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SHIFT QUALITY & LINKAGE ADJUSTMENT

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Most service technicians know that transmission throttle linkage adjustment affects TorqueFlite shift performance. However, unless you happen to be an automatic transmission specialist, chances are you don’t know how and why throttle pressure actually changes shift characteristics and affects shift quality. And, unless you have some understanding of how throttle pressure gets into the act you’ll never be able to appreciate how important correct throttle linkage adjustment is to shift quality and the general welfare and life of the clutches and bands.

Accordingly, this Reference Book reviews the highlights of the relationship between the shift valves, the throttle valve and the kickdown valve. It also explains the operation of the full-throttle kickdown and the part-throttle downshift. Once you are equipped with this knowledge, you’ll do a better job of adjusting external TorqueFlite linkages because you’ll understand what you are doing and why. Oh yes! The last two sections tell you how to adjust throttle and shift linkages and how to avoid common mistakes which result in incorrect adjustment and poor shift quality.
There have been more changes and refinements in the 1971 TorqueFlites than in any other model year. These changes add up to exceptionally smooth shift quality on both upshifts and downshifts. And as you probably know, the part throttle downshift feature has been added to all TorqueFlites except those used with the high-performance 440 and 426-Hemi options.

**Fig. 1—1971 TorqueFlites are exceptionally smooth**

**KEEP THOSE SMOOTHIES SMOOTH**
Our TorqueFlites have always been able to hold their own in smoothness and overall performance against anything else on the market. In addition, they were pretty tolerant of a little shift linkage and throttle linkage misadjustment. They weren’t at their best if these adjustments weren’t right on the button but they let some well-meaning, but uninformed jackleg mechanics get away with linkage adjustments that left a lot to be desired . . . particularly when it came to incorrect throttle rod adjustment.

The new TorqueFlites are the best ever but they simply won’t put up with careless linkage adjustment. If the throttle rod is too long, throttle pressure will be higher than necessary and the shifts will not be as smooth as they should be. If throttle linkage is too short, throttle pressure will be low and the bands and clutches will slip during application and release. But before we get into the nuts and bolts of throttle linkage adjustment, we better review the highlights of what goes on inside a TorqueFlite transmission so you’ll understand how and why adjustments affect shift performance.

**JUST THE SIMPLE BASICS PLEASE**
A comprehensive explanation of the entire valve body would be a bit much for one Tech Reference Book and considerably more than a tired master technician would care to tackle after a hard day’s work. Don’t panic and do keep on reading. Our discussion of what goes on inside a TorqueFlite will be confined to a simplified explanation of the relationship between the 2-3 shift valve, the throttle valve, the kickdown valve and the manual valve. This will help you understand how external adjustments affect shift quality and appreciate why you owe it to your customers to adjust those TorqueFlite throttle linkages correctly . . . on all models, past and present.

**Fig. 2—These valves affect shift quality**

**IT STARTS WITH THE MANUAL VALVE**
The manual valve is something like a hydraulic switch. When the driver selects a forward gear or
reverse, he is simply shifting or changing the position of the manual valve. This routes pressure so that the right bands and clutches are applied or released for the gear range selected. Incidentally, in all forward gears the manual valve routes pressure directly to the rear clutch without going through either of the shift valves. In reverse it routes pressure directly to apply the front clutch and the reverse band. All automatic upshifts and downshifts are controlled by the shift, throttle, governor and kickdown valves.

**CONSIDER THE 2-3 SHIFT VALVE**
In order to understand automatic upshifts and downshifts it is necessary to know what the shift valves do and how the throttle and kickdown valves control the shift valves. The easiest way to explain all this is to take one at a time, starting with the 2-3 shift valve. Figure 4 is a greatly simplified representation of the 2-3 shift valve. Governor pressure is applied to the left end of the valve and throttle pressure plus a spring push against the right end of the valve.

It is important to keep these facts in mind. Governor pressure increases with car speed and tries to push the valve to the right. Throttle pressure increases with throttle opening and this tries to push the valve to the left. In other words, the 2-3 shift valve movement is controlled by changes in throttle and governor pressure.

**THE GOVERNOR AND DOWNSHIFT PLUGS**
Governor pressure is not applied directly to the right end of the 2-3 shift valve. Instead, it is applied to the governor plug which pushes on the shift valve. Throttle pressure is applied to the other end of the 2-3 shift valve or to a downshift plug . . . depending on throttle opening. We will go into more detail on the downshift and governor plugs later on when we get into a discussion of full-throttle kickdown and part-throttle downshift.
At lower car speed and wider throttle opening, governor pressure is lower than throttle pressure. The shift valve moves to the left and pressure is routed to apply the kickdown band and to release the front clutch. This downshifts the transmission to second or keeps it from upshifting... as the case may be.

When throttle pressure isn't right
Governor pressure isn't an external service adjustment but throttle pressure is easily changed. You do this by changing the effective length of the transmission throttle linkage. Consider the kind of problems that are caused by incorrect throttle linkage adjustment.

If throttle pressure is higher than it should be, upshifts will be delayed so they will come at higher than normal shift speed. And, shifts will be abrupt and harsh instead of smooth and crisp.

If throttle pressure is low, upshifts will be early, that is, they'll occur at lower than normal shift speed. The application and release of the clutches and bands will be dragged out and shifts will be mushy instead of smooth and crisp. And, poor shift quality is not the worst effect of low throttle pressure. Abnormal slippage of the kickdown band and front clutch causes abnormal wear and early failure of the friction material.

The kickdown valve
Up to this point we have been talking about normal automatic upshifts and downshifts which occur as a result of normal changes in the balance...
between governor pressure and throttle pressure. Next, let’s consider driver-controlled downshifts. The throttle valve is actually controlled or operated by the kickdown valve. The two are mechanically connected by a spring. When the accelerator is floorboarded, the kickdown valve bottoms out the throttle valve and sends full-throttle pressure to the right end of the shift valve. The valve moves to the left to provide a full-throttle kickdown.

**MAXIMUM FULL-THROTTLE KICKDOWN SPEED**
The maximum speed at which kickdown can be obtained is limited, by design, to prevent undesirable overspeeding of the engine. At speeds above the design kickdown range, governor pressure is higher than throttle pressure acting on the shift valve.

In addition, the diameter of the governor plug is larger than the diameter of the shift valve. As a result, the total push or hydraulic force trying to push the valve to the right is greater than the throttle pressure force that is trying to push the valve to the left. That is why the valve doesn’t move to the left and provide a kickdown shift at higher speeds.

**ABOUT THAT PART-THROTTLE DOWNSHIFT**
Several changes were made in the valve body to provide the part-throttle downshift feature. The most obvious of these changes is the addition of a downshift plug at the throttle-pressure end of the 2-3 shift valve. Notice that the diameter of the downshift plug is greater than the diameter of the shift valve. So, for a given amount of throttle pressure, the hydraulic force acting on the downshift plug is greater than the force acting on the smaller diameter of the shift valve.

When the driver steps on the gas, throttle pressure on the downshift plug increases until it overcomes governor pressure. This moves the shift valve to the left to provide a part-throttle downshift at speeds below about 40 miles an hour. The actual speed at which this shift occurs depends on both car speed and throttle opening. At lower speed, governor pressure is low so less throttle opening and throttle pressure is needed to obtain a downshift. At higher speeds it takes a wider throttle opening and more throttle pressure to offset governor pressure and get a “part-throttle” downshift.
As was pointed out earlier, throttle linkage adjustment always has been an important factor in good shift quality. And the refinements incorporated in the 1971 TorqueFlites have made this adjustment more critical and more important than ever. It is not difficult to make this adjustment correctly but on the other hand, it is quite easy to make it incorrectly if you do not observe and understand a few simple precautions. Here's what throttle linkage adjustment is all about.

**GENERAL PRECAUTIONS AND CONSIDERATIONS**
What you are shooting for is minimum throttle pressure when the engine is at correct curb-idle speed. And, the throttle linkage must be adjusted so that the throttle lever at the transmission will start to move the minute the driver starts to open the throttle. To accomplish this, the engine idle speed must be correct and the curb-idle screw must be against its stop when adjusting throttle rod length. The engine must be warmed up so that the choke is open and the fast-idle cam is rotated so that the fast-idle screw is off the cam. These preliminary precautions apply to all models regardless of the type throttle linkage used. If the car you are servicing has a carburetor with a curb-idle solenoid, you must turn the ignition off while adjusting throttle linkage so that the solenoid stem will be extended and the throttle will actually be in the curb-idle position.

**SPECIAL TRANSMISSION THROTTLE LEVER TOOL**
One of the most common reasons for incorrect throttle linkage adjustment has been incorrect positioning of the transmission throttle lever. When adjusting the linkage, the lever must be held against its stop so that the throttle valve is in the minimum-pressure position when the carburetor is at curb-idle. Forget past instructions for obtaining this condition and use the new special throttle lever tool to hold the throttle lever in position while you adjust throttle rod length.

The new special tool slips onto the end of the throttle lever shaft and the spring holds the throttle lever forward against its stop. This establishes the minimum throttle pressure condition.

**IF THE THROTTLE SHAFT IS TOO SHORT**
The new special tool can be used on past as well as present models to obtain correct linkage adjustment. However, you may run into a condition
where the end of the throttle shaft does not extend enough above the throttle lever to accommodate the special tool. This is not because the shaft is too short but is caused by the throttle lever being positioned too near the end of the shaft. If you run into this condition, loosen the transmission throttle lever and move it down where it belongs so that there is room enough on the end of the shaft to take the special tool.

**DIRECT-ACTING V-8 LINKAGE**

The direct-acting transmission throttle linkage, used on some of our V-8 engine models, is illustrated in Figure 14. At the carburetor end of the linkage, the slotted section of the rod rests against the carburetor throttle lever pin. The lower end of the linkage is connected to the transmission throttle lever.

![Fig. 14—Linkage used on some V-8 models](Image)

**ADJUSTMENT'S AT THE SLIP JOINT**

Throttle rod adjustment is provided by a slip joint and lock screw arrangement. A spring pulls the entire linkage forward so that it follows the movement of the throttle lever as the throttle is opened.

The purpose of that long slot in the forward end of the throttle rod is sometimes questioned. At first glance it would seem much simpler to connect the throttle rod directly to the carburetor throttle lever. However, all of our transmission throttle linkages have this slot method of attachment for a very good reason.

![Fig. 15—Adjustment provided at slip joint](Image)

![Fig. 16—Slot lets throttle return to idle position](Image)

If the transmission throttle lever should bind or get stuck in the "open-throttle" position, the transmission throttle linkage could interfere with carburetor throttle movement. That long slot lets the carburetor throttle lever and pin move forward regardless of what happens to the transmission throttle lever and linkage. In other words, that slot eliminates the possibility of the transmission throttle linkage interfering with the throttle closing.

**ADJUSTING THE DIRECT-ACTING LINKAGE**

Observe all of the preliminary steps and conditions: engine warm, choke open, carburetor at curb idle and special tool installed at the transmission.

Loosen the throttle rod adjusting screw and adjust the length of the linkage so that the rear of the slot
rests against the pin on the carburetor throttle lever. This is an easy adjustment to make providing you push everything in the right direction before you tighten the lock screw.

You must hold the retainer forward so that the slot in the front link is bottomed against the throttle pin. At the same time, you must push the throttle rod part of the linkage rearward just firmly enough to take all of the freeplay out of the linkage. Do not push so hard that you overcome the pull of the special tool spring at the transmission.

The easiest way to make this adjustment with only two hands is to squeeze the rod and the retainer between forefinger and thumb as illustrated in Figure 18. By pushing rearward on the rod with your forefinger and at the same time pushing forward on the retainer with your thumb, it is easy to take all of the slack out of the linkage in the right direction and to hold this adjustment while you tighten the lock screw.

**AVOID THE FREEPLAY FOUL-UP**

Unfortunately, time was when the procedure for adjusting throttle linkage called for pulling the throttle rod upward or forward (away from the transmission) to make sure the lever at the transmission was against its stop before adjusting the linkage. Trouble with that procedure is that considerable freeplay is provided in this linkage to insure against binding. If you pull the linkage forward or away from the transmission instead of pushing it toward the transmission, you could wind up with a linkage adjustment that is as much as 1/2-inch too short. That would result in low throttle pressure throughout the range and contribute to slippage and damage to the clutch and band facings. There is no reason why you should have any trouble adjusting the linkage exactly right . . . thanks to the new transmission lever tool. In any event, it is safer to have the linkage slightly too long than to have it too short.

**LINKAGE FOR SIX-CYLINDER MODELS**

An entirely different linkage is used on Torque-Flite cars having 6-cylinder engines. This is illustrated in Figure 19. It has a slotted upper rod, a bellcrank and an adjustable lower throttle rod.

![Diagram](image-url)
Notice that in this setup the upper throttle rod is connected directly to the carburetor throttle lever. The slot at the lower end of the upper throttle rod contacts a pin in the bellcrank that is part of the linkage. In other words, the anti-throttle-bind feature is at the bellcrank instead of at the carburetor throttle lever. However, it serves the same purpose as the slot in the linkage used on V-8 models. Contact between bellcrank pin and the slot is the point of reference for adjusting this linkage.

A slip joint or link at the upper end of the lower rod provides the means of adjusting the throttle rod length.

**HERE’S HOW YOU ADJUST IT**
The preliminary precautions are the same: engine warmed up, choke open, throttle at curb idle and the special tool installed at the transmission.

Loosen the slip joint lock screw; then, push the adjuster link forward while pushing the lower rod gently, but firmly, to the rear. Push just hard enough to remove all freeplay in the direction of the transmission without stretching the special tool spring. Use thumb and forefinger to hold the adjuster link and the lower rod in this position while you tighten the lock screw. Double-check yourself to make sure the slot is still in contact with the bellcrank pin after the lock has been tightened. Remove the special tool and that’s all there is to doing it right.

**THREE-SECTION LINKAGE FOR V-8 MODELS**

On some models with V-8 engines it is not practical to use the direct-acting linkage. On these models a somewhat more complicated linkage, having three rods and two bellcranks, is used. There is an adjustable upper rod, an upper bellcrank, and an adjustable intermediate rod. At the transmission end of the linkage, a lower bellcrank and a rod complete the connection to the transmission throttle lever.

**INTERMEDIATE ROD FIRST...UPPER ROD LAST**
The intermediate rod must always be adjusted first so that the geometry of the two bellcranks will be correct. This is necessary because of dimensional variations between the transmission and the upper bellcrank.
If intermediate rod adjustment is incorrect, either too long or too short, throttle pressure will be low for all throttle positions. Upshifts will occur at lower-than-normal shift speeds and will be dragged out instead of crisp and decisive.

**INTERMEDIATE ROD ADJUSTMENT**
Correct intermediate rod adjustment depends on positioning the upper bellcrank and the transmission throttle lever in their proper, predetermined positions before adjusting the ball socket at the upper end of the intermediate rod. The upper bellcrank and the bellcrank bracket have index holes in them to simplify the correct positioning of the bellcrank. Slip a piece of 3/16” rod through these holes to lock the bellcrank in position while adjusting the intermediate rod.

Install the special tool at the transmission shift lever. The 3/16” pin and the special tool establish the correct geometric relation between bellcrank and transmission throttle lever.

Adjust the intermediate rod by separating the socket at the upper end of the rod from the ball stud on the bellcrank. Thread the ball socket on or off the rod until it lines up exactly with the ball. The ball socket must line up with the ball while pushing downward on the intermediate rod firmly enough to remove all freeplay from that part of the linkage. This is another of those places where you can get into trouble if you pull up on the rod instead of pushing it downward. Pulling up on the intermediate rod will take the freeplay out in the wrong direction and can result in low throttle pressure for all throttle positions.

**UPPER THROTTLE ROD ADJUSTMENT**
When the intermediate rod is correctly adjusted, attach the socket to its ball on the bellcrank and remove the 3/16” rod from the index holes. Do not remove the special tool from the transmission throttle lever shaft. It must remain in place until you have completed the adjustment of the upper throttle rod.

It is difficult if not impossible to tell whether or not the upper throttle rod is correctly adjusted with the spring and the retaining washer in place. Disconnect the intermediate rod spring and remove the retaining clip and washer from the carburetor throttle lever pin.

Check the adjustment of the upper throttle rod. The rear of the slot should just touch the pin on...
the throttle lever but it must not push on the pin hard enough to hold the throttle above specified curb idle. On the other hand, the slotted section of the rod must not move away from the throttle lever pin when it is pushed lightly to the rear to remove all linkage freeplay. Here again, adjustment is checked with the special tool installed at the transmission and all freeplay taken out by pushing the linkage toward the transmission.

If the linkage is too long or too short, slip the slotted section off the throttle lever pin and thread it on or off the rod until the length is correct.

Don’t forget to recheck your adjustment by pushing rearward on the rod to make sure it does not move away from the pin. When the adjustment is correct, reassemble the washer and clip, and reattach the spring. Remove the special tool from the transmission throttle lever shaft.

That takes care of transmission throttle lever adjustment. I think you will agree that it is not difficult to get this adjustment exactly right. And now you know how important this adjustment is to good shift quality and trouble-free operation of a TorqueFlite transmission.

SHIFT LINKAGE HIGHLIGHTS AND REVIEW

TorqueFlite transmission shift linkages are virtually the same for the 1971 and the 1970 models so there is nothing much new to learn about adjusting them. The only significant change has been the elimination of the slave linkage on most of the 1971 models. The slave linkage is still used on the full-size cars with console shift and TorqueFlite.

ABOUT THAT SLAVE LINKAGE

On console models, the slave linkage is nothing more than a connection between the transmission shift lever and the shift housing (without shift lever) on the steering column. The slave linkage moves the steering column shift tube and housing so that the steering wheel cannot be locked when the car is in motion. In other words, it positions
the shift housing so that the ignition key can’t be turned to “lock” unless the transmission is in PARK, or in REVERSE for a manual transmission.

The only drawback to a slave linkage is that it does increase shift effort. This is particularly undesirable on models with manual transmission. So, the steering column for cars with console and manual transmission has been redesigned to eliminate the shift tube and the need for a slave linkage. The slave linkage has been retained on full-size cars with TorqueFlite because the added selector effort is not important in these applications.

THE ACCIDENTAL-LOCK INHIBITOR
The shift housing on all other console shift models now has a device called a “Steering Column Lock Inhibitor.” It prevents the accidental locking of the steering column. You must push the inhibitor ring downward and hold it there while you turn the ignition key to the lock position. The inhibitor accomplishes manually what the slave linkage does automatically . . . protection against accidental locking of the steering wheel.

SHIFT FIRST AND SLAVE LAST
On console models, past and present, with slave linkage, you must adjust the shift linkage first. Adjust the slave linkage last and always doublecheck yourself to make sure the ignition key can be turned to the lock position when the shift selector is in park, or in reverse on manual transmission models.

TORQUEFLITE SHIFT LINKAGE ADJUSTMENT REVIEW
The general rule on TorqueFlite shift linkage adjustment is: make sure the shift selector lever is in park and the shift control lever at the transmission is pushed all of the way toward the rear. This will insure that shift lever is in the “park” detent while adjusting the linkage. The following illustrations and suggestions will serve to refresh your memory on adjusting the various TorqueFlite transmission shift linkages.

COMPACT AND INTERMEDIATE MODELS
On compact and intermediate models, the linkage adjustment is at the sliding swivel located at the inner end of the torque shaft. This is shown in Figure 31.

CHALLENGER AND BARRACUDA LINKAGE
A torque shaft is also used on Challenger and Barracuda models. However, the adjustment is made at a swivel located at the outer end of the torque shaft as shown in Figure 32.
CHRYSLER, DODGE AND PLYMOUTH MODELS
The linkage used for full-size models is shown in Figure 33. Notice that adjustment is provided by slotted joint in the front shift rod. The important thing to remember on all models from compacts to full size is that you loosen the slip joint or swivel, put the selector lever in "park", push the shift lever at the transmission to the rear and tighten the adjustment.

The 4-speed manual transmission now has a lever-type shift interlock similar to the one introduced on the 3-speed manual transmission last year. This new shift housing assembly doesn’t change the external linkage adjustment procedure in any way. However, if you try to install this new shift housing with both shifter forks in place, you’ll probably go out of your tree before you find out that it can’t be done that way.

UNRELATED ITEM ON 4-SPEED TRANSMISSIONS
This session is mostly about TorqueFlite throttle and shift linkage adjustment. However, there is one little unrelated item on 4-speed manual transmissions that is worth mentioning because knowing about it might save you a bit of trouble.

The secret is to put the 1-2 shift fork in place in the transmission before you attempt to install the shift housing. So don’t waste your time trying to assemble that cover with forks in place. Instead, open your 1971 Service Manual and follow the step-by-step instructions therein. It’ll save you a lot of time and more than a little frustration.