

Editor's Preface:

I found this document as a series of scans (of Ford Motor Company documents) on the Internet and am of the belief that the documents are in the public domain. The images included in this text are cropped versions of the original scans, and have been cleaned-up for brightness and contrast.

Using Optical Character Recognition software, I have converted the text from images to formatted html text.

The reader should realize that this manual covers the earlier "T-Shift" type Dana model 20 transfer case. The later "J-Shift" type transfer case varies slightly in construction and operation. I have used this manual as a guide in the disassembly and reassembly of my "J-Shift" case, and have begun to make notes where the two case types differ. I have not integrated these differences into written form as of yet, but plan to do so in the near future. I also realize that the text incorporated in the images may be fuzzy or hard to read, and I plan to fix this using image editing software.

Check back for further updates.

Douglas Bohn - 27 November 2002

Update Schedule:

12-04-2002 – I reworked most of the illustrations by cutting out the blurry text, and adding new text to hopefully make them more readable.

11-29-2002 - I have added my comments on the disassembly of my J-Shift case. These comments are placed in the disassembly narrative in their proper order, and are distinguished with a heavier, red italic text, such as:

[Editor's Note: Sample of J-Shift addenda, blah blah blah...]

PART 6-3 - 4-Wheel Drive Transfer Case

1 - DESCRIPTION AND OPERATION

A manually shifted 2-speed transfercase in the 4-wheel drive Bronco controls the power from the engine and transmission to the front and rear driving axles (Fig. 1). The transfer case shift lever positions, from front to rear, are 4L (low gear, all wheels), N (Neutral), 2H (high gear, rear wheels), and 4H (high gear, all wheels).

POWER FLOW - NEUTRAL POSITION

When the transfer case gears are in neutral (Fig. 1), power from the front main transmission drives the transfer case input shaft and drive gear. The drive gear drives the idler shaft and the high-speed gear that free-runs on the front output shaft. Therefore, no power can be delivered to either the front, or rear axle, even when the front main transmission is in gear.

POWER FLOW—4L POSITION (LOW GEAR, ALL WHEELS)

When the transfer case shift lever is shifted into the 4-wheel low position, it pushes the two sliding gears back into engagement with the idler shaft low-speed gear teeth.

The power flows from the main drive gear to the idler drive gear and shaft, and to the idler low-speed gear. From the low-speed, the power flows through the two sliding gears to their respective output shafts to give speed reduction.

POWER FLOW—2H POSITION (HIGH GEAR, REAR-WHEELS)

When the transfer case shift lever is shifted into the 2-wheel high position, the two sliding gears are pulled forward out of engagement from the idler shaft low-speed gear, leaving the front output sliding gear in neutral and pulling the rear output sliding gear farther forward into engagement with the clutch teeth of the main drive gear. This locks the main input shaft directly to the rear wheel output shaft.

The power flows directly from the transmission to the rear axle without any reduction of speed.

The front output sliding gear remains in a neutral position, the idler shaft drive gear turns the high-speed gear free on the front output shaft, and there is no power to the front axle.

POWER FLOW—4H POSITION (HIGH GEAR, ALL WHEELS)

When the transfer case shift lever is shifted into the 4-wheel high position, it pulls the rear output and front output sliding gears forward into engagement with the clutch teeth of the main drive gears. This locks the rear output shaft directly to the main input shaft, and the front output shaft to the high-speed idler shaft gear.

The power from the transmission flows from the drive gear in two directions. Direct drive to the rear axle flows through the rear output shaft. Direct drive to the front axle flows through the idler shaft drive gear, high-speed gear, and front output shaft.

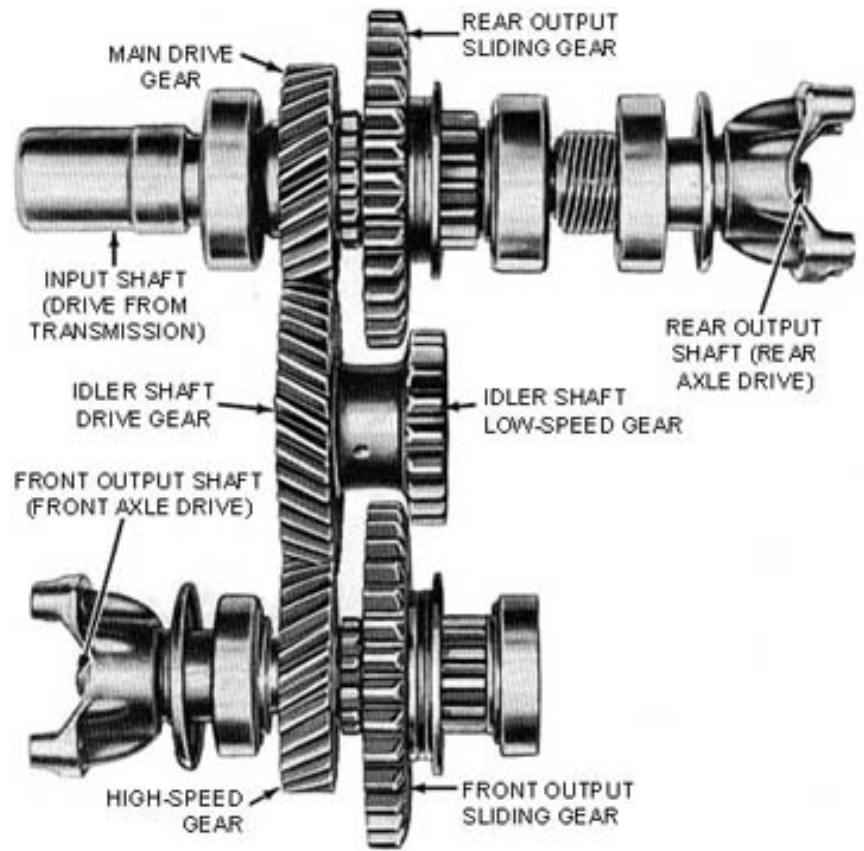


Figure 1 – Transfer Case Gear Train in Neutral

2 - REMOVAL AND INSTALLATION

REMOVAL

1. Raise the vehicle on a hoist.
2. Support the transfer case shield with a jack and remove the bolts that attach the shield to the frame side rails. Remove the shield.
3. Drain the transmission and transfer case lubricant.
4. Disconnect the front and rear drive shafts at the transfer case (Fig. 2).
5. Disconnect the speedometer cable at the transfer case.
6. Disconnect the shift rods from the transmission shift levers. Then, place the first-reverse gearshift lever into the first gear position, and insert the fabricated tool (Fig. 2). This tool will prevent the input shaft roller bearings from dropping into the transmission case when separating the transfer case from the transmission and output shaft.
7. Cut the lock wire and remove the two bolts, washers, plates, and insulators that secure the crossmember to the transfer case adapter.
8. Remove the crossmember-to-frame side support attaching bolts.
9. Raise the transmission and remove the upper insulators from the crossmember. Remove the crossmember.
10. Disconnect the shift rod from the transfer case shift lever bracket.
11. Remove the bolt that attaches the shift lever bracket to the transfer case adapter, and allow the assembly to hang by the shift lever.
12. Secure the transfer case to a transmission jack, and remove the transfer case-to-transmission attaching bolts.
13. Move the transfer case and jack rearward until it clears the transmission output shaft (Fig. 2). Lower the transfer case.

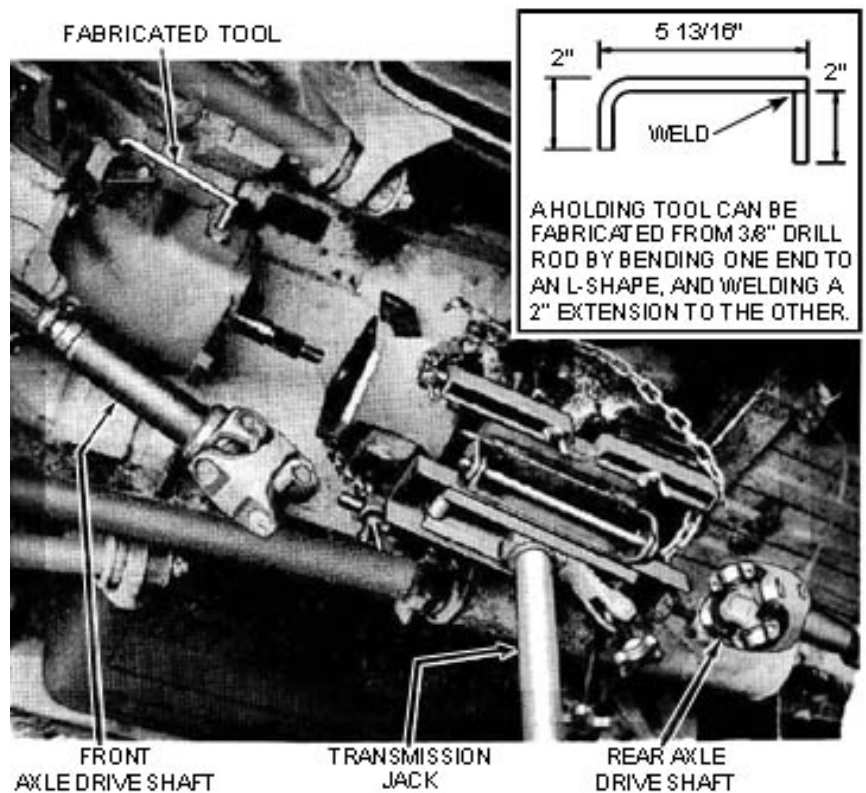


Figure 2 – Removing or Installing Transfer Case

INSTALLATION

1. Position the transfer case to the transmission (Fig. 2) and install the attaching bolts. Torque the bolts to specifications.
2. Position the shift lever to the transfer case adapter, and install the attaching bolt.
3. Connect the shift rod to the shift lever bracket and secure with the spring washer, flat washer, and cotter pin.
4. Raise the transmission and transfer case high enough to provide clearance for installing the crossmember. Position the upper insulators to the crossmember and install the cross-member-to-frame side support attaching bolts.
5. Align the bolt holes in the transfer case adapter with those in the crossmember, then lower the transmission and remove the jack.
6. Install the crossmember-to-transfer case adapter bolts, insulators, plates, and washers. Secure the bolts with lock wire.
7. Remove the fabricated tool, and connect each shift rod to its respective lever on the transmission with a spring washer, flat washer, and cotter pin.
8. Connect the speedometer cable.
9. Install the rear axle drive shaft to the transfer case, and torque the attaching bolts to specifications.
10. Install the front wheel drive shaft to the transfer case, and torque the attaching bolts to specifications.
11. Fill the transmission and transfer case to the proper levels with the recommended lubricant.
12. Position the transfer case shield to the frame side rails, and install the attaching bolts.

3 - MAJOR REPAIR OPERATIONS

DISASSEMBLY

1. Clean the dirt from the transfer case, and remove the bottom cover plate.
2. Remove the retaining plug, flat washer, detent spring, and ball that engage the front drive shift rail detent rod. Then, remove the plug from the front drive detent rod access hole (Fig. 3)
3. Remove the retaining plug, detent spring, and ball that engage the rear drive shift rail detent rod (Fig. 3).
4. Remove the idler shaft Lock plate from the rear of the case.
5. Using a hammer and soft drift, drive the idler shaft rearward and out of the case. Then, lift the thrust washers and idler gear from the case (Fig. 4). When removing the idler gear, do not lose any of the rollers.

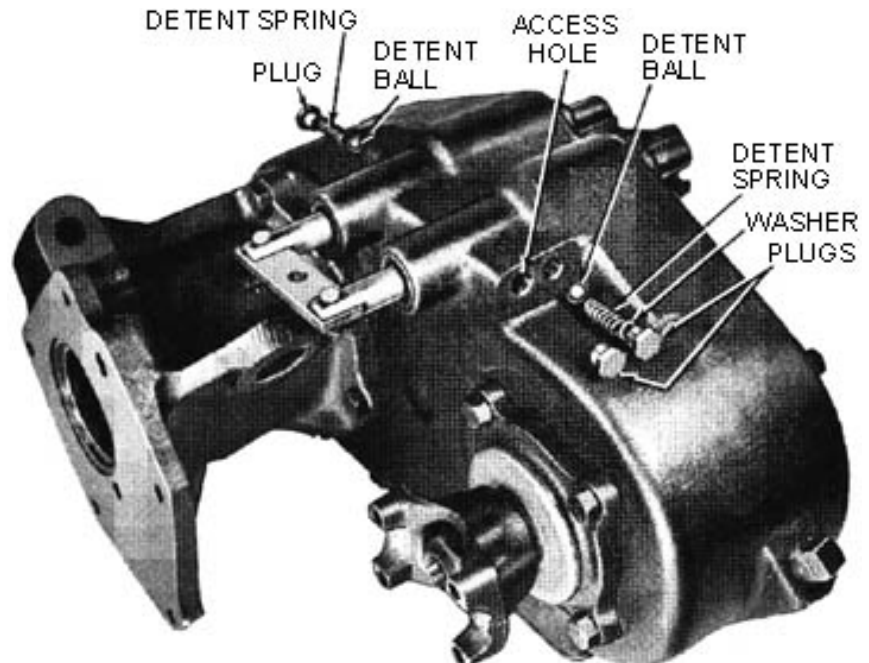


Figure 3 – Front and Rear Drive Shift Rail Detent Balls, Springs, and Plugs

6. Remove the flange retaining nuts from the front and rear output shafts (Fig. 5).

7. Remove the flange from the front and rear output shafts (Fig. 6). Discard the front flange O-ring.

8. Remove the bolts securing the adapter housing to the case and remove the adapter as an assembly (Fig. 7).

8A. [Editor's note: With my J-Shift case, I found that I could remove the adapter housing, but that the input shaft cluster was press-fit into the main case. If this is the situation with your J-Shift case, do not worry. Don't Attempt to pry the cluster out, because you could damage the machined surfaces. Simply remove the adapter housing and proceed to step 9. You will remove the input shaft assembly in step 9A]

9. Remove the bolts that attach the rear output shaft bearing retainer to the case, and remove the retainer and output shaft as an assembly. Be careful not to lose any of the rollers.

9A. If, in step 8 or 8A you were only able to remove the adapter housing, due to the press fit of the input shaft assembly, note that now that the rear output shaft assembly is removed, you have access through the main case to LIGHTLY tap the input shaft assembly out of its press fit with soft (wood, plastic, brass) drift. Set the input shaft assembly to the side with its adapter housing.

10. Disconnect the shift rail link from the two shift rails.

(J-Shift Case owners do not need to do this since their rails are not actually connected together)

11. Lift the rear output shaft sliding gear from the case (Fig. 7).

12. Remove the setscrew securing the rear shift fork to the shift fork to the shift rail. Then, remove the rear drive shift rail and fork from the case (Fig. 7).

[Editor's note: In order for the sliding

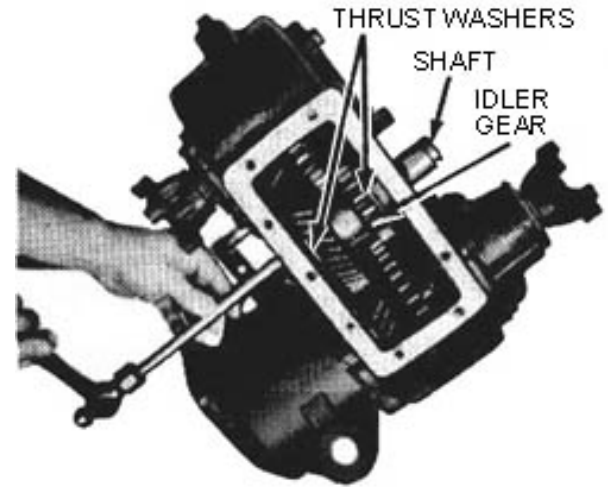


Figure 4 – Removing Idler Shaft

gear to be removed from the shift fork, the fork must be able to rotate all the way over to the inspection port. In my case this was not an option, since the shift fork stopped short of the inspection port. I solved the problem as described in step 12A below]

12A. Note that the rear drive shift fork is secured to its shift rail by means of a sunken, Allen head set screw. This setscrew could be removed with a 3/16" Allen key, but this could prove tedious since there is limited clearance, and the Allen key only affords 6 positions of grab. This inconvenience can be worked around using a 1/4"-hex-drive Allen-type bit – the type of bit that might be found in a universal screwdriver type tool set. Inset the (3/16"size) bit into the setscrew. A 12-pointed 1/4" box end wrench may now be used to turn the Allen bit, removing the setscrew. The 12-point wrench affords more versatility than a 6-point wrench because of its in-between increments. Do not back the setscrew out entirely – just enough to free the shift fork from the shift rail. Once the shift fork is unsecured from the shift rail, the fork can swing freely on the rail and the sliding gear can be removed through the inspection port. Once the gear is removed, slide the shift rail out from the shift fork and out of the case. Remove the shift fork from the case.

13. Remove the front output shaft rear cover and shims. Tie the shims together.

14. Remove the front output shaft bearing retainer and gasket. Remove the retainer seal if it is worn or damaged.

15. Tap the threaded end of the front output shaft to remove the rear bearing cup from the case bore.

16. Wedge the front output shaft front bearing away from the main drive gear to allow removal of the snap ring from its groove in the shaft. Then, tap the shaft and rear bearing out of the case (Fig. 8).

[Editor's note: Your J-shift case MAY

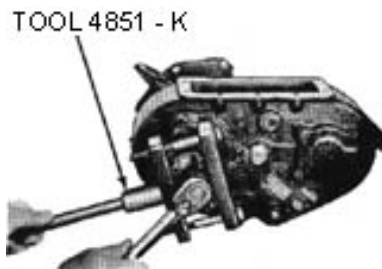


Figure 5 – Removing or Installing Flange Retaining Nut

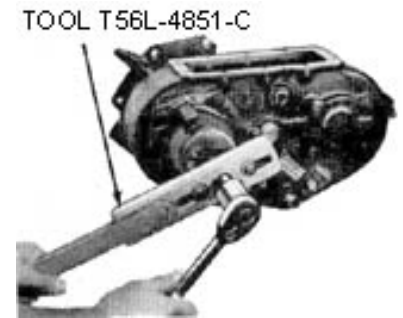


Figure 6 – Removing Flange

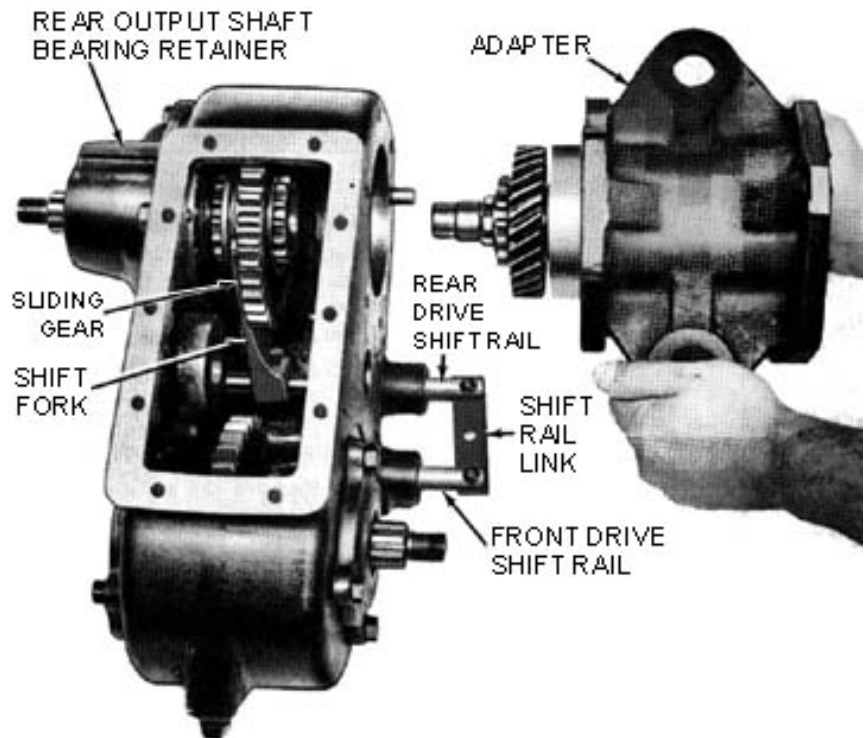


Figure 7 – Removing or Installing Adapter Housing

NOT have the aforementioned c-clip on the front drive output shaft in between the bearing cone and the high speed drive gear. If not, note that the front bearing cone is mildly pressed onto the shaft at the splined area. You are able to CAREFULLY (with a light hammer and a soft drift) tap the shaft assembly toward the rear of the case, driving the front bearing cone off the shaft. You can now remove the shaft assembly.

17. Lift the sliding gear, main drive gear, front bearing, spacer, and snap ring from the case.

18. Remove the front cup from the case bore.

19. Remove the setscrew securing the front shift fork to the shift rail. Then, remove the shift rail and fork from the case.

20. Remove the detent rods (Fig. 9).

20A. With the later J-Shift case, you may notice that there is only ONE detent rod (Figures 9 and 18). While there may be debate over the existence of one or two rods, several J-Shift case owners have reported that they have only one rod. This single rod will be removed from the plughole at the rear of the left side, passing through to the single right-hand plughole.

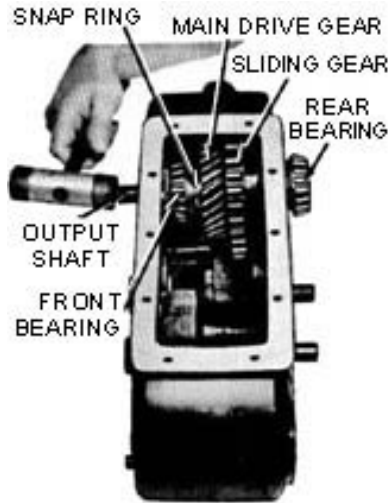


Figure 8 – Removing Front Output Shaft

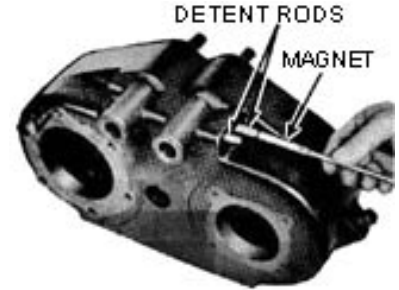


Figure 9 – Removing Detent Rods

PARTS REPAIR OR REPLACEMENT

INPUT SHAFT

1. Remove the snap ring from the front of the shaft (Fig. 10).
2. Place the adapter housing and input shaft on a press, and press the shaft out of the main drive gear and housing.
3. Remove the bearing retaining snap ring from the housing bore, and remove the bearing.
4. Remove the seal in the adapter housing if it is worn or damaged.
5. If the adapter housing seal was removed, install a new seal with the tool shown in Fig. 11.
6. Place the bearing in the housing and secure with the snap ring.
7. Using the main drive gear as a base, press the input shaft through the housing, seal, bearings, and main drive gear. Install the snap ring on the front of the shaft.

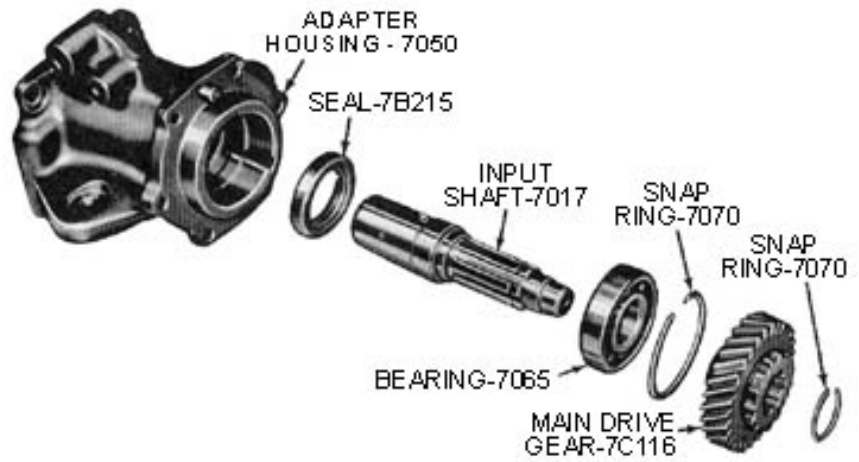


Figure 10 – Input Shaft, Disassembled

REAR DRIVE OUTPUT SHAFT

1. Remove the needle bearings from the bore of the shaft (Fig. 12).
2. Remove the speedometer driven gear from the bearing retainer housing.
3. Place the bearing retainer and rear output shaft assembly in a press, and press the shaft out of the retainer.
4. Lift the speedometer drive gear and shims from the shaft (Fig. 12). Tie the shims together.
5. Press the outer cup, bearing and seal from the bearing retainer as shown in Fig. 13.
6. Remove the inner cup with the tool shown in Fig. 13.
7. Remove the inner bearing from the output shaft with the tool shown in Fig. 14.
8. Press the shaft onto the inner bearing with the tool shown in Fig. 14.
9. Install the outer cup in the bearing retainer with tool T55P-4616A1.
10. Install the inner cup with tool T56T-461 6-A2.



Figure 11 – Installing Adapter Housing Seal

11. Position the outer bearing into the bearing retainer. Then, place the shims and speedometer drive gear on the output shaft, and install the shaft in the bearing retainer housing.

12. Place the bearing retainer and shaft in a vise. Install the output shaft flange and torque the retaining nut to specifications. Install a dial indicator on the flange end of the output shaft, and check the end play. The end play should be 0.003-0.005 inch. If not within these limits, adjust the shim pack (Fig. 12) between the speedometer drive gear and rear output shaft outer bearing.

13. After establishing the correct end play, remove the output shaft flange and press the bearing retainer seal in the housing with tool T56T-46 16-A. Install the speedometer driven gear.

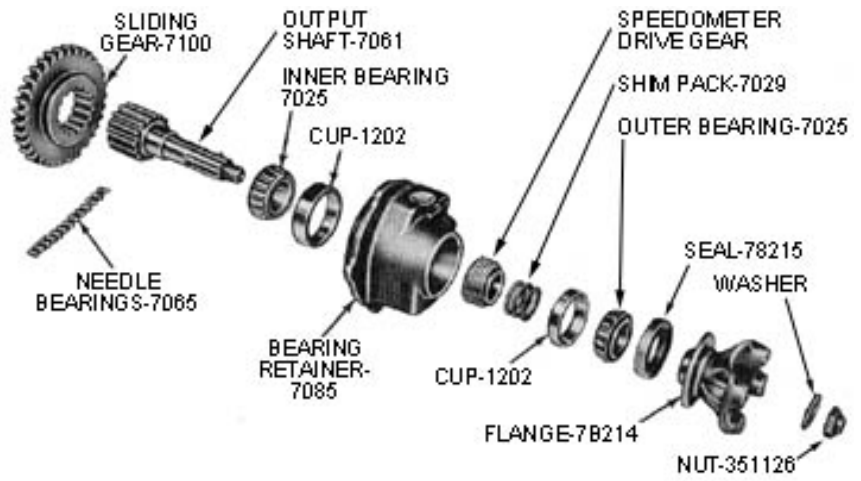


Figure 12 – Rear Drive Output Shaft, Disassembled

FRONT DRIVE OUTPUT SHAFT

1. To remove the front output shaft rear bearing, use the sliding gear as a base and press the bearing from the shaft.

2. Install the bearing as shown in Fig. 15.

SHIFT RAIL OIL SEALS

1. Remove the shift rail seals as shown in Fig. 16.

2. Install the two shift rail oil seals, using the tool shown in Fig. 17.

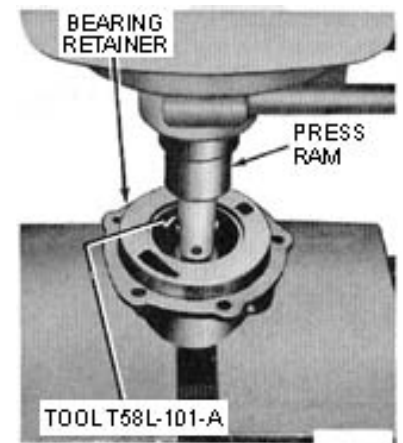


Figure 13 – Removing Rear Bearing Retainer Outer Cup, Bearing, and Seal

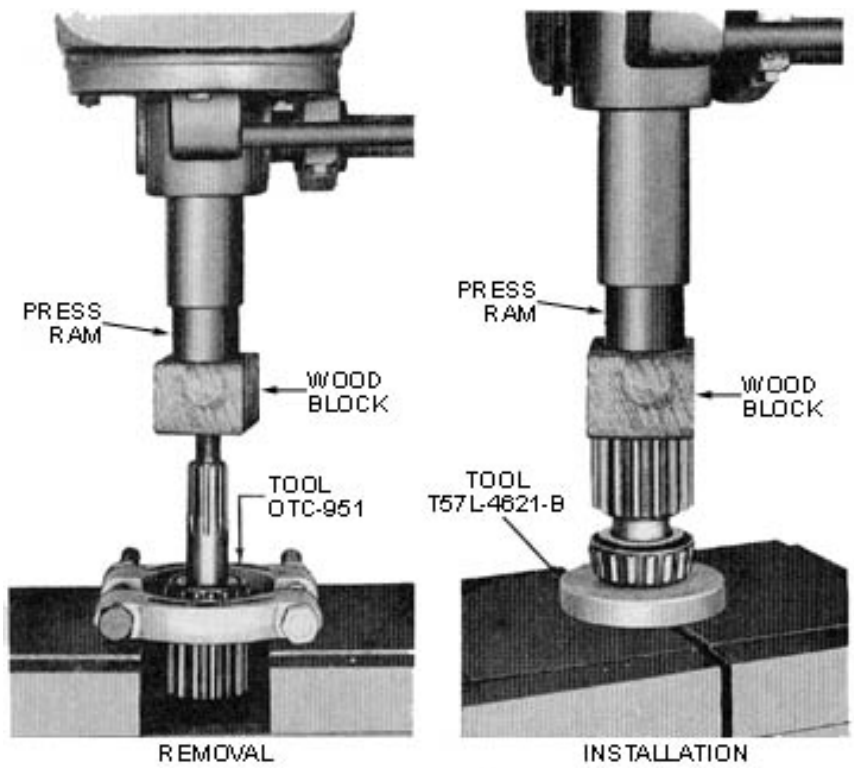


Figure 14 – Replacing Output Shaft Inner Bearing

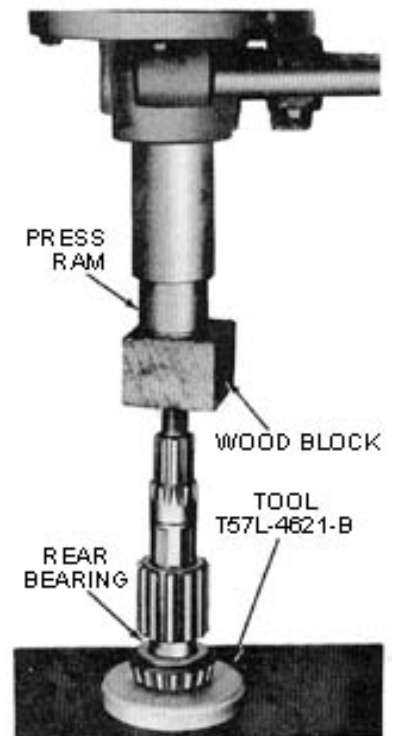


Figure 15 – Installing Front Output Shaft Rear Bearing

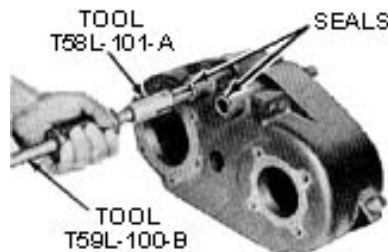


Figure 16 – Removing Shift Rail Seals

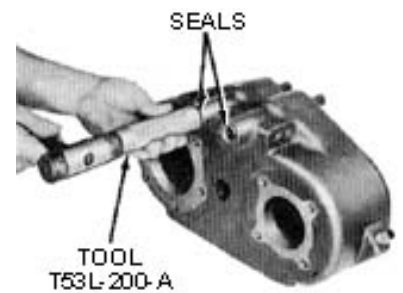


Figure 17 – Installing Shift Rail Oil Seals

ASSEMBLY

1. Install the front detent rod in the case.
2. Slide the front drive shift rail all the way into the case, and position the shift fork on the rail as the rail goes into the case. Secure the fork to the rail with the setscrew.
3. Position the front output shaft sliding gear in the shift fork.
4. Install the rear detent rod in the case.
5. Slide the rear drive shift rail into the case, and position the shift fork on the rail as the rail goes into the case. Secure the fork to the rail with the setscrew. The shift rails should be inserted so that the detents are positioned as shown in Fig. 18.
6. While holding the sliding gear and main drive gear in position, install the front output shaft and rear bearing assembly through the two gears from the rear of the case.

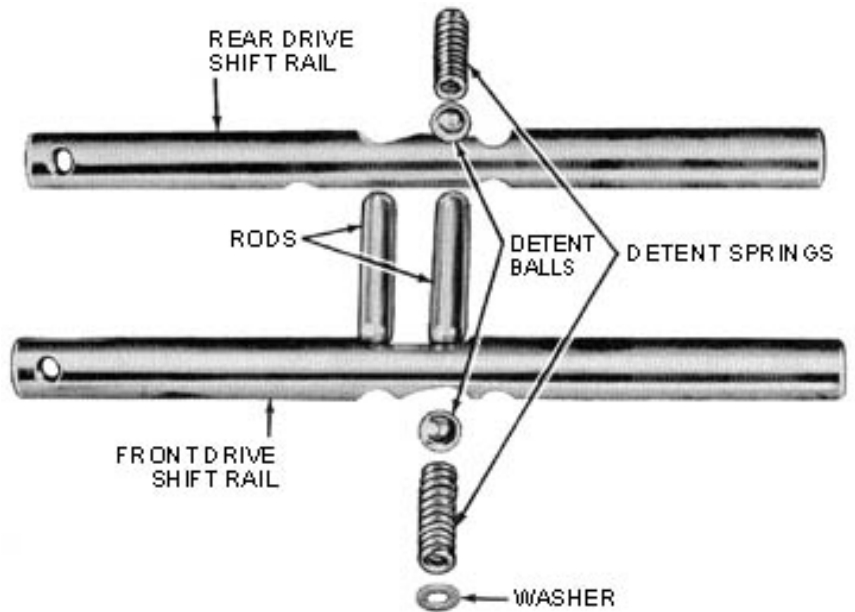


Figure 18 – Shift Mechanism

7. Install the main drive gear spacer and secure with the snap ring (Fig. 19).
8. Install the front output shaft rear bearing cup.
9. Position the front output shaft rear cover and shims to the case, and install the attaching bolts.
10. Using front flange and the tool shown in Fig. 5, install the front output shaft front bearing on the shaft. Install the front bearing cup (Fig. 19).
11. If the front bearing retainer oil seal was removed, install a new seal by using tool T57-L7657. Position the bearing retainer and gasket to the case, and install the attaching bolts.

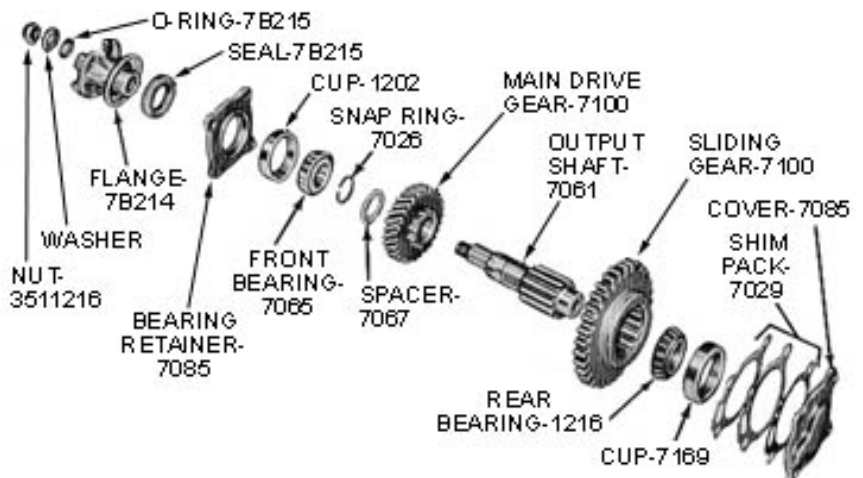


Figure 19 – Front Output Shaft, Disassembled

12. Place the rear output shaft rear bearing retainer on a workbench, and install 13 needle bearings in the splined hub of the output shaft with Vaseline or grease.

13. Position the rear output shaft rear bearing retainer assembly to the case and install the attaching bolts.
14. Install the rear output shaft sliding gear in the shifting fork and on the splines of the output shaft.
15. Position the adapter housing assembly to the rear output shaft and case. Install the attaching bolts (Fig. 7)
16. Install the roller bearings in the bore of the idler shaft gear with vase-line or grease.
17. Position the idler gear and thrust washers in the case, and drive the idler shaft into the rear of the case through the idler gear and thrust washers. After installing the idler shaft, tap the sides of the case to relieve tension from the case. Install the idler shaft lock plate.
18. Secure the shift rail link to the two shift rails.
19. Install the front and rear drive shift rail detent balls, springs, and retaining plugs. Be sure that the heavier loaded spring and flat washer are installed in the front drive shift rail. Install the rod access hole plug.
20. Install the flange, washer, and retaining nut on each of the output shafts, using the tool shown in Fig. 5. Be sure to install a new O-ring in the front output shaft flange. Torque the attaching nuts to specifications.
21. Install a dial indicator on the front drive output shaft and check the end play as shown in Fig. 20. The end play should be 0.003-0.005 inch. If not within these limits, adjust the shim pack at the front output shaft rear cover.
22. Position the cover plate to the case and install the attaching bolts.

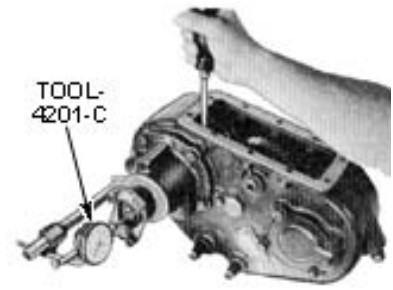


Figure 20 – Checking Front Drive Output Shaft End Play

PART 6-4 - Specifications

ECONOLINE

TRANSMISSION GEAR RATIO

| Engine CID | Ratios | | |
|------------|--------|------|------|
| | 1st | 2nd | Rev. |
| 170-IV | 3.41 | 1.86 | 3.51 |
| 240-1V | 2.99 | 1.75 | 3.17 |
| 302-2V | 2.99 | 1.75 | 3.17 |

ADJUSTMENTS

APPROXIMATE LUBRICANT REFILL CAPACITY

| | |
|--------------|-----------|
| Transmission | 3.5 Pints |
|--------------|-----------|

TORQUE LIMITS

| TRANSMISSION | Ft.-lbs. |
|--|----------|
| Input Shaft Gear Bearing Retainer to Transmission Case | 30-36 |
| Transmission to Flywheel Housing | 37-42 |
| Transmission Cover to Transmission Case | 14-19 |

| TRANSMISSION | |
|----------------------------|--|
| Detent Set Screw Head | Flush to 0.020 inch below case surface |
| End Play— Reverse Idler | 0.004-0.018 inch |
| End Play—Countershaft Gear | 0.004-0.018 inch |

BRONCO

TRANSMISSION GEAR RATIO

| Engine C I D | Ratios | | |
|---------------------|---------------|------------|-------------|
| | 1st | 2nd | Rev. |
| 170-1V | 3.41 | 1.86 | 3.51 |
| 289-2V | 2.99 | 1.75 | 3.17 |

ADJUSTMENTS

TRANSMISSION

| | |
|----------------------------|--|
| Detent Screw Head | Flush to 0.020 inch Below case surface |
| End Play-Reverse Idler | 0.004—0.018 inch |
| End Play-Countershaft gear | 0.004—0.018 inch |

TRANSFER CASE

| | |
|-----------------------------------|------------------|
| Front Drive Output Shaft-End Play | 0.003—0.005 inch |
| Rear Drive Output Shaft-End Play | 0.003—0.005 inch |

TORQUE LIMITS

| TRANSMISSION AND TRANSFER CASE | Ft.-Lbs. |
|--|-----------------|
| Crossmember to Adapter Bolts | 30-40 |
| Transfer Case Adapter to Transmission Case Bolts | 35-45 |
| Crossmember to Side Support Bracket Nuts | 40-60 |
| Drive Shaft Flange to Transfer Case Output Shafts Nuts | 125-150 |
| Adapter to Transfer Case Bolts | 25-35 |
| Rear Output Shaft Bearing Retainer Bolts | 25-35 |
| Front Output Shaft Bearing Retainer Bolts | 25-35 |
| Transmission Control Bellcrank Pivot Bolt and Nut | 35-45 |

| | |
|--|-------|
| Speedometer Cable Retainer to Transmission Extension | 3-4.5 |
| Transmission Extension to Transmission Case | 42-50 |
| Flywheel Housing to Engine | 40-50 |
| Gear Shift Lever to Cam & Shaft Assembly Lock Nuts | 18-23 |
| U-Joint Flange to Output Shaft | 60-80 |
| Filler Plug | 10-20 |
| Drain Plug | 20-30 |
| Shifter Fork Set Screw | 10-18 |

APPROXIMATE LUBRICANT REFILL CAPACITY

| | US. Measure | Imperial Measure |
|---------------|--------------------|-------------------------|
| Transmission | 3.50 Pints | 3.0 Pints |
| Transfer Case | 2.75 Pints | 2.25 Pints |

SPECIAL TOOLS

| Tool Number | Description |
|--------------------|---|
| T50T-100-A | Impact Hammer-Long |
| T59L-100-B | Impact Hammer-Short |
| T58L-101-A | Puller Attachment |
| T53L-200-A | Handle Adapter-Female 1/2—13 |
| T57L-4220-A4 | Differential Bearing Assembly Remover |
| T53T-462-B | Drive Pinion Bearing Cone Replacer-Front and Rear |
| T57-L-4621-B | Pinion Bearing Cone Replacer |
| 4201-C | Backlash and Runout Gauge |
| 4851-K | Universal Joint Flange Holder |
| T56L-4851-C | Flange (Universal Joint) Axle End Remover |
| T52T-6500-DJD | Reverse Shift Rail Pliers |
| T63P-7025-A | Output Shaft Bearing Remove and Replacer |
| T63P-7111-B | Cluster Gear Roller Retainer Shaft |
| 164 E-7052-B | Extension Housing Oil Seal Replacer |

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