VOLVO

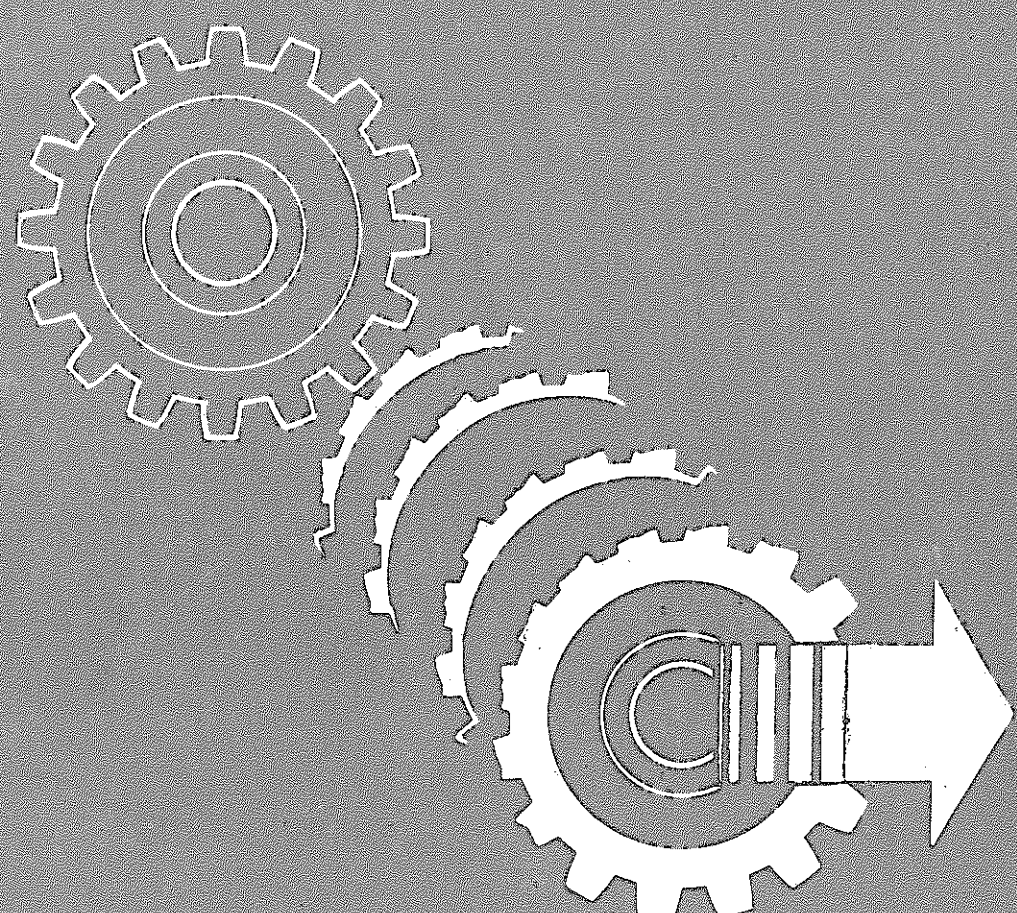
Service Manual

Reconditioning

Section 4 (43)

Manual transmissions M 46, M 47, M 47 II including types J & P Overdrives

700



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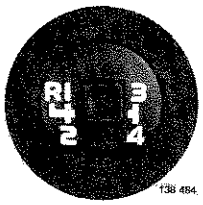
Order number TP 30941/1

Foreword

M 46 Transmission



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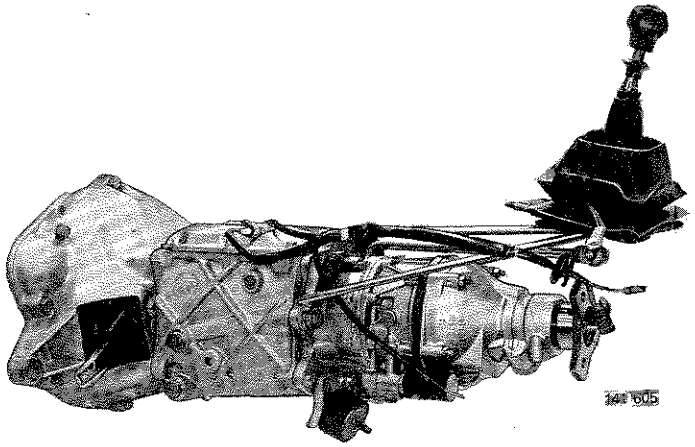
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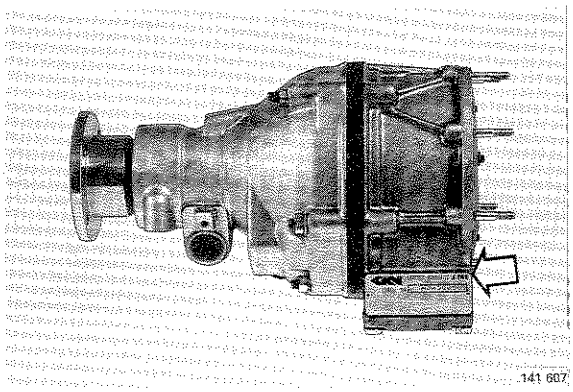
Four-speed transmission with electrically-operated overdrive.Transmission housing of cast iron or aluminium. There are two types of overdrive, Type J and Type P.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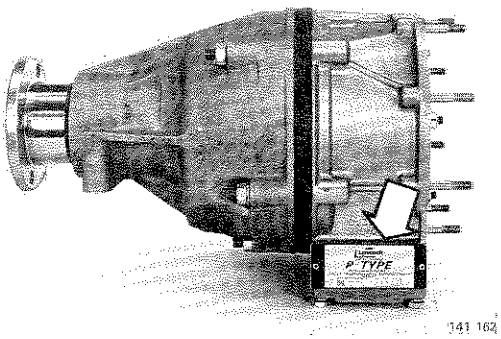
Type J

Overdrive is engaged by a solenoid which changes the oil flow direction. The gear ratio is changed by a planetary gear.



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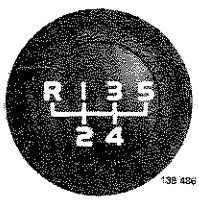
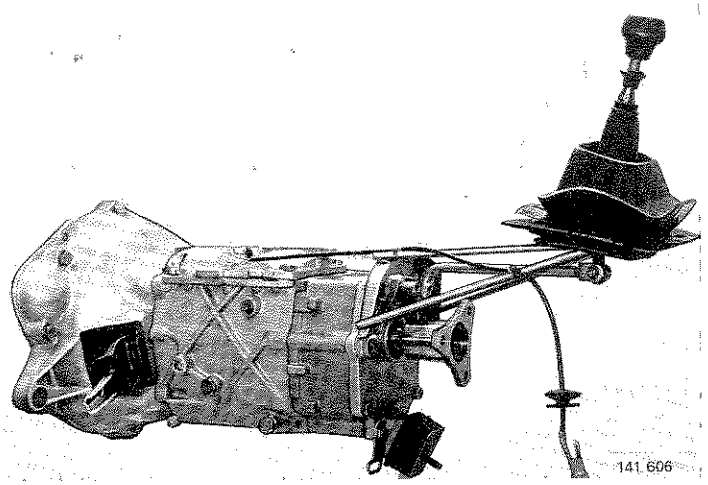
Type P

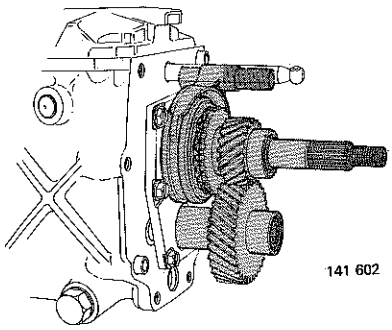
Stronger than Type J and is used in combination with high-torque engines. Has no connection for speedometer cable.

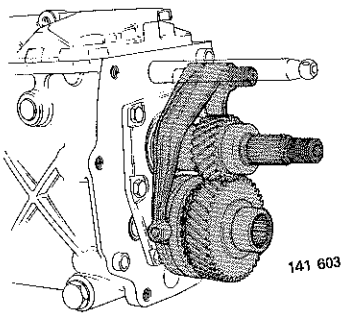
M 47/M 47 II Transmissions





Five-speed transmission with the fifth gear assembly located in the rear extension. From 1986, the fifth gear synchronizer and gear wheel are located on the countershaft (previously on the main shaft). Hence the designation M 47 II. Both types have aluminium housings.





M 47

An additional shaft incorporating a shift fork engages/ disengages the fifth gear. The fifth gear synchronizer and gear wheel are located on the main shaft.

M 47 II

The fifth gear shift fork is extended to reach the synchronizer and gear wheel on the countershaft.

Specifications

Reduction ratios

	M 46	M 47/M 47 II
1st gear	4.03:1	4.03:1
2nd gear	2.16:1	2.16:1
3rd gear	1.37:1	1.37:1
4th gear	1:1	1:1
Overdrive (5th gear on M 47/M 47 II)	0.79:1	0.83:1 (M 47 II: 0.82:1)
Reverse	3.68:1	3.68:1

Clearances

Reverse gear to shift fork	0.1–1.0 mm 0,004–0.04 in	0.1–1.0 mm 0.004–0.04 in
End float: input shaft	0.01–0.20 mm 0.0004–0.008 in	0.01–0.20 mm 0.0004–0.008 in 0.01–0.10 mm
countershaft	clearance 0.03 mm (0.0012 in) for pre-tension 0.05 mm (0.002 in)	
main shaft	0.01–0.20 mm (0.0004–0.008 in)	0.01–0.20 mm (0.0004–0.008 in)
5th gear synchronizer hub		0.01–0.20 mm (M47 only) (0.0004–0.008 in)

Overdrive oil pressures

4th gear	approx 0.15 MPa (21 psi)
Overdrive engaged	**Type J**
D 24 T, with asbestos-free friction linings	2.8–3.1 MPa (400–440 psi)
Gasoline turbo with asbestos-free friction linings	< 3.4 MPa (485 psi)
Gasoline turbo with old type friction linings	3.9–4.2 MPa (555–600 psi)
Remaining, with old type friction linings	3.7–4.0 MPa (525–570 psi)
	Type P
All	2.,8–3.,1 MPa (400–440 psi)

Lubricant

Type	*ATF type F or G
Oil capacity, M 46	2.3 litre (2.4 US qt)
M 47	1.3 litre (1.35 US qt)

* In case of complaints use Volvo Thermal Oil, P/N 1161243-3. Volvo Thermal Oil should only be used for vehicles driven in areas where the temperature seldom drops below −10°C (14°F) or for high-mileage vehicles such as Taxis.

Tightening torques

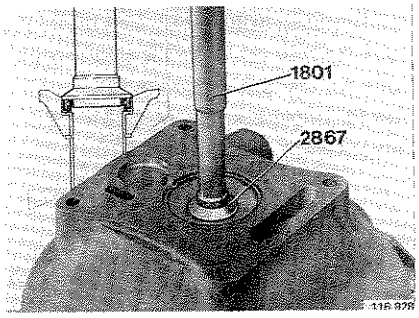
	Nm	ft lb
Bell housing bolts	35–50	25–35
Bolts for rear cover (shift assembly)	35–50	25–35
Bolts for transmission cover	15–25	10–20
Bolt for countershaft, M 47/M47 II	35–45	25–30
Drive flange nuts, M 47, M 16	70–90	50–65
M 20	90–110	65–80
M 46	165–180	120–135
Nut for rear housing M 46	12–18	9–13
Nut for 5th gear synchronizer, M 47 II	120	90

Overdrive

Plug for relief valve	22	16
Plug for filter	22	16
Plug for check valve	22	16
Oil pan bolts	10	7
Nuts on stud bolts, front housing	12	9
rear housing	12	9
Solenoid valve (solenoid)	50	40
Nuts for bearing holder	10	7
Plug, oil pressure gauge connection	15	11

Special tools

999	Description – use
1801-3	**Standard handle:** installing clutch housing seal
1845-0	**Press tool:** installing drive flange
2412-8	**Drift:** installing seal, bearing, output shaft in overdrive
2413-6	**Drift:** installing front bearing on M 47
2520-8	**Stand:** for fixture 5130
2709-7	**Puller:** removing overdrive
2806-1	**Drift:** installing bearing in holder for clutch unit
2834-3	**Gauge:** oil pressure
2835-0	**Centering shaft:** for planetary gear to output shaft
2836-8	**Plug wrench:** for plugs
2852-5	**Support:** installing synchronizer hub
2853-3	**Support:** removing synchronizer hub
2867-3	**Drift:** installing clutch housing seal
2985-3	**Wrench:** removing main shaft bearing
2986-1	**Drift:** installing countershaft bearing
5058-6	**Puller:** removing main shaft bearing
5064-4	**Drift:** installing seal in rear housing
5069-3	**Puller:** seal
5090-9	**Tube:** installing damper
5096-6	**Spacer:** 5th gear housing (B 28 tool, 4 pcs)
5103-0	**Drift:** removing bearing in holder for clutch unit
5130-3	**Fixture:** used with stand 2520 or 5154
5131-1	**Puller:** removing countershaft bearings
5154-7	**Puller bolt:** for 5058



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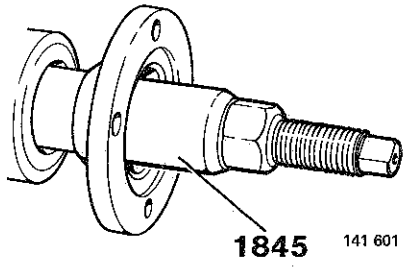

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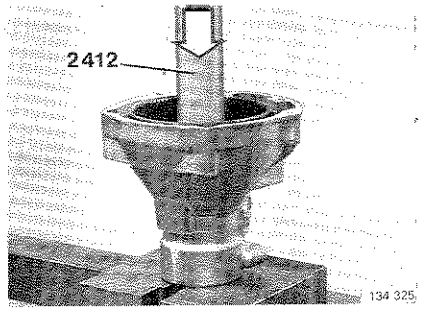

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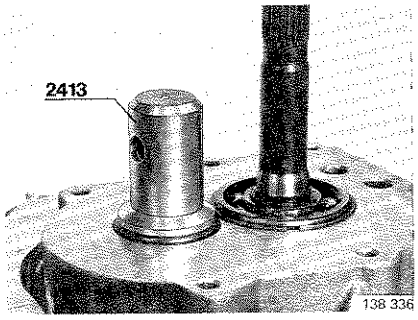

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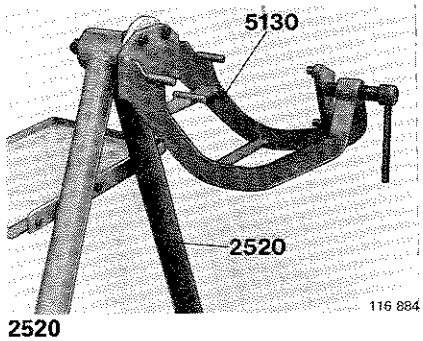

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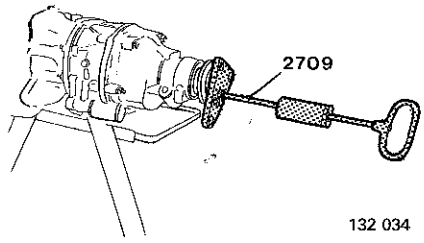

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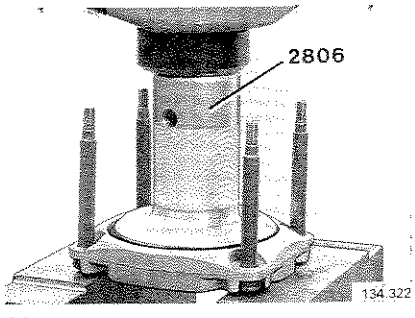

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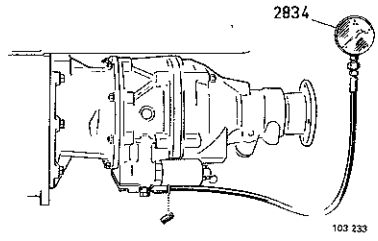

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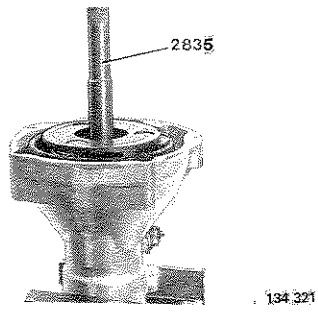

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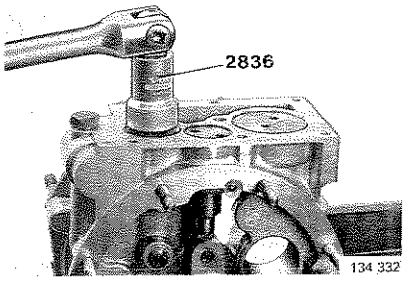

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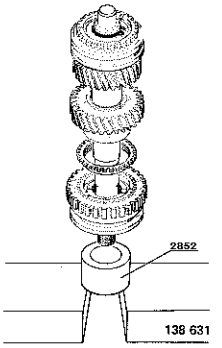

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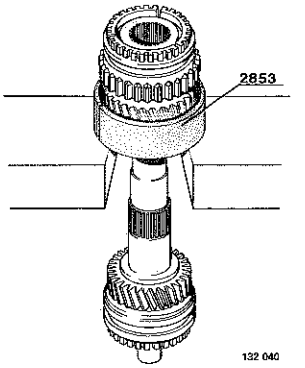

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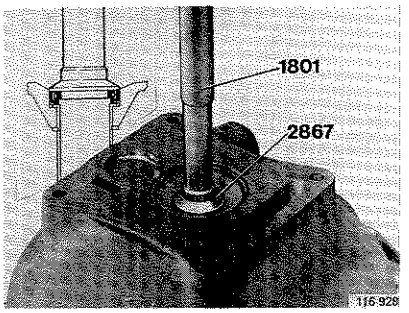

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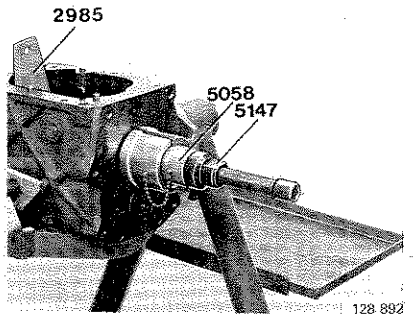

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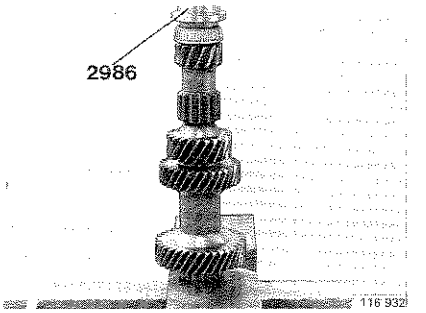

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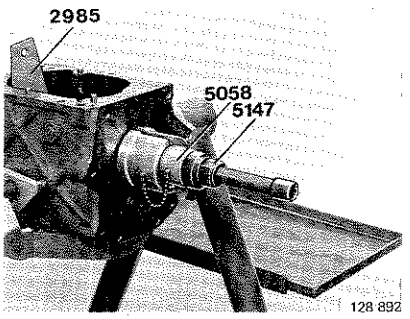

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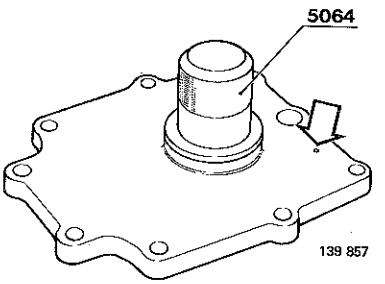

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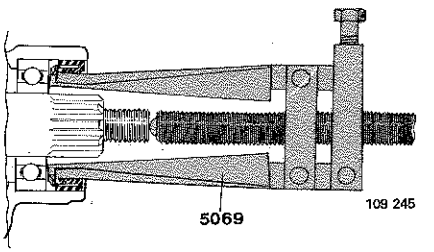

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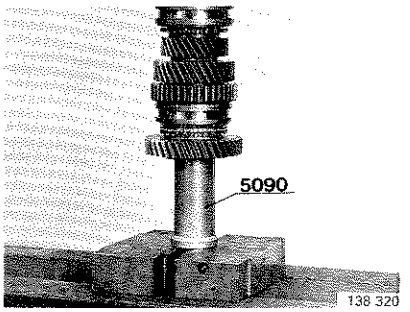

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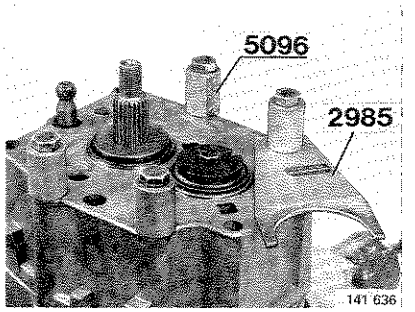

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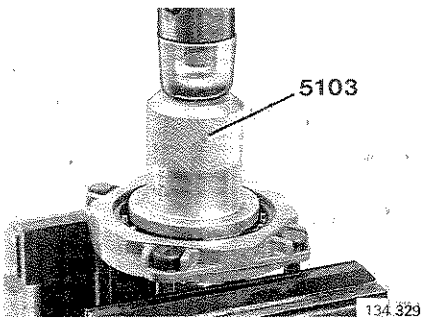

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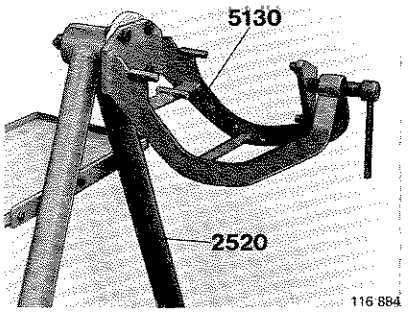

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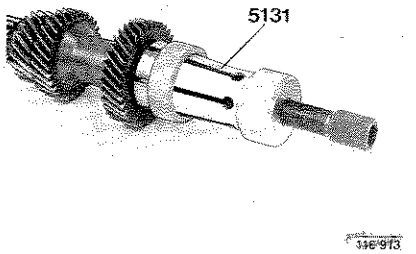

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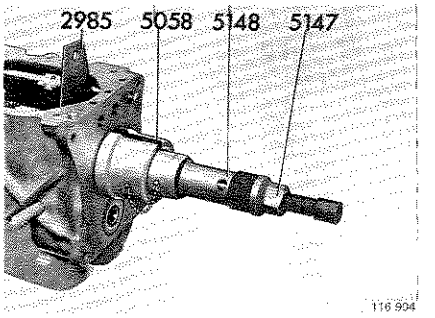
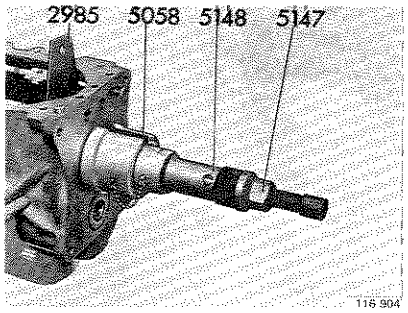


5147

999	Description – use
5148-4	**Extension for 5058 (2 pcs)**
5149-3	**Wrench:** for round drive flange
5154-3	**Bench attachment:** for fixture 5130
5172-5	**Crow foot wrench:** for solenoid valve
5177-4	**Puller:** front bearing on countershaft, aluminium housing
5180-8	**Drift:** installing bearing on countershaft, aluminium housing
5183-2	**Puller:** for relief valve
5210-3	**Ring:** installing rollers in one-way clutch
5261-6	**Puller:** removing front bearing on countershaft
5262-4	**Puller:** 5th gear synchronizer hub
5304-4	**Puller:** removing drive flange
5305-1	**Ring:** for 5262 on M 47 II
5306-9	**Press tool:** installing bearing on main shaft and 5th gear M 47/ M 47 II
5308-5	**Drift:** installing rear housing seal, overdrive
5973-6	**Washer:** support for 998 7693 synchronizer/gear M 47 II
5986-0	**Shaft:** disassembling 5th gear synchronizer/gear M 47 II
998	
7693-0	**Puller:** removing 5th gear housing M 47/M 47 II
9177-0	**Torque gauge:** measuring damper torque



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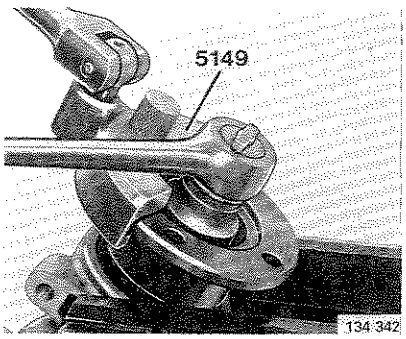

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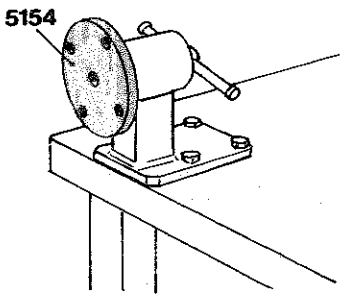

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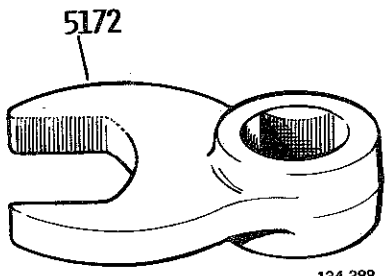

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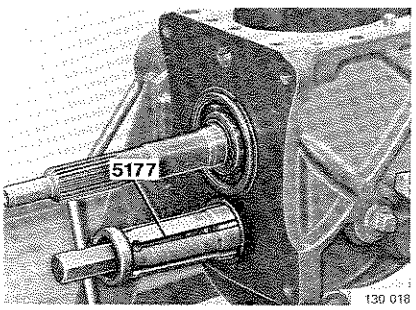

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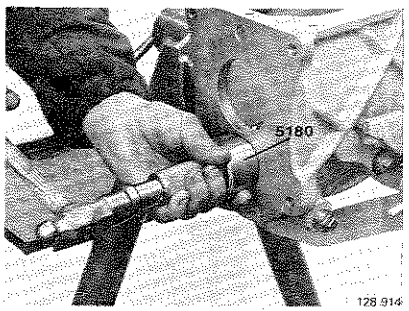

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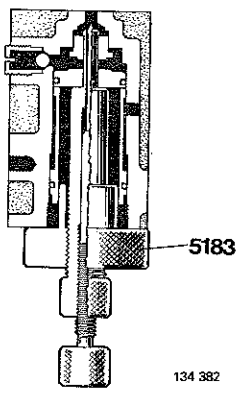

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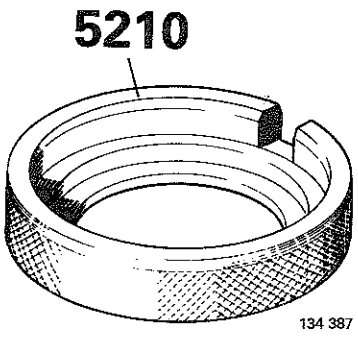

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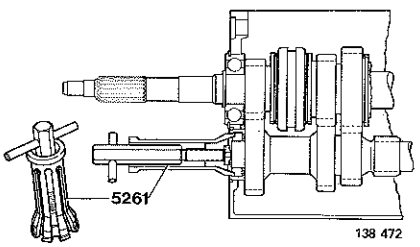

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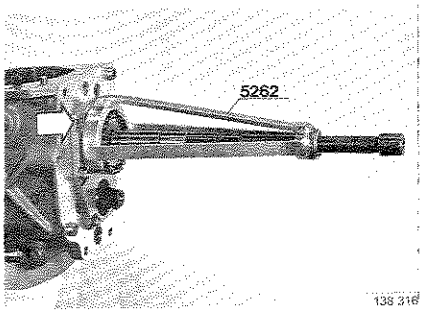

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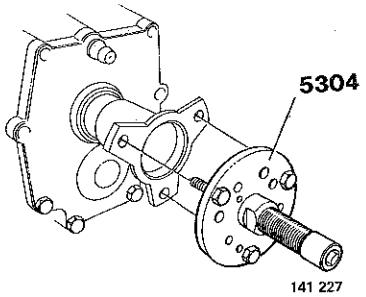

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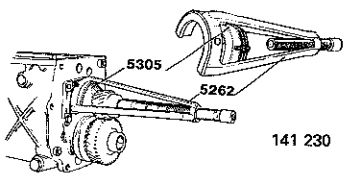

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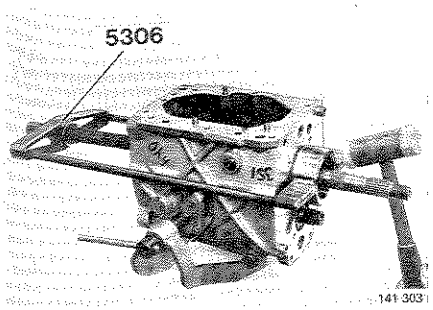

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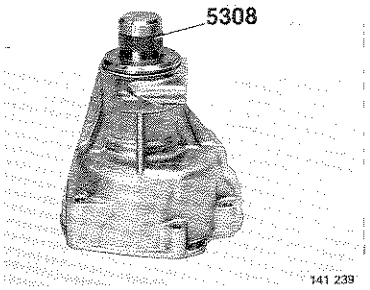

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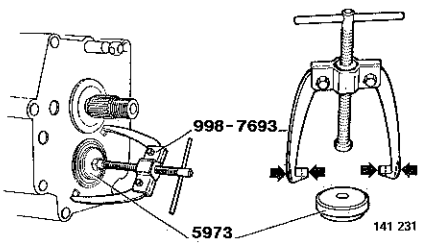
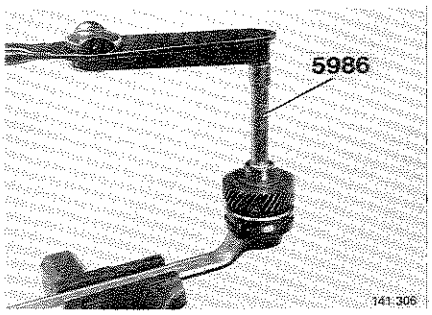


5973



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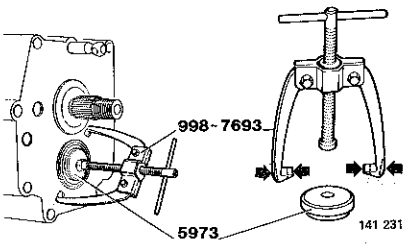
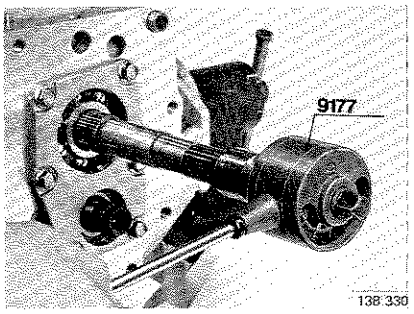


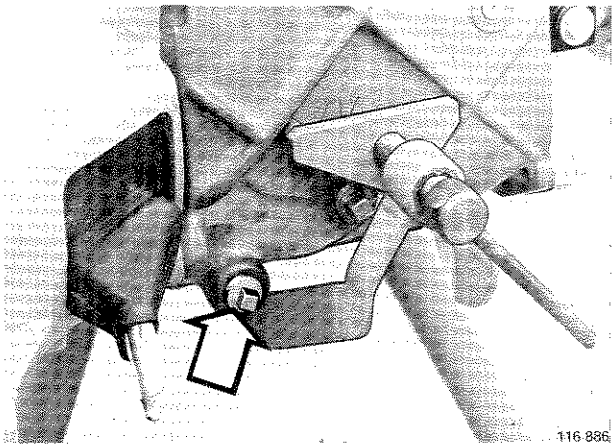
998 7693



9177

A. Disassembling M 46

Special tools: 5130+2520 or 5154, 2709, 2853, 2985, 5058, 5131, 5147, 5148 (2 pcs), 5177

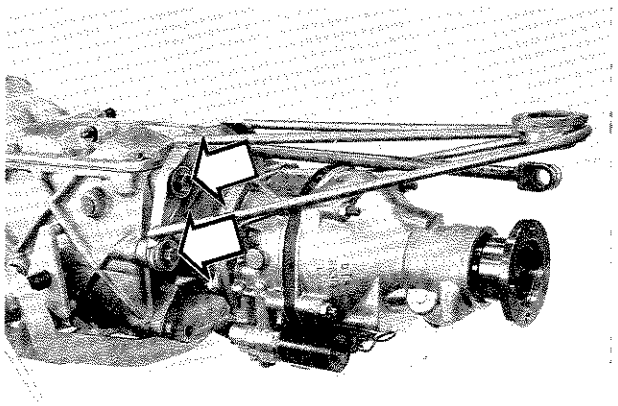


A1

Mount transmission on fixture 5130 on floor stand 2520 or bench support 5154

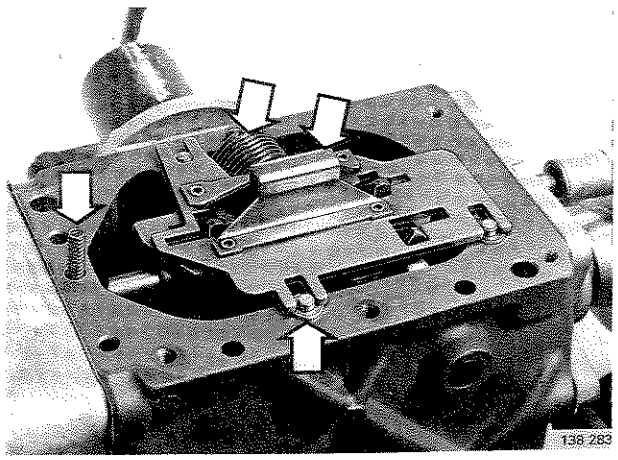
A2

Drain oil



A3

Remove gear shift assembly



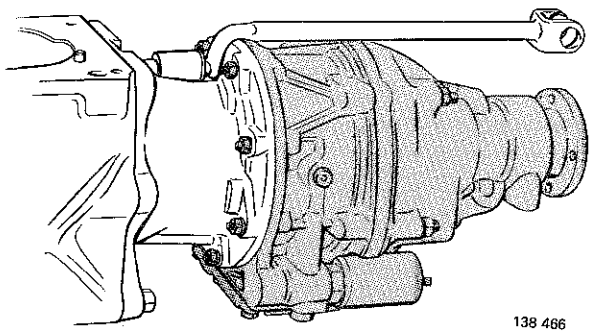
A4

Remove transmission cover and gasket

A5

Remove selector plate and return spring

Lift off washers, spring and ball.



A6

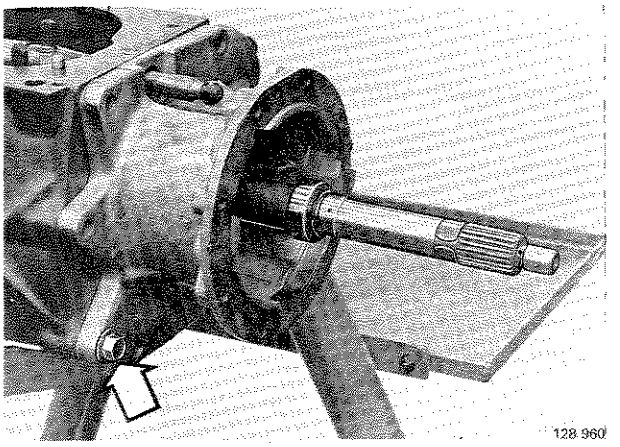
Disconnect overdrive from intermediate housing

If required: use puller **2709**

A7

Remove gear selector rod

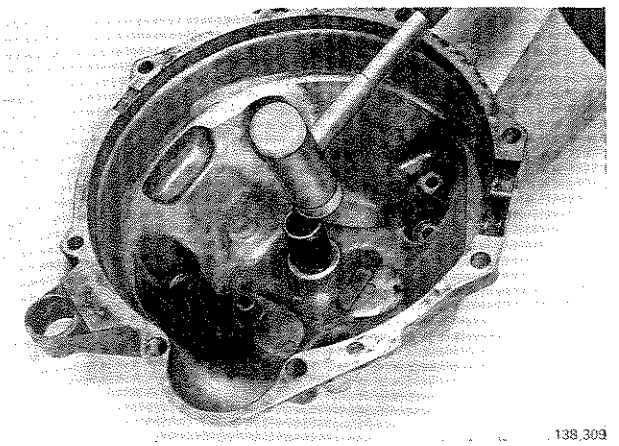
Tap out both lock pins.



A8

Remove intermediate housing

Remove gasket.
Collect adjusting shims.



A9

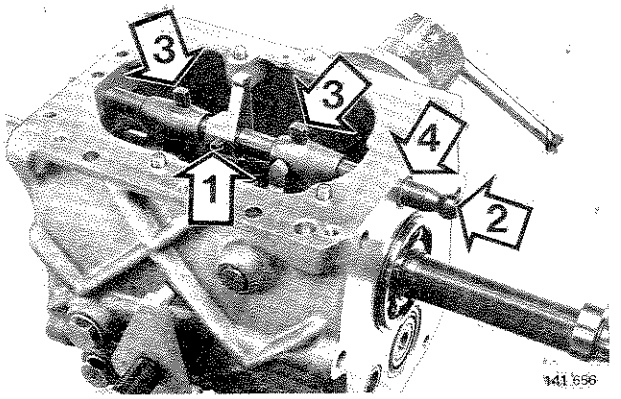
Remove clutch fork and clutch release bearing

Save spacer washer.

A10

Remove clutch housing and gasket

Save adjusting shims.
Tap pipe rearwards to loosen seal. Some pipes have a lock ring, remove it first.



A11

Tap out lock pin (1)

A12

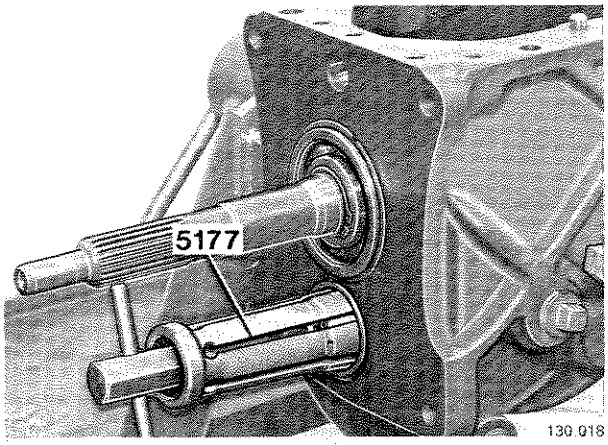
Remove selector shaft (2)

A13

Remove shift forks (3)

A14

Remove selector shaft seal (4)

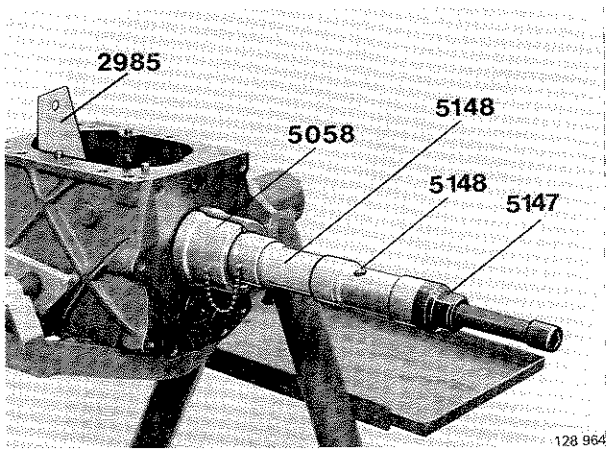


A15

Remove outer races for countershaft bearings

Transmission with aluminum housing:

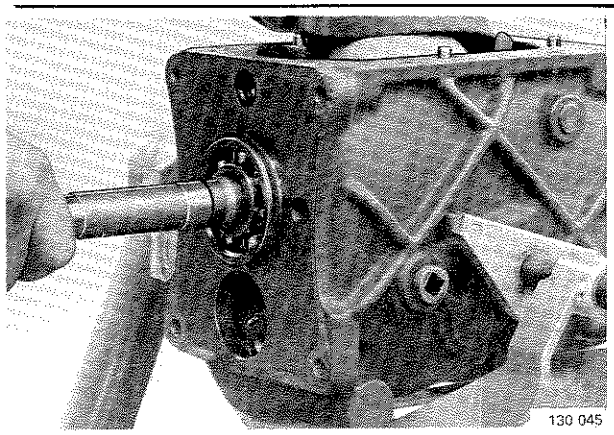
Carefully tap shaft in both directions to enable puller 5177 to grip races.



A16

Remove main shaft bearings

Remove oil pump eccentric.
Remove lock ring and ring for main shaft bearing.
Place tool **2985** between input shaft and front synchronizer.
Use puller **5058,** two extensions **5148** and puller bolt **5147** to pull off bearing.
Remove bearing thrust washer but leave tool **2985** in position.



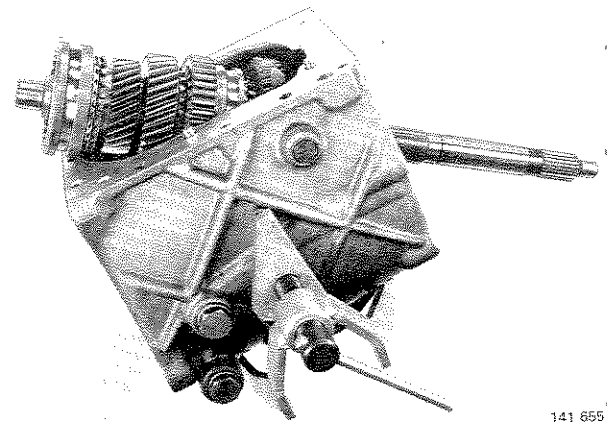
Removing all shafts

A17

Remove input shaft and synchronizer ring

Pull out shaft. If bearing sits tight in housing, leave tool **2985** in place and tap main shaft with a mallet.

Note! Make sure that front part of countershaft contacts bottom of housing.



A18

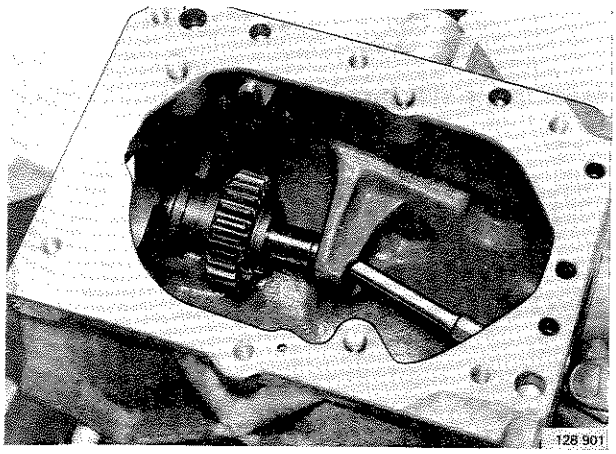
Lift out main shaft

First turn transmission.

A19

Lift out countershaft

Turn transmission back.
Use a plastic mallet to tap out rear bearing race.
Remove shaft.



A20

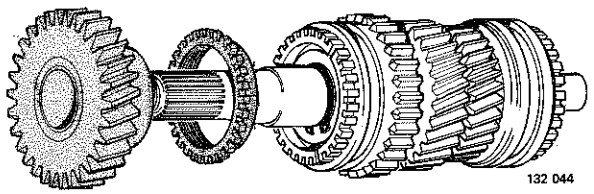
Remove reverse gear wheel and shaft

Use a drift to push shaft rearwards.

A21

Remove selector for reverse gear

Disassembling main shaft

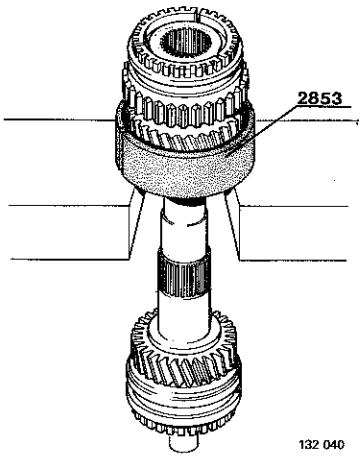


Transmission equipped with damper:

A22

Press off washer, remove springs and brake ring. Remove 1st gear with synchronizer ring.

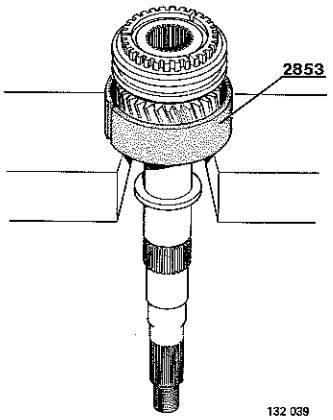
Remove lock ring for synchronizer hubs.



A23

Press off 1st—2nd synchronizer hub and 2nd gear wheel with synchronizer ring

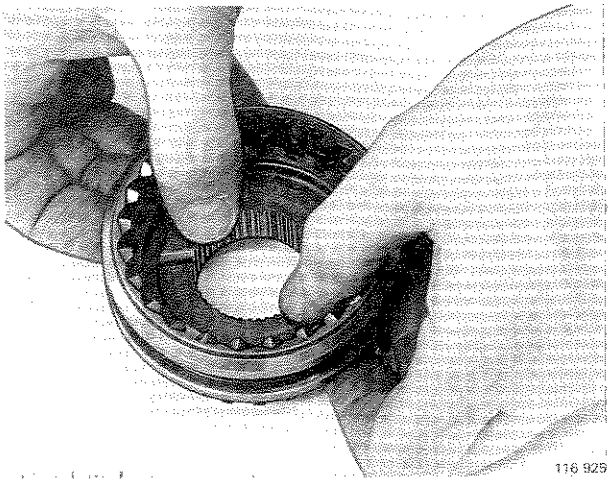
Use support **2853**.



A24

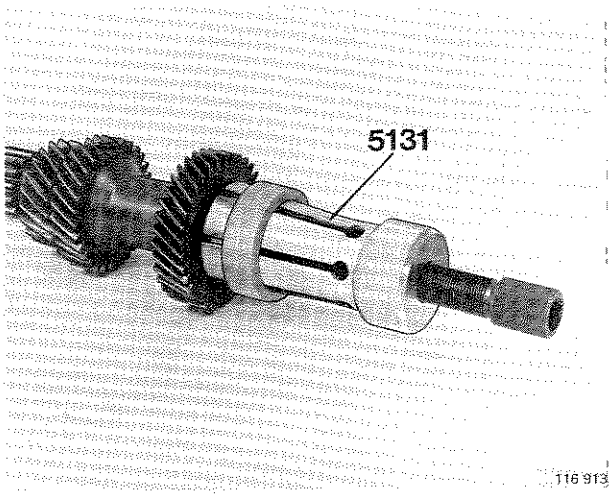
Press off 3rd—4th synchronizer hub and 3rd gear wheel

Use suport **2853**.



A25

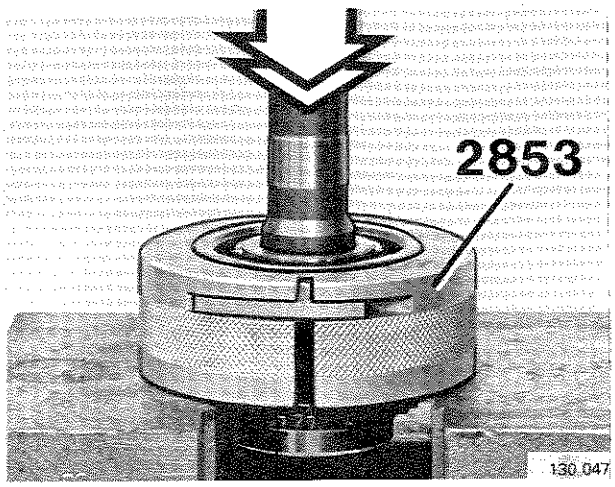
Disassemble synchronizers



A26

Remove countershaft bearing

Use puller **5131.**



A27

Remove input shaft bearing

Use support **2853.**

A28

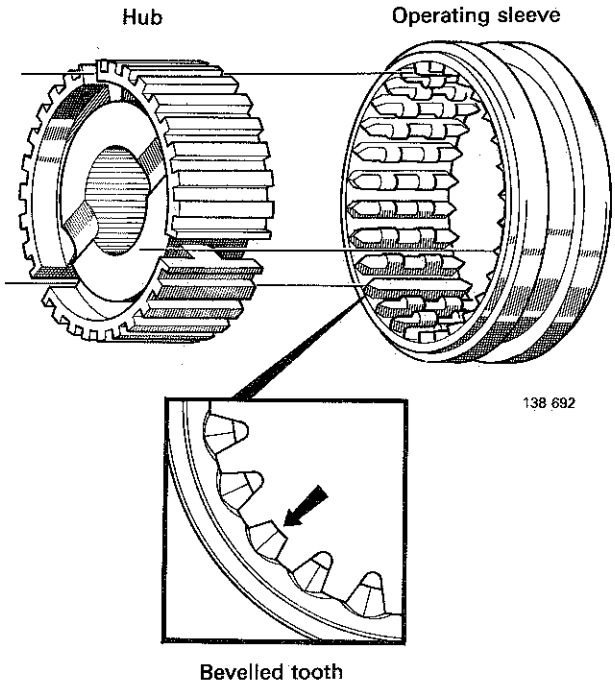
Clean and examine all parts

Wash all parts with solvent. Dry with compressed air.

Examine all parts. Replace worn or damaged parts and all seals and gaskets.

B. Assembling M 46

Special tools: 1801, 2852, 2853, 2867, 2986, 5090, 5180, 5306



Assembling main shaft

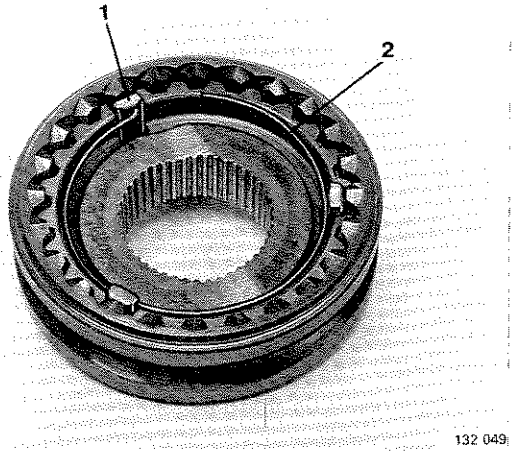
B1

Assemble both synchronizers

Place hub in operating sleeve.

3rd–4th gear synchronizer:

Three recesses in hub should align with the three bevelled teeth in operating sleeve.



B2

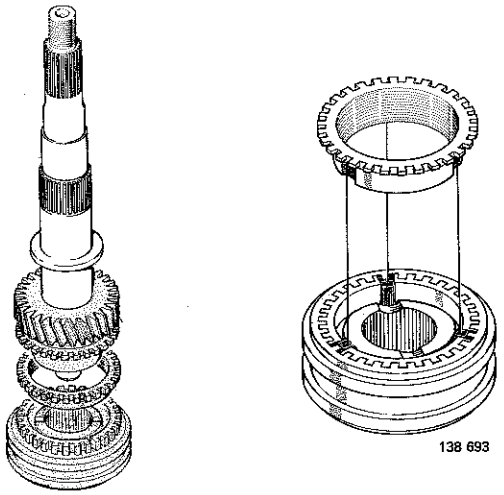
Install sliding keys (1) and springs (2)

Lock sliding keys ("dogs") with springs. Hook both springs to the same sliding key.

Install one spring counter-clockwise. Turn synchronizer over and install second spring, also counter-clockwise.

If spring is bent, free end must point away from hub.

Assembling



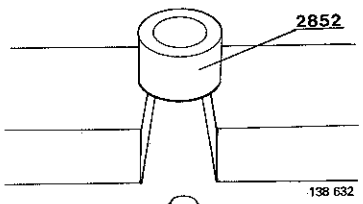
B3

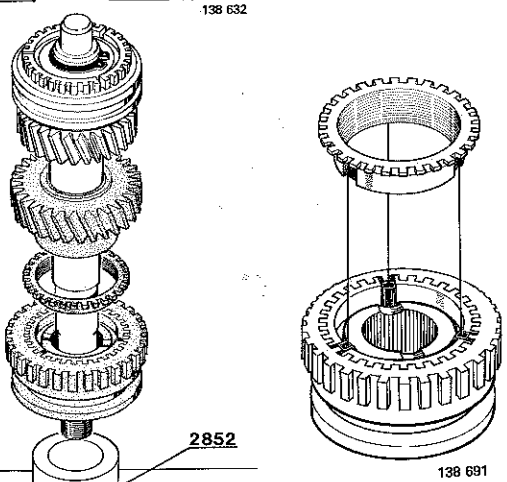
Oil main shaft. Install 3rd gear wheel and synchronizer.
Press on 3 rd—4th gear synchronizer hub.

Note! On some transmissions, the gear wheel has a needle bearing. Make sure that it is fitted.

Make sure synchronizer ring is facing correct way. Turn wear surface on synchronizer hub UP.

Use support **2852**.





Invert shaft

B4

Oil shaft. Install 2nd gear wheel and synchronizer. Press on 1st—2nd gear synchronizer hub.

Make sure synchronizer ring is fitted correctly.

Use support **2852**.

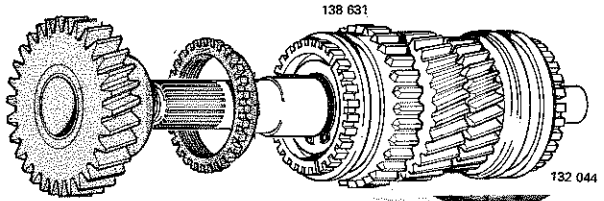
B5

Install lock rings for both synchronizers

Transmission without damper:

B6

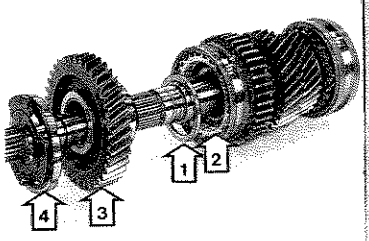
Install synchronizer ring and gear wheel for 1st gear



Transmission with damper:

B7

Install thrust washer (1), if applicable, synchronizer ring (2) and gear wheel (3) for 1st gear



B8

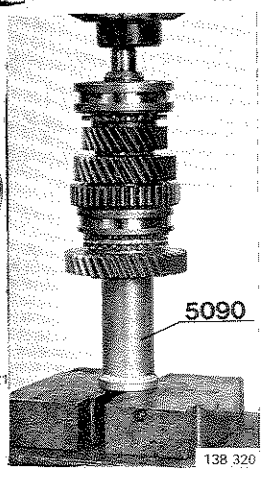
Assemble damper

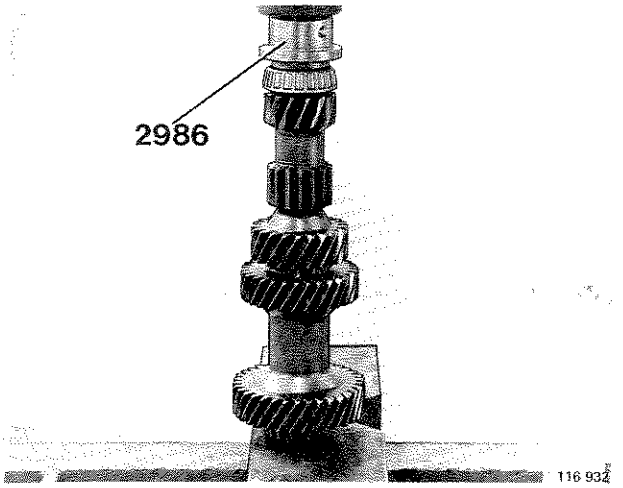
Oil parts. Position springs in brake ring and twist washer into brake ring.

B9

Press damper (4) on main shaft

Use a file to remove sharp edges. Use tube **5090** when pressing on damper.



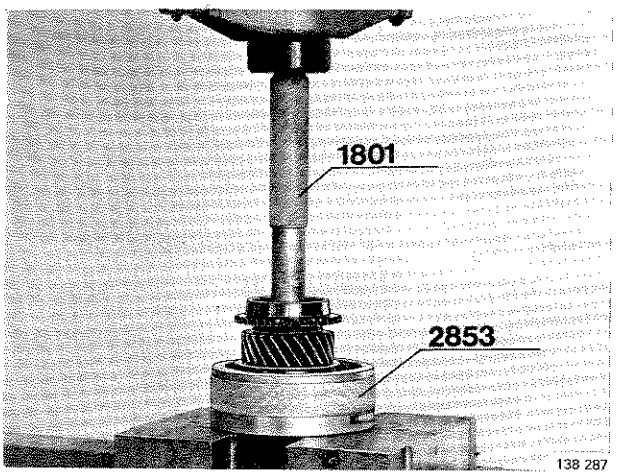


B10

Press both bearings on main shaft

Use drift **2986.**

Note! Two types of rear bearings. Check transmission serial number to see that correct bearing is used.



B11

Press bearing on input shaft

Use standard handle **1801** and support **2853.**

B12

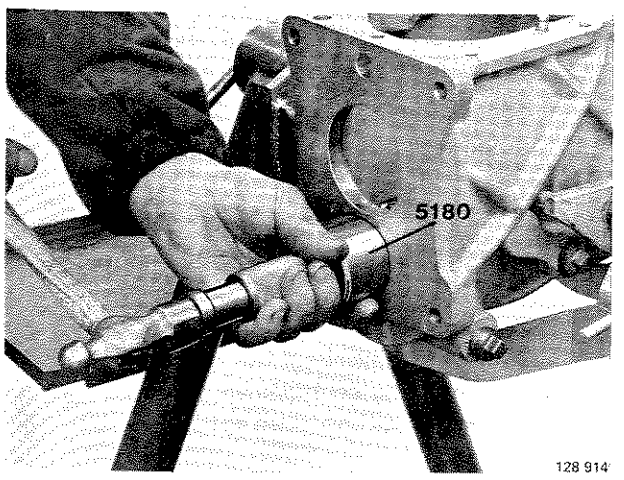
Install lock ring on input shaft

For transmissions with cast iron housing: proceed to operation B22.

Operations B13–B21 only apply to transmissions with aluminium housing.

Determining thickness of countershaft shims

The countershaft should have a preload of 0.03–0.05 mm (0.0012–0.0020 in). If countershaft, countershaft bearing or rear end bearing was replaced, shim thickness must be determined.



Note! Apply assembly paste to aluminium surfaces prior to installing bearings and shafts.

Part Number 1 161 006-0 Aerosol
1 161 078-9 Can

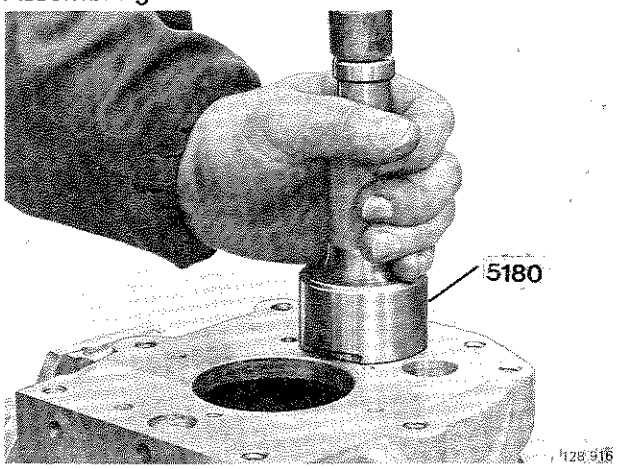
B13

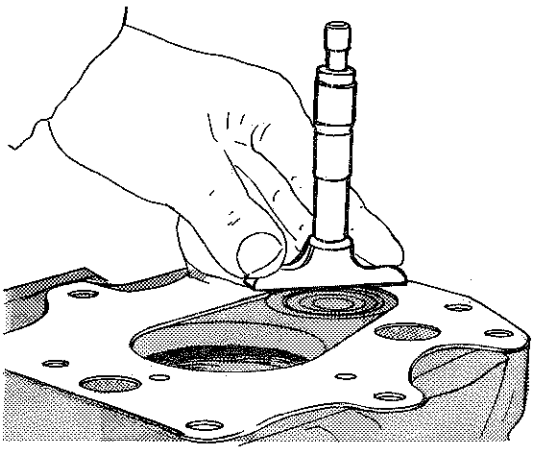
Install countershaft in housing

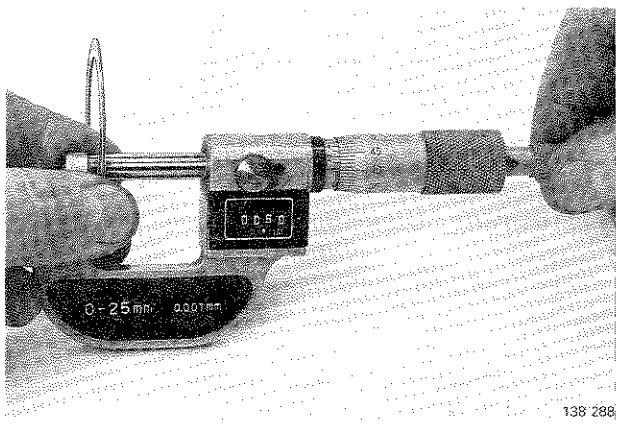
B14

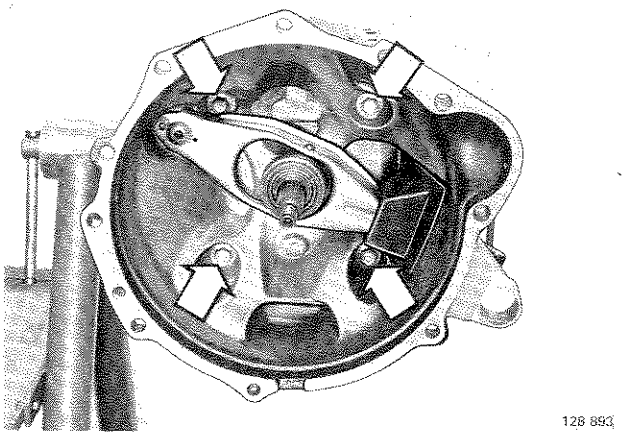
Install front bearing race for countershaft

Use drift **5180** large end facing race. Let race protrude approx. 1 mm (0.04 in). It will take up correct position when installing clutch cover.









B15

Install clutch housing and gasket

Torque to 35–50 Nm (25–35 ft lb).

B16

Turn transmission so that rear end faces UP

B17

Install rear bearing race for countershaft

Use drift **5180** small diameter facing rear bearing race. Make sure bearing has no play. Rotate shaft and tap until there is no play (shaft has light resistance).

B18

Measure distance between outer bearing race for countershaft and housing end face including gasket

Position gasket on end face.
Use depth micrometer and note distance.

B19

Calculate thickness of shim for countershaft

Preload should be **+0.03 to–0.05 mm. (+0.0012 to –0.0020 in)**

Example:

	mm	in	mm	in
Distance bearing race to gasket face	1.79	0.0705	1.79	0.0705
Clearance/preload	–0.03	–0.0012	+0.05	+0.0020
	1.76	0.0693	1.84	0.0725

Choose shim 1.80 mm (0.0709 in). If possible, choose shim of thickness to obtain countershaft preload. Following shims are available:

P/N	mm	in
949048–3	0.05 mm	0.002 in
948298–5	0.10 mm	0.004 in
948299–3	0.15 mm	0.006 in
948300–9	0.35 mm	0.014 in
948301–7	0.50 mm	0.020 in
948302–5	0.70 mm	0.028 in
948303–3	1.00 mm	0.040 in

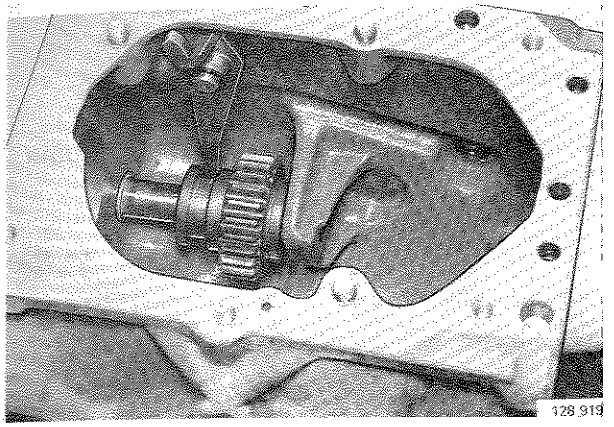
B20

Remove clutch cover and gasket

B21

Remove countershaft

Continue assembling transmission as described for transmission with cast iron housing. The only difference is installing countershaft and determining shim thickness, as described above.



Installing shafts in transmission housing

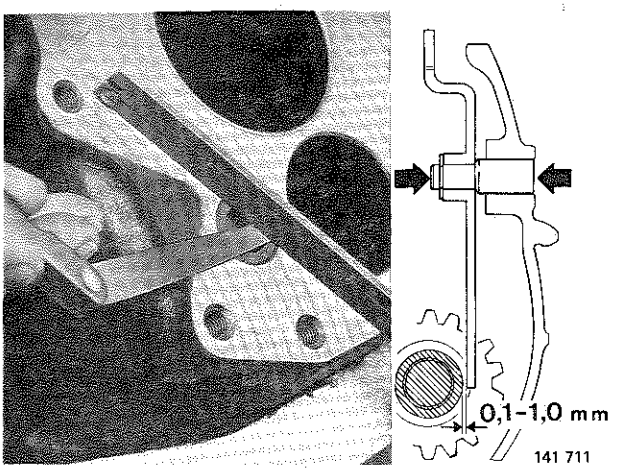
B22

Install gear selector for reverse gear

Install lock ring for shift fork.

B23

Install reverse gear wheel and shaft



B24

Check/adjust position of reverse gear shaft

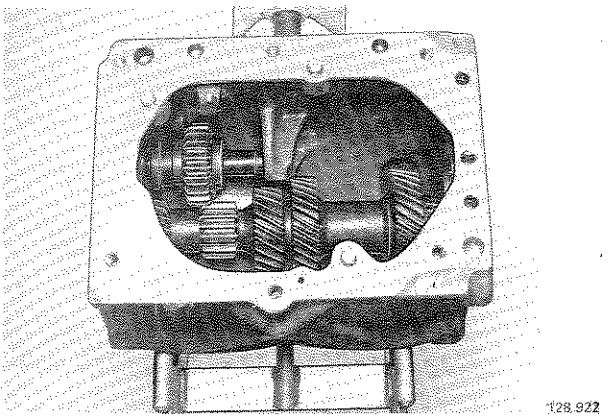
Shaft end should be flush with housing or max. 0.05 mm (0.002 in) inside housing face. See left.

B25

Check/adjust clearance between reverse gear wheel and shift fork

Adjust by tapping shift fork bearing stud, using a drift. See right illustration.

Correct clearance: 0.1–1.0 mm (0.004–0.040 in).



B26

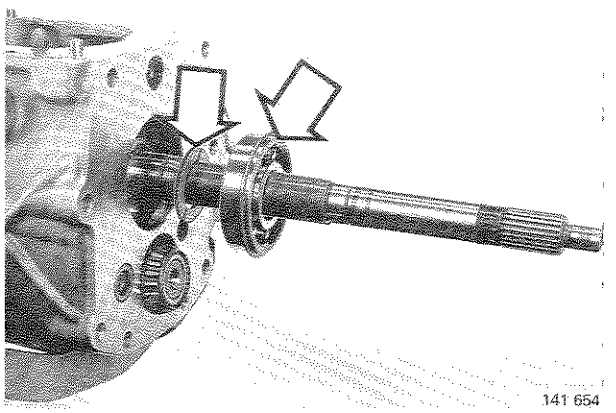
Place countershaft in bottom of housing

B27

Place main shaft in housing

First turn housing

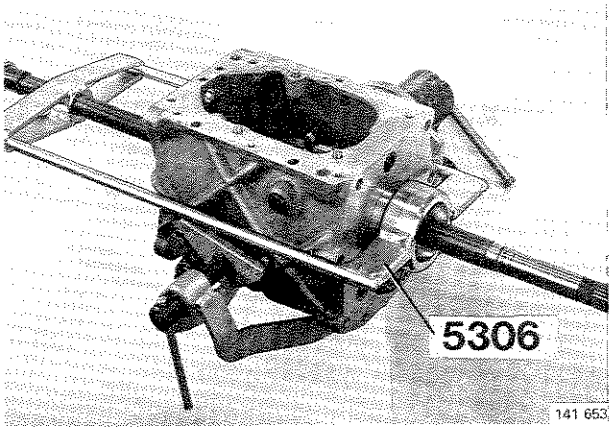
Installing main shaft rear bearing



B28

Install thrust washer (only transmissions without damper) and bearing with lock ring on main shaft

Countershaft should be positioned in bearings.



B29

Press main shaft bearing into position

Use press tool **5306.**

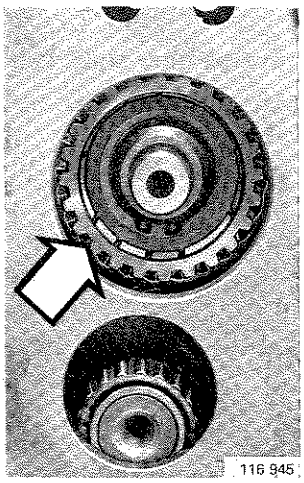
Make sure gear teeth do not clash and become damaged when pressing on bearing.

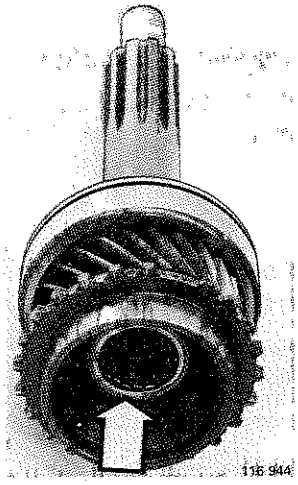
B30

Make sure lock ring on bearing contacts housing

If required, tap press tool with a mallet until bearing positions correctly.

Installing input shaft



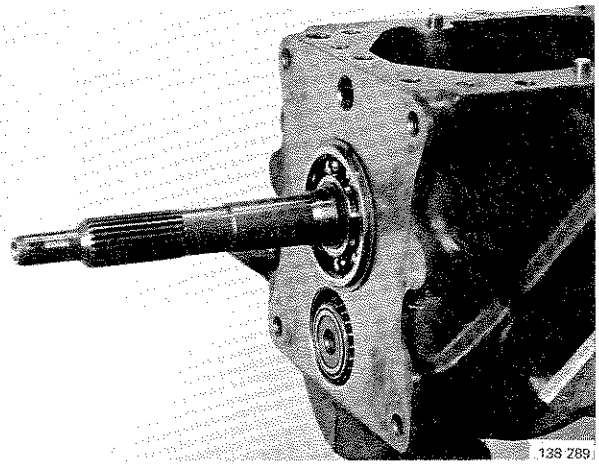


B31

Position 4th gear synchronizer ring in synchronizer hub

B32

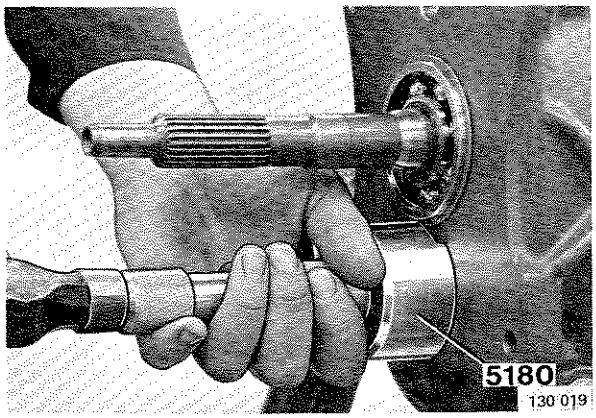
Grease and install roller bearing in input shaft



B33

Install input shaft, lift countershaft

Tap bearing outer race with a mallet if bearing is stiff. Place countershaft bearings in position before input shaft.

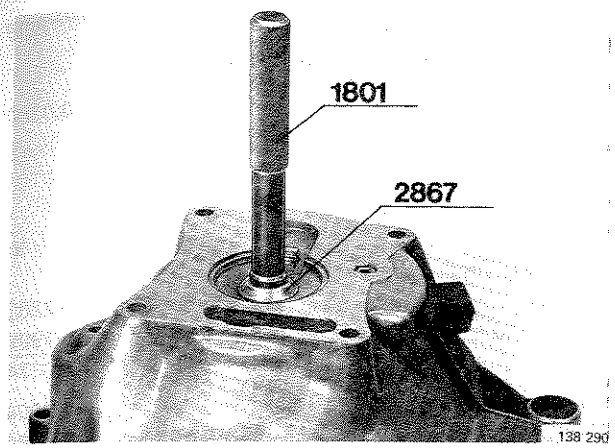


B34

Install outer races for countershaft

Transmission with aluminium housing:

Use drift **5180.**
Front bearing: large end of drift.
Rear bearing: small end of drift.

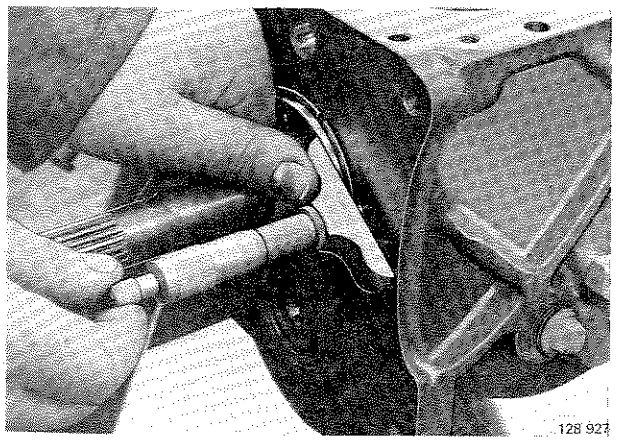


B35

Grease and install seal in bell housing
First check that tube bottoms.
Use drift **2687** and standard handle **1801**.

Determining thickness for shim on input shaft

Input shaft should have an end clearance of 0.01–0.20 mm (0.0004–0.0080 in). If bearing on input shaft or bell housing was replaced, shim thickness must be determined.

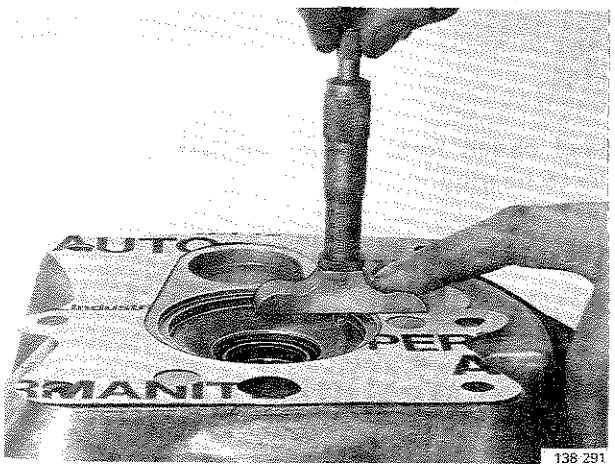


B36

Measure distance between outer face of input shaft bearing and front face of transmission

Make sure lock ring on bearing abuts housing.

Use depth micrometer and note reading.



B37

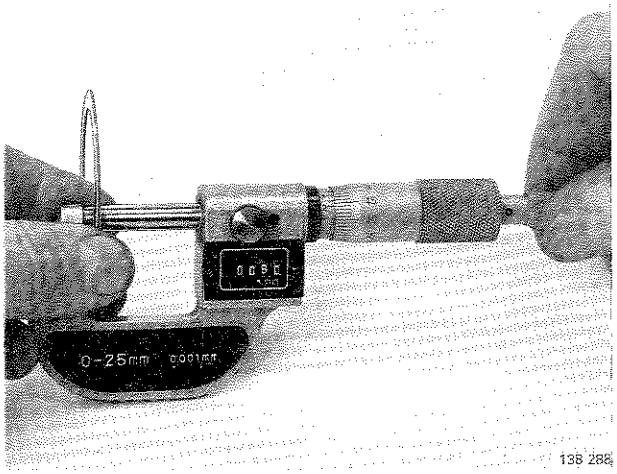
Position gasket on clutch housing

B38

Measure distance between outside of gasket and bottom of bearing seat

Note reading.

B39



138 288

Calculate shim thickness for input shaft

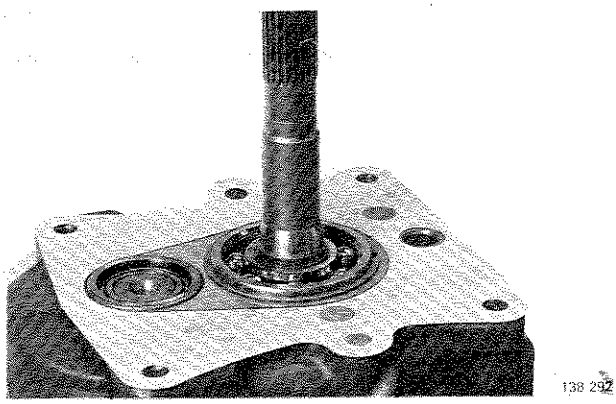
Permissible end play. 0.01–0.20 mm (0.0004–0.0080 in).

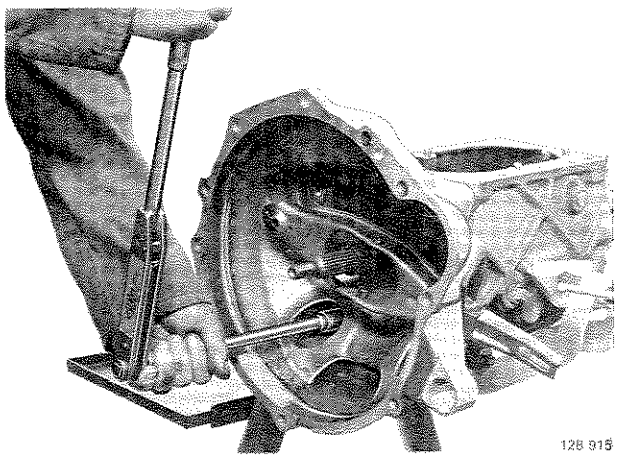
Example:

Distance:	mm	in
– Gasket face to bearing recess	5.80	0.2283
– Bearing to transm. housing	–4.85	–0.1909
	=0.95	=0.0374
Deduct end play	–0.01	–0.0004
	to 0.20	to 0.0080
Determined shim thickness:	=0.75	=0.0294
	to 0.94	to 0.0370
Select shim thickness	0.90 mm	0.035 in

Following shim thicknesses are available:

P/N	mm	in
3292838–4	0.25	0.010
948008–X	0.60	0.024
948009–6	0.75	0.030
948010–4	0.90	0.036
948011–2	1.00	0.040


138 292


128 915

Installing clutch housing ("bell housing")

B40

Grease transmission gasket face and install gasket

B41

Position shim in clutch housing

Apply grease to hold shim in position.

B42

Install clutch housing

Torque to 35–50 Nm (25–35 ft lb)

B43

Install clutch fork, spacer washer and clutch release bearing

Prior to installing, grease bearing sliding surface and ball joint.

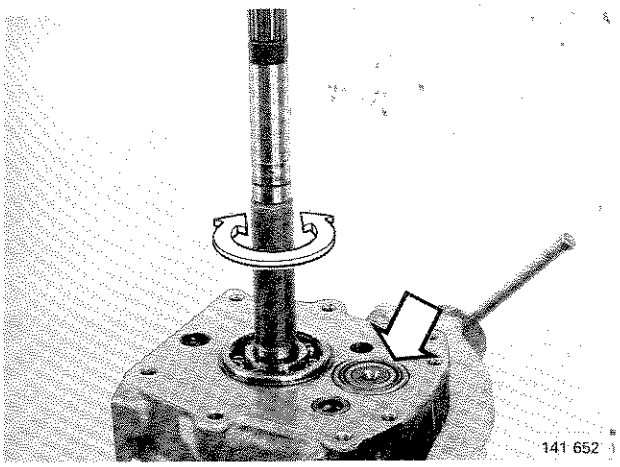
Sparingly apply grease to splines. (Do not forget washer under ball joint.)

Transmissions with aluminium housing: proceed to operation B46.

Operation B44–B45 only apply to transmissions with cast iron housings.

Determining thickness for shim on countershaft

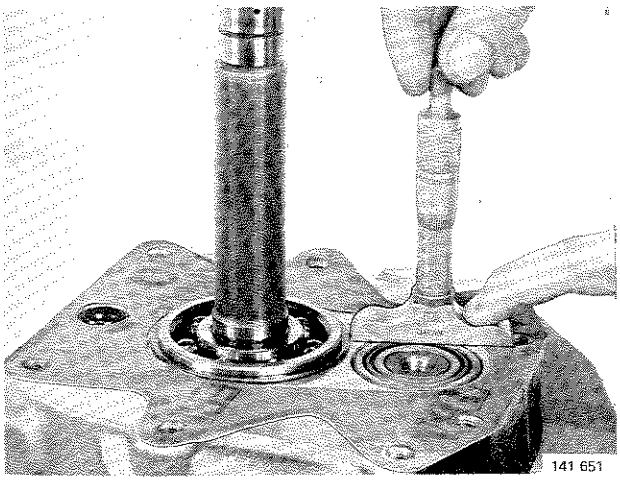
End float should be 0.025–0.10 mm (0.001–0.004 in). If the countershaft, any of its bearings, or the rear case/intermediate housing have been replaced the shim thickness should be determined.



B44

Make sure bearing races are correctly positioned

Depress races while turning main shaft a couple of turns until bearing rollers have centered.



B45

Position gasket. Measure distance between countershaft outer bearing race and gasket face.

Use depth micrometer and note reading.

Example:	mm	in
Distance race to gasket face	1.68	0.0661
permitted end float	−0.025	−0.0001
	to 0.10	to 0.0040
	=1.58	=0.0660
	to 1.655	to 0.0621

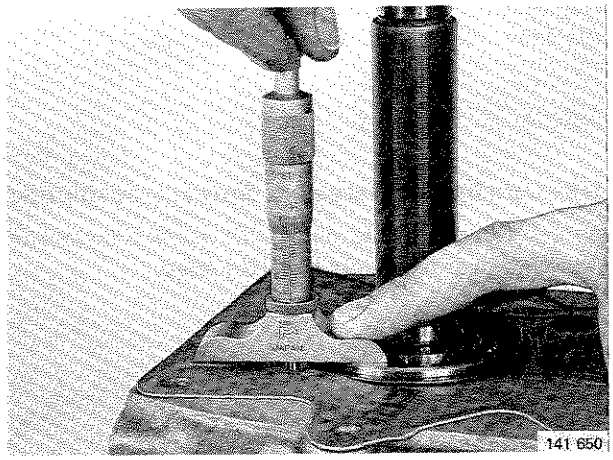
Select shim thickness **1,65 mm.** (0.066 in)

Following shim thicknesses are available:

P/N	**mm**	**in**
949048–3	0.05	0.002
948298–5	0.10	0.004
948299–3	0.15	0.006
948300–9	0.35	0.014
948301–7	0.50	0.020
948302–5	0.70	0.028
948303–3	1.00	0.040

Determining thickness for shim on main shaft

Main shaft end float should be 0.01–0.20 mm (0.0004–0.0080 in.). If a main shaft bearing or the intermediate section has been replaced, the shim thickness should be deteremined.

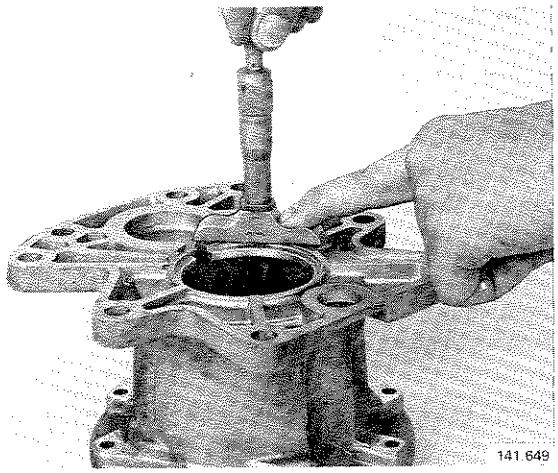


B46

Position gasket. Measure distance between outer face of main shaft bearing and rear face of transmission housing

Make sure bearing spacer ring abuts housing.

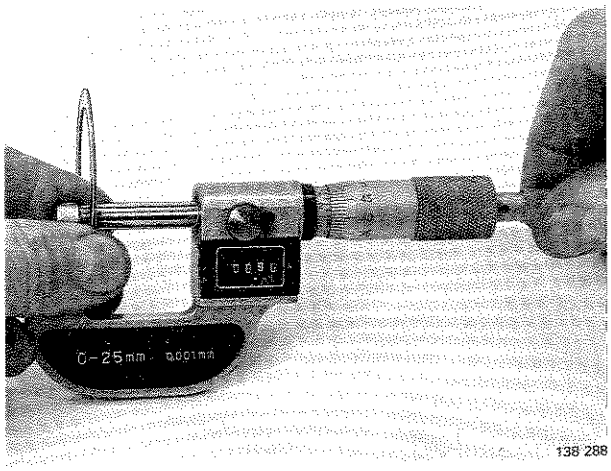
Use depth micrometer and note reading.



B47

Measure distance between intermediate section contact face and bottom of bearing seat

Note reading.



B48

Calculate shim thickness

Permitted end float: 0.01–0.20 mm (0.0004–0.0080 in).

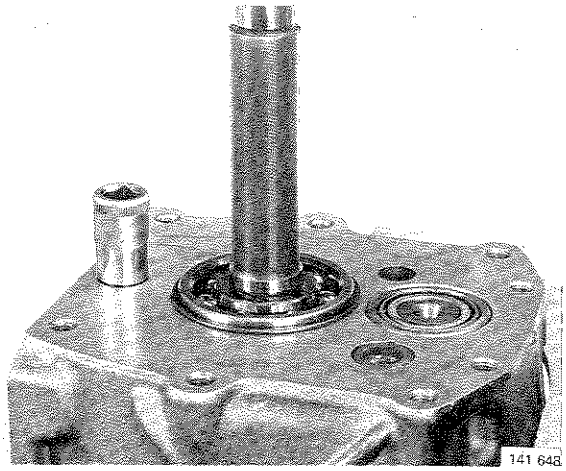
Example:

Distance:	mm	in
– Face to seat	5.50	0.2165
– Bearing to gasket face	−4.46	−0.1756
	=1.04	=0.0409
Deduct end float	−0.01	−0.0004
	to 0.20	to 0.0329
	to 0.84	to 0.0405

Select shim thickness **1,00 mm** (0.040 in).

Following shim thicknesses are available:

	mm	in
948008-4	0.60	0.024
948009-6	0.75	0.030
948010-4	0.90	0.036
948011-2	1.00	0.040

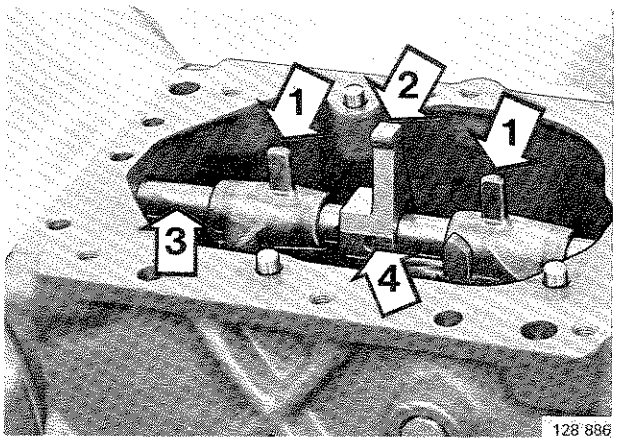


Installing intermediate section

B49

Install selector shaft seal in housing

Use a socket to depress seal.



B50

Install shift forks (1)

Make sure lugs face correctly.

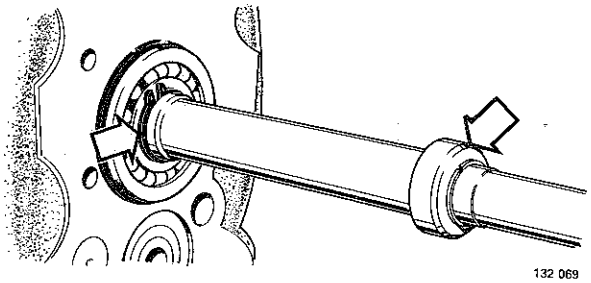
B51

Install gear selector (2) and selector shaft (3)

Gear selector collar forwards, grooves in selector shaft facing UP.

B52

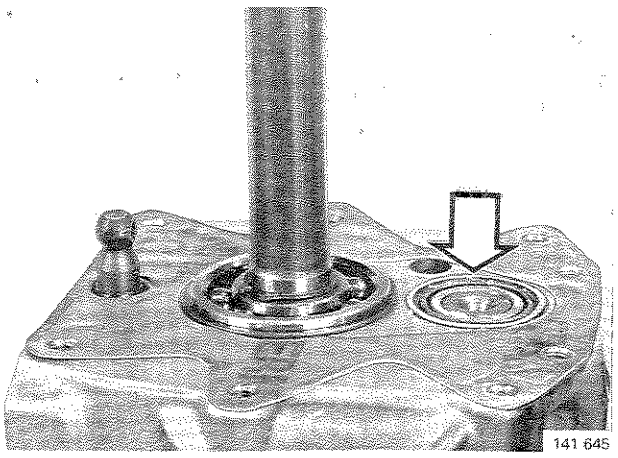
Install lock pin (4) in gear selector



B53

Install lock ring for bearing and oil pump cam with lock ring

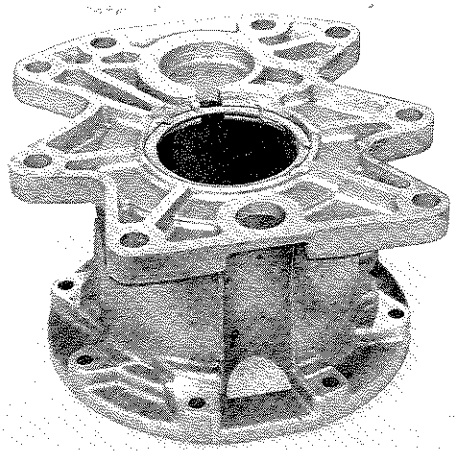
Install key for cam in main shaft.



B54

Grease transmission rear face. Position gasket and shims for countershaft

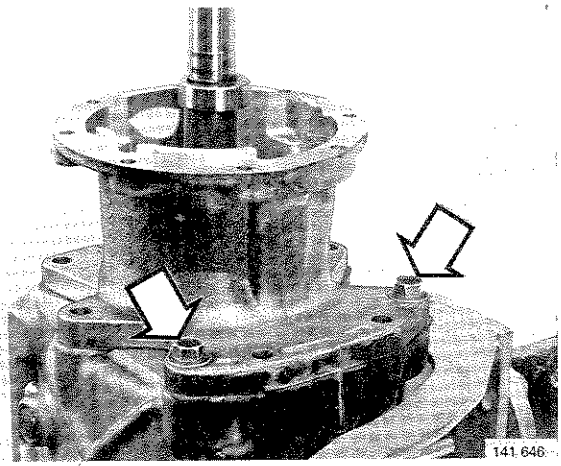
Grease shims to hold them in position.


141 647

B55

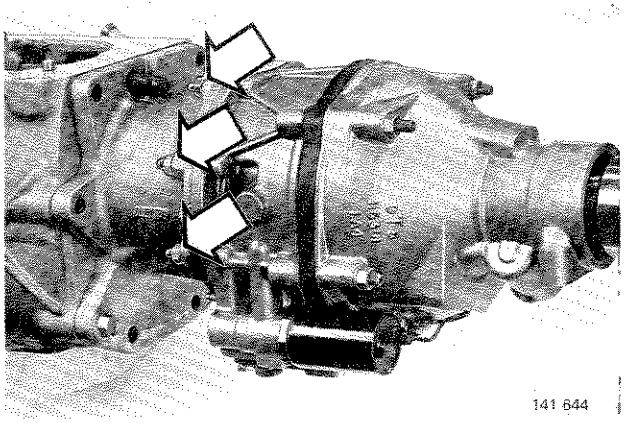
Position main shaft shims in intermediate section

Use grease to hold shims in position.


141 646

B56

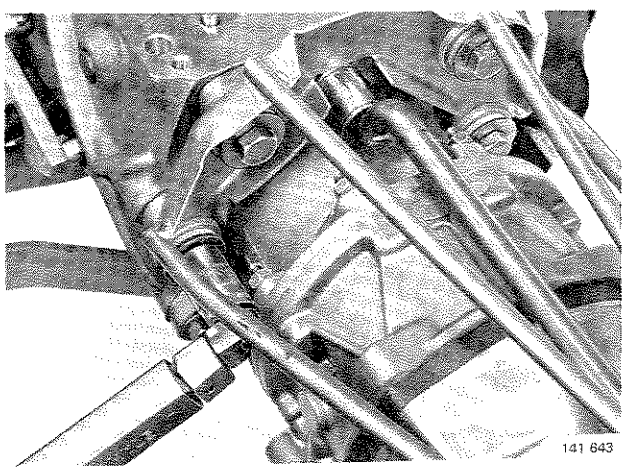
Install intermediate section


141 644

B57

Install overdrive

Torque bolts to 12 Nm (9 ft lb).


141 643

B58

Install selector rod

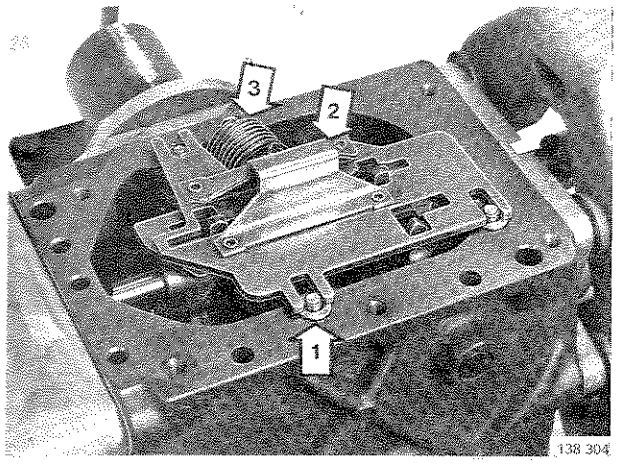
Grease and install rubber ring in joint. Use sleeve to lock pins.

B59

Install selector bracket

Note: Bolt-washer-spacer tube-washer.

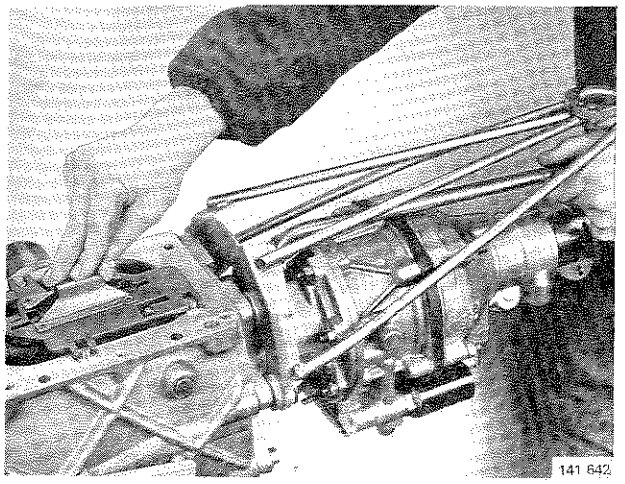
Torque bolts for rear end.
Torque: 35–50 Nm (25–35 ft lb).



138 304

B60

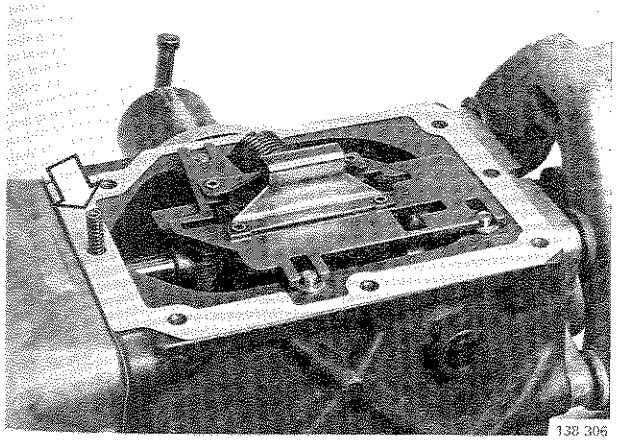
Install washers (1), selector plate (2) and return spring (3)


141 642

B61

Check function

Move selector plate by hand to check that all gears can be engaged and disengaged.

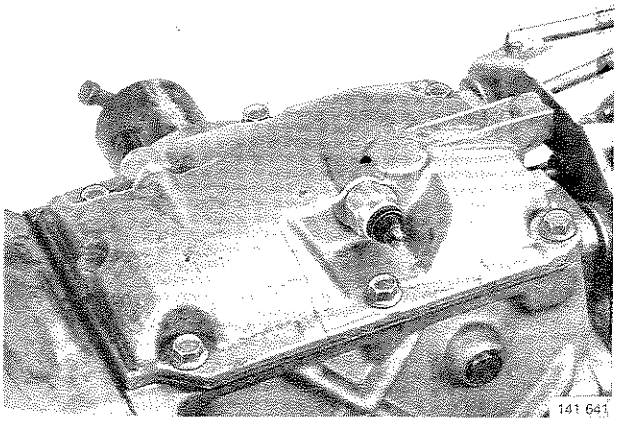

138 306

B62

Grease contact face and position gasket

B63

Install interlock ball and spring


141 641

B64

Install transmission cover

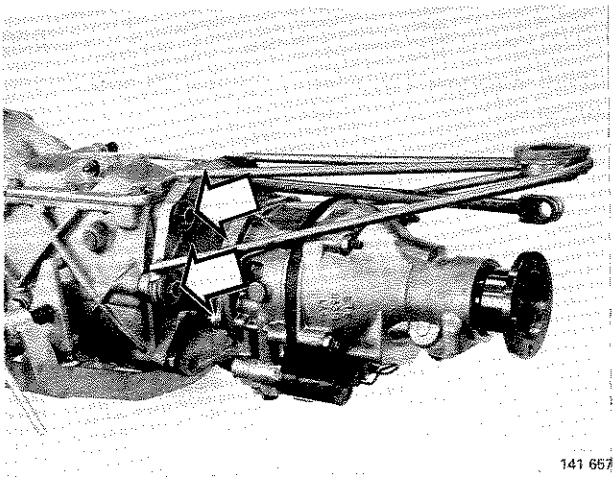
Torque bolts to 15–25 Nm (11–20 ft lb).

B65

Install reversing light (back-up light) switch

Also install overdrive switch and attach wire from solenoid.

B66



141 657

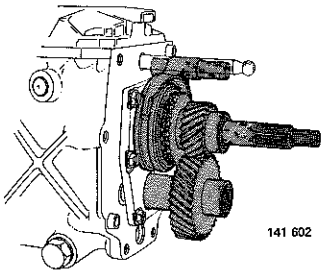
Check that all overdrive bolts are tight and that there are no leaks

C. Disassembling M 47, M 47 II

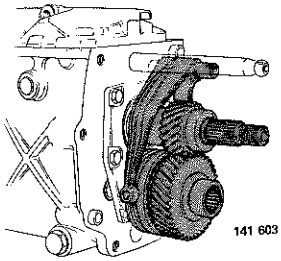
Special tools: 5130+2520 or 5154, 2853, 2985, 5058, 5131, 5147, 5148, 5261, 5262, 5304, 5305, 5973, 5986

On M 47 II the 5th gear synchronizer is on the counter shaft. On the early version (M 47–1985) it is on the main shaft.

M 47

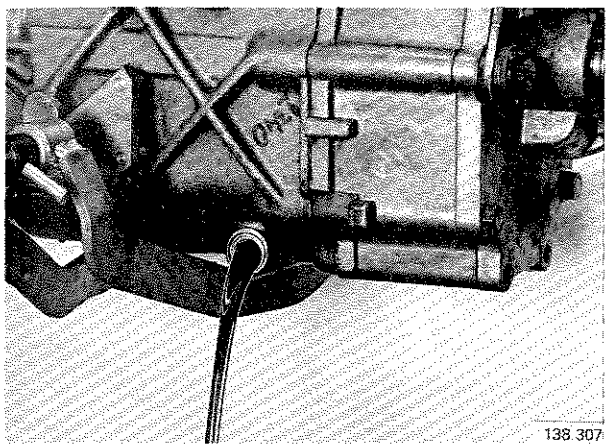


141 602



141 603

M 47 II



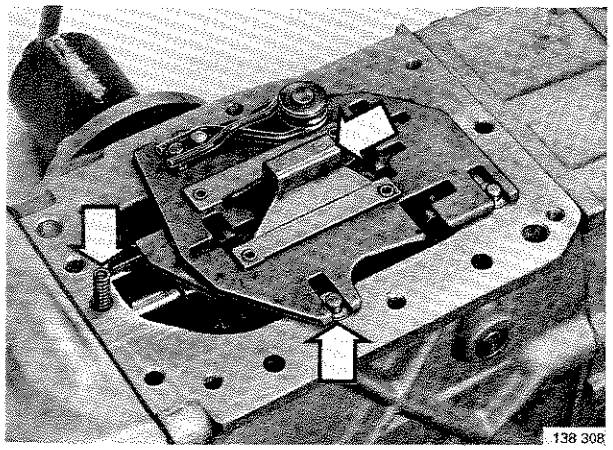
138 307

C1

Mount transmission on fixture 5130 on floor stand 2520 or bench support 5154

C2

Drain oil



138 308

C3

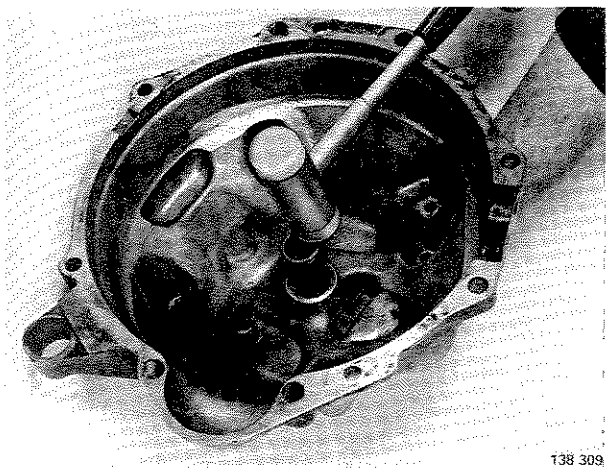
Remove transmission cover and gasket

Remove selector plate.

C4

Remove selector plate

Lift off washers, spring and interlocking ball.



138 309

C5

Remove clutch fork

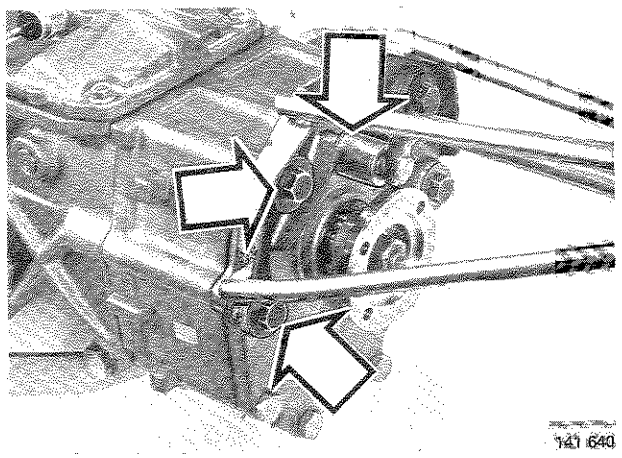
Save spacer washer. Remove release bearing.

C6

Remove clutch housing ("bell housing") and gasket

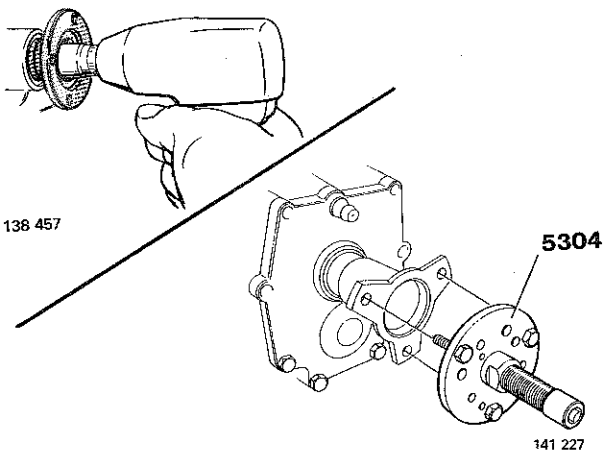
Save adjusting shims.

Tap pipe rearwards to loosen seal. Some pipes have a lock ring, remove it first.



C7

Remove gear selector bracket and selector rod

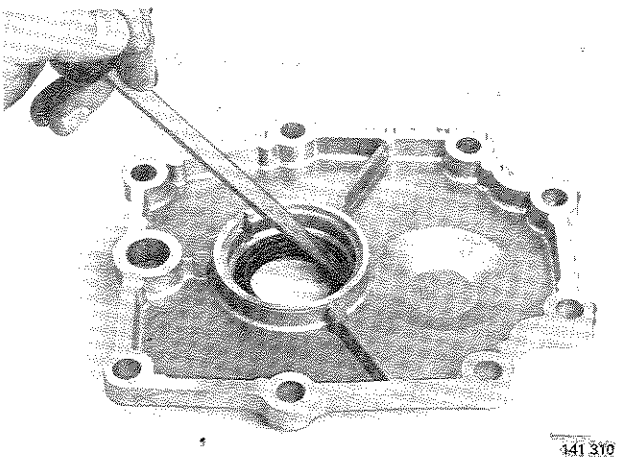


C8

Remove drive flange

Engage two gears to lock transmission, prior to loosening nut.

If drive flange is difficult to remove, use puller **5304.** It fits both the round and three-armed drive flanges.



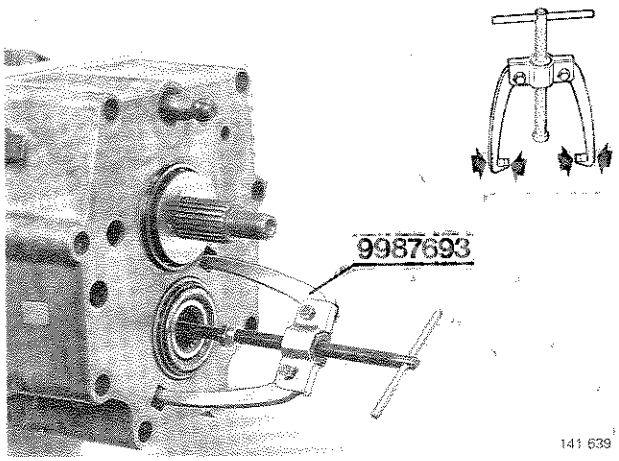
C9

Remove rear end cover and gasket

C10

Remove rear end cover seal

M 47 II: proceed to operation C22.



Operations C 11 to C 21 only refer to M 47.

Removing 5th gear, M 47

C11

Remove bolt, washer and shims for countershaft

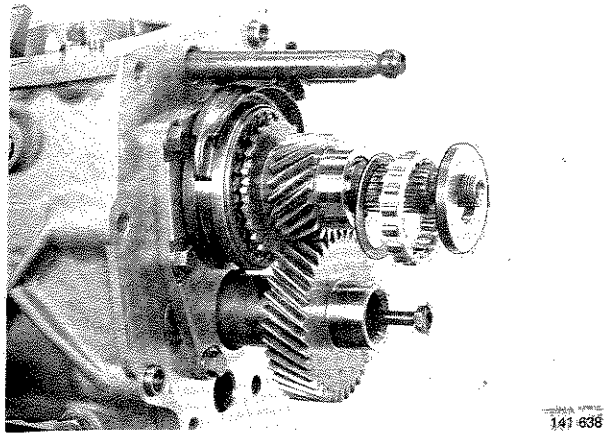
Reinstall bolt, 5–6 turns, no washer.

C12

Pull off 5th gear housing

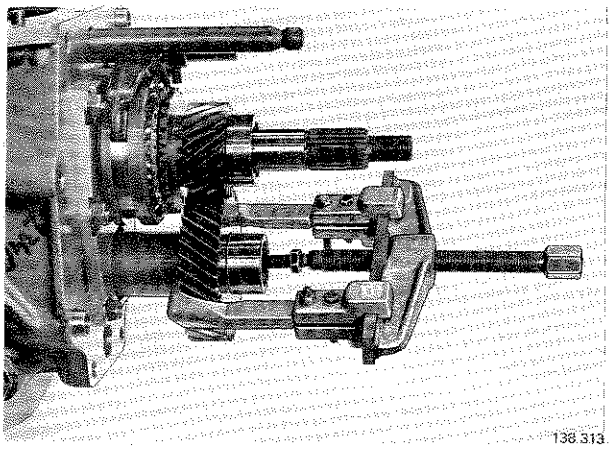
Use puller **998 7693-0**

Note: Puller claws should be ground as shown.
Remove gasket.
Remove selector shaft seal.


141 636

C13

Remove thrust washer and roller bearing with washer


138 313

C14

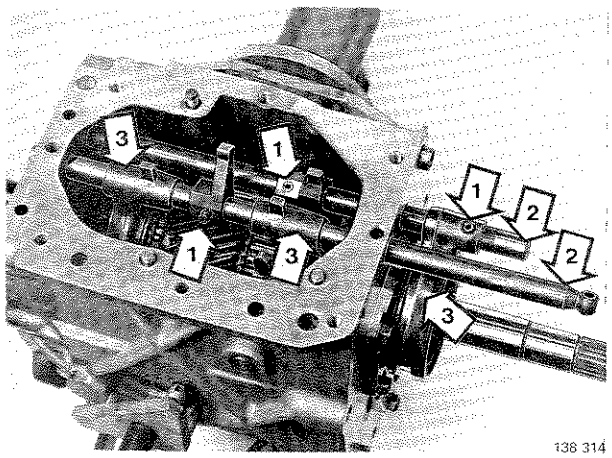
Pull off gear wheel from countershaft

Use universal puller.

C15

Remove gear wheel with needle bearing, support ring and synchronizer ring from main shaft

Remove long bolt from countershaft.



138 314

C16

Tap out three pins (1)

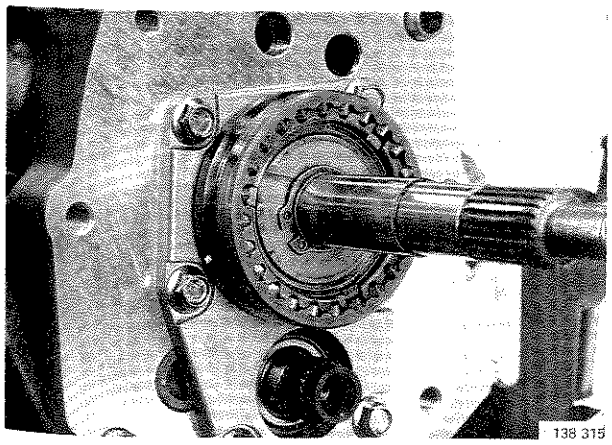
Support shafts to prevent them from bending when pins are removed.

C17

Pull out selector shafts (2)

C18

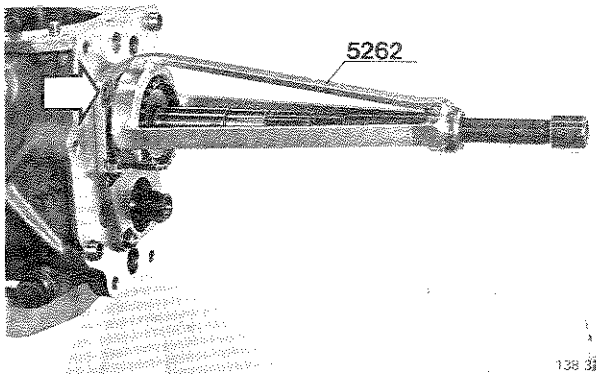
Remove shift forks (3)


138 315

C19

Remove spring. Disassemble 5th gear synchronizer.

Remove lock ring for hub.



138 316

C20

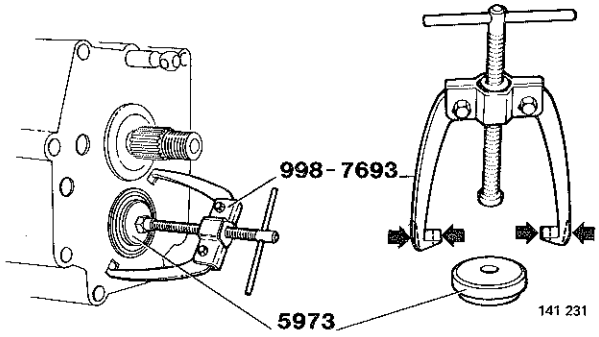
Remove two upper screws retaining bearing holder

C21

Pull off hub

Use puller **5262.**
Save adjusting shims.

Proceed to operation C32.



141 231

Operations C22 to C31 only apply to M 47 II.

Removing 5th gear, M 47 II

C22

Remove bolt, washer and countershaft shims

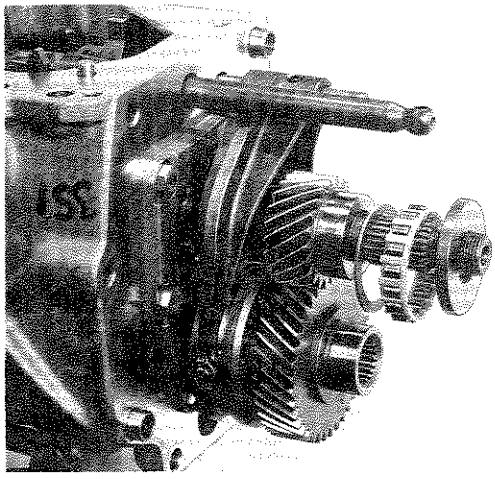
C23

Pull off 5th gear housing

Refit bolt with washer **5973.** Tighten bolt by hand until it bottoms.

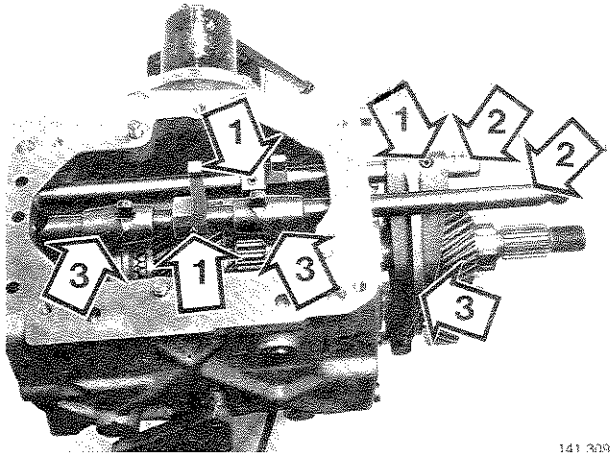
Use puller **998 7693** to pull off 5th gear housing.
Note: grind puller claws as shown.

Remove gasket and selector shaft seal.


141 300

C24

Remove thrust washer and roller bearing with washer



141 309

C25

Tap out three pins (1)

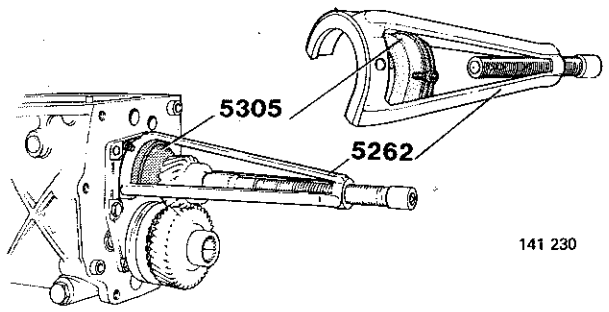
Support shafts to prevent them from bending when pins are removed.

C26

Pull out selector shafts (2)

C27

Remove shift forks (3)



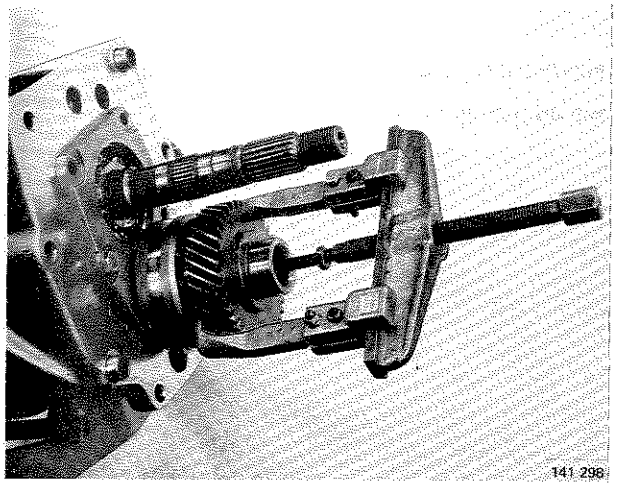
141 230

C28

Pull off 5th gear wheel

Remove two upper bearing holder screws.

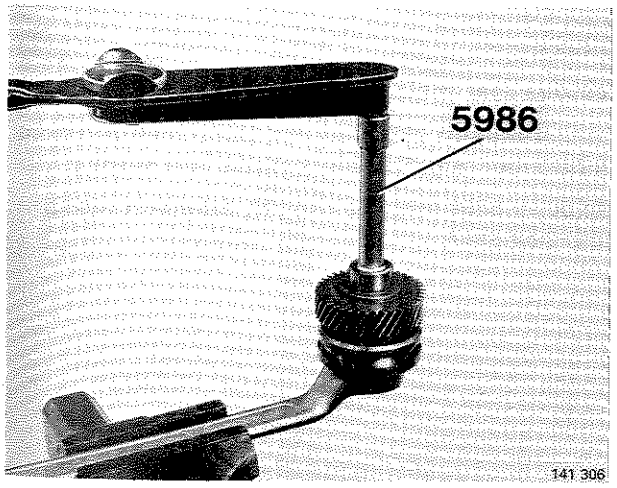
Use puller **5262** and ring **5305.**


141 298

C29

Pull off 5th gear wheel and synchronizer

Use universal puller, supported on bolt head.



141 306

C30

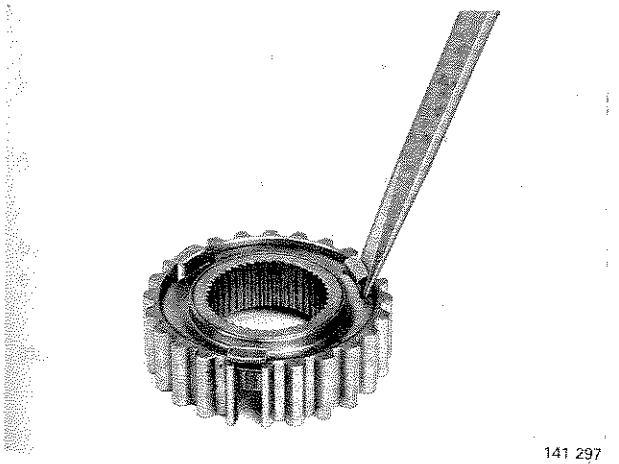
Disassemble 5th gear wheel/synchronizer

Clamp a box-end wrench in a vice. Place synchronizer nut in wrench.

Use shaft **5986** plus torque wrench to loosen nut.

Note: If nut comes loose at a lower torque than 30 Nm (22 ft lb), a **new nut** should be used when reassembling.

Dismantle parts.

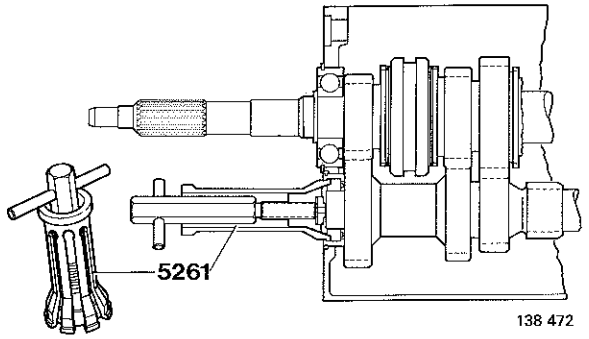

141 297

C31

Remove washer on 5th gear synchronizer hub

This operation should only be performed if a part is to be replaced.

Use screwdriver to pry washer loose.



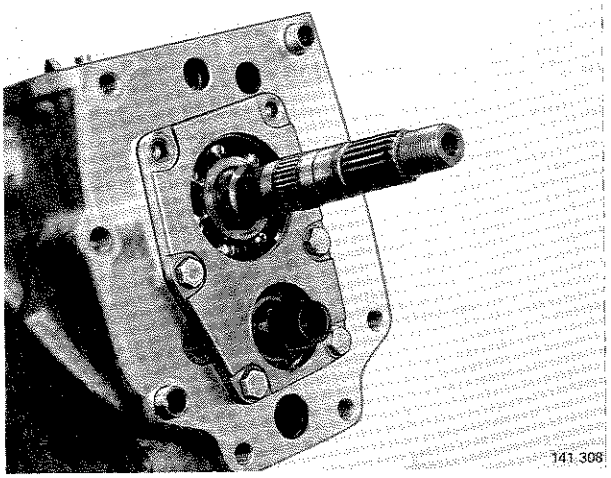
138 472

C32

Pull out front countershaft bearing

Use puller **5261**.

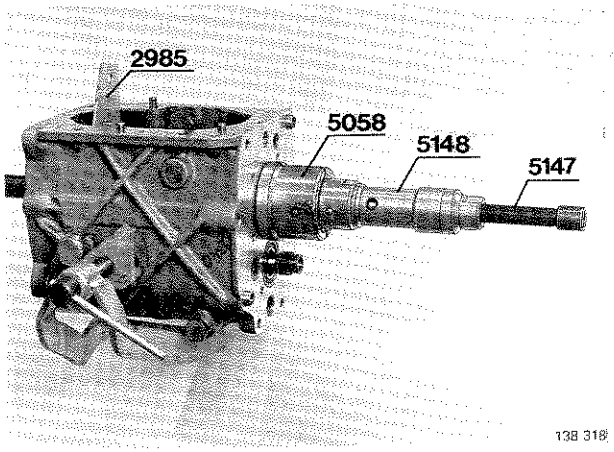
Insert puller claws between rollers, pull out spindle to expand puller and pull out bearing.


141 308

C33

Remove bearing holder from rear face

Save adjusting shims.



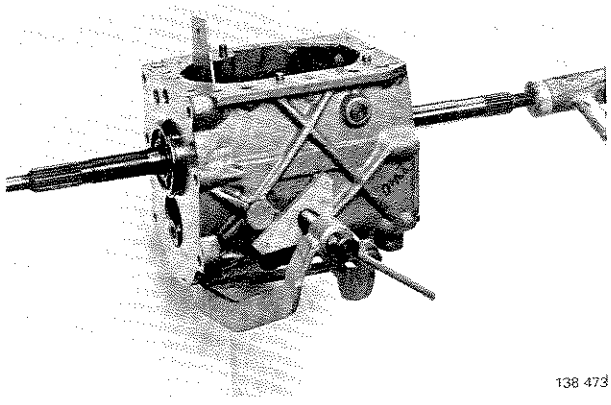
138 318

C34

Remove rear main shaft bearing

Position support **2985** between input shaft and front synchronizer ring. Remove lock ring and bearing.

Use puller **5058** (without spindle), extension **5248** and puller bolt **5147**.


138 473

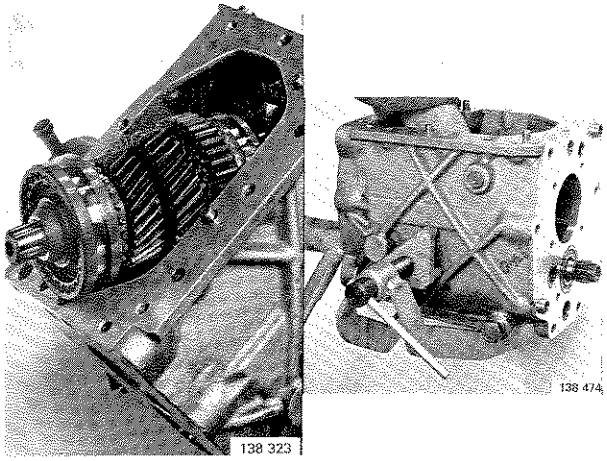
Removing all shafts

C35

Remove input shaft with synchronizer ring

Pull out shaft. If bearing is hard to remove leave support **2985** in position and tap main shaft with a mallet.

Note: Make sure that front part of countershaft abuts bottom of housing.



C36

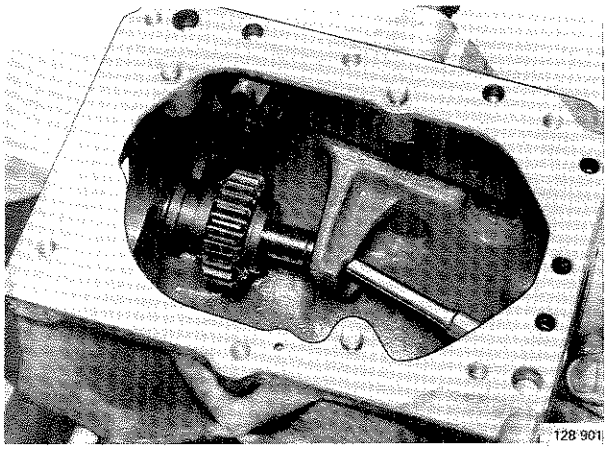
Remove main shaft

Turn transmission and remove main shaft.

C37

Remove countershaft

Turn transmission back. Tap out rear bearing race with a plastic mallet. Remove countershaft.



C38

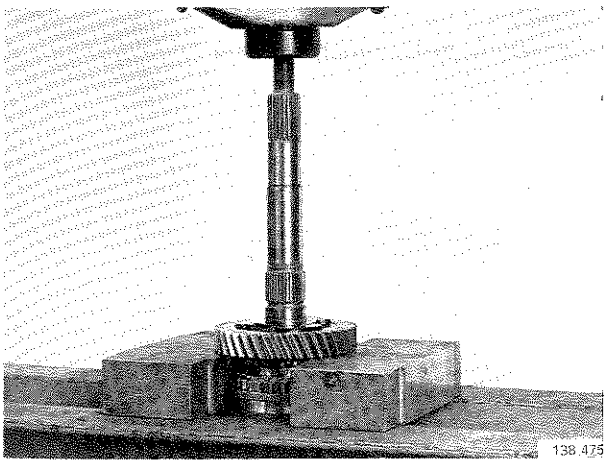
Remove reverse gear and shaft

Use a drift to force shaft rearwards.

C39

Remove reverse gear shift fork

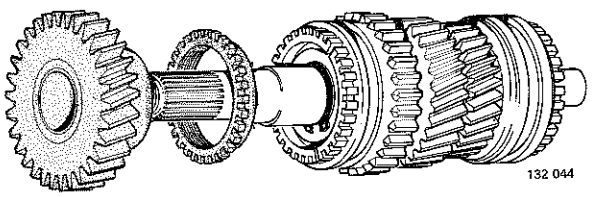
Disassembling main shaft



Transmission with damper:

C40

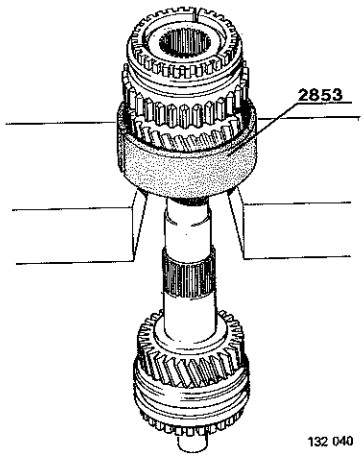
Press off washer. Remove springs and brake ring



C41

Remove thrust washer and 1st gear wheel with synchronizer ring

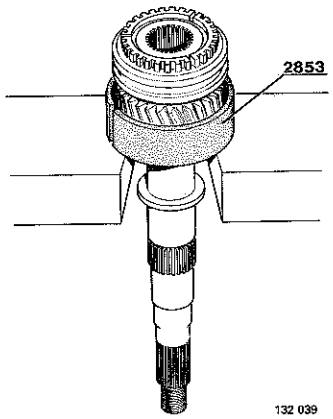
Remove lock rings for synchronizer hubs.



C42

Press off 1st—2nd synchronizer hub and 2nd gear wheel with synchronizer ring

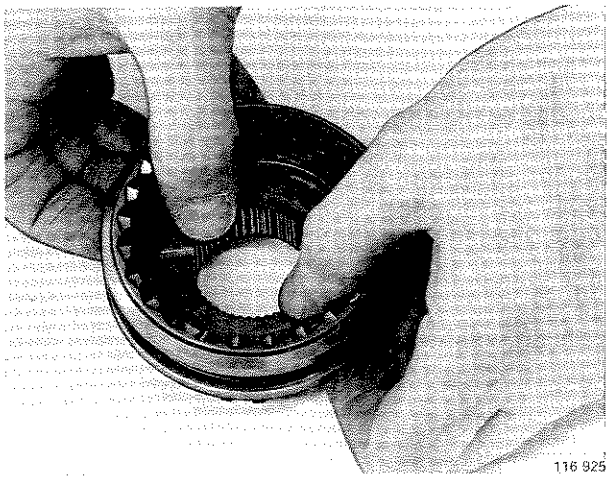
Use support **2853.**



C43

Press off 3rd—4th synchronizer hub and 3rd gear wheel.

Use support **2853.**



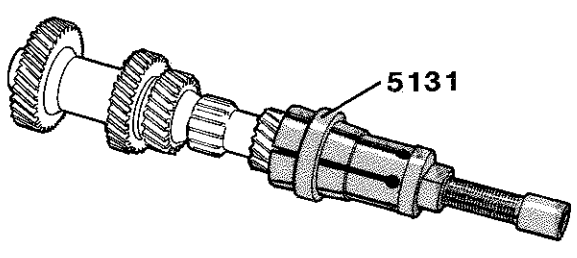
C44

Disassemble both synchronizers

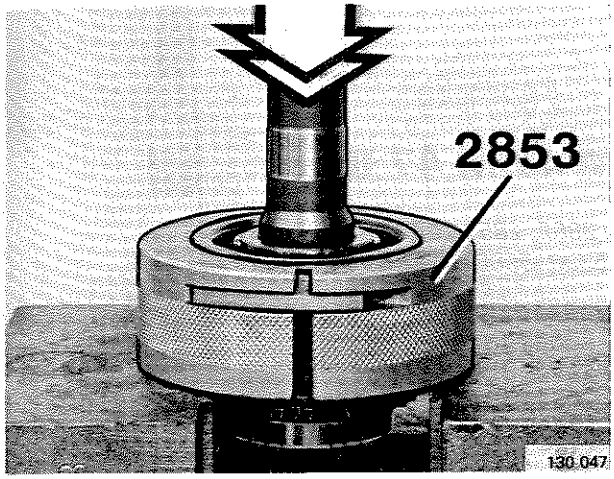
C45

Remove bearing on countershaft

Use puller **5131.**



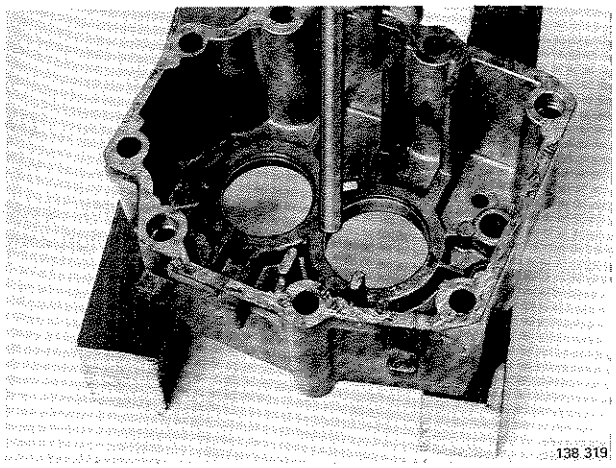
C46



Remove input shaft bearing

Use support **2853.**

C47



Remove bearing races from 5th gear housing

Use brass drift.

C48

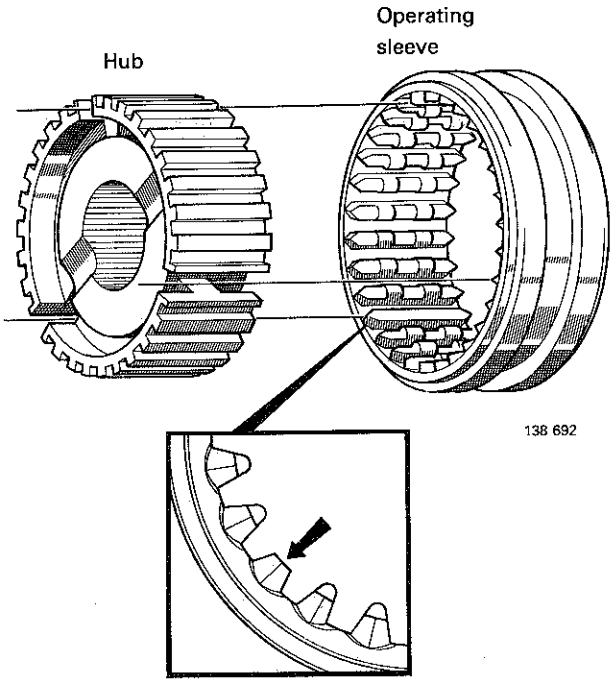
Clean and check

Clean all parts in solvent. Dry with compressed air.

Check all parts. Replace all worn or damaged parts and all gaskets and seals.

D. Assembling M 47/M 47 II

Special tools: 1801, 2413, 2852, 2853, 2867, 2985, 5064, 5090, 5096, 5306, 5986, 9177

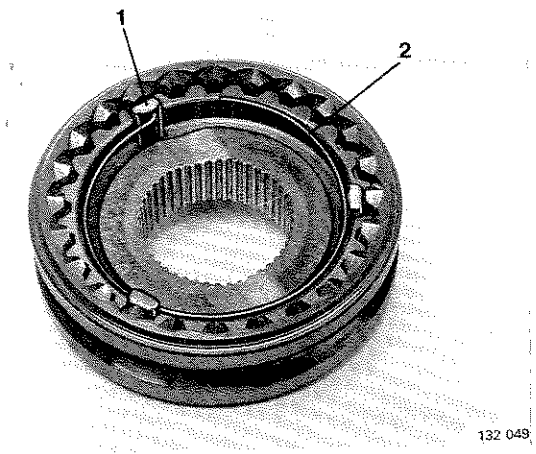


Assembling main shaft

D1

Assemble both synchronizers

Place hub in operating sleeve. 3rd–4th gear synchronizer: Three recesses in hub should align with three bevelled teeth in operating sleeve.

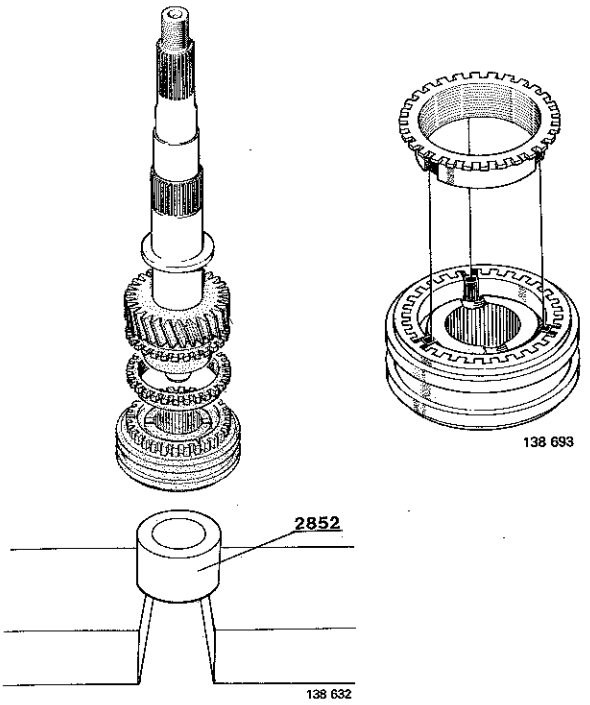


D2

Install sliding keys (1) and springs (2)

Lock sliding keys ("dogs") with springs. Hook both springs to the same sliding key.

Install one spring counter-clockwise. Turn synchronizer over and install second spring, also counter-clockwise.
If spring is bent, free end must point away from hub.

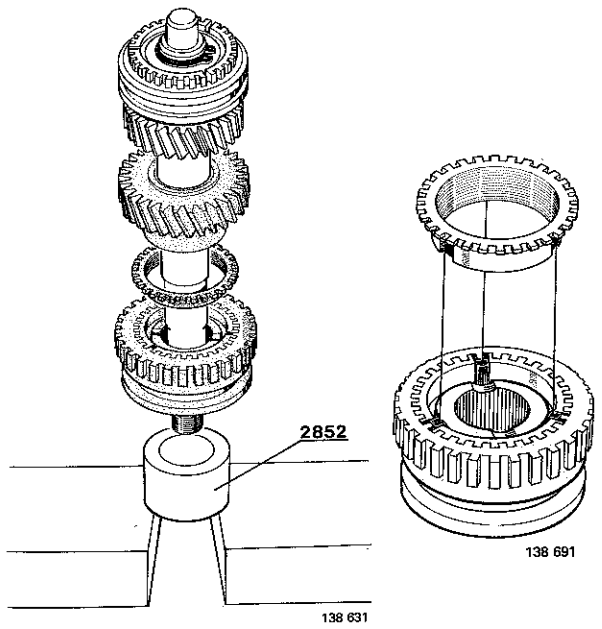


D3

Oil main shaft. Install 3rd gear wheel and synchronizer ring. Press on 3rd–4th gear synchronizer hub.

Make sure synchronizer ring is facing correct way.

Turn wear surface on synchronizer hub UP. Use support **2852.**



Invert shaft

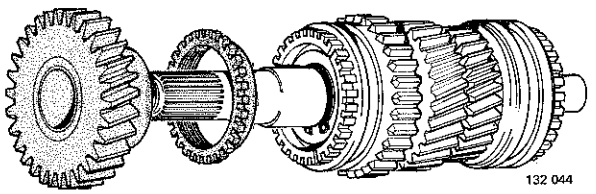
D4

Oil shaft. Install 2nd gear wheel and synchronizer ring. Press on 1st–2nd gear synchronizer hub.

Make sure synchronizer ring is fitted correctly. Use support **2852.**

D5

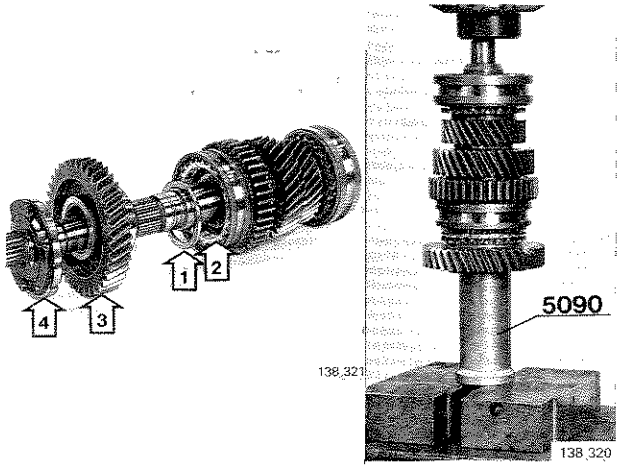
Install lock rings for both synchronizers



Transmission without damper:

D6

Install synchronizer ring and gear wheel for 1st gear and thrust washer



Transmission with damper:

D7

Install thrust washer (1) if applicable, synchronizer ring (2) and 1st gear wheel (3)

D8

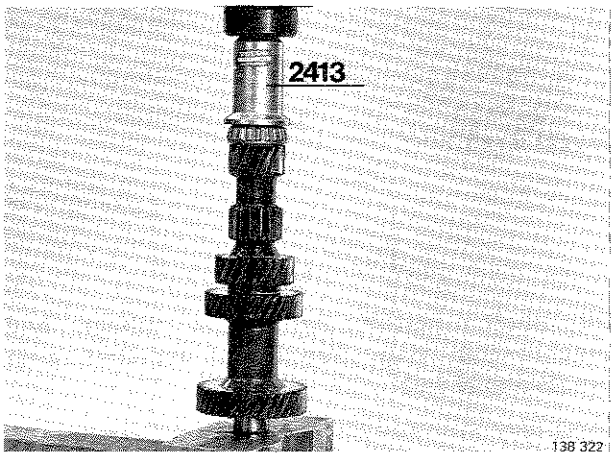
Assemble damper

Oil parts. Position springs in brake ring and twist washer into brake ring.

D9

Press damper (4) on main shaft

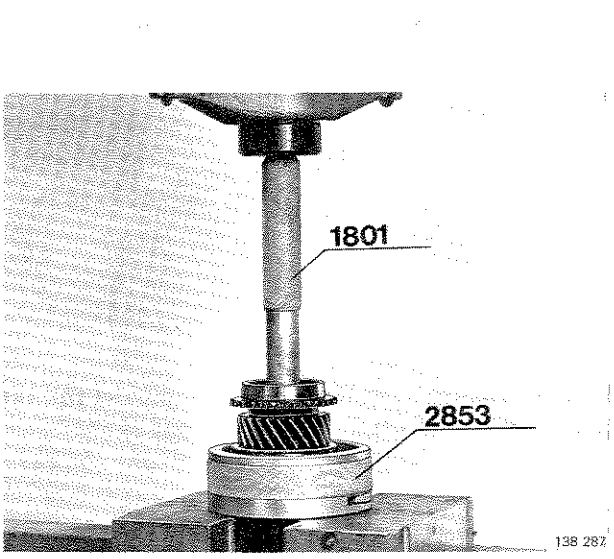
Use a file to remove sharp edges. Use **5090** to press on damper.



D10

Press rear bearing on countershaft

Use drift **2413.**



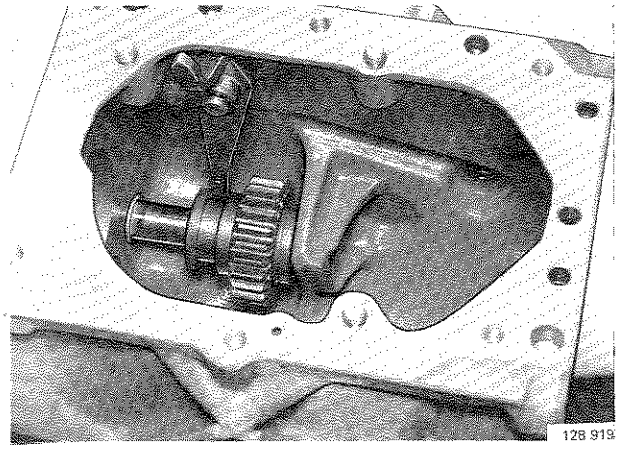
D11

Press bearing on input shaft

Use standard handle **1801** and support **2853.**

D12

Install lock ring on input shaft



Installing shafts

Note: Apply assembly paste to aluminium surfaces prior to installing bearings and shafts.

Part Number 1 161 006-9 Aerosol
1 161 078-9 Can

D13

Position reverse gear shift fork

Install lock ring.

D14

Install reverse gear and shaft

D15

Check/adjust position of reverse gear

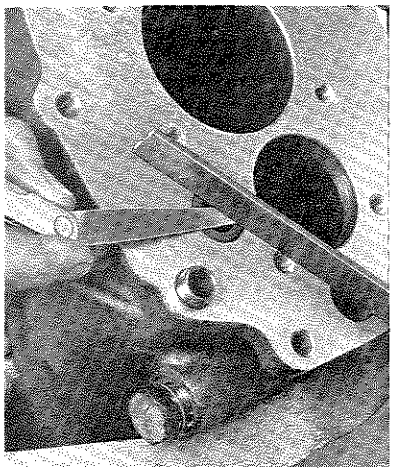
Shaft end should be flush with housing or max. 0.05 mm (0.002 in) below housing face.

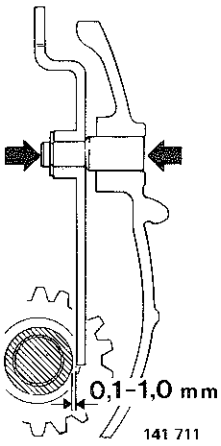
D16

Check/adjust clearance between reverse gear wheel and shift fork

Adjust by tapping shift fork bearing stud, with a drift.

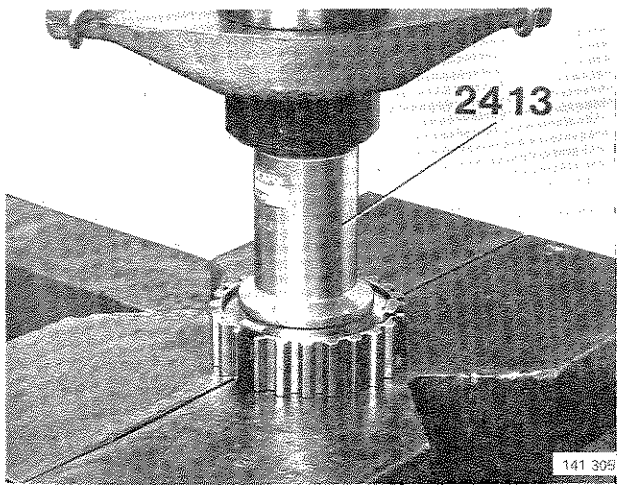
Correct clearance: **0.1–1.0 mm (0.004–0.040 in).**





M 47: proceed to operation D 22.

Operations D 17 to D 21 only apply to M 47 II.

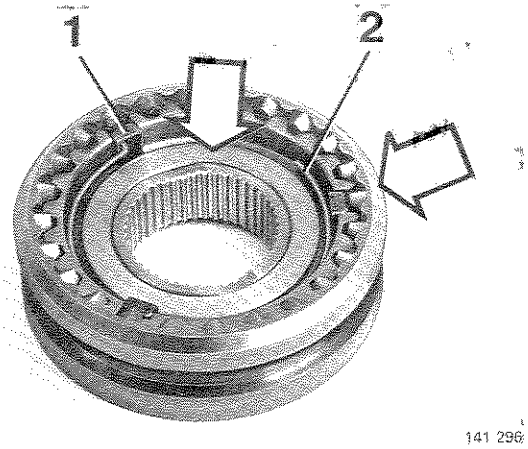


Assembling 5th gear synchronizer and gear wheel

D17

Fit washer to 5th gear synchronizer hub

Use drift **2413.** First position spring counter-clockwise in hub.



D18

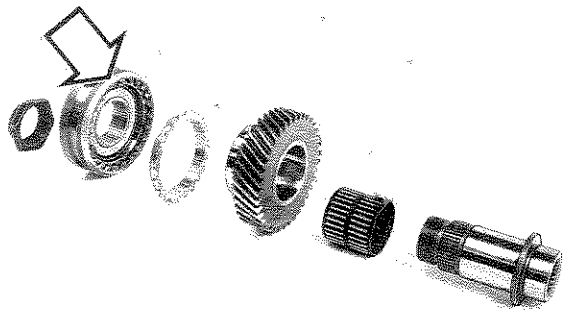
Assemble hub and operating sleeve

Three recesses in hub should align with three bevelled teeth in operating sleeve. Hub washer and bevelled part of operating sleeve should face same direction.

D19

Install sliding keys (1) and spring (2)

The two springs should hook on to the same sliding key. Position spring counter-clockwise as shown in illustration.



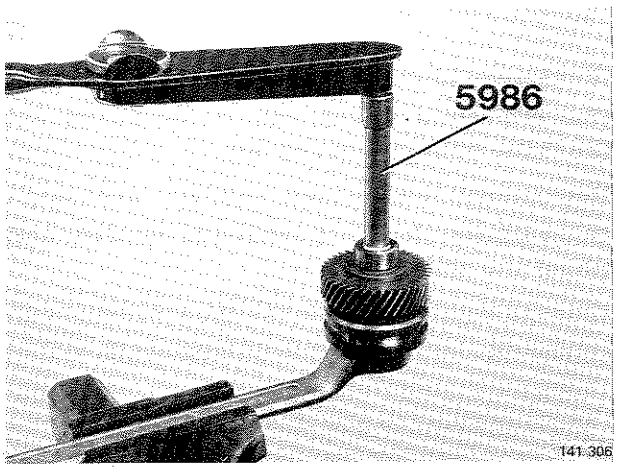
141 304

D20

Assemble shaft, needle bearing, gear wheel and synchronizer

Bevelled edge of sleeve should face gear wheel.

Install nut finger tight.



141 306

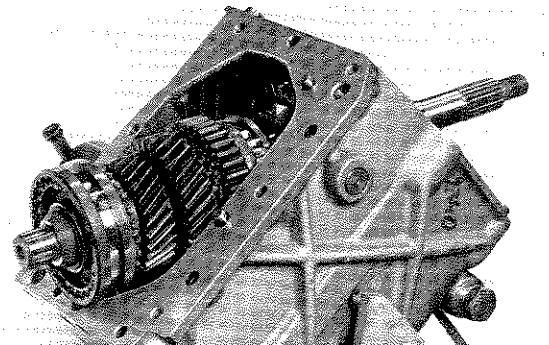
D21

Torque nut

Clamp a 42 mm box-end wrench in a vice. Place nut in box-end wrench. Use shaft **5986** and torque wrench.

Note: During tightening, torque should be 40–80 Nm (30–60 ft lb). If below, replace nut.

Torque: 120 Nm (88 ft lb).



138 323

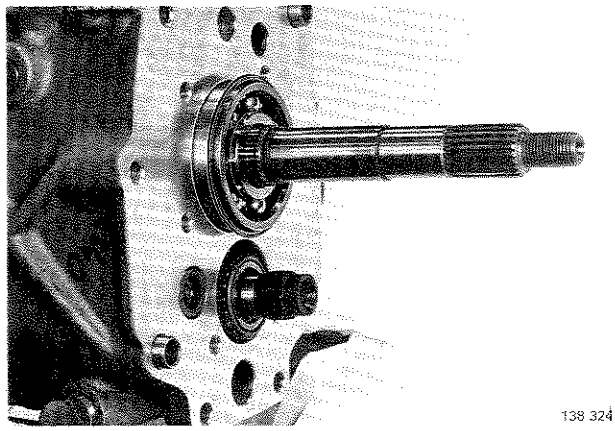
D22

Place countershaft in bottom of housing

D23

Place main shaft in housing

First turn housing.



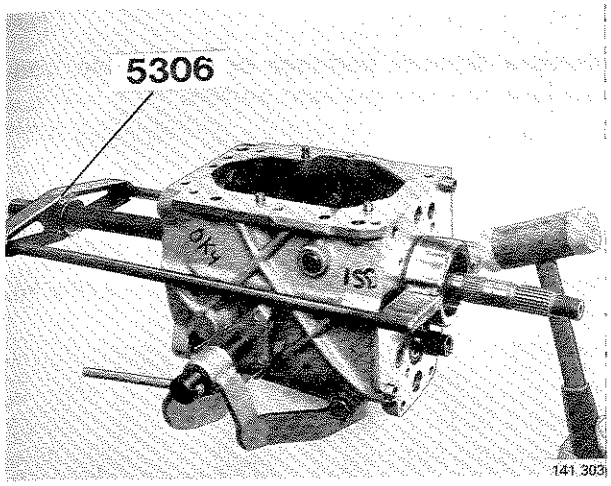
138 324

Installing rear bearing on main shaft

D24

Position bearing with lock ring on main shaft

Countershaft should lie in bearing recesses.



D25

Press main shaft bearing into position

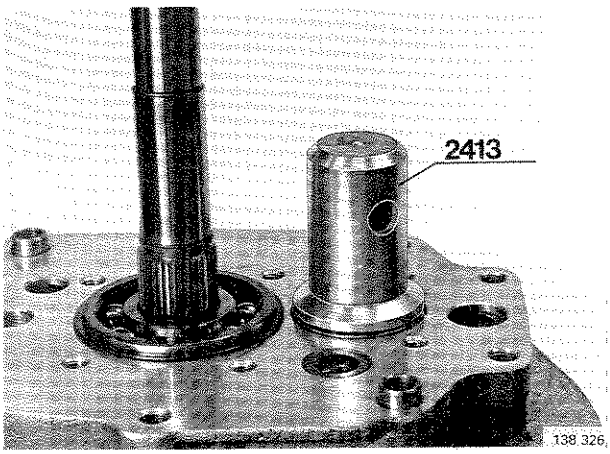
Use press tool **5306.**

Take care not to damage gear teeth when pressing bearing into position.

D26

Make sure bearing lock ring abuts housing

If necessary, tap press tool with a mallet until bearing seats correctly.



D27

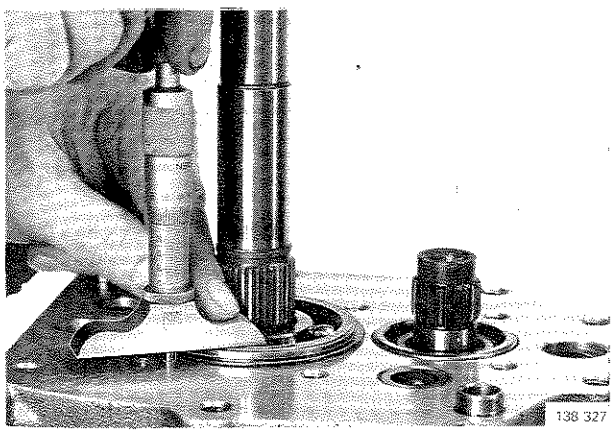
Install rear countershaft bearing race

Use drift **2413.**

Note: Top of race must be below housing face. Race will take correct position when cage is installed.

Determining thickness of main shaft shims

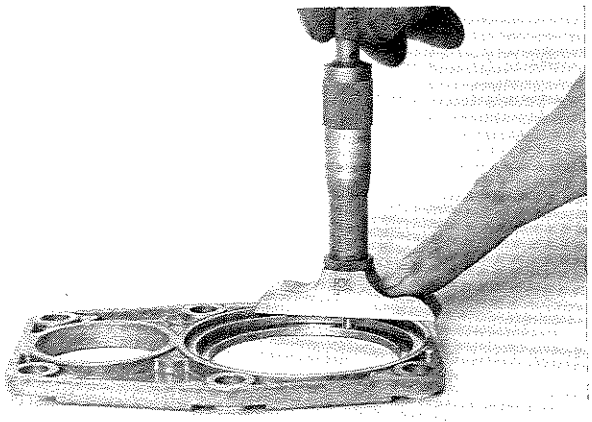
Main shaft end float should be 0.01–0.20 mm (0.0004–0.0080 in). If main shaft bearing or bearing holder has been replaced, shim thickness should be determined.



D28

Measure distance between outer face of main shaft bearing and rear face of transmission housing

Use depth micrometer and note reading.



138 328

D29

Measure distance between bearing holder contact face and bearing seat bottom

Note reading.

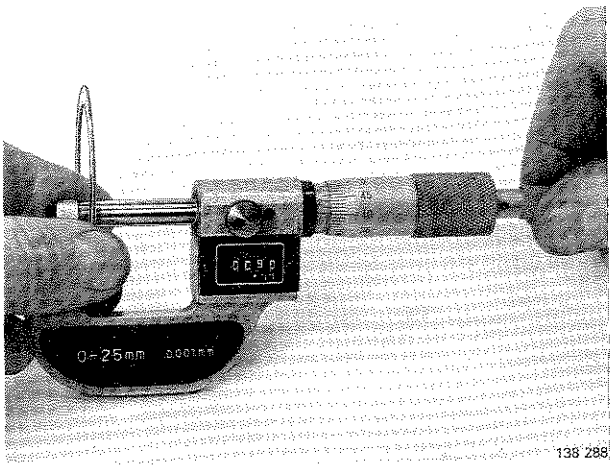
D30

Calculate thickness of shims for main shaft

Permitted end float: 0.01–0.20 mm (0.0004–0.0080 in).

Example:

	mm	in
Distance:		
– Face to seat	5,50	0.2165
– Bearing to housing	–4,71	–0.1854
	=0.79	=0.0311
Deduct end float	–0.01	–0.0004
	to 0.20	to 0.0080
	= 0.59	= 0.0231
	to 0.78	to 0.0307

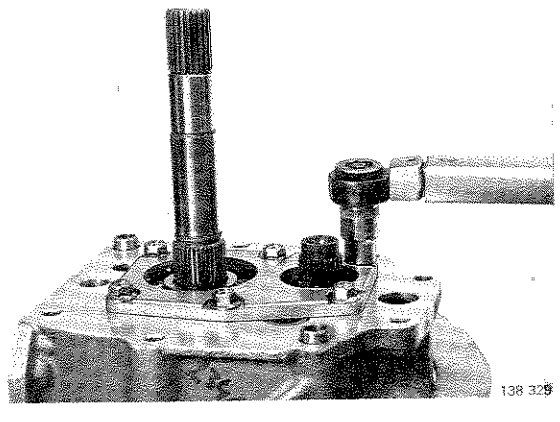


138 288

Select shim thickness **0,75 mm** (0.030 in)

Following shim thickness are available:

P/N	mm	in
3292838-4	0.25	0.010
948008-4	0.60	0.024
948009-6	0.75	0.030
948010-4	0.90	0.036
948011-2	1.00	0.040



138 329

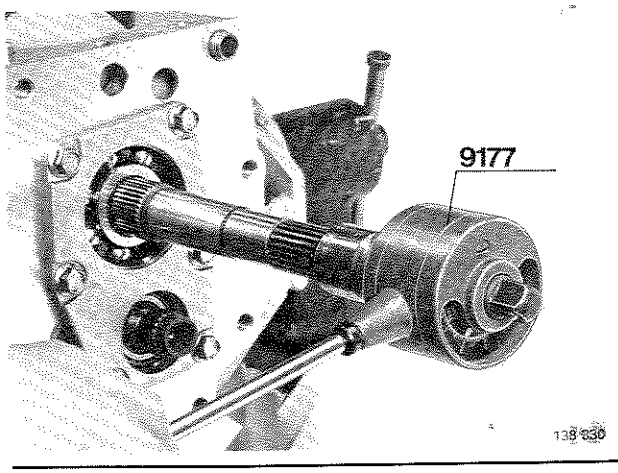
D31

Install bearing holder

Torque to 15–25 Nm (11–20 ft lb)

Note: Do not interchange short bolts with long cover bolts

Tap bearing holder to seat bearing races.



138 830

Transmissions with damper:

D32

Check torque for output shaft

Use torque gauge **9177** and hold 1st gear wheel by hand.

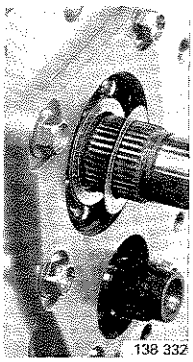
Correct torque: **0.8–2.5 Nm** (7–22 in lb)

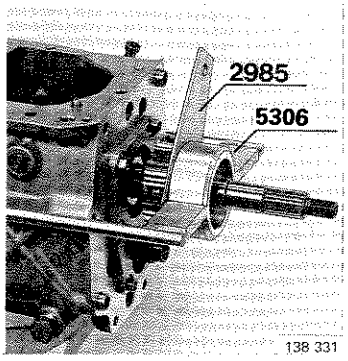
M 47 II: Proceed to operation D 37.

Operations D33 to D36 only refer to M 47.

Installing 5th gear synchronizer hub Calculating shim thickness

Adjust bearing position to obtain a clearance of max 0.20 mm (0.008 in) to lock ring.


138 332



138 331

D33

Install original shim, as applicable

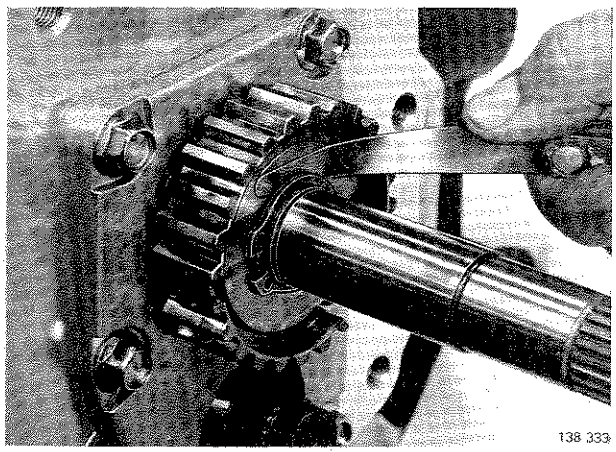
D35

Install lock ring

D36

Measure clearance between lock ring and hub

If clearance exceeds **0,20 mm, (0.008 in),** remove hub and install shim.


138 333

Example:

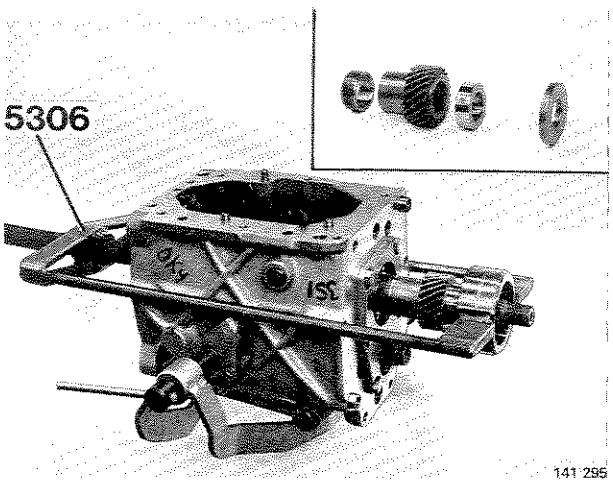
Distance hub to lock ring : 0.25 mm (0.010 in)

Select shim thickness 0.15 mm (0.006 in)

Following shims are available:

P/N	mm	in
34615-5	0.10	0.004
120116-9	0.15	0.006
34614-8	0.35	0.014
947120-2	0.50	0.020

Proceed to operation D38.



141 295

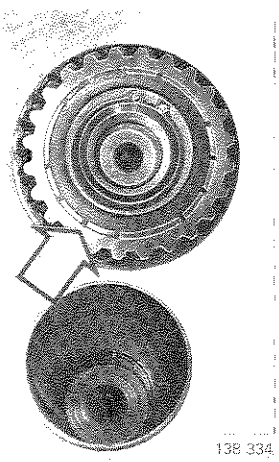
Operation D37 only applies to M 47 II.

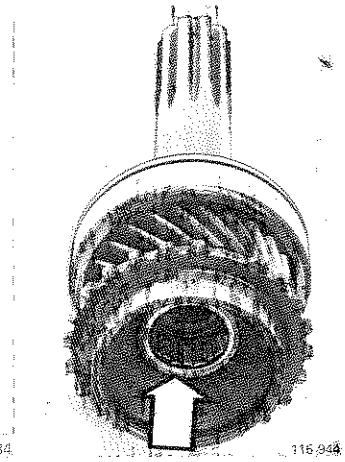
Installing 5th gear wheel

D37

Press on spacer washer, 5th gear wheel and bearing race

Use press tool **5306** with thrust washer as support.





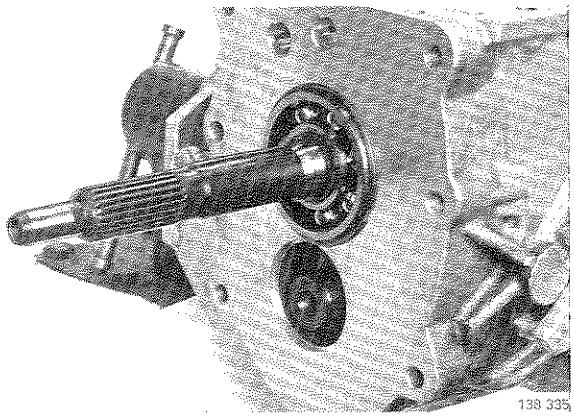
Installing input shaft

D38

Position 4th gear synchronizer ring in synchronizer hub

D39

Grease and install roller bearing in input shaft

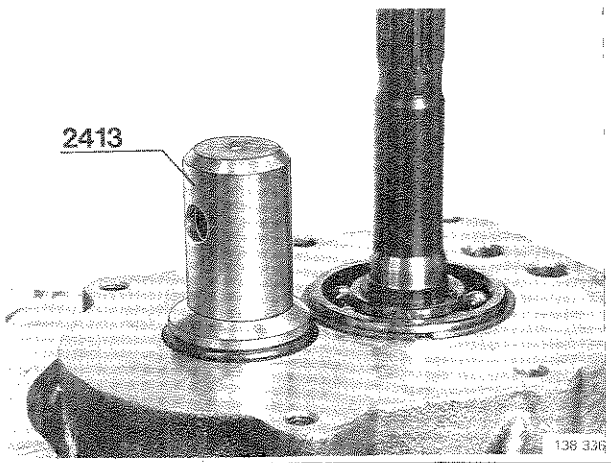


D40

Install input shaft, lift countershaft

Tap bearing with a plastic mallet if it is difficult to move it.

Lift intermediate shaft before positioning input shaft.



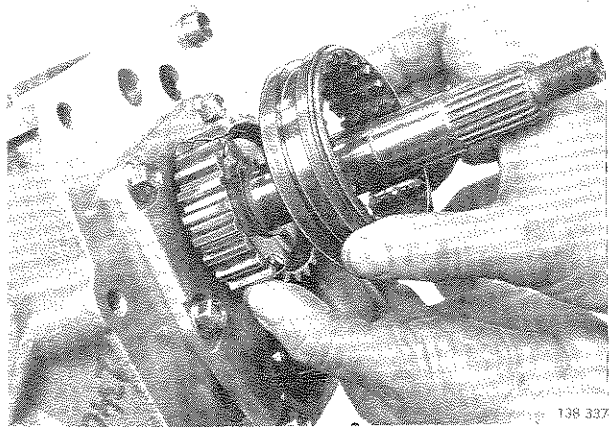
D41

Install front countershaft bearing

Use drift **2413.**

M 47 II; Proceed to operation D 45.

Operations D42 to D44 only refer to M47.



Assembling 5th gear synchronizer, M 47

D42

Install 3 sliding keys

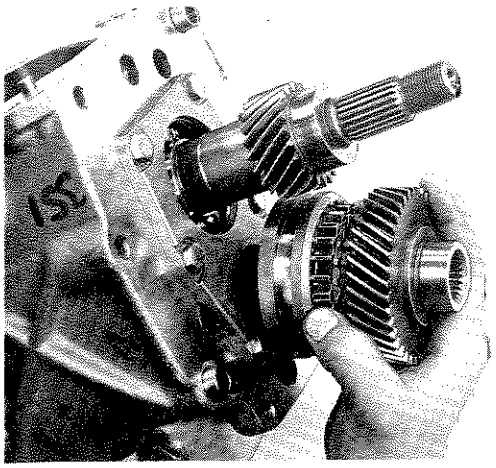
D43

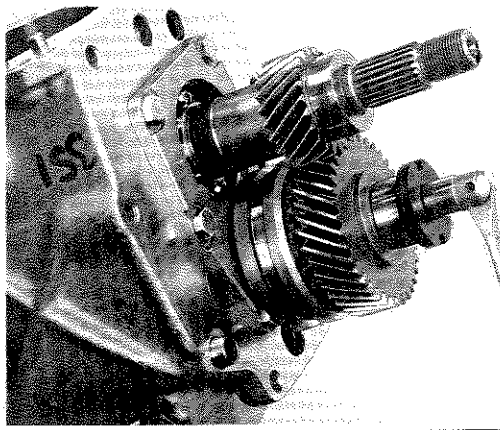
Position sleeve so that bevelled teeth align with sliding keys

D44

Install spring

Proceed to operation D47.





Operations D 45 to D 46 only refer to M 47 II

Installing 5th gear and synchronizer, M 47 II

D45

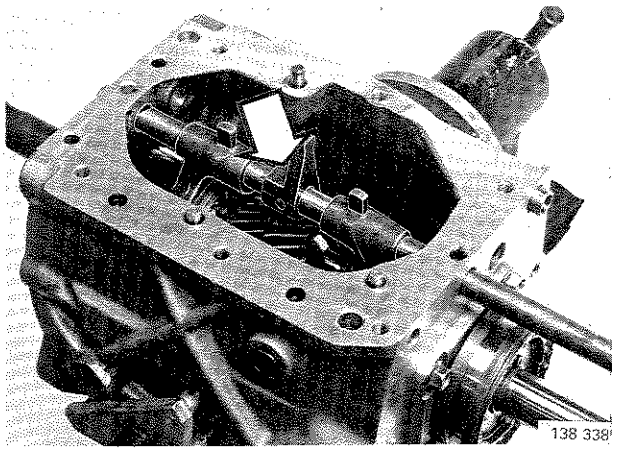
Install 5th gear synchronizer and gear wheel on countershaft

First pull out operating sleeve so that half of hub becomes visible. Then install synchronizer and gear wheel on countershaft.

D46

Press on synchronizer and gear wheel

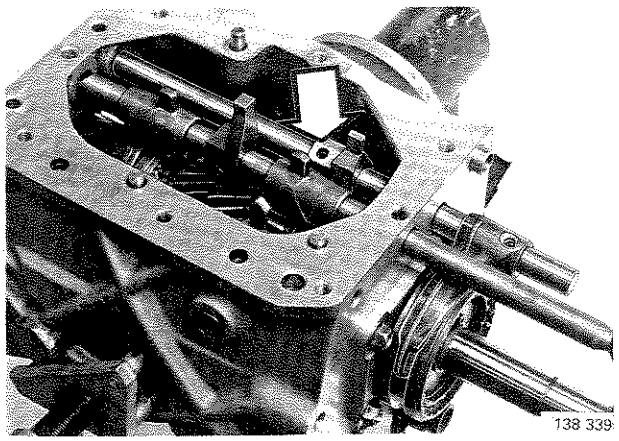
Install bolt and washer. Tighten until bolt bottoms.



D47

Install 1st–2nd and 3rd–4th gear selector fork, gear selector and selector shaft

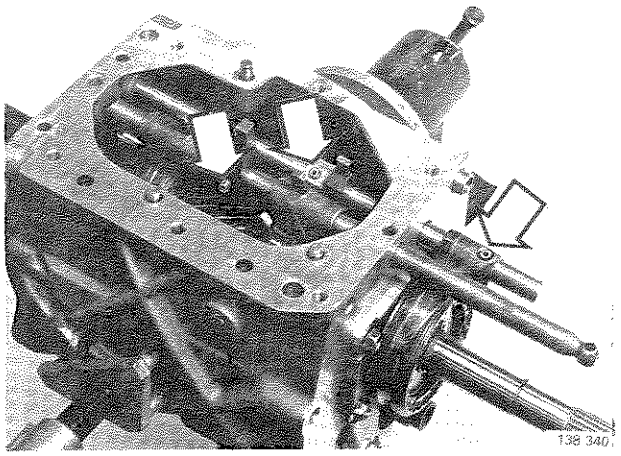
Make sure sliding lugs are positioned correctly. Gear selector lug should face forwards.



D48

Install 5th gear shift fork, gear selector and selector shaft

Gear selector lug should face forwards.



D49

Install locking pins (3 ×)

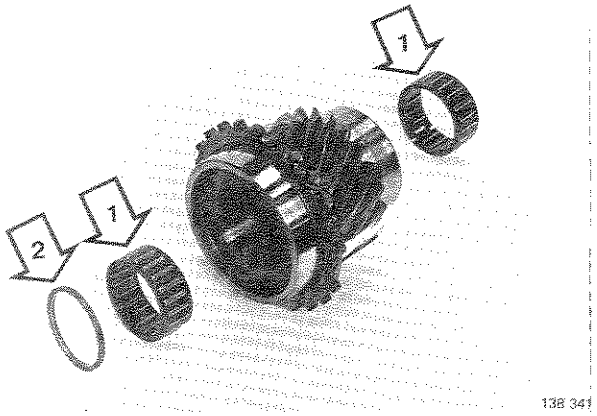
Grooves in selector shaft should face UP.

Pin in 5th gear shift fork should be flush with surface. Support 5th gear selector shaft when tapping pins into position.

M 47 II: Proceed to operation D 53.

Operations D 50 to D 52 only refer to M 47.

Installing 5th gear wheel, M 47

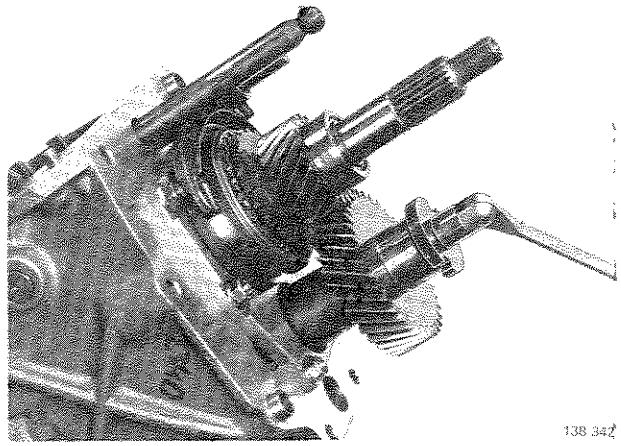


D50

Grease and install two needle bearings (1) and spacer (2) in 5th gear wheel

D51

Install synchronizer ring on synchronizer hub



D52

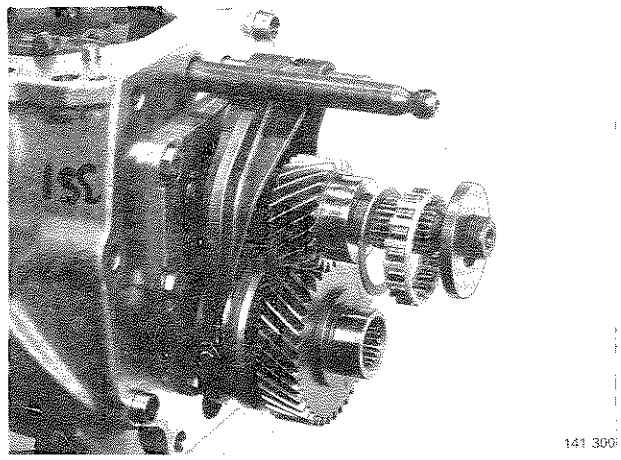
Install both gear wheels

Install bolt and washer on countershaft.

Pull bolt to press on large gear wheel.

Make sure large gear wheel is correctly positioned.

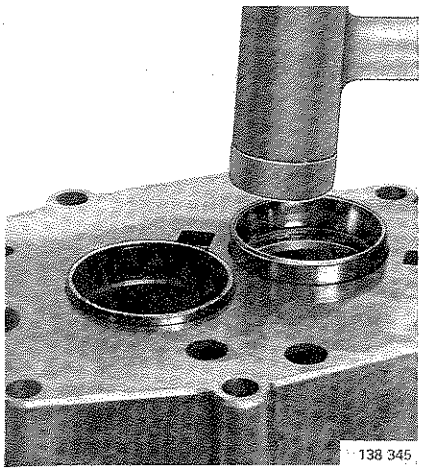
Remove bolt and washer.

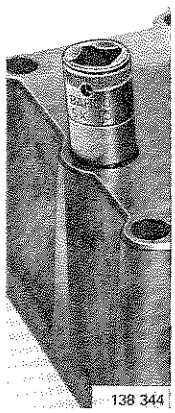


D53

Install washer, roller bearing and thrust washer

Enclosed side of bearing should face rearwards.

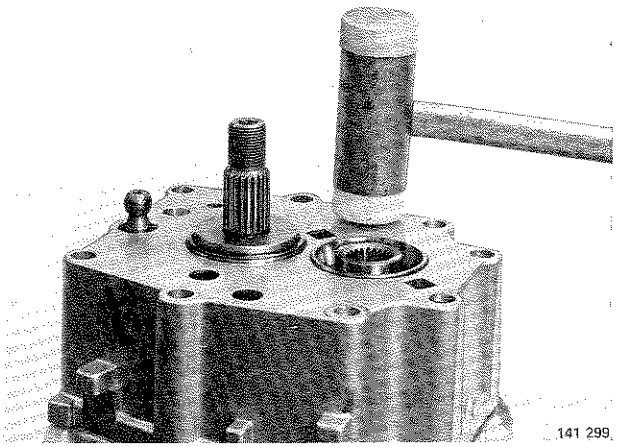

138 345


138 344

D54

Install bearing races and selector shaft seal in 5th gear housing

Tap bearing races into position with a plastic mallet. Use a socket to install selector shaft seal.


141 299

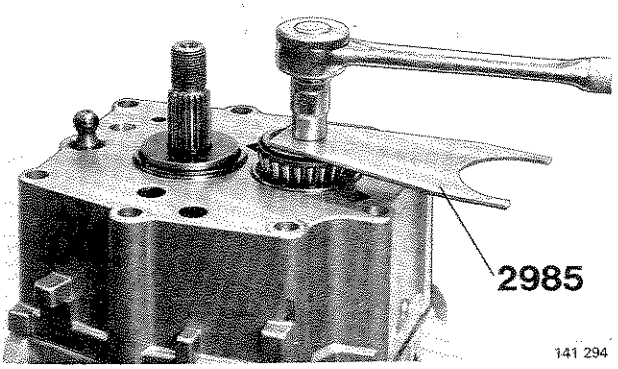
D55

Grease contact face, position gasket and install 5th gear housing

Carefully tap 5th gear housing into position.

Determining countershaft shim thickness

Countershaft should have an end float of 0.01–0.10 mm (0.0004–0.0040 in). If countershaft, any of its bearings, or the rear case/intermediate housing have been replaced the shim thickness must be determined.



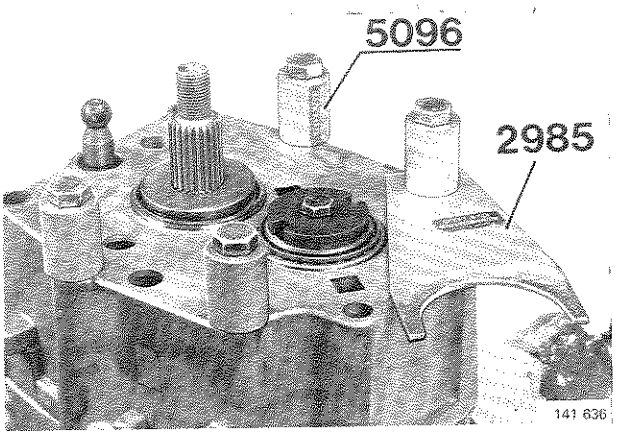
141 294

D56

Install rear countershaft bearing M 47 II:

Place support 2985 under nut when pressing bearing into position. Then install correct washer with old shim pack and tighten bearing to bottom.

Note: Make sure washer teeth align with gear teeth.



D57

Attach 5th gear housing

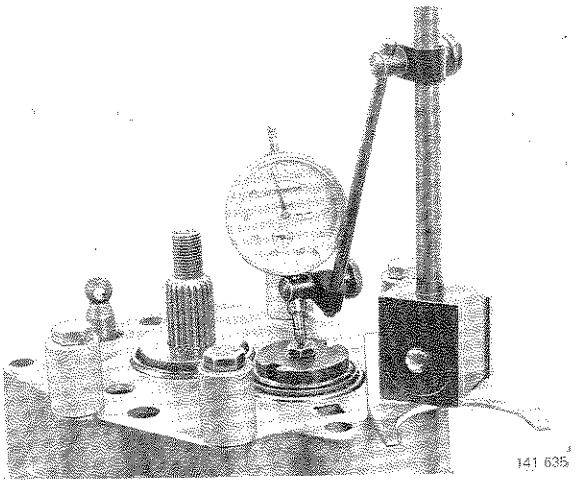
Use shift bracket bolts and 4 × **5096** (B28-tools) as spacers.

D58

Install support 2985 on one of the bolts

Torque bolts to 35–50 Nm (26–37 ft lb).

Position dial indicator



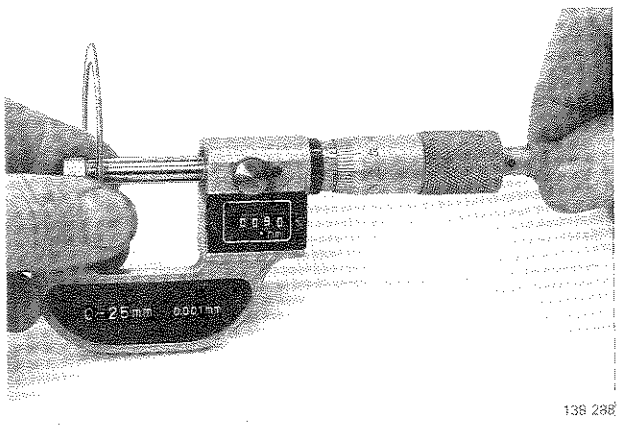
D59

Push up and turn shaft to set front bearing. Calibrate dial indicator zero

D60

Lower and turn shaft to set rear bearing. Read dial indicator

Note reading.
(If no play exists, select thinner shim.)



D61

Calculate thickness of countershaft shim

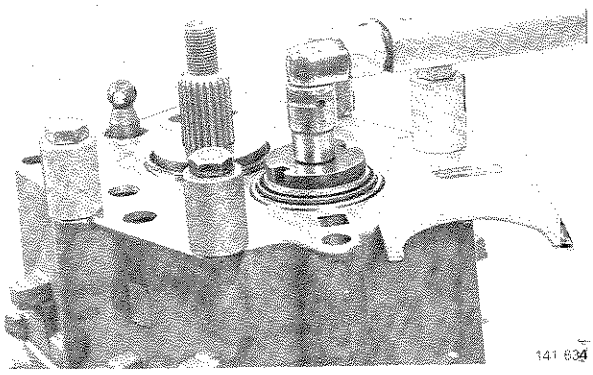
Permitted end float: **0.01–0.10 mm. (0.004–0.0040 in).**

Example:	mm	in
Measured clearance	0.25	0.0098
Existing shim pack	+0.55	+0.0220
Total clearance	= 0.80	= 0.0318
Deduct end float	−0.01	−0.0004
	to 0.10	to 0.0040
Shim thickness	= 0.70	=0.0278
	to 0.79	to 0.0314

Select shim thickness 0.75 mm (0.030 in).

Following shim thicknesses are available

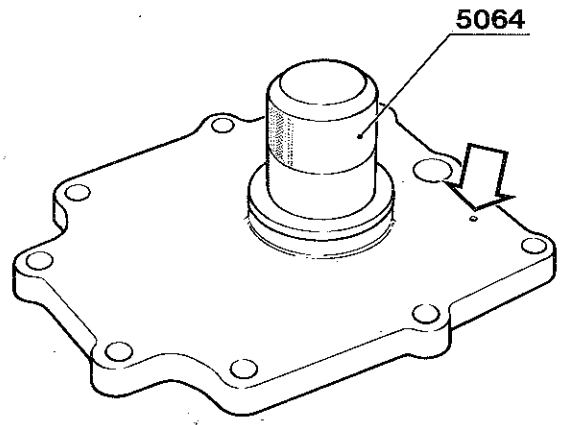
P/N	**mm**	in
3294334-2	0.10	0.004
3294335-9	0.15	0.006
3294336-7	0.25	0.010
3204069-3	0.55	0.022
3204070-1	0.75	0.030



D62

Install new shim pack, washer and a new self-locking bolt, or use thread locking compound 1161053-2

Engage two gears to lock transmission. Torque to: 35–45 Nm (25–32 ft lb).



Installing rear end cover

D63

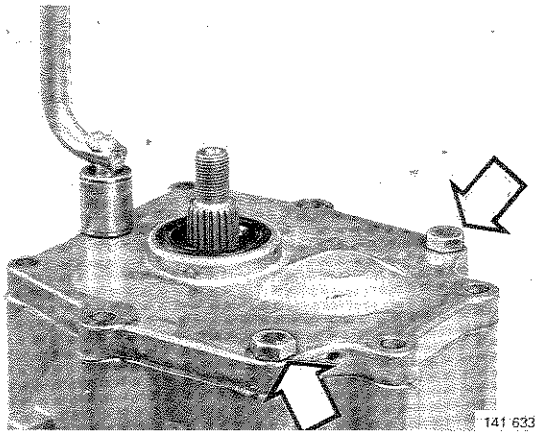
Make sure vent hole is not blocked

D64

Install seal in rear end cover

Grease and install output shaft seal. Use drift **5064**.

Seal should be positioned **2,5 mm** (0.1 in) inside flange.



D65

Grease housing face and position gasket

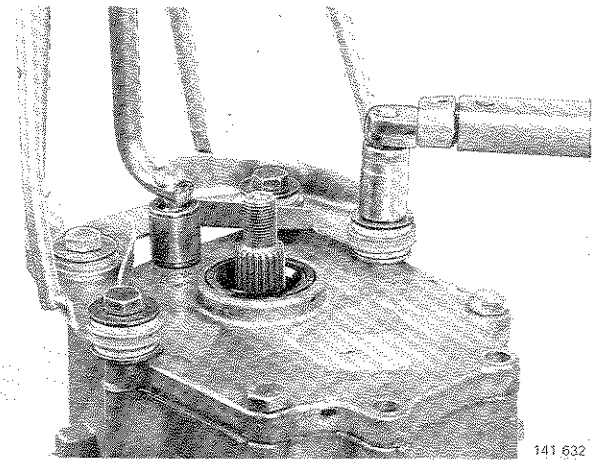
D66

Use two bolts to attach rear end cover

D67

Attach gear selector rod

Grease and install rubber ring in joint. Use sleeve to lock pins.

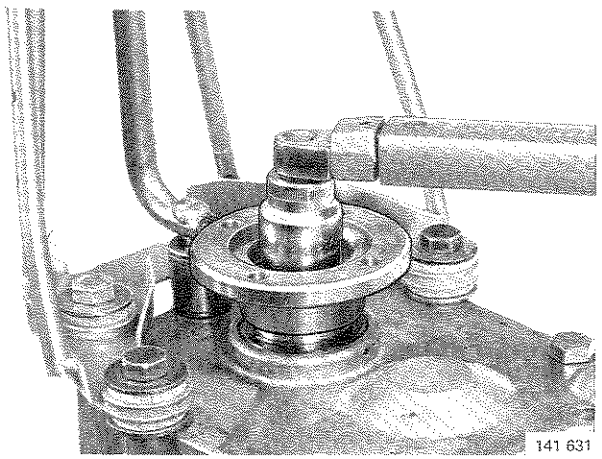


D68

Install selector bracket

Note: Bolt – washer – spacer tube – washer.

Torque bolts to 35–50 Nm (25–35 ft lb).



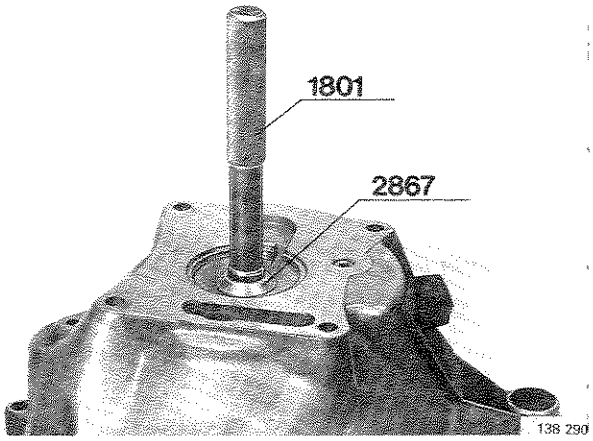
D69

Install drive flange

Torque nut to:

Bolt M16 ..... **70–90 Nm** (50–60 ft lb)
Bolt M20 ..... **90–110 Nm** (65–80 ft lb)

Engage two gears to lock transmission.



D70

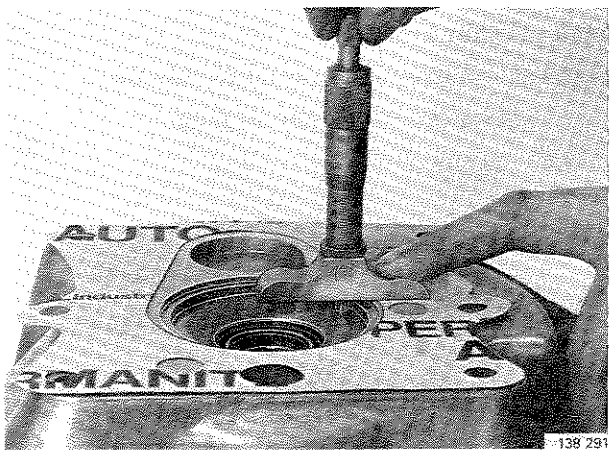
Grease and install seal in bell housing

Make sure pipe is at bottom.

Use drift **2867** and standard handle **1801.**

Determining input shaft shim thickness

Permitted end float: **0.01—0.20 mm.** (0.0004—0.0080 in). If input shaft, bearing on input shaft, or clutch housing has been replaced, shim thickness must be determined.



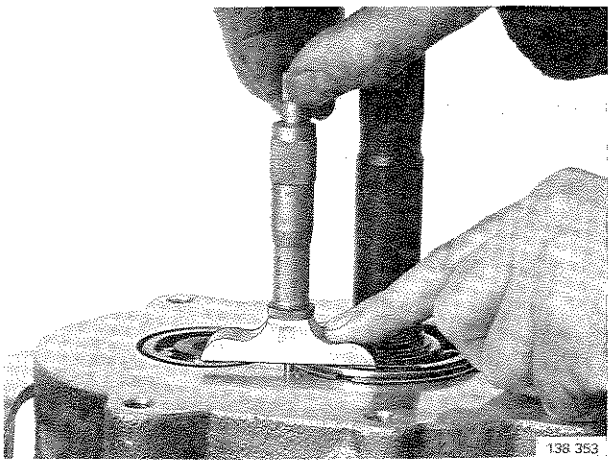
D71

Position gasket on clutch housing

D72

Measure distance between gasket top and bearing seat bottom

Note distance



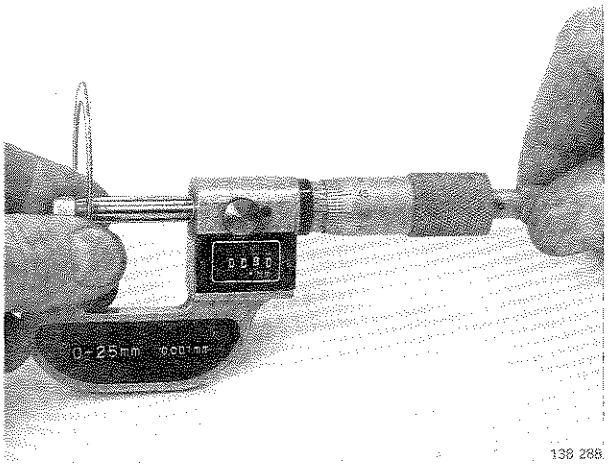
D73

Make sure bearing spacer washer abuts housing

D74

Measure distance between upper face of input shaft bearing and front face of transmission housing

Use depth micrometer and note reading.



138 288

D75

Calculate input shaft shim thickness

Permitted end float: **0.01–0.20 mm.** (0.0004–0.0080 in).

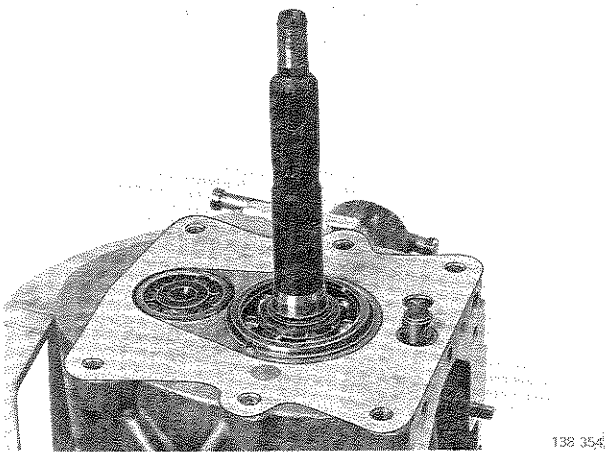
Example:

Distance:	mm	in
– gasket face to bearing seat	5.80	0.2283
– bearing to housing	–4.85	–0.1909
	=0.95	=0.0374
Deduct end float	–0.01	–0.0004
	to 0.20	to 0.0080
Calculated shim thickness	=0.75	=0.0294
	to 0.94	to 0.0370

Select shim thickness **0.90 mm.** (0.036 in).

Following shim thicknesses are available:

P/N	**mm**	**in**
3292838-4	0.25	0.010
948008-8	0.60	0.024
948009-6	0.75	0.030
948010-4	0.90	0.036
948011-2	1.00	0.040


138 354

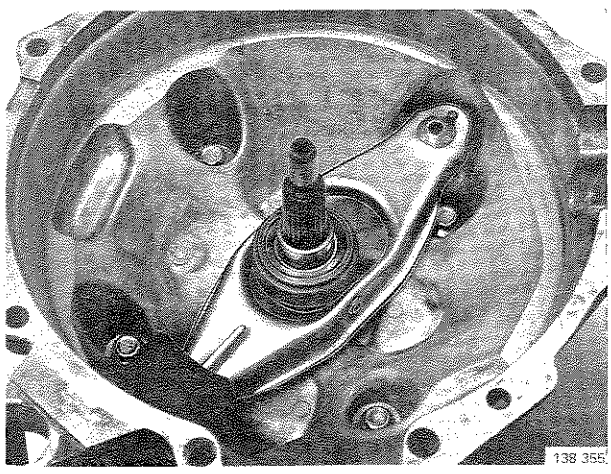
D76

Grease transmission gasket face and position gasket

D77

Position shim in clutch housing

Apply grease to hold shim in position.


138 355

D78

Install bell housing

Torque to **35–50 Nm** (25–35 ft lb).

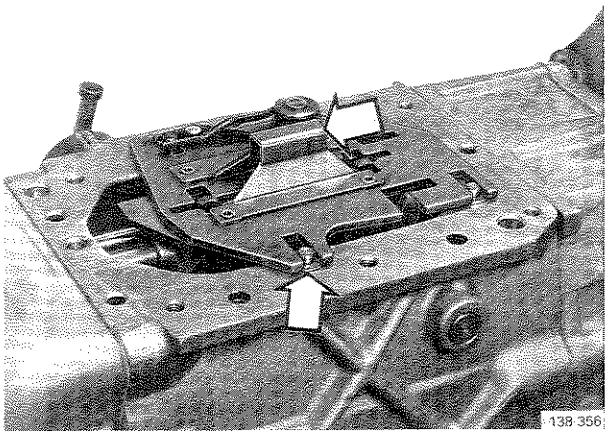
D79

Install clutch release fork, washer and release bearing

First apply grease to bearing sliding surface and ball joint.

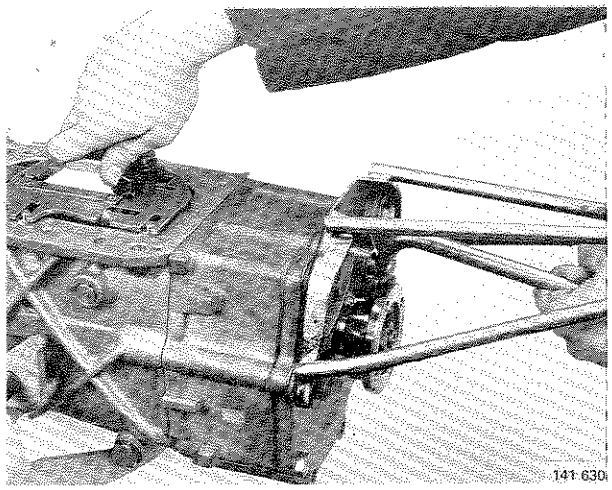
Sparingly apply grease to splines.

Do not forget to place washer beneath ball



D80

Install sliding washers and selector plate



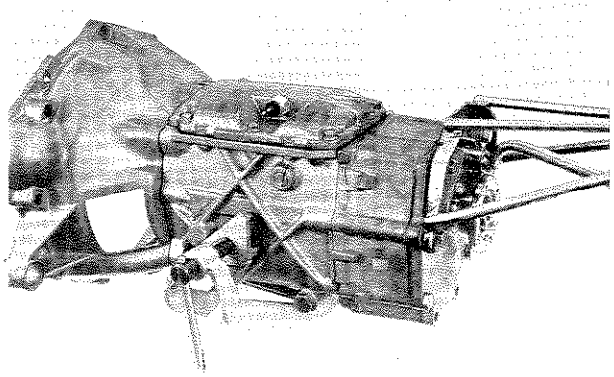
D81

Check function

Move selector plate by hand to check that all gears can be engaged and disengaged.

D82

Install interlock ball and spring



D83

Grease housing face and position gasket

D84

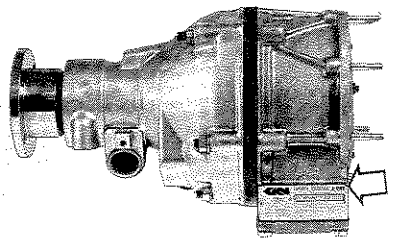
Install transmission cover

Torque bolts to 15–25 Nm (11–20 ft lb).

E. Disassembling Type J and Type P, overdrives

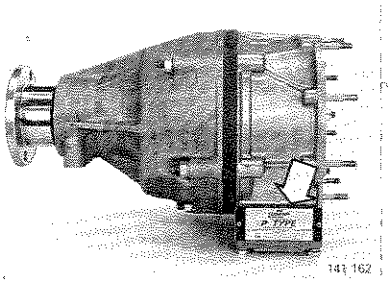
Special tools: 2836, 5069, 5103, 5149, 5172, 5183, 5210, 5303, 5304, 5973,

Type J

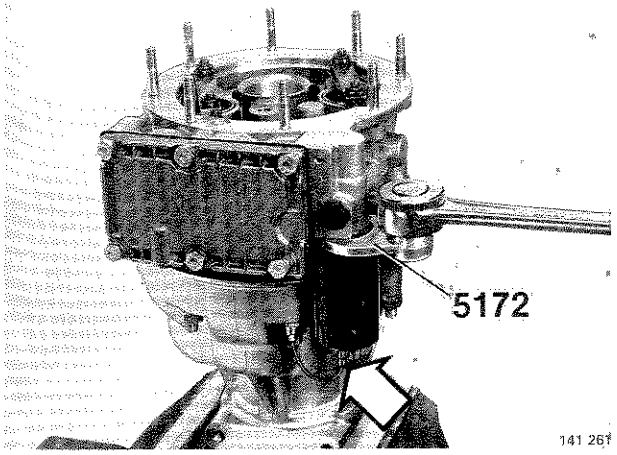


141 607

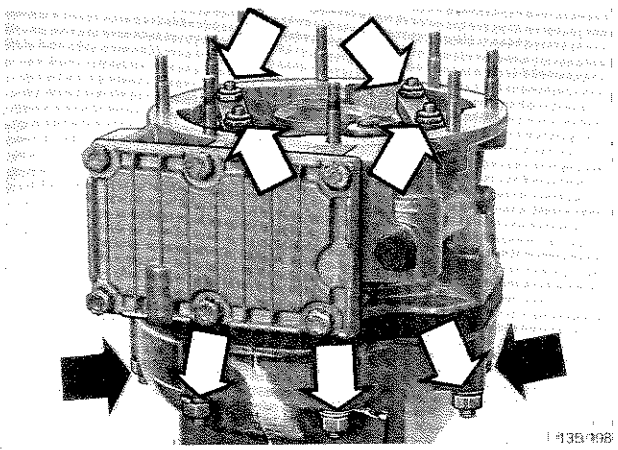
Type P



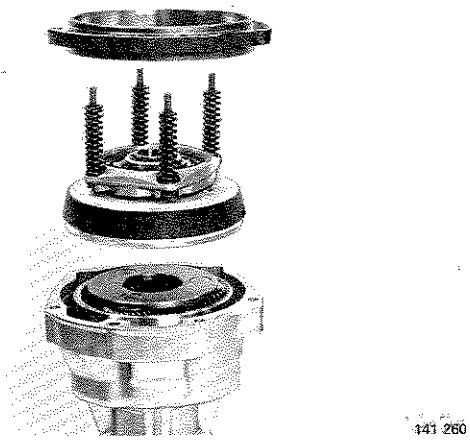
141 162



141 261



135 168



141 260

Disassembling

E1

Clamp overdrive rear end in a vice protected by soft jaws

E2

Remove solenoid valve

Use crow-foot wrench **5172**. Disconnect ground wire.

E3

Remove:

- bridges.
- front and rear housing nuts

Note: Last two nuts removed should be opposite each other. Loosen the nuts stepwise.

E4

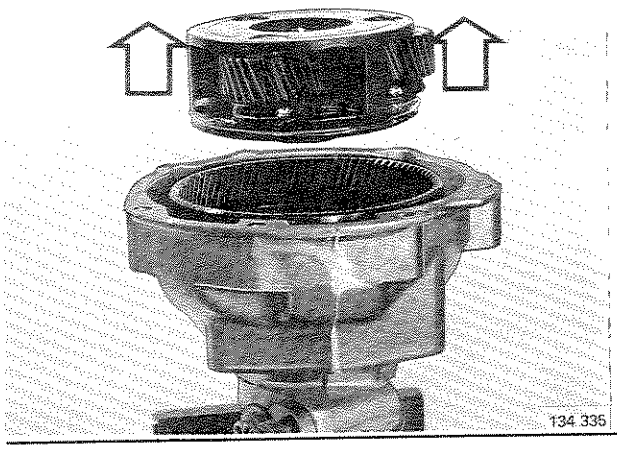
Remove front housing assembly

E5

Remove:

- brake drum
- springs. Lift out clutch, thrust bearing and sun gear assembly.

Type P: Proceed to operation E7.



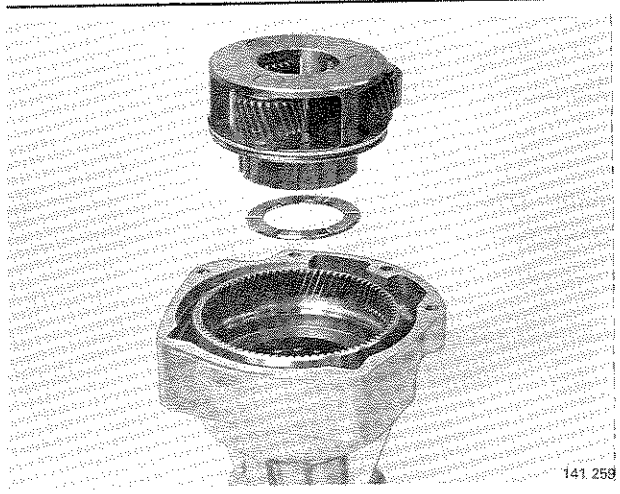
Operation E6 only applies to Type J. Overdrive.

E6

Remove planetary gear assembly

Replace planetary gear assembly if gears or carrier are damaged.

Proceed to operation E9.

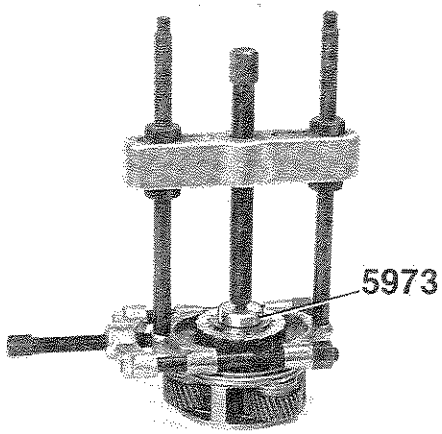


Operations E7 to E8 only refer to Type P Overdrive.

E7

Remove:

- planetary gear carrier
- thrust washer



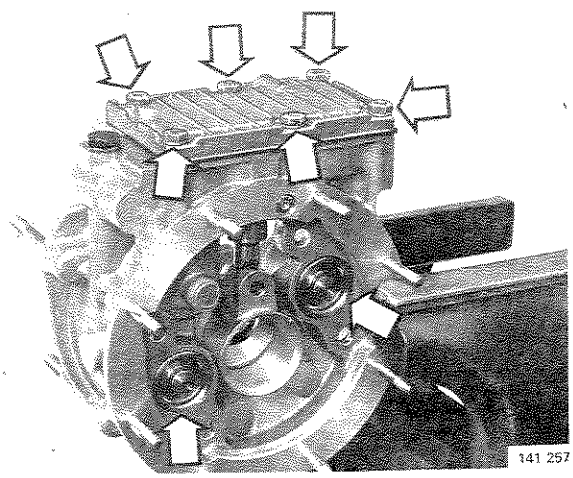
If one-way clutch or planetary gear carrier is to be replaced:

E8

Pull off one-way clutch from planetary gear carrier

Use universal type puller.
Place washer **5973** under puller spindle.

Replace planetary gear assembly if damaged



Disassembling front housing

E9

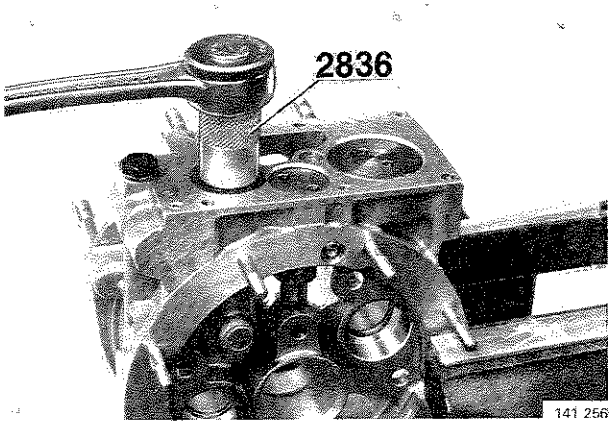
Clamp overdrive front part in a vice protected by soft jaws

E10

Remove:

- oil pan and strainer
- pistons. Use pliers.

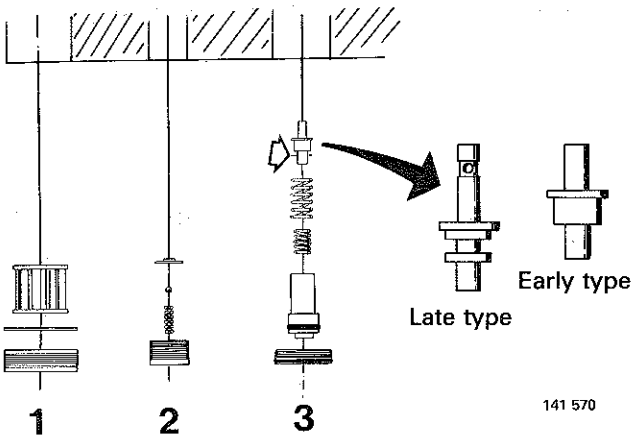
E11



Remove oil filter plugs, check valve and relief valve

Use plug wrench **2836**. Tap plugs with a plastic mallet to facilitate removal.

E12

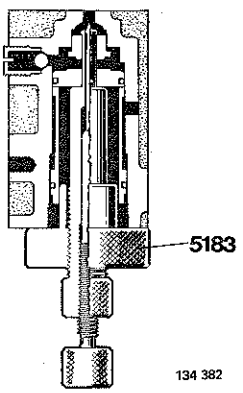


Remove:

1. Oil filter
2. Check valve and spring, ball and seat
3. Relief valve assembly. (If replacing, always use new type relief valve).

Examine relief valve piston. If scored, it will damage O-ring. Replace relief valve assembly.

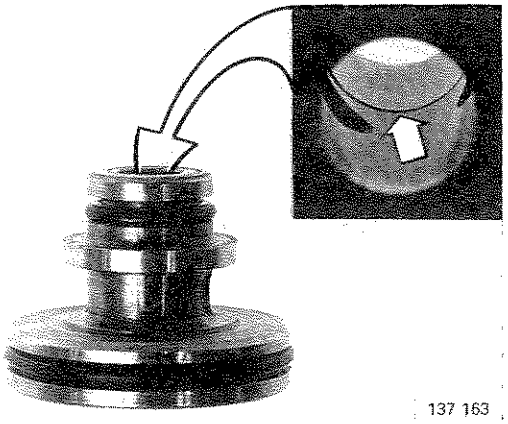
E13



Withdraw cylinder and relief valve seat

Use extractor **5183**.

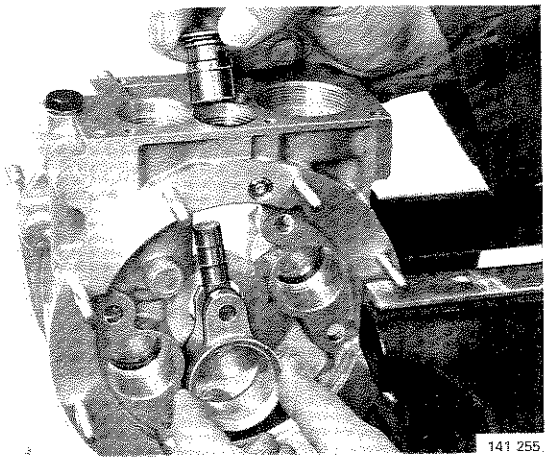
E14



Examine relief valve

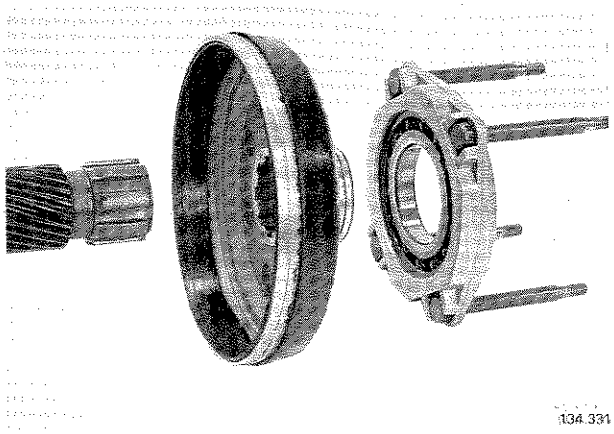
If engagement valve is slow or if overdrive slips on engagement, it is particularly important to check following.

Check valve seat. If there are signs of wear, replace relief valve assembly.



E15

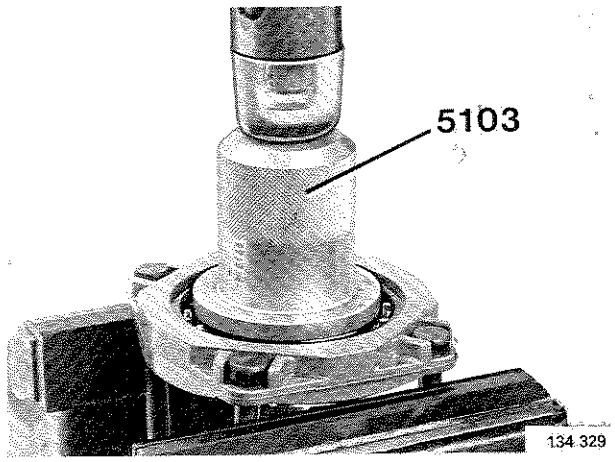
Remove cylinder and pump piston



Disassembling clutch assembly

E16

Remove lock ring. Pull out sun gear and clutch disc from bearing carrier

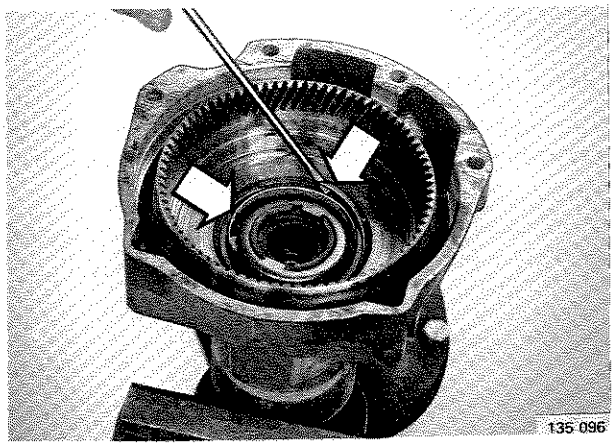


E17

Remove lock ring. Tap out bearing from carrier.

Use drift **5103.**

Type P: Proceed to operation E22.



Operations E18 to E21 only refer to Type J.

Disassembling rear housing. Type J Overdrives

E18

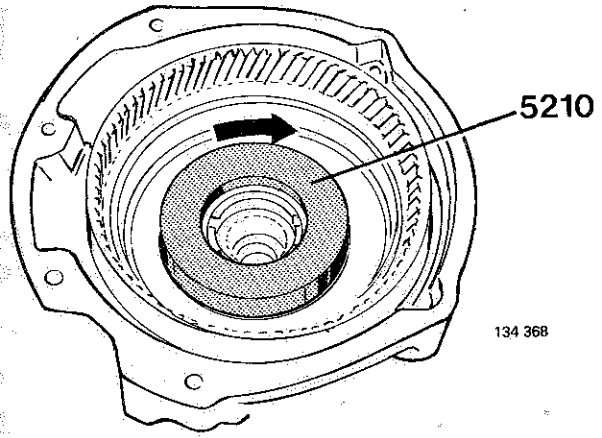
Clamp overdrive rear housing in a vice protected by soft jaws

E19

Remove lock ring and one-way clutch oil slinger

Note: Turn one-way clutch in locking direction and make sure that outer ring does not slip on input shaft.

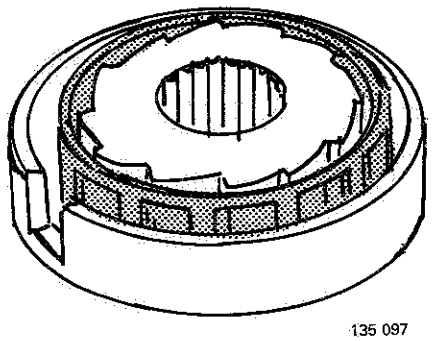
E20



Remove one-way clutch

Use ring **5210.** Turn ring clockwise

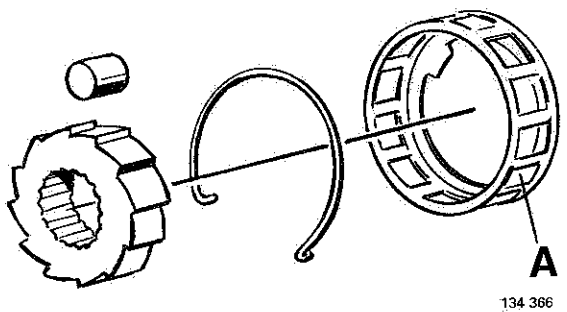
E21



Examine roller cage

Invert ring with one-way clutch in it. Check to see if roller cage is oval. If so, replace with new type, Volvo P/N 1 209 726-7.

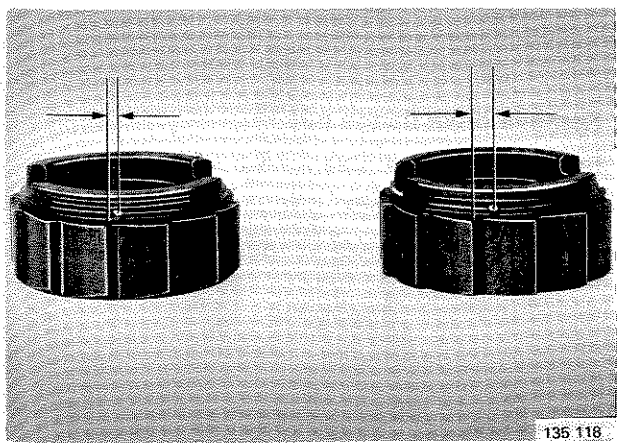
E22



Disassemble one way clutch

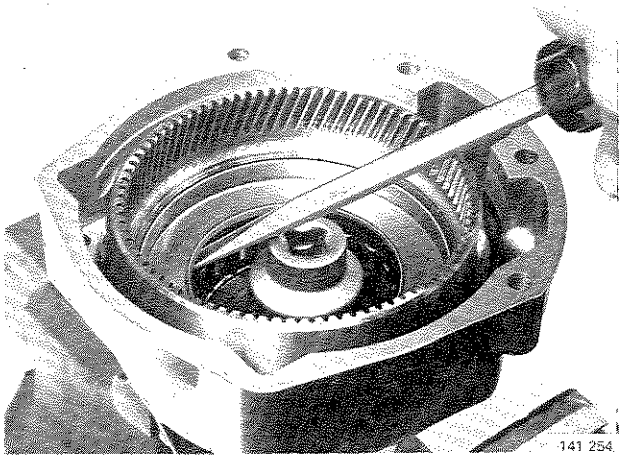
Note Illustrations show an early version of one-way clutch.

Replace any damaged parts.



If early type one-way clutch is fitted, replace it with new type: Volvo P/N 1 209 484-3. (Location of lock spring hole is new.) See illustration.

Proceed to operation E26



141 254

Operations E 22 to E 25 only refer to Type P.

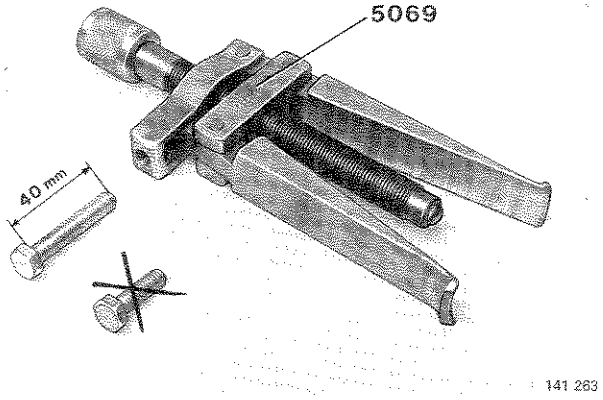
Disassembling rear housing, Type P, Overdrive

Clamp overdrive rear housing in a vice protected by soft jaws

E23

Pry up oil slinger in two places to install puller 5069.

Place a socket on hub. Use a screwdriver to pry up oil slinger.

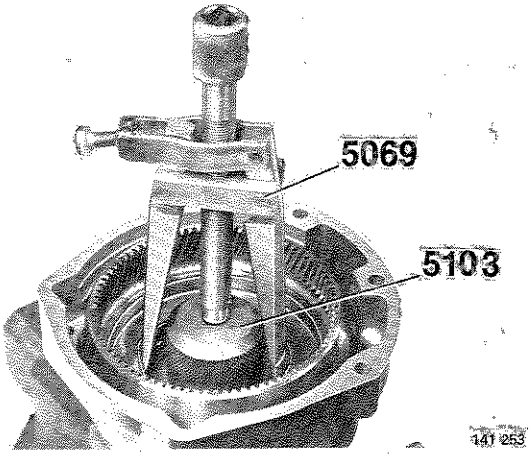


141 263

E24

Modification to tool 5069

Replace center bolt with a 40 mm long bolt, threaded along entire length. P/N 998 9709.

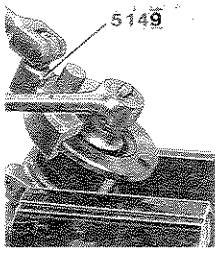


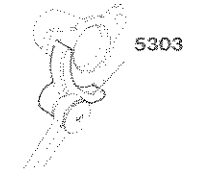
141 253

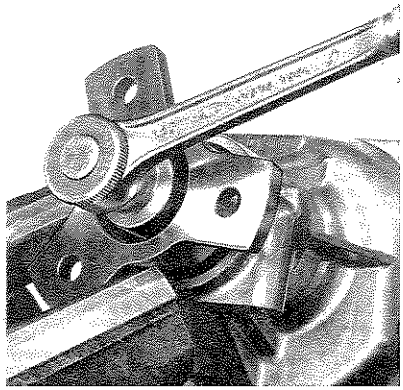
E25

Place drift 5103 (group 21 tool) in bottom of housing. Use puller 5069 to draw out oil slinger.

Remove roller cage.







E26

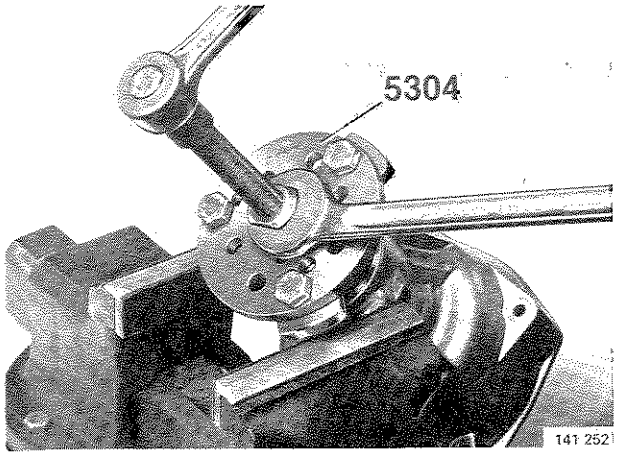
Remove drive flange nut

Round drive flange: Use wrench 5149 to hold.

Three-arm drive flange: Clamp drive flange in a vice.

Note: Use wrench 5303 when removing drive flange from vehicle.

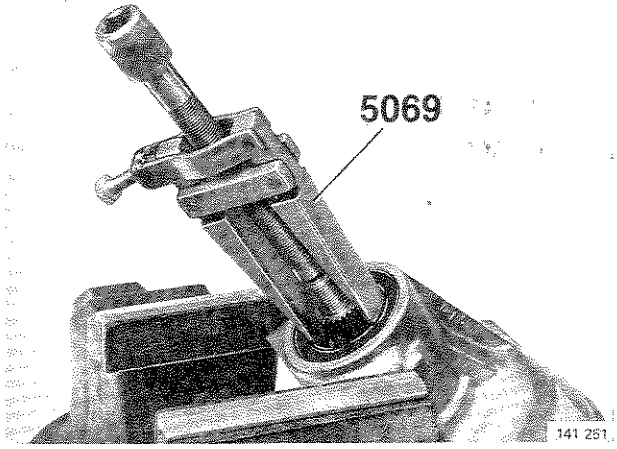
E27



Withdraw drive flange

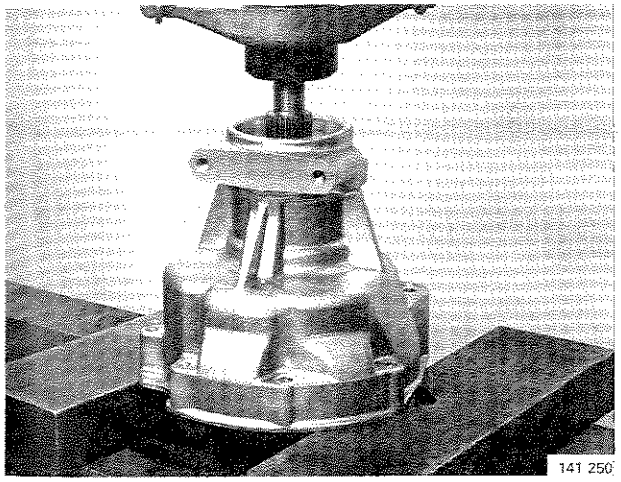
Use puller **5304** if required.

E28



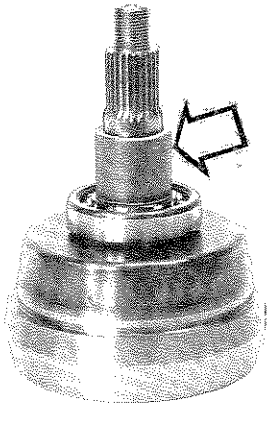
Remove oil seal with puller 5069.

E29



Press out output shaft

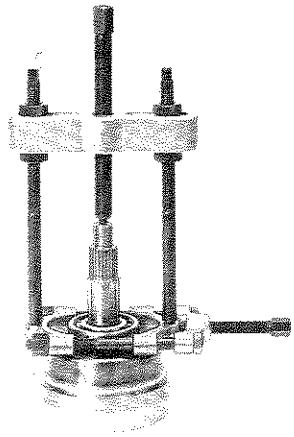
E30



Remove spacer sleeve

(On Type J: speedometer drive gear.)

E31



141 248

Withdraw output shaft bearing

E32

141 247

Tap out bearing from rear housing

(Only if bearing is to be replaced.) Use brass drift.

F. Examining overdrive

Cleaning and checking

Check:

- that control orifice drilling between relief valve and solenoid is free from dirt. If it is not possible to blow-clean, use a pointed matchstick. Do not attempt to clean the orifice with wire or its calibration may be impaired.
- that groove in front of ring gear in output shaft is thoroughly clean. (Dirt collects here as a result of centrifugal force.) Clean all parts and check carefully for signs of wear, cracks or other damage. Check following carefully:
- that filter is undamaged
- operating pistons for scores or wear
- valves for wear
- all gear wheels and bearings for cracks and wear.

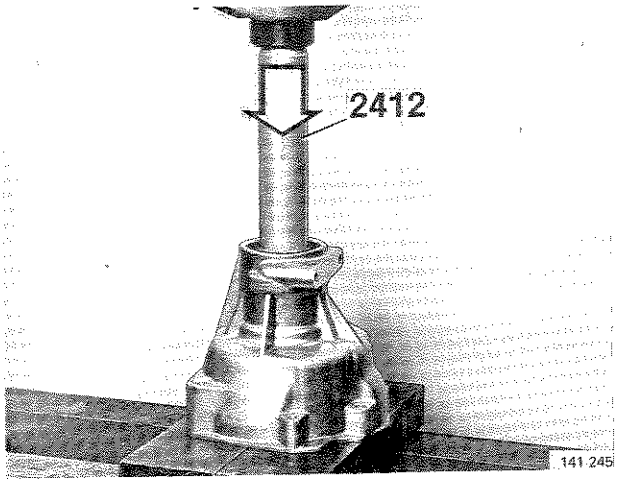
Check:

- that clutch return spring is 55.5±1.5 mm (2·1852 0.060 in) long
- that springs are not misshaped or cracked
- brake ring for cracks, scores, wear etc.
- cone clutch for signs of burning or wear
- solenoid by means of a 12 volt battery and an Ammeter. Power consumption = 1.5—2.0A. Check movement of solenoid plunger.

G. Assembling Type J and Type P overdrives

Special tools: 1845, 2412, 2806, 2834, 2835, 2836, 5149, 5172, 5210, 5308

Use new gaskets, O-rings and seals when assembling overdrive. Observe utmost cleanliness since the hydraulic system is very sensitive to dirt.

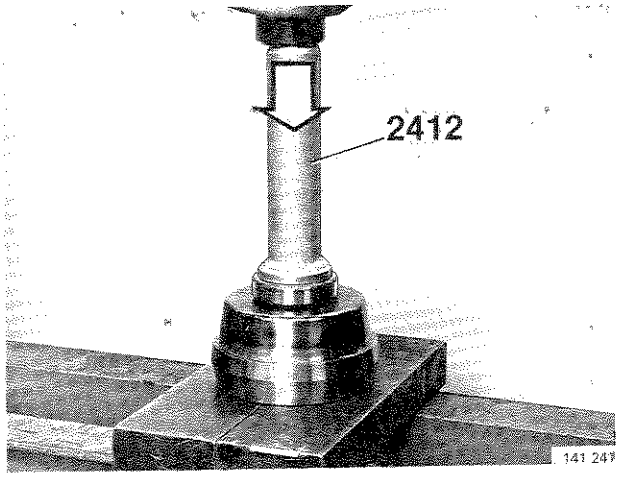


Assembling rear housing

G1

Press bearing in rear housing

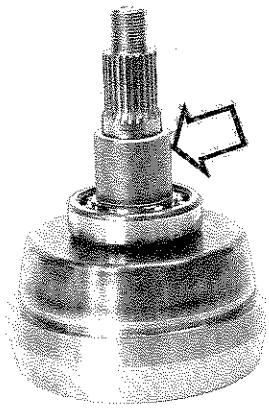
Use drift **2412.**



G2

Press on bearing on output shaft

Use drift **2412.**

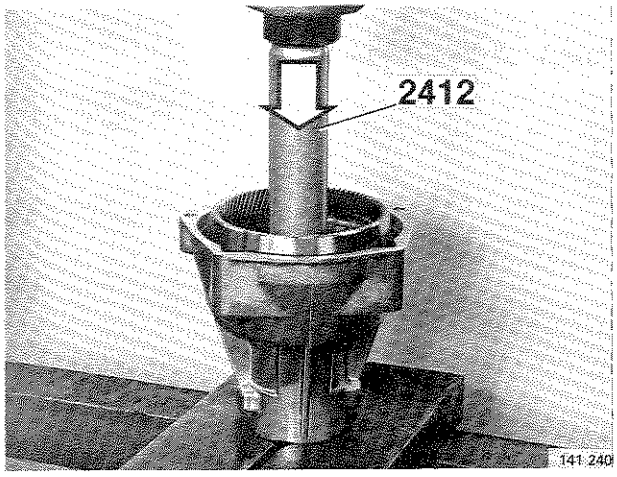


G3

Install spacer sleeve on output shaft

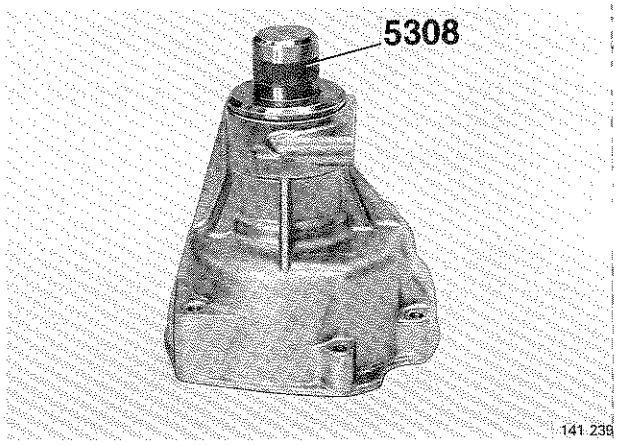
(On Type J: speedometer drive gear.)

G4



Press output shaft in rear housing
Use drift **2412.**

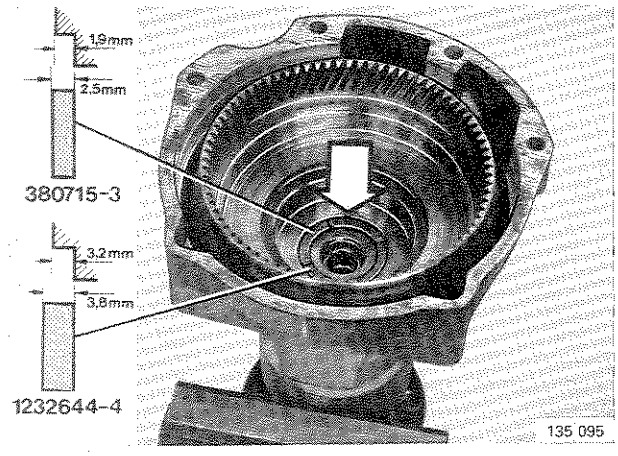
G5



Tap oil seal into rear housing

Use drift **5308.**

Type P: Proceed to operation G13.



Operations G6 to G12 only refer to Type J.

Before installing one-way clutch:

G6

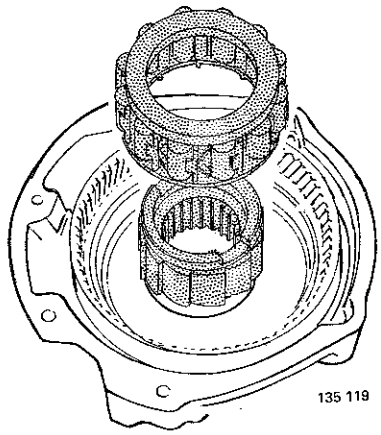
Make sure thrust washer is correctly positioned

If thrust washer is replaced, make sure that it is correctly positioned. It should be 0.6 mm (0.024 in) above edge.

G7

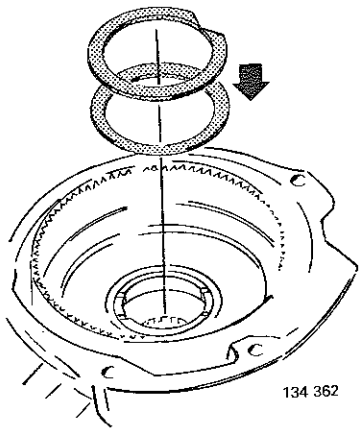
Correct thrust washers:

- Use thickness 2.5 mm (0.1 in), P/N 380 715-3, for early version of output shaft, P/N 380 679-1 and P/N 1 232 105-5.
- Use thickness 3.8 mm (0.15 in), P/N 1 232 644-4, for output shaft P/N 1 232 646-3.



G8

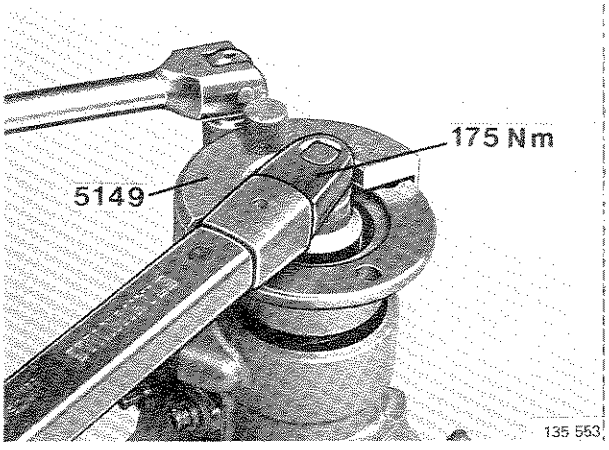
Install one-way clutch hub and roller cage with rollers



G9

Install oil slinger and lock ring

Check that one-way clutch functions correctly.



G10

Install drive flange

Apply locking fluid, P/N 1 161 075-5, to splines. Be careful not to apply to seal.

Use press tool **1845** if required.

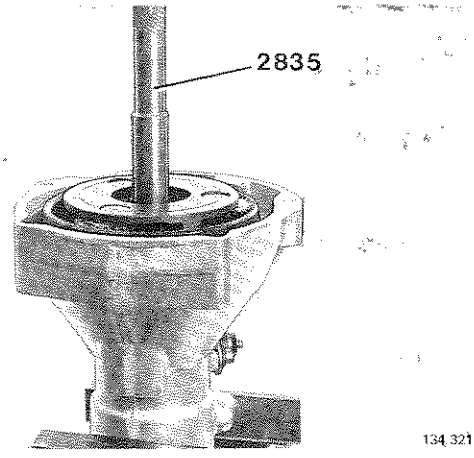
G11

Install nut

Round drive flange: use wrench **5149.**

Three-arm drive flange: clamp drive flange in a vice.

Torque to 175 Nm (130 ft lb).

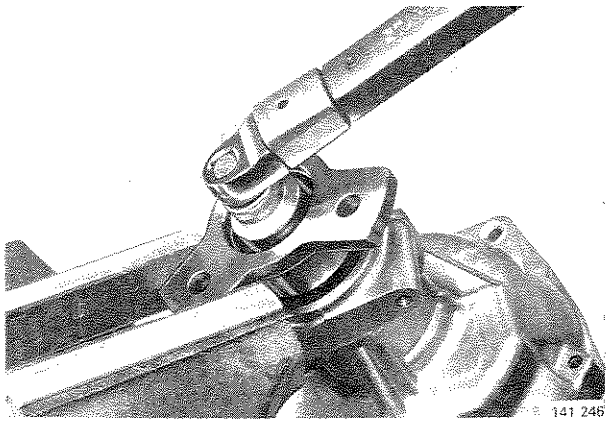


G12

Install planetary gear on output shaft

Guide splines into carrier and one-way clutch hub. Use centering drift **2835.**

Proceed to operation G 18.



Operations G13 to G17 only apply to Type P.

G13

Install drive flange

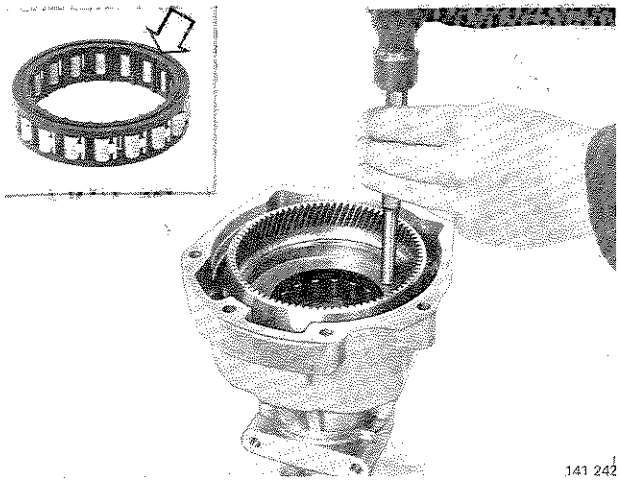
Apply locking compound, P/N 1 161 075-5, to splines. Be careful not to apply to seal. Use press tool **1845** if required.

G14

Install nut

Round drive flange: use wrench **5149.**

Three-arm drive flange: clamp drive flange in a vice. Torque to 175 Nm (130 ft lb).

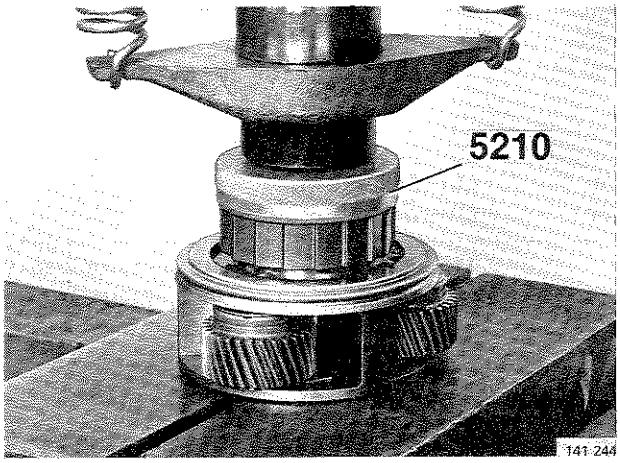

141 242

G15

Position roller cage for one-way clutch

Groove on roller cage should face UP.

Use a drift to tap in oil slinger.



141 244

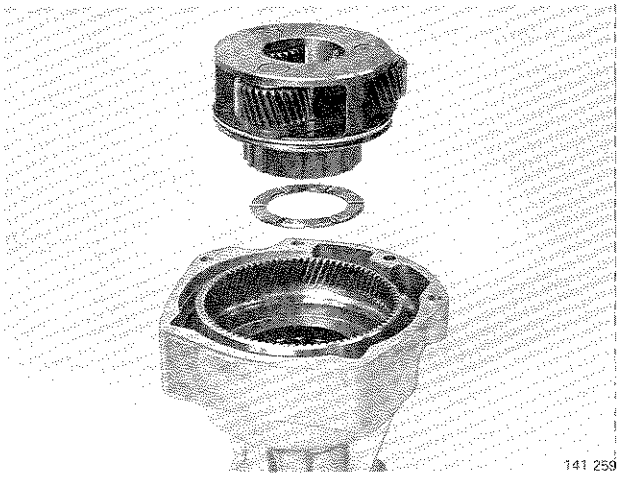
G16

Press one-way clutch hub on to planetary gear carrier

Wipe off splines.

Bevelled edge on hub should face DOWN.

Use ring **5210** when pressing.

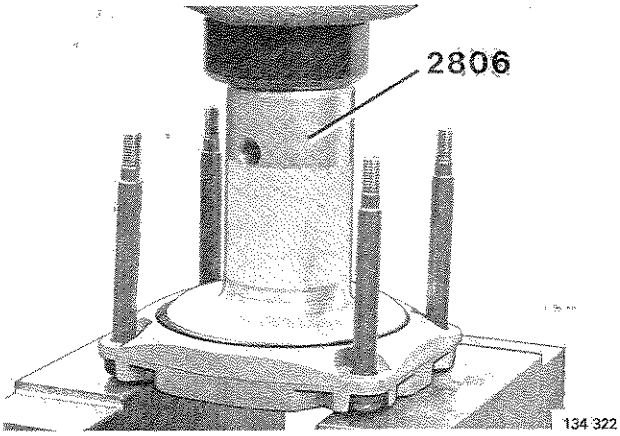

141 259

G17

Install:

- brass thrust washer
- planetary gear carrier

Installing clutch assembly



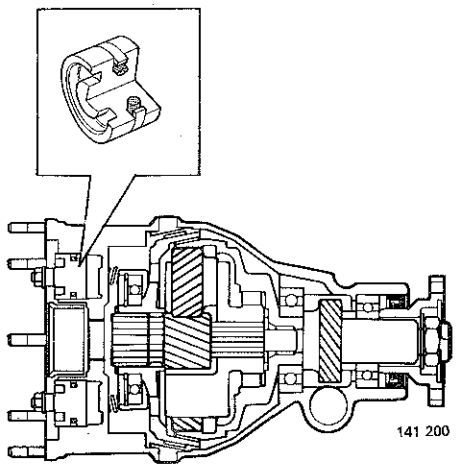
134 322

G18

Press in bearing

Use drift **2806.** Attach lock ring

Type P: Proceed to operation G 21.


141 200

Operations G 19 to G 21 only apply to Type J.

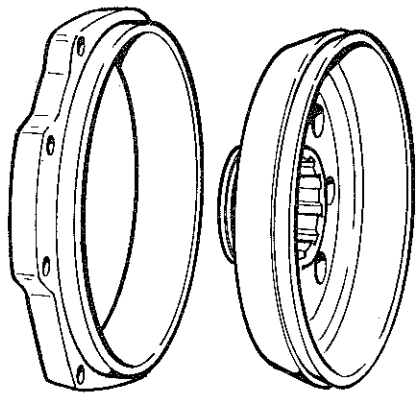
G19

Asbestos-free clutch linings in overdrive Type J for D 24 T

From transmission serial number 1 208 438/107 770, the D24 T is equipped with asbestos-free linings in the overdrive. However, there are some D 24 T models with higher transmission serial numbers which have the old type friction linings, see below.

Engine	Transmission serial number	Overdrive Volvo P/N	Laycock Overdrive No	
D24T	1 208 438/107 770-108 305	1 208 478	115 970	With asbestos-free clutch linings
D24T	1 208 438/108 306-	1 208 478 or	115 970	With asbestos-free clutch linings
		1 208 282	115 925	With old type clutch linings

The asbestos-free material has improved friction properties, which make it possible to reduce overdrive oil pressure to 2.8–3.1 MPa (400–440 psi). The new clutch linings also have a larger area.



141 604

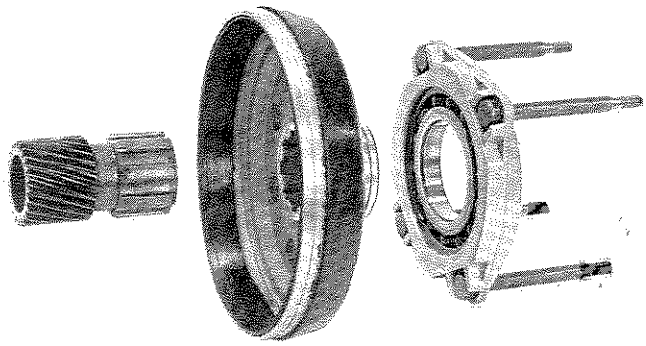
G20

When overhauling

For Turbo vehicles, clutch linings of the asbestos-free type (P/N 1 377 039-1) should be used, unless already used as shown in chart above.

When replacing clutch linings, the brake drum should also be replaced. P/N 380 910-0.

(All Type P overdrives have asbestos-free clutch linings.)



134 331

G21

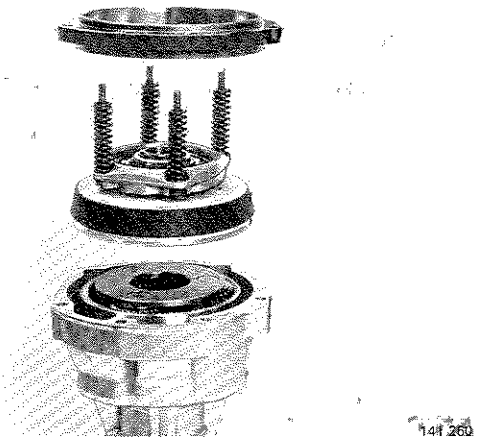
Dry clutch in a warm place

All moisture must be removed from the friction lining before the clutch is fitted to the front housing. When dry, oil lining with ATF type F or G.

G22

Install:

- sun gear
- clutch
- lock rings.



141 260

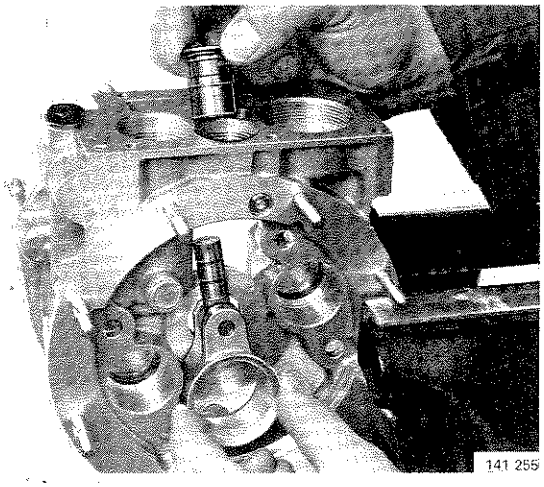
G23

Install:

- clutch assembly
- springs
- gasket between rear housing and brake drum. Make sure gasket is installed correctly.
- brake drum

Assembling front housing

Prior to assembling, make sure front housing is carefully cleaned. The hydraulic system is very sensitive to dirt.

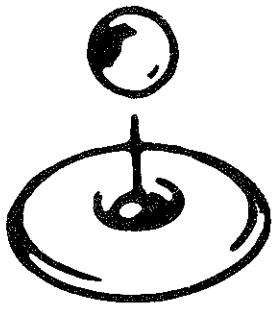


141 255

G24

Lubricate oil pump with ATF before fitting to front housing

Make sure that the groove and bevel on the pump plunger are aligned with the recess for the pressure filter. This prevents knocking noise from pump.



135 121

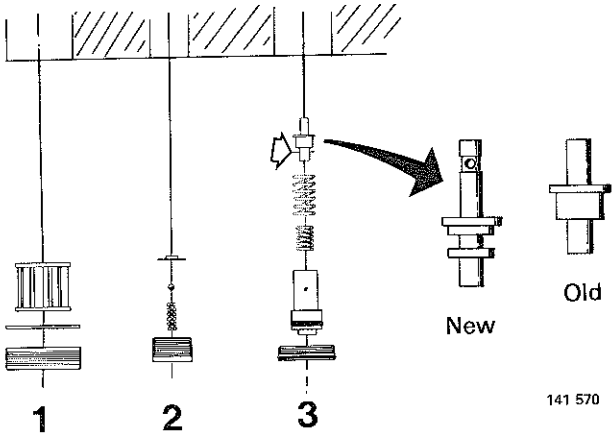
G25

Check non return valve seat for leakage

Blow through the valve to check for leakage. If the leakage is slight place the seat and steel ball on a flat surface and tap the ball with a plastic mallet. Recheck.

If the leakage is large the valve seat is probably too oval and therefore should be replaced. Make sure when fitting the valve that the steel ball is positioned correctly.

G26

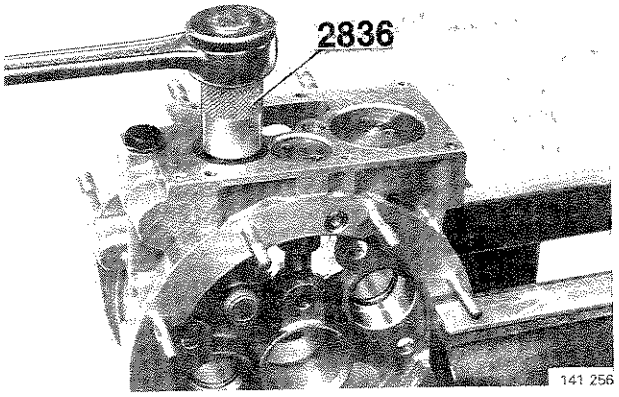


Install:

1. Oil filter, gasket and plug.
2. Seat, ball, spring and plug for check valve. Make sure ball is positioned correctly.
3. Relief valve parts. Always use new type if piston is replaced. Install shims, if applicable.

Note: If new clutch linings of asbestos-free type have been installed, no shims should be fitted to the relief valve.

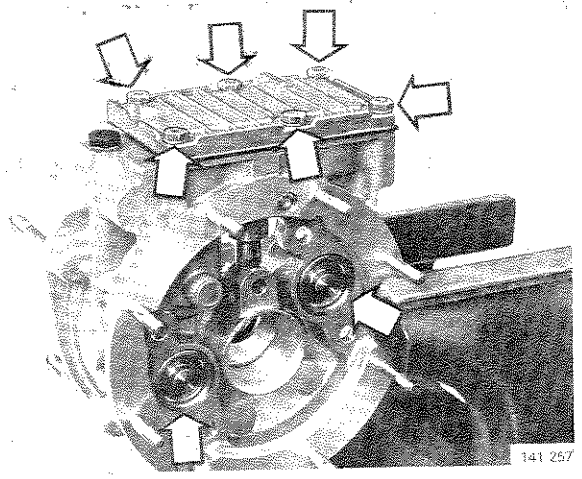
G27



Torque plugs

Use plug wrench **2836** and torque to **22 Nm (16 ft lb)**.

G28



Install oil pan

Install strainer and gasket.

Make sure magnet in oil pan is cleaned.

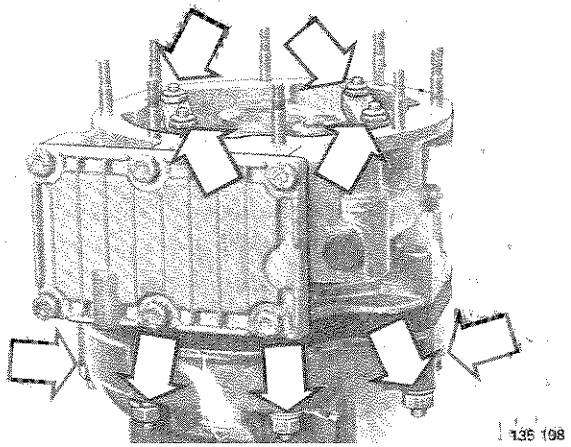
Torque bolts to 10 Nm (7 ft lb).

G29

Position clutch pistons in cylinders

Note: As a running modification during the Spring of 1985, 4 mm longer clutch pistons with a Teflon ring on the outside of the O-ring for improved sealing, have been installed. Pistons with O-rings should be replaced by new type pistons with Teflon ring, P/N 1 377 041-7.

G29



Assemble rear and front housings

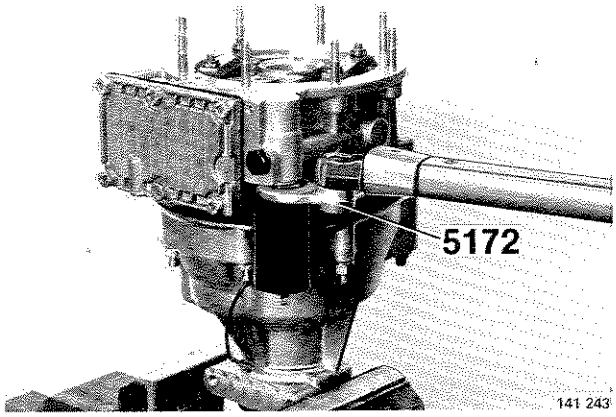
Note: Make sure gasket fitted between brake drum and rear housing is installed.

Remove remains of old nylon washers from two upper bolts on rear housing. Install new nylon washers, small end towards rear housing. Torque nuts in stages to 12 Nm (9 ft lb).

G30

Install bridges

Torque nuts to 10 Nm (7 ft lb).



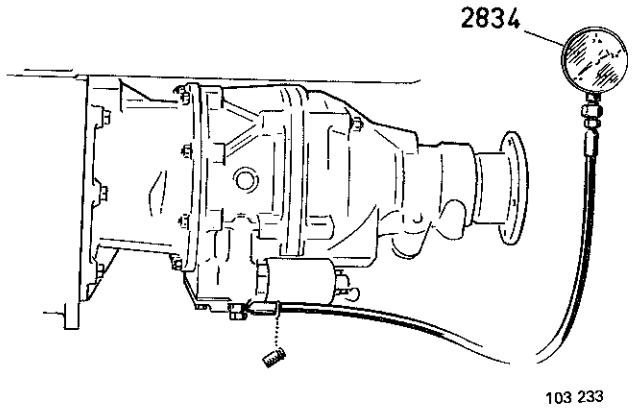
Install solenoid. Attach ground wire.

Use crow-foot wrench **5172.**

Torque to 50 Nm (37 ft lb).

H. Testing oil pressure

Special tool: 2834



The oil pressure can be checked when driving on test rollers or highway.

Remove plug or switch below control valve and connect test gauge **2834.**

Drive in 4th gear, overdrive disengaged, speed 70 km/h (45 mph). Pressure should be approx. 0.15 MPa (21 psi).

Engage overdrive. Pressure should increase to:

Type J		
D24T and gasoline Turbo	**Rebuilt** with asbetos-free clutch linings	**3.1–3.4 MPa** (440–483 psi)
D24T	**Originally** with asbestos-free clutch linings (overdrive P/N 115 970)	**2.8–3.1 MPa** (400–440 psi)
Gasoline Turbo	With **old type** clutch linings	**3.9–4.2 MPa** (554–596 psi)
Re-maining	With old type clutch linings	**3.7–4.0 MPa** (525–568 psi)
Type P		
All		**2.8–3.1 MPa** (400–440 psi)

Disengage overdrive and check time for pressure reduction to 0.15 MPa (21 psi).

Time must not exceed 3 seconds.

M 46 Transmission components

(Fold-out 1)

M 46 Transmission components

1 Needle bearing
2 2nd gear wheel
3 Synchronizer ring
4 Spring
5 Operating sleeve
6 Synchronizer hub
6a Washer
7 Sliding key ("dog")
8 Synchronizer ring
9 Lock ring
10 1st gear wheel
11 Damper
12 Spring
13 Brake cone
14 Drive flange
15 Needle bearing
16 Thrust washer (if not equipped with damper)
17 Sleeve
18 Input shaft
19 Needle bearing
20 Lock ring
21 Synchronizer ring
22 Spring
23 Operating sleeve
24 Synchronizer hub
25 Sliding key
26 Synchronizer ring
27 3rd gear wheel
28 Needle bearing
29 Main shaft
30 Lock ring
31 Intermediate shaft ("countershaft")
32 Reverse gear wheel
33 Stud shaft
34 Overdrive switch
35 Transmission (top) cover
36 Gasket
37 Spring
38 Selector plate
39 Pin
40 Engaging lug
41 Shift fork
42 Gear selector
43 Washer
44 Guide pin
45 Spring
46 Lock ring
47 Reverse gear selector
48 Selector shaft

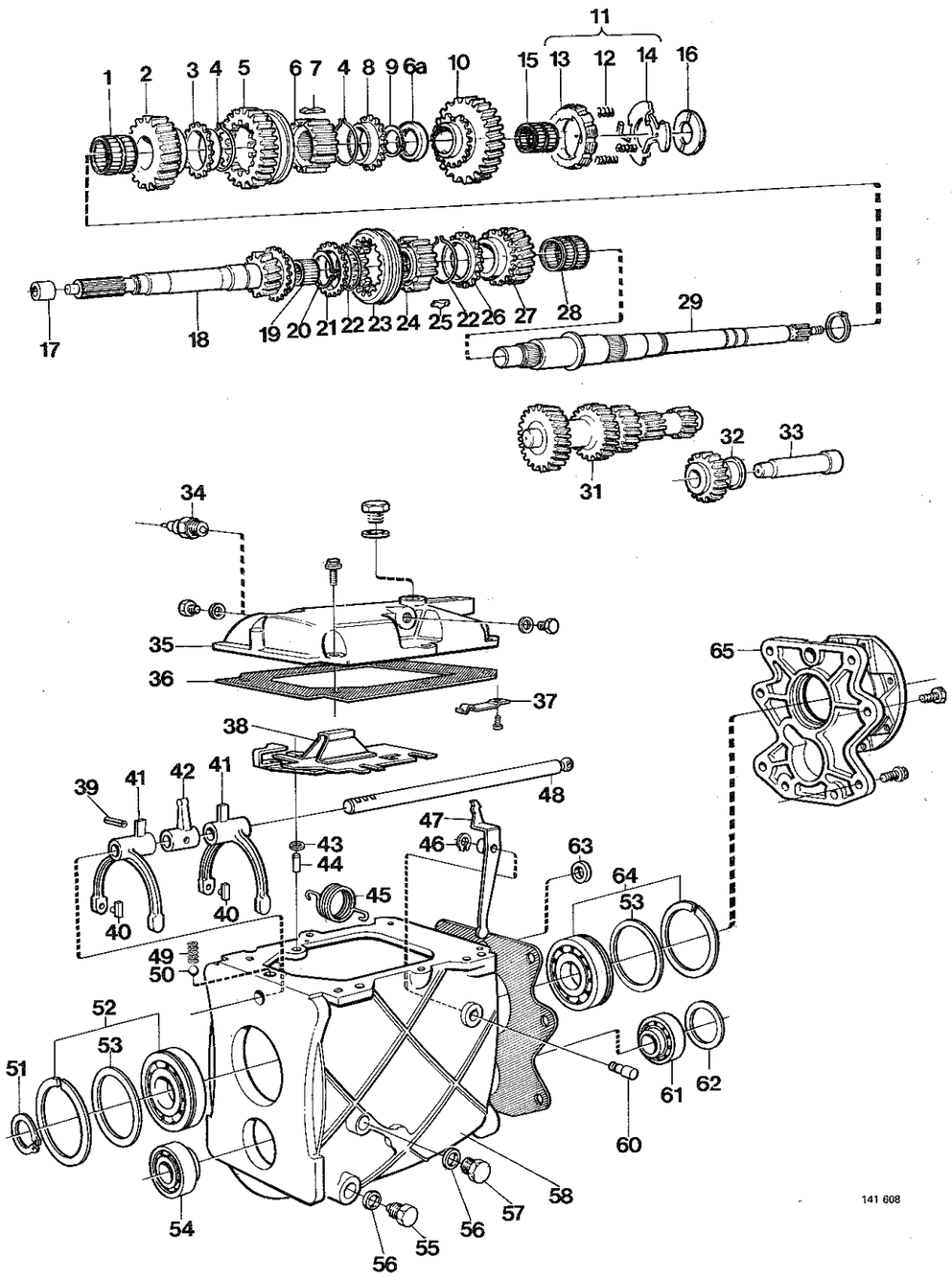
49 Spring
50 Interlocking ball
51 Lock ring
52 Ball bearing
53 Shim, thicknesses

P/N	mm	in
3292838-4	0.25	0.010
948008-8	0.60	0.024
948009-6	0.75	0.030
948010-4	0.90	0.036
948011-2	1.00	0.040

54 Roller bearing
55 Magnetic debris plug
56 Gasket
57 Plug
58 Transmission housing
59 Gasket
60 Stud shaft
61 Roller bearing
62 Shim, thicknesses

P/N	mm	in
949048-3	0.05	0.002
948298-5	0.10	0.004
948299-3	0.15	0.006
948300-9	0.35	0.014
948301-7	0.50	0.020
948302-5	0.70	0.028
948303-3	1.00	0.040

63 Seal
64 Ball bearing
65 Intermediate housing



M 47 Transmission components

(Fold-out 2)

M 47 Transmission components

1 Rear end cover
2 Seal
3 Top cover
4 Gasket
5 Spring
6 Selector plate
7 5th gear housing
8 Gasket
9 Roller bearing
10 Bearing outer race
11 Speedometer drive gear
12 Bearing outer race
13 Bearing inner race
14 Shim, thicknesses:

P/N	mm	in
3294334-2	0.10	0.004
3294335-9	0.15	0.006
3294336-7	0.25	0.010
3204069-3	0.55	0.022
3204070-1	0.75	0.030

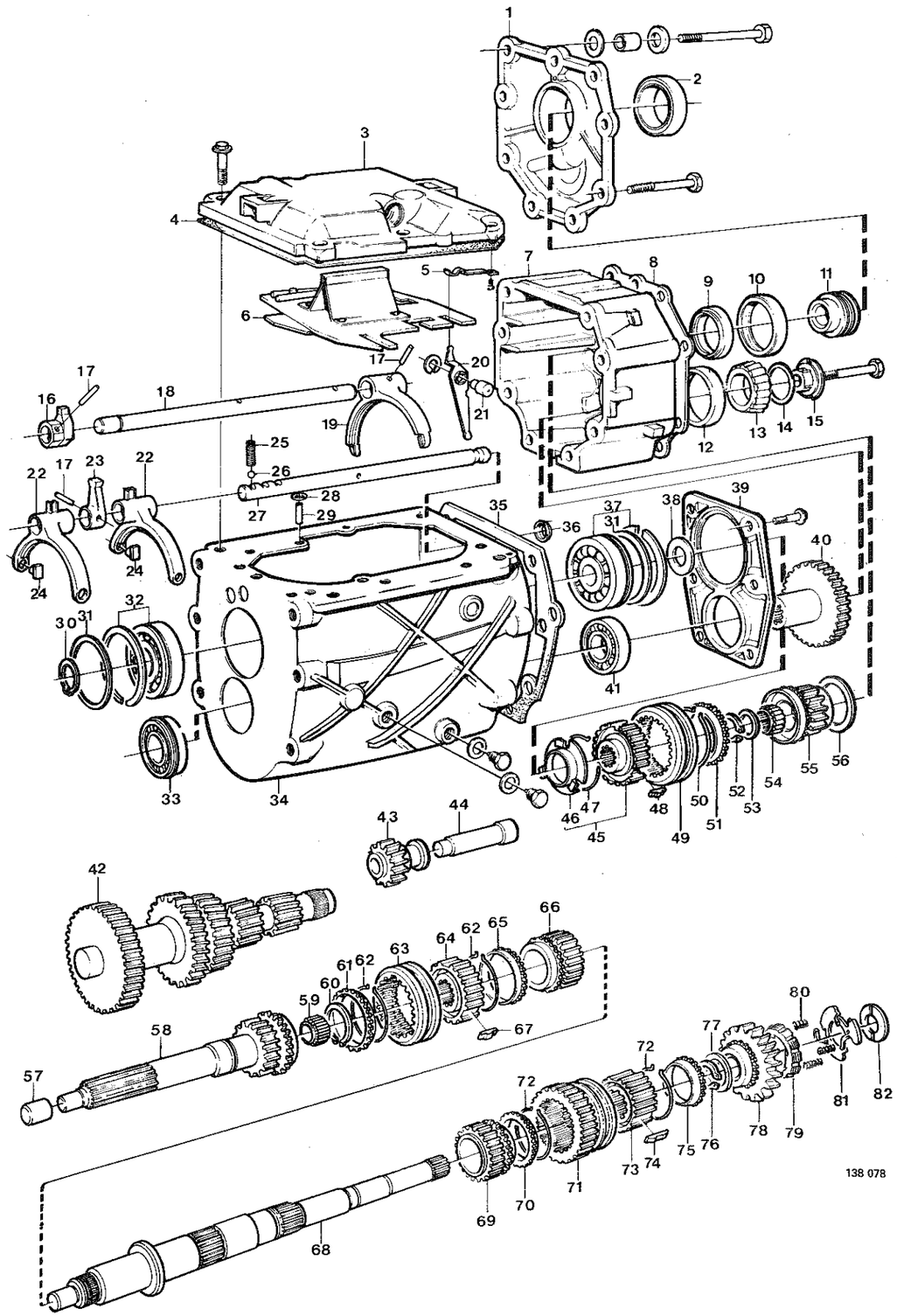
15 Washer
16 Gear selector
17 Pin
18 Selector shaft
19 Shift fork
20 Reverse gear selector
21 Stud shaft
22 Shift fork
23 Gear selector
24 Engaging lug
25 Spring
26 Interlocking ball
27 Selector shaft
28 Sliding washer
29 Guide pin
30 Lock ring
31 Shim, thicknesses:

P/N	mm	in
3292838-4	0.25	0.010
948008-4	0.60	0.024
948009-6	0.75	0.030
948010-4	0.90	0.036
948011-2	1.00	0.040

32 Ball bearing
33 Roller bearing
34 Transmission housing
35 Gasket
36 Seal
37 Ball bearing
38 Shim, thicknesses

P/N	mm	in
34615-5	0.10	0.004
120116-9	0.15	0.006
34614-8	0.35	0.014
947120-2	0.50	0.020

39 Bearing holder
40 Drive gear
41 Roller bearing
42 Intermediate shaft
43 Reverse gear wheel
44 Stud shaft
45 Synchronizer hub
46 Drive flange
47 Spring
48 Sliding key ("dog")
49 Operating sleeve
50 Spring
51 Synchronizer ring
52 Lock ring
53 Spacer
54 Needle bearing
55 5th gear wheel
56 Spacer
57 Sleeve
58 Input shaft
59 Needle bearing
60 Lock ring
61 Synchronizer ring
62 Spring
63 Operating sleeve
64 Synchronizer hub
65 Synchronizer ring
66 3rd gear wheel
67 Sliding key
68 Main shaft
69 2nd gear wheel
70 Synchronizer ring
71 Operating sleeve
72 Spring
73 Synchronizer hub
74 Sliding key
75 Synchronizer ring
76 Lock ring
77 Washer
78 1st gear wheel
79 Damper cone
80 Spring
81 Drive flange
82 Thrust washer (if not equipped with damper)



1 R
2 S
3 T
4 G
5 S
6 S
7 L
8 R
9 S
10 5
11 W
12 R
13 G
14 B
15 R
16 B
17 T
18 B
19 B
20 S
th

M 47 II Transmission components

(Fold-out 3)

21 W
22 B
23 G
24 P
25 S
26 S
27 G
28 E
29 S
30 Ir
31 W
32 G
33 L
34 S
th

35 B
36 R
37 S
38 B
39 S

M 47 II Transmission components

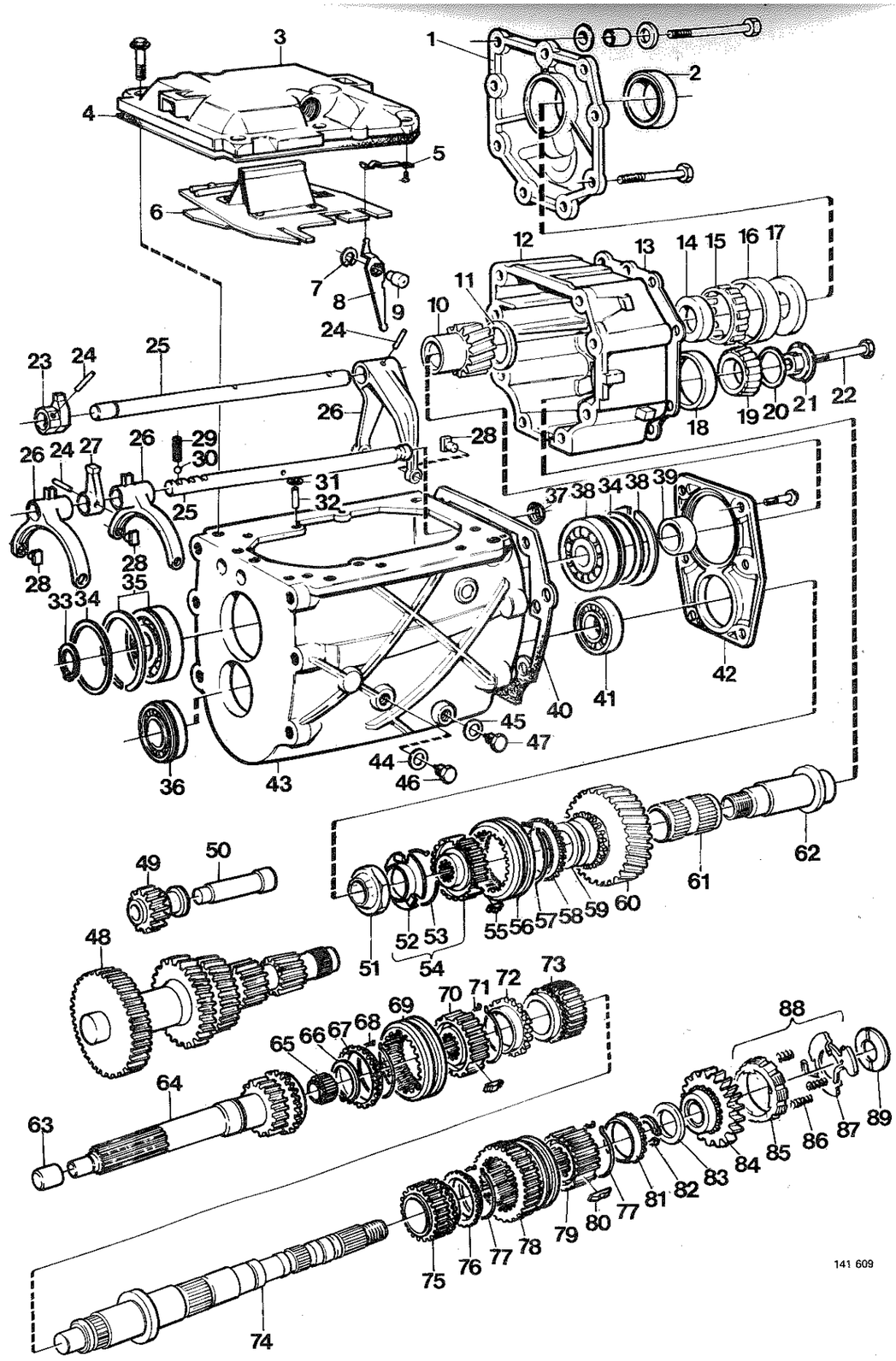
1 Rear end cover
2 Seal
3 Top cover
4 Gasket
5 Spring
6 Selector plate
7 Lock ring
8 Reverse gear selector
9 Stud shaft
10 5th gear wheel
11 Washer
12 Rear housing
13 Gasket
14 Bearing outer race
15 Roller bearing
16 Bearing inner race
17 Thrust washer
18 Bearing outer race
19 Bearing inner race
20 Shim, thicknesses:

P/N	mm	in
3294334-2	0.10	0.004
3294335-9	0.15	0.006
3294336-7	0.25	0.010
3204069-3	0.55	0.022
3204070-1	0.75	0.030

21 Washer
22 Bolt
23 Gear selector
24 Pin
25 Selector shaft
26 Shift fork
27 Gear selector
28 Engaging lug
29 Spring
30 Interlocking ball
31 Washer
32 Guide pin
33 Lock ring
34 Shim, thicknesses:

P/N	mm	in
948008-8	0.60	0.024
948009-6	0.75	0.030
948010-4	0.90	0.036
948011-2	1.00	0.040

35 Ball bearing
36 Roller bearing
37 Seal
38 Ball bearing
39 Spacer
40 Gasket
41 Roller bearing
42 Bearing holder
43 Transmission housing
44 Gasket
45 Seal
46 Plug
47 Magnetic debris plug
48 Intermediate shaft
49 Reverse gear wheel
50 Stud shaft
51 Nut
52 Washer
53 Spring
54 Synchronizer ring
55 Sliding key ("dog")
56 Operating sleeve
57 Spring
58 Synchronizer ring
59 Washer
60 Gear wheel
61 Needle bearing
62 Shaft
63 Sleeve
64 Input shaft
65 Needle bearing
66 Lock ring
67 Synchronizer ring
68 Spring
69 Operating sleeve
70 Synchronizer hub
71 Spring
72 Synchronizer ring
73 3rd gear wheel
74 Main shaft
75 2nd gear wheel
76 Synchronizer ring
77 Spring
78 Operating sleeve
79 Synchronizer hub
80 Sliding key
81 Synchronizer ring
82 Lock ring
83 Washer
84 1st gear wheel
85 Brake cone
86 Spring
87 Drive flange
88 Damper
89 Thrust washer (if not equipped with damper)



Type J, Overdrive components

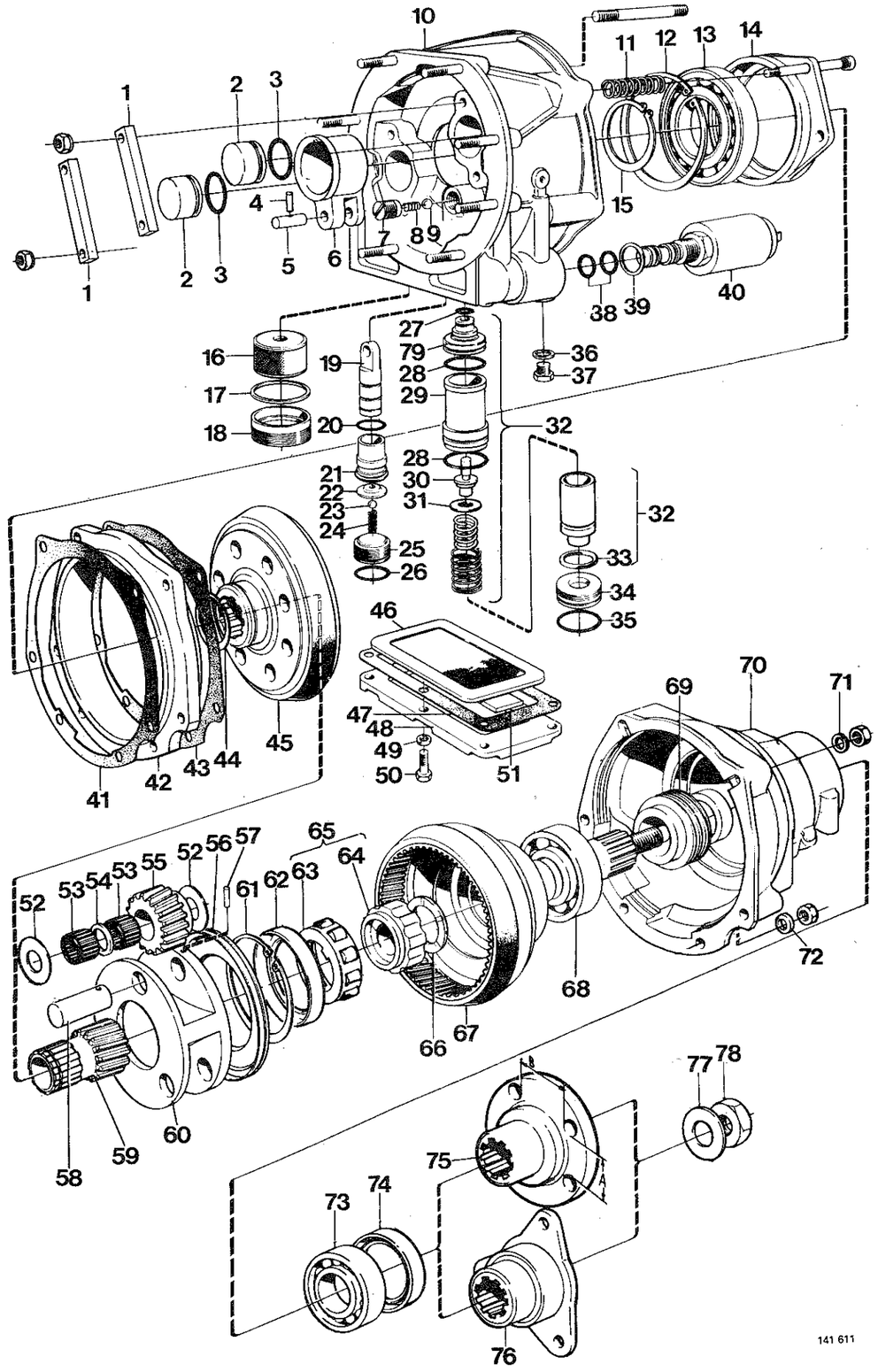
(Fold-out 4)

Type J Overdrive components

1 Bridge
2 Clutch piston
3 O-ring
4 Pin
5 Guide pin
6 Pump link
7 Relief valve
8 Spring
9 Ball
10 Front housing
11 Spring
12 Lock ring
13 Clutch bearing
14 Bearing holder
15 Lock ring
16 Oil filter
17 Washer
18 Plug
19 Pump piston
20 O-ring
21 Pump cylinder
22 Seat
23 Ball
24 Spring
25 Plug
26 O-ring
27 O-ring
28 O-ring
29 Cylinder
30 Piston
31 Pressure adjusting shim, thicknesses:

P/N	mm	in
1209450-4	0.05	0.0020
1209451-2	0.13	0.0052
1209452-0	0.25	0.0100
1209453-8	0.76	0.0300

32 Relief valve assembly
33 O-ring
34 Plug
35 O-ring
36 Seal
37 Plug
38 O-ring
39 Seal
40 Solenoid valve
41 Gasket
42 Brake drum
43 Gasket
44 Lock ring
45 Clutch
46 Strainer
47 Gasket
48 Oil pan
49 Spring washer
50 Bolt
51 Debris magnet
52 Thrust washer
53 Needle bearing
54 Spacer washer
55 Planetary gear wheel
56 Oil slinger
57 Lock pin
58 Shaft
59 Sun gear
60 Planetary gear carrier
61 Lock ring
62 Race
63 Roller cage
64 One-way clutch hub
65 One-way clutch
66 Thrust washer
67 Output shaft
68 Ball bearing
69 Speedometer drive gear
70 Rear housing
71 Spring washer
72 Seal
73 Ball bearing
74 Seal
75 Drive flange, round
76 Drive flange, three-armed
77 Washer
78 Nut
79 Seat



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Type P Overdrive components

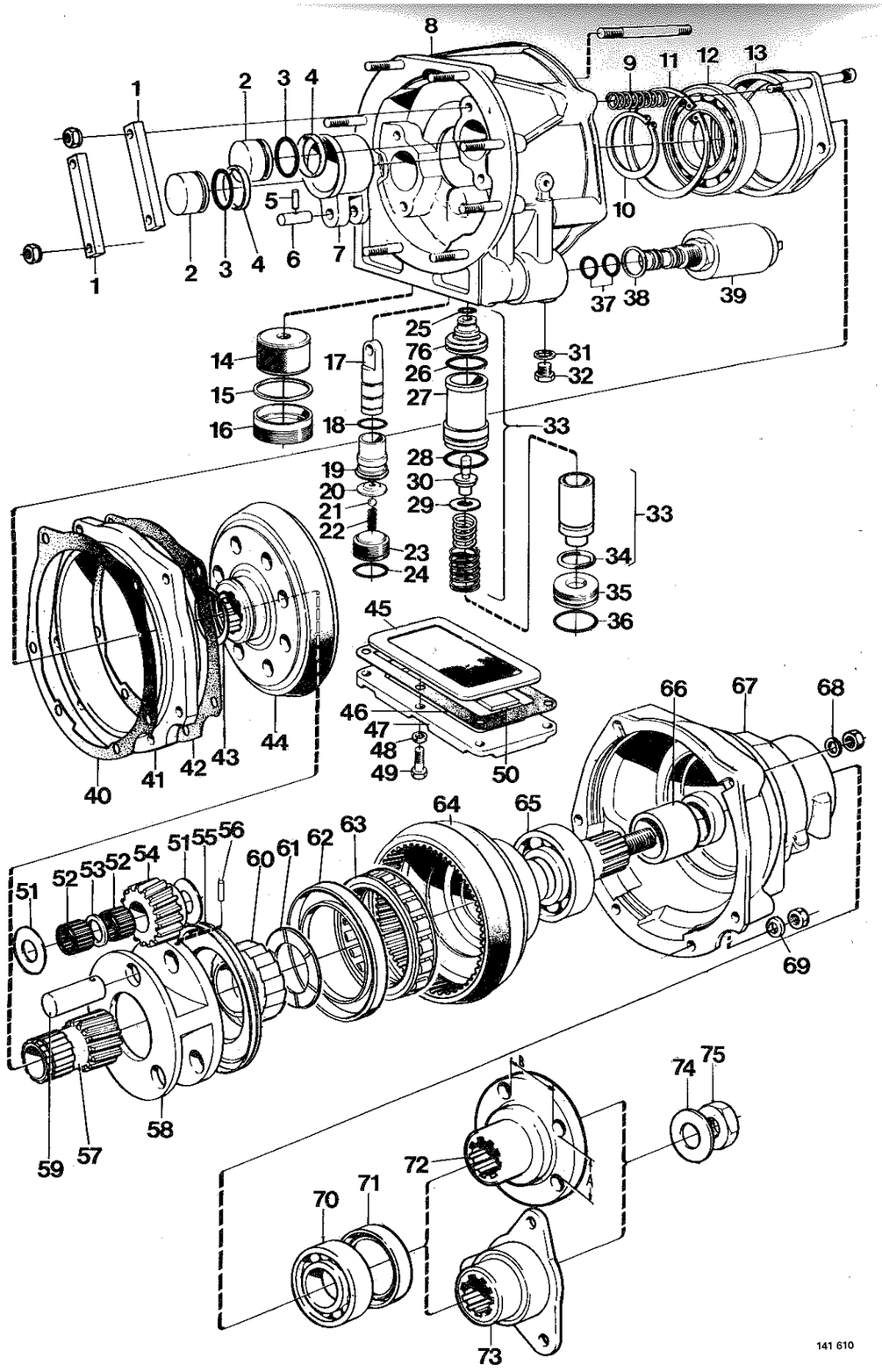
(Fold-out 5)

Type P Overdrive components

1 Bridge
2 Clutch piston
3 O-ring
4 Teflon ring
5 Pin
6 Guide pin
7 Pump link
8 Front housing
9 Spring
10 Lock ring
11 Lock ring
12 Clutch bearing
13 Bearing holder
14 Oil filter
15 Washer
16 Plug
17 Pump piston
18 O-ring
19 Cylinder
20 Seat
21 Ball
22 Spring
23 Plug
24 O-ring
25 O-ring
26 O-ring
27 Cylinder
28 Pressure adjusting shim, thicknesses:

P/N	mm	in
1209450-4	0.05	0.0020
1209451-2	0.13	0.0052
1209452-0	0.25	0.0100
1209453-8	0.76	0.0300

30 Piston
31 Seal
32 Plug
33 Relief valve assembly
34 O-ring
35 Plug
36 O-ring
37 O-ring
38 Seal
39 Solenoid valve
40 Gasket
41 Brake drum
42 Gasket
43 Lock ring
44 Clutch
45 Strainer
46 Gasket
47 Oil pan
48 Spring washer
49 Bolt
50 Debris magnet
51 Thrust washer
52 Needle bearing
53 Spacer
54 Planetary gear wheel
55 Oil slinger
56 Locking pin
57 Sun gear
58 Planetary gear carrier
59 Shaft
60 One-way clutch hub
61 Thrust washer
62 Race
63 Roller cage
64 Output shaft
65 Ball bearing
66 Spacer
67 Rear housing
68 Spring washer
69 Seal
70 Ball bearing
71 Seal
72 Drive flange, round
73 Drive flange, three-armed
74 Washer
75 Nut
76 Seat



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