TCC HYDRAULIC OPERATION

The Torque Converter is uniquely constructed in that the converter clutch apply circuit is independent to the converter in and out fluid. Additionally, the converter could contain either 1 or 2 friction plates depending on the size of the engine .

Figure 34 below, illustrates how the converter clutch apply piston contours to the flywheel side of the torque converter cover. The friction plates lug to a hub splined to the turbine shaft while the steel plates lug to the converter cover. When the clutch is commanded on, apply fluid is fed through the center of the turbine shaft and fills the area between the converter cover and piston. The piston applies the friction plates to the steel plates locking the turbine shaft to the cover.

Converter fill is fed into the converter between the converter hub that drives the pump gears and the stator shaft. The fluid's return path is between the stator shaft and turbine shaft.

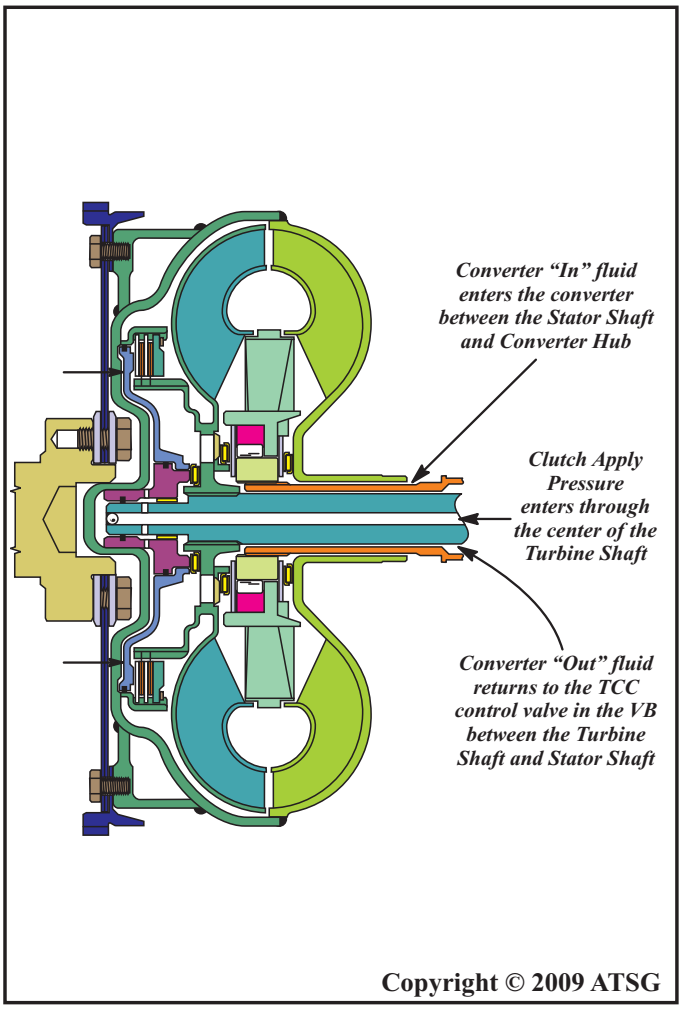


Figure 34

TCC ELECTRONIC OPERATION

The TCM controls the converter clutch apply with Electronic Modulated Converter Clutch (EMCC) software using the TCC (PWM) solenoid and the TCC valve in the valve body. There are four output logic states that can be applied as follows;

- ***No EMCC***
- ***Partial EMCC***
- ***Full EMCC***
- ***Gradual-To-No EMCC***

No EMCC

Under "No EMCC" conditions, the TCC (PWM) solenoid is OFF. There are several conditions that can result in "No EMCC" operations. It can be iniated due to a fault in the transmission or because the TCM does not see the need for EMCC under current driving conditions.

Partial EMCC

Partial EMCC operation modulates the TCC (PWM) solenoid (duty-cycle) to obtain partial converter clutch application. Partial EMCC is maintained until Full EMCC is called for and actuated. During Partial EMCC some slip does occur. Partial EMCC will usually occur at low vehicle speeds, low load and light throttle situations.

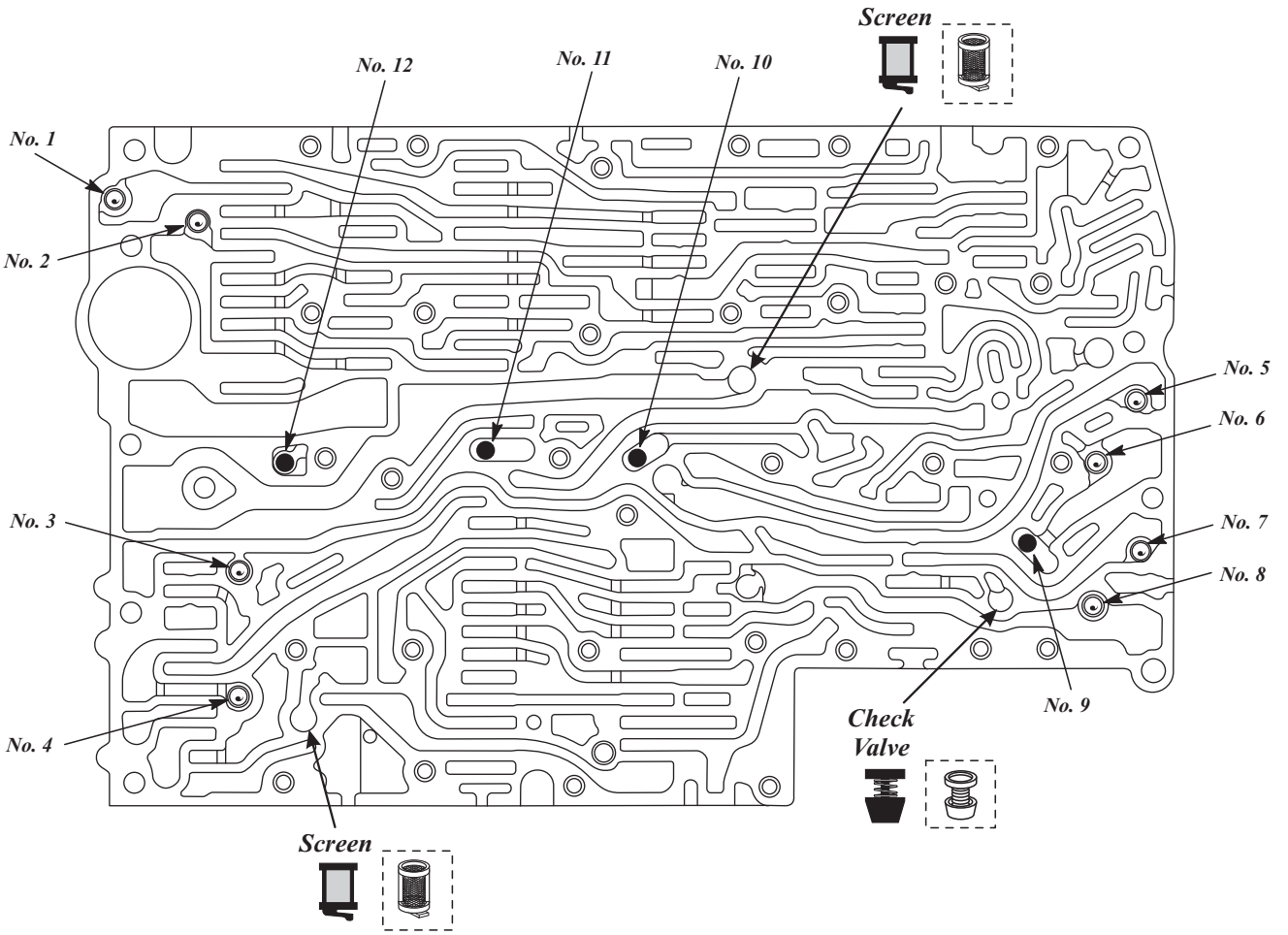
Full EMCC

During Full EMCC operation, the TCM increases the TCC (PWM) solenoid duty-cycle to full ON, after Partial EMCC brings the engine speed within the desired slip range of transmission input speed in relation to engine rpm.

Gradual-To-No EMCC

This operation is to soften the change from Full or Partial EMCC to No EMCC. This is done at mid-throttle by decreasing the TCC (PWM) solenoid duty-cycle.

CHECK BALL LOCATION AND IDENTIFICATION



Number	Function	Size	Material
1	K1 Clutch Exhaust	5.4 MM (.215")	Steel
2	B1 Clutch Exhaust	5.4 MM (.215")	Steel
3	K2 Clutch Exhaust	5.4 MM (.215")	Steel
4	Torque Converter Clutch	5.4 MM (.215")	Steel
5	B2 Clutch Exhaust	5.4 MM (.215")	Steel
6	K3 Clutch Exhaust	5.4 MM (.215")	Steel
7	B2 Clutch Counter Exhaust	5.4 MM (.215")	Steel
8	B3 Clutch Exhaust	5.4 MM (.215")	Steel
9	K3 Shuttle Ball	5.4 MM (.215")	Plastic
10	3-4 Shift Group Shuttle Ball	5.4 MM (.215")	Plastic
11	Pressure Reducing Shuttle Ball	5.4 MM (.215")	Plastic
12	Modulator Pressure Shuttle Ball	5.4 MM (.215")	Plastic

Figure 35

CASE PASSAGE IDENTIFICATION

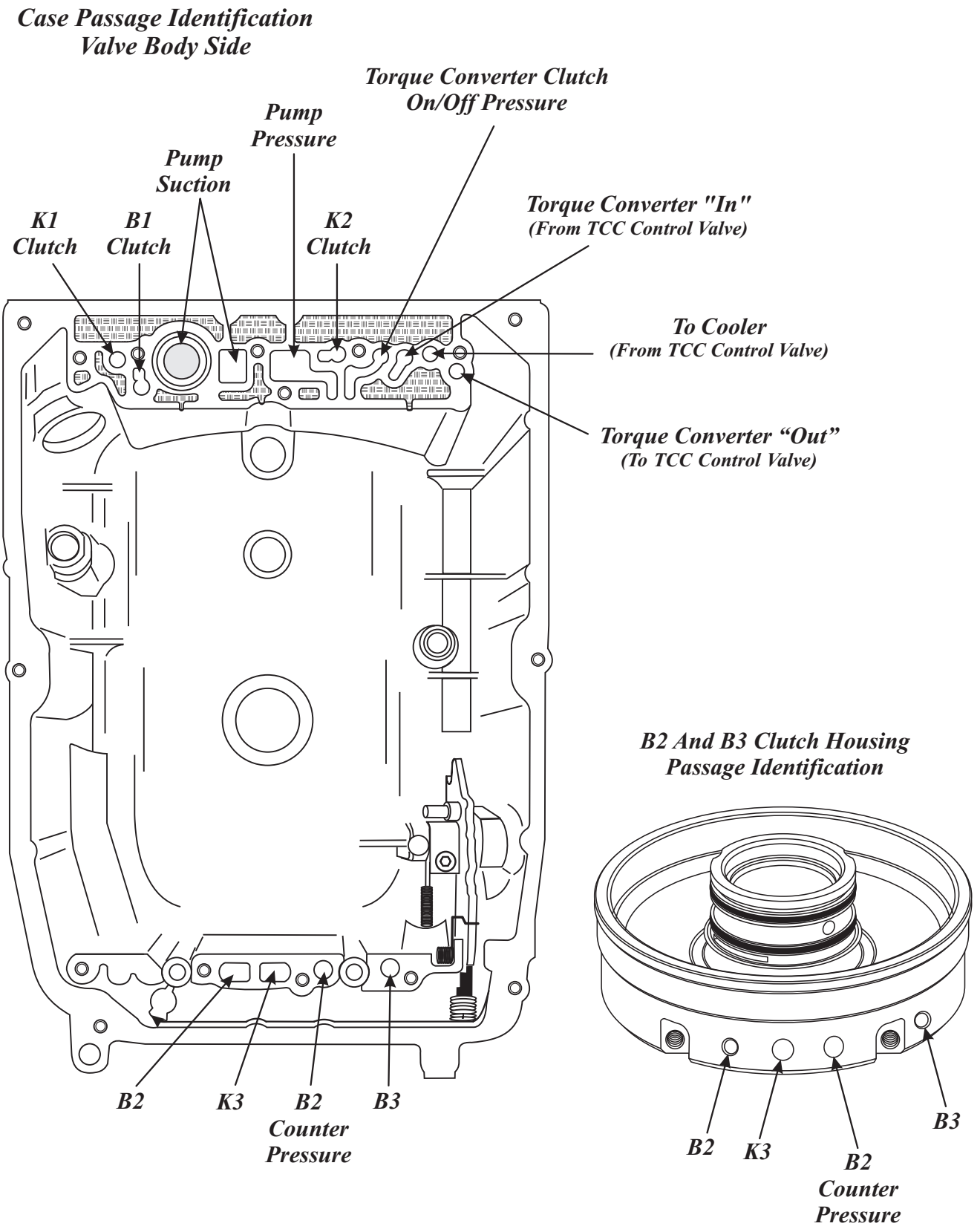
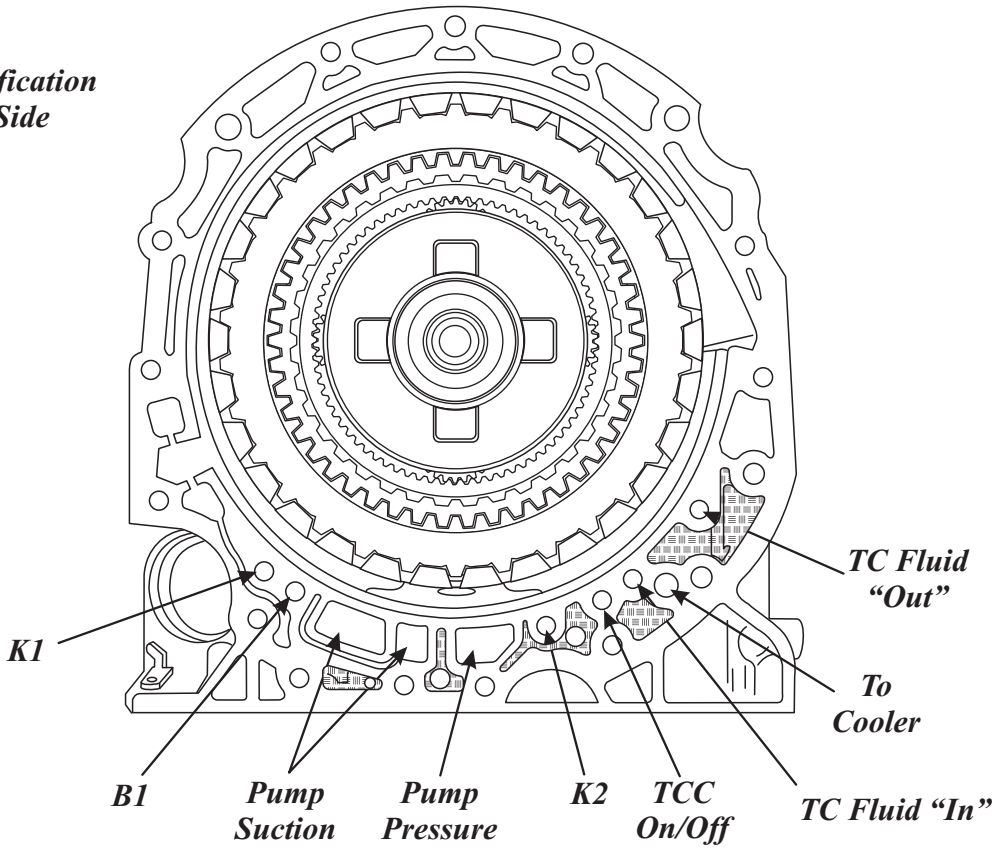


Figure 36

CASE PASSAGE IDENTIFICATION

Case Passage Identification
Converter Housing Side



Converter Housing
Passage Identification

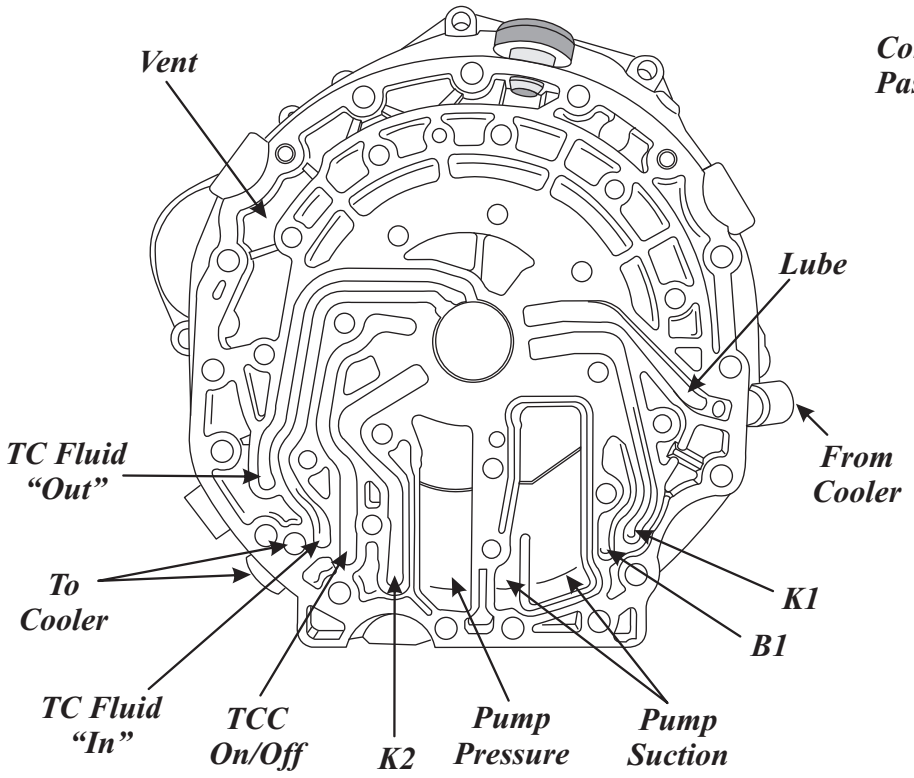


Figure 37

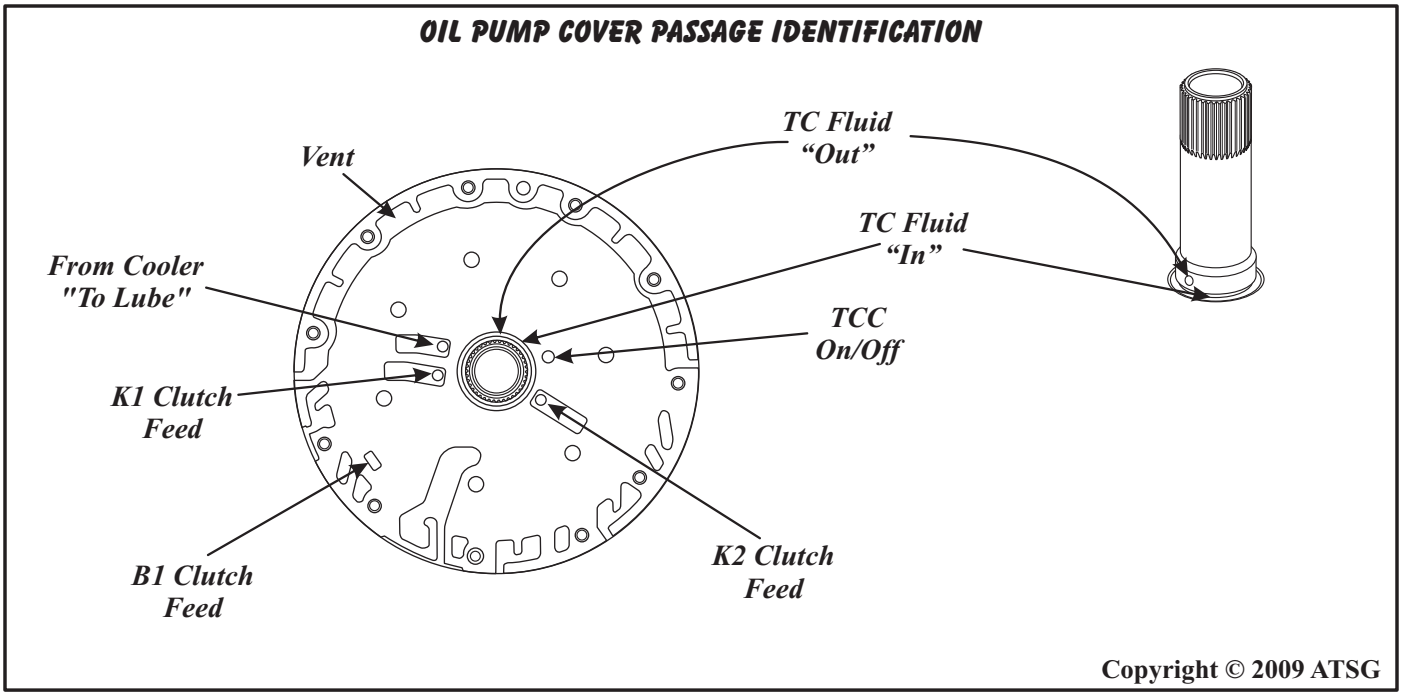


Figure 38

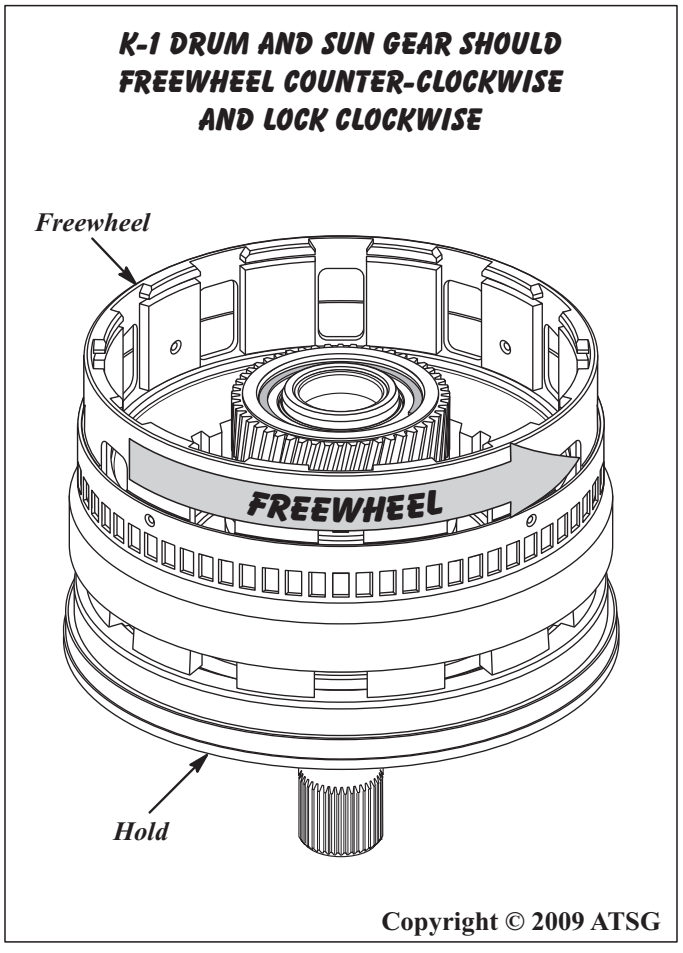


Figure 39

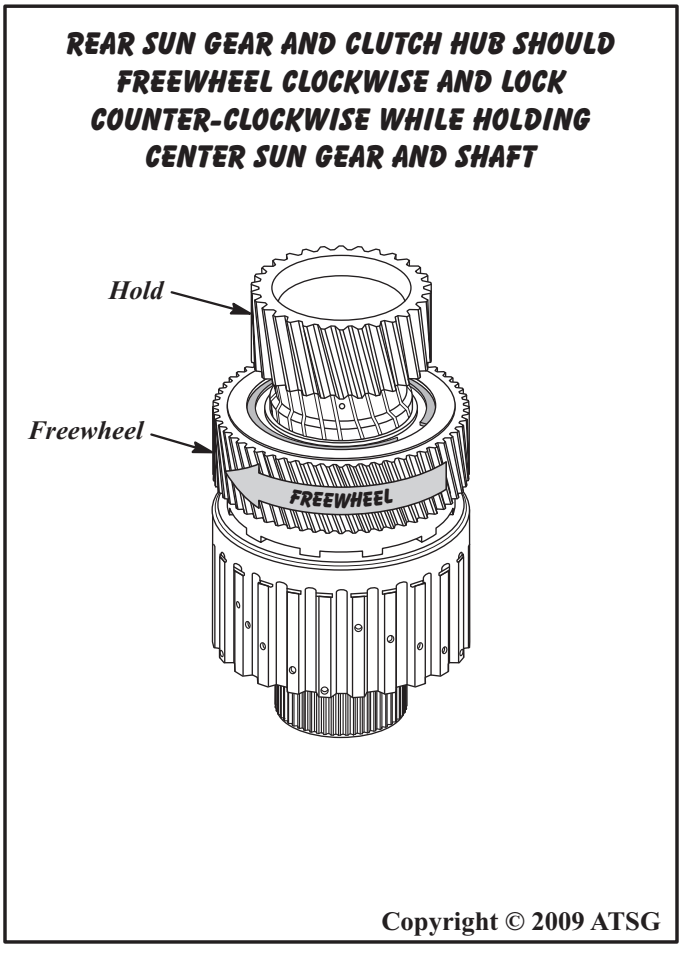


Figure 40

SAFETY PRECAUTIONS

Service information provided in this manual by ATSG is intended for use by professional, qualified technicians. Attempting repairs or service without the appropriate training, tools and equipment could cause injury to you or others.

The service procedures we recommend and describe in this manual are effective methods of performing service and repair on this unit. Some of the procedures require the use of special tools that are designed for specific purposes.

This manual contains CAUTIONS that you must observe carefully in order to reduce the risk of injury to yourself or others. This manual also contains NOTES that must be carefully followed in order to avoid improper service that may damage the vehicle, tools and/or equipment.

TRANSMISSION DISASSEMBLY

1. The complete transmission should be steam cleaned on the outside, to remove any dirt or grease, before disassembly begins.
2. The standard GM 350 holding fixture works just fine on the 722.6 transmission, as shown in Figure 41, which will give you the benefit of rotating the transmission easily.
3. Remove the torque converter from transmission and set aside to drain.
   Caution: Use care when removing the torque converter, to avoid personal injury and/or damage to converter, as it is heavy.
4. Install the holding fixture shown in Figure 41, install the unit in bench fixture and rotate the transmission so bell is facing up.

Continued on Page 40

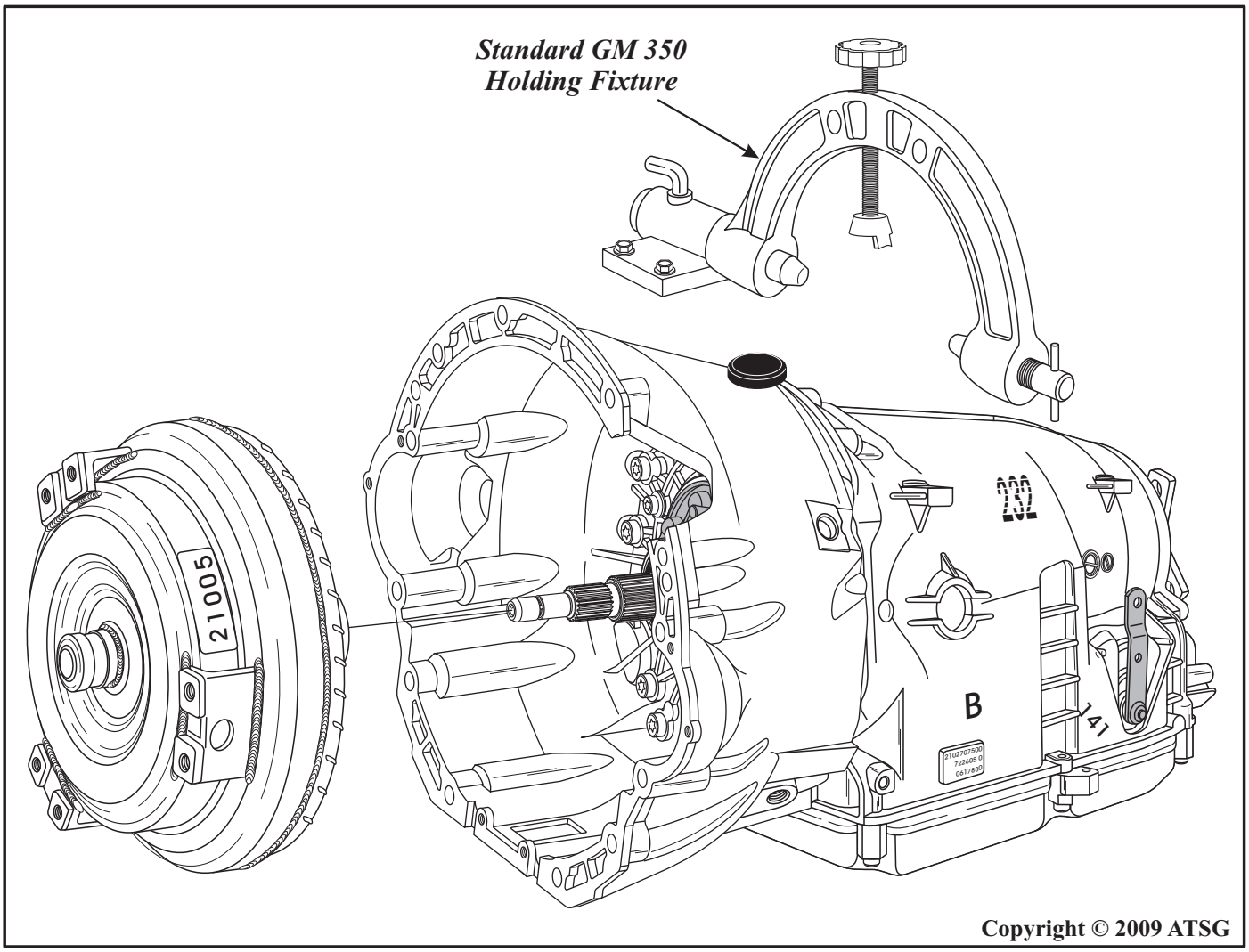


Figure 41

TRANSMISSION DISASSEMBLY (CONT'D)

5. Install dial indicator on transmission, as shown in Figure 42, with the plunger against flat spot on the input shaft.
6. Zero dial indicator and move the input shaft in and out to measure end-play.
7. Record measurement for assembly reference. End-play should be 0.3-0.5mm (.012"-.020").
8. Rotate transmission so that output shaft yoke is facing up, as shown in Figure 43.
   Caution: Drain pan may be required under transmission to catch fluid.
9. Place the transmission in the Park position to prepare for removal of the output shaft nut.
10. Remove the output shaft drive yoke retaining nut, using a 30 mm, 12 point socket, as shown in Figure 43.
11. Remove the output shaft drive yoke, as shown in Figure 43.
12. Remove and discard the transmission rear seal, as shown in Figure 43.
13. Remove the transmission output shaft washer, as shown in Figure 43.
    Note: Tag the washer, or tie-wrap it to the yoke since it is very similar to the geartrain end-play shim and they "must not" be interchanged.

Continued on Page 41

Input Shaft End-Play Should Be 0.3 - 0.5 mm (.012" - .020")

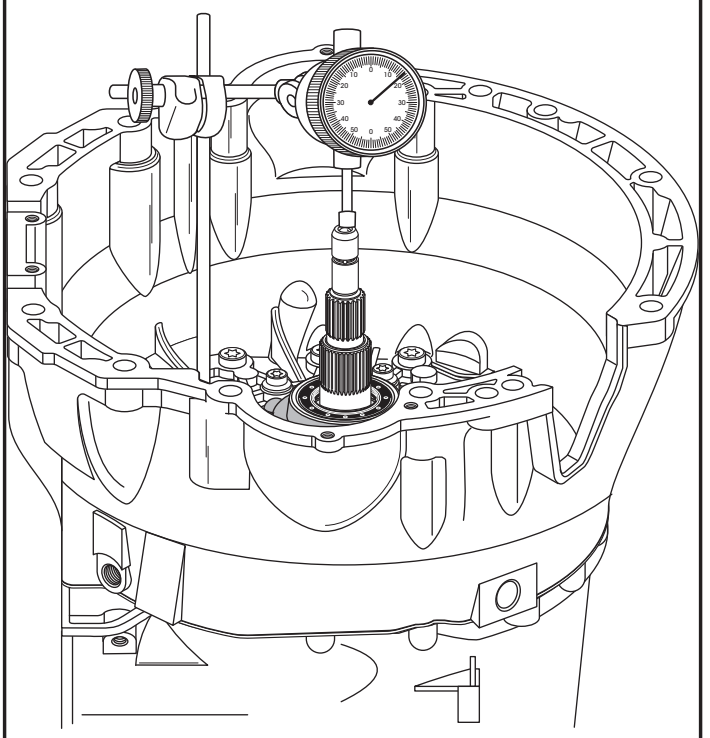
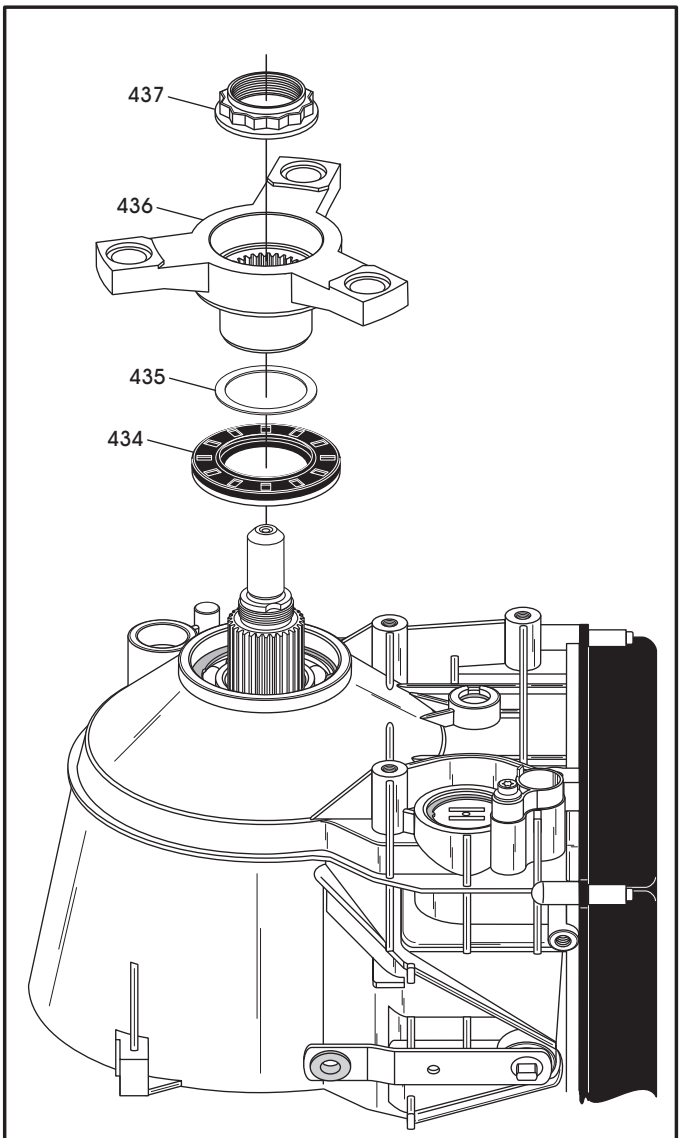


Figure 42



434 REAR TRANSMISSION SEAL.
435 OUTPUT SHAFT THRUST WASHER.
436 OUTPUT SHAFT DRIVE YOKE.
437 REAR DRIVE YOKE RETAINING NUT.

Figure 43

TRANSMISSION DISASSEMBLY (CONT'D)

14. Remove the 2 converter housing to case bolts on the rear of case by converter housing, using a 40 Torx bit, as shown in Figure 44.
15. Rotate transmission so that the bottom pan is facing up as shown in Figure 45.
16. Remove the six oil pan bolts and the spacers, as shown in Figure 45.
17. Remove the oil pan, remove and discard oil pan rubber gasket, as shown in Figure 45.

Continued on Page 42

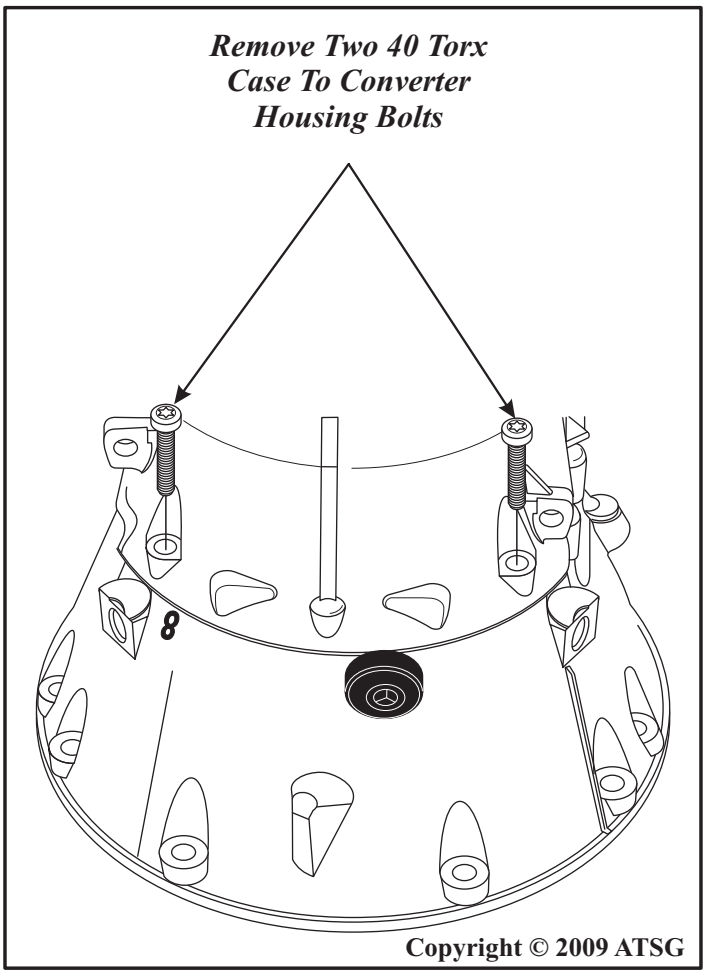
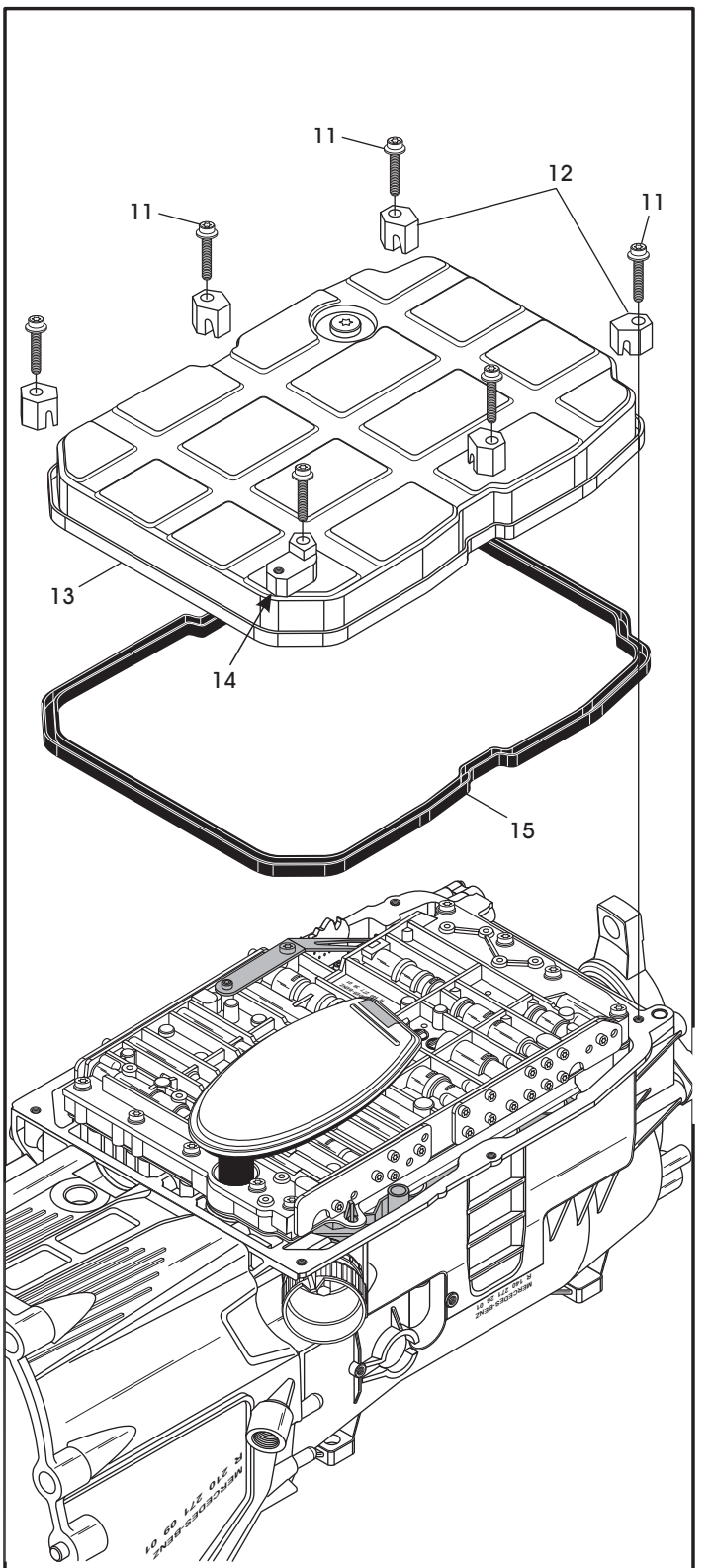


Figure 44



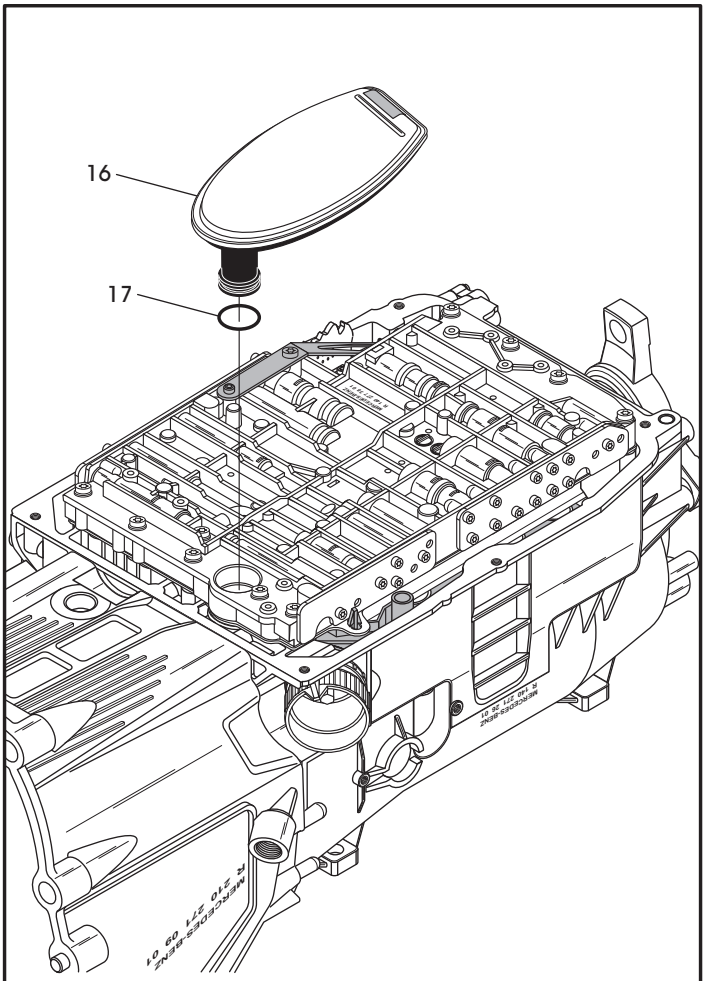
11 OIL PAN RETAINING BOLTS (6 REQUIRED).
12 OIL PAN SPACER/CLAMP (5 REQUIRED).
13 OIL PAN.
14 OIL PAN SPACER/CLAMP WITH BRACKET (1 REQUIRED).
15 OIL PAN TO CASE RUBBER GASKET SEAL.

Figure 45

TRANSMISSION DISASSEMBLY (CONT'D)

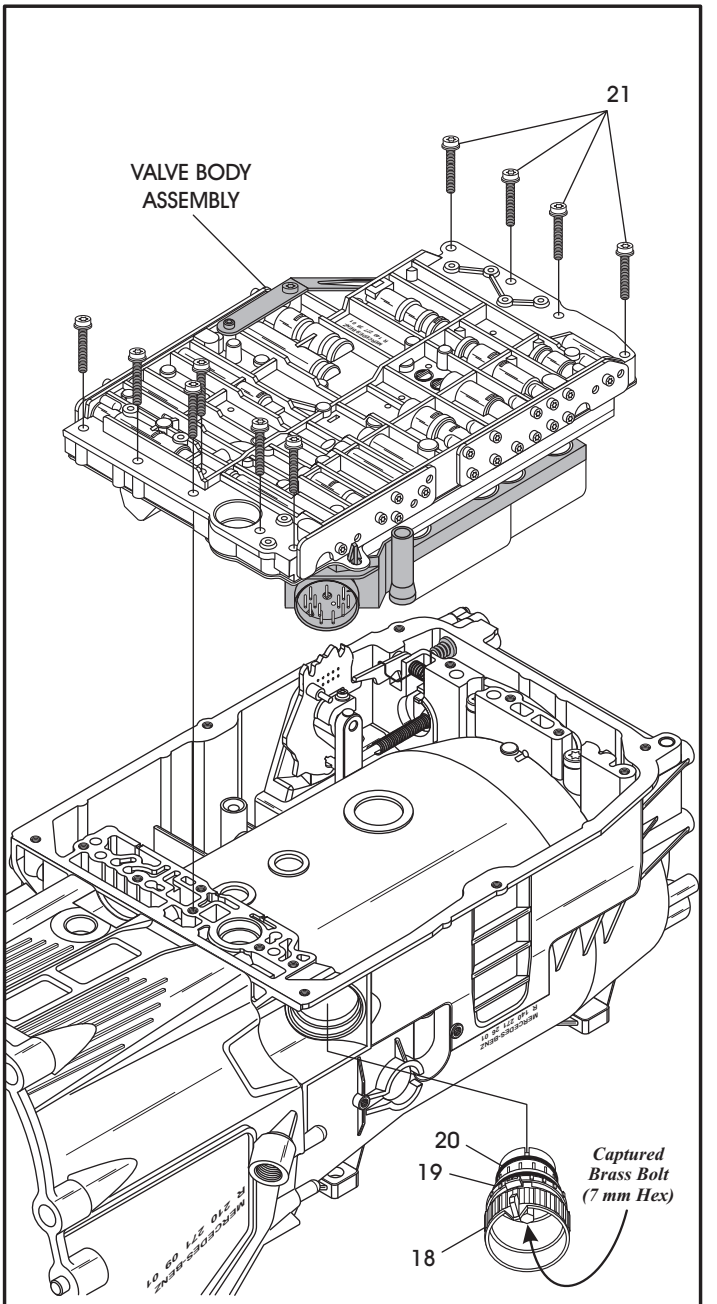
18. Remove the oil filter by pulling straight up, as shown in Figure 46 and discard filter and the "O" ring seal.
19. Remove the case to electrical conductor plate sealing sleeve, as shown in Figure 47.
    Note: You must remove the "captured" brass bolt in the center of the sleeve, as shown in Figure 47, using a 7 mm socket (9/32" socket will work as well).
20. Remove and discard both the large and small "O" ring seals (See Figure 47).
21. Remove the ten valve body retaining bolts, as shown in Figure 47, using a 30 torx bit.
22. Remove the complete valve body assembly, as shown in Figure 47, by lifting straight up.
23. Set the complete valve body assembly aside for the component rebuild section.

Continued on Page 43



16 OIL FILTER ASSEMBLY.
17 OIL FILTER NECK "O" RING SEAL.

Figure 46



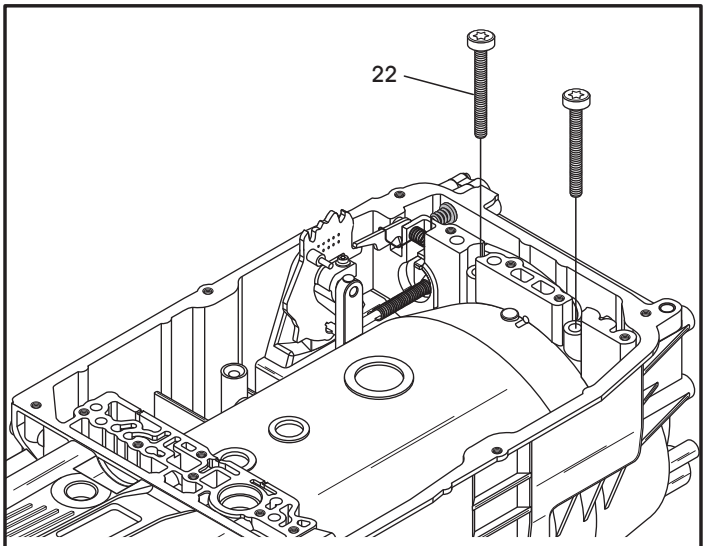
18 CASE TO ELECTRICAL CONDUCTOR PLATE SEALING SLEEVE.
19 CASE SLEEVE LARGE "O" RING SEAL..
20 CASE SLEEVE SMALL "O" RING SEAL.
21 VALVE BODY RETAINING BOLTS (10 REQUIRED).

Figure 47

TRANSMISSION DISASSEMBLY (CONT'D)

24. Remove the two B-2 clutch housing retaining bolts, as shown in Figure 48, using 40 Torx bit.
25. Rotate transmission so that converter housing is facing up as shown in Figure50.
26. Remove the remaining 15 converter housing to case bolts from inside the converter housing, as shown in Figure 49 and 50, using 40 Torx bit.
    Note: Do not remove the circle of 30 Torx bolts shown in Figure 49. This is easier done in component rebuild.
27. Remove converter housing, oil pump and B-1 clutch as an assembly, as shown in Figure 50.
28. Set converter housing, oil pump and B-1 clutch assembly aside for component rebuild.

Continued on Page 44



22 B-2 CLUTCH HOUSING RETAINING BOLTS (2 REQUIRED).

Figure 48

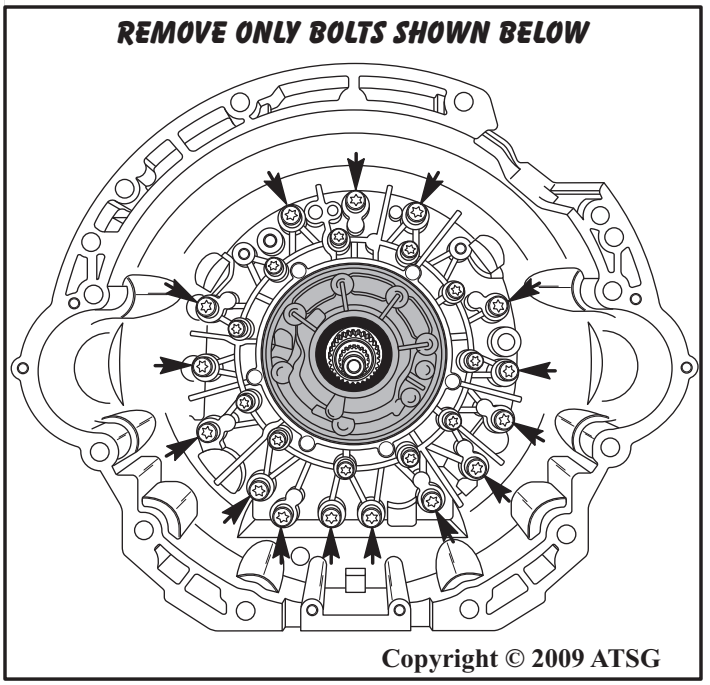
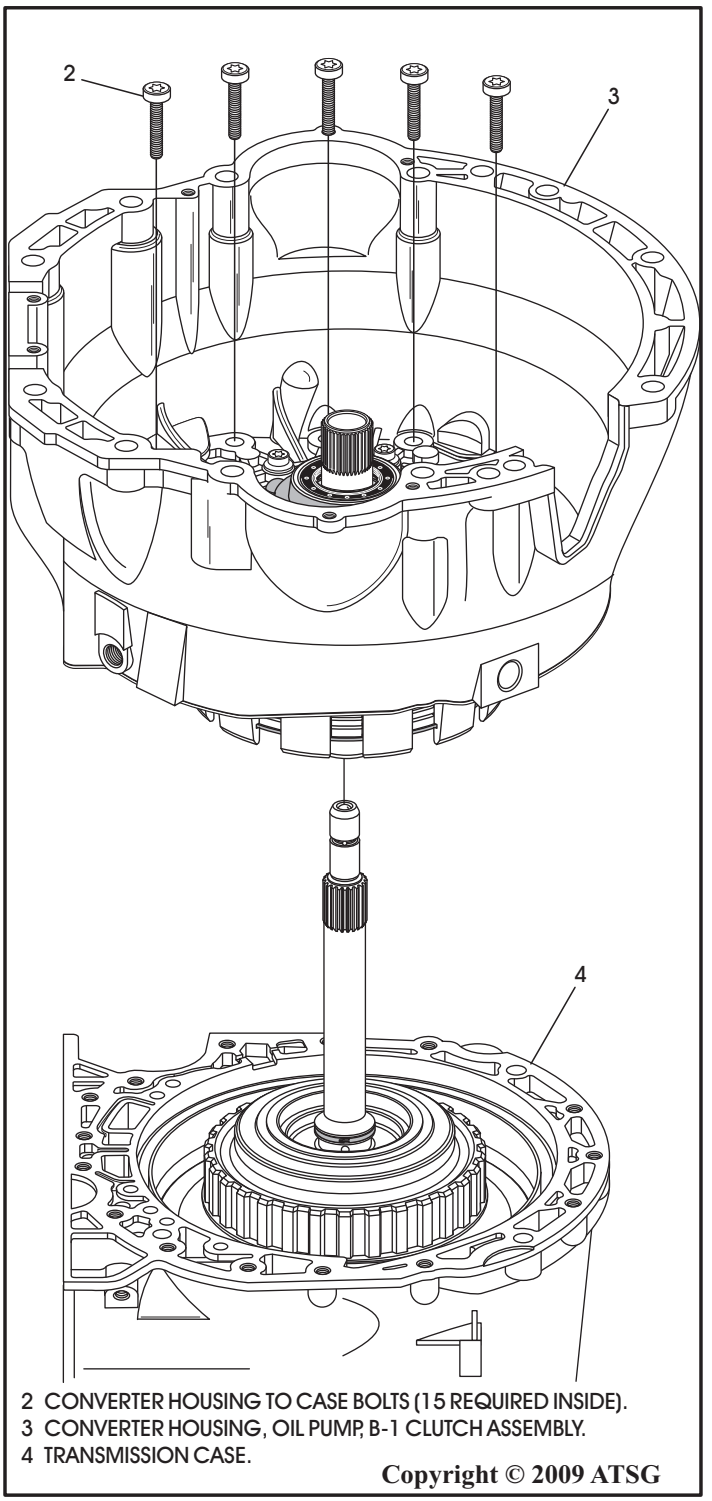


Figure 49



2 CONVERTER HOUSING TO CASE BOLTS (15 REQUIRED INSIDE).
3 CONVERTER HOUSING, OIL PUMP, B-1 CLUTCH ASSEMBLY.
4 TRANSMISSION CASE.

Figure 50

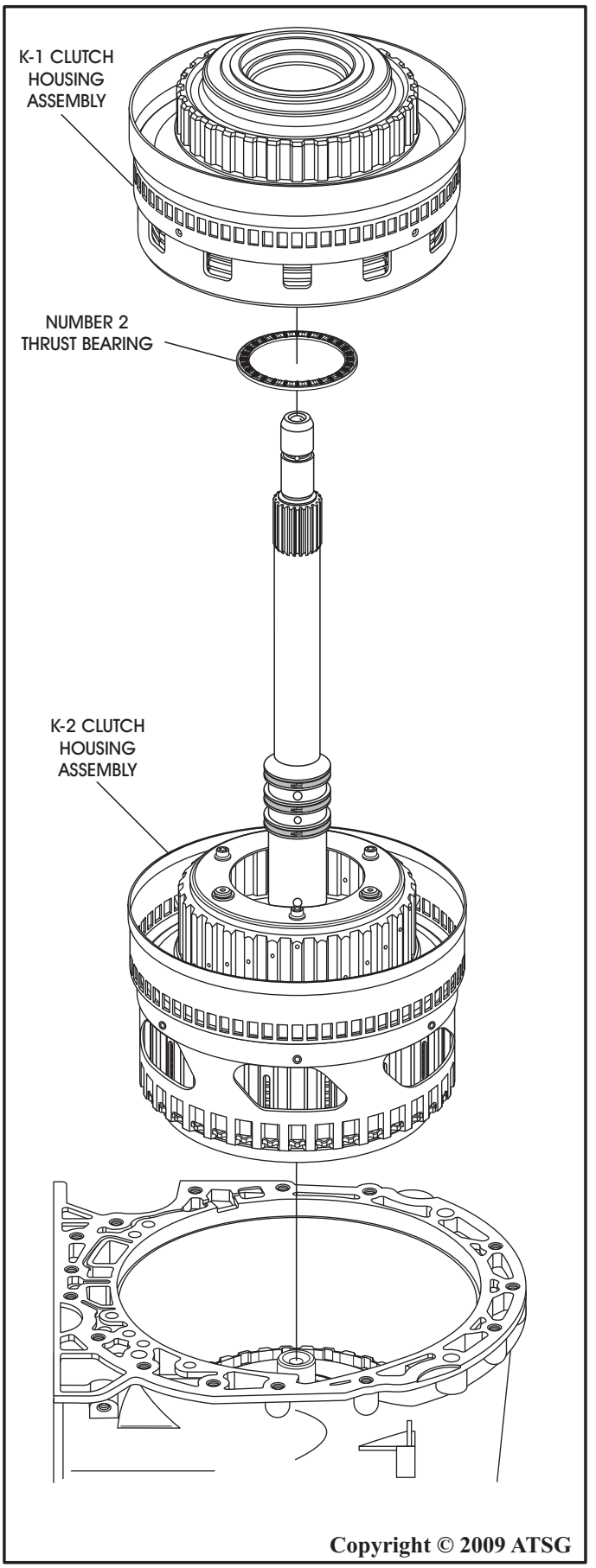
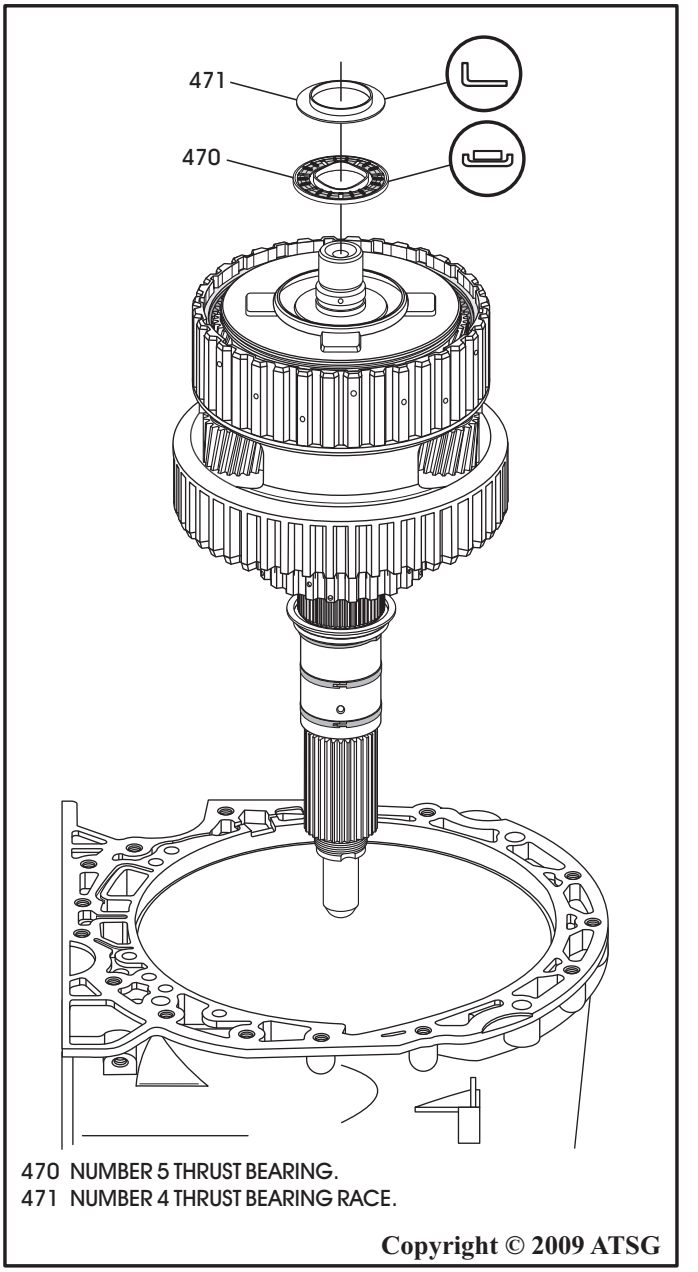


Figure 51

TRANSMISSION DISASSEMBLY (CONT'D)

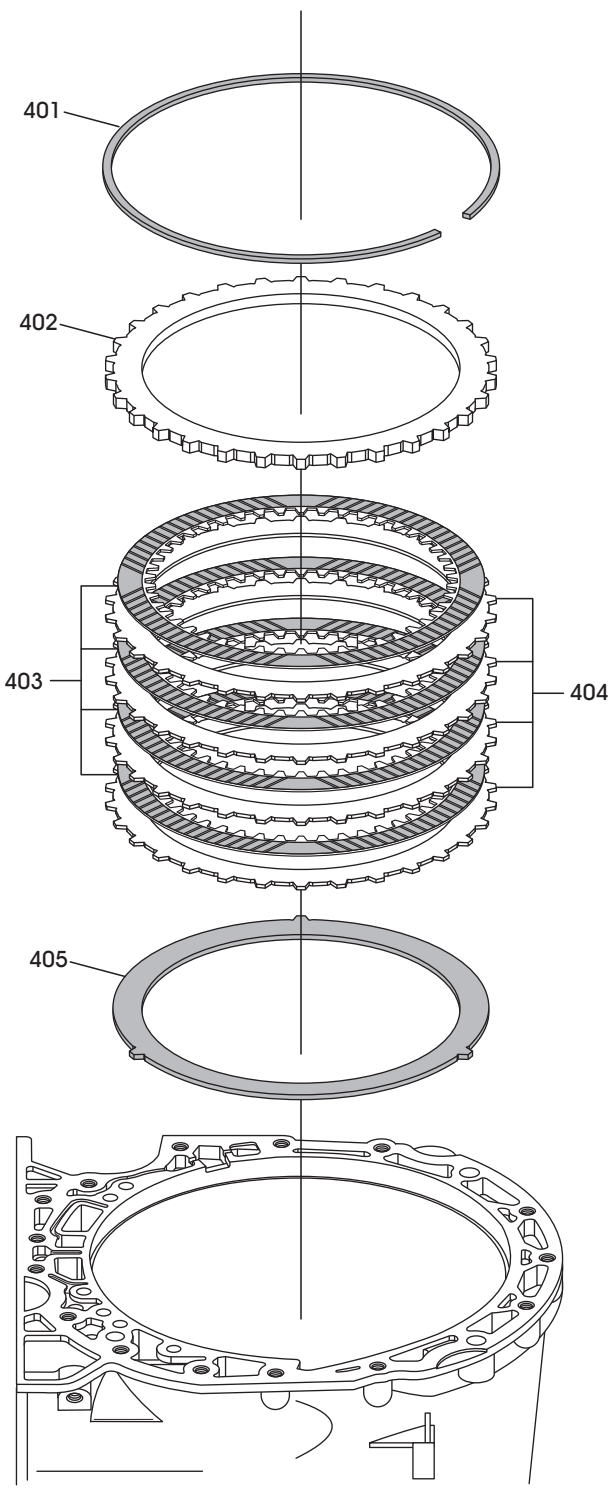
29. Remove the K-1 and K-2 clutch housings from the case, as shown in Figure 51, and set both aside for component rebuild.
Note: These can be removed as an assembly and seperated after removal. Remove the number 2 thrust bearing.
30. Remove the complete gear train assembly from the case, as shown in Figure 52, and set aside for component rebuild.
Note: Number 4 thrust bearing race may be stuck to K-2 clutch housing.

Continued on Page 45



470 NUMBER 5 THRUST BEARING.
471 NUMBER 4 THRUST BEARING RACE.

Figure 52



401 B-3 CLUTCH "*SELECTIVE*" SNAP RING.
402 B-3 CLUTCH BACKING PLATE.
403 B-3 CLUTCH FRICTION PLATES (QTY VARIES, SEE CHART).
404 B-3 CLUTCH STEEL PLATES (QTY VARIES, SEE CHART).
405 B-3 CLUTCH CUSHION PLATE.

Figure 53

TRANSMISSION DISASSEMBLY (CONT'D)

31. Remove the B-3 *selective* snap ring, as shown in Figure 53.
    Note: It is recommended that all snap rings be tagged for identification as many are very similar, but will not interchange.
32. Remove complete B-3 clutch pack, as shown in Figure 53.
33. Remove the B-2 clutch housing assembly, as shown in Figure 54, and set aside for the component rebuild section.

Continued on Page 46

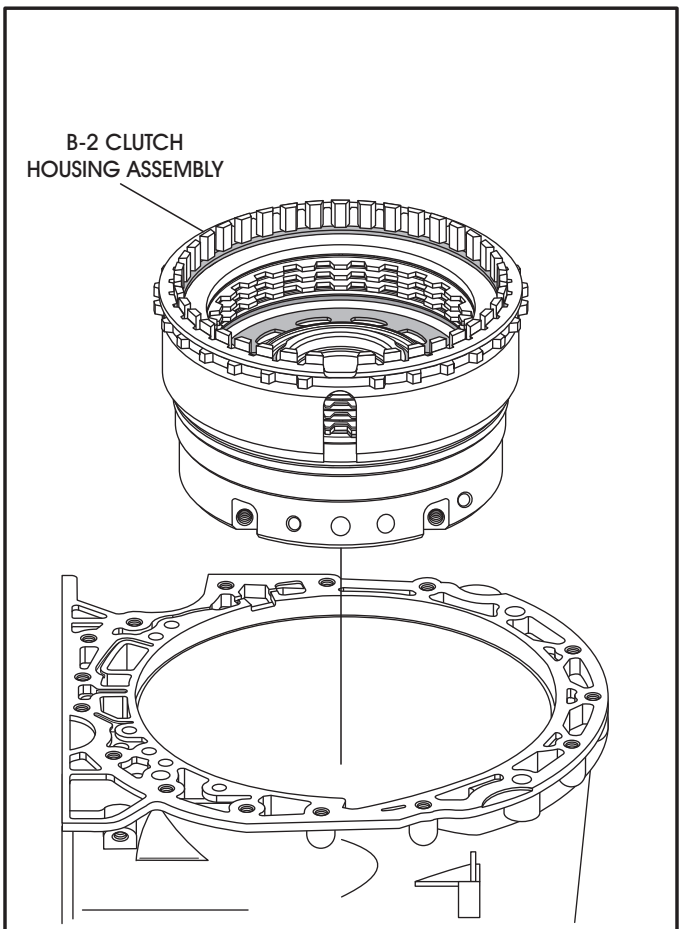
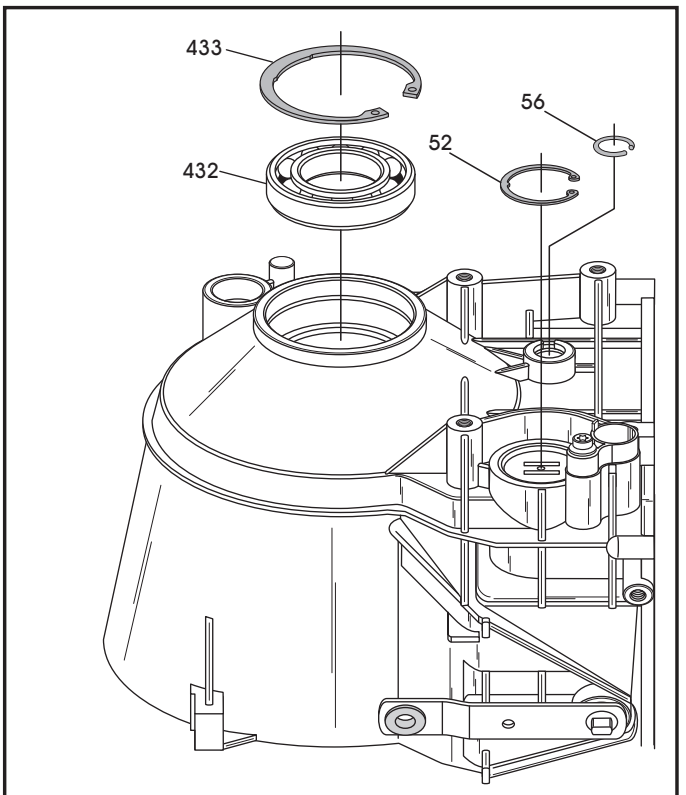


Figure 54

TRANSMISSION DISASSEMBLY (CONT'D)

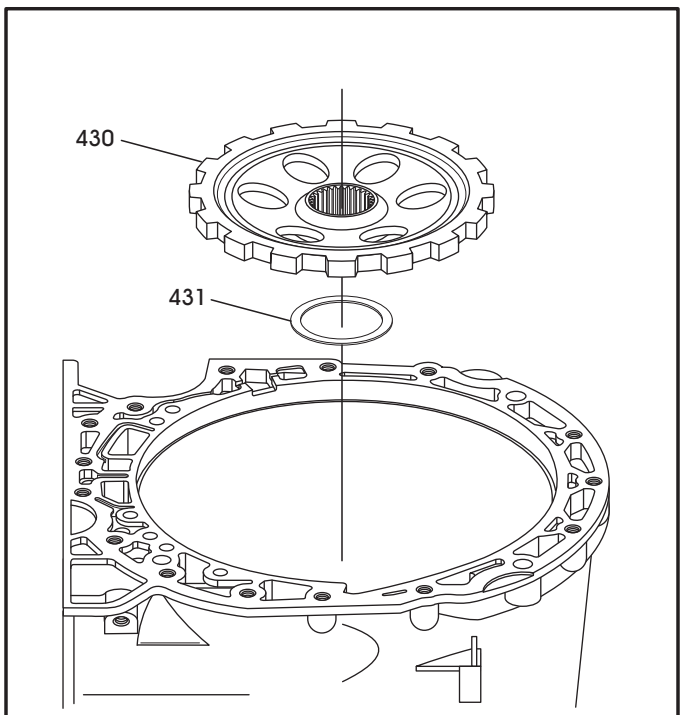
34. Remove the parking gear and transmission end play shim, as shown in Figure 55.
    Note: Tag the end-play shim, or tie-wrap it to the parking gear since it is very similar to the output shaft washer and they "must not" be interchanged.
35. Rotate transmission case so that rear is facing up, as shown in Figure 56.
36. Remove the ball bearing retaining snap ring, as shown in Figure 56.
37. Remove the ball bearing from the case, as shown in Figure 56.
38. Remove the parking rod guide sleeve retaining snap ring (52), in preparation for removing the internal linkage (See Figure 56).
39. Remove the parking pawl pivot pin retaining circlip (56), in preparation for removing the internal linkage (See Figure 56).
40. Rotate the transmission case so that pan rail is facing up, as shown in Figure 57, and remove linkage bolt using 30 Torx bit.
41. Remove outside shift lever and manual shaft from case, as shown in Figure 58.

Continued on Page 48



52 PARKING ROD GUIDE SLEEVE RETAINING SNAP RING.
56 PARKING PAWL PIVOT PIN RETAINING CIRCLIP
432 REAR TRANSMISSION BALL BEARING.
433 REAR BALL BEARING RETAINING SNAP RING.

Figure 56



430 PARKING GEAR.
431 PARKING GEAR TO REAR BEARING SHIM (END-PLAY).

Figure 55

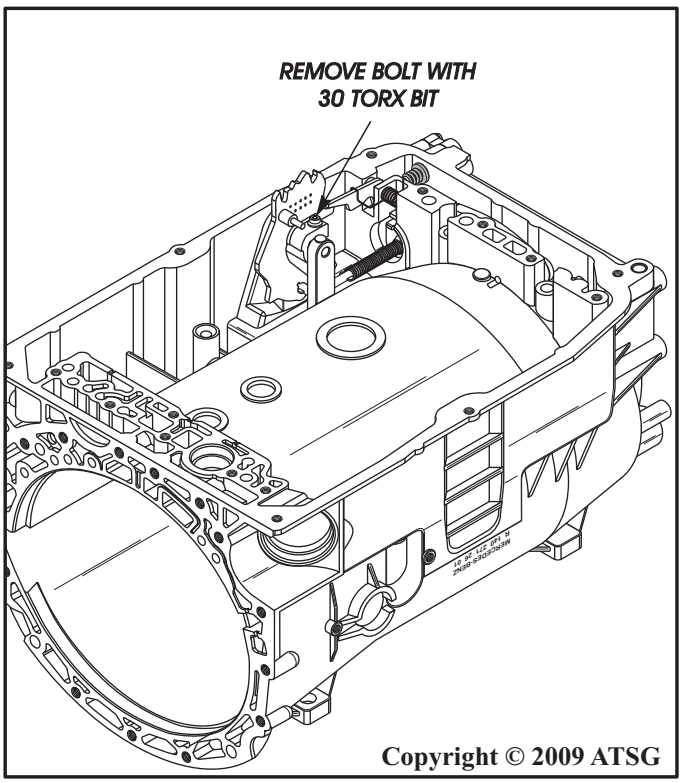


Figure 57

TRANSMISSION DISASSEMBLY (CONT'D)

42. Remove inside detent lever and parking rod as an assembly from case (See Figure 58).
43. Push the parking pawl down against the spring pressure and remove the parking rod guide sleeve (See Figure 58).
44. Use a pick through the hole in case, as shown in Figure 58, to push the parking pawl pivot pin out of case.

Continued on Page 48

PARKING LINKAGE EXPLODED VIEW

40 OUTSIDE SHIFT LEVER AND MANUAL SHAFT ASSEMBLY.
41 MANUAL SHAFT SEAL.
42 INSIDE DETENT LEVER.
43 PARKING PAWL ACTUATOR ROD.
44 INSIDE DETENT LEVER RETAINING BOLT.
45 LOCK PAWL PIVOT PIN (ELIMINATED 1999).
46 LOCK PAWL (ELIMINATED 1999).
47 LOCK PAWL RETURN SPRING (ELIMINATED 1999.
48 PARKING PAWL RETURN SPRING.
49 PARKING PAWL.
50 PARK LOCK INTERLOCK LINKAGE (ELIMINATED 1999).
51 PARK LOCK INTERLOCK LINKAGE RETAINING BOLT.
52 PARKING ROD GUIDE SLEEVE RETAINING SNAP RING.
53 PARKING ROD GUIDE SLEEVE "O" RING SEAL.
54 PARKING ROD SLEEVE.
55 PARKING ROD SLEEVE TENSION SPRING.
56 PARKING PAWL PIVOT PIN RETAINING CIRCLIP.
57 PARKING PAWL PIVOT PIN "O" RING SEAL.
58 PARKING PAWL PIVOT PIN.

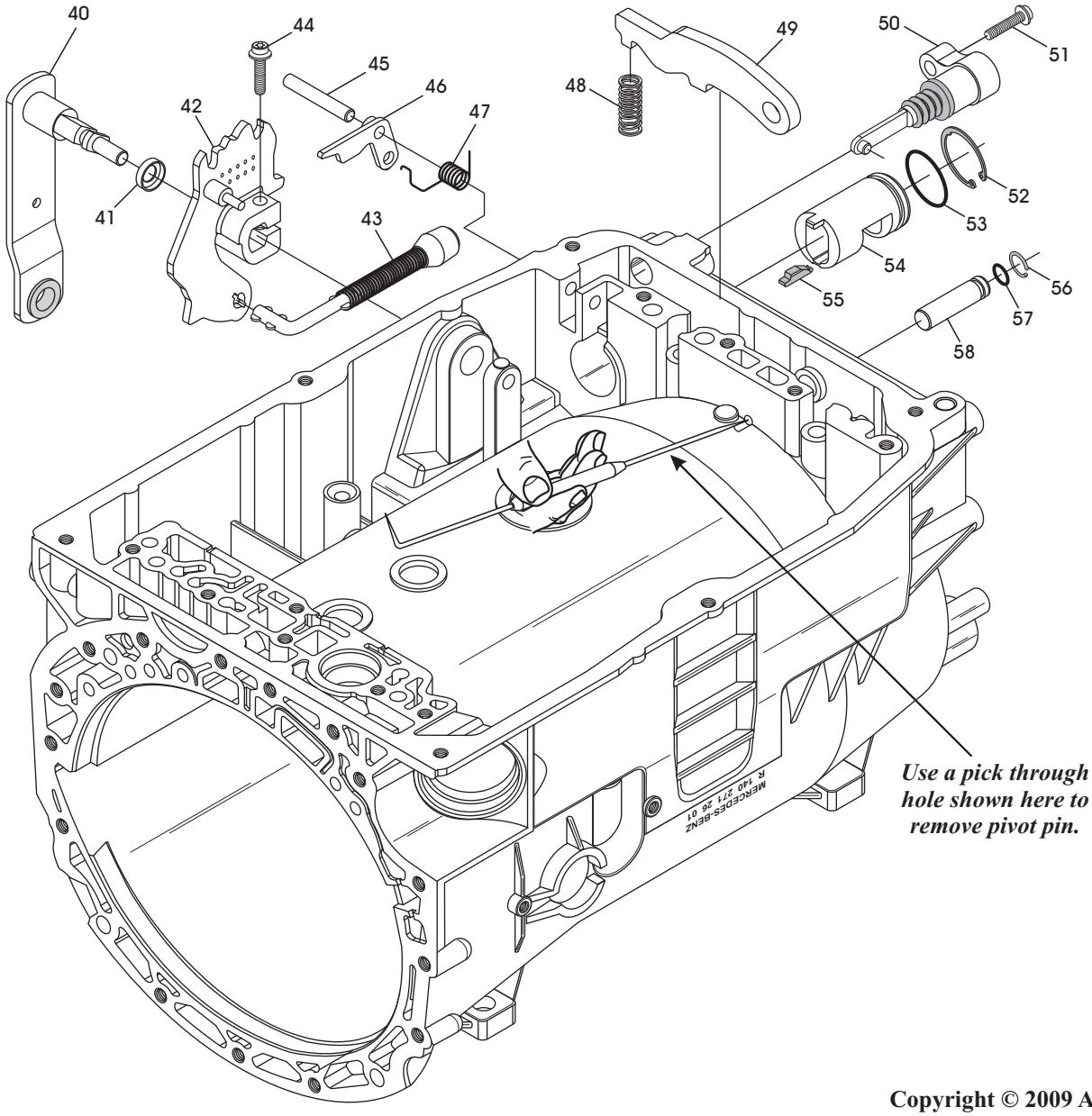


Figure 58

TRANSMISSION DISASSEMBLY (CONT'D)

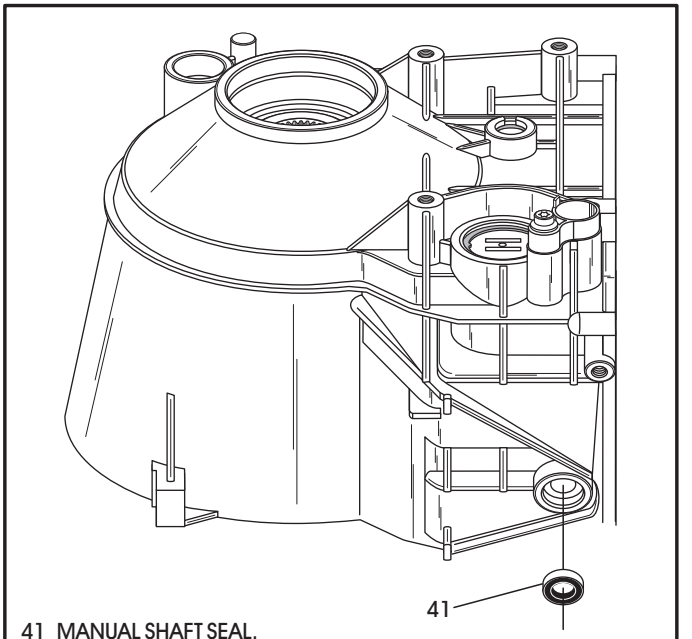
45. The Parking Lock Interlock Linkage (PLIL), as shown in Figure 58, cannot be removed unless you first remove the lock pawl pivot pin (45), lock pawl (46), and lock pawl spring (47). ***Note: The pivot pin is very difficult to remove as it goes into a blind hole and "staked".***
46. If the PLIL is not broken and not leaking, our suggestion is, leave it alone.
47. If it does need replacement, you must figure a way to remove the pivot pin.
48. When going back in, the pin also needs some type of sealer in the case end.

COMPONENT REBUILD

Transmission Case Assembly

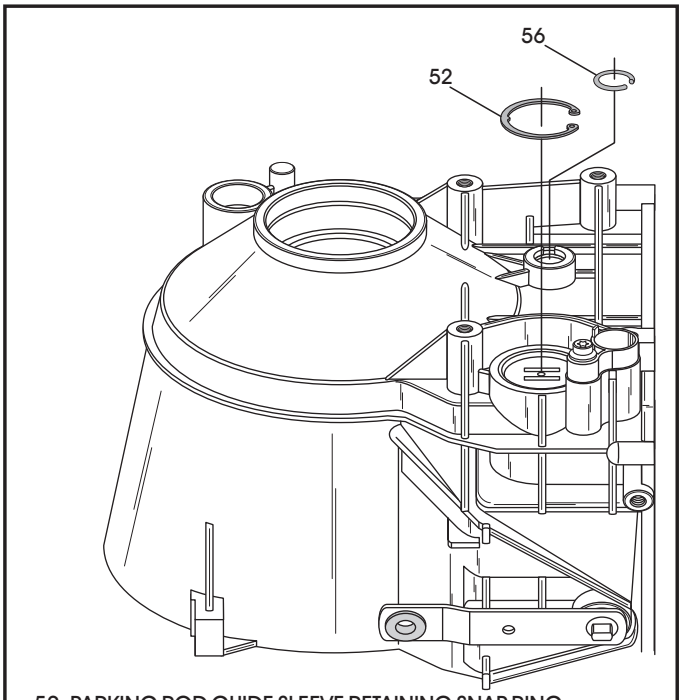
1. Clean all transmission case parts thoroughly and dry with compressed air.
2. Inspect all transmission case parts thoroughly for any wear and/or damage.
3. Install parking pawl and return spring into the case, as shown in Figure 58.
4. Install new "O" ring seal on the parking pawl pivot pin, as shown in Figure 58, and lube with s small amount of Trans-Jel®.
5. Install parking pawl pivot pin into case bore and through parking pawl (See Figure 58).
6. Install new "O" ring seal on the parking rod guide sleeve, as shown in Figure 58, and lube with a small amount of Trans-Jel®.
7. Push down on the parking pawl against spring pressure and install parking rod guide sleeve into the case bore, with the tension spring on the guide sleeve facing away from pan rail, as shown in Figure 58.
8. Install new manual shaft seal into case bore using the proper driver (See Figure 59).
9. Install the parking rod into the inside detent lever, as shown in Figure 58.
10. Install the assembly into the case with the park rod going into the sleeve, install the outside shift lever and manual shaft through the case and into the inside detent lever, as shown in Figure 58.
11. Install the retaining bolt and torque the bolt to 8 N·m (71 in.lb.).
12. Rotate transmission case so that rear is facing up, as shown in Figure 60.
13. Install the circlip and the snap ring, as shown in Figure 60, and ensure fully seated.
14. Transmission case is now ready for the final assembly process.

Component Rebuild
Continued on Page 49



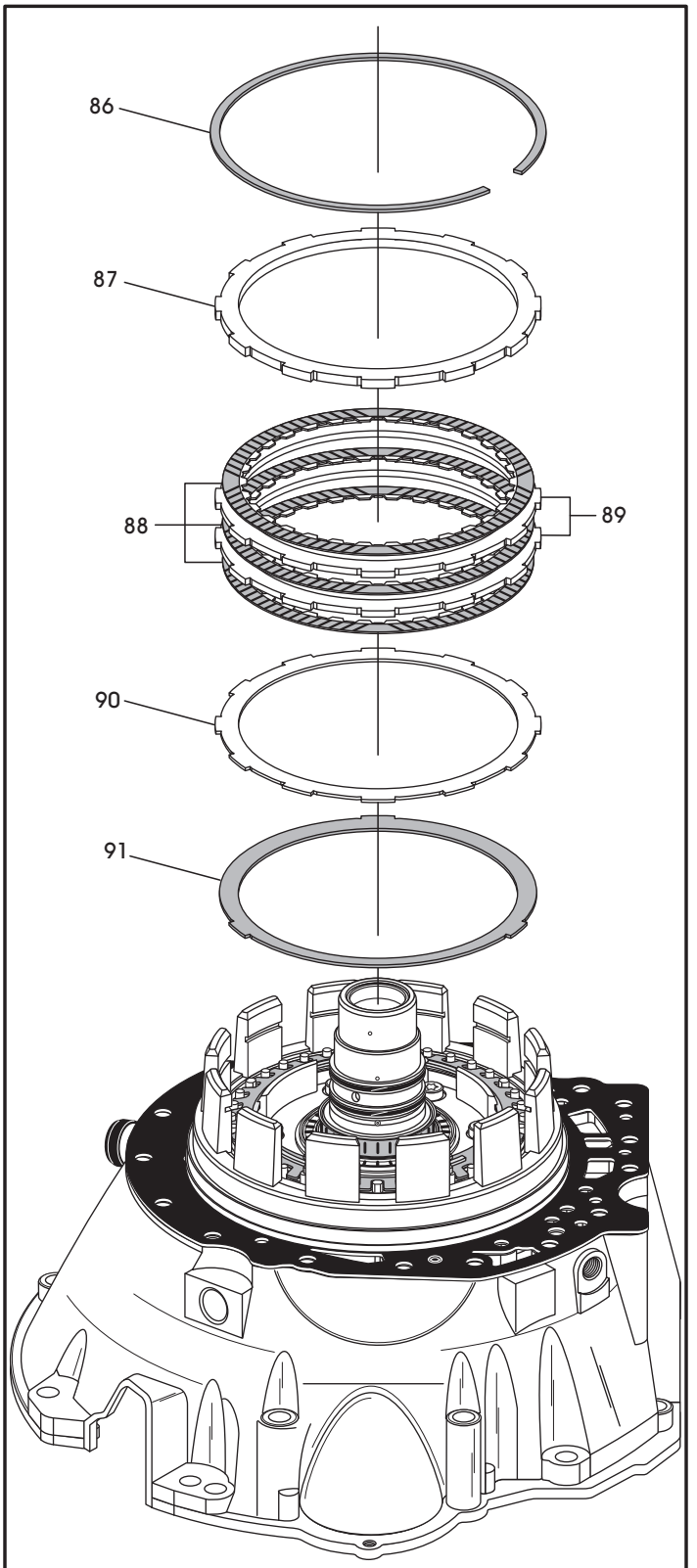
41 MANUAL SHAFT SEAL.

Figure 59



52 PARKING ROD GUIDE SLEEVE RETAINING SNAP RING.
56 PARKING PAWL PIVOT PIN RETAINING CIRCLIP.

Figure 60



86 B-1 CLUTCH BACKING PLATE "*SELECTIVE*" SNAP RING.
87 B-1 CLUTCH BACKING PLATE.
88 B-1 CLUTCH FRICTION PLATES (QTY. VARIES, SEE CHART).
89 B-1 CLUTCH STEEL PLATES (QTY. VARIES, SEE CHART).
90 B-1 CLUTCH APPLY PLATE (.071").
91 B-1 CLUTCH CUSHION PLATE.

Figure 61

COMPONENT REBUILD (CONT'D)

Oil Pump And B-1 Clutch Assembly

1. Place converter housing, oil pump, B-1 clutch assembly face down on a flat work surface, as shown in Figure 61.
2. Remove the B-1 clutch *selective* snap ring, as shown in Figure 61.
   Note: It is recommended that all snap rings be tagged for identification as many are very similar, but will not interchange.
3. Remove the complete B-1 clutch, as shown in Figure 61.
4. Turn the converter housing over and remove the 11 retaining bolts, as shown in Figure 62, using a 30 Torx bit.

Continued on Page 50

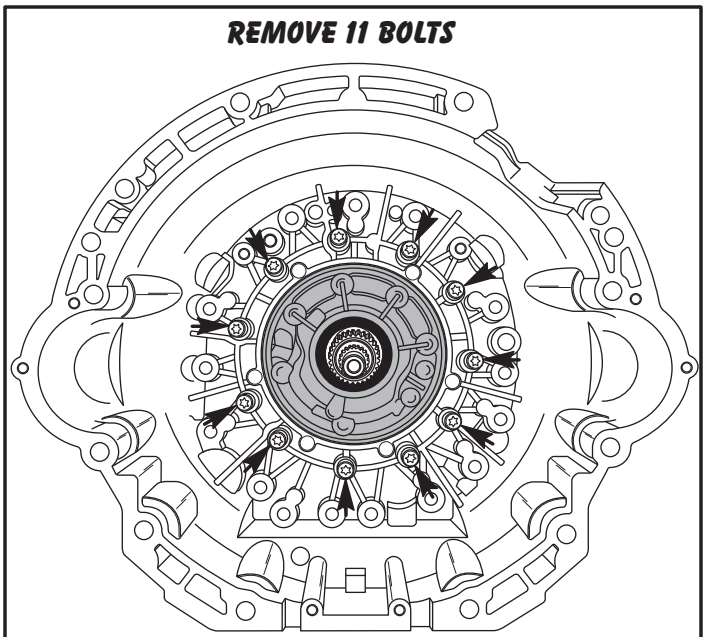
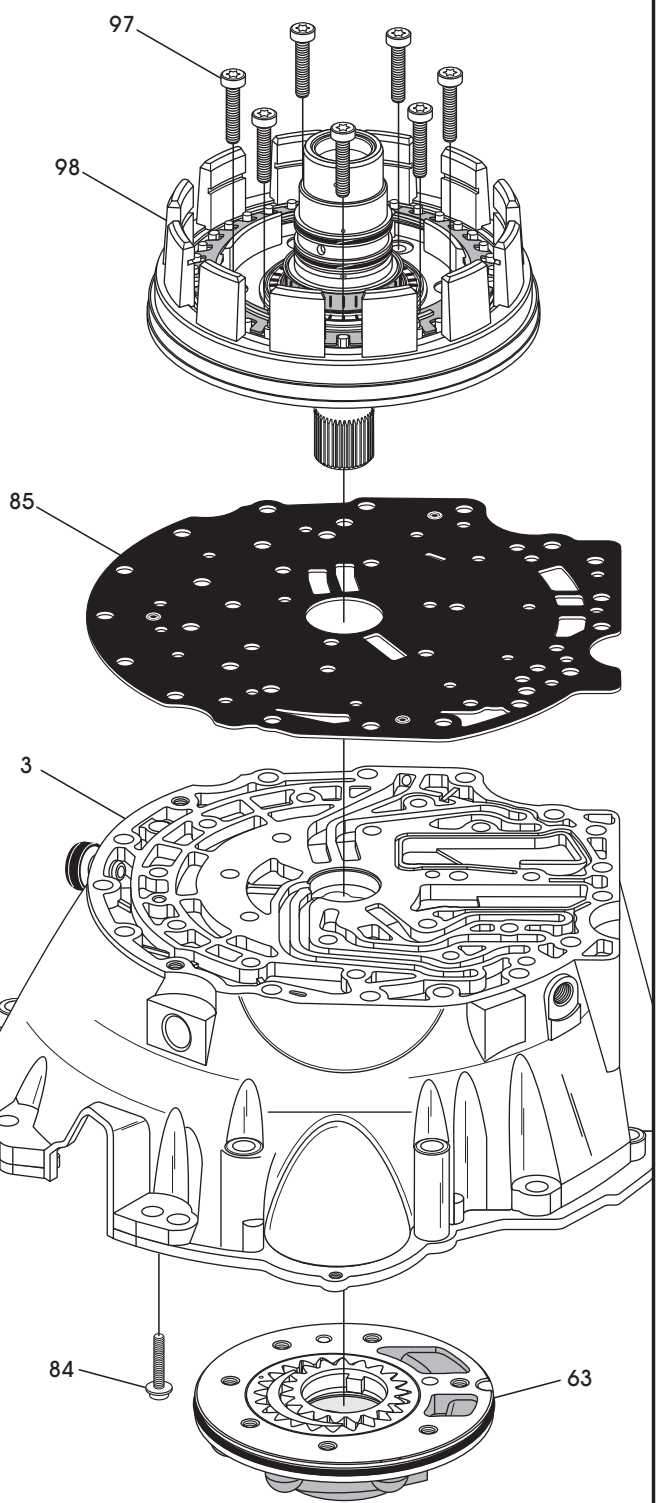


Figure 62

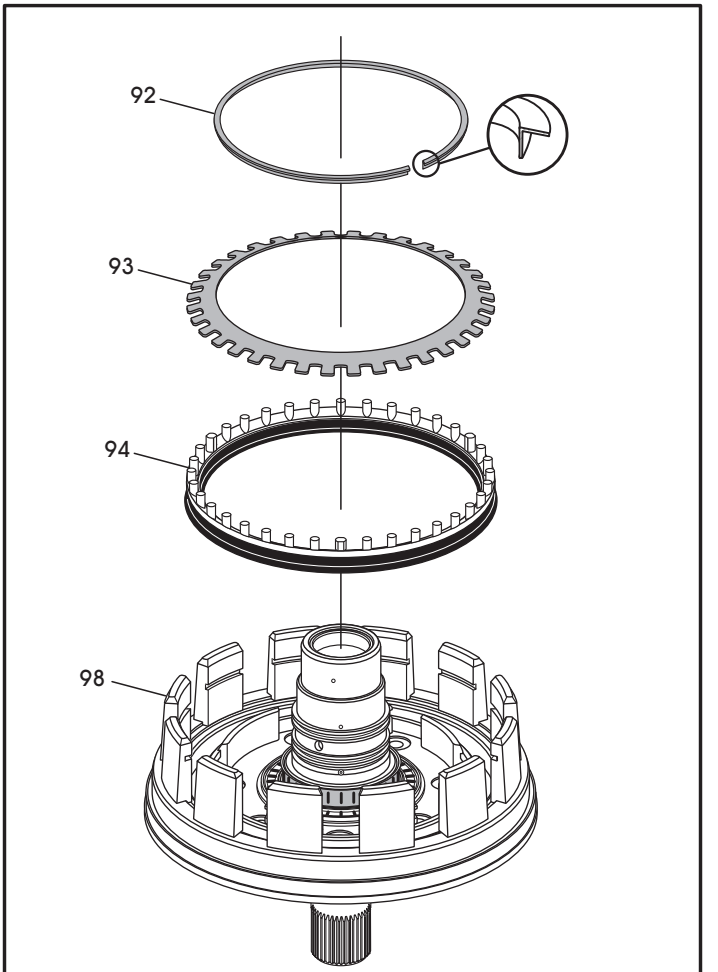


3 TORQUE CONVERTER HOUSING.
63 OIL PUMP ASSEMBLY
84 B-1 CLUTCH HOUSING RETAINING BOLTS (11 REQUIRED).
85 CONVERTER HOUSING TO CASE SPACER PLATE.
97 B-1 CLUTCH HOUSING TO OIL PUMP BOLTS (7 REQUIRED).
98 B-1 CLUTCH HOUSING AND OIL PUMP COVER ASSEMBLY.

Figure 63

Oil Pump And B-1 Clutch Assembly (Cont'd)

5. Remove seven B-1 clutch housing to oil pump retaining bolts, as shown in Figure 63.
6. Seperate converter housing, oil pump, B-1 clutch housing, as shown in Figure 63.
7. Compress B-1 clutch return spring and remove the "L" shaped snap ring (See Figure 64).
8. Remove the B-1 clutch return spring and apply piston, as shown in Figure 64.
9. For the rebuild process we will begin with the oil pump on Page 51.



92 B-1 CLUTCH PISTON RETURN SPRING "L" SHAPED SNAP RING.
93 B-1 CLUTCH PISTON DIAPHRAGM RETURN SPRING.
94 B-1 CLUTCH MOLDED APPLY PISTON.
98 B-1 CLUTCH HOUSING AND OIL PUMP COVER ASSEMBLY.

Figure 64

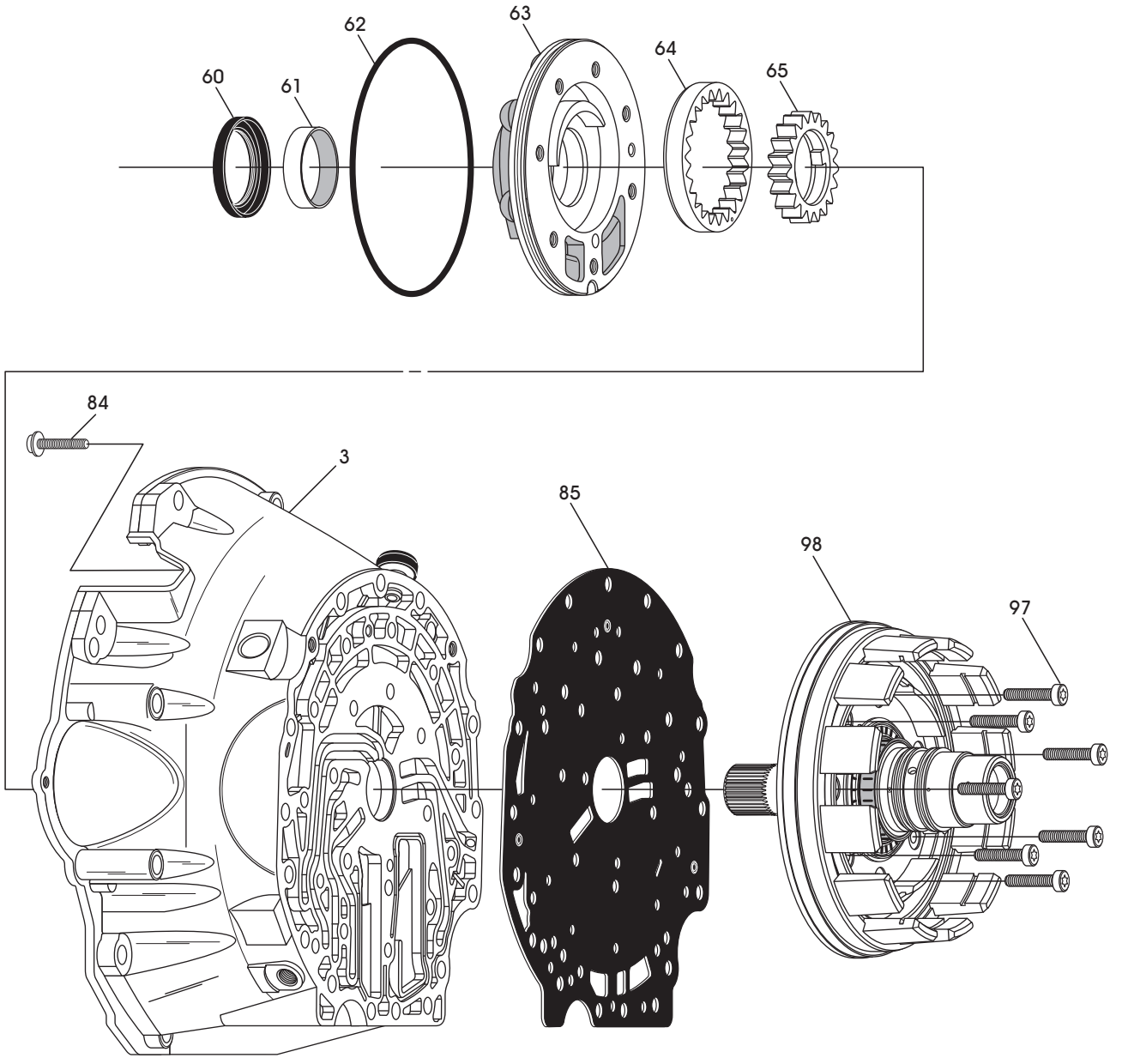
Oil Pump And B-1 Clutch Assembly (Cont'd)

10. Clean all converter housing, oil pump and the B-1 clutch parts thoroughly and dry with compressed air.

11. Inspect all converter housing, oil pump and the B-1 clutch parts thoroughly for any wear and/or damage.

Continued on Page 52

OIL PUMP AND RELATED PARTS, EXPLODED VIEW



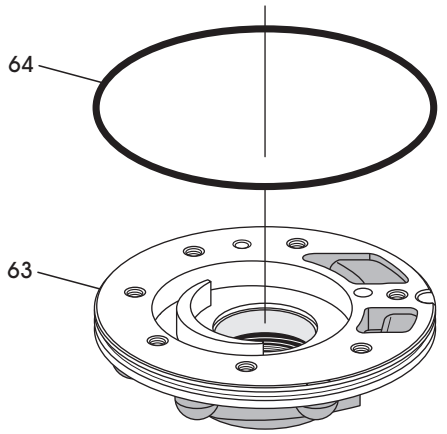
3 TORQUE CONVERTER HOUSING.
60 TORQUE CONVERTER SEAL.
61 TORQUE CONVERTER HUB BUSHING.
62 OIL PUMP BODY TO CONVERTER HOUSING "O" RING SEAL.
63 OIL PUMP BODY .
64 OIL PUMP OUTER GEAR.
65 OIL PUMP INNER GEAR.
84 CONVERTER HOUSING TO B-1 CLUTCH HOUSING BOLTS (11).
85 CONVERTER HOUSING TO CASE SPACER PLATE.
97 B-1 CLUTCH HOUSING TO PUMP BODY BOLT (7 REQUIRED).
98 B-1 CLUTCH HOUSING AND OIL PUMP COVER ASSEMBLY.

Figure 65

Oil Pump And B-1 Clutch Assembly (Cont'd)

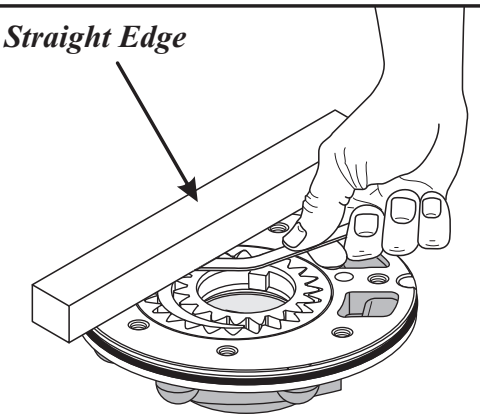
12. Install new oil pump bushing as necessary using the proper driver (See Figure 65).
13. Install new converter hub seal into pump body using the proper seal driver (See Figure 65).
14. Turn the oil pump body over and install new "O" ring seal, as shown in Figure 66, and lube with a small amount of Trans-Jel®.
15. Install the oil pump outer gear with the "dot" facing up, or the champfer facing down, as shown in Figure 67.
16. Install oil pump inner gear in either direction, as shown in Figure 67.
17. Measure gear to face clearances with straight edge and feeler gage, as shown in Figure 68.
18. To measure inner gear to crescent clearance, pull the inner gear into tight mesh with outer gear, and measure between teeth of inner gear and crescent, as shown in Figure 69.
19. Any excessive wear equals pump replacement.

Continued on Page 53



62 OIL PUMP BODY TO CONVERTER HOUSING "O" RING SEAL.
63 OIL PUMP BODY .

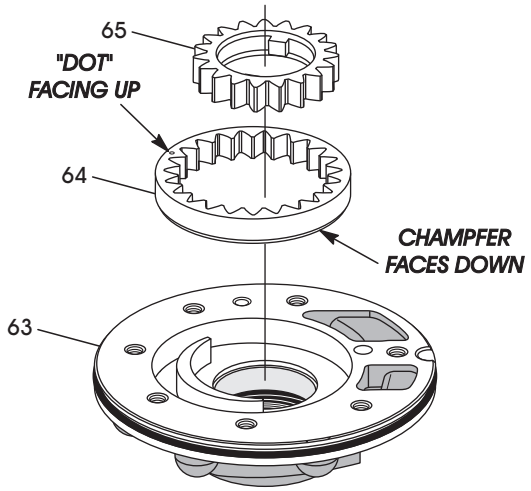
Figure 66



Oil Pump Specifications

COMPONENT	*SPECIFICATION*
INNER GEAR TO FACE	.0008" - .0025"
OUTER GEAR TO FACE	.0008" - .0027"
OUTER GEAR TO BODY	.003" - .005"
INNER GEAR TO CRESCENT	.033" - MAX

Figure 68



63 OIL PUMP BODY .
64 OIL PUMP OUTER GEAR.
65 OIL PUMP INNER GEAR.

Figure 67

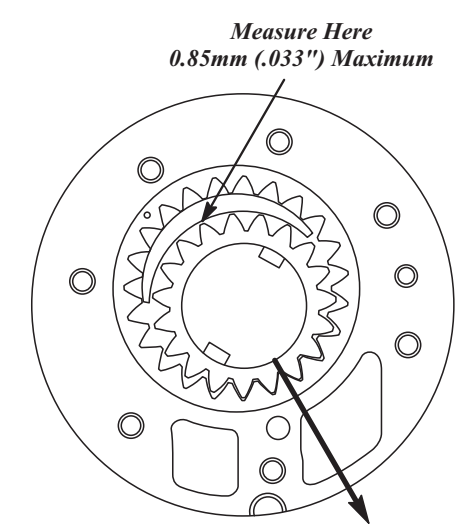


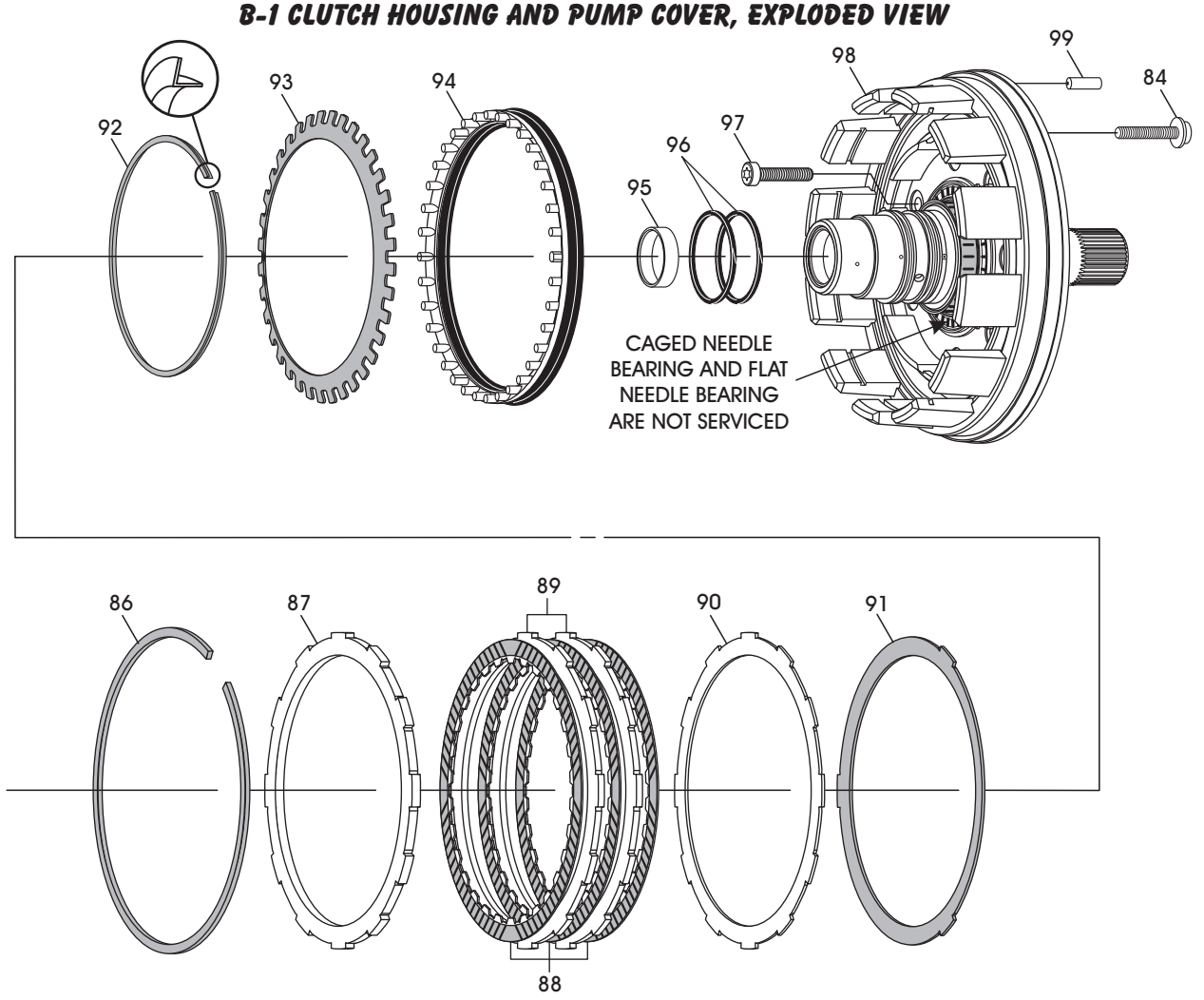
Figure 69

Oil Pump And B-1 Clutch Assembly (Cont'd)

20. The B-1 clutch return spring is the diaphragm style, as shown in Figure 70.
21. The snap ring for diaphragm style return spring is "L" shaped, as shown in Figure 70.
    Note: This is to keep return spring centered on the B-1 clutch apply piston.
22. The B-1 clutch apply piston is a molded piston and can be used again if not damaged.
23. The number one thrust bearing is located under a pressed on caged roller bearing on B-1 clutch housing, as shown in Figure 70.
    Note: Neither of these bearings are serviced. If they are damaged, you must replace the B-1 clutch housing. The bushing (95) shown in Figure 70 is also not serviced.

Continued on Page 54

B-1 CLUTCH HOUSING AND PUMP COVER, EXPLODED VIEW



84 B-1 CLUTCH HOUSING RETAINING BOLTS (11 REQUIRED).
86 B-1 CLUTCH BACKING PLATE "*SELECTIVE*" SNAP RING.
87 B-1 CLUTCH BACKING PLATE.
88 B-1 CLUTCH FRICTION PLATES (QTY. VARIES, SEE CHART).
89 B-1 CLUTCH STEEL PLATES (QTY. VARIES, SEE CHART).
90 B-1 CLUTCH APPLY PLATE (.071").
91 B-1 CLUTCH CUSHION PLATE.
92 B-1 CLUTCH PISTON RETURN SPRING "L" SHAPED SNAP RING.
93 B-1 CLUTCH PISTON DIAPHRAGM RETURN SPRING.
94 B-1 CLUTCH MOLDED APPLY PISTON.
95 B-1 CLUTCH HOUSING BUSHING (NOT SERVICED).
96 K-1 CLUTCH SCARF-CUT SEALING RINGS.
97 B-1 CLUTCH HOUSING TO PUMP BOLT (7 REQUIRED).
98 B-1 CLUTCH HOUSING AND PUMP COVER ASSEMBLY.
99 ALIGNMENT DOWEL.

Figure 70

Oil Pump And B-1 Clutch Assembly (Cont'd)

24. Ensure that the alignment dowel is in place in the B-1 clutch housing, as shown in Figure 71.
25. Lubricate the B-1 clutch apply piston and the seal surfaces in the housing with small amount of Trans-Jel®.
26. Install the B-1 clutch apply piston, as shown in Figure 72.
27. Install the B-1 clutch return spring, as shown in Figure 72.
28. Compress the return spring using a foot press and install the "L" shaped snap ring, as shown in Figure 72.

Continued on Page 55

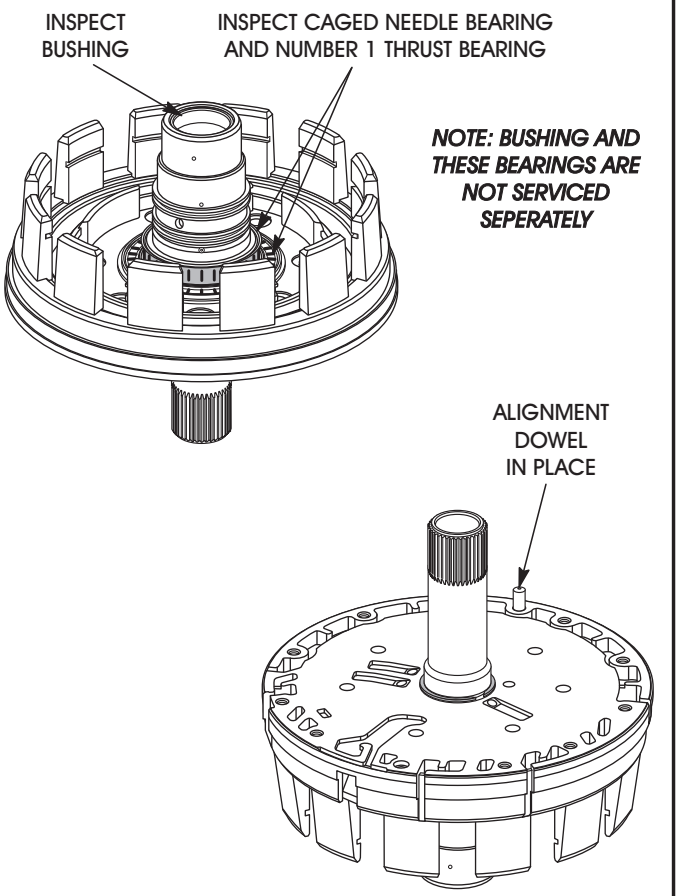


Figure 71

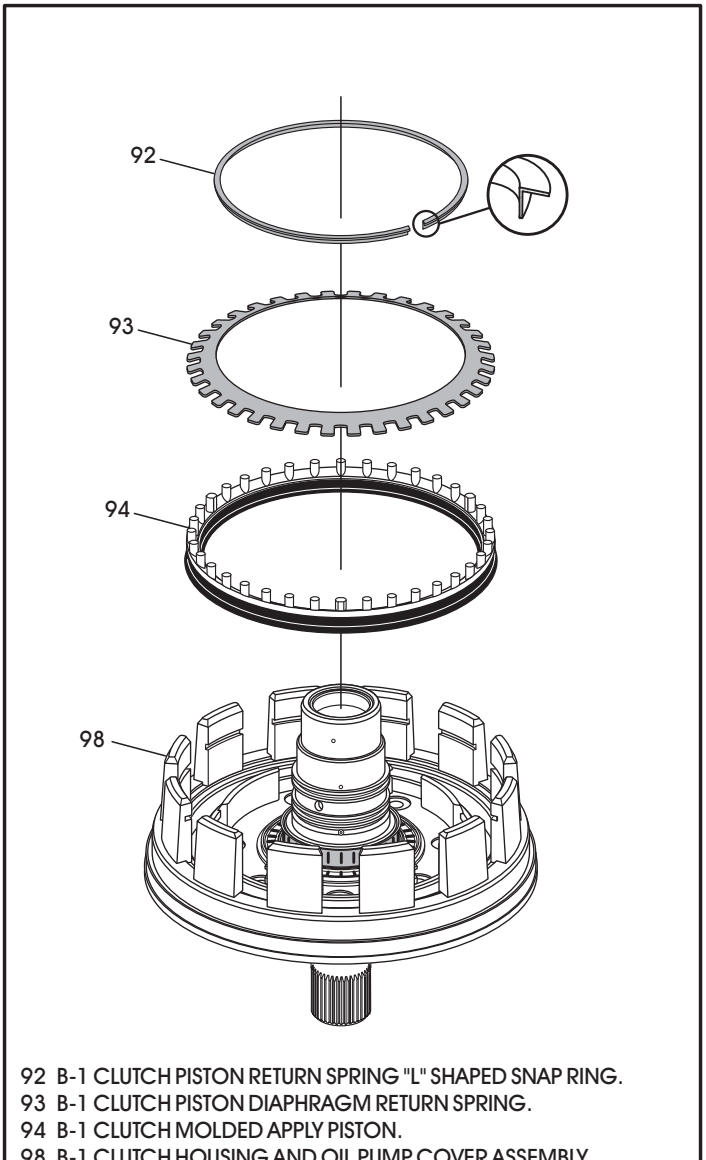
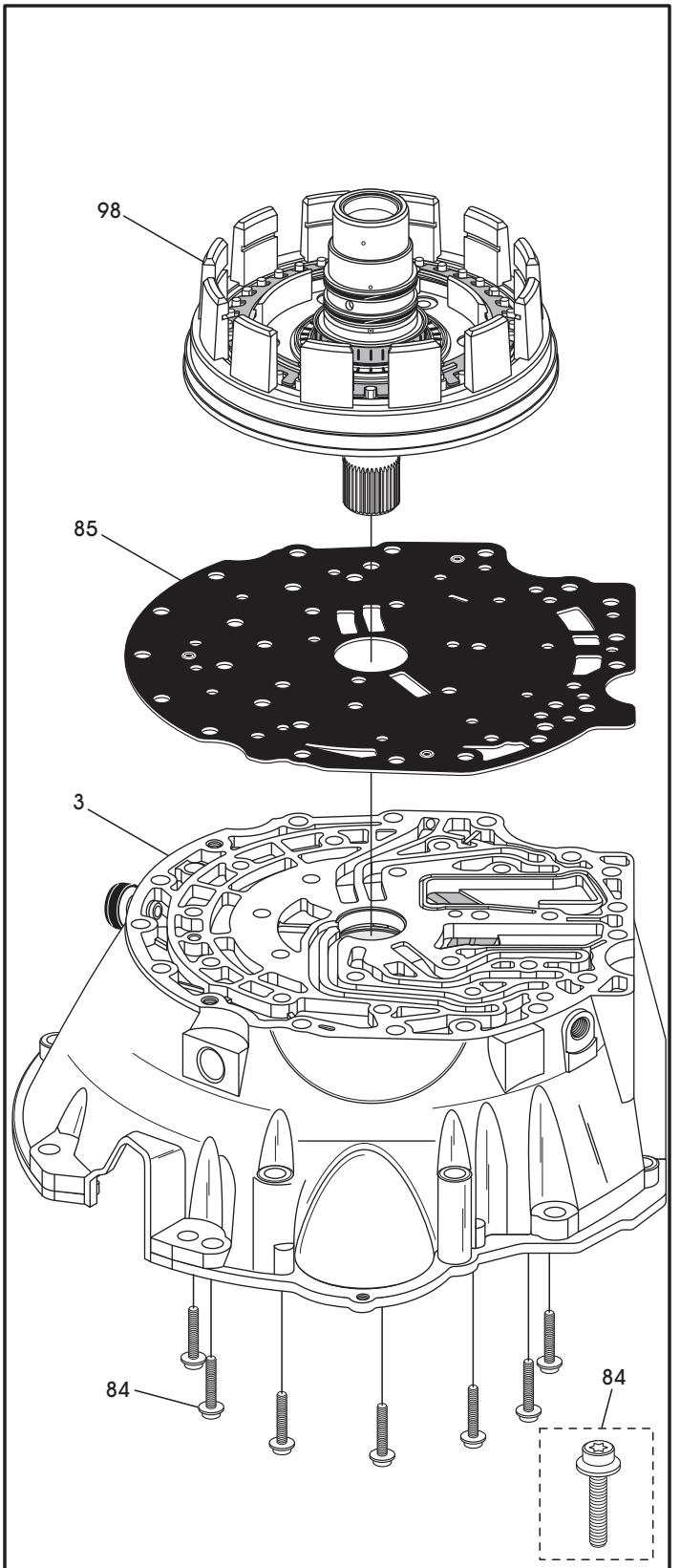


Figure 72



3 TORQUE CONVERTER HOUSING.
84 B-1 CLUTCH HOUSING RETAINING BOLTS (11 REQUIRED).
85 CONVERTER HOUSING TO CASE SPACER PLATE.
98 B-1 CLUTCH HOUSING AND OIL PUMP COVER ASSEMBLY.

Figure 73

Oil Pump And B-1 Clutch Assembly (Cont'd)

29. Place the converter housing face down on flat work surface, as shown in Figure 73.
30. Place converter housing to case spacer plate on converter housing, as shown in Figure 73.
31. Install the B-1 clutch housing with piston onto spacer plate, as shown in Figure 73.
32. Install the eleven clutch housing retaining bolts as shown in Figure 73.
33. Torque the B-1 clutch housing retaining bolts to 10 N·m (88 in.lb.) (See Figure 74).

Continued on Page 56

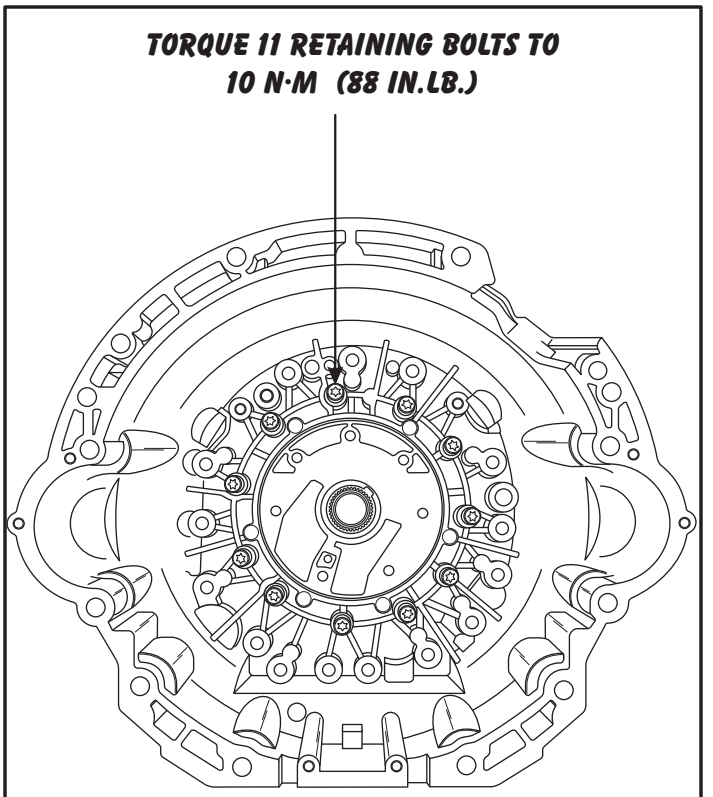


Figure 74