



# C4 TRANSMISSION

## DIAGNOSIS, ADJUSTMENT and LIGHT REPAIR

*And*



# COURSE 7501.3



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## **Ford C4 Transmission Service Training (Course 7500.1 and 7501.3)**

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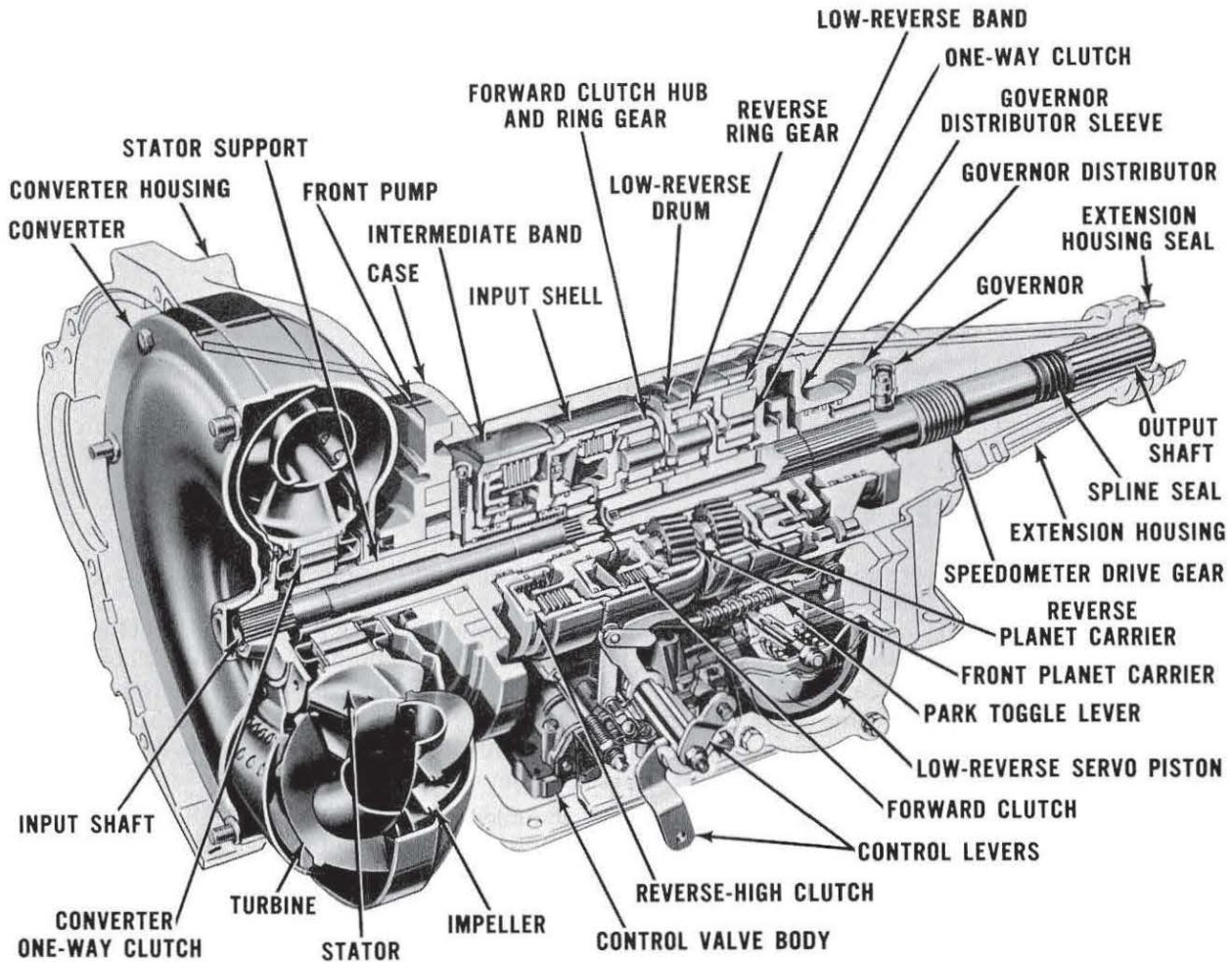
# **C4 TRANSMISSION**

## **PRINCIPLES of OPERATION**



SERVICE TRAINING

**COURSE 7500.1**



<b>GEAR RATIOS</b>	<b>FIRST 2.46:1</b>	<b>HIGH 1.00:1</b>
	<b>SECOND 1.46:1</b>	<b>REVERSE 2.20:1</b>
<b>CONVERTER RATIO (STALL)</b>	<b>2.10:1 AVERAGE</b>	



## GEAR TRAIN POWER FLOW

### FIRST GEAR D

In first gear D, the forward clutch and the one-way clutch are applied. Engine power flows through the torque converter to the transmission input shaft, to the forward clutch cylinder, across the forward clutch plates, to the front unit ring gear hub, and then to the ring gear.

The ring gear rotates the front planet gears. The planet carrier, which is splined to the output shaft, has a tendency to remain stationary. This causes the front planet pinions to rotate clockwise and the sun gear to rotate counterclockwise. Counterclockwise rotation of the sun gear causes clockwise rotation of the planet pinions in the reverse planet carrier. With the reverse planet carrier held by the one-way clutch (and reverse band in manual low), the output shaft ring gear is forced to rotate clockwise by the reverse planet pinions at a reduction in speed. Output shaft ring gear rotation is transferred to the output shaft directly by the output shaft hub. This output shaft rotation requires that the front planet carrier rotate at the same speed and in the same direction (clockwise), since it is splined to the output shaft. Consequently, the front ring gear and planet assembly are rotating in the same direction (clockwise), but the planet carrier is rotating at a slower speed than the ring gear. As a consequence, the front planets are, in fact, turning clockwise, as previously indicated.

This clockwise rotation results in the counterclockwise rotation of the sun gear. The resultant gear ratio is a combination of the ratios provided by the front and reverse planet assemblies.

The input to output ratio in first gear is 2.46:1.

### FIRST GEAR 1

In first gear 1, the low and reverse band is applied. The band application makes engine braking possible. In first gear D, the car can freewheel.

### SECOND GEAR

In second gear, the forward clutch and the intermediate band are applied. Engine power flows from the torque converter turbine to the transmission input shaft, to the forward clutch cylinder, across the forward clutch plates to the front planetary unit ring gear hub, and then to the front unit ring gear.

The ring gear rotates the planet gears and forces them to walk around the stationary sun gear. As the planet gears walk around, they take the planet carrier with them and the planet carrier drives the output shaft. The planet carrier is splined to the output shaft.

The sun gear is held stationary by the intermediate band, which is applied against the reverse and high clutch drum. The reverse and high clutch drum is locked to the input shell, and the input shell is locked to the sun gear.

The gear action in second gear is that of a simple planetary gear set in reduction. This ring gear drives, the sun gear is held, and the load is on the planet gear carrier.

In second gear, the input to output ratio is 1.46:1.



## CONTROL PRESSURE REGULATION IN 1 (AND 2) OPERATION

Both the engine and the rear wheels can produce a high transmission input torque. Even though the torque input may come in through the output shaft, it is still a torque input, as far as the transmission clutches and bands are concerned.

On the previous chart, we saw how throttle pressure adjusts control pressure to engine input torque. On this chart, we will see how the manual valve adjusts control pressure to rear wheel input torque.

On some C4 models, the transmission will downshift to first gear, from high or second, at speeds as high as 40 mph, when the selector lever is moved into 1. Should this shift occur at closed throttle with only a throttle pressure boost arrangement in the control system, the shift would occur at minimum control pressure (about 50 psi).

In the current C4 transmission, a newly designed line coasting boost valve will automatically raise control pressure for manual 3-1, 3-2, and 2-1 shifts at closed throttle at all road speeds.

In this diagram, first gear 1 is shown as a starting gear. Our interest here is to show control pressure regulation in 1 operation, versus control pressure regulation in D operation.

When the manual valve is shifted to 1, control pressure flows to the forward clutch and the lower valley of the D2 valve. It flows to and through the D2 valve to the low and reverse servo and to the ball shuttle valve (upper). From the ball shuttle valve, control pressure flows to three places.

Let's take the three flows from the shuttle valve in their order of complexity.

From the shuttle valve, the least complicated control pressure flow is to the lower face of the 2-3 shift valve top land and to the manual low valve.

From the shuttle valve, the second most complicated control pressure flow is to the downshift valve. The downshift valve is a limiting valve. It is assembled under spring compression and it has a face area differential in its valley. At about 120-psi pressure in the valley, pressure force and spring force are equal.

From the shuttle valve, the most complicated flow and its regulation thereafter, is to the line coasting boost valve. The line coasting boost valve is assembled under a 4-1/4 pound spring compression. In its rest position, it is wide open. This means that control pressure flow to the line coasting boost valve in 1 and 2 flows through the valve to the main regulator booster valve. In D, there is no control pressure flow to the coasting boost valve.

The line coasting boost valve is a limiting valve. It has an upper and lower valley face area differential. The lower valley face is larger in area than the upper valley face. When pressure is present in the valley, a downward force is produced in the valley (and on the valve). When pressure in the valley is about 80 psi, the pressure force on the valve balances the spring force on the valve. At a coasting boost pressure of 80 psi (and with no throttle pressure at the top), the line coasting boost valve is in balance. It is limiting coasting boost pressure to a maximum of 80 psi.

With a line coasting boost valve pressure of 80 psi (and no throttle pressure) working at the main pressure booster valve, control pressure will be regulated to about 110 psi. This occurs only at engine idle with the car stationary or at engine idle with the car coasting.

In addition to line boost and spring force, throttle pressure force also works at the top of the line coasting boost valve.

Remember, that the line coasting boost valve is installed under a 4-1/4 pound spring force. Coasting boost pressure works on a valley differential area (0.052 square inches) in opposition to spring force. Throttle pressure, at the top of the line pressure coasting boost valve, works on an "equal" area (0.049 square inches) in opposition to spring force.

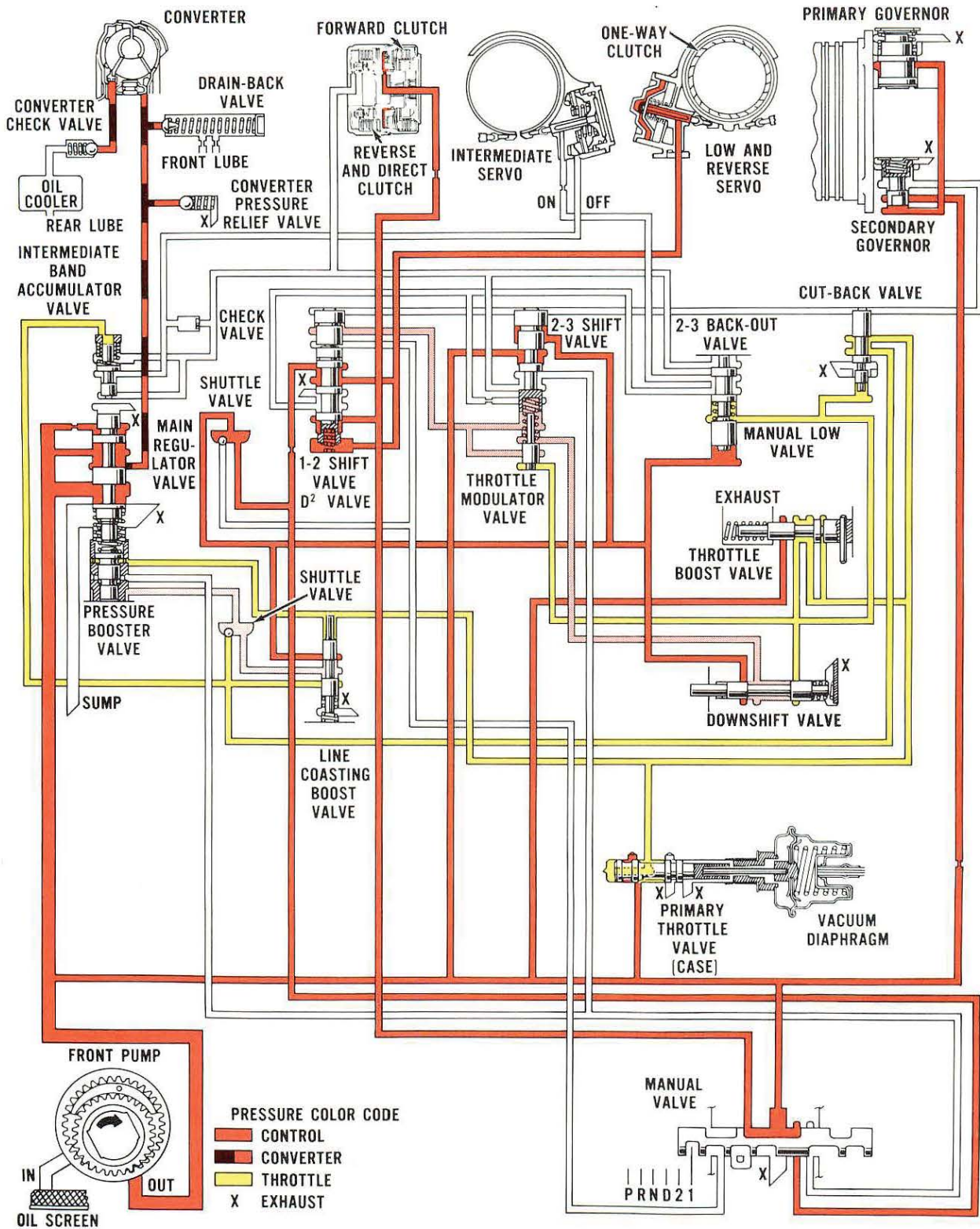
All of this means that throttle pressure and coasting boost pressure can work together or separately, and that they must produce a force (pressure times area) of 4-1/4 pounds to balance the line coasting boost valve. This coming-into-balance means that line coasting boost pressure does not exceed 80 psi, nor does it fall below 80 psi, should the transmission be shifted into 1 (or 2) with zero throttle pressure.

At 10 inches of intake manifold vacuum, throttle pressure will be about 40 psi and will be equal to line coasting boost valve pressure. This means that at vacuum values below 10 inches, throttle pressure before cutback in 1 (and 2), will be higher than coasting boost pressure, and the shuttle valve will direct throttle pressure, rather than line coasting boost pressure, to the booster valve.

On the transmission control pressure gauge, with a normal transmission, gauge readings will be as follows:

1. At engine idle and car stationary in D, the gauge will read 55-61.
2. At 10 inches of vacuum and car stationary in D, the gauge will read 93-104.
3. At stall in D, the gauge will read 137-150.
4. At engine idle and car stationary in 1 (and 2), the gauge will read 55-113. Attaining the higher limit at idle will depend on the individual pump capacity, oil temperature, etc. The higher control pressure in 1 and 2 comes from the line coasting boost pressure flow to the main booster valve.
5. At 10 inches of vacuum and car stationary in 1 (and 2), the gauge will read 93-104. As the throttle is advanced from idle (above 18 inches) to 10 inches in 1 (and 2), the gauge readings will usually drop slightly. This is caused by the increase in throttle pressure decreasing the line coasting boost pressure.
6. At stall in 1 (and 2), the gauge will read 137-150.

See chart page 7501.1-17 for the control pressure curves versus manifold vacuum in D and 1 (and 2) operations.



## CONTROL PRESSURE REGULATION IN 1 (AND 2) OPERATION

# **C4 TRANSMISSION**

**DIAGNOSIS, ADJUSTMENT  
and LIGHT REPAIR**



**COURSE 7501.3**

## FOREWORD

Material in these instructor's notes has been developed to assist you in making an effective presentation. A list of the necessary training aids, along with tool and equipment requirements, is included. The suggested time schedules will aid you in scheduling your training sessions. Details of classroom and shop area organization are provided to enable you to make advance preparations in these areas.

In keeping with our policy of standardized training, a lesson plan has been prepared for each unit of instruction. This plan is intended as a guide for the overall presentation. Separate columns are used to list those items which must be covered by the instructor, and a check on subject coverage is given in the columns headed "What the Technician Should Know" and "What the Technician Should Be Able To Do." A column headed "Assignments" lists those operations which will provide the necessary manipulative skills and experiences.

Examination questions have been included as a section, and the use of these questions will give the instructor a valuable insight into the effectiveness of his training. The main body of notes is not intended to be used verbatim, but as a set of "lead-in" statements to stimulate classroom discussion and technician participation. No effort has been made to structure these materials so rigidly as to cause the instructor to lose his individuality. Each instructor is expected to take these materials and develop a presentation which will best fit his particular situation.

## SUGGESTED TRAINING UNIT TIME SCHEDULE

Chart presentation . . . . .	30 minutes
Throttle linkage adjustment . . . . .	20 minutes
Manual-shift linkage adjustment . . . . .	20 minutes
Neutral start switch adjustment . . . . .	10 minutes
Band adjustments . . . . .	30 minutes
Diagnosis	
• Control pressure . . . . .	60 minutes
• Clutches and bands . . . . .	40 minutes
Recap and examination . . . . .	30 minutes
<b>TOTAL TIME</b>	<b>4 hours</b>

## ORGANIZATION OF CLASSROOM AND SHOP AREA

Adequate seating	Clear area for test cars
Proper lighting	Exhaust outlet
Adequate ventilation	Compressed air
Pencils and paper for Technicians	Hoist
Chart stand	Chalkboard

## TRAINING AIDS REQUIRED

Flip Chart 7501.3	Failed clutches and bands
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## TOOLS AND EQUIPMENT REQUIRED

Transmission pressure gauge	Common hand tools
Vehicles equipped with Cruise-O-Matic	Oil drain pan
Inch-pound torque wrench	Transmission fluid
Fender covers	1/4-inch gauge pin
	Tool T59P-77370-B

## LESSON PLAN

WHAT THE TECHNICIAN SHOULD KNOW	WHAT THE TECHNICIAN SHOULD BE ABLE TO DO	DISCUSSION TOPICS	ASSIGNMENTS
Why is it important to follow recommendations for adding fluid.	Explain the reasons for the recommendations.	Fluid requirements.	List possible results of improper "add to" procedure.
Nature and location of throttle linkage adjustments.	Determine need for adjustment.	Throttle linkage adjustment procedure.	Adjust throttle linkage.
Procedures for making adjustments. Location of adjustments.	Perform manual-shift linkage adjustments.	Manual-shift linkage adjustments.	Adjust manual-shift linkage.
Location of adjustment points. Need for adjustment.	Adjust the neutral start switch.	Neutral start switch adjustment.	Check neutral start switch adjustment.
Band adjustment procedures. Use of special tools.	How to adjust bands.	Band adjustment procedures.	Adjust bands: <ul style="list-style-type: none"> <li>• Intermediate</li> <li>• Low and Reverse</li> </ul>
How pressure checks are made. Meaning of test results.	Relate test results to cause of malfunction.	Control pressure checks.	Check control pressures in all positions.
How control pressure is changed. Effect of improper control pressure.	Recognize need for control pressure adjustment.	Control pressure adjustment.	Adjust control pressure.
Clutch and band application for each drive condition.	Relate clutch and band operation to malfunction.	Clutch and band diagnosis.	List clutch and band relationship.

## SUGGESTED EXAMINATION

This suggested examination is based on material in this course. An answer key is provided following the last question.

Select any or all of the questions as an examination for Service Technicians.

1. The low and reverse band adjustment mileage interval is:
  - a. 24,000 miles
  - b. 36,000 miles
  - c. as required
2. On the Ford car, the throttle linkage is adjusted:
  - a. at wide-open throttle
  - b. at closed throttle
  - c. from a 4-1/4 inch accelerator pedal height
3. A detent is installed in the throttle linkage to:
  - a. provide a steady rest for the drivers foot at heavy-throttle operation
  - b. warn the driver when the pedal is at maximum carburetor, and that further pedal depression will bring in a downshift
  - c. provide an overrun so that the carburetor throttle valve does not "jam" in its wide-open position
4. The manual valve locating detent is:
  - a. in the linkage at the top of the steering column
  - b. a rooster comb plate linked to the manual valve by the park toggle rod
  - c. directly on the manual valve
5. The neutral start switch will seldom require adjustment, because the:
  - a. manual-shift linkage is spring-loaded to compensate for wear
  - b. switch is attached directly to the transmission manual lever
  - c. manual linkage compensates for seasonal temperature changes
6. Control pressure rise should start at a vacuum gauge reading of about:
  - a. 20 inches
  - b. 17 inches
  - c. 10 inches
7. A stall test for slippage in D2 tests the:
  - a. converter, the intermediate band and the one-way clutch
  - b. converter, the forward clutch and the one-way clutch
  - c. converter, the forward clutch and the intermediate band
8. If the diaphragm unit push-rod is left out at assembly, the transmission will:
  - a. always shift at the high limit (road speed)
  - b. always shift at the low limit (road speed)
  - c. downshift 3-2-1 on a coastdown
9. The C4 Cruise-O-Matic cannot be locked into first or second gear by tightening a band as can be done on the 2-speed Fordomatic, because the:
  - a. intermediate band holds the reverse and high clutch drum
  - b. forward clutch cylinder is splined to the input shaft
  - c. only way power can flow from the converter and into the gear train is through one or both multiple-disc clutches
10. If the selector lever is moved to L with the car going 80 mph in high gear, the transmission will:
  - a. stay in high
  - b. downshift to intermediate
  - c. downshift to first

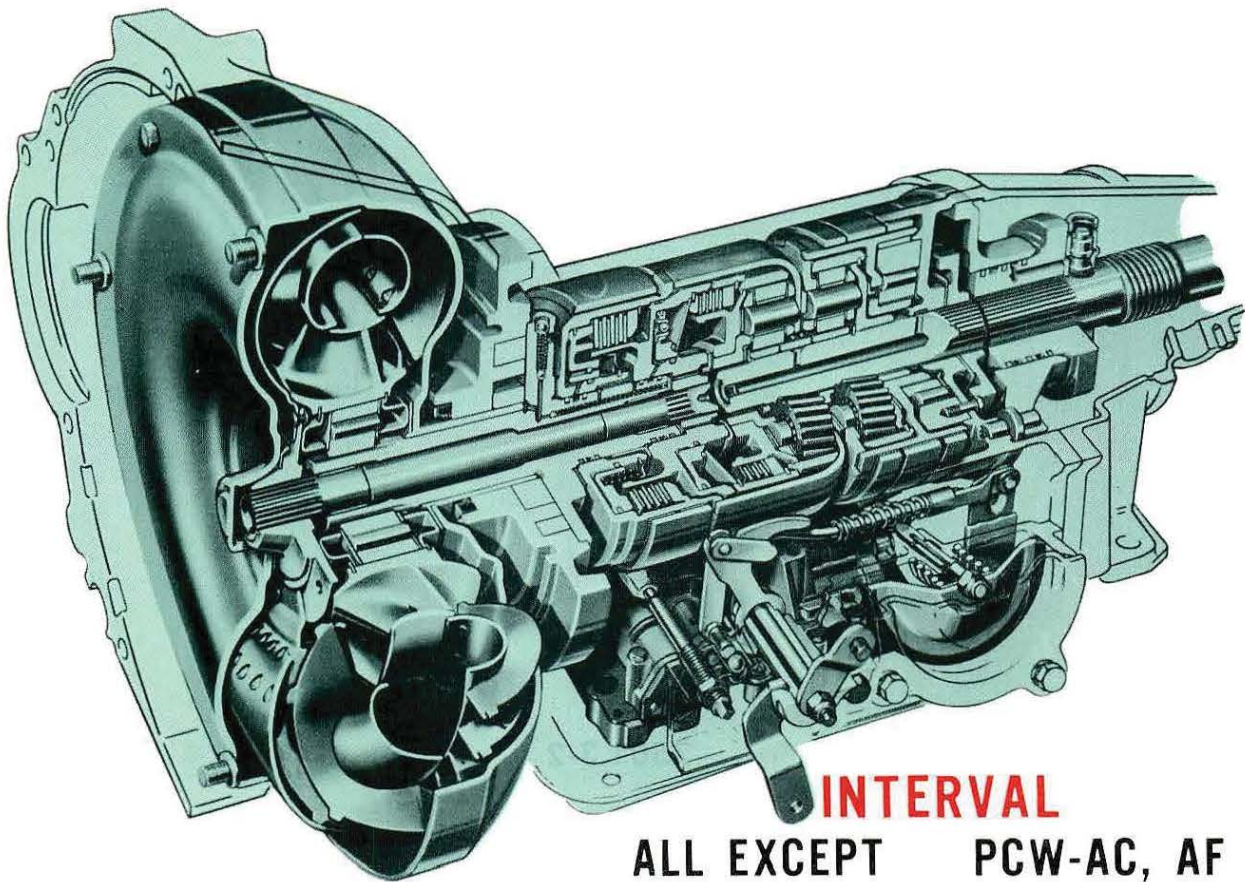
### ANSWER KEY

- |      |      |      |      |       |
|------|------|------|------|-------|
| 1.—b | 3.—b | 5.—b | 7.—c | 9.—c  |
| 2.—a | 4.—c | 6.—b | 8.—b | 10.—b |

**7501.3-1**

**TRANSMISSION FLUID**

Use only automatic transmission fluids having a Ford Qualification Number indicating fluid meets Ford specifications.



## INTERVAL

● CHECK FLUID LEVEL	ALL EXCEPT <u>PCW-AC, AF</u>	<u>PCW-AC, AF</u> <u>289-4V H.P.</u>
● ADJUST INTERMEDIATE BAND	6,000 MILES	6,000 MILES
● ADJUST REVERSE BAND	36,000 MILES	6,000 MILES
● LUBRICATE KICKDOWN LINKAGE	AS REQUIRED	12,000 MILES
	6,000 MILES	6,000 MILES

## FLUID CAPACITIES—APPROXIMATE

MODELS PCS	7 <sup>3</sup> / <sub>4</sub> QUARTS
MODELS PCW-AA, AC, AD, AF, J, M	8 <sup>3</sup> / <sub>4</sub> QUARTS
MODELS PCV, PCW-AG,R, S; PCZ; PDA	10 <sup>1</sup> / <sub>4</sub> QUARTS
MODELS PCW-AH	10 <sup>1</sup> / <sub>2</sub> QUARTS

# TRANSMISSION MAINTENANCE

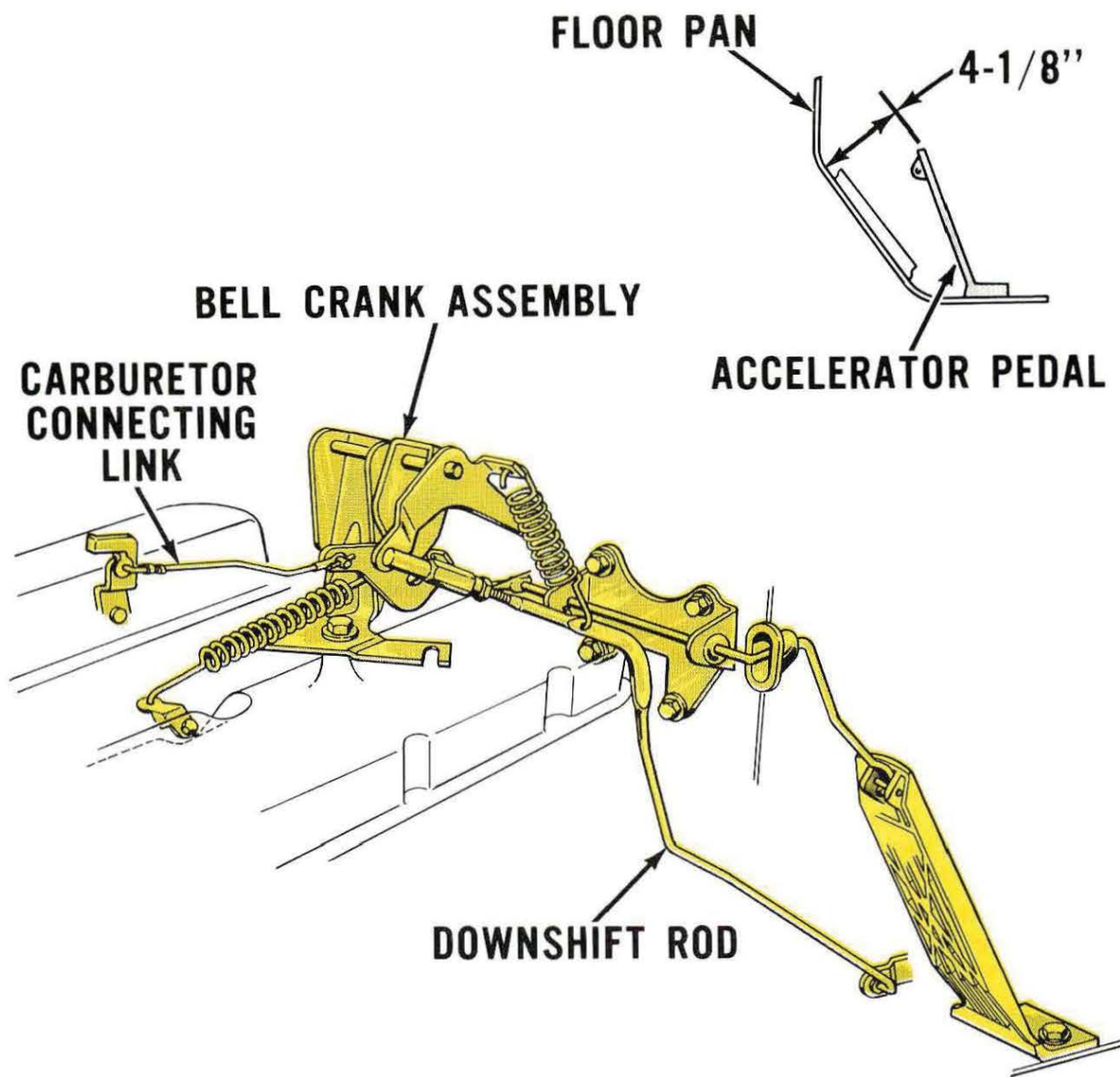


## 7501.3-2

### THROTTLE LINKAGE ADJUSTMENT

#### FALCON AND COMET

1. With the engine at normal operating temperature, adjust the engine idle speed 475-500 rpm, with the selector lever in D1 or D2. **Apply the parking brake firmly prior to making this adjustment.**
2. Bottom the dashpot plunger, and check the clearance between the bottomed plunger and the carburetor throttle lever. The throttle lever must be against its idle stop during this check. If necessary, adjust to a clearance of 0.060-0.090 inch.
3. Adjust the accelerator connecting link to obtain a pedal height of 4-1/8 inches.
4. With the engine off, push the accelerator pedal down against the floor and hold it there. Insert a block of wood between the instrument panel lower flange and the pedal.
5. Disconnect the downshift rod from the bell crank assembly. Hold the downshift rod firmly downward so that the downshift transmission lever is against its internal stop. In this position, adjust the downshift rod trunnion so that it enters the bell crank assembly lever easily. Connect the trunnion and tighten the locknut.
6. Release the accelerator pedal and install the return spring.



# FALCON-COMET THROTTLE LINKAGE

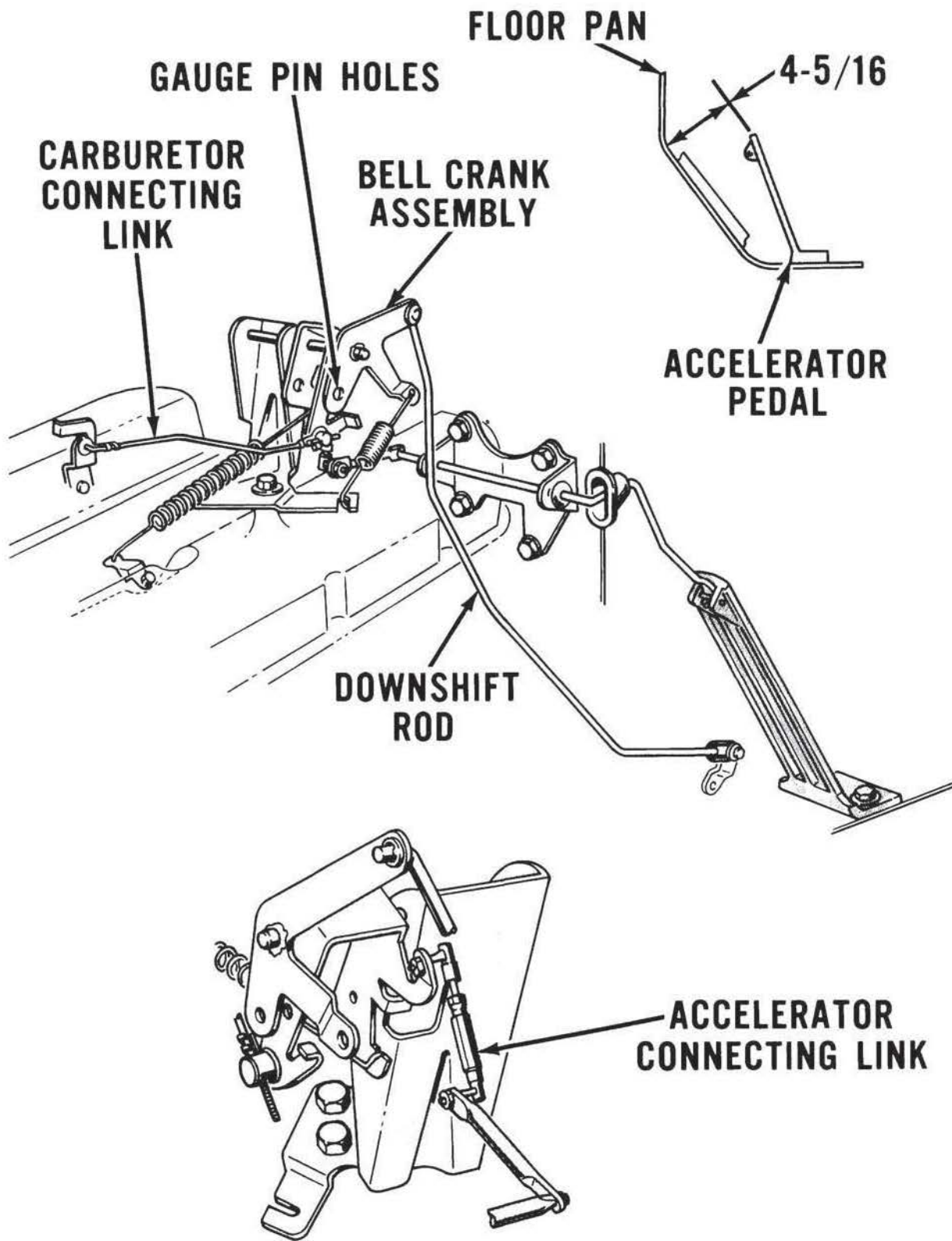


## 7501.3-3

### THROTTLE LINKAGE ADJUSTMENT—Continued

#### FAIRLANE

1. With the engine at normal operating temperature, adjust the engine idle speed to 475-500 rpm, with the selector lever in D1 or D2. Apply the parking brake firmly prior to making this adjustment.
2. Bottom the dashpot plunger, and check the clearance between the bottomed plunger and the carburetor throttle lever. The throttle lever must be against its idle stop during this check. If necessary, adjust to a clearance of 0.060-0.090 inch.
3. Disconnect the carburetor connecting link from the bell crank assembly, and insert a 1/4-inch gauge pin through the gauge pin holes.
4. Lift the carburetor connecting link to its operating position. Maintain forward pressure on it so that the carburetor throttle lever is held solidly against the idle adjusting screw. With forward pressure on the link, adjust its length so that it can be freely assembled to the bell crank lever. Lengthen the link one thread from this free-fitting position. Remove the gauge pin and connect the link.
5. Check the alignment of the gauge pin holes. Open the throttle, and permit the throttle linkage retracting spring to return the linkage to its idle position. The gauge pin must enter freely. If necessary, readjust the carburetor connecting link to obtain free entry for the gauge pin.
6. Adjust the accelerator connecting link to obtain a pedal height of 4-5/16 inches.
7. The downshift rod is not adjustable.



# FAIRLANE THROTTLE LINKAGE

