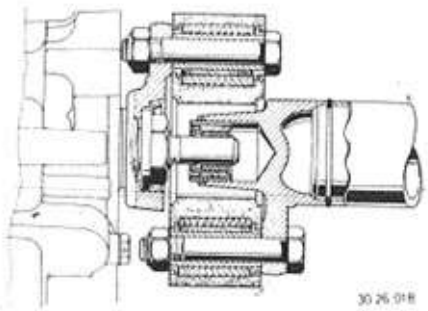
Pull out the propeller shaft from the centering pin on the transmission.
Important!
Do not disconnect the propeller shaft on the slide.

* See Specifications



20 26 036

Replace the coupling.
Install the coupling that the arrows face the flange arms.
Tightening torque*.

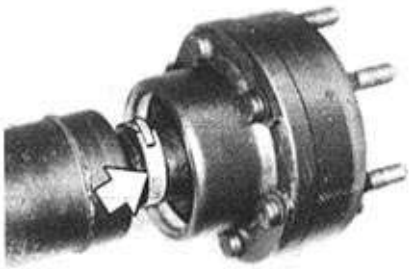


30 26 018

Installation:
Check the center, lubricating with Molykote Longterm 2.
Replace a damaged center.

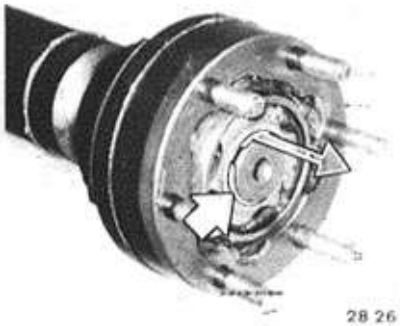
* See Specifications

26 11 160 REPLACING CONSTANT VELOCITY JOINT FOR PROPELLER SHAFT



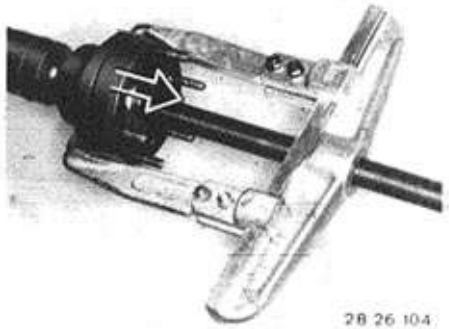
28 26 102

Remove propeller shaft assembly – see 26 11 000.
Remove hose clamp.



28 26 103

Remove circlip.
Installation:
Replace circlip.



28 26 104

Pull off constant velocity joint complete with dust cover.

28 26 105

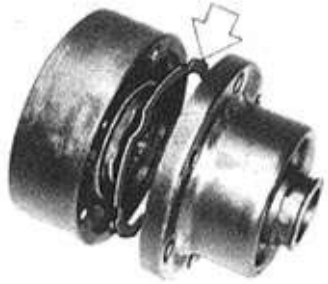
Press knurled head bolts and washers out of constant velocity joint.

28 26 106

Press off dust cover.

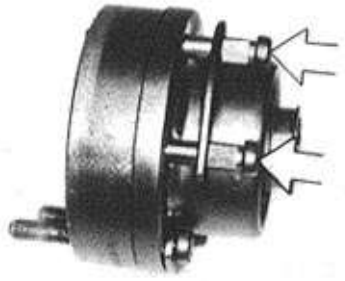
28 26 107

Pack new constant velocity joint with 60 grams of grease*.
Note:
Do not cant inner race with cage, since balls would fall out.



28 26 108

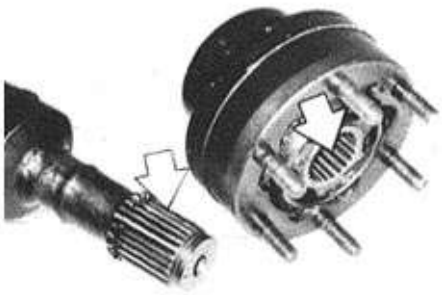
Place gasket in shoulder provided for this purpose.
Press on dust cover.
Installation:
Check that bores are located correctly.



28 26 109

Press in knurled head bolts with washers.

* Source: HWB

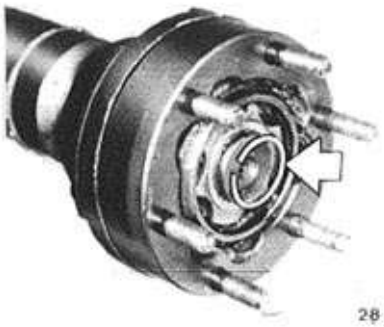


28 26 110

Clean splines to remove grease and then coat with a bolt cement*.
Important!
Keep bolt cement out of ball paths.

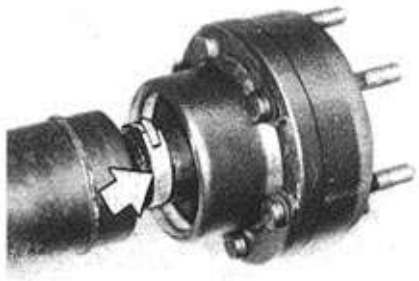
28 26 111

Drive constant velocity joint on propeller shaft with Special Tool 23 1 040.



28 26 112

Insert circlip.
Note:
Check for correct and tight fit.

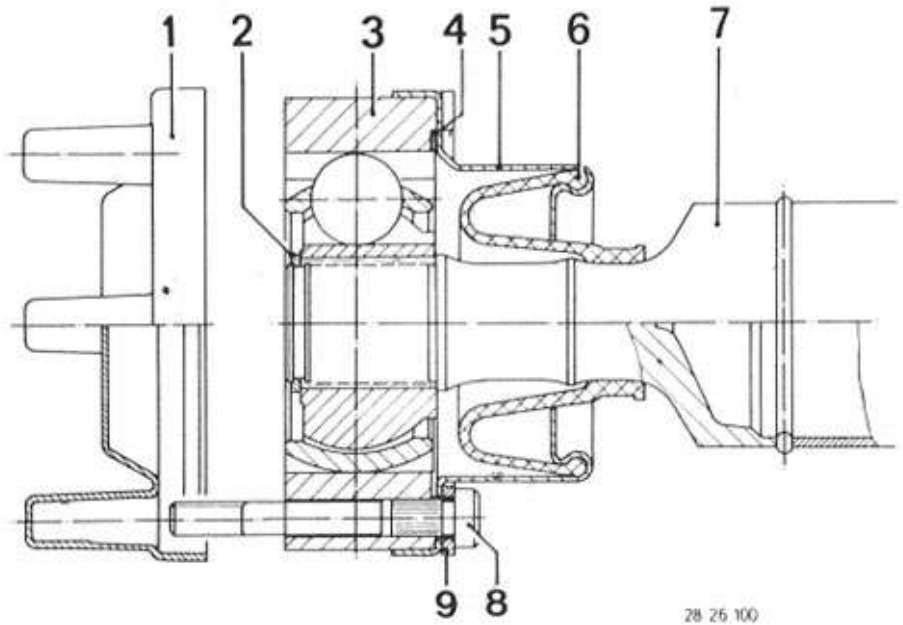


28 26 102

Install hose clamp on dust cover.

* Source: HWB

Constant Velocity Joint Assembly

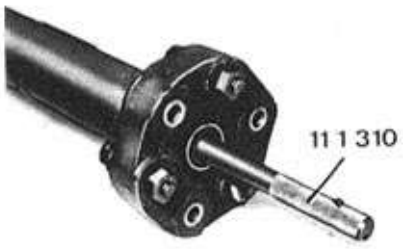


28 26 100

1 Transport cap
2 Circlip
3 Constant velocity joint
4 Gasket
5 End cover
6 Dust cover
7 Propeller shaft
8 Bolt
9 Washer

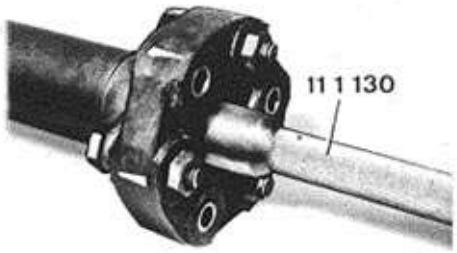
26 11 501 REPLACING PROPELLER SHAFT FRONT END CENTER

– Propeller Shaft Removed –



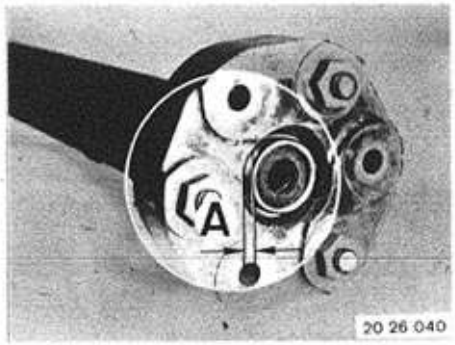
20 26 038

Pack center with viscous grease and drive out with Special Tool 11 1 310.
The pressure on the grease packing drives out the center mount.



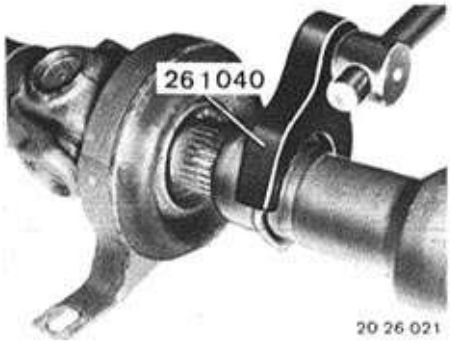
20 26 039

Lubricate center with Molykote Longterm 2 and drive in with Special Tool 11 1 130.
Sealing lip faces out.



20 26 040

Protrusion A = 4.5 mm (0.177").



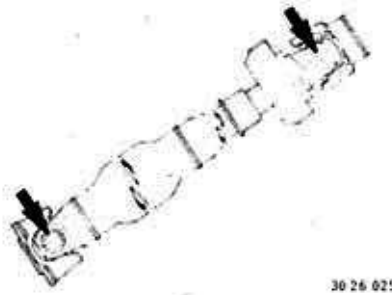
20 26 021

26 12 001 REPLACING PROPELLER SHAFT CENTER MOUNT ASSEMBLY

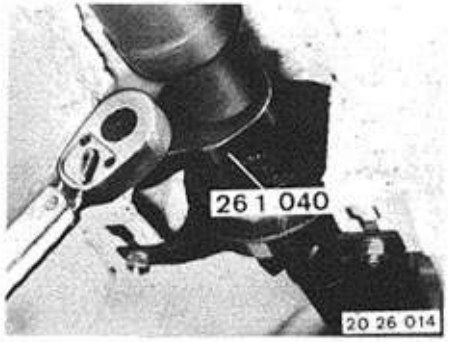
Version with Slide:
Remove propeller shaft 26 11 000.
Unscrew threaded sleeve with Special Tool 26 1 040.
Pull off front propeller shaft section.
Important!
Propeller shaft was balanced in assembled state and must not be turned in slide.
Punch mark an unmarked propeller shaft.

20 26 015

Installation:
Lubricate slide with Molykote Longterm
Slide on threaded sleeve (1), washer (2) a rubber ring (3).
Assemble propeller shaft that punch marks are aligned.


30 26 025

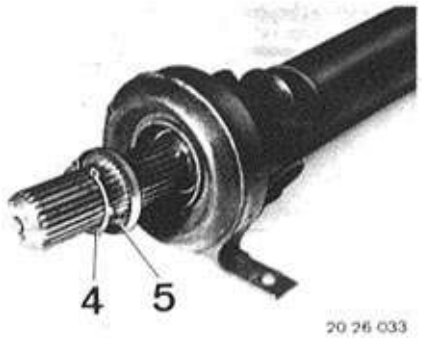
Note:
Propeller shaft sections are mounted to have universal joints in one plane.
If slide had been taken apart without punch marking, only wrong installation by 180° is possible because of balancing.



20 26 014

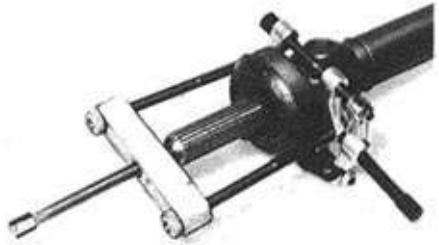
Installation:
Tighten threaded sleeve with Special Tool 26 1 040 after finishing installation.
Tightening torque*.

* See Specifications
** Source: HWB



20 26 033

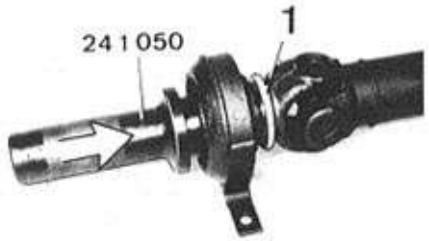
Lift out circlip (4) and remove dust guard (5).


20 26 032

Pull off center mount complete with grooved ball bearing.

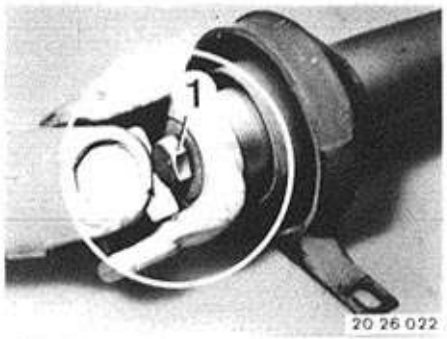

20 26 025

Press grooved ball bearing into center mount.

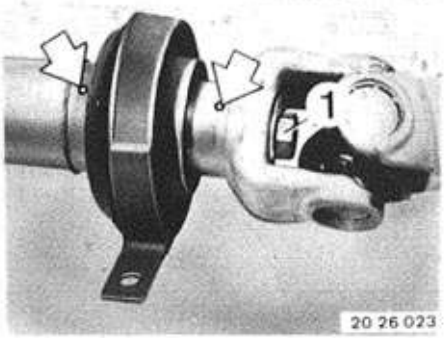


20 26 034

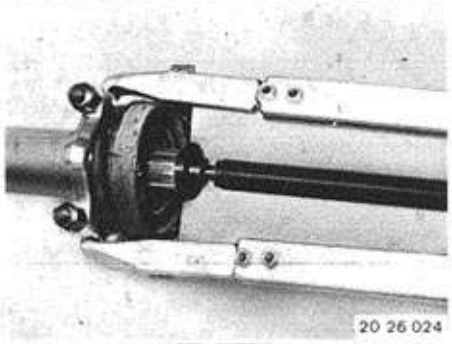
Slide on dust guard (1).
Press on center mount with Special Tool 24 1 050.
Installation:
Check installed position of dust guard – flush with center mount.
Important!
Check clearance of center mount.



Propeller Shaft without Slide:
Remove propeller shaft 26 11 000.
Unscrew bolt (1).
Punch mark propeller shaft sections to each other.
Pull off front propeller shaft section.
Important!
Propeller shaft was balanced as an assembly – splines must not be displaced.



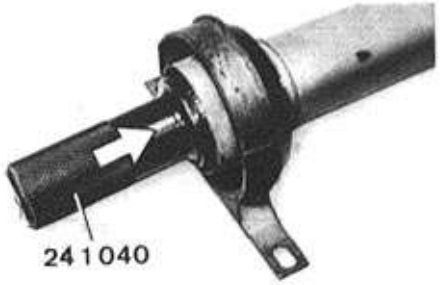
Installation:
Assemble propeller shaft that punch marks are aligned.
Lock bolt (1) with a bolt cement**.
Tightening torque*.



Pull off center mount complete with grooved ball bearing.

Press grooved ball bearing into center mount.

* See Specifications
** Source: HWB



Drive on center mount with Special Tool 24 1 040.
Important!
Check clearance between center mount and dust guard.

TROUBLESHOOTING PROPELLER SHAFT

Condition	Cause	Correction
Grunting from stopped car	Propeller shaft without influence	Check engine tuning – adjust the exhaust assembly
Shaking while moving off in forward or reverse gear (center mount knocking)	Propeller shaft not aligned precisely	Align propeller shaft (S.I. 26 01 77 (235))
	Runout on centering pin, transmission or final drive flanges	Check runout of centering pin and flanges with a dial gage – see Specifications; adjust or replace final drive flange
	Center mount rubber damaged. Propeller shaft length compensator.	Replace center mount – 26 12 001. Important! Tighten* screw-on sleeve with Special Tool 26 1 040.
	Universal joints worn or seized.	Check clearance and movement, replacing propeller shaft if necessary – 26 11 000.
	Engine/transmission mounts not okay.	Check mounts, aligning or replacing if necessary.
	Coupling rubber damaged.	Replace coupling – 26 11 051.
Shaking between 40 and 50 km/h (25 and 30 mph)	Propeller shaft not aligned precisely.	Align propeller shaft.
	Runout on centering pin, transmission or final drive flanges.	Check runout of centering pin and flanges with a dial gage – see Specifications; adjust or replace final drive flange.
	Center mount rubber damaged. Propeller shaft length compensator.	Replace center mount – 26 12 001. Important! Tighten* screw-on sleeve with Special Tool 26 1 040.
	Universal joints worn or seized.	Check clearance and movement, replacing propeller shaft if necessary – 26 11 000.
	Coupling rubber damaged.	Replace coupling – 26 11 051.

* See Specifications for tightening torque.

TROUBLESHOOTING PROPELLER SHAFT

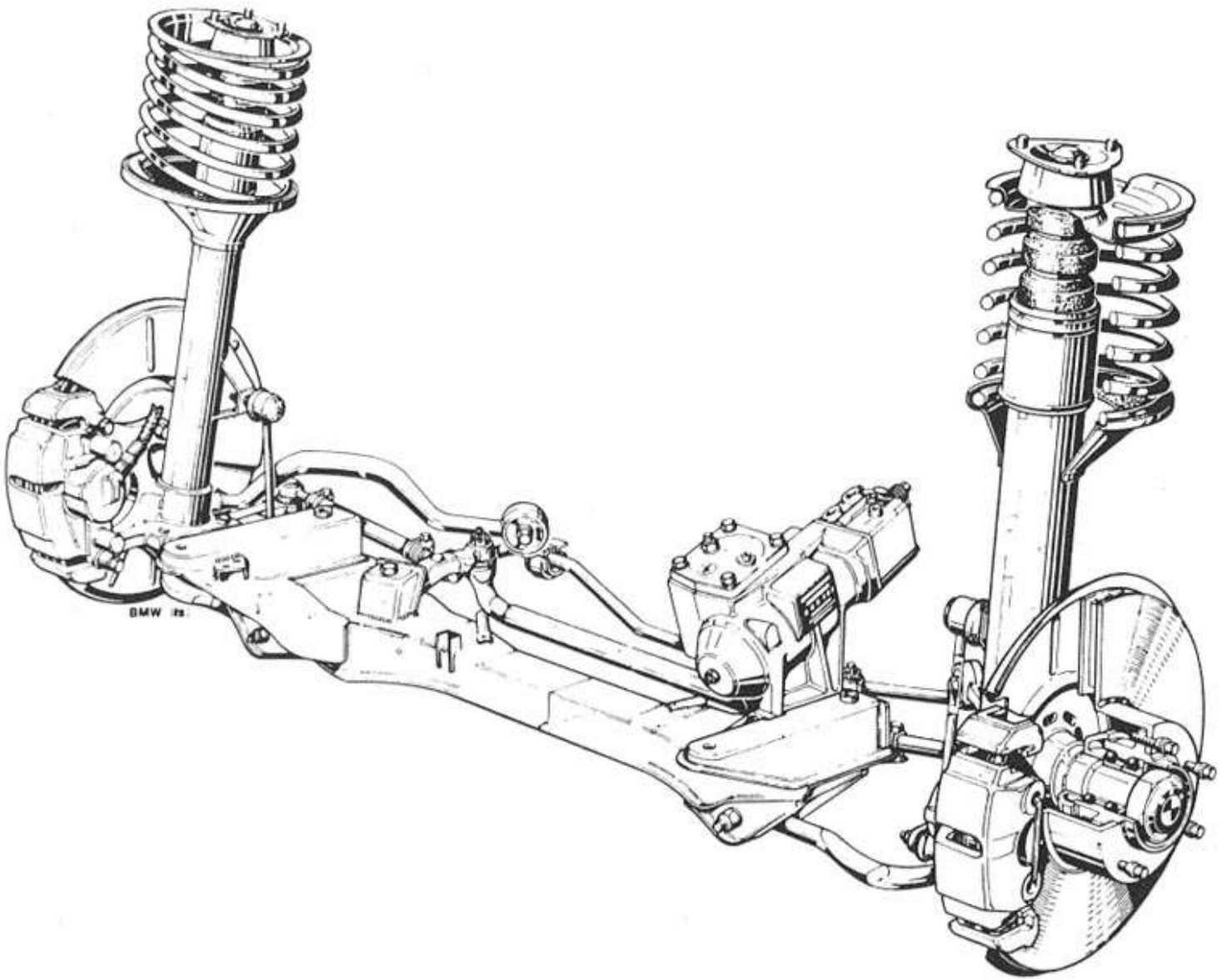
Condition	Cause	Correction
Grunting from 60 km/h (37 mph) on	Propeller shaft not aligned precisely or installed with tension – length compensator.	Align propeller shaft or check movement of length compensator, lubricating slide with Molykote Longterm 2 and tightening screw-on sleeve* if necessary.
	Center damaged.	Replace center – 26 11 501.
	Runout on centering pin, transmission or final drive flanges.	Check runout of centering pin and flanges with a dial gage – see Specifications; adjust or replace final drive flange.
	Centering incorrect due to worn flange bores (bolts loose).	Replace transmission or final drive flange.
	Considerable imbalance of propeller shaft, balancing plate torn off.	Balance or replace propeller shaft.
	Universal joints worn or seized.	Check clearance and movement, replacing propeller shaft if necessary – 26 11 000.
Center mount loud while driving	Center mount not perpendicular to propeller shaft, not or insufficiently preloaded.	Preload center mount at right angle to propeller shaft in forward direction by 4 to 6 mm (0.157 to 0.236").
	Center mount grooved ball bearing not okay.	Replace grooved ball bearing – 26 12 001.

* See Specifications for tightening torque.

31 Front axle

31-0

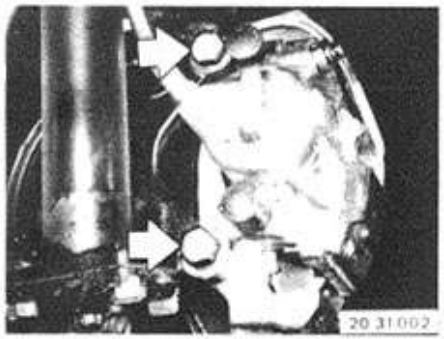
FRONT AXLE LAYOUT DRAWING



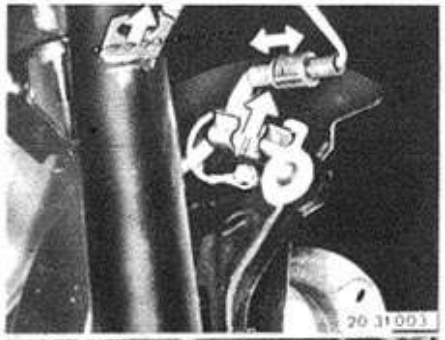
28 31 001

31 10 000 REMOVING AND INSTALLING FRONT AXLE ASSEMBLY

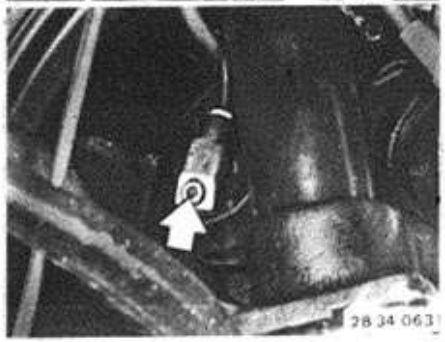
Remove and install front wheels 36 10 300.
Remove splash guard.
Note:
Check front axle alignment with optical tester after installation 32 00 034.



Disconnect and tie down left and right brake calipers.
Brake lines remain connected.
Installation:
Tightening torque*

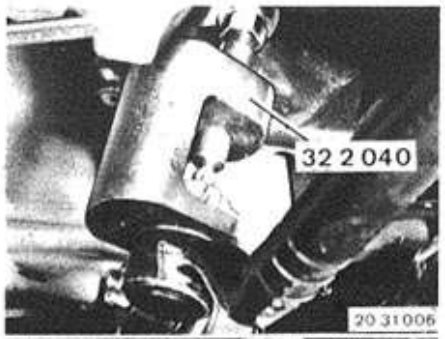


Left Side:
Pull plug out of clamp and rubber grommet out of bracket.
Disconnect ground wire.

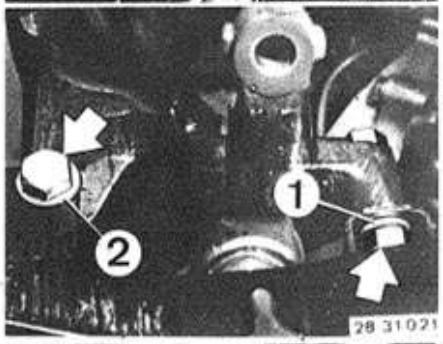


Unscrew ABS pulse sensors on left and right sides.

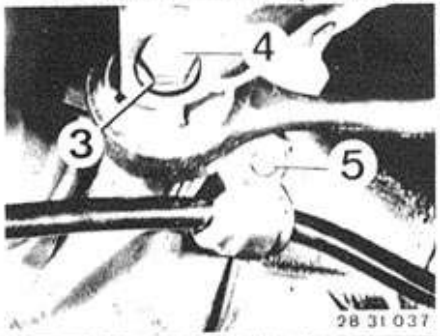
* See Specifications of Group 34



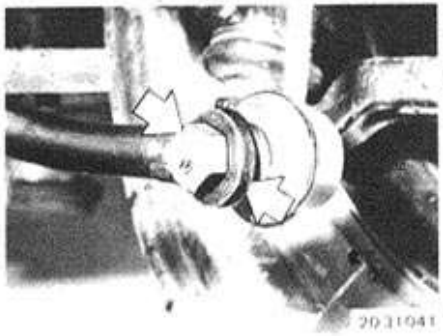
Remove cotter pin and unscrew castle nut.
Press off tie rod on steering drop arm with Special Tool 32 2 040.
Installation:
Tightening torque*
Lock castle nut with cotter pin.



Unscrew steering gear mounting bolts (hold on nuts).
1 = Washer
2 = Washer (both sides)
Tie down steering gear with a piece of wire.
Lines remain connected.
Installation:
Replace self-locking nuts.
Tightening torque*.

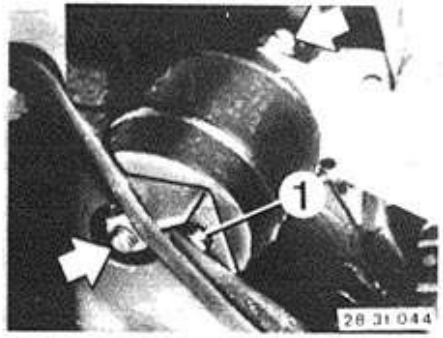


Unscrew bolts (4 and 5) on left and right sides.
3 = washer (both sides)
Installation:
Replace self-locking nuts.
Tightening torque* with car in normal position*.

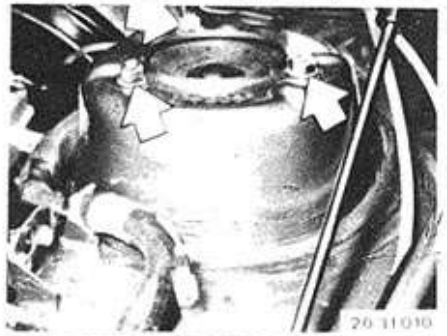


Disconnect push rods on left and right sides.
Hold on ball joint with a fork wrench.
Installation:
Replace self-locking nuts.
Tightening torque*.

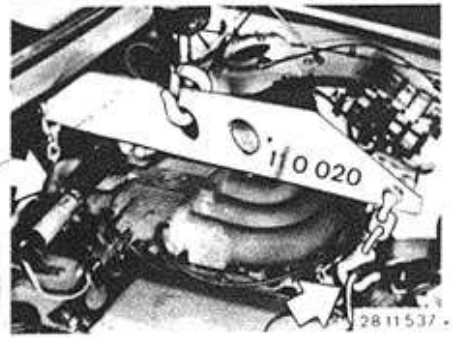
* See Specifications of Group 31/32



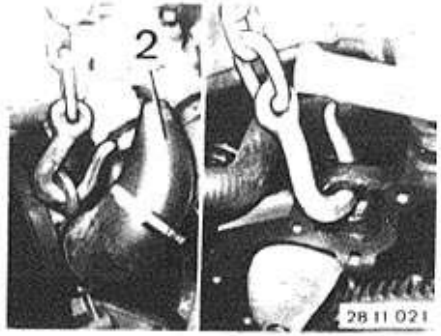
Unscrew engine mounts at bottom on left and right sides.
Loosen engine mount at top right.
Installation:
Check for correct installed position.
Turning lock of mounts is located in bore (1).
Tightenipg torque*.



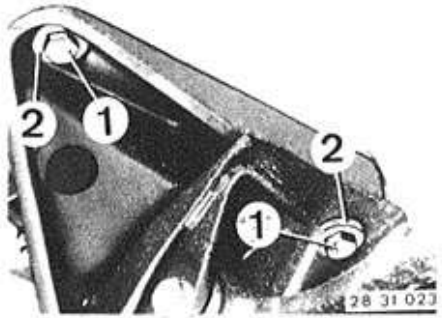
Support spring strut shock absorbers.
Disconnect left and right mounts in wheel houses.
Installation:
Replace self-locking nuts.
Tightening torque*.



Engines M 20 and M 21:
Attach Special Tool 11 0 020 on engine.



Engine M 30:
Drain coolant partially.
Disconnect water hose (2) and attach Special Tool 11 0 020.
Installation:
Fill and bleed cooling system 17 00 039.

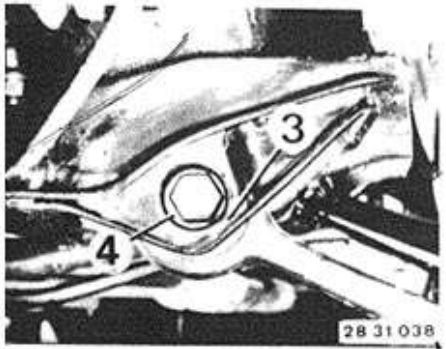


Place workshop jack underneath front axle carrier.
Unscrew engine carrier bolt (1) and lower front axle slowly.
Caution!
Springs struts must not be allowed to fall out or drop down – ball joints would be damaged.
Installation:
Install bolts with washers (2).
Tightening torque*.

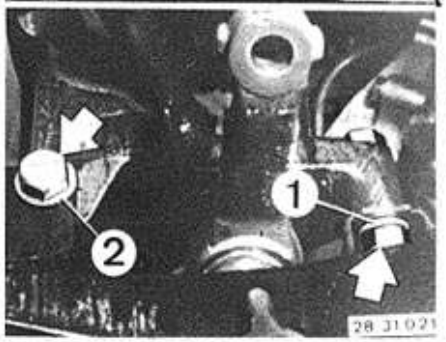
* See Specifications of Gr. 11/31

* See Specifications of Gr. 31

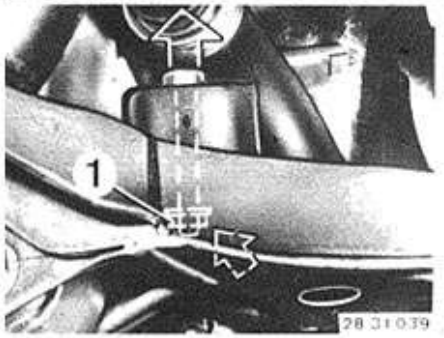
31 11 001 REPLACING FRONT AXLE CARRIER



Unscrew control arm on mount (3) at left and right sides.
4 = Washer (both sides)
Installation:
Replace self-locking nuts.
Tightening torque* for car loaded down to normal position*.
Check front wheel alignment with optical tester – see 32 00 034.

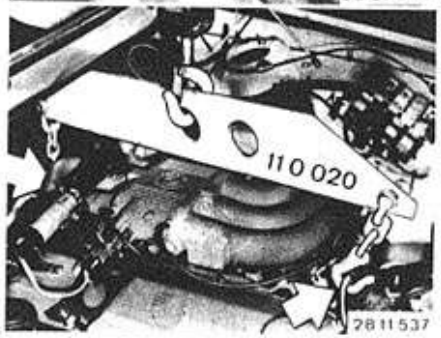


Unscrew steering gear mounting bolts.
1 = Washer
2 = Washer (both sides)
Suspend steering gear from car on a piece of wire.
Installation:
Replace self-locking nuts.
Tightening torque*.

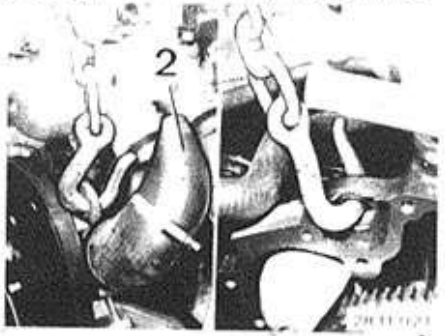


Unscrew steering guide arm.
1 = Washer
Installation:
Replace self-locking nut.
Tightening torque*.

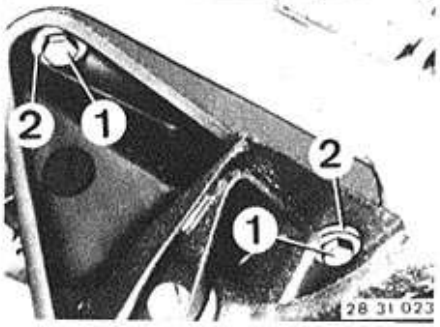
Unscrew engine mounts at bottom left and right.
Loosen engine mount at top right.
Installation:
Check for correct installed position.
Turning lock of mount must be in bore (1).
Tightening torque*.



Engines M 20 and M 21:
Attach Special Tool 11 0 020 on engine.



Engine M 30:
Drain some of coolant.
Disconnect water hose (2).
Attach Special Tool 11 0 020 on engine.
Installation:
Fill and bleed cooling system, see 17 00 039.

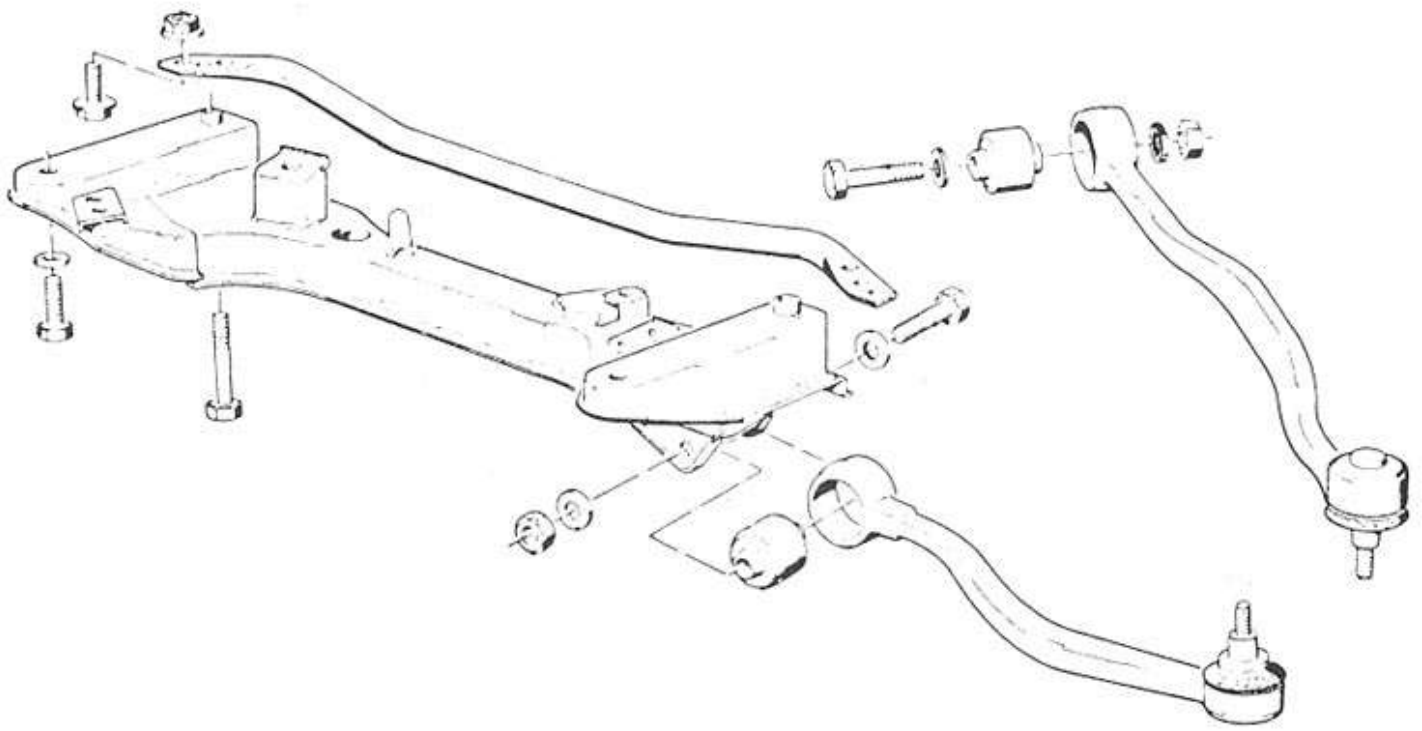


Unscrew engine carrier bolt (1).
Installation:
Install bolts with washers (2).
Tightening torque*.

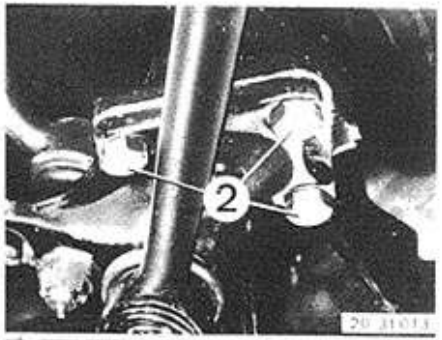
* See Specifications of Gr. 31/32

* See Specifications of Gr. 11/31

FRONT WHEEL SUSPENSION LAYOUT DRAWING

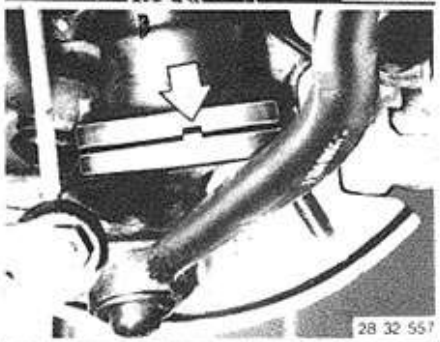


630 31 100

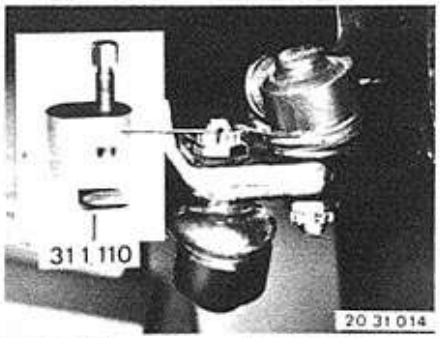


31 12 001 REMOVING AND INSTALLING LEFT OR RIGHT CONTROL ARM

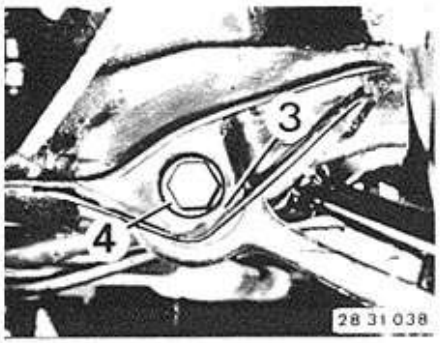
Remove and install front wheel 36 10 300.
Unscrew bolts (2).
Lift off tie rod arm on spring strut.
Installation:
Clean threads of bores and bolts.
Lock bolts with bolt cement**.
Tightening torque*.



Check for correct installed position.

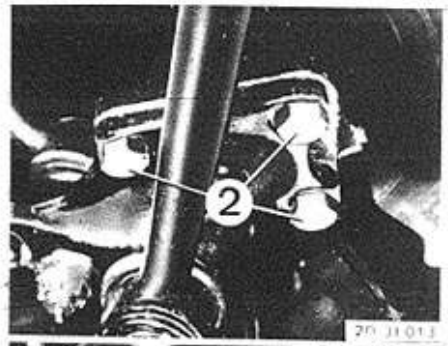


Remove cotter pin and unscrew castle nut.
Press off ball joint with Special Tool 31 1 110.
Installation:
Clean ball journal and bores to remove grease and dirt.
Tightening torque*.
Lock nut with cotter pin.



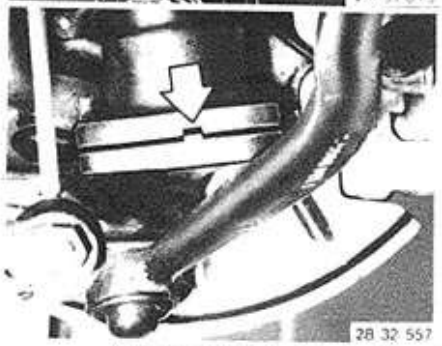
Unscrew control arm on mount (3).
4 = Washer (both sides)
Installation:
Replace self-locking nut.
Tightening torque* for a car in normal position*.

* See Specifications of Group 31/32
** Source: HWB

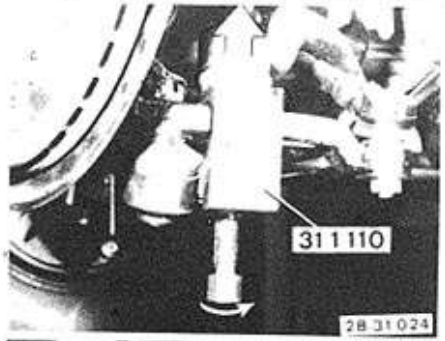


31 12 090 REMOVING AND INSTALLING OR REPLACING LEFT OR RIGHT THRUST STRUT

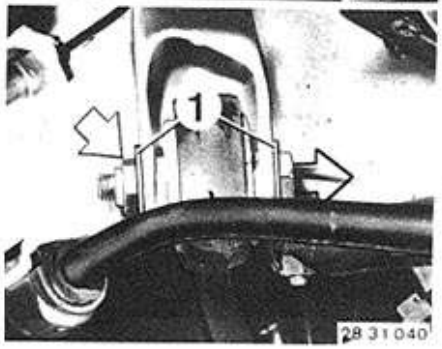
Remove front wheel 36 10 300.
Unscrew bolts (2).
Lift tie rod arm off of spring strut.
Installation:
Clean threads of bores and bolts.
Install bolts with bolt cement**
Tightening torque*.



Check for correct installed position.

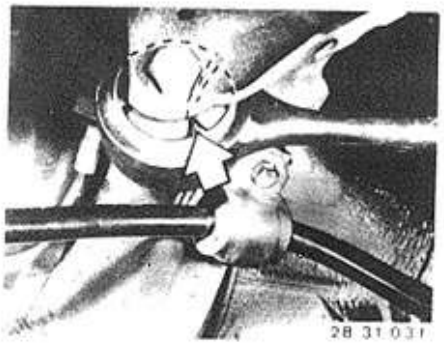


Remove cotter pin and unscrew nut.
Press off ball joint with Special Tool 31 1 110.
Installation:
Clean bore to remove grease and dirt.
Tightening torque*.
Lock castle nut with a cotter pin.

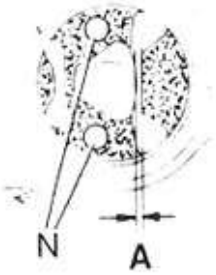


Unscrew thrust strut on mount.
Installation:
Thrust struts are marked with
L for left or
R for right.
Replace self-locking nuts.
1 = Washer (both sides)
Tightening torque* for a car in normal position*.

* See Specifications of Gr. 31/32
** Source: HWB

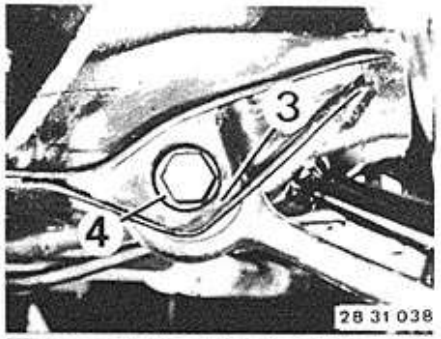


Checking Thrust Strut Mounts:
Car loaded down to normal position*.
Measure distance between rubber mount and centering sleeve with a feeler gage blade.



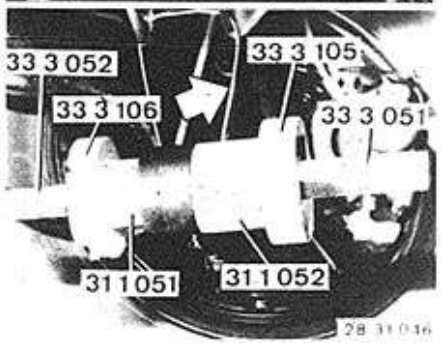
A = 0.8 to 1.8 mm (0.031 to 0.071").
Important!
Engine M 20:
Rubber mount without beads (N).
Engines M 21 and M 30:
Rubber mount with beads (N).
Replace thrust strut mount (see 31 12 147), if measured distance is smaller or greater than specified distance.

* See Specifications of Gr. 32

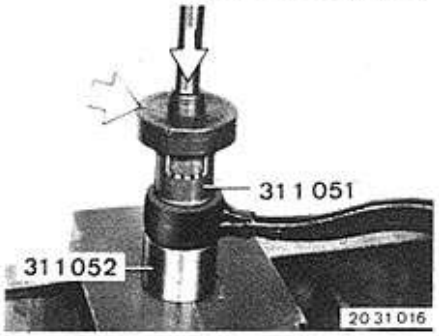


31 12 130 REPLACING RUBBER MOUNT IN LEFT OR RIGHT CONTROL ARM

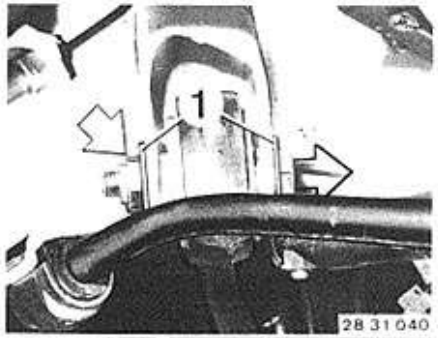
Unscrew control arm on bracket (3).
Installation:
4 = Washer (both sides)
Replace self-locking nut.
Tightening torque* for car loaded down to normal position*.



Suspend control arm from car on piece of wire (prevents damage on ball joint).
Pull out rubber mount with Special Tools 31 1 051 / 052 and 33 3 051 / 052 / 105 / 106.
Installation:
Rubber mount and control arm bore free of grease.
Pull in rubber mount from bevelled side of control arm.



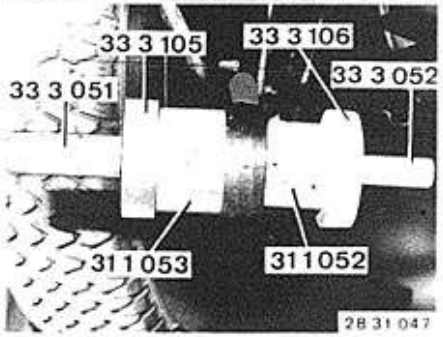
Control Arm Removed:
Press rubber mount out and in on a press with Special Tool 31 1 051 / 052.



31 12 147 REPLACING RUBBER MOUNT IN LEFT OR RIGHT THRUST STRUT

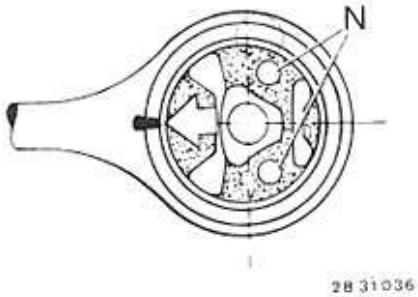
Unscrew bolt.
Installation:
1 = Washer (both sides)
Replace self-locking nut.
Tightening torque* for car loaded down to normal position*.

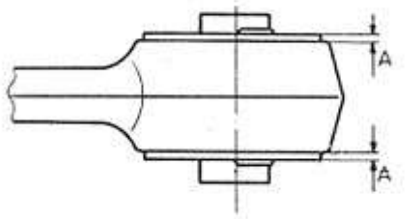
Important:
Always replace both .



Pull out rubber mount with Special Tools 31 1 052 / 053 and 33 3 051 / 052 / 105 / 106.

Installation:
Check Rubber Mount Codes:
Engine M 20 = without beads
Engine M 21 = with beads (N)
Engine M 30 = with beads (N)

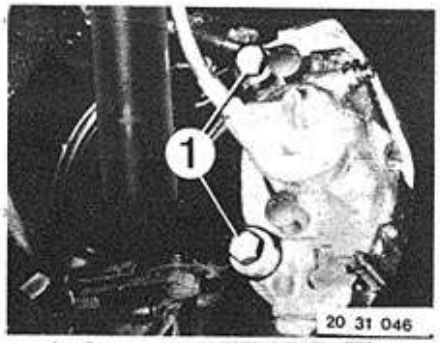




Rubber mount and thrust strut bore free of grease.
Pull in rubber mount with special tools that arrow faces mark.
Protrusion (A) must be uniform.

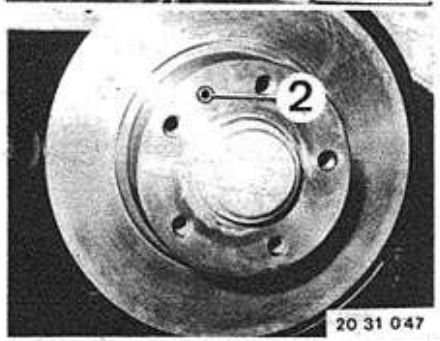
* See Specifications

* See Specifications

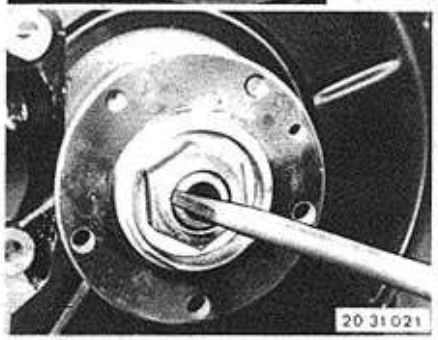


31 21 180 REPLACING BEARINGS (WHEEL HUB) FOR FRONT WHEEL

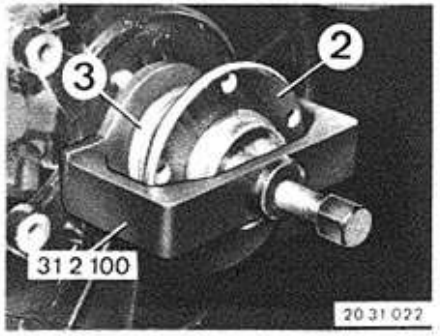
Remove and install front wheel 36 10 300.
Unscrew bolts (1).
Installation:
Tightening torque*.



Pull off and suspend brake caliper with a piece of wire.
Wires and brake line remain connected.
Unscrew bolt (2) with Special Tool 34 1 020.
Remove brake disc.

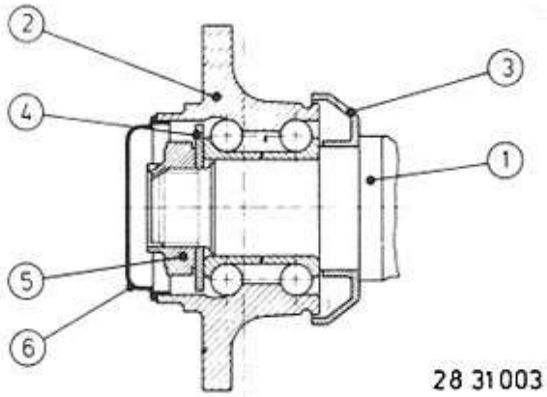


Pry off grease cap.
Chisel locking edge of nut out of groove.
Unscrew nut with Special Tool 31 2 080.
Important:
Use grease cap only once. Fit new grease cap with sealing compound HWB no. 81 22 8 407 420.

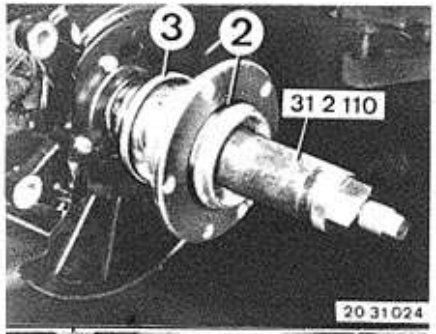


Pull off bearing assembly (2) and cover (3) with Special Tool 31 2 100.

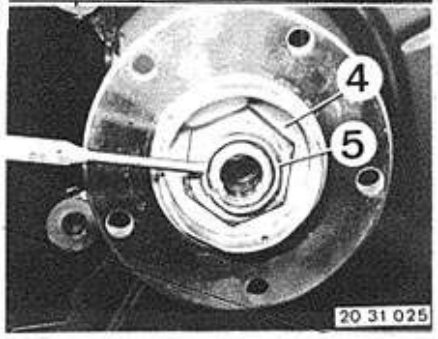
* See Specifications of Gr. 34



Wheel Bearings
1 = Stub axle
2 = Bearing assembly
3 = Cover
4 = Washer
5 = Nut
6 = grease cap
Important!
Bearing assembly is permanently lubricated for service life and cannot be disassembled.



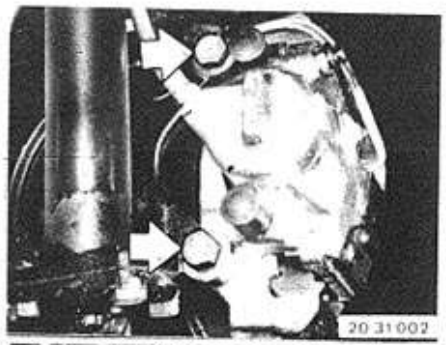
Place cover (3) on stub axle.
Pull on bearing assembly (2) and cover (3) with Special Tool 31 2 110.



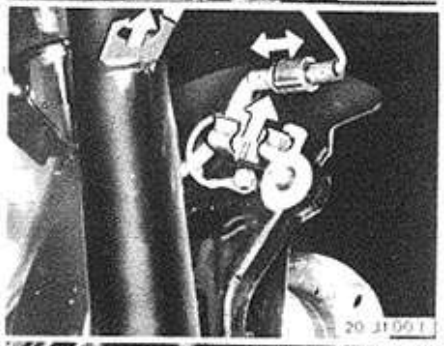
Install washer (4) and new nut (5).
Tighten nut to correct torque* and lock in groove
Pack grease cap with grease* and press on to hub.

* See Specifications of Gr. 31

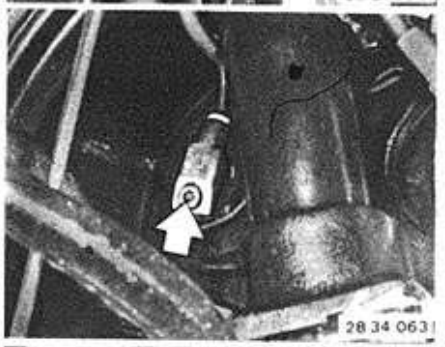
31 31 000 REMOVING AND INSTALLING LEFT OR RIGHT SPRING STRUT ASSEMBLY



Remove and install front wheel 36 10 300.
Disconnect and suspend brake caliper with a piece of wire.
Brake line remains connected.
Installation:
Tightening torque*.



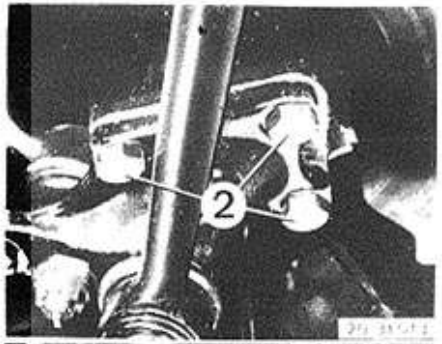
Left Side:
Lift plug out of clip and rubber grommet out of holder.
Disconnect ground wire.
Disconnect plug.



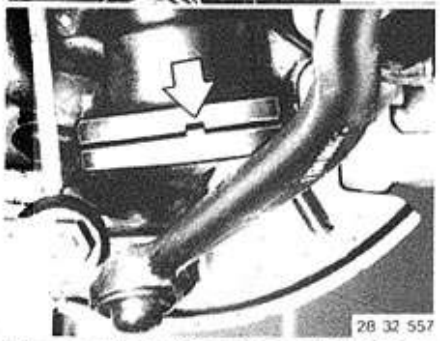
Cars with ABS:
Remove ABS pulse transmitter.

Disconnect stabilizer push rod.
Hold with fork wrench.
Installation:
Tightening torque*.

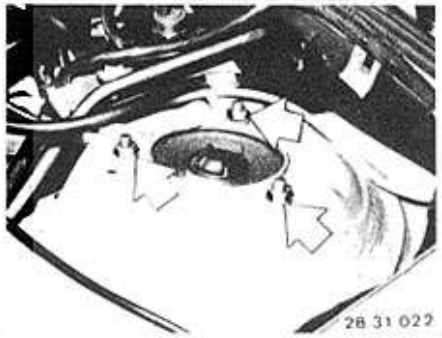
* See Specifications of Gr. 31/34



Unscrew bolts (2) on tie rod arm.
Installation:
Clean threads of bores and bolts.
Lock bolts with bolt cement**.
Tightening torque*.



Check for correct installed position.



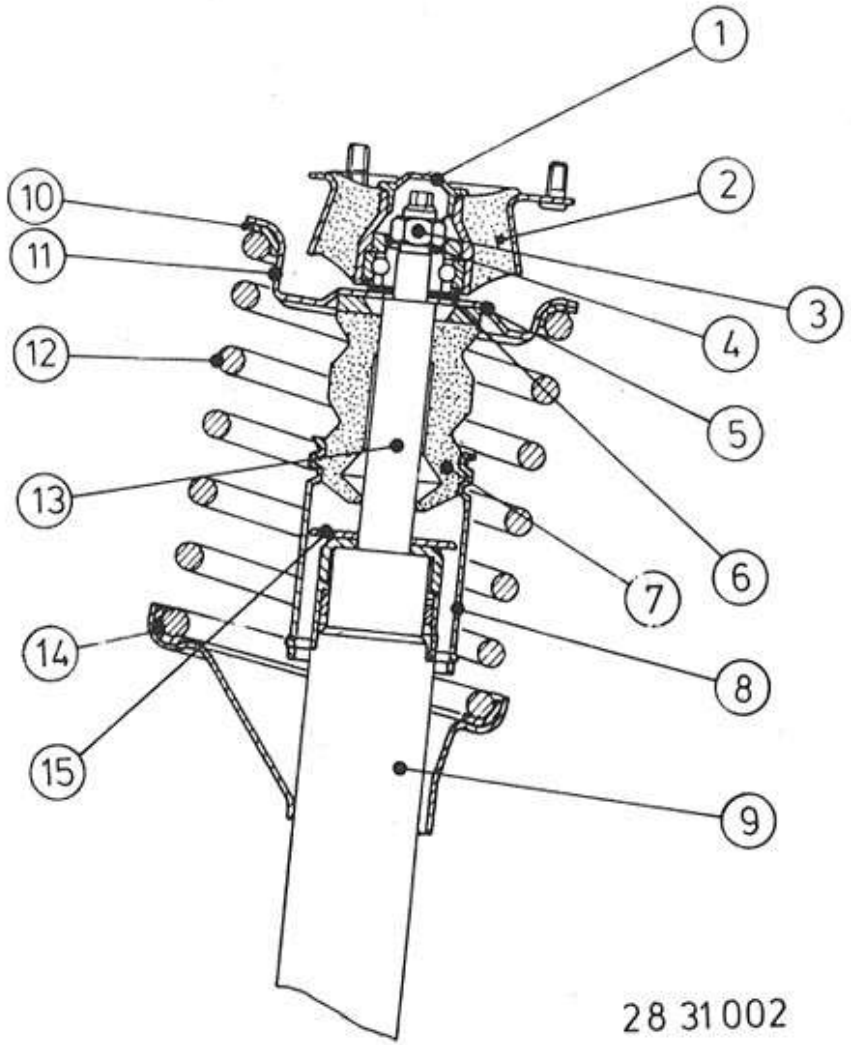
Support spring strut shock absorber.
Unscrew spring strut mount on wheel house.
Installation:
Replace self-locking nut.
Tightening torque*.

Important!
Always store shock absorbers standing upright. If shock absorbers are stored laying down with piston rods run in, they could cause a rattling noise when used again.
Correction:
Store shock absorbers standing upright, with piston rods run out at room temperature 24 hours.

* See Specifications of Gr. 31
** Source: HWB

SPRING STRUT ASSEMBLY DRAWING – ENGINES M 20 / M 30

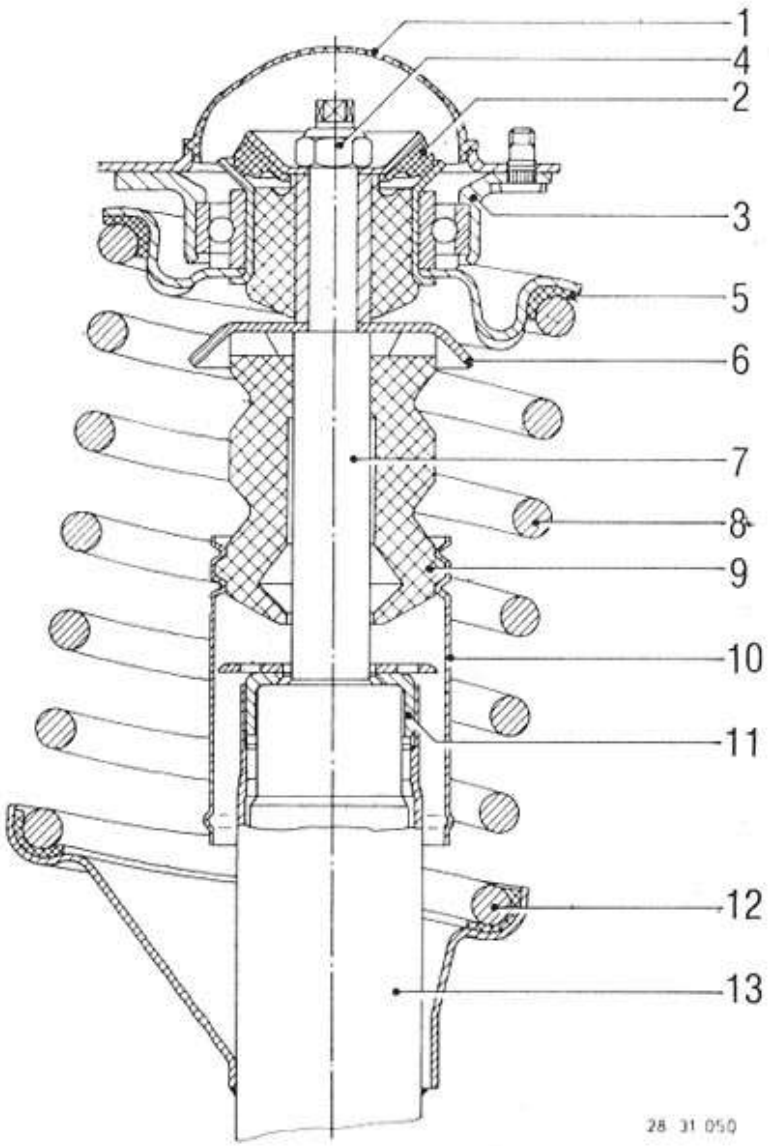
1 = Cap
2 = Mount
3 = Self-locking nut
4 = Washer
5 = Insulator
6 = Washer
7 = Rubber damper
8 = Protective tube
9 = Shock absorber
10 = Upper rubber ring
11 = Upper spring retainer
12 = Coil spring
13 = Shock absorber piston rod
14 = Lower rubber ring
15 = Screw-on ring

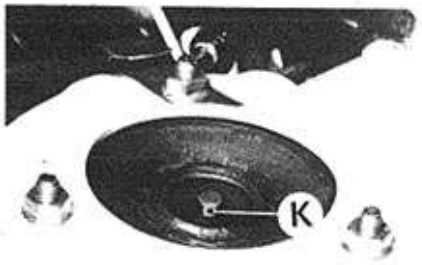


31-10a

SPRING STRUT ASSEMBLY DRAWING – ENGINE M 21

1 = Cap
2 = Rubber mount
3 = Mount
4 = Self-locking nut
5 = Upper rubber ring
6 = Washer
7 = Shock absorber piston rod
8 = Coil spring
9 = Rubber damper
10 = Protective tube
11 = Screw-on ring
12 = Lower rubber ring
13 = Shock absorber

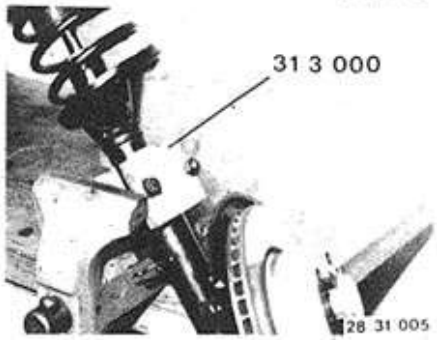




28 31 035

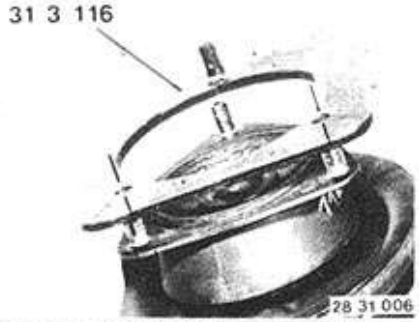
31 32'001 REPLACING LEFT OR RIGHT FRONT SPRING STRUT SHOCK ABSORBER

Important!
Always replace a shock absorber with one having same code* K.
To know whether shock absorbers have to be replaced, check installed absorbers with a "Shok Tester" or removed in a shock absorber testing machine.



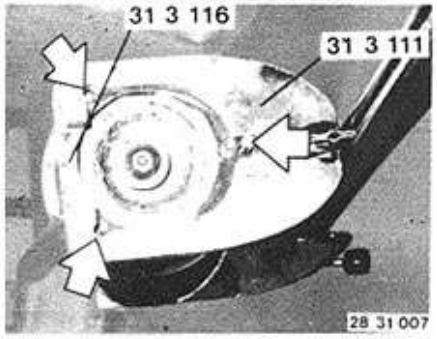
28 31 005

Remove and install spring strut assembly 31 31 000.
Clamp spring strut in a vise with Special Tool 31 3 000.



28 31 006

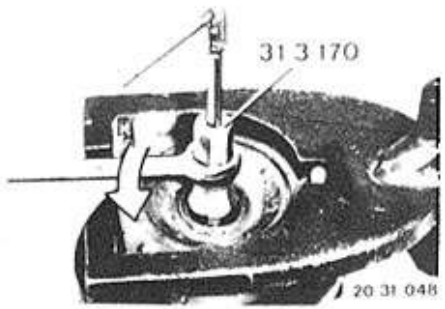
Apply Special Tool 31 3 116 on mount.



28 31 007

Compress coil spring with Special Tool 31 3 111.
Important!
Bolt of mount and Special Tool 31 3 116 must be in openings.

* See Specifications of Gr. 31

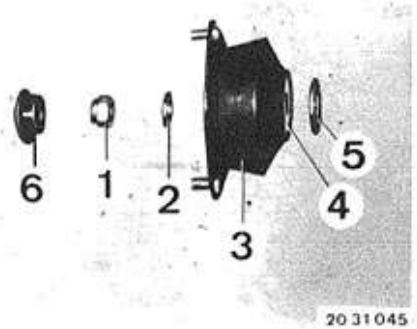


20 31 048

Lift off end cap.
Unscrew self-locking nut with Special Tool 31 3,170, while holding on piston rod.
Installation:
Replace self-locking nut.
Tightening torque*.

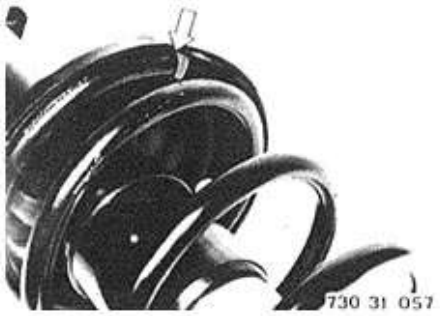
Remove washer (2).
Screw in Special Tool 31 3 115 entire length of threads.
Release and remove spring compressor tool.

28 31 020



20 31 045

Lift off mount.
Installed Order – Engines M 20 / M 30:
1 = Self-locking nut
2 = Washer with small diameter
3 = Mount
4 = Insulator
5 = Washer with large diameter
6 = Cap
Inside curved surface of insulator (4) faces mount.
Installed Order – Engine M 21:
See page 31 - 10a



730 31 057

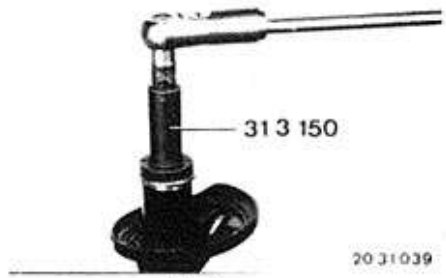
Take off upper spring retainer with rubber ring and coil spring.
Installation:
Check upper and lower rubber rings, replacing if necessary.
Ends of coil springs must fit on shoulders in lower and upper spring retainers.

* See Specifications of Gr. 31

Installation:
Check protective tube and rubber damper, replacing if necessary.

20 31 038

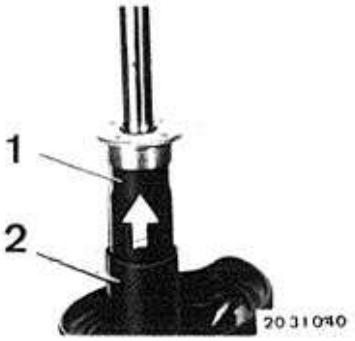
Unscrew threaded ring with Special Tool 31 3 150.
Installation:
Tightening torque*.



20 31 039

Gas Pressure Absorbers:
Unscrew threaded ring with Special Tool 31 3 190.
Installation:
Tightening torque*

28 31 045

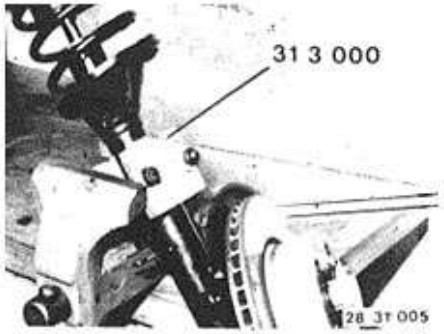


20 31 040

Pull out shock absorber (1).
Installation:
Remove old oil from spring strut tube (2).
Fill new shock absorber with engine oil** prior to installing.
Engine oil will carry off heat from shock absorber to the spring strut tube.
Important!
Front axle gas pressure struts must not be installed with oil.
See Service Information of Group 37.
Only store shock absorbers standing upright. If shock absorbers are stored laying down, with their piston rods run in, this could lead to rattling or knocking noise when used in car again.
Remedy:
Store shock absorbers in upright position with piston rod run out at room temperature for 24 hours.

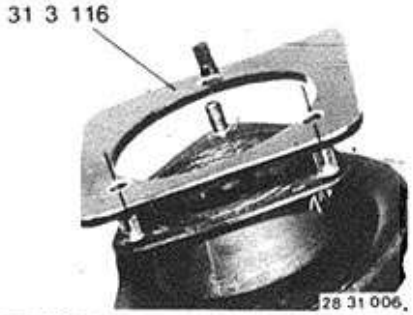
* See Specifications of Gr. 31

** See Service Information of Gr. 00

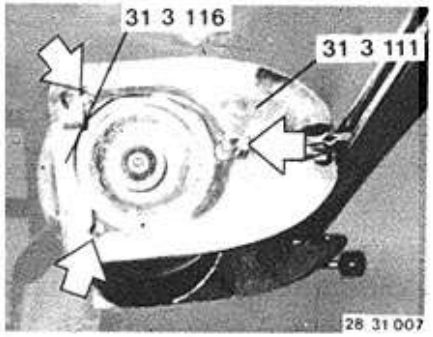


31 33 001 REPLACING LEFT OR RIGHT SPRING STRUT MOUNT

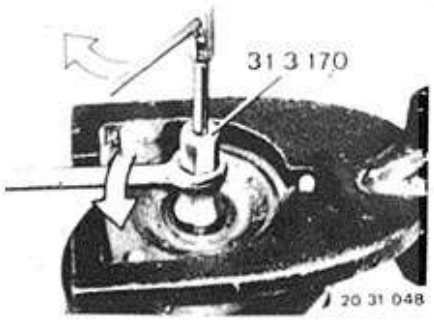
Remove and install spring strut assembly 31 31 000.
Clamp spring strut in a vise with Special Tool 31 3 000.



Apply Special Tool 31 3 116 on mount.

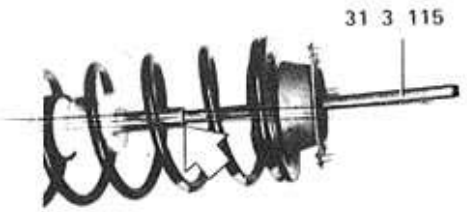


Compress coil spring with Special Tool 31 3 111.
Important!
Bolts on mount and Special Tool 31 3 116 must fit in openings.

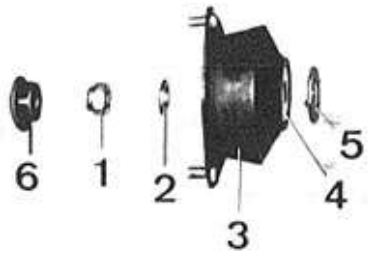


Pull off end cap.
Unscrew self-locking nut with Special Tool 31 3 170, counterholding on piston rod.
Installation:
Replace self-locking nut.
Tightening torque *.

* See Specifications of Gr. 31

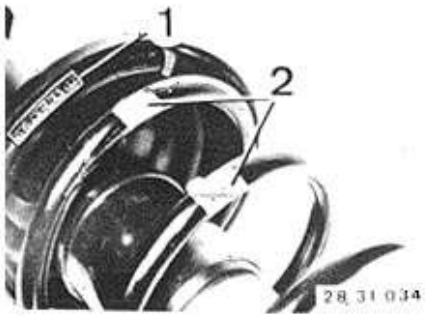


Remove washer (2).
Screw in Special Tool 31 3 115 entire length of threads.
Release and remove coil spring compressor tool.



Lift off mount.
Installed Order – Engines M 20 / M 30:
1 = Self-locking nut
2 = Washer with small diameter
3 = Mount
4 = Insulator
5 = Washer with large diameter
6 = Cap
Inside curved surface of insulator (4) faces mount.
Installed Order – Engine M 21:
See page 31 - 10a

Lift off upper spring retainer with rubber ring and coil spring.
Installation:
Check upper and lower rubber rings, replacing if necessary.
Ends of coil spring must fit on shoulders in lower and upper spring retainers.

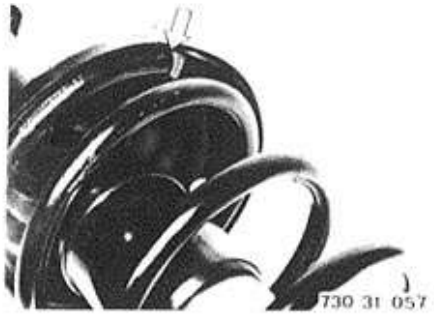


31 33 100 REMOVING AND INSTALLING OR REPLACING COIL SPRING FOR LEFT OR RIGHT FRONT SPRING STRUT

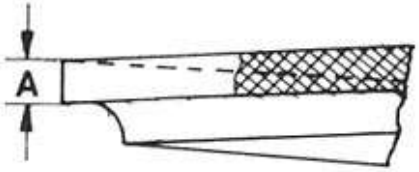
Remove spring strut mount 31 33 001.
Take off upper spring retainer with rubber ring and coil spring.
Important!
Only install pairs of springs with same BMW number (1) (located on end of spring) and same color code (2) (either with or without red paint stripe) on one axle.
Refer to spare part microfiche for cross reference of springs according to vehicle type and, if applicable, special equipment (e.g. air conditioner, sport suspension, etc.) as well as dates of introduction.
The BMW number on the spring can be used to determine the spare part number and therefore the correct spring for a pertinent vehicle type according to the spare part microfiche.
Example:

1. Spring with red color code:
   Number on spring = 1 125 332
   Add 1 = part number = 1 125 333
2. Spring without red color code:
   Number on spring = 1 125 332
   Add 2 = part number = 1 125 334

Installation:
Check protective tube and rubber damper, replacing if necessary.



Installation:
Check upper and lower rubber rings, replacing if necessary.
Ends of coil spring must fit on shoulders in lower and upper spring retainers.

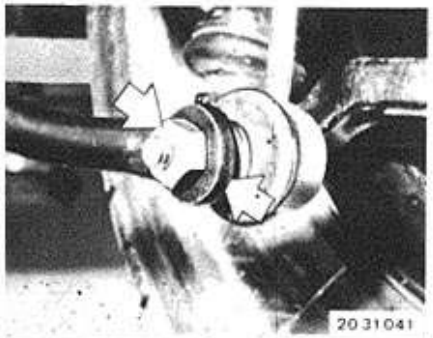


Installation:
Use upper rubber ring* with thickness (A) for springs with red color code.
A = 9 mm (0.354").

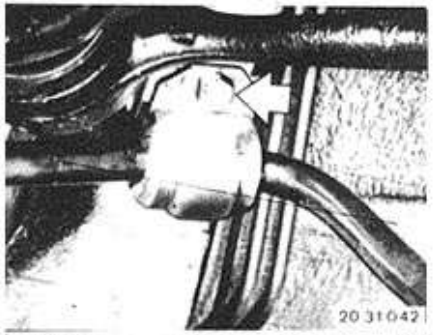
28 31 011

* See Specifications of Gr. 31

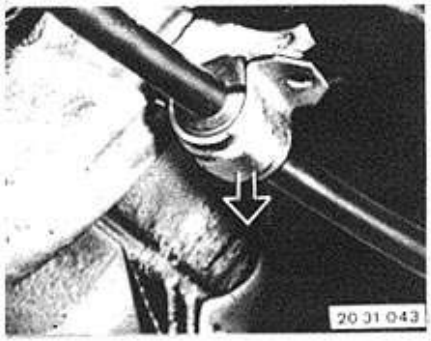
31 35 000 REMOVING AND INSTALLING STABILIZER



Disconnect push rods on left and right sides.
Hold on ball socket joint with a fork wrench.
Installation:
Tightening torque*.



Unscrew bolts.
Installation:
Tightening torque*.



Press off retaining clamps and stabilizer.
Installation:
Slotted end of rubber mount faces forward rear.

* See Specifications of Gr. 31

TROUBLESHOOTING FRONT AXLE

Condition	Cause	Correction
Grinding noise (louder in curves)	a) Wheel bearings defective	a) Replace wheel bearings
Vibration	a) Wheels imbalanced	a) Balance wheels
	b) Rims have lateral/radial runout	b) Replace rims, if necessary
	c) Tires have radial runout	c) Match or replace tires
Steering wheel shake	a) Wheels imbalanced	a) Balance wheels
	b) Rims have lateral/radial runout	b) Replace rims, if necessary
	c) Shock absorber effect insufficient	c) Replace shock absorbers
	d) Thrust strut mount defective	d) Replace thrust strut mount 31 12 090
	e) Wrong thrust strut mount installed	e) Replace thrust strut mount 31 12 090
	f) Steering gear play excessive	f) Adjust pressure point
Rattling noise	a) Shock absorber cartridge loose in spring strut	a) Tighten threaded ring (check threads)
	b) Ball joint on control arm worn	b) Replace control arm
	c) Ball joint on thrust rod worn	c) Replace thrust rod
	d) Stabilizer rubber mount worn	d) Replace rubber mount
	e) Ball joints of push rod worn	e) Replace push rod
	f) Front axle carrier mounted loosely on body	f) Tighten (check threads)

TROUBLESHOOTING FRONT AXLE.

Condition	Cause	Correction
Long after-swinging of body after passing over rough road	Shock absorber efficiency weak (see Troubleshooting Shock Absorbers)	Replace shock absorbers
Wipping of body when passing over successive rough road surfaces	Shock absorber efficiency weak (see Troubleshooting Shock Absorbers)	Replace shock absorbers
Rising of body when accelerating	Shock absorber efficiency weak (see Troubleshooting Shock Absorbers)	Replace shock absorbers
Wheels jumping even on normal road surfaces	Shock absorber efficiency weak (see Troubleshooting Shock Absorbers)	Replace shock absorbers
Car breaking out when braking	Shock absorber efficiency weak (see Troubleshooting Shock Absorbers)	Replace shock absorbers
Breaking out (skidding) in curves due to poor track holding	Shock absorber efficiency weak (see Troubleshooting Shock Absorbers)	Replace shock absorbers

TROUBLESHOOTING SHOCK ABSORBERS

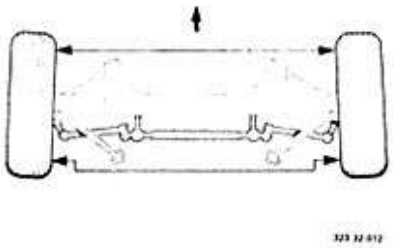
The condition of shock absorbers can only be checked with a Shock Tester or in a shock absorber testing machine.

Condition	Cause	Correction
Shock absorbers knocking (bottoming)	a) Rubber damper defective	a) Check/replace rubber damper
	b) Shock absorber efficiency insufficient	b) Replace shock absorber
Shock absorber noise	a) Shock absorber cartridge loose	a) Tighten screw-on ring – inspect threads
	b) Installed shock absorber had been stored laying down with piston rod run in	b) Store shock absorber standing upright at room temperature 24 hours and with piston rod run out
	c) Shock absorber defective	c) Replace shock absorber
Poor handling	a) Shock absorber efficiency weak	a) Replace shock absorber
Flat spots on tire treads	a) Shock absorber defective	a) Replace shock absorber

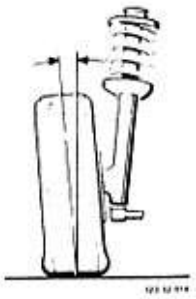
32 Steering and wheel alignment

Supplement restraint system

GENERAL INFORMATION / DEFINITIONS



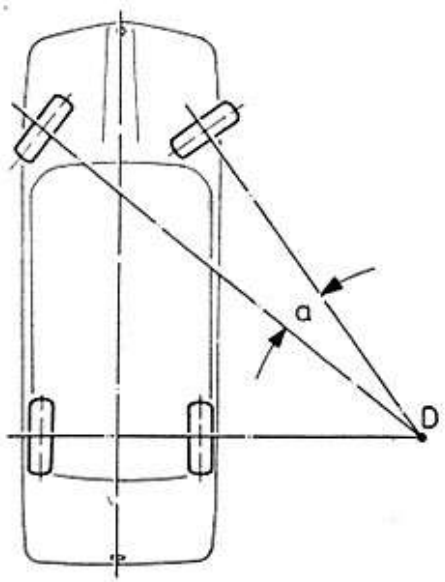
TOE
is the reduction in distance of front of front wheels to rear of front wheels. Toe prevents the wheels from running apart while driving and consequently wheel shimmy and grinding, excessive tire wear, excessive loads on steering linkage and joints as well as hard steering of car. Toe is measured in "straight ahead position".



CAMBER
is the inclination of the wheel to the car's axial plane, measured in the car's lateral plane with "straight ahead drive".

KING PIN INCLINATION
is the angle, by which the king pin is iclined inward from a perpendicular line to the lateral axis of the car.
The king pin inclination produces returning forces, which return the road wheels and steering wheel to straight ahead after driving through a curve or around a corner.

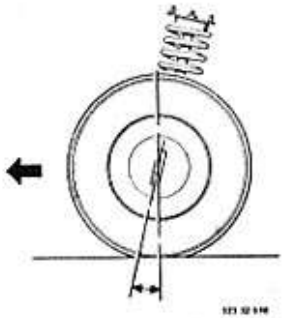
Camber and king pin inclination determine the location of the wheel contact point with the road surface. King pin inclination reduces the leverage, on which frictional forces are engaged, which makes it easier to turn the wheels to left or right lock. In addition, the jolts from rough road surfaces do not have strong influence on the steering.



323 32 013

TOE DIFFERENCE ANGLE
is the angular position of the wheel on the inside of a curve to the wheel on the outside of a curve when driving in a curve. The steering is designed that the angular position of the wheels changes as steering lock progresses. The toe difference angle provides information on the pertinent operation of the steering trapezoid for left or right steering lock from the center position. A correctly adjusted toe difference angle produces equal values for left and right lock in due consideration for plant tolerances.

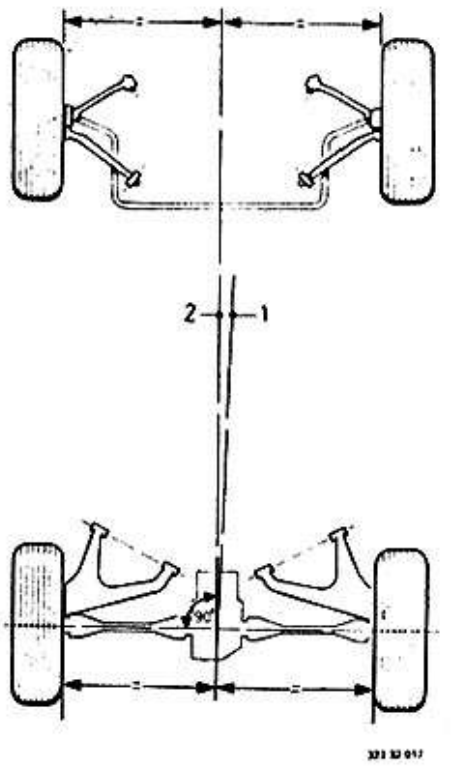
a = Toe difference angle
D = Turning circle center point



CASTER
is the inclination of the king pin* in forward direction as seen from the side.

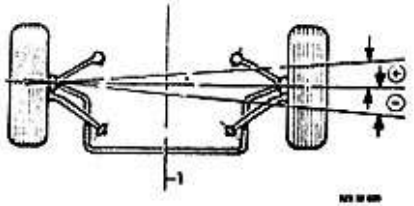
The wheels are pulled and not pushed because of caster. In a similar manner to king pin inclination, when driving in curves or around corners, returning forces are produced to help return the wheels to straight ahead position.

The "king pin" is equal to a line through the center point of the spring strut mount and control arm ball joint.



GEOMETRICAL AXIS 1
is the bisecting line of an angle from the total rear wheel toe. Front wheel measurements are taken in reference to this axis.

SYMMETRICAL AXIS 2
is a center line running through the front and rear axles.



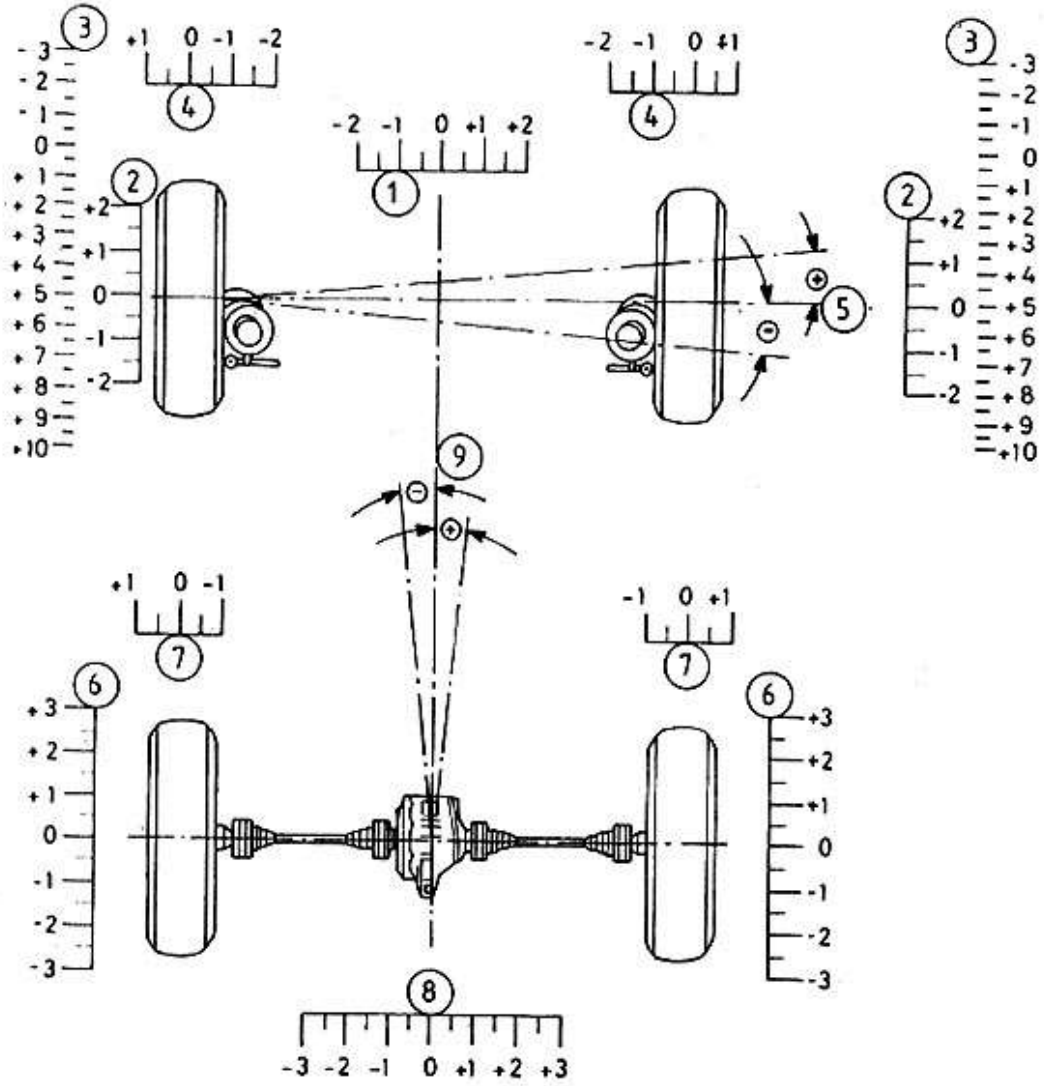
WHEEL OFFSET
is the angle, by which one front wheel is displaced more toward front or rear than the other front wheel.

CHECKING AND ADJUSTING ALIGNMENT OF FRONT WHEELS AND REAR WHEELS WITH OPTICAL TESTER

32 00 034
32 00 054

Requirements prior to checking wheel alignment:
1. Good, uniform tire treads.
2. Specified tire inflation pressure**.
3. Wheel rims in perfect condition*.
4. Specified wheel bearing play
5. Car brought to normal position*.
6. Specified height*.

Check actual values with an optical tester.
Fill in test sheet.
Nominal values*.



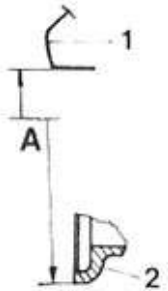
1 = Toe
2 = Camber
3 = Caster (with 10° or 20° wheel lock)
4 = Toe difference angle (with 20° wheel lock)
5 = Wheel offset
6 = Camber
7 = Rear wheel position
8 = Toe
9 = Geometrical axis

730 32 001

* See Specifications of Gr. 31/32/33/36
** See Service Information of Gr. 36

TROUBLESHOOTING FRONT WHEEL ALIGNMENT

Condition	Cause	Correction
1 Toe deviation	a) Car not in normal position b) Tie rod(s) bent c) Track arm on spring strut deformed d) Tie rod ball joints worn e) Rubber mount in control arm defective	a) Height level, see Specifications of Group 31 b) Replace tie rod(s) c) Replace track arm d) Replace tie rods or ball joints e) Replace rubber mount
2 Camber deviation Camber is given by design and cannot be adjusted.	a) Rubber mount in control arm defective b) Control arm deformed c) Spring strut deformed d) Guide joint worn e) Suspension sag excessive f) Front axle carrier deformed g) Spring strut mount holder deformed h) Distortion in floor assembly (engine carrier) i) Unfavorable summation of tolerances	a) Replace rubber mount b) Replace control arm c) Replace spring strut d) Replace control arm e) Replace coil springs Height level, see Specifications of Group 31 f) Replace front axle carrier g) Repair front end of body h) Repair body i) Install eccentric mount
3 Caster deviation Caster is given by design and cannot be adjusted.	a) Strut bent b) Rubber mount for strut defective c) Control arm bent d) Spring strut deformed e) Wheel house (spring strut mount) deformed f) Distortion in floor assembly (engine carrier)	a) Replace strut b) Replace rubber mount c) Replace control arm d) Replace spring strut e) Repair front end of body f) Repair body
4 Toe difference angle deviation	Assuming camber and caster are correct: a) Tie rods not adjusted uniformly b) Track arm on spring strut bent	a) Adjust toe to same value on left and right sides b) Replace track arm
5 Wheel offset deviation (alignment tester Type F 1600)	Assuming front wheels have equal single toe to geometrical axis: a) Front axle carrier deformed b) Engine carrier deformed c) Control arm deformed d) Strut deformed	a) Replace front axle carrier b) Repair body c) Replace control arm d) Replace strut

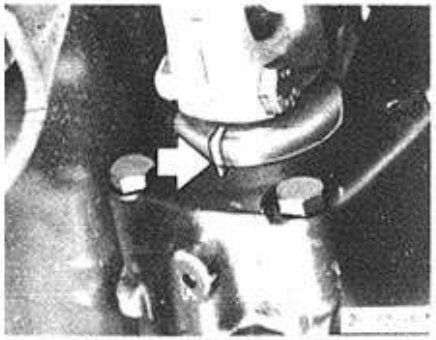


32 00 004 ADJUSTING TOE AND TOE DIFFERENCE ANGLE

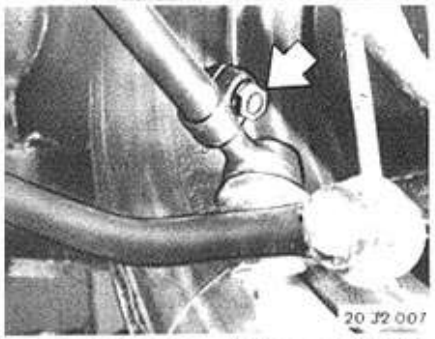
Measuring Height Level:
Measure on all wheels, from wheel house lower edge (1) to ring flange (2) at height of wheel center.
A = Nominal value**.

Correcting Camber:
The front axle camber can be corrected by ± 30' with the installation of eccentric mounts, if camber correction is necessary due to summation of unfavorable tolerances (not 524 td).
Important!
Changes in axle geometry (axle – body) caused in an accident may not be eliminated with this measure.

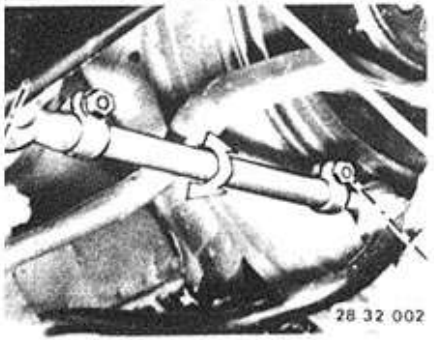
28 32 091



Set steering gear to straight ahead position (marks on case and spindle).



Loosen both tie rod bolts.
Installation:
Tightening torque* for car loaded down to normal position*.

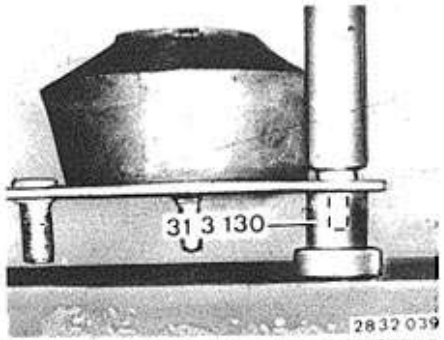


Adjust toe on left and right wheels to nominal value* by turning threaded sleeves.
Installation:
Make sure ball joints are not turned.

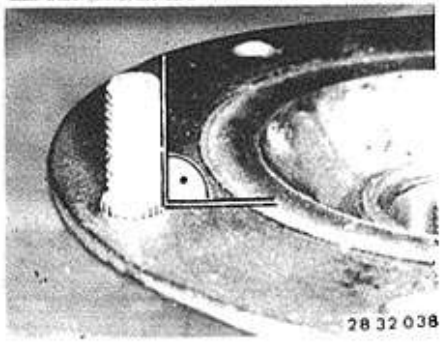
* See Specifications
** See Specifications of Gr. 31/33

Example:

Camber nominal value:	+ 10' ... – 50'
Camber actual value:	– 1° 10'
+ correction	+ 30'
New actual value:	– 40'



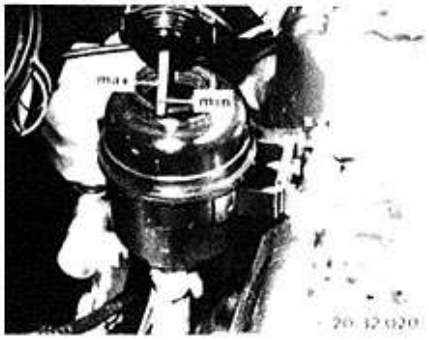
Eccentric mounts are marked at bores with "+" and "–".
Press knurled head bolts into "+" or "–" bores as required (see example) with Special Tool 31 3 130.



Important!
Knurled head bolts must be perpendicular in mounts and flush.
Replace front spring strut mounts 31 33 001.

TROUBLESHOOTING REAR WHEEL ALIGNMENT

Condition	Cause	Correction
6 Camber deviation	a) Car not in normal position/suspension sag excessive b) Rubber mount on rear axle carrier defective c) Rubber mount on final drive defective d) Silent blocks in trailing arm defective e) Rear axle carrier deformed f) Trailing arm deformed g) Distortion in floor assembly	a) Height level, see Specifications of Group 31 b) Replace rubber mount c) Replace rubber mount d) Replace silent blocks e) Check or replace rear axle carrier f) Check or replace trailing arm g) Repair body
7 Rear wheel position deviation	a) Rear axle carrier displaced laterally b) Distortion in floor assembly	a) Check rubber mount on rear axle carrier, replacing if necessary b) Repair body
8 Toe deviation	a) Car not in normal position or suspension sag excessive b) Rubber mount on rear axle carrier defective c) Rubber mount on final drive defective d) Silent blocks in trailing arm defective e) Rear axle carrier deformed f) Trailing arm deformed g) Summation of unfavorable tolerances	a) Height level, see Specifications of Group 31 b) Replace rubber mount c) Replace rubber mount d) Replace silent blocks e) Check rear axle carrier, replacing if necessary f) Check or replace trailing arm g) Install eccentric silent blocks, see 33 22 561
9 Geometrical axis deviation (alignment tester Type F 1600)	Assuming total rear wheel toe is correct: a) Distortion in floor assembly	a) Repair body



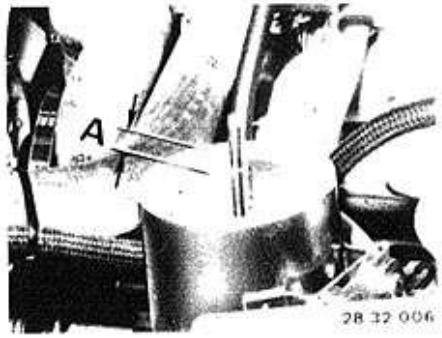
32 13 006 FILLING AND BLEEDING POWER STEERING

A) Cars Without Hydraulic Brake Boost:

1. Filling With Engine Stopped:
   Fill oil tank up to "MAX" mark on oil dipstick.

2. Bleeding:
   Start engine.
   Turn steering twice each against left and right lock.

3. Check oil level with engine stopped.
   Correct hydraulic fluid* level up to "MAX" mark.



B. Cars With Hydraulic Brake Boost:

1. Filling With Engine Stopped:
   Fill oil tank up to (A) = approx. 25 mm (1") below edge.

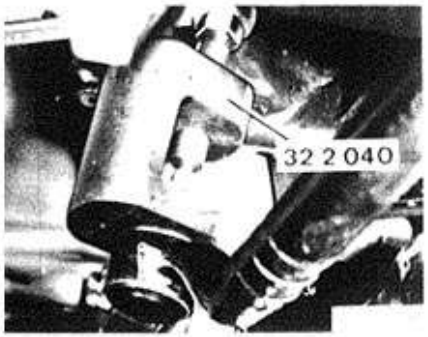
2. Filling and Bleeding With Running Engine:

2.1 Filling:
   Pour in remaining hydraulic fluid* uniformly while starting the engine.

2.2 Bleeding:
   Turn steering wheel twice each against left and right lock. Operate brake pedal 5 times, wait approx. 30 seconds and then operate brakes another 5 times.

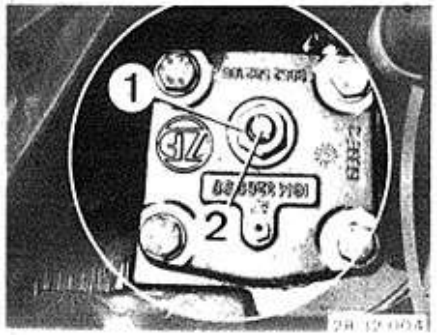
3. Checking Oil Level With Engine Stopped:
   Operate brake pedal until reservoir is discharged (reservoir is empty when oil level stops rising – visual check – or when force on pedal increases suddenly – force test –). Oil level should be approx. 10 mm (0.394") below upper edge of tank when brake pedal is released.
   Correct wrong oil level with engine stopped.

* See Service Information of Gr. 00

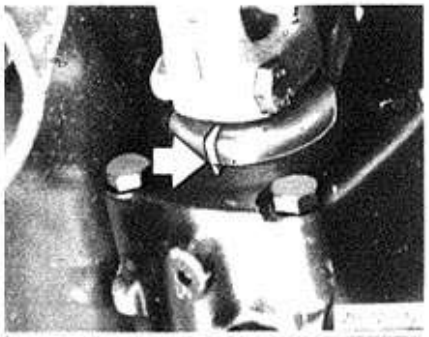


32 13 014 ADJUSTING PRESSURE POINT

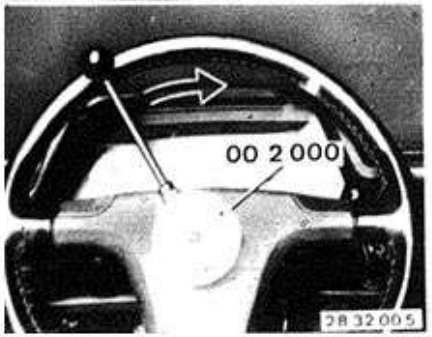
Requirements:
Steering gear and mounts/joints of steering column in perfect condition.
Remove cotter pin and unscrew castle nut.
Pry tie rod off of steering drop arm with Special Tool 32 2 040.
Installation:
Tightening torque*.
Lock castle nut with cotter pin.



Adjusting:
Turn steering wheel counterclockwise about 1 turn from straight ahead position.
Loosen nut (1) on steering gear and turn adjusting screw (2) until specified friction torque* is reached while passing the pressure point.
Installation:
Tightening torque* for lock nut.



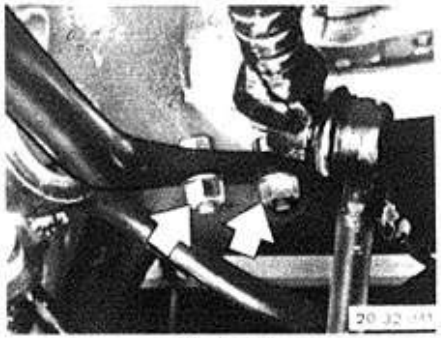
Set steering gear to straight ahead position (marks on spindle and housing aligned).



Take off BMW emblem.
Turn steering wheel counterclockwise about 1 turn.
After mounting friction torque meter 00 2 000 turn steering wheel clockwise past the pressure point and read the friction torque*.

* See Specifications

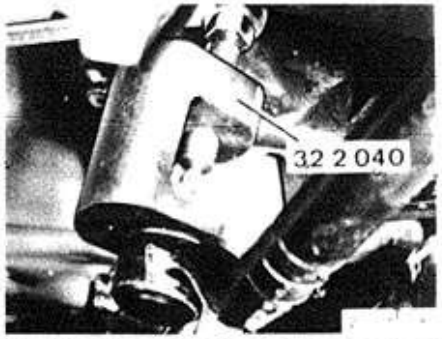
* See Specifications



32 13 060 REMOVING AND INSTALLING POWER STEERING GEAR

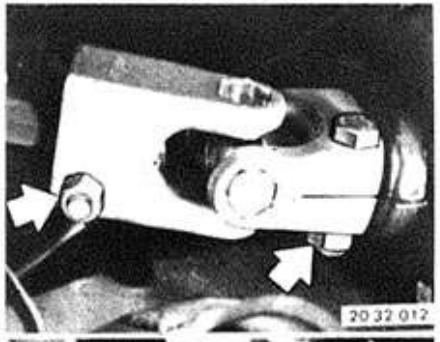
Discharge pressure in reservoir by operating brake pedal about 20 times.
Draw off brake fluid in tank.
Remove connecting pipe.
Installation:
Replace self-locking nuts.
Fill and bleed hydraulic system 32 13 006.

Never reuse drained hydraulic fluid!

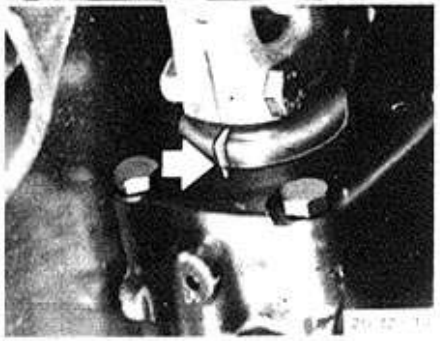


Remove cotter pin and unscrew castle nut.
Press tie rod off of steering drop arm with Special Tool 32 2 040.
Installation:
Tightening torque*.
Lock nut with a cotter pin.

Important:
Cars with SRS remove steering wheel 3233 000

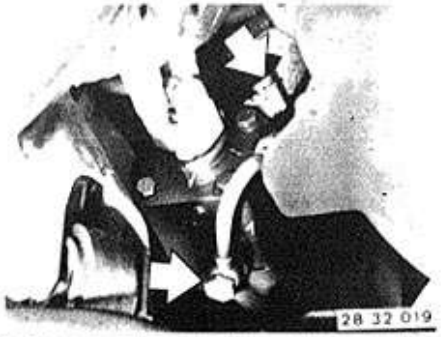


Unscrew bolts.
Push universal joint off of steering gear.
Installation:
Bolts must be in locking grooves of shafts.
Replace self-locking nuts.
Tightening torque*.

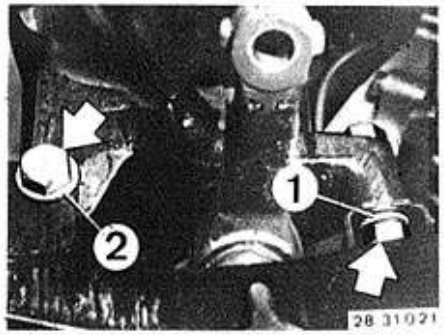


Installation:
Check straight ahead position of steering wheel and steering gear (marks on case and steering spindle).

* See Specifications



Disconnect hydraulic lines.
Plug open connections with dust caps.
Installation:
Replace seals.
Tightening torque*.
Provide sufficient space between hoses and body parts.

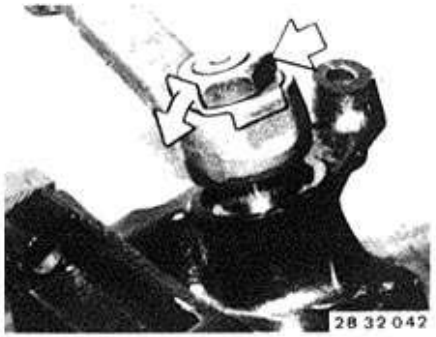


Unscrew steering gear mounting bolts.
1 Washer
2 Washer (both sides)
Remove steering gear from below.
Installation:
Replace self-locking nuts.
Tightening torque*.

* See Specifications

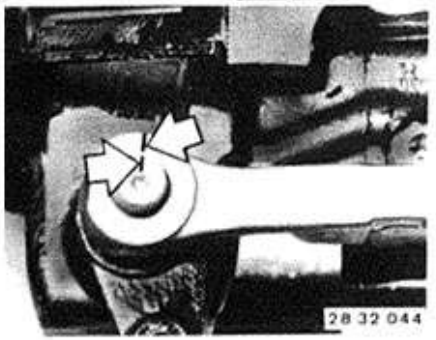
32 13 631 REPLACING RADIAL OIL SEAL FOR SECTOR SHAFT AND STEERING WORM/SEALING INTERMEDIATE COVER POWER STEERING GEAR REMOVED

Absolute cleanliness is necessary for work on steering gears!
Power steering gear code number:
8052 955



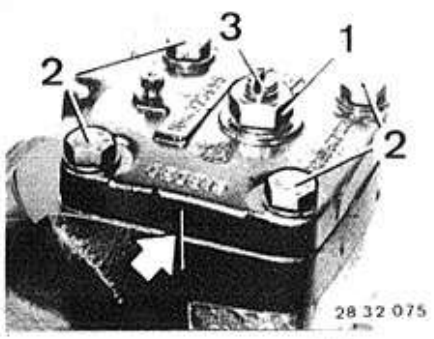
Bend open lockplate and unscrew nut.
Installation:
Replace lockplate.
Tightening torque*.

Pull off steering drop arm with Special Tool 32 2 000.

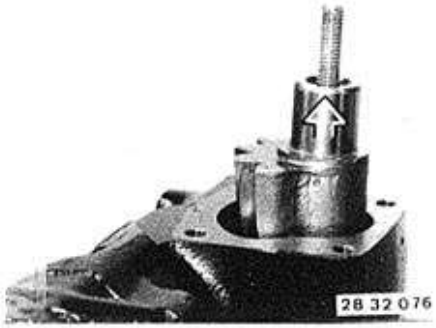


Installation:
Check installed position – marks on steering drop arm and shaft.

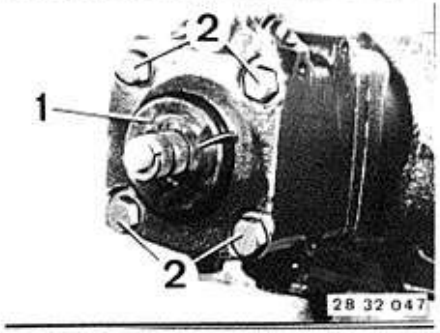
* See Specifications



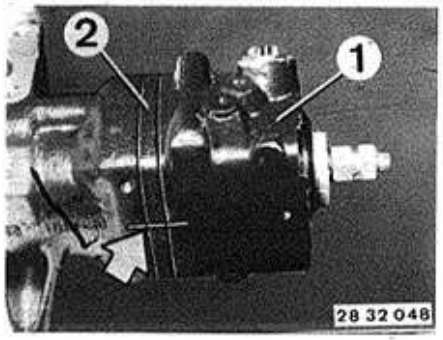
Mark position of cover to case.
Unscrew nut (1).
Unscrew bolts (2) and lift off cover by turning adjusting screw (3).



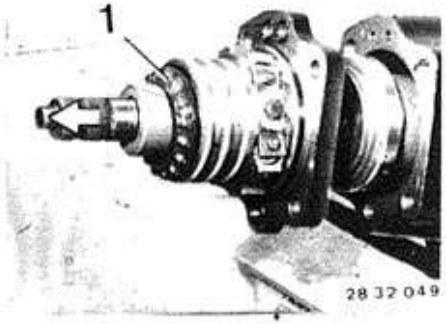
Pull sector shaft out of case.



Pull off cap (1).
Unscrew bolts (2).



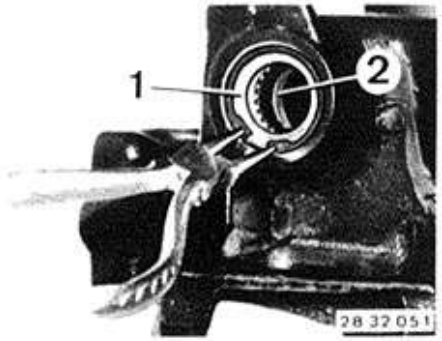
Mark position of valve housing (1) and intermediate cover (2) to case.
Take off valve housing (1).



Take off annular ball bearing (1).
Pull out worm with piston.


28 32 050

Set up piston and remove worm by turning clockwise.
Caution!
23 loose balls.



Remove circlip.
Press out outer radial oil seal (1) and inner radial oil seal (2).

Lubricate lips of the radial oil seal with grease.
Insert support ring (3) and press in radial oil seal (2) (lip facing inside of case) with Special Tool 32 1 060.
Press in radial oil seal (1) with Special Tool 32 1 070 (lip facing inside of case) and install retainer (4).

Replace seals (1 ... 4) and O-rings underneath.
Coat seals with hydraulic fluid*.

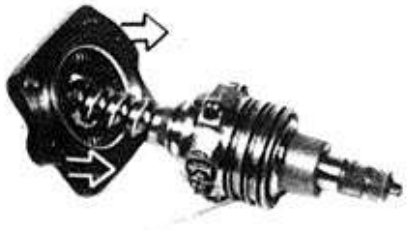
Replace seal (1) and O-ring (2) underneath.
Coat seal with hydraulic fluid*.

Replace O-rings (1 ... 3) on both sides and O-ring (4).

Place thrust washer (1) and axial bearing (2) in intermediate cover (with a little grease).

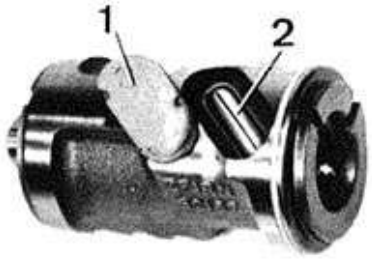
* See Service Information of Gr. 00

Mount intermediate cover (being careful not to damage worm seal) on worm head.



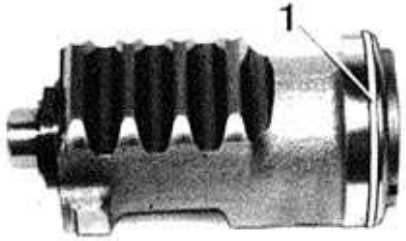
28 32 057

Pull off cap (1) and remove circulating tube (2).



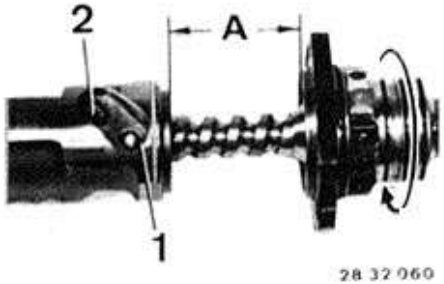
28 32 058

Replace seal (1) and O-ring behind it.
Coat seal with hydraulic fluid*.



28 32 059

Press worm head into piston to depth A = approx. 6 cm (2.362").
Install 16 balls through bore (1) in threaded channel of worm, while turning the worm until balls are carried along to bore (2).



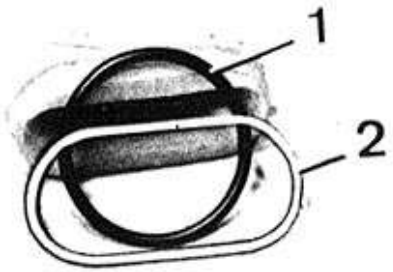
28 32 060

* See Service Information of Gr. 00

Place 7 balls (both outside balls with grease) in circulating tube and insert circulating tube in piston.

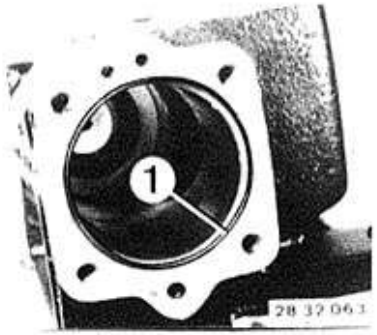
28 32 061

Place O-ring (1) and seal (2) in cap.
Press cap into piston.



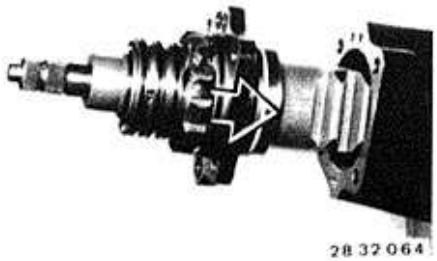
28 32 062

Place O-ring (1) in steering gear case.



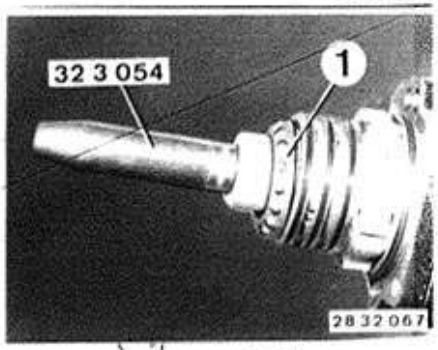
28 32 063

Press piston (being careful not to damage piston seal) into steering gear case.

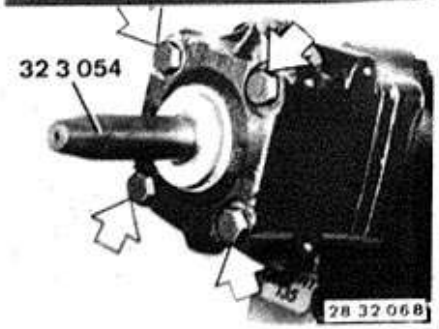


28 32 064

Install new radial oil seal (lip lubricated with grease) in valve housing with Special Tool 32 1 080 (lip of seal faces inside of case).

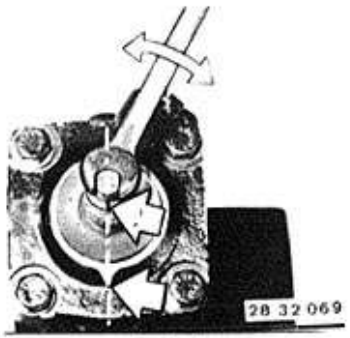


Install ball bearing (1) and Special Tool 32 3 054.

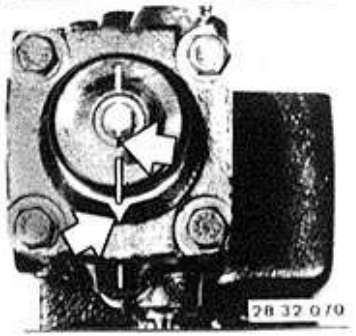


Slide valve housing carefully over seals of worm head and tighten bolts.
Tightening torque*.
Remove Special Tool 32 3 054.

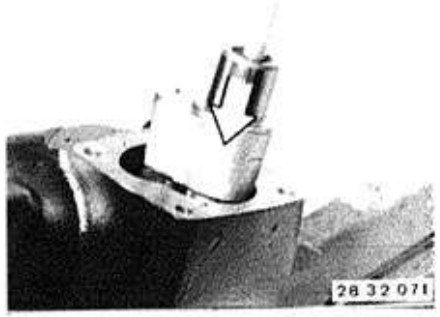
* See Specifications



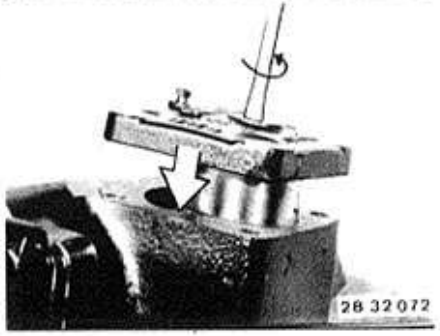
Turn steering to lock on one side.
Turn back about 2 turns until marks on spindle and case are aligned = straight ahead position.



Pack cap with grease and press on to spindle marks on spindle, cap and case must align.

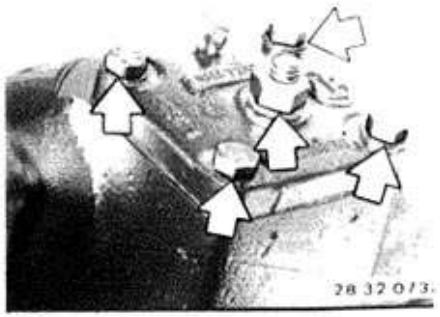


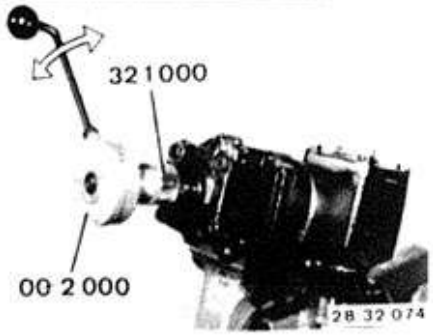
Slide in sector shaft carefully with mark on face at right angle to piston axis (being careful not to damage radial oil seals).



Replace O-ring in cover.
Position cover on case by turning adjusting screw counterclockwise.

Tighten cover bolts.
Tightening torque*.
Screw on lock nut finger tight (sealing surface facing cover).





Adjusting Pressure Point:
Mount Special Tool 32 1 000 on spindle and connect friction torque meter 00 2 000.
Measure friction torque about 1/2 turn before final lock.
Set steering gear to straight ahead position.
Turn adjusting screw until when passing the pressure point the friction torque is 40 to 50 Ncm (3.5 to 4.3 in. lbs.) higher than the value measured earlier.
Total friction torque must not exceed 160 Ncm (14 in. lbs.).
Tighten lock nut with torque of 25 Nm (18 ft. lbs.).
Recheck friction torque.

Attach steering drop arm.
Check operation of system after installing steering gear

* See Specifications

TROUBLESHOOTING POWER STEERING

Condition	Cause	Correction
Steering hard to turn from center to left or right	a) Pressure point adjusted too tight	a) Adjust pressure point
Steering turns automatically to end position on one side	a) Valve maladjusted to hydraulic center	a) Replace steering gear - adjustments only by manufacturer
Steering wheel has excessive play	a) Steering gear loose on front axle carrier b) Universal joints have excessive play c) Coupling loose d) Tie rod ends worn e) Sector shaft not meshing in teeth of piston without play f) Play between worm and piston g) Worm has axial play h) Insufficient oil in system	a) Tighten steering gear b) Replace universal joints c) Tighten coupling d) Replace tie rod ends e) Adjust pressure point f) Replace steering gear g) Replace steering gear h) Add oil* and bleed hydraulic system 32 13 006
Steering wheel shakes	a) Wheels have imbalance or radial runout b) Wheel alignment incorrect c) Thrust strut bent d) Rubber mount for thrust strut defective e) Control arm bent f) Shock absorbers without effect g) Bearing sleeve in steering guide arm defective h) Air in hydraulic circuit	a) Balance wheels; replace rims and/or tires in case of radial runout b) Check/adjust front wheel alignment with optical tester c) Replace thrust strut d) Replace rubber mount e) Replace control arm f) Replace shock absorbers g) Replace bearing sleeve h) Bleed hydraulic system 32 13 006
Steering moves hard against left or right stop	a) No pressure build up in lower pressure chamber b) No pressure build up in upper pressure chamber c) Insufficient oil in system d) Drive belt loose/defective e) Control valve seized in pump f) Filter is clogged g) Valve piston seized or leaks h) Piston seal damaged i) Teflon rings in steering worm head leak k) Teflon ring in intermediate cover leaks l) Air in hydraulic system m) System filled with unsuitable, strong foaming oil	a) Replace steering gear b) Replace steering gear c) Add oil* and bleed hydraulic system 32 13 006 d) Tighten or replace drive belt e) Replace power steering pump f) Replace filter – clean lines g) Replace steering gear h) Seal steering gear i) Seal steering gear k) Seal steering gear l) Bleed hydraulic system 32 13 006 m) Fill hydraulic system with specified oil*

* See Service Information of Gr. 00

TROUBLESHOOTING POWER STEERING

Condition	Cause	Correction
Hydraulic fluid loss	a) Hose connection leaks	a) Tighten hose connections, replacing hoses if necessary
	b) Oil tank seal leaks	b) Replace seal
	c) Radial oil seal for sector shaft leaks	c) Seal steering gear
	d) Radial oil seal for steering spindle leaks	d) Seal steering gear
	e) O-ring in cover leaks	e) Seal steering gear
	f) O-rings in intermediate cover leak	f) Seal steering gear

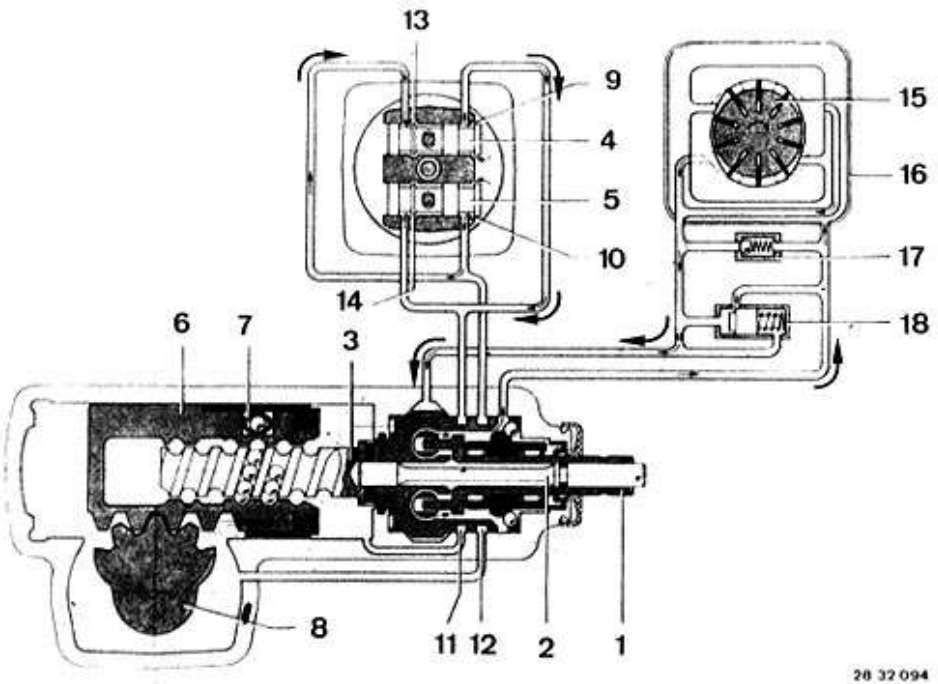
DESIGN AND DESCRIPTION OF BALL AND NUT POWER STEERING

The housing contains a complete mechanical steering gear, the control valve and operating cylinder. Steering spindle (1) is connected elastically with worm (3) via torsion bar (2) and with valve pistons (4 and 5) without play. The valve pistons are installed transversely in the worm head. The connection between piston (6) and worm (3) is accomplished with an infinite line of balls. When turning the worm the balls are taken up at one end by circulating tube (7) and put out again at the other end of the balls. Piston (6) and sector shaft (8) are meshed. The special shape of teeth on the sector shaft permits zero-play adjustment with an adjusting screw.

In neutral position of valves (4 and 5) the oil flow delivered by the pump passes through the steering and can flow through the opened feed and return control edges to the cylinder chamber and return flow. Hydraulic support cuts in when valve pistons (4 and 5) are moved out of neutral position. This happens when force is transmitted from the steering wheel of from the steering drop arm via the sector shaft and pistons to the worm. Torsion bar (2) then serves as a link. It deforms itself in the elastic range and returns the valve pistons to neutral position after releasing the steering wheel. Moving valves (4 and 5) will let the oil flow into only one of the operating cylinder chambers and in this manner support the rotating motion of the steering spindle and/or counteract the jolt from rough roads.

Steering Wheel in Neutral Position:

Oil flows from the impeller pump into the worm head, through feed grooves (9 and 10) ro radial grooves (11 and 12). From here via connecting bores to the right and left cylinder chambers and via opened return flow grooves (13 and 14) back to the oil tank. The valve is also illustrated in cross section.

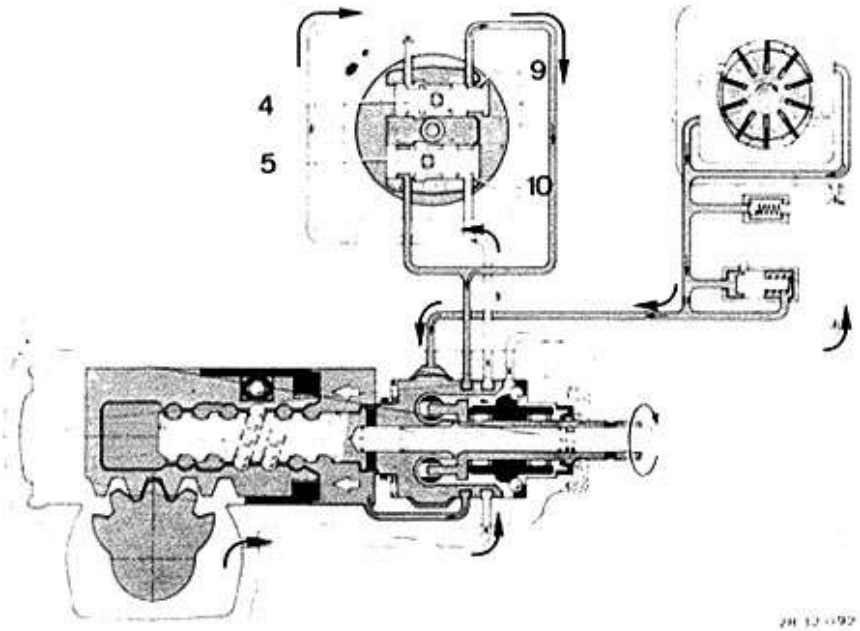


15 = Pump
16 = Oil tank
17 = Safety valve
18 = Control valve

28 32 094

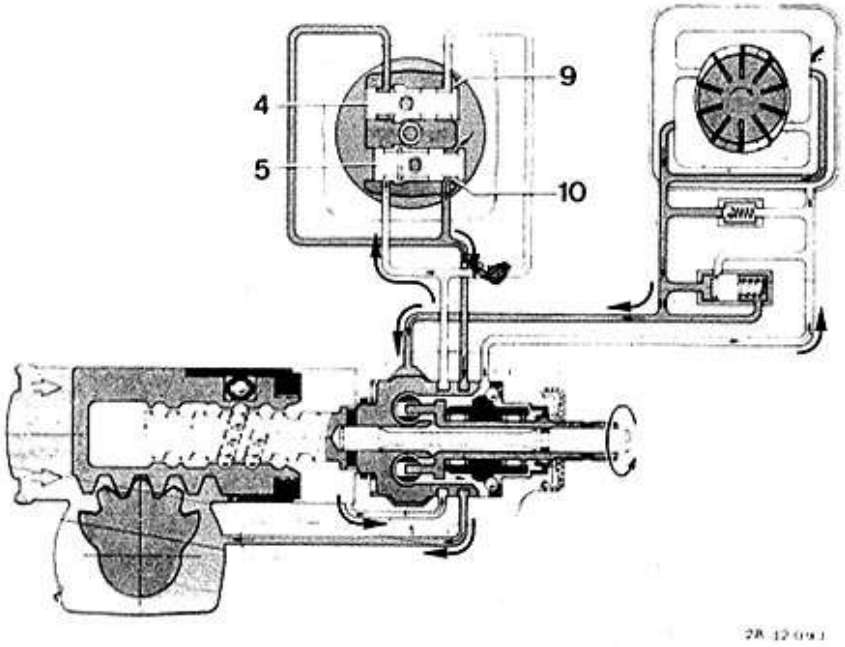
Steering Wheel Turned Clockwise:

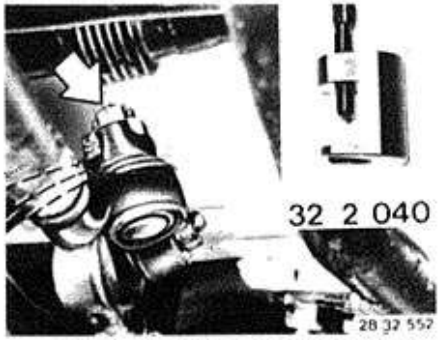
Valve piston (4) is displaced to the right and feed groove (9) opened. Valve piston (5) is displaced to the left and feed groove (10) closed. This lets the oil flow into the right cylinder chamber. Oil in the left cylinder chamber is forced out and flows back into the oil tank.



Steering Wheel Turned Counterclockwise:

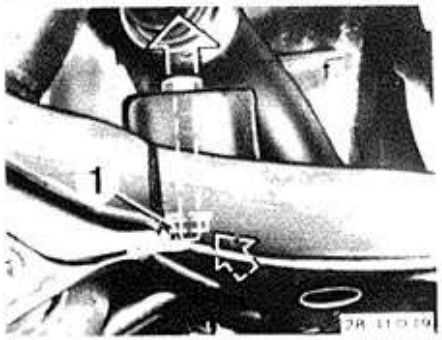
Valve piston (5) is displaced to the right and feed groove (10) opened. Valve piston (4) is displaced to the left and feed groove (9) closed. This lets the oil flow into the left cylinder chamber. Oil in the right cylinder chamber is forced out and flows back into the oil tank.



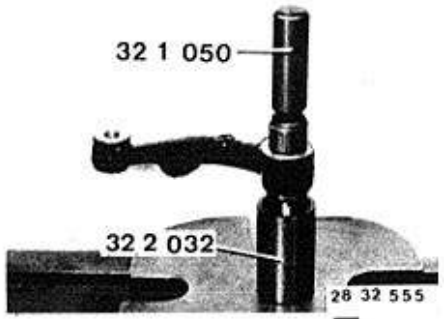


32 21 080 REMOVING AND INSTALLING STEERING GUIDE ARM

Remove cotter pin and unscrew castle nut.
Press off ball joint with Special Tool 32 2 040.
Installation:
Tightening torque*.
Lock castle nut with a cotter pin.

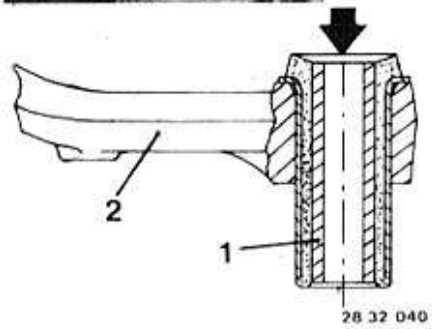


Remove steering guide arm.
1 = Washer
Installation:
Check fluid block, replacing if necessary.
Tightening torque*.

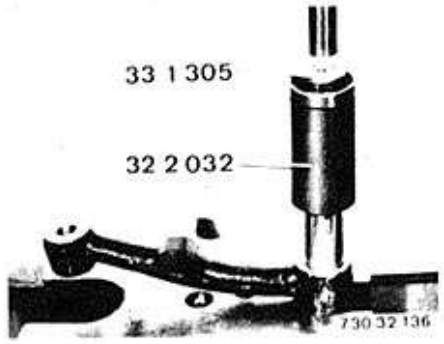


32 21 091 REPLACING FLUID BLOCK FOR STEERING GUIDE ARM

Remove and install steering guide arm 32 21 080.
Press out fluid block with Special Tools 32 1 050 and 32 2 032.

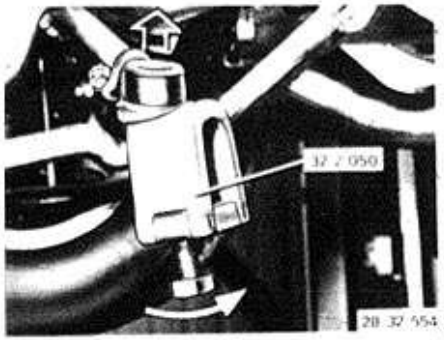


Check pressing in direction.
1 = Fluid block
2 = Steering guide arm



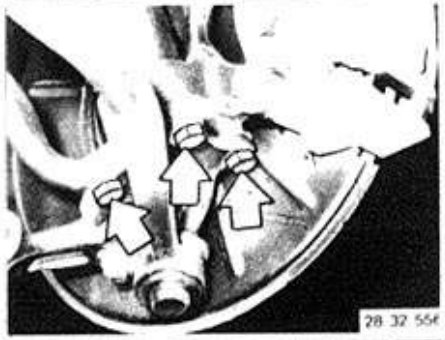
Press in new fluid block against stop with Special Tools 33 1 305 and 32 2 032.

* See Specifications

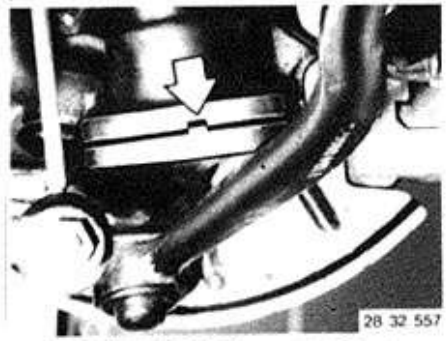


32 21 101 REPLACING LEFT OR RIGHT TIE ROD ARM

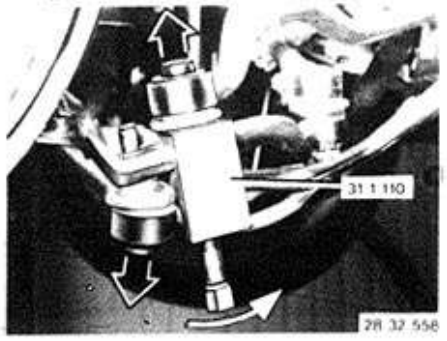
Remove and install front wheel 36 10 300.
Remove cotter pin and unscrew castle nut.
Press off ball joint with Special Tool 32 2 050.
Installation:
Tightening torque*.
Lock nut with cotter pin.
Check front wheel alignment with optical tester 32 00 034.



Unscrew bolts.
Installation:
Clean threads of tapped bores and bolts.
Lock bolts with bolt cement**.
Tightening torque*.

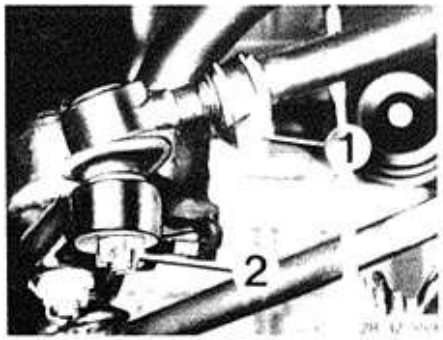


Check for correct installed position.



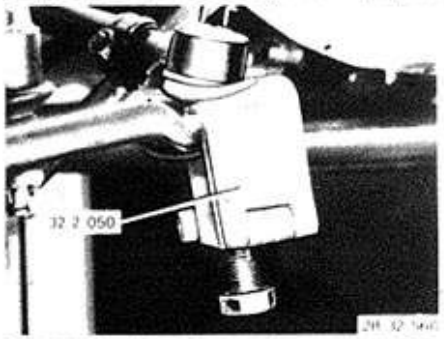
Remove cotter pin and unscrew castle nut on control arm and strut.
Press off ball joints with Special Tool 31 1 110.
Installation:
Tightening torque*.
Lock nut with cotter pin.

* See Specifications of Gr. 32
** Source: HWB

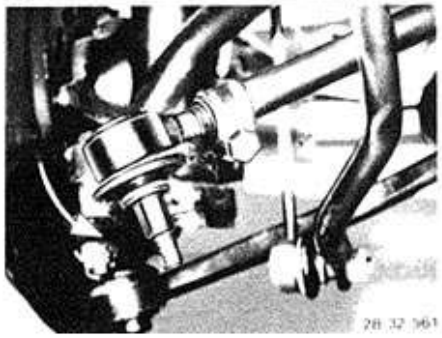


32 21 151 REPLACING LEFT OR RIGHT TIE ROD END

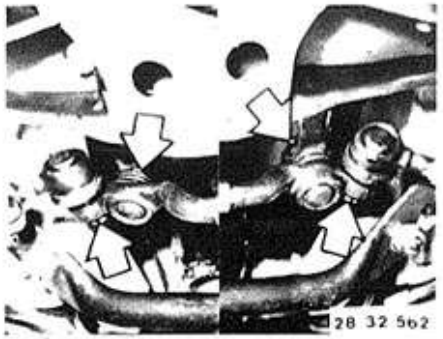
Remove and install front wheel 36 10 300.
Loosen bolt (1).
Remove cotter pin and unscrew castle nut (2).
Installation:
Tightening torque* for bolt (1) with car in normal position*.
Lock castle nut with cotter pin.
Check front wheel alignment with optical tester 32 00 034.



Press off ball joint with Special Tool 32 2 050.

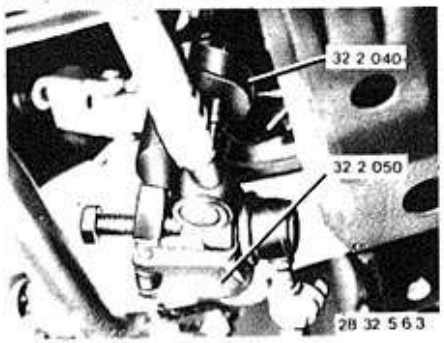


Unscrew tie rod end.



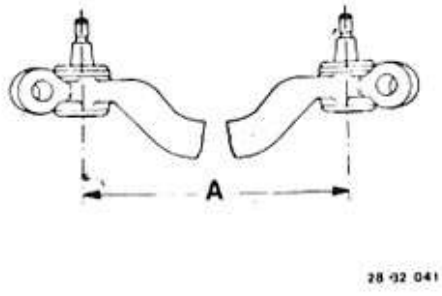
32 21 281 REPLACING CENTER TIE ROD

Remove cotter pin and unscrew castle nut.
Installation:
Tightening torque*.
Lock nuts with cotter pins.
Check front wheel alignment with optical tester 32 00 034.



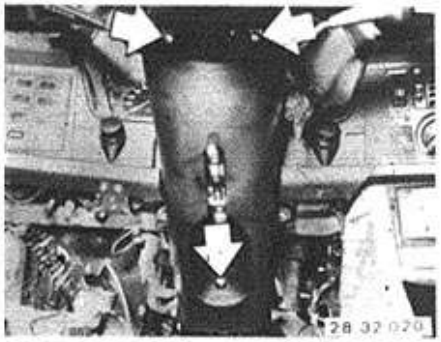
Press off side tie rods with Special Tool 32 2 050 and center tie rod with Special Tool 32 2 040.

Distance A = 500 ± 1 mm (19.685 ± 0.039").



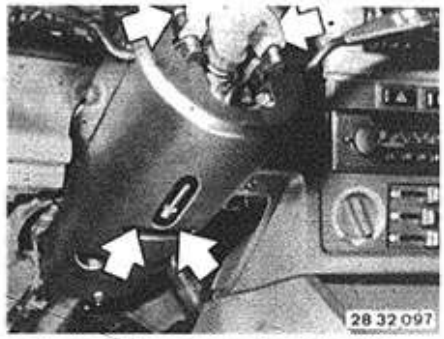
* See Specifications of Gr. 32

* See Specifications of Gr. 32

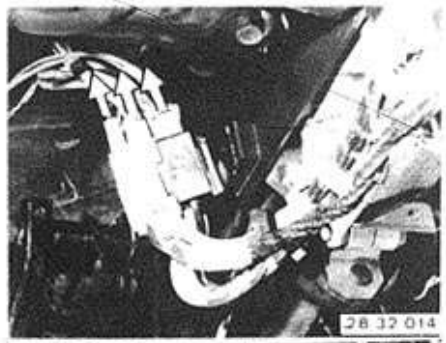


32 31 090 REMOVING AND INSTALLING COMPLETE STEERING COLUMN

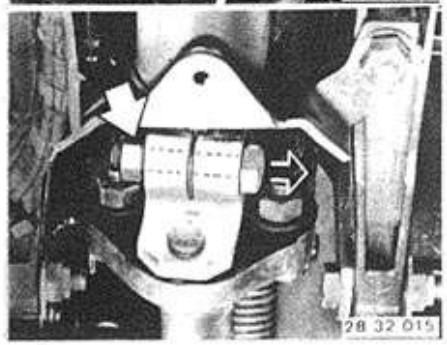
Disconnect the battery ground lead.
Remove the steering wheel – see 32 33 000.
Remove the instrument panel trim at bottom – see 51 45 180.
Remove the lower steering column casing.



Since 1986 Models:
Unscrew the steering column casing.

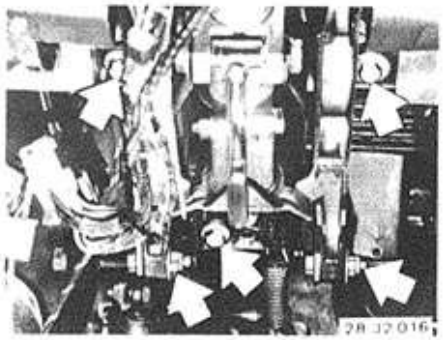


Disconnect the central electric plugs.



Remove the bolt and pull the coupling off of the upper steering spindle.
Installation:
The bolt must be in the locking groove.
Replace the self-locking nut.
Tightening torque*.

* See Specifications

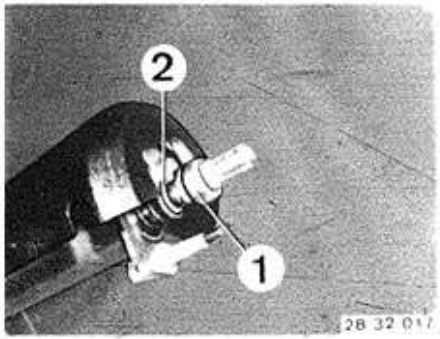


Unscrew bolts and remove the steering column.
Installation:
Replace self-locking nuts.
Tightening torque*.

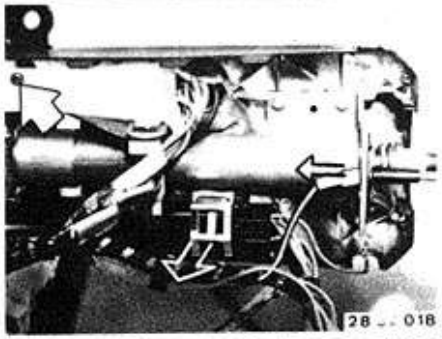
* See Specifications

32 31 . . . DISASSEMBLING/ASSEMBLING STEERING COLUMN – STEERING COLUMN ASSEMBLY REMOVED

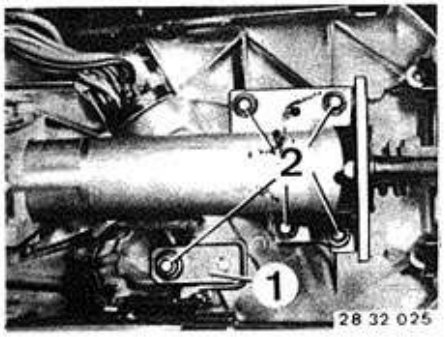
Unscrew headlight dimmer and windshield wiper switch.



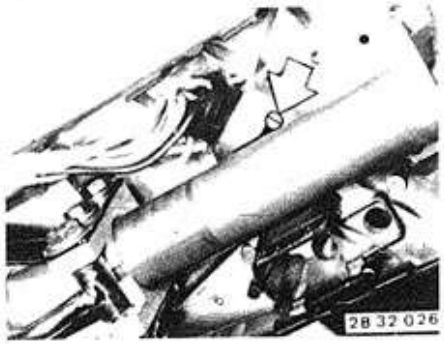
Remove collar (1).
Installation:
Recess of collar (1) must lock snap ring (2).



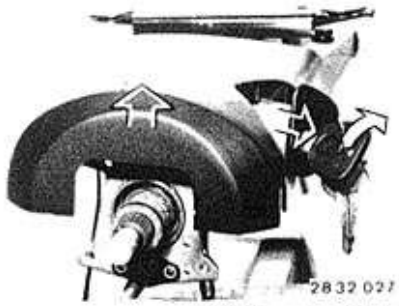
Remove flasher relay with holder.
Pull off wires for horns.
Unscrew bolt.



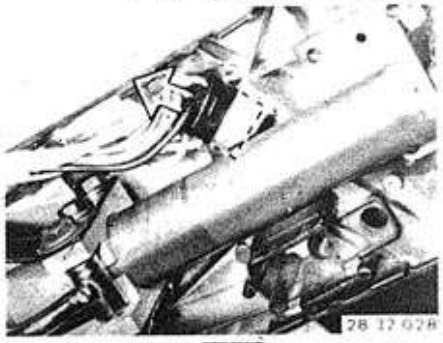
Remove shear-off screws (2) with a chisel or similar tool.
Take off steering lock plate (1).



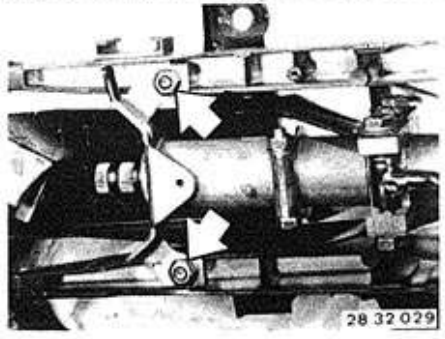
Unscrew setscrew.
Installation:
Lock setscrew with paint.



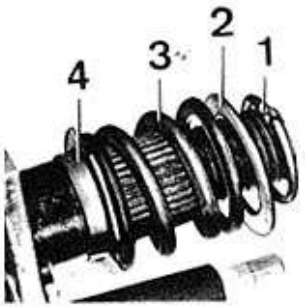
Press casing upper section away from outer tube.
Turn ignition key in "start" direction and pull out complete steering lock.



Remove ignition/starter switch.

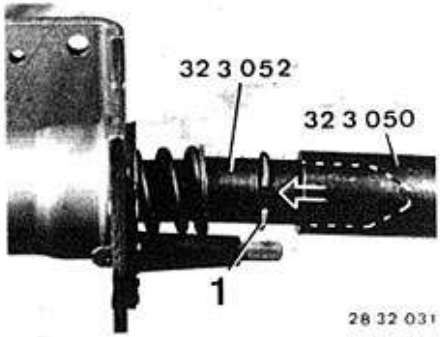


Unscrew bolts and take off outer tube on casing upper section.



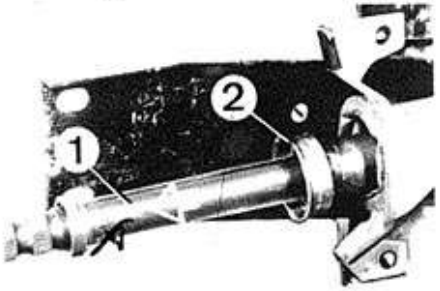
28 32 030

Remove snap ring (1), washer (2), spring (3) and ring (4).
Installation:
Stem of ring (4) faces bearing.



28 32 031

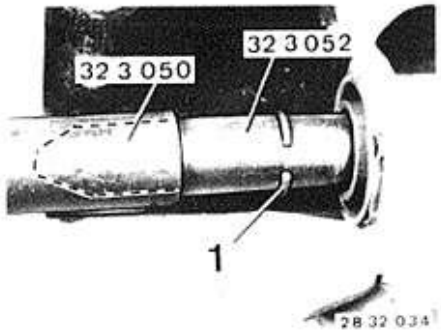
Installation:
Mount snap ring (1) with Special Tools 32 3 052 and 32 3 050.



28 32 032

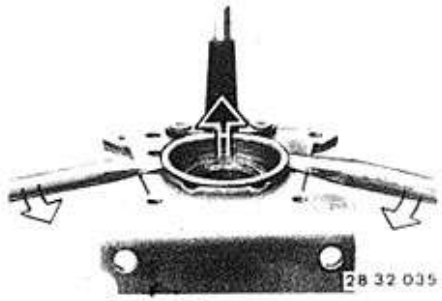
Pull steering spindle (1) and lower bearing (2) out of outer tube.

Take off snap ring (1), collar ring (2), ring (3) and bearing (4).
Installation:
Stem of ring (3) faces bearing.
Snap ring (1) locks in recess of collar ring (2).

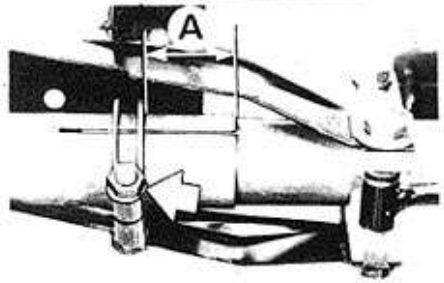


28 32 034

Installation:
Push steering spindle into outer tube.
Knock in bearing with Special Tool 00 5 550.
Install ring (3) and collar ring (2).
Mount snap ring (1) with Special Tools 32 2 052 and 32 3 050.


28 32 035

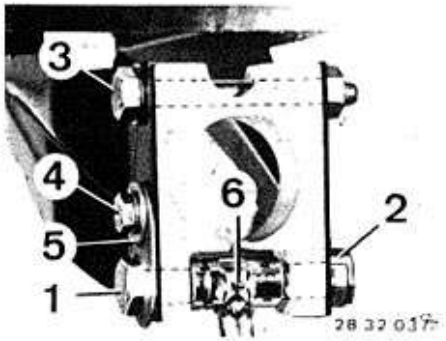
Lift upper steering spindle bearing out of outer tube with a screwdriver.
Installation:
Knock in bearing with Special Tool 00 5 550.



28 32 036

Loosen clamp.
Installation:
Check distance (A) from clamp to end of outer tube.
A = 42 to 45 mm (1.653 to 1.772").
Tighten clamp only after screwing outer tube on casing upper section.
Tightening torque*.

* See Specifications of Gr. 32



Bend open lockplate.
Unscrew bolts (1 ... 4).
Bolt (1) has left-hand threads.

Installing Instructions and Step Order for Clamp:

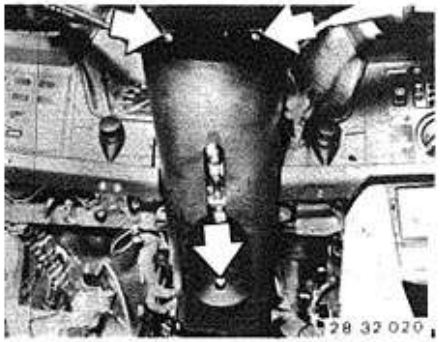
1. Screw in bolt (2) with lockplate, tighten to specified torque* and lock.
   Lever (6) will be in center of clamp in "OFF" position.

2. Screw in bolt (1) (with left-hand threads) and tighten to specified torque*.
   Lever (6) in "OFF" position.

3. Tighten bolt (3) to specified torque*.
   Lever (6) in "OFF" position.

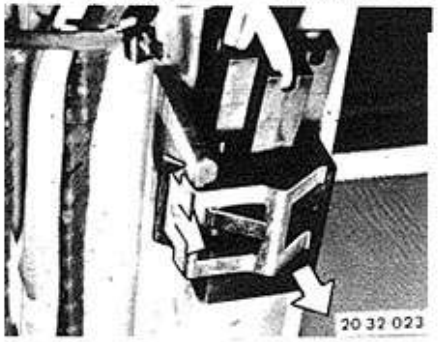
4. Bolt lockplate (5) with bolt (4).

* See Specifications



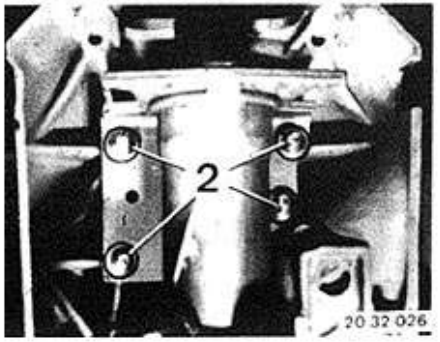
32 32 001 REPLACING COMPLETE STEERING LOCK

Disconnect battery ground lead.
Remove and install steering wheel 32 33 000.
Remove and install instrument panel trim at bottom 51 45 180.
Detach steering column casing at bottom.



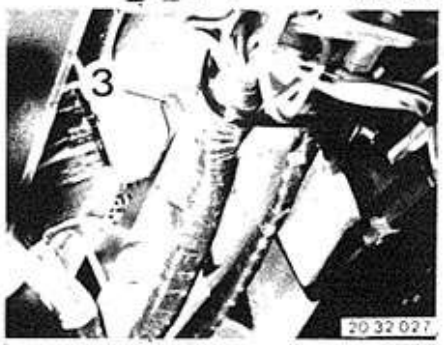
Pull off flasher relay with holder.

Unscrew headlight dimmer and windshield wiper switch.

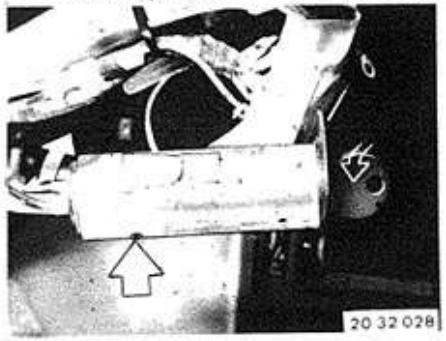


Remove shear-off screws (2) with a chisel or similar tool.

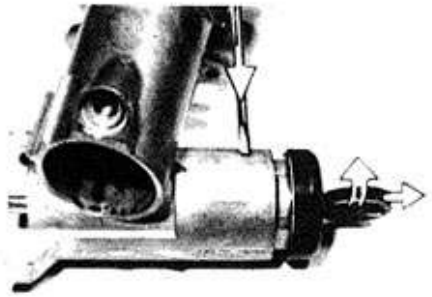
Remove shear-off screw (1) with a chisel or similar tool.



Unscrew setscrew (3).
Installation:
Lock setscrew with paint.

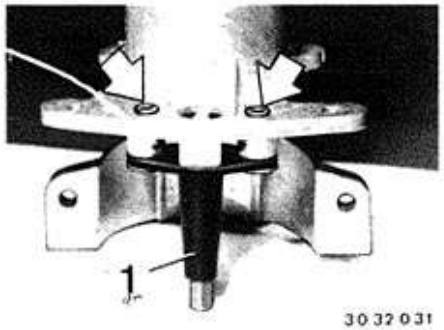


Press down on steering column and pull out steering lock.
Installation:
Check positioning of steering lock and ignition switch to each other.



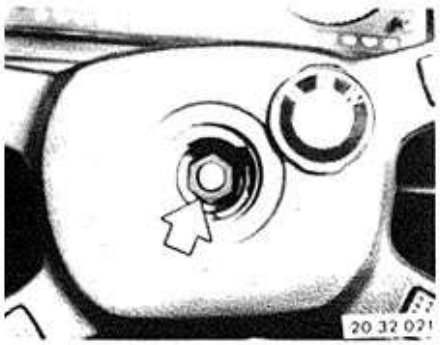
30 32 030

Press down the lock with a screwdriver.
Turn the key until it is stopped and pull out the lock cylinder.



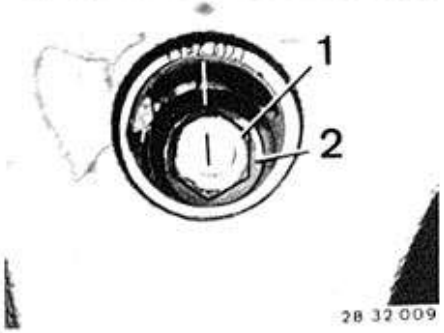
30 32 031

Drill off the rivets and screw the carbon brush contact (1) on the new steering lock.



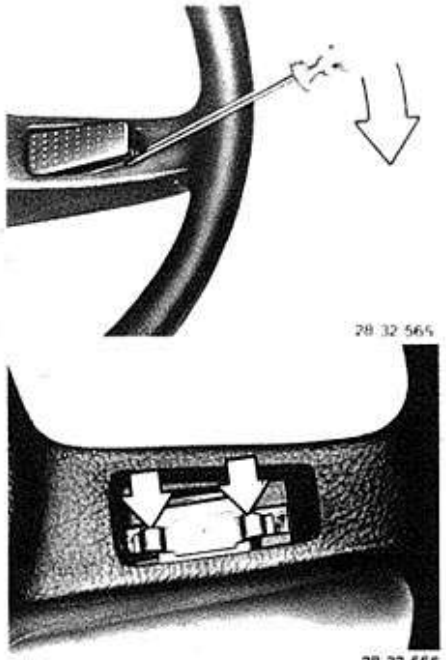
32 33 000 REMOVING AND INSTALLING OR REPLACING STEERING WHEEL

Lift out BMW emblem.



Unscrew nut (1) and remove with washer (2).
Mark position of steering wheel to steering spindle.
Pull off steering wheel.
Installation:
Replace self-locking nut.
Tightening torque*.
Important!
Don't damage turn signal cancelling cams.

from 1986 models on:
Steering wheel can only be pulled off after unlocking steering lock..



32 33 041 REPLACING HORN BUTTON ON STEERING WHEEL

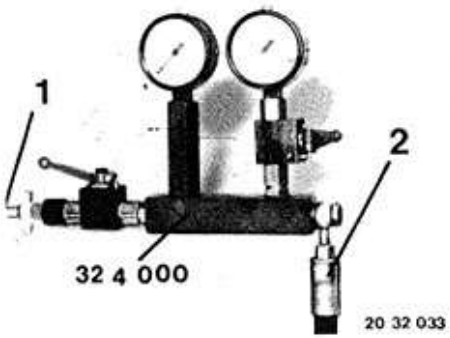
Lift out horn button carefully with a screwdriver.

Installation:
Install spring contact with curved surface facing up.

* See Specifications of Gr. 32

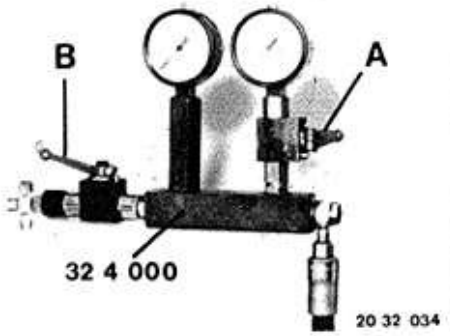
32 41 005 CHECKING OPERATION OF POWER STEERING (H-31 SYSTEM)

– Engine At Operating Temperature –
Check hydraulic fluid level in tank.
Check all hose connections and equipment (pump, brake booster, power flow regulator and steering gear) for leaks before checking operation.



20 32 033

Discharging Pressure:
Operate brake pedal about 20 times with engine stopped.
Install pressure tester 32 4 000 between pump and power flow regulator.
1 = Power flow regulator or steering gear connection
2 = Pump connection



20 32 034

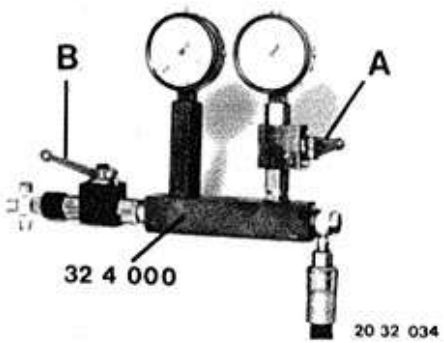
A = Shutoff valve (low pressure: 0 to 15 bar or 0 to 213 psi)
Caution!
Shutoff valve (A) must always be closed for high pressure tests to avoid damaging pressure tester.
B = Shutoff valve (high pressure: 0 to 150 bar or 0 to 2133 bar)
Open valve (B).
Close valve (A).
Start engine – fill hydraulic fluid** in tank.
Bleeding System:
Turn steering wheel two times each against left and right locks.
Operate brake pedal 5 times, wait 30 seconds and operate pedal another 5 times.
Hydraulic fluid temperature should be approx. 50° C (122° F) for all tests.
Turning steering wheel against locks with engine running could cause a rise in temperature.

** See Service Information of Gr. 00

1. Checking Flow Pressure:
Open valve (B).
Close valve (A) and run engine.
Open valve (A) and read pressure when pressure is less than 15 bar (213 psi).
Max. permissible flow pressure of 8 bar (114 psi) must not be exceeded.
Pressure Greater Than 8 Bar (114 psi):

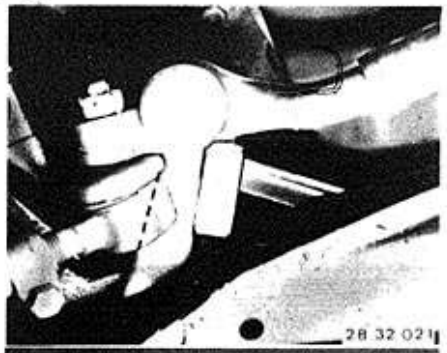
32 41 505 CHECKING POWER FLOW REGULATOR AND STEERING GEAR

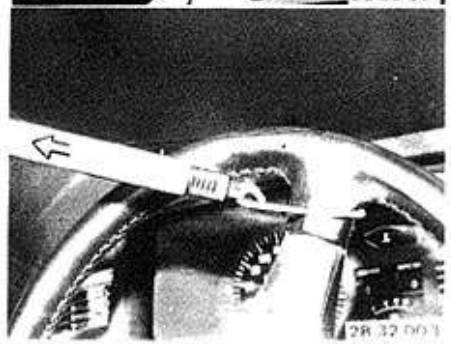
Discharge pressure.
Install pressure tester between power flow regulator and steering gear.
Bleed system.
Carry out test as described above.
If pressure is less than 8 bar (114 psi), replace power flow regulator 34 33 100.
If pressure is more than 8 bar (114 psi), replace steering gear 32 13 060.
Recheck flow pressure between pump and power flow regulator.



2. Checking Pump:
Inställ pressure tester between pump and power flow regulator.
Close valve (A).
Start engine.
Close valve (B) max. 10 seconds and read pressure.
Rated pump pressure* ± 10 % should be reached.
Rated pressure* not reached, check drive belt tightness – 32 41 109.
Rated pressure* exceeded, replace pump – 32 41 061.
Repeat test.
Rated pressure* still not reached, replace pump – 32 41 061.

3. Checking Reservoir Charging Pressure:
Pressure tester between pump and power flow regulator.
System bled.
Engine not started.
Valve (B) open.
Valve (A) closed.
Start engine and observe pressure tester.
Pressure must rise to max. 57 bar (811 psi) and then drop immediately to less than 8 bar (114 psi).
If max. permissible pressure of 57 bar (811 psi) is exceeded or there is no immediate pressure drop after reaching max. permissible pressure, replace power flow regulator – see 34 33 100.

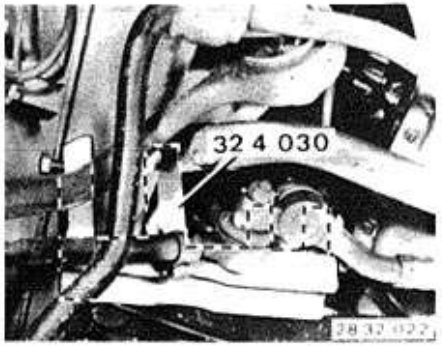




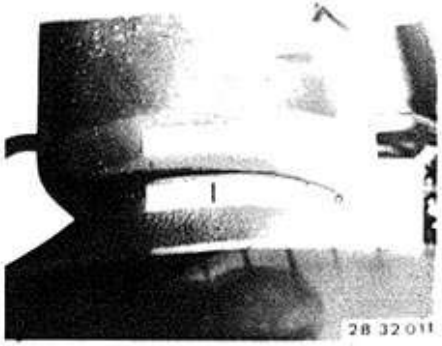
4. Power Steering:
Pressure tester between pump and power flow regulator.
System bled.
Valve (B) open.
Valve (A) closed.
Engine not started.
Lift car.
Stop steering from reaching final left lock by 1/2 to 3/4 steering wheel turn with a piece of wood or similar item.

Start engine.
Pull steering wheel against final left lock with a force of 100 N (22 lbs.) (force meter) about 5 seconds and read pressure.
Limit final right lock and repeat test on right lock.
If pressure values are lower than pump pressure determined in point 2, replace steering gear – 32 13 060.

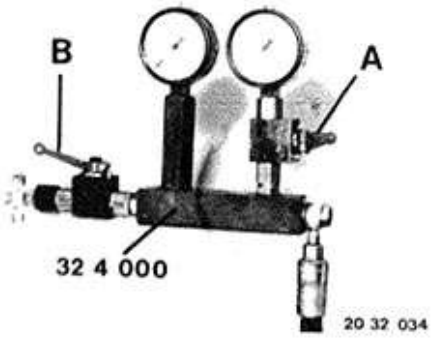
* See Specifications



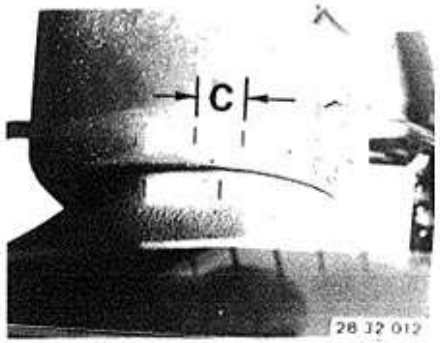
5. Checking Mechanical Play of Steering:
– Pressure point adjusted 32 13 014.
– No play in steering column.
Pressure meter between pump and power flow regulator.
System bled.
Valve (B) open.
Valve (A) closed.
Engine not started.
Steering drop arm held in straight ahead position with Special Tool 32 4 030.



Paste strips of paper on steering wheel hub and casing upper section.
Make mark (center) on steering wheel hub.

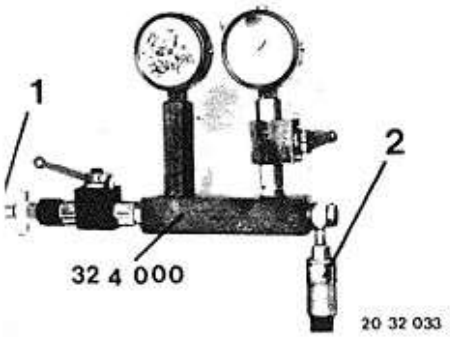


Start engine.
Open valve (A).
Read flow pressure.



Turn steering wheel counterclockwise until pressure-meter shows 1 bar (14 psi) more pressure than flow pressure value.
Mark position of steering wheel hub.
Repeat this in clockwise direction.
If max. permissible travel (C) = 7 mm (0.276") is exceeded, replace steering gear 32 13 060.
Remove special tool holder and pressure meter.
Bleed hydraulic system and, if necessary, add hydraulic fluid**.

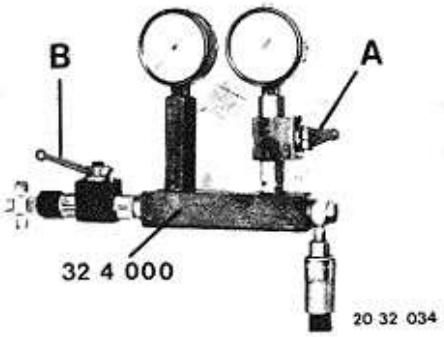
** See Service Information of Gr. 00



32 41 009 CHECKING POWER STEERING PUMP
– Engine At Operating Temp. –

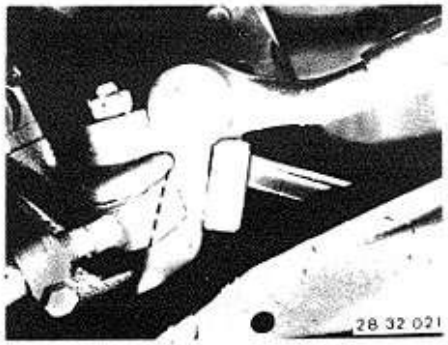
Cars Without H-31 System:

1. Power Steering Pump:
Disconnect pressure line (1) on power pump and connect it on pressure tester 32 4 000.
Connect pressure line (2) from pressure tester 32 4 000 on power pump.
Installation:
Tightening torque*.
Bleed hydraulic system 32 13 006.

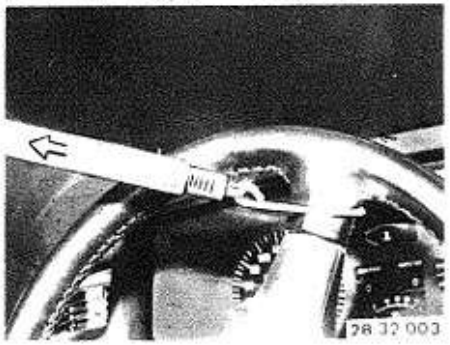


Test:
Valve (A) must always be closed for high pressure tests (pressure tester would be damaged!).
Open valve (B) and bleed hydraulic system – 32 13 006.
Close valve (B) max. 10 seconds with engine running and read pressure.
Rated pump pressure* must be reached with a tolerance of max. – 10 %.

If this pressure is not reached, check drive belt tightness – 32 41 109.
If pressure is still not reached, replace power steering pump – 32 41 060.

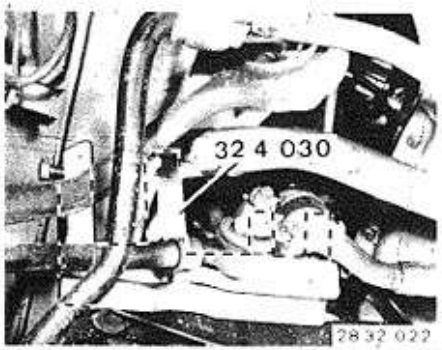


2. Power Steering:
Lift car.
Stop steering from reaching final left lock by 1/2 to 3/4 of a steering wheel turn with a piece of wood or similar item.



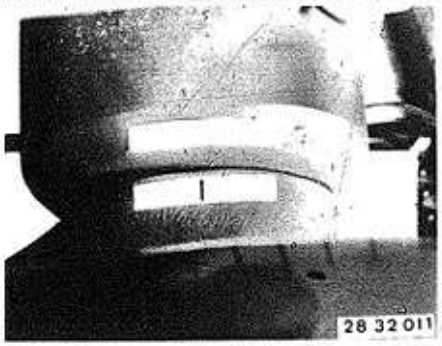
Run engine warm.
Pull steering wheel against final left lock about five seconds with a force of 100 N or 22 lbs. (check with force meter).
Read pressure on pressure tester 32 4 000.
Limit final right lock and repeat same test on right lock.
If pressure values are less than the previously measured pump pressure, replace steering gear – see 32 13 060.

* See Specifications

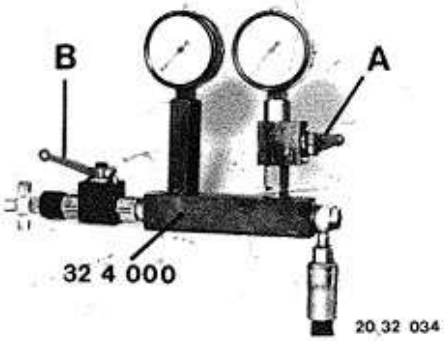


3. Mechanical Play in Steering:
Pressure Point Adjusted –

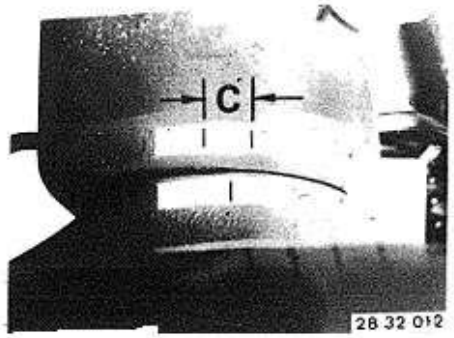
Hold steering drop arm in straight ahead position with Special Tool 32 4 030. (marks on housing and steering shaft)



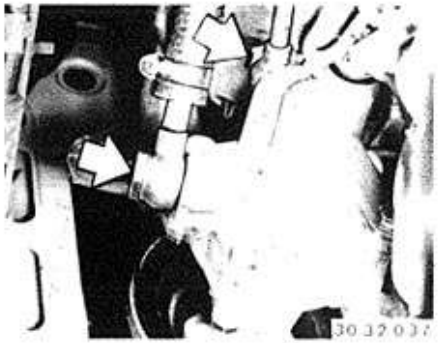
Paste strips of paper on steering wheel hub and casing upper section.
Mark center on steering wheel hub.



Open valve (B).
Close valve (A).
Run engine at idle speed.
Open valve (A).
Read flow pressure.

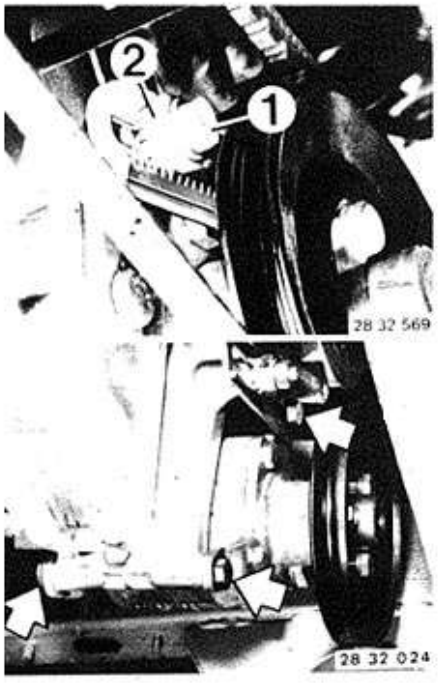


Turn steering wheel anticlockwise until pressure tester shows 1 bar (14 psi) more pressure than the measured flow pressure value.
Mark position on steering wheel hub.
Repeat procedures on right lock.
If maximum permissible travel (C) = 7 mm (0.276") is exceeded, check joint disc.
If joint disc is okay, replace steering gear.
Remove pressure tester 32 4 000 and bleed hydraulic system – 32 13 006.



32 41 060 REMOVING AND INSTALLING POWER STEERING PUMP

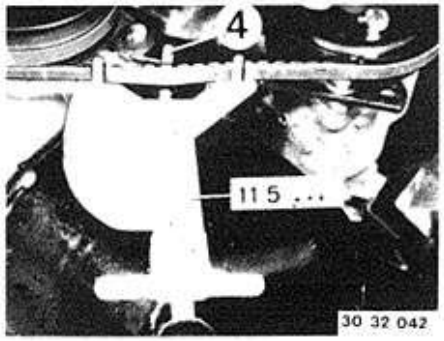
If applicable, discharge pressure reservoir by operating brake pedal about 20 times.
Draw off hydraulic fluid in tank.
Disconnect lines.
Plug open connections with dust caps.
Installation:
Replace seals.
Tightening torque*.
Fill and bleed hydraulic system – see 32 13 006.
Important!
Never reuse drained hydraulic fluid.



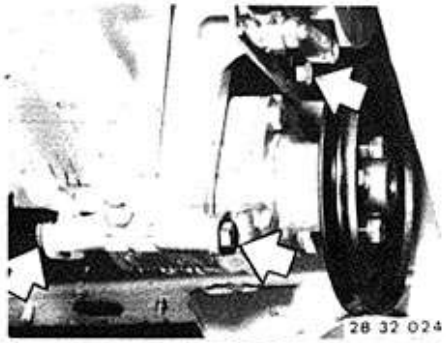
Loosen nut (1) and release drive belt by turning toothed element (2).
Unscrew bolts.

Unscrew bolts.

* See Specifications of Gr. 32

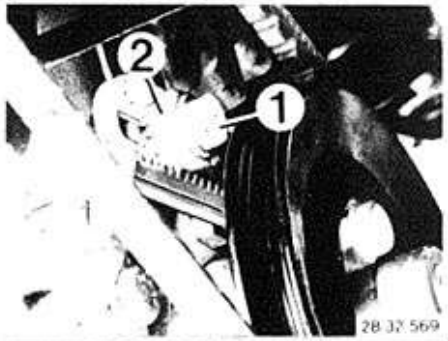


Installation:
Tighten drive belt before tightening bolts.
Tighten toothed element with 8 to 8.5 Nm (5.8 to 6.1 ft. lbs.) and tighten nut.
Check drive belt tightness with Special Tool 11 5 . . ..
Hook (4) rests on tooth tip.

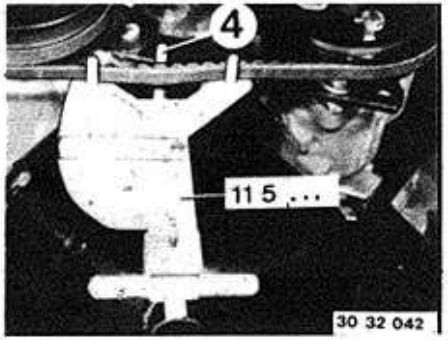


32 41 109 TIGHTENING DRIVE BELT FOR POWER STEERING PUMP

Unscrew splash guard.
Loosen mounting bolts of pump and tensioning bar.



Loosen clamping bolt (1).
Tighten toothed element (2) with 8 to 8.5 Nm (5.8 to 6.1 ft. lbs.) and lock with bolt (1).



Check belt tightness with tester 11 5 . . .
Hook (4) rests on tip of tooth.
Tighten bolts.
Caution!
Make sure of sufficient space between hoses and body-mounted parts, making corrections on hose connections if necessary.

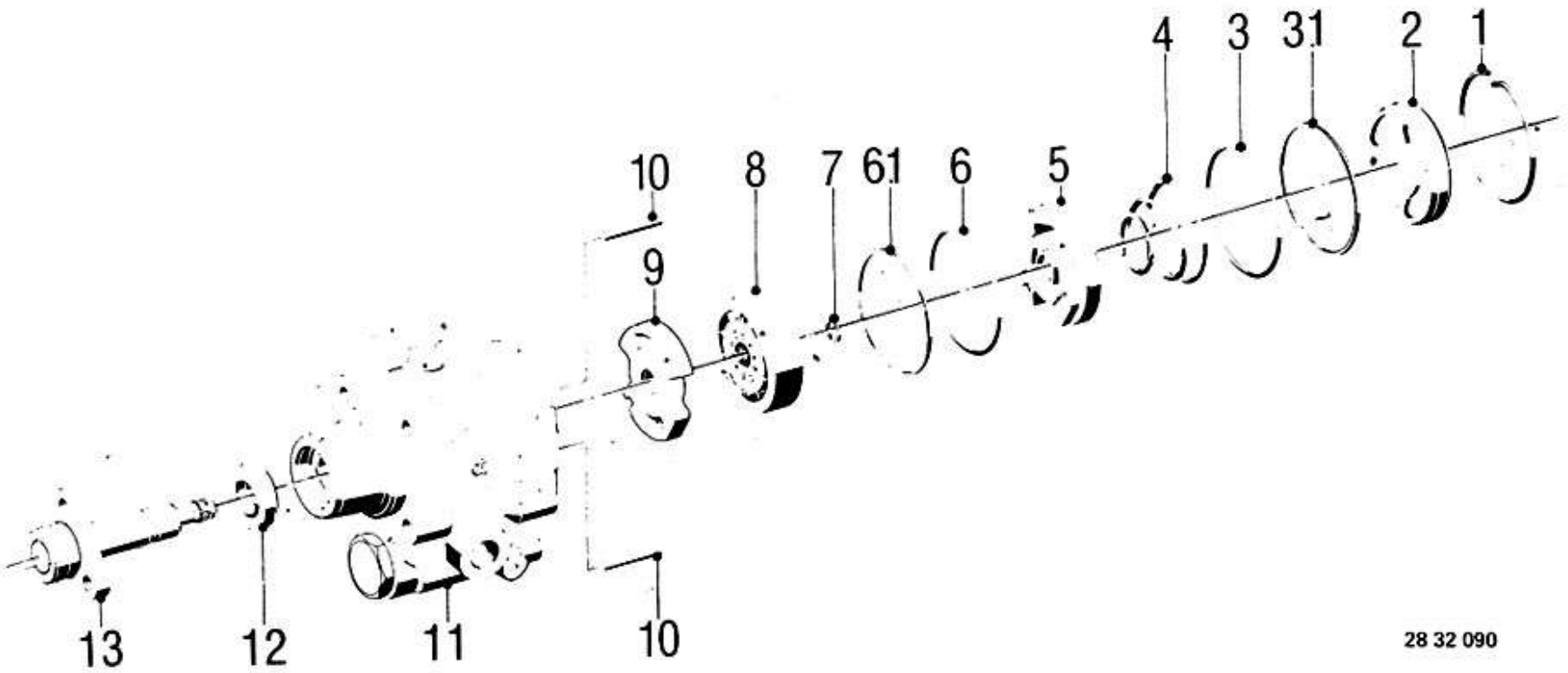
32 41 131 REPLACING CONSOLE FOR POWER STEERING PUMP

Engine M 30:
Remove and install alternator 12 31 020.
Remove and install power steering pump 32 41 060.
Take off console.
Installation:
Tightening torque*.
Check distance between engine oil pan and console with a feeler gauge and correct with shims of pertinent thickness (see Parts Catalog)

* See Soecifications

32-35

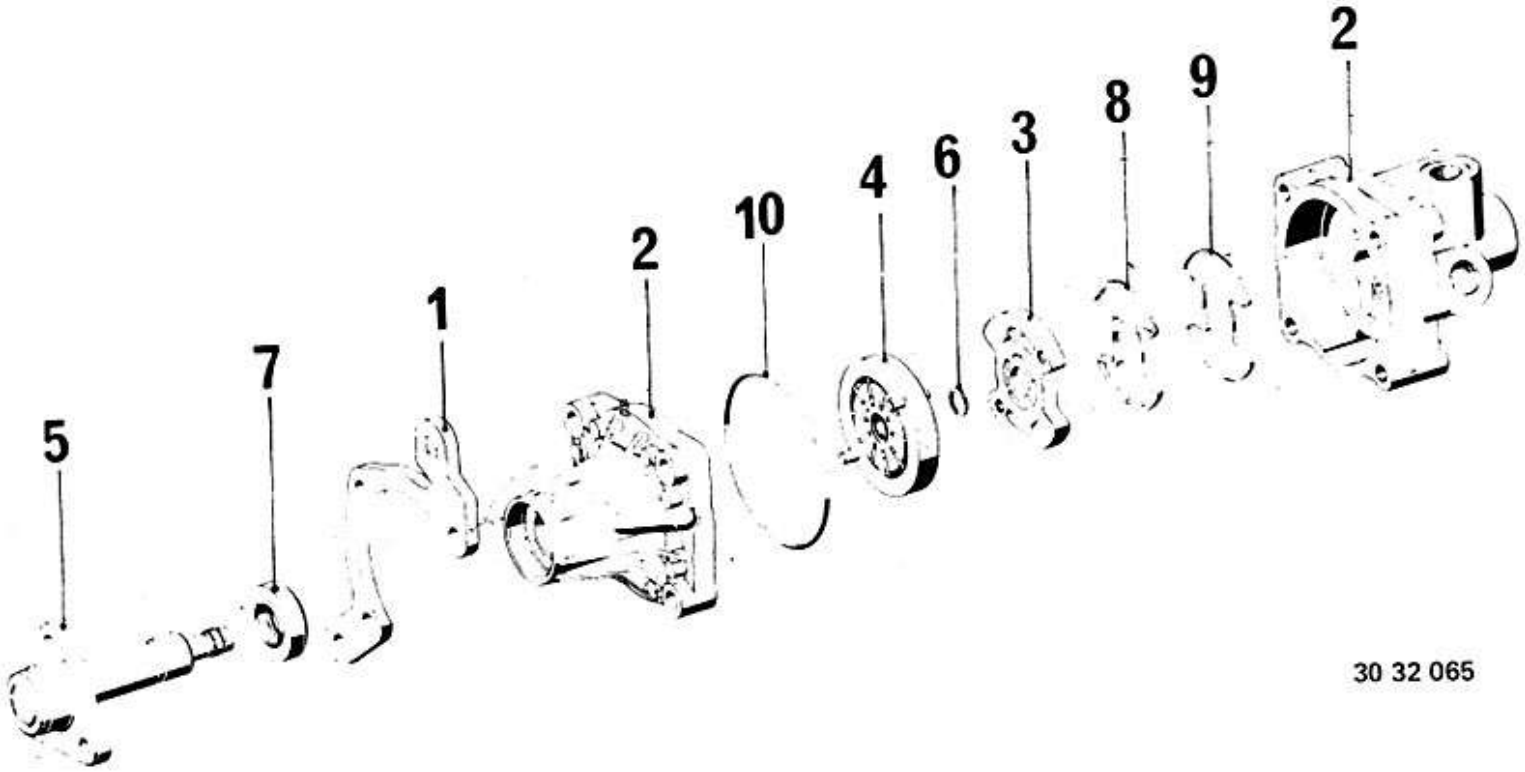
POWER STEERING PUMP ASSEMBLY DRAWING – Code No. 7671 955 ..



1 Hook-type snap ring
2 Cover
3 O-ring
3.1 Support ring
4 Spring
5 Face plate
6 O-ring
6.1 Support ring
7 Snap ring
8 Rotor set
9 Face plate
10 Dowel pin
11 Housing
12 Radial oil seal
13 Input shaft

32-36

POWER STEERING PUMP ASSEMBLY DRAWING – Code No. 7681 955 . . .

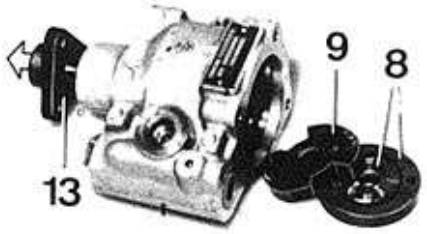


30 32 065

1 Holder
2. Housing
3. Face plate
4 Rotor
5 Shaft
6 Snap ring
7 Radial oil seal
8 Seal
9 Guide
10 O-ring

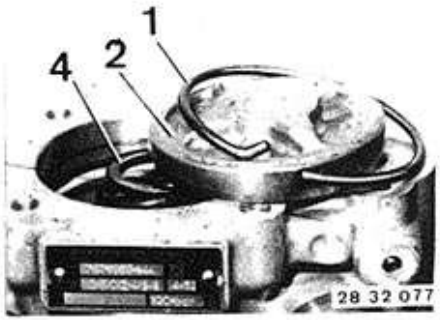
32 41 553 DISASSEMBLING/ASSEMBLING POWER STEERING PUMP – PUMP REMOVED –

A) Pump Code Number: 7671 955 144.
Absolute cleanliness is essential when working on power steering pumps



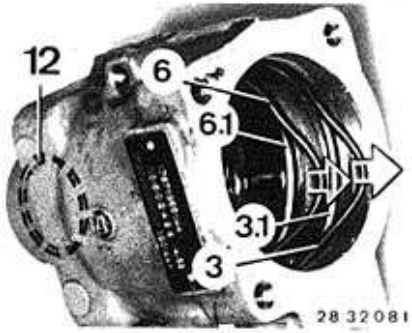
28 32 080

Tilt out rotor set (8) and face plate (9).
Pull out input shaft (13).



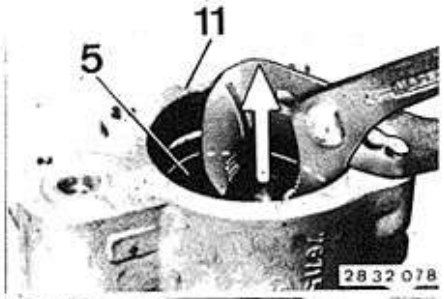
28 32 077

Pull hook-type snap ring (1) out of groove with a pliers.
Take off cover (2) and spring (4).



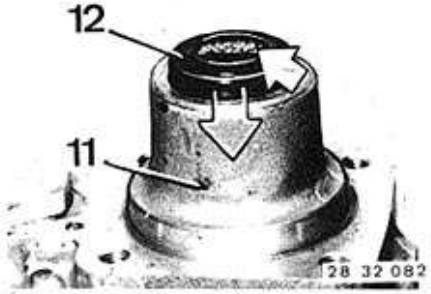
28 32 081

Remove radial oil seal (12) and O-rings (3 and 6).
Support rings (3.1 and 6.1) remain in housing.
Clean all parts thoroughly.



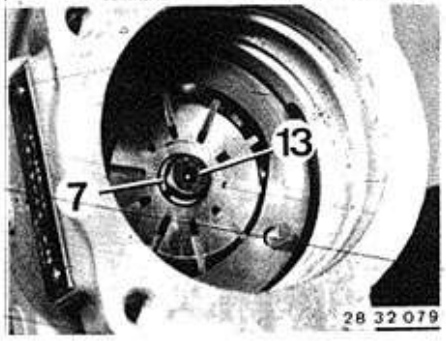
28 32 078

Pull out face plate (5) from housing (11).



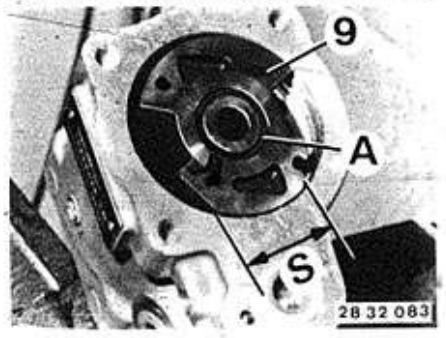
28 32 082

Assembling.
Lubricate all parts with hydraulic fluid.
Pack radial oil seal (12) between sealing lip and dust lip with grease and install seal in housing (11) with a suitable mandrel (sealing lip faces in).



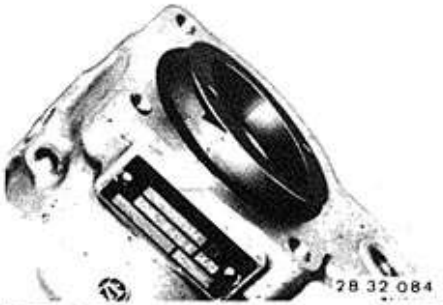
28 32 079

Push rotor on shaft (13) and lift out snap ring (7).

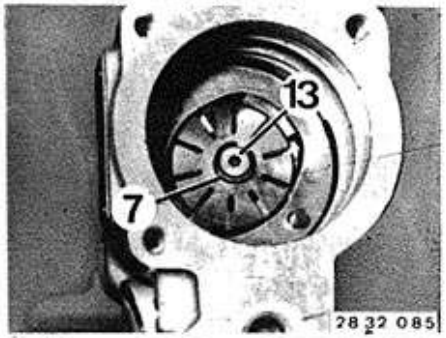


28 32 083

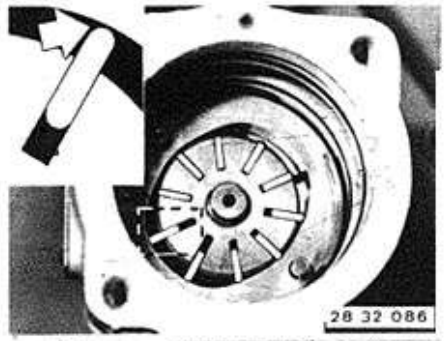
Guide drive shaft (13) into housing (11).
Insert dowel pins (10) in housing bores.
Mount face plate (9) on dowel pins (10) with short side (S) facing valve.
Groove (A) faces cover.



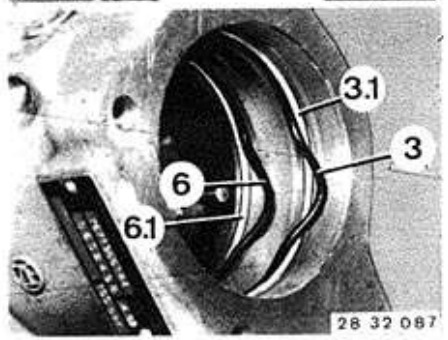
Mount cam ring with cast arrow facing cover end (arrows show turning direction of pump) on dowel pins (10).



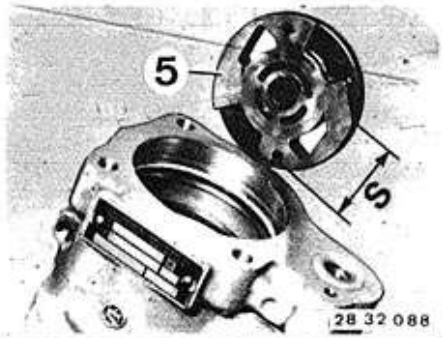
Install rotor with chamfer facing drive end on shaft (13)
Install snap ring (7) in radial groove of shaft (13).
Push down on shaft (13) until snap ring (7) rests in opening of rotor.



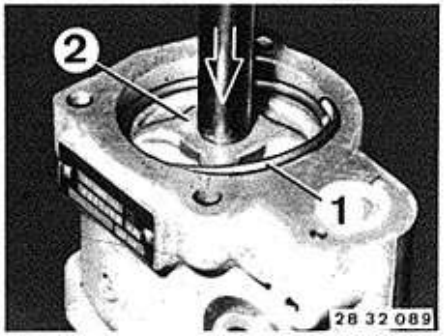
Insert wings with polished, rounded outside surfaces facing cam ring.
Check that wings move easily.



Insert O-rings (3 and 6).
Support ring (3.1) is in front of and support ring (6.1) behind O-ring.



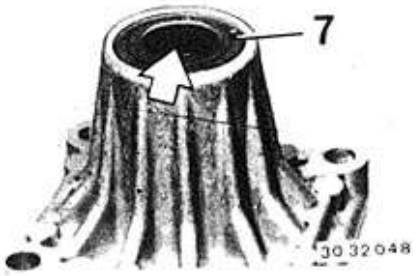
Install face plate (5) on dowel pins (10) with short side (S) facing valve.



Install spring (4) with large diameter end facing cover.
Press cover (2) into housing with a hydraulic press far enough, that hook-type snap ring can be installed in groove.

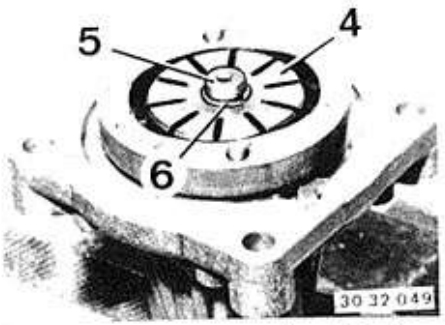
Check operation of power steering pump after installation

B) Pump Code Number: 7681 955 . . .
Absolute cleanliness is essential when working on power steering pumps.

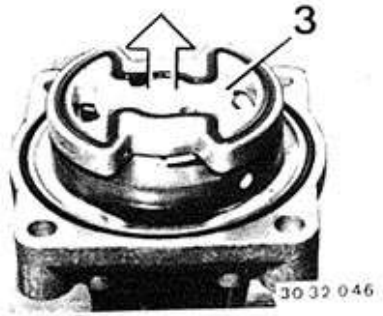


Assembling:
Clean all parts and lubricate with hydraulic fluid.
Replace radial oil seal (7) – sealing lip faces in and pack space between sealing and dust lips with grease.

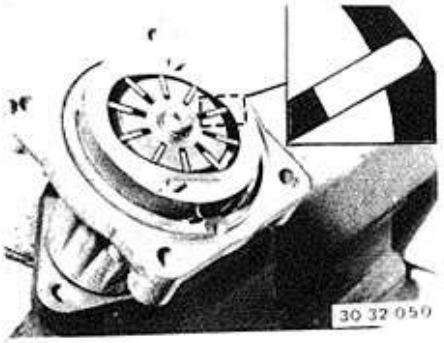
Mark position of holder (1) to pump body (2).
Unscrew bolts and take body apart.



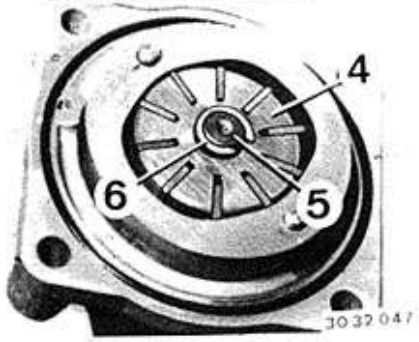
Guide shaft (5) into body.
Install rotor (4) – groove for snap ring faces up – and insert snap ring (6) in radial groove of shaft.



Remove face plate (3).

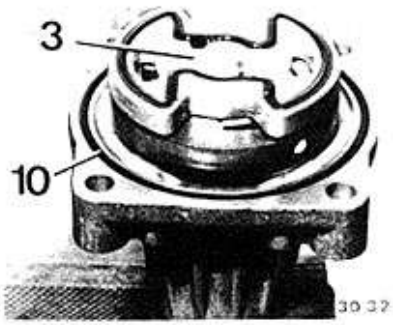


Insert wings with polished, rounded outside surfaces facing cam ring.
Check that wings move easily.

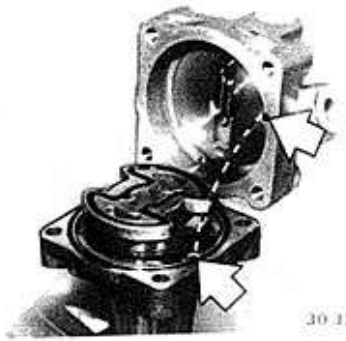


Press rotor (4) on shaft (5) downward.
Remove circlip (6) and pull shaft out of body.
Remove rotor (4) with wings.

Install seal (8) – wide side facing down – and place guide (9) in face plate (3).



Place face plate (3) on dowel pins.
Replace O-ring (10).



Mount body -- check position of bores -- and bolt down with holder.
Tightening torque = 16 to 19 Nm (12 to 14 ft. lbs.).

After finishing installation, check operation of power steering pump

32 - 50

SUPPLEMENT RESTRAINT SYSTEM

COMPONENTS

a) SRS steering wheel with impact shell and padded cap, in which airbag, gas generator and ignition pill are integrated.

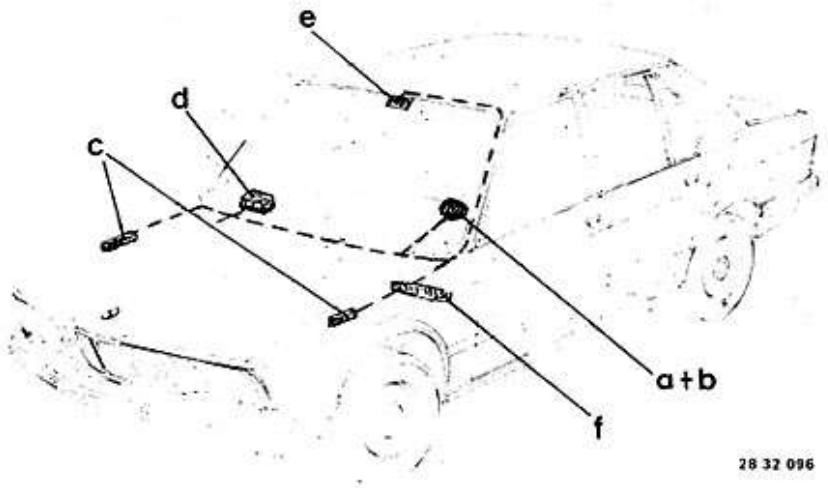
b) Contact ring – guarantees power supply to ignition pill.

c) Two crash sensors (front left and right on wheel house) and safety switch (left).

d) Electronic diagnosis unit (in glove box) with integrated safing sensor (prevents unwanted activation).

e) SRS indicator lamp integrated in check control.

f) Knee guard.



28 32 096

DESCRIPTION

The supplement restraint system (SRS) does not replace fastening the seat belts!.

The system is activated by sensors, whereby there must be car deceleration equal to a direct head-on collision impact of at least 18 km/h (11 mph) against a solid (non-giving) obstacle.

The electric circuit is made and a gas generator ignited. This causes sudden burning of a solid fuel mixture, which in turn releases a non-poisonous gas to completely inflate the folded airbag in the SRS steering wheel within approximately 30 milliseconds.

The crash inflated airbag reduces the severity of injury to the head and upper part of the body in head-on collisions. Discharging takes place through two holes on the side of the airbag facing away from the driver.

MONITORING

The supplement restraint system is monitored continuously by a diagnosis unit from ignition switch position 1 on. The SRS indicator lamp comes on and goes out again after about 6 seconds to show that the system is ready for use.

If this lamp comes on again, there is a detected defect in the system – see "Troubleshooting".

Important!

Always first call the flashing code check control before disconnecting the battery. Disconnecting the battery will cancel the memory of the diagnosis unit and a briefly occurring defect could no longer be pinpointed.

SAFETY REGULATIONS FOR HANDLING "AIRBAG" GAS GENERATORS

Non-conformance with these instructions could lead to unwanted activation of the system and injury.

The airbag unit is a pyrotechnical object. Handling, transporting and storing are subject to "legislation concerning explosive materials" (Explosive Substance Laws of Sept. 13, 1976).

The specifications listed below are in reference to the Federal Republic of Germany. There must always be conformance with pertinent legislation in other countries.

1. Transporting

1.1 It is forbidden to transport airbag gas generators in the passenger compartment of a car!

1.2 Company level transportation must always be in the trunk (luggage compartment) or cargo room of a vehicle and in packed state – the quantity of units is limited to 50.

2. Storing

2.1 The maximum permitted quantity of airbag gas generators in one working room is twenty (20).

2.2 Storage of up to 200 units is permitted in a suitable and lockable room.

2.3 Airbag generators must be stored in packaging suitable for transportation.

3. Installation and Removal:

SRS components and plugs can be recognized immediately on the orange color code.

Tests and installation/removal may only be performed by personnel with qualified training in BMW service.

Working on the "supplement restraint system" always requires the battery to be disconnected, the negative pole or terminal to be covered and the SRS plug (steering column) to be disconnected. If work on the system has to be interrupted, the gas generator must not be left laying around without supervision.

Components of the supplement restraint system may not be repaired. Instead they must always be replaced.

Conformance with the following points is essential.

- Never treat the airbag unit with cleaning solutions or grease.
- Never subject an airbag unit to temperatures above 100° C (212° F).
- Airbag units, front sensors and electronic diagnosis units, which have fallen down from a height of 0.5 meters (1 and 1/2 feet) or more, cannot be installed in cars again.
- The supplement restraint system can only be checked electrically in the car, see "Troubleshooting", and only with the testers mentioned in pertinent section.
- Airbag units may only be stored with the padded side facing up, since if the generator of an airbag facing down would be ignited, the generator would be catapulted up and could cause injury.
- The ignition pill of gas generators must never be aimed at persons regardless of the circumstances.

Procedures for Repairing and After Accidents:

Always disconnect the battery, cover the negative pole or terminal and disconnect both plugs of the front sensors in the engine compartment and the SRS plug (steering column), to be sure that power supply to the gas generator is interrupted, prior to performance of body straightening work or welding work with an electric welder. Also refer to other instructions in the repair manual.

After Accidents:

If the airbag had been activated, always replace all components with exception of wiring when not damaged.

4. Scrapping "SRS" Cars:

In accordance with accident prevention regulations "SRS" gas generators must be rendered unusable prior to scrapping. This is necessary since the gas generator is a pyrotechnical object and could cause injury if activated incorrectly (for example with a torch during scrapping). SRS gas generators must be ignited in the cars meant for scrapping from the outside and with the doors of the car closed. The igniter, Special Tool 62 1 270, developed by BMW for this purpose must be used.

Non-ignited generators are a source of danger (also for the environment)!

1. Remove lower section of steering column casing and disconnect the SRS plug (orange).
2. Connect the igniter on the SRS plug.
3. Connect the igniter on a 12 V battery. Distance from car: 10 meters (32 feet)
4. Keep as far away from car as the length of the igniting lead permits – always stand in front of the car (this also concerns other persons).
5. Operate the ignition switch.

Caution!
The burning off of solid fuel will heat the airbag unit – danger of burning hands!
Wash hands after touching ignited generators!

TROUBLESHOOTING

The "supplement restraint system" employs a defect detector and memory, even for briefly occurring defects. If the "SRS" indicator lamp does not go out after starting, there could be one or more defects. A flashing code from the indicator lamp will help only personnel with qualified training in BMW service to pinpoint and eliminate the defect(s).

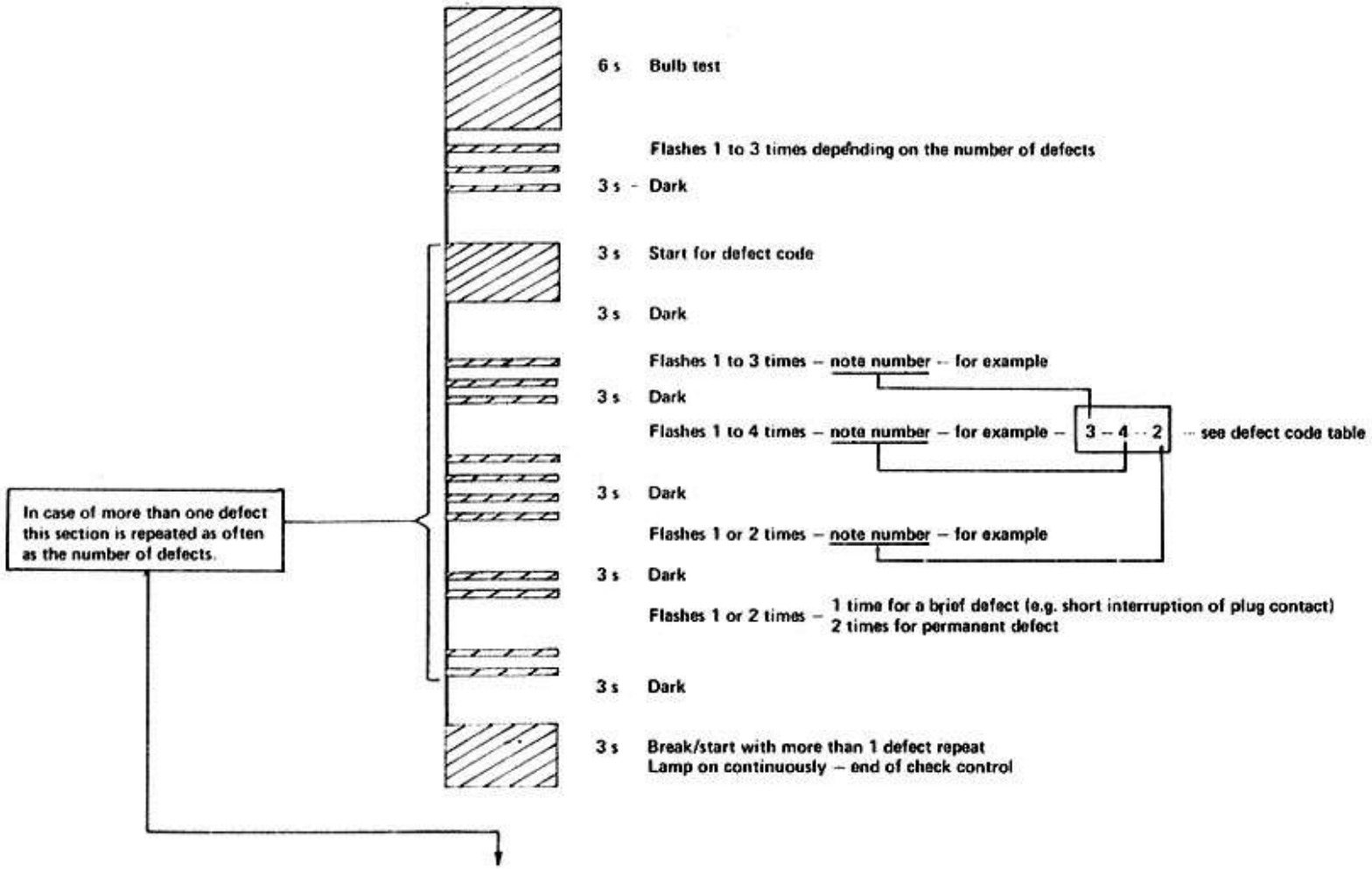
The flashing code can be called by performing the following procedures and as often as desired.

A) Turn off the ignition.

B) Connect SRS diagnosis plug 62 1 250 in the engine diagnosis socket (pins 1 and 6 are bridged).

C) Turn the ignition lock to position 1.

Flashing code will now run off and the number of flashes must be counted.



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DEFECT CODE TABLE

1 – 1 – 1 = B
1 – 1 – 2 = A
1 – 4 – 1 = H
1 – 4 – 2 = G
2 – 1 – 1 = K
2 – 1 – 2 = J
2 – 2 – 1 = M
2 – 2 – 2 = L
2 – 3 – 1 = O
2 – 3 – 2 = N
2 – 4 – 1 = Q
2 – 4 – 2 = P
3 – 1 – 1 = S
3 – 1 – 2 = R
3 – 2 – 1 = U
3 – 2 – 2 = T
3 – 3 – 1 = W
3 – 3 – 2 = V
3 – 4 – 1 = Y

Example: 3 – 4 – 2 = X – see defect code X in testing instructions

TESTING INSTRUCTIONS

After finishing the flashing code call, always disconnect the battery for troubleshooting and cover the negative pole or terminal. Make tests with a BMW service tester or digital tester II at room temperature. Using different testers could activate the SRS.
Pull off the SRS diagnosis plug.

After finishing repairs the last step would be connecting the battery again and checking the function of the system.

If there is a brief defect, cancel the memory of the diagnosis unit by disconnecting and connecting the battery. Check pertinent parts for tight fit and damage with the ignition on. Replace pertinent parts, if a defect is displayed.

Defect Code A or B =

Higher or lower resistance in gray-white/gray wire to SRS unit.

↓

Disconnect plug for diagnosis unit (in glove box). —— yes → Defect Code A:
Connect SRS test plug 62 1 260 and check wire with an ohmmeter.
3.0 to 5.0 ohms?

Defect Code A:
Measure resistance of wire against car ground.
Resistance 200 to 600 ohms? —— yes → See defect code H.

no

Replace diagnosis unit.

Defect Code B:
Replace diagnosis unit.

no

↓

Disconnect plug (on steering column). —— yes → Replace wire.
Connect SRS test plug 62 1 260 and check wire with an ohmmeter.
3.0 to 5.0 ohms?

no

↓

Take SRS unit off of steering wheel and pull off plug. —— yes → Replace SRS unit.
Connect wires of SRS test plug 62 1 260 and measure resistance on disconnected plug with two test points.
1.4 to 1.8 ohms?

no

↓

Replace contact ring.

Defect Code H =
G =

Insulation of power supply wire to SRS unit against ground or against positive insufficient.

↓

Visual inspection of wires and plugs for cracks, dirt and moisture, replacing if necessary.

Defect Code K =
J =

Insulation of power supply wire to left sensor against ground or against positive insufficient. → or break in wire (only J or L)

↓

Visual inspection of wires and plugs for cracks, dirt (salt film) and moisture, replacing if necessary.

↓

Disconnect 4-pin plug on diagnosis unit and measure wire resistance.
9.5 to 10.5 k-ohms? — yes → Replace diagnosis unit.

↓ no

Disconnect plug on front sensor and measure resistance of front sensor.
9.5 to 10.5 k-ohms? — yes → Replace wire.

↓ no

Replace front sensor.

Defect Code M =
L =

Right sensor – see K + J above.

Defect Code O =

Insufficient ground connection between sensors or diagnosis unit and body.

↓

Visual inspection of mounting parts and plugs for corrosion, replacing if necessary.

Defect Code N + H + K =

Left front sensor closed.

↓

Replace left front sensor.

Defect Code N + H + M =

Right front sensor closed.

↓

Replace right front sensor.

Defect Code N + V + K =

See K.

Defect Code N + V + M =

See M.

Defect Code Q, P, S, R, U, T, W, Y, X =

Defect in diagnosis unit.

↓

Replace diagnosis unit.

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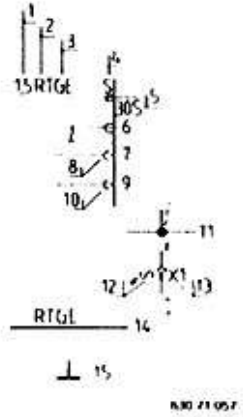
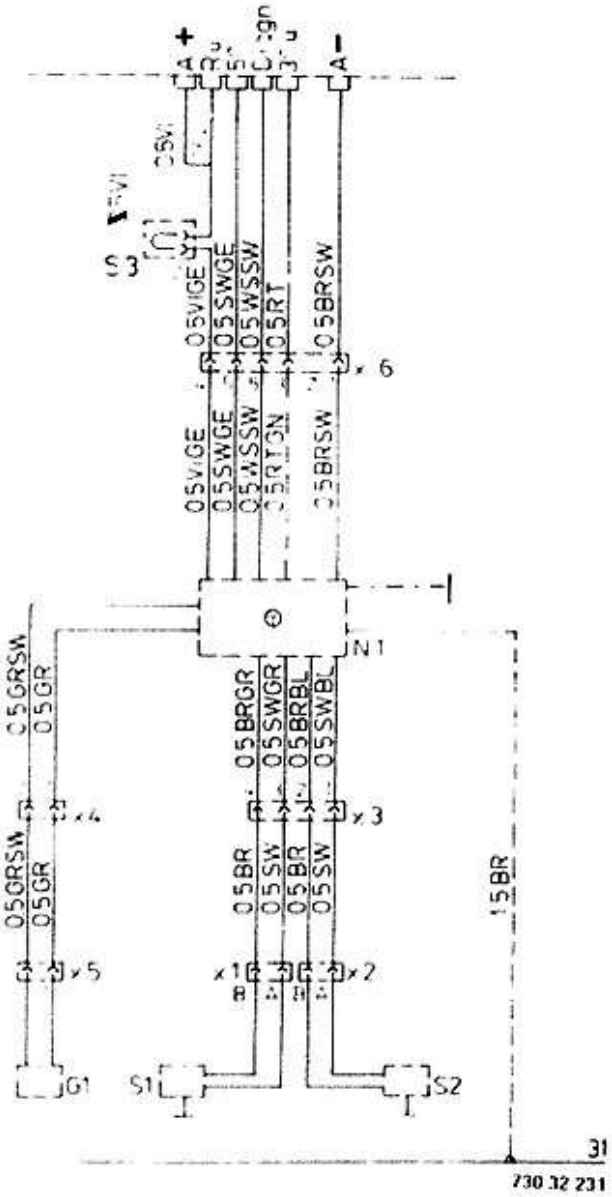




Explanation of Wiring Diagram Codes:

1 = Wire cross section size in mm^2
2 = Basic wire color
3 = Spiral wire color
4 = Socket number
5 = Terminal designation
6 = Screwed connection (wire connector)
7 = Round male plug
8 = Round female plug
9 = Flat male plug
10 = Flat female plug
11 = Soldered point or connector
12 = Socket number
13 = Plug designation
14 = Wires without size data always 0.75 mm^2
15 = Ground

Wire Color Codes:

BL blue
BR brown
GE yellow
GN green
GR gray
RT red
SW black
VI violet
WS white
TR transparent

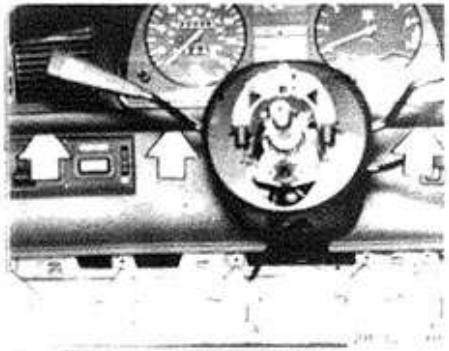
A (+,-) check control
G1 Generator driver
N1 SRS electronics
S1 Front sensor left
S2 Front sensor right
S3 Safety switch

X1 Plug - front sensor left
X2 Plug - front sensor right
X3 Plug - electronics
X4 Plug - generator electronics
X5 Plug - generator steering column
X6 Plug - wire harness center section

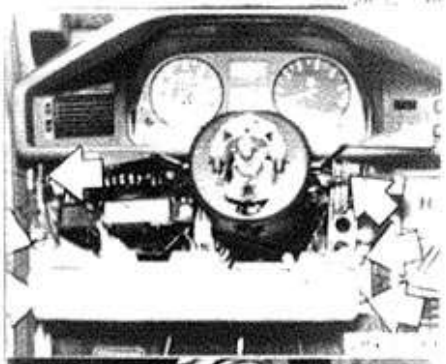
– – – Electronics - Cipro
–.–.– Electronics - Siemens

32 31 090 REMOVING AND INSTALLING STEERING COLUMN ASSY. (SRS)

Caution!
Conform with the safety regulations.
Improper handling could cause unwanted activation of SRS and in turn lead to injury!
Remove the steering wheel — see 32 33 000.
Remove the instrument panel trim at bottom left — see 51 45 180.

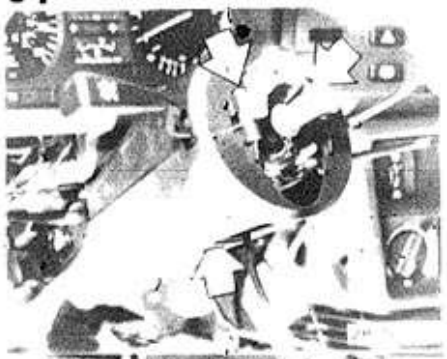


Remove trim panels.

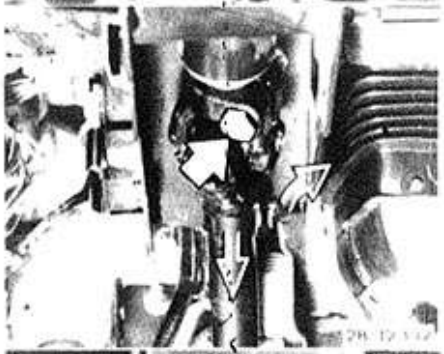


Remove knee guard.

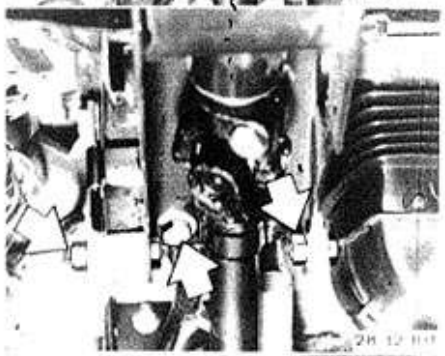
Disconnect plugs.



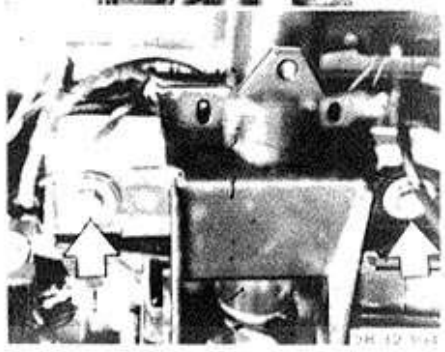
Remove trim panel.



Unscrew the bolts.
Installation:
Install the spacer.
Replace the self-locking nuts.
Tightening torque*.

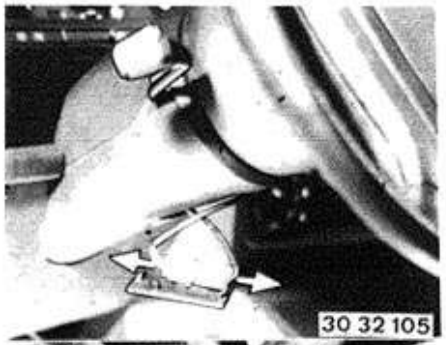


Disconnect the return spring.
Unscrew bolt and pull joint off of the steering spindle.
Installation:
The bolt must be located in the locking groove of the steering spindle.
Replace the self-locking nut.
Tightening torque*.



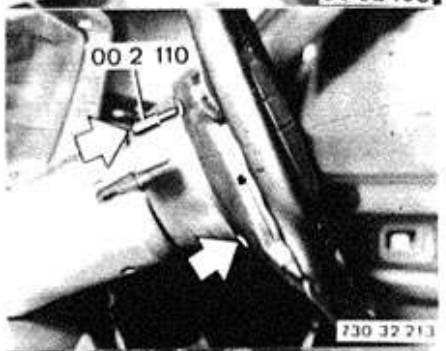
Unscrew bolts and remove the steering column.
Installation:
Install plastic sleeves.
Tightening torque*.

* See Specifications

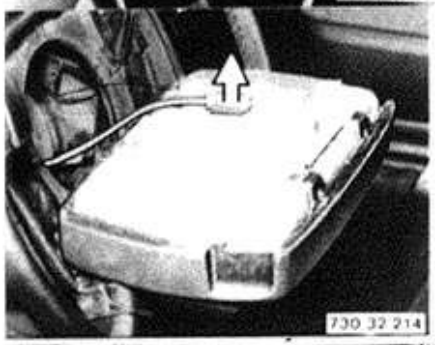


32 33 000 REMOVING AND INSTALLING STEERING WHEEL (SRS)

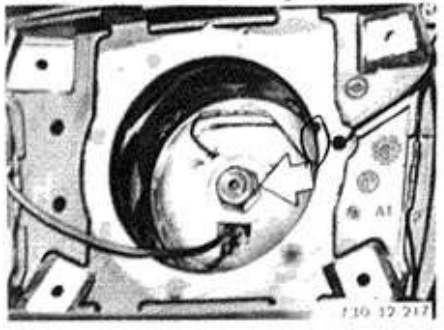
Caution!
Conform with the safety regulations.
Improper handling could cause unwanted activation of SRS and in turn lead to injury!
Disconnect the battery and cover the negative pole or terminal.
Lift cap out of the lower steering wheel casing section and disconnect the plug.



Unscrew four bolts with Special Tool 00 2 110.
Installation:
Tightening torque*.

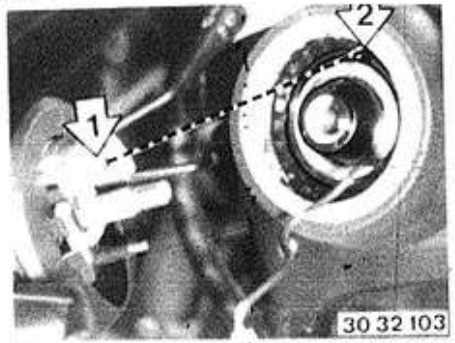


Pull off the plug and remove the airbag unit.
Caution!
The airbag unit must always be laid aside (in trunk of car) with the impact pad facing up.
Installation:
Be careful not to clamp the wires.

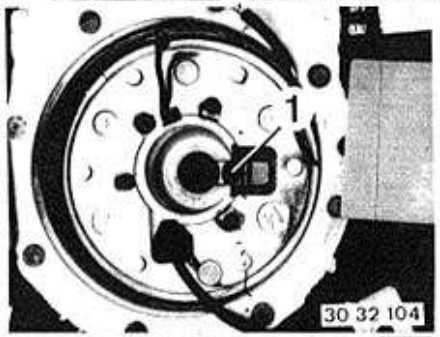


Turn the steering wheel to straight ahead position (marks on steering gear and steering spindle aligned).
Unscrew and remove the nut with washer.
Important!
The steering wheel can only be pulled off after unlocking the steering lock.

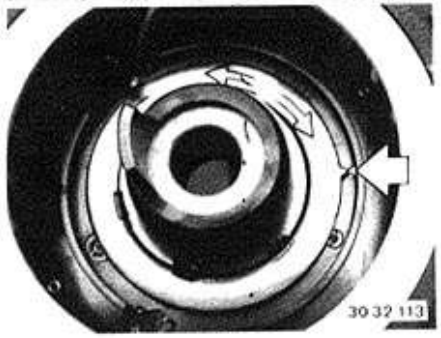
* See Specifications



Installation:
Lock pin (1) must engage in opening (2).
Replace the self-locking nut.
Tightening torque*.



Note:
Loosening the nut will activate spring lock (1) which holds the contact ring in center position.

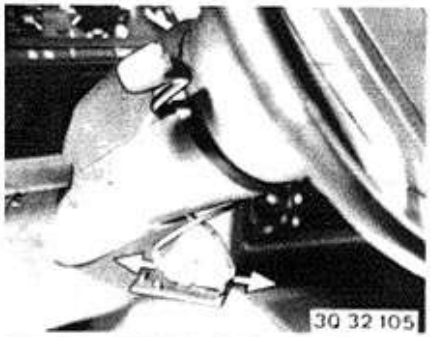


Adjusting Center Position If Necessary.
Press down spring (1), turn the contact ring against the left or right stop and then turn it back about 3 turns until the arrow marks for the center position are aligned.
Now release spring (1).

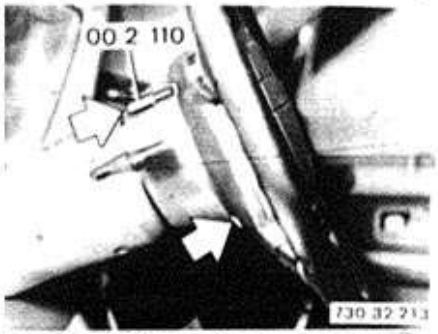
* See Specifications.

32 34 020 REMOVING AND INSTALLING OR REPLACING AIRBAG UNIT (SRS)

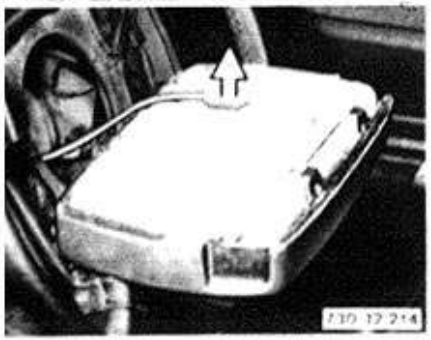
Caution!
Conform with the safety regulations! Improper handling could cause unwanted activation of SRS and in turn lead to injury! Disconnect the battery and cover the negative pole or terminal.



Lift cap out of the lower steering wheel casing section and disconnect the plug.



Unscrew four bolts with Special Tool 00 2 110.
Installation
Tightening torque*.

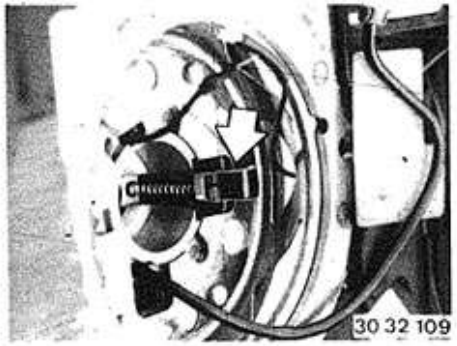


Pull off the plug and remove the airbag unit.
Caution!
The airbag unit must always be laid aside (in trunk of car) with the impact pad facing up.
Installation
Be careful not to clamp the wires.

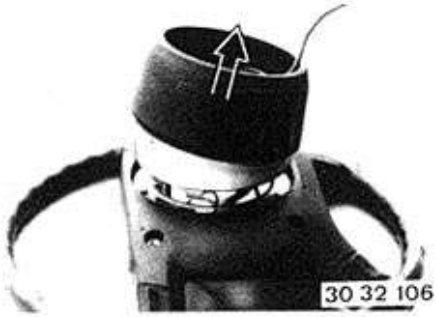
* See Specifications

32 34 510 REPLACING CONTACT RING (SRS)

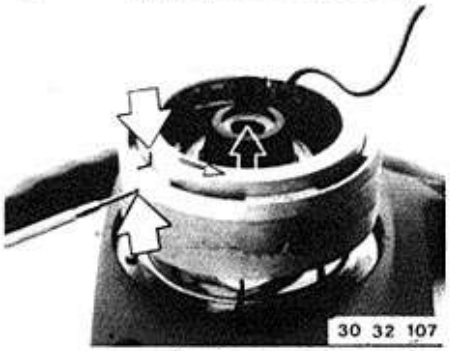
Caution!
Conform with the safety regulations!
Improper handling could cause unwanted activation of SRS and in turn lead to injury!
Remove the steering wheel – see 32 33 000.



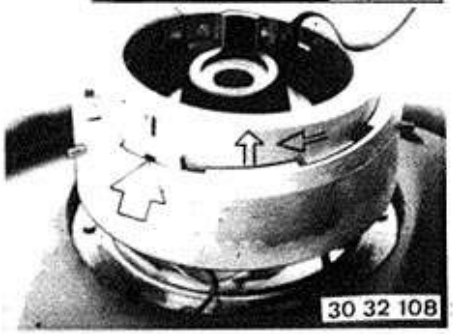
Lift out the lock with a screwdriver.
Installation:
Connect the spring on the lock and insert it in the bore.
Press the lock down until it engages.



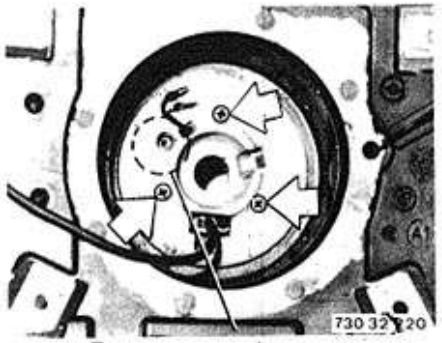
Pull off the casing.
Installation:
Lubricate the horn slip ring with grease.



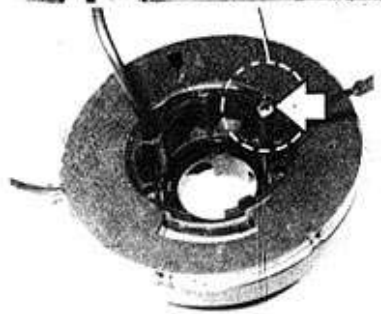
Mark the position of the circlip to the hub.
Unscrew three studs.
Press the circlip down, turn and remove it.



Installation:
Place the circlip in the hub, turn and pull it up.
The studs must be in the openings of the circlip.



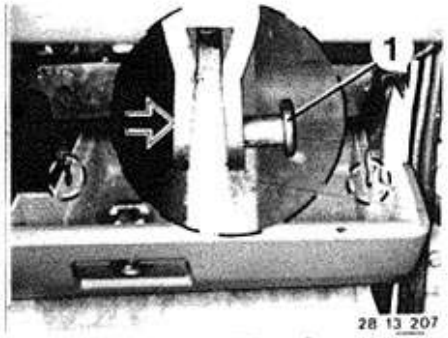
Disconnect the plug.
Unscrew the screw and take off the contact ring.



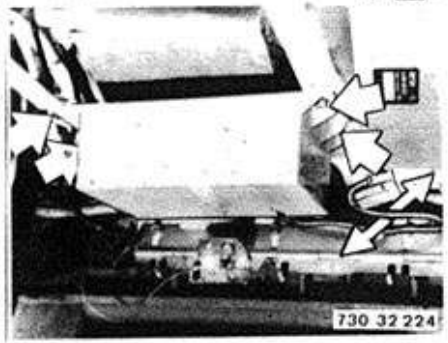
Important!
A new contact ring is held in the center position with a screw.
Remove this screw after screwing the contact ring on the steering wheel.

65 77 010 REMOVING AND INSTALLING OR REPLACING DIAGNOSIS UNIT (SRS)

Caution!
Conform with the safety regulations!
Improper handling could cause unwanted activation of SRS and in turn lead to injury!
Disconnect the battery and cover the negative pole or terminal.



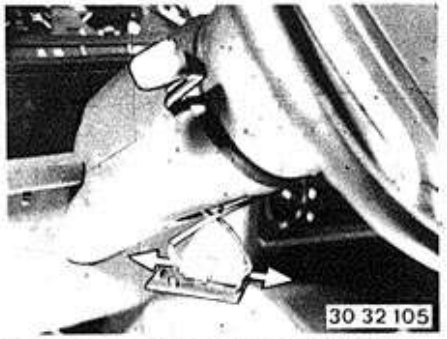
Push out the pin.
Disconnect the strap on the left and right sides.
Remove the trim panel.



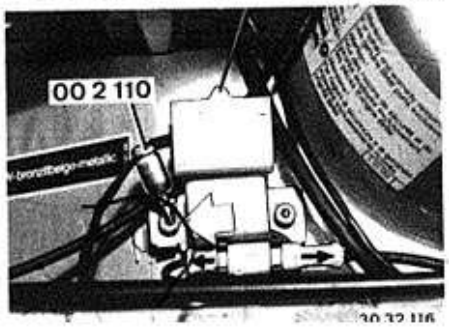
Disconnect the plugs (behind the insulation sheet).
Remove the diagnosis unit.

65 77 020 REMOVING AND INSTALLING OR REPLACING ONE FRONT SENSOR (SRS)

Caution!
Conform with the safety regulations!
Improper handling could cause unwanted activation of SRS and in turn lead to injury!
Disconnect the battery and cover the negative pole or terminal.



Lift the cap out of the lower steering column casing section and disconnect the plug.

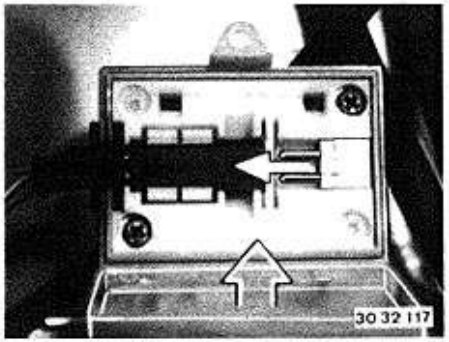


Disconnect the plug and unscrew the bolts with Special Tool 00 2 110.
Installation:
The arrow faces forward.
Tightening torque*.

* See Specifications

65 77 040 REPLACING SAFETY SWITCH (SRS)

Caution
Conform with the safety regulations!
Improper handling could case unwanted activation of SRS and in turn lead to injury!
Disconnect the battery and cover the negative pole or terminal.

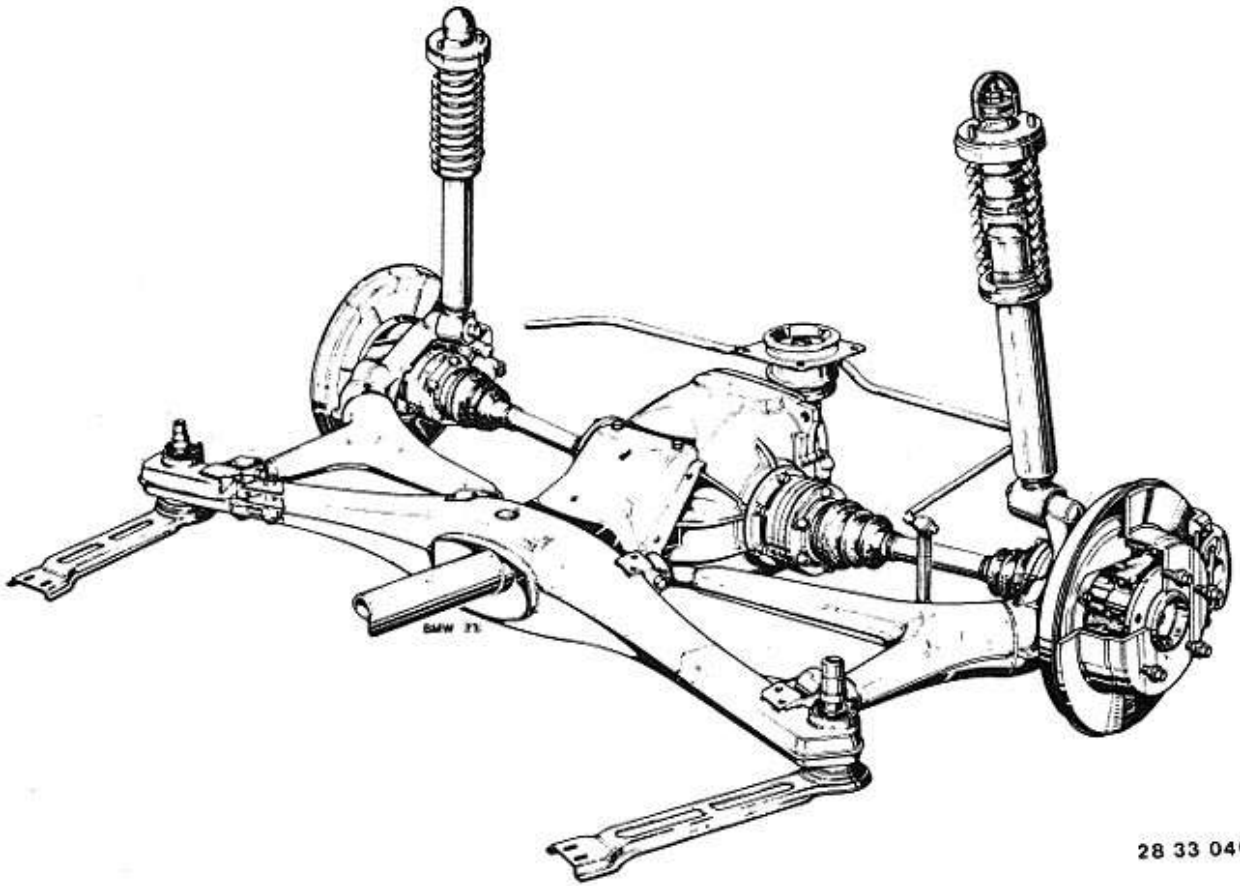


Open the cover, take off the plug and unscrew the screws.
Note:
Opening the cover will destroy the safety switch, which must then be replaced.
Installation:
Screw on the safety switch.
Insert the plug.
Push the contact bridge toward the plug.
Close the cover.

33 Rear axle

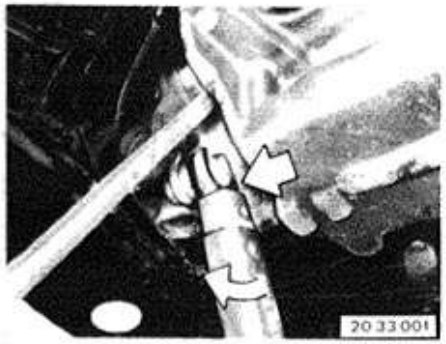
33-0

LAYOUT DRAWING OF RAER AXLE ASSEMBLY

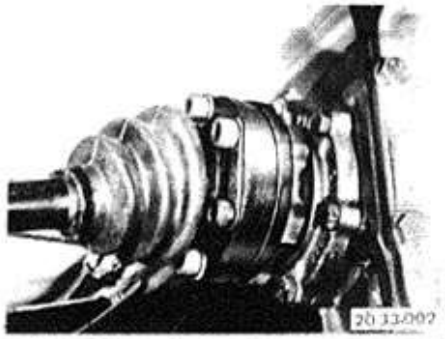


28 33 046

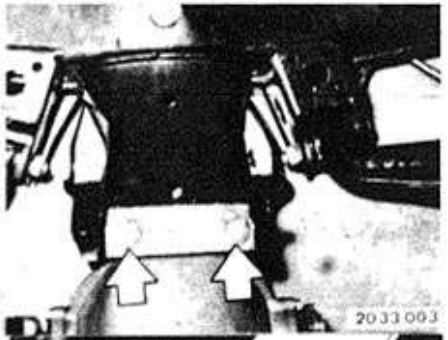
33 10 010 REMOVING AND INSTALLING FINAL DRIVE



Unscrew propeller shaft.
Installation:
Replace self-locking nuts.
Tighten nuts with a torque wrench and special wrench socket**
Tightening torque*.



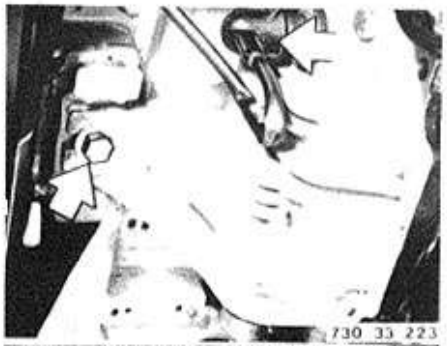
Unscrew output shafts and suspend from car on pieces of wire.
Installation:
Tightening torque*.



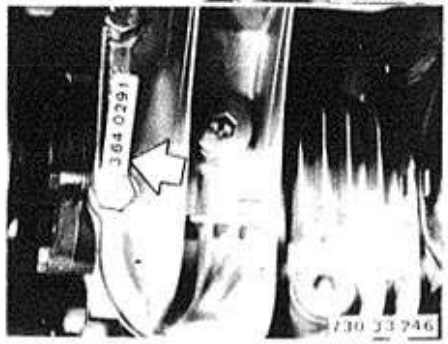
Unscrew final drive bolts on rear axle carrier at top.
Installation:
First locate final drive on rear axle carrier with the top bolts.
Tightening torque*.

Support final drive with a jack.
Unscrew front bolts on left and right sides.
Installation:
Tightening torque*.

* See Specifications
** Source: HWB



Pull off wires on speedometer pulse sensor.
Unscrew mounting bolt of rubber mount and lower final drive.
Installation:
Tightening torque*.



Installation:
When replacing, check ratio* and final drive version.
Ratio digits are stamped on the data plate (1).

BREAKING IN PROCEDURES AFTER REPLACING/REPAIRING FINAL DRIVE

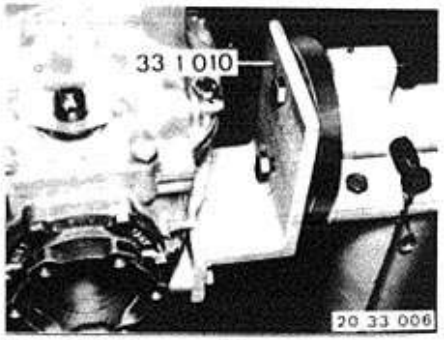
The preload of the tapered roller bearing requires strict conformance with the breaking-in procedures.

According to these breaking-in procedures the car must be operated during the first 1,000 km (600 miles) with alternating engine speeds and road speeds, however never faster than 2/3rds of the permissible top speed in 4th gear (direct).
In the case of cars with a five speed manual transmission (overdrive) 2/3rds of the permissible top speed in 4th gear is applicable for 5th gear.

In case of non-conformance with these breaking-in procedures the tapered rollers and inner race guide collar would seize and lead to constant noise, excessive heat and oil loss.

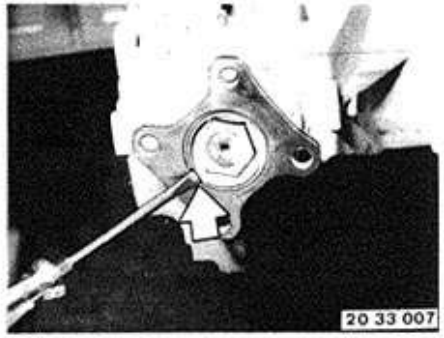
Mount label with information on next oil change in view of driver.

* See Specifications



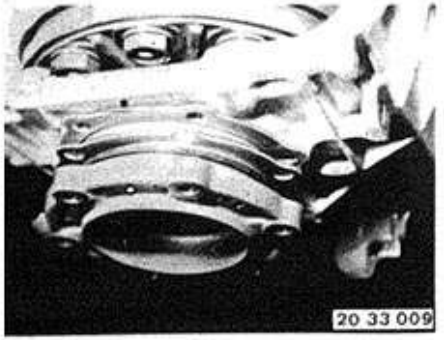
33 11 011 REPLACING SHAFT SEAL FOR FINAL DRIVE INPUT FLANGE

Remove final drive – see 33 10 010 in pertinent model repair manual microfiche, beginning with 1985 models.
Mount final drive on Special Tool 33 1 010.
Drain oil. Take off case cover.
Installation:
Replace gasket. Tightening torque*.
Add oil – oil volume*
See Service Information of Group 00 for approved oil.



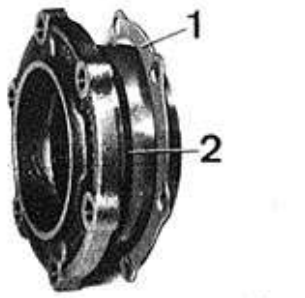
Remove lockplate.

Press off drive flanges with a tire iron.

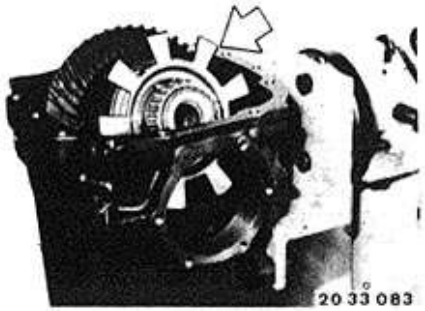


Punch mark both bearing caps.
Remove both bearing caps.
Important!
Don't mix up the bearing caps and spacers.
If necessary, hold the spacers on bearing caps with pieces of wire.
Installation:
Tightening torque*.

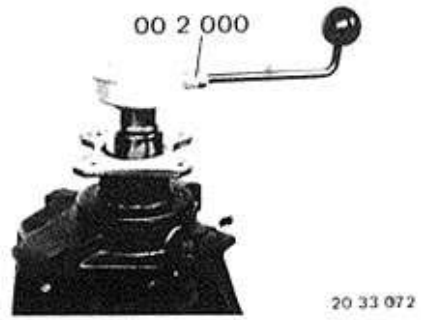
* See Specifications



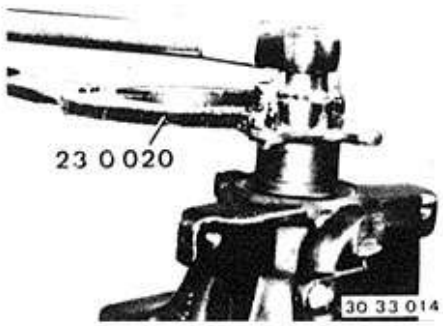
Differential case bearings and backlash are adjusted with shims (1).
Check O-ring (2), replacing if necessary.



Remove differential assembly.
Important!
Don't bend the pulse spider.

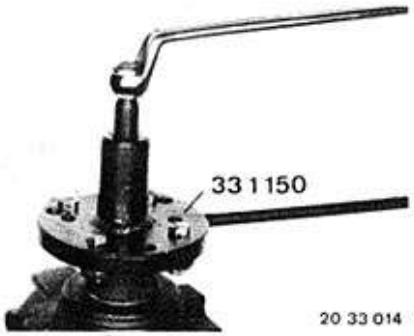


Measure friction torque with torque meter 00 2 000 and note the value.
Important!
The measured friction torque value + friction torque of new shaft seal (20 Ncm/2 in. lbs.) must be reached when assembling, but not exceeded.

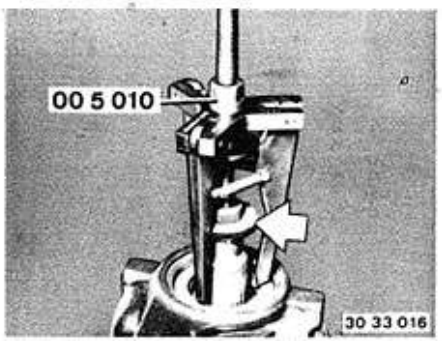


Hold the input flange with Special Tool 23 0 020
Unscrew the collar nut.
Installation:
Tightening torque*.

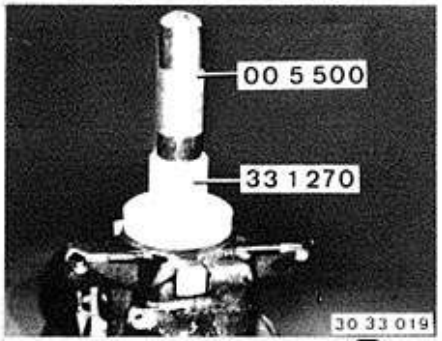
* See Specifications



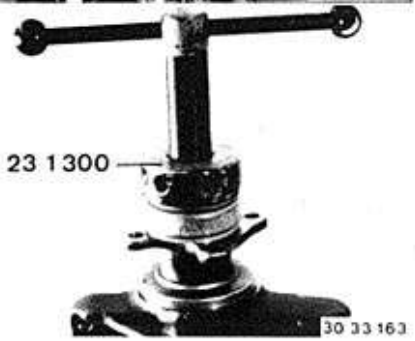
Pull off the input flange with Special Tool 33 1 150.



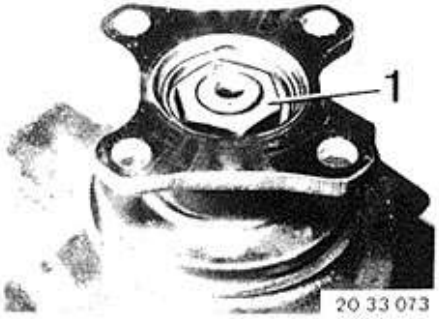
Pull out the shaft seal with Special Tool 00 5 010 and a thrust piece.



Dip the shaft seal in final drive gear lube and drive in the seal flush with Special Tool 33 1 270.



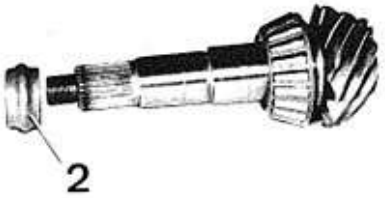
Press new input flange on to the input shaft with Special Tool 23 1 300, but do not tighten. The bushing does not have to be replaced when replacing the input flange.



Tighten the input flange with the collar nut in steps, measuring the friction torque between steps.

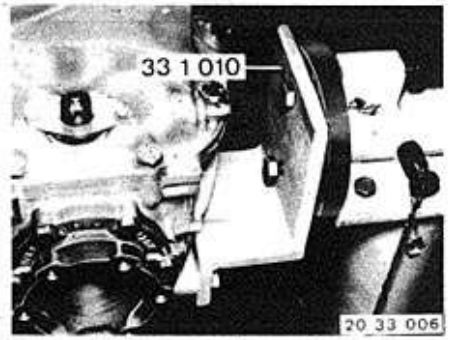
Adjust the drive pinion to the friction torque value measured prior to disassembling and add 20 Ncm (2 in. lbs.).
Example:

Measured torque	160 Ncm (14 in. lbs.)
New shaft seal	+ 20 Ncm (2 in. lbs.)
Pinion bearing adjusted to	180 Ncm (16 in. lbs.)



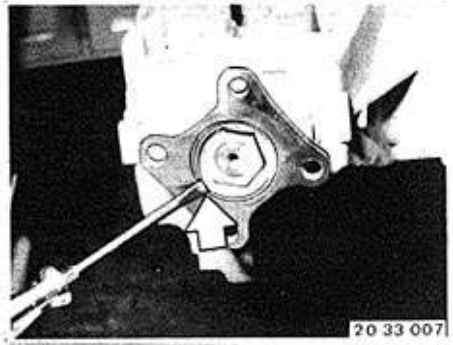
If the friction torque value (see example) is exceeded, replace bushing (2) and repeat the measuring procedures.
This requires removing and installing drive pinion – see 33 12 551.
Installation:
Drive in a new lockplate with Special Tools 33 4 050 and 00 5 500.

Installation:
Install complete differential, checking for correct installation of bearing caps.
The differential bores (1) always face up when the differential is installed correctly and this can be seen on the outside by way of tab (2).
If applicable, check backlash and tooth contact pattern.
See 33 12 551 for additional information.

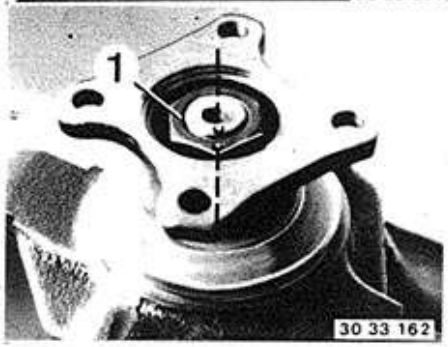


33 1T 512 REPLACING SHAFT SEAL FOR INPUT FLANGE
– Final Drive Removed –

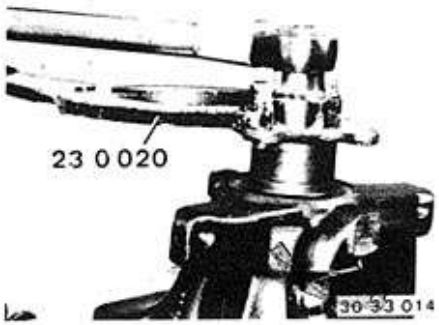
Remove final drive – see 33 10 010 in the pertinent model repair manual microfiche, beginning with 1985 models.
Mount final drive on Special Tool 33 1 010.
Drain oil.
Installation:
Pour in oil – oil volume*.
See Service Information of Group 00 for oil grade.



Lift out the lockplate.
Installation:
Drive in the new lockplate with Special Tools 33 4 050 and 00 5 500.

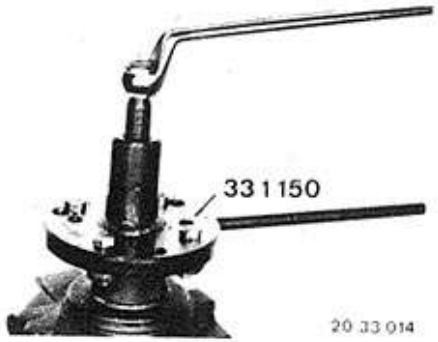


Punch mark position of nut (1) to the input shaft.

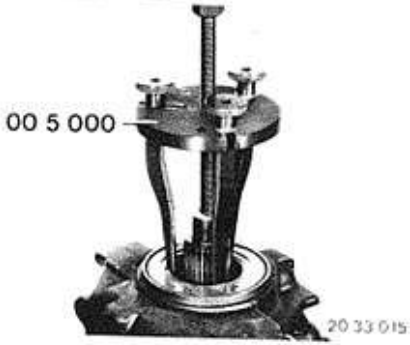


Unscrew nut (1), counterholding on the flange with Special Tool 23 0 020.

* See Specifications

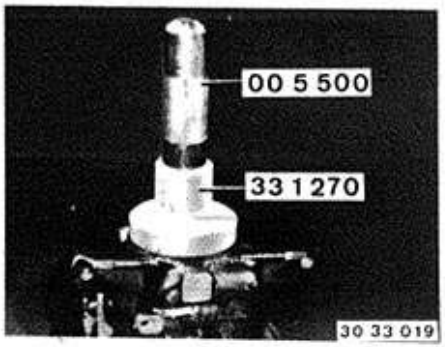


Pull off the input flange with Special Tool 33 1 150.

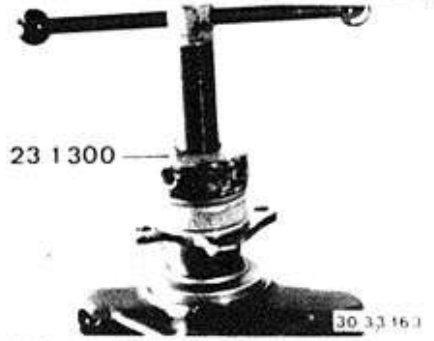


Pull out the shaft seal with Special Tool 00 5 010 and a suitable thrust piece.

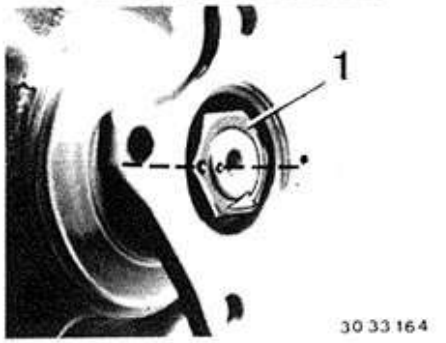
Installation:
If the bearing surface on the input flange is scored seriously, replace the input flange.
Important!
If the input flange has to be replaced, measure the friction torque with the old input flange.
If applicable, tighten the nut to the punch mark, measure and note the friction torque value – see 33 11 011.
The old shaft seal does not have to be installed for measuring.



Dip a new shaft seal in final drive gear lube** and drive in the seal flush with Special Tool 33 1 270.

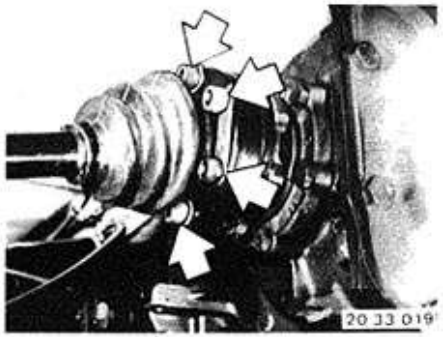


Press on the input flange, if necessary with Special Tool 23 1 300; do not tighten.



Tighten the input flange with collar nut (1) and then turn the nut further until the punch marks are aligned precisely.
Important!
Never tighten the collar nut past the punched marks and then back again, since then the bushing would have to be replaced – see 33 12 551.
Installation:
Replace the lockplate.
Pour in final drive gear lube**.

** See Service Information of Gr. 00

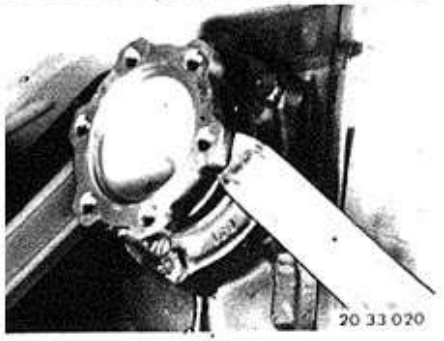


33 11 151 REPLACING SHAFT SEAL FOR DRIVE FLANGE

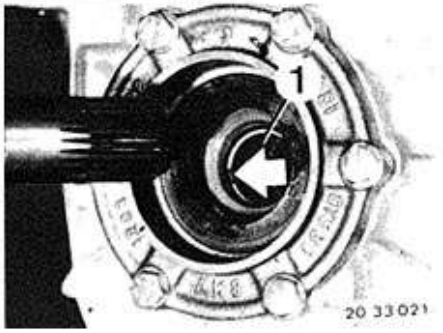
Detach output shaft at drive flange.
Suspend output shaft with a piece of wire.

Installation:

Tightening torque [1].

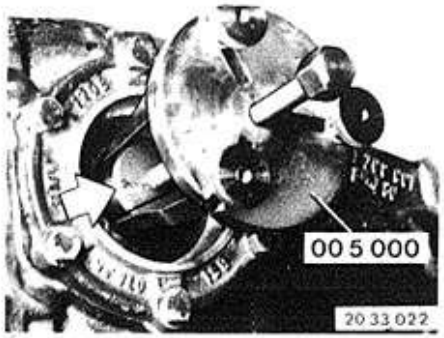


Press off drive flange with a tire iron.

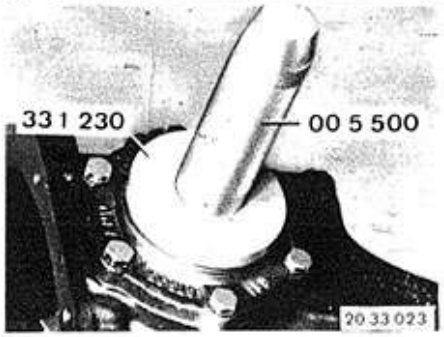


Installation:

Before installing the drive flange, place round wire snap ring in groove of differential case that both ends of snap ring are recessed in groove. This will prevent lateral bending of the ring. Press in drive flange by hand and turn slightly until round wire snap ring is heard to engage. Replace stretched snap rings.



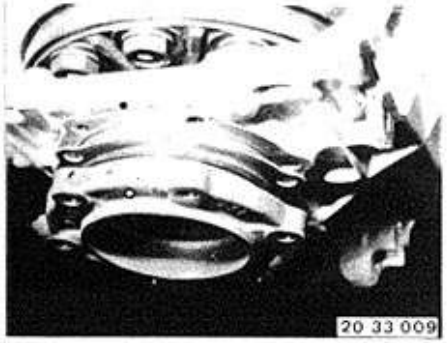
Pull out shaft seal with Special Tool 00 5 000 and pressure pad.



Installation:

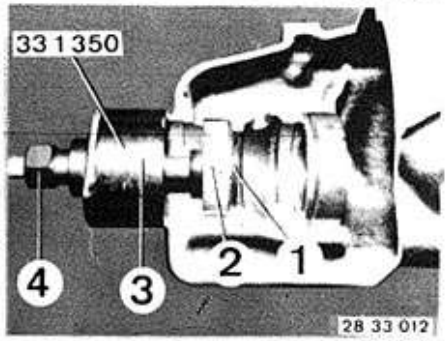
Dip shaft seal in final drive oil.
Knock in shaft seal against stop with Special Tools 33 1 230 and 00 5 500.
Replace drive flange when bearing surface has extreme scoring.

See Specifications

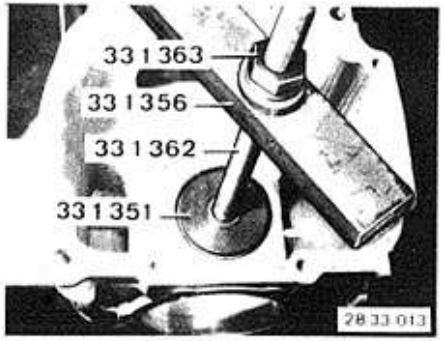


33 12 551 REPLACING DRIVE PINION AND RING GEAR
FINAL DRIVE REMOVED

Remove drive pinion (see "Replacing Shaft Seal for Input Flange" 33 11 011).
Important!
Measure total friction torque and note value.
Mark bearing caps.
Don't mix up washers.
Measure friction torque of drive pinion bearings and note value.



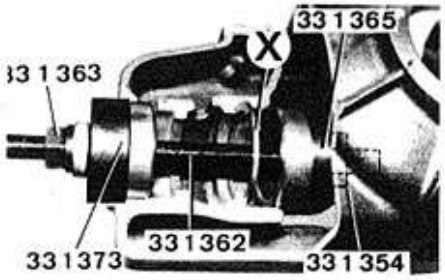
Pull out front bearing outer race with Special Tool 33 1 350.
1 Spreader
2 Front bearing outer race
3 Pulling bell
4 Pressure bolt



Pull out rear bearing outer race with Special Tool 33 1 360.
Puller consists of:

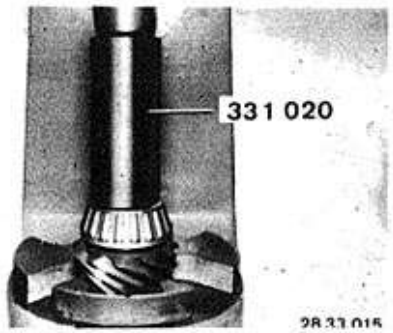
Puller head	33 1 351
Threaded spindle	33 1 362
Bearing bridge	33 1 356
Pressure nut	33 1 363

Important!
Shim (X) is located underneath the rear bearing outer race and will be required again for adjustment of drive pinion.

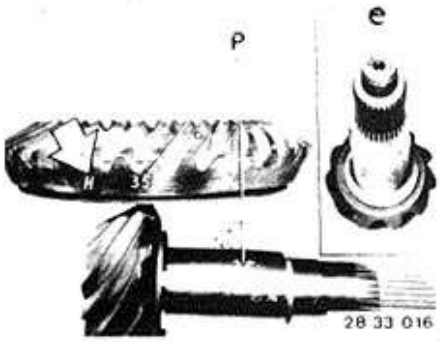


Install old shim (X) in front of rear bearing outer race.
Pull in bearing outer races with Special Tool 33 1 360.
Puller consists of:

Pulling disc for front race	33 1 373
Pulling disc for rear race	33 1 365
Threaded spindle	33 1 362
Pressure nut	33 1 363
Nut	33 1 354

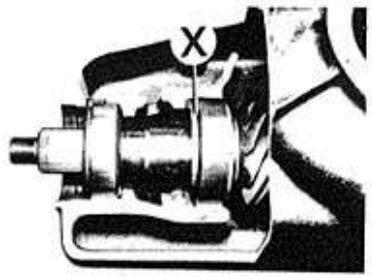


Press taper roller bearing on to drive pinion with Special Tool 33 1 020.

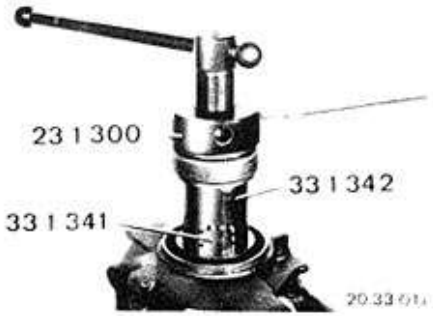


Important!
Drive pinions and ring gears are matched for optimum smooth running in special machines. The match code (P) is electrically inscribed in the drive pinion and ring gear.
Never install a ring gear and drive pinion with different match codes (P) together.

The number inscribed with a + or – sign is the deviation from basic setting C in hundreths of millimeters and is required to determine thickness of shim.
e + is added to C.
e – is subtracted from C.
K or H is tooth type code.
K = Klingelnberg teeth
H = Gleason teeth



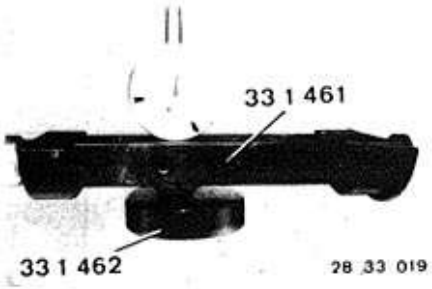
To determine the correct thickness of shim (X), install drive pinion with new taper roller bearing but without the clamping bush.



Place drive pinion in rear bearing outer race. Screw Special Tool 33 1 341 on drive pinion and pull front taper roller bearing on to drive pinion with Special Tools 23 1 300 and 33 1 342

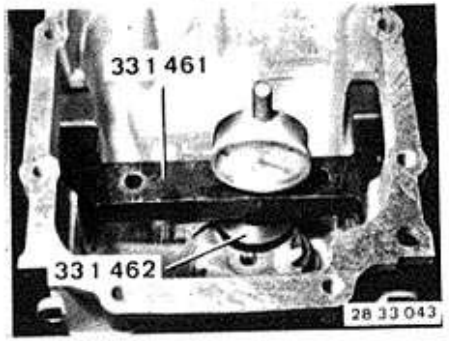
Attach drive flange.
Tighten collar nut to adjust friction torque of drive pinion taper roller bearing to 250 Ncm (22 in. lbs.).

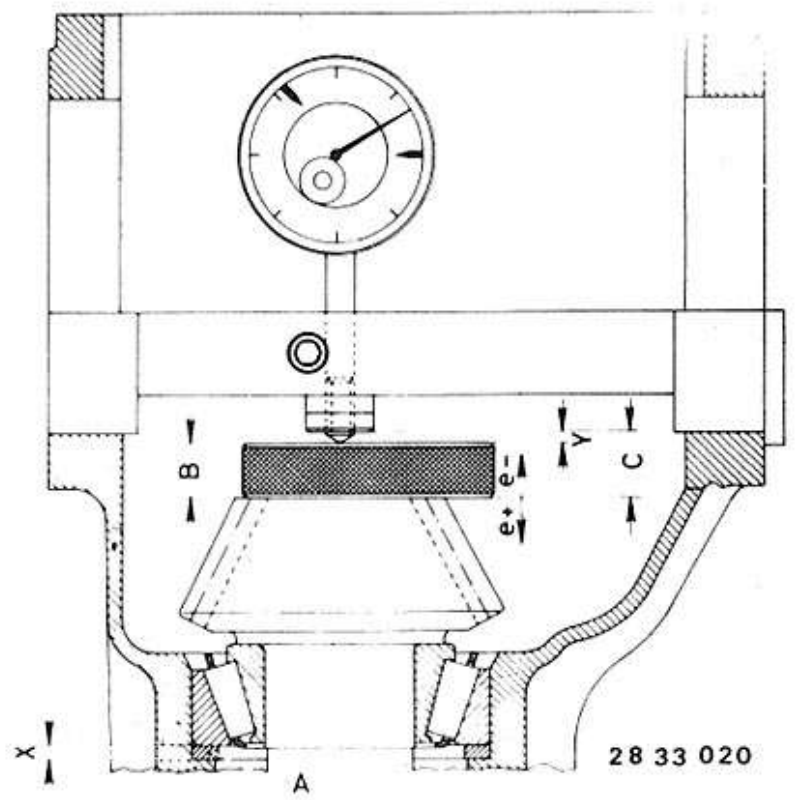
Mount dial gauge in Special Tool 33 1 461.
Place Special Tool 33 1 461 with dial gauge on Special Tool 33 1 462 and set dial gauge with preload to 0 (zero).



Place Special Tool 33 1 462 on drive pinion.
Place Special Tool 33 1 461 in case.
Determine Y.

Basic setting	C	11.50 mm (0.453")
Master gauge	B	9.50 mm (0.374")





Example I

C		11.50 mm (0.453")
e –		0.10 mm (0.004")
C target		11.40 mm (0.449")
Value Y measured with dial gauge	+	1.80 mm (0.071")
Sum B		9.50 mm (0.374")
Sum Y	+	1.80 mm (0.071")
C actual		11.30 mm (0.445")
C target		11.40 mm (0.449")
C actual	–	11.30 mm (0.445")
a		0.10 mm (0.004")
Master gauge A		4.14 mm (0.163")
– a		0.10 mm (0.004")
Shim X		4.04 mm (0.159")

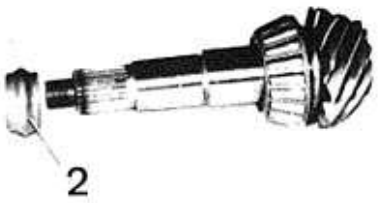
If C target is greater than C actual, "a" is subtracted (–) from shim thickness X.

Example II

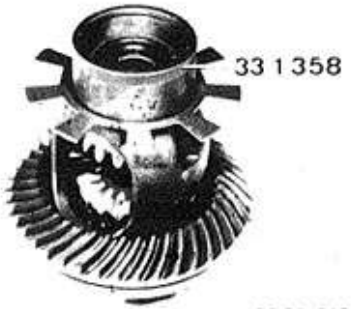
C		11.50 mm (0.453")
e +		0.10 mm (0.004")
C target		11.60 mm (0.457")
Value Y measured with dial gauge	+	2.20 mm (0.087")
Sum B		9.50 mm (0.374")
Sum Y	+	2.20 mm (0.087")
C actual		11.70 mm (0.461")
C actual		11.70 mm (0.461")
C target	–	11.60 mm (0.457")
a		0.10 mm (0.004")
Master gauge A		4.10 mm (0.161")
+ a		0.10 mm (0.004")
Shim X		4.20 mm (0.165")

If C target is smaller than C actual, "a" is added (+) to shim thickness X.

The permissible tolerance for distance (X) depends on the tolerances for a certain shim thickness ranging from 0.01 to 0.03 mm (0.0004 to 0.0012").



Remove drive pinion and rear bearing outer race.
Press in shim (X) of determined thickness and bearing outer race.
Install drive pinion with new clamping sleeve (2).
Knock in shaft seal and attach input flange.

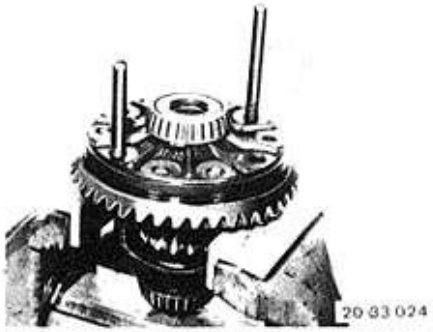


20 33 012

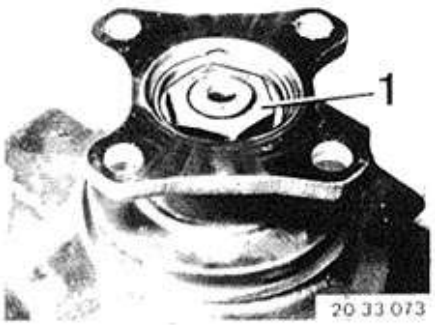
Press pulse spider off of differential case.
Installation:
Press on pulse spider with Special Tool 33 1 358.

20 33 016

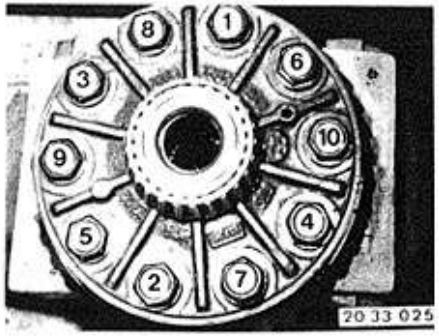
Tighten collar nut and measure friction torque.
Adjust drive pinion bearing to friction torque value measured prior to disassembling plus 20 Ncm (2 in. lbs.) for new shaft seal.



Detach ring gear (cold).
Installation:
Clean threads thoroughly with a tapper.
Heat ring gear to max. 100° C (212° F), checking temperature with a thermocolor pencil.
Mount ring gear with 2 staybolts (made locally) as guides.



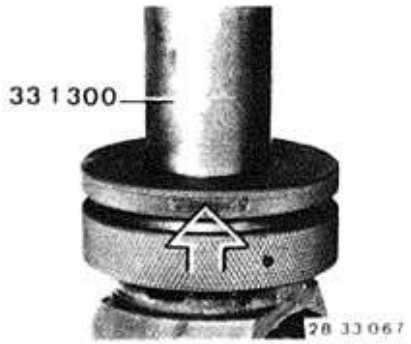
Important!
Collar nut (1) must be tightened to at least the specified torque value[1].
If this value is not reached or the friction torque is exceeded, replace clamping bush (2) and repeat check.



Install new bolts with Loctite No. 270 and tighten in order of 1 through 10.
Tightening torque[1].
Tighten bolts to torque angle[1].

[1] See Specifications

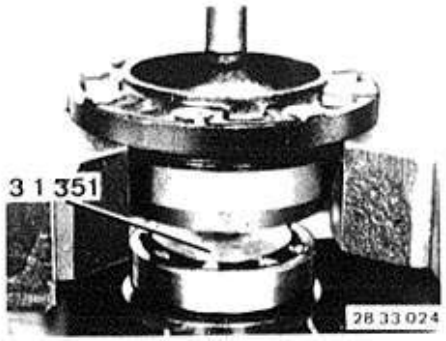
[1] See Specifications



Pull off tapered roller bearing on differential case with Special Tools 33,1 300 and 33 1 305.

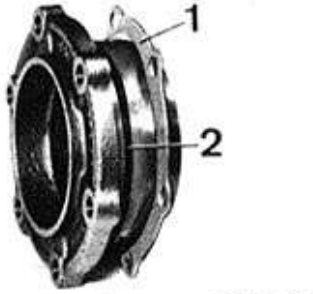
Installation:
Press on new tapered roller bearing cold with Special Tool 31 1 003.

Remove shaft seals from both bearing covers.
Installation:
Dip new shaft seals in final drive oil.
Knock in shaft seals against stop with Special Tools 33 1 230 and 00 5 500.

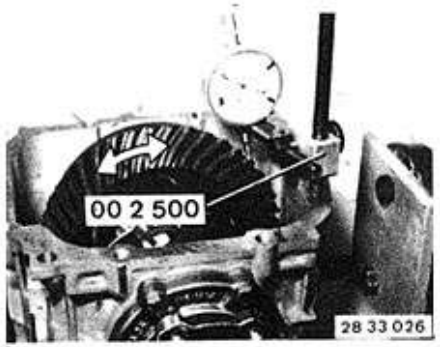


Press out bearing outer race with Special Tool 33 1 351.
Important!
Puller spider must engage in bearing outer race.

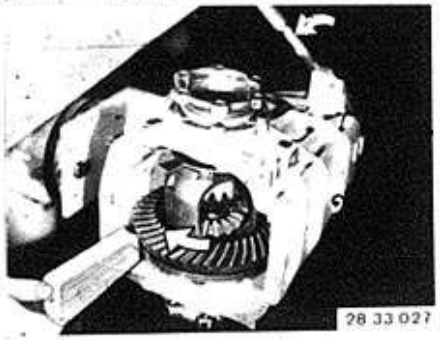
Installation:
Press in new bearing outer races with Special Tool 33 1 365.



Install bearing covers (marked) with corresponding washers (1).
Check O-ring (2), replacing if necessary.

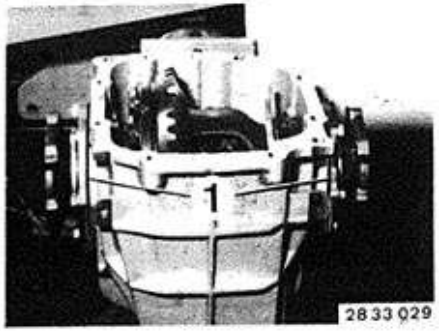


Mount Special Tool 00 2 500 and measure backlash[1].
Important!
The tooth contact pattern is always deciding for correctly adjusted drive pinion/ring gear sets.



To check the tooth contact pattern, coat ring gear with printer's ink, turn ring gear several times in both directions and stop suddenly with a piece of hard wood.
Correct backlash and tooth contact pattern by changing shims from one side to the other.

Measure total friction torque and compare with value determined prior to disassembling.
Add 20 Ncm (2 in. lbs.) for each replaced shaft seal.



Important!
Changing the total thickness of shims (1) would change the friction torque value.
The backlash and tooth contact pattern must be adjusted again after adjusting the friction torque.

[1] See Specifications

Basic Information on Tooth Contact Patterns

Gleason Teeth:

A
Correct tooth contact pattern without load.

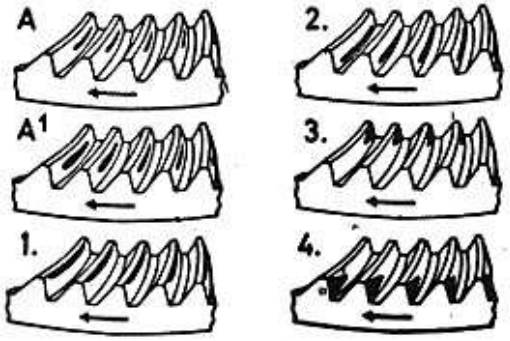
A 1
Loads will shift tooth contact pattern outward slightly.
Moving the ring gear will mainly change the backlash, but will also displace the contact pattern in longitudinal direction of teeth.
Moving the drive pinion will displace the contact pattern in favor of tooth height, but the backlash will be altered just very slightly.
Here are the four basic incorrect tooth contact patterns, which usually appear in combination. Knowing these patterns will facilitate making adjustments.

1. High, narrow contact pattern (tip contact) on ring gear. Move drive pinion toward ring gear shaft and perhaps correct backlash by backing ring gear off of drive pinion.
2. Deep, narrow contact pattern (root contact) on ring gear. Move drive pinion away from ring gear shaft and perhaps correct backlash by moving in ring gear.
3. Short contact pattern on small tooth end (toe contact) of ring gear. Move ring gear away from drive pinion. Maybe move drive pinion closer to ring gear shaft.
4. Short contact pattern on large tooth end (heel contact) of ring gear. Move ring gear toward drive pinion. Prehaps back drive pinion away from ring gear shaft.

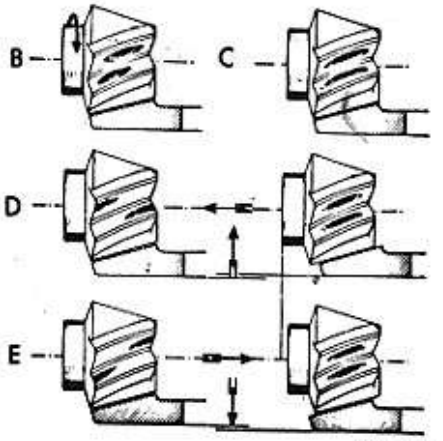
Klingelnberg (Palloid) Teeth:

Tooth contact pattern on forward and reverse flanks of drive pinion should be at approximately center of tooth length and tooth height.

B Tooth contact pattern off load.
C Tooth contact pattern under load.
D By installing a thicker shim X behind drive pinion the contact pattern of forward flank will shift toward the large drive pinion diameter, while on the reverse flank it will move closer to the small drive pinion diameter.
E Other possible changes (see drawing).

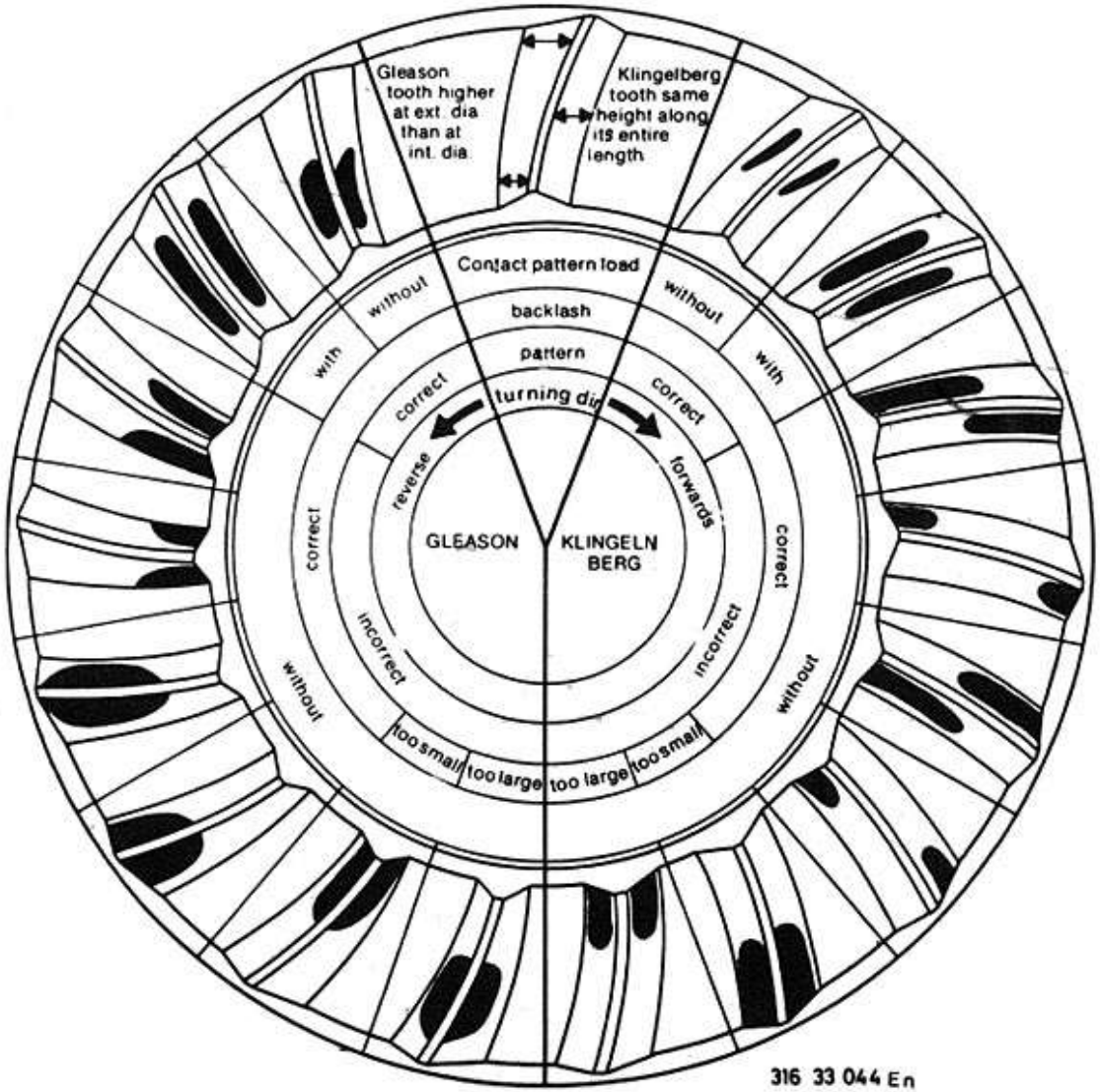


28 33 030



28 33 031

Adjustment of contact pattern

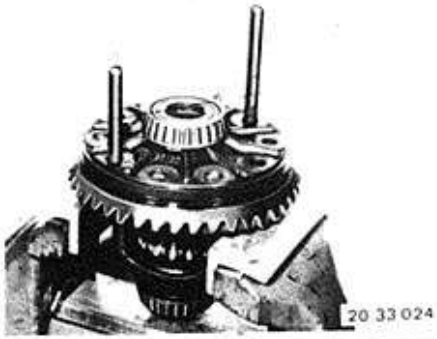


316 33 044 En

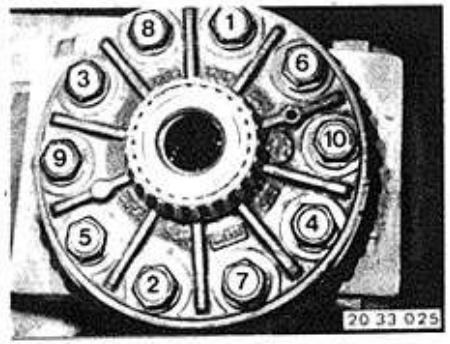
33 13 611 ·REPLACING DIFFERENTIAL GEARS –DIFFERENTIAL REMOVED–

20.33 012

Press off pulse spider.
Installation:
Press on pulse spider with Special Tool 33 1 358.

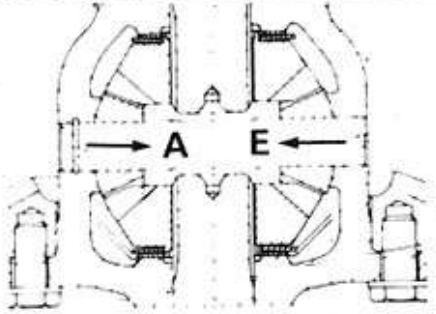

20 33 024

Take off ring gear (cold).
Installation:
Clean threads thoroughly (tapper).
Heat ring gear to max. 100° C (212° F) and check temperature with a thermocolor pencil.
Install ring gear with 2 locally manufactured staybolts as guides.



20 33 025

Install new bolts with Loctite No. 270 and tighten in order of 1 through 10.
Tightening torque*.
Retighten bolts to torque angle*.

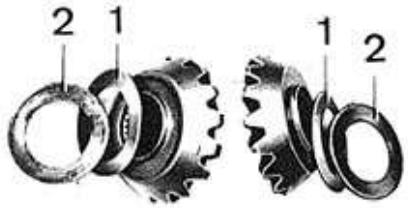


Press out differential gear shaft from large countersunk end with Special Tool 33 1 470.
A = Pressing-out direction
E = Pressing-in direction

* See Specifications

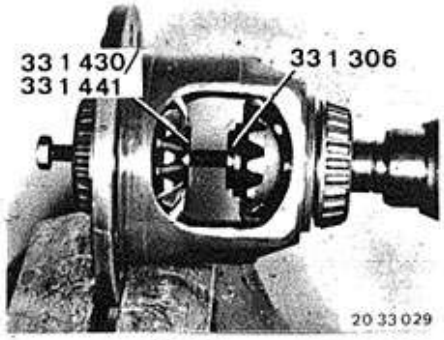

20 33 027

Turn out differential bevel gears with drive flange.
Remove differential side gears with diaphragm springs and shims.



20 33 028

Install both differential side gears with diaphragm springs (1) and shims (2).
Inside curved surfaces of diaphragm springs (1) face differential side gears.
Center differential side gears with drive flanges.

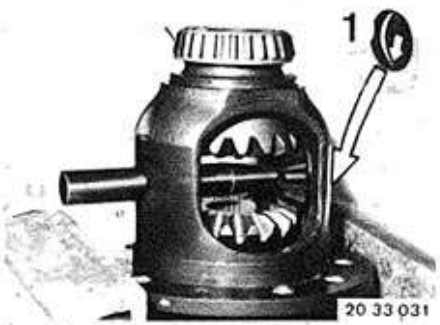


20 33 029

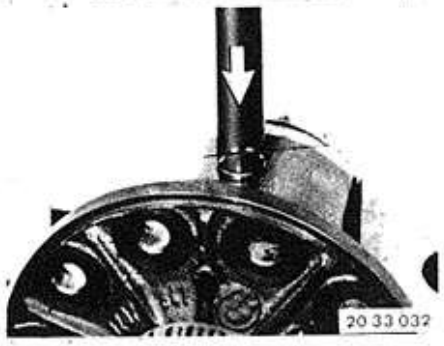
Insert Special Tool 33 1 306 on one side.
Apply Special Tools 33 1 441 and 33 1 430.
Tighten special tool spindle to press differential side gears so far apart, that the drive flange can just barely be turned.


20 33 030

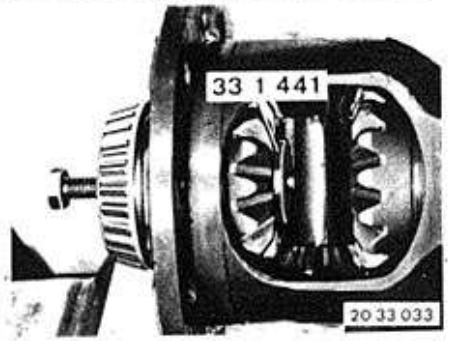
Install differential bevel gears exactly opposite each other.
Move differential gears to installed position by turning drive flange.
Remove special tools.



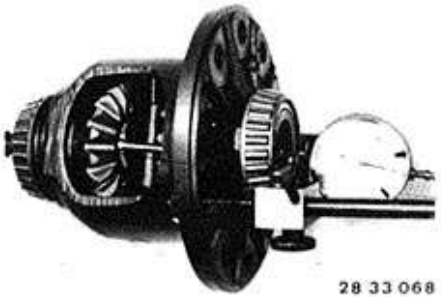
Make sure circlip (1) is installed in correct position.
Push in mandrel from side without circlip.



Position differential gear shaft's chamfer on mandrel and press in.
The pressing-in force will increase considerably when circlip has engaged.
Important!
Stop pressing-in procedure when force rises danger of shearing off the circlip!
Don't push back differential gear shaft after installation.



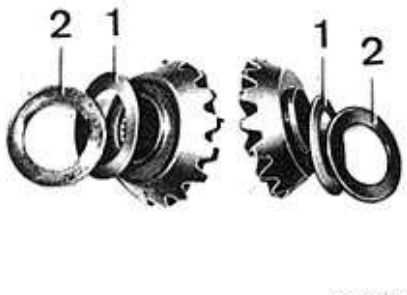
Measuring Pre-load of Diaphragm Springs:
Install Special Tools 33 1 441 and 33 1 431.
Tighten special tool spindle by hand.



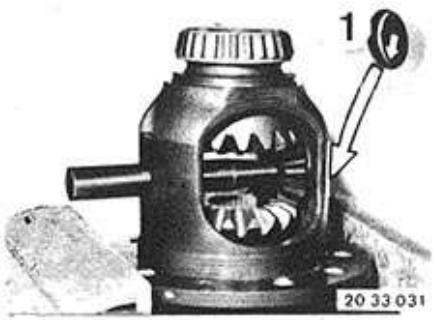
Mount dial gauge with holder, consisting of Special Tools 33 1 420, 00 2 505 and 00 2 506, on differential case.
Set dial gauge on stopped shaft gear to zero with pre-load.

Tighten spindle that diaphragm springs are pressed flat.
Read dial gauge.
Loosen spindle.
Turn shaft gear and repeat test at several points.
A play of 0.03 to 0.1 mm (0.0012 to 0.0040") is required to prevent pressing diaphragm springs flat.
The lower value would be ideal.
Repeat test on opposite shaft gear.

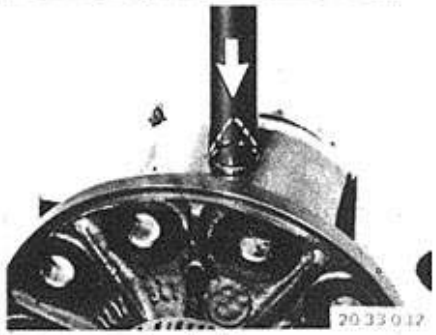
Excessive Play:
Install thicker shim.
Insufficient Play:
Install thinner shim.
Shims (2) are available in thickness steps of 0.05 mm (0.0020").
Apply same procedures for opposite side.



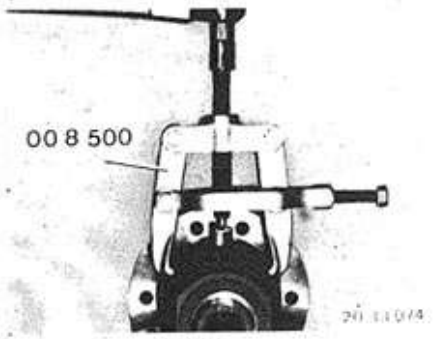
Install shims (2) of determined thickness and diaphragm springs (1).
Inside curved surfaces of diaphragm springs (1) face differential case.



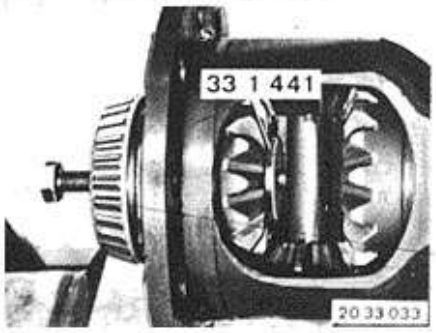
Step performed with Special Tool 00 8 500:
Check for correct installed position of circlip (1).
Slide in Special Tool 33 1 470 from end without a circlip.



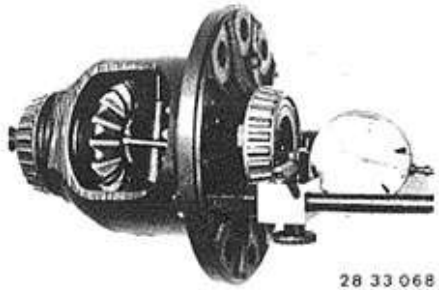
Apply differential gear shaft with large opening on mandrel and press in, until approx. 1 to 2 cm (3/8" to 3/4") of shaft is still visible.



Apply Special Tool 00 8 500 on differential cage and pull in differential gear shaft with a torque breaking wrench.
Torque Adjusting Value:
22 Nm (16 ft. lbs.) for 18 mm (0.709") spindle diameter.
22 Nm (16 ft. lbs.) for 20 mm (0.787") spindle diameter.
Important!
Lubricate centering point on differential gear shaft with oil before applying the spindle.
Do not push back differential gear shaft after installation.
Make sure last quarter of torque, from approx. 17 Nm (12 ft. lbs.), is made at constant speed (not suddenly).

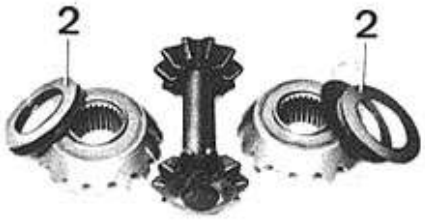


Measuring Preload of Diaphragm Springs:
Install Special Tool 33 1 441 and spindle.
Tighten spindle by hand.

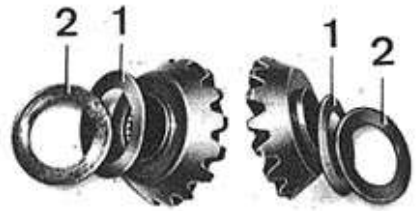


Apply dial gauge with holder.
Set dial gauge to zero with preload.

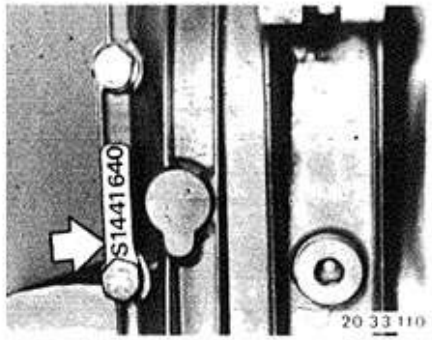
Tighten spindle enough that diaphragm spring is pressed flat.
Read dial gauge.
Loosen spindle.
Turn differential side gear and repeat test at several points.
A play of 0.03 to 0.1 mm (0.001 to 0.004") is required to prevent pressing diaphragm springs flat.
Lowest value would be ideal.
Repeat test on opposite differential side gear.



Excessive Play:
Install thicker shim.
Insufficient Play:
Install thinner shim.
Shims (2) are available in thickness steps of 0.05 mm (0.0020").
Opposite end procedures are identical.



Install shims (2) of determined thickness and diaphragm springs (1).
Inside curved surface of diaphragm springs (1) faces differential case.



LIMITED SLIP DIFFERENTIAL WITH 25 % LOCKING RATIO

The limited slip differential is marked with a "S" on the case or data plate.
A limited slip differential has the following advantages.

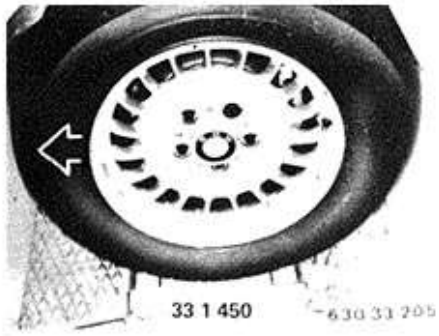
a) Prevention of wheel slip when driving on rough road surfaces.

b) Prevention of wheel slip when moving off with different traction underneath left and right sides of car wheels.

c) Prevention of wheel slip when driving fast on wet roads.

d) Prevention of wheel slip on inside of curve when driving fast in curves.

e) Prevention of slip when driving fast on roads with different traction between left and right.



Checking Function Without Removing:

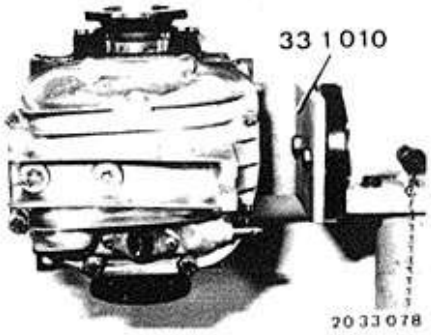
a) Level workshop floor.

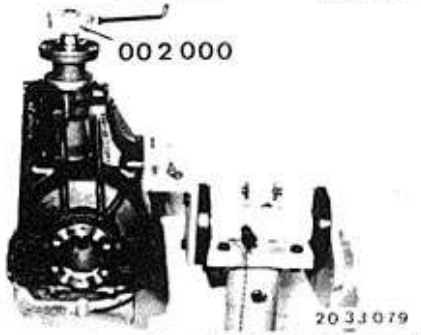
b) Drive car with left rear wheel on Special Tool 33 1 450.

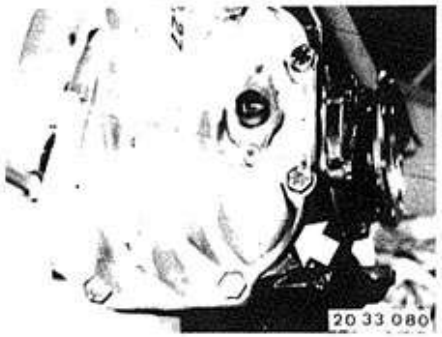
c) Release parking brake completely.

d) Engage 1st gear and accelerate engine.

e) Function of limited slip differential is okay, if the car can be driven off of Special Tool 33 1 450.







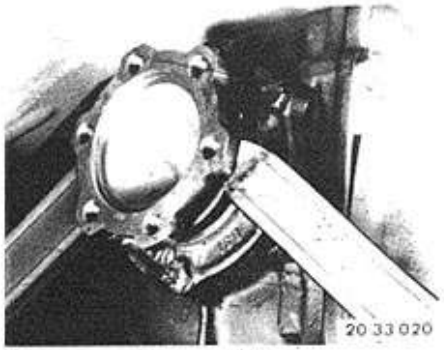
33 14 011 REPLACING LIMITED SLIP DIFFERENTIAL ASSEMBLY

Remove and install final drive 33 10 010.
Drain oil.
Mount final drive on Special Tool 33 1 010.
Installation:
Add oil – oil volume*.
Refer to Service Information of Group 00 for approved oil.

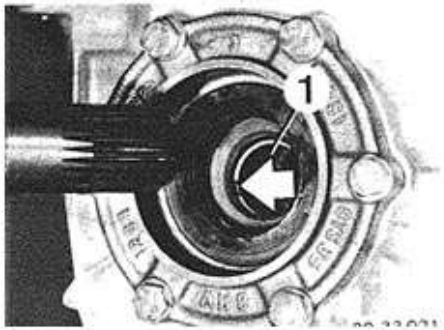
Determine total friction torque with Special Tool 00 2 000 before disassembling and note value.
For Example:
280 Ncm (24 in. lbs.).

Detach transmission cover.
Installation:
Replace gasket.
Tightening torque*.

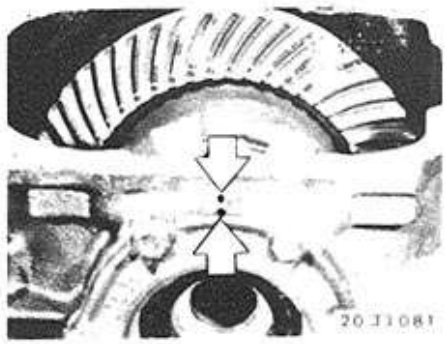
* See Specifications



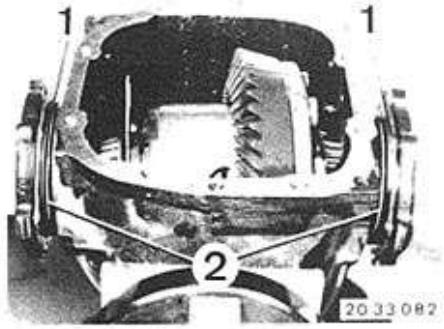
Pry off both drive flanges with a tire iron.



Installation:
Before installation of the drive flange, place round wire snap ring (1) in groove of differential case that both ends are recessed in groove.
This prevents lateral bending of the ring.
Push in and turn drive flange slightly by hand until round wire snap ring is heard to engage.
Replace stretched snap rings.

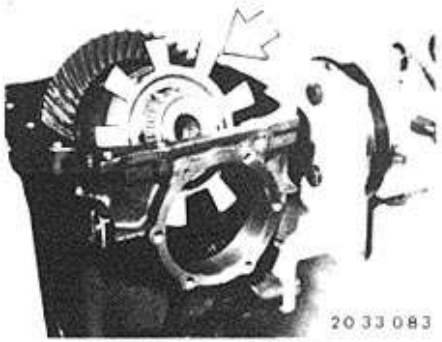


Detach both bearing caps.
Important!
Mark bearing caps - don't mix them up.
Installation:
Tightening torque*.

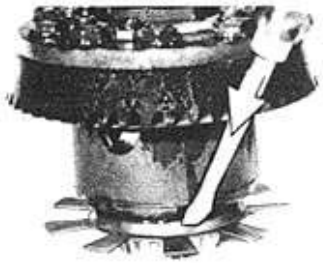


Differential case bearings and backlash are adjusted with shims (1).
Check O-ring (2), replacing if necessary.
Important!
A change in total thickness of shims (1) will change the friction torque value.
After adjusting the friction torque, the backlash and tooth contact pattern must be adjusted again.

* See Specifications

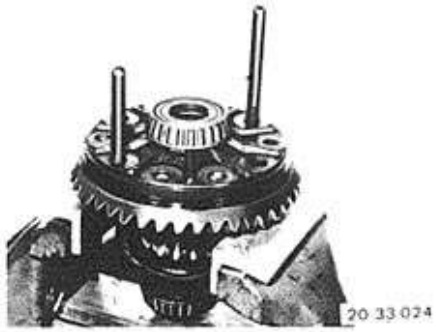


Remove complete limited slip differential.
Installation:
Don't bend pulse spider.



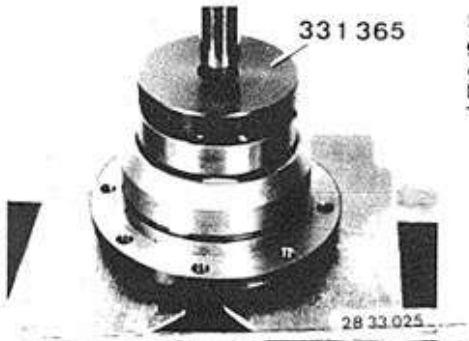
Press off pulse spider.

Installation:
Press on pulse spider with Special Tool 33 1 358.

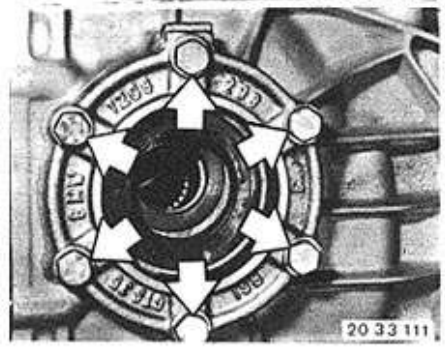


Detach ring gear (cold).
Installation:
Clean threads thoroughly (with a tapper).
Heat ring gear to max. 100° C (212° F), checking temperature with a thermocolor pencil.

Mount ring gear with 2 locally made staybolts as guides.
Install new bolts with Loctite No. 270 and tighten in order of 1 through 10.
Tightening torque*.
Retighten bolts to torque angle*.

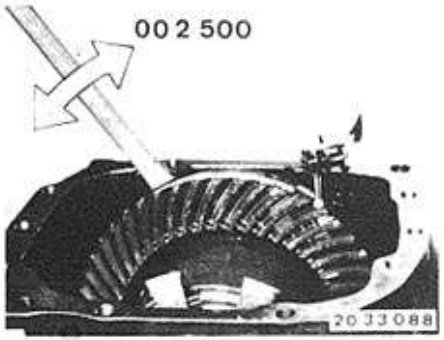


Install new limited slip differential with ring gear and pulse spider.
Installation:
Press in new bearing outer races with Special Tool 33 1 365.

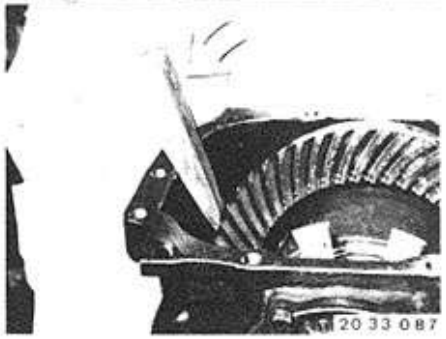


Tighten bearing cap bolts uniformly.
Measure total friction torque with Special Tool 00 2 000.
The value found before disassembling plus 20 Ncm (1.7 in. lbs.) for each replaced shaft seal should be reached, but not exceeded.
Friction torque too high = use thinner shims.
Friction torque too low = use thicker shims.

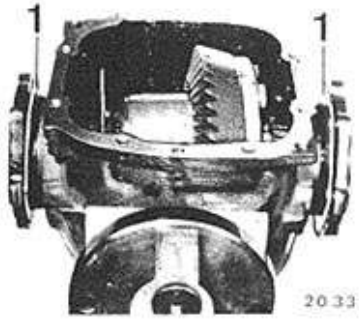
* See Specifications



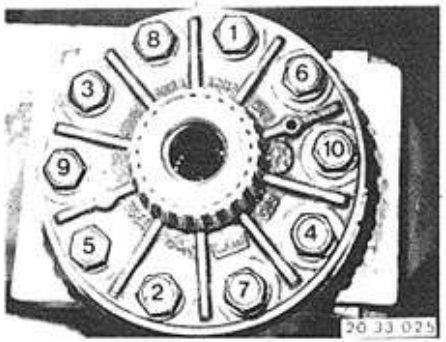
Mount Special Tool 00 2 500 and measure backlash*.
Important!
The tooth contact pattern is always important for a perfectly adjusted pinion/ring gear set.

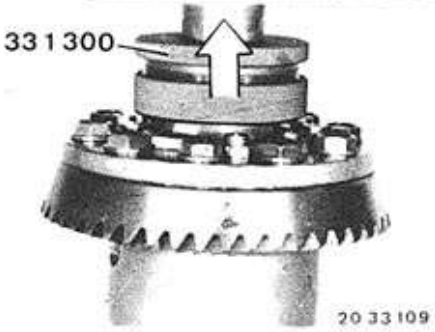


To check the tooth contact pattern, coat ring gear with printer's ink, turn gear ring in both directions several times and stop suddenly with a piece of hard wood.



To correct backlash* and tooth contact pattern, exchange shims (1) from one side to the other.
Important!
Don't change total thickness of shims.





33 14 045 SERVICE INSTALLING LIMITED SLIP DIFFERENTIAL

Remove and install complete differential 33 13 010.
Detach ring gear on differential case (cold).
Installation:
Clean bolt threads.
Heat ring gear to max. 100° C (212° F).
Install new bolts with Loctite*.
Tightening torque*.
Tighten bolts in order of 1 through 10.
Tighten bolts to torque angle*.

Pull off tapered roller bearing on differential case with Special Tool 33 1 300.
Installation:
Press on tapered roller bearings cold.
Replace defective tapered roller bearings.
Further procedures are identical with those for replacing complete limited slip differential, see

See Specifications

* See Specifications

33 14 613 DISASSEMBLING/ASSEMBLING LIMITED SLIP DIFFERENTIAL
LIMITED SLIP DIFFERENTIAL REMOVED

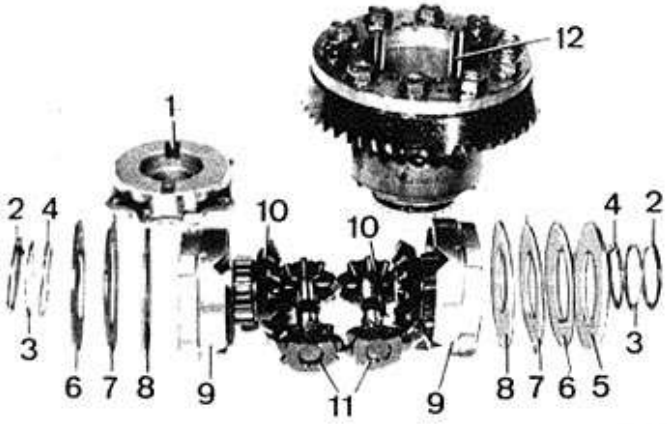

2033091

Unscrew case cover mounting bolts.
Take off case cover.


2033092

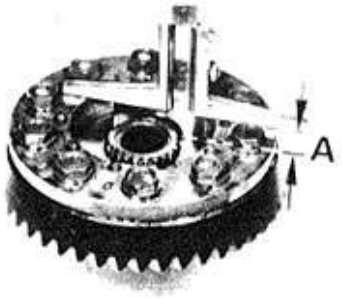
Turn case upside down and let parts slide out.
Installed Order:

1 Case cover
2 Thrust washer
3 Diaphragm spring
4 Stepped washer
5 Spacer
6 Diaphragm spring
7 Outer plate
8 Inner plate
9 Thrust ring
10 Differential side gear
11 Differential gears with differential shafts
12 Differential case



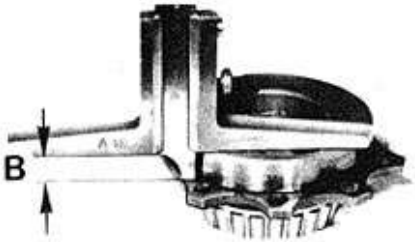
2033093

Installation:
Check all parts for wear, e.g. Molybdenum coat, splines, etc..
Lubricate all parts with approved final drive oil before assembling.



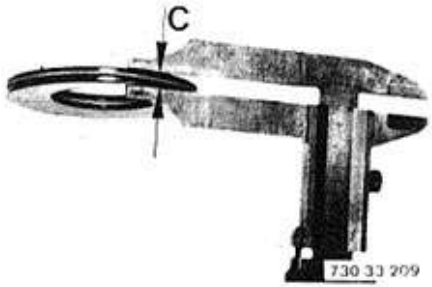
2011094

Install following parts in correct installed order to measure the pre-load.
Spacer (5), outer plates (7), inner plate (8), thrust rings (9), differential side gears (10) and differential gears with differential shafts (11).
Measure distance A from case edge to outer plate, e.g. A = 19.5 mm (0.768").



2033095

Measure distance B on cover, e.g.
B = 14.4 mm (0.567").



730 33 209

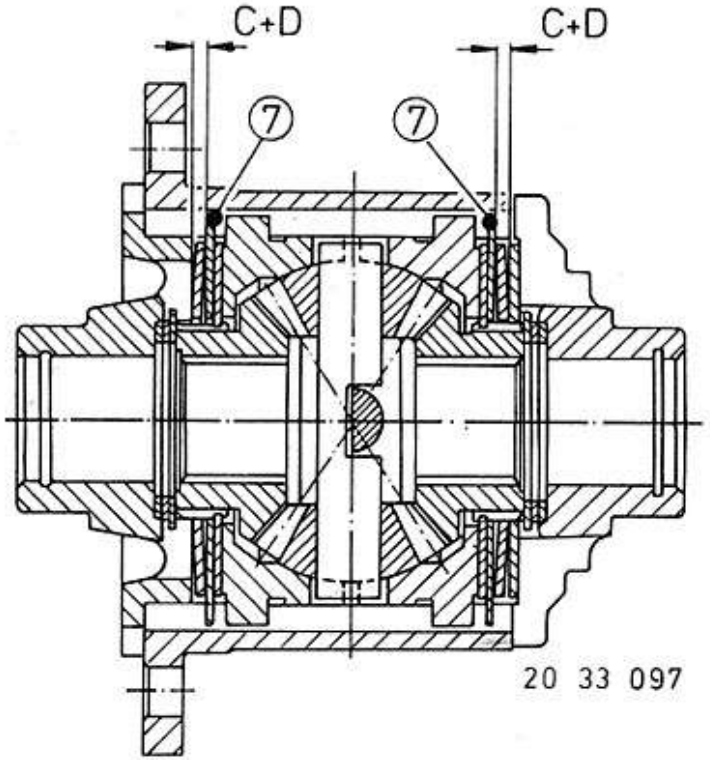
Place both diaphragm spring curved surfaces together.
Measure distance C on diaphragm springs, e.g.
C = 4.8 mm (0.189").

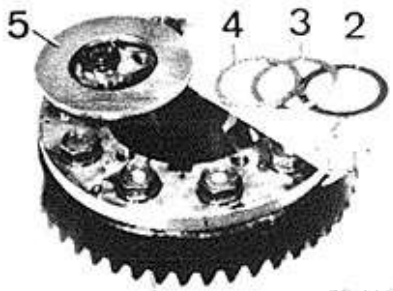
An installed clearance of 0.1 to 0.4 mm (0.004 to 0.016") is required to prevent pressing the diaphragm springs flat.
Example:

B (cover)	14.4 mm (0.567")
C (diaphragm springs)	4.8 mm (0.189")
A (case)	19.5 mm (0.768")
Sum of B + C	19.2 mm (0.756")
Installed clearance D	0.3 mm (0.012")

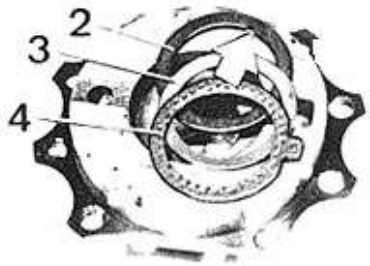
Correct any deviation in installed clearance D by installing outer plates of appropriate thickness.

Remove all parts from case and insert with the additional parts, thrust washers (2), diaphragm springs (3) and stepped washers (4).
Mount and press on case cover (12) firmly (don't bolt).
The pre-load of small diaphragm springs (3) should produce an uniform gap all around (check with feeler gauge blade).
If there is no clearance between cover and case, check diaphragm springs (3), thrust washers (2) and stepped washers (4).





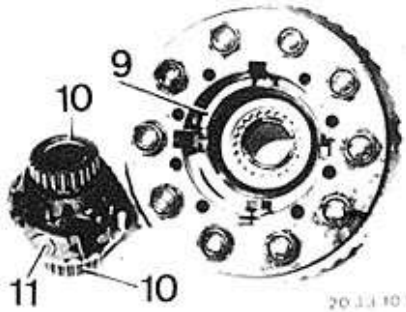
Installed Order:
Thrust washer (2) with oil pockets facing case (down).
Diaphragm spring (3) with inside curved surface facing differential shaft (up).
Stepped washer (4) with smooth side facing diaphragm spring (down) and tab engaging in guide in case.



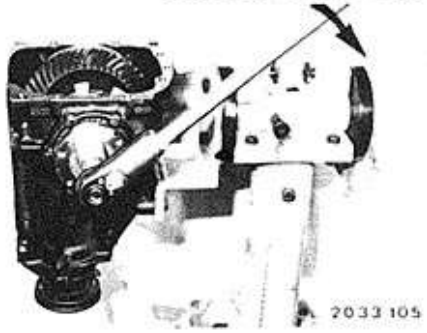
Insert thrust washer (2) with oil pockets facing cover, diaphragm spring (3) with inside curved surface facing out and stepped washer (4) with smooth side facing diaphragm spring and with tab in case cover groove in case with grease.

Install spacer (5), diaphragm spring (6) with inside curved surface facing differential shaft and outer plate (7) with 4 tabs.
Install molybdenum coated inner plate (8).

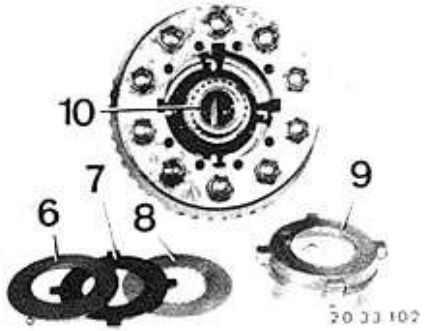
Mount case cover with washers (don't let steppe washer slide out of groove).
Install bolts with Loctite No. 270 and tighten cover uniformly.
Installation:
Tightening torque*.



Install thrust ring (9) and differential side gear (10) by turning in guides or spline of inner plate.
Install differential gears with shafts (11), second differential side gear (10) and thrust ring (9).



Check slip torque* of differential lock by holding one and driving other differential side gear.
Make up tool locally for this purpose by, for example, welding a nut on a drive flange which is no longer required.



Install molybdenum coated inner plate (8) and outer plate (7).
Insert diaphragm spring (6) with inside curved surface facing differential shaft (down).

* See Specifications