SERVICE REFERENCE BOOK

Diagnosing the HYDRAULICALLY OPERATED Transmission

in CHRYSLER and DE SOTO Passenger Cars

Prepared by CHRYSLER CORPORATION
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Trying to fix up a transmission without knowing how it works, and what each part is supposed to do, is like trying to use the “hunt and peck” system on a typewriter that doesn't have any symbols on the keys. You can make a lot of mistakes, and waste a lot of time that way!

Actually, the hydraulically operated transmission is simply a conventional, constant mesh unit, with a hydraulic piston to do the shifting, and an electrical system to turn the hydraulic pressure on and off. It's easy to find out whether any difficulty is electrical, because the current should be off for upshift, and on for downshift. All you need is a test light to see whether it's right or not. If the electrical system goes on and off like it should, you can see if the hydraulic piston's going back and forth, by watching it through the hole for the interrupter switch. (Of course you need to have the transmission in gear and the wheels turning, so the pump will be working, and giving you oil pressure to move the piston.) It's only if both the electrical and hydraulic systems check out okay and the transmission still doesn't shift to the gear it should, that you have to get into the transmission itself.
The point is, when you know the transmission you can find out if the fault is electrical, hydraulic, or mechanical, in a couple of minutes, just by checking the current at the solenoid and the piston movement under the interrupter switch. And it's a lot better to find that out BEFORE you pull a transmission, than after you've done a lot of work that wasn't necessary at all.

If you know how to put your finger on the main difficulties that may come along, anything else should be easy,

IF YOU JUST STOP LONG ENOUGH TO FIGURE OUT WHAT TO LOOK FOR AND WHERE TO LOOK FOR IT.

DON'T FORGET TECH'S EASY REMINDER FOR CHECKING THE TRANSMISSION

"FOR THE UPSHIFT everything's UP"

Car speed, accelerator pedal, relay contact arm, solenoid plunger, oil control valves and pressure on the piston.

FOR THE DOWNSHIFT everything's DOWN"

"UP" IS UP

"DOWN" IS DOWN
1. IF THE TRANSMISSION DOESN’T UPSHIFT

As you know, the transmission should be ready to shift up from third to high, in the driving range, at about 14 miles an hour. As soon as the driver lifts his foot from the accelerator the actual shift should occur. But suppose it doesn’t. . . how do you find what’s wrong? Before checking into the transmission at all, be sure the engine returns to idle properly. If it’s running too fast, the shift will be delayed. But assuming you found the engine idle to be right, then what?

IS IT THE ELECTRICAL SYSTEM?

Well, the first thing to check is whether the electrical system’s calling for the shift or not. You can do that by using a test light right at the solenoid. Clip one lead of the test light to the solenoid terminal, and the other to a good ground. Now, when you turn the ignition switch on, the light should come on. That’s because the governor contacts are closed, letting current flow through the relay magnet, closing the relay contacts, and completing the circuit from the battery to the sole-
noid. And as long as current goes to the solenoid the solenoid plunger is pushed down, holding the oil pilot valve closed.

But now with the shift lever in neutral, start the engine and speed it up, to open the governor points. The light should go out whenever the engine speed is above what it would be at fourteen miles an hour in third. But if the light stays on, you know there's something wrong in the electrical system.

Here's where a little figuring will save you a lot of time. Stop to think what it is that keeps the current from going off at low speeds. Remember, it's the electro-magnet, in the relay, holding the contacts closed. So, unless you have a broken spring, or a short, in the relay (neither of which are very likely) the question now narrows down to what prevents the electro-magnet from being turned off when it should. It's turned on by the ground connection through the governor contacts. So, if it doesn't turn off, either the governor contacts are dirty and not breaking contact, or else the wire from the relay magnet (the TH terminal) must be grounded somewhere.
That ground would have to be either in the circuit to the kickdown switch in the carburetor, or in the wire to the governor. You can check the kickdown switch itself, simply by disconnecting the wire from the switch (Just be sure the free end of the wire isn't touching a ground anywhere!) Now, if the test light at the solenoid still doesn't go out when you speed up the engine, you know the ground must be in the governor circuit.

To find out whether it's in the wire, or in the governor, all you do is disconnect the wire at the governor terminal. If the light still stays on you know the wire must have rubbed bare against the frame, or some other ground, so it doesn't make any difference whether the governor points open up or not. The fix for that is just to tape up the wire at the damaged point and to correct its position so it won't chafe again.

If the light goes off, you know you've pinned the difficulty right down to the governor itself. What's more, you've done it with just three quick tests — with the test light at the solenoid, and speeding up the engine — first with all connections untouched, second with the kickdown switch disconnected, and third with the governor disconnected.
FIXING THE GOVERNOR

There are two things that you can do to put the governor back in good working order again. One is to clean up the points, in case they've become corroded enough to keep from breaking the circuit. As you know, the contacts are located in the governor cover, and can be cleaned very easily, by lifting the switch arm, spring and contact plate right off. Those contacts are silver, so clean them by using a clean cloth or brush, with a little carbon tetra-chloride, or just the eraser on the end of a pencil. Never use a file, or anything rough, like sandpaper, emery cloth, or crocus cloth. When you put the switch arm back on again, lay the contact plate in place, contact point down. Then, with the bump, or the high side of the indentation on the switch arm on top, hook the arm into place on the cover. Just putting that arm on upside down can throw the governor timing completely off. The second operation on the governor is to free up the plunger action. All that's needed is to put a few drops of fine oil in the vent hole on the side of the plunger and work the plunger up and down. Turning it back and forth a few times will also help to be sure it's perfectly free.

When you put the cover back on, be sure the gasket is in place, and that the cover attaching screws are pulled down tight. Otherwise, you may alter the speeds at which the governor points open and close. If the cover is defective a new cover can be installed without having to replace the entire unit.

CAUTION

In case it is necessary to replace the governor, be sure the copper gasket is in position between the governor and the case. Then tighten the governor down by hand only. Using a hammer on the wrench can crack the governor housing.
CHECKING UP ON THE HYDRAULIC SYSTEM

If the electrical system tests out okay, you know the difficulty must be either in the hydraulic system, or due to some mechanical fault in the transmission itself. In order to test the hydraulic system, you have to have the transmission in gear, and the rear wheels turning. That's because the transmission oil pump is driven off the main shaft, so there's no hydraulic pressure until the main shaft turns. So the first thing to do is to get the rear wheels off the floor, by blocking the car up on jack stands.

CAUTION

Don't take a chance on holding up the rear wheels merely with a jack. If the car should come off the jack, while the rear wheels were spinning, anyone near may get seriously hurt, to say nothing of the car and anything that happened to be in its path!

WATCHING PISTON MOVEMENT

Before you start the engine you'll want to take the interrupter switch out of the transmission case, so you can look down into the transmission itself to see whether the piston's moving or not. You'll need a flashlight, so you can see inside the case. Now, with everything safe, it's okay to start the engine, and put the transmission in gear. By looking down through the inspection hole in the floorboard you can see the
piston return spring holding the piston in the back position. When you speed up the engine so the speedometer shows around fourteen miles an hour (with the lever in the driving range) the piston should move forward, completely covering the hole in the case.

CHECKING OIL LEVEL AND PRESSURE

If the piston doesn’t move ahead when the engine’s speeded up, one of the first things to check is the oil level. That’s easy to do by taking out the filler plug to see if the oil is level with the bottom of the hole. If it needs more oil, be sure you always use 10-W engine oil, only, either in summer or winter.

With enough oil in the transmission, the next thing to check is the pressure. First stop the engine, and then remove the pressure line plug (that’s the upper of the two hexes on the right side of the mainshaft
rear bearing retainer). Connect a pressure gauge in its place, and start up the engine. With the transmission in third, and the speedometer showing about fifteen miles an hour, the pressure should show at least forty pounds. Some transmissions, particularly the earlier ones, will build up considerably more pressure than that. If the pressure's too low, the relief valve may not be seating properly, so you'd take it out and clean up the whole assembly, as well as the seat. The oil strainer should also be taken out and cleaned, as a regular practice, because if it gets clogged the pump won't get enough oil, and pressure will fall off.

**PRESSURE LOSS PAST THE PISTON**

If the oil level is correct, but the pressure does not build up to the proper point, the difficulty could be due to a scored piston. That means pulling down the transmission to remove and replace the piston. Severe scoring on the cylinder will require replacement of the case. *Always* check both control valves before getting into the transmission.
FREEING UP CONTROL VALVES

A pilot valve that didn't come up to the open position when the solenoid no longer held it down, could keep the transmission from shifting to high. (Remember, to Upshift, everything's UP . . . including both hydraulic control valves.) So you take off the solenoid and push the pilot valve down against its spring. It should come right back up. If it doesn't, take out the plug underneath the valve, remove the spring, and push the valve itself out. You can clean it up with crocus cloth. When the pilot valve needs attention, it's always a good idea to take out the main control valve and clean it up too, even though it's not likely to stick on the upshift. Incidentally, the bleed hole added as an improvement to later main valves, in no way alters the valve action. On most transmissions you'll find a plug above as well as beneath the main valve, which is a help if you have to push the valve down.

SHINE IT UP!
AS A LAST RESORT...

PULL THE TRANSMISSION

If the light goes on and off at the solenoid, and if the piston moves back and forth as it should, the difficulty must be mechanical, and to do anything about it you almost always have to take the transmission out of the car; otherwise it's next to impossible to see what's wrong, or what you're doing.

You may find a binding condition in the direct speed shift rail, which keeps it from moving ahead as it should. Something may be keeping the automatic clutch sleeve from moving ahead freely. Or the free wheeling control sleeve may be sticking. If the teeth of the direct speed clutch sleeve, or the teeth of the main drive pinion have become damaged they won't mesh easily, and you may get only a partial engagement. If the transmission has been disassembled before, you might find that the direct speed clutch sleeve isn't properly indexed with the free wheeling control sleeve. Any of those things might interfere with smooth upshifting. Complete instructions for taking down the transmission and putting it back together again are in your shop manual.
SPECIAL NOTE: Before putting a transmission back in the car, test the hydraulic action—on the bench—with oil at the correct level. You can do this easily, simply by revolving the mainshaft by hand, clockwise—enough pressure will build up to move the piston ahead.

2. IF THE TRANSMISSION WON'T DOWNSHIFT

If you don't get a downshift when you should, you're looking for just the opposite of what caused no upshift. (To shift down, everything's down, remember?) The current should be on, the solenoid plunger down, both oil control valves down, and pressure should be off the piston.

IS THE ELECTRICAL SYSTEM ON AS IT SHOULD BE?

When the car slows down, the governor points should close, putting the relay magnet into operation, closing the relay contacts, and completing the circuit from the battery to the solenoid. You can find out whether that's happening or not, simply by using a test light at the solenoid, and turning the ignition switch on.

CHECK THE FUSE

If there's no current at the solenoid, the first, and easiest thing to do is to check the fuse at the relay. You can't always tell by looking at it, so twist it gently, to be sure the fuse strip is connected at both ends. If there's any doubt, put in a new fuse. Incidentally, a good fuse doesn't blow without some reason, so be sure you check that the leads to the relay are on the right terminals before you put in a new one, or you'll just blow the second one.
FIX ANY POOR CONNECTIONS

One of the easiest ways for an electrical system to go wrong is because of a poor connection. So, before you start testing any of the electrical units, be sure every connection is tight.

TEST THE RELAY

To be sure current is getting to the relay, leave the ignition turned on, and use the test light at the coil terminal and then at the battery terminal of the relay. That will show whether there’s a break in the wire from the coil to the relay. If it’s okay, ground the relay at the TH terminal, then clip one lead of the test light to the solenoid terminal of the relay, and the other lead to a ground. The light should come on. If it doesn’t you know the relay is defective and should be replaced. If the relay’s okay, move the test light over to the solenoid itself. If you don’t get a light, you know the wire between the relay and the solenoid is broken. If you get a light at the solenoid, but it goes out when you remove the ground from the relay, you know you’ve narrowed the search down to the governor circuit.
WIRE OR GOVERNOR?

Just as before, you can find out whether the trouble is in the wire or the governor, by disconnecting the lead from the governor itself. Then ground the wire against the transmission case. The test light at the solenoid should come on, unless the wire is broken. If the governor itself is at fault, either the weights or the plunger are sticking, so the points don't get closed. Then you free up the action, the way we talked about under no upshift.

TESTING THE SOLENOID

Of course, if current is getting to the solenoid, but there's no downshift, the solenoid may be defective. To check it, take it out, rest it on the transmission case to provide a ground, and with the wire connected to the terminal, turn the ignition on and off. The plunger should be forced out when the current's on. If it isn't you need to install a new solenoid.
3. NO DOWNSHIFT ON KICKDOWN

If the transmission doesn't shift down to third when the accelerator is pushed to floor, at any speed from about fifteen to forty-five miles an hour, the difficulty is probably somewhere in the kickdown circuit. Before making an *electrical* check, make sure that the throttle linkage actually pushes the kickdown switch plunger all the way in when the accelerator pedal is down to the floor.

You can check whether the kickdown switch itself is working, without running the engine or turning on the ignition. Clip one lead of the test light to the switch terminal, and the other to the *negative* terminal of the battery. The test light should come on when you push the switch plunger all the way in. If it doesn’t, remove the plates at each end of the switch housing and clean all contact points. If you find that the piston has become stuck in the up position, it will be necessary to remove the carburetor and disassemble, in order to remove and clean up the piston.

**CHECK THAT LINKAGE!**
TESTING THE INTERRUPTER SWITCH

One condition that could interfere with the downshift, particularly on the kickdown, would be a defective interrupter switch. This would mean that the torque through the automatic clutch sleeve isn’t relieved, to let the piston return spring to free the sleeve from the main drive pinion. To check the switch, disconnect the lead from the relay, clip one lead of the test light to the switch terminal, and the other to the negative terminal of the battery. Now, with the engine running, and the transmission in gear, the test light should flash on when the piston moves ahead. It also should come on faintly during the return movement of the piston; but the upshift flash is easier to see, because the piston moves slower so the flash lasts longer. If the switch does not work, it must be replaced.
CHECKING THE HYDRAULIC SYSTEM

If the pilot valve sticks, so the solenoid can’t push it down, or if the main valve isn’t free, so its spring can push it down, the oil pressure won’t be shut off from the piston. It’s always a good idea to clean up both valves, in case of faulty downshift.

You can always check piston action, by looking in through the opening for the interrupter switch, as we did when checking the upshift.

Before YOU PULL THE TRANSMISSION

ONE LAST LOOK!

If you’re sure the electrical and hydraulic systems are working as they should, but there’s still no downshift, you’ll have to get into the transmission itself. Before you actually take the transmission out of the car, check to see that the lock screw that holds the shifting fork to the rail hasn’t worked loose. This can be done by removing the plug provided for that purpose just ahead of the governor. The cause of the difficulty could be right there.
WHEN THE TRANSMISSION UPHIFTS IMMEDIATELY

If you have difficulty due to a transmission that shifts from third to high almost as soon as the car is in motion, you have one of the conditions we discussed under failure to downshift. Unless the pilot valve itself is sticking, the solenoid isn't holding the valve down, as it should. So either the solenoid isn't getting current, or else it's defective. As in no downshift, the lack of current may be from poor connections, a broken wire, a defective relay, faulty governor operation, or, of course, merely a blown fuse.

SLOW OR DELAYED UPHIFT

Once in a while you get a transmission that checks through okay, but still is erratic, or reluctant to upshift at the right time. Before you get too worried about the transmission itself, it would be a good idea to take a look at the throttle linkage. You see, if the

CHECK THROTTLE LINKAGE.
throttle doesn't go back to the idle position as quickly as it should when the driver lifts his foot off the accelerator to call for the upshift, the engine speed is too high for the gears to synchronize promptly and smoothly. More than once, as simple a thing as freeing up a sticking hinge pin on the bottom of the accelerator pedal has cleaned up so-called transmission trouble. Freeing up all throttle linkage and checking for possible interferences is good routine procedure, if only as a way of avoiding possible future difficulties.

A slow upshift can also be caused by a scored piston. As we said earlier, that means pulling down the transmission, replacement of the piston and possibly the case.

If a piston is to be replaced, the new type of piston, the one without the drain slots, can be used in either new or older transmission cases. Do not put an old type piston in a new case, because with drain slots in the old piston and bleeder holes in the new case, the pressure may not build up sufficiently to complete the shift. Your parts lists will give you the effective points for old and new pistons and cases.
NO NEED TO GUESS

One of the best things about the hydraulically operated transmission, as far as servicing it is concerned, is that its operation depends upon a small number of very simple units. Once you have a good understanding of how those units work together, there's no guesswork in finding out which one is causing difficulty. You can figure out what to look for and where to look for it, just by going over the charts before you even look at the car itself. For instance, with no upshift, you know the current's not being cut off when it should. And by looking at the chart you see that the only places you need to look are beyond the TH terminal of the relay, to the kickdown switch or the governor. No need to waste time making needless checks at other parts of the circuit.

Studying the chart would show you what to do even if something as unusual should happen as having the ignition system go unexplainably dead. The only thing that could cause that, as far as the transmission is concerned, would be the interrupter switch. Either it would have to be shorted, or else the piston would be stopped at the point where it closed the contacts
in the switch. Tracing the circuit on the chart you can see that the wire from the ignition coil goes to the battery terminal of the relay, and through the fuse. So, to stop the ignition system from grounding through the interrupter switch, all you have to do is to remove the fuse at the relay. The engine can then be started, the gears will synchronize so the shift sleeve and piston can go back, and you can replace the fuse.

The time you spend in getting to really know the transmission will pay you back many times over. It will save you time, labor and money. It will help you to build up extra good will with customers because of the fast service you give them and because they don’t have to keep coming back with the difficulty still not fixed. Finally, the sure, easy way you find and correct the difficulty is proof to the owner that he made the right choice first when he bought the car, and the second when he brought it back to you for service.

There's no surer way to make Boosters than that!

IT'S SWELL NOW!
# TEST YOURSELF

## WITH THESE QUESTIONS!

1. The only two instruments you need to diagnose the hydraulically operated transmission are a test light and a pressure gauge.  
   - **TRUE** [ ]  
   - **FALSE** [ ]

2. If the solenoid is faulty, the transmission won’t *upshift*.  
   - **TRUE** [ ]  
   - **FALSE** [ ]

3. If the test light at the solenoid goes out when the engine is speeded up, the governor circuit is working properly.  
   - **TRUE** [ ]  
   - **FALSE** [ ]

4. Oil pressure in the transmission should be above forty pounds at 15 miles an hour.  
   - **TRUE** [ ]  
   - **FALSE** [ ]

5. If the transmission won’t *downshift*, the pilot valve may be stuck down.  
   - **TRUE** [ ]  
   - **FALSE** [ ]

6. An immediate *upshift* may be due to a blown fuse.  
   - **TRUE** [ ]  
   - **FALSE** [ ]

7. Governor points should be cleaned with a file.  
   - **TRUE** [ ]  
   - **FALSE** [ ]

8. A delayed *upshift* may be corrected by freeing up the hinge pin at the bottom of the accelerator pedal.  
   - **TRUE** [ ]  
   - **FALSE** [ ]

9. Failure to *upshift* could be caused by a broken wire between the relay and the solenoid.  
   - **TRUE** [ ]  
   - **FALSE** [ ]

10. The first thing to do if the transmission won’t *downshift* is to replace the solenoid.  
    - **TRUE** [ ]  
    - **FALSE** [ ]