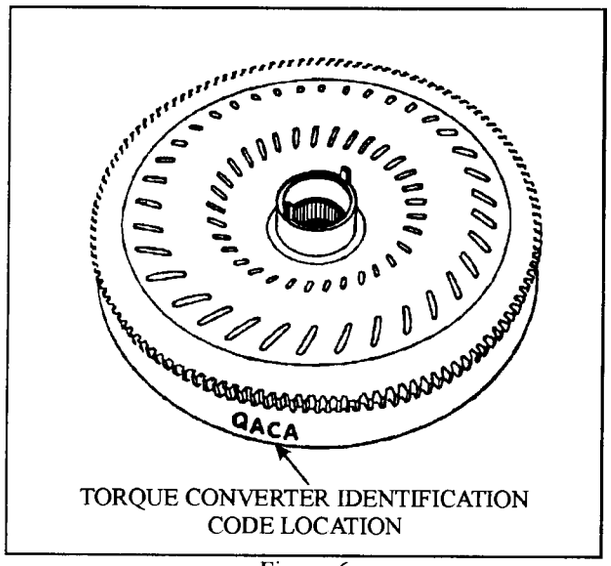
V.W. - AUDI - PASSAT
095 - 096 - 097

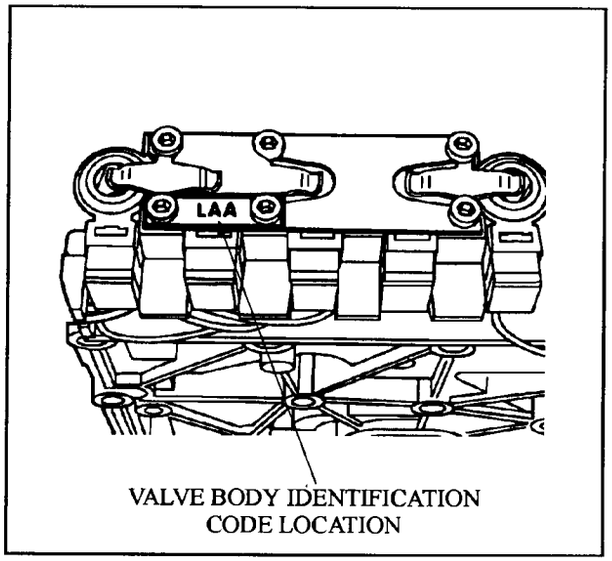
INDEX

VW 096
IDENTIFICATION
CONTINUED



TORQUE CONVERTER IDENTIFICATION
CODE LOCATION

Figure 6



VALVE BODY IDENTIFICATION
CODE LOCATION

Figure 7

096 GEAR RATIOS

MODEL	FIRST	SECOND	THIRD	FOURTH	REVERSE	FINAL DRIVE
APB	2.714	1.551	1.000	0.679	2.111	4.222
APC	2.714	1.551	1.000	0.679	2.111	4.222
APE	2.714	1.551	1.000	0.679	2.111	4.222
CBZ	2.714	1.551	1.000	0.679	2.111	4.222
CFA	2.714	1.551	1.000	0.679	2.111	4.222
CFC	2.714	1.551	1.000	0.679	2.111	4.222
CFF	2.714	1.441	1.000	0.742	2.884	3.700
CFH	2.714	1.441	1.000	0.742	2.884	4.222
CHG	2.714	1.441	1.000	0.742	2.884	3.700

Figure 8

V.W. AUDI 096 - 097
SOLENOID RESISTANCE CHECK

SOLENOIDS Continued
To check each solenoid for resistance, place the positive lead of a multimeter to pin # 1 in the connector. With the ground lead of the meter, check each solenoid by touching the appropriate ground pin (Use Figure 18 for pin location). Below is a chart that can be used as a quick reference guide.

DEVICE TO BE CHECKED	NEGATIVE METER LEAD TO PIN #	OHMS VALUE *
Solenoid #1	Pin # 3	60
Solenoid #2	Pin # 4	60
Solenoid #3	Pin # 5	60
Solenoid #4	Pin # 6	60
Solenoid #5	Pin # 7	60
Solenoid #7	Pin # 10	60
ATF Sensor	Pin # 12	200K
Solenoid #6 place negative lead to pin 8 and positive lead to pin 2. Should read approximately 5 ohms.		

**** All values are approximate at room temperatue.***

The electrical management system that operates or controls this transaxle is called DIGIMAT. No it is not misspelled, it is just a strange name. Unfortunately, this Digimat ECU has a permanent fault memory and self diagnosis capability with stored codes that can only be retrieved with the use of a VAG 1551 scanner by, guess who? Fahrvergnugen! Short for V.W.. This means that when this unit comes into your shop in failsafe, and it is a 93 model or earlier, you'll have to run it down to your FRIENDLY and COOPERATIVE Volkswagen Dealership and ask them to hook up their scanner to retrieve the codes.
If you want to shift the transmission separate from the computer, it can be done if you have patience. First supply 12 volts through a 20 amp fuse to pin # 1 in the connector and keep it there. Now you can begin to ground the appropriate pins:

Ground pin 6 to get 1st gear.
Ground pins 4 and 6 to get 2nd gear.
No grounds is a hydraulic 3rd gear.
Ground pin 5 for a mechanical 3rd gear.
Here is the Grand Finale':
Ground pins 3, 4, 5 and 6 to get 4th gear.

This test can be helpful in a pinch, but the best way to As you can see the solenoid shift pattern is quite different when it is compared to any other solenoid shifted transmission. This shouldn't have come at much of a surprise, after all, it is a Digimat electrical system.
When the selector lever is placed into Drive, line pressure is fed to the K1 and K2 clutch. The K1 clutch can be thought of as a 1st to 3rd clutch and the K2 as a 3rd and reverse clutch. When solenoid #4 is energized by grounding pin # 6, the K2 clutch feed is exhausted allowing just the K1 clutch to be applied. A spring and roller one way clutch now becomes effective and the transaxle has first gear.
To make a shift into 2nd, solenoid # 4 remains energized to keep the K2 clutch from applying. Solenoid # 2 is energized by grounding pin # 4 which allows the B2 clutch (2/4 clutch) to come on.
A shift into a hydraulic 3rd gear takes place when all the grounds are removed. The K1 clutch is still applied, the B2 clutch comes off and now the K2 clutch finally comes on because the # 4 solenoid was turned off. With both the K1 and K2 clutch on at the same time, the planetary gear set is locked spinning 1:1.
A mechanical 3rd gear can be achieved by grounding the # 5 pin which energizes the # 3 solenoid. This allows the K3 clutch (3/4 clutch) to be applied. The K3 clutch drum is splined into a damper plate in the torque converter which provides a direct mechanical link to the crank shaft eliminating the need for a converter clutch. This also produces the mechanical 3rd gear. Remember, the K1 and K2 clutch is still applied, by energizing the # 3 solenoid, we add the K3 clutch connecting the gear train to the crank shaft which eliminates all converter slip.
The shift into 4th gear occurs when a ground is made to the # 3 pin to energize the # 1 solenoid. This exhaust oil from the K1 clutch turning this clutch off. Solenoid # 2 is turned back on to apply the B2 clutch (2/4 clutch), the K3 clutch (3/4 clutch) is already on from the mechanical 3rd shift. Solenoid # 4 is turned back on to exhaust the oil from the K2 clutch (3rd and reverse). All this happens at once leaving the B2 and K3 clutches as the only two clutch packs on to achieve 4th gear. Mario Aristides from Independent Transmissions has provided us with valve body illustrations for this book. (See Figures 169 - 172 on Pages 72 - 75), Thanks Mario!

V.W. AUDI 096 - 097
TRANSAXLE POWER FLOW
(D) POSITION 2ND GEAR

Selector lever position "D", 2nd gear.

With the selector lever placed in the "D" position, the manual valve directs line pressure to the K1 and K2 clutches. Solenoid EV4 in the valve body is energized by the computer and exhausts the pressure from the K2 clutch circuit which allows only clutch K1 to be applied. When the computer commands second gear, solenoid EV2 is energized and applies the second and fourth gear brake (B2). Power flows from the impeller in the converter to the turbine shaft through the K1 clutch , which is rotating in a clock wise direction. The B2 Brake holds the K2 clutch drum from turning which holds the large sun gear drive shell from turning. The K1 Clutch drives the small sun gear drive shaft in a clock wise direction. The small sun gear drive shaft is splined into the small sun gear, rotating it in a clock wise direction. The small sun gear rotates the short planetary pinions in a counter clock wise direction. This will drive the tall planetary pinions in a clock wise direction. The tall planetary pinions will walk around the drive shell sun gear and rotate the output ring gear in a clock wise direction. The output ring gear will rotate the transfer drive gear in a clock wise direction. The transfer drive gear will rotate the transfer driven gear in a counter clock wise direction. Since the transfer driven gear is splined to the pinion gear shaft, the pinion gear will also rotate in a counter clock wise direction. This action will cause the differential ring gear to rotate in a clock wise direction and thereby provide power to the drive axles giving a forward movement at a ratio of 1.551 to 1.

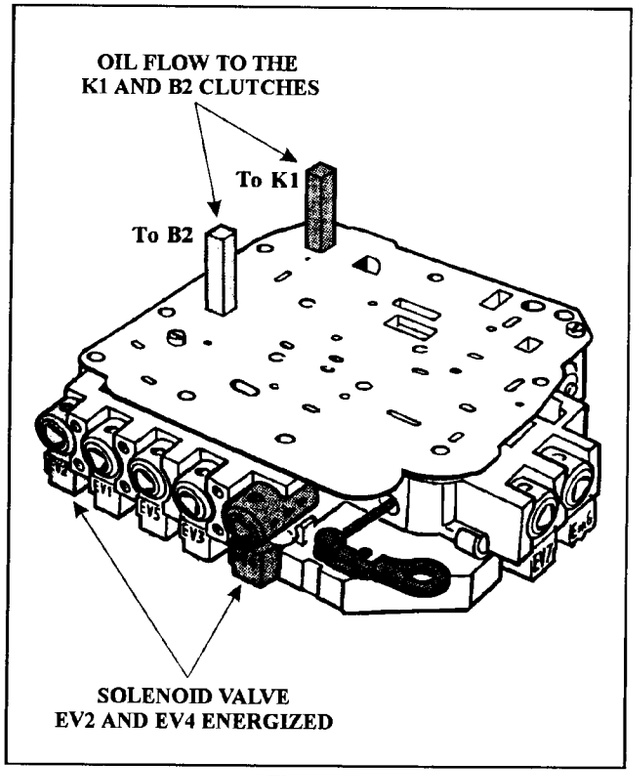
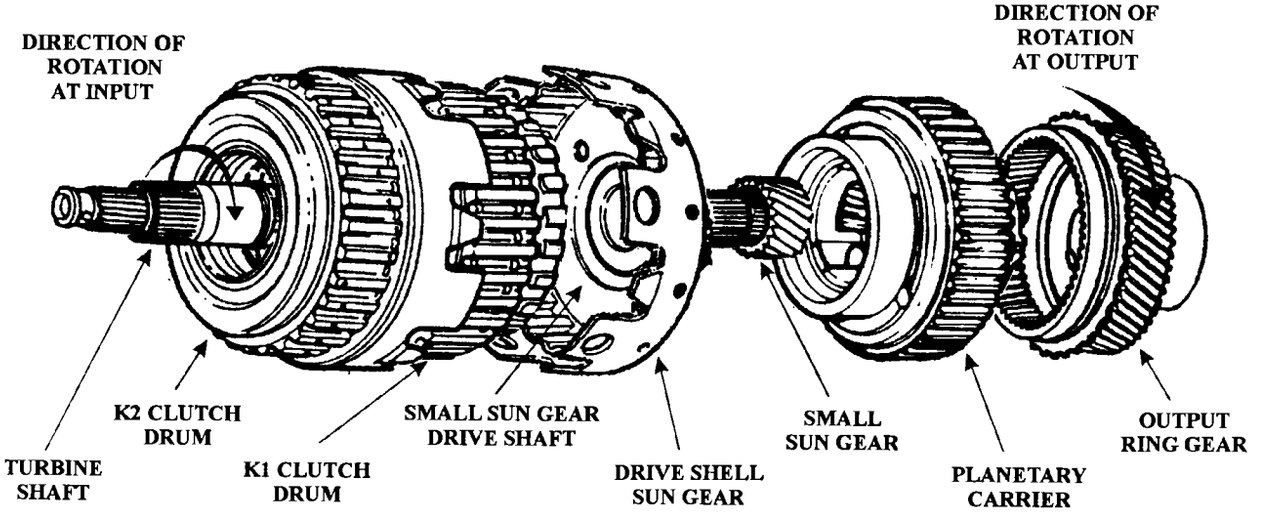


Figure 40



1. Attach the transmission to a transmission repair stand or a suitable work area, assuring that the transmission will not roll over and damage any of the electrical connections or other components (See Figure 49).

2. Remove the four 13mm bolts for the transmission pan and remove the pan, gasket and the gasket spacers and set them aside (See Figure 50).

3. Remove the two 10mm bolts that hold the filter to the valvebody then set the bolts and filter aside (See Figure 50).

4. There are fourteen #30 Torx head bolts that hold the valve body to the case. There is one 10mm bolt that holds the wire harness at the pass-through connector to the case. There is one 10mm bolt that holds a bracket for the wire harness on the outside of the transmission. Remove these bolts and set them aside. Carefully lift the valve body away from the transmission while sliding the harness through the case. Be careful not to damage the harness connector (See Figure 50).

5. Remove the B1 clutch feed plug in the case and inspect the plug for cracks then remove the two o-rings from the plug and discard them (See Figure 51).

6. Remove the seven #30 Torx head bolts that hold the pump assembly in the case then set the bolts aside (See Figure 52).

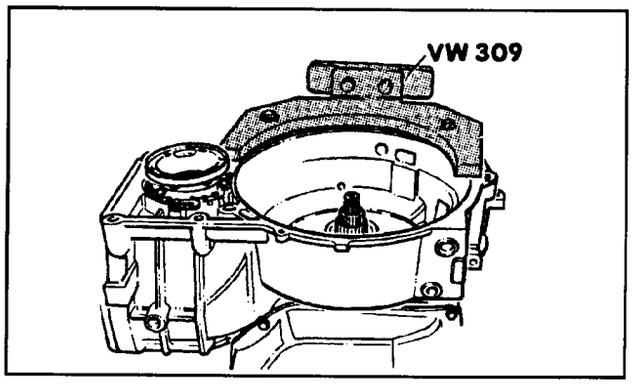


Figure 49

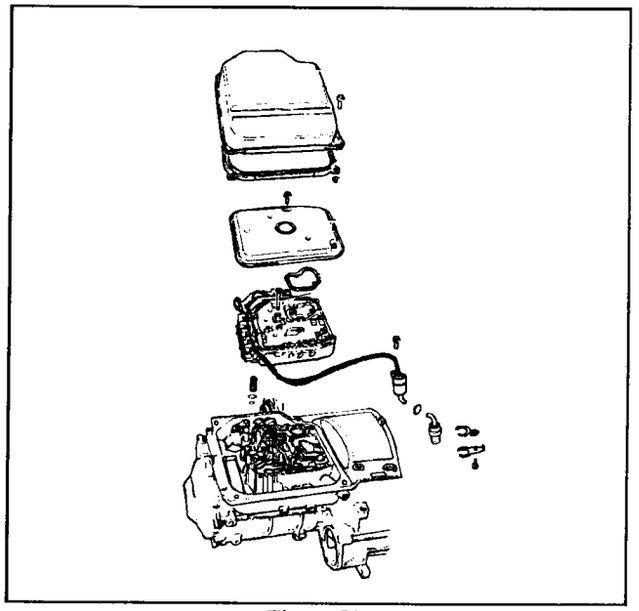


Figure 50

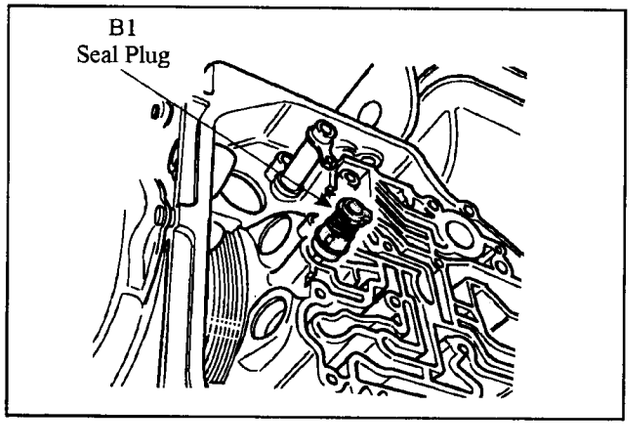


Figure 51

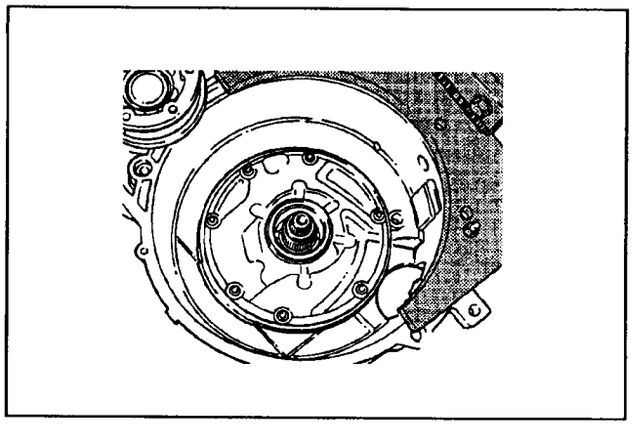
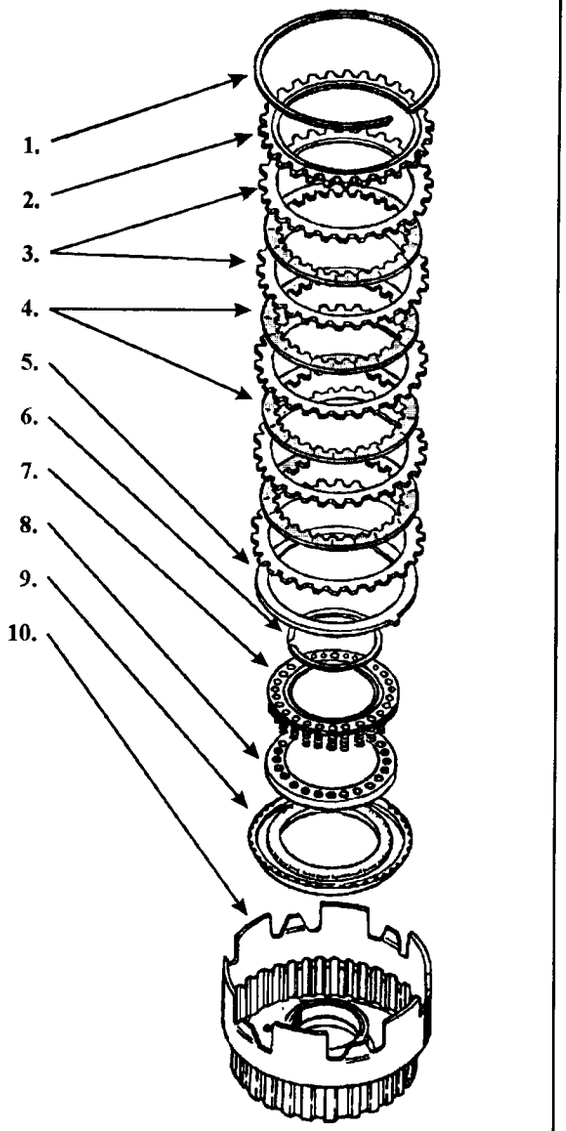


Figure 52

V.W. AUDI 096 - 097
K2 CLUTCH DRUM DISASSEMBLY



1. Snap ring clutch retaining
2. Clutch pressure plate
3. Clutch steel plates
4. Clutch friction plates
5. Waved clutch cushion steel plate
6. Snap ring spring retainer
7. Clutch piston spring retainer
8. Piston retainer spring seat
9. Vulcanized clutch piston
10. K2 clutch drum

Figure 75

16. Using a screwdriver, remove the snap ring that retains the K2 clutches in the drum.
17. Remove the pressure plate along with the steel plates the friction plates and the waved cushion steel plate (See Figure 75).
18. Place the K2 drum in a suitable press and compress the spring retainer for the piston (See Figure 76). Use caution when compressing the spring retainer it is fragile and may be bent beyond use if not compressed evenly.
19. With the spring retainer compressed, remove the snap ring for the spring retainer using a pair of snap ring pliers.
20. Remove the spring retainer, the plastic spring seat and the vulcanized piston from the K2 drum
21. Inspect the clutch piston for any signs of the vulcanized lip seal cracking or separating from the piston or any signs of hardening from age. If the piston shows any of these signs of wear, it must be replaced.

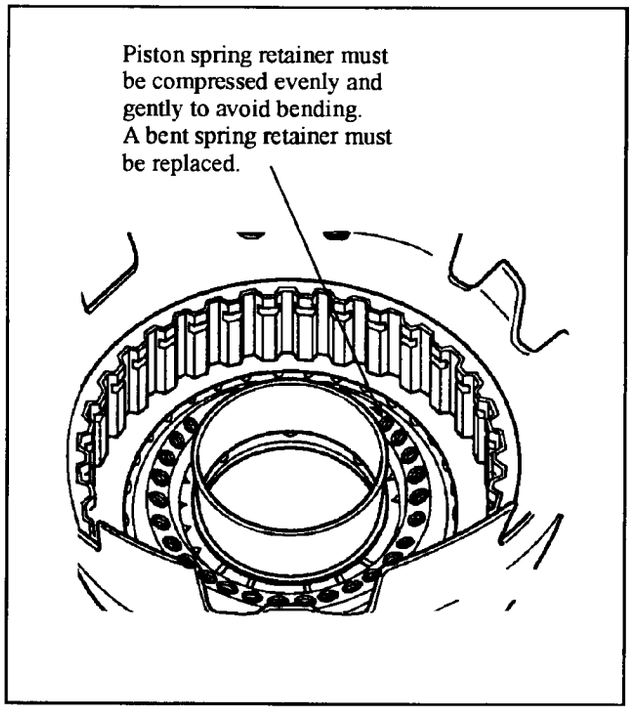


Figure 76

V.W. AUDI 096 - 097
DIFFERENTIAL DISASSEMBLY

6. Remove the retaining nut for the pinion gear shaft.

7. Using a gear puller carefully remove the transfer driven gear from the pinion gear shaft (See Figure 93).

8. Remove the retaining bolts from the bearing cover then carefully lift and remove the cover from the transmission case. Examine the bearing race for wear (See Figure 94).

9. Lift and remove the selective spacing shim for the bearing and the parking gear.

10. Remove the locking bolt that holds the threaded bearing cover then remove the cover by turning. Take care not to damage any of the threads on the bearing cover.

11. Carefully remove the pinion gear shaft from the transmission housing.

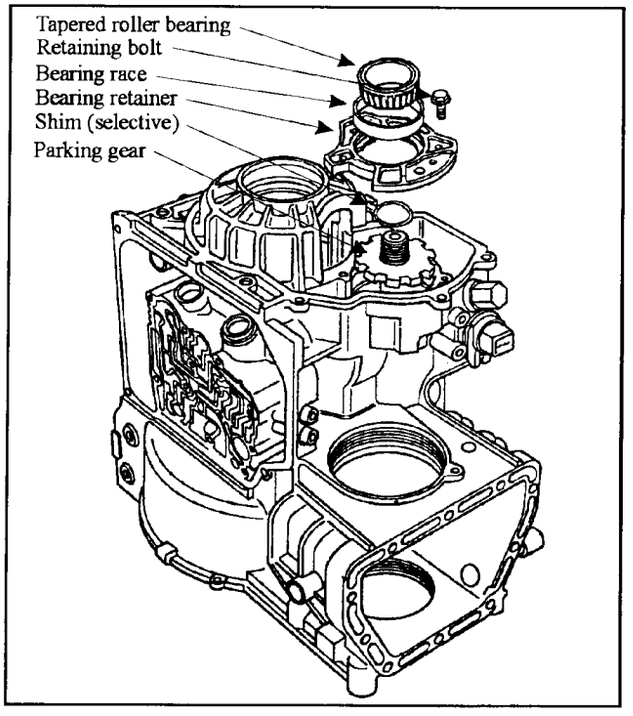


Figure 94

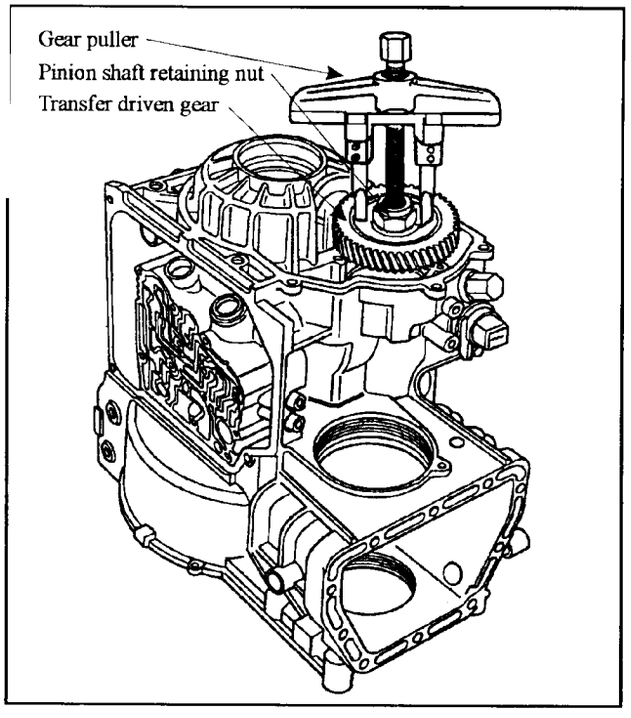


Figure 93

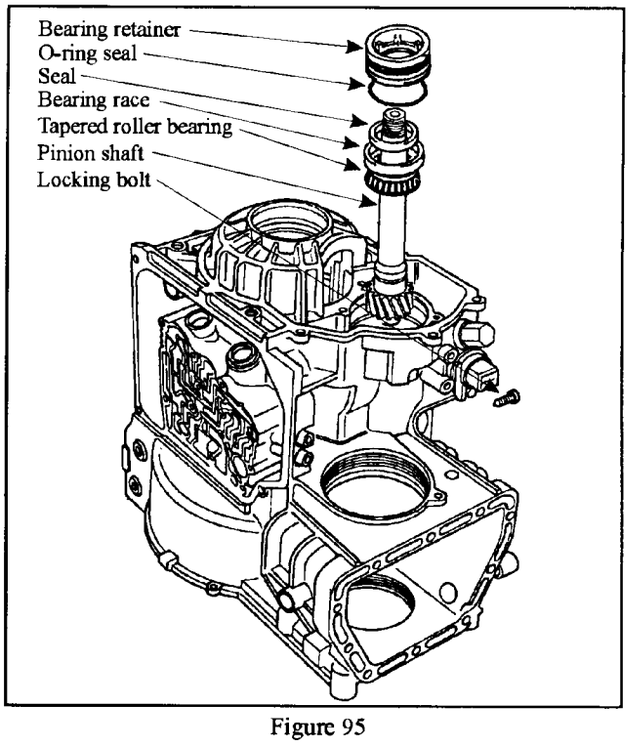


Figure 95

V.W. 096
PINION SHAFT ADJUSTMENT

To check pinion shaft end play, utilize the following manufacturer's procedure and calculation:

1. Place two 1.5mm (0.60") thick shims onto the pinion shaft as shown if Figure 115.
2. Install the pinion drive gear with the tapered roller bearing on the shaft. Engage the parking gear and tighten the 41mm hex head nut to 250 Nm (185 ft.lb.)
3. Attach a dial indicator to measure the shaft. set the gauge to read 1mm (0.040") and then ZERO the gauge.
4. Move the pinion shaft and read the end play clearance of the gauge.

An example of end play clearance of 0.93mm (0.004") will be used for the following calculation that is needed to determine the shim needed for proper end play.

IMPORTANT: When performing this end play check, never turn the pinion shaft during this procedure.

CALCULATION:

1. Always use the total thickness of the shims installed: 3mm (1.20")
2. Always use the figure 0.12mm (0.004") for the preload.
3. Always use the figure 0.10mm (0.003") for the compression.
4. This is how you calculate these numbers with the endplay clearance that was obtained with the dial indicator to determine the shim to be used.

1. Add the clearance of the pinion shaft .93mm (0.04")
   to the preload figure .12mm (.004")
   and to the compression figure .10mm (.003")
   TOTAL 1.15mm (.047")
2. Subtract the total of the shim thickness used from the total calculated in step 1 above.
   3.00mm (1.20")
   MINUS 1.15mm (0.47")
3. The remaining number is the size of shim to be used.
   1.85mm (0.73")
4. Remove the transfer driven gear, and determine shim according to table on (Page 55 Figure 121). Install shim onto pinion shaft.
5. Reinstall the transfer driven gear, and tighten locking nut to 185 ft.lb. and peen nut over with a drift punch.

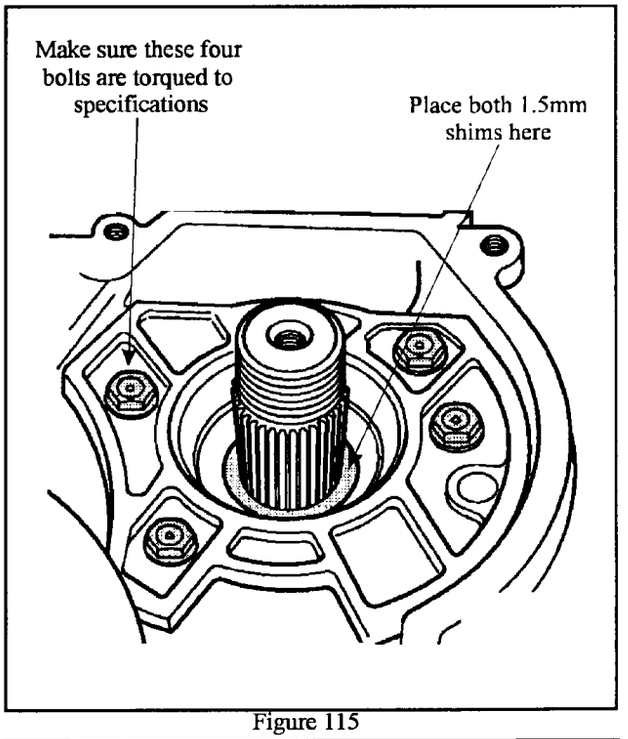


Figure 115

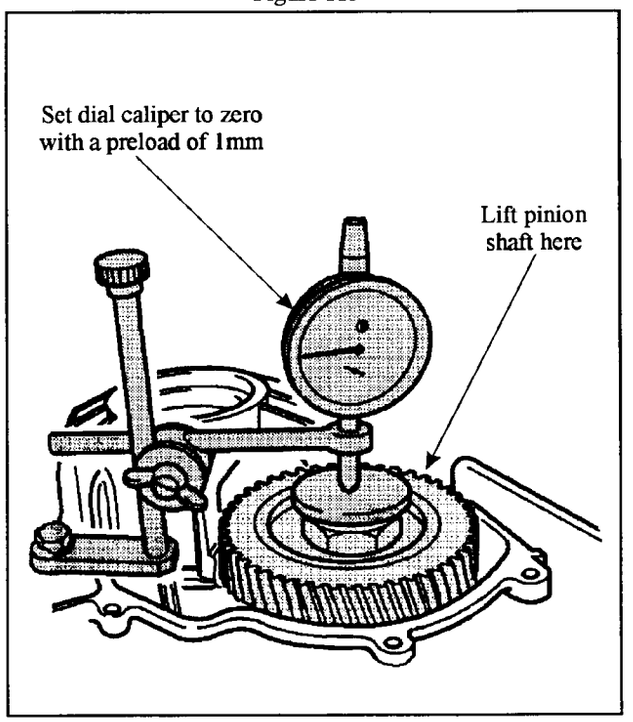


Figure 116

7. Install the bearing race and the torrington bearing onto the output ring gear and secure with a small amount of Vaseline (See Figure 142).

8. Install a new O-ring in the planetary and the bearing race as shown in Figure 143.

9. Install the planetary into the output ring gear.

10. Install the B1 clutches into the transmission housing in the following order. Thick steel, steel plate, friction plate, steel plate, friction plate, steel plate, friction plate, steel plate, friction plate, pressure plate piston return spring (See Figure 144).

11. Set clutch clearance using a feeler gauge in the case between the frictions and steels of the B1 clutch as shown in Figure 144. Set clearance to approximately .008" to .010" per friction.

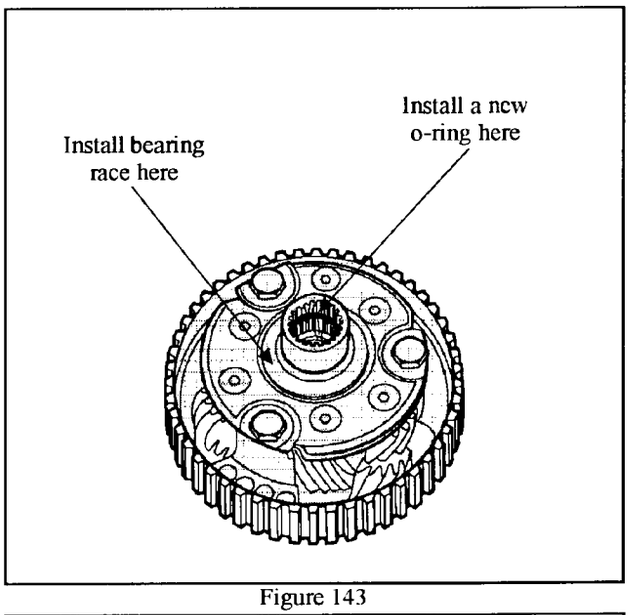


Figure 143

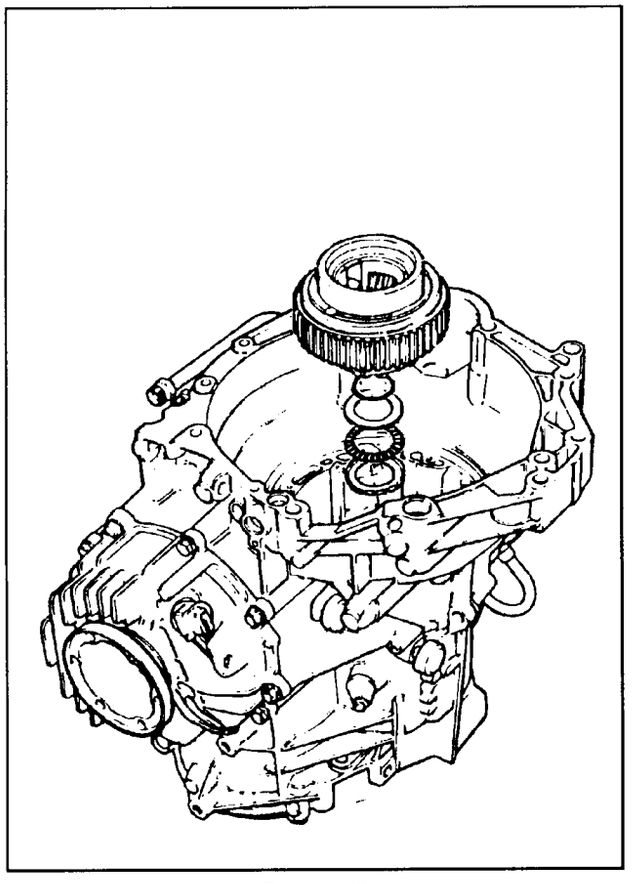


Figure 142

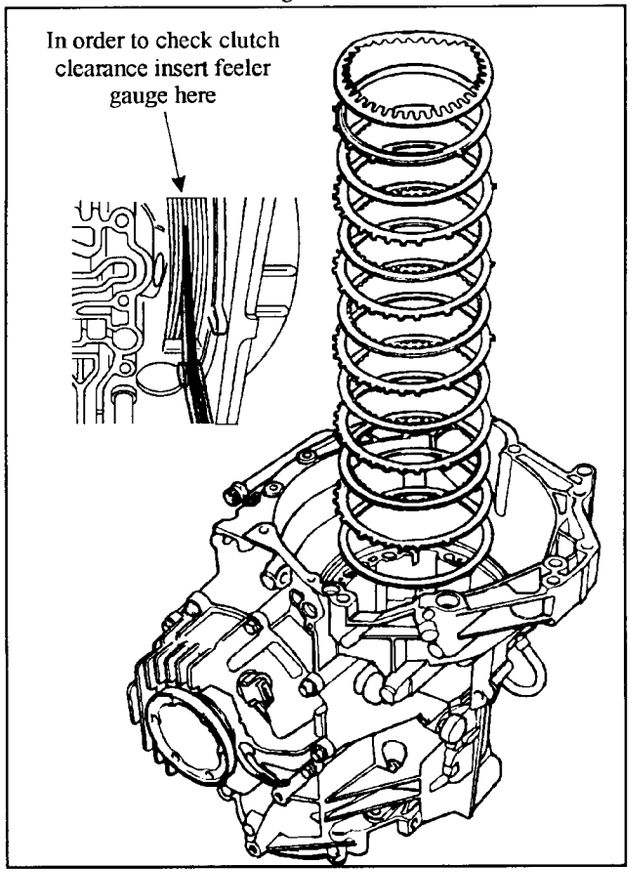


Figure 144

V.W. AUDI 096 - 097
B2 CLUTCH ADJUSTMENT

1. To adjust the B2 brake, first calculate the thickness of the last externally toothed plate. This is done by determining the size of the gap and calculating the thickness of the externally toothed steel plates. Example: (Gap = "A" minus "B" minus 3.6)
2. In order to calculate "A", measure from the transmission housing to the last friction plate with a depth gauge. Press down on the last friction plate and take a measurement of the depth between the transmission housing and the last friction plate (See Figure 158)
Example: Reading "A" = 30.2 mm
3. To calculate "B", place a straightedge onto the stator support and measure with depth gauge to gasket of the pump flange as shown in Figure 159.
Example: Reading = 40.1 mm
Minus Straightedge = 19.5 mm ("B" = 20.6 mm)
(Gap = 30.2 mm minus 20.6 mm minus 3.6 = 6.00 mm)
4. Determine the thickness of the last steel plate by using the table in Figure 157 below. It may be necessary to use two steels for the last steel plate instead of one.

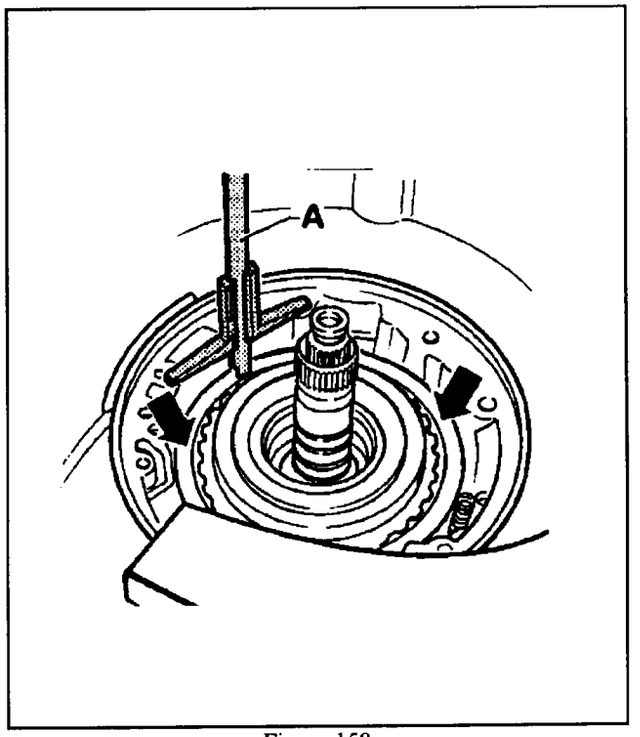


Figure 158

Shim Table

Gap in (mm)	Shims in (mm)
0.00 - 2.54	1.4
2.55 - 3.09	1 + 1
3.10 - 3.49	1.2 + 1.2
3.50 - 3.89	1.4 + 1.4
3.90 - 4.29	1.6 + 1.6
4.30 - 4.69	1.8 + 1.8
4.70 - 5.04	1.2 + 1.2 + 1.6
5.05 - 5.25	1.2 + 1.2 + 1.8

Steel Plate Table

Gap in (mm)	Steel Plate in (mm)
4.25 - 4.49	2.75
4.50 - 4.74	3.00
4.75 - 4.99	3.25
5.00 - 5.24	3.50
5.25 - 5.49	3.75
5.50 - 5.74	2.00 + 2.00
5.75 - 5.99	2.00 + 2.25
6.00 - 6.24	2.25 + 2.25
6.25 - 6.49	2.25 + 2.50
6.50 - 6.74	2.50 + 2.50
6.75 - 7.00	2.50 + 2.75

Figure 157

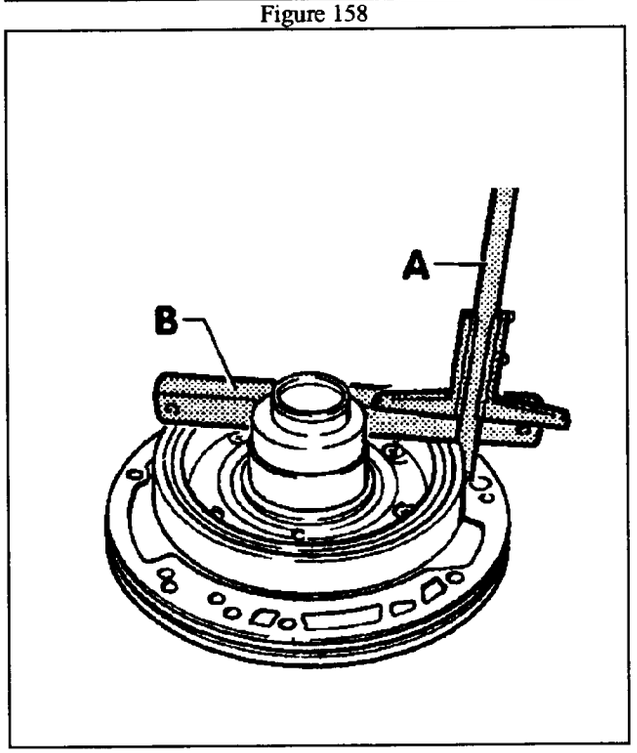


Figure 159

33. Check the end play on the turbine shaft. After the pump has been installed, attach a dial gauge holder to the transaxle housing, and place a dial gauge on the turbine shaft with a preload of 1 mm (See Figure 163).
34. Move the turbine shaft up and down and make a note of the play on the dial gauge.
35. Minimum allowable end play will be 0.5 mm, maximum allowable end play will be 1.2 mm.
36. Install two new O-rings on the B1 seal plug and insert the seal plug into the case in the location shown in Figure 164.
37. Carefully set the control valve assembly on the transaxle housing and hand thread the 14 #30 Torx head bolts that hold the control valve assembly to the case. Torque these bolts evenly to 44 in.lb. Figure 165.
38. Install a new O-ring on the wiring harness pass through connector and gently insert into the harness connector hole in the case (See Figure 165).
39. Install the 10 mm bolt that holds the harness to the case, and torque the bolt to 84 in.lb.

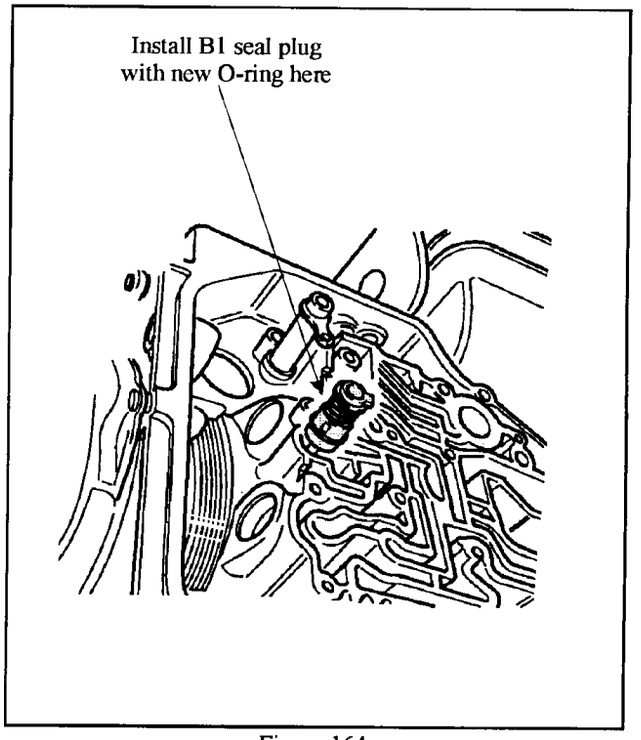


Figure 164

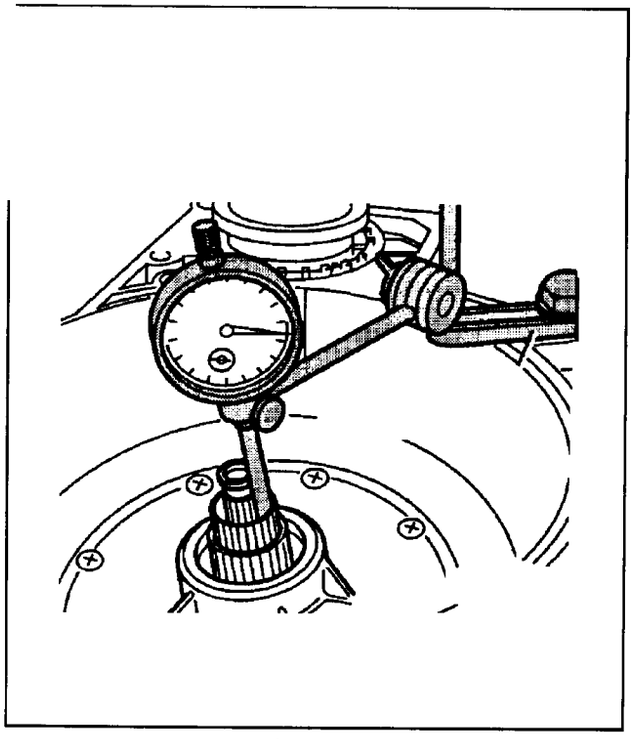


Figure 163

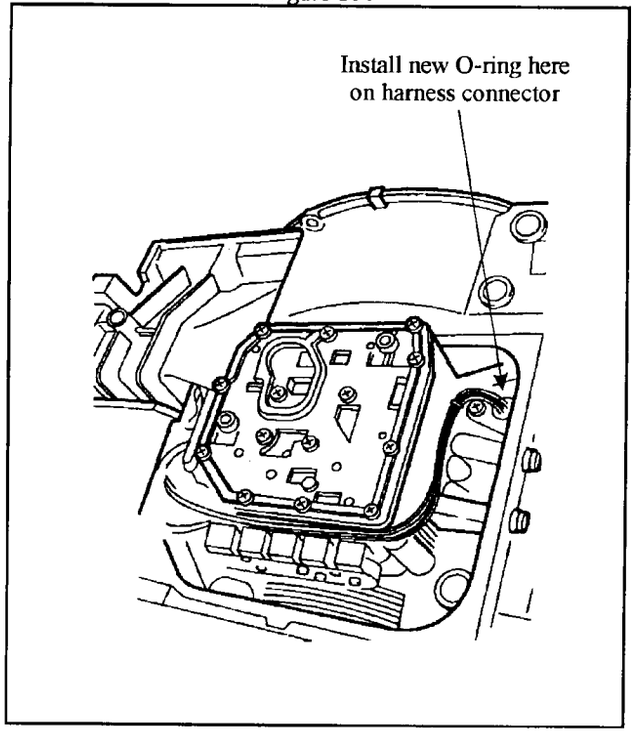


Figure 165

V.W. AUDI 096 - 097
VALVE BODY CONT.

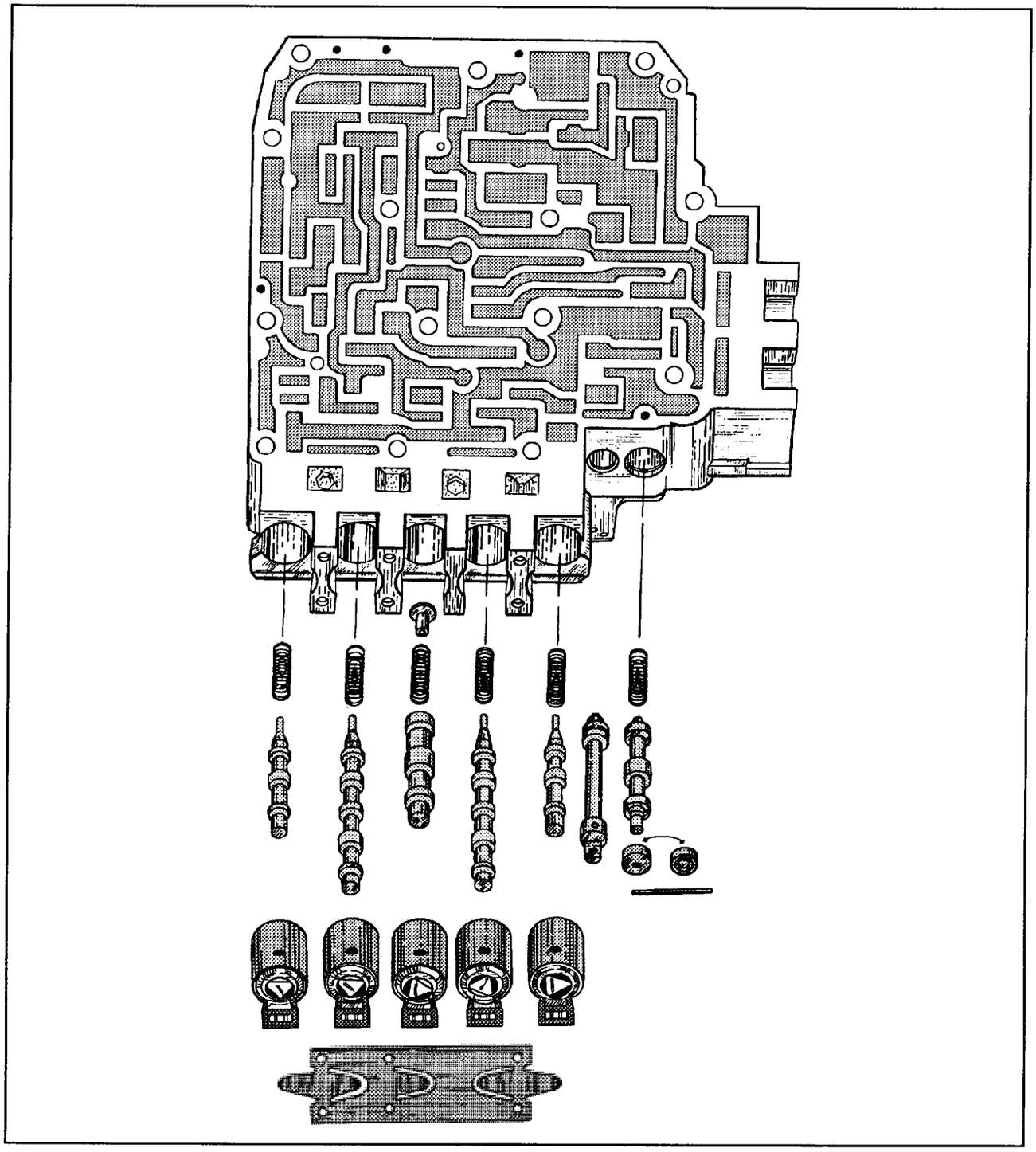


Figure 170

V.W. AUDI 096 - 097
VALVE BODY

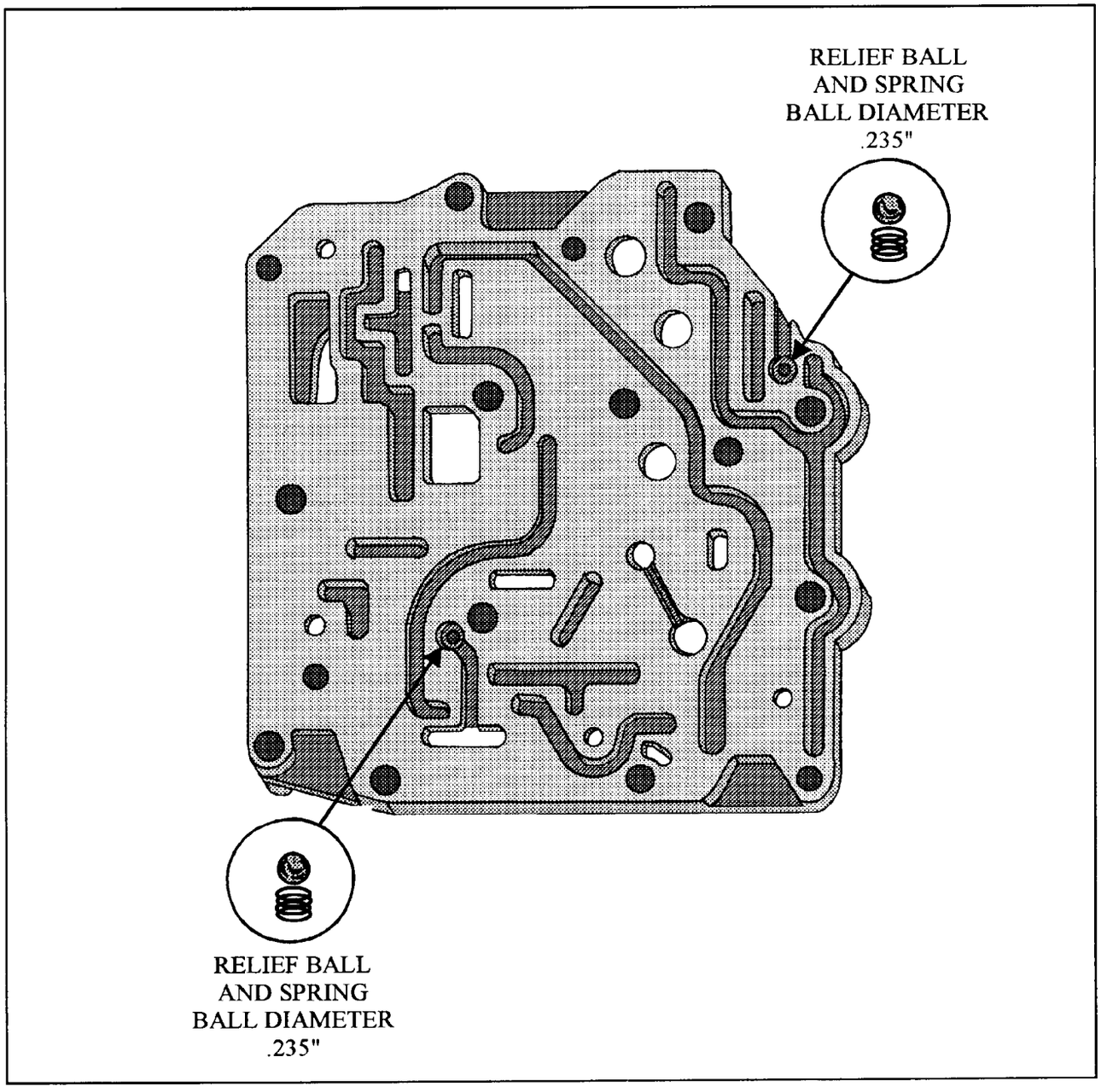


Figure 172

V.W. AUDI 096 - 097
ANSWERMATIC
AIR TEST PLATE

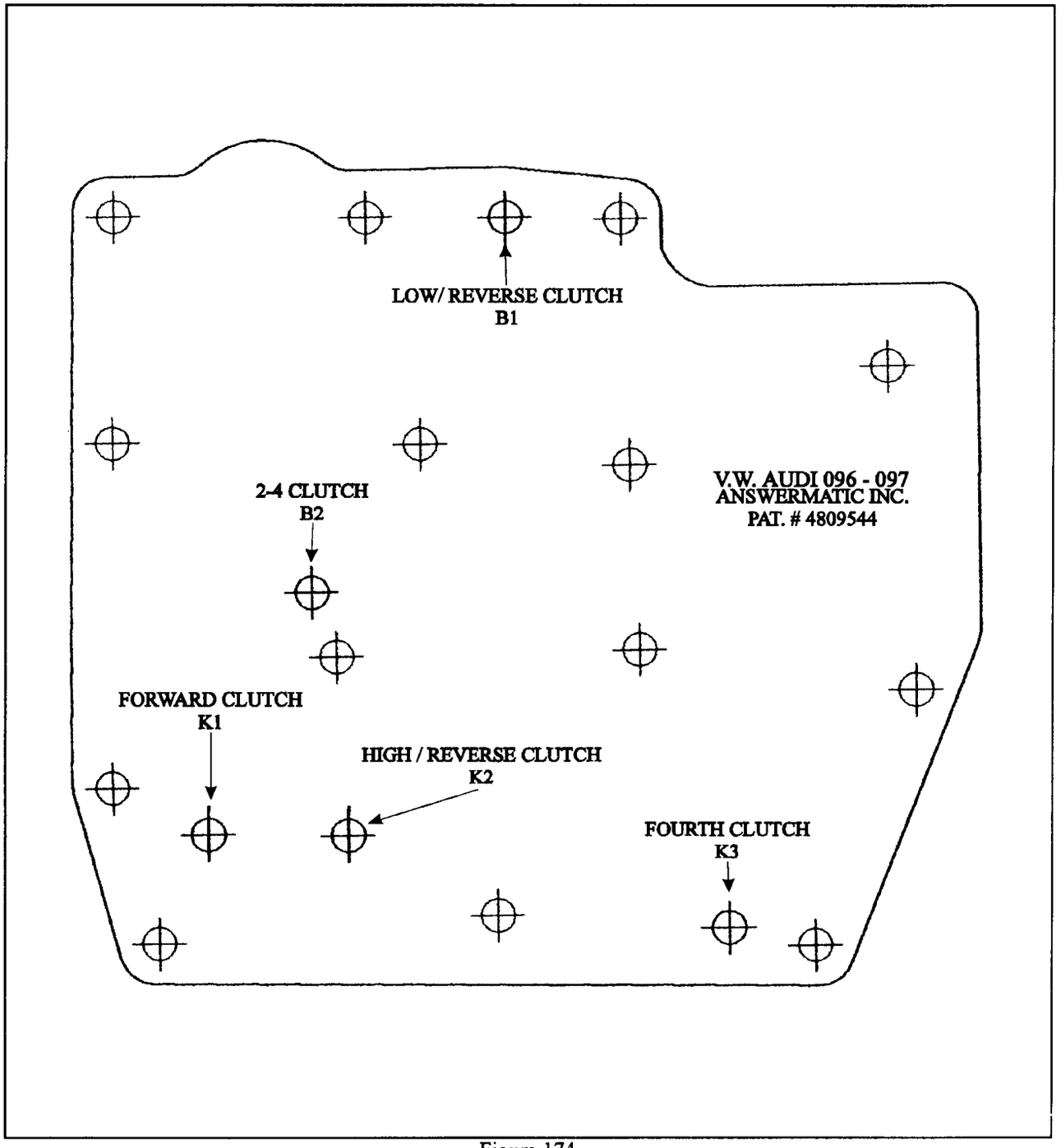


Figure 174

Malfunction	Possible cause	Correction
No. 14 Selector lever position: D, 3, 2, or 1 No drive in all ranges	Malfunction of the K1 clutch the B1 brake or the low roller clutch	Remove the transmission and inspect the K1 clutch, the B1 brake and the low roller clutch Repair or replace as necessary
No. 15 Gear selections not taking place	Solenoid or valves stuck in the control valve assembly	Remove the valve body and clean thoroughly or replace the valve body
No. 16 Uncontrolled or harsh shifts	Short circuit between solenoid wiring or Wiring harness. Valve in valve body stuck or solenoid faulty.	Check the wiring harness in the transmission and the valve body Repair or replace as necessary
No. 17 Shifting: changing gears one particular shift is harsh	Check in which gear the harsh shifting occurs Valve in valve body or solenoid faulty. Clutch element faulty	Remove the valve body and clean thoroughly or replace the valve body Remove the ttransmission and inspect the clutch elements Repair or replace as necessary
No. 18 Transmission selects the emergency mode	Incorrect control module installed. Valve body wiring harness faulty. Valve body faulty	Select the proper Contorol Module and replalce as necessary Begin a complete electrical diagnosis including computer pin check Repair or replace wiring or electrical components as necessary
No. 19 Parking lock will not engage	Selector lever cable defective or incorrectly adjusted Parking pawl, parking gear, or park rod actuator mechanism faulty.	Replace the selector lever cable and adjust Inspect the parking pawl, parking gear, and park rod actuator mechanism Replace or repair as necessary
No. 20 Noise in the final drive	Taper roller bearing loud Drive pinion loud Output gear loud Input gear loud Differential loud	Replace the tapered roller bearings Replace the drive pinion bearings or gears Repalce the output gear Replace the input gear Replace the differential

Figure 177