SERVICE REFERENCE BOOK

HYDRAULIC TRANSMISSION

MAINTENANCE

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TECH SEZ:

THINK THE JOB THROUGH FIRST!

Ever find yourself jumping into a job of fixing something, only to suddenly realize that what you are about to do just doesn’t make sense? That sometimes happens, and it’s because we don’t take the time to think things out carefully.

Take this hydraulically operated transmission, for example. Every once in a while you’ll find yourself trying to correct some unusual operating condition by working on the transmission, when the transmission isn’t at fault at all.

But, there’s nothin' wrong!

You’ll find a couple of examples of that kind of a situation in this reference book. And you’ll find some other information that will be mighty useful, too. Briefly, here’s what this book is about:
ENGINE IDLE SPEED SETTING

Every so often you'll have a customer coming into the service department and telling you that his engine stalls just as he comes to a stop. This can be mighty embarrassing at a busy intersection. A lot of times the customer will mention the hydraulically operated transmission as the source of the trouble. Maybe you'll even go along with him that it is the transmission. Usually, you'll both be wrong.

Generally speaking, this engine stalling is caused by the engine idle speed being too low! The engine just isn't turning over enough r.p.m.'s to keep it from stalling at low speeds.
On the other hand, too high an idle will cause a transmission to upshift too slow. Adjusting the idle speed in both cases should eliminate the complaints. The correct engine idle speed with the transmission in neutral, is 475 r.p.m. You can get this idle speed right on the button by using a tachometer.

**MOMENTARY ENGINE MISS DURING UPHSHIFT**

Maybe you have had an occasional case of a momentary engine miss that occurs at approximately 14 m.p.h. or higher. Usually when this happens you immediately think of the transmission electrical circuit. In the majority of cases, you'd be wrong.

These momentary misses are usually caused by a borderline condition somewhere in the engine ignition system. Ask yourself these questions the next time you are confronted with this problem.

*Is there a miss at any other speed?*

*Why does it occur just as the direct speed piston moves for the shift?*

You can find the answer to this first question by making a road test. You find that the engine misses only after the transmission governor points are open. This leads you into the second question. Why does it occur at just this particular moment?

Thinking back to what you learned earlier about the transmission you probably think immediately of the interrupter switch. This interrupter switch, you say, interrupts the engine ignition—but on downshift. This is an upshift condition. The interrupter switch circuit is supposed to be de-energized.
STUDY THE CIRCUIT. Let's look for a moment at what could happen. Get out the diagram shown on the Downshift Chart which came with Kit Eleven of Volume Two. Suppose that the car has reached the speed at which upshift normally occurs. The governor points are opened. The solenoid is de-energized. Hydraulic pressure is being applied to the direct-speed piston. The piston moves forward. But—it can't complete the shift until you lift your foot from the accelerator to relieve engine torque.

Now, with the piston partly way forward, the ramp of the piston closes the points of the interrupter switch. You'll notice that one lead from the interrupter switch is connected to the coil positive terminal and that the other lead is connected to the governor terminal. Let's follow this circuit a little farther. Notice that the interrupter switch lead to the governor is a take-off of the governor lead to the solenoid. The other solenoid lead goes to the coil negative terminal. Therefore, if we by-pass the governor, the combined circuits of the solenoid and the interrupter switch complete a circuit from one primary terminal of the coil to the other primary terminal of the coil. There is also another lead from the coil primary terminal to the distributor.

Right here is where we connect up the transmission electrical units with the ignition system—through the distributor primary lead.
HERE’S WHAT HAPPENS. Let’s assume that you have enough resistance in the ignition circuit—either in the primary circuit or in the secondary circuit—so that you are not getting full secondary output to the spark plugs but are still getting enough current to make the plugs fire under normal operating conditions. But, in addition to that resistance, you have one or two spark plugs which are partially fouled, or which have a wider gap than they should have. This condition sets up additional resistance to the flow of secondary current.

You understand, of course, that the secondary output of the coil comes from a collapse of the primary current when the distributor points open—the primary current then flows back to the coil and sets up a magnetic field around the secondary windings, producing the secondary current. That secondary current is discharged to ground through the spark plugs. But, if the current is a little weak through extra resistance in the primary circuit, and the spark plugs add extra resistance to the flow of current because the spark plug electrodes are gapped too wide, that secondary current can’t find a path to ground. So, it feeds back into the primary circuit of the coil.
THE HYDRAULICALLY OPERATED TRANSMISSION

OPERATION IN UP-SHIFT POSITION (FOURTH SPEED)
THE HYDRAULICALLY OPERATED TRANSMISSION
OPERATION IN UPGRADE POSITION (FOURTH SPEED)
Now, if you will follow this reverse flow of current on your chart diagram (on page 7) you'll see that the current would flow from the coil positive terminal through the interrupter switch circuit. Since the interrupter switch points are closed, current will continue to flow through the switch and to the governor. It will bypass the governor, because the governor points are open and there is no way the current can reach ground. Therefore, current will continue on through the solenoid and reach the other primary terminal of the coil. The whole action takes place at the speed of a wink. It lasts about as long as it takes a spark plug to fire.
The fact that there is this reversal of current is unimportant under ordinary conditions. The description of the circuit followed by this current flow-back is given just to show that the current has to go somewhere. But, this reversal of current is important when there is enough resistance in the ignition primary or secondary circuits to affect the total output of secondary current to the spark plug. The result of that resistance is the failure to produce a spark at the plug—and the engine misfires!

Actually, you'll usually find the cause of the miss right at the spark plug itself—due either to fouled electrodes or to incorrect electrode gap.

**WHAT TO DO ABOUT IT.** So, now that we know what causes this miss we can start correcting this complaint by making a check of the ignition circuit. You'll want to start this check, of course, by making certain that the ignition wiring is tight and clean. You've found out long ago that a dirty or loose wire connection can cause a lot of trouble, and sometimes cause you a lot of unnecessary work, if a check of the wiring is not made at the start.

However, before making a voltage drop check of the circuits, you'll probably check the spark plugs next. Clean them up if they need it, and check the electrodes for proper gap. Remember, that gap is .035".
If you haven't turned up the cause of the miss at this point, then you'll have to check the battery, coil, condenser, and the distributor points as well as all the wire connections.

**FAILURE TO DOWNSHIFT**

Whenever you run into a case of failure to downshift, stop for a moment and ask yourself these two questions:

*What has to happen in order for the transmission to downshift?*

*What checks should I make to determine what is causing the failure to downshift?*

The answer to the first question is easy. The solenoid has to be energized so it can push the ball valve off its seat and relieve hydraulic pressure against the piston.

The answer to the next question isn't quite as easy. To find that answer you'll have to make a complete check of the transmission electrical circuit.

To begin with—check the wiring connections to see if they are all clean and tight. Nine times out of ten you'll find a loose connection to be the cause of the trouble. The following steps are suggested to give a complete check of the electrical circuit.

*NOTE: Ignition switch is on for all tests which follow.*
**TEST NUMBER ONE**—Connect one lead of the test light to a good ground. Connect the other lead to the battery terminal of the circuit breaker.

A. If the light DOES NOT come on, the trouble is in the wire from the circuit breaker to the ignition coil. So inspect the connections and repair or replace this wire.

B. If the light DOES come on, everything is okay—to this point.

**TEST NUMBER TWO**—For this test leave the ground lead in place. Move the other lead to the solenoid terminal of the circuit breaker.

A. If the light DOES NOT come on, the trouble is in the circuit breaker. Replace this unit.

B. If the light DOES come on, the circuit breaker is okay.

**TEST NUMBER THREE**—For this test leave the ground lead in place. Move the other lead to the red wire terminal of the solenoid.

A. If light DOES NOT come on, the trouble is in the red wire connecting the solenoid to the circuit breaker.

B. If the light DOES come on, the circuit is complete to this point.

**TEST NUMBER FOUR**—With one lead of the test light connected to ground, remove the yellow wire from the solenoid and connect the other test light lead to the end of the yellow wire.

A. If the test light DOES NOT come on, it indicates that the trouble is in the yellow wire, and that it should be repaired or replaced.

B. If the test light DOES come on, it proves that there is a complete circuit to the solenoid.
A quick check of this circuit can be made by placing a screwdriver against the solenoid. If there is a magnetic pull on the screwdriver it indicates that the circuit is complete to the solenoid, and that the solenoid is energized. However...

This does not necessarily prove that the solenoid is operating properly. On the other hand, if there is no magnetic attraction of the solenoid to the screwdriver, it indicates that the trouble is either in the yellow wire or in the solenoid itself.

The next step is to remove the solenoid and test it at the battery. Hold the solenoid with the plunger up. Connect one terminal of the solenoid to the battery negative terminal, and ground the other solenoid terminal. If the plunger moves out of the solenoid when the circuit is made, and falls back when the circuit is broken, the solenoid is okay. If it doesn't test okay, replace the solenoid.

**TEST NUMBER FIVE**—Leave the ground lead in place. Connect the yellow wire to the solenoid and disconnect the yellow wire at the governor. Connect the other test light lead to the yellow wire.

A. If the light DOES NOT come on, the trouble is in the yellow wire connecting the solenoid to the governor. Inspect the connections and repair or replace the wire.

B. If the light DOES come on, you’ll know that the circuit is complete from the coil to the governor terminal, so the next point to check is the governor.
But—don't file the governor points or use an abrasive on them. These points are silver and abrasives will ruin them.

**CHECKING THE GOVERNOR**—You can check the governor points by taking off the cover and lifting out the switch arm and the contact plate. If the points need cleaning, touch them up with a clean cloth or a small brush dampened with carbon tetrachloride.

Another thing, don't worry about finding a little oil inside the governor. Oil naturally works up the governor shaft from the transmission case. It doesn't do a bit of harm.

If the governor points are burned or pitted too badly to be cleaned up, don't replace the entire governor. All you need is the cover and switch assembly.

When you're re-assembling the cover be sure the contact point on the plate is down. Then, hook the arm in place on the cover with the high side of the indentation up.
You can check the plunger for stickiness by moving it up and down with the fingers. If it sticks, you can usually free it up with oil. Shoot a few drops of light oil into the vent hole in the plunger and move the plunger up and down a few times to spread this oil around.

When you're all set to reinstall the governor cover and switch assembly, keep these simple precautions in mind. Make sure the cover screws are properly tightened, and be sure the lubricant plate, which is also the gasket, is in place under the governor. If the gasket is left out, you'll get oil leaks.

If you still haven't tracked down the cause of your failure you'll have to check into the interrupter switch circuit. Remove the blue wire from the interrupter switch and connect one of the test leads in its place. Then, connect the other lead to the red wire terminal on the solenoid, and start the engine.

Place the rear end up on jacks and shift to the driving range. Accelerate to about twenty-five miles per hour to be sure the transmission shifts up. Then, let the engine slow down. When the speedometer reaches about eleven miles per hour, the test light should flash on and off with a faint glow. (If you're making this test under bright lights, cup the test light with your hand so you won't miss that faint glow.) If the light doesn't flash on, or if it stays on and the engine stalls, the switch will have to be replaced.
LATE DOWNSHIFT

A loose connection, particularly at the solenoid, can cause the downshift to come late. This lateness can cause the engine to surge after downshifting, or might even stall the engine if the shift comes at a very low speed. You see, with loose or dirty connections, current to the solenoid is reduced. This, in turn, lowers the instant effectiveness of the solenoid, so there is a lag in the opening of the ball valve for the downshift. So . . .

CHECK THAT WIRING BEFORE YOU START CHECKING THE ELECTRICAL UNITS!
OIL LEVEL

Low lubricant level in the transmission is another factor that enters into shifting. If oil in the transmission is low, the pressure on the piston will be low, and there will be a slow shift. You can check this oil level by removing the filler plug and inserting your finger into the transmission. If the oil is up to the bottom of the hole, there is enough oil. If you find it necessary to add oil,

**REMEMBER...**

**USE ONLY 10-W ENGINE OIL!**

The capacity of the transmission is three and one-half pints for a complete refill after draining. Fill the transmission to the lower edge of the filler plug hole.

CIRCUIT BREAKER

Listen carefully as the engine runs. If there is a clicking noise in the circuit breaker, there is a **short circuit** in one of two possible places:

- **The red wire from the circuit breaker to the solenoid,**
- or
- **The brown wire to the anti-stall control.**

So, check these wires and repair or replace them if found to be faulty.
UPSHIFT TIP

Here's a condition that sometimes takes place during upshifting that may have puzzled you. The owner may report that two clicks are heard when the automatic shift takes place. The second click is heard when the accelerator is depressed after having been released for the upshift.

The reason for the first click is that the automatic clutch sleeve goes into a coast block position when the accelerator is released for the initial shift. When the accelerator is depressed, the speed of the main drive pinion is increased and the automatic clutch sleeve moves into full engagement on the pinion, completing the shift. The final engagement of the clutch sleeve on the pinion causes the second click.

This condition is normal, and does not indicate that there is something wrong in the transmission. It should be explained to owners as a noise that is heard upon completion of the shift.
PIN-TYPE SYNCHRONIZER

A new pin-type synchronizer is now being used in the hydraulically operated transmission. You will notice that this new pin-type synchronizer and the older plate-type look very different. Although this difference is very apparent when you look at the two synchronizers, there is actually no difference in the job they do. The operating principle is the same for both types. There are, however, a number of new parts with which you should become acquainted.

Disassembly of the new pin-type synchronizer is simple, and will be quite plain to you when you come to it. However, there are certain points in the assembly of this unit which require some explanation.
ASSEMBLY OF PIN-TYPE SYNCHRONIZER

Assembly of the pin-type synchronizer is easier if you stand the mainshaft on end, front end upward.

1. Install the thrust washer and the low-speed gear, making certain that the clutch teeth are facing up and toward the front of the transmission.

2. Install the low-speed gear front thrust washer. Make sure that you use the correct washer (#1324596). The inside diameter of the earlier washer (#1112724) used on the plate-type synchronizer is larger, causing it to fit too loosely on the mainshaft. This looseness allows it to move off center enough to block the clutch gear sleeve so that the splines in the sleeve will not engage the splines on the low-speed gear. This will make it difficult or impossible to shift into the power range.

    **NOTE:** This new low-speed gear front thrust washer will work satisfactorily with the earlier plate-type synchronizer.

3. Next, assemble the clutch gear and sleeve. On one side of the clutch gear you will see an etched mark. Index this etched mark with the marks which you will find on the clutch gear sleeve. With a grease pencil or piece of chalk, make index marks on the other side of the gear and the sleeve so that you can see them after the parts are installed.
4. Now install this clutch gear on the mainshaft. Make certain that the washer face of this gear is up. You can tell this face easily. It has a slightly raised "washer-like" surface. The opposite face of the gear is ground flat.

5. You have probably noticed that there are two identical stop ring assemblies. Be sure that you check the cone face of these stop ring assemblies for nicks or damage. Nicks in these rings tend to pick up small particles of metal or dirt which interfere with proper synchronizing action. Install one of these stop ring assemblies over the shaft, pins up, fitting the ring into the low-speed gear.

6. Next, slide the clutch gear sleeve over the mainshaft, and mesh it with the clutch gear.
The clutch gear sleeve is installed with the extended part of the sleeve up. Make sure that the chalk or grease pencil marks are indexed. This indexing is important. The clutch gears are selectively fitted to the clutch gear sleeve in the position which will give the smoothest action of the sleeve on the gear. The stop ring assembly pins extend through three of the holes in the clutch gear sleeve.

7. Install the other stop ring assembly so that the three pins enter the remaining set of holes in the clutch sleeve.

8. Now, install the outer steel synchronizer stop ring.

9. Install the rear thrust washer and the bearing roller thrust washer.

10. Now, place the blocker ring over the clutch teeth on the direct-speed gear, and slide this assembly on to the main-shaft.

11. Next comes the first set of thirty-six bearing rollers which go between the mainshaft and the direct-speed gear.

12. Then, install the bearing roller spacer and the other set of thirty-six rollers.

13. Now, slide on the direct-speed gear thrust bearing assembly. Make sure that the bearing race with the largest inside diameter is installed first.

14. Next, install the thrust bearing washer and the snap ring.
15. With the snap ring in place, check the synchronizer ring clearance. This clearance is the space between the end of the front stop ring pins and the face of the rear stop ring. Make sure that the pins on one stop ring do not drag, cutting into the opposite stop ring.

To check this synchronizer ring clearance, push the clutch gear sleeve up on the direct-speed gear. Make sure that this sleeve is all the way up so that the front stop ring assembly is seated tightly in the outer steel synchronizer stop ring.

Holding the sleeve in this position, use a feeler gauge to check the synchronizer clearance. There must be a minimum clearance of .018" and a maximum clearance of .060".

If clearance is found to be less than .018", with the .003-to .008-inch end play in the gear train, remove the stop ring and carefully dress off the pin until the right clearance is obtained. This may be done by placing a piece of abrasive paper on a surface plate and dressing down the pin to the proper clear-
ance. Round off the end of each pin so that they will not dig into the surface of the other ring.

Fit the two rings together in their normal positions to see if the pins in one ring are the same height as the pins in the other ring. If they aren't, use the same method to dress them off until all pins are the same height.

HEY! DRESS DOWN THOSE PINS!

16. After reinstalling the synchronizer and other parts, including the thrust bearing washer and the snap ring, check the clearance between the third-speed gear thrust bearing washer and the snap ring. There should be from .003” to .008” clearance between the two. The thickness of the snap ring controls this clearance. If the clearance is not within limits, install the snap ring that will give the proper clearance. Snap rings are available in thicknesses of .087”, .092”, .097” and .101”.

17. Install the spreader spring washer and the spreader spring. Use heavy cup grease to hold these parts in place — otherwise, they might drop into the transmission case when you start to install the mainshaft assembly.
18. Now, install the extension case and the mainshaft assembly to the transmission case.

19. Just before you bolt the extension case to the transmission case, check to make certain that the index mark on the direct-speed clutch sleeve is aligned with the index mark on the direct-speed gear.

20. Position the manual clutch gear sleeve in neutral. Move the reverse idler gear to the fully disengaged position when re-installing the gearshift cover. This will let both shifting forks drop into their grooves.

21. Now, refill the transmission with approximately three and one-half pints of 10-W engine oil or until the oil level reaches the bottom of the filler plug hole.

AND DON'T FORGET THE FILLER PLUG!
INTERNAL-EXPANDING PARKING BRAKE

If you’ve been working around the hydraulically operated transmission lately you’ve probably noticed the new internal-expanding parking brake. It’s located just to the rear of the transmission and, like the earlier external-contracting brake, operates on the propeller shaft. You’ll notice also that the new brake shoes are completely inclosed. This will keep out dirt and oil and require a minimum of servicing. There are, however, a few points that you ought to know about adjusting this new brake.

Take a look at the picture on this page. It gives you a good idea of the parts which make up this new brake assembly. Notice that the two brake shoes—which resemble smaller models of wheel brake shoes—are both self-energizing.
ADJUSTMENTS—There are two (2) adjustments that have to be made on this new internal-expanding parking brake. Both are quite simple.

*Shoe-to-drum clearance is made at the brake shoe adjusting nut.*

*Operating cable adjustment is made at the jam nut.*

Let's take these adjustments and check off the steps necessary to make them. You'll notice that, although there are two adjustments to be made, each adjustment is actually a part of one major adjustment.

So... when a customer drives in and says his parking brake is not holding properly, make these simple adjustments.

*NOTE:* Place the transmission shifting lever in "Neutral" and release the parking brake operating lever before making these brake adjustments. Also, disconnect the propeller shaft.
1. First, remove the adjusting nut cover, so that you can get at the brake shoe adjusting nut.

2. Then, loosen the brake cable guide clamp bolt and back the cable housing jam nut off all the way.

3. To make the shoe-to-drum clearance adjustments:
   A. Turn the brake shoe adjusting nut downward until the shoes are tight against the brake drum.
   B. Back off this adjusting nut until it “clicks” into the nearest notch or locked position. Then, back off this nut two more clicks. This gives proper shoe-to-drum clearance.

4. Now make the operating cable adjustment:
A. Push the cable and housing as far as possible into the cable guide, tighten the guide clamp bolt just tight enough to prevent the cable from coming back out of its own accord. When clamped in this position the end of the cable will push the operating lever against one brake shoe and cause a slight drag on the drum.

B. Now tighten the jam nut, turning the brake drum at the same time to check the amount of drag on the drum. Continue tightening the jam nut until all drag on the drum is removed.

C. Tighten the cable guide clamp bolt to lock the cable housing in position. Check again to make sure that the jam nut is tight against the guide.
5. Try the brake operating lever for proper amount of travel. When properly adjusted, the parking brake lever should require from four to six "clicks" of the ratchet to set the parking brake.

6. If more than six clicks are required to set the brake after adjustment has been made, the adjustment is too loose. This can usually be corrected by loosening the cable guide clamp bolt slightly and tightening the jam nut to reduce cable travel. The jam nut should not be turned more than one turn before again checking the parking brake lever travel. Repeat this operation until proper adjustment is made. And remember—turn the drum by hand while tightening jam nut to be sure the drum is free of drag when the adjustment is completed.

7. If tightening the jam nut does not adjust the parking brake lever travel within the required four to six clicks of the ratchet to set the brake, recheck the shoe-to-drum clearance.

8. Now, install the brake shoe adjusting nut cover, and connect the propeller shaft.

**A COUPLE OF PARKING BRAKE TIPS**

Four special bolts are used to attach the parking brake drum to the transmission shaft flange. If the nuts for these bolts are not pulled down good and tight, you'll get a snapping noise that seems to come from the parking brake or the front universal joint. This noise is similar to the noise you get from a loose wheel attaching nut.
This is one of those "once in a blue moon" noises, but if you do run into it, pull the flange nuts down good and tight before you pull the brake or transmission down looking for the noise.

Here's some more dope about the brake drum and flange bolts that may come in handy. On early production cars with the new hand brake, the flange bolts were a press fit in the brake drum. On present production cars the serrations on the flange bolts have been changed slightly and the holes in the drum have been slightly enlarged so the flange bolts are no longer a press fit in the drum. So, if you replace a drum for any reason, don't be surprised if the bolts are a slip fit in the drum. This looseness is normal and has been provided to simplify assembly of the flange and drum.
TEST YOURSELF
WITH THESE QUESTIONS

1. The engine idle speed of cars equipped with the hydraulically operated transmission should be set at 475 r.p.m. when the transmission is in neutral. **RIGHT □** **WRONG □**

2. An occasional miss in the engine during acceleration at approximately 14 m.p.h. (or at upshift speed) is usually due to high resistance in the ignition circuit. **RIGHT □** **WRONG □**

3. A test for failure to downshift when the car slows down must cover the entire transmission electrical system. **RIGHT □** **WRONG □**

4. If the governor points are pitted or burned, replace the governor cover and switch assembly. **RIGHT □** **WRONG □**

5. A late downshift could be caused by a loose connection at the solenoid. **RIGHT □** **WRONG □**

6. A double click sometimes heard during upshift is normal. **RIGHT □** **WRONG □**

7. Clearance between the synchronizer stop ring pins and the surface of the opposite stop ring must be between .018” and .060”.

8. Clearance between the direct-speed gear thrust bearing washer and the snap ring must be between .003” and .008”.

9. The oil level in the transmission must be up to the bottom of the filler plug hole. **RIGHT □** **WRONG □**

10. The propeller shaft must be disconnected when adjusting the internal-expanding parking brake. **RIGHT □** **WRONG □**
NEXT!