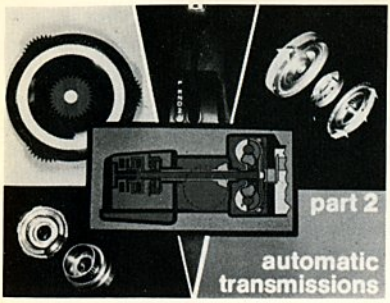
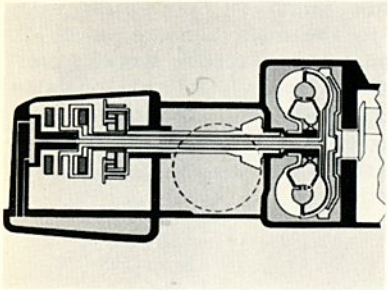
Automatic Transmission Part 2

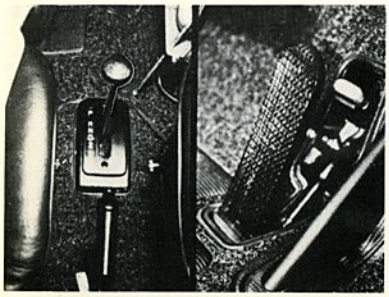
Dealer Level Training



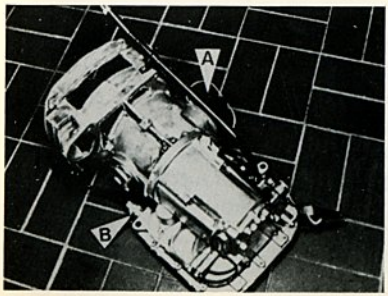
Automatic Transmission Part 2



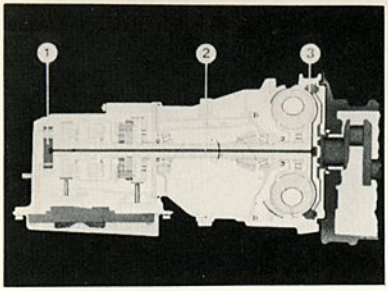
This filmstrip will explain how Automatic Transmissions shift, how to trouble shoot and how to make basic adjustments. While the theory behind Automatic Transmissions may, at times, seem complicated, it's really based on simple mechanical principles.



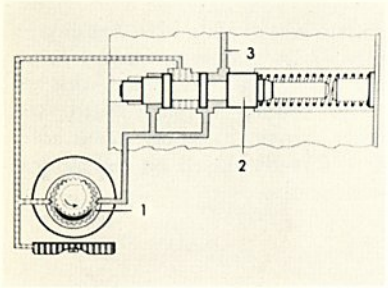
There are two types of controls that cause the transmission to shift. First, the manually operated controls which are the shift lever and the accelerator pedal (both of which were discussed earlier). These are both connected to the transmission's valve body.



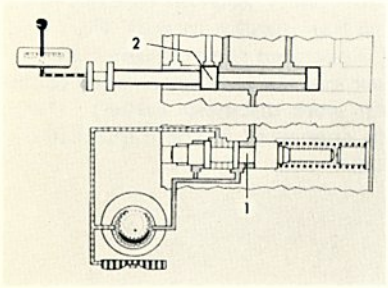
The second type of controls, the automatic controls, include pressure from the governor A, and throttle pressure from the vacuum unit B. They also work through the valve body.



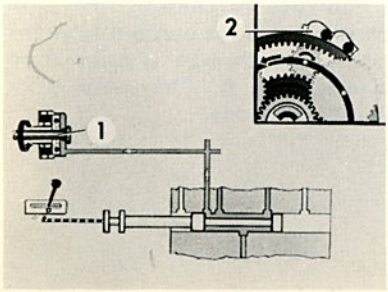
All of the hydraulic pressures that we use in the transmission—hydraulic pressures to apply brake bands, and apply and release clutches as well as to lubricate the transmission and to control when shifts take place, all have their orgin at one point, the ATF pump #1. The ATF pump is driven by a shaft #2 which is attached by a spline to the impeller of the torque convertor #3, so that the pump is driven at engine crankshaft speed.



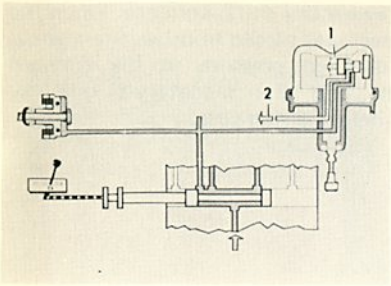
From the pump #1, pressurized ATF passes to the main pressure valve #2, which maintains a specific working pressure #3 for the hydraulically operated clutches, brakes, and transmission controls. Excess ATF is returned to the transmission sump.



From the main pressure valve #1 main pressure goes directly to the manual valve, #2 which is directly connected to the shift lever and directs pressure to other parts of the valve body.

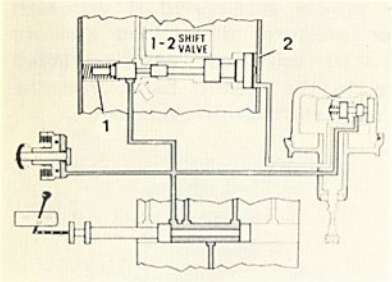


For example, when the transmission lever is in the "D" drive, position, the manual valve sends main pressure directly to #1, the forward clutch which drives the large sun gear of the planetary gear set. The ring gear of the planetary is held in position by its one-way clutch #2 and the vehicle is in first speed.



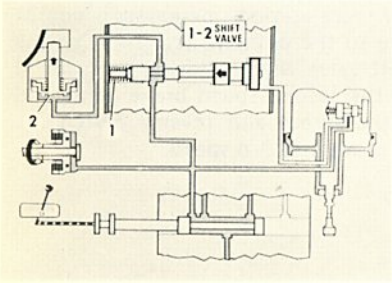
Main pressure (shown in red) is also available to the governor #1. The governor is a centrifugal valve attached to the transmission pinion shaft.

The faster the vehicle goes, the faster the governor turns and the higher the governor pressure #2. So governor pressure has a direct relationship to road speed.

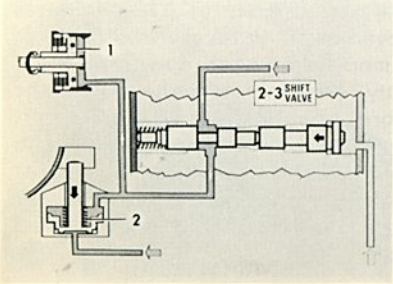


Now let's see how greater road speed and increasing governor pressure cause a shift from first to second.

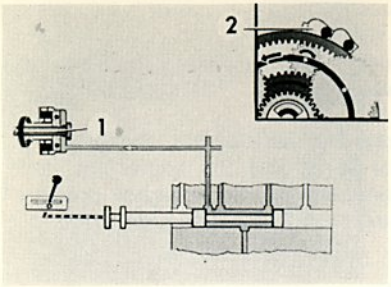
Notice that the 1-2 shift valve is blocking main pressure, at the arrow. The 1-2 shift valve is held in this position by spring pressure, #1. Governor pressure #2 is on the other end, opposing the spring pressure.



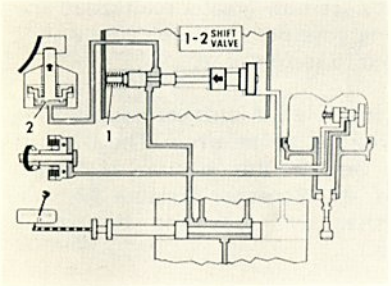
As road speed increased, governor pressure (blue) increases until it overcomes the 1-2 shift spring #1. The shift valve moves to the left, allowing main pressure (red) to go to the second gear brake band #2. The brake band is applied, and the transmission automatically shifts to second.



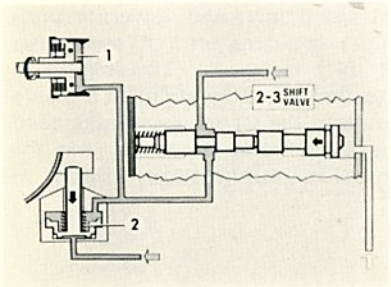
As we continue to accelerate now in second, governor pressure continues to increase until it overcomes the spring of the 2-3 shift valve—the valve that controls the shift from 2nd to 3rd. That valve moves to the left and allows main pressure (red) to reach the direct and reverse clutch #1 and at the same time directs pressure to the release side of the second brake band #2. This pressure immediately releases the second brake band . . . Leaving the forward clutch and the direct and reverse clutch engaged. The transmission is now in 3rd speed.



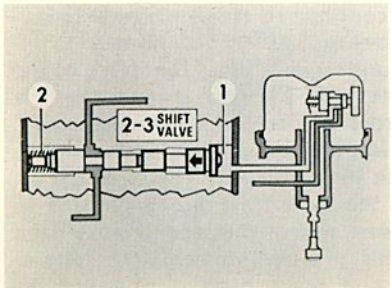
Let's review this shift sequence. When the shift lever was placed in drive, the manual valve directed pressure to the forward clutch, and the planetary's one-way clutch held the ring gear.



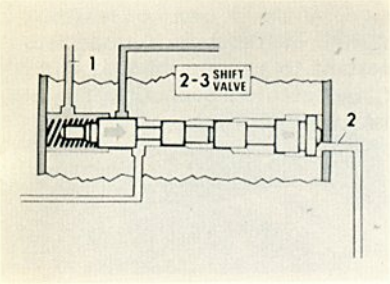
As the vehicle accelerated it increased governor pressure, this added pressure moved shift valve 1-2, which directed pressure to the second band, and the transmission shifted into 2nd gear.



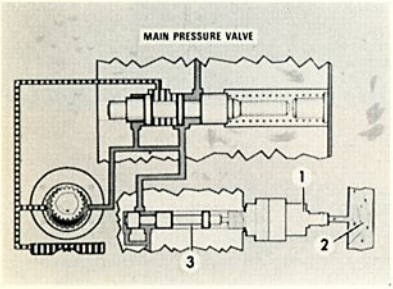
Further acceleration increased governor pressure to the point where it moved the 2-3 shift valve which allowed pressure to release the second speed brake band, and apply the direct and reverse clutch . . . and so move into 3rd speed.



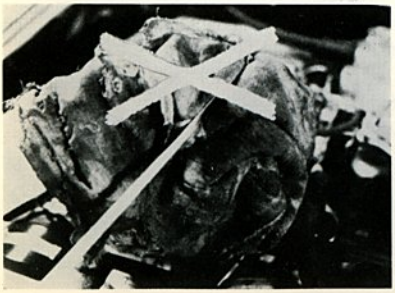
Looking at a diagram of the shift valves and governor in third gear will help us understand how we can down-shift automatically. Governor pressure #1, is the only force opposing that of the 2-3 shift spring #2. In order to move this valve to the right and shift to 2nd, we must either lower governor pressure #1 by slowing down, or increase the force on the 2-3 shift spring #2.



To increase the force on the 2-3 shift spring throttle pressure our second automatic control #1 is admitted to the spring end of the shift valve, overcoming governor pressure #2, causing the valve to move to the right. This shuts off pressure to the direct and reverse clutch and to the release side of the second band. The band takes hold—and the transmission shifts to second.



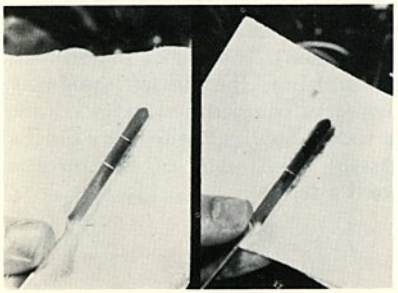
Here is how this varying throttle pressure is created. At the top is the main pressure valve we saw before. Below, is the vacuum unit #1 mounted on the transmission. A hose connects it to the intake manifold—#2. The vacuum unit controls the throttle pressure valve #3. This valve takes the main pressure (red) and modifies it into the varying primary throttle pressure—(green). The higher the primary throttle pressure, the longer the lower gears will stay engaged despite increasing vehicle speed. So you can see why precise and careful adjustment of the throttle pressure is essential.



Although the transmission's hydraulic controls seem rather complicated, maintenance, repairs and adjustments are very simple. Cleanliness is important with all repair work but it's doubly important with automatic transmissions since it only takes a microscopic piece of material to damage or jam a valve, causing improper operation.

So that nothing is overlooked when a transmission malfunction is suspected, it is important to trouble shoot it and adjust it in a specific sequence starting with the basic checks.

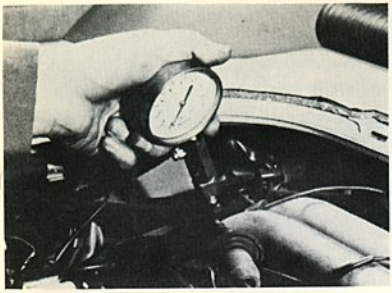
First, always check the ATF level of the transmission. Check it warm with the engine running at idle, in park. The level must be between the upper and lower marks on the dip stick.



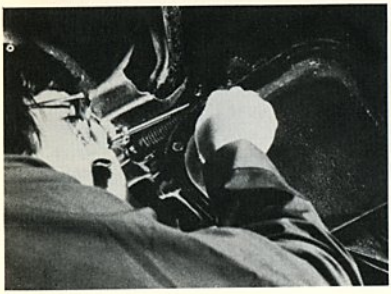
Too much ATF as well as too little can cause incorrect operation. Too much ATF may foam, allowing air bubbles into the valve body, which will disturb the hydraulic controls. While checking the level, pay particular attention to the condition of the ATF. If it is contaminated or looks or smells burned, it is an indication of mechanical problems within the transmission.

When you are satisfied with the condition and level of the ATF

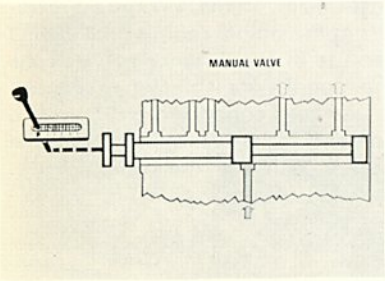
Check the engine.



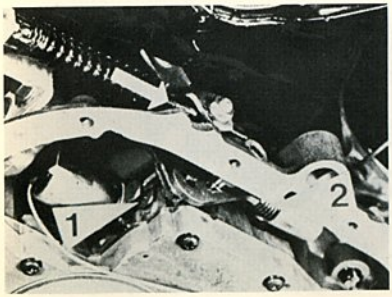
One of our major automatic controls, the vacuum unit, will not function properly if the engine vacuum is not correct. Incorrect valve adjustments, poor compression or just poor state of engine tune, will cause an automatic transmission to shift erratically. Always be sure that the engine is operating properly.



Check the adjustment of the manual valve. Remember that in the Park position, all main pressure must be stopped at the manual valve.

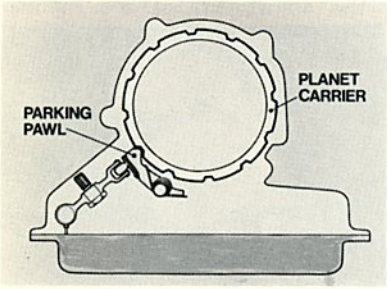


An incorrectly adjusted manual valve can cause clutches to drag and wear, by allowing main pressure to leak in and partially apply them.



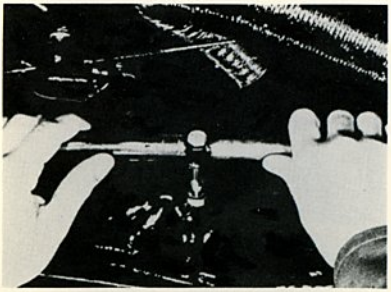
For this reason, it is critical that the cable (green arrow) be adjusted so that the manual valve #1 is fully seated. This means the parking pawl spring #2 must be compressed.

To adjust, place the selector level in Park and loosen the shift cable lock-nut. Force the shift lever on the transmission against spring tension of the parking pawl, to the rear, with a screw driver—and then while holding it, tighten the cable lock-nut.

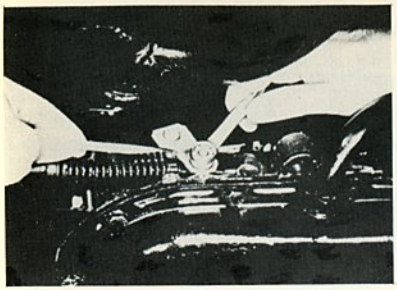


The parking pawl is a simple mechanical linkage that engages a pawl into teeth on the planet carrier, thereby locking the rear wheels. If the car is moving and the carrier is rotating rapidly, when it won't engage because the shape of its teeth will cause the pawl to be pushed out against spring tension.

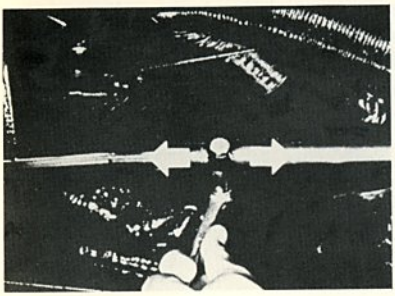
The shift linkage of the VW type 2 is different from the simple cable of the type 3 & 4. Because of the distance between the shift lever and the transmission it is necessary to use two connected shift rods, a cable, detent springs and balls near the transmission to locate the manual valve.



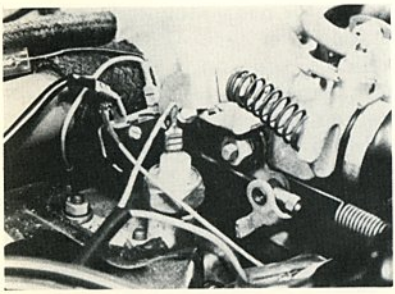
To adjust-select park: Loosen the clamp that holds the two shift rods and pull the rods apart.



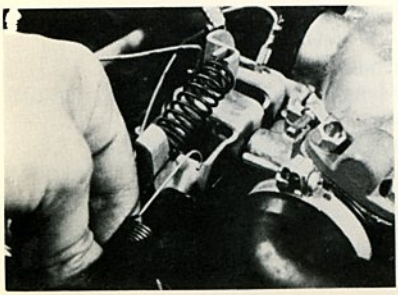
Loosen the shift cable lock-nut and press the shift lever on the transmission fully to the rear against its spring pressure. While holding it in position, tighten the shift cable locknut.



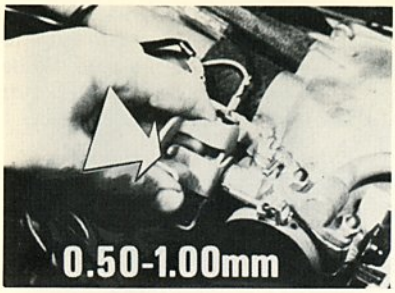
Finally, push the front shifting rod forward while holding the rear rod in position and tighten the shift rod clamp bolt. The last adjustment is the kickdown switch.



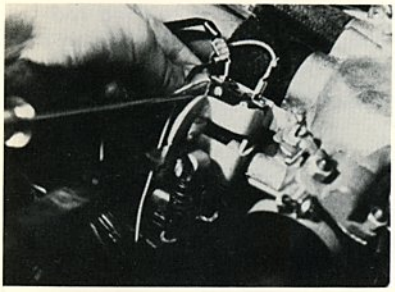
The type 3 kickdown switch is near the throttle shaft mounted on the intake air distributor.



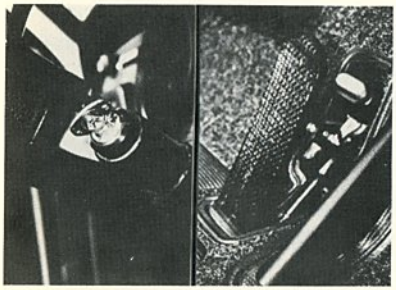
To adjust, simply turn the ignition on, detach the throttle return spring and fully open the throttle valve.



Push the lever against its spring pressure. The solenoid must operate, click with a clearance of 0.50-1.00 mm. in the lever.



To adjust, slightly loosen the switch mounting screws. Hold the clearance with a feeler gauge, move the switch until the solenoid just operates, then tighten the screws.

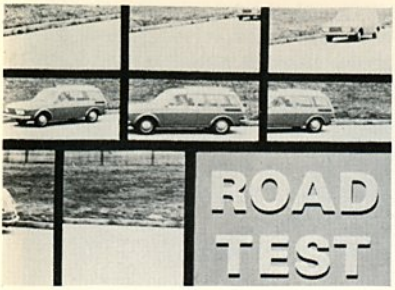


The accelerator pedal-mounted kickdown switch found on type 4's, and 2's with automatic transmission, is not adjustable. To check its operation simply turn on the ignition and fully open the throttle. If it is working, a click will be heard when the solenoid operates.

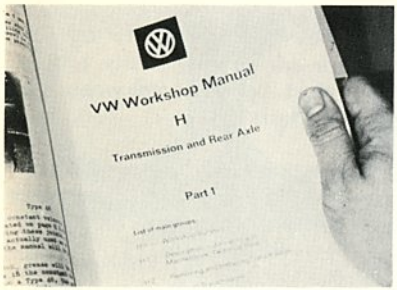
- **ATF level/condition**
- **engine adjustments**
- **shift linkage adjustment**
- **kickdown switch**

These are the Basic checks . . .

1 ATF level and condition
2 Engine adjustments
3 Manual valve to shift linkage adjustment
4 Kickdown switch adjustment

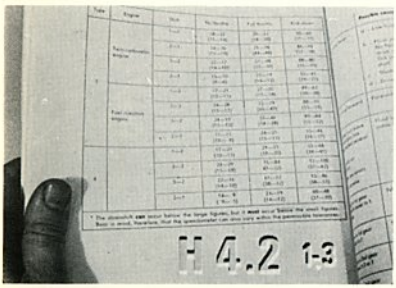


After the basic checks have been made the next step is the road test. The purpose of the road test is to see if the transmission shifts properly at the correct speed.

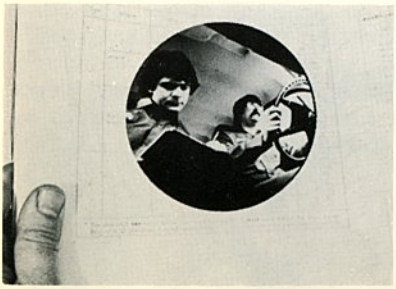


The workshop manual and workshop bulletins contain information as to when the particular model should shift.

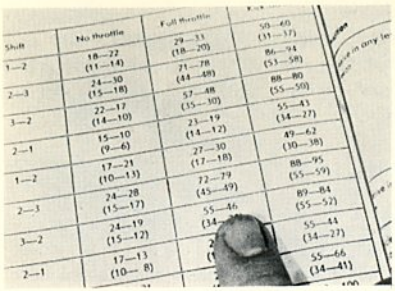
For example—



This chart found on page H 4.2 1-3 of the Work Shop manual volume "H" part one, shows the shift points in kilometers per hour and, in parentheses, miles per hour.



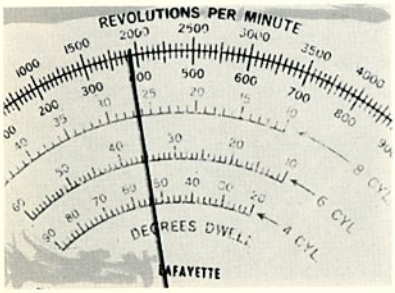
Remember, a road test is necessary to verify these shift points. Road testing is a two man operation. For safety sake always have a partner handle the check list so that you can concentrate on the driving.



The shift point chart is simple: the transmission should shift at the speed in the chart at the throttle opening indicated. It should shift quickly and smoothly without interruption in the power flow, or engine racing. For example, during full throttle it should shift from first to second at between 17-18 mph and second to third at 45-49 mph.

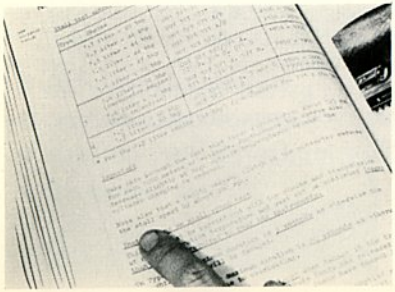
The stall speed test, checks the condition of the one way clutch in the torque converter. There are definite safety precautions that must be observed when performing a stall test:

Attach a tachometer so you can read it from the driver's seat. Set the hand brake and put your left foot firmly on the service brake.



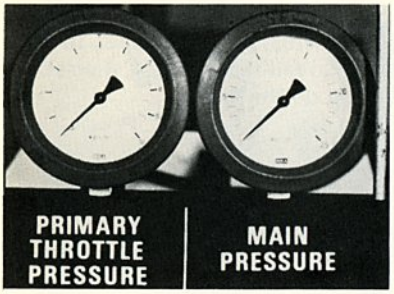
Then, start the engine and select Drive. Fully open the throttle and read the highest RPM.

Only do this very briefly otherwise the transmission will heat up and may be damaged.



Check the workshop manual and workshop bulletins for the current specifications on the model you are working on. A defective one-way clutch will reduce engine speed from its specifications by about 400 RPM.

The final check is the transmission pressure test, checking the Main Pressure and Primary Throttle Pressure. Against specifications in the work shop manual.

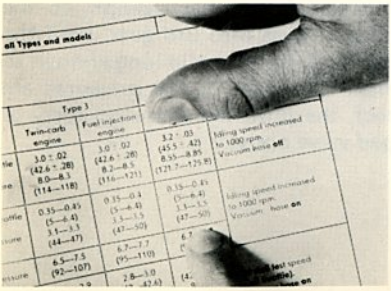


To check pressure attach the transmission gauge set to the transmission.

The left hand gauge is for Primary Throttle Pressure
0-10 kg/cm2
0-140 psl

The right hand gauge is for main Pressure
0-25 kg/cm2
0-350 psl

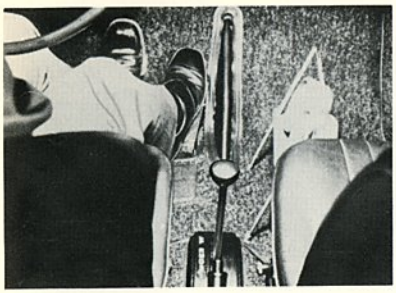
Disconnect and plug the vacuum hose and run the engine at 1000RPM in Neutral while observing the primary throttle pressure gauge. If it is incorrect according to the workshop manual test chart, adjust it by turning the adjusting screw in the vacuum unit. If the pressure cannot be adjusted, the vacuum unit must be replaced.



Only after primary throttle pressure is correct continue the pressure checks by observing the gauges and following the test sequence.

Check the primary and main pressures at 1000 RPM in Neutral both with the vacuum hose off and with the vacuum hose on.

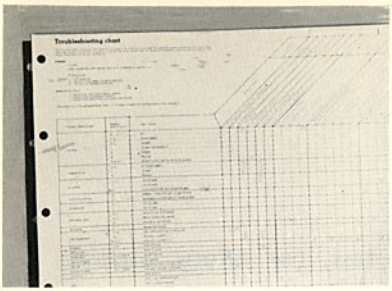
From inside the vehicle, with both brakes applied, select Reverse and check the main pressure.



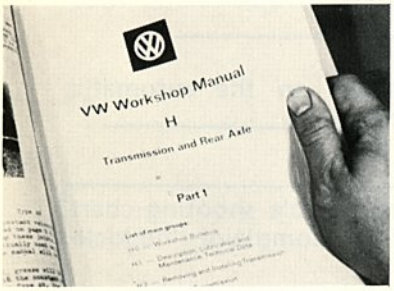
Again, with both brakes applied select Drive, momentarily accelerate to full throttle and read the pressure, then select Reverse and do the same.

The final pressure check is performed on the road. Again, bring along a partner to read the gauges so you can concentrate on driving.

While driving faster than 18mph, so the transmission goes into 3rd gear, hold the accelerator at full throttle long enough to read main pressure. If the pressures are incorrect, the probable cause is a dirty or damaged valve body.



As with other vehicle systems, diagnosis of problems is a matter of following a logical series of tests and using their results to find the cause.



Always use the procedures outlined in the workshop manual. They work. By systematically following the proper test procedures you should be able to successfully diagnose any malfunction in the VW Automatic Transmission.

QUESTIONS

1. When performing a stall speed test, for safety, always apply _____ .

2. The part of an automatic transmission that relates road speed to pressure is called the _____ .

3. Before performing pressure checks on the automatic transmission, always perform the _____ .

For the following questions use the trouble shooting chart found in the back of the book and this complaint "no kick-down in selector position D or 2".

4. Which adjustments should be made first?

_____

5. What repairs require transmission removal?

_____

_____

6. Which section of the Workshop Manual has information on a defective kickdown switch?

_____

NOTES

ANSWERS

1. When performing a stall speed test, for safety, always apply **both brakes.**

2. The part of an automatic transmission that relates road speed to pressure is called the **governor.**

3. Before performing pressure checks on the automatic transmission, always perform the **basic checks.**

For the following questions use the trouble shooting chart found in the back of the book and this complaint "no kick-down in selector position D or 2".

4. Which adjustments should be made first?

Adjust kickdown switch

5. What repairs require transmission removal?

Sticking kickdown valve
Damaged paper gasket

6. Which section of the Workshop Manual has information on a defective kickdown switch?

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NOTES

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