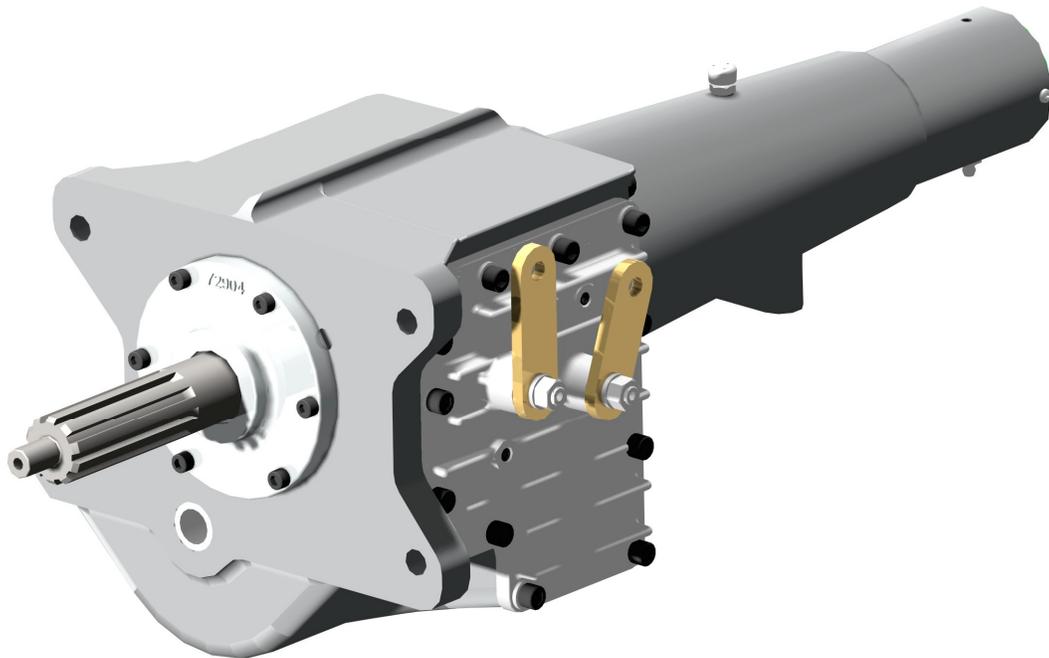




## **Rebuild Instructions for 70001 and 70010 Transmission**



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## Notice

Read all instructions before proceeding. These instructions should be used if you want to service the complete 70001 or 70010 transmission and rebuild kit 70041 was purchased. Rebuild kit 70041 includes the following items.

Part Number	Description	Quantity
70046	Clutch Assembly Wire	1
71003	Oring	4
71010	Retaining Ring	1
71011	Seal, Front	1
71012	Bushing, Input Shaft	1
71016	Spring, Clutch Release	1
71017	Steel Clutch Pressure Disc	6
71018	Metallic Friction Disc	6
71026	Thrust Bearing	2
71035	Oring	1
71040	Output Housing Bushing & Seal	1
71046	Oring	1
71063	Oring	1
73009	Thrust Race, Intermediate Shaft	1

Read *70001 and 70010 Clutch Rebuild Instructions* if you only want to service the clutch assembly to replace the clutch discs.

## **Recommended Tools for Complete Transmission Rebuild**

Arbor press

Drill press

Oring pick

Retaining ring pliers

Allen wrenches

Torque wrench

Magnaflux machine

Runout gauge

#18 and #31 drill bits

Large flat blade screwdriver

Small flat blade screwdriver

Philips head screwdriver

Saf-T-Lok R80

Loctite 277

Silicone sealant

Light grease

Parts washer

Combination wrenches

Feeler gauges

## Disassembly Procedure

1. Disconnect all plumbing connected to the transmission and remove the transmission from the vehicle.
2. Before disassembly, inspect the case and output housing for cracks. The areas where cracking is most likely to occur are at the ribs of the case and around the output housing bolts. Inspect the input shaft for indications of damage. Damage to the output housing oil seal and bushing can indicate problems inside the transmission.
3. Drain all fluids from the transmission by removing the fill and drain plugs (71041 & 71059).
4. Remove the nuts (73022) and lock washers (73023) retaining the shift levers (73024 & 73021).
5. Remove the shift levers.
6. Remove the side cover socket head cap screws (71001) and lock washers (71043).
7. Remove the side cover (72001).
8. Remove the six socket head cap screws (71009) passing through the front retainer (72004).
9. Remove the front retainer.
10. Spin the input shaft (74020) and look for broken or missing teeth on the gears.
11. Remove the input shaft.
12. Remove the input shaft bushing (71012) and discard it.
13. Remove the retaining ring (71010) from the input shaft.
14. Remove the bearing (71008) from the input shaft.
15. Use a small flat blade screwdriver to remove the oil seal (71011) from the front retainer. Do not scratch or damage the front retainer. Discard the oil seal.
16. Remove the synchronizer (74021).
17. Remove the two bolts (71038) passing through the reverse idler shaft cover (73020).
18. Tap on the end of the reverse idler shaft (73011) that is closest to the front of the transmission to remove the reverse idler shaft cover.
19. Remove the reverse idler shaft from the rear of the transmission.
20. Remove the reverse idler gear (74004).

21. Position the transmission case on its front face.
22. Open the clutch bleeder (71027) and remove the bleeder screw.
23. Remove the three piston cap socket head cap screws (71034).
24. Remove the piston cap (73013).
25. Remove the three clutch actuator pins (71030).
26. Remove the piston (73015) from the piston cap by first rotating the piston approximately  $\frac{1}{4}$  turn while keeping the piston cap stationary. Then slide a socket head cap screw through the piston cap until contact is made with the piston. Then push on the end of the socket head cap screw to remove the piston. Do not scratch the inner diameter of the piston cap.
27. Remove the piston oring (71035) and discard it.
28. Remove the two screws (71065) from the output housing (72003 or 72021) that retain the oil seal (71040).
29. Remove the oil seal from the output housing and discard it.
30. Remove the bushing set screw (71064).
31. Remove the grease fitting (71037).
32. Remove the four output housing bolts (71042) and three lock washers (71061).
33. Use a flat blade screwdriver to pry the output housing from the transmission case (72002 or 72020).
34. Use retaining ring pliers to expand the retaining ring (71022) that is around the large bearing (71023) in the output housing. Do not remove the retaining ring from the output housing.
35. Tap on the yoke end of the output shaft (74010) while expanding the retaining ring (71022) to remove it from the output housing.
36. Remove the retaining ring (71024) that is around the output shaft.
37. Remove all gears and bearings from the output shaft.
38. Remove the bushing (71040) from the output housing and discard it.
39. Use a large flat blade screwdriver to compress the clutch by placing the blade between the inner rear face of the transmission case and the intermediate shaft (74008) and then using a prying motion.

40. Place the clutch assembly wire (70046) over the clutch housing and driven gear – input mesh. See Figures 2 and 3.
41. Remove the intermediate shaft retainer (73014) by pushing on the counter shaft pin end that is closest to the front of the transmission.
42. Remove the counter shaft pin (73010) from the transmission case and check for signs of wear and damage. Replace the counter shaft pin if there are grooves in the outer diameter of the pin.
43. Remove the clutch assembly through the hole normally occupied by the output housing.
44. Remove the oring (71046) from the front of the transmission case and discard it.
45. Remove the clutch assembly wire from the clutch assembly.
46. Separate all bearings and thrust washers and look for signs of damage, such as missing needle rollers or cracks in the thrust washers.
47. Look for cracks on the large thrust washer (73009). Replace the thrust washer if there is damage. A new thrust washer is provided in the 70041 rebuild kit.
48. Remove the forward clutch ring (73007) from the driven gear – input mesh (74002).
49. Remove the large oring (71063) and discard it.
50. Inspect the thrust washers (71032) in the clutch drum for cracks. Replace the thrust washers if there is damage.
51. Separate the metallic friction discs (71018) from the steel clutch pressure discs (71017).
52. Measure the thickness of the metallic friction discs and steel clutch pressure discs with calipers or micrometers. Replace any disc that is thinner than 0.075”.
53. Measure the thickness of the rear clutch disc (71021). Replace the disc if it is thinner than 0.178”.
54. Measure the thickness of the forward clutch ring (73007). Replace the ring if it is thinner than 0.210”.  
Remove all burrs and raised edges before reassembly.
55. Use a parts washer to clean all gears, shafts, bearings, case, output housing and anything else that has oil and/or dirt on it. The side cover does not need to be disassembled before cleaning. All dried silicone must be removed. Replace any needle roller bearings if the rollers fall out of the cages during cleaning.

56. Use pressurized air to remove excess parts washer fluid. Do **NOT** allow any of the bearing components to spin while removing excess parts washer fluid. Damage and/or injury could occur.
57. Use a wire brush to remove any silicone not removed in the parts washer
58. Visually inspect the synchronizer after cleaning. Visually check that the lugs on the synchronizer are back tapered. Replace the synchronizer if the lugs are not back tapered, have rounded corners, or if there are problems keeping the transmission in gear.
59. Reinspect the case and output housing after washing.
60. Use a Magnaflux machine to inspect the first gear driven, input and output shafts, synchronizer, and counter shaft gears for cracks. Follow the instructions provided with the Magnaflux. A Maganflux is necessary to find cracks that are not visible to the naked eye.
61. Check for runout on the output shaft. The output shaft must be mounted between centers. Runout should be checked in front of the yoke splines and on both ground bearing surfaces. Subtract the largest runout value from the smallest measured at each position to calculate the runout. 0.007” or less is acceptable runout. Replace the output shaft if there is more than 0.007” runout at any position.

### **Reassembly Procedure**

1. Apply Saf-T-Lok R80 to the outer diameter of the new output housing bushing (71040).
2. Align one of the precut grooves in the inner diameter of the bushing with the grease fitting hole in the output housing (72003 or 72021).
3. Use an arbor press to press the bushing into the output housing until the bushing and output housing are flush.
4. Apply Saf-T-Lok R80 to the outer diameter of the new output housing oil seal (71011).
5. Use an arbor press to press the oil seal into the output housing.
6. Align the grease fitting hole in the output housing with a #18 drill bit and drill through the bushing.
7. Align the bushing set screw hole in the output housing with a #18 drill bit and drill through the bushing.
8. Align an oil seal screw hole in the output housing with a #31 drill bit and drill into the oil seal. Only drill through the outer steel ring of the oil seal. Repeat for the other screw.

9. Use compressed air to remove any chips and debris.
10. Thread two oil seal screws (71065) into the output housing.
11. Apply Loctite 277 to the threads of the bushing set screw (71064).
12. Thread the bushing set screw into the output housing until the brass tip of the set screw is flush with the inner diameter of the bushing. Then turn the bushing set screw ¼ turn counter-clockwise.
13. Thread the grease fitting (71037) into the output housing. Do not over tighten the grease fitting as severe damage to the output housing could result.
14. Install the new intermediate shaft oring (71046) into the transmission case (72002 or 72020).
15. Thread the fill and drain plugs (71041 & 71059) into the transmission case. Do not overtighten the plugs as severe damage to the transmission case could result. The drain plug has a magnet on the end of it and it is threaded into the hole that is closest to the bottom of the transmission case.
16. Install a new oring (71035) into the groove in the piston (73015). The piston oring is red.
17. Apply light grease to the piston oring.
18. Press the piston into the piston cap (73013). The cutouts in the piston must align with the holes in the piston cap.
19. Pack all of the bearings with grease.
20. Assemble the output shaft using Figure 1 as reference.
21. Slide the output shaft assembly into the output housing
22. Expand the retaining ring (71022) already in the output housing
23. Press the output shaft assembly into the output housing until the retaining ring (71022) engages with the groove in the large roller bearing (71023).
24. Assemble the clutch using Figure 2 or 3 as reference. There are two models of the 70001 and 70010 transmissions. The newer models do **NOT** use a retaining ring to locate the first driver gear (74012). The older models use a retaining ring (71047) to locate the first driver gear (74012). Figure 2 should be used if a retaining ring is **NOT** used to locate the first driver gear (74012). Figure 3 should be used if a retaining ring (71047) is used to locate the first driver gear (74012). The clutch requires six metallic friction discs (71018)

and five steel clutch pressure discs (71017) if the retaining ring is **NOT** used. The clutch requires six metallic friction discs (71018) and six steel clutch pressure discs (71017) if the retaining ring (71047) is used. Apply one of the recommended fluids to each metallic friction disc (71018) before it is installed.

25. Compress the clutch assembly and place the clutch assembly wire (70046) over the clutch housing and the driven gear – input mesh. See Figures 2 and 3.
26. Position the transmission case on its front face.
27. Pass the clutch assembly through the large hole in the rear of the transmission case.
28. Place one thrust washer (71025) onto the intermediate shaft.
29. Place one needle thrust bearing (71026) onto the thrust washer (71025).
30. Place one thrust washer (71025) onto the thrust bearing (71026). There should now be one thrust bearing (71026) between two thrust washers (71025).
31. Align the clutch assembly, thrust washers, and thrust bearing with the counter shaft pin hole in the transmission case.
32. Pass the counter shaft pin (73010) through the center of the thrust washers, thrust bearing, and clutch assembly, but do not push the counter shaft pin through the front of the transmission case.
33. Now place the transmission case onto its back face while preventing the counter shaft pin from falling out of the transmission case.
34. Apply grease to one flat face of the intermediate shaft thrust race (73009).
35. Place the greased surface of the intermediate shaft thrust race against the top surface of the driven gear - input mesh (74002).
36. Place a needle thrust bearing (71026) onto the intermediate shaft thrust race (73009). Position the needle thrust bearing on the intermediate shaft thrust race so that the needle thrust bearing is just visible through the counter shaft pin hole in the transmission case.
37. Place a thrust washer (71013) onto the needle thrust bearing (71026).
38. Align the intermediate shaft thrust race, needle thrust bearing, and thrust washer with the counter shaft pin hole in the transmission case.

39. Now push the counter shaft pin through the front of the main case. Verify that there is a thrust washer touching the transmission case at each end of the clutch assembly. Verify that the counter shaft pin passes through all of the components shown in Figures 2 and 3.
40. **Remove the clutch assembly wire from the clutch assembly.**
41. Verify the operation of the clutch by compressing it with a large flat blade screwdriver. The clutch should disengage when the screwdriver is removed. Do not proceed until the clutch operates correctly and opens completely when the screwdriver is removed. There should be 0.080" to 0.100" of clutch movement. Check this with feeler gauges.
42. Apply a thin layer of silicone to the main case around the output housing opening and around the openings for the clutch actuator pins and piston cap screws. Do not allow silicone to enter the holes for the clutch actuator pins.
43. Slide the output housing into the main case. Mesh the gears on the output shaft with the gears on the intermediate shaft as the output housing is installed.
44. Install the four 7/16-14 x 1.50" output housing bolts (71042) and three lock washers (71061). A lock washer is not used on the bolt closest to the piston cap. Apply anti-seize to the bolts if the transmission case is magnesium. Torque the bolts to 40-45 ft-lbs in a criss cross pattern.
45. Place the intermediate shaft retainer (73014) onto the transmission case.
46. Install the three clutch actuator pins (71030).
47. Check the clutch movement again by pushing on the exposed ends of the clutch actuator pins. There should be 0.080" to 0.100" of free play.
48. Apply silicone to the face of the piston cap (73013).
49. Attach the piston cap to the main case with three 1/4-20 x 2.25" socket head cap screws (71034). Position the piston cap so that the bleeder is closest to the output housing bolt that does not use a lock washer. Apply anti-seize to the screws if the transmission case is magnesium. Torque the screws to 60 in-lbs (5 ft-lbs).
50. Apply anti-seize to the bleeder screw (71027).
51. Install the bleeder screw completely then back out two turns.

52. Lay the transmission on its side with the side cover cutout facing up.
53. Apply a light coating of a recommended fluid to the output shaft spline inside the transmission case.
54. Install the synchronizer (74021). The side with six lugs points towards the output housing.
55. Verify that the synchronizer slides freely and does not bind.
56. Grease the inner diameter of the reverse idler gear bushing in the reverse idler gear (74004).
57. Place the reverse idler gear into the main case with the groove closer to the front of the transmission case.
58. Slide the reverse idler shaft (73011) through the transmission case and the reverse idler gear.
59. Slowly spin the reverse idler gear and apply grease to the shift fork groove in the outer diameter of the reverse idler gear.
60. Apply a thin film of silicone to the reverse idler shaft cover (73020).
61. Place the reverse idler shaft cover over the reverse idler shaft and secure it to the transmission case with two 1/4-20 x 0.50" socket head cap screws (71038). Apply anti-seize to the screws if the transmission case is magnesium. Torque the screws to 60 in-lbs (5 ft-lbs).
62. Slide the roller bearing (71008) onto the input shaft (74020). The bearing retaining ring should be away from the input shaft gear teeth.
63. Install the retaining ring (71010) into the groove in the input shaft. The sharp corner on the inner diameter of the retaining ring should be closest to the input shaft splines.
64. Grease the inner diameter of the input shaft and insert the new input shaft bushing (71012) into the input shaft.
65. Grease the end of the output shaft.
66. Slide the input shaft assembly into the main case.
67. Rotate the input shaft and check for any problems such as binding or excessive noise.
68. Slide the reverse idler gear until it engages and rotate the output shaft to check for problems. The output shaft should spin. Any binding of the transmission gears indicates a problem.
69. Disengage the reverse idler gear.
70. Slide the synchronizer until it engages with the input shaft and rotate the input shaft. Check for problems.

71. Grease the groove in the synchronizer while the input shaft is spinning.
72. Slide the synchronizer into the neutral position.
73. Apply Saf-T-Lok R80 to the outer diameter of the front retainer oil seal (71011).
74. Press the oil seal into the front retainer (72004) until the oil seal can go no further into the front retainer.  
  
See Figure 4 for the proper orientation of the front retainer oil seal.
75. Apply grease to the front retainer oil seal.
76. Apply silicone to the back face of the front retainer.
77. Slide the front retainer over the input shaft. The oil return galley in the front retainer should be positioned towards the bottom of the transmission. The front retainer bolt pattern is not symmetric to prevent incorrect installation.
78. Thread the six 1/4-20 x 1.00" socket head cap screws (71009) through the front retainer and into the transmission case. Apply anti-seize to the screws if the transmission case is magnesium. Torque the screws to 60 in-lbs (5 ft-lbs) in a criss cross pattern.
79. Slide a yoke into the output housing. The yoke should slide and spin freely. The bushing set screw may need to be adjusted if the yoke binds.

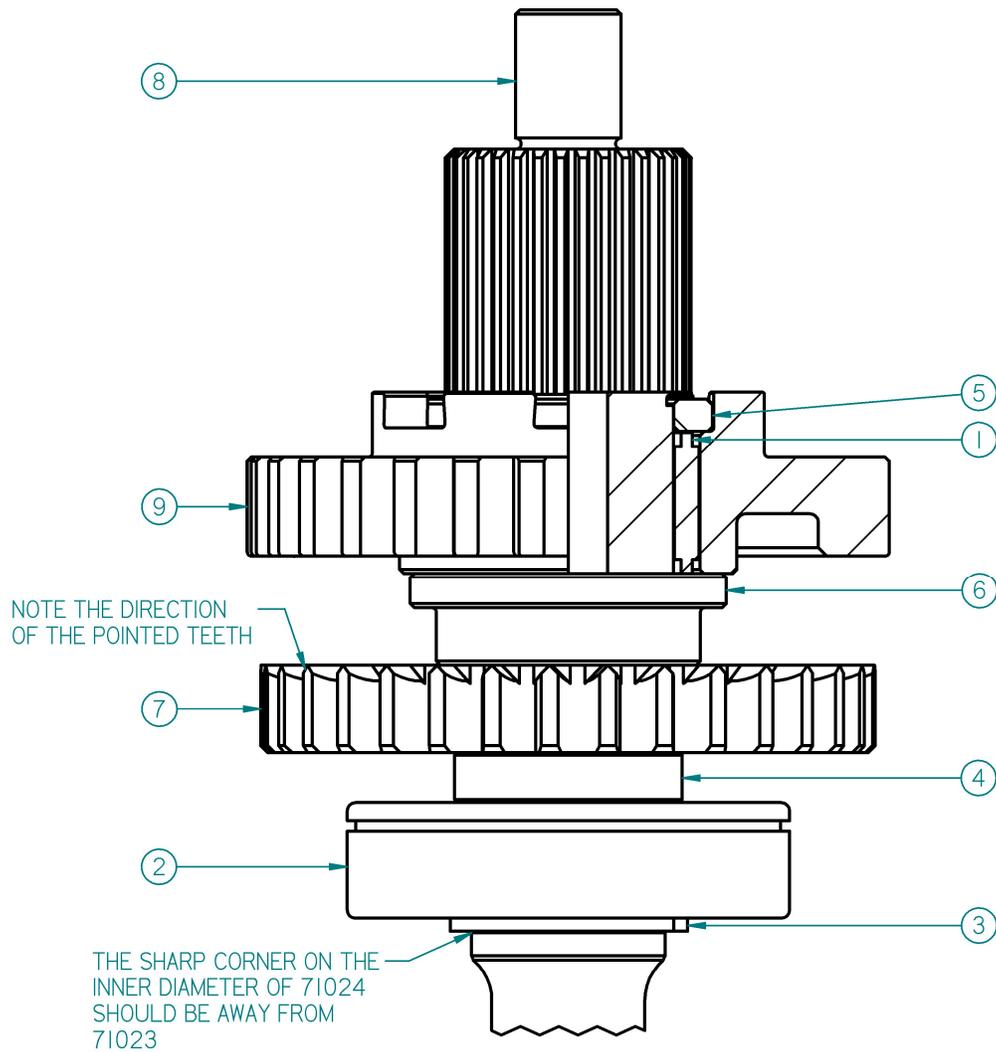
### **Side Cover Rebuild Procedure**

1. Remove the outside shift levers if still attached.
2. Remove the three 5/16-18 x 0.31" set screws, detent springs (71004), and detent balls (71006).
3. Begin sliding the first/high shift rod (73006) out of the side cover (72001). Continue until the first/high shift lever (73003) can be disengaged from the first/high shift rod. Do not slide the first/high shift rod any further.
4. Push the first/high shift lever out of the side cover.
5. Remove the two orings (71003)
6. Install new orings onto the first/high shift lever.
7. Apply grease to the hole in the side cover.
8. Apply grease to the groove cut in the shift fork (73002).

9. Reinstall the first/high shift lever into the side cover.
10. Align the circular tab on the first/high shift lever with the groove in the first/high shift fork before completely pushing the first/high shift rod into the side cover.
11. Repeat steps 3-10 for the reverse shift rod (73005) and reverse shift lever (73003).
12. Place one detent ball into each of the three threaded holes in the front face of the side cover.
13. Place one detent spring into each of the three threaded holes in the front face of the side cover.
14. Apply Loctite 277 to the threads of the three 5/16-18 x 0.31" set screws.
15. Thread one set screw into each of the three threaded holes in the front face of the side cover. The screws should be tightened until flush with the side cover.
16. Slide the shift rods by rotating the shift levers. You should be able to feel the detents as the shift rods slide. The detents should be firm, but should not prevent the shift rods from sliding. The detents should not be too soft or they will not contribute to keeping the transmission in gear. Adjust the set screws in 1/4 turn increments until the feel of the detents is satisfactory.

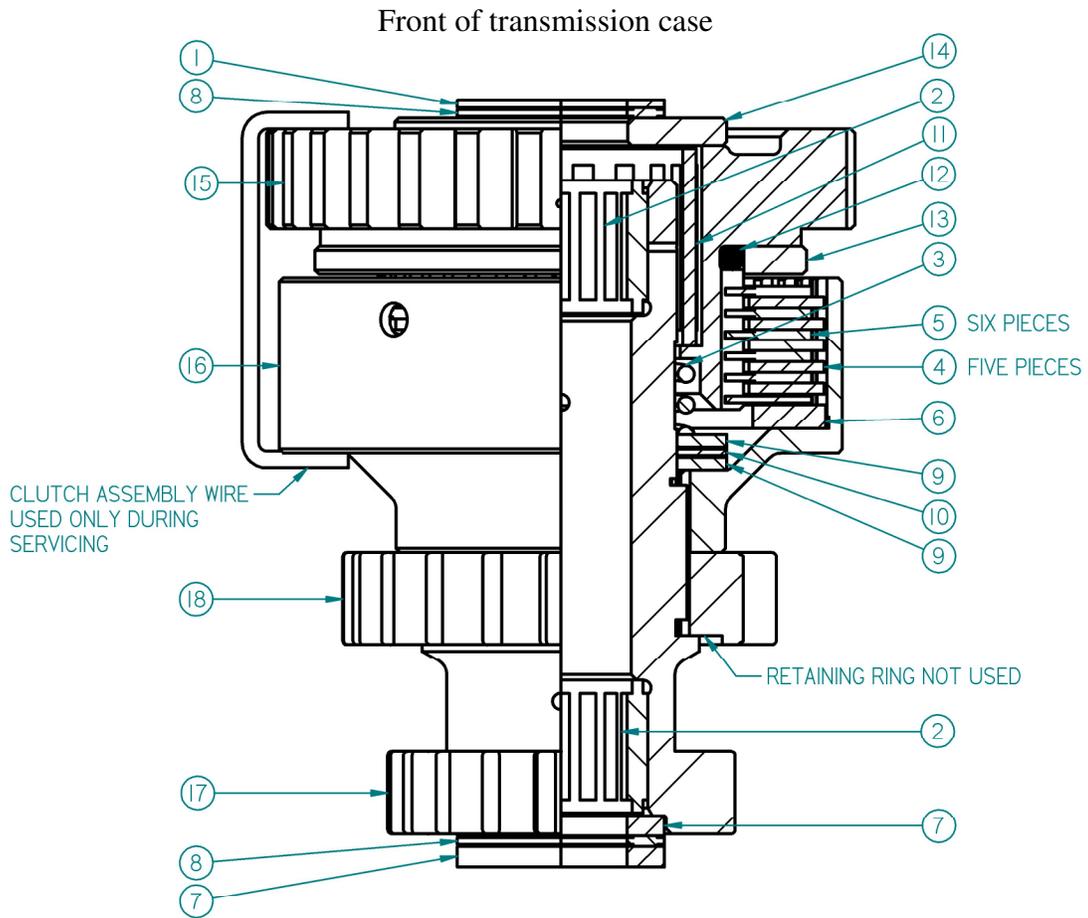
### **Final Assembly Procedure**

1. Apply silicone to the surface of the side cover that mates to the transmission case.
2. Move the synchronizer and the reverse idler gear to their neutral positions.
3. Move both shift levers on the side cover to their neutral positions.
4. Reinstall the side cover. Be sure that the shift forks engage with the synchronizer and the reverse idler gear.
5. Attach the side cover to the transmission case using eleven 5/16-18 x 0.87" socket head cap screws (71001) and lock washers (71043). Apply anti-seize to the screws if the transmission case is magnesium. Torque the bolts to 200 in-lbs (17 ft-lbs) in a criss cross pattern.
6. Reinstall the outside shift levers (73024 & 73021) using nuts (73022) and lock washers (73023). The longer lever is for high/low. The shorter lever is for reverse/neutral. Torque the nuts to 250 in-lbs (21 ft-lbs).
7. Shift the transmission to low, high, and then reverse to verify that the transmission is functioning correctly.
8. Refill the transmission with the recommended fluid after installing onto the vehicle.



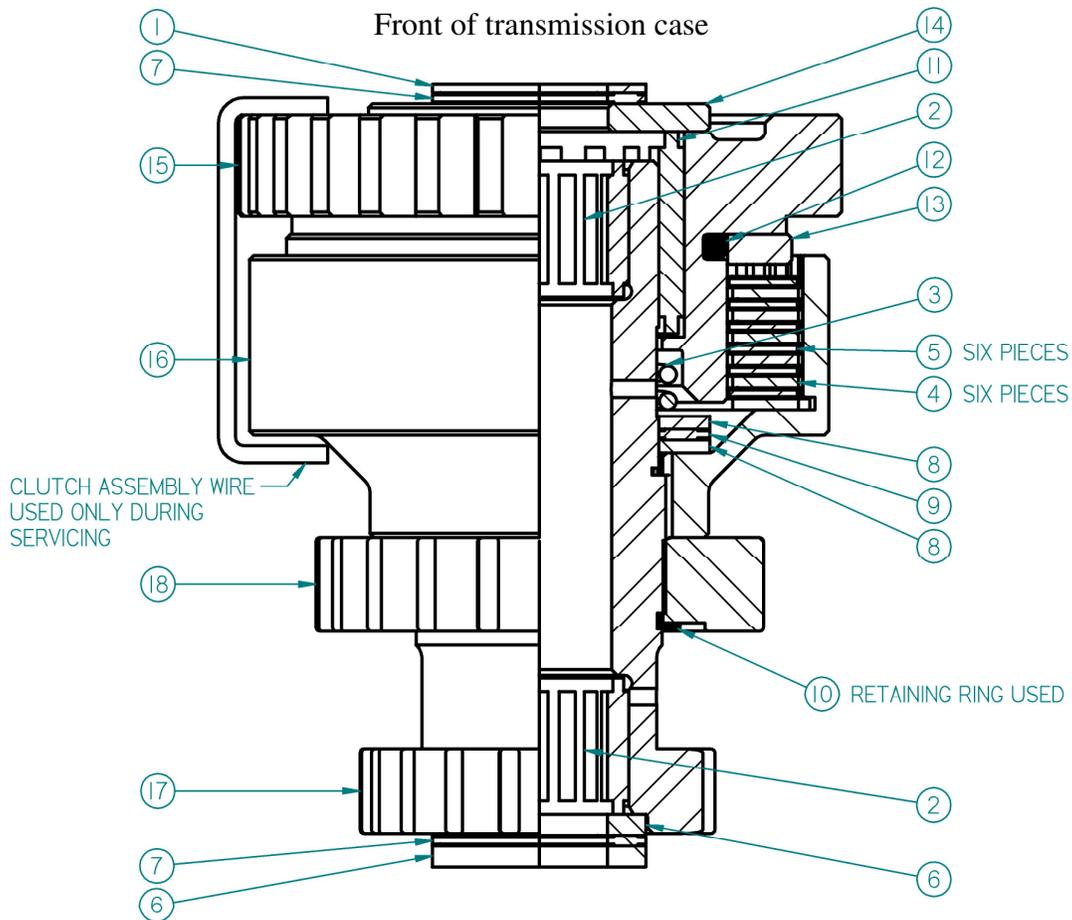
Item Number	Part Number	Description
1	71019	INA UNIT CAGE #C-243016
2	71023	NEW DEPARTURE BEARING #6307NR
3	71024	TRUARC RETAINING RING #5160-137 SHR-137
4	73012	OUTPUT SHAFT BEARING SPACER
5	73017	SPACER - FIRST GEAR
6	73031	LOW-REVERSE SPACER
7	74007	DRIVEN REVERSE GEAR
8	74010	OUTPUT SHAFT
9	74011	GEAR DRIVEN FIRST

**Figure 1. Output shaft assembly**



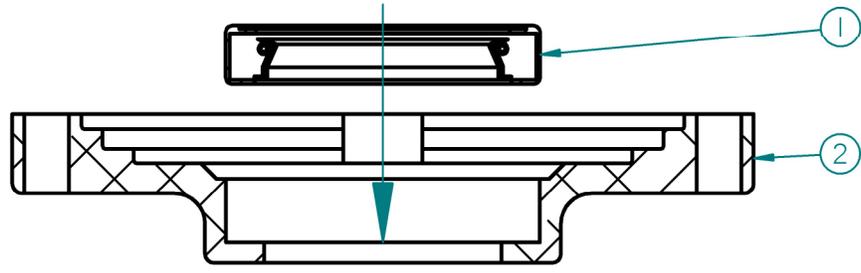
Item Number	Part Number	Description
1	71013	TORRINGTON THRUST WASHER #TRB-1625 (.060-.063 THICK)
2	71015	INA UNIT CAGE #C-162116
3	71016	SPRING - CLUTCH RELEASE
4	71017	STEEL CLUTCH PRESSURE DISC
5	71018	METALLIC FRICTION DISC
6	71021	REAR CLUTCH DISK (.183 THICK)
7	71025	TORRINGTON THRUST WASHER #TRE-1625 (.154-.157 THICK)
8	71026	TORRINGTON NEEDLE THRUST BEARING #NTA-1625
9	71032	TORRINGTON THRUST WASHER #TRC-2840 (.092-.095 THICK)
10	71033	TORRINGTON NEEDLE THRUST BEARING #NTA-2840
11	71049	INA UNIT CAGE #C-283424
12	71063	ORING 70 DUROMETER NITRILE
13	73007	FORWARD CLUTCH RING
14	73009	THRUST RACE INTERMEDIATE SHAFT
15	74002	DRIVEN GEAR - INPUT MESH
16	74006	CLUTCH HOUSING
17	74008	INTERMEDIATE SHAFT
18	74012	GEAR - FIRST DRIVER

**Figure 2. Clutch assembly without retaining ring (71047).**



Item Number	Part Number	Description	Item Number	Part Number	Description
1	71013	TORRINGTON THRUST WASHER #TRB-1625 (.060-.063 THICK)	10	71047	SMALLEY RETAINING RING WS-187
2	71015	INA UNIT CAGE #C-162116	11	71049	INA UNIT CAGE #C-283424
3	71016	SPRING - CLUTCH RELEASE	12	71063	ORING 70 DUROMETER NITRILE
4	71017	STEEL CLUTCH PRESSURE DISC	13	73007	FORWARD CLUTCH RING
5	71018	METALLIC FRICTION DISC	14	73009	THRUST RACE INTERMEDIATE SHAFT
6	71025	TORRINGTON THRUST WASHER #TRE 1625 (.154 .157 THICK)	15	74002	DRIVEN GEAR - INPUT MESH
7	71026	TORRINGTON NEEDLE THRUST BEARING #NTA-1625	16	74006	CLUTCH HOUSING
8	71032	TORRINGTON THRUST WASHER #TRC-2840 (.092-.095 THICK)	17	74008	INTERMEDIATE SHAFT
9	71033	TORRINGTON NEEDLE THRUST BEARING #NTA-2840	18	74012	GEAR - FIRST DRIVER

**Figure 3. Clutch assembly with retaining ring (71047).**



Item Number	Part Number	Description
1	71011	OIL SEAL
2	72004	FRONT RETAINER

**Figure 4. Front retainer oil seal installation.**