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INTERIM*
D-30-108-000/SF-002
1998-11-10

SPECIFICATION
FOR
REBUILDING THE VW 005 TRANSAXLE ASSEMBLY USED IN
TRUCKS, UTILITY, LIGHT, 4X4 MILITARY DESIGN ILTIS CDN SERIES
NSN - 2520-21-896-8902

1. SCOPE

1.1 Scope.- This specification covers the requirement for rebuilding VW 005, 5-speed manual transaxle assembly used in Trucks, Utility, Light, 4X4 Military Design, Iltis Cdn Series used by the Canadian Forces. This specification includes rebuild procedures, standards, testing, special specification includes a separate specification for rebuilding the clutch assembly.

1.1 Purpose.- The purpose of this specification is to establish high quality standards for rebuilding the subject transaxle and accessories in order to provide a transaxle assembly with long trouble-free life.

1.2 Responsibility.- The contractor shall be responsible for meeting the requirements specified herein.

2. APPLICABLE DOCUMENTS

2.1 Government documents.- The following documents form part of this specification to the extent specified herein. Unless otherwise specified, the issue or amendment of documents effective for a particular contract shall be that in effect on the date of the request for proposal.

AQAP-4	NATO Inspection System Requirements for Industry
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MIL-L-2105	Lubricating Oil, Gear, Multipurpose Grade 80W90
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OPI/BPR DSVEM 2

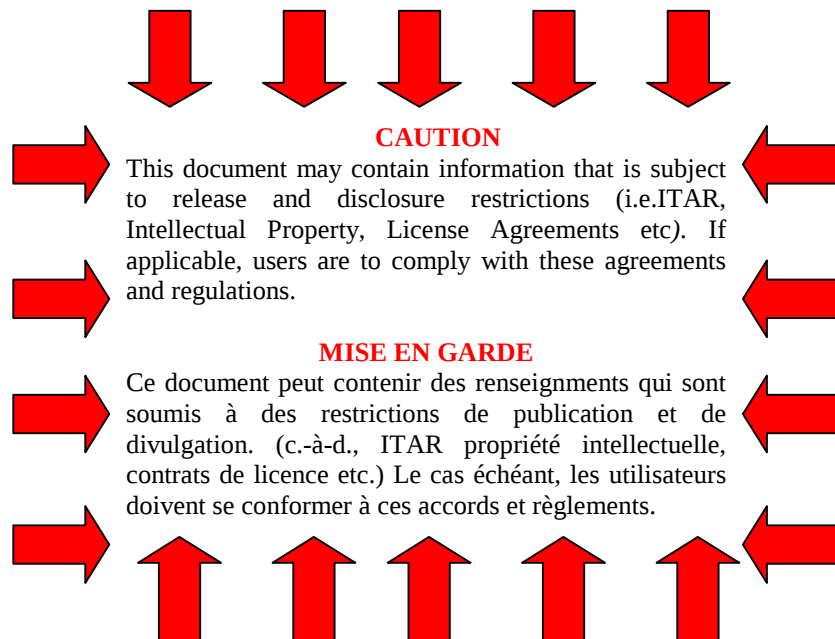
* The following issue will be bilingual.

Issued on Authority of the Chief of the Defence Staff

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MIL-B-131	Barrier Material, Water-Vapour Proof, Flexible, Heavy (36 inch wide roll)
C-04-010-022/VP-001	Preservation for Storage and Shipment of Vehicles and Vehicular Components

Copies of this specification and the above documents may be obtained from the Department of National Defence, Ottawa, Ontario, K1A 0K2, Attention: DDDS 3-6.

2.2 Other publications.- The following documents form part of this specification to the extent specified herein. Effective dates shall be those in effect on the date of manufacture. Source is as shown.

Canadian Government Publishing Centre,
Supply and Services Canada, Ottawa, Ontario K1A 0S9

1-GP-12	Standard for Paint Colours
31-GP-3	Compound, Corrosion Preventive, Solvent Cutback, Cold Application Soft Film
CAN/CGSB-3.8M	Cleaning Solvent Hydrocarbon Type
43-GP-3M	Standard for Tape Adhesive, Pressure Sensitive, Water Resistant

3. REQUIREMENTS

3.1 General.- The contractor shall rebuild each transaxle assembly supplied by DND in accordance with the requirements of this specification using the procedures and standards specified in 3.4 and 3.5. The contractor shall return each rebuilt transaxle assembly to DND as a complete drop in assembly packaged in a reusable metal storage and shipping container as specified herein. The transaxle shall be ready to operate after depreservation and installation.

3.1.1 The transaxle assembly shall be completely disassembled. All components as listed in 3.4.2 and Table III shall be thoroughly cleaned and dried before being inspected for condition and wear. Cleaning solvent to CAN/CGSB2-3.8M or commercial equivalent may be used for cleaning.

3.1.2 The clutch assembly shall be cleaned, inspected, rebuilt, preserved and packaged as per the procedures and standards listed within its specification found as Appendix 1.

3.1.3 Components listed in Table II shall be replaced with new O.E.M. parts during rebuild.

3.1.4 Any components missing from the transaxle assembly at time of disassembly shall be replaced with serviceable or new O.E.M. components at time of rebuild.

3.1.5 The contractor shall record all measurements required to determine component wear and condition. These measurements shall be recorded on data sheets designed and provided by the contractor and compared to the standards listed in 3.5 and Table IV. Components that fail to meet minimum standards shall be replaced with new or serviceable O.E.M. components. For standards not listed herein, the contractor shall use good judgement to the minimum of SAE Standards and Practices. If the serviceability of a component is in doubt, the component shall be replaced. Quality Assurance Authority (QAA) shall be consulted in all such cases.

3.1.6 For procedures not detailed herein, the contractor shall complete the work in accordance with accepted good engineering practices. The standards of workmanship and material shall be acceptable to the QAA.

3.1.7 The contractor shall ensure that all components are secured in accordance with the torque standards listed in Table V.

3.1.8 The contractor shall use tools designed for the purpose of the operation to be performed. Tools other than the Special Tools listed in 3.7 and Table VI must be approved by QAA. General rebuild tools and machines shall be in good working order.

3.1.9 Upon completion of rebuild, the transaxle assembly shall consist of all the components listed in Table I. Figures 1 to 10 are provided for component identification and location within the assembly.

3.1.10 Each rebuilt transaxle assembly shall be subjected to a dynamometer run-in and performance check. Dynamometer test procedures and standards are listed in 3.8.

3.1.11 When the rebuilt and run-in has been given final acceptance by QAA, the transaxle assembly shall be painted, preserved and packaged in accordance with procedures specified in paragraph 5.

3.1.12 The contractor shall retain the differential flange assembly hexagon head screws (Figure 9, Item 22) and the transmission bolts (long-through) Figure 3, Item 13 upon disassembly and use them throughout the assembly and adjustment process. New cap screws and bolts will be installed on final installation.

3.1.13 General Data

Make	Volkswagen
Model	VW005

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Type	5-speed manual with integrated differential	
Lubricant capacity	3.6 L	
Lubricant type	MIL-L-2105C	
	Above -20°C	80W90
	-20°C to -31°C	75W90
Ratio (transmission)	Final drive	5.285:1
	1st gear	3.909:1
	2nd gear	2.277:1
	3rd gear	1.458:1
	4th gear	1.086:1
	Cross-country gear	7.603:1
	Reverse gear	7.318:1

Differential Operation Manual disengagement

3.2 Transaxle components. - Table I lists the components comprising the VW005 Transaxle. Refer to Figures 1 to 10 for component identification and location within the assembly.

3.3 Mandatory parts replacement. - Table II lists parts that shall be replaced with new O.E.M. components during transaxle rebuild, see Figures 1 to 10 for component identification and location within the assembly.

3.4 Rebuild procedures. - The following provides the step-by-step procedures to be used in the rebuild of the Transaxle.

3.4.1 Disassembly

3.4.1.1 Separating transmission from differential. - See Figure,11 and proceed as follows:

- Mount the transaxle on a repair stand.
- Drain the oil.
- Remove the left and right support assemblies.
- Pry the cap (1) from the propeller shaft flange (2).
- Straighten the lock on the flange securing nut (11).
- Remove the flange securing nut using a 36 mm socket and holder Matra 3028 to hold the flange, see Figure 12. Remove holder Matra 3028.
- Remove the flange from the pinion shaft (12) using Extractor VW391, M-8 Bolts and a 27-mm open end wrench, see Figure 13.

- (h) Remove the two dowel pins (4), see Figure 11, from the transmission cover (3) and transmission housing (6) (top and bottom).
- (j) Remove the spring pin (10) of the selector fork shaft (9) for cross-country and reverse gears by driving the pin into the case. The pin can be tapped out later when the cover is removed.
- (k) Pull out the shaft (9) for the selector fork.
- (m) Remove the ten long cap screws and two short cap screws (5) securing the cover to the transmission housing.
- (n) Remove the cover and gasket from the transmission housing.
- (p) Remove the transmission from the differential housing by removing the two dowel pins (7) and the two cap screws (8).

3.4.1.2 Removing the clutch release bearing and guide sleeve.- See Figure 14 and proceed as follows:

- (a) Release the left and right clutch release bearing springs (1) by using a screwdriver to unhook the springs from the fingers on the shaft (7).
- (b) Pull the release bearing (2) off the guide sleeve (6).
- (c) Remove the three cap screws (3) and remove the locking collar (4) and the guide sleeve (6).

3.4.1.3 Removing the clutch release bearing shaft and seals.- See Figure 14 and proceed as follows:

- (a) Relieve tension on the shaft (7). By using brake spring pliers, grip under the spring and pry the spring (9) to one side using a screwdriver.
- (b) Remove the clutch lever (17).
- (c) Remove the snap ring (14) and pry off the plastic cap (13).
- (d) Pry the plastic bushing (11) and O-ring (12) from the shaft.
- (e) Work the shaft all the way to one side until it is free of the bushing (5). Push the shaft in the opposite direction until the end is clear of the housing and remove the shaft and release shaft spring (9).
- (f) Using a small screwdriver, pry the O-ring (10) out of the housing.
- (g) Remove the clutch-shaft stop (8) for access to the bushing.

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CAUTION

Ensure the jaws of the extractor do not protrude past the inner edge of the bushing. If the jaws contact the surface of the housing, they will cause damage to the housing.

- (h) Insert Internal Extractor KUKKO 21/3 into the bushing and tighten the nut, see Figure 15.
- (j) Insert Sliding Hammer W771 through the shaft opening in the housing.
- (k) Screw the hammer shaft into the extractor, using Adapter VW771/15, see Figure 15.
- (m) Remove the bushing.

3.4.1.4 Removing the starter bushing.- See Figure 16 and proceed as follows:

- (a) Insert Internal Puller 788-14 into the starter bushing.
- (b) Install Puller KUKKO 22-2.
- (c) Remove the bushing from the differential housing.

3.4.1.5 Removing the two-wheel drive and interlock levers.- See Figure 17 and proceed as follows:

- (a) Remove the bolt, nut and washer (7) securing the two-wheel drive lever (5) to the shaft (6).
- (b) Mark the lever and the end of the shaft for reassembly.
- (c) Remove the lever.
- (d) Remove the interlock lever (1) from the shaft (2) by driving out the spring pin (3).
- (e) Remove the lever.
- (f) Remove the three socket head cap screws from the interlock shaft cover (4).
- (g) Remove the cover and shaft.

3.4.1.6 Removing the left drive flange and seals.- See Figure 18 and 19 and proceed as follows:

- (a) Remove the bushing and the speedometer driven gear.
- (b) Install two bolts in the drive flange and place a pry bar between them to prevent the flange from turning.
- (c) Remove the centre bolt from the drive flange.
- (d) Pull the drive flange from the housing.
- (e) Pull out the seal using Extractor Hook VW771/37 and Sliding Hammer VW771.

3.4.1.7 Removing the right drive flange.- Proceed as follows:

- (a) Pierce and pry out the drive flange cover.
- (b) Install two bolts in the drive flange and place a pry bar between them to the flange from turning, see Figure 18.
- (c) Remove the drive flange centre bolt and washer.
- (d) Remove the drive flange.
- (e) Remove the half shaft and needle bearing from the drive flange.

3.4.1.8 Removing the differential flange assembly.- Proceed as follows:

- (a) Remove the nine cap screws from the differential flange.
- (b) Remove the differential flange assembly. If required use brass drift and punch.
- (c) Remove the spacer and shim from crown gear shaft.
- (d) Remove the crown gear and carrier from the differential housing.

3.4.1.9 Removing the differential bearing races.- Proceed as follows:

- (a) Remove the pinion shaft bearing race and shim using Arbor 2050 and Sliding Hammer VW771/L see Figure 20.
- (b) Remove the left carrier bearing race and shims using Internal Extractor KUKKO 21-7, Puller KUKKO 22-2 and a 32-mm wrench, see Figure 21.

3.4.1.10 Removing the input shaft need bearing and seal.- Proceed as follows:

- (a) Remove the input shaft needle bearing using Internal Extractor KUKKO 21-5 and Sliding Hammer VW771 see Figure 22.

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(b) Pry the seal from the housing.

3.4.1.11 Disassembling the differential flange assembly.- See Figure 23 and proceed as follows:

- (a) Place the differential flange (13) in a vise.
- (b) Pry or drive out the two oil seals (1 and 2).
- (c) Remove the detent plug (9) and seal (10).
- (d) Remove the spring (11) and detent (12).
- (e) Remove the two-wheel drive sending unit (7) and extension shaft (8).
- (f) Remove the seal (5) from the selector shaft (14).
- (g) Remove the snap rings (6 and 16) from the selector shaft.
- (h) Remove the shaft (14), selector fork (15) and sliding collar (17).
- (j) Remove the bearing race (18) and shims (19) from the housing using a brass drift.
- (k) Pull out the tubular key (20) and remove the magnet (21).

3.4.1.12 Disassembling the crown gear and carrier.- See Figure 24 and proceed as follows:

- (a) Remove the drive flange shim (6) .
- (b) Remove the speedometer drive gear (11).
- (c) Secure the assembly in a vise.
- (d) Remove the large carrier bearing (14) using Puller KUKKO 44-2 and Pressure Piece 40-105. Ensure that the puller fits into the grooves on the carrier, see Figure 25.
- (e) Remove the small carrier bearing (10), see Figure 24, using Puller OTC 1025 and Pressure Piece 40-105, see Figure 26.
- (f) Remove the ten cap screws (12), see Figure 24, from the carrier (8).
- (g) Drive the crown gear off the carrier, see Figure 27.
- (h) Drive out the tubular key (9), see Figure 24, that secures the shaft for the pinion gears.

- (j) Drive out the shaft (7) for the pinion gears (4) and side gears (2) and remove the two nuts (5).
- (k) Remove the pinion gears and thrust washers (3) by turning the gears to the opening.
- (m) Remove the side gears and shims (1).

3.4.1.13 Disassembling the transmission. - See Figure 28 and proceed as follows:

- (a) Clamp the transmission in a vise.
- (b) Remove the cross-country gear (11) including thrust washer (12), needle bearing (10) and bushing (9). Using Puller 44-2.
- (c) Remove the selector fork (8).

NOTE

Mark the operating sleeve (7) and hub (6) for identification (if not removed as a unit).

- (d) Remove the hub with the operating sleeve.
- (e) Remove the needle bearing (5), and then remove the reverse gear (3) and bushing (4). Using Slide Hammer and Adaptor 711/1 and 711/37.
- (f) Remove the thrust washer (2) and shim (1) . The shim is smaller than the thrust washer.
- (g) See Figure 29, secure input shaft in soft jawed vise and remove the socket head cap screw (27) and washer (28) from the input shaft (13).
- (h) Remove the operating link for first and second gear by removing the two cap screws and lock washers, see Figure 30.
- (j) Remove the gear detent plugs, plungers and springs (green), see Figure 31.
- (k) Remove the center gear detent plug, see Figure 31.
- (m) See Figure 29 and remove the spring pin (14) from the shifter rod (21) at the selector fork (15) for third and fourth gears.
- (n) Remove the cross-country and reverse gear shifter rod (23) ensuring that the third/fourth shifter rod (21) is in the neutral detent position.

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- (p) Remove the interlock pin (22) from the third and fourth gear shifter rod.
- (q) Remove the third and fourth gear shifter rod (21) and selector fork (15) by turning the rod towards the countershaft (1) 90°.
- (r) Remove the four cap screws (24) from the support plate (25) and remove the plate.
- (s) Remove the retaining washer (26).
- (t) Install a support plate M8x20 cap screw fully into the input shaft, see Figure 32.
- (u) Install the Support Plate and Thrust Piece VW447h with four M8x35 cap screws, see Figure 33.
- (v) Turn the cap screw in the centre of the input shaft counterclockwise. This will press the input shaft out of the bearing race (29) , see Figure 29.
- (w) Remove the input shaft (13) and bearing race (31).
- (x) Remove the support plate and ball bearing (30).
- (y) Secure countershaft in soft jaw vise and remove the socket head cap screw (12) and washer (11) from the countershaft (1).
- (z) Remove the snap ring and retaining washer, see Figure 34.
- (aa) Press the countershaft from the races. Using Thrust Pad VW431 and Puller KUKKO 44-2, see Figure 35.
- (bb) Remove the bearing (7), races (6 and 8) and thrust washer (5), and. countershaft see Figure 29.
- (cc) Remove the counter shaft reverse gear (4).
- (dd) Remove the pinion shaft (16), shifter rod (17) and attached selector fork (18).
- (ee) Remove the detent and spring (unpainted) and the short and long interlocking plungers from the housing, see Figure 36.
- (ff) Press the countershaft needle bearing out of the transmission housing using Mandrel Matra 30-505 and Distance Sleeve VW472/2, see Figure 37.
- (gg) Remove the input shaft roller bearing (32) using a brass drift, see Figure 29.

- (hh) Tap the pinion bearing race and shims out of the transmission housing using Thrust Plate VW447i.

3.4.1.14 Disassembling the transmission cover.- See Figure 38 and proceed as follows:

- (a) Remove the lock screw (1) holding the oil trap (2).
- (b) Remove the lock screw (4) that locks the idler gear shaft (3).
- (c) Use Slide Hammer 711/1 and 21/3 to remove the idler shaft (3).
- (d) Remove the gear (7) and two sets of bearings (6).
- (e) Remove the two thrust washers (5 and 8).
- (f) Remove the snap ring (16) from the countershaft roller bearing (15).
- (g) Remove the countershaft roller bearing using Internal Extractor Hazet 788-30, and the sliding hammer, see Figure 39.
- (h) Pry the two pinion shaft seals (13 and 14) from the cover (9), see Figure 38.
- (j) Using Thrust Plate W447i and Mandrel VW407, press the pinion shaft roller bearing (12) from the cover, see Figure 40.
- (k) Remove the reverse light switch plug (11) and seal (10), see Figure 38.

3.4.1.15 Disassembling the pinion shaft.- See Figure 41 and proceed as follows:

- (a) Press off the first gear (10) and bearing (9).
- (b) Remove the needle bearing (11) and first gear.
- (c) Remove the first gear synchronizing ring (12).
- (d) Remove the snap ring (13).
- (e) Mark the synchronizer hub (17) and sleeve (16) if they are to be separated and remove the synchronizing unit (14) by gently prying the second gear synchronizing ring away from the second gear (8). Then install KUKKO 17-2 and tap pinion shaft (1) through synchronizer unit (14).
- (f) Remove the second gear synchronizing ring (15).
- (g) Remove the second gear (8) and needle bearing (7).

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- (h) Remove the snap ring (6).
- (j) Press off third gear (5).
- (k) Remove the snap ring (4).
- (m) Press off fourth gear (3).
- (n) Press off the tapered roller bearing (2).

3.4.1.16 Disassembling the input shaft.- See Figure 42 and proceed as follows:

- (a) Remove the circlip (10).
- (b) Remove fourth gear (9).
- (c) Remove the needle bearing (8) for fourth gear.
- (d) Remove the synchronizing ring (7) for fourth gear.
- (e) Remove the snap ring (6).
- (f) Press off the operating sleeve (11) and synchronizer hub (12) with synchronizing ring (1).
- (g) Remove third gear (2).
- (h) Remove the needle bearing (3) for third gear.

3.4.2 Cleaning and inspection.- Table III lists the components of the transaxle assembly that shall be cleaned and inspected for condition and wear. All components shall be cleaned with cleaning solvent to CAN/CGSB-3.8M or a commercial equivalent, dried and inspected.

3.4.2.1 The following operations shall be carried out as applicable to place the components in serviceable condition:

- (a) Clean all threads (internal and external) with a tap or thread chaser.
- (b) Remove all burrs and scratches with crocus cloth or a fine stone.

3.4.2.2 Components shall be inspected as applicable for the following:

- (a) Cracked housings and supports.
- (b) Elongated holes.
- (c) Loose fitting dowel pins.

- (d) Worn, seized or rough turning bearings.
- (e) Chipped or excessively worn gear teeth.
- (f) Worn or bent shafts.
- (g) Weak springs.
- (h) Weak or worn circlips.
- (j) Worn detents and plungers.
- (k) Bent or worn selector forks.

3.4.2.3 The contractor shall use good judgement to the minimum of SAE Standards and Practices as to the serviceability of a component. If the serviceability of a component is in doubt, the component shall be replaced with a new or serviceable O.E.M. component and the unserviceable component held for QAA inspection and decision, see Figures 2 to 10 for component identification and location within the assembly.

3.4.2.4 The transmission housing and clutch lever shall be painted in accordance with 5.1 prior to assembly of the transaxle.

3.4.3 Assembly and Adjustments

3.4.3.1 General.- When choosing a new shims for adjustment, measure each shim at several different points with a micrometer. The thickness of available shims is such that it is possible to obtain any desired thickness to within a tolerance of ± 0.04 mm. Ensure new shims are undamaged and free from burrs. Do not install shims that are not in good condition.

3.4.3.2 Assembling the pinion shaft.- See Figure 41 and proceed as follows :

- (a) Press on taper roller bearing (2).
- (b) Heat fourth gear to 120°C and press the fourth gear onto the shaft with the fourth gear shoulder facing towards the third gear, see Figure 43. Wait approximately 3 minutes for heat transfer and press the gear fully home. (This is essential to assure accurate adjustment of axial play.)
- (c) Install the thickest circlip (4) that will fit into the gap, see Figure 44. See Figure 45 for a list of circlips.
- (d) Check the clearance between fourth gear and the circlip. Clearance should be 0.00 and not exceed 0.02 mm.

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- (e) Press the third gear (5) onto the shaft so that the third gear shoulder faces towards the second gear (8), see Figure 41.
- (f) Install a circlip (6).
- (g) Check the clearance between third gear and the circlip. The clearance should be 0.00 and not exceed 0.04 mm.
- (h) Adjust the clearance by selecting a suitable circlip. Keep as near as possible to the lower limit. Figure 46 lists available circlips.
- (j) Install the second gear needle bearing (7), see Figure 41.
- (k) Install second gear.
- (m) Install second gear synchronizing ring (15).
- (n) Check the clearance between the synchronizing ring and the second gear cone, see Figure 47. The gap, when new, is 1.0 to 1.77 mm. The minimum gap is 0.5 mm.
- (p) Press on the operating sleeve (16) and synchronizer hub (17) so that the fork groove faces towards first gear (10), see Figure 41. Ensure the ring grooves and keys are aligned.
- (q) Install the snap ring (13).
- (r) Check the clearance between the snap ring and the synchronizer hub. Clearance should be 0.00 and not exceed 0.04 mm. Adjust the clearance by selecting a suitable snap ring. Stay as near as possible to the lower limit of clearance. Figure 48 lists available snap rings.
- (s) Install the first gear synchronizing ring (12) ensuring that the ring grooves are aligned with the keys in the hub, see Figure 41.
- (t) Install the needle bearing (11) for first gear and install first gear (10).
- (u) Check the clearance between the synchronizing ring and first gear. Clearance should be between 1.00 and 1.70 mm when new. The minimum gap is 0.50 mm.
- (v) Install the roller bearing (9) by pressing on with Pressure Piece VW454 and Thrust Plate VW401. Check the clearance between the bearing and first gear, see Figure 49. Clearance should be between 0.10 and 0.40 mm.

3.4.3.3 Assembling the input shaft.- See Figure 42 and proceed as follows:

- (a) Install the needle bearing (3) for third gear (2).
- (b) Install the third gear (2) with the teeth facing towards second gear.
- (c) Install the synchronizing ring (1) for third gear.
- (d) Check the clearance between the synchronizing ring and the gear cone, refer to paragraph 3.4.3.2(n).
- (e) Press on the operating sleeve (11) and synchronizer hub (12) so that the wide shoulder of the hub faces towards the fourth gear (9). Ensure the cutaway portions on the synchronizer hub are aligned with the keys on the hub.
- (f) Install the snap ring (6).
- (g) Using a feeler gauge, check the clearance between the hub and the snap ring. Clearance should be between 0.00 and 0.50 mm. Adjust the clearance by selecting a suitable snap ring. Try to keep the clearance towards the lower value. Figure 50 lists available snap rings.
- (h) Check the clearance between the second and third gears. Clearance should be between 0.00 and 0.35 mm.
- (j) Install the needle bearing (8) for fourth gear, see Figure 41.
- (k) Install the fourth gear synchronizing ring (7) , ensuring that the cutaway portion on the ring aligns with the keys on the synchronizer hub (12).
- (m) Install the fourth gear (9) with the gear teeth away from the third gear (2).
- (n) Check the clearance between the synchronizing ring and the gear cone, refer to paragraph 3.4.3.2(n).
- (p) Install the circlip (10). Check the clearance between the fourth gear and the circlip, clearance should be between 0.10 and 0.35 mm. Keep to lower value.

3.4.3.4 Assembling the crown gear and carrier.- See Figure 24 and proceed as follows:

- (a) Mount the carrier (8) in a vise.
- (b) Heat the small carrier bearing (10) to about 100°C. Place the bearing on the end of the carrier and using Sleeve 40-21 press the bearing fully home, see Figure 51.

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- (c) Heat the large carrier bearing (14) to about 100°C. Place the bearing on the end of the carrier and using Tube VW415a and Thrust Plate VW447i press the bearing fully home, see Figure 52.
- (d) Heat the crown gear (13) to about 100°C and place the crown gear on the carrier. Ensure the bolt holes in the carrier and crown gear are aligned.

CAUTION

To prevent damage, do not torque the cap screws that secure the crown gear to the carrier until the crown gear and carrier have cooled.

- (e) Install the ten cap screws (12) and torque to 100 N.m. (74 ft-lb) in a diagonal sequence.
- (f) Apply hypoid gear oil to the side gears (2) and pinion gears (4).
- (g) Install the side gears with thinnest shims (0.5 mm) (1) in the carrier.
- (h) Apply a small amount of grease to the pinion gears to hold the thrust washers (3) in place and place a washer on each gear.
- (j) Install a pinion gear in each side opening of the carrier and turn the gears until the holes in the gears are aligned with the holes in the carrier for the shaft (7).
- (k) Install the top and bottom nuts (5) in the carrier.
- (m) Drive in the shaft until the hole in the shaft for the spring pin (9) is aligned with hole in the carrier.

NOTE

From this point onward the pinion gears and thrust washers must not be interchanged.

- (n) Press the pinion gears outwards, towards the carrier, and check the play of the side gears. If no play of the gears can be felt by hand and the gears turn easily without sticking, it is not necessary to adjust the side gears. The maximum allowable play of the side gears is 0.10 mm. Adjust the side gears if necessary. Proceed as follows:
 - i Tap out the side gear shaft.
 - ii Remove the pinion gears and thrust washers.

- iii Remove the side gears and shims.
 - iv Choose new shims for the side gears so that the play of the side gears is not greater than 0.10 mm. Figure 53 lists the shims that are available for side gears.
 - v Repeat steps (g) through (m).
- (p) Tap in the spring pin (9) to secure the shaft.

3.4.3.5 Crown gear and pinion adjustments.- Proceed as follows:

- (a) Careful adjustment of the crown gear and pinion is essential to ensure that the transaxle gives long service and runs silently. During manufacture, the crown gear and pinion are matched and run on special testing machines to ensure a correct mesh pattern and silent running in both directions. The position for quietest running is obtained by moving the pinion axially and lifting the crown gear away from the no-play meshing position to maintain the backlash within the specified tolerances. See Figure 54 for the adjustments and identification markings of the crown gear and pinion.
- (b) Figure 55 shows the location of the shims that affect the crown gear and pinion settings. Adjust the crown gear and pinion settings in the following order:
 - i Determine the total shim thickness for the crown gear, S Total (S1 plus S2), to give the specified preload of the differential carrier bearings.
 - ii Determine the total shim thickness for the pinion, S Total (S3 plus S4), to give the specified preload of the pinion bearings.
 - iii Distribute the total shim thickness for the pinion between S3 and S4 in order that the distance from the center axis of the crown gear to the face of the pinion corresponds to dimensions "R", see Figure 54, as determined during manufacture.
 - iv Distribute the total shim thickness for the crown gear between S1 and S2 to obtain the specified backlash between the crown gear and pinion.

3.4.3.6 Installing bearing races.- Proceed as follows:

- (a) Heat the differential housing or the area around the bearing race for the pinion to 150°C and drive the bearing race into the housing with Thrust Pad 3062 and Needle Bearing Drift VW295, see Figure 56. Do not install the adjusting shims at this time. Hold the race in place with the press for 1 or 2 minutes until the heat transfer has taken place.

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NOTE

The differential housing can be heated with a hot air blower, cleaning equipment, water bath or steam jet. A soft welding flame can also be used but care must be taken to heat the complete area around the bearing race seat as constantly and evenly as possible in order to avoid stress and distortion to the housing.

- (b) Drive the bearing race of the left carrier bearing fully home with Thrust Pad VW511 and Needle Bearing Drift VW295, see Figure 57. Do not install the adjusting shims at this time.
- (c) Press the bearing race of the differential flange assembly fully home with Thrust Pad VW472/1, see Figure 58. Do not install the adjusting shims at this time.
- (d) Press the pinion bearing race into the transmission housing with Thrust Pad VW511, see Figure 59. Do not install the adjusting shims at this time.

3.4.3.7 Carrier bearing preload adjustment "S Total"(S1 + S2)

- (a) Place the carrier in the differential housing ensuring the crown gear teeth are towards the differential flange.
- (b) Install the differential flange and eight cap screws. Torque the cap screws to 25 N.m (18 ft-lb) in a diagonal sequence.
- (c) Install Dial Gauge Bracket VW387, End Plate (50 mm) VW385/17, Dial Gauge V/35.1 and a dial gauge extension that is about 85 mm long on the carrier, see Figure 60 and use an M8X40 capscrew 70 to prevent damage to the differential housing.
- (d) Set the dial gauge to zero with a 1-mm preload.
- (e) Move the carrier up as far as it will go and note the reading (example reading: 1.42 mm).

NOTE

Do not turn the crown gear, otherwise the bearings will settle and measurement will be incorrect.

- (f) Determine the total shim thickness, S Total, where total shim thickness equals the dial gauge reading plus the preload allowance which is a constant value of 0.50 mm. Note the following example:

Preload allowance (constant value)	0.50 mm
Dial gauge reading (example only)	+ <u>1.42 mm</u>
Total shim thickness (S Total)	<u>1.92 mm</u>

- (g) Remove dial gauge and differential flange.
- (h) Using a brass drift and hammer, tap the bearing race from the differential flange.
- (j) Choose shims of the correct thickness from those shims available for S Total and S2, see Figure 61.
- (k) Install the total shim thickness (as eg 1.92 mm) in the housing.
- (m) Using Thrust Piece VW472/1, press the bearing race fully home.

3.4.3.8 Carrier turning torque measurement. - Proceed as follows:

- (a) Lubricate the carrier bearings with hypoid gear oil.
- (b) Place the carrier in the housing and install the differential flange and cap screws. Torque the cap screws to 25 N.m (18 ft-lb) in a diagonal sequence.
- (c) Install Split Sleeve VW521/8, Adapter VW521/4 in the carrier and attach a torque gauge with a range of 0 to 600 N.cm (0 to 53.1 in-lb), see Figure 62, and measure the turning torque. If new carrier bearings have been installed on the carrier, the turning torque must be at least 250 N.cm (22.1 in-lb). If used bearings have been installed, the turning torque must be at least 30 N.cm (2.6 in-lb). Remove split sleeve and adapter from differential carrier.
- (d) Use a brass drift and a hammer to remove the differential flange and crown gear and carrier.

3.4.3.9 Pinion bearing preload adjustment "S Total" (S3 + S4). - Proceed as follows :

- (a) Install the preassembled pinion shaft in the differential housing.
- (b) Install the transmission housing on the differential housing using four short capscrews and torque them to 25 N.m (18 ft-lb).
- (c) Install End Plate VW385/17, Dial Gauge Bracket VW387, a threaded rod, (one of the set of Bolts VW294b/3) and a dial gauge, see Figure 63.
- (d) Set the dial gauge to zero with a 1-mm preload.
- (e) Move the pinion up as far as it will go and note the dial gauge reading (example reading: 1.30 mm).

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CAUTION

Do not turn the pinion shaft when taking this measurement, otherwise the bearings will settle and upset the reading.

- (f) Determine the total shim thickness, S Total ($S3 + S4$), where total shim thickness equals the dial gauge reading plus the preload allowance which is a constant value of 0.30 mm. Note the following example:

Preload allowance (constant value)	0.30 mm
Dial gauge reading (example only)	<u>+1.30 mm</u>
Total shim thickness (S Total)	<u>1.60 mm</u>

- (g) Remove the dial gauge and threaded rod from the transmission housing.
- (h) Remove the transmission housing.
- (j) Tap the bearing race out of the transmission housing with a brass drift and hammer.
- (k) Choose shims of the correct thickness from those shims available for S Total and S4, see Figure 64, and install the shims, amounting to the total shim thickness, behind the bearing race in the transmission housing.
- (m) Press the bearing race into the transmsion housing with Thrust Pad VW511.

3.4.3.10 Pinion Adjustment (S3 and S4)

3.4.3.10.1 Adjustment. - After installing the shims for the pinion preload adjusment, S Total, distribute the S Total between S3 and S4. To adjust, proceed as follows:

- (a) Install the transmission housing on the differential housing and torque the cap screws to 25 N.m (18 ft-lb).
- (b) Turn the pinion several times in both directions to settle the pinion bearings.
- (c) See Figure 65 and assemble the universal measuring bar as follows:
- AdjustthesettingringofUniversalMeasuringBarVW385/1 to 50 mm (centre of hole to outside edge of ring, Distance "a").
 - Install Dial Gauge Extension VW385/15(9.3 mm)on Measuring Rod 30 mm VW385/14 and install on Measuring Bar VW385/1.

- iii Install the dial gauge fully in the end of the measuring bar. Extract the gauge 1 mm and lock it.
- iv Set the Master Gauge VW385/30 to "Ro" which is 59.65 mm, see Figure 54, and install the gauge on the measuring bar.
- v Set the dial gauge to "0".
- (e) Remove Master Gauge VW385/30 from the measuring bar.
- (f) Move the adjustable setting ring as far back as it will go.
- (g) Install End Plate 50-mm VW385/17 on the end of the pinion.
- (h) Insert the measuring bar through the differential housing. Ensure dial gauge pin contacts centre of 50-mm end plate and install the differential flange and four cap screws, see Figure 66. Failure to maintain contact between the dial gauge pin and 50-mm end plate during the following procedure could result in the 50-mm end plate being dislodged from the pinion shaft.
- (j) Move the second centring disc outward with the adjustable setting ring until the measuring bar will just turn by hand.
- (k) Turn the measuring bar slightly until the dial gauge defects approximately 0.2 mm lower. Then turn the measuring bar in opposite direction until the dial gauge shows maximum deflection.
- (m) Note the counter-clockwise reading in red figures (example reading: 0.46 mm) and calculate the shim thickness for S3, where S3 equals "e" plus "r" ("e" is the dial gauge reading at maximum deflection and "r" is the deviation marked on the crown gear, see Figure 3-4-44). Note the following example:

e	0.46 mm
r	<u>+0.18 mm</u>
S3	<u>0.64 mm</u>

- (n) See Figure 67 for a list of shims for S3 and choose shims that will provide the correct thickness.
- (p) Determine the thickness of S4 where S4 equals S Total minus S3. Note the following example:

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S Total	1.60 mm
S3	<u>-0.64 mm</u>
S4	<u>0.96 mm</u>

- (q) See Figure 64 for a list of shims for S4 and choose shims that will provide the correct thickness.
- (r) Remove the differential flange and measuring bar.
- (s) Remove the transmission housing and pinion shaft. Tap out the bearing race and preload adjusting shims from the transmission housing.
- (t) Install the newly selected S4 shims in the transmission housing and press the bearing race fully home with Thrust Pad VW511.
- (u) Remove the bearing race from the differential housing with Arbor 2050 and Sliding Hammer VW771.
- (v) Heat the front differential housing or the area around the bearing race for the pinion to 150°C and drive the bearing race and S3 shims into the housing with tool Thrust Pad 3062 and Needle Bearing Drift VW295. Hold the race in place for 1 or 2 minutes until the heat transfer has taken place.

NOTE

The differential housing can be heated with a hot air blower, cleaning equipment, water bath or steam jet. A soft welding flame can also be used but care must be taken to heat the complete area around the bearing race seat as constantly and evenly as possible in order to avoid stress and distortion to the housing.

- (w) Check Dimension "r", see Figure 54, after installing the pinion adjusting shims:
 - i Install the pinion shaft in the differential housing.
 - ii Install the transmission housing, cover and cap screws. Torque the cap screws to 25 N.m (18 ft-lb). Turn the pinion in both directions several times.
 - iii Repeat steps (c) through (k) and note the reading. If the correct shims have been installed, the dial gauge counter-clockwise reading, in red figures, will be the same as Deviation "r", which is marked on the crown gear to within ± 0.04 mm.

- iv Remove the differential flange and measuring bar.
- (x) Remove the transmission cover and housing and lubricate the pinion bearings with hypoid gear oil.
- (y) Install the transmission housing and cover and torque the cap screws to 25 N.m (18 ft-lb).
- (z) Install an M10 x 20 capscrew in the end of the pinion shaft. Using a torque gauge with a range of 0 to 600 N.cm, measure the turning torque, see Figure 68. If new pinion bearings have been installed, the pinion turning torque must be 200 to 400 N.cm (17.7 to 35.4 in-lb) and for used bearings 30 to 60 N.cm (2.6 to 5.3 in-lb). Remove the M10 x 20 capscrew from the pinion shaft.

3.4.3.11 Crown gear backlash adjustment (S1 and S2).- Proceed as follows:

- (a) Remove the transmission housing and pinion shaft from the differential housing. Place the carrier in the differential housing
- (b) Install the pinion shaft in the differential housing.
- (c) Install the transmission housing and cap screws.
- (d) Turn the pinion in both directions to settle the tapered roller bearings.
- (e) Install the differential flange and eight cap screws. Torque the cap screws to 25 N.m (18 ft-lb).
- (f) Install Dial Gauge Bracket VW387, using an M8 x 40 capscrew, Adjustable Measuring Lever VW388, Adapter VW521/4, Split Sleeve VW521/8, Dial Gauge V35.1, and Dial Gauge Extension VW382/10, see Figure 69.
- (g) Adjust Measuring Lever VW388 to 79 mm (from Adapter VW521/4 to end of lever). Tighten locking screw on Measuring Lever VW388.
- (h) Turn Adapter VW521/4 counter-clockwise and set the dial gauge to zero.
- (j) Without moving the pinion, turn Adapter VW521/4 clockwise and record the reading.
- (k) Repeat measurement another three times, turning the crown gear through 90° each time, and record the readings.

NOTE

If the difference between any of the four backlash readings is greater than 0.06 mm, either the crown gear and pinion are not installed correctly, or they are

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defective. Ensure the crown gear and pinion are installed correctly and, if necessary, install a new crown gear and pinion.

- (m) Add the four readings together and divide by 4 to calculate the average backlash. Note the following example:

First reading	0.84 mm
Second reading	0.85 mm
Third reading	0.84 mm
Fourth reading	<u>0.83 mm</u>
Total	<u>3.36 mm</u>

$$\text{Average backlash} = 3.36 \text{ v } 4 = 0.84 \text{ mm.}$$

- (n) Calculate the shim thickness for S2 where S2 equals S Total minus average backlash plus required final backlash (constant value of 0.15 mm). Note the following example:

S Total (S1 + S2)	1.92 mm
Average backlash	<u>-0.84 mm</u>
	1.08 mm
Required final backlash	<u>+0.15 mm</u>
S2	<u>1.23 mm</u>

- (p) Choose shims of the correct thickness for S2. Figure 61 lists shims for S2.

- (q) Calculate the shim thickness for S1 where S1 equals S Total minus S2. Note the following example:

S Total	1.92 mm
S2	<u>-1.23 mm</u>
S1	<u>0.69 mm</u>

- (r) Choose shims of correct thickness for S1. Figure 70 lists shims for S1.

- (s) Remove the transmission housing, pinion shaft, and differential flange, and the carrier from the differential housing.
- (t) Using a brass drift and hammer, remove the bearing race and shims from the differential flange.
- (u) Install the newly selected shims for S2 in the differential flange and press the race into the flange with Thrust Piece VW472/1.
- (v) Using a brass drift and hammer, remove the carrier bearing race from the differential housing.
- (w) Install the newly selected shims for SI in the differential housing and drive the bearing race into the housing with Needle Bearing Drift VW295 and Thrust Pad VW511.
- (x) Check the crown gear backlash. Proceed as follows:
 - i Place the crown gear and carrier in the differential housing.
 - ii Install the differential flange and eight cap screws. Torque the cap screws to 25 N.m (18 ft-lb).
 - iii Install the pinion shaft and transmission housing.
 - iv Set up the dial gauge as previously done for backlash adjustment, see Figure 69.
 - v Repeat steps (g) to (k). Start the measurement at a different point each time. The backlash must be 0.10 to 0.20 mm each time and the difference between any of the four readings must not be greater than 0.05 mm.
- (y) Remove the measuring tools.

3.4.3.12 Drive flange adjustment (Right Side).- Between the half shaft gear and spacer, there must be a clearance of 0.20 to 0.50 mm. To adjust the clearance, proceed as follows:

- (a) Measure Dimension "a" from the inner race of the tapered roller bearing on the carrier to the outer edge of the differential flange, see Figure 71. Allow for the thickness of the straight edge when measuring.
- (b) Choose a shim of the correct thickness for Dimension "a". Figure 72 lists available shims.
- (c) Remove the differential flange.
- (d) Remove the carrier from the housing.

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- (e) Install the shim and spacer against the larger carrier bearing.

3.4.3.13 Spacer adjustment (non-locking differential).- Proceed as follows:

- (a) Install setting shims in the end of the carrier on top of the nut. One of the shims must be 0.30 mm thick and the two other shims 0.90 mm thick for a total thickness of 2.10 mm.
- (b) Install the half shaft, needle bearing, right drive flange, washer and centre bolt and torque the bolt to 25 N.m (18 ft-lb).
- (c) Lift up the drive flange and measure the gap between the half shaft gear and spacer with a feeler gauge, see Figure 73.
- (d) See Figure 74 and choose a shim that is the correct thickness. More than one shim may be required.
- (e) Remove the drive flange, half shaft, needle bearing and setting shims from the carrier.
- (f) Install the newly selected shim(s) in the end of the carrier.
- (g) Install the half shaft, needle bearing, drive flange, washer and centre bolt and measure the gap between the half shaft gear and spacer. The gap should be 0.20 to 0.50 mm.

3.4.3.14 Installing the input shaft bearing.- To install, press the input shaft bearing into the transmission housing with Needle Bearing Drift VW295 and Thrust Pad 30-507, see Figure 75.

3.4.3.15 Installing the countershaft needle bearing.- To install, press the needle bearing into the transmission housing with Mandrel 30-505 and Installer 40-503, see Figure 76.

3.4.3.16 Assembling the transmission.- The outer races and S3 and S4 adjusting shims for the pinion were installed during the pinion adjustment. To assemble, see Figure 29 and proceed as follows:

- (a) Using grease, install the short, interlock plunger in the housing between the opening for the first and second gear shifter rod and the opening for third and fourth gear shifter rod. See Figure 77.
- (b) Install the detent and spring (unpainted) in the opening (centre hole) for the third and fourth gear shifter rod. Ensure the detent faces up.
- (c) Using grease, install the long, interlock plunger in the housing between the opening for the cross-country and reverse gear shifter rod and the opening for the third and fourth gear shifter rod, see Figure 77.

- (d) Install the first and second shifter rod (17) and selector fork (18) on the synchronizing hub of the pinion shaft (16) and insert the pinion shaft and shifter rod into the housing (3).
- (e) Install the countershaft reverse gear (4) in the housing. Ensure the shoulder of the gear faces towards the differential end of the housing.
- (f) Insert the countershaft (1) into the housing.
- (g) Install the thrust washer (5) on the countershaft and press the first inner race (6) for the bearing onto the shaft.
- (h) Install the bearing (7). Ensure the groove in the bearing outer race faces towards the differential end of the housing and the groove is aligned with the groove in the housing.
- (j) Using Adapter 295A, install the second inner race (8) into place on the countershaft.
- (k) Measure the width of the circlip groove in the housing and choose a snap ring (10) that is the correct thickness. Install the snap ring in the housing. Figure 78 lists available circlips.
- (m) Measure the gap between the circlip and bearing (7) and choose a retaining washer (9) that is the correct thickness, see Figure 79. Figure 80 lists available washers.
- (n) Remove the circlip and install the newly selected retaining washer and circlip. Ensure the locking lip of the washer fits into the bearing groove.
- (p) Clamp the countershaft in a soft-jawed vise to prevent the shaft from turning and install a washer (11) and socket head cap screw (12) on the end of the shaft. Torque the cap screw to 25 N.m (18. ft-lb).
- (q) Install the input shaft bearing race (31) on the input shaft (13).
- (r) Install the assembled input shaft in the housing.
- (s) Install the ball bearing (30) on the end of the input shaft and install the bearing race (29). Ensure the groove in the bearing race aligns with the groove in the housing.
- (t) Install the washer (28) and socket head screw (27) and torque to 25 N.m (18 ft-lb).

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- (u) Determine the thickness of the retaining washer (26) for the input shaft:
 - i Measure Dimension "a" from the transmission housing to the outer race of the input shaft bearing with a depth gauge, see Figure 81. Ensure the ball bearing is against the roller bearing.
 - ii Choose a retaining washer of the correct thickness. Figure 82 lists available washers. Install the retaining washer ensuring the locking lip of the washer aligns with the groove in the housing and bearing.
 - iii Install the retaining washer, the support plate (25) and four cap screws (24). Torque the cap screws to 25 N.m (18 ft-lb).
- (v) Install the selector fork (15) for third and fourth gear on the input shaft synchronizing hub.
- (w) Insert the shifter rod (21) for third and fourth gears into the center opening in the housing and through the selector fork. Ensure the 3-4 interlock pin (22) is in the shifter rod.
- (x) Insert the cross-country and reverse gear shifter rod (23) into the remaining opening in the housing. Ensure the lug on the rod points towards the countershaft (1). The third and fourth gear shifter rod (21) must be in its neutral detent position.
- (y) If required, install the spring pin in the reverse and cross-country shifter rod.
- (z) Install the operating link on the first and second gear shifter rod with cap screws and torque to 15 N.m (11 ft-lb), see Figure 83.
- (aa) Install the spring pin (14) in the selector fork (15) and shifter rod (21) for third and fourth gear.
- (bb) Install the gear detent plugs, detents, springs (green) and new washers for the first and second gears and the cross-country and reverse gears .
- (cc) Install the centre gear detent plug for third and fourth gear.
- (dd) Determine the thickness for the pinion shaft shim for reverse gear. Proceed as follows:
 - i Measure Dimension "a" from the transmission housing to the pinion bearing with a depth gauge, see Figure 84. Ensure the pinion shaft is held in place while measuring.

- ii Select a shim that is the correct thickness. Figure 85 lists pinion shaft shims for reverse gear.
- iii Install the reverse gear adjusting shim (1) and thrust washer (2) on the pinion shaft, see Figure 28.
- (ee) Install the reverse gear (3) on the pinion shaft. Ensure the dog clutch faces away from the housing.
- (ff) Install the reverse gear needle bearing (5) and bushing (4) onto the pinion shaft and into the reverse gear.
- (gg) Install the hub (6) and sleeve (7) on the pinion shaft. Ensure the flat side of the hub faces away from the housing.
- (hh) Move all gears into neutral.
- (jj) Install the selector fork (8) for reverse and cross-country gears on the operating sleeve (7) ensure the selector fork engages the lug of the reverse and cross-country gear selector rod. Ensure the flat side of the fork is nearest the transmission housing.
- (kk) Install the needle bearing (10) and bushing (9) for the cross-country gear (11) on the pinion shaft.
- (mm) Install the cross-country gear (11) and thrust washer (12) on the pinion shaft. Ensure the dog clutch side of the gear faces towards the selector fork.

3.4.3.17 Assemble the transmission cover.- See Figure 38 and proceed as follows:

- (a) Install the reverse warning light switch plug (11) and seal (10).
- (b) Press the pinion shaft roller bearing (12) into the cover with Thrust Plate VW447i and Punch VW407, see Figure 86.

NOTE

The cover can be heated with a hot air blower, cleaning equipment, water bath or steam jet. A soft welding flame can also be used but care must be taken to heat the complete area around the bearing race seat as constantly and as evenly as possible in order to avoid stress and distortion to the cover.

- (c) Install the countershaft roller bearing (15) in the cover with Needle Bearing Drift VW295 and Bearing Installer 30-204, see Figure 87.

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- (d) Install the circlip (16) in the cover.
- (e) Install the thrust washer (8) with the two flats in the cover. Ensure the tapered shoulder of the washer faces towards the back end of the cover and the flat portion of the washer faces the countershaft bearing (15).
- (f) Install the notched thrust washer (5) in the cover. Ensure the notch is towards the threaded hole for the oil trap lock screw (1) and the tapered portion of the washer faces towards the front of the cover.
- (g) Install the two needle bearings (6) in the idler gear (7) and place the gear in the cover ensuring the angular grooves are towards the flats of the thrust washer (8).
- (h) Insert the idler gear shaft (3) into the cover and through the bearings. Ensure the screw hole in the shaft is aligned with the screw hole in the transmission cover and the flat portion of the shaft is in line with the flat portion on the bottom of the thrust washer (8).
- (j) Apply sealer to the threads of the shaft lock screw (4) and install the screw. Torque to 25 N.m (18 ft-lb).
- (k) Install the oil trap (2). Ensure the rounded portion of the trap fits in the groove in the transmission housing, and against the idler gear shaft.
- (m) Install the oil trap lock screw (1). Ensure the screw fits into the notch in the top thrust washer (5) and torque the screw to 25 N.m (18 ft-lb).

3.4.3.18 Assemble the differential flange.- The bearing race and S2 shims were installed during the Crown Gear Backlash Adjustment. See Figure 23 and proceed as follows:

- (a) Mount the flange (13) in a vise.
- (b) Install the magnet (21) on the flange and tap in the spring pin (20).
- (c) Install the selector fork (15) on the sliding collar (17). Ensure the shoulder at the top of the fork faces towards the race in the flange and place the fork and collar in the flange.
- (d) Insert the selector shaft (14) into the flange (13) from the race side of the flange. Ensure the small, splined end of the shaft enters the flange first.

- (e) Install the circlips (6 and 16) on the end of the selector shaft.
- (f) Install a new seal (5) on the end of the selector shaft with the lips of the seal facing in and, using Tube VW421, drive in the seal until it is flush with the flange, see Figure 88.
- (g) Insert the detent (12) and spring (11) into the flange and install the plug (9) and a new seal (10).
- (h) Install the extension shaft (8) and the two-wheel drive sending unit (7).

3.4.3.19 Installing the clutch housing starter bushing.- To install, drive the clutch housing starter bushing into the housing with Bushing Installer B183012363, see Figure 89.

3.4.3.20 Installing the input shaft needle bearing.- Ensure the lettering on the race faces out, away from the differential housing, and drive the bearing into the housing with Installer 40-503 and Needle Bearing Drift 30-505 until the bearing is flush with the housing, see Figure 90.

3.4.3.21 Assembling the differential.- To assemble, proceed as follows:

- (a) Place the carrier in the differential housing. Ensure the crown gear faces towards the differential flange.
- (b) Install the drive flange adjusting shim and spacer on the large carrier bearing.
- (c) Apply sealing compound and place the flange on the differential housing.
- (d) Install nine cap screws and torque to 25 N.m (18 ft-lb).
- (e) Install the drive flange shim in the open end of the carrier shaft.
- (f) Grease two, new, oil seals and install the seals one at a time with Seal Installer 3025, see Figure 91. Use end "A" of Seal Installer 3025 for the inner seal and end "B" for the outer seal. Ensure the spring side of each seal faces in, towards the shifter fork. Ensure grease is applied to the seals at the points shown in Figure 92.
- (g) Install the half shaft in the carrier. Ensure the splines of the shaft are aligned with the splines of the sliding collar.
- (h) Install the needle bearing and drive flange on the half shaft. Ensure the drive flange is engaged in the sliding collar.
- (j) Install the washer on the drive flange. Ensure the hole in the washer is engaged on the split pin.

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- (k) Install the centre bolt and torque it to 25 N.m (18 ft-lb).
- (m) Apply sealing compound and install the drive flange cover.
- (n) Install the interlock shaft (2), see Figure 17, and cover (4) and secure with three socket head cap screws. Torque the cap screws to 15 N.m (11 ft-lb).
- (p) Install a new seal on the shaft and install the interlock lever (1) on the shaft, ensuring the lever points down. Tap in a spring pin (3) to secure the lever.
- (q) Install the speedometer drive gear on the end of the carrier nearest the crown gear with the shoulder to the outside and ensuring it engages in the shaft.
- (r) Grease the lip of a new oil seal and install with Seal Installer 3024. Drive in the seal until the outer end of the seal is 9.00 to 9.50 mm inside the housing, see Figure 93. Ensure the lip of the seal faces inward. Use end "A" of Seal Installer 3024.
- (s) Install the drive flange by turning it until the splines engage and push the flange home.
- (t) Install the centre bolt and torque the bolt to 25 N.m (18 ft-lb).
- (u) Install the speedometer driven gear and bushing in the differential housing.

3.4.3.22 Installing transmission to differential housing.- To install, proceed as follows:

- (a) Ensure the cross-country locking catch is in the correct position to allow the cross-country and reverse shifter rod to engage in the differential housing, see Figure 94.
- (b) Install the assembled transmission on the differential housing and install two dowels and two, short cap screws. Torque the cap screws to 25 N.m (18 ft-lb).
- (c) Place a gasket and sealer on the transmission housing and install the cover.
- (d) Install two dowels for the transmission cover and housing.
- (e) Install the two short cap screws and torque to 25 N.m (18 ft-lb).
- (f) Install the ten long cap screws and torque to 25 N.m (18 ft-lb) in a diagonal sequence.

- (g) Install a new "O" ring seal on the shaft for the selector fork and insert the shaft into the transmission cover and install a spring pin.
- (h) Grease and install two new output oil seals, one at a time, with Seal Installer 3026, see Figure 95. Use end "A" of Installer 3026 to install the inner seal and end "B" for the outer seal. Ensure the lip of the inner seal faces in and the dust shield lip of the outer seal faces out. Apply plenty of grease to the seals in that areas indicated in Figure 96.
- (j) Install the propeller shaft drive flange with Remover Installer VW391.
- (k) Install Counter Holder Matra 3028 on the drive flange and install the flange securing nut, see Figure 97. Torque the nut to 150 N.m (111 ft-lb) and lock the nut onto the shaft. The nut can only be used twice.
- (m) Install the cap in the propeller shaft drive flange.
- (n) Install the two-wheel drive lever on the selector shaft ensuring the scribe marks on the shaft and lever are aligned.
- (p) See Figure 98 and adjust the two-wheel drive lever. Proceed as follows:
 - i Move the interlock lever fully forward.
 - ii Move the two-wheel drive lever fully forward.
 - iii Measure the distance between the centre points on the levers. The distance should be 102 mm.
 - iv If the distance between the centre points is not 102 mm, reposition the two-wheel drive lever on the splines until the measurement is correct.
 - v When the drive lever is in the correct position, install the bolt and washers. Secure with a plastic nut.

3.4.3.23 Installing the transaxle input shaft oil seal. - To install, proceed as follows:

- (a) Lubricate the seal with grease.
- (b) Install a protective sleeve over the splines to avoid damage to the seal.
- (c) Lubricate and slide the seal over the sleeve, lip side first, and start it squarely into the housing.

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- (d) Remove the protective sleeve from the splines.
- (e) Position Seal Installer VW454 and Driving Sleeve Matra 30-100 against the seal and drive it into the housing, see Figure 99.

NOTE

Do not grease the guide sleeve.

- (f) Install the guide sleeve and locking collar with the three cap screws and torque to 15 N.m (11 ft-lb).

3.4.3.24 Installing the clutch release bearing shaft and seals.- See Figure 14 and proceed as follows:

- (a) Place the bushing (5) on Needle Bearing Drift VW295.
- (b) Insert the drift through the shaft opening in the housing, see Figure 100.
- (c) Drive home the bushing.
- (d) Install the new lightly lubricated 0-ring (10) in the groove in the housing.
- (e) Install a new release shaft stop (8) with the feet facing down.
- (f) Lubricate the inside of the shaft bushing (5).
- (g) Install the spring (9) on the shaft (7) with the straight end pointing up towards the housing and position the release shaft in the housing.
- (h) Insert the end of the shaft into the bushing (5).
- (j) Tap the end of the shaft until one arm of the shaft (7) is in line with the groove on the stop.
Tap the arms down as far as they will go.
- (m) Lubricate the plastic bushing (11).
- (n) With the lug on the bushing facing outwards, fit the lug into the groove in the housing, and tap the bushing all the way into the housing.
- (p) Grease a new 0-ring (12). Install the 0-ring on the shaft and push it into the recess in the bushing.
- (q) Install the bushing cap (13). Push the cap on until its inner edge seats on the 0-ring (12) on the bushing.

- (r) Install the circlip (14).
- (s) Using brake spring pliers and a screwdriver, work the spring (9) towards the middle of the shaft until it is on the left-hand side of the left arm of the shaft. Hook the end of the spring over the left arm of the shaft.
- (t) Install the clutch lever so that the end of the lever is in line with the lower edge of the boss on the flywheel housing, see Figure 101.
- (u) Install the cap screw, two flat washers and nut. Torque to 25 N.m (18 ft-lb).

3.4.3.25 Installing the clutch release bearing.- See Figure 14 and proceed as follows:

- (a) Slide the bearing (2) over the guide sleeve(6).
- (b) Hook the securing springs (1) onto the fingers of the shaft (7). Ensure the springs properly hook behind the fingers.

3.4.3.26 Installing the transaxle supports.- To install, proceed as follows:

- (a) Install the left and right supports on the transaxle with three spring washers and three hexagon head cap screws in each support.
- (b) Torque the cap screws to 40 N.m (30 ft-lb).

3.4.3.27 Adjustments required for replaced parts

3.4.3.27.1 General.- The replacement of certain transaxle components necessitates that adjustments be made, see Figure 102.

3.5 Rebuild standards.- Table -IV lists the rebuild standards for the transaxle assembly. These standards shall be strictly adhered to.

3.6 Torque standards.- Table V list the torque standards that shall be used when rebuilding the transaxle assembly.

3.7 Special tools.- Table VI lists all the special tools recommended for use in the rebuild of the transaxle assembly. Tools other than those listed must meet the approval of the Quality Assurance Authority.

3.8 Dynamometer test.- A dynamometer test shall be made on each rebuilt transaxle assembly as follows:

3.8.1 Fill transaxle to the full mark with multi-purpose gear lubricating oil 80W90 to MIL-L-2105.

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3.8.2 Provision shall be provided to drive the transaxle under "no-load" and "load" conditions and to shift the gears both up and down through the total gear range and engage and disengage two-wheel drive.

3.8.3 transaxle shall operate at least 1 minute at 1000-2000 input RPM to comply with the requirements specified at 3.8.2 to ensure that all interior parts are coated with lubricant and that gear changes are made smoothly and easily. It should not be possible to engage cross-country gear with two-wheel drive engaged. Objectional noises originating in the transaxle or failure to engage or disengage the gears easily and smoothly during the dynamometer test shall be cause for rejection.

3.8.4 The components listed at Table VII shall be Government Supplied Material (GSM) to the contractor to provide a means for shifting.

4. QUALITY ASSURANCE PROVISIONS

4.1 Inspection requirements.- DND Quality Assurance at source is required. The contractor is responsible for carrying out inspections and processing to the approval of the Quality Assurance Authority.

4.1.1 The contractor's system of inspection shall meet the requirements of AQAP-4.

4.1.2 The Quality Assurance Authority reserves the right to perform any inspections considered necessary to ensure that material and services conform to specified and contractual requirements.

5. PAINTING, PRESERVATION, PACKAGING AND MARKING

5.1 Painting.- All openings, threads and machined surfaces of the transmission housing shall be masked prior to the following painting procedure. The transmission and clutch lever shall be the only components painted.

- (a) Prime with a 0.0005-inch thick coat of vinyl wash primer, Pittsburg Y-4002 or equivalent.
- (b) Apply a 0.0015-inch thick coat of red oxide primer, Pittsburg Y-70138 or equivalent.
- (c) Apply a 0.0015-inch thick coat of vinyl black finish paint, Pittsburg Y-011 or equivalent.

5.2 Preservation.- After final acceptance by QAA the transaxle shall be preserved in the following manner:

- (a) Drain the gear oil and reinstall the plug.

- (b) Place the transmission in neutral.
- (c) Place a plastic cap in the gear shift lever opening.
- (d) Remove the clutch release bearing and pack in accordance with 10.5.2(c) and 10.5.3.2 in Appendix 1.
- (e) Coat all machined surfaces with compound, corrosion preventive, solvent cutback, cold application soft film to 31-GP-3 and wrap with barrier material, water-vapour proof, flexible, heavy to MIL-B-131 and seal with tape adhesive, pressure sensitive, water resistant to 43-GP-3M.
- (f) The speedometer driven gear and bushing and the two-wheel drive switch shall be sealed with tape adhesive, pressure sensitive, water resistant 43-GP-3M.

5.3 Packaging.- A legible stamped or engraved metal plate shall be attached to the transaxle in an approved location showing the following information:

- (a) Name of firm or workshop that rebuilt the transaxle.
- (b) Day, month and year of transaxle rebuild.
- (c) Firm or workshop order number.

5.3.1 The transaxle shall be properly supplied with:

- (a) CF 942, NSN 8135-21-872-2435, Identity and Condition Tag.
- (b) CF 2248, NSN 7530-21-870-3866, Lubrication Record for Shipment and Preservation Tag.
- (c) Instructions for depreservation.

5.3.2 Prior to placing the transaxle assembly into the shipping and storage container, the container shall be inspected and the following steps performed as required:

- (a) Perform any repairs.
- (b) Paint the base and cover in accordance with one coat of primer to 1-GP-84 and one coat of enamel paint Olive Drab 503-321 to 1-GP-12.
- (c) Mandatory Parts Replacement - Table I lists hardware and components of the container that shall be replaced with new O.E.M. components; see Figure 103 for component identification.

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- (d) Container components - Table IX lists all of the components of the shipping and storage container. All components less Mandatory Parts Replacement shall be inspected and replaced with new O.E.M. components as required, see Figure 103 for component identification.

5.3.3 The transaxle assembly shall be placed and secured on the holding brackets on the base of the shipping and storage container.

5.3.4 Table VIII lists components that shall remain in their original or rebuilt packaging and be secured around the transaxle assembly in the base of the container. A checklist will accompany the components.

5.3.5 The cap screws holding the two halves of the container together shall be torqued to the value stipulated by the container manufacturer.

5.3.6 The container shall be pressurized with dry air in a manner and to the pressure stipulated by the container manufacturer.

5.4 Marking.-The shipping and storage container shall have the following stencilled on each end:

- (a) Transaxle NSN.
- (b) TRANSAXLE ASSEMBLY - ILTIS.
- (c) MRN - B 183 398 101.
- (d) QTY - 1.
- (e) WT. -
- (f) Date of transaxle rebuild.

5.4.1 The following shall be stencilled on both sides:

REUSABLE CONTAINER - DO NOT DESTROY CF PROPERTY

5.4.2 The contractor shall install an aluminum plaque on the container with the following data stamped on it:

- (a) Name of rebuild contractor or workshop.
- (b) Work order number of contractor or workshop.
- (c) Date of rebuild.
- (d) Transaxle NSN.

6. NOTES

6.1 Ordering data.- Procurement documents should specify the title, number, and date of this specification.

6.2 Design Authority.- The Design Authority is the Director of Support Vehicles Engineering and Maintenance.

6.3 Quality Assurance Authority.- The Quality Assurance Authority will be stipulated in the contract.

6.4 Returnable parts.- All components that fail to meet standards shall be returned to DND through the Quality Assurance Authority.

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Table I Transaxle components

Figure No	Item No	NSN	MRN	Description	Qty
1	1		B 183 300 001	Transaxle Assembly	1
2	1	2520-21-896-8899	B 183 398 007	Support Assembly	1
				Transaxle RH	
2	2	5310-12-142-8151	N 010 440 3	Scr.-Hex. Hd. (M10X40)	3
2	3		N 012 231 4	Washer-Spr . (10.2X18X.8)	3
2	4	2520-21-894-1463	183 399 114 A	Support-Transaxle, RH	1
2	11	2520-21-896-8901	B 183 398 055	Support-Assembly	1
				Transaxle LH	
2	12	2520-21-894-1407	183 399 113 A	Support-Transaxle, LH	1
2	13	5310-12-142-8151	N 012 231 4	Washer-Spr. (10.2X18X.8)	3
2	14		N 010 440 3	Scr.-Hex. Hd. (M10X40)	3
3	1	5315-21-896-9739	N 013 214 1	Pin-Dowel (8M6X18)	2
3	2		014 301 473	Pin-Dowel (12M6X28)	1
3	3		N 010 332 4	Scr. Hex. Hd. (M8X32)	4
3	4		005 301 211 A	Housing-Transmission	1
3	5	5330-12-173-3052	005 301 235	Gasket-Trans Rear Hous.	1
3	6		N 900 441 01	Pin-Dowel (12M6X18)	1
3	7	5305-21-896-9754	005 301 269	Scr.	1
3	8	2520-21-896-8897	005 301 279 A	Trap-Oil	1
3	9	2520-21-896-8896	005 301 231	Housing-Trans Rear End	1
3	10	5340-21-896-9742	019 301 115	Plug-End Cover	1
3	11	5310-12-145-5250	N Oil 558 2	Washer-Flat (8.4X15X1.6)	12
3	12	4730-21-896-4726	N 016 161 1	Plug (M18X105)	1
3	13	5306-21-896-9744	005 301 281	Bolt-Trans. Through	10
3	14	5305-12-140-8266	N 014 702 5	Scr.-Socket Hd. (M6X15)	3
3	15	5310-12-142-8171	N 012 226 5	Washer-Spg. (B6X12X.5)	3
3	16	5310-21-896-8898	B 183 398 003	Cover Ass'y-Interlock Shaft	1
3	17	5330-12-173-3049	019 301 457	Seal	1
3	18		005 301 453	Cover-Interlock Shaft	1
3	19	5340-12-175-3361	005 301 115	Plug-Timing Hole	1
3	20		005 301 103 A	Housing - Differential	1
3	21	5365-12-166-4321	111 301 127 E	Plug	1
3	22	4730-12-175-5449	113 301 141 B	Plug	1
3	23	5315-21-896-2718	N 013 344 2	Pin-Spring (4X30)	1
3	24	2520-21-896-4753	084 301 143 A	Magnet	1
3	25	3120-12-196-0374	014 301 155	Bushing-Starter	1
3	26	5330-12-175-8257	183 711 395	Gasket-Shift Tower	1
4	1		005 311 113	Seal-Input Shaft	1

Table I Transaxle components (cont'd)

Figure No	Item No	NSN	MRN	Description	Qty
4	2		B 019 311 111	Bushing-Input Shaft	1
4	3		088 311 123	Bearing-Needle	1
4	4		016 311 344	Circlip	1
4	5		016 311 115	Brg.-Needle 4th Gear	1
4	6		005 311 351	Gear-4th Speed	1
4	7		088 311 295 C	Ring-Synchronizer	2
4	8		088 311 317	Snap Ring (1.50)	1
4	8		088 311 317 B	Snap Ring (1.56)	1
4	8		088 311 317 C	Snap Ring (1.62)	1
4	9		311 301 B	Synchronizer W/Sleeve	1
4	10		088 311 311 D	Spring	2
4	11		088 311 245	Key-Locking	3
4	12		005 311 285	Gear-3rd Speed	1
4	13		016 311 213	Brg.-Needle 3rd Gear	1
4	14		005 311 105 C	Shaft-Input	1
4	15		005 311 371 B	Brg.-Roller	1
4	16		005 311 810	Brg.-Ball	1
4	17		005 311 837	Ring-Retaining (1.00)	1
4	17		005 311 837 A	Ring-Retaining (1.10)	1
4	17		005 311 837 B	Ring-Retaining (1.20)	1
4	17		005 311 837 C	Ring-Retaining (1.30)	1
4	18		005 311 374	Plate-Support	1
4	19		N 010 240 7	Scr.-Hex. Hd. (M8X20)	4
4	20		005 311 373 A	Washer	1
4	21		N 014 710 7	Scr.-Socket Hd. (M8X20)	1
5	1		088 311 391	Shim (0.20)	1
5	1		088 311 391 A	Shim (0.25)	1
5	1		088 311 391 B	Shim (0.30)	1
5	1		088 311 391 C	Shim (0.35)	1
5	1		088 311 391 D	Shim (0.40)	1
5	1		088 311 391 E	Shim (0.65)	1
5	1		088 311 391 F	Shim (0.90)	1
5	1		088 311 391 G	Shim (1.15)	1
5	2		088 311 220 E	Brg.-Taper Roller	1
5	3		005 311 149	Gear-4 th Speed	1
5	4		088 311 363	Circlip (2.34)	1
5	4		088 311 363	Circlip (2.36)	1
5	4		088 311 363	Circlip (2.38)	1
5	4		088 311 363	Circlip (2.40)	1
5	4		088 311 363 AJ	Circlip (2.42)	1
5	4		088 311 363	Circlip (2.44)	1
5	4		088 311 363	Circlip (2.46)	1

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Table I Transaxle components (cont'd)

Figure No	Item No	NSN	MRN	Description	Qty
5	4	5365-12-167-8733	088 311 363 AQ	Circlip (2.48)	1
5	4		088 311 363 AS	Circlip (2.50)	1
5	5		005 311 131	Gear-3rd Speed	1
5	6		088 311 287	Circlip (1.65)	1
5	6		088 311 287 A	Circlip (1.70)	1
5	6		088 311 287 B	Circlip (1.75)	1
5	7		088 311 229 B	Brg.-Needle 2nd Gear	1
5	8		005 311 271	Gear-2nd Speed	1
5	9		088 311 295 C	Ring-Synchronizer	2
5	10		005 311 239	Synchronizer Ass'y	1
5	11		088 311 311 D	Spring	2
5	12		088 311 313	Key-Locking	3
5	13		088 311 327	Ring-Snap SW (33X1.50)	1
5	13		088 311 327 A	Ring-Snap SW (33X1.55)	1
5	13		088 311 327 B	Ring-Snap SW (33X1.60)	1
5	14		088 311 207	Brg.-Needle 1 st Gear	1
5	15		005 311 257	Gear-1st Speed	1
5	16		088 311 375	Brg.-Taper Roller	1
5	17		088 311 393	Shim (0.24)	1
5	17		088 311 393 A	Shim (0.27)	1
5	17		088 311 393 B	Shim (0.30)	1
5	17		088 311 393 C	Shim (0.33)	1
5	17		088 311 393 D	Shim (0.36)	1
5	17		088 311 393 E	Shim (0.39)	1
5	17		088 311 393 F	Shim (0.42)	1
5	17		088 311 393 G	Shim (0.45)	1
5	17		088 311 393 H	Shim (0.69)	1
5	17		088 311 393 J	Shim (0.93)	1
5	17		088 311 393 K	Shim (1.17)	1
5	17		088 311 393 L	Shim (1.41)	1
5	18		005 311 395	Shim (2.30)	1
5	18		005 311 395 A	Shim (2.40)	1
5	18		005 311 395 B	Shim (2.50)	1
5	18		005 311 395 C	Shim (2.60)	1
5	18		005 311 395 D	Shim (2.70)	1
5	18		005 311 395 E	Shim (2.80)	1
5	18		005 311 395 F	Shim (2.90)	1
5	18		005 311 395 G	Shim (3.00)	1
5	18		005 311 395 H	Shim (3.10)	1
5	18		005 311 395 J	Shim (3.20)	1
5	19		005 311 413	Washer-Thrust	1
5	20		005 311 233	Race-Inner Reverse/C.C.	2
5	21		005 311 234	Brg.-Needle Cross Ctry	2

Table I Transaxle components (cont'd)

Figure No	Item No	NSN	MRN	Description	Qty
5	22	5330-12-173-3056	005 311 841 A	Gear-Reverse	1
5	23		005 311 827	Collar Ass'y Sliding	1
5	24		005 311 817 A	Gear-Cross Country	1
5	25		005 311 235	Brg.-Roller	1
5	26		005 409 277	Seal-Shaft-Inner	1
5	27		005 409 278	Seal-Shaft-Outer	1
5	28		005 311 845 A	Flange Ass'y-Drive	1
5	29		005 311 849 A	Ring-Splash	1
5	30		014 311 379	Nut-Hex.	1
5	31		005 409 289	Cap-Sealing	1
5	32		183 521 141	Seal	1
6	1	5305-21-896-9754	005 311 823	Shaft-Idler Gear	1
6	2		005 301 269	Scr.	1
6	3		005 311 871	Washer-Thrust	1
6	3		005 311 871	A Washer-Thrust	1
6	4		005 311 825	Brg.-Needle Idler Gear	2
6	5		005 311 821	Gear-Idler	1
6	6		005 311 873	Washer-Thrust	1
6	7		005 311 809	Brg.-Roller	1
6	8		N 012 290 2	Circlip (52X2)	1
6	9		005 311 805 A	Countershaft	1
6	10		005 311 807	Brg.-Needle	1
6	11		005 311 811	Gear-Reverse	1
6	12	5365-12-156-4642	005 311 815	Washer-Thrust	1
6	13		005 311 810	Brg.-Ball	1
6	14		005 311 837	Ring-Retaining (1.00)	1
6	15		N 012 290 2	Circlip (52X2)	1
6	15		N 900 433 01	Circlip (52X1.86)	1
6	16		005 311 373	A Washer	1
6	17		N 014 710 7	Scr.- Socket Hd.	1
7	1		005 311 579	Rod-Operating	1
7	2		N 013 335 1	Pin-Spring (6X22)	4
7	3		N 012 416 1	Circlip (16X1)	2
7	4		088 311 723	Washer	1
7	5		005 311 541	A Shaft-Interlock	1
7	6	5365-12-156-4642	005 311 575	Rod Ass'y-Selector	1
7	7		N 023 258 1	Pin-Spring	1
7	8		N 900 560 01	Seal (7.3X2.4)	1
7	9		005 311 615	Shaft- Selector	1
7	10		014 311 629	Plunger-Interlock (Long)	1
7	11		014 311 635	Link- Interlock	1

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Table I Transaxle components (cont'd)

Figure No	Item No	NSN	MRN	Description	Qty
7	12		005 311 567	Rod.-3rd/4th Gear Selector	1
7	13	5305-12-179-7488	N 090 194 2	Scr.-W/Washer (M7X16)	2
7	14		005 311 629	Plunger-Interlock (Short)	1
7	15	2520-21-896-2457	014 311 621	Detent	3
7	16	5360-21-897-5887	005 311 641	Spring	3
7	17		005 311 549	Fork Ass'y-Selector	1
7	18		005 311 573	Fork-Reverse Selector	1
7	19	5365-21-896-7221	005 311 689	Plug-Detent	2
7	20	5330-21-896-7239	005 311 599	Seal	2
7	21	5305-21-896-9755	088 311 721	Scr. Stop	1
7	22	5330-21-896-7238	088 311 599	Seal	1
7	23		088 311 561 B	Lever-3rd/4th Gear Selector	1
7	24	2520-21-894-1408	005 301 521 A	Lever-Interlock Shaft	1
7	25	5310-21-893-8728	N 011 184 3	Nut-Hex. Elastic (M8)	1
7	26	5310-12-183-9645	N 011 525 13	Washer-Flat (8.4X16X1.6)	2
7	27	2520-12-175-3375	005 409 745	Lever Ass'y-Locking	1
7	28	5306-21-893-8760	N 010 247 8	Scr.-Hex. Hd. (M8X35)	1
7	29	5330-21-893-1655	005 398 001	Kit-Transaxle Seal	1
8	1		005 409 143	Gears-Crown and Pinion Set	1
8	2	5365-21-895-4919	005 409 381	Shim (0.15)	1
8	2	5365-21-895-4920	005 409 381 A	Shim (0.20)	1
8	2	5365-21-895-4921	005 409 381 B	Shim (0.25)	1
8	2	5365-21-895-4922	005 409 381 C	Shim (0.55)	1
8	2	5365-21-895-4923	005 409 381 D	Shim (0.60)	1
8	2	5365-21-895-4924	005 409 381 E	Shim (0.65)	1
8	2	5365-21-895-4925	005 409 381 F	Shim (0.80)	1
8	2	5365-21-895-4926	005 409 381 G	Shim (1.35)	1
8	2	5365-21-895-4927	005 409 381 H	Shim (1.50)	1
8	2	5365-21-895-4928	005 409 381 J	Shim (1.65)	1
8	3	3110-21-896-6522	005 409 123	Brg.-Taper Roller	1
8	4	5315-21-896-2719	005 409 177	Pin-Diff. Gear	1
8	5		005 409 121 D	Carrier-Diff.	1
8	6	5315-21-896-2717	N 013 319 1	Pin-Spring (5X36)	1
8	7	5330-12-180-5262	001 301 131	Seal	1
8	8	6680-12-175-5451	014 409 193 A	Bushing-Speedometer Drive	1
8	9	6680-12-175-5450	088 409 197	Gear-Driven	1
8	10	3110-21-896-6523	016 409 123	Brg.-Taper Roller	1

Table I Transaxle components (cont'd)

Figure No	Item No	NSN	MRN	Description	Qty
8	11	5306-21-896-2605	088 409 135 A	Bolt-Hex. Hd.	10
8	12	5365-21-895-4929	005 409 385	Shim (0.15)	1
8	12	5365-21-895-4930	005 409 385 A	Shim (0.20)	1
8	12	5365-21-895-4931	005 409 385 B	Shim (0.25)	1
8	12	5365-21-895-4932	005 409 385 C	Shim (0.50)	1
8	12	5365-21-895-4933	005 409 385 D	Shim (0.80)	1
8	12	5365-21-895-4934	005 409 385 E	Shim (1.00)	1
8	12	5365-21-895-4935	005 409 385 F	Shim (1.50)	1
8	13		016 409 187	Gear-Speedometer Drive	1
8	14	5330-12-174-1850	005 409 399	Seal-Flange Shaft	1
8	15	5305-12-142-8470	N 010 395 2	Scr.-Hex. Hd. (M8X110)	1
8	16	2520-21-894-1400	005 409 343	Flange-Shaft	1
8	17	2520-21-894-1401	005 409 375 A	Seal-Dust	1
8	18	5310-21-896-2652	011 519 215	(0.50) Shim	2
8	18	5310-21-896-2648	088 409 249	(0.60) Shim	2
8	18	5310-21-896-2655	088 409 249 A	(0.70) Shim	2
8	18	5310-21-896-2656	088 409 249 B	(0.80) Shim	2
8	19	5365-12-179-4374	091 417 189	Was her –Thrust	2
8	20	2520-21-896-4766	005 498 081	Gears-Side/Pinion Set	1
8	21	5310-21-893-8697	087 409 373	Nut-Flange	2
8	22	5310-21-896-2657	183 525 293	(0.3) Shim	1
8	22	5310-21-896-2658	183 525 293 A	(0.6) Shim	1
8	22	5310-21-896-2659	183 525 293 B	(0.9) Shim	1
9	1	5330-12-173-3049	019 301 457	Seal	1
9	2	5365-21-895-4918	N 042 363 1	Circlip (16X1.5)	1
9	3	2520-21-896-4796	005 409 473 B	Fork-Selector	1
9	4	5340-12-176-0219	005 409 409	Cover-Drive Flange	1
9	5	5305-12-142-8470	N 010 395 2	Scr.-Hex. Hd. (BM8X110)	1
9	6	5315-21-896-2455	N 013 290 1	Pin-Spring (5X12)	1
9	7	5310-12-175-6332	005 409 717	Washer	1
9	8	2520-21-896-4536	005 409 285 B	Flange-RH. Drive	1
9	9		005 409 315	Bearing-Needle	1
9	10	5330-12-174-1352	005 409 255	Seal-Outer	1
9	11	5330-12-174-1353	005 409 256	Seal-Inner	1
9	12	2520-21-896-4765	005 409 715	Collar-Sliding	1
9	13		005 409 291 A	Shaft-Half	1
9	14	4730-21-896-4723	N 016 027 5	Plug (M14X1.5)	1
9	15	5330-12-173-3050	084 311 719	Seal	1
9	16	5360-21-896-6232	014 311 641 A	Spring	1
9	17	2520-21-896-2457	014 311 621 A	Detent	1
9	18	2520-21-896-4758	005 409 131 C	Flange-Diff.	1
9	19	4730-21-896-4726	N 016 161 1	Plug (M18X1.5)	1
9	20	2520-21-896-4797	005 409 475 B	Shaft-Selector	1

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Table I Transaxle components (cont'd)

Figure No	Item No	NSN	MRN	Description	Qty
9	21	5365-21-895-4917	N 012 404 1	Circlip (21X1.2)	1
9	22		N 010 332 4	Scr.-Hex. Hd. (M8X32)	9
9	23	5310-21-896-2649	005 409 737	Washer (0.3)	1
9	23	5310-21-896-2650	005 409 737 A	Washer (0.6)	1
9	23	5310-21-896-2651	005 409 737 B	Washer (0.9)	1
9	24		005 409 423	Spacer	1
9	25	5315-21-898-4047	857 525 137	Pin-Switch Diff.	1
9	26	4730-21-898-2409	8482141	Switch-Adapter	1
9	27	5930-21-201-0782	1041080002	Switch-Front Diff.	1
10	1	5330-12-173-3053	N 900 562 01	Seal (25.3X2.4)	1
10	2	5306-21-893-8763	N 010 350 8	Scr.-Hex. Hd. (M8X50)	1
10	3	5310-12-143-1138	N 015 401 1	Washer-Flat (8.4X21X4)	2
10	4	3120-12-175-5030	005 141 711	Bushing-Left	1
10	5	5330-12-175-3054	N 900 561 01	Seal (19.6X4.5)	1
10	6	5340-12-175-3370	005 141 753	Cap-Left Bushing	1
10	7	5365-12-175-7342	N 012 640 1	Circlip (20X1.75)	1
10	8	2520-21-894-1507	B 005 141 719	Lever-Clutch	1
10	9	5310-12-124-3844	N 011 008 5	Nut-Hex. (MS)	1
10	10	5305-21-896-9743	N 090 194 1	Scr.-W/Washer (M7X16)	3
10	11	5365-12-175-8256	113 141 176	Collar-Locking	1
10	12	2520-12-173-3880	113 141 181 B	Sleeve-Guide	1
10	13	3120-21-894-2796	088 141 713 B	Bushing/Bearing	1
10	14	2520-12-175-3369	088 141 749 B	Stop-Shaft	1
10	15	2520-21-894-1500	088 141 701 B	Shaft-Release	1
10	16	5360-12-175-6329	088 141 723 A	Spring	1

Table II Mandatory parts replacement

Figure No	Item No	NSN	MRN	Description	Qty
2	2		N 010 440 3	Scr.-Hex. Hd. (M10X40)	3
2	3	5310-12-142-8151	N 012 231 4	Washer-Spg. (10.2X18X.8)	3
2	13	5310-12-142-8151	N 012 231 4	Washer-Spg. (10.2X18X.8)	3
2	14		N 010 440 3	Scr.-Hex. Hd. (M10X40)	3
3	3		N 010 332 4	Scr.-Hex. Hd (M8X32)	4
3	5	5330-12-173-3052	005 301 235	Gasket -Trans . Re ar	1
3	7	5305-21-896-9754	005 301 269	Scr.	1
3	11	5310-12-145-5250	N 011 558 2	Washer-Flat (8.4X15X1.6)	12
3	13	5306-21-896-9744	005 301 281	Bolt-Trans. Through	10
3	14	5305-12-140-8266	N 014 702 5	Scr. -Socket Hd. (M6X15)	3
3	15	5310-12-142-8171	N 012 226 5	Washer-Spg. (B6X12X.5)	3
3	17	5330-12-173-3049	019 301 457	Seal	1
3	19	5340-12-175-3361	00 301 115	Plug-Timing Hole	1
3	23	5315-21-896-2718	N 013 344 2	Pin-Spring (4X30)	1
3	25	3120-12-196-0374	014 301 155	Bushing-Starter	1
3	26	5330-12-175-8257	183 711 395	Gasket-Shift Tower	1
4	1		005 311 113	Seal-Input Shaft	1
4	2		B 019 311 111	Bushing-Input Shaft	1
4	4		016 311 344	Circlip	1
4	8		088 311 317 C	Snap Ring (1.62)	1
4	8		088 311 317 B	Snap Ring (1.56)	1
4	8		088 311 317	Snap Ring (1.50)	1
4	17		005 311 837	Ring-Retaining (1.00)	1
4	17		005 311 837 A	Ring-Retaining (1.10)	1
4	17		005 311 837 B	Ring-Retaining (1.20)	1
4	17		005 311 837 C	Ring-Retaining (1.30)	1
4	19		N 010 240 7	Scr.-Hex. Hd. (M8X20)	4
4	20		005 311 373 A	Washer	1
4	21		N 014 710 7	Scr. -Socket Hd. (M8X20)	1
5	1		088 311 391	Shim (0.20)	1
5	1		088 311 391 A	Shim (0.25)	1
5	1		088 311 391 B	Shim (0.30)	1
5	1		088 311 391 C	Shim (0.35)	1
5	1		088 311 391 D	Shim (0.40)	1
5	1		088 311 391 E	Shim (0.65)	1
5	1		088 311 391 F	Shim (0.90)	1
5	1		088 311 391 6	Shim (1.15)	1
5	4		088 311 363 AA	Circlip (2.34)	1
5	4		088 311 363 AC	Circlip (2.36)	1

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Table II Mandatory parts replacement (cont'd)

Figure No	Item No	NSN	MRN	Description	Qty
5	4	5365-12-167-8733	088 311 363 AE	Circlip (2.38)	1
5	4		088 311 363 AG	Circlip (2.40)	1
5	4		088 311 363 AJ	Circlip (2.42)	1
5	4		088 311 363 AL	Circlip (2.44)	1
5	4		088 311 363 AN	Circlip (2.46)	1
5	4		088 311 363 AQ	Circlip (2.48)	1
5	4		088 311 363 AS	Circlip (2.50)	1
5	6		088 311 287	Circlip (1.65)	1
5	6		088 311 287 A	Circlip (1.70)	1
5	6		088 311 287 B	Circlip (1.75)	1
5	13		088 311 327	Ring-Snap SW (33X1.50)	1
5	13		088 311 327 A	Ring-Snap SW (33X1.55)	1
5	13		088 311 327 B	Ring-Snap SW (33X1.60)	1
5	17		088 311 393	Shim (0.24)	1
5	17		088 311 393 A	Shim (0.27)	1
5	17		088 311 393 B	Shim (0.30)	1
5	17		088 311 393 C	Shim (0.33)	1
5	17		088 311 393 D	Shim (0.36)	1
5	17		088 311 393 E	Shim (0.39)	1
5	17		088 311 393 F	Shim (0.42)	1
5	17		088 311 393 G	Shim (0.45)	1
5	17		088 311 393 H	Shim (0.69)	1
5	17		088 311 393 J	Shim (0.93)	1
5	17		088 311 393 K	Shim (1.17)	1
5	17		088 311 393 L	Shim (1.41)	1
5	18		005 311 395	Shim (2.30)	1
5	18		005 311 395 A	Shim (2.40)	1
5	18		005 311 395 B	Shim (2.50)	1
5	18		005 311 395 C	Shim (2.60)	1
5	18		005 311 395 D	Shim (2.70)	1
5	18		005 311 395 E	Shim (2.80)	1
5	18		005 311 395 F	Shim (2.90)	1
5	18		005 311 395 G	Shim (3.00)	1
5	18		005 311 395 H	Shim (3.10)	1
5	18		005 311 395 J	Shim (3.20)	1
5	19		005 311 413	Washer-Thrust	2
5	26	5330-12-173-3056	005 409 277	Seal-Shaft Inner	1
5	27	5330-12-174-1851	005 409 278	Seal-Shaft Outer	1
5	30	5310-12-175-6322	014 311 379	Nut-Hex.	1
5	31	5340-12-176-0218	005 409 289	Cap-Sealing	1
5	32	5330-12-179-3693	183 521 141	Seal	1
6	2	5305-21-896-9754	005 301 269	Scr.	1
6	3		005 311 871	Washer-Thrust	1

Table II Mandatory parts replacement (cont'd)

Figure No	Item No	NSN	MRN	Description	Qty
6	3		005 311 871 A	Washer-Thrust	1
6	6		005 311 873	Washer-Thrust	1
6	12		005 311 815	Washer-Thrust	1
6	15		N 012 290 2	Circlip (52X2)	1
6	15		N 900 433 01	Circlip (52X1.86)	1
6	16		005 311 373 A	Washer	1
6	17		N 014 710 7	Scr. -Socket Hd. (M8X20)	1
7	2		N 013 335 1	Pin-Spring (6X22)	4
7	4		088 311 723	Washer	1
7	7		N 023 258 1	Pin-Spring	1
7	8		N 900 560 01	Seal (7.3X2.4)	1
7	13	5305-12-179-7488	N 090 194 2	Scr.-W/Washer (M7X16)	2
7	20	5330-21-896-7239	005 311 599	Seal	2
7	21	5305-21-896-9755	088 311 721	Scr. Stop	1
7	22	5330-21-896-7238	088 311 599	Seal	1
7	25	5310-21-893-8728	N 011 184 3	Nut-Hex. Elastic (MS)	1
7	26	5310-12-183-9645	N 011 525 13	Washer-Flat (8.4X16X1.6)	2
7	28	5306-21-893-8760	N 010 247 8	Scr. -Hex. Hd. (M8X35)	1
7	29	5330-21-893-1655	005 398 001	Kit-Transaxle Seal	1
8	2	5365-21-895-4919	005 409 381	Shim (0.15)	1
8	2	5365-21-895-4920	005 409 381 A	Shim (0.20)	1
8	2	5365-21-895-4921	005 409 381 B	Shim (0.25)	1
8	2	5365-21-895-4922	005 409 381 C	Shim (0.55)	1
8	2	5365-21-895-4923	005 409 381 D	Shim (0.60)	1
8	2	5365-21-895-4924	005 409 381 E	Shim (0.65)	1
8	2	5365-21-895-4925	005 409 381 F	Shim (0.80)	1
8	2	5365-21-895-4926	005 409 381 G	Shim (1.35)	1
8	2	5365-21-895-4927	005 409 381 H	Shim (1.50)	1
8	2	5365-21-895-4928	005 409 381 J	Shim (1.65)	1
8	6	5315-21-896-2717	N 013 319 1	Pin-Spring (5X36)	1
8	7	5330-12-180-5262	001 301 131	Seal	1
8	11	5306-21-896-2605	088 409 135 A	Bolt-Hex. Hd.	10
8	12	5365-21-895-4929	005 409 385	Shim (0.15)	1
8	12	5365-21-895-4930	005 409 385 A	Shim (0.20)	1
8	12	5365-21-895-4931	005 409 385 B	Shim (0.25)	1
8	12	5365-21-895-4932	005 409 385 C	Shim (0.50)	1
8	12	5365-21-895-4933	005 409 385 D	Shim (0.80)	1
8	12	5365-21-895-4934	005 409 385 E	Shim (1.00)	1
8	12	5365-21-895-4935	005 409 385 F	Shim (1.50)	1
8	14	5330-12-174-1850	005 409 399	Seal-Flange Shaft	1
8	15	5305-12-142-8470	N 010 395 2	Scr. -Hex. Hd. (M8X110)	1
8	17	2520-21-894-1401	005 409 375 A	Seal-Dust	1

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Table II Mandatory parts replacement (cont'd)

Figure No	Item No	NSN	MRN	Description	Qty
8	18	5310-21-896-2652	011 519 215	(0.50) Shim	2
8	18	5310-21-896-2648	088 409 249	(0.60) Shim	2
8	18	5310-21-896-2655	088 409 249 A	(0.70) Shim	2
8	18	5310-21-896-2656	088 409 249 B	(0.80) Shim	2
8	19	5365-12-179-4374	091 517 189	Washer-Thrust	2
8	22	5310-21-896-2657	183 525 293	(0.3) Shim	1
8	22	5310-21-896-2658	183 525 293 A	(0.6) Shim	1
8	22	5310-21-896-2659	183 525 293 B	(0.9) Shim	1
9	1	5330-12-173-3049	019 301 457	Seal	1
9	5	5305-12-142-8470	N 010 395 2	Scr.- Hex. Hd. (BM8X110)	1
9	6	5315-21-896-2455	N 013 290 1	Pin-Spring (5X12)	1
9	10	5330-12-174-1352	005 409 255	Seal-Outer	1
9	11	5330-12-174-1353	005 409 256	Seal-Inner	1
9	15	5330-12-173-3050	084 311 719	Seal	1
9	22		N 010 332 4	Scr. -Hex. Hd. (M8X32)	9
9	23	5310-21-896-2649	005 409 737	Washer (0.3)	1
9	23	5310-21-896-2650	005 409 737 A	Washer (0.6)	1
9	23	5310-21-896-2651	005 409 737 B	Washer (0.9)	1
10	1	5330-12-173-3053	N 900 562 01	Seal (25.3X2.4)	1
10	2	5306-21-893-8763	N 010 350 8	Scr. -Hex. Hd. (M8X50)	1
10	3	5310-12-143-1138	N 015 401 1	Washer-Flat (8.4X21X4)	2
10	4	3120-12-175-5030	005 141 711	Bushing- Left	1
10	5	5330-12-175-3054	N 900 561 01	Seal (19.6X4.5)	1
10	6	5340-12-175-3370	005 141 753	Cap-Left Bushing	1
10	9	5310-12-124-3844	N 011 008 5	Nut-Hex. (M8)	1
10	10	5305-21-896-9743	N 090 194 1	Scr.-W/Washer (M7X16)	3
10	11	5365-12-175-8256	113 141 176	Collar-Locking	1
10	13	3120-21-894-2796	088 141 713 B	Bushing/Bearing	1
10	14	2520-12-175-3369	088 141 749 B	Stop-Shaft	1

Table III Components for cleaning and inspection

Figure No	Item No	Description
2	4	Support - Trans axle R.H.
2	12	Support - Transaxle L.H.
3	1	Pin-Dowel (8M6x18)
3	2	Pin-Dowel (12M6x28)
3	4	Housing - Transmission
3	6	Pin-Dowel (12M6x18)
3	8	Trap - Oil
3	9	Housing - Transmission Cover
3	10	Plug - End Cover
3	12	Plug - (M18x105)
3	18	Cover - Interlock Shaft
3	20	Housing - Differential
3	21	Plug
3	22	Plug
3	24	Magnet
4	3	Bearing - Needle
4	5	Bearing - Needle 4th Gear
4	6	Gear - 4th Speed
4	7	Ring - Synchronizer
4	9	Synchronizer w/ Sleeve
4	10	Spring
4	11	Key - Locking
4	12	Gear - 3rd Speed
4	13	Bearing - Needle 3rd Gear
4	14	Shaft - Input
4	15	Bearing - Roller
4	16	Bearing - Ball
4	18	Plate - Support
5	2	Bearing - Taper Roller
5	3	Gear r- 4th Speed
5	5	Gear - 3rd Speed
5	7	Bearing - Needle 2nd Gear
5	8	Gear - 2nd Speed
5	9	Ring - Synchronizer
5	10	Synchronizer Assembly
5	11	Spring
5	12	Key - Locking
5	14	Bearing - Needle 1st Gear
5	15	Gear - 1st Speed
5	16	Bearing - Taper Roller
5	20	Race - Inner Reverse/CC
5	21	Bearing - Needle CC

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Table III Components for cleaning and inspection (cont'd)

Figure No	Item No	Description
5	22	Gear – Reverse
5	23	Collar Assembly - Sliding
5	24	Gear - Cross Country
5	25	Bearing - Roller
5	28	Flange Assembly - Drive
5	29	Ring - Splash
6	1	Shaft - Idler Gear
6	4	Bearing - Needle Idler Gear
6	5	Gear - Idler
6	7	Bearing - Roller
6	8	Circlip (52x2)
6	9	Countershaft
6	10	Bearing - Needle
6	11	Gear - Reverse
6	13	Bearing - Ball
6	14	Ring - Retaining (1.00)
7	1	Rod - Operating
7	3	Circlip (16x1)
7	5	Shaft - Interlock
7	6	Rod Assembly - Selector
7	10	Plunger - Interlock (Long)
7	11	Link - Interlock
7	12	Rod - 3rd/4th Gear Selector
7	14	Plunger - Interlock (Short)
7	15	Detent
7	16	Spring
7	17	Fork Assembly - Selector
7	18	Fork - Reverse Selector
7	19	Plug - Detent
7	23	Lever - 3rd/4th Gear Selector
7	24	Lever - Interlock Shaft
7	27	Lever Assembly - Locking
8	1	Gears - Crown and Pinion
8	3	Bearing - Taper Roller
8	4	Pin - Differential Gear
8	5	Carrier - Differential
8	9	Gear - Driven
8	10	Bearing - Taper Roller
8	13	Gear - Speedometer Drive
8	16	Flange - Shaft
8	20	Gears - Side/Pinion Set
8	21	Nut - Flange

Table III Components for cleaning and inspection (cont'd)

Figure No	Item No	Description
9	2	Circlip (16x1.5)
9	3	Fork - Selector
9	4	Cover - Drive Flange
9	7	Washer
9	8	Flange - R.H. Drive
9	9	Bearing - Needle
9	12	Collar - Sliding
9	13	Shaft - Half
9	14	Plug - (M14x1.5)
9	16	Spring
9	17	Detent
9	18	Flange - Diffrential
9	19	Plug (M18x1.5)
9	20	Shaft - Selector
9	21	Circlip (21x1.2)
9	24	Spacer
10	7	Circlip (20x1.75)
10	8	Lever - Clutch
10	12	Sleeve - Guide
10	15	Shaft - Release
10	16	Spring

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Table IV Rebuild standards

Description	Standard
1. Fourth Gear to Circlip – Clearance	0.00 mm – Max 0.02 mm
2. Third Gear to Circlip – Clearance	0.00 mm – Max 0.04 mm
3. Synchronizing Ring to Second Gear Cone – Clearance	New 1.0 to 1.7 mm Min 0.5 mm
4. Second Gear Synchronizer Hub to Snap Ring - Clearance	0.0 mm – Max 0.04 mm 0.0 Adjust to lowest limit
5. Synchronizing Ring to First Gear – Clearance	New 1.0 to 1.7 mm Min 0.50 mm
6. Roller Bearing to First Gear -Clearance	0.10 to 0.40 mm
7. Synchronizing Ring to Third Gear Cone – Clearance	New 1.0 to 1.7 mm Min 0.5 mm
8. Third Gear Synchronizer Hub to Snap Ring – Clearance	0.0 to 0.50 mm Adjust to lowest limit
9. Second Gear to Third Gear –Clearance	0.00 to 0.35 mm
10. Synchronizing Ring to Fourth Gear Cone – Clearance	New 1.0 to 1.7 mm Min 0.5 mm
11. Side Gears to Pinion Gears - Backlash	0.0 mm (gears turn without binding) Max 0.10 mm
12. Crown Gear to pinion – Mesh	Dimension "R" as indicated on the Crown and Pinion ± 0.04 mm
13. Carrier Bearing – Preload	As determined by "S Total" (S1 + S2) Measurement
14. Carrier Turning-Torque	New Bearings - 250 N. cm (22.1 in-lb) Used Bearings Min -30 N.cm (2.6 in-lb)

Table IV Rebuild standards (cont'd)

Description	Standard
15. Pinion Bearing – Preload	As determined by "S Total" (S3 + S4) Measurement
16. Pinion Turning – Torque	New Bearings - 200 to 400 N.cm (17.7 to 35.4 in-lb) Used Bearings - 30 to 60 N.cm (2.6 to 5.3 in-lb)
17. Crown Gear – Backlash	0.10 to 0.20 mm
18. Half Shaft Gear to Spacer – Clearance	0.20 to 0.50 mm
19. Countershaft Circlip Groove	1.86 to 2.16 mm
20. Countershaft Bearing to Circlip	1.05 to 1.44 mm
21. Transmission Housing to Input Shaft Bearing Outer Race	1.05 to 1.44 mm
22. Transmission Housing to Pinion Shaft Bearing For Reverse Gear	10.20 to 11.20 mm
23. Interlock Lever to TW Wheel Drive Lever - Center to Center	102 mm

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Table V Torque standards

Description		
Crown Gear to Carrier	100 N.m	74 ft-lb
Differential Flange to Housing	25 N.m	74 ft-lb
Carrier Turning Torque (minimum with new bearings)	250 N.cm	22.1 in-lb
Carrier Turning Torque (minimum with old bearings)	30 N.cm	2.6 in-lb
Transmission Housing to Differential Housing	25 N.m	18 ft-lb
Transmission Cover to Transmission Housing	25 N.m	18 ft-lb
Pinion Shaft Turning Torque (with new bearings)	200 to 400 N.cm	17.2 to 35.4 in-lb
Pinion Shaft Turning Torque (with old bearings)	30 to 60 N.cm	2.6 to 5.3 in-lb
Drive Flange Center Bolt (right side)	25 N.m	18 ft-lb
Countershaft Cap Screw	25 N.m	18 ft-lb
Input Shaft Cap Screw	25 N.m	18 ft-lb
Input Shaft Support Plate to Housing	25 N.m	18 ft-lb
Operating Link to First/Second Gear Shifter Rod	15 N.m	11 ft-lb
Idler Gear Shaft Lock Screw	25 N.m	18 ft-lb
Oil Trap to Transmission Cover	25 N.m	18 ft-lb
Interlock Shaft Cover to Differential Housing	15 N.m	11 ft-lb
Drive Flange Center Bolt (left side)	25 N.m	18 ft-lb
Input Shaft Guide Sleeve	15 N.m	11 ft-lb
Propeller Shaft Drive Flange Nut	150 N.m	111 ft-lb
Transaxle Supports to Differential Housing	40 N.m	30 ft-lb
Clutch Lever to Clutch Shaft	25 N.m	18 ft-lb

Table VI Special tools

Item	NSN	MRN	Description	Use
1	5120-12-176-1109	Matra 3028	Holder	Holding Propeller Shaft Flange
2	5120-21-896-7696	VW 391	Remover/ Installer	Removing/Installing Drive Flange from Pinion Shaft
3	5120-21-896-7680	KUKKO 21/3	Internal Extractor	Removing Clutch Shaft Bushing
4	5120-21-896-7698	VW 771/1	Sliding Hammer	Used with various extractors
5	5120-21-896-7702	VW 771/15	Adapter	Used with Sliding Hammer
6	5120-21-899-4857	VW 788-14	Internal Puller	Removing Starter Bushing
7		KUKKO 22-2	Puller	Used with various Extractors and Pullers
8	5120-21-896-7705	VW 771/37	Extractor Hook	Removing Seals used with Sliding Hammer
9		2050	Arbor	Removing Pinion Shaft Bearing Race
10		KUKKO 21-7	Internal Extractor	Removing Left Carrier Bearing Race
11	5120-21-896-7690	KUKKO 22-2	Puller	Used with various Extractors
12		KUKKO 21-5	Internal Extractor	Removing Input Shaft Needle Bearing
13	5120-21-896-7695	KUKKO 44-2	Puller	Removing Large Carrier Bearing
14	5120-12-176-1102	40-105	Pressure Piece	Used with various Pullers

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Table VI Special tools (cont'd)

Item	NSN	MRN	Description	Use
15	5120-12-176-1104	OTC 1025	Puller	Removing Small Carrier Bearing
16		VW 447h	Thrust Piece	Removing Input Shaft
17		VW 431	Thrust Pad	Removing Countershaft from Bearing Race
18		Matra 30-505	Mandrel	Removing/Installing Countershaft Needle Bearing
19		W 472/2	Distance Sleeve	Used with Matra 30-505
20		VW 4471	Thrust Plate	Used for various Pressing Operations
21		Hazet 788-30	Internal Extractor	Removing Countershaft Roller Bearing
22		W 407	Mandrel	Used with Thrust Plate VW 447i to Remove/Install Pinion Shaft Bearing
23		VW 454	Pressure Piece	Used for various Pressing Operations
24		W 401	Thrust Plate	Used for various Pressing operations
25	5120-12-181-6888	40-21	Sleeve	Installing Small Carrier Bearing
26		VW 415A	Tube (60 mm dia)	Installing Large Carrier Bearing
27		3062	Thrust Pad	Installing Pinion Bearing Race

Table VI Special tools (cont'd)

Item	NSN	MRN	Description	Use
28	5120-21-896-7669	VW 295	Needle Bearing Drift	Used with Various Thrust Pads to Remove and Install Needle Bearings and Seals
29		VW 511	Thrust Pad	Installing Left Carrier Bearing Race and Trans Pinion Bearing Race
30		VW 472/1	Thrust Piece	Installing Diff. Flange Bearing Race
31	5120-21-896-7697	VW 387	Dial Gauge Bracket	Used with Dial Gauge for various checks
32		VW 385/17	End Plate (50 mm)	Used with Dial Gauge for various checks
33		V/35.1	Dial Gauge	Used for various checks
34		VW 385/15	Dial Gauge Extension	Used with Dial Gauge for Pinion Adjustment
35		VW 385/1	Measuring Bar	Used for Pinion Adjustment
36		VW 385/14	Measuring Rod (30 mm)	Used with Measuring Bar for Pinion Adj.
37		W 521/8	Split Sleeve	Used with Torque Gauge to Measure Turning Torque
38		VW 521/4	Adapter	Used with VW 521/8 and Torque Gauge
39		VW 388	Adjustable Measuring Lever	Used to Measure Crown Gear Backlash
40		VW 382/10	Dial Gauge Extension	Used to Measure Crown Gear Backlash

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Table VI Special tools (cont'd)

Item	NSN	MRN	Description	Use
41	5120-12-176-1107	30-507	Thrust Pad	Installing Input Shaft Bearing
42		40-503	Installer	Installing Countershaft Needle Bearing
43		30-204	Installer	Installing Counter-shaft Roller Bearing
44		VW 421	Tube (28 mm dia)	Installing Selector Shaft Seals
45		3025	Seal Installer	Installing Right Flange Seals
46		3024	Seal Installer	Installing Left Flange Seals
47		Matra 30-100	Driving Sleeve	Installing Input Shaft Seal
48		3026	Seal Installer	Installing Output Flange Seals
49		VW 295A	Adapter	Installing Second Inner Race on Countershaft
50		B 183 012 363	Bushing Installer	Installing Starter Bushing
51	5120-21-899-4889	VW 294b/3	Set of Bolts (4 pieces)	Used with Dial Gauge Bracket
52		VW418A	Thrust Pad	Removing Input Shaft Seal
53		KUKKO 17-2	Arbor	Various pressing operations
54		VW 385/30	Master Gauge	Used with 385/1
55		VW 385/3	Centering Rings	Used with 385/1

Table VII GSM components

NSN	MEN	Description	Qty
2520-12-175-3364	B 183 711 121	Lever - Gear Shift	1
5355-12-175-3895	183 711 141	Knob - Shift Lever	1
2520-12-175-3367	183 711 142	Collar	1
5315-12-180-8497	B 183 711 417 A	Pin Assembly	1
5310-12-180-5263	N 012 853 2	Clip (#3)	1
2520-12-179-6246	183 711 127	Bushing	1
2520-12-179-6245	183 711 145 A	Rod Assembly – Pull	1
5360-12-175-6325	183 711 197 B	Spring	1
2520-12-175-3366	183 711 149	Stopper - Shift Tube	1
5305-21-893-8814	N 013 021 1	Scr.-Slot (M6x16)	1
5310-12-146-8397	228 500 158	Nut-Hex. Elastic (M10)	1 4
	N 090 315 1	Scr. w/Washer (M8x25)	
2520-12-175-3363	183 711 107	Base - Gear Shift	1
2520-21-894-1478	183 711 065	Finger – Selector	1
5360-12-175-6324	183 711 199	Spring – Conical	1
3120-21-175-5029	183 711 191	Seat – Spring	1
5330-12-175-8257	183 711 395	Gasket - Shift Tower	1
5310-12-175-6339	183 711 595	Washer	2
	N 023 641 1	Circlip (A10x1)	1
2520-12-175-3376	B 183 711 585	Lever – Operating	1
5365-12-124-1219	N 015 529 1	Snap Ring	1
5340-12-896-9741	N 015 528 1	Clip - Lock (S10)	1

Table VIII Container mandatory parts replacement

* Item	NSN	MRN	Description	Qty
2	6850-21-883-0610	VC2-2x2YRx2 FT	Capsule - Zerust VC1	1
4		RG-240	Seal (5x5x96.75 Long)	1
7	5310-21-896-4885	228 521 045	Nut-Elastic (M12)	1
13	5310-12-146-8397	228 500 158	Nut-Hex. Elastic (M10)	2
21	5310-12-146-8397	228 500 158	Nut-Hex. Elastic (M10)	1
22	6685-00-618-1822	2155	Indicator-Moisture	1
28	5310-00-088-1251	MS-51922-1	Nut-Self Locking (1/4-20)	1
31	5310-00-057-7080	MS-51922-29	Nut-Self Locking (7/16-20)	10
33		MIL-D-3464	Dessicant-Bagged Activated	1
34		34x8x3x26 GA	Seal-Wire	2

* Item numbers are as shown at Figure 103.

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Table IX Container components

Item	NSN	MRN	Description	Qty
1	8145-21-899-9683	8477870-1	Container Ass'y - Transaxle	1
2	6850-21-883-0610	VC2-2x2YRx2FT	Capsule-Zerust VC1	1
3	8145-21-899-9694	8477868-1	Cover Ass'y	1
4		RG-240	Seal (5x5x96.75 Long)	1
5	5305-00-709-8523	MS-90726-87	Bolt-Hex. Hd. (7/16-20x1 1/4)	10
6	5310-00-809-4061	MS-27183-15	Washer-Flat (7/16)	20
7	5310-21-896-4885	228 521 045	Nut-Elastic (M12)	1
8	5310-12-184-5360	224 020 015	Washer-Flat (13x24x2.5)	1
9		B 183 099 001	Bolt-Hex. Hd. (M10x110)	2
10	5310-12-175-6305	B 183 199 447	Washer	4
11	5340-12-173-7964	183 199 381 A	Mount Rubber	4
12	5310-12-145-2243	224 000 025	Washer-Flat (10.5x24x4)	2
13	5310-12-146-8397	228 500 158	Nut-Hex. Elastic (M10)	2
14		222 005 565	Bolt-Hex. Hd. (M10x1.5x55)	1
15		1294	Washer-Flat	1
16	5340-21-897-8287	8477854-1	Cushion-Rubber	2
17	3120-21-897-8930	8477855-1	Bushing	1
18	5340-21-897-8285	8477837-1	Support-Angle	1
19		222 026 065	Bolt-Hex. Hd. (M12x1.75x60)	1
20	5310-12-145-4776	224 000 035	Washer-Flat (10.5x30x2.5)	1
21	5310-12-146-8397	228 500 158	Nut-Hex. Elastic (M10)	1
22	6685-00-618-1822	2155	Indicator-Moisture	1
23	4820-00-242-4064	645E-6	Valve-Filler	1
24	4820-01-099-4231	C-13-B	Valve-Relief	1
25	8145-21-899-9701	8384318-1	Cover-Instrument	1
26	5310-00-809-4058	MS27183-10	Washer-Flat (9/32)	2
27		WN-6	Nut-Wing (1/4-20 UNC)	1
28	5310-00-088-1251	MS-51922-1	Nut-Self Locking (1/4-20)	1
29	9905-21-899-9720	8477867-1	Plate-Identification	1
30	5320-21-842-7104	SD 54 BS	Rivet-Pop (5/32X.379)	4
31	5310-00-057-7080	MS51922-29	Nut-Self Locking (7/16x20)	10
32	8145-21-899-9695	8477858-1	Base Assembly	1
33		MIL-D-3464	Dessicant-Bagged Activated	1
34		34x8x3x26 GA	Seal-Wire	2

Table X Transaxle replacement accessories

NSN	MRN	Description	Qty
2520-12-192-3596	A 302 101 501	Clutch – Disc	1
2520-12-166-2743	A 102 101 203	Pressure Plate – Clutch	1
5360-12-175-6328	113 141 165 B	Bearing – Release	1
5360-12-175-6327	113 141 177 C	Spring – Left	1
5305-12-169-6486	113 141 178 C	Spring – Right	1
5330-12-175-8254	N 014 739 1	Scr. - Socket Hd. (M8x16)	6
5330-12-175-8257	049 103 583	Gasket - Intermediate Plate	1
5330-12-179-3693	183 711 395	Gasket - Shift Tower	1
	183 521 141	Seal - Propeller Shaft	1

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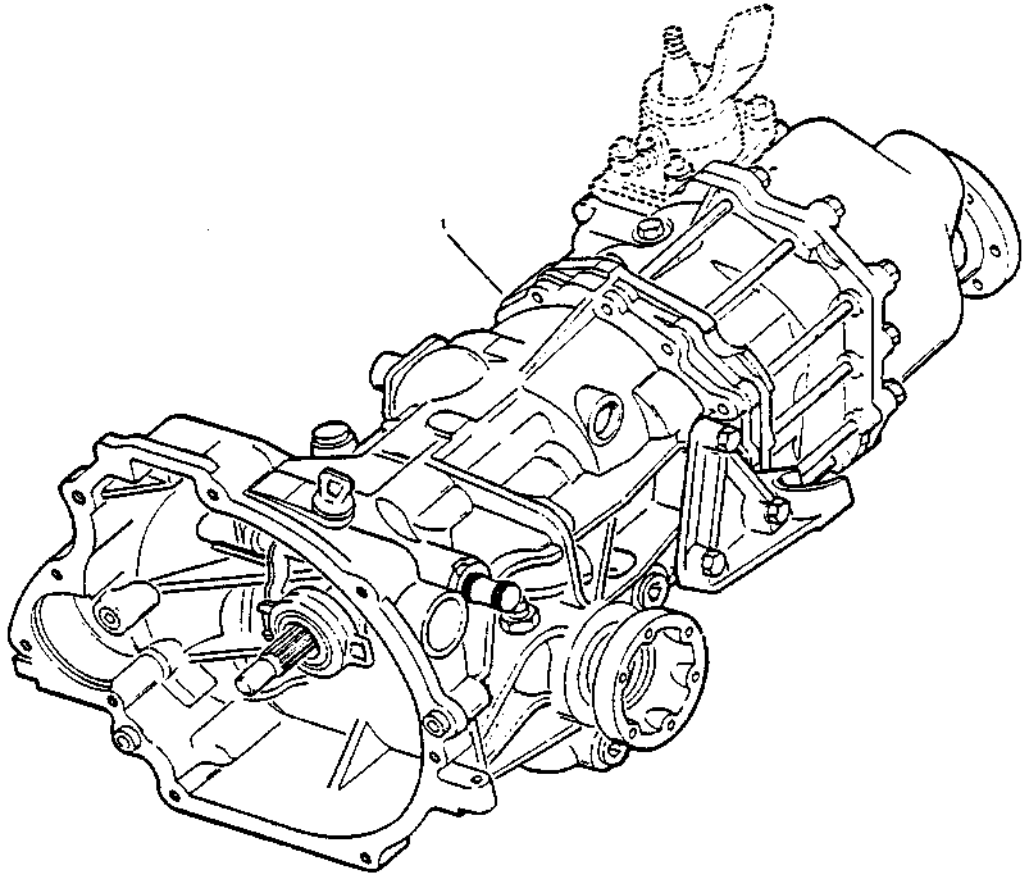


Figure 1 Transaxle Assembly

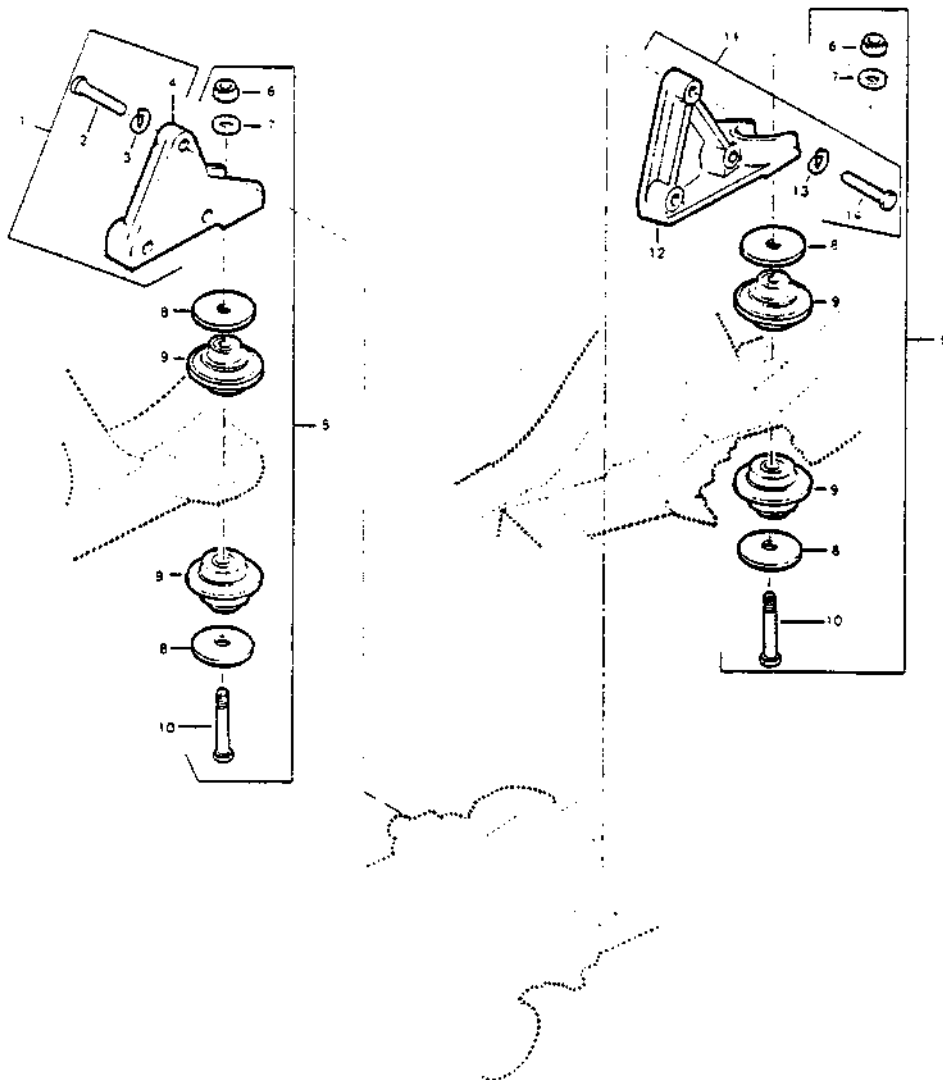


Figure 2 Transmission Mounts

D-30-108-000/SF-002

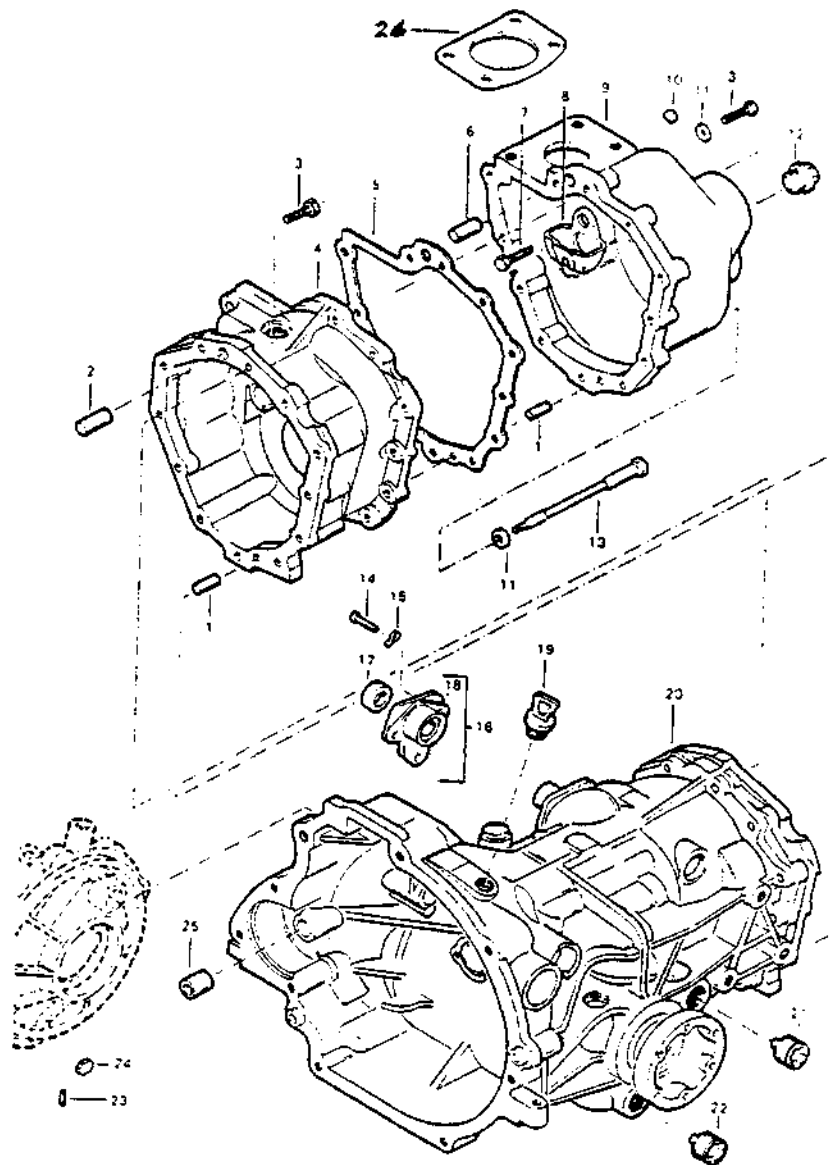


Figure 3 Transaxle Housings

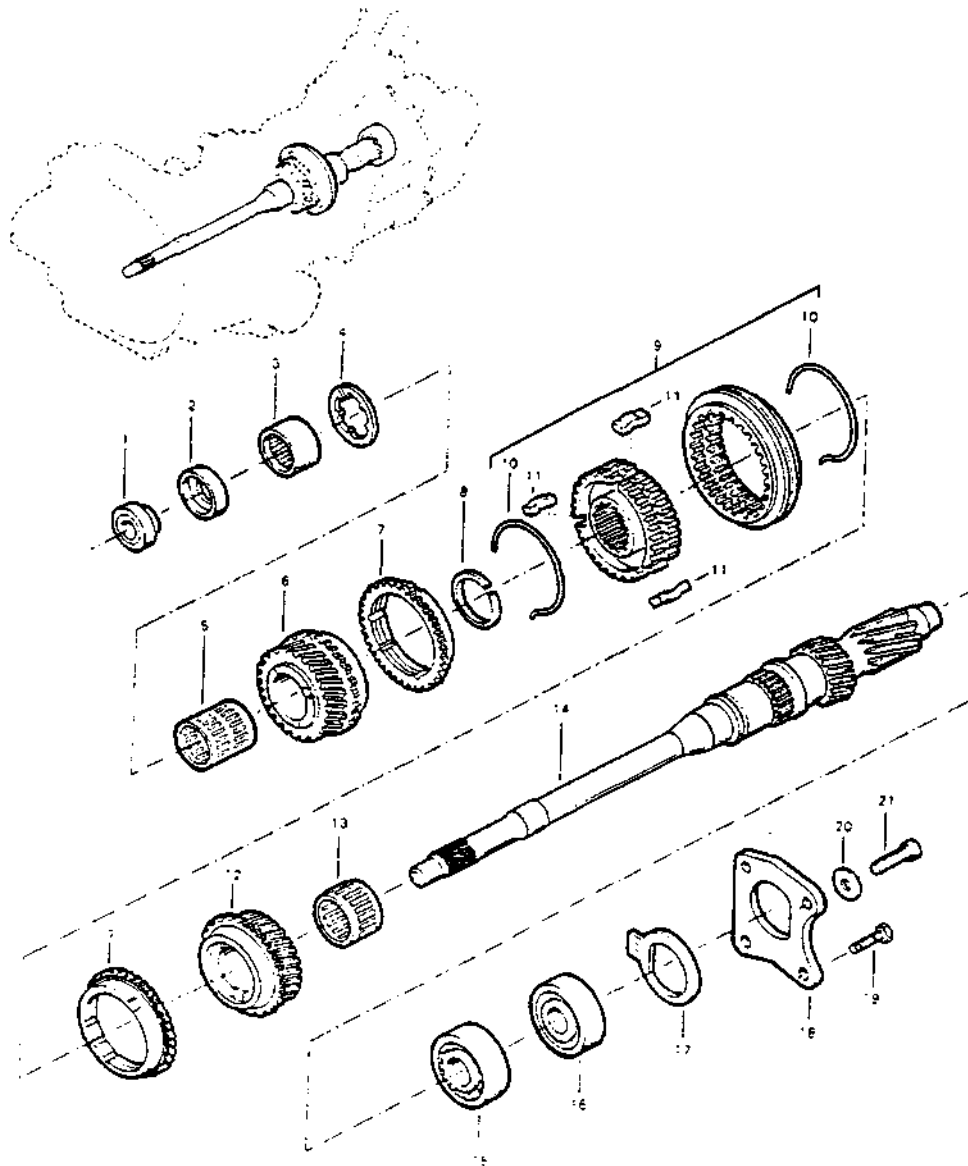


Figure 4 Transmission Input Shaft

D-30-108-000/SF-002

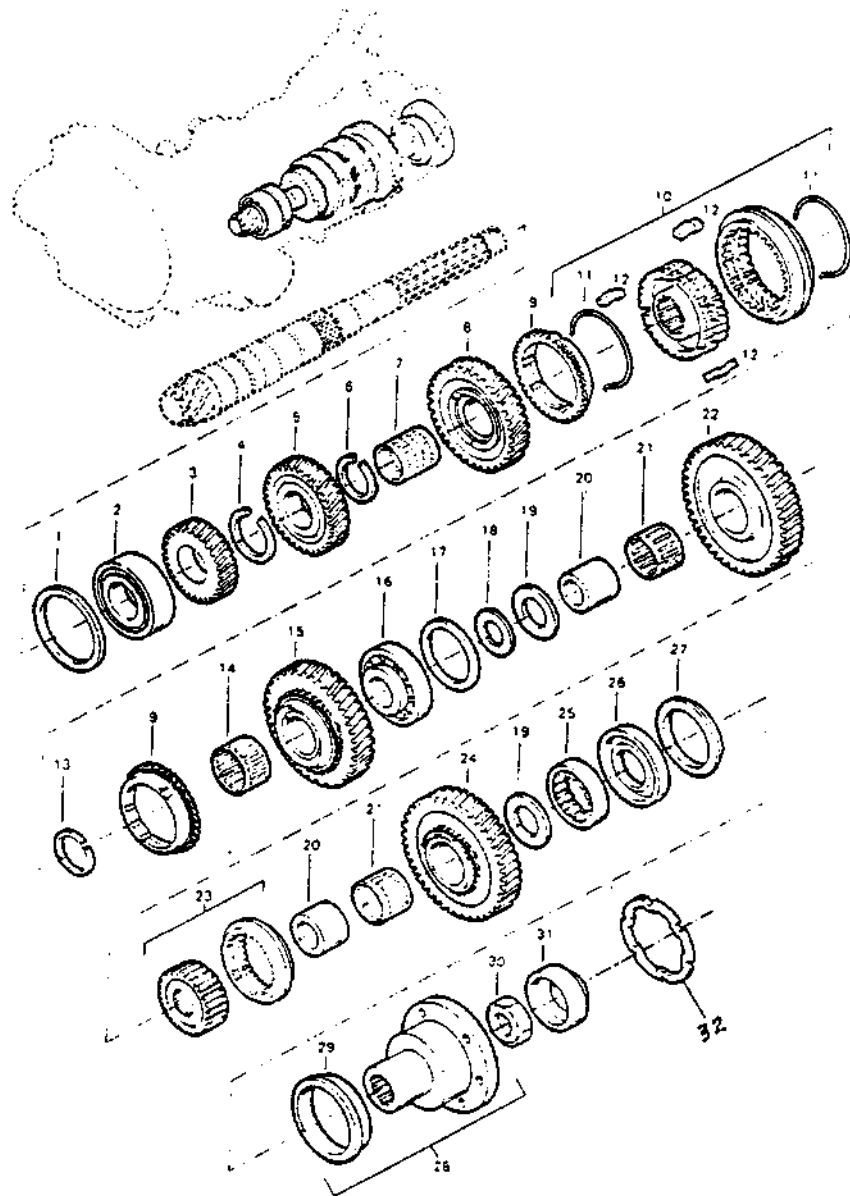


Figure 5 Transmission Pinion Shaft

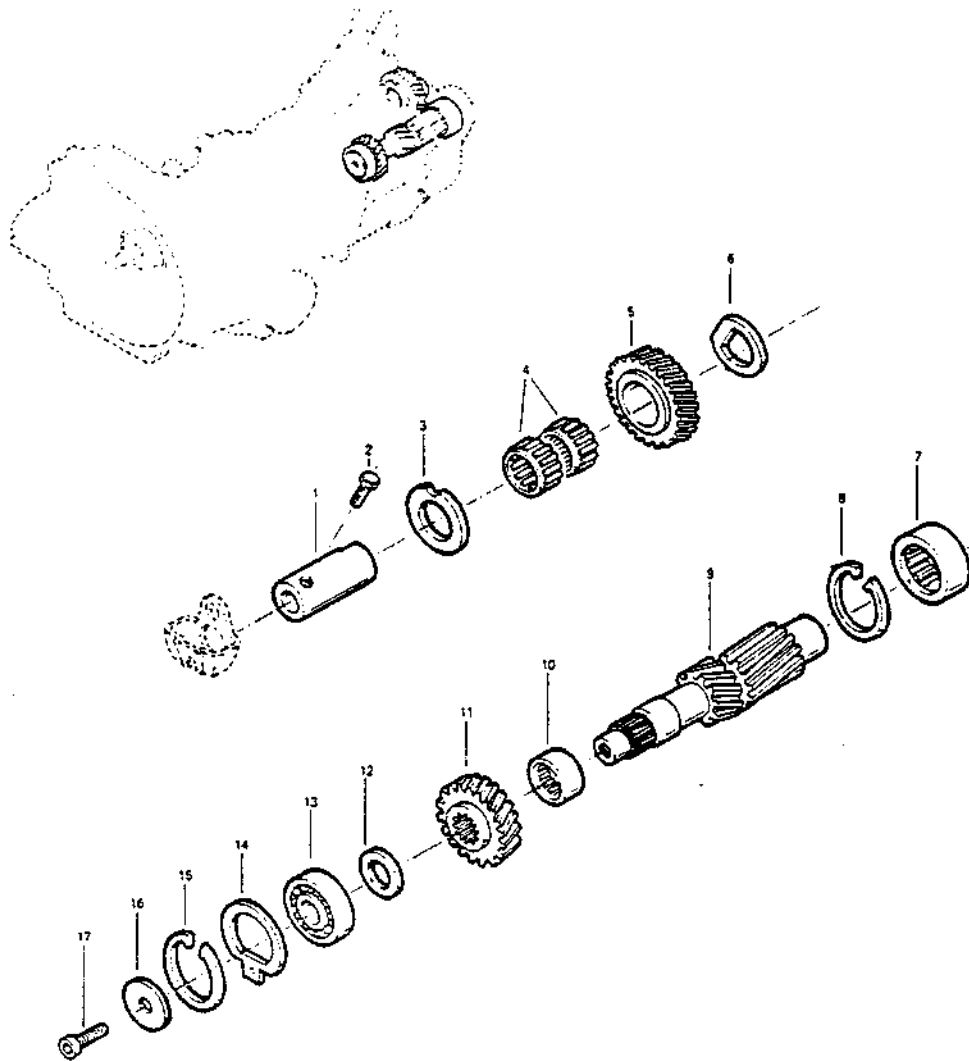


Figure 6 Transmission Countershaft

D-30-108-000/SF-002

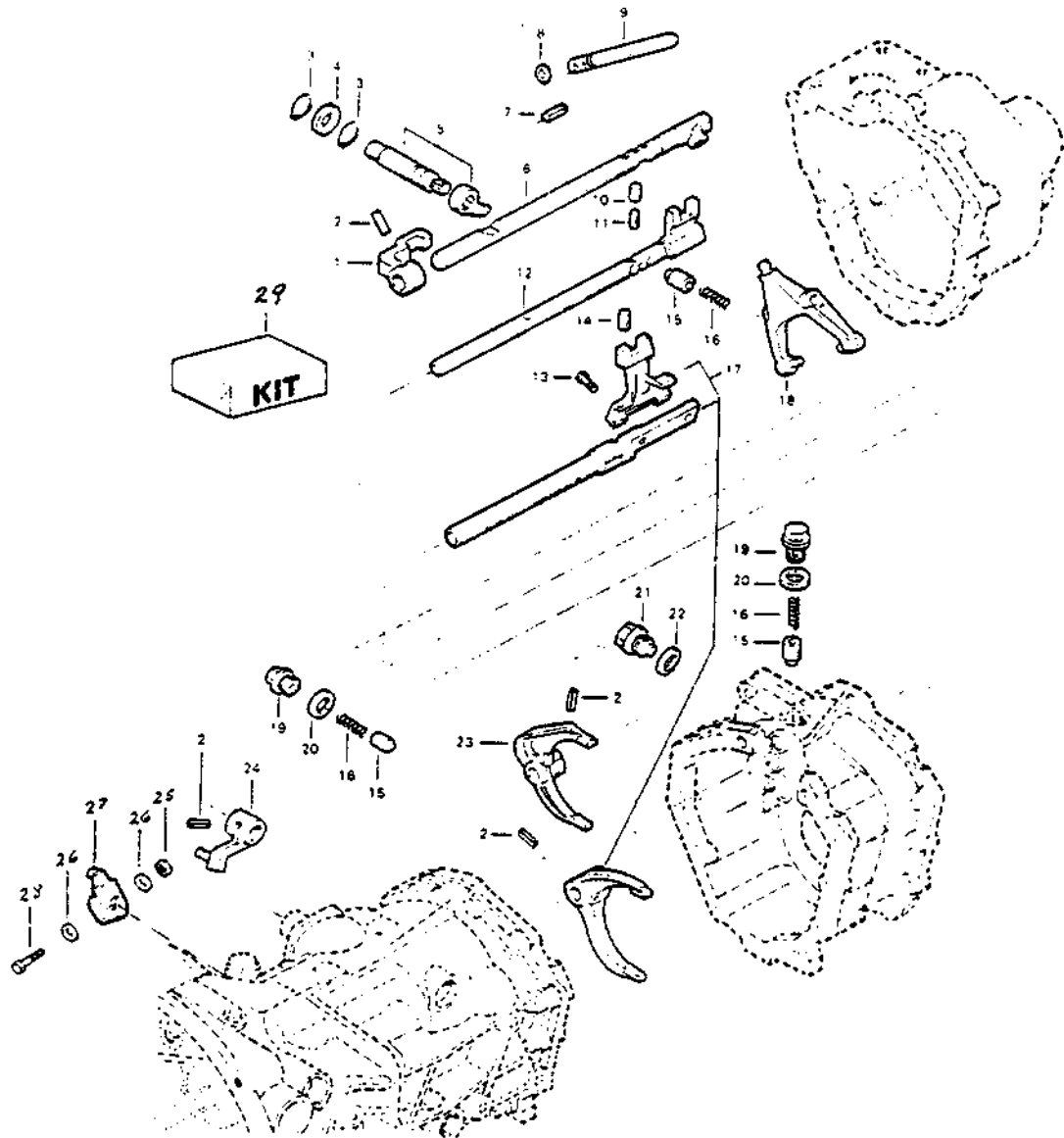


Figure 7 Forks and Selector Shafts

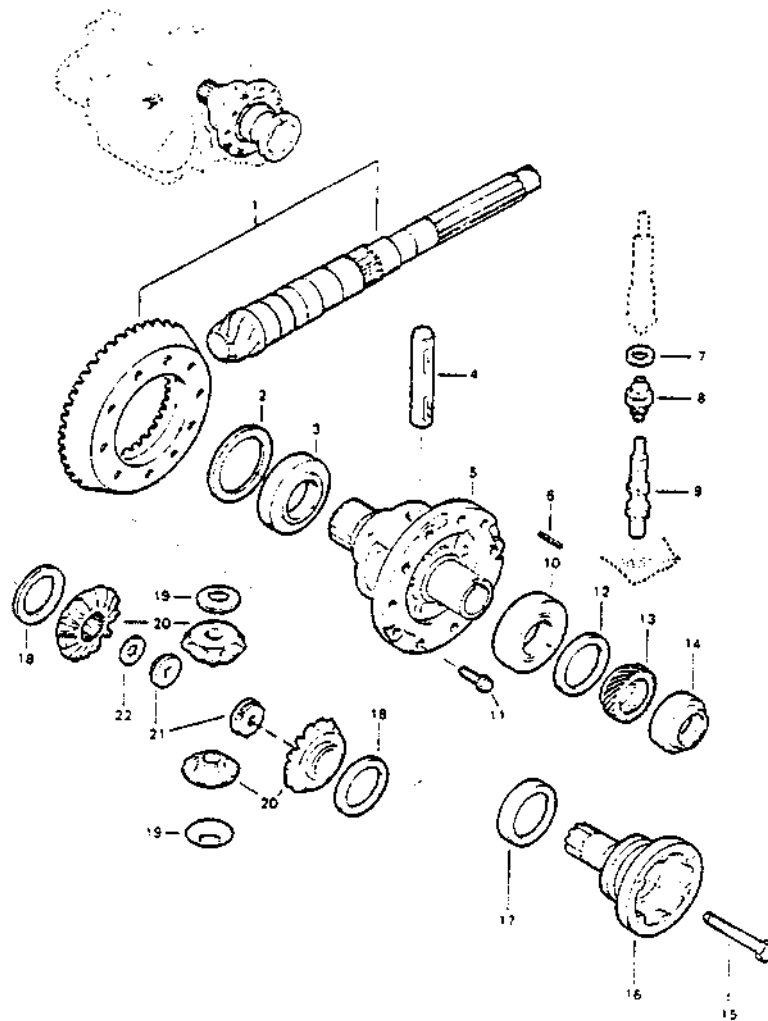


Figure 8 Front Differential

D-30-108-000/SF-002

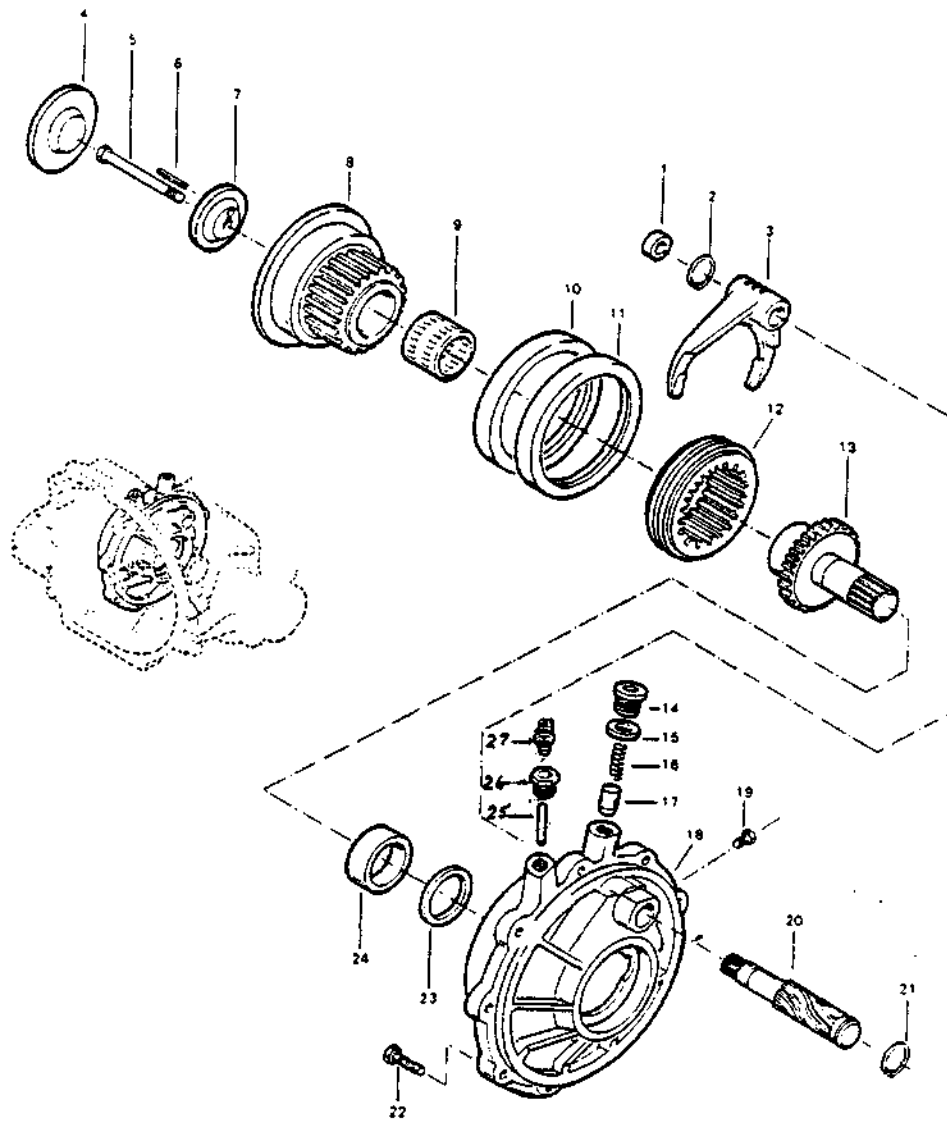


Figure 9 Cover for Front Differential

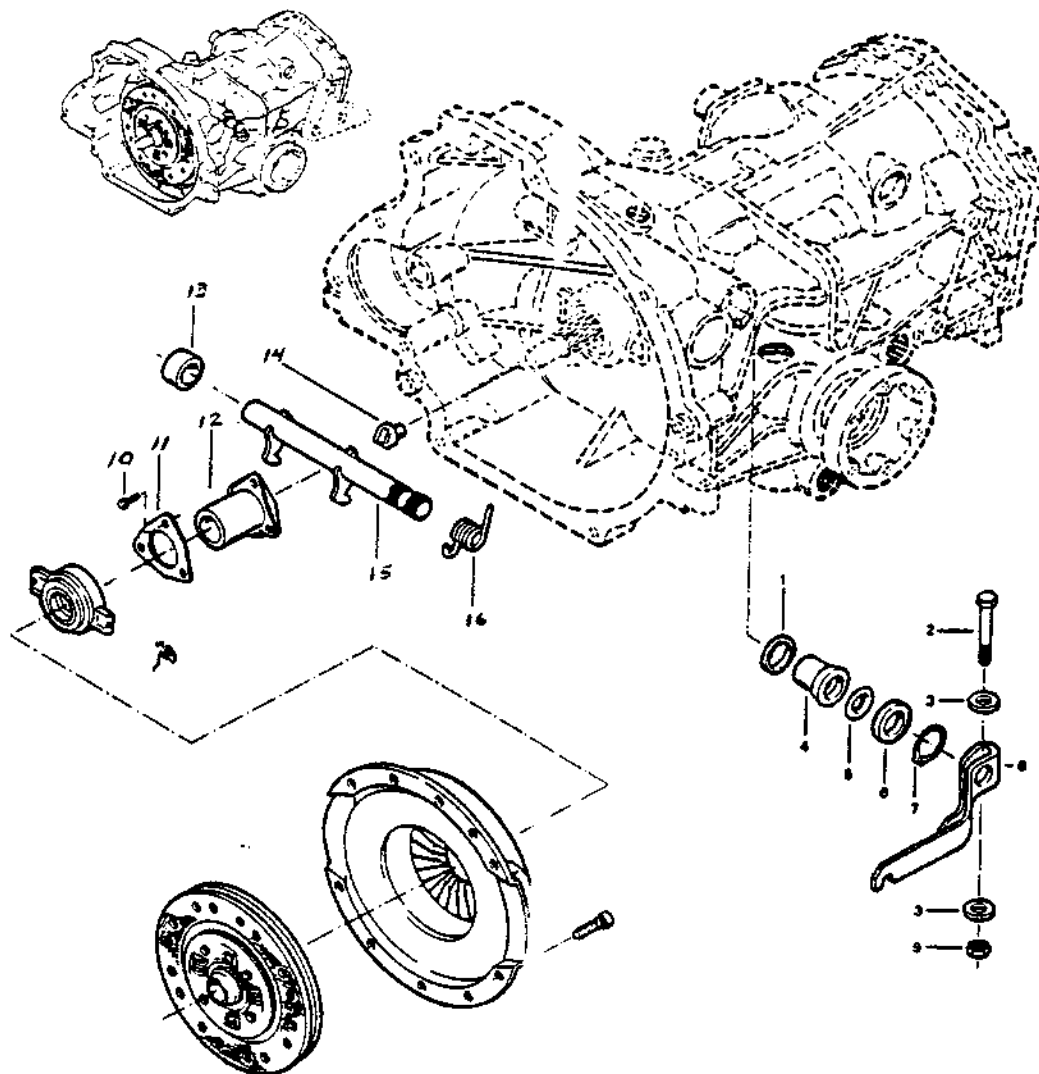
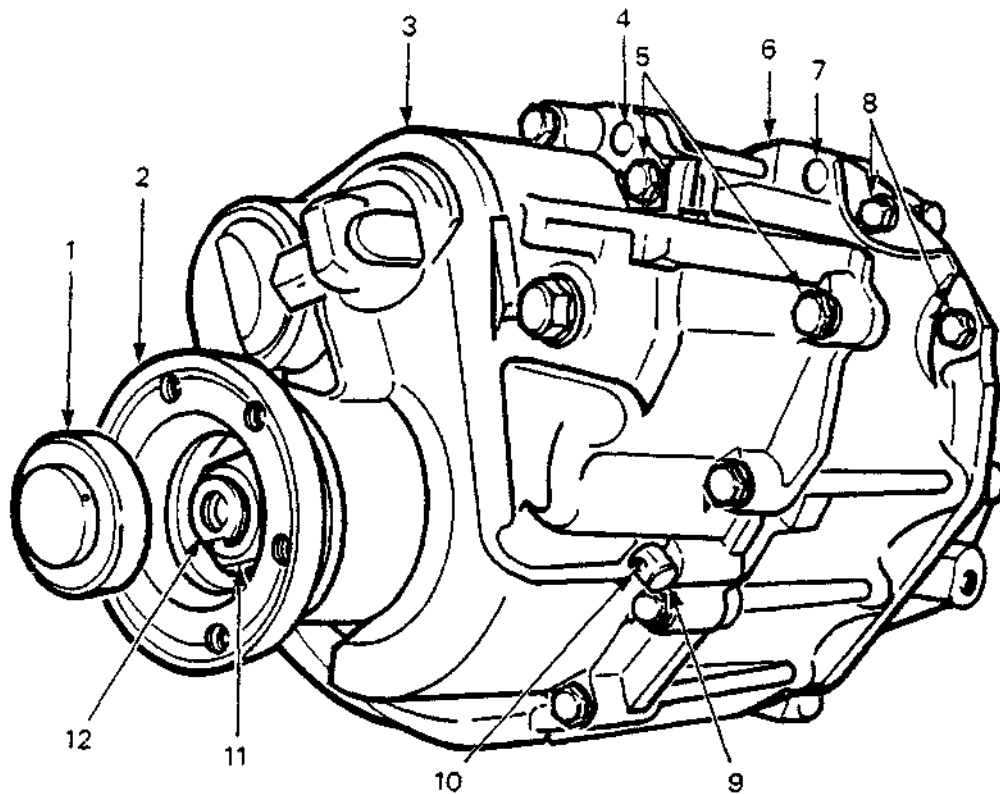


Figure 10 Clutch Housing and Shaft

D-30-108-000/SF-002



- | | | | |
|----|------------------------|-----|---------------------|
| 1. | Cap | 7. | Dowel Pin |
| 2. | Propeller Shaft Flange | 8. | Short Cap Screw |
| 3. | Transmission Cover | 9. | Selector Fork Shaft |
| 4. | Dowel Pin | 10. | Spring Pin |
| 5. | Short Cap Screw | 11. | Flange Securing Nut |
| 6. | Transmission Housing | 12. | Pinion Shaft |

Figure 11 Transmission Assembly

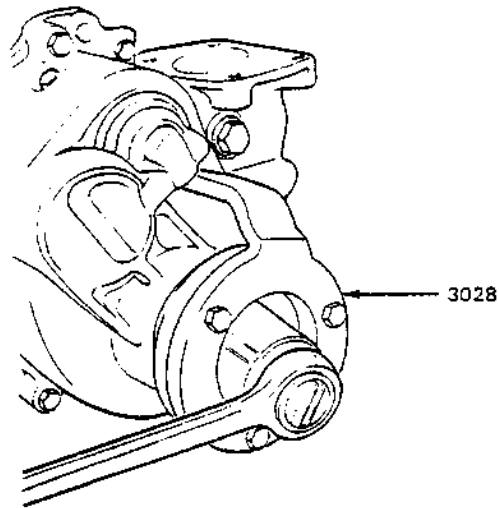


Figure 12 Removal of Propeller Shaft Drive Flange Nut

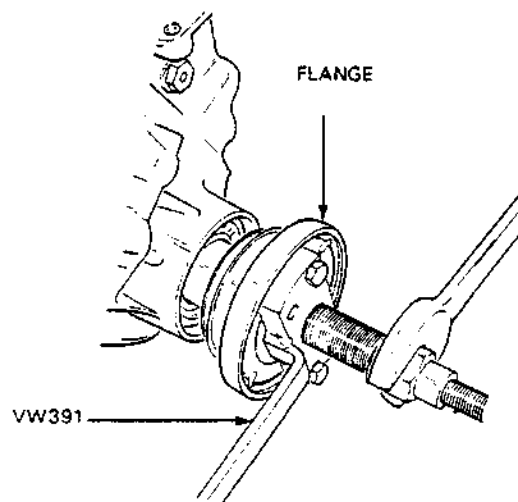
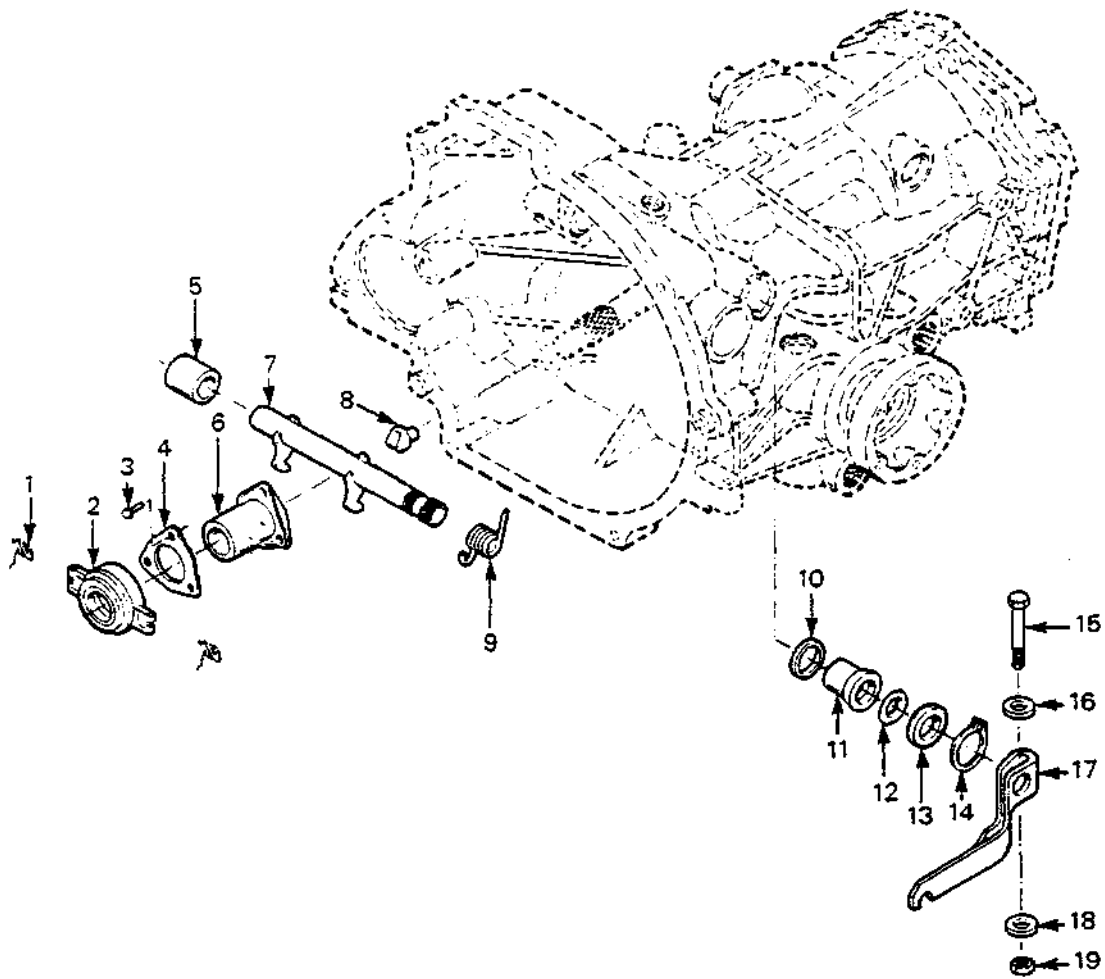


Figure 13 Removal of Propeller Shaft Drive Flange

D-30-108-000/SF-002



- | | | | |
|----|------------------------|-----|-----------------|
| 1. | Securing Springs | 10. | O-Ring |
| 2. | Clutch Release Bearing | 11. | Plastic Bushing |
| 3. | Cap Screw | 12. | O-Ring |
| 4. | Locking Collar | 13. | Plastic Cap |
| 5. | Bushing | 14. | Circlip |
| 6. | Guide Sleeve | 15. | Bolt |
| 7. | Release Shaft | 16. | Washer |
| 8. | Shaft Stop | 17. | Clutch Lever |
| 9. | Release Shaft Spring | 19. | Nut |
| | | 18. | Washer |

Figure 14 Clutch Release Bearing and Shaft Assembly

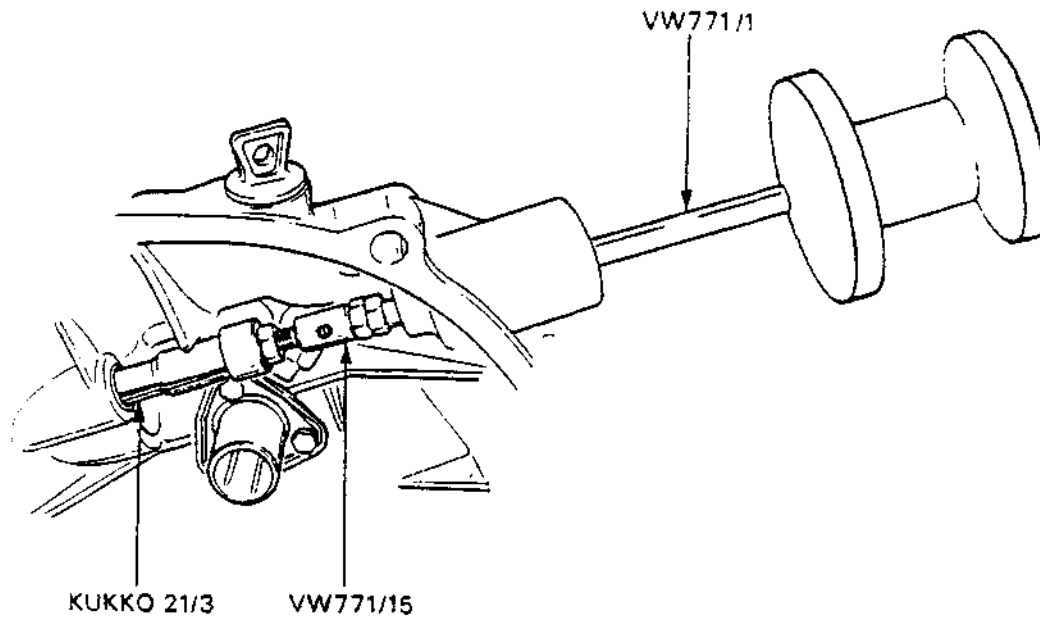


Figure 15 Removal of Clutch Release Shaft Bushing

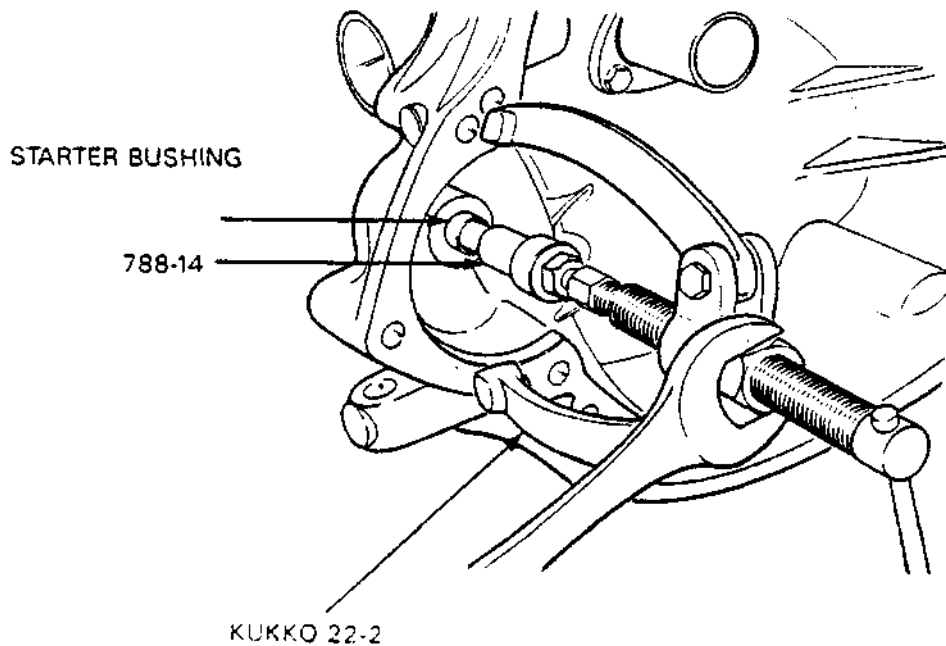


Figure 16 Removal of Starter Bushing

D-30-108-000/SF-002

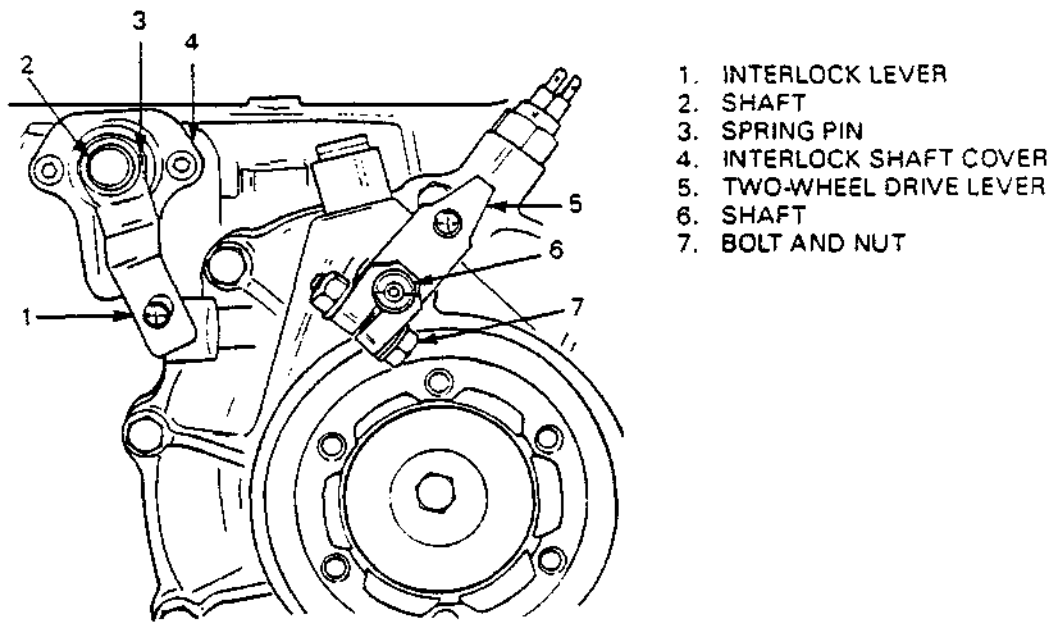


Figure 17 Two-Wheel Drive and Interlock Levers

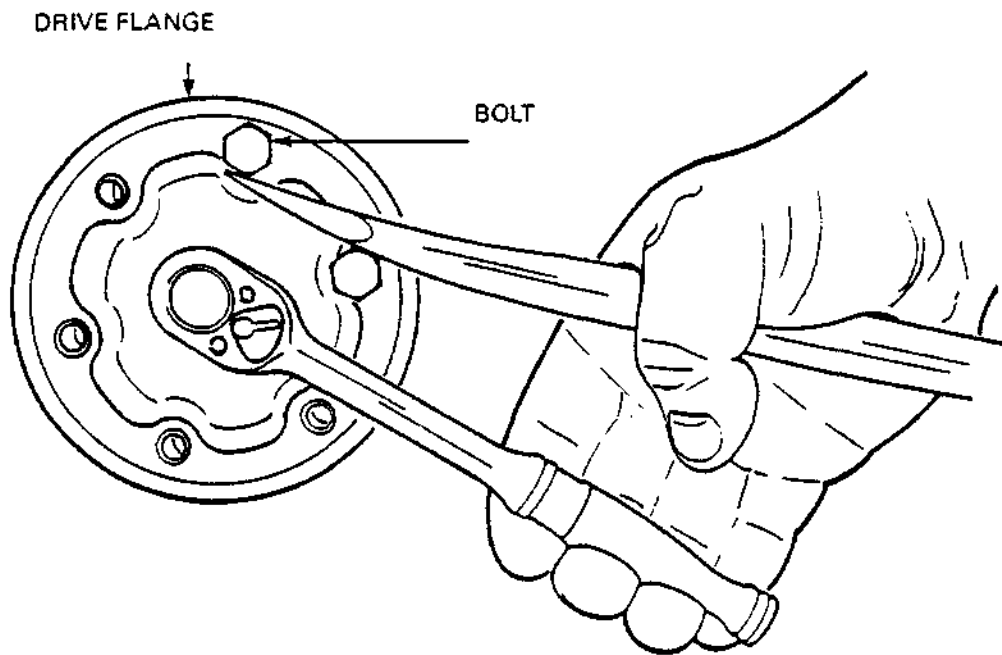


Figure 18 Removal of Drive Flange Center Bolt

D-30-108-000/SF-002

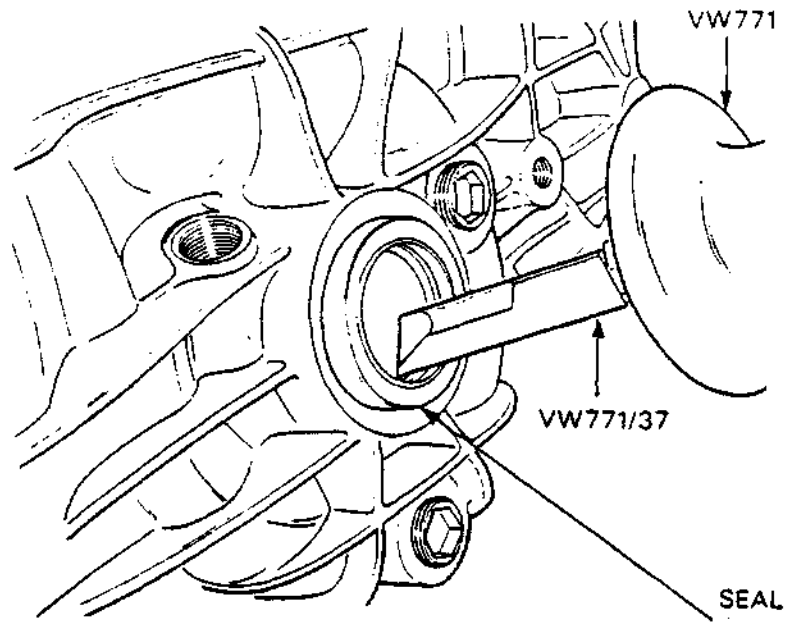


Figure 19 Removal of Left Drive Flange Seal

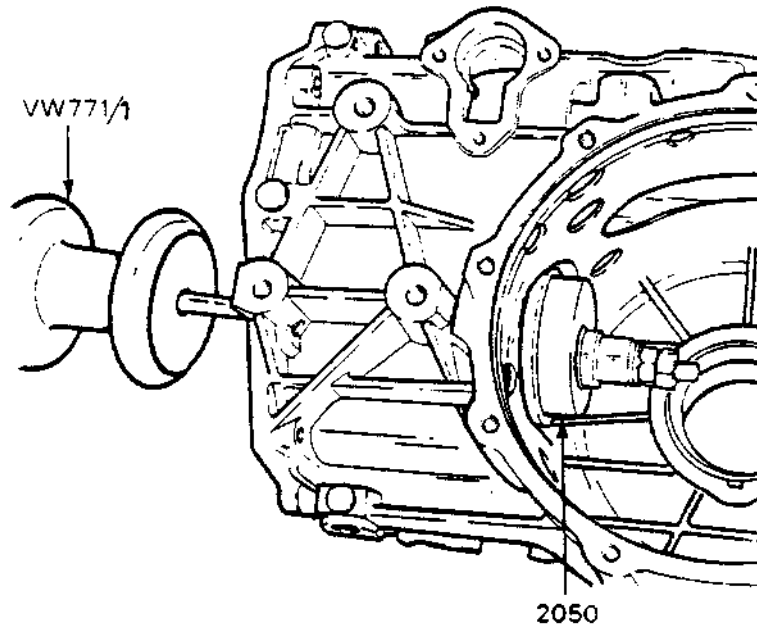


Figure 20 Removal of Pinion Shaft Bearing Race and Shim

D-30-108-000/SF-002

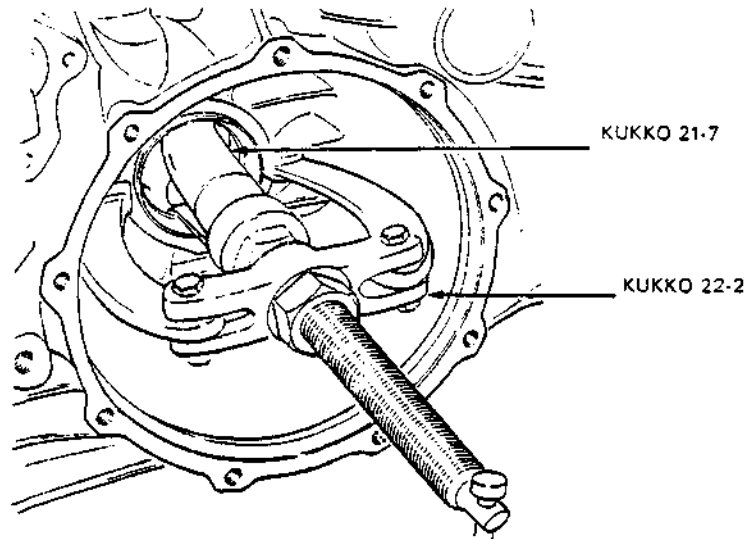


Figure 21 Removal of Left Carrier Bearing Race and Shim

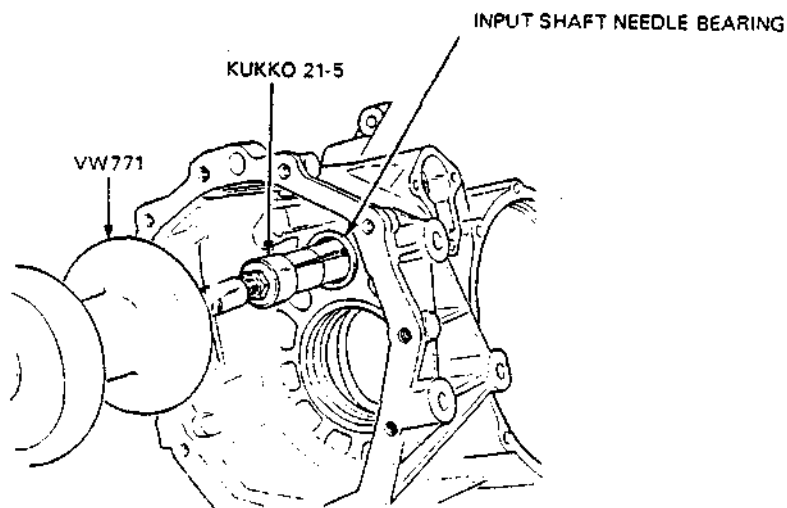
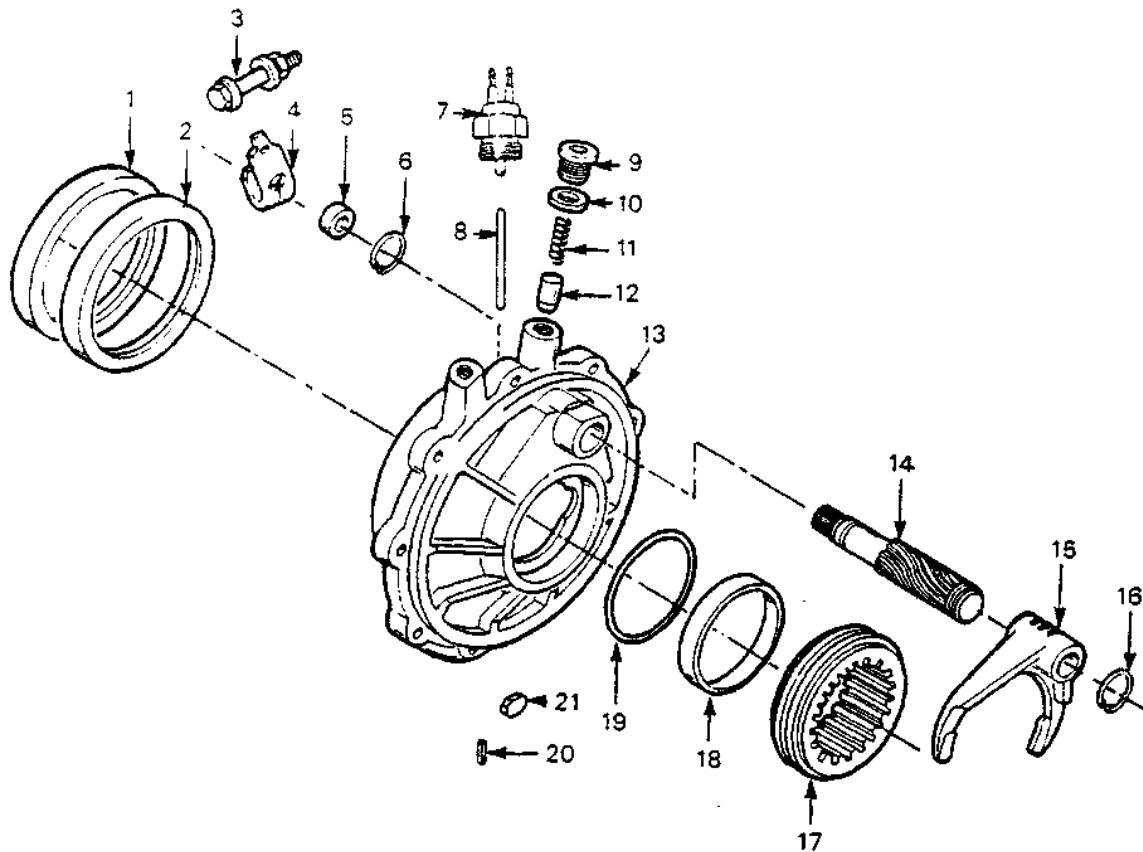


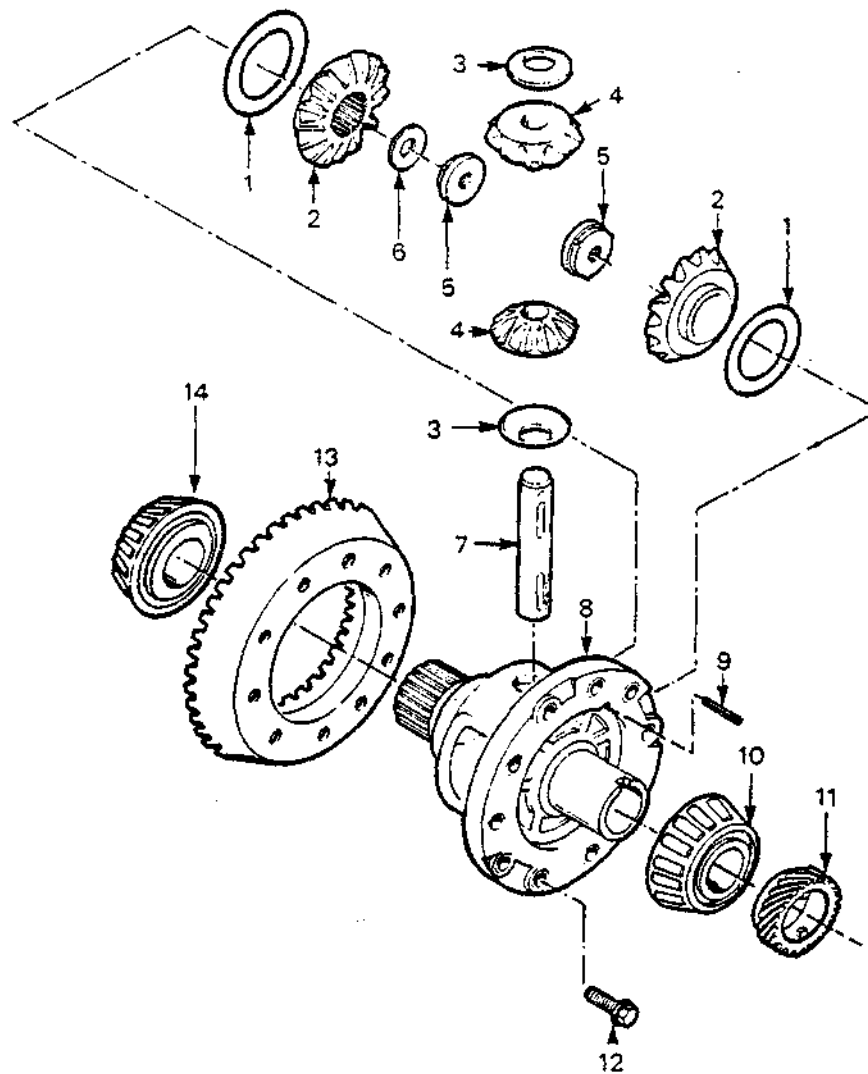
Figure 22 Removal of Input Shaft Needle Bearing



- | | | | |
|-----|------------------------------|-----|---------------------|
| 1. | Oil Seal | 13. | Differential Flange |
| 2. | Oil Seal | 14. | Selector Shaft |
| 3. | Nut, Bolt and Washers | 15. | Selector Fork |
| 4. | Two-Wheel Drive Lever | 16. | Circlip |
| 5. | Selector Shaft Seal | 17. | Sliding Collar |
| 6. | Circlip | 18. | Bearing Race |
| 7. | Two-Wheel Drive Sending Unit | 19. | Shim |
| 8. | Extension Shaft | 20. | Tubular Key |
| 9. | Detent Plug | 21. | Magnet |
| 10. | Seal | | |
| 11. | Spring | | |
| 12. | Detent | | |

Figure 23 Differential Flange Assembly

D-30-108-000/SF-002



- | | | | |
|----|----------------------|-----|------------------------|
| 1. | Shims | 8. | Carrier |
| 2. | Side Gears | 9. | Spring Pin |
| 3. | Thrust Washers | 10. | Small Carrier Bearing |
| 4. | Pinion Gears | 11. | Speedometer Drive Gear |
| 5. | Nuts | 12. | Cap Screw |
| 6. | Drive Flange Shim(s) | 13. | Crown Gear |
| 7. | Shaft | 14. | Large Carrier Bearing |

Figure 24 Crown Gear and Carrier Assembly

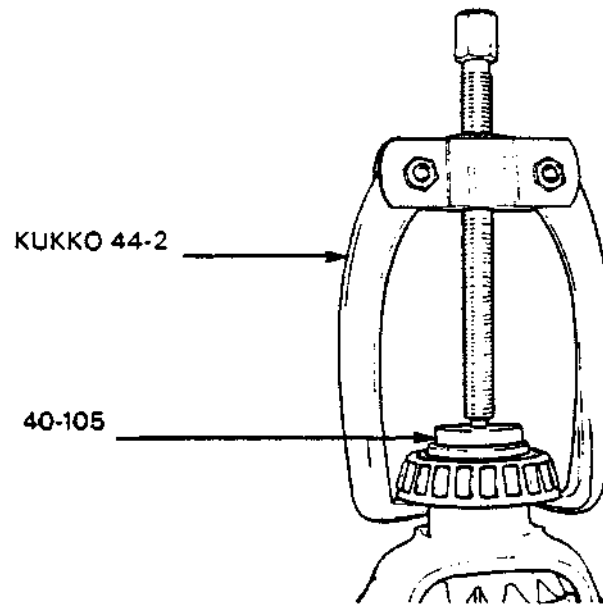


Figure 25 Removal of Large Carrier Bearing

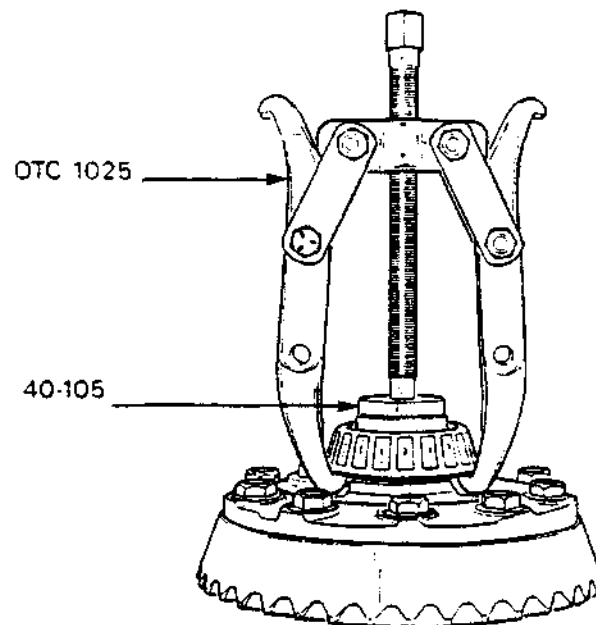


Figure 26 Removal of Small Carrier Bearing

D-30-108-000/SF-002

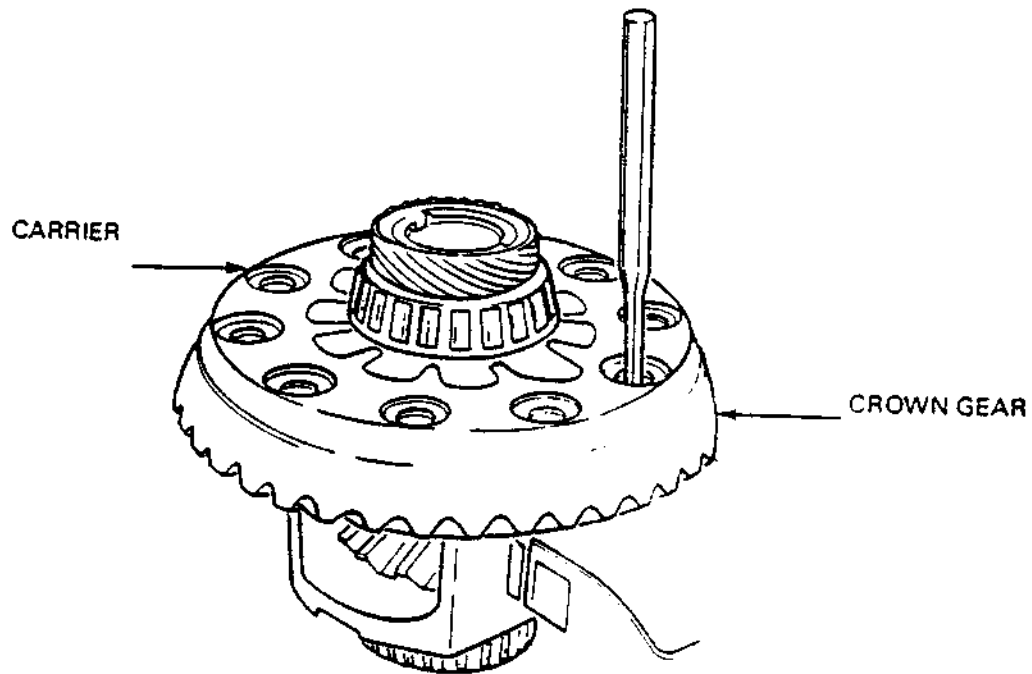
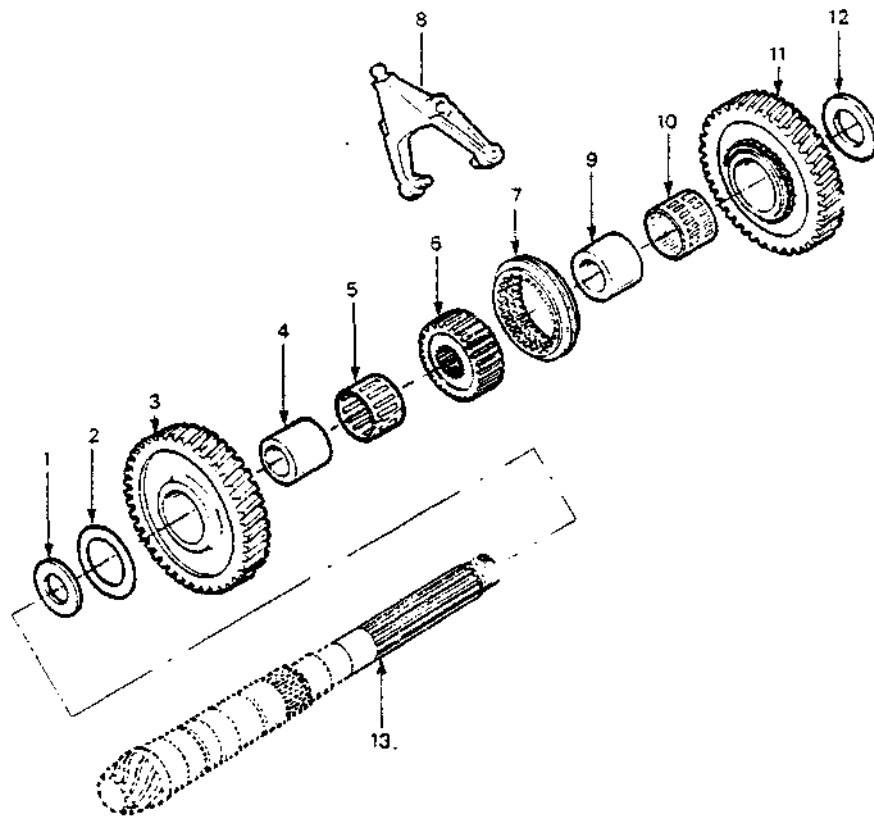


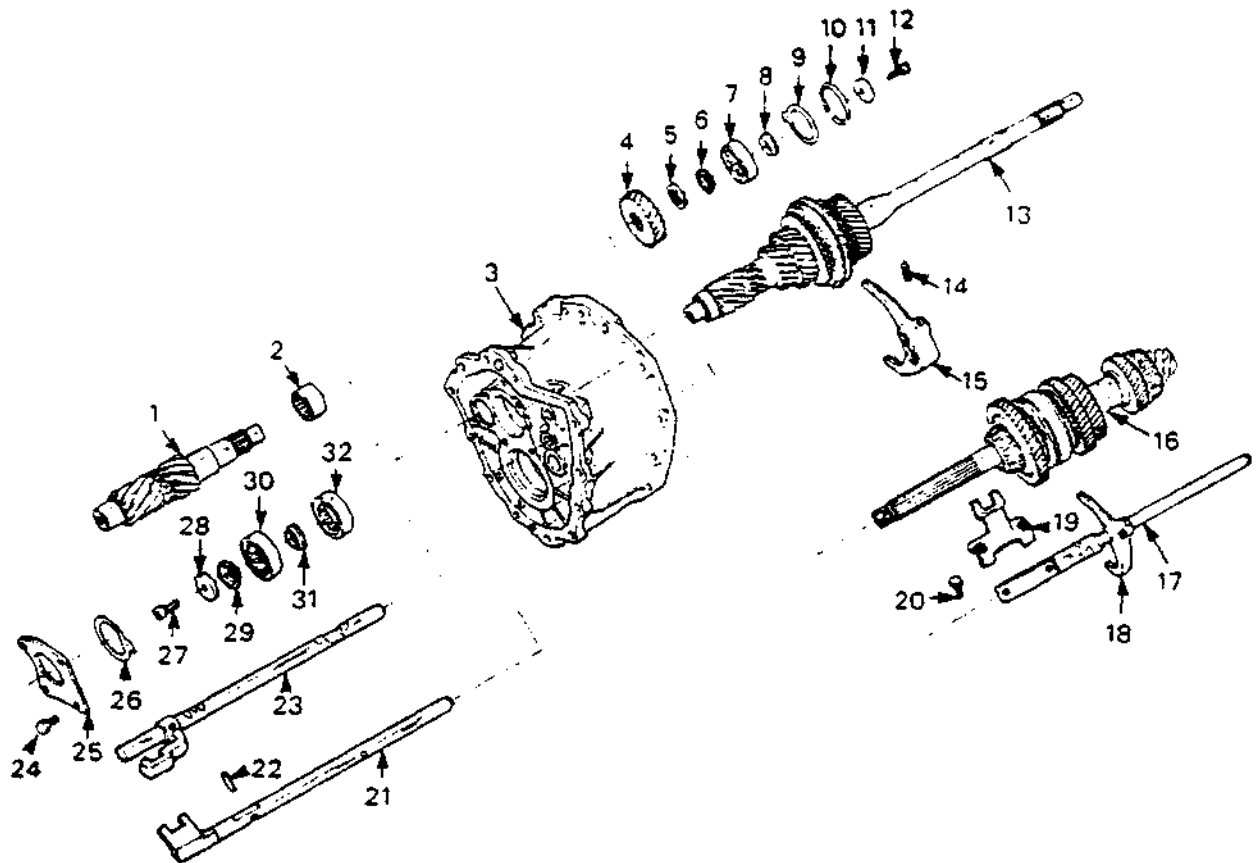
Figure 27 Removal of Crown Gear from Carrier



- | | | | |
|----|------------------|-----|--------------------|
| 1. | Shim | 8. | Selector Fork |
| 2. | Thrust Washer | 9. | Bushing |
| 3. | Reverse Gear | 10. | Needle Bearing |
| 4. | Bushing | 11. | Cross Country Gear |
| 5. | Needle Bearing | 12. | Thrust Washer |
| 6. | Hub | 13. | Pinion Shaft |
| 7. | Operating Sleeve | | |

Figure 28 Reverse and Cross-Country Gear Assembly

D-30-108-000/SF-002



- | | | | |
|-----|-----------------------------|-----|-----------------------|
| 1. | Countershaft | 17. | 1-2 Shifter Rod |
| 2. | Countershaft Needle Bearing | 18. | 1-2 Selector Fork |
| 3. | Transmission Housing | 19. | Operating Link |
| 4. | Countershaft Reverse Gear | 20. | Cap Screw |
| 5. | Thrust Washer | 21. | 3-4 Shifter Rod |
| 6. | Bearing Race | 22. | 3-4 Interlock Pin |
| 7. | Bearing | 23. | CC/R Shifter Rod |
| 8. | Bearing Race | 24. | Cap Screw |
| 9. | Retaining Washer | 25. | Support Plate |
| 10. | Snap Ring | 26. | Retaining Washer |
| 11. | Washer | 27. | Socket Head Cap Screw |
| 12. | Socket Head Cap Screw | 28. | Washer |
| 13. | Input Shaft | 29. | Bearing Race |
| 14. | Tubular Key | 30. | Ball Bearing |
| 15. | 3-4 Selector Fork | 31. | Bearing Race |
| 16. | Pinion Shaft | 32. | Roller Bearing |

Figure 29 Transmission Assembly

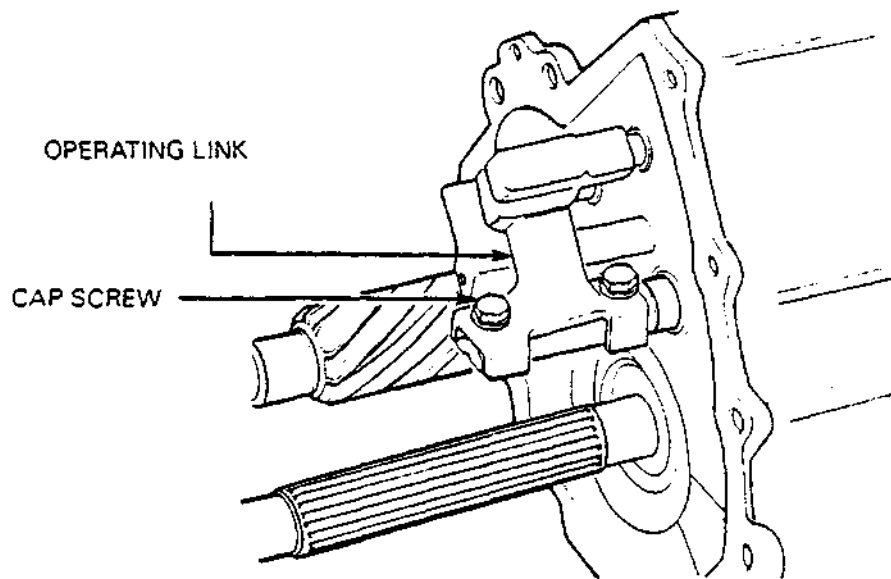


Figure 30 First and Second Gear Operating Link

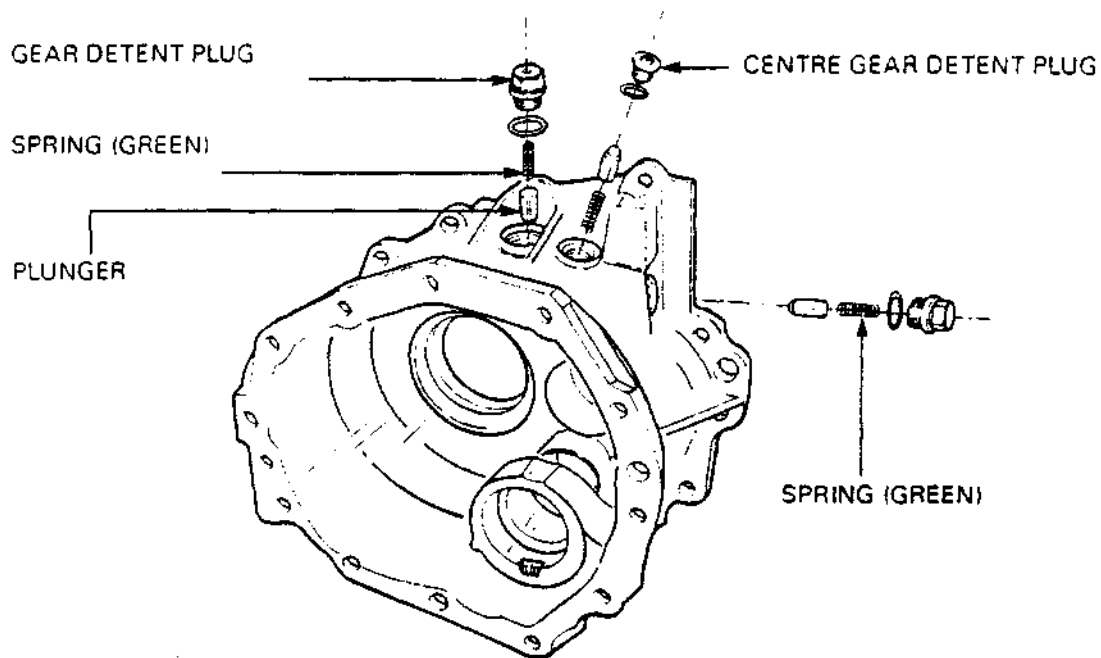


Figure 31 Gear Detent Plugs, Plungers and Springs

D-30-108-000/SF-002

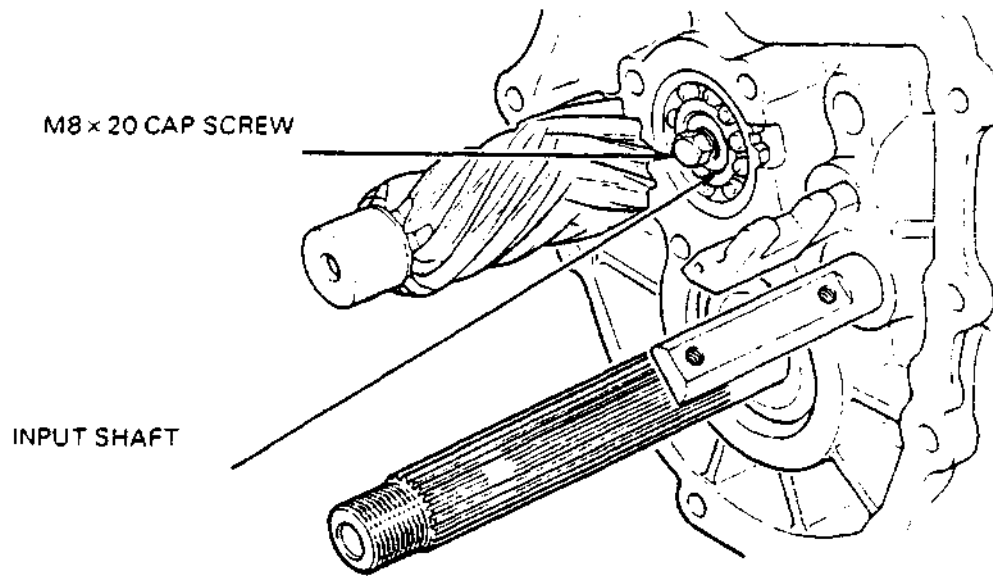


Figure 32 Cap Screw Installed on Input Shaft

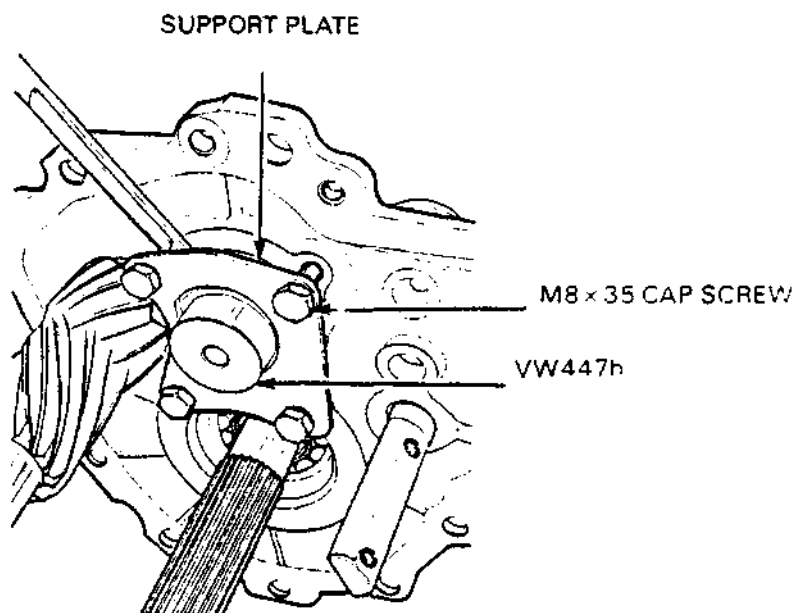


Figure 33 Support Plate and VW447h Installed

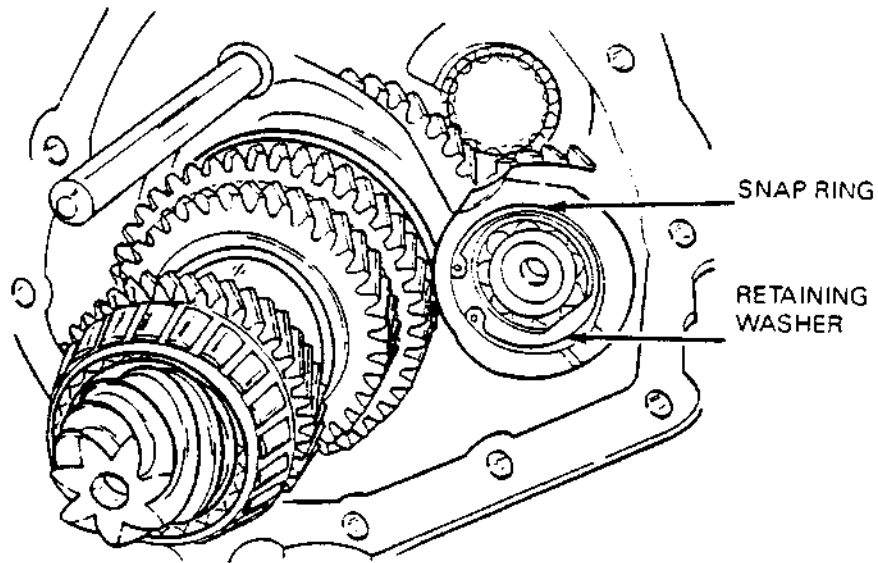


Figure 34 Countershaft Snap Ring and Retaining Washer

D-30-108-000/SF-002

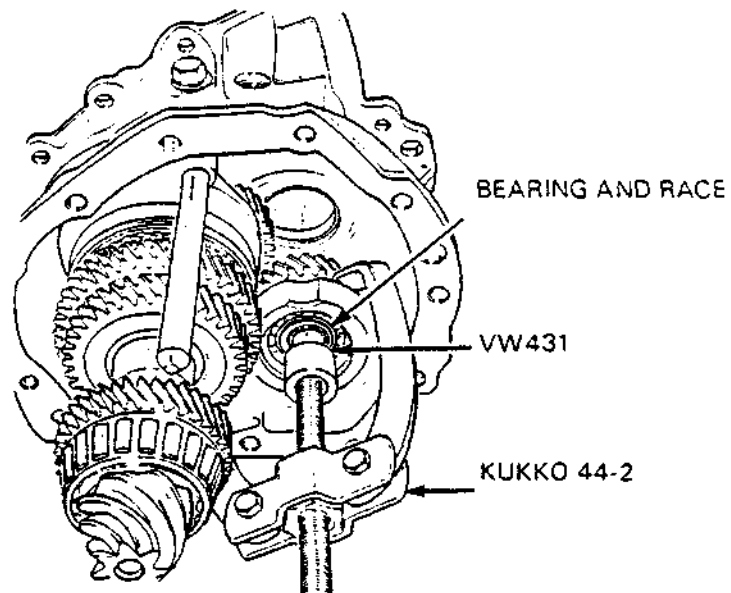


Figure 35 Removal of Countershaft

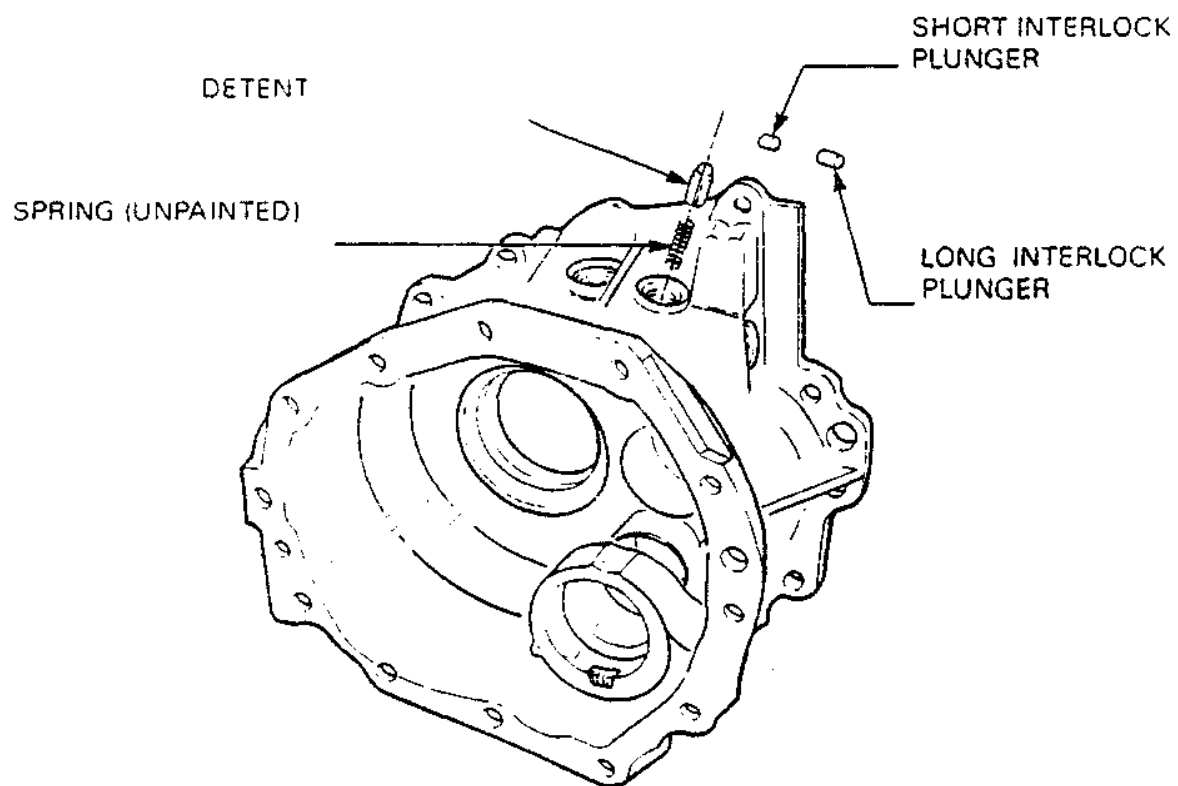


Figure 36 Interlocking Plungers, Gear Detent Plug and Spring

D-30-108-000/SF-002

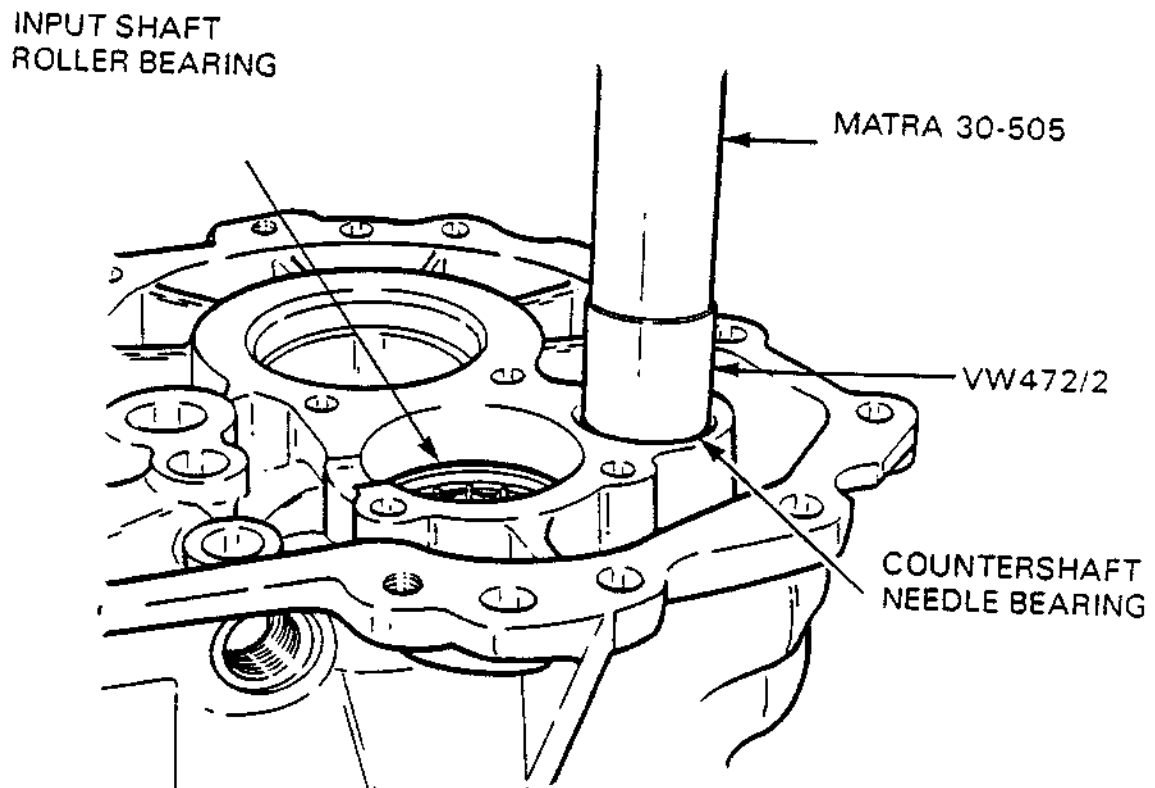
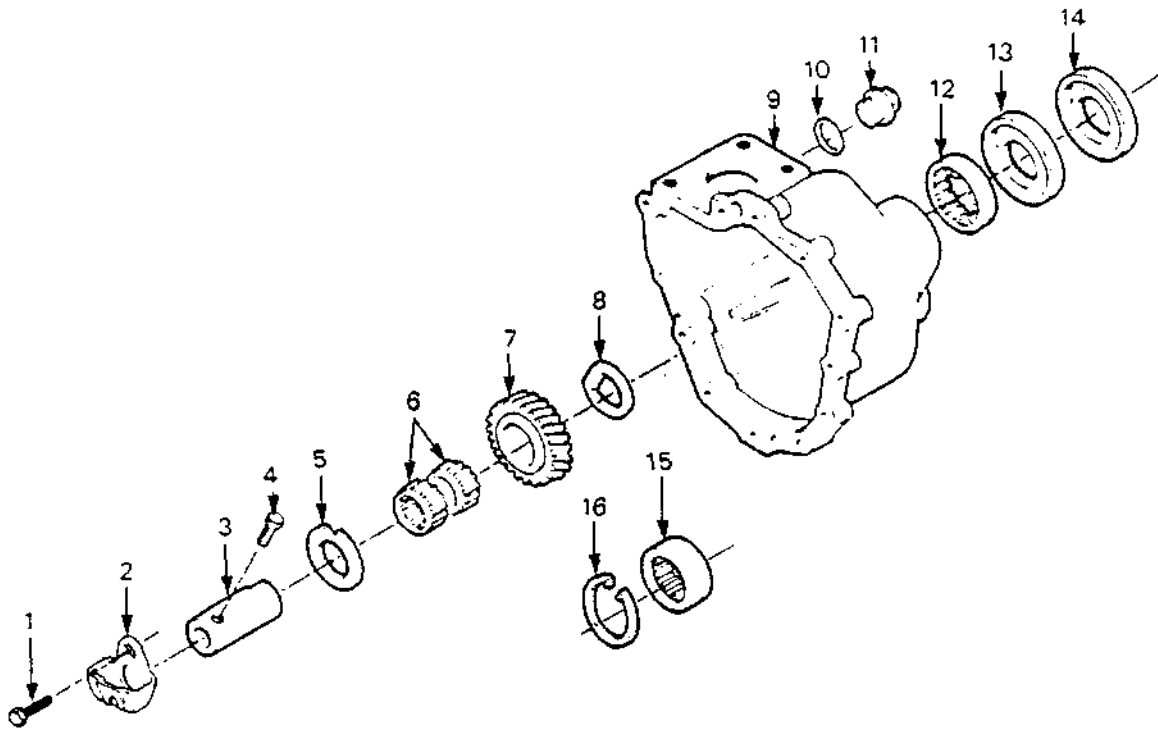


Figure 37 Removal of Countershaft Needle Bearing



- | | | | |
|----|---------------------|-----|-----------------------------|
| 1. | Oil Trap Lock Screw | 9. | Transmission Cover |
| 2. | Oil Trap | 10. | Seal |
| 3. | Idler Gear Shaft | 11. | Reverse Light Switch Plug |
| 4. | Shaft Lock Screw | 12. | Pinion Shaft Roller Bearing |
| 5. | Thrust Washer | 13. | Pinion Shaft Seal-Inner |
| 6. | Bearings | 14. | Pinion Shaft Seal-Outer |
| 7. | Idler Gear | 15. | Countershaft Roller Bearing |
| 8. | Thrust Washer | 16. | Circlip |

Figure 38 Transmission Cover Assembly

D-30-108-000/SF-002

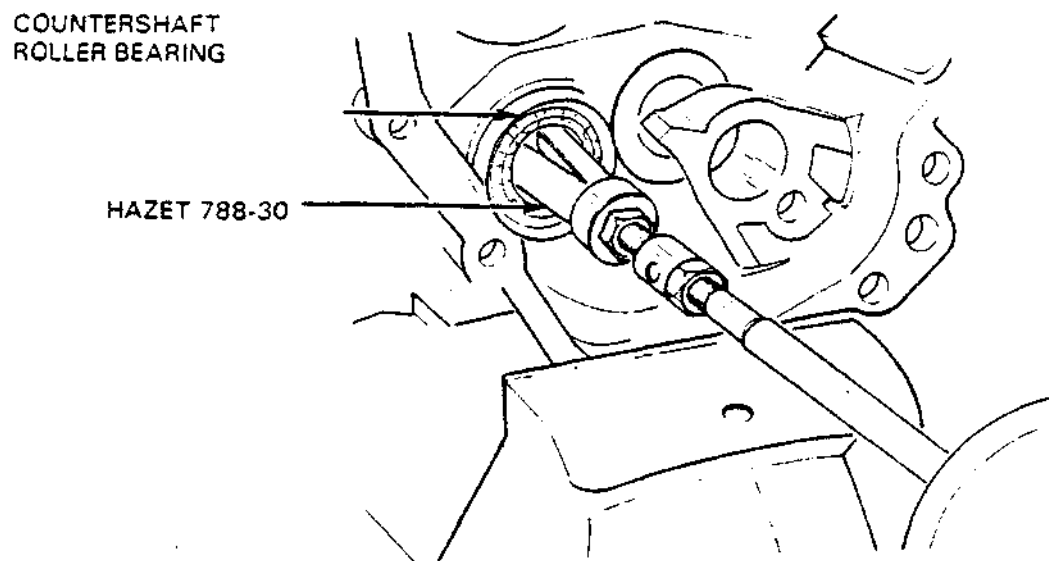


Figure 39 Removal of Countershaft Roller Bearing

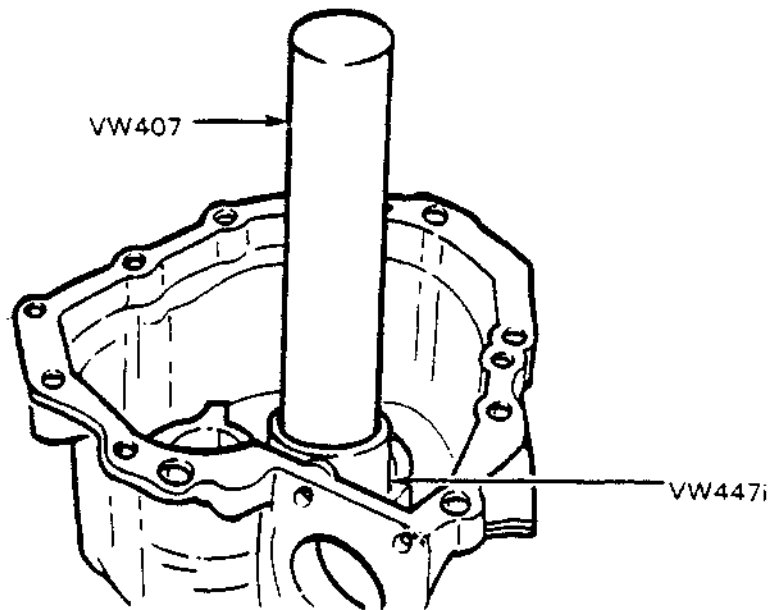
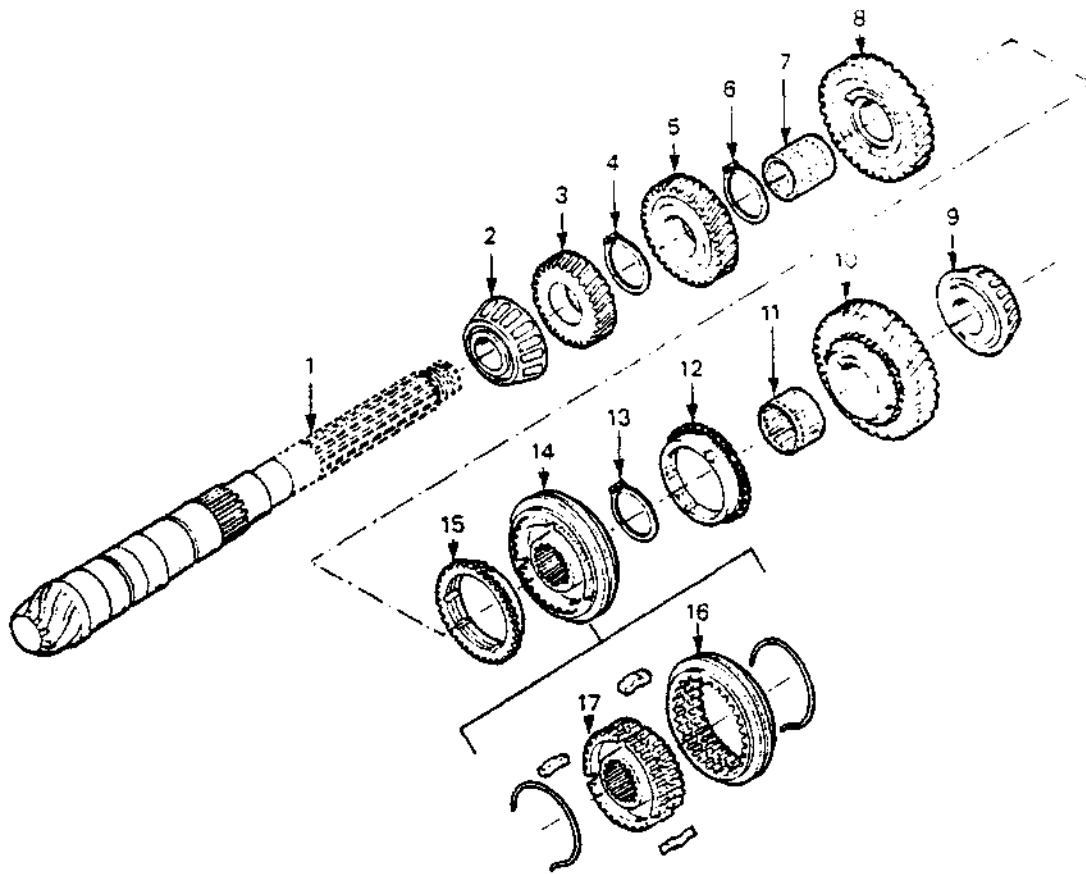


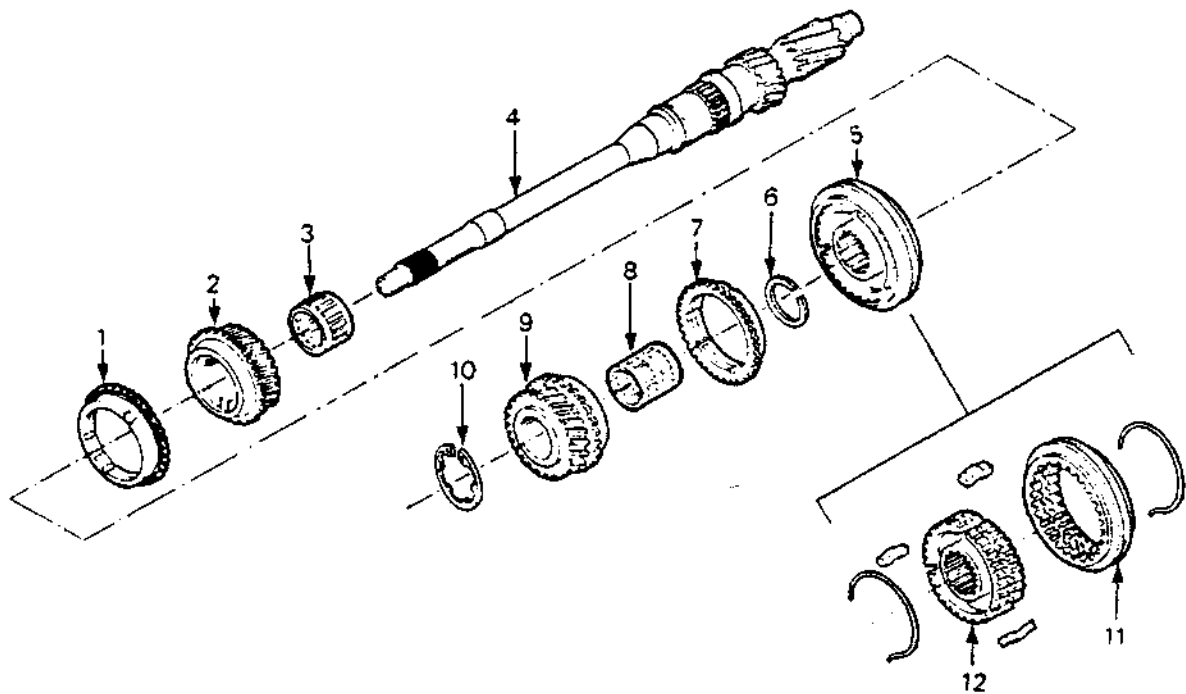
Figure 40 Removal of Pinion Shaft Roller Bearing

D-30-108-000/SF-002



1. PINION SHAFT
2. TAPERED ROLLER BEARING
3. FOURTH GEAR
4. SNAPPING
5. THIRD GEAR
6. SNAPPING
7. NEEDLE BEARING
8. SECOND GEAR
9. TAPERED ROLLER BEARING
10. FIRST GEAR
11. NEEDLE BEARING
12. FIRST GEAR SYNCHRONIZING RING
13. SNAPPING
14. SYNCHRONIZING UNIT
15. SECOND GEAR SYNCHRONIZING RING
16. SLEEVE
17. SYNCHRONIZER HUB

Figure 41 Pinion Shaft Assembly



- | | | | |
|----|------------------------------|-----|-------------------------------|
| 1. | Third Gear Synchronizer Ring | 7. | Fourth Gear Synchronizer Ring |
| 2. | Third Gear | 8. | Needle Bearing |
| 3. | Needle Bearing | 9. | Fourth Gear |
| 4. | Input Shaft | 10. | Circlip |
| 5. | Synchronizing Unit | 11. | Operating Sleeve |
| 6. | Snap Ring | 12. | Synchronizer Hub |

Figure 42 Input Shaft Assembly

D-30-108-000/SF-002

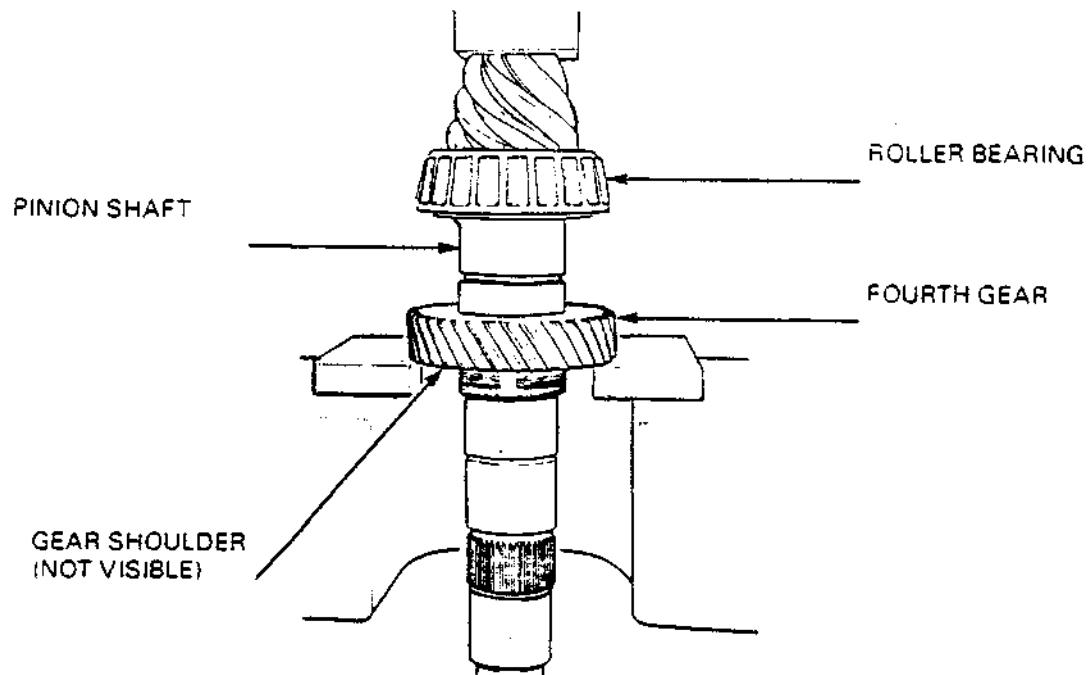


Figure 43 Installation of Roller Bearing and Fourth Gear

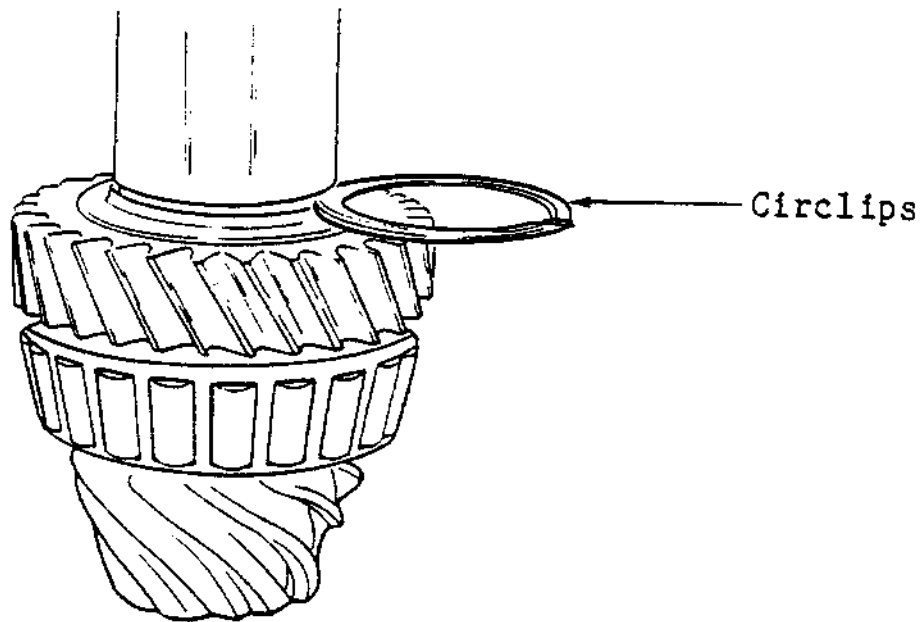


Figure 44 Selection of Circlips for Fourth Gear

D-30-108-000/SF-002

Mfr Part No	Thickness (mm)
B 088 311 363 AA	2.34
B 088 311 363 AC	2.36
B 088 311 363 AE	2.38
B 088 311 363 AG	2.40
B 088 311 363 AJ	2.42
B 088 311 363 AL	2.44
B 088 311 363 AN	2.46
B 088 311 363 AQ	2.48
B 088 311 363 AS	2.50

Figure 45 Circlips for Fourth Gear

Mfr Part	Thickness (mm)
B 088 311 287	1.65
B 088 311 287 A	1.70
B 088 311 287 B	1.75

Figure 46 Circlip for Third Gear

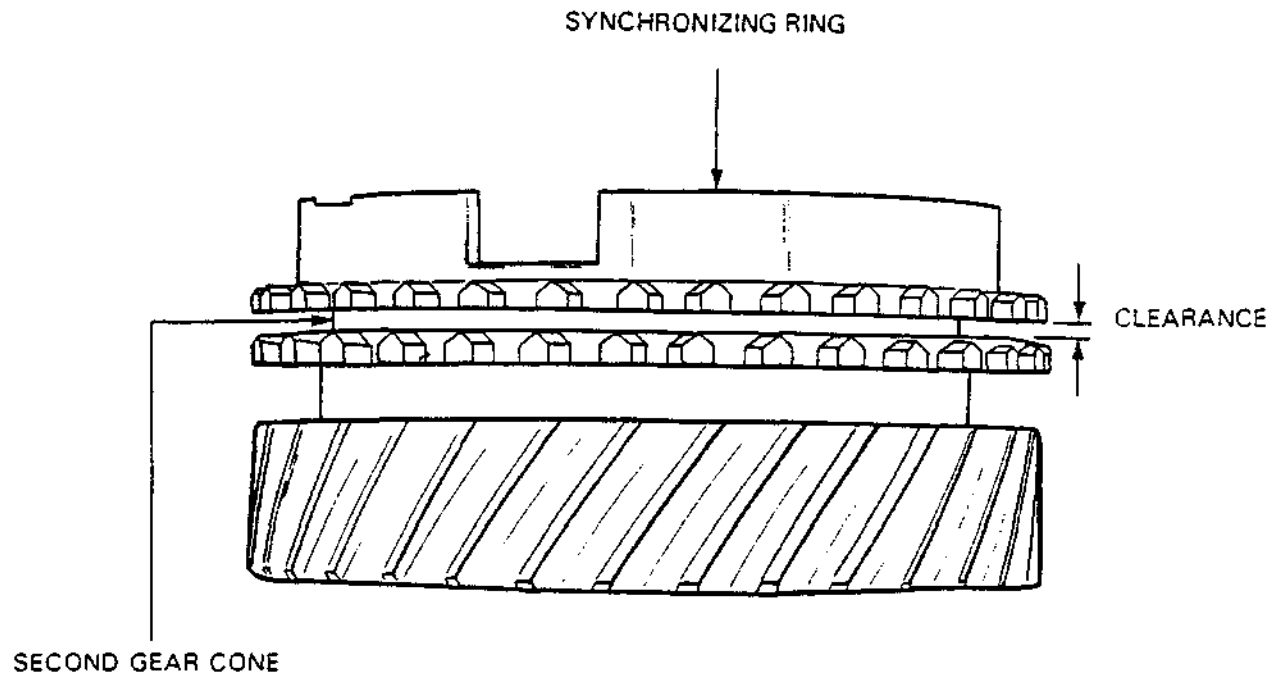


Figure 47 Clearance Between Synchronizing Ring and Gear Cone
(Second Gear Illustrated)

Mfr Part No	Thickness (mm)
B 088 311 327	1.50
B 088 311 327 A	1.55
B 088 311 327 B	1.60

Figure 48 Snap Rings for Synchronizing Hub

D-30-108-000/SF-002

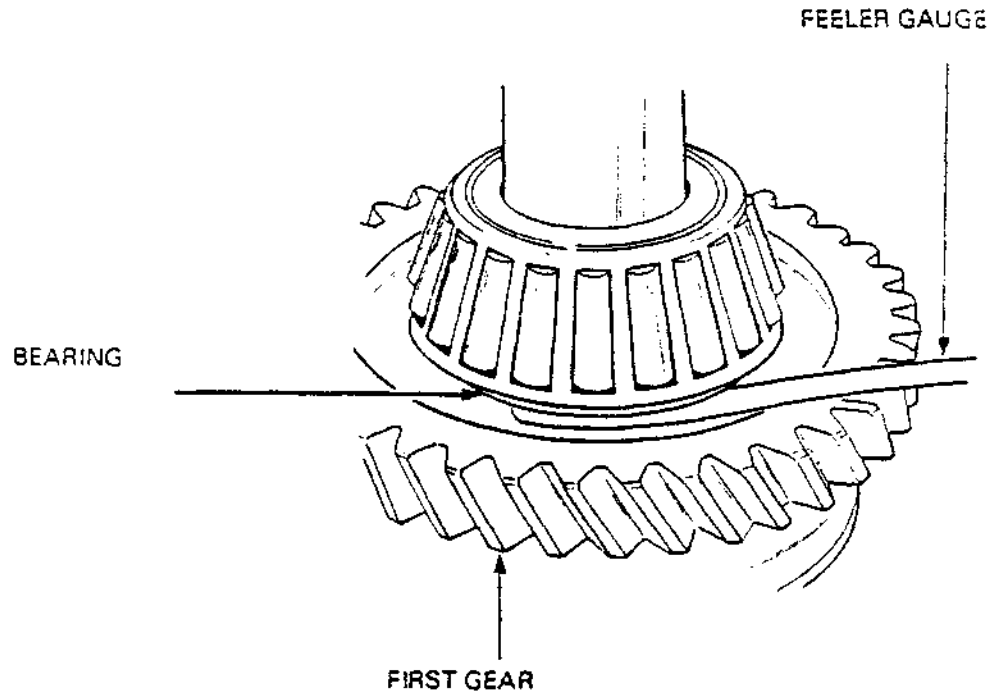


Figure 49 Checking Clearance Between Bearing and First Gear

Mfr Part No	Thickness (mm)
B 088 311 317	1.50
B 088 311 317 B	1.56
B 088 311 317 C	1.62

Figure 50 Snap Rings for Input Shaft Synchronizing Hub

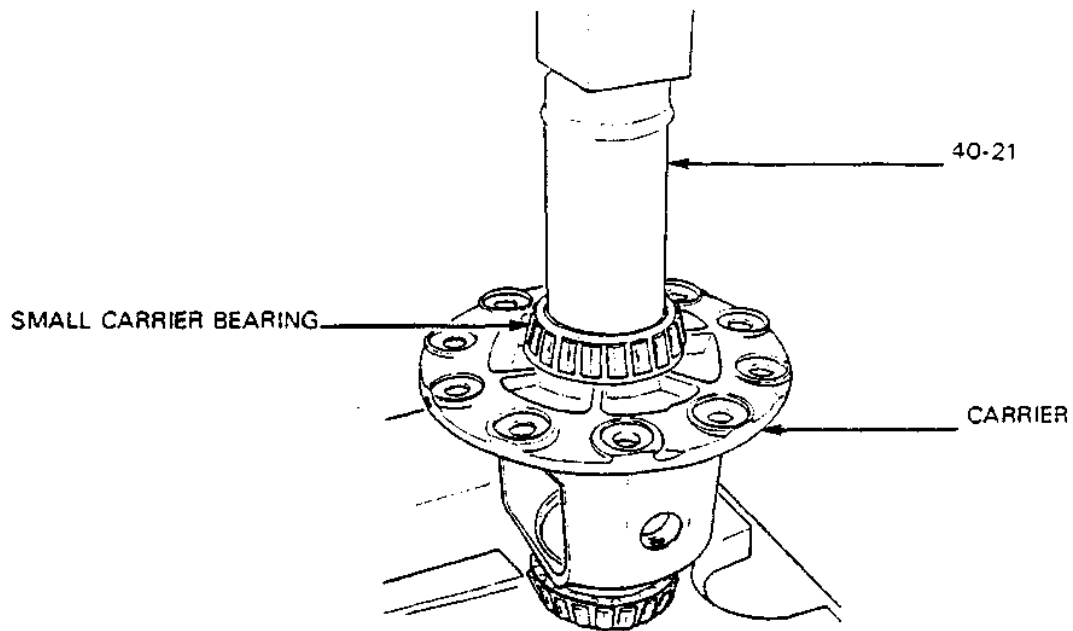


Figure 51 Installation of Small Carrier Bearing

D-30-108-000/SF-002

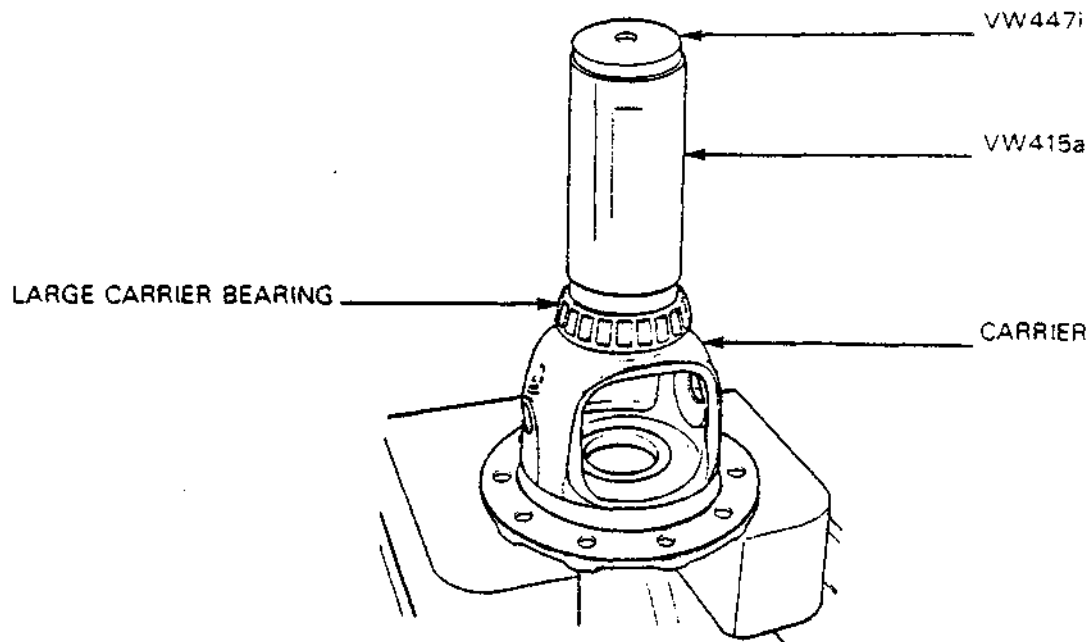


Figure 52 Installation of Large Carrier Bearing

Mfr Part No	Thickness (mm)
B Oil 519 215	0.50
B 088 409 249	0.60
B 088 409 249 A	0.70
B 088 409 249 B	0.80

Figure 53 Shims Available for Side Gears

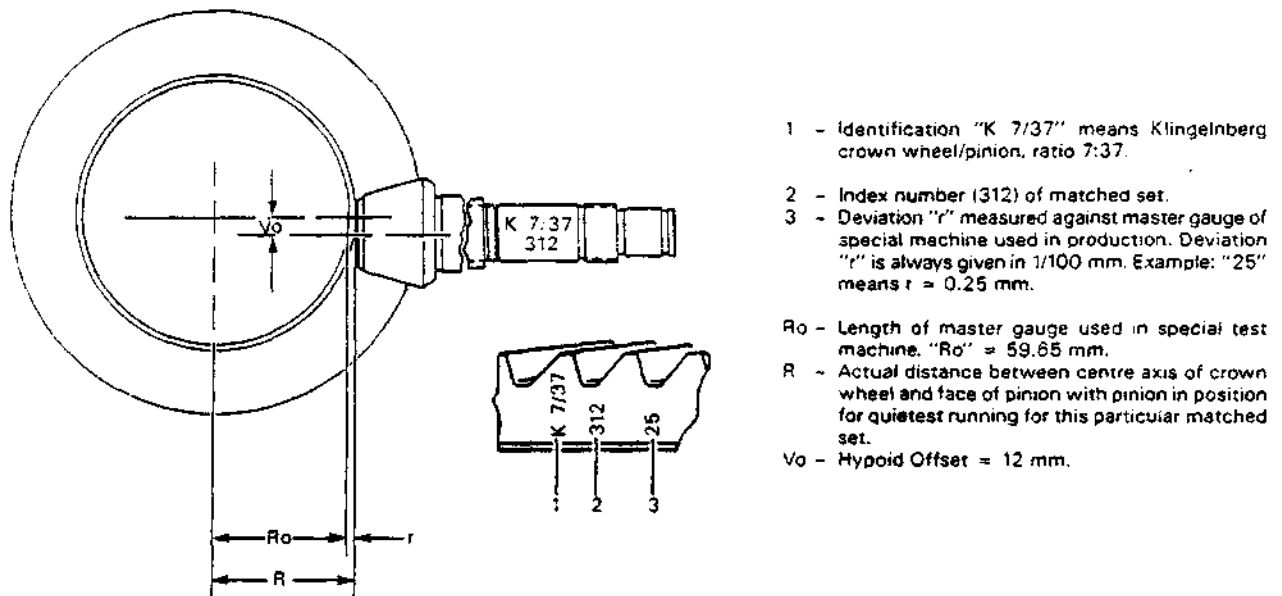


Figure 54 Crown Gear and Pinion Adjustments and Identification Markings (Transaxle)

D-30-108-000/SF-002

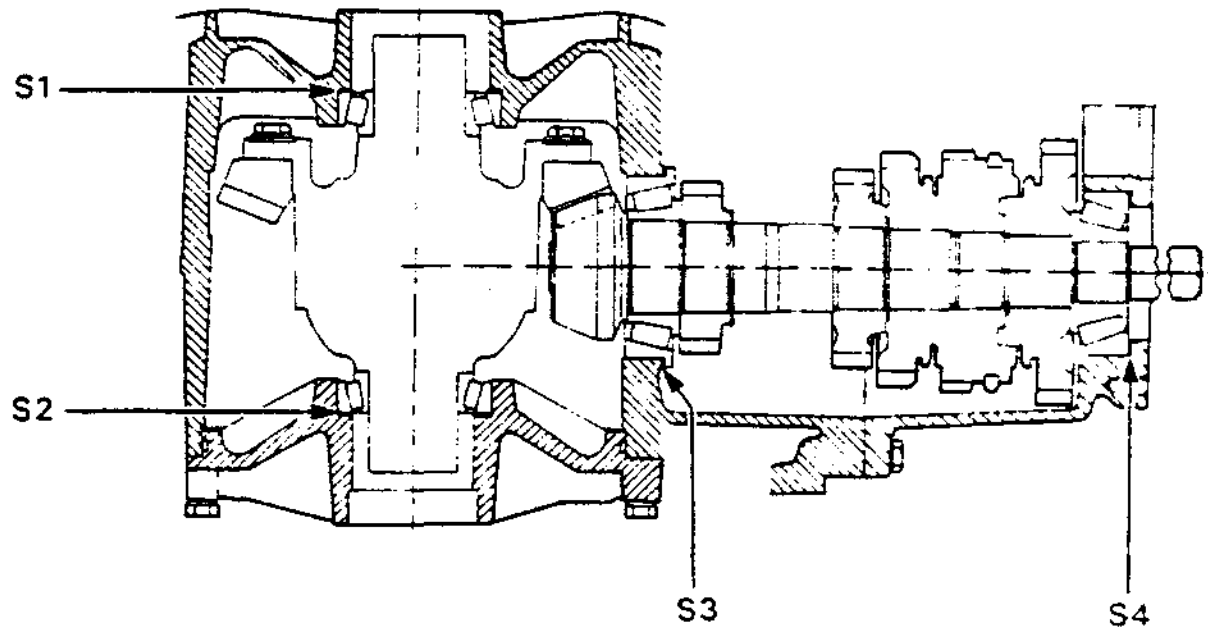


Figure 55 Location and Identification of Transaxle Adjusting Shims

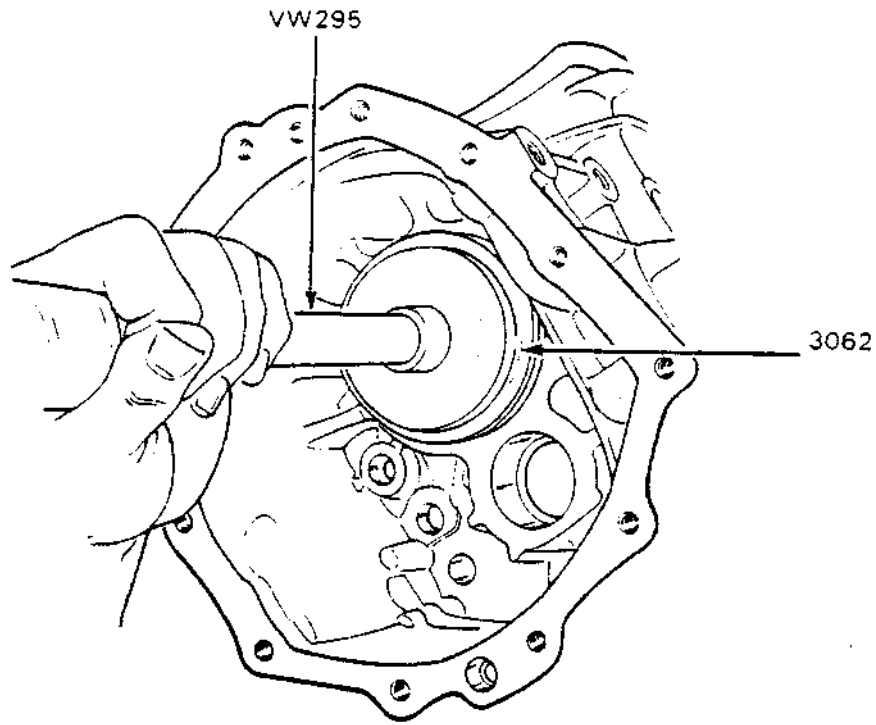


Figure 56 Installation of Pinion Bearing Race in Differential Housing

D-30-108-000/SF-002

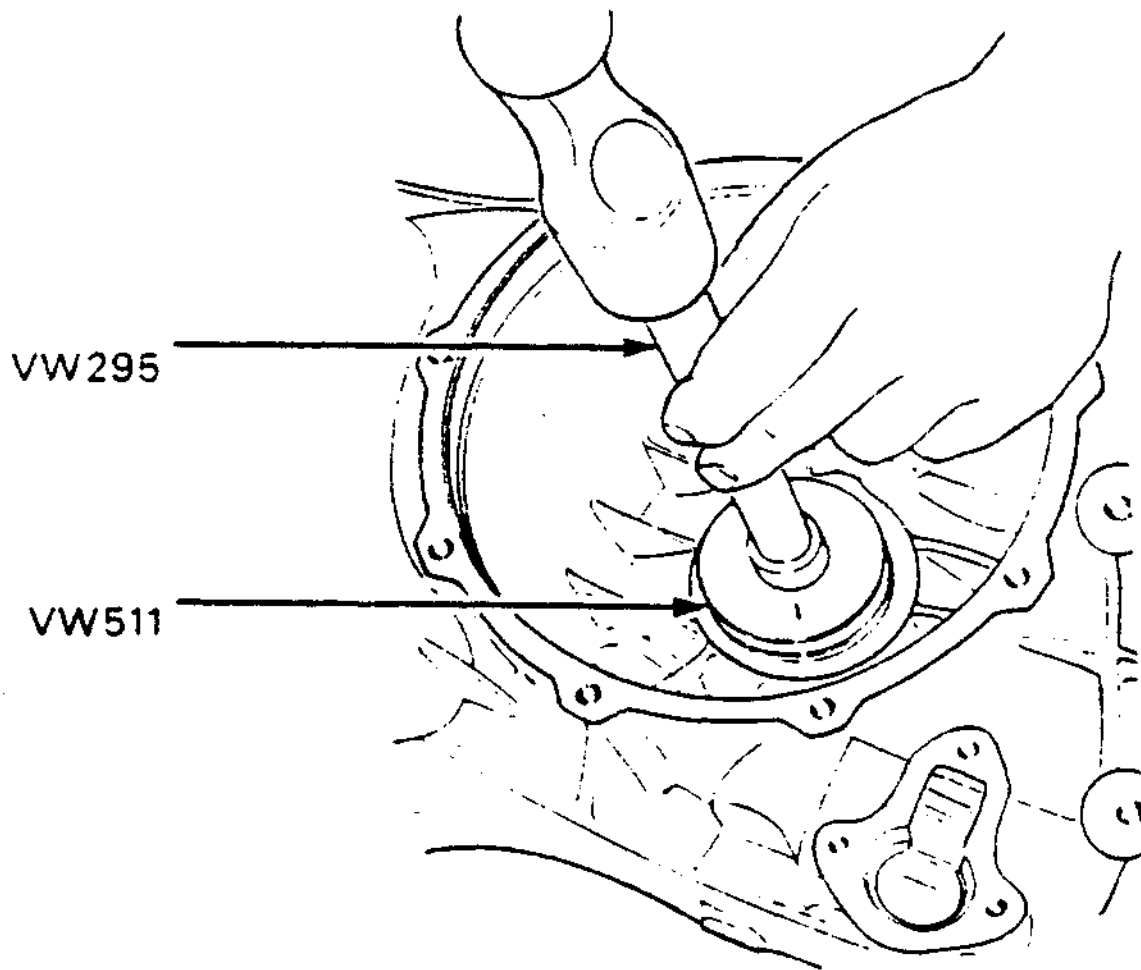


Figure 57 Installation of Left Carrier Bearing Race

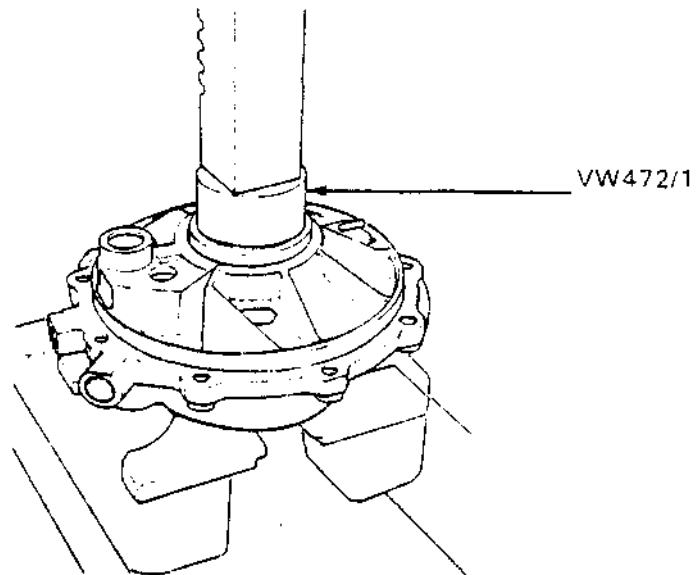


Figure 58 Installation of Differential Flange Bearing Race

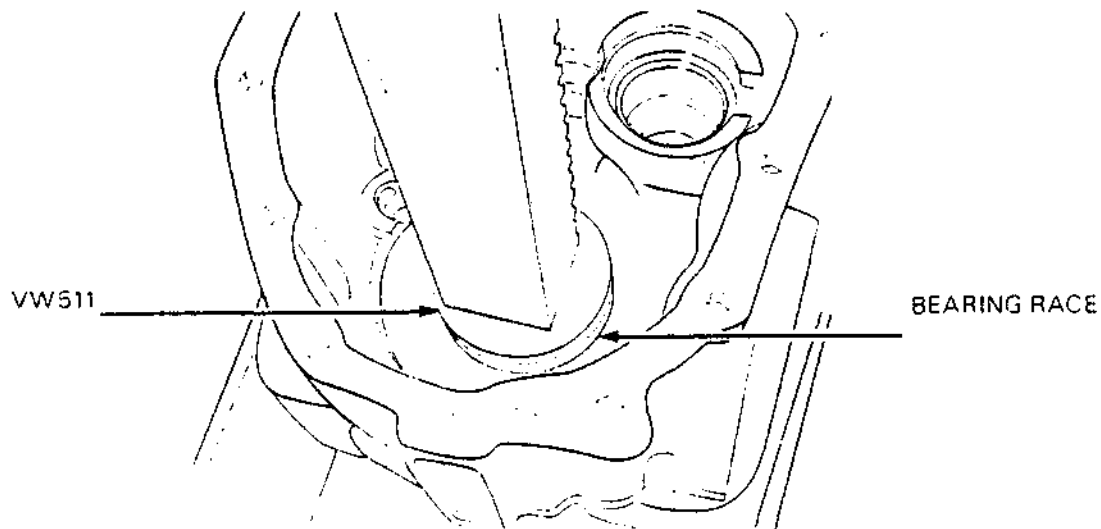


Figure 59 Installation of Pinion Bearing Race in Transmission Housing

D-30-108-000/SF-002

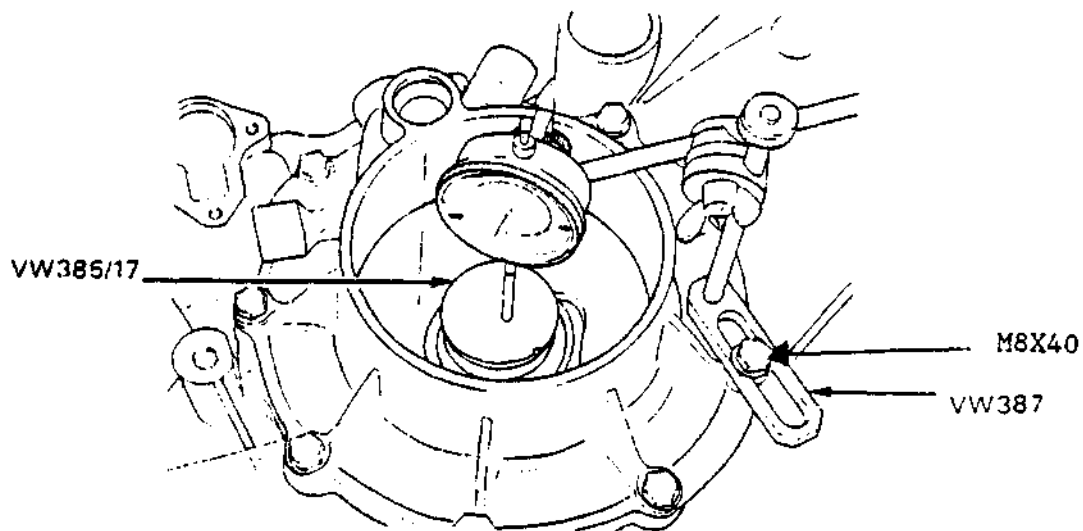


Figure 60 Measurement of Carrier Axial Play

Mfr Part No	Thickness (mm)
B 005 409 381	0.15
B 005 409 381 A	0.20
B 005 409 381 B	0.25
B 005 409 381 C	0.55
B 005 409 381 D	0.60
B 005 409 381 E	0.65
B 005 409 381 F	0.80
B 005 409 381 G	1.35
B 005 409 381 H	1.50
B 005 409 381 J	1.65

Figure 61 Shims for S Total and S2

D-30-108-000/SF-002

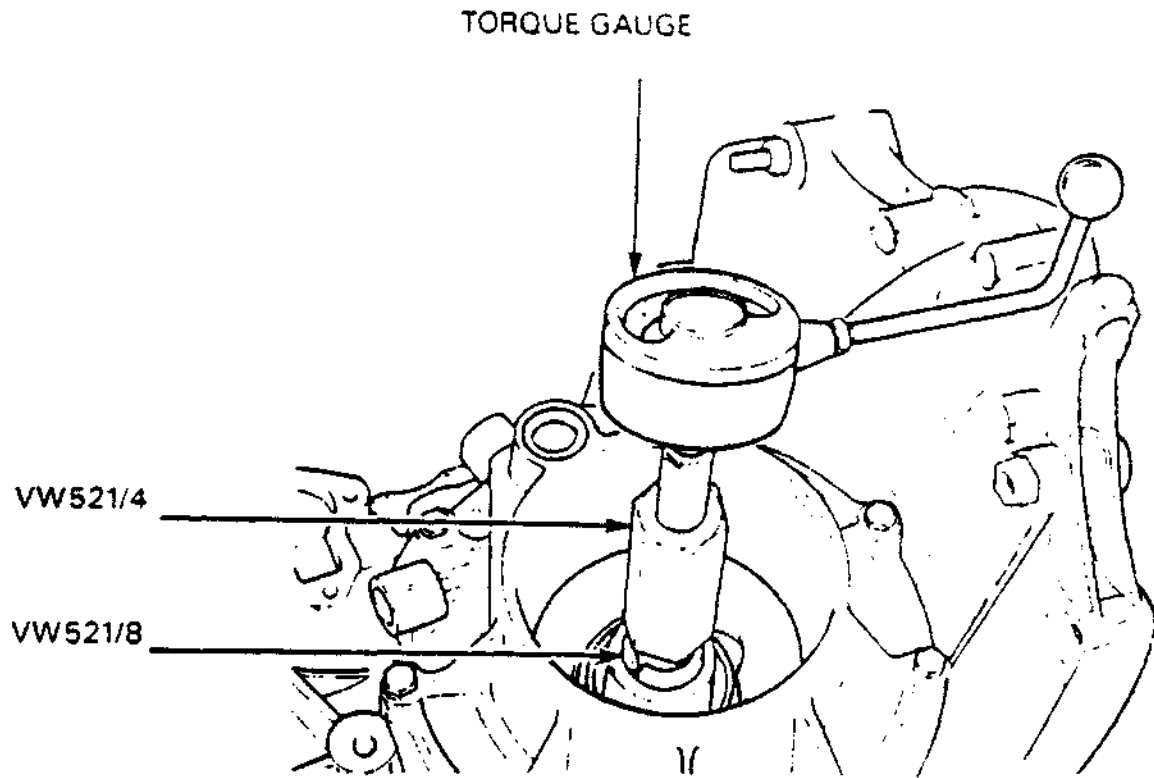


Figure 62 Carrier Turning Torque Measurement

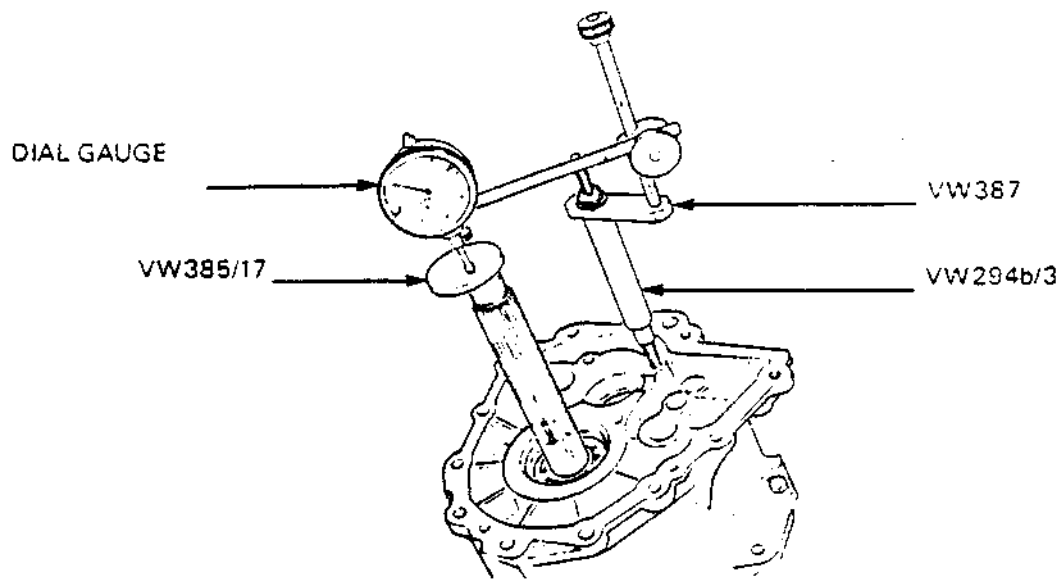


Figure 63 Measurement of Pinion Axial Play

D-30-108-000/SF-002

Mfr Part No	Thickness (mm)
B 088 311 393	0.24
B 088 311 393 A	0.27
B 088 311 393 B	0.30
B 088 311 393 C	0.33
B 088 311 393 D	0.36
B 088 311 393 E	0.39
B 088 311 393 F	0.42
B 088 311 393 G	0.45
B 088 311 393 H	0.69
B 088 311 393 J	0.93
B 088 311 393 K	1.17
B 088 311 393 L	1.41

Figure 64 Shims for Pinion S Total and S4

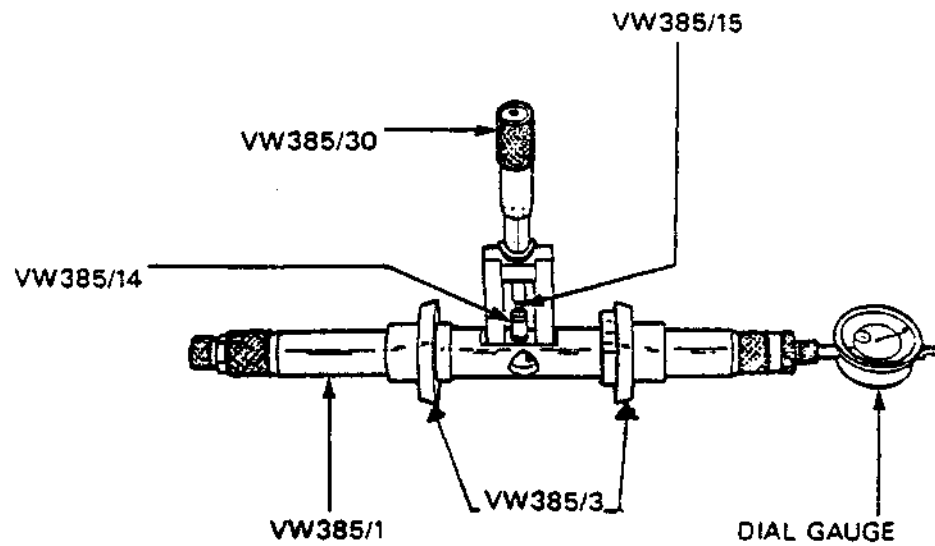


Figure 65 Universal Measuring Bar

D-30-108-000/SF-002

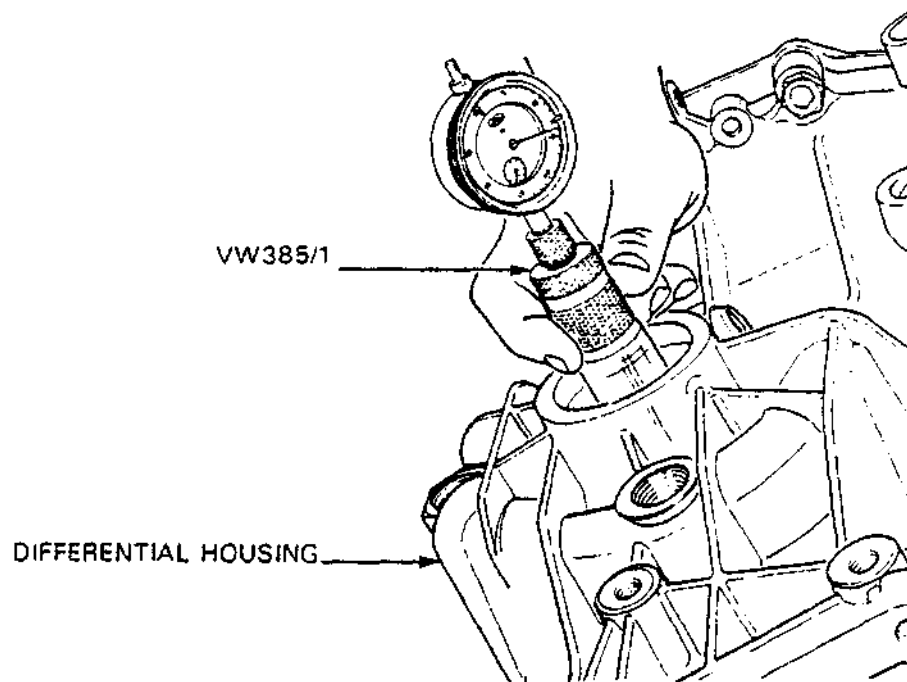


Figure 66 Universal Measuring Bar Installed in Transaxle

Mfr Part No	Thickness (mm)
B 088 311 391	0.20
B 088 311 391 A	0.25
B 088 311 391 B	0.30
B 088 311 391 C	0.35
B 088 311 391 D	0.40
B 088 311 391 E	0.65
B 088 311 391 F	0.90
B 088 311 391 G	1.15

Figure 67 Shims for S3 (Transaxle)

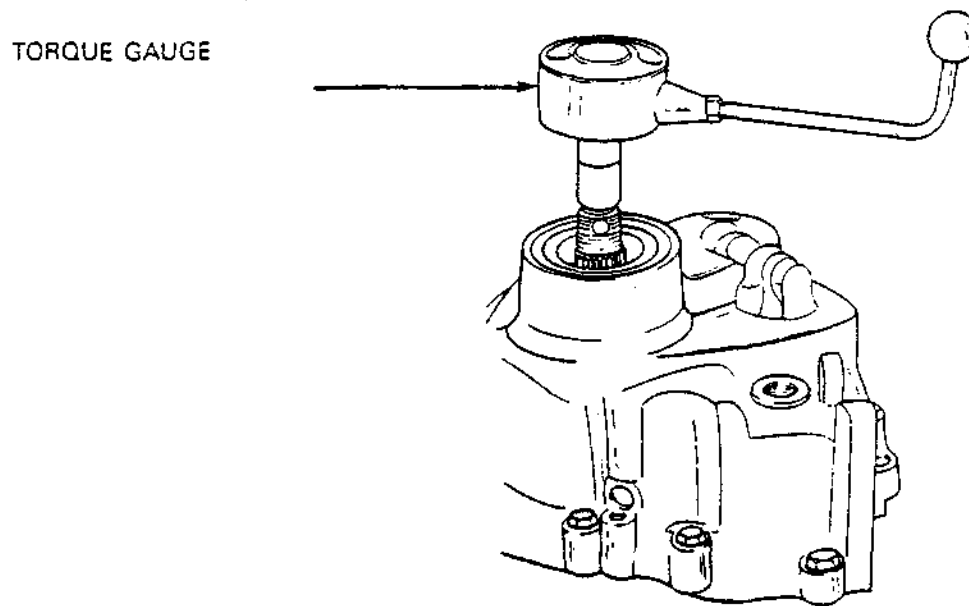


Figure 68 Measurement of Pinion Turning Torque

D-30-108-000/SF-002

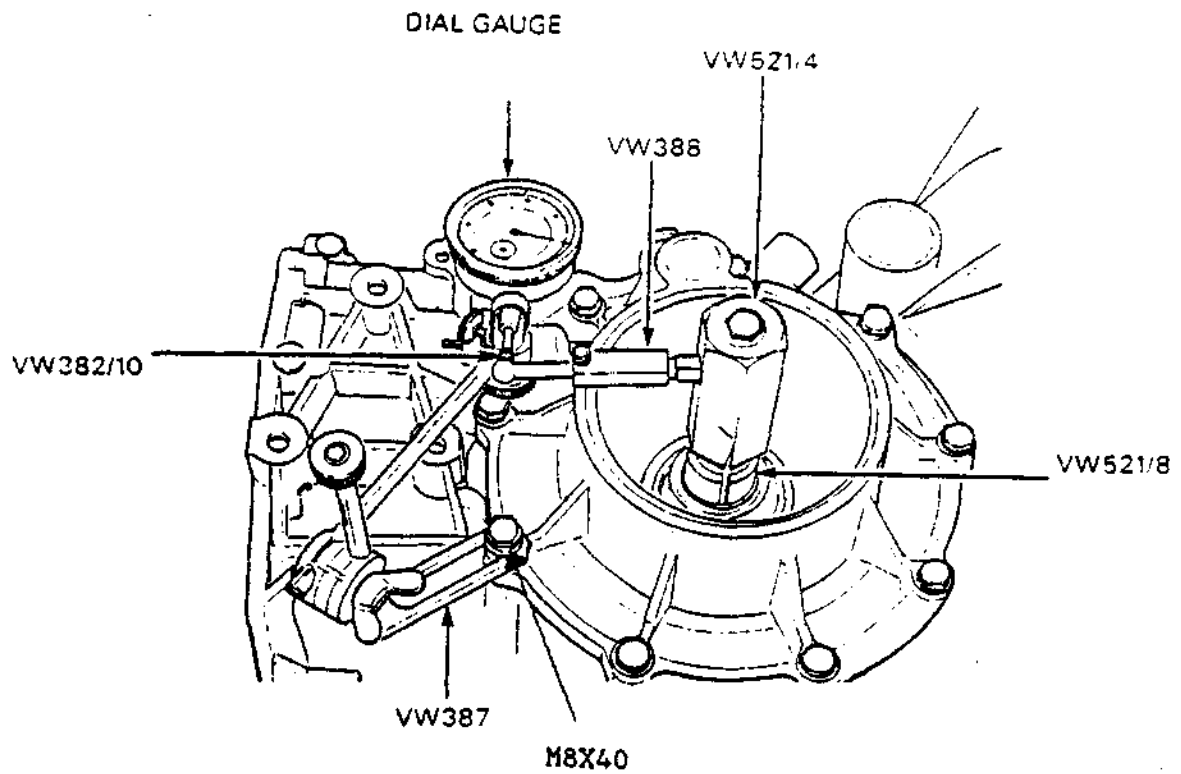


Figure 69 Measurement of Crown Gear Backlash

Mfr Part No	Thickness (mm)
B 005 409 385	0.15
B 005 409 385 A	0.20
B 005 409 385 B	0.25
B 005 409 385 C	0.50
B 005 409 385 D	0.80
B 005 409 385 E	1.00
B 005 409 385 F	1.50

Figure 70 Shims for S1 (Transaxle)

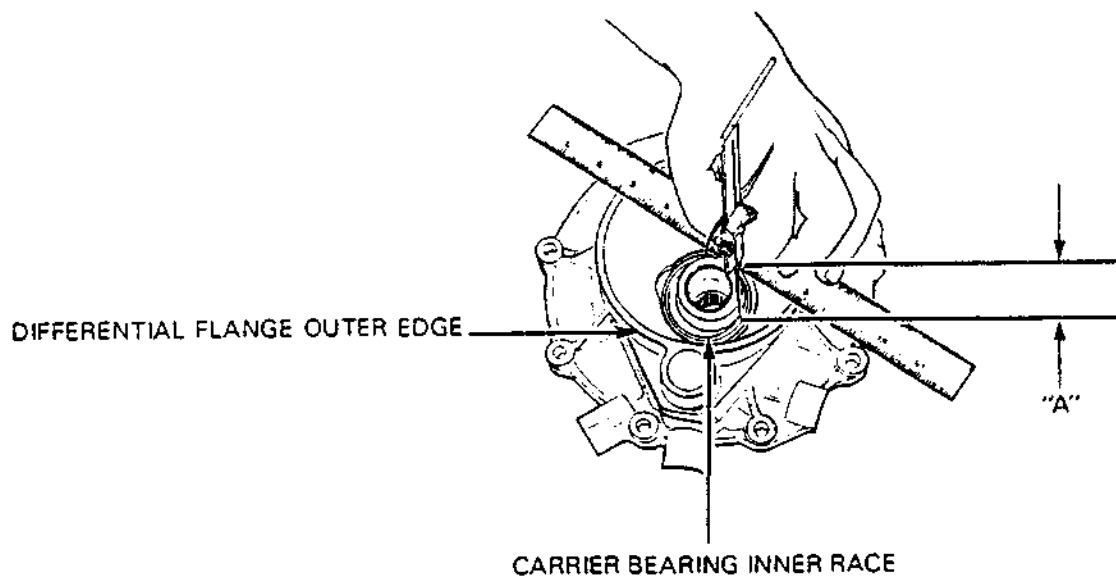


Figure 71 Measurement for Drive Flange Shim Thickness

D-30-108-000/SF-002

Dimension "a" (mm)	Shim Thickness (mm)	Mfr Part No
84.55 to 84.85	none	
84.86 to 85.15	0.30	B 005 409 737
85.16 to 85.45	0.60	B 005 409 737 A
85.46 to 85.80	0.90	B 005 409 737 B

Figure 72 Shims Available For Dimension "a"

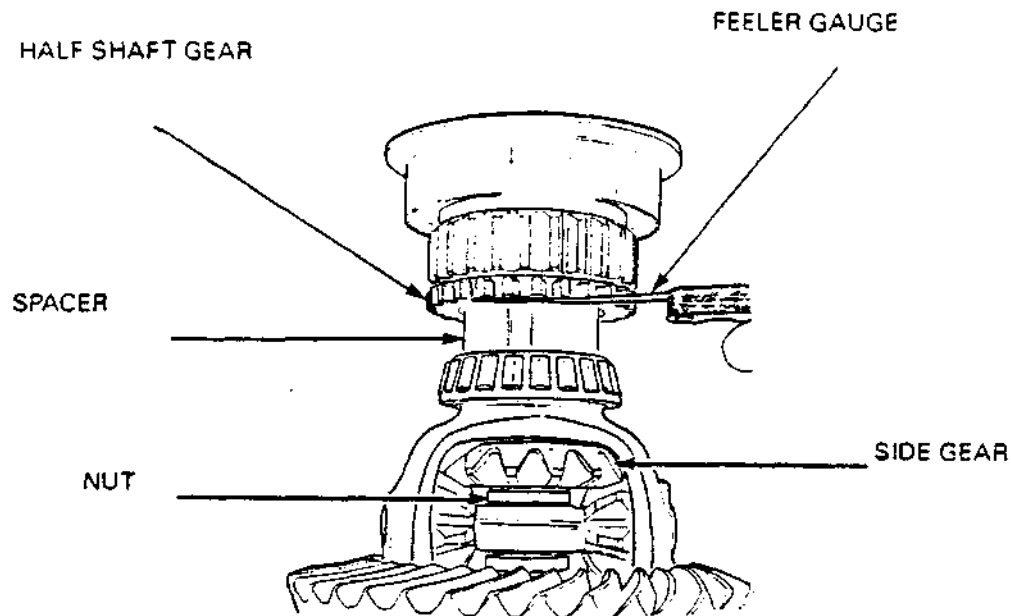


Figure 73 Measurement of Gap Between Half Shaft Gear and Spacer

ap (mm)	Shim Thickness (mm)	Mfr Part No
2.42 to 2.10	None	
2.09 to 1.80	0.30	B 183 525 293
1.79 to 1.50	0.60	B 183 525 293
1.49 to 1.20	0.90	B 183 525 293 B

Figure 74 Shims to Adjust the Drive Flange

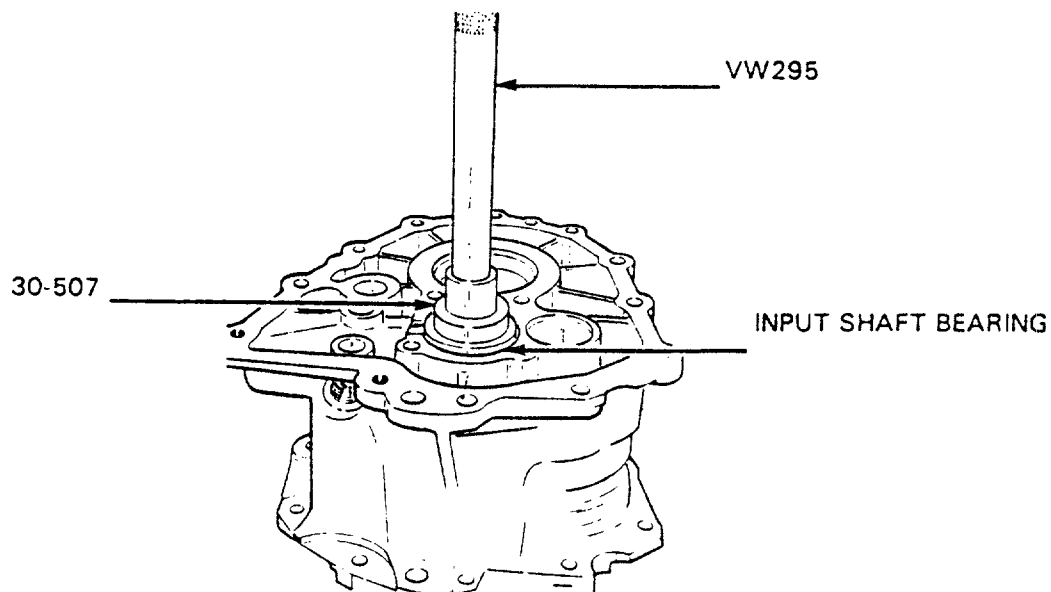


Figure 75 Installation of Input Shaft Bearing

D-30-108-000/SF-002

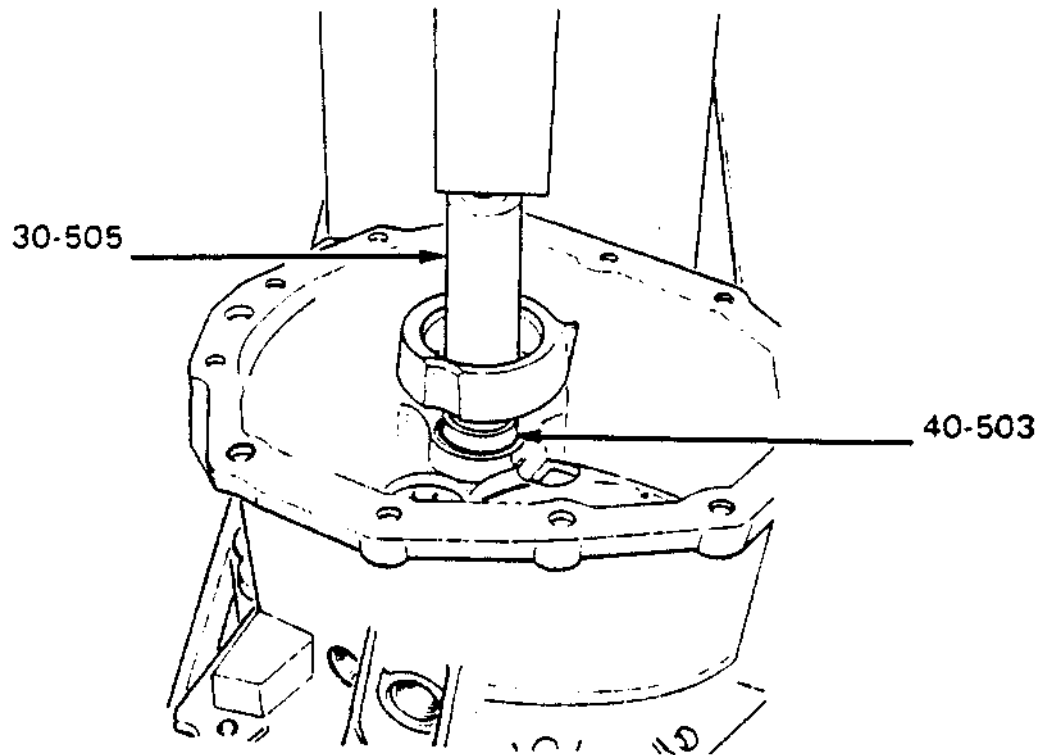


Figure 76 Installation of Countershaft Needle Bearing

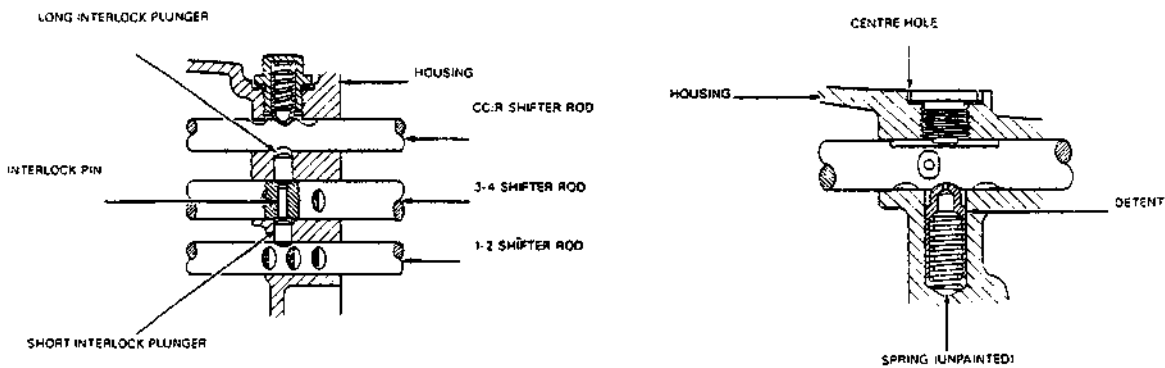


Figure 77 Interlock Plunger, Detent and Spring Installed

Groove Width (mm)	Circlip Thickness (mm)	Mfr Part No
1.86 to 2.04	1.85	N 900 433.0
2.05 to 2.16	2.00	N 12 290.2

Figure 78 Circlips for Countershaft

D-30-108-000/SF-002

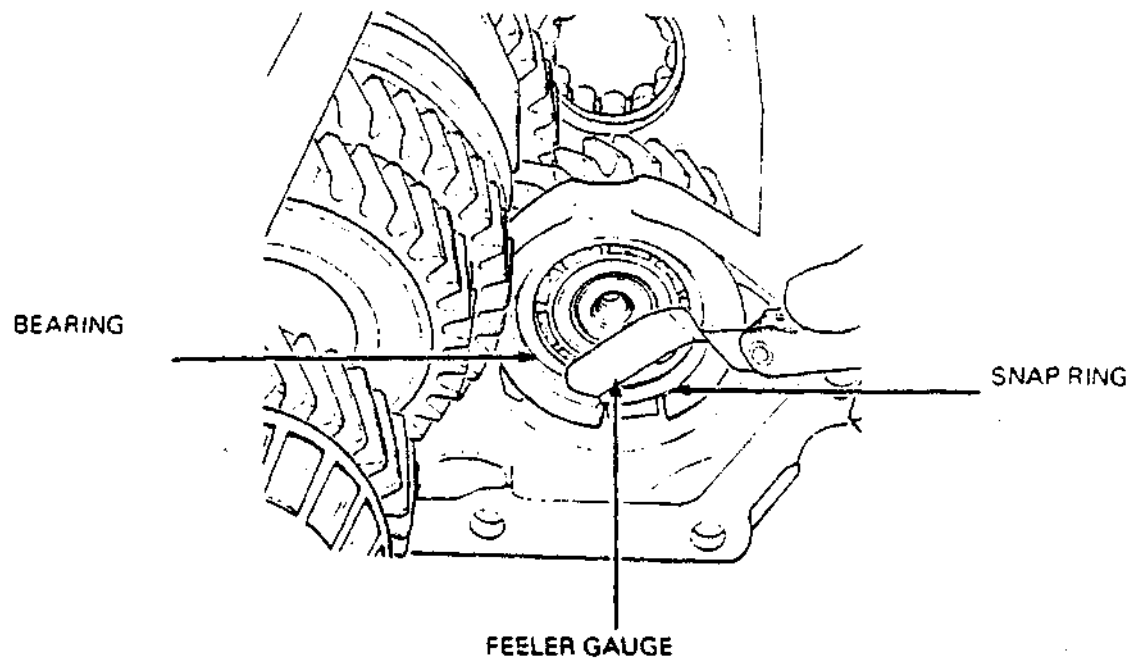


Figure 79 Measurement of Gap Between Snap Ring and Bearing

Gap	Washer Thickness (mm)	Mfr Part No
1.05 to 1.14	1.00	B 005 311 837
1.15 to 1.24	1.10	B 005 311 837 A
1.25 to 1.34	1.20	B 005 311 837 B
1.35 to 1.44	1.30	B 005 311 837 C

Figure 80 Retaining Washers for Countershaft

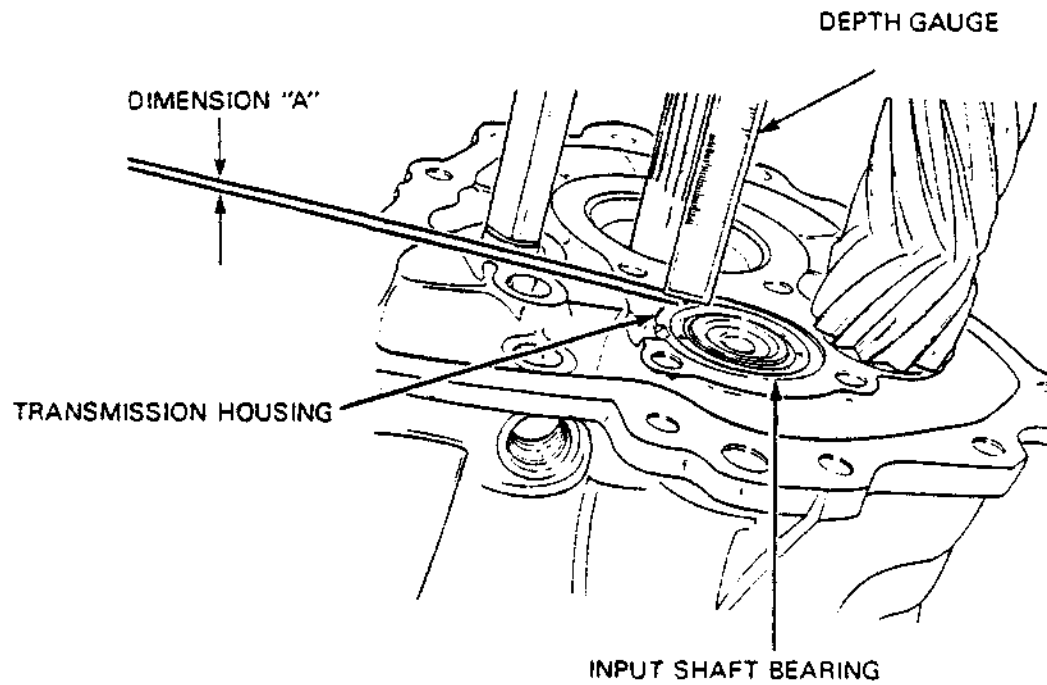


Figure 81 Measurement for Input Shaft Retaining Washer

D-30-108-000/SF-002

Dimension "a"	Retaining Washer Thickness (mm)	Mfr Part No
1.05 to 1.14	1.00	B 005 311 837
1.15 to 1.24	1.10	B 005 311 837 A
1.25 to 1.34	1.20	B 005 311 837 B
1.35 to 1.44	1.30	B 005 311 837 C

Figure 82 Retaining Washers for Dimension "a"

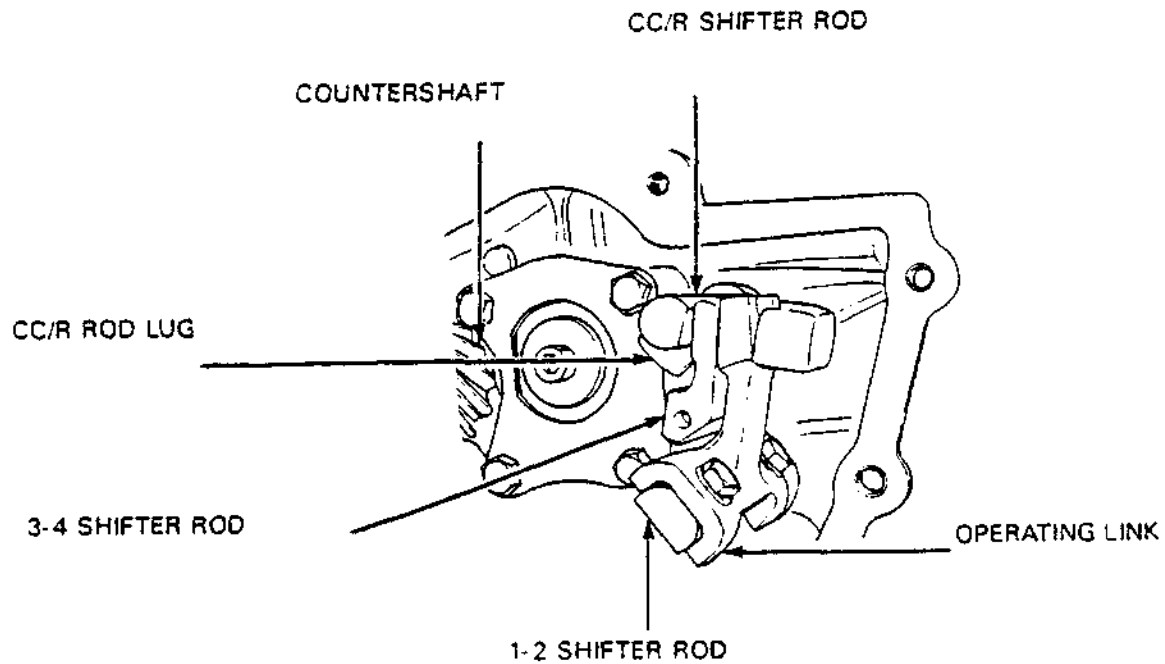


Figure 83 Shifter Rods Installed

D-30-108-000/SF-002

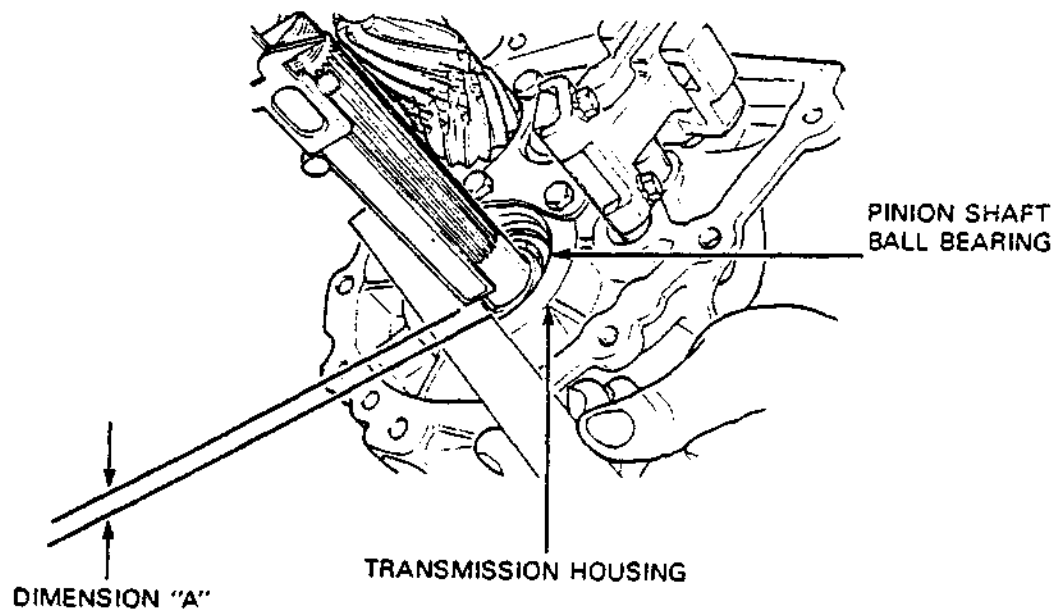


Figure 84 Measurement for Reverse Gear Adjusting Shim

Dimension "a"	Thickness (mm)	Mfr Part No
10.20 to 10.30	2.30	B 005 311 395
10.30 to 10.40	2.40	B 005 311 395 A
10.40 to 10.50	2.50	B 005 311 395 B
10.50 to 10.60	2.60	B 005 311 395 C
10.60 to 10.70	2.70	B 005 311 395 D
10.70 to 10.80	2.80	B 005 311 395 E
10.80 to 10.90	2.90	B 005 311 395 F
10.90 to 11.00	3.00	B 005 311 395 G
11.00 to 11.10	3.10	B 005 311 395 H
11.10 to 11.20	3.20	B 005 311 395 J

Figure 85 Pinion Shaft Adjusting Shims for Reverse Gear

D-30-108-000/SF-002

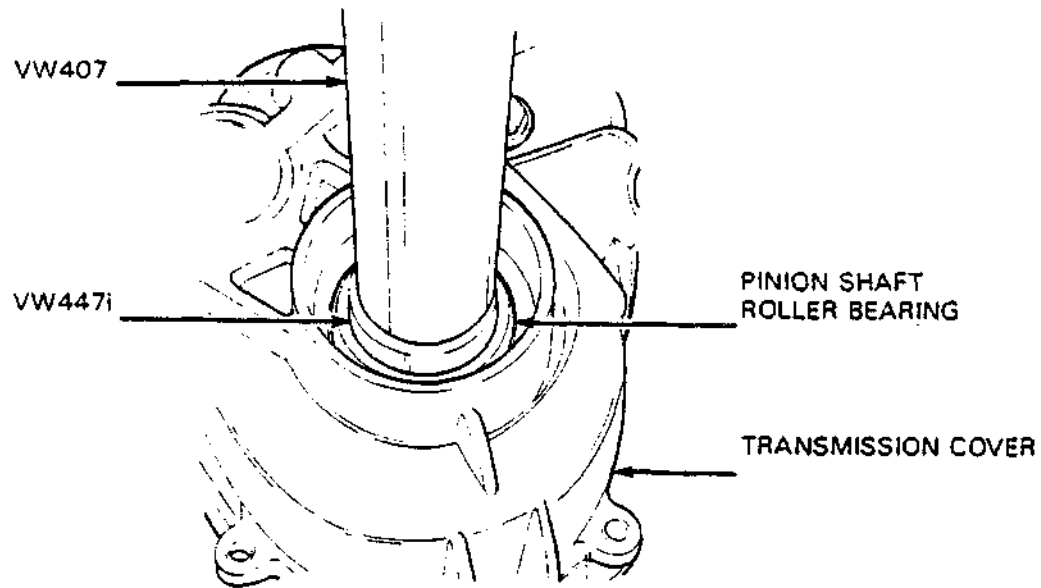


Figure 86 Installation of Pinion Shaft Roller Bearing

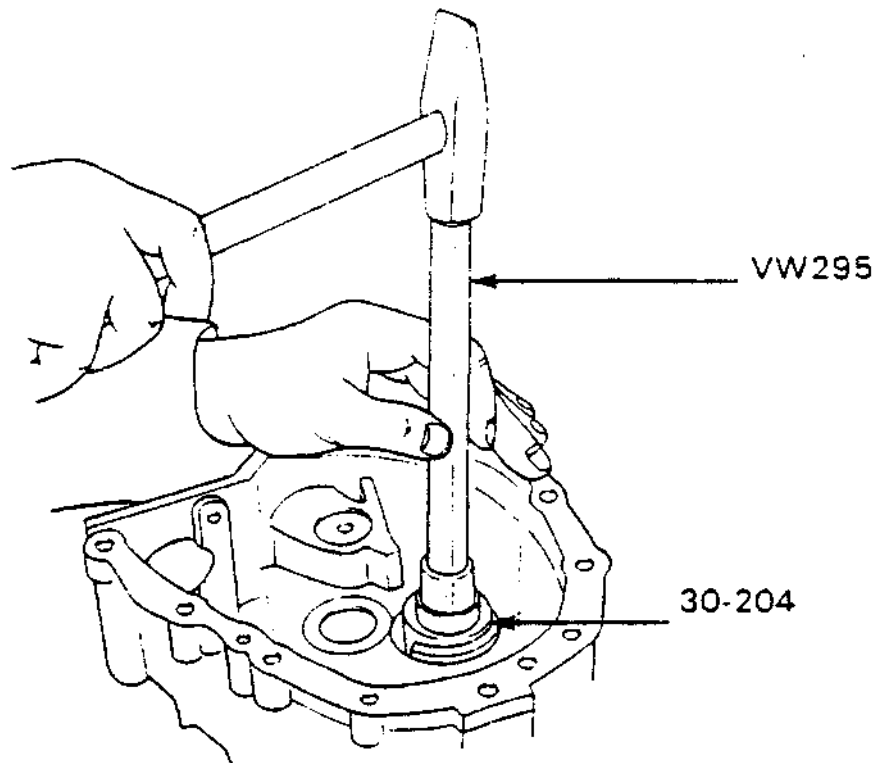


Figure 87 Installation of Countershaft Roller Bearing

D-30-108-000/SF-002

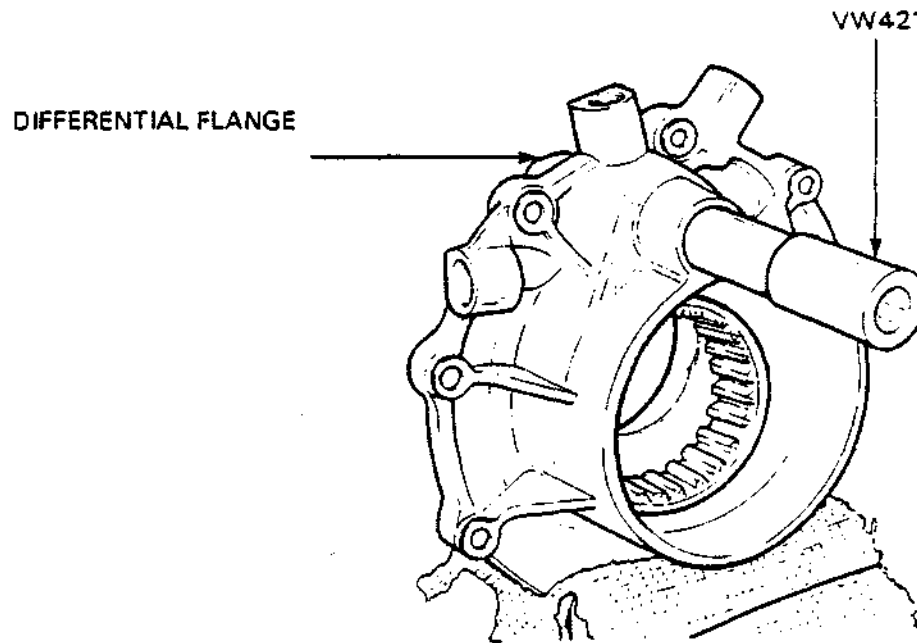


Figure 88 Installation of Selector Shaft Oil Sea

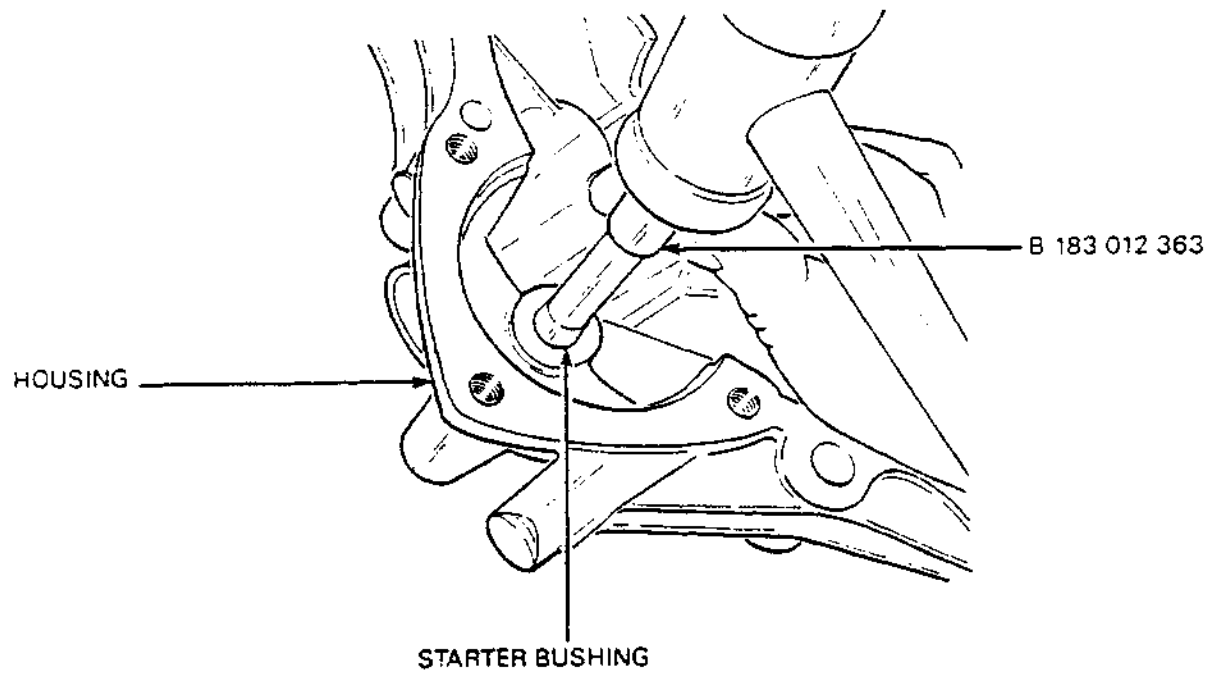


Figure 89 Installation of Clutch Housing Starter Bushing

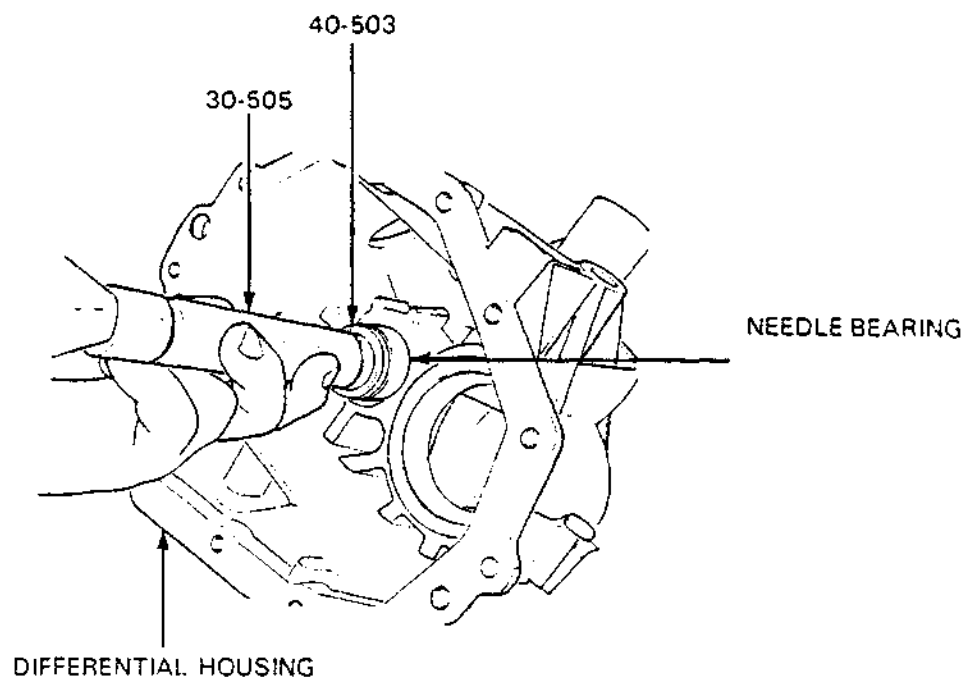


Figure 90 Installation of Input Shaft Needle Bearing

D-30-108-000/SF-002

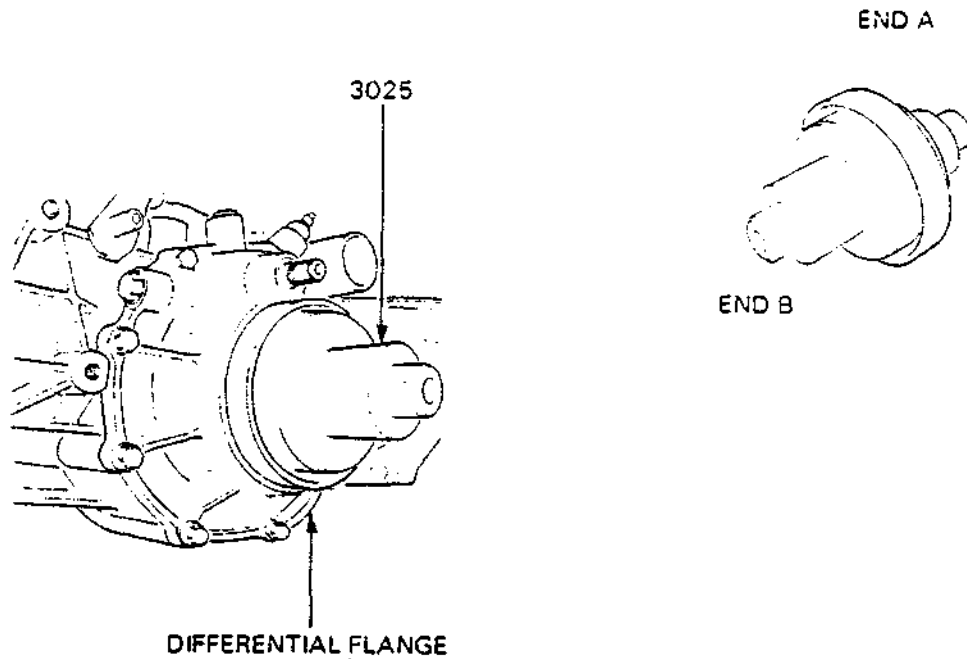


Figure 91 Installation of Oil Seals in Differential Flange

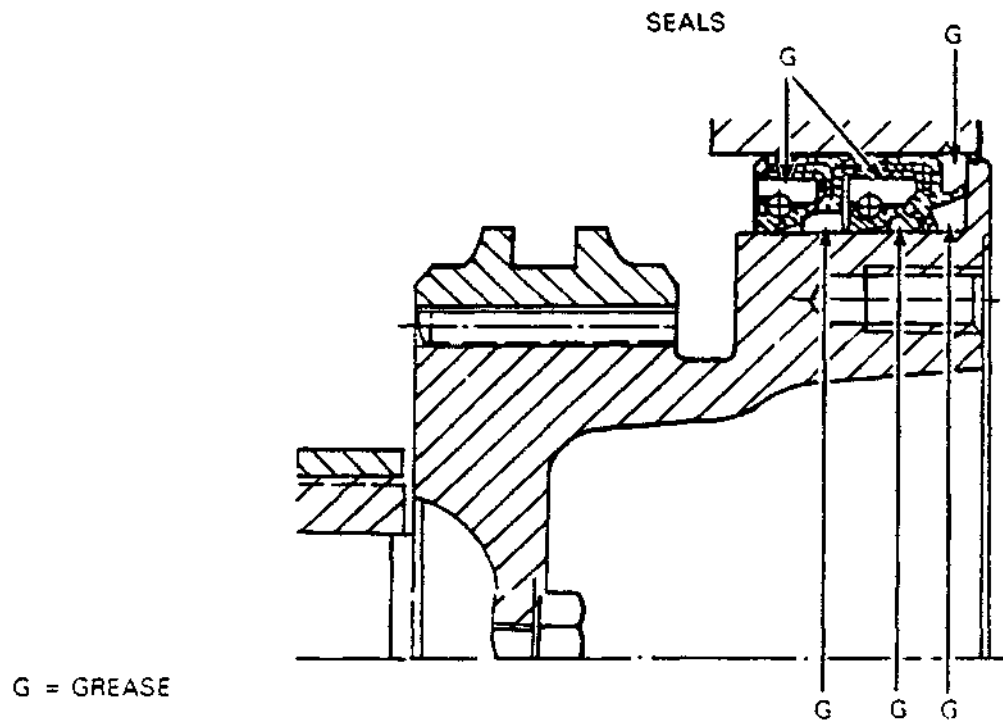


Figure 92 Grease Points for Differential Flange Oil Seals

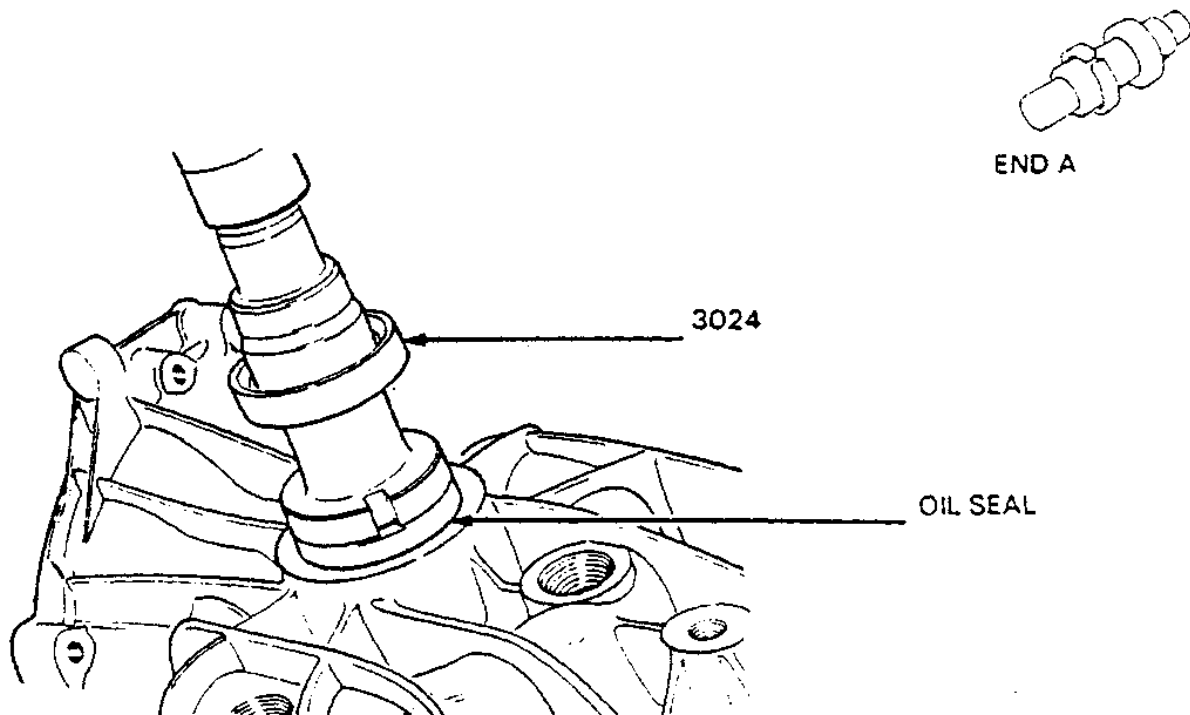


Figure 93 Installation of Left Drive Flange Oil Seal

D-30-108-000/SF-002

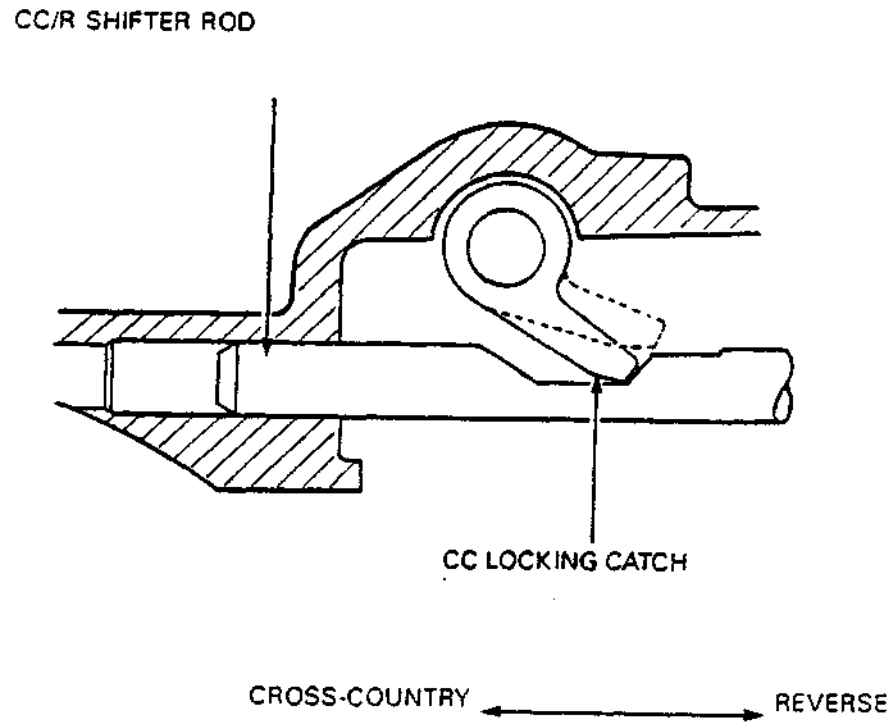


Figure 94 Cross-Country Locking Catch

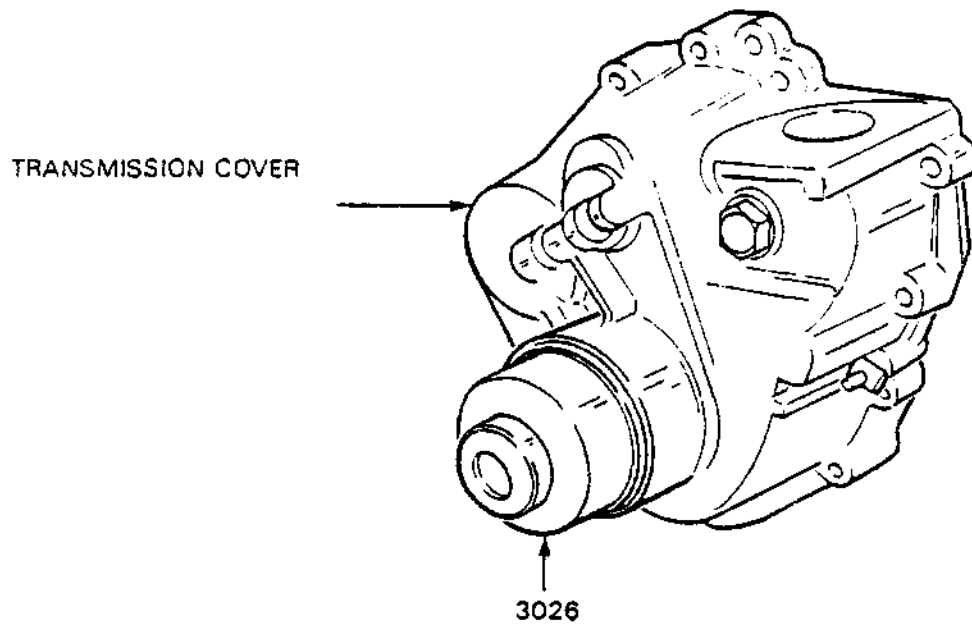


Figure 95 Installation of Propeller Shaft Drive Flange Oil Seals

D-30-108-000/SF-002

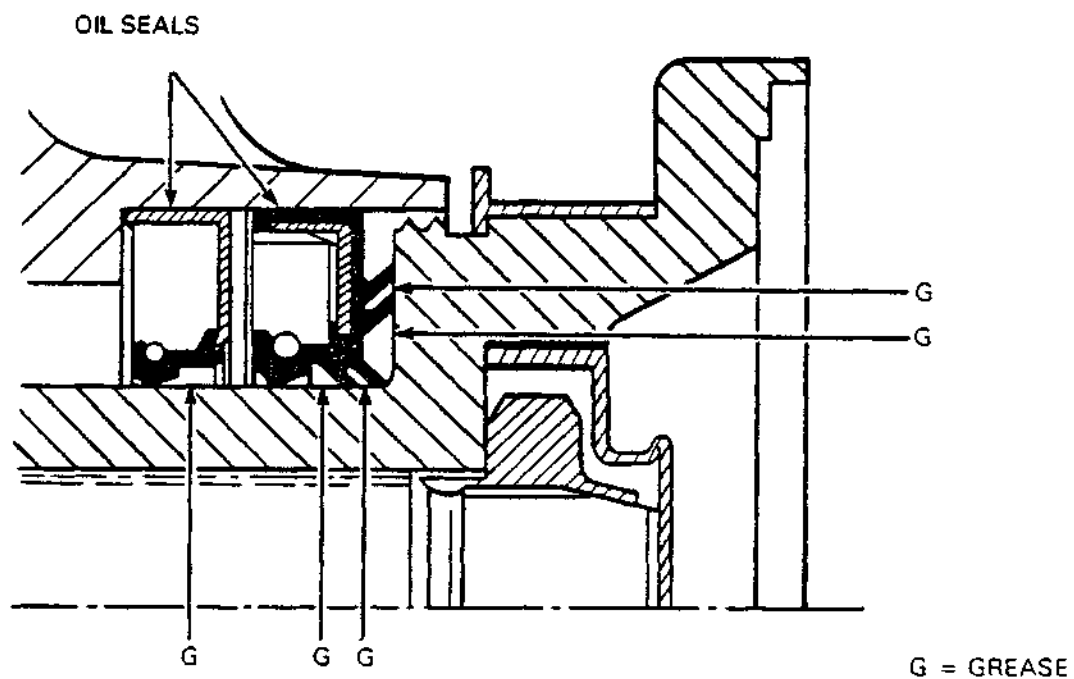


Figure 96 Grease Points for Propeller Shaft Drive Flange Oil Seals

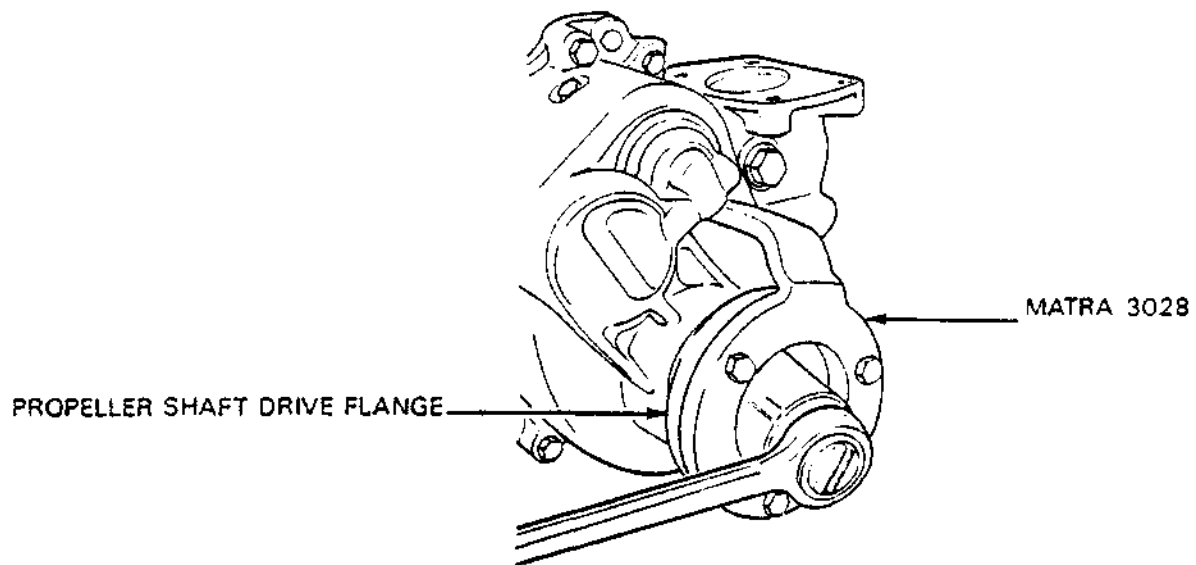


Figure 97 Installation of Propeller Shaft Drive Flange

D-30-108-000/SF-002

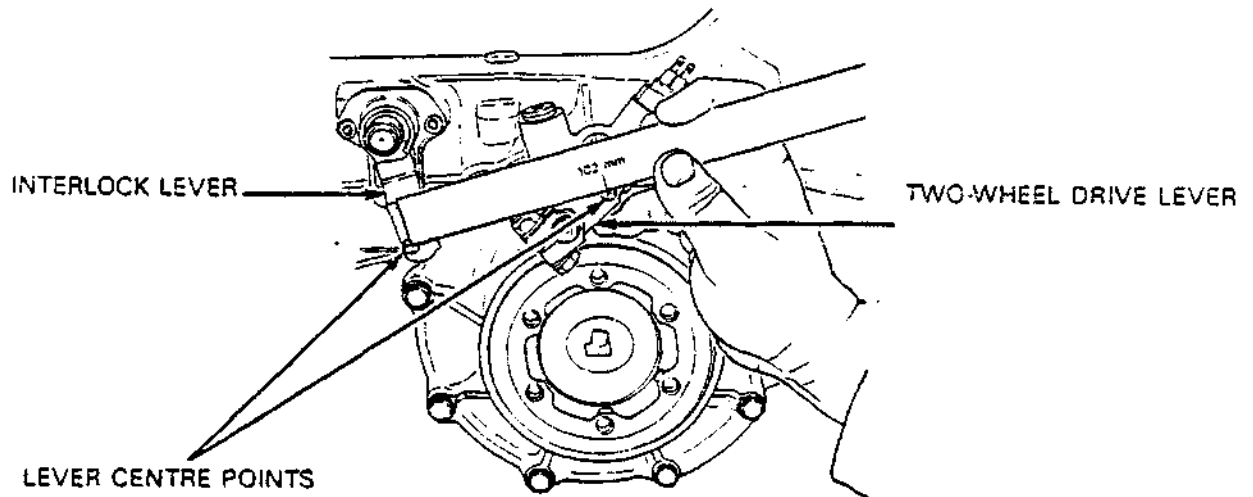


Figure 98 Two-Wheel Drive Lever Adjustment

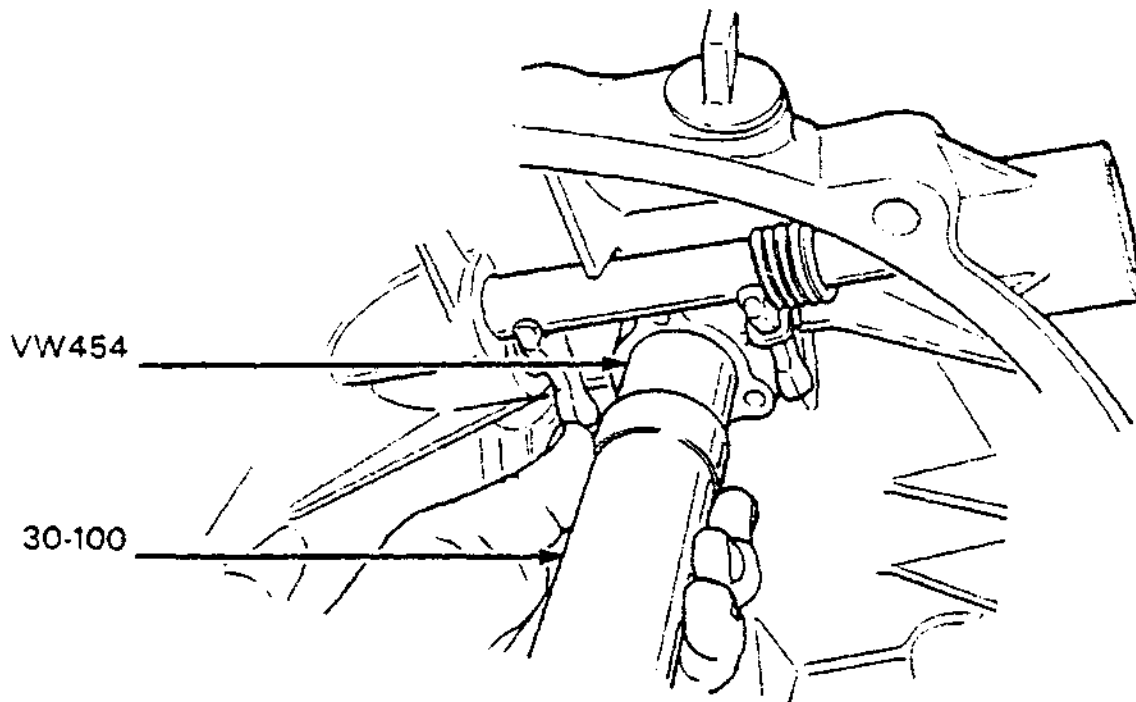


Figure 99 Installation of Transaxle Input Shaft Oil Seal

D-30-108-000/SF-002

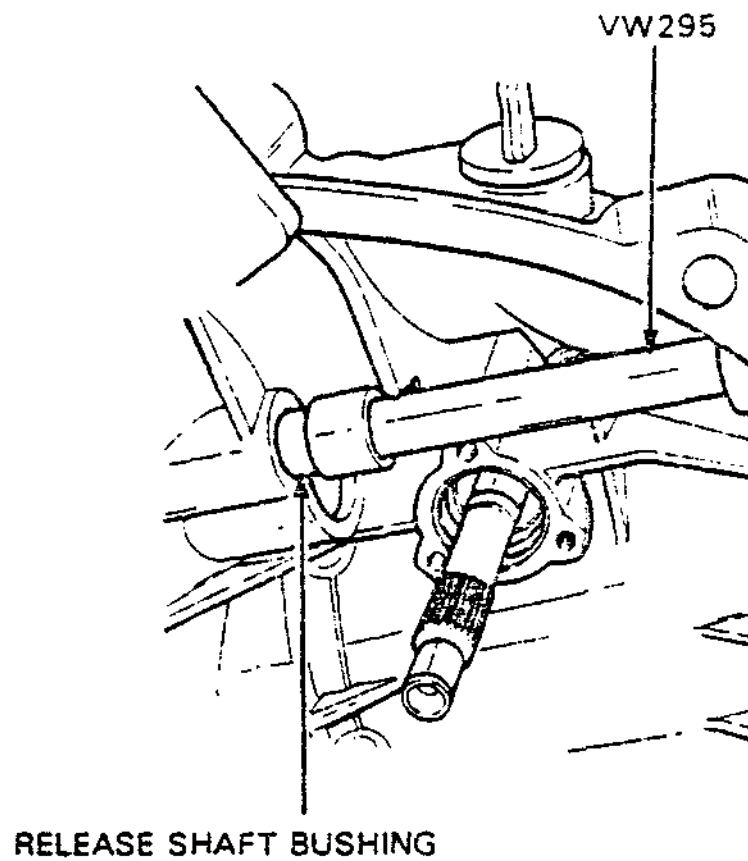


Figure 100 Installation of Clutch Release Shaft Bushing

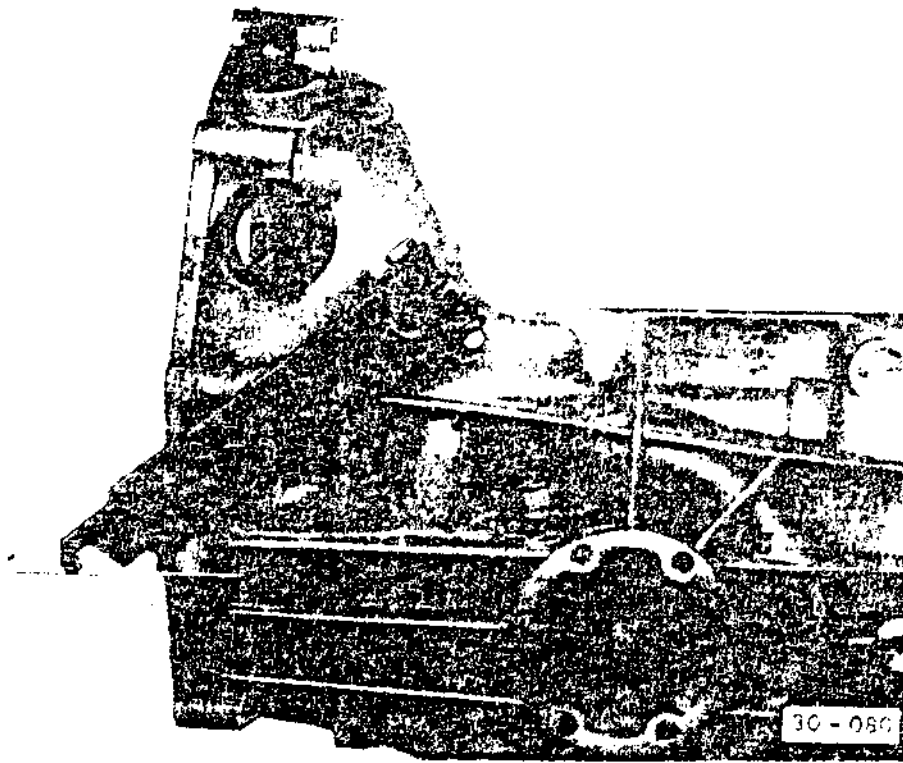


Figure 101 Installation of Clutch Lever

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Part Replaced	Crown Gear (S1+S2) Adjustment	Pinion (S3+S4) Adjustment	Drive Flange Adjustment	Spacer Adjustment (Non-Locking Differential)
Differential - Housing	X	X	X	X
Transmission - Housing		X		
Differential - Carrier	X		X	X
Pinion Shaft Bearing		X		
Differential Carrier Bearings	X		X	X
Crown Gear and Pinion	X	X	X	X
Differential Flange Assembly	X		X	X
Drive Flange			X	X

Figure 102 Transaxle Adjustments Required for Replaced Parts

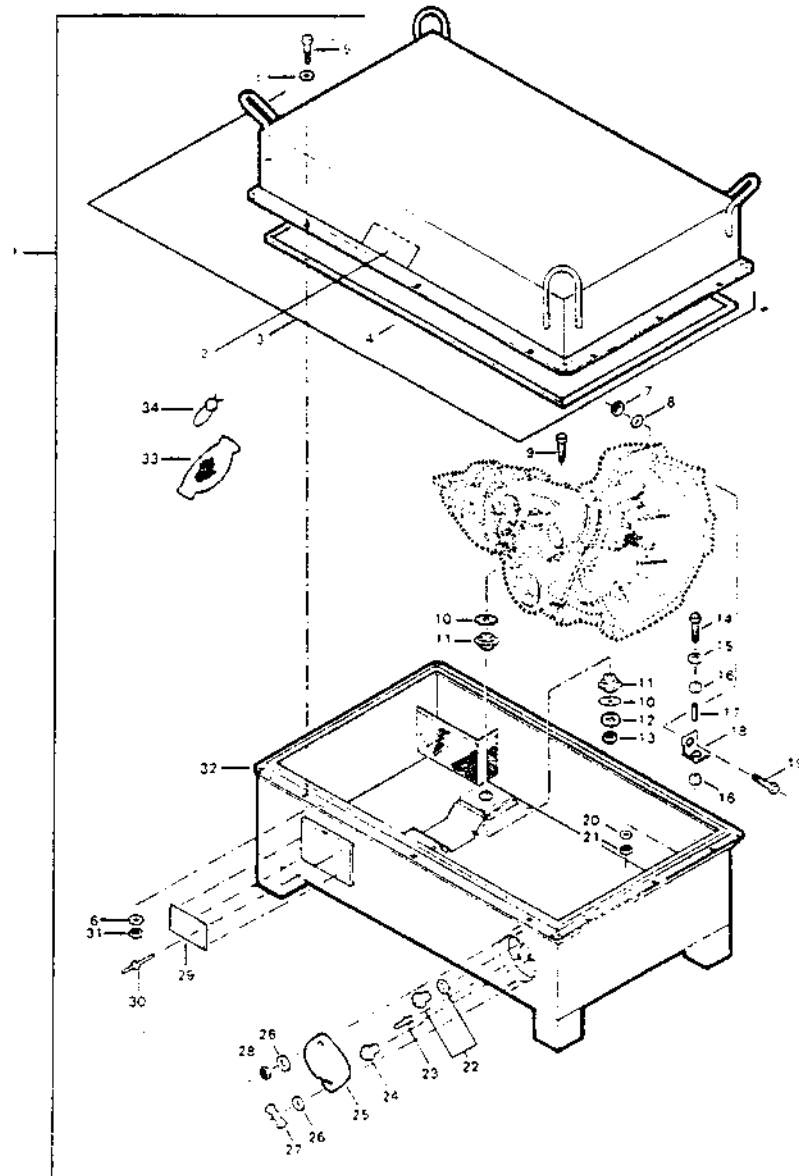


Figure 103 Transmission Container

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APPENDIX 1

SPECIFICATION

FOR

REBUILDING THE CLUTCH ASSEMBLY USED IN TRUCKS,

UTILITY, LIGHT, 4X4 MILITARY DESIGN ILTIS CDN SERIES

10.1 SCOPE

10.1.1 Scope.- This specification covers the requirement for rebuilding the clutch assembly used in Trucks, Utility, Light, 4X4 Military Design, Iltis Canadian Series used by the Canadian Forces. This specification includes rebuild standards, and procedures, packaging and quality assurance provisions.

10.1.2 Purpose.- The purpose of this specification is to establish high quality standards for rebuilding the clutch assembly to provide long trouble-free life.

10.1.3 Responsibility.- The contractor shall be responsible for meeting the requirements specified herein.

10.2 APPLICABLE DOCUMENTS

10.2.1 Government documents.- The following documents form part of this specification to the extent specified herein. Unless otherwise specified, the issue or amendment of documents effective for a particular contract shall be that in effect on the date of the request for proposal.

AQAP-4	NATO Inspection System Requirements for Industry
C-04-010-022/VP-001	Preservation for Storage and Shipment of Vehicles and Vehicular Components
MIL-B-131	Barrier Material, Water-Vapour Proof, Flexible, Heavy (36 inch wide roll)

Copies of this specification and the above documents may be obtained from the Department of National Defence, Ottawa, Ontario, K1A 0K2, Attention: DDDS 3-6.

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10.2.2 Other publications.- The following documents form part of this specification to the extent specified herein. Effective dates shall be those in effect on the date of manufacture. Source is as shown.

Canadian Government Publishing Centre,
Supply and Services Canada, Ottawa, Ontario K1A 0S9

CAN/CGSB-3.8M	Cleaning Solvent Hydrocarbon Type
43-GP-3M	Standard for Tape, Adhesive, Pressure Sensitive, Water Resistant
1-GP-105	Primer, Quick Drying

10.3. REQUIREMENTS

10.3.1 Requirements.- The contractor shall rebuild each clutch assembly supplied by DND in accordance with the requirements specified herein using the procedures and standards specified in 10.3.3 and 10.3.4.

10.3.1.1 If the clutch assembly is being rebuilt as part of a transaxle engine assembly rebuild, it shall be preserved and packaged as specified herein and placed in the transaxle container with the transaxle.

NOTE: When a new clutch assembly is returned with a transaxle assembly for rebuild, check the condition of the preservation and packaging of the unused clutch assembly and place it back in the transaxle container.

10.3.1.2 If the clutch assembly is being rebuilt as a component only, it shall be preserved and packaged as specified herein and returned to DND as a complete drop-in assembly.

10.3.1.3 The clutch assembly shall be thoroughly cleaned before being inspected for condition and wear.

10.3.1.4 The contractor shall record all measurements required to determine component wear and condition. These measurements shall be recorded on data sheets designed and provided by the contractor and compared to the standards listed in 10.3.4. Components that do not meet the minimum standards shall be replaced with new or serviceable O.E.M. components. For standards not listed herein, the contractor shall use good judgement to the minimum of SAE Standards and Practices. If the serviceability of a component is in doubt, the component shall be replaced. Quality Assurance Authority shall be consulted in all such cases.

10.3.1.5 The contractor shall use tools designed for the purpose of the operation to be performed.

10.3.1.6 Upon completion of rebuild, the clutch assembly shall consist of all the components listed in Table I. Figure 1 provides component identification.

10.3.1.7 The release bearing, springs right and left, clutch disc lining and the screw socket head (M8x16) shall be Mandatory Parts Replacement.

10.3.2 Clutch assembly components.- Table I lists the components of the Iltis clutch assembly; refer to Figure 1 for component identification.

10.3.3 Clutch rebuild procedures.- The following provides the step-by-step procedures for rebuilding the ILTIS clutch assembly.

10.3.3.1 Cleaning and inspection.- To clean and inspect, proceed as follows :

- (a) Clean the pressure plate and inspect the clutch disc contact surface for signs of heat discoloration, and cracks.
- (b) Using a straight edge and feeler gauge, inspect the contact surface of the pressure plate for wear and distortion, see Figure 2. If inward taper or distortion exceeds 0.3 mm (0.012-inch), replace the pressure plate.
- (c) Check the pressure plate cover for cracks and ensure the rivets are tight and undamaged. Replace the pressure plate, if necessary, see Figure 3.
- (d) Check the diaphragm spring fingers at the location of the throw-out bearing contact for grooving. If grooving exceeds 0.3 mm (0.012-inch) in depth, replace the pressure plate, see Figure 3.
- (e) Remove the old friction material from the clutch disc, clean and check the disc for cracks and loose rivets. Replace the disc, if necessary.
- (f) Rivet new friction material to the clutch disc.
- (g) Check the disc for run-out; measure 2.5 mm from the outer edge of the disc. The maximum run-out is 0.5 mm, see Figure 4.

3.4 Standards.- The following lists the standards for the Iltis clutch assembly. The standards shall be strictly adhered to when determining the serviceability of the components. For standards not listed herein, the contractor shall use good judgement to the minimum of SAE Standards and Practices as to the serviceability of the component. If the serviceability of a component is in doubt, the component shall be replaced with a new or serviceable OEM component.

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Pressure Plate

Inward taper or distortion	0.30 mm (0.012-inch) maximum
Diaphragm spring fingers grooving	0.30 mm (0.012-inch) depth maximum

Clutch Disc

New frictional material thickness	3.9 ± 0.1 mm
Clutch disc run-out	0.50 mm maximum

10.4. QUALITY ASSURANCE PROVISIONS

10.4.1 Inspection requirements.- DND Quality Assurance at source is required. The contractor is responsible for carrying out inspections and processing to meet quality assurance requirements acceptable to the Quality Assurance Authority.

10.4.1.1 The contractor's system of inspection shall meet the requirements of AQAP-4.

10.4.1.2 The Quality Assurance Authority reserves the right to perform any inspections considered necessary to ensure that material and services conform to specified and contractual requirements.

10.5. PAINTING, PRESERVATION, PACKAGING AND MARKING

10.5.1 Painting.- All metal surfaces of the clutch disc and the pressure plate shall be coated with a 0.0015 inch thick coat of red oxide primer, quick, drying 1-GP-105. Do not paint the lining material of the clutch. disc.

10.5.2 Preservation.- After final rebuild acceptance by Quality Assurance Authority, the contractor shall place the clutch assembly into preservation in the following manner:

- (a) The pressure plate shall be wrapped in barrier material to MIL-B-131 and sealed with tape pressure sensitive to 43-GP-3M.
- (b) The clutch disc shall be sealed in a heavy paper bag and sealed.
- (c) The release bearing shall be wrapped in barrier material and sealed with tape pressure sensitive.
- (d) The clutch assembly mounting capscrews shall be kept in their original polyurethane bag.

10.5.3 Packaging.- A legible stamped or engraved metal plate shall be attached to the clutch assembly in an approved location showing the following information:

- (a) Name of firm or workshop that rebuilt the clutch assembly.
- (b) Day, month and year of rebuild.
- (c) Firm or workshop order number.
- (d) The clutch assembly NSN and description.

10.5.3.1 The clutch assembly shall be properly tagged with:

- (a) CF942, NSN8135-21-872-2435, Identity and Condition Tag.
- (b) A CF 2248, NSN 7530-21-870-3866, Lubrication Record for Shipment and Preservation Tag.

10.5.3.2 The clutch disc, pressure plate, release bearing and mounting screws shall be placed in a cardboard box and sealed.

10.5.4 Marking.- The cardboard box shall have a label adhered to the outside containing the following information:

- | | | | |
|-----|---------------------|--------------------------------|-------|
| (a) | NSN2520-12-192-3595 | Clutch Disc | Qty 1 |
| (b) | NSN2520-12-192-3596 | Pressure Plate-Clutch | Qty 1 |
| (c) | NSN2520-12-166-2743 | Bearing-Release | Qty 1 |
| (d) | NSN5305-12-169-6486 | Scr. Soc. Hed-Mounting (M8xl6) | Qty 6 |
| (e) | Rebuild date. | | |
| (f) | Weight. | | |

10.5.4.1 The cardboard box shall be properly tagged with:

- (a) ACF942A, NSN 7690-21-868-6739 Identity and Condition Label.
- (b) A CF 2248, NSN 7530-21-870-3866 Lubrication Record for Shipment and Preservation Tag.

10.6. NOTES

10.6.1 Ordering data.- Procurement documents should specify the title, number, and date of this specification.

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10.6.2 Design Authority.- The Design Authority is the Director of Support Vehicles Engineering and Maintenance.

10.6.3 Quality Assurance Authority.- The Quality Assurance Authority will be stipulated in the contract.

10.6.4 Returnable parts.- Components that fail to meet standards shall be returned to DND through the Quality Assurance Authority.

Table I - Clutch Assembly Components

Item	NSN	MRN	Description	Qty
1	2520-12-192-3595	A 302 101 501	Clutch - Disc	1
2	2520-12-192-3596	A 102 101 203	Pressure Plate - Clutch	1
3	2520-12-166-2743	113 141 165 B	Brg - Release	1
4	5360-12-175-6328	113 141 177 C	Spring - Left	1
4	5360-12-175-6327	113 141 178 C	Spring - Right	1
5	5305-12-169-6486	N 014 739 1	Scr. Socket Hd. (M8x16)	6

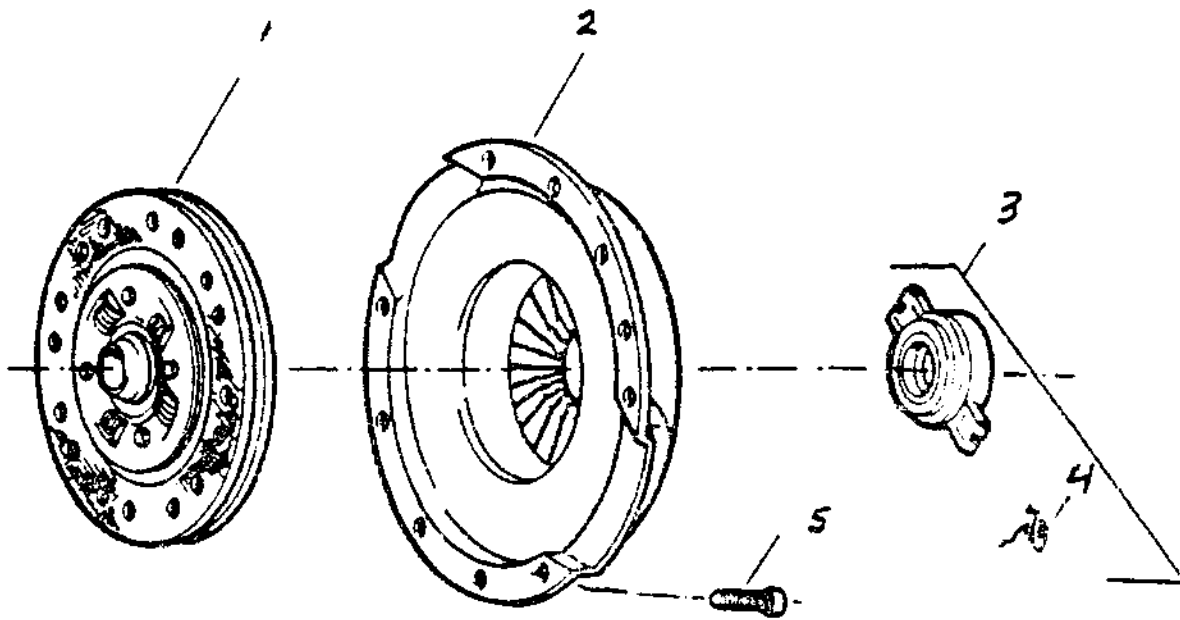


Figure 1 Clutch Assembly

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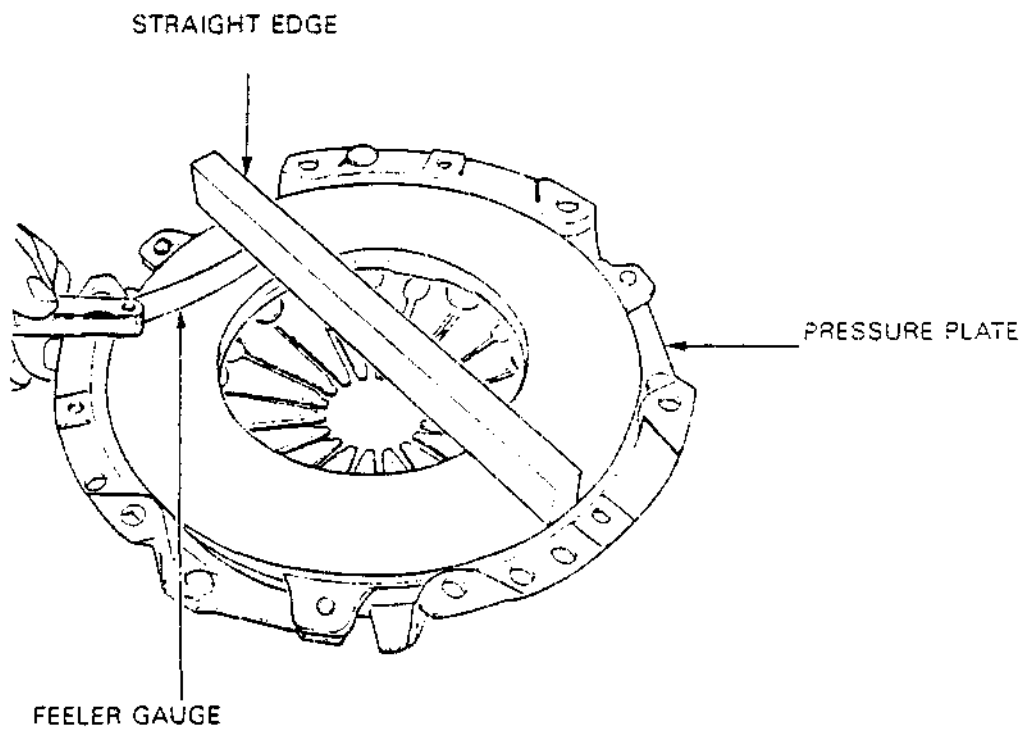


Figure 2 Pressure Plate Distortion Check

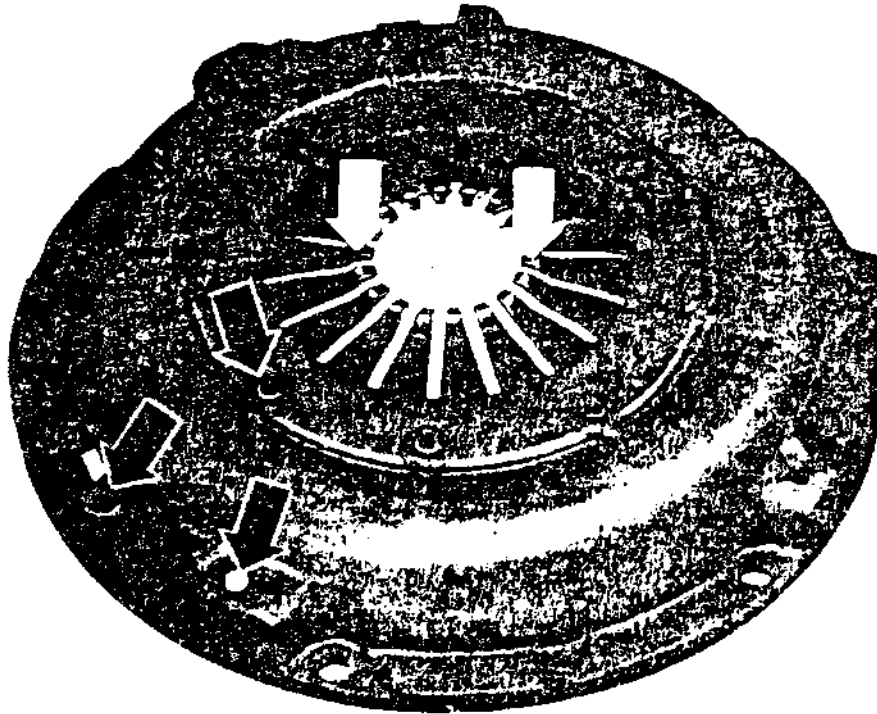


Figure 3 Checking Diaphragm Spring Fingers and Rivets

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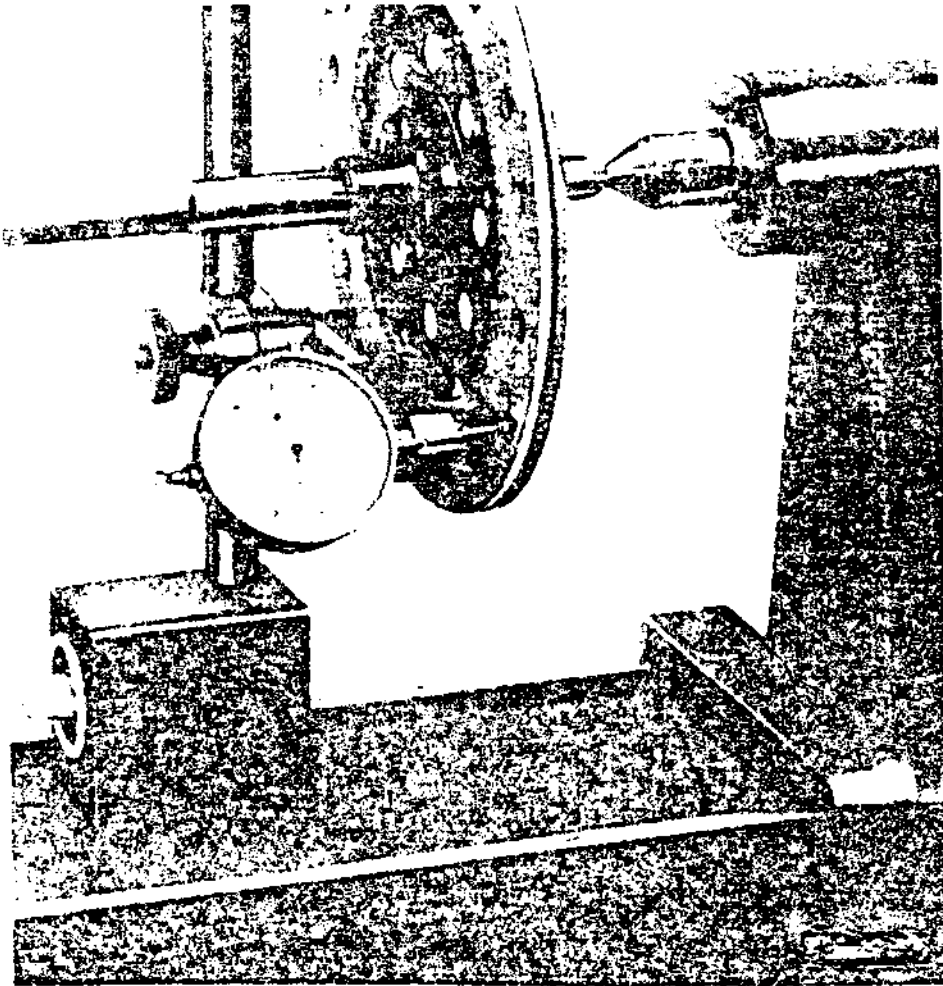


Figure 4 Checking Clutch Disc Run-out