ARTICLE BEGINNING

AUTOMATIC TRANSMISSIONS
Volkswagen Type 01M

Cabrio, Golf, Golf III, GTI Jetta, Jetta III, Passat

APPLICATION & LABOR TIMES

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Labor Times</th>
<th>Trans.</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) R &amp; I</td>
<td>(2) Overhaul</td>
<td></td>
</tr>
<tr>
<td>1995-96</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabrio</td>
<td>4.4 ..........</td>
<td>6.3 ....</td>
<td>01M (CLK)</td>
</tr>
<tr>
<td>Golf, GTI &amp; Jetta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-Cylinder</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td>4.4 ..........</td>
<td>6.3 ....</td>
<td>01M (CLK)</td>
</tr>
<tr>
<td>Turbo Diesel</td>
<td>4.4 ..........</td>
<td>6.3 ....</td>
<td>01M (CKZ)</td>
</tr>
<tr>
<td>V6</td>
<td>4.4 ..........</td>
<td>6.3 ....</td>
<td>01M (CLB)</td>
</tr>
<tr>
<td>Passat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-Cylinder</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td>4.9 ..........</td>
<td>6.3 ....</td>
<td>01M (CLK)</td>
</tr>
<tr>
<td>Turbo Diesel</td>
<td>4.9 ..........</td>
<td>6.3 ....</td>
<td>01M (CKZ)</td>
</tr>
<tr>
<td>V6</td>
<td>4.9 ..........</td>
<td>6.3 ....</td>
<td>01M (CLB)</td>
</tr>
</tbody>
</table>

(1) - Removal and installation of transmission from vehicle chassis.
(2) - On bench overhaul for transmission and differential.
DOES NOT include removal and installation.

IDENTIFICATION

Volkswagen Audi Group (VAG) transaxle type is cast into top of transaxle case, next to ATF cooler. Transaxle code and build date are located on top of transaxle case, next to starter.

DESCRIPTION & OPERATION

Transaxle includes a 4-speed automatic transmission, lock-up torque converter, final drive and solenoid-operated valve body. See Fig. 1. Under normal conditions, all shifts are controlled by a Transaxle Control Module (TCM). See Fig. 2. Fourth gear is an overdrive gear.
Fig. 1: Cross-Sectional View Of Transaxle Components
Courtesy of Volkswagen United States, Inc.
The transmission elements consist of a planetary gear set, one-way roller clutch, 3 apply clutches, 2 brake clutches and a torque converter lock-up clutch. See Figs. 1 and 3.

All 4 forward gears are hydraulically activated. When the lock-up clutch is engaged, the forward gears become mechanically driven by eliminating torque converter slip. The lock-up clutch is
engaged depending on engine load and vehicle speed.

Power from the transmission is connected to the drive pinion through transfer gears. A ring gear and differential assembly are connected to flanges which spin the drive axles.

The electronic control consists of a TCM (located under rear seat), control solenoids, various sensors and switches. The control solenoids direct oil pressure inside the valve body. Solenoid valves No. 1-4 control the apply and brake clutches. Solenoid valves No. 5 and 7 control shift smoothness. Solenoid valve No. 6 is a frequency valve and controls the main hydraulic pressure. The TCM controls the main hydraulic pressure by varying the duty cycle.

The TCM monitors input and output signals. If electrical problems occur, TCM will record faults in TCM memory and may go into fail-safe mode (also known as emergency running mode). If TCM enters fail-safe mode, the transaxle will operate manually in reverse, 1st or 3rd gear. In fail-safe mode, 3rd gear operates with gear selector in 2nd, 3rd or "D". If engine is started with TCM in fail-safe mode, TCM activates 3rd gear hydraulically. The TCM memory can only be read using Scan Tool (VAG 1551) and Adapter (VAG 1551/3).

The TCM also controls shift lock system. This system locks the gear selector in Park or Neutral position unless the brake pedal is pressed. The TCM uses a shift lock control relay to release a gear-selector mounted solenoid. See Fig. 2.
LUBRICATION & ADJUSTMENTS

NOTE: See appropriate AUTOMATIC TRANSMISSION SERVICING article in TRANSMISSION SERVICING section.

TROUBLE SHOOTING

SYMPTOM DIAGNOSIS

Leak At Torque Converter
Check drive plate clearance, torque converter bushing, oil seal or oil pump assembly. Repair as necessary.

Transaxle Fluid In Coolant
Faulty transaxle oil cooler. Replace transaxle oil cooler and friction plates in transaxle. Clean transaxle.

Transaxle & Differential Oils Mixed
Replace “O” ring and drive pinion seal on inner bearing support.

Gear Selector Hard To Move
Check gear selector between shifter and transaxle. Repair as necessary. Check parking lock assembly inside transaxle. Repair as necessary.

No Drive In 1st Gear
Check for faulty 1st-3rd apply clutch or reverse brake clutch.

No Drive In “D”, “2” Or “3”
Check for faulty 1st-3rd apply clutch or one-way clutch.

No 2nd Gear In “D”, “2” Or “3”
Check for faulty 2nd-4th brake clutch.

No 3rd Gear In “D” Or “3”
Check for faulty reverse apply clutch.

No 4th Gear In “D”
Check for faulty 2nd-4th brake clutch.

No Reverse
Check for faulty reverse apply clutch or reverse brake clutch.

No Drive In All Forward Gear Positions
Check for faulty 1st-3rd apply clutch, reverse brake clutch or one-way clutch.

Missing Shifts Up Or Down
Check valve body for sticking valve(s) or faulty shift solenoid(s).

Erratic Or Harsh Shifts
Short in wiring to shift solenoid(s) or faulty shift solenoid(s). Check for proper throttle angle adjustment. See TECHNICAL SERVICE BULLETINS.

Harsh Shift In One Gear Only
Determine elements involved. Air check elements. Check for faulty shift solenoid or shift valve.

Stuck In Emergency Running Mode
Check for incorrect TCM installed, faulty wiring, bad solenoid electrical strip (inside oil pan) or stuck valve.

Park Lock Will Not Engage
Check for misadjusted selector lever cable. Check for faulty locking mechanism.

Bucking Or Poor Idling
Check throttle housing and air ducts for leaks. Check for possible air entering oil pump pickup.

Excess Engine RPM Drop When Shifting Into 1st Gear
Faulty Powertrain Control Module (PCM).

Engine Starts In Gear Or No Start In Park/Neutral
Check for faulty Park/Neutral safety switch.

Shift Lock Not Holding Selector In Park/Neutral
Check for faulty shift lock solenoid, shift lock mechanism or bad TCM

MECHANICAL, HYDRAULIC & ELECTRICAL COMPONENTS

1) If gear selector is stuck in Park or Neutral position, go to SHIFT LOCK SYSTEM under TROUBLE SHOOTING. If gear positions are missing, shift quality is poor or no shifts are possible, ensure all electrical connections are okay and fluid level is correct.

2) If problems are still present, disconnect electrical connector at transaxle. Test drive vehicle. Check if transaxle will operate manually in reverse and 1st gear. Move gear selector to 2nd, 3rd or "D" position. Transaxle should operate in 3rd gear (2nd, 3rd or "D").

3) If transaxle operates as described, problem may be electrical. See ELECTRONIC SELF-DIAGNOSTICS. If transaxle does not operate as described, problem may be mechanical or hydraulic. See ROAD TEST.

NOTE: If transaxle does not operate in manual 1st gear, check 1st-3rd apply clutch and reverse brake clutch for damage or
wear. If transaxle does not operate in manual reverse gear, check reverse apply clutch and reverse brake clutch for damage or wear.

ROAD TEST

WARNING: DO NOT exceed safe or legal speed limits during road test.

1) Road test vehicle with transaxle in "D" range. With vehicle at a speed above kickdown speed, press throttle pedal down and note kickdown shift speeds. Compare kickdown shift speeds to kickdown shift speed specifications. See KICKDOWN SHIFT SPEED SPECIFICATIONS table.

NOTE: In the following table, letter suffix following gear application refers to Hydraulic ("H") or Mechanical ("M") gear operation. Hydraulic or manual gear operation depends on operating mode of torque converter lock-up clutch.

KICKDOWN SHIFT SPEED SPECIFICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>Kickdown (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-Cylinder (CLK)</td>
<td></td>
</tr>
<tr>
<td>1H-1M</td>
<td>30-34</td>
</tr>
<tr>
<td>1M 2H</td>
<td>30-34</td>
</tr>
<tr>
<td>2H-2M</td>
<td>61-65</td>
</tr>
<tr>
<td>2M 3H</td>
<td>61-65</td>
</tr>
<tr>
<td>3H-3M</td>
<td>85-89</td>
</tr>
<tr>
<td>3M 4H</td>
<td>85-89</td>
</tr>
<tr>
<td>4H 4M</td>
<td>85-89</td>
</tr>
<tr>
<td>4M 4H</td>
<td>86-83</td>
</tr>
<tr>
<td>4H 3M</td>
<td>86-83</td>
</tr>
<tr>
<td>3M 3H</td>
<td>61-57</td>
</tr>
<tr>
<td>3H 2M</td>
<td>61-57</td>
</tr>
<tr>
<td>2M 2H</td>
<td>61-57</td>
</tr>
<tr>
<td>2H 1M</td>
<td>26-22</td>
</tr>
<tr>
<td>1M 1H</td>
<td>26-22</td>
</tr>
<tr>
<td>Turbo Diesel (CKZ)</td>
<td>(1)</td>
</tr>
<tr>
<td>V6 (CLB)</td>
<td></td>
</tr>
<tr>
<td>1H-1M</td>
<td>37-41</td>
</tr>
<tr>
<td>1M 2H</td>
<td>37-41</td>
</tr>
<tr>
<td>2H-2M</td>
<td>76-80</td>
</tr>
<tr>
<td>2M 3H</td>
<td>76-80</td>
</tr>
<tr>
<td>3H 3M</td>
<td>111-115</td>
</tr>
<tr>
<td>3M 4H</td>
<td>111-115</td>
</tr>
<tr>
<td>4H 4M</td>
<td>111-115</td>
</tr>
<tr>
<td>4M 4H</td>
<td>112-108</td>
</tr>
<tr>
<td>4H 3M</td>
<td>112-108</td>
</tr>
<tr>
<td>3M 3H</td>
<td>75-71</td>
</tr>
<tr>
<td>3H 2M</td>
<td>75-71</td>
</tr>
<tr>
<td>2M 2H</td>
<td>75-71</td>
</tr>
</tbody>
</table>
2H-1M ............................................ 32-28
1M-1H ............................................ 32-28

(1) - Information not available from manufacturer.

2) Connect scan tool and appropriate adapter to diagnostic connector. Select function 08 "READ MEASURING VALUE BLOCK". Test solenoid valves and upshift speeds following scan tool manufacturers instructions.

3) If transaxle does not shift within specified MPH range, and scan tool values are within specification, determine affected elements. See APPLY & BRAKE CLUTCH APPLICATION.

4) If all apply and brake clutch elements are affected, check oil pump, oil filter, cooler lines, solenoid valve No. 6, and condition of torque converter and/or engine. Repair as necessary.

5) If one or more apply and brake clutch elements are affected, remove valve body. Locate appropriate fluid circuit in transaxle case and valve body. Check for leaks and/or blockage. Repair as necessary.

6) If hydraulic circuits are okay, or problems with apply and brake clutch elements are mechanical, repair transaxle.

NOTE: If transaxle does not operate in manual 1st gear, check 1st-3rd apply clutch and reverse brake clutch for damage or wear. If transaxle does not operate in manual reverse gear, check reverse apply clutch and reverse brake clutch for damage or wear.

APPLY & BRAKE CLUTCH APPLICATION

APPLY & BRAKE CLUTCH APPLICATION (1)

Gear Application .................................. Elements In Use

1st Gear .......... 1st-3rd Apply & One-Way Clutch Holding
2nd Gear ................. 1st-3rd Apply & 2nd-4th Brake
3rd Gear .................... 1st-3rd & 4th Apply Clutches
4th Gear ....................... 4th Apply & 2nd-4th Brake
Reverse .................... Reverse Apply & Reverse Brake
Park & Neutral ............... All Apply & Brake Clutches

Released Or Ineffective

(1) - All forward gear elements shown are in "hydraulic-state". Forward gear elements switch to a "mechanical-state" with the addition of torque converter lock-up clutch apply.

SHIFT LOCK SYSTEM

Operation
All models are equipped with an electronic shift lock system. TCM controls shift lock system. See Fig. 2. This system locks gear selector in Park or Neutral position unless brake pedal is pressed. TCM uses shift lock control relay to release a solenoid mounted on gear selector assembly.

**NOTE:** Shift lock relay will not lock gear selector when vehicle speed is greater than 3 MPH.

A mechanical control cable prevents ignition key from being removed unless gear selector is in Park position. With ignition key removed, gear selector locks in Park position.

**NOTE:** If battery is disconnected or discharged, gear selector can be moved out of Park position by turning ignition key to START position.

**Functional Check**
1) With ignition key removed, ensure gear selector cannot be moved from "P" position. Insert key in ignition switch.
2) Turn ignition on. Ensure gear selector can only be moved with brake pedal pressed. Move gear selector to "N" position.
3) Without pressing brake pedal, ensure gear selector cannot move out of "N" position. Press brake pedal down. Ensure it is now possible to move gear selector.
4) If shift lock system does not operate as described, adjust gear selector, solenoid and control cable. If shift lock system does not operate after adjustments are made, check shift lock electrical system with Scan Tool (VAG 1551).
5) See testing information under ELECTRONIC SELF-DIAGNOSTICS. See Figs. 10-13. If any problems are found, service harness or components. If no problems are found, TCM may be defective. If shift lock system still does not operate correctly, check for worn or damaged parts and replace as necessary. See Figs. 2 and 4.
Fig. 4: Exploded View Of Shift Lock & Gear Selector Assembly
Courtesy of Volkswagen United States, Inc.
NOTE: Perform the following adjustments in order given.

Control Cable Adjustment
Loosen lock screw at gear selector lever on transaxle. Move gear selector in center console to Park position. Ensure front wheels are locked. Tighten cable housing to gear selector lever lock screw.

Shift Lock Solenoid Adjustment
Place gear selector in "N" or "P" position. Loosen shift lock solenoid mounting screws. Insert a .019" (.30 mm) feeler gauge between shift lock solenoid push rod and shift lever. See Fig. 5. If necessary, move shift lock solenoid and tighten screws.

Shift Lock Cable Adjustment
1) Move gear selector to "1" position. Remove steering column covers. Turn ignition key to START position and release. Check clearance between shift lock cable lever and ignition switch locking pin.

2) Clearance should be .028" (.70 mm). If clearance is not correct, loosen lock nut on shift lock cable sheath. Position shift lock cable lever to obtain correct clearance. Tighten lock nut. See Fig. 6. Tighten gear selector housing screws and install steering column covers.
Removal & Installation (Control Cable)
Remove lower cover from center console. Remove circlip from control cable end. Remove exhaust covers. On models equipped with V6 engines, remove catalytic converter. On all models, loosen lock nut and remove control cable from shift lever on transaxle. To install, reverse removal procedure. Adjust control cable. See CONTROL CABLE ADJUSTMENT under SHIFT LOCK SYSTEM.

Removal & Installation (Shift Lock Cable)
1) Remove shift lever handle. Remove center console cover. Disconnect negative battery cable and wait 30 seconds.
2) Using Torx wrench, remove air bag retaining screws from rear side of steering wheel. Lift off air bag unit from steering wheel, and tilt air bag unit downward. Disconnect wiring connector from air bag unit. Remove steering wheel. Remove dash panel.
3) Place gear selector in rear position. Loosen screw holding cable sheath to gear selector support. Remove cable from lever. See Fig. 7.
4) Remove cover from ignition switch. Remove spring clip holding cable housing to ignition assembly. Lift and tilt shift lock cable housing upward. Pull up shift lock cable until shift lock cable unhooks from ignition switch. See Fig. 8.

Fig. 7: Removing Shift Lock Cable From Shift Lever Support
Courtesy of Volkswagen United States, Inc.

Fig. 8: Removing Shift Lock Cable From Ignition Switch
Courtesy of Volkswagen United States, Inc.
5) Remove shift lock cable from under dash near A/C-heater housing and remove from vehicle. To install, position shift lock cable through under-dash panels. See Fig. 9. To complete installation, reverse removal procedure. Adjust shift lock control cable. See SHIFT LOCK CABLE ADJUSTMENT under SHIFT LOCK SYSTEM.

![Fig. 9: Routing Shift Lock Cable To Ignition Switch](Courtesy of Volkswagen United States, Inc.)

**ELECTRONIC SELF-DIAGNOSTICS**

**RETRIEVING TROUBLE CODES**

1) Electronic control consists of a TCM (located under rear seat), control solenoids, and various sensors and switches. TCM monitors input and output signals. See Fig. 2.

2) If TCM detects problems in transaxle-related circuits or devices, TCM may record a trouble code in memory. To retrieve obtain trouble codes, use Scan Tool (VAG 1551) and Adapter (VAG 1551/3). All trouble code and related testing information is contained in scan tool.

**TESTING**

**ELECTRICAL**

**NOTE:** Manufacturer does not provide electrical component tests or specifications. All testing information is contained in Scan Tool (VAG 1551).

1) To isolate TCM circuit problems without a scan tool, circuit resistance and voltage can be checked by using Test Box (VAG 1598/18).

2) When checking circuit voltage, leave battery connected with test box connected to TCM and TCM vehicle harness. When checking circuit resistance, disconnect negative battery cable and connect test.
box to TCM vehicle harness. Leave TCM disconnected.

3) **Measure voltage and resistance between specified sockets on test box.** See Figs. 10-13. If a problem is found, service harness or components as necessary. If no problem is found, TCM may be defective.

### RESISTANCE & VOLTAGE TESTS

<table>
<thead>
<tr>
<th>Sockets On VAG 1598/18</th>
<th>Area To Be Tested</th>
<th>* Testing Requirements &amp; Additional Steps</th>
<th>Test Result Specifications</th>
<th>If Test Results NOT Within Specs</th>
</tr>
</thead>
</table>
| 23 + 1                 | Transaxle TCM Voltage Supply | \* Switch Ignition ON | About Battery Voltage | Check Wire From Terminal No. 1 
Check Wire From Terminal No. 23 
For Continuity With C/15A In Relay Panel |
| 5 + 28                 | Throttle Position (TP) Sensor | \* Switch Ignition OFF 
No Throttle 
Full Throttle | 700-1800 Ohms 
2100-3900 Ohms | Check Wiring 
Calibrate Throttle Position (TP) Sensor |
| 5 + 50                 | Throttle Position (TP) Sensor | \* Switch Ignition OFF 
No Throttle 
Full Throttle | 2100-3900 Ohms 
700-1800 Ohms | Check Wiring 
Calibrate Throttle Position (TP) Sensor |
| 29 + 15                | Solenoid Switch For Shift Interlock | \* Switch Ignition ON 
Select Lever In P Or N 
Brakes Applied | About Battery Voltage | Check Wiring 
Replace Shiftlock Solenoid |
| 15 + 1                | Signal From Brake Light Switch | \* Switch Ignition ON 
DO NOT Apply Brakes 
Brakes Applied | 0 Volt | Check Wiring 
Replace Brake Light Switch |

*Fig. 10: Testing TCM Harness & Components (1 of 4)*
*Courtesy of Volkswagen United States, Inc.*
### RESISTANCE TESTS

<table>
<thead>
<tr>
<th>VAQ 1598/18 Terminals</th>
<th>Component To Be Tested</th>
<th>Test Conditions &amp; Additional Steps</th>
<th>Specified Value Or Results</th>
<th>If Test Results NOT Within Specs</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 + 1</td>
<td>Multifunction Switch</td>
<td>• Switch Ignition OFF&lt;br&gt;Move Selector Lever To Positions R, N, D, 2 &amp; 3&lt;br&gt;Move Selector Lever To Position P &amp; 1</td>
<td>.8 – 1.0 Ohms</td>
<td>Check Wire Routing&lt;br&gt;Replace Multifunction Switch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 + 1</td>
<td></td>
<td>• Switch Ignition OFF&lt;br&gt;Move Selector Lever To Position P, R, 2 &amp; 1&lt;br&gt;Move Selector Lever To Position N, D &amp; 3</td>
<td>.8 – 1.0 Ohms</td>
<td></td>
</tr>
<tr>
<td>62 + 1</td>
<td></td>
<td>• Switch Ignition OFF&lt;br&gt;Move Selector Lever To Position P, R, N &amp; D&lt;br&gt;Move Selector Lever To Position 3, 2 &amp; 1</td>
<td>Open</td>
<td></td>
</tr>
<tr>
<td>18 + 1</td>
<td></td>
<td>• Switch Ignition ON&lt;br&gt;Move Selector Lever To Position P, R &amp; N&lt;br&gt;Move Selector Lever To Position D, 3, 2 &amp; 1</td>
<td>About Battery Voltage</td>
<td></td>
</tr>
<tr>
<td>55 + 67</td>
<td>Solenoid Valve No. 1</td>
<td>• Switch Ignition OFF</td>
<td>55 – 65 Ohms</td>
<td>Check Harness</td>
</tr>
<tr>
<td>55 + 1</td>
<td>Control Unit Removed</td>
<td>Open</td>
<td>Replace Valve Body</td>
<td></td>
</tr>
<tr>
<td>54 + 67</td>
<td>Solenoid Valve No. 2</td>
<td>• Switch Ignition OFF</td>
<td>55 – 65 Ohms</td>
<td>Check Harness</td>
</tr>
<tr>
<td>54 + 1</td>
<td>Control Unit Removed</td>
<td>Open</td>
<td>Replace Valve Body</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 11: Testing TCM Harness & Components (2 Of 4)

Courtesy of Volkswagen United States, Inc.
### RESISTANCE TESTS

<table>
<thead>
<tr>
<th>Sockets On VAG 1598/18</th>
<th>Area To Be Tested</th>
<th>• Testing Requirements &amp; Additional Steps</th>
<th>Test Result Specifications</th>
<th>If Test Results NOT Within Specs</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 + 67</td>
<td>Solenoid Valve No. 3</td>
<td>• Switch Ignition OFF</td>
<td>55 – 65 Ohms</td>
<td>Check Harness Routing</td>
</tr>
<tr>
<td>9 + 1</td>
<td></td>
<td>TCM Disconnected</td>
<td>Open</td>
<td>Replace Valve Body</td>
</tr>
<tr>
<td>47 + 67</td>
<td>Solenoid Valve No. 4</td>
<td>• Switch Ignition OFF</td>
<td>4.5 – 6.5 Ohms</td>
<td>Check Harness Routing</td>
</tr>
<tr>
<td>47 + 1</td>
<td></td>
<td>TCM Disconnected</td>
<td>Ohms</td>
<td>Replace Valve Body</td>
</tr>
<tr>
<td>56 + 67</td>
<td>Solenoid Valve No. 5</td>
<td>• Switch Ignition OFF</td>
<td>55 – 65 Ohms</td>
<td>Check Harness Routing</td>
</tr>
<tr>
<td>56 + 1</td>
<td></td>
<td>TCM Disconnected</td>
<td>Open</td>
<td>Replace Valve Body</td>
</tr>
<tr>
<td>58 + 22</td>
<td>Solenoid Valve No. 6</td>
<td>• Switch Ignition OFF</td>
<td>4.5 – 6.5 Ohms</td>
<td>Check Harness Routing</td>
</tr>
<tr>
<td>58 + 1/22 + 1</td>
<td>ICM Unconnected</td>
<td>Open</td>
<td>Replace Valve Body</td>
<td></td>
</tr>
<tr>
<td>10 + 67</td>
<td>Solenoid Valve No. 7</td>
<td>• Switch Ignition OFF</td>
<td>55 – 65 Ohms</td>
<td>Check Harness Routing</td>
</tr>
<tr>
<td>10 + 1</td>
<td></td>
<td>TCM Disconnected</td>
<td>Open</td>
<td>Replace Valve Body</td>
</tr>
<tr>
<td>23 + 20</td>
<td>Solenoid Switch for Shift Interlock</td>
<td>• Switch Ignition OFF</td>
<td>14 – 25 Ohms</td>
<td>Check Harness Routing Replace Shiftlock Solenoid Assembly</td>
</tr>
<tr>
<td>1 + 16</td>
<td>Kickdown Switch</td>
<td>• Switch Ignition OFF</td>
<td>DO NOT Press Accelerator Pedal</td>
<td>Check Harness Routing Adjust Or Replace Accelerator Cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TCM Disconnected</td>
<td>Open</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 12: Testing TCM Harness & Components (3 Of 4)**

Courtesy of Volkswagen United States, Inc.

<table>
<thead>
<tr>
<th>VAG 1598/18 Terminals</th>
<th>Component To Be Tested</th>
<th>• Test Conditions &amp; Additional Steps</th>
<th>Specified Value Or Results</th>
<th>If Test Results NOT Within Specs</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 + 65</td>
<td>Vehicle Speed Sensor</td>
<td>• Switch Ignition OFF</td>
<td>800 – 900 Ohms</td>
<td>Check Harness Routing Replace Vehicle Speed Sensor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• TCM Disconnected</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Set Ohmmeter To 2 k/ohm Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 + 67</td>
<td>ATF Temperature Sensor</td>
<td>• Switch Ignition OFF</td>
<td>24,700 Ohms</td>
<td>Check Harness Routing Replace Valve Body</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• TCM Disconnected</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Set Ohmmeter To 200 k/ohm Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ATF Temperature 86°F (20°C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Set Ohmmeter To 200 k/ohm scale</td>
<td>About 48,800 Ohms</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ATF Temperature 149°F (80°C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ATF Temperature 245°F (10°C)</td>
<td>About 7400 Ohms</td>
<td></td>
</tr>
<tr>
<td>21 + 66</td>
<td>Transmission Vehicle Speed Sensor</td>
<td>• Switch Ignition OFF</td>
<td>800 – 900 Ohms</td>
<td>Check Harness Routing Replace Vehicle Speed Sensor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• TCM Disconnected</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Set Ohmmeter To 2 k/ohm Scale</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 13: Testing TCM Harness & Components (4 Of 4)**

Courtesy of Volkswagen United States, Inc.
HYDRAULIC PRESSURE

Check operation of apply and brake clutches by air checking fluid passages of valve body and transaxle case. Install Pressure Gauge (VAG 1702) to transaxle pressure tap located near dipstick tube. Check main hydraulic pressure under normal driving conditions. See MAIN PRESSURE table. If main hydraulic pressures are not correct, check for incorrect idle speed, problem with pump or sticking valves in valve body. Repair as necessary.

MAIN PRESSURE

<table>
<thead>
<tr>
<th>Application</th>
<th>psi (Bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idle RPM</td>
<td>49-55 (3.4-3.8)</td>
</tr>
<tr>
<td>2000 RPM (1)</td>
<td>146-164 (10.1-11.3)</td>
</tr>
<tr>
<td>Idle RPM</td>
<td>94-109 (6.5-7.5)</td>
</tr>
<tr>
<td>2000 RPM (1)</td>
<td>334-348 (23.0-24.0)</td>
</tr>
</tbody>
</table>

(1) - With solenoid valve connector disconnected. After test, reconnect solenoid valves and using appropriate scan tool, erase trouble codes from memory.

STALL SPEED

CAUTION: DO NOT operate engine at stall speed for more than 5 seconds. If you need to repeat stall speed test, wait 20 seconds.

1) Engage parking brake and block drive wheels. Connect tachometer to engine. Warm engine to normal operating temperature.
3) Compare measured stall speed with stall speed specification. See STALL SPEED SPECIFICATIONS table. If stall speed is within range, test is complete.
4) If stall speed is up to 200 RPM too low, check engine condition and adjustments. If stall speed is greater than 200 RPM too low, torque converter is faulty. If stall speed is too high, check 1st-3rd apply clutch or one-way clutch for slipping or damage.

STALL SPEED SPECIFICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLK</td>
<td>2600-2900</td>
</tr>
<tr>
<td>CLB &amp; CKZ</td>
<td>2250-2550</td>
</tr>
</tbody>
</table>
ON-VEHICLE SERVICE

DRIVE AXLE SHAFTS

See appropriate AXLE SHAFTS article in AXLE SHAFTS & TRANSFER CASES section.

OIL COOLER FLUSHING

1) Remove external oil filter. Remove oil lines and allow fluid to drain. Using pressurized solvent, flush remaining fluid and debris from oil lines and cooler. Repeat flushing if necessary.

2) Use pressurized shop air to remove solvent from oil lines and oil cooler. Install a new external oil filter.

TRANSAXLE COMPONENTS

Following components may be serviced with transaxle in vehicle. For removal and installation procedures, see TRANSAXLE DISASSEMBLY.

* Drive Flanges
* External Oil Filter
* Gear Selector Lever
* Multifunction Switch, Speedometer Drive Shaft & Speed Sensor
* Oil Pan & Valve Body Assembly
* Planetary Gear Cover

REMOVAL & INSTALLATION

See appropriate AUTOMATIC TRANSMISSION REMOVAL article in TRANSMISSION SERVICING section.

TORQUE CONVERTER

1) Remove torque converter. Check torque converter for any wear or damage, and replace if necessary. If torque converter is being reused, drain old fluid.

2) Extract ATF from torque converter using Torque Converter Service Station (VAG 1358 A) and Probe (VAG 1358 A/1).

TRANSAXLE DISASSEMBLY

TRANSAXLE UNIT

1) Remove torque converter. Remove oil pan and valve body assembly. Remove sealing plug from transaxle case. See Fig. 14.

2) Measure and record turbine shaft end play. See Fig. 15. Remove oil pump bolts. Using two M8 bolts, remove oil pump from front of transaxle. See Fig. 16.
3) Remove all clutches with support tube, 2nd-4th gear clutch plates, springs and spring caps together. See Figs. 17 and 18.

4) Lock drive shell in place by inserting a screwdriver through hole of large sun gear into side of transaxle case. See Fig. 19. Loosen and remove small planetary drive shaft bolt, washer and shim. See Fig. 20. Remove small planetary drive shaft.

5) Remove large drive shaft and sun gear. Remove Vehicle Speed Sensor (VSS) from transaxle case. Remove supporting tube and one-way clutch circlips. Remove one-way clutch assembly.

6) Remove planetary carrier with dished spring. Remove reverse brake clutch assembly. See Figs. 17, 20 and 21. DO NOT remove input gear assembly, unless bearing or gear damage is present.
Fig. 15: Checking Turbine Shaft End Play
Courtesy of Volkswagen United States, Inc.

Fig. 16: Removing Oil Pump
Courtesy of Volkswagen United States, Inc.
Fig. 17: Exploded View Of Transaxle Components
Courtesy of Volkswagen United States, Inc.

Fig. 18: Removing Turbine Shaft With 2nd-4th Brake Clutch & 1st-3rd Apply Clutch
Courtesy of Volkswagen United States, Inc.
Fig. 19: Locking Small Sun Gear Drive Shell
Courtesy of Volkswagen United States, Inc.

Fig. 20: Removing Small Planetary Drive Shaft
Courtesy of Volkswagen United States, Inc.
FINAL DRIVE & TRANSFER GEARS

1) Drain gear oil. Attach 1 INCH-1 lb. torque wrench to a 1 5/8" (41 mm) socket wrench. See Fig. 22. Measure and record total roller bearing turning torque of drive pinion gear. This measurement is required for reassembly reference if roller bearings are reused.

2) Engage parking pawl. Using a 7/8" (22 mm) Allen wrench socket, remove fastener nut. See Fig. 22. Remove dished washer, shim and bearing.

3) Install fastener nut. Using Pressing Adapter (VW#71), thread tool until 1/8" clearance is present between bearing race and fastener nut.

4) Pull input gear out until it bottoms in pressing adapter.
Remove pressing adapter. Remove input transfer gear assembly from transaxle case.

5) Remove speedometer drive shaft. See Fig. 23. On left axle flange, remove bolt and remove axle flange. On right axle flange, remove circlip. Using puller, remove right axle flange.

6) Remove differential ring gear cover. If bearings are being reused, mark differential adjuster ring (torque converter side) bearing carrier to transaxle case. Using Bearing Adjuster Ring Socket (3155), remove both differential bearing carriers. See Fig. 24. Remove differential assembly from transaxle case. See Fig. 23.

7) Remove drive pinion and input transfer gear cover (if not already removed). See Fig. 25. Using INCH-lb. torque wrench, measure turning force of drive pinion and transfer gear bearings. Record measurement for reassembly.

8) Engage parking pawl. Remove nut from pinion. See Fig. 26. Using puller, remove output gear. See Fig. 27. Remove selector shaft and parking pawl assembly. See Fig. 36. Remove outer bearing support. Remove parking gear from pinion. Remove pinion and bearing from transaxle. Using pin socket, remove inner bearing support with drive pinion seal.
Fig. 23: Exploded View Of Drive Gear Assembly
Courtesy of Volkswagen United States, Inc.
Fig. 24: Removing Bearing Adjuster Ring Bearing Carrier
Courtesy of Volkswagen United States, Inc.

Fig. 25: Locating Planetary & Input Gear Assembly
Courtesy of Volkswagen United States, Inc.
Fig. 26: Exploded View Of Drive Pinion & Output Gear Assembly
Courtesy of Volkswagen United States, Inc.

Fig. 27: Removing Pinion Drive Gear
Courtesy of Volkswagen United States, Inc.
COMPONENT DISASSEMBLY & REASSEMBLY

FINAL DRIVE

1) Disassemble differential. See Fig. 28. If ring gear or differential housing is damaged, replace differential housing. To reassemble differential, reverse disassembly.

NOTE: If differential bearings are replaced, check differential side bearing preload and ring gear position. See FINAL DRIVE & TRANSFER GEARS under TRANSAXLE REASSEMBLY.

2) Using puller, remove roller bearing from differential housing. Remove speedometer drive gear and bushing.

3) Check all bearing races in adjuster rings and replace if necessary. Using hydraulic press, replace bearing race(s). Replace each roller bearing and race as a set.

Fig. 28: Exploded View Of Differential
Courtesy of Volkswagen United States, Inc.
OIL PUMP & 2ND-4TH BRAKE CLUTCH PISTON

Disassemble oil pump and 2nd-4th brake clutch piston. Check for worn or damaged parts and replace as necessary. Replace all seals and reassemble. See Fig. 29.

NOTE: Specifications are not available from manufacturer.

Fig. 29: Exploded View Of Oil Pump & 2nd-4th Brake Clutch Piston
Courtesy of Volkswagen United States, Inc.
ONE-WAY CLUTCH

1) Disassemble one-way clutch. Check for worn or damaged parts and replace as necessary. Compress each spring and install into cage. See Fig. 30.

2) Hold cage assembly with large lugs up. Install cage assembly into outer ring. See Figs. 31-33. Rotate cage clockwise until lugs touch stop. Install piston into outer ring.
PLANETARY CARRIER

NOTE: Disassembly and reassembly procedures are not available from manufacturer.

Inspection & Adjustment
1) Inspect planetary carrier, pinion gears, sun gears and related parts for wear or damage. Replace parts as necessary.
2) Assemble sun gear drive shells, planetary carrier, small sun gear, pinion drive transfer gear and all related bearings and washers onto small planetary drive shaft. See Figs. 17 and 20.
3) Place assembly into transaxle case. Install adjustment shim, washer and bolt to pinion drive transfer gear end of small planetary drive shaft. Using a screwdriver, lock large sun gear drive shell to transaxle case. See Fig. 19. Tighten bolt to 22 ft. lbs. (30 N.m).
4) Place Dial Indicator Support (VW 382/7) on top of assembly. See Fig. 34. Measure end play of small sun gear drive shaft.
5) If end play is not .009-.014 (.23-.37 mm), replace adjustment shim. Adjustment shims range in thickness from .040" (1.00 mm) to .114" (2.90 mm) in .004" (.10 mm) increments.
APPLY CLUTCH PLATE APPLICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>Number Of Plates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Clutch</td>
<td></td>
</tr>
<tr>
<td>Inner</td>
<td>5</td>
</tr>
<tr>
<td>Outer</td>
<td>5</td>
</tr>
<tr>
<td>1st-3rd Clutch</td>
<td></td>
</tr>
<tr>
<td>Inner</td>
<td>5</td>
</tr>
<tr>
<td>Outer</td>
<td></td>
</tr>
<tr>
<td>CLB &amp; CLK</td>
<td>5</td>
</tr>
<tr>
<td>CKZ</td>
<td>4</td>
</tr>
<tr>
<td>4th Clutch</td>
<td></td>
</tr>
<tr>
<td>Inner</td>
<td></td>
</tr>
<tr>
<td>CLB &amp; CKZ</td>
<td>6</td>
</tr>
<tr>
<td>CLK</td>
<td>5</td>
</tr>
<tr>
<td>Outer</td>
<td></td>
</tr>
<tr>
<td>CLB &amp; CKZ</td>
<td>5</td>
</tr>
<tr>
<td>CLK</td>
<td>4</td>
</tr>
</tbody>
</table>

REVERSE APPLY CLUTCH

**NOTE:** Soak all friction-faced clutch plates in ATF for at least 15 minutes before installation.

1) Mark circlip for installation reference and remove.

Disassemble clutch plates. See Fig. 35. Compress spring support, and remove circlip. Remove clutch piston.

2) Check for worn or damaged parts and replace as necessary.

Ensure check ball in clutch housing is not damaged. Piston seal is part of piston. If damaged, replace reverse apply clutch piston.

Reassemble reverse apply clutch. See APPLY CLUTCH PLATE APPLICATIONS table.

**NOTE:** Assembled clutch clearance specification is not available from manufacturer. Ensure thrust plate is installed with shouldered side facing circlip.
REVERSE & 2ND-4TH BRAKE CLUTCHES

Reverse and 2nd-4th brake clutches are disassembled and reassembled during transaxle disassembly and reassembly. See TRANSAXLE DISASSEMBLY and TRANSAXLE REASSEMBLY.

TRANSAXLE CASE

1) Remove multifunction switch, all seals, manual valve assembly, parking pawl and sensors. If necessary, remove parking pawl pin, detent spring screws and selector rod for manual valve from case. See Fig. 36. Inspect bushings and bearing races, and replace if necessary.

2) Install new "O" ring to gear change shaft. Install gear
change shaft. Install parking pawl pin (if removed). Using a center punch, peen parking pawl pin. Install operating rod for manual valve, detent spring screws, multifunction switch and new seals.

Fig. 36: Exploded View Of Transaxle Case Components
Courtesy of Volkswagen United States, Inc.

TRANSFER GEARS

Using puller and adapter, remove tapered bearing from output gear. See Fig. 37. Using hydraulic press, install bearing to drive pinion transfer gear. Set transfer and drive pinion gears aside.
VALVE BODY

NOTE: Disassembly and reassembly procedures are not available from manufacturer.

1ST & 3RD APPLY CLUTCH

1) Remove support ring. Mark circlip for installation reference, and remove circlip. Disassemble clutch plates. See Fig. 38. Remove diaphragm spring circlip. Compress spring support, and remove circlip. See Fig. 39. Remove spring plates and clutch piston.

2) Remove piston rings from piston. Piston seal is part of piston. If damaged, replace 1st-3rd apply clutch piston. Remove seal rings from turbine shaft. Check for worn or damaged parts and replace as necessary. Ensure check ball in clutch housing is not damaged.
Fig. 38: Exploded View Of 1st-3rd Apply Clutch
Courtesy of Volkswagen United States, Inc.
3) Install new seal rings to clutch piston, and install piston in clutch housing. Install plate springs. Compress spring support and install circlip. See Fig. 39.

4) Install bottom thrust plate with smooth side facing clutch plate. Install one inner splined and one outer splined clutch plate into clutch housing. See Fig. 38.

5) Place inner plate carrier on bench. Install remaining clutch plates to inner plate carrier. See APPLY CLUTCH PLATE APPLICATIONS. Insert top thrust plate with smooth side facing clutch plate. Install support ring with step tabs up after installing thrust plate, friction plates and steel plates. See Fig. 40.

6) Install inner plate carrier into clutch housing. Install circlip in clutch housing. See Fig. 41.
4TH APPLY CLUTCH

NOTE: Soak all friction-faced clutch plates in ATF for at least 15 minutes before installation.

1) Mark circlip for installation reference and remove. Disassemble clutch plates. See Fig. 42. Compress spring support ring, and remove circlip. Remove spring support ring and spring. Remove clutch piston.

2) Remove front impeller seal rings. DO NOT remove inner impeller seal rings unless damaged. Check for worn or damaged parts and replace as necessary.

3) Piston seal is part of piston. If damaged, replace 3rd-4th apply clutch piston. Reassemble 3rd-4th apply clutch. See APPLY CLUTCH PLATE APPLICATIONS table.

NOTE: Assembled clutch clearance specification is not available from manufacturer. Ensure top thrust plate is installed with shouldered side facing circlip.
Fig. 42: Exploded View of 4th Apply Clutch
Courtesy of Volkswagen United States, Inc.
TRANSAXLE REASSEMBLY

FINAL DRIVE & TRANSFER GEARS

NOTE: Reassembly procedures include bearing and shim adjustments. Perform all steps in the order given. If no parts were replaced, skip adjustment steps and reassemble final drive and transfer gear assembly using new seals. Ensure turning torque of complete assembly is within specifications. See INPUT TRANSFER GEAR ADJUSTMENT & REASSEMBLY procedure. If turning torque is not within specifications, check all adjustments.

Drive Pinion Roller Bearing Adjustment

1) Install drive pinion assembly with smaller bearing and inner bearing support (with pinion seal and "O" ring). Install parking gear (rounded side facing drive pinion gear), park lock lug and large pinion bearing race support. Go to next step.

NOTE: Install drive pinion seal with lip opening facing closest roller bearing.

2) If reusing drive pinion and large pinion bearing, DO NOT remove existing shims from drive pinion shaft. See Fig. 43. Go to step 4. If replacing drive pinion and/or pinion bearings, install large pinion roller bearing to drive pinion. Go to next step.

3) Remove large roller bearing race support. Place two .06" (1.5 mm) thick shims onto drive pinion shaft. See Fig. 43. Install large roller bearing race support. Go to next step.

4) Install output drive pinion gear and nut. See Figs. 36 and 44. Engage parking lug to lock drive pinion shaft. Tighten nut to 184 ft. lbs. (250 N.m). Go to next step.

5) If reusing drive pinion and large pinion bearing, go to step 9. If replacing drive pinion and/or pinion bearings, go to next step.

6) DO NOT rotate drive pinion. Mount a dial indicator on transaxle case. See Fig. 45. Move drive pinion up and down (DO NOT rotate). Measure and record end play. Go to next step.

Fig. 43: Installing Drive Pinion Shim
Courtesy of Volkswagen United States, Inc.
7) Drive pinion requires .008" (.220 mm) preload. To determine correct shim thickness, perform the following procedure. Dimensions are given as an EXAMPLE ONLY:

* Subtract end play reading .037" (0.93 mm) recorded in step 6) from .118" (3.00 mm) shim pack added in step 3). This will
result in zero end play.
* Next, subtract .008" (.220 mm) to achieve required preload.
* Total shim thickness required to achieve correct preload would be .073" (1.85 mm).
* Shims are available in thickness ranging from .040-.106" (1.00-2.70 mm), in .001" (.025 mm) increments.

8) Remove nut, drive pinion gear and bearing. Install shim calculated in step 7). Apply gear oil to bearings. Install drive pinion gear and nut. Tighten nut to 184 ft. lbs. (250 N.m) to seat bearings.

9) Using INCH-lb. torque wrench, rotate torque wrench at least 8 turns to determine turning torque. Measure turning torque of drive pinion roller bearings. See Fig. 46. See DRIVE PINION ROLLER BEARING SPECIFICATIONS table. After turning torque is correct, bend locking plate on nut.

**DRIVE PINION ROLLER BEARING SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Application</th>
<th>Turning Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Bearings</td>
<td>7-11 INCH Lbs. (.73-1.20 N.m)</td>
</tr>
<tr>
<td>Used Bearings</td>
<td>(1) Same As Before Disassembly</td>
</tr>
</tbody>
</table>

(1) - Recorded during disassembly. See FINAL DRIVE & TRANSFER GEARS under TRANSAXLE DISASSEMBLY.

---

Input Transfer Gear Adjustment & Reassembly

1) Ensure inner race for roller bearing is installed in transaxle case.

2) Install input transfer gear with roller bearing and axial...
needle bearing (flat side facing input gear) into transaxle case. See Figs. 1, 44 and 47. Align lugs on outer roller bearing to fit between lugs on inner roller bearing. See Fig. 48.

3) Install outer roller bearing (without dished washer or shim) on input transfer gear. See Figs. 44 and 47. Engage parking gear. Using an Allen-head socket, tighten fastener nut to 74 ft. lbs. (100 N.m). See Fig. 49.

4) Remove fastener nut. Using a dial indicator, measure distance between input transfer gear and inner race of roller bearing. See Fig. 50. Measure thickness of dished washer.
Fig. 48: Aligning Lugs On Input Transfer Gear Roller Bearings
Courtesy of Volkswagen United States, Inc.

Fig. 49: Tightening Fastener Nut On Input Transfer Gear Roller Bearings
Courtesy of Volkswagen United States, Inc.

Fig. 50: Checking Distance Between Input Transfer Gear & Inner Race Of Roller Bearings
Courtesy of Volkswagen United States, Inc.
5) Add dished washer thickness to distance measured in step 3). Subtract .007" (.180 mm) to obtain shim thickness for desired roller bearing preload. Shims are available in thickness ranging from .040-.106" (1.00-2.70 mm), in .001" (.025 mm) increments.

6) Install selected shim. Install dished washer with curved side facing fastener nut. Apply ATF to bearings. Install and tighten fastener nut to 184 ft. lbs. (250 N.m) to seat bearings.

7) Using INCH lb. torque wrench, rotate torque wrench at least 8 turns to determine turning torque. Measure combined turning torque of pinion and input transfer gear roller bearings. See Fig. 46. See INPUT TRANSFER GEAR ROLLER BEARING SPECIFICATIONS table.

INPUT TRANSFER GEAR ROLLER BEARING SPECIFICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>Turning Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Bearings</td>
<td></td>
</tr>
<tr>
<td>Without Drive Pinion Bearings</td>
<td>18 INCH Lbs. (2.0 N.m)</td>
</tr>
<tr>
<td>With Drive Pinion Bearings</td>
<td>(1) 27 INCH Lbs. (3.0 N.m)</td>
</tr>
<tr>
<td>Used Bearings</td>
<td>(2) Same As Before Disassembly</td>
</tr>
</tbody>
</table>

(1) - Based on a drive pinion torque of 9 INCH Lbs. (1.0 N.m).
(2) - Recorded during disassembly. See FINAL DRIVE & TRANSFER GEARS under TRANSAXLE DISASSEMBLY.

8) Remove fastener nut. If necessary, select a shim and recheck roller bearing preload. If roller bearing preload is okay, apply Locking Compound (AMV 100 01) to shaft side of roller bearing.

9) Align lugs with notches of opposite roller bearing. See Fig. 48. Install axial needle bearing with flat side facing drive shaft. Engage parking gear lug. Install fastener nut and tighten to 184 ft. lbs. (250 N.m).

Final Drive Assembly

1) Oil bearings and place differential assembly inside transaxle. Install seals, "O" rings and new bearing races (if required) to bearing carrier and bearing adjuster ring.

2) Install and tighten bearing carrier to 111 ft. lbs. (150 N.m). Install locking tab.

3) Install bearing adjuster ring. Tighten adjuster ring. See Fig. 51. If using original bearings, tighten bearing adjuster ring to marks made during disassembly.

4) If using new bearings, differential or bearing carrier, tighten bearing adjuster ring to 37 ft. lbs. (50 N.m). Turn bearing adjuster ring 5 locking lugs tighter. Install locking tab. See Fig. 51.

5) Using INCH lb. torque wrench, rotate torque wrench at least 8 turns to determine turning torque. Measure combined turning torque of pinion, input transfer gear and differential side roller bearings. See Fig. 46. See DIFFERENTIAL ROLLER BEARING SPECIFICATIONS.
DIFFERENTIAL ROLLER BEARING SPECIFICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>Turning Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Including Transfer &amp; Pinion Bearings</td>
<td></td>
</tr>
<tr>
<td>New Bearings</td>
<td>33 inch lbs. (3.7 N.m)</td>
</tr>
<tr>
<td>Used Bearings</td>
<td>Same as before disassembly</td>
</tr>
<tr>
<td>Differential Side Bearings Only</td>
<td></td>
</tr>
<tr>
<td>New Bearings</td>
<td>5-7 inch lbs. (0.6-0.8 N.m)</td>
</tr>
<tr>
<td>Used Bearings</td>
<td>Same as before disassembly</td>
</tr>
</tbody>
</table>

(1) - Recorded during disassembly. See FINAL DRIVE & TRANSFER GEARS under TRANSAXLE DISASSEMBLY.

6) Install circlips to end of each axle. See Fig. 52. Install "O" rings and new seals to drive axle flange. Fill space between seal and dust lip with multi-purpose grease.

7) Install drive axle flanges to transaxle. Install and tighten differential cover bolts to 21 ft. lbs. (28 N.m). Install speedometer drive.
TRANSMISSION

NOTE: Soak all friction-faced clutch plates in ATF for at least 15 minutes before installation. Apply assembly lubrication to all bushings, washers, shims and bearings before installation. See Fig. 17.

1) Input transfer gear, drive pinion and differential assemblies should be adjusted and installed at this time. Install axial needle bearing to input transfer gear. See Fig. 53. Install "O" ring and planetary carrier. Install washer and axial needle bearing into planetary carrier. See Figs. 25 and 54. Install end plate shim for reverse brake clutch plates. See Fig. 55.

2) Install reverse brake clutch plates. See Fig. 56. See BRAKE CLUTCH PLATE APPLICATIONS table. Using Assembly Ring (VW 3267), install one-way clutch and secure using circlip. See Figs. 57 and 58.

3) Using a feeler gauge, check installed reverse brake clutch clearance. See Fig. 59. Clearance should be .047-.071" (1.2-1.8 mm). If clearance is not as specified, replace end plate shim. End plate shims are available in thicknesses ranging from .040" (1.0 mm) to .070" (1.9 mm) in .004" (.10 mm) increments.

Fig. 53: Installing Axial Needle Bearing To Input Transfer Gear
Courtesy of Volkswagen United States, Inc.
Fig. 54: Installing Planetary Carrier & Axial Needle Bearing
Courtesy of Volkswagen United States, Inc.

Fig. 55: Exploded View Reverse Brake Clutch Assembly
Courtesy of Volkswagen United States, Inc.
Fig. 56: Installing Reverse Brake Clutch Plates
Courtesy of Volkswagen United States, Inc.

Fig. 57: Installing One-Way Clutch
Courtesy of Volkswagen United States, Inc.
BRAKE CLUTCH PLATE APPLICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>Number Of Plates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Clutch</td>
<td></td>
</tr>
<tr>
<td>Inner</td>
<td>5</td>
</tr>
<tr>
<td>Outer</td>
<td>5</td>
</tr>
<tr>
<td>2nd-4th Clutch</td>
<td></td>
</tr>
<tr>
<td>Inner</td>
<td>6</td>
</tr>
</tbody>
</table>
4) Install upper circlip for support tube. See Fig. 58.
Install washer and needle bearing into large sun gear drive shell. See Fig. 17. Install large sun gear drive shell. See Fig. 60.
5) Install small sun gear drive shell. Install small planetary drive shaft with needle bearings. See Figs. 17, 61 and 62. Using a screwdriver, lock small sun gear drive shell to large sun gear drive shell. See Fig. 19. Install adjustment shim, washer and bolt on end of small planetary drive shaft. Tighten bolt to 22 ft. lbs. (30 N.m).
6) Ensure end play is .009-.014" (.23-.37 mm). If end play is not as specified, recheck assembly or adjustment. See PLANETARY CARRIER under COMPONENT DI SASSEMBLY & REASSEMBLY.
7) Install bearing, washer, and impeller shaft and 4th apply clutch. See Fig. 63. Install bearing, washer and 1st-3rd apply clutch with turbine shaft assembly. See Fig. 64. Install thrust shims on 1st-3rd apply clutch housing. Install reverse apply clutch and support tube. See Fig. 65.

NOTE: Turbine shaft end play was measured before disassembly. If end play is okay, use original thrust shims. If end play is not okay or new parts are installed, calculate end play and install required thrust shims.

8) For checking purposes, install oil pump gasket and oil pump. See Fig. 17. Position dial indicator and Support (VW 387) on transaxle case. See Fig. 66.

9) Press dial indicator on turbine shaft, and apply .040" (.10 mm) preload. Move turbine shaft up and down. Turbine shaft end play should be .019-.047" (.50-1.20 mm).

10) If end play is okay, go to next step. If end play is not okay, install required thrust shims. Thrust shims are available in thicknesses ranging from .04" (1.0 mm) to .07" (1.8 mm) in .008" (.20 mm) increments. Recheck turbine shaft end play.

11) Remove oil pump and oil pump gasket. Install support tube and .118" (3.0 mm) thick outer splined plate for reverse apply clutch. Ensure groove on support tube engages wedge of one-way clutch. See Figs. 17 and 65.

12) Install friction plates and outer splined plates for reverse apply clutch into transaxle case. See Fig. 67. Install 3 caps and springs. Install 2nd-4th brake clutch plates. See Fig. 68. See BRAKE CLUTCH PLATE APPLICATIONS table. Install 3 spring caps to springs.
3rd-4th Apply Clutch & Impeller Shaft Assembly

Fig. 63: Installing 4th Apply Clutch & Impeller Shaft
Courtesy of Volkswagen United States, Inc.

1st-2nd Apply Clutch & Turbine Shaft Assembly

Fig. 64: Installing 1st-3rd Apply Clutch & Turbine Shaft
Courtesy of Volkswagen United States, Inc.
Fig. 65: Installing Support Tube
Courtesy of Volkswagen United States, Inc.

Fig. 66: Checking Turbine Shaft End Play
Courtesy of Volkswagen United States, Inc.

Fig. 67: Installing 2nd-4th Brake Clutch Plate & Springs
Courtesy of Volkswagen United States, Inc.
13) DO NOT install top outer splined clutch plate or waved spring washer. Determine clearance of 2nd-4th brake clutch. Press 2nd-4th brake clutch assembly down. Using a depth gauge, measure distance from top of oil pump flange to 2nd-4th brake clutch (inner splined). See Fig. 69.

14) Place a straightedge across top of piston. Place gasket on oil pump flange. Using depth gauge, measure distance from straightedge to oil pump flange gasket. See Fig. 70. Subtract thickness of straightedge.

15) Subtract distance measured in step 13) from distance calculated in step 14). This gives 2nd-4th brake clutch-to-piston distance.

16) Subtract .140" (3.6 mm) from value calculated in step 15). This determines thickness of last outer splined 2nd-4th brake clutch plate. Outer splined 2nd-4th brake clutch plates are available in thickness ranging from .080-.148" (2.00-3.75 mm), in .010" (.25 mm) increments.

NOTE: Manufacturer uses .140" (3.6 mm) value to allow for waved spring washer thickness installed with 2nd-4th brake clutch plates.

17) Install last outer 2nd-4th brake clutch plate. Install waved spring washer. Install oil pump gasket. Install "O" ring to oil pump, and install oil pump. Install cover for transfer gears.

Fig. 69: Measuring Oil Pump Flange-To-Clutch Plate
Courtesy of Volkswagen United States, Inc.

Fig. 70: Measuring Height Of Piston

Fig. 71: Installing Manual Valve Operating Lever
Courtesy of Volkswagen United States, Inc.
**Fig. 72: Installing Valve Body**

*Courtesy of Volkswagen United States, Inc.*

## TORQUE SPECIFICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>Ft. Lbs. (N.m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential Bearing Carrier</td>
<td>111 (150)</td>
</tr>
<tr>
<td>Differential Housing Cover Bolts</td>
<td>21 (28)</td>
</tr>
<tr>
<td>Drive Axle Flange Bolts</td>
<td>33 (45)</td>
</tr>
<tr>
<td>Drive Pinion Bearing &amp; &quot;O&quot; Ring Support</td>
<td>148 (200)</td>
</tr>
<tr>
<td>Drive Pinion Nut</td>
<td>184 (250)</td>
</tr>
<tr>
<td>Input Transfer Gear Nut</td>
<td>184 (250)</td>
</tr>
<tr>
<td>Oil Cooler Banjo Bolts</td>
<td>26 (35)</td>
</tr>
<tr>
<td>Small Planetary Drive Shaft Bolt</td>
<td>22 (30)</td>
</tr>
<tr>
<td>Starter-To-Transaxle Bolts</td>
<td>44 (60)</td>
</tr>
<tr>
<td>Subframe-To-Transaxle Support Nut</td>
<td>44 (60)</td>
</tr>
<tr>
<td>Torque Converter Nuts</td>
<td>44 (60)</td>
</tr>
<tr>
<td>Transaxle-To-Engine Bolts</td>
<td></td>
</tr>
<tr>
<td>10-mm Diameter</td>
<td>44 (60)</td>
</tr>
<tr>
<td>12-mm Diameter</td>
<td>59 (80)</td>
</tr>
<tr>
<td>Transaxle-To-Transaxle Support Bolts</td>
<td>44 (60)</td>
</tr>
</tbody>
</table>

**INCH Lbs. (N.m)**

<table>
<thead>
<tr>
<th>Application</th>
<th>INCH Lbs. (N.m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detent Spring Screws</td>
<td>84 (10)</td>
</tr>
<tr>
<td>Differential Bearing Carrier/Adjuster</td>
<td></td>
</tr>
<tr>
<td>Locking Tab Bolt</td>
<td>108 (12)</td>
</tr>
<tr>
<td>Oil Pan Bolts</td>
<td>108 (12)</td>
</tr>
<tr>
<td>Oil Pump-To-Transaxle Bolts</td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td>71 (8)</td>
</tr>
<tr>
<td>Step 2</td>
<td>Additional 90 Degrees</td>
</tr>
<tr>
<td>Transfer Gear Cover Bolts</td>
<td>71 (8)</td>
</tr>
</tbody>
</table>
TRANSMISSION SPECIFICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>In. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch Clearance</td>
<td></td>
</tr>
<tr>
<td>Apply Clutches</td>
<td>(1)</td>
</tr>
<tr>
<td>Brake Clutches</td>
<td></td>
</tr>
<tr>
<td>2nd-4th</td>
<td>(2) .060-.068 (1.50-1.74)</td>
</tr>
<tr>
<td>Reverse</td>
<td>.047-.071 (1.2-1.8)</td>
</tr>
<tr>
<td>Gear &amp; Shaft End Play</td>
<td></td>
</tr>
<tr>
<td>Planetary Carrier</td>
<td>.009-.014 (.23-.37)</td>
</tr>
<tr>
<td>1st-3rd To Reverse Apply Clutch</td>
<td>.019-.047 (.50-1.20)</td>
</tr>
<tr>
<td>Turbine Shaft</td>
<td>.019-.047 (.50-1.20)</td>
</tr>
</tbody>
</table>

(1) - Assembled clutch clearance is not available.
(2) - See TRANSMISSION under TRANSAXLE REASSEMBLY.

TECHNICAL SERVICE BULLETINS

SHIFTING ERRATIC, HARSH OR DELAYED

1993-On Cabrio, Golf, GTI, Jetta & Passat (Group 01, TSB No. 97-01, 1-8-97)
Transaxle may shift erratic, harsh or hold shifts too long (delayed upshifts) with no trouble codes stored in memory. This condition is normally caused by improper throttle angle setting. If shifting quality is a concern, perform THROTTLE ANGLE SETTING procedure.

NOTE: On a newly installed TCM basic settings must be set prior to performing the following procedure. Basic settings can be set with Scan Tool (VAG 1551) using Function "04", Display "000".

Throttle Angle Setting
1) Connect scan tool. Turn ignition on. Press "1" to select RAPID DATA TRANSFER. Enter address word 02 "TRANSM SSN ON ELECTRONICS" and advance until "SELECT FUNCTION XX" appears in scan tool display.
2) Press buttons "0", then "8" to select function 08 "READ MEASURING VALUE BLOCK". Press "Q" button to confirm input. Press "Q" button once more, then enter group No. 001. Press "Q" button to confirm input.
3) Print screen. While observing scan tool display, slowly press accelerator pedal until display reads 25 percent. DO NOT release
pedal. Print screen.

4) While observing scan tool display, slowly press accelerator pedal until display reads 50 percent. DO NOT release pedal. Print screen.

5) While observing scan tool display, slowly press accelerator pedal until display reads 75 percent. DO NOT release pedal. Print screen.

6) While observing scan tool display, slowly press accelerator pedal until display reads 99 percent. DO NOT release pedal (resistance of kickdown switch should be felt). Print screen.

7) Continue pressing accelerator pedal to its stop while observing fourth digit on right-side 8 digit display. Fourth digit must change from 0 to 1, indicating kickdown. Hold for 5 seconds to set throttle angle.

8) Release accelerator pedal, then press right arrow button on scan tool. Select function 06 "END OUTPUT". Repeat procedure from beginning.

9) Compare voltage readings and throttle angle percentages on printout from first test with that of second test. If readings do not match, throttle angle was set incorrectly.

10) If readings do match, road test vehicle and activate kickdown switch several times to ensure proper operation.

WIRING DIAGRAMS
Fig. 73: 1995 Transaxle Wiring Diagram (Cabrio, Golf & Jetta 2.0L - Early Production)
Fig. 74: 1995 Transaxle Wiring Diagram (Cabrio 2.0L - Late Production)
Fig. 75: 1995 Transaxle Wiring Diagram (Golf & Jetta 2.0L - Late Production)
Fig. 77: 1995 Transaxle Wiring Diagram (Passat)
Fig. 78: 1996 Transaxle Wiring Diagram (Cabrio)
Fig. 79: 1996 Transaxle Wiring Diagram (Golf 2.0L & Jetta 2.0L & 2.8L)
END OF ARTICLE