

## **Getriebe automatisch**

Transmission – automatic

Boîte à vitesses – automatique

Cambio automatico

Caja de cambio automático

Växellåda – automatisk

Transmissie, automatische

## 24 Automatic Transmission ZF 3 HP – 22

Specifications .....	Page 24-0/3
2400004 Selector lever, throttle cable and transmission cable-adjusting .....	00/1
009 Hydraulic pressure values – checking .....	00/3
020 Transmission – removing and installing .....	00/4
040 Exchange transmission – installing .....	00/8
080 Automatic transmission – stripping and assembling .....	00/9
2411000 Transmission oil pan – removing and installing .....	11/1
050 Transmission cover – removing and installing/sealing .....	11/1
2412001 Oil seal for torque converter – renewing .....	12/1
011 Radial seal for output flange – renewing .....	11/3
031 O-ring for speedometer drive bush – renewing .....	12/3
101 Radial seal for manual selection valve shaft – renewing .....	12/3
2423020 Plate clutches and brakes – renewing .....	23/1
2430000 Control unit – removing and installing .....	30/1
001 Control unit – renewing .....	30/1
2431000 Primary pump – removing and installing .....	31/1
150 Oil mesh filter on control unit – detaching and attaching .....	31/2
2432000 Centrifugal governor – removing and installing .....	32/1
503 Centrifugal governor – stripping and assembling .....	32/1
2434000 Parking lock pawl – removing and installing .....	34/1
101 Throttle cable – replacing .....	34/1
701 Torsion spring for throttle cable – renewing .....	34/2
730 Torsion spring for parking lock cam – renewing .....	34/4
2440000 Torque converter – removing and installing .....	40/1
001 Torque converter – renewing .....	40/2
2471001 Rubber mounting for transmission – renewing .....	71/1
Trouble-shooting – automatic transmission .....	71/3

## Automatic transmission

## Specifications

Model	320/6 A	323 i A *)
2400 . . . Transmission, general		
Make/designation		ZF/3 HP - 22
Transmission number	1 043 000 058	1 043 000 059
Code letter on type plate	C	D
Mechanical ratios -		
1st		2.478 : 1
2nd		1.478 : 1
3rd		1.000 : 1
Reverse		2.090 : 1
Speedometer drive		2.500 : 1
Oil grade	For approved grades of automatic transmission fluid (ATF), see Service Information Group 24 (automatic transmission)	
Total oil content of new or exchange transmission (including oil cooler)	1 (Imp. pints, US quarts)	5.7 + 0.4 (10.0 + 0.7, 6.0 + 0.42)
Initial content of new or exchange transmission	1 (Imp. pints, US quarts)	2.4 (4.2, 2.5)

\*) Version for Sweden



## Automatic transmission

## Specifications

Model	320/6 A	323 i A *)
2400 . . . Transmission, general – (continued)		
Quantity to be added during oil changes (transmission at normal operating temperature, handbrake applied, selector lever in 'P' position, engine stopped). Add 1 liter (1.75 Imp. pints, 1.05 US quarts), then run engine at idle speed and continue to add oil until two-thirds up the space between the two dipstick marks)	1 (Imp. pints, US quarts)	2.0 (3.5, 2.1)
Quantity of oil represented by space between dipstick marks	1 (Imp. pints, US quarts)	app. 0.4 (0.7, 0.42)
Towing away		
– up to a distance of	km (miles)	50 (31)
– permissible max. speed	km/h (mile/h)	50 (31)
distances above 50 km (30 miles)		<sup>1)</sup>

\*) Version for Sweden

<sup>1)</sup> Add 1 liter (1.75 Imp. pints, 1.05 US quarts) of ATF to the specified content of the transmission, or else detach and tie up the propeller shaft at the final drive. After the vehicle has been repaired, do not forget to reduce the ATF content of the transmission to the correct level.



# Specifications

## Automatic transmission

Model	320/6 A		323 i A *)
2400 ... Upward shift points <sup>1)</sup>			
Selector lever position 'D'			
1st – 2nd gear			
Full-throttle accelerator position			
Shift point at:			
Engine speed	1/min	4300 ± 380	4260 ± 380
Road speed	km/h (mile/h)	49 ± 5 (30.4 ± 3.1)	51 ± 5 (31.7 ± 3.1)
Selector lever position 'D'			
1st – 2nd gear			
Kickdown accelerator position			
Shift point at:			
Engine speed	1/min	5850 ± 330	5820 ± 330
Road speed	km/h (mile/h)	68 ± 4 (42.3 ± 2.5)	72 ± 4 (44.7 ± 2.5)
Selector lever position 'D'			
2nd – 3rd gear			
Full-throttle accelerator position			
Shift point at:			
Engine speed	1/min	5240 ± 230	5220 ± 230
Road speed	km/h (mile/h)	101 ± 5 (62.8 ± 3.1)	107 ± 5 (66.5 ± 3.1)

\*) Version for Sweden

1) Check on a flat, level surface; speed data disregard speedometer error

## Specifications

### Automatic transmission

Model	320/6 A	323 i A *)
24 00 . . . Upward shift points <sup>1)</sup> (continued)		
Selector lever position 'D'		
2nd – 3rd gear		
Kickdown accelerator position		
Shift point at:		
Engine speed	1/min	5830 ± 220
Road speed	km/h (mile/h)	120 ± 5 (74.6 ± 3.1)
24 00 . . . Downshift points <sup>2)</sup>		
Selector lever position 'D'		
(3rd – 2nd gear)		
Full-throttle accelerator position		
Shift point at:		
Engine speed	1/min	3130 ± 140
Road speed	km/h (mile/h)	85 ± 6 (52.8 ± 3.7)
Selector lever position 'D'		
(3rd – 2nd gear)		
Kickdown accelerator position		
Shift point at:		
Engine speed	1/min	3900 ± 150
Road speed	km/h (mile/h)	115 ± 5 (71.5 ± 3.1)

\*) Version for Sweden

<sup>1)</sup> Check on flat, level road; speed data disregard speedometer error

<sup>2)</sup> Downshift point cannot be exceeded

# Specifications

## Automatic transmission

Model	320/6 A		323 i A *)
24 00 ... Downshift points <sup>1)</sup> (continued)			
Selector lever position 'D'			
(2nd – 1st gear)			
Kickdown accelerator position			
Shift point at:			
Engine speed	1/min	3490 ± 190	3430 ± 190
Road speed	km/h (mile/h)	62 ± 5 (38.5 ± 3.1)	66 ± 5 (41.0 ± 3.1)
Downshift point from 3rd to 2nd gear			
– manual lever movement –			
Shift point at:			
Engine speed	1/min	3500 ... 4000	116 ... 129 (72.1 ... 80.2)
Road speed	km/h (mile/h)	110 ... 122 (68.4 ... 75.8)	
Downshift point from 2nd to 1st gear			
– manual lever movement –			
Shift point at:			
Engine speed	1/min	2800 ... 3450	64 ... 76 (39.8 ... 47.2)
Road speed	km/h (mile/h)	61 ... 72 (37.9 ... 44.7)	

\*) Version for Sweden

<sup>1)</sup> Downshift point cannot be exceeded



Automatic transmission		Specifications	
Model		320/6 A	323 i A *)
24 00 . . . Main pressures			
Main pressure (gauge) in selector lever position 'R'			
Idle speed	bar (lb/in <sup>2</sup> )		
Kickdown	bar (lb/in <sup>2</sup> )	17.3 . . . 19.4 (246 . . . 276)	12.5 . . . 14.5 (178 . . . 206)  16.5 . . . 18.3 (235 . . . 260)
in selector lever positions D, 2, 1, P and N			
Idle speed	bar (lb/in <sup>2</sup> )		
Kickdown	bar (lb/in <sup>2</sup> )	7.6 . . . 8.5 (108 . . . 121)	5.5 . . . 6.4 (78 . . . 91)  7.2 . . . 8.0 (102 . . . 114)
24 30 . . . Control unit			
Adjustment setting between control unit housing and needle on throttle pressure plunger	mm (in)		11,5 (0.45)
24 40 . . . Torque converter			
Torque converter diameter	mm (in)		240 (9.44)
Color code (paint spot)		blue	yellow
Stall speed	1/min	2270	2060
Starting ratio		2.36	2.06

\*) Version for Sweden

# Automatic transmission

Automatic transmission		Specifications	
Model		320/6 A	323 i A *)
Tightening torques			
2400 . . . Transmission, general			
Transmission to engine. M 12 × 60 mm	Nm		78 . . . 86
	kpm		8 . . . 8.8
	lb.ft		58 . . . 63
2411 . . . Transmission housing with cover			
Transmission extension to main transmission housing (M 8)	Nm		23 . . . 26
	kpm		2.3 . . . 2.6
	lb.ft		17.0 . . . 19.2
Cover plate at converter dome, M 6 × 16 mm	Nm		8 . . . 9
	kpm		0.8 . . . 0.9
	lb.ft		5.9 . . . 6.6
Converter dome to transmission (M 8)	Nm		23 . . . 26
	kpm		2.3 . . . 2.6
	lb.ft		17.0 . . . 19.2
Screw plug at intermediate plate M 10 × 1 mm	Nm		15 . . . 17
	kpm		1.5 . . . 1.7
	lb.ft		11.1 . . . 12.5
Oil pan to transmission (M 6)	Nm		8 . . . 9
	kpm		0.8 . . . 0.9
	lb.ft		5.9 . . . 6.6

\*) Version for Sweden

## Automatic transmission

## Specifications

Model	320/6 A	323 i A *)
Tightening torques (continued)		
24 11 ... Transmission housing with cover (continued)		
Oil drain plug in oil pan, M 10 × 1 mm	Nm kpm lb.ft	15 ... 17 1.5 ... 1.7 11.1 ... 12.5
Oil filler tube at oil pan	Nm kpm lb.ft	100 ... 115 10.2 ... 11.7 74 ... 85
Oil filler tube at converter dome, M 6 × 16 mm	Nm kpm lb.ft	8 ... 9 0.8 ... 0.9 5.9 ... 6.6
Screw plug at transmission, M 18 × 1.5 mm	Nm kpm lb.ft	40 ... 46 4.1 ... 4.7 29 ... 34
24 12 ... Speedometer drive bushing		
Hex bolt for speedometer bushing	Nm kpm lb.ft	10 ... 11 1.0 ... 1.1 7.4 ... 8.1
24 21 ... Transmission shafts		
Shouldered nut for output shaft/ output flange	Nm kpm lb.ft	100 ... 115 10.2 ... 11.7 74 ... 85

\*) Version for Sweden



## Specifications

## Automatic transmission

Model	320/6 A		323 i A *)
Tightening torques (continued)			
24 30 . . . Control unit			
Machine screw (Torx screw), M 5, on control unit	Nm kpm lb.ft	6 . . . 7 0.6 . . . 0.7 4.4 . . . 5.2	
Control unit to transmission (M 6)	Nm kpm lb.ft	10 . . . 11 1.0 . . . 1.1 7.4 . . . 8.1	
24 31 . . . Oil pump			
Oil pump attachment (M 6)	Nm kpm lb.ft	10 . . . 11 1.0 . . . 1.1 7.4 . . . 8.1	
24 32 . . . Speed-controlled governor			
Governor flange to transmission housing (M 8)	Nm kpm lb.ft	15 . . . 17 1.5 . . . 1.7 11.1 . . . 12.5	
Threaded rod at centrifugal governor (M 6)	Nm kpm lb.ft	3 . . . 3.5 0.3 . . . 0.36 2.2 . . . 2.6	
Hex nut at threaded rod	Nm kpm lb.ft	9 . . . 10 0.9 . . . 1.0 6.6 . . . 7.4	
Hex bolt on centrifugal governor (M 6)	Nm kpm lb.ft	10 . . . 11 1.0 . . . 1.1 7.4 . . . 8.1	

\*) Version for Sweden

## Specifications

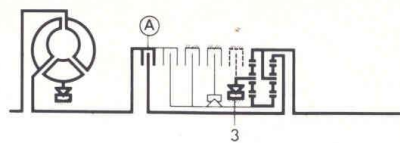
### Automatic transmission

Model	320/6 A		323 i A *)
Tightening torques (continued)			
24 40 . . . Torque converter			
Torque converter to driving disc, M 8 × 12 mm	Nm kpm lb.ft	25 . . . 27 2.5 . . . 2.7 18.4 . . . 19.9	
24 51 . . . External shift mechanism components			
Selector lever to transmission, M 8 × 1 mm	Nm kpm lb.ft	8 . . . 10 0.8 . . . 1.0 5.9 . . . 7.4	
24 71 . . . Transmission mountings			
Cross-member to body (M 8)	Nm kpm lb.ft	22 . . . 24 2.2 . . . 2.4 16.2 . . . 17.7	
Rubber mountings to cross-member (M 10)	Nm kpm lb.ft	43 . . . 48 4.4 . . . 4.9 32 . . . 35	
Rubber mounting to transmission (M 10)	Nm kpm lb.ft	43 . . . 48 4.4 . . . 4.9 32 . . . 35	

\*) Version for Sweden

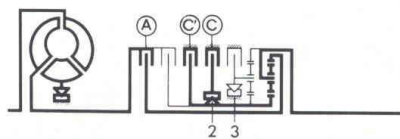
### Power flow diagram – 3 HP 22 1st gear

Clutch A is engaged. On traction the planetary gear carrier bears against freewheel 3; on the overrun it turns freely on the freewheel. With the selector lever in position 1, clutch D is also engaged to permit engine braking.



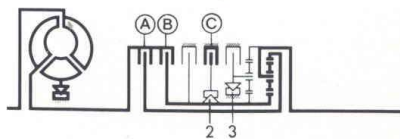
### 2nd gear

Clutches A, C' and C are engaged. Freewheel 3 is overrun. The hollow shaft with sun wheel is blocked.



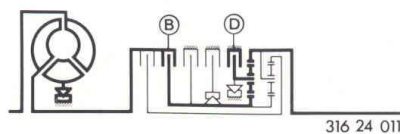
### 3rd gear

Clutches A, B and C are engaged. Freewheels 2 and 3 are overrun. The complete planetary gear set turns as a unit in the ratio 1:1.



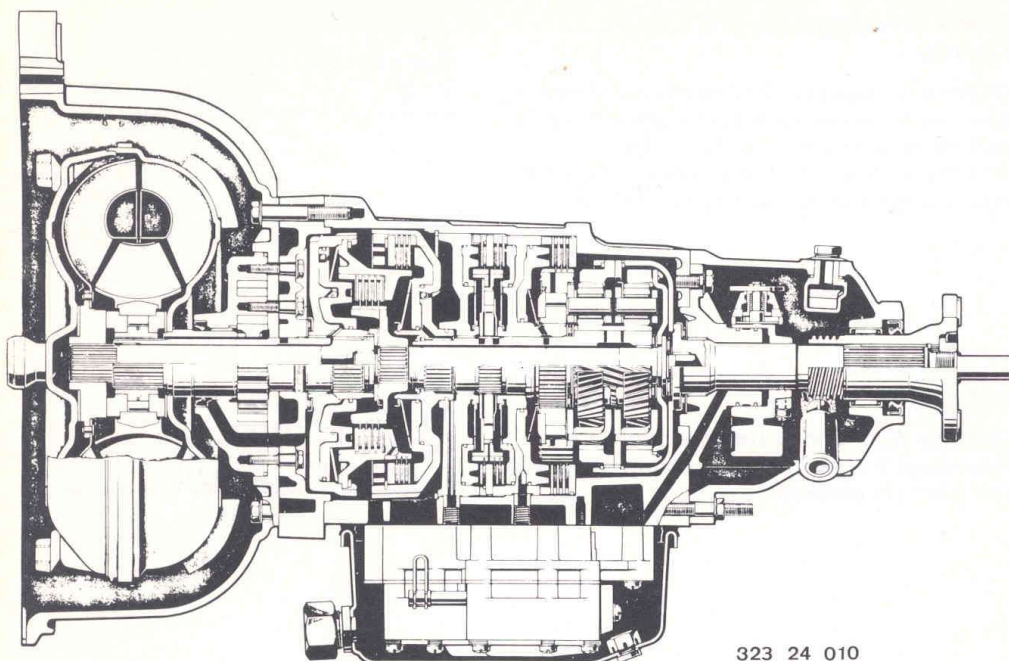
### Reverse gear

Clutches B and D are engaged. By locking the planetary gear carrier, the direction of rotation of the output shaft is reversed.

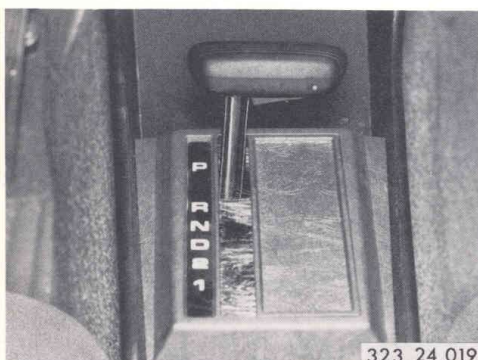


316 24 011





323 24 010



323 24 019

The 3 HP-22 transmission is fully automatic. It has a torque converter and Simpson planetary gear train.

P Neutral

R Reverse

N Neutral

D 1st, 2nd and 3rd gears

2 1st and 2nd gears – 3rd gear locked out

1 1st gear – 2nd and 3rd gears locked out

In selector lever position P the transmission output shaft is locked mechanically by the parking pawl.

R = Reverse gear

The engine must be started with the selector lever in position N or P. No power is transmitted to the rear wheels.

The lever should remain in position D under normal driving conditions in order to obtain the best possible fuel consumption.

The transmission can be made to change down early by operating the kickdown control with the accelerator pedal.

Selector lever position 2 prevents undesirable upward changes from 2nd to 3rd gear on hills. In addition, engine braking is improved.

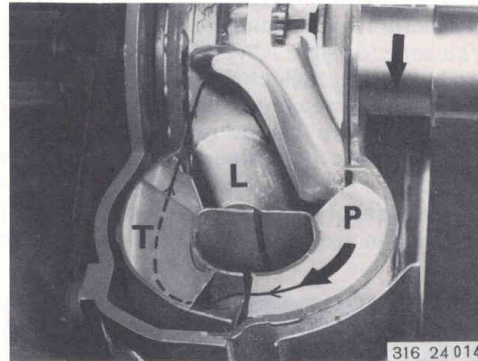
Selector position 1 is particularly suitable for continuous engine braking effect on severe gradients.

The selector lever may be moved to position 1 or 2 at any road speed. The transmission will then no longer change up into the next higher gear.

*The torque converter operates as a fluid coupling and a means of multiplying output torque. The pump wheel or impeller P turns at the same speed as the engine and directs the oil clockwise into turbine wheel (T). When a gear is engaged the turbine wheel with the input shaft is connected by way of the clutches to the planetary gear train. As engine speed increases, the shape of the turbine wheel blades causes the oil to be diverted in an anti-clockwise direction from the turbine wheel into the rotor (L), which is prevented from turning against the direction of engine rotation by a freewheel. From here the oil is conducted with a minimum of disturbance back to the pump wheel. The back pressure caused by changing the direction of flow produces an increase in torque. Maximum torque multiplication occurs when the vehicle is standing still, the pump wheel is driven by the engine at full throttle and the oil is attempting to bring the stationary turbine wheel into motion.*

As road speed increases, the difference in speeds of rotation between the pump and turbine wheels falls, until the so-called lock-up point is reached at a ratio of 1:1. At this point the rotor ceases to be locked against the freewheel and begins to run forwards in the oil flow and the vehicle begins to overrun and attempts to turn the engine. The torque converter functions as a straightforward fluid coupling. On the overrun this means that the braking effect of the engine can be partially exploited.

*The primary pump is driven from the torque converter at engine speed. Its function is to supply oil to the converter, the control unit and the clutches.*



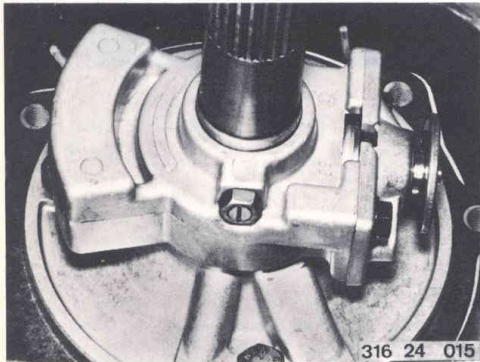
### Key to hydraulic control circuit diagram

*The main pressure valve determines the pressure level in the control unit. As soon as the control unit is filled with oil, the oil supply passage to the converter is opened. As the flow rate increases, excess oil is returned to the intake passage of the primary pump.*

*The converter pressure valve prevents excess pressure from building up in the converter.*

*The selector slide valve is operated mechanically from the selector lever. It directs the oil pressure in the control unit to the appropriate circuits for the desired gear ratios.*

*The regulator determines the shift points with the shift valves in accordance with throttle valve pressure. The regulator pressure is developed in proportion to output shaft speed of rotation.*



Neither upward nor downward shifts can take place if the regulator plunger or bushing is blocked or seizes. Clean the regulator (see 24 32 503).

*The throttle pressure valve is connected to the throttle cable and determines the shift points, depending on the position of the throttle butterflies.*

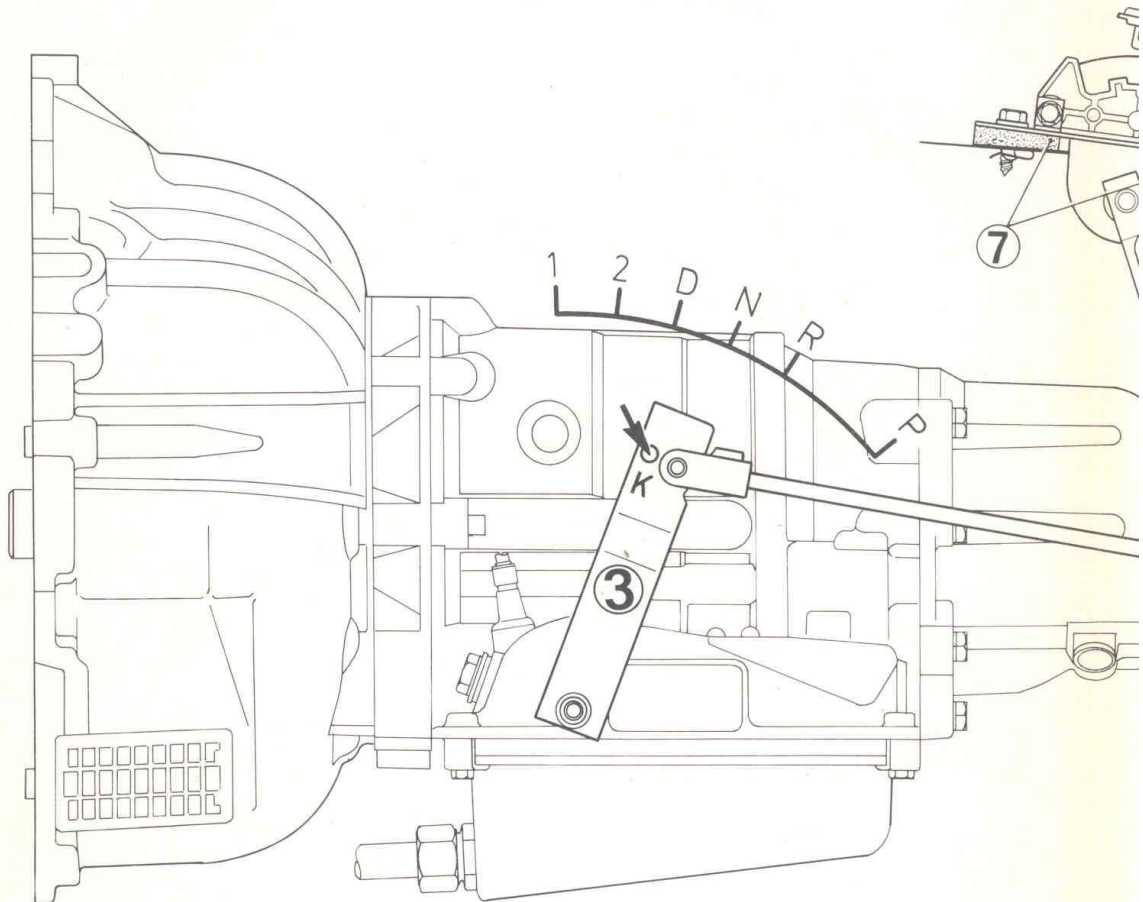
*The shut-off valves initiate down-shifts through the gears, independently of throttle butterfly position. In addition, the shut-off valves prevent further automatic gear shifts when the selector lever is in position 1 or 2.*

*The selector valves determine the gear selected. As soon as spring pressure in the selector valve is overcome by regulator pressure, the oil supply can reach the clutch valves and engage the relevant clutches. When the kick-down mechanism is operated, spring pressure is reinforced by throttle pressure. This means that the engine must reach a higher speed before the regulator pressure can overcome the combined spring and throttle pressure.*

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



**24 00 004 Floor selector lever, throttle linkage and  
throttle cable – adjusting**



**A) Adjusting gear shift**

Before adjusting, check firm seating of pivot mount.

The selector rod (1) must be connected to the unmarked hole in selector lever (3).

Detach the shift rod (1) from the shift lever lower section (2).

Engage the selector lever (3) on the transmission in position N.

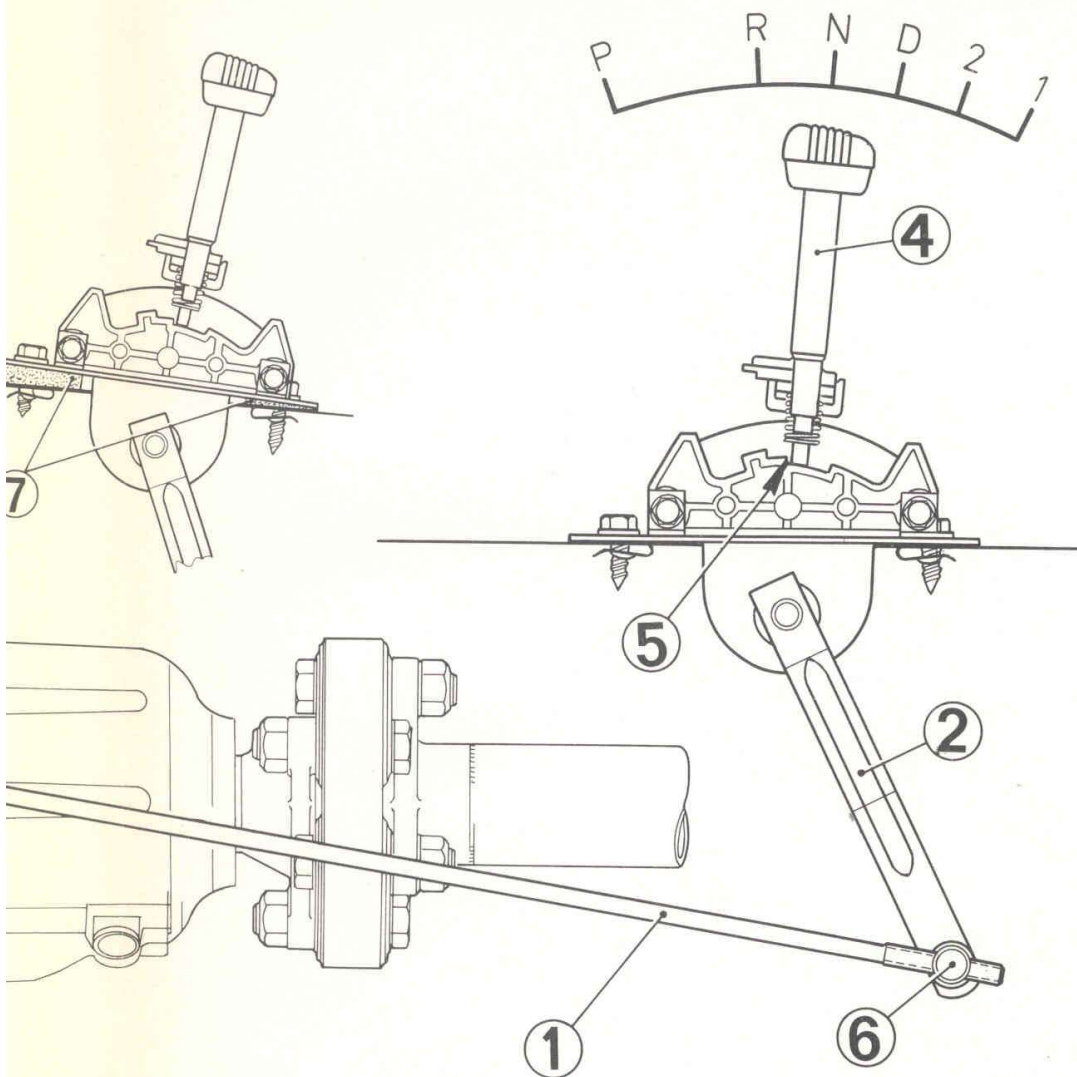
Press shift lever (4) against stop (5) on the gate.

Alter the length of the shift rod (1) until pin (6) is aligned with the hole in the lower part of the shift rod (2).

Now shorten the shift rod (6) by 1 to 2 turns at pin (6).

Attach shift rod and secure.

*Note:* If car has air conditioning, underlay blocks (7) must be installed between the pivot mount and the floor plate, and shift rod (1) must be connected to hole K in selector lever (3).



323 24 011

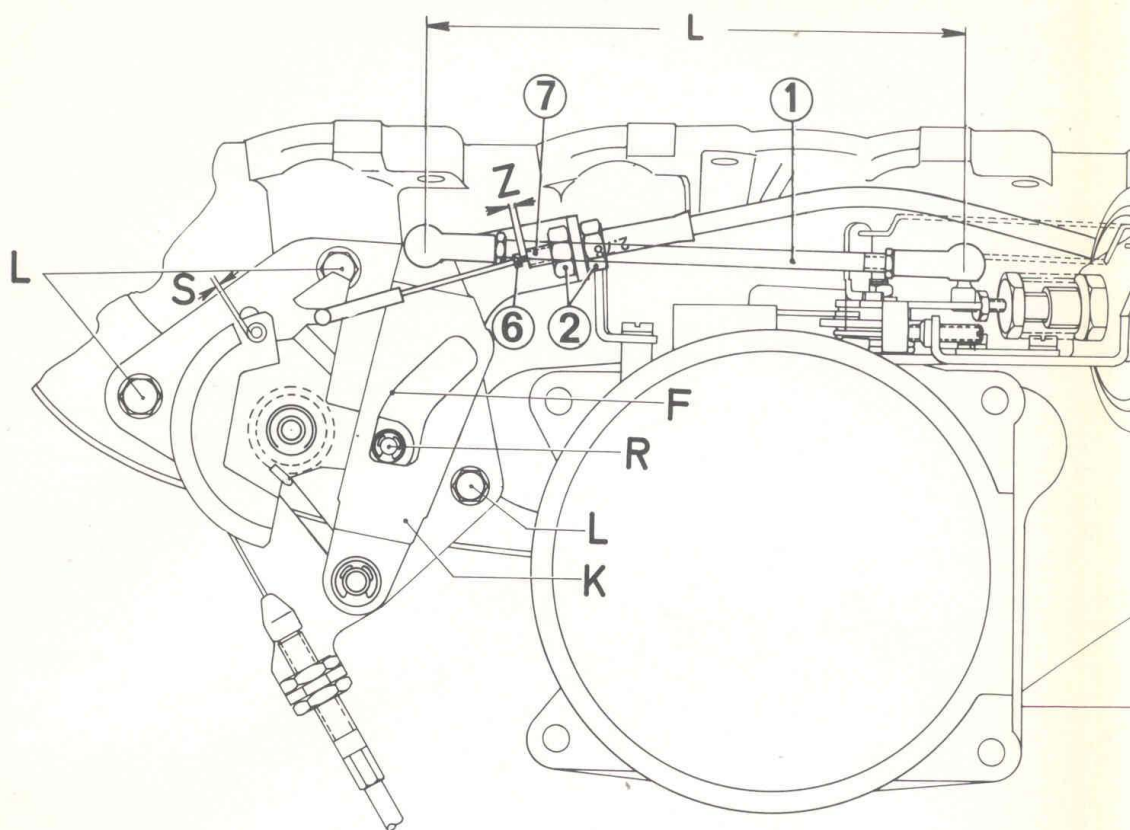
the

ivot  
(3).

ZF 3 HP-22







#### **B) Adjusting the throttle cable**

Check length of pull rod (1).  $L = 165.5 \pm 0.5 \text{ mm}$  ( $6.516 \pm 0.020 \text{ in}$ ).

Check throttle operation: roller (R) on the accelerator cable lever must be touching the running surface (F) of the gate lever (K). Free travel before the throttle butterfly lever is moved must not exceed 1.5 mm (0.06 in).

If this is not the case, move the throttle actuating mechanism along in its slots (L).

The throttle cable must be free from stresses in the idle position.

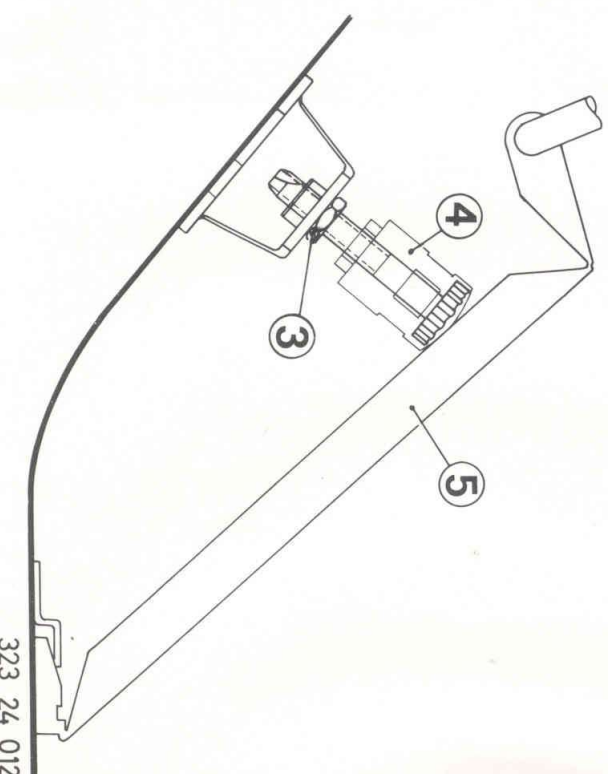
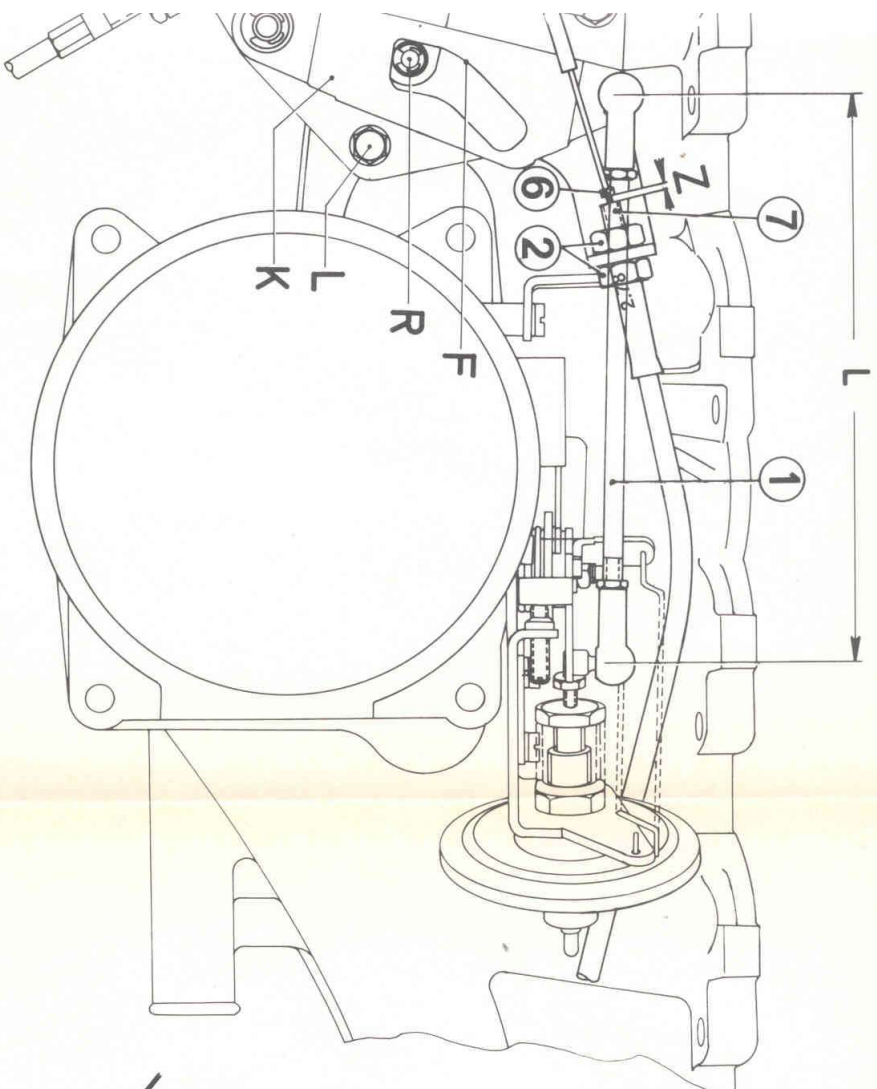
Play at nipple 'S' = 0.5 mm (0.02 in).

With the engine idling (throttle butterfly lifter raised), adjust play (Z) to 0.25...0.75 mm (0.010...0.030 in) with nuts (2). The cable must not hang down slack when this is done.

Slacken nut (3). Screw in the kickdown stop (4).

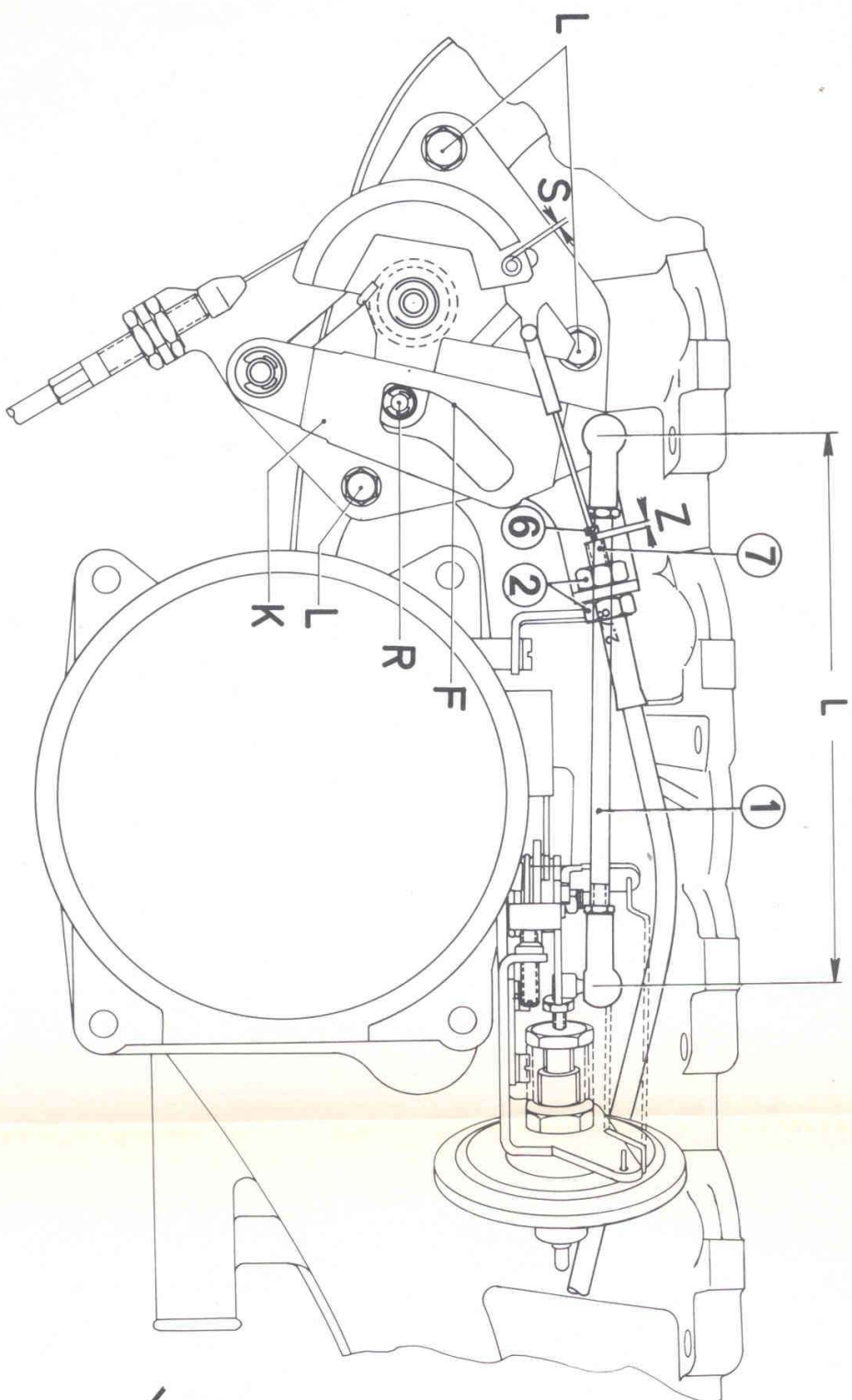
Depress the accelerator pedal (5) until the full-throttle position is obtained (pressure point at transmission). In this position, unscrew the kickdown stop until it is touching the accelerator pedal.

Depress the accelerator pedal (5) fully, to the kickdown position. The distance (Z) from the lead block (6) to the end of the wire cable outer sheath (7) must now be at least 45 mm (1.77 in).

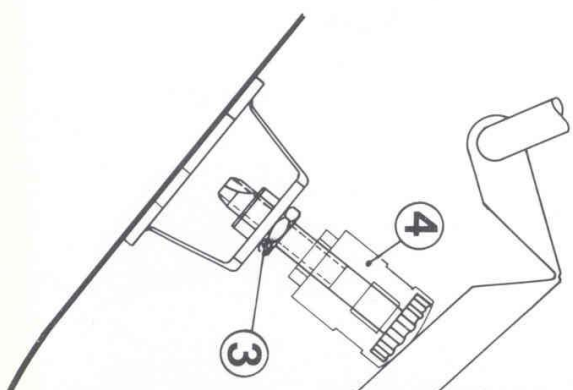


323 24 012

<sup>e</sup> =  $165.5 \pm 0.5$  mm ( $6.516 \pm 0.020$  in).  
 r (R) on the accelerator cable lever must be touching the run-  
 ner (K). Free travel before the throttle butterfly lever is moved  
 in).  
 he throttle actuating mechanism along in its slots (L).  
 he from stresses in the idle position.  
 .02 in).  
 the butterfly lifter raised), adjust play (Z) to  $0.25 \dots 0.75$  mm



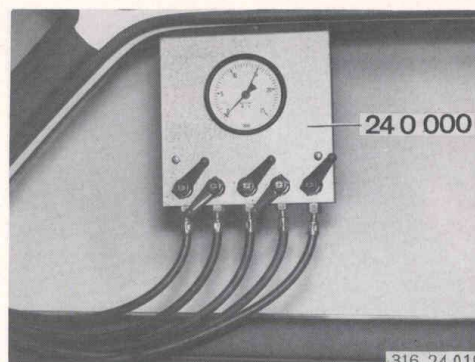
B) Adjusting the throttle cable  
 Check length of pull rod (1).  $L = 165.5 \pm 0.5 \text{ mm}$  ( $6.516 \pm 0.020 \text{ in.}$ ).  
 Check throttle operation: roller (R) on the accelerator cable lever must be touching the run-





### 24 00 009 Hydraulic pressures – checking

Attach the 24 0 000 tester or 13 3 061 together with hose 24 0 021 to the door window.

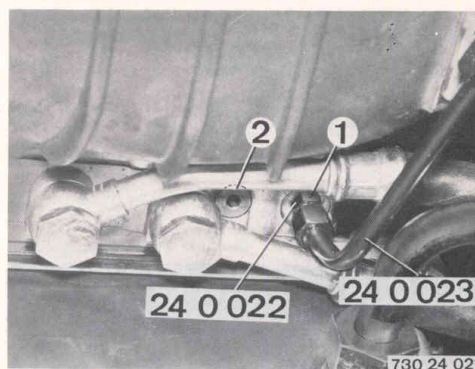


Connect tester 24 0 000 or 13 3 061 in conjunction with hose 24 0 021, and check pressure values.

1 Main pressure:

adapter 24 0 022 and elbow 24 0 023

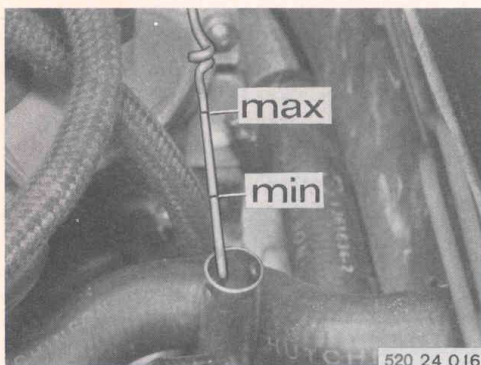
2 Clutch A:



#### Test:

Disconnect accelerator cable, engine speed 1500 min <sup>-1</sup>	Selector lever position	Accelerator cable position
Main pressure <sup>1)</sup> (gauge)	R	Brake pedal applied, handbrake on 1. Idle speed 2. Kickdown
Main pressure <sup>1)</sup>	D, 2, 1, P, N	Brake pedal applied, handbrake on 1. Idle speed 2. Kickdown

<sup>1)</sup> See specifications



*When installing:* Restore automatic transmission fluid level with the transmission at normal operating temperature, the selector lever in position P and the engine running at idle speed.

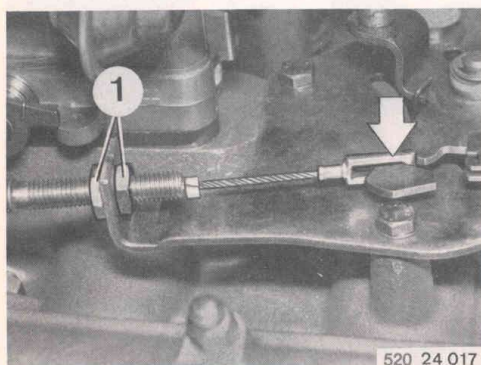
The car should stand on a flat, level surface. If the transmission is at normal operating temperature, the oil level must be between the two dipstick marks.

The quantity of oil represented by the space between the MIN and MAX marks is approx. 0.4 liter (0.42 US quart, 0.7 Imp. pint).

Wipe the dipstick with a non-fluffy cloth.

**Warning:** If automatic transmission fluid level is too high, serious foaming and splash losses will occur and the transmission will overheat when the car is driven fast.

If the fluid level is too low, the valves will chatter, foaming will occur and the engine will overspeed when the car is cornered.

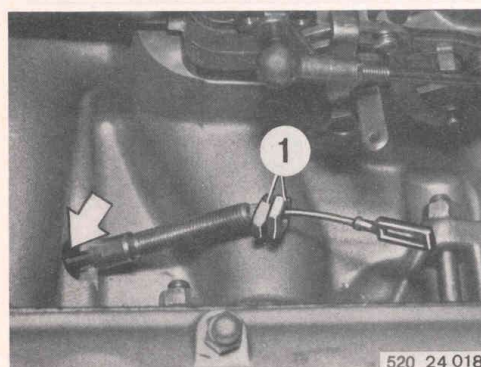


#### 24 00 020 Transmission – removing and installing

Loosen nuts (1).

Disconnect the throttle cable.

*When installing:* Adjust throttle cable – see 24 00 004.



Unscrew nuts (1). Pull throttle cable down through hole on intake manifold.



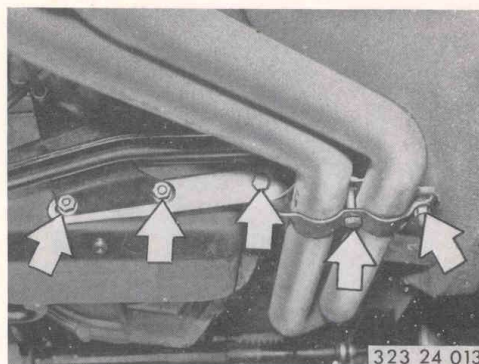
**Drain the oil.**

*Warning: Do not re-use old oil.*

*When installing: If the oil has a burnt smell and is discolored black, the transmission must be stripped. If the oil has a metallic grey tinge, it contains either aluminium or iron abraded particles. Aluminium, unlike iron, is not trapped by the magnetic drain plug.*

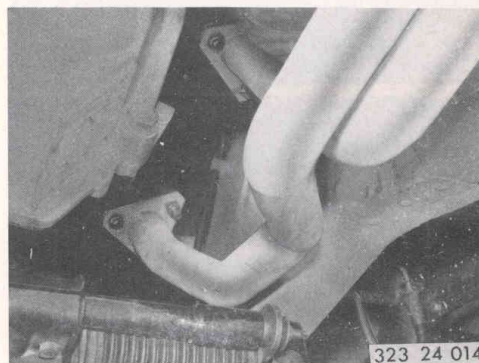
*Warning: If the transmission is defective in this way, blow through the oil cooler and pipes with compressed air and flush out twice with ATF. Detach the exhaust pipe holder.*

*When installing: relieve stresses in exhaust pipe holder.*

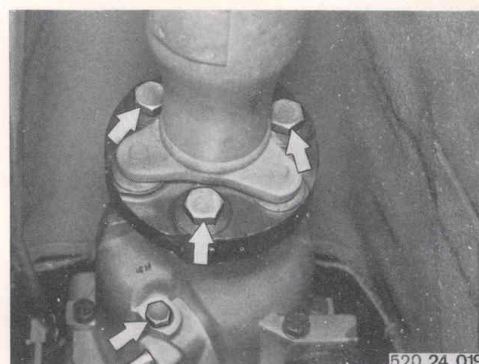


**Detach exhaust pipe from exhaust manifolds.**

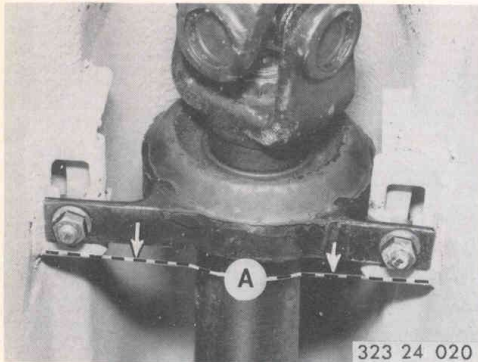
*When installing: Check gaskets and renew if necessary.*



**Detach propeller shaft from transmission.  
Remove speedometer shaft.**







**Detach center bearing.**

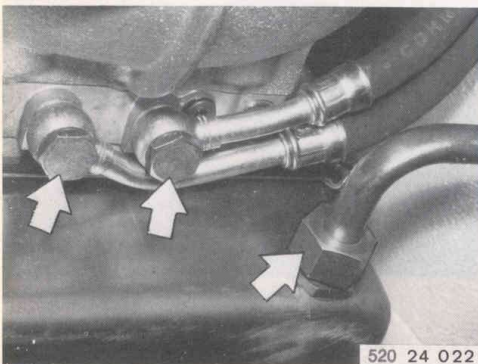
*When installing:* Preload center bearing 2 mm (0.08 in) forwards (A).



**Compress propeller shaft halves at sliding joint, hinge down and pull away from centering journal.**

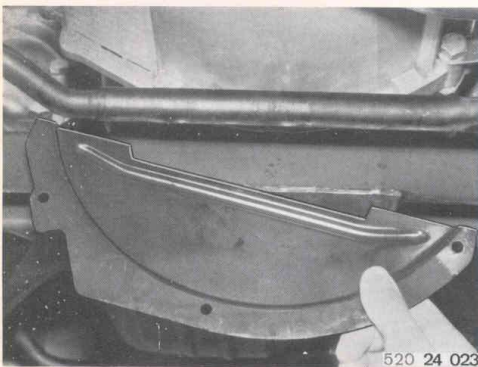
**Detach shift rod (3) from selector lever.**

*When installing:* adjust selector lever – 24 00 004.



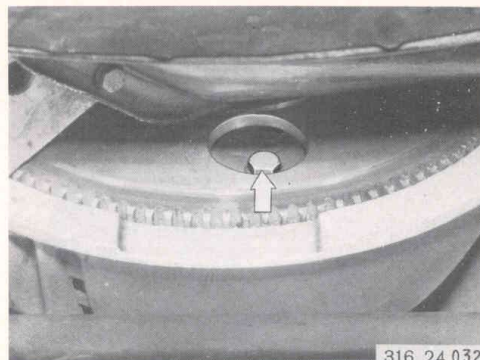
**Detach oil filler pipe.**

**Detach oil cooler lines at transmission.**



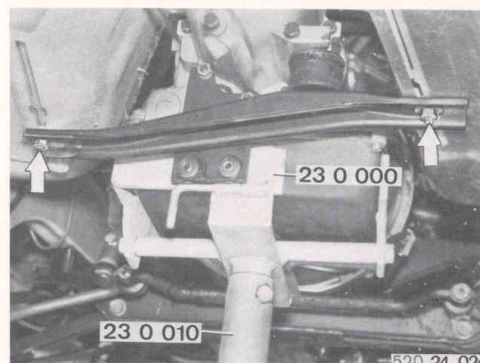
**Remove cover plate.**

Detach the torque converter from the driving disc at four points.  
Turn the engine over while doing this.



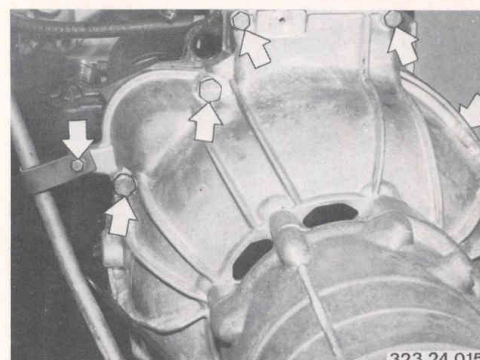
316 24 032

Support transmission with adapter 23 0 000 in conjunction with support tube 23 0 010.  
Detach cross-member from body.



520 24 024

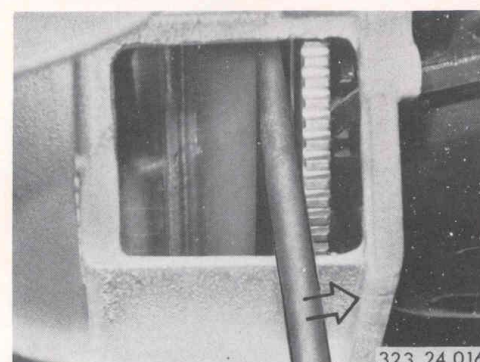
Lower transmission as far as front axle beam.  
Remove retaining bolts at transmission.



323 24 015

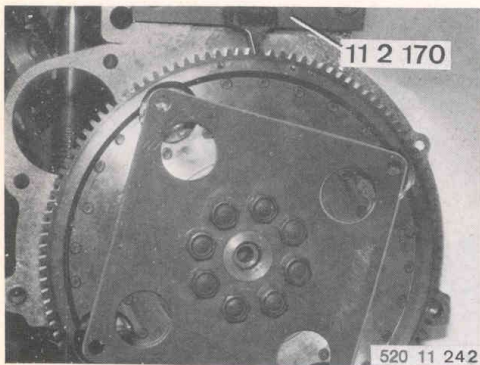
Lift out the protective grille.  
Pull the transmission away from the engine, pressing the torque converter off at the same time.

**Warning:** Before installing, check correct position of torque converter.



323 24 016



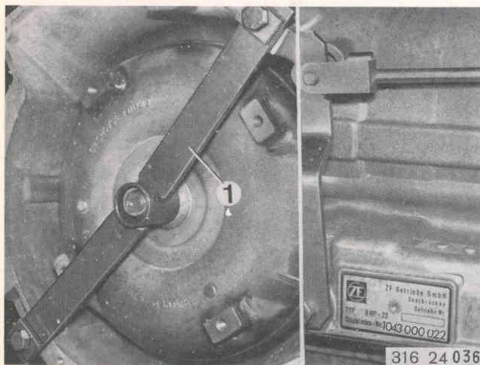


*When installing:* Examine driving disc for fractures or cracking, and renew if necessary. Prevent flywheel from turning with holder 11 2 170.

Remove the expansion bolts.

*Warning:* Never re-use expansion bolts; install new bolts with Loctite Ref. No. 270.

Make sure the tapped holes are absolutely clean.



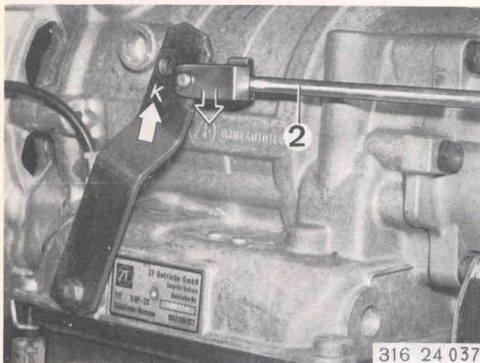
#### 24 00 040 Exchange transmission – installing

Remove the transmission – 24 00 020.

*Warning:* Before installing an exchange transmission, always blow through the oil cooler and pipes with compressed air and flush out twice with ATF.

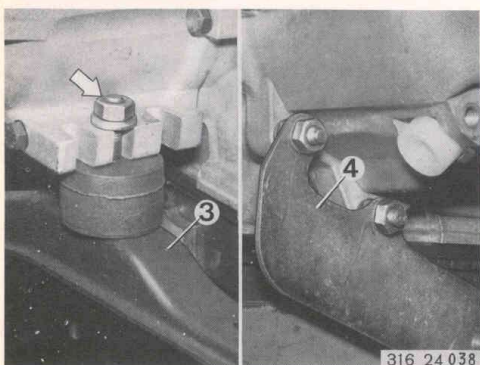
Note transmission code<sup>1)</sup> on type plate.

Detach the transit bar (1).



Transfer selector rod (2) to new transmission.

*When installing:* Connect selector rod (2) to unmarked hole (no code letter) on selector lever. Insert clamp spring from the top downwards.



Transfer cross-member (3) and exhaust pipe holder (4) to new transmission.

<sup>1)</sup> See specifications



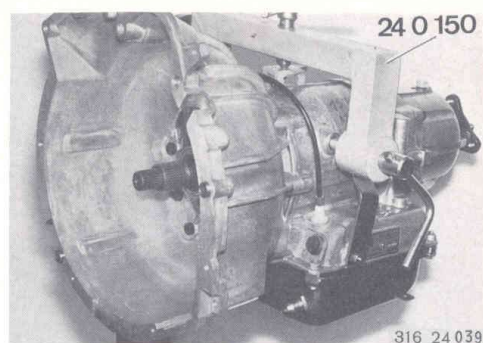
**24 00 080 Transmission – stripping and assembling**

Remove the transmission – 24 00 020.

Remove the torque converter – 24 40 000.

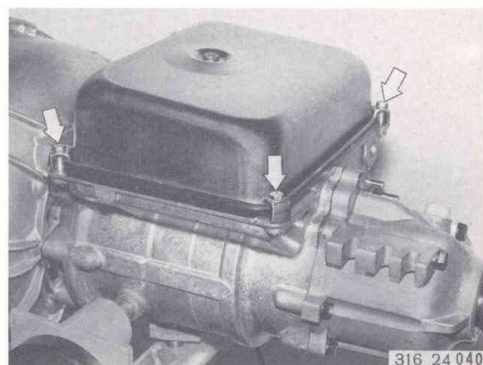
Attach transmission to hanger 24 0 150 in conjunction with assembly stand.

*Warning:* Do not overtighten clamp bolts or transmission casing will be distorted.

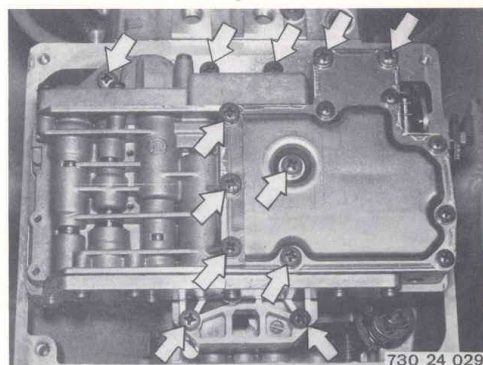


**A) Stripping**

Detach the oil pan.

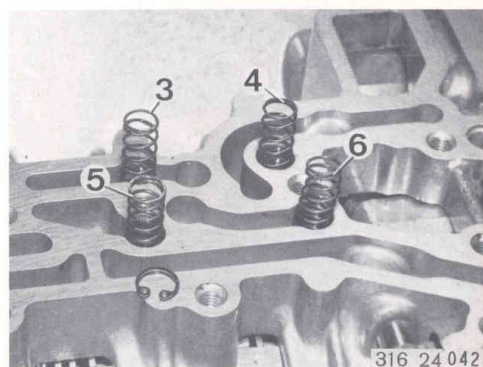


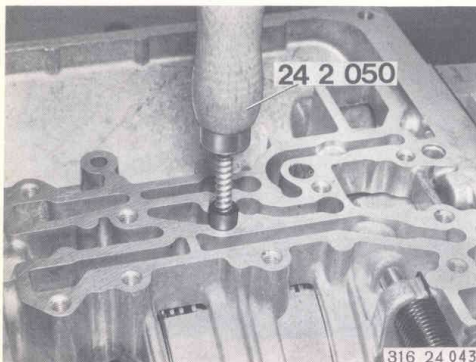
Remove the control unit.



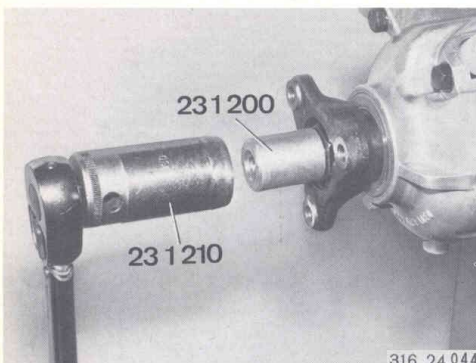
Extract the circlips.

Remove coil springs (3 to 6).

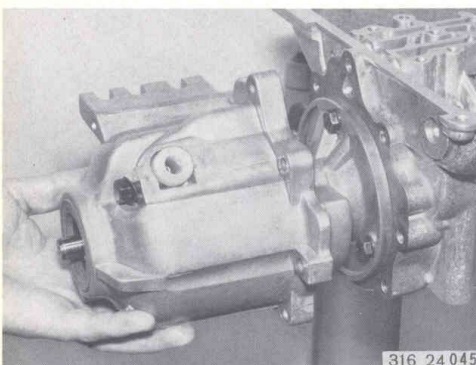




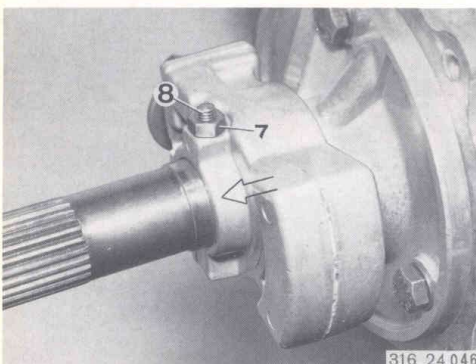
Extract the sealing sleeves with special tool 24 2 050.



Engage the parking lock.  
Mount guide bushing 23 1 200.  
Remove shouldered nut with socket head 23 1 210.  
Pull off the output flange.



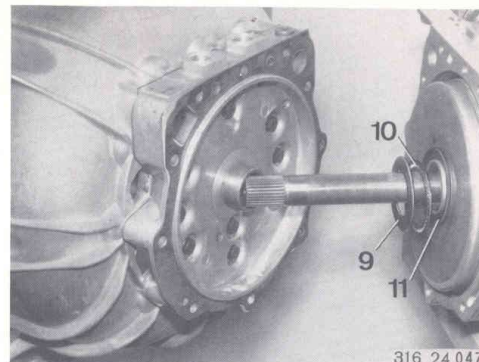
Detach the exhaust pipe support.  
Detach the transmission extension.



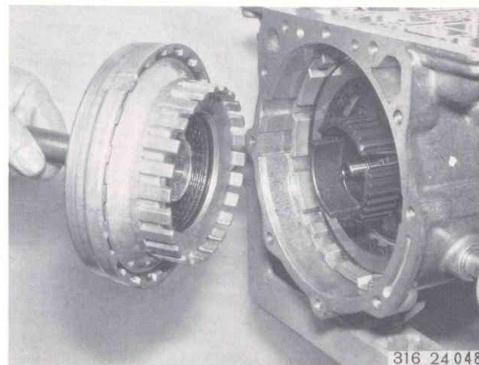
Loosen nut (7) and unscrew stud (8) by approx. 3 turns.  
Pull off the governor.

**Detach converter dome with intermediate plate.**

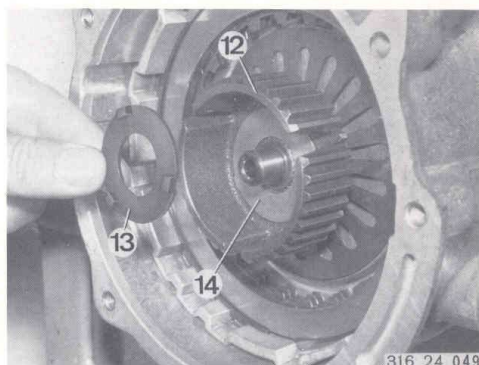
**Warning:** Note thrust washer (9), needle roller bearing (10) and angled disc (11).



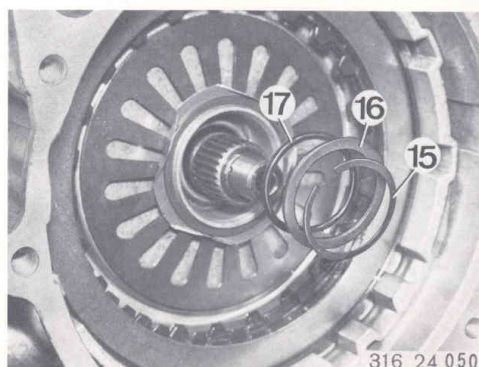
**Remove input shaft with clutch A.**



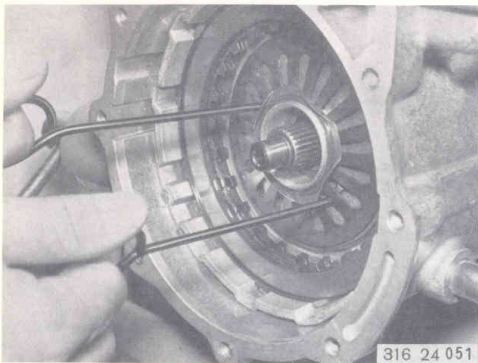
**Remove plate carrier (12) for clutch A, with thrust washer (13) – plastic – and thrust washer (14) – metal.**



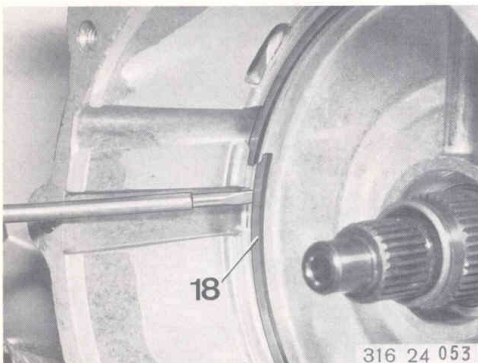
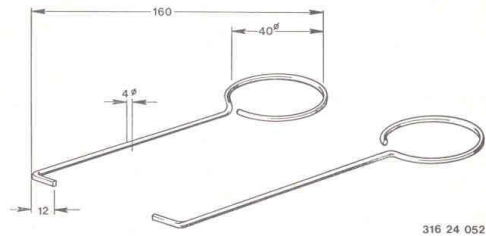
**Extract circlip (15).**  
**When clutch B is removed, cover disc (16) and sealing ring (17) will also be pulled out.**



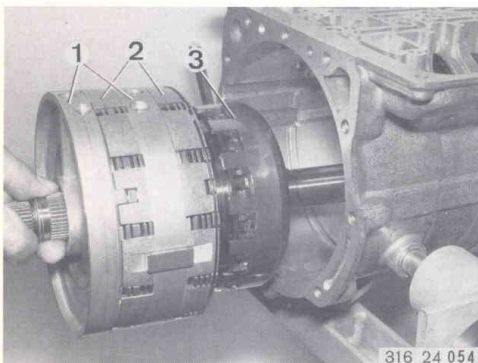




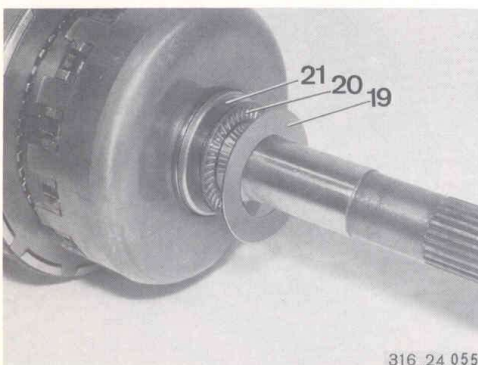
Pull out clutch B with two wire hooks made up in your own workshop.  
Sketch for making up hooks (dimensions in millimeters):



Extract snap ring (18).

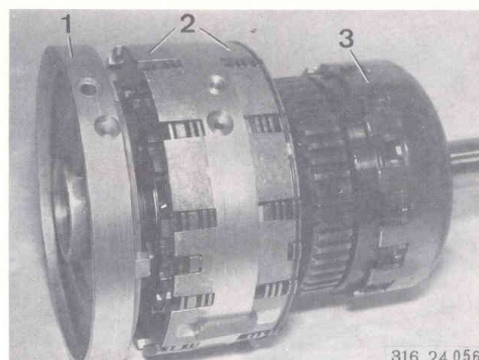


Pull out the complete cluster:  
centering plates (1), clutches C', C and D (2) and planetary gear set with output shaft (3).



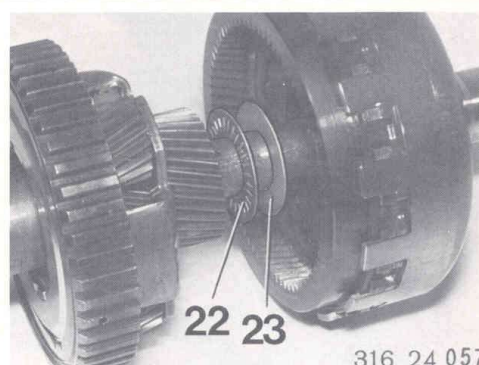
**Warning:** Note thrust washer (19), needle roller bearing (20) and angled disc (21).

Pull off centering plate (1) and clutch cluster (2) with clutches C', C and D from output shaft (3).

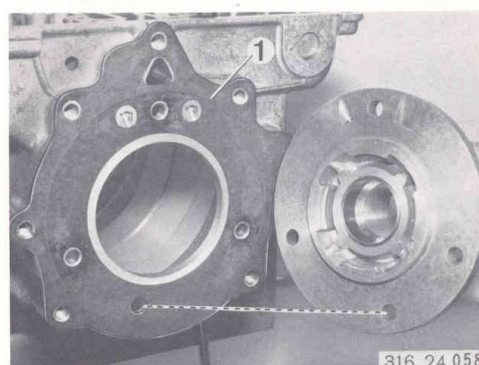


Remove planetary gear set with sun wheel shaft.

*Warning:* Note needle roller bearing (22) and thrust washer (23).

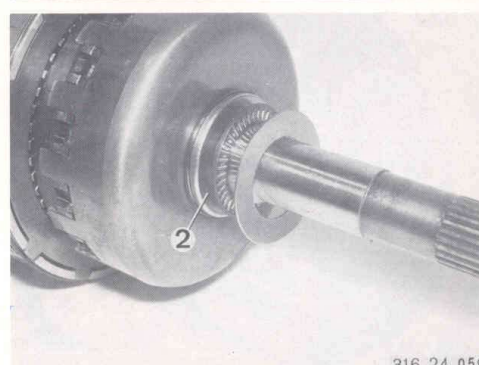


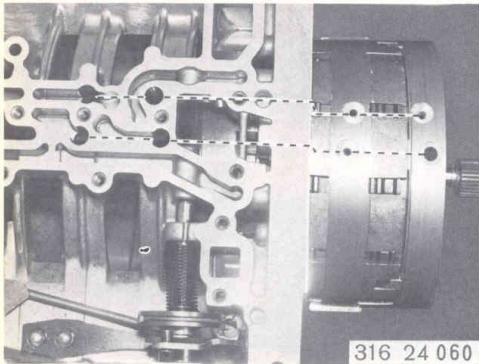
**B) Assembling**  
Detach the governor flange.  
Use a new gasket (1).



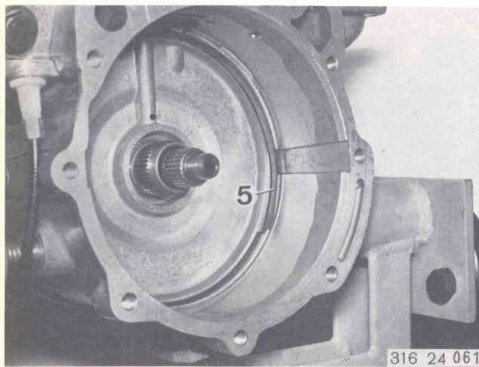
Attach the angled disc (2) with grease, so that the angled-away side is against the output shaft.

Place the needle roller bearing and the thrust washer on the output shaft.

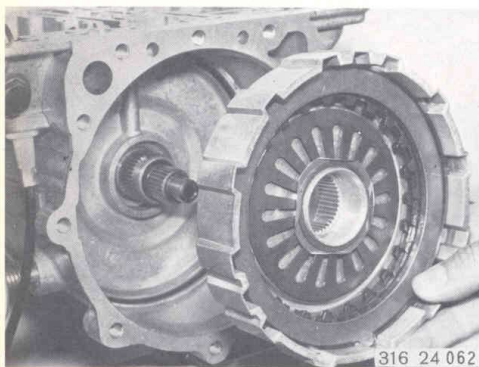




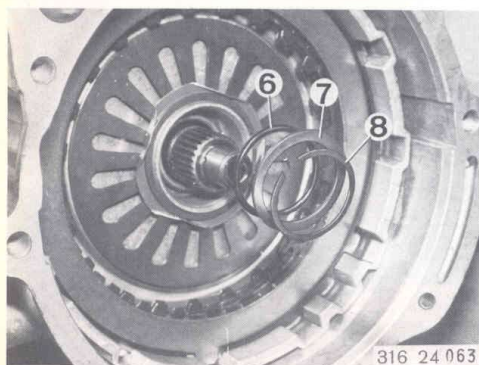
**Note:** The keys must be in the center of the slot in the cylinder. The parking lock pawl must not be engaged. Insert the complete output side cluster into the transmission housing so that the 4 oil holes coincide with the holes in the underside of the transmission housing.



**Insert the snap ring (5).**



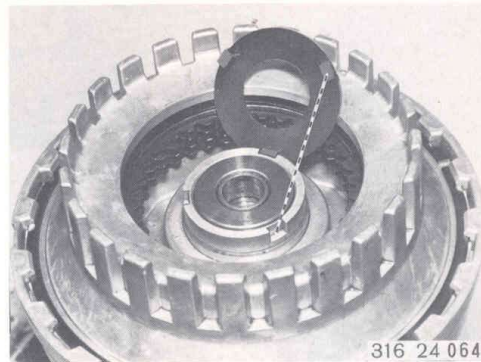
**Install clutch B.**



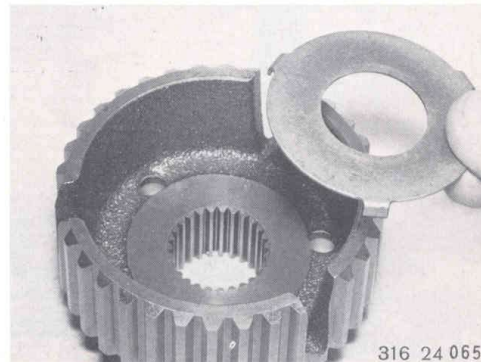
**Insert sealing ring (6) and press in fully with thrust washer (7).  
Insert circlip (8).**



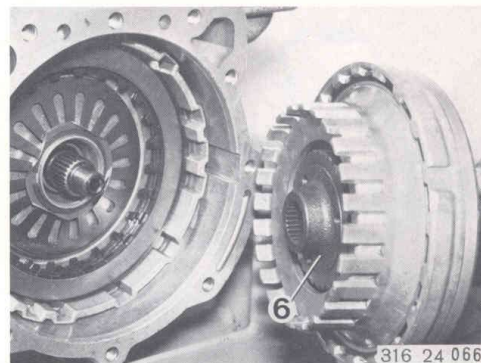
**Attach the plastic thrust washer with grease so that the lugs engage in the cutouts on cylinder A.**



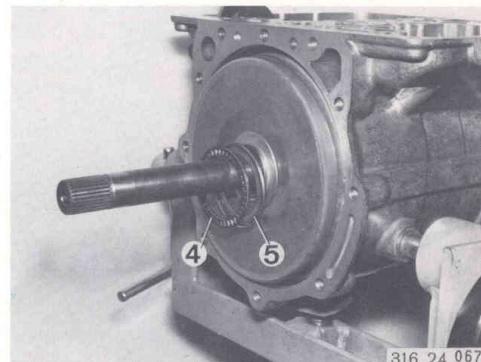
**Attach the metal thrust washer with grease inside the plate carrier.**

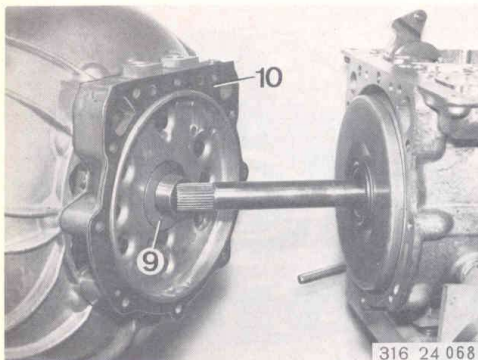


**Install the plate carrier (6) in clutch A, turning it backwards and forwards slightly while inserting. Insert clutch A in the transmission housing.**

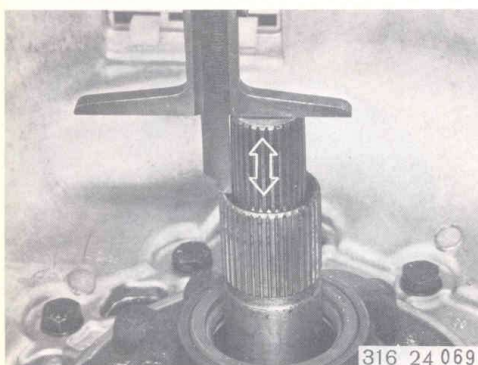


**Attach angled disc (5) to the input shaft with the shoulder towards needle roller bearing (4).**

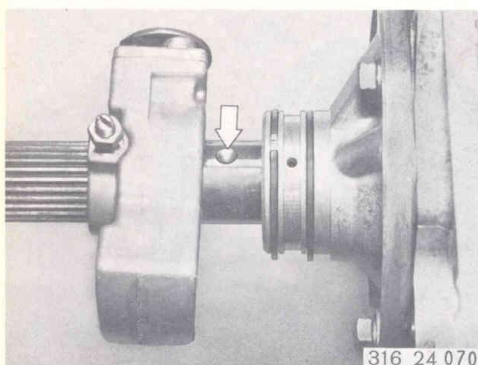




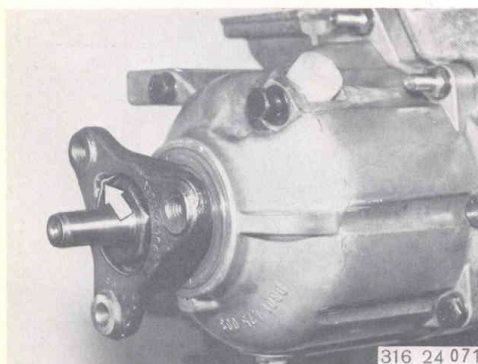
Attach thrust washer (9) and gasket (10) to converter dome with a little grease. Push the converter dome on to the input shaft, and secure.



Check input shaft endplay.  
Desired value: 0.3 ... 1.5 mm (0.0012 ... 0.060 in).



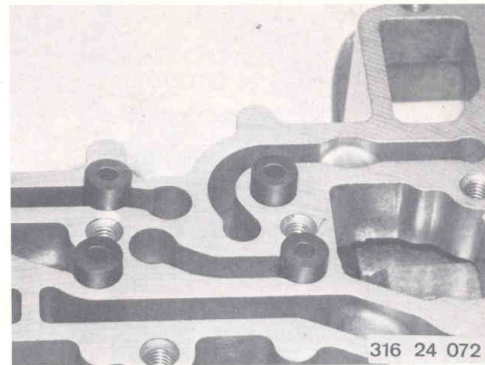
Compress piston rings slightly and at the same time push the governor on to the governor flange.  
Unscrew the setscrew to simplify location of the recess in the output shaft.  
Secure governor with setscrew in recess on output shaft and prevent from moving with a centerpunch mark.



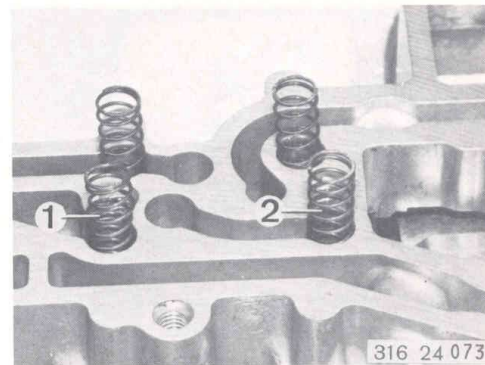
Pack the radial sealing ring lips with grease. Attach the transmission extension and output flange. Coat the shouldered nut with Curil K2 or Loctite 572 before installing. Engage the parking lock and tighten the nut<sup>1)</sup>. Place keeper plate on nut and secure in groove on output flange.

<sup>1)</sup> See specifications

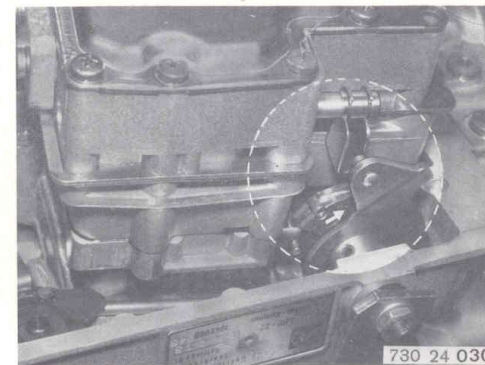
Drive the 4 sealing sleeves fully in with a suitable drift.



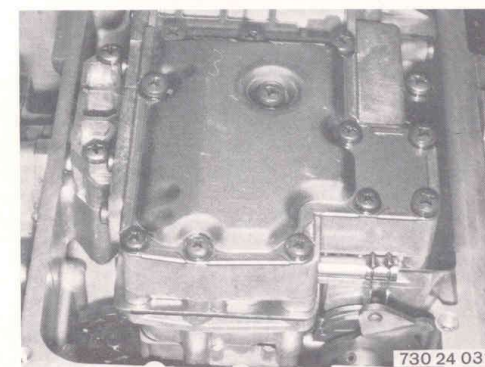
Insert and secure the coil springs. The two shorter springs (1 and 2) are at the selector lever side.



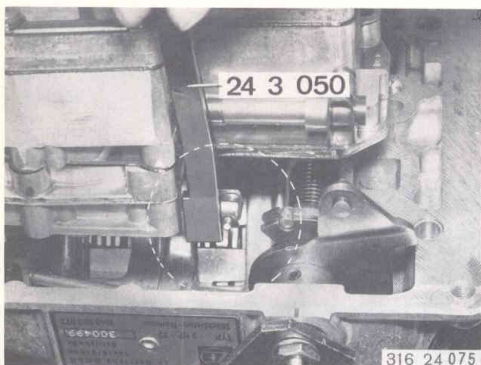
Attach the control unit so that the clip on the selector slide valve can be engaged with the actuating finger of the pawl. To do this, pull up the wire cable slightly so that the throttle cam stays clear of the throttle pressure valve.



Screw on the control unit without tightening.



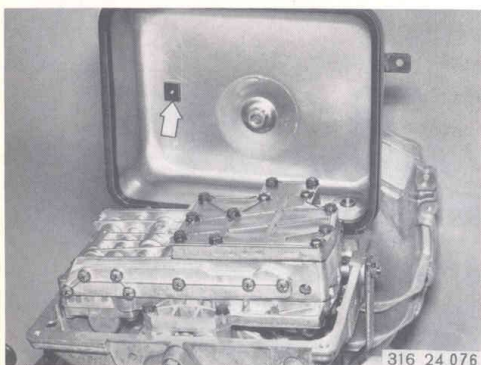




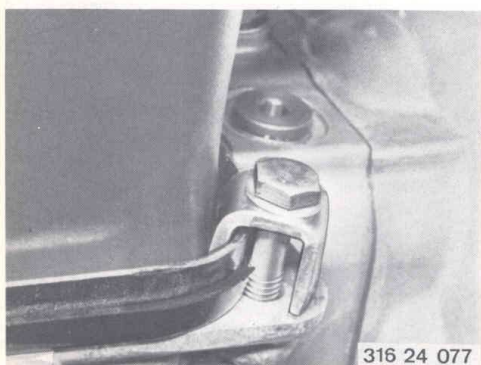
Align the control unit with gauge 24 3 050. If no gauge is available, the distance from the control unit casing to the peg in the throttle pressure plunger must be 11.5 mm (0.453 in). Tighten the control unit in this position.

With 'Torx' screws:

Tighten them with insert 002 100 and torque wrench 002 050.<sup>1)</sup>



Place the gasket on the oil pan joint face. Insert the magnetic disc. Installed position: next to oil strainer.



Bolt down the oil pan with its retaining brackets. The shorter arm of the retaining bracket presses against the oil pan.

<sup>1)</sup> torque see Specifications

### 24 11 000 Oil pan – removing and installing

**Drain the oil (ATF).**

**Warning:** Do not re-use old oil.

**When installing:** If the old oil smells burnt or is discolored black, the transmission must be stripped and inspected. If the oil has a metallic gray tinge, it contains abraded aluminum or ferrous particles. Note that unlike iron or steel, aluminum is not trapped by the magnet.

Place the car on a flat, level surface.

Restore fluid level with selector lever at P, transmission at normal operating temperature and engine idling.

With the engine at normal operating temperature, the oil level must be between the two marks on the dipstick.

The quantity of oil between the minimum and maximum marks on the dipstick is app. 0.4 liter (0.71 Imp. pint, 0.42 US quart).

If the oil level is too high, severe foaming will result, oil will be lost through agitation and the temperature will rise excessively when driving fast.

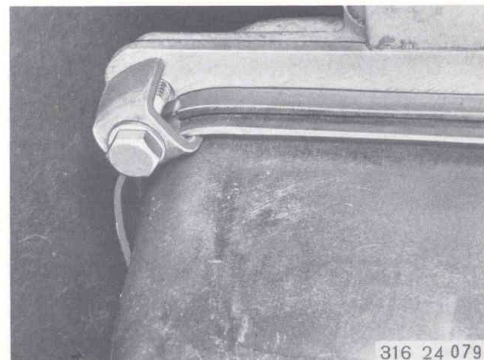
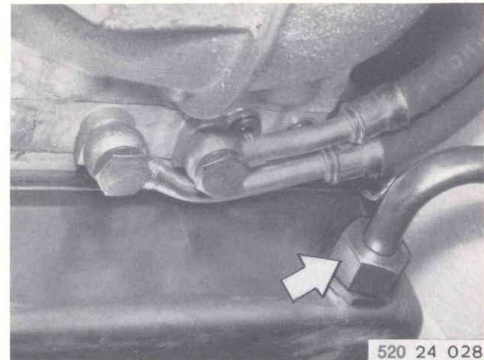
If the oil level is too low, the valves will chatter in the transmission, foaming will occur and the engine will overspeed.

Detach the oil filler pipe from the oil pan.

Detach the oil pan.

**When installing:** Secure oil pan with retaining brackets; the shorter arm of the brackets presses against the oil pan.

**Warning:** Insert the magnetic disc (1) next to the oil strainer in the oil pan. Attach gasket (2).



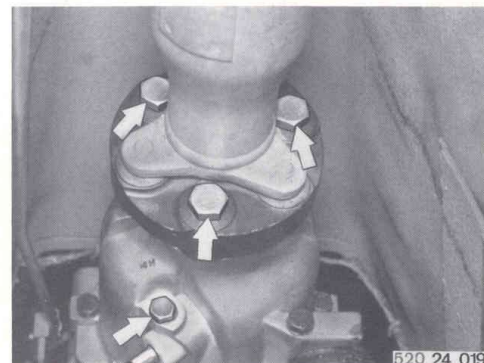
### 24 11 050 Transmission cover – removing and installing/sealing

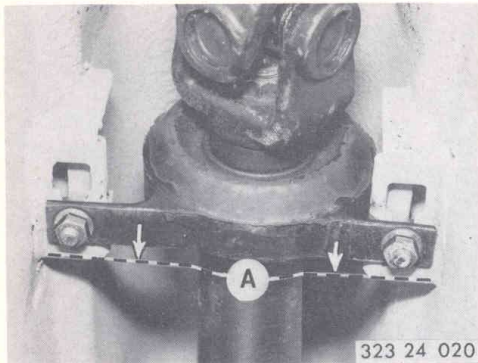
Detach the exhaust pipe support and the exhaust pipes at the exhaust manifolds.

**When installing:** Attach exhaust pipe support so that no stresses are trapped.

Detach propeller shaft from gearbox.

Remove speedometer shaft.



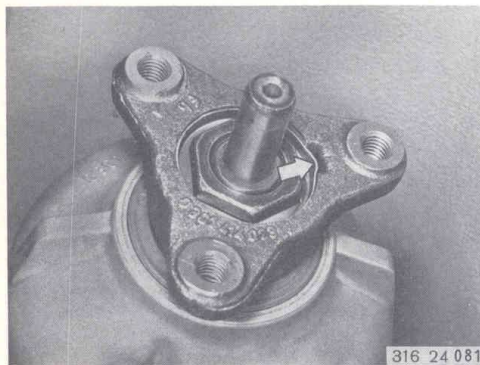


**Detach center bearing.**

*When installing:* **Preload center bearing forwards (A) by 2 mm (0,08 in).**

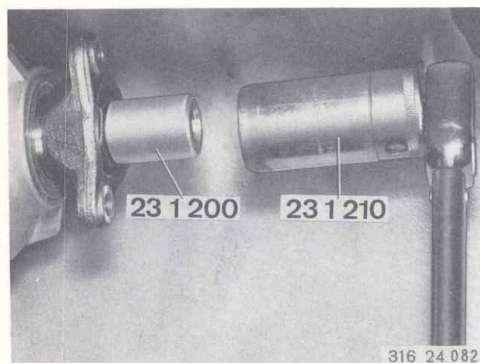


**Compress propeller shaft sections together at sliding joint, hinge down and pull away from centering journal.**



**Lift out keeper plate.**

*When installing:* **Drive keeper plate into groove on output flange.**



**Engage the parking lock.**

**Mount guide bushing 23 1 200.**

**Remove shouldered nut<sup>1)</sup> with socket head adapter 23 1 210.**

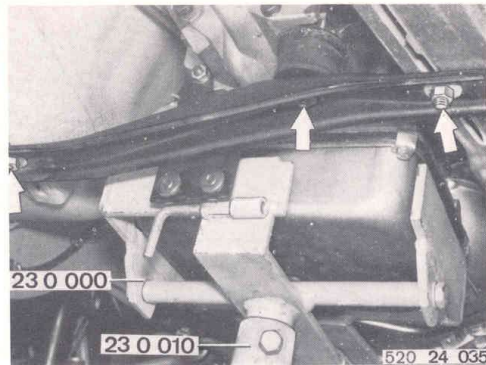
**Pull off output flange.**

*When installing:* **apply Curil K 2 or Loctite 572 to shouldered nut.**

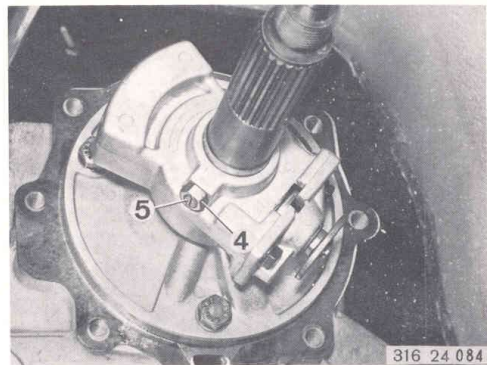
<sup>1)</sup> See specifications



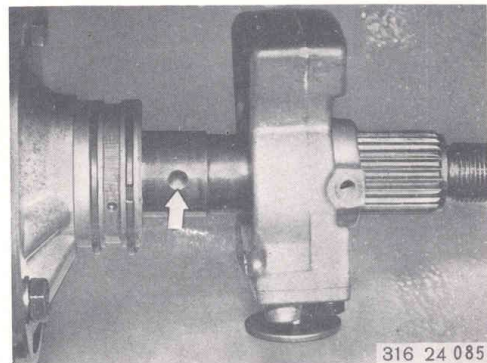
Support transmission with adapter 23 0 000 in conjunction with tube 23 0 010.  
Remove cross-member.  
Lower transmission.  
Take off transmission cover.



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

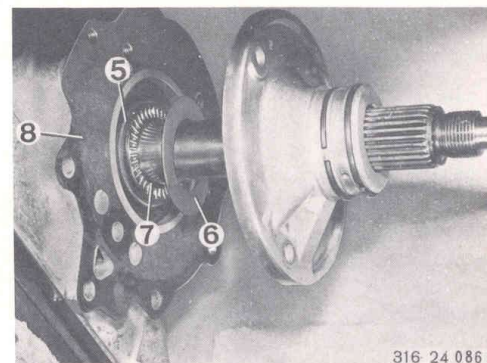


*When installing:* Compress the piston rings slightly, and at the same time push the governor on to the governor flange. To help in locating the recess in the output shaft, remove the stud. Secure the governor in the recess on the output shaft with the threaded stud, and prevent from moving with a centerpunch mark.



Detach the bearing flange.

*Note:* angled disc (5), thrust washer (6) and needle roller bearing (7). Renew gasket (8).



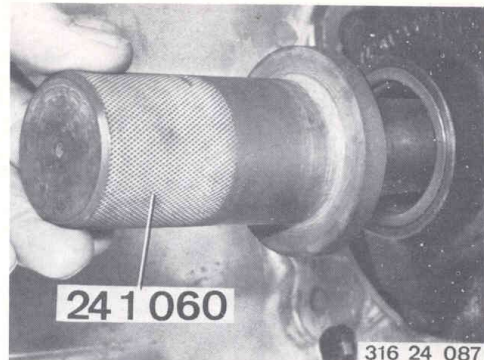
**24 12 001 Radial sealing ring for torque converter – renewing**

Remove (install) the torque converter – 24 40 000.

Extract the radial sealing ring.

*When installing:* Pack the cavity between the sealing lips with grease.

Drive the radial sealing ring in until firmly seated with drift 24 1 060.

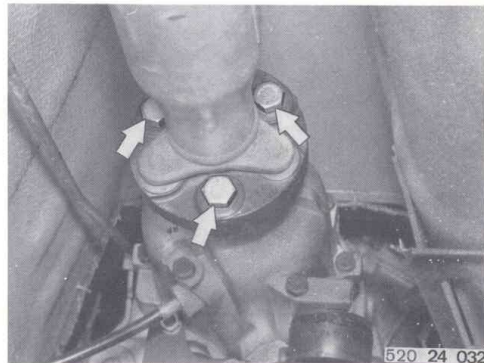


**24 12 011 Output flange radial sealing ring – renewing**

Detach exhaust pipe support and exhaust pipes from exhaust manifold.

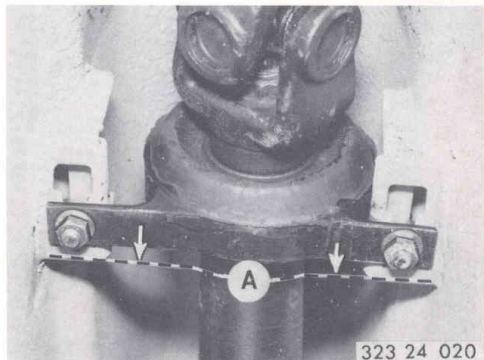
*When installing:* relieve trapped stresses in exhaust pipe support.

Detach propeller shaft from transmission.



Detach center bearing.

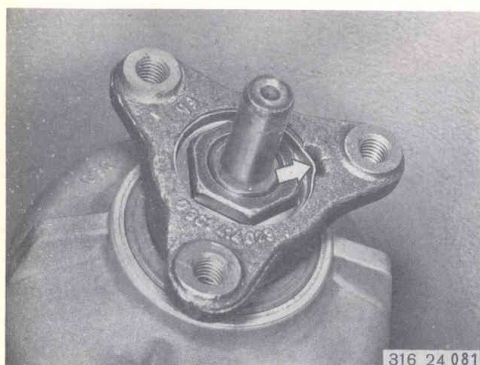
*When installing:* Preload the center bearing forwards (A) by 2 mm (0.08 in).



Compress the propeller shaft together at the sliding joint, hinge down and pull away from centering journal.

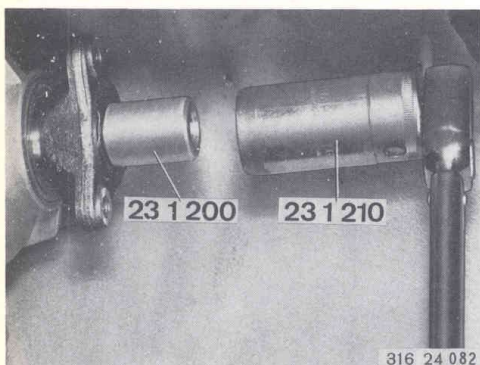






**Extract the keeper.**

*When installing:* Drive keeper into groove on output flange.



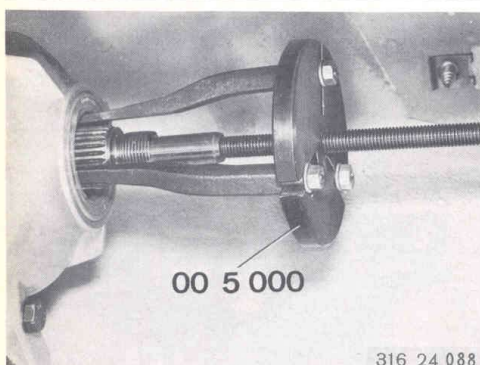
**Engage the parking lock.**

**Mount guide bushing 23 1 200.**

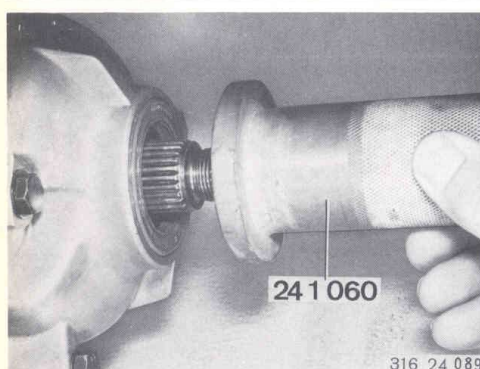
**Remove shouldered nut<sup>1)</sup> with socket head 23 1 210.**

**Pull off the output flange.**

*When installing:* Coat shouldered nut with Curil K 2 or Loctite 572.



**Remove the radial sealing ring with extractor 00 5 000.**



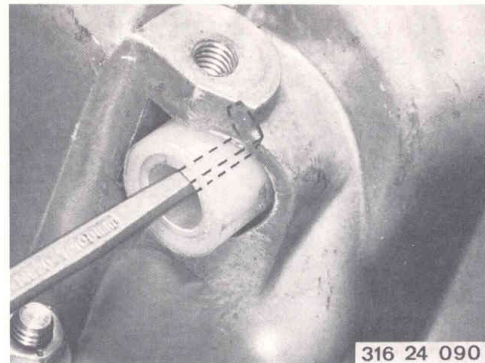
*When installing:* Pack the cavity between the sealing lips with grease. Drive in the radial sealing ring until firmly seated with drift 24 1 060.

<sup>1)</sup> See specifications

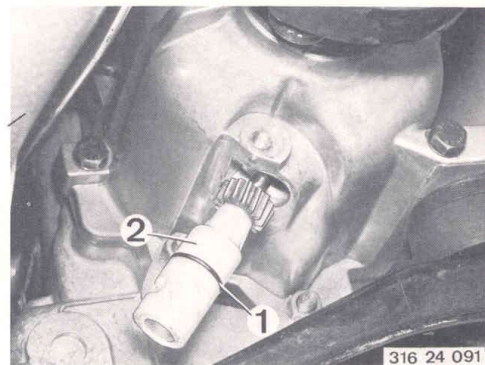


**24 12 031 O-ring for speedometer drive shaft bushing – renewing**

Detach the speedometer drive shaft.  
Pull out the speedometer shaft bushing with an angled screwdriver.



Renew the O-ring (1).  
If the radial sealing ring is leaking, the speedometer shaft bushing (2) must be renewed.

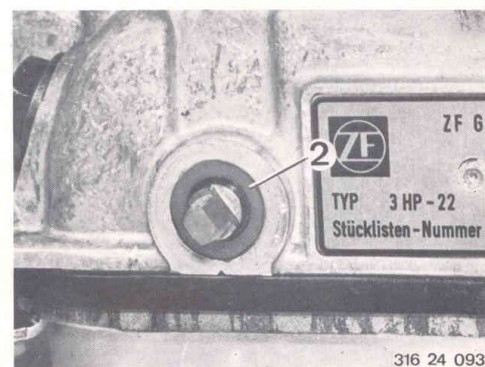


**24 12 101 Radial sealing ring for manual shift valve shaft – renewing**

Detach selector lever (1) from transmission.



Extract the radial sealing ring (2).  
When installing: Drive the radial sealing ring in until flush.



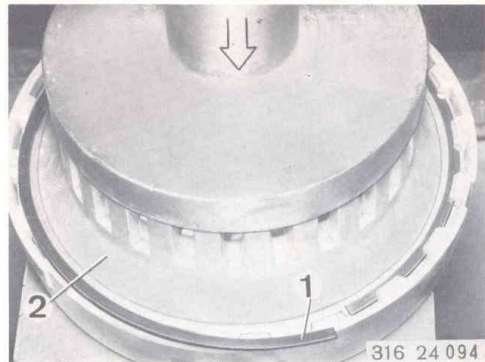
**24 23 020 Plate clutches and disc brakes – renewing**

**Strip the transmission – 24 00 080.**

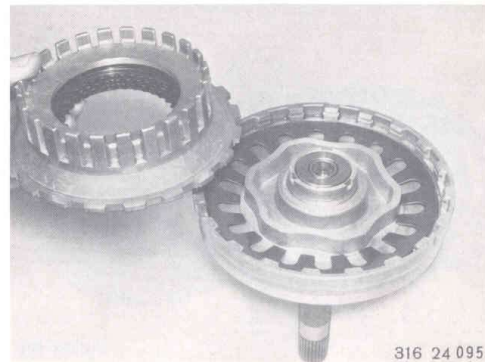
**Clutch A**

**Compress the clutch plates and extract snap ring (1).**

**Take off plate carrier (2).**



**Lift out the plate cluster and the diaphragm spring.**



**Installation order:**

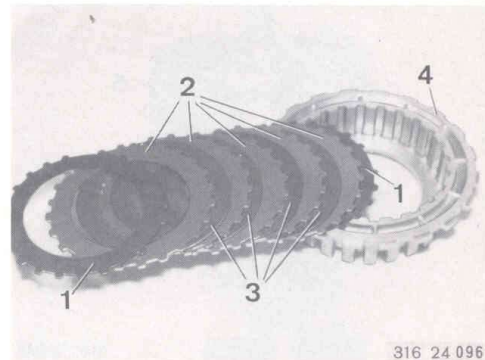
**1 Corrugated outer plates**

**2 Outer plates**

**3 Lined plates**

**4 Plate carrier**

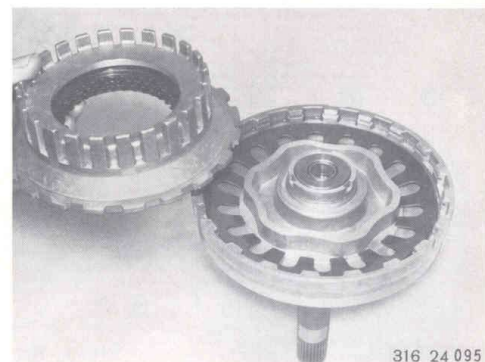
**When installing: Place new lined plates in ATF at 70°C for approx. 20 minutes.**

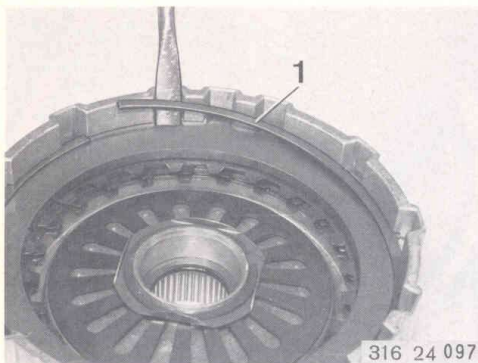


**Place diaphragm spring in input shaft housing with convex side down.**

**Insert plate cluster with plate carrier.**

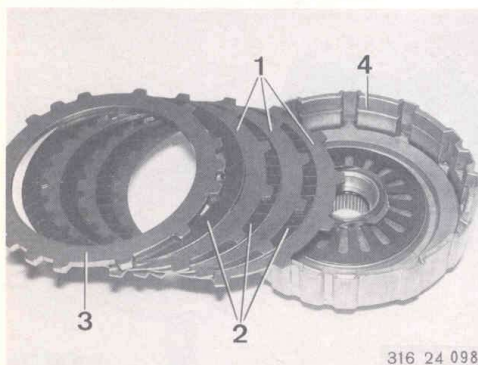
**Compress the clutch plates and insert the snap ring.**





#### Clutch B

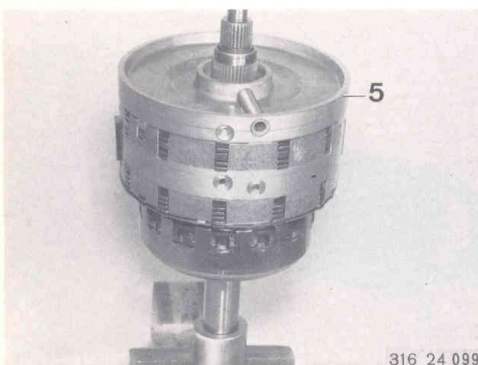
Extract the snap ring (1).  
Remove outer and lined plates.



#### Installation order:

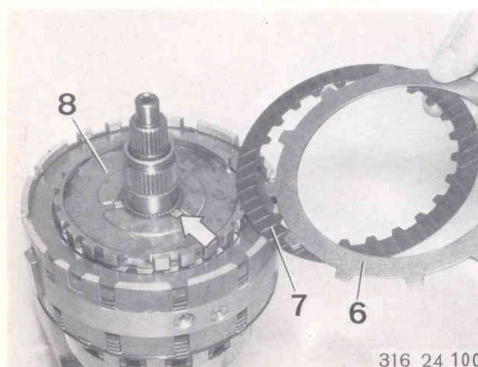
- 1 1.8 mm (0.071 in) outer plates – 3
- 2 Lining plates – 3
- 3 4.5 mm (0.177 in) outer plate – 1
- 4 Housing

*When installing:* Place new lined plates in ATF at 70°C for approx. 20 minutes.



#### Clutch C'

To simplify assembly, place the complete cluster in a pipe of 29 mm (1.14 in) inside diameter, and clamp into vise.  
Take off centering plate (5).



Remove outer plate (6), lining plate (7) and freewheel (8) for 2nd speed range.

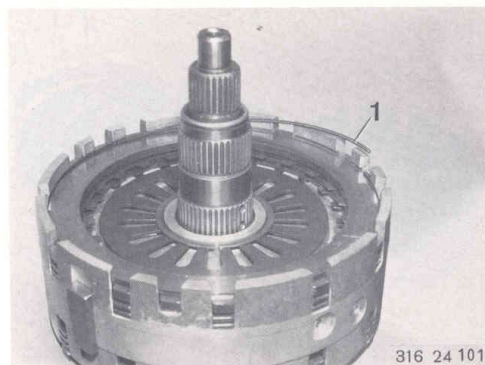
*When installing:* Install freewheel (8) with the bent-over lugs of the retaining plate visible on top.

Place new lined plates in ATF at 70°C for approx. 20 minutes.



### Clutch C

Extract the snap ring (1).



Remove the plates.

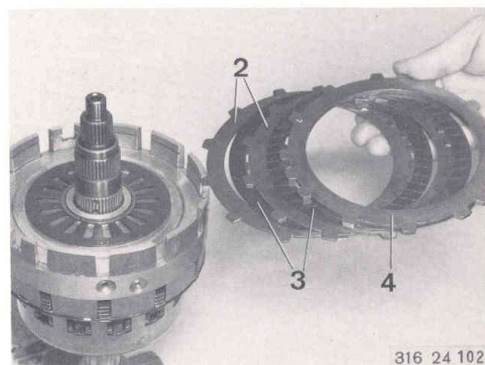
Installation order:

2 1.8 mm (0.071 in) outer plates – 2

3 Lining plates – 2

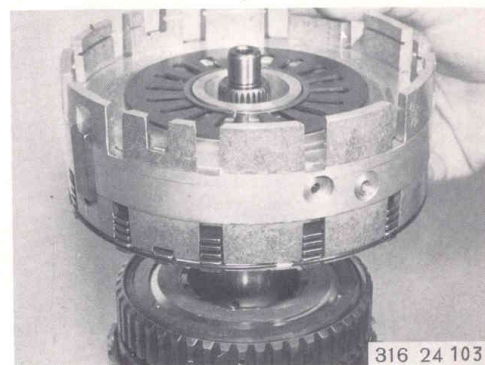
4 4.5 mm (0.177 in) outer plate – 1

When installing: Place new lined plates in ATF heated to 70°C for approx. 20 minutes.

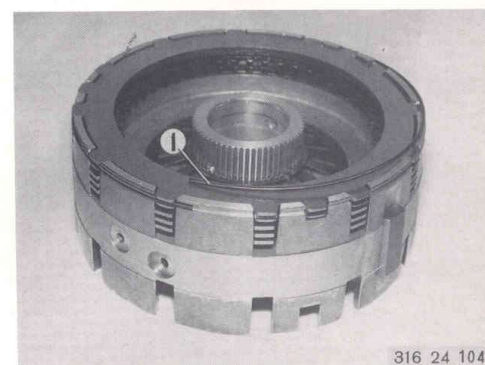


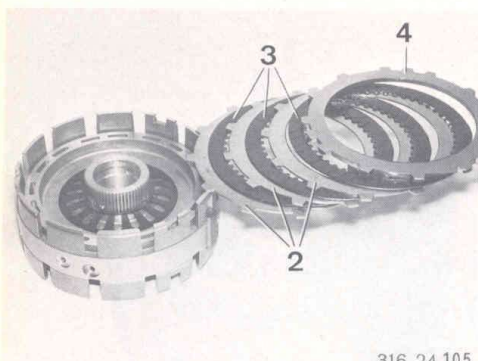
### Clutch D

Separate clutch body with clutch D from planetary gear set.



Extract the snap ring (1).





316 24 105

**Lift out the plate cluster.**

**Installation order:**

**2 1.8 mm (0.071 in) outer plates – 3**

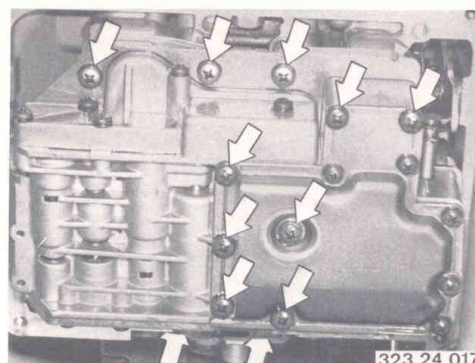
**3 Lining plates – 3**

**4 4.5 mm (0.177 in) outer plate – 1**

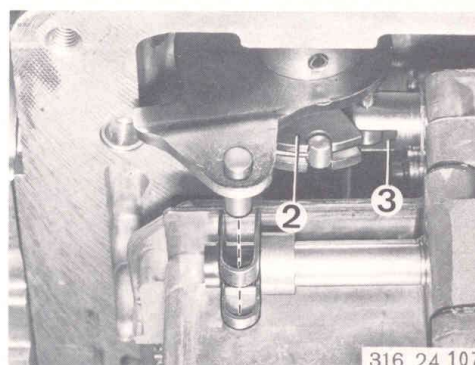
**When installing: Place new lined plates in ATF heated to 70°C for approx. 20 minutes.**

### 24 30 000 Control unit – removing and installing

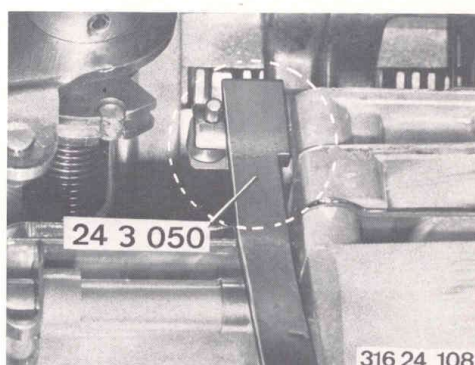
Take off the oil pan – 24 11 000.  
Remove the control unit.



*When installing:* Attach the control unit so that the clip on the selector slide valve can be engaged in the actuating finger of the pawl. To do this, pull up the transmission Bowden cable slightly so that the throttle cam (2) is clear of the throttle pressure valve (3).



Screw on the control unit but do not tighten. Align control unit with gauge 24 3 050. If no gauge is available, the distance from the control unit casing to the peg in the throttle pressure plunger must be 11.5 mm (0.453 in). Tighten the control unit down in this position. With 'Torx' screws: Tighten them with insert 002 100 and torque wrench 002 050.<sup>1)</sup>



### 24 30 001 Control unit – renewing

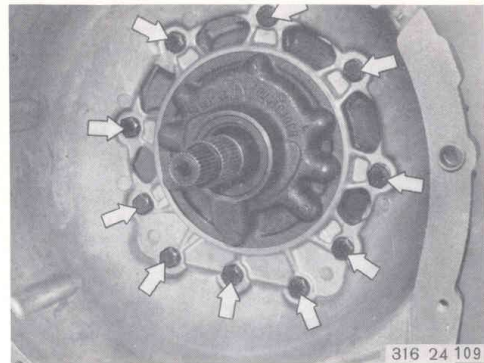
Work stages are identical with "Control unit – renewing and installing" – 24 30 000.

<sup>1)</sup> torque see Specifications

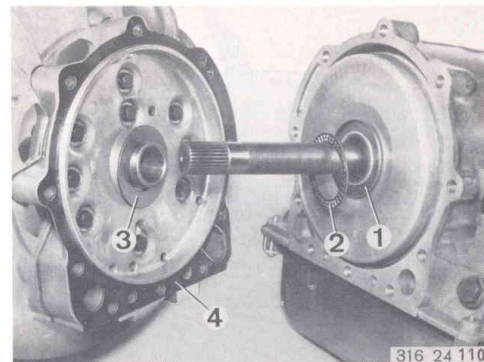


**24 31 000 Primary pump – removing and installing**

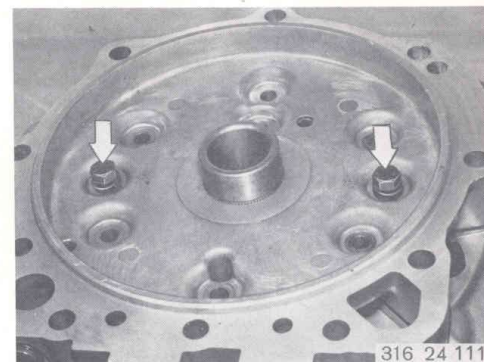
Remove torque converter – 24 40 000.  
Detach converter dome with intermediate plate.



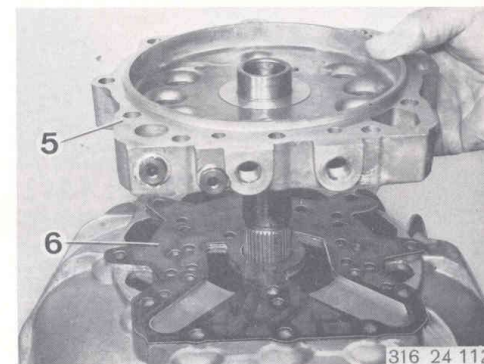
*When installing:* Place angled disc (1) on input shaft with shoulder towards needle roller bearing (2).  
Attach thrust washer (3) to converter dome with grease.  
Renew gasket (4).

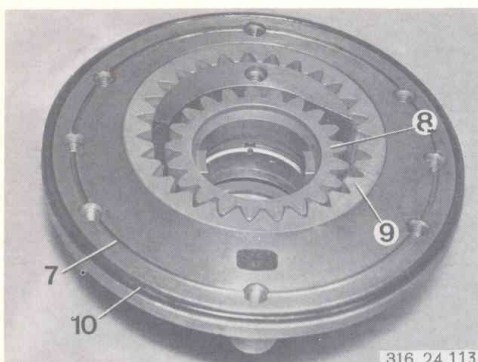


Detach intermediate plate from converter dome.  
Loosen two bolts on opposite sides by a few turns only.  
Strike the primary pump lightly to dislodge it from the converter dome.  
Remove the bolts and take off the primary pump.



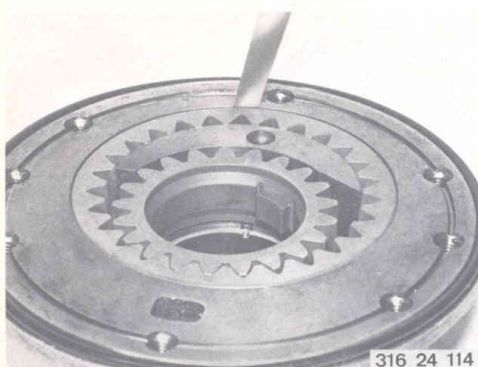
Take off the intermediate plate (5).  
*When installing:* Renew gasket (6).



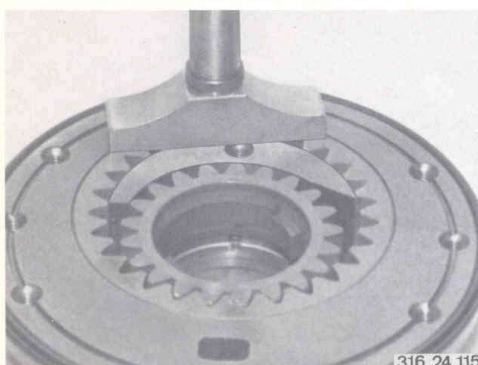


*When installing:* The primary pump, consisting of the pump housing (7), annulus (8) and pump impeller (9), can only be renewed as a complete unit.

Check O-ring (10) and renew if necessary.



Check radial clearance<sup>1)</sup> between driven gearwheel and pump housing, turning the gearwheel through 360° while doing so.



Check endplay<sup>1)</sup> of both gears in relation to end face, using a depth gauge.



With driving flange 24 3 140, check primary pump for smooth free running. Repeat this test after attaching the intermediate plate.

<sup>1)</sup> See specifications

**24 31 150 Oil strainer on control unit – detaching and attaching**

**Remove oil pan – 24 11 000.**

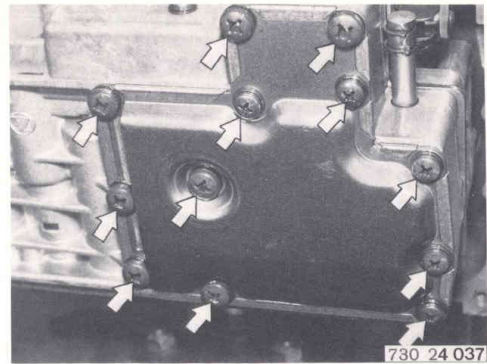
**Detach oil strainer.**

*When installing: Clean oil strainer.*

**Renew oil strainer if signs of resin deposits are detected (brownish, burned-on deposits).**

**With 'Torx' screws:**

**Tighten them with insert 002 100 and torque wrench 00 20 50.1)**



1) torque see Specifications

ZF 3 HP-22

24-31/3

2.7B

1) torque see Specifications

2.7B

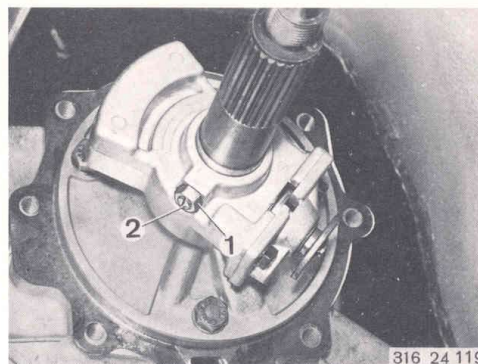
ZF 3 HP-22

24-31/3

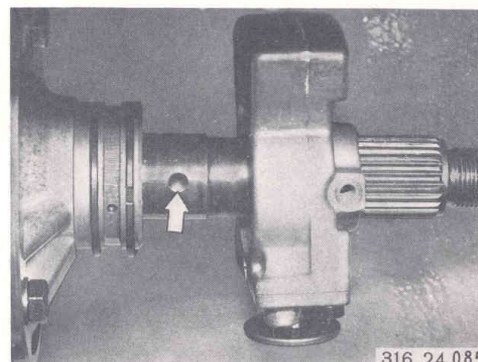


### 24 32 000 Centrifugal governor – removing and installing

Remove transmission cover – 24 11 050.  
Loosen nut (1) and unscrew threaded stud (2) by approx. 3 turns.  
Pull off the governor.



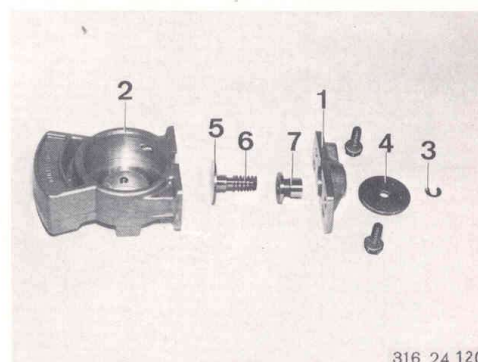
*When installing:* Compress the piston rings slightly and at the same time push the governor on to its flange.  
To assist in locating the recess in the output shaft, unscrew the threaded stud. Secure the governor in the recess with the stud and prevent from moving with a centerpunch mark.



### 24 32 503 Centrifugal governor – stripping and assembling – Governor removed –

Detach cover (1) from housing (2).  
Extract the circlip (3) and take off washer (4).  
Remove governor piston (5), spring (6) and bushing (7).

*When installing:* Governor piston must slide easily in the bushing.



### 24 34 000 Parking lock pawl – removing and installing

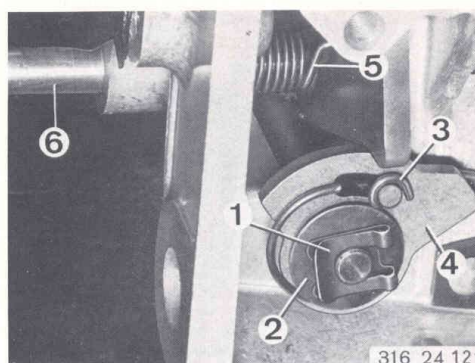
Remove the control unit – 24 30 000.

Take off the transmission cover – 24 11 050.

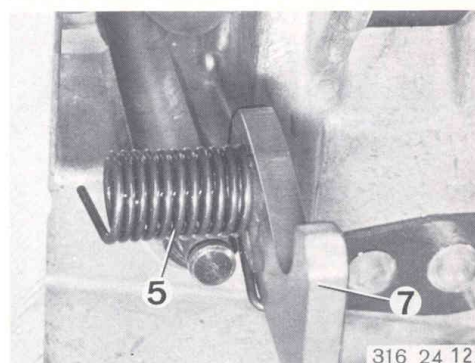
Extract the keeper (1) and take off the washer (2).

Disconnect spring (3) and pull off the parking lock cam (4).

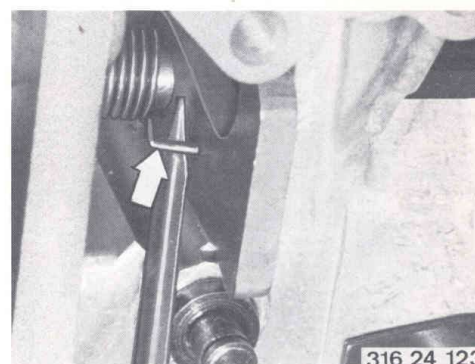
Disconnect torsion spring (5) and press out pin (6) from the inside with a screwdriver, or pull out.



*When installing:* Press in the pin and at the same time push torsion spring (5) with pawl (7) on to the pin. The straight end of the spring must point upwards, towards the transmission housing. The front end of the spring should be at the left, behind the pawl.



Place the front end of the spring round the right side of the pawl.



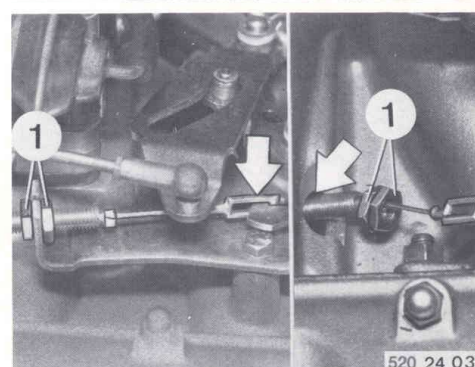
### 24 34 101 Accelerator (throttle position) cable – renewing

Detach the accelerator cable and remove from thrust mount.

Slacken nuts (1).

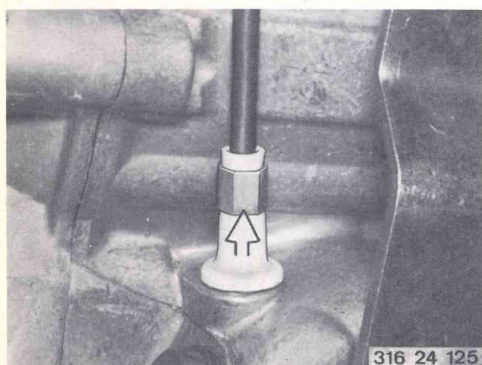
Lift out wire cable.

Unscrew nuts (1) and pull cable down through hole on intake manifold.

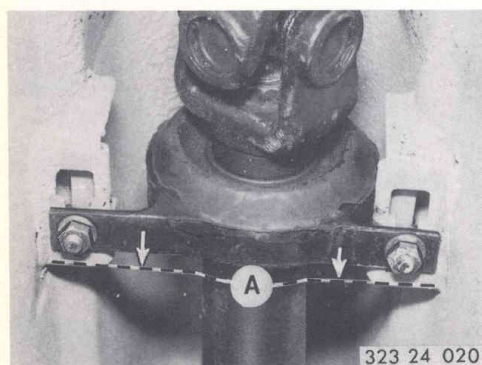




Detach the oil pan – 24 11 000.  
Move selector lever to N.  
Press accelerator cam forwards and detach cable from cam.

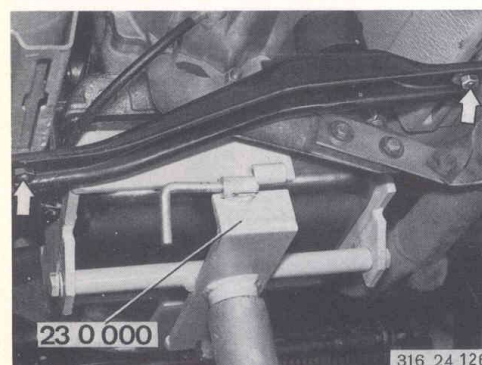


Press the accelerator cable forwards out of the housing.  
*When installing:* Adjust the accelerator cable (see 24 00 004).



24 34 701 Torsion spring for throttle position cable – renewing

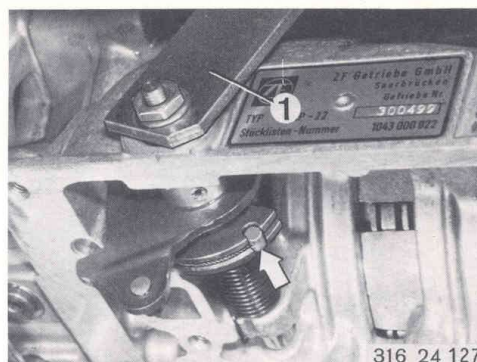
Detach the propeller shaft center bearing.  
*When installing:* Preload by 2 mm (0.08 in) towards front of car.



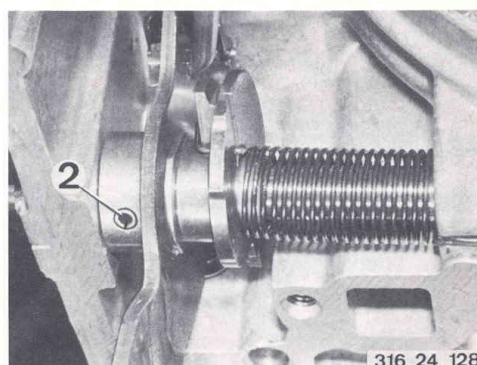
Support transmission with adapter 23 0 000.  
Detach cross-member from body.  
Lower transmission as far as front axle beam.



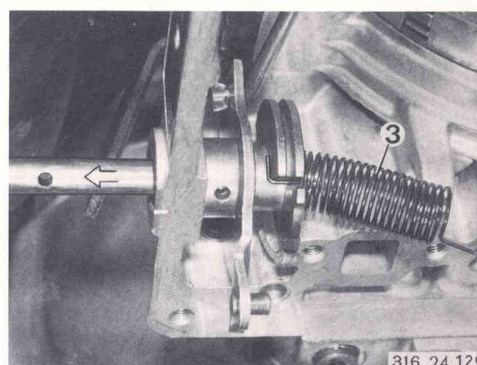
Remove the control unit – 24 30 000.  
 Detach the selector lever (1) from the transmission.  
 Disconnect the throttle position cable.



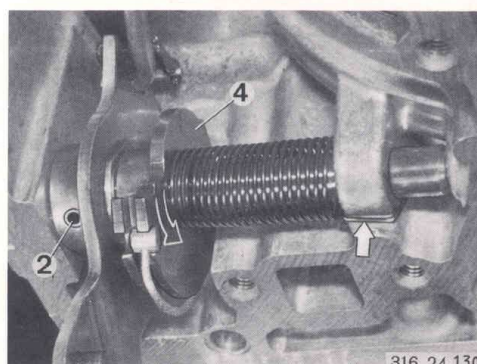
Drive out locking collet (2) in position N.

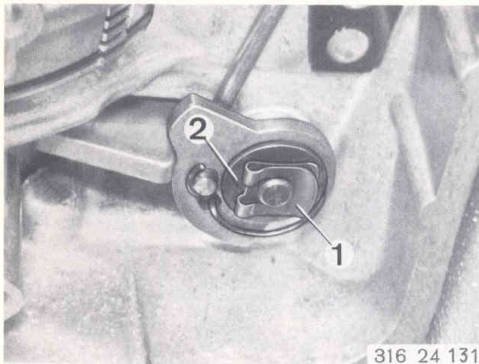


Pull the selector shaft out until the torsion spring (3) can be removed.



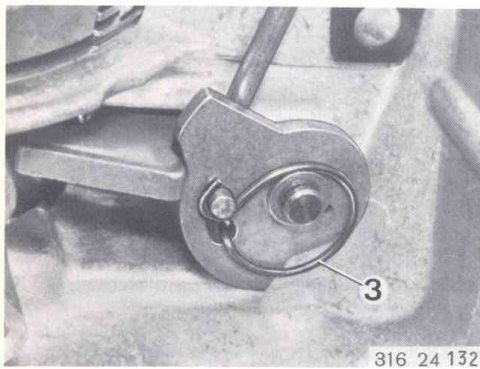
*When installing:* Attach the shorter arm of the spring to throttle cam (4).  
 Place the longer arm of the spring in the slot in the housing.  
 Install the selector lever.  
 With throttle cam (4), preload the torsion spring by one turn anticlockwise.  
 Connect the throttle position cable and secure the detent pawl with locking collet (2).





**24 34 730 Torsion spring for parking lock cam – renewing**

**Remove the control unit – 24 30 000.  
Extract the keeper (1) and take off washer (2).**



**Remove the torsion spring (3).**

**24 40 000 Torque converter – removing and installing**

**Remove and install transmission – 24 00 020.** Using handgrips 24 4 000, carefully pull the torque converter out of the primary pump.

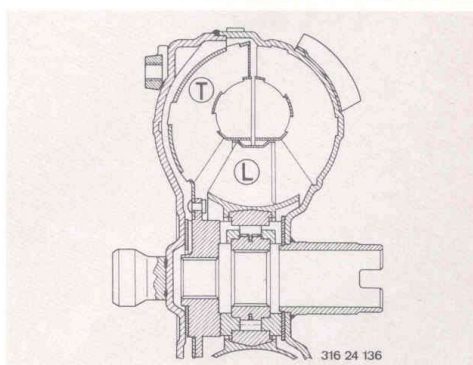
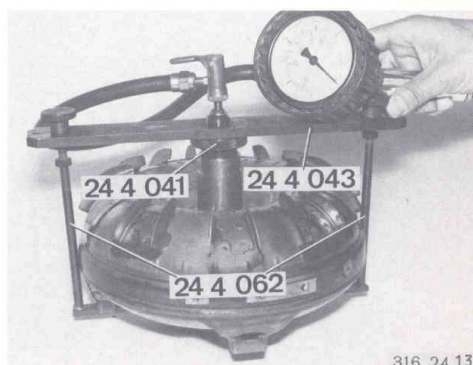
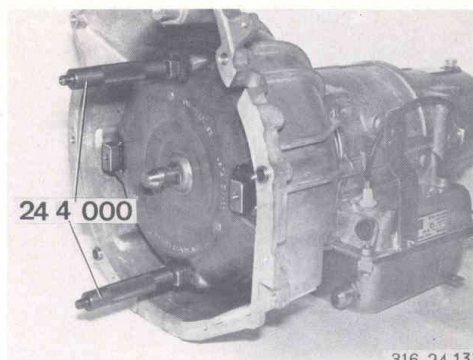
*Warning:* Automatic transmission fluid will escape.

*When installing:* Check torque converter for leaks with device 24 4 041 in conjunction with retaining bracket 24 4 043 and retaining bolts 24 4 062. Test pressure 0.5 atmg (7.1 lb/in<sup>2</sup>).

*Warning:* this operation is dangerous unless the retaining bracket is used.

If the running surface on the converter shaft is damaged, the torque converter must be renewed.

If the guide wheel (L) or turbine wheel (T) cannot be rotated by hand, the torque converter must be renewed – 24 40 001.



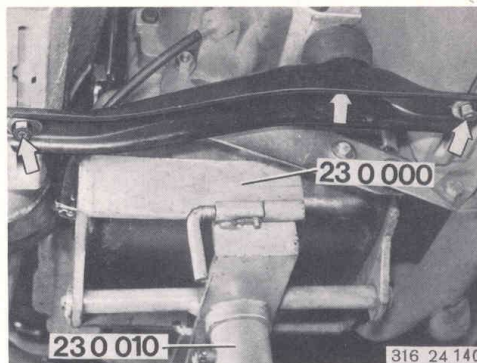


**24 71 001 Rubber mounting for automatic transmission – renewing**

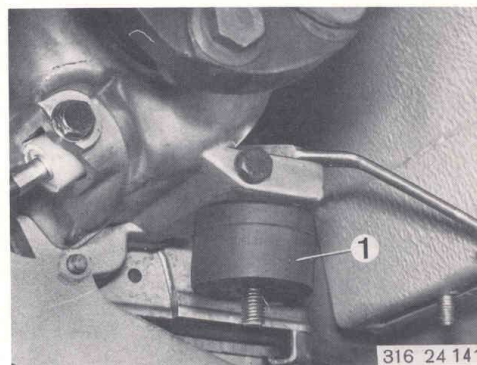
**Support transmission with adapter 23 0 000 and tube 23 0 010.**

**Remove the cross-member.**

**Lower the transmission.**



**Detach the rubber mounting (1) with a slightly cranked open-ended wrench.**



ZF 3 HP-22

24-71/1

2.78

24-71/1

ZF 3 HP-22

24-71/1

### Trouble-shooting – 3 HP-22 automatic transmission

Fault	Cause	Remedy
Shift points <sup>1)</sup> are too high	<ul style="list-style-type: none"> <li>a) Accelerator cable setting incorrect</li> <li>b) Governor bushing sticking</li> <li>c) Governor piston rings failed or worn</li> <li>d) Throttle pressure valve not operating correctly</li> <li>e) Shift valves sticking</li> </ul>	<ul style="list-style-type: none"> <li>a) Adjust accelerator cable</li> <li>b) Clean or renew governor</li> <li>c) Renew piston rings</li> <li>d) Exchange control unit</li> <li>e) Exchange control unit</li> </ul>
Shift points <sup>1)</sup> are too low	<ul style="list-style-type: none"> <li>a) Accelerator cable setting incorrect</li> <li>b) Governor bushing sticking</li> <li>c) Throttle pressure valve not operating correctly</li> <li>d) Leaking plastic balls in channel plate</li> </ul>	<ul style="list-style-type: none"> <li>a) Adjust accelerator cable</li> <li>b) Clean or renew governor</li> <li>c) Exchange control unit</li> <li>d) Exchange control unit</li> </ul>
Shift points too high or too low, shift action too slow and too 'soft'	<ul style="list-style-type: none"> <li>a) Clutch C + C' damaged during 1st-2nd gear shift</li> <li>b) Clutch B damaged during 2nd-3rd gear shift</li> </ul>	<ul style="list-style-type: none"> <li>a) Renew clutches C + C'</li> <li>b) Renew clutch B</li> </ul>
Kickdown inoperative	<ul style="list-style-type: none"> <li>a) Accelerator cable setting incorrect</li> <li>b) Control unit setting incorrect</li> <li>c) Throttle pressure valve sticking</li> <li>d) Plastic balls in channel plate leaking</li> </ul>	<ul style="list-style-type: none"> <li>a) Adjust accelerator cable</li> <li>b) Adjust control unit</li> <li>c) Exchange control unit</li> <li>d) Exchange control unit</li> </ul>
Selector lever will not move to P position	<ul style="list-style-type: none"> <li>a) Selector linkage out of adjustment</li> <li>b) Parking lock pawl mechanism defective</li> </ul>	<ul style="list-style-type: none"> <li>a) Adjustment selector linkage</li> <li>b) Repair pawl mechanism</li> </ul>
Selector jams in P position	<ul style="list-style-type: none"> <li>a) Parking lock pawl jammed in teeth on output boss</li> <li>b) Excessive friction in parking lock mechanism</li> </ul>	<ul style="list-style-type: none"> <li>a) Renew parking lock pawl</li> <li>b) Repair parking lock mechanism</li> </ul>

### Trouble-shooting – 3 HP-22 automatic transmission

Fault	Cause	Remedy
Transmission will not remain in P position (slips out)	a) Selector rod out of adjustment	a) Adjust selector rod
Car will not move forward or in reverse	a) Too little ATF in transmission b) Pump drive failed c) Driving disc broken d) Parking lock pawl sticking e) Clutches A and B defective	a) Restore correct oil level b) Exchange converter and pump c) Renew driving disc d) Renew pawl e) Strip and recondition transmission
Car will not move forwards	a) Selector linkage out of adjustment b) Clutch A failed or oil losses in feed line	a) Adjust selector linkage b) Renew clutch A
Car will not move in reverse	a) Selector linkage out of adjustment b) Clutch B or D failed c) Clutch valve and damper B not working correctly d) Fluid level too low, pump priming	a) Adjust selector linkage b) Strip the transmission c) Exchange control unit d) Restore correct fluid level
Slipping or judder when starting in R position	a) Clutch B or D damaged b) Severe leakage of oil in B or D feed lines	a) Strip transmission b) Strip transmission
Car does not move in R or 2 selector positions	a) Shift valve stuck in 3rd gear position	a) Renew control unit; strip transmission if abraded particles are noted in oil pan
Violent jolt or distinct double jerk when R is selected	a) Damper B failed, gate incorrectly laid out	a) Renew control unit
Car cannot be started with lever at 0	a) Switch on transmission has failed	a) Renew transmission switch
Car creeps forward or moves off in 0 position	a) Selector linkage out of adjustment b) Clutch A exhausts too slowly c) Clutch A failed (fused together)	a) Adjust selector linkage b) Strip transmission c) Strip transmission
Car stays in 1st gear when D is selected	a) Shift valve 1–2 sticking b) Governor bushing sticking	a) Exchange control unit b) Clean or renew governor
Car remains in 1st or 2nd gear when D is selected	a) Shift valve 2–3 sticking	a) Exchange control unit
Car can only be driven in 2nd gear	a) Shift valves 1–2 and 2–3 are sticking	a) Exchange control unit
Car can only be driven in 3rd gear	a) Shift valves 1–2 and 2–3 sticking b) Governor bushing sticking	a) Exchange control unit b) Clean or renew governor



### Trouble-shooting – 3 HP-22 automatic transmission

Fault		Cause	Remedy
Drag when shifting from one gear to the next		a) Accelerator cable has become detached or is out of adjustment	a) Reconnect or adjust cable
		b) Oil level too low	b) Restore correct oil level
Drag during shift from 1st to 2nd gear		c) Throttle pressure valve sticking	c) Exchange control unit
		d) Clutch A defective	d) Strip transmission
Drag when shifting from 2nd to 3rd gear		a) Slipping clutches C and C'	a) Strip transmission
		b) Clutch valve and damper C not working	b) Strip transmission
3rd gear slipping		c) Accelerator cable has become detached or is out of adjustment	c) Reconnect or adjust cable
		d) Oil level too low	d) Restore correct oil level
Stall speed <sup>1)</sup> too high		e) Throttle pressure valve sticking	e) Exchange control unit
		f) Freewheel F failed	f) Strip transmission
Stall speed <sup>1)</sup> too low		a) Clutch B slipping	a) Renew clutch B
		b) Accelerator cable has become disconnected or is out of adjustment	b) Reconnect or adjust cable
Transmission up or down shifts are too violent		c) Oil level too low	c) Restore correct oil level
		d) Throttle pressure valve sticking	d) Strip the transmission
Transmission judders when car is driven away briskly from a standstill		e) Freewheel E failed	e) Strip the transmission
		a) Clutch B slipping	a) Strip the transmission
Transmission up or down shifts are too violent		b) Accelerator cable detached or out of adjustment	b) Reconnect or adjust cable
		c) Oil level too low	c) Restore correct oil level
Transmission up or down shifts are too violent		d) Oil pressure too low	d) Strip the transmission
		e) Throttle pressure valve sticking	e) Exchange control unit
Transmission up or down shifts are too violent		a) Oil level too low	a) Restore correct oil level
		b) Clutch engaged is slipping	b) Strip transmission
Transmission up or down shifts are too violent		c) Freewheel F or G slipping	c) Strip transmission
		a) Converter defective	a) Exchange converter
Transmission up or down shifts are too violent		b) Engine down on power	b) Check engine
		a) Clutch A failed	a) Renew clutch A
Transmission up or down shifts are too violent		b) Center propeller shaft bearing failed	b) Renew center bearing
		c) Freewheel F or G failed	a) Strip transmission
Transmission up or down shifts are too violent		a) Accelerator cable setting is incorrect	a) Adjust cable
		b) Clutch A failed	b) Strip transmission

### Trouble-shooting – 3 HP-22 automatic transmission

Fault	Cause	Remedy
Car moves in position N	<ul style="list-style-type: none"> <li>a) Selector linkage out of adjustment</li> <li>b) Clutch A (forward) is rused together</li> <li>c) Clutch B (reverse) is fused together</li> </ul>	<ul style="list-style-type: none"> <li>a) Adjust selector linkage</li> <li>b) Strip transmission</li> <li>c) Strip transmission</li> </ul>
No 1st gear braking action in positions 2 or 1	<ul style="list-style-type: none"> <li>a) Clutch valve and damper C failed</li> <li>b) Clutch D failed</li> </ul>	<ul style="list-style-type: none"> <li>a) Exchange control unit</li> <li>b) Renew clutch D</li> </ul>
No 2nd gear braking action in positions 2 or 1	<ul style="list-style-type: none"> <li>a) Clutch C' failed</li> </ul>	<ul style="list-style-type: none"> <li>a) Renew clutch C'</li> </ul>
Transmission can be down-shifted from 2 to 1 manually too early (above 80 km/h = 50 mile/h)	<ul style="list-style-type: none"> <li>a) Inhibit valve pressure too high</li> <li>b) Pressure losses in governor and shift valves</li> </ul>	<ul style="list-style-type: none"> <li>a) Renew control unit</li> <li>b) Strip transmission</li> </ul>
Transmission shifts down from 2 to 1 manually too late (below 40 km/h = 25 mile/h)	<ul style="list-style-type: none"> <li>a) Inhibit valve pressure too low</li> <li>b) Governor pressure too high</li> </ul>	<ul style="list-style-type: none"> <li>a) Renew control unit</li> <li>b) Strip transmission</li> </ul>
Stall speed in forward gear <sup>1)</sup> too high	<ul style="list-style-type: none"> <li>a) Clutch A or 1st gear free-wheel slipping</li> </ul>	<ul style="list-style-type: none"> <li>a) Strip transmission</li> </ul>
Stall speed in forward gear <sup>1)</sup> too low	<ul style="list-style-type: none"> <li>a) Engine not developing rated power output</li> <li>b) Converter freewheel failed</li> </ul>	<ul style="list-style-type: none"> <li>a) Check engine settings</li> <li>b) Renew converter</li> </ul>
Screaching sound, varies with speed and load reversal	<ul style="list-style-type: none"> <li>a) Propeller shaft center bearing failed</li> </ul>	<ul style="list-style-type: none"> <li>a) Renew center bearing</li> </ul>
Clattering sound at idle speed	<ul style="list-style-type: none"> <li>a) Broken driving plate</li> <li>b) Torn weld lugs on converter</li> </ul>	<ul style="list-style-type: none"> <li>a) Renew driving plate</li> <li>b) Renew converter</li> </ul>
Rattling sound at idle speed; disappears when accelerator is depressed in 0 position	<ul style="list-style-type: none"> <li>a) Valve chatter in control unit</li> <li>b) Oil pump priming</li> </ul>	<ul style="list-style-type: none"> <li>a) Restore correct oil level</li> <li>b) Tighten bolts securing control unit, check gasket</li> </ul>
Oil leaks on converter bell housing	<ul style="list-style-type: none"> <li>a) Shaft sealing ring failed</li> <li>b) O-ring at primary pump housing failed</li> <li>c) Converter leaking at weld seams</li> <li>d) Plugs leaking</li> </ul>	<ul style="list-style-type: none"> <li>a) Renew shaft sealing ring</li> <li>b) Renew O-ring</li> <li>c) Renew converter</li> <li>d) Renew sealing ring</li> </ul>
Output flange covered in oil	<ul style="list-style-type: none"> <li>a) Shaft sealing ring failed</li> </ul>	<ul style="list-style-type: none"> <li>a) Renew shaft sealing ring</li> </ul>