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SPECIFICATION

FOR

REBUILDING THE VW 005.B REAR DIFFERENTIAL ASSEMBLY

USED IN TRUCKS, UTILITY, 4X4 MILITARY DESIGN ILTIS CDN. SERIES

NSN 2520-21-894-1405

1. SCOPE

1.1 Scope.- This specification covers the requirements for rebuilding the VW 005.B rear differential assembly used in Trucks, Utility, Light, 4X4 Military Design Iltis Cdn. Series used by the Canadian Armed Forces. This specification includes rebuild procedures, standards, testing, special tools, painting, preservation, packaging and quality assurance provisions.

1.2 Purpose.- The purpose of this specification is to establish high quality standards for rebuilding the subject differential in order to provide a differential with long trouble-free life.

1.3 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.

SPECIFICATIONS AND STANDARDS

AQAP-4	NATO Inspection System Requirements for Industry

OPI/BPR DSVEM 2
* The following issue will be bilingual.

Issued on Authority of the Chief of the Defence Staff
Publiée avec l'autorisation du Chef de l'état-major de la Défense

Canada

MIL-L-2105	Lubricating Oil, Gear, Multipurpose (Metric)
MIL-B-131	Barrier Materials, Watervapourproof, Flexible, Heat-Sealable
MIL-D-3464	Dessicants, Activated, Bagged, Packaging Use and Static Dehumidification
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 publications form part of this specification to the extent specified herein. Effective dates shall be those in effect on the date of manufacture. Sources are as shown:

Canadian Government Publishing Centre,
Supply and Services Canada, Ottawa, Ontario, K1A 0K2

1-GP-12	Standard for Paint Colors
31-GP-3	Compound, Corrosion Preventive, Solvent Cutback, Cold Application, Soft Film
CAN2-3.8M	Dry Cleaning Solvent
43-GP-3M	Standard for Tape Adhesive, Pressure Sensitive, Water Resistant

3. REQUIREMENTS

3.1 General.- The contractor shall rebuild each differential 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 differential assembly packaged in a reusable metal storage and shipping container as specified herein. The differential shall be ready to operate after depreservation and installation.

3.1.1 The differential assembly shall be completely disassembled. All components listed in 3.4.2 (Table III) shall be thoroughly cleaned and dried before being inspected for condition and wear. Dry cleaning solvent CAN2-3.8M or commercial equivalent may be used for cleaning.

3.1.2 Components listed in Table II Mandatory Parts Replacement shall be replaced with new OEM parts during rebuild. Although shims and thrust washers have been included as Mandatory Parts Replacement, they are reusable provided they are undamaged.

3.1.3 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 Rebuild Standards listed in Table IV. Components that fail to meet minimum standards shall be replaced with new or serviceable OEM 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.

3.1.4 For procedures not detailed in this specification, the contractor shall complete the work in accordance with accepted good engineering practices. The standards of workmanship and material shall be acceptable to the Quality Assurance Authority.

3.1.5 The contractor shall ensure that all components are secured in accordance with the Torque Standards listed in Table V.

3.1.6 The contractor shall use tools designed for the purpose of the operation to be performed. The use of tools other than the Special Tools listed in Table VI must be approved by Quality Assurance Authority.

3.1.7 The contractor shall retain the differential flange assembly hexagon head screws (Figure 1, Item No. 11) upon disassembly and use them throughout the assembly and adjustment process. New cap screws will be installed on final installation of the flange.

3.1.8 Upon completion of rebuild, the differential assembly shall consist of all of the components listed in Table I. Figures 1 and 2 are provided for component identification and location within the assembly.

3.1.9 Each rebuild differential shall be subjected to a break-in and performance check on a dynamometer as specified in 3.8.

3.1.10 When the overhaul and run-in has been given final acceptance by Quality Assurance Authority, the differential assembly shall be painted, preserved and packaged in accordance with procedures specified in paragraph 5.

3.1.11 Technical data

(a) Make - Volkswagen.

(b) Model - VW 005.B.

(c) Type - Hypoid.

(d) Lubricant capacity - 1.6 litres.

(e) Ratio - 5.286:1.

(f) Operation - Manual lock.

3.2 Rear differential components.- Table I lists all of the components of the VW 005.B Rear Differential (Figures 1 and 2 provide component identification and location within the assembly).

3.3 Mandatory parts replacement.- Table II lists the components that shall be replaced with new OEM components during rear differential rebuild (see Figures 1 and 2 for component identification).

3.4 Differential rebuild procedures.- The following provides the step by step procedures for rebuilding the VW 005.B Rear Differential Assembly.

3.4.1 Disassemble the differential

3.4.1.1 Remove the lock lever

(a) Mount the differential in a vise. Remove the drain plug and drain all the oil from the differential.

(b) Remove the nut, two flat washers and the bolt and pull the lock lever from the shaft.

3.4.1.2 Remove the drive flanges (left and right side)

(a) Install two bolts in either the left or right drive flange and, using a bar to prevent the drive flange from turning, remove the centre bolt from the drive flange.

(b) Repeat step (a) for the other drive flange.

(c) Pull out both drive flanges from the differential housing.

3.4.1.3 Remove differential flange assembly - See Figure 3 for identification of components.

(a) Remove the nine cap screws and the flange assembly.

(b) Mount the assembly in a vise.

(c) Remove the differential lock gear (24).

(d) Pry or drive out both oil seals (26 and 27).

(e) Remove the detent plug (9) and seal (10).

(f) Remove the spring (11) and detent (12).

(g) Remove the differential lock sending unit (13) and extension shaft (14).

(h) Pry the oil seal (19) from the selector shaft (16).

(j) Remove the snap rings (15 and 18) from the selector shaft.

(k) Withdraw the selector shaft from the assembly and remove the selector fork (17) and sliding collar (25).

(m) Remove shim (21) if it failed to come out with the drive flange.

(n) Using a brass drift and hammer, tap out the outer race (46) and shims (45).

(p) Pull out the spring pin (23) and remove the magnet (22).

3.4.1.4 Remove crown gear and carrier assembly - See Figure 3 and proceed as follows:

(a) Turn the propeller shaft drive flange (41) until one of the openings in the carrier (49) is in line with the pinion shaft (31).

(b) Tip the end of the carrier up and remove the assembly from the differential housing (5).

3.4.1.5 Disassemble crown gear and carrier - See Figure 4 and proceed as follows:

(a) Remove the drive flange shims (6).

(b) Secure the assembly in a vise.

(c) Remove the large carrier bearing (13) using puller KUKKO 44-2 and press Pad 40-105. Ensure that the puller fits into the grooves on the carrier, see Figure 5.

(d) Remove the small carrier bearing (10) using puller OTC 1025 and Press Pad 40-105, see Figure 6.

(e) Remove the ten cap screws (11) from the carrier (8).

(f) Drive the crown gear (12) off the carrier, see Figure 7.

(g) Drive out the spring pin (9) that secures the shaft for the pinion gears.

(h) Drive out the pinion gear shaft (7) and remove the two nuts (5).

(j) Remove the pinion gears (4) and thrust washers (3) by turning the gears to the opening.

(k) Remove the side gears (2) and shims (1).

3.4.1.6 Remove the pinion shaft - See Figure 3 and proceed as follows:

(a) Using a punch and hammer, unlock the collar of the pinion shaft nut (40).

(b) Install Retainer Matra 3028 on the propeller shaft drive flange (41) and remove the pinion shaft nut, see Figure 8.

(c) Remove the propeller shaft drive flange. If necessary, use Remover/-Installer VW391 to remove the flange, see Figure 9.

(d) Place a block of wood in the differential housing to prevent damage to the pinion and press out the pinion shaft (31).

3.4.1.7 Disassemble the Pinion Shaft - See Figure 3 and proceed as follows:

(a) Remove the "O" ring (42) from the pinion shaft (31).

(b) Using parting Appliance KUKKO 17-1, press inner bearing (32) from the pinion shaft, see Figure 10.

3.4.1.8 Remove the pinion shaft bearing races and seals - See Figure 3 and proceed as follows:

(a) Using Extractor Hook VW771/37, and Sliding Hammer VW771/1, remove both oil seals (43 and 44) one at a time, see Figure 11.

(b) Remove the pinion shaft outer bearing (39) and spacer sleeve (36).

(c) Using Internal Puller KUKKO 21-7 and Puller KUKKO 22-2, remove the pinion shaft outer bearing race (38) and spacer ring (37), see Figure 12.

(d) Using a brass drift and hammer, tap out the pinion shaft oil seal (35).

(e) Using Thrust Pad Matra 3061 and Driving Sleeve Matra 30-100, press out the race (33) and shims (34) for the inner bearing, see Figure 13.

3.4.1.9 Remove the drive flange oil seal and carrier bearing race (right side - See Figure 3 and proceed as follows:

(a) Using a brass drift and hammer, tap out the drive flange oil seal (3).

(b) Using Internal Puller KUKKO 21-7 and KUKKO Puller 22-2, remove the carrier bearing race (59) and shims (60), see Figure 14.

3.4.2 Cleaning and inspection.- Table III lists all components that are to be cleaned and inspected for condition and wear, see Figure 3 for component identification.

3.4.2.1 Cleaning.-

(a) Clean all components with dry cleaning solvent CAN2-3.8M or commercial equivalent and blow dry with compressed air.

(b) Clean all threads with a thread chaser or tap.

(c) Remove nicks and burrs from all machined surfaces with a fine stone or crocus cloth.

3.4.2.2 Inspection.-

(a) Inspect the differential housing, flange housing and the carrier housing for cracks and damage to sealing and bearing race surfaces.

(b) Inspect all bearings and races for pitting, discolouration due to excessive heat and excessive bearing looseness or binding.

(c) Inspect all gear teeth for chipped teeth, wear caused by improper meshing and pitting.

(d) Inspect all shafts for straightness, gouges and excessive wear.

(e) Inspect all shims and thrust washers for condition and measure their thickness at several points. Shims and thrust washers can be reused if they are in good condition.

(f) Inspect the selector fork for twist.

(g) Check the sending unit for continuity.

3.4.3 Assembly and Adjustments

3.4.3.1 Assemble the crown gear and carrier.- See Figure 15 and proceed as follows:

(a) Place the carrier (8) on a press.

(b) Heat the small carrier bearing (10) to about 100°C. Place the bearing on the end of the carrier and press the bearing fully home with Tool Sleeve 40-21, see Figure 16.

(c) Heat the large carrier bearing (13) to about 100°C. Place the bearing on the end of the carrier and press the bearing fully home with Tube VW415A and Thrust Plate VW447i, see Figure 17.

(d) Heat the crown gear (12) 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 (11) and torque to 100 N·m (74 ft-lb).

(f) Apply hypoid gear oil to the side gears (2) and pinion gears (4).

(g) Install the side gears with the thinnest (0.50 mm) shims (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 side gear shaft (7).

(k) Install the top and bottom nuts (5) in the carrier.

(m) Drive in the pinion gear shaft until the hole in the shaft for the spring pin (9) is aligned with hole in the carrier.

(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 pinion 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 18 lists those shims that are available for the side gears.

v Install the side gears and shims in the carrier and repeat steps (h) through (m).

(p) Tap in the spring pin (9) to secure the pinion gear

3.4.3.2 Install the bearing races - See Figure 3 and proceed as follows:

(a) Press the carrier bearing race (46) into the differential flange (8) with Thrust Piece VW472/1, see Figure 19.

(b) Press the carrier bearing race (59) into the differential housing (5) with Thrust Pad VW511 and Needle Bearing Drift VW295, see Figure 20.

(c) Press the pinion shaft inner bearing race (33) into the differential housing (5) with Thrust Pad 3062, Arbor 2050 and Threaded Spindle VW517, see Figure 21.

(d) Using Mandrel VW551, install the pinion shaft oil seal (35), see Figure 22, to a depth of 20 mm from the upper surface of the seal to the shoulder of the larger diameter, see Figure 23.

(e) Place the spacer ring (37) in the differential housing (5).

(f) Press in the pinion shaft outer bearing race (38) with Threaded Spindle VW517, Pressure Plate 30-205 and Thrust Pad 3062, see Figure 24.

3.4.3.3 Install the pinion shaft inner bearing.-

(a) Heat the pinion shaft bearing (32) to about 120°C, see Figure 3. Press the bearing onto the pinion shaft (31) with Tube VW519 and Thrust Plate VW401, see Figure 25.

3.4.3.4 Crown gear and pinion adjustments.-

(a) Careful adjustment of the crown gear and pinion is essential to ensure that the differential gives long service and runs silently. During manufacture, the crown gear and pinion are matched and run on special testing machines to ensure 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.

(b) Figure 26 identifies the location of the shims that affect the crown gear and pinion settings. Adjust the crown gear and pinion settings in the following order: See 3.4.3.5 for detailed adjustment and pinion procedure.

i Determine the total shim thickness for the crown gear adjustment, S Total (S1 plus S2), to give the specified preload of the differential carrier bearings.

ii Determine the thickness of S3, pinion axial adjustment.

iii Distribute total shim thickness, S Total, between S1 and S2 to obtain the specified backlash between the crown gear and pinion.

3.4.3.5 Differential carrier bearings preload adjustment "S total" (S1 + S2)

(a) Ensure the pinion shaft is removed and the carrier bearing races are installed without the shims.

(b) Place the carrier in the differential housing. Ensure the crown gear is nearest the right side of the housing.

(c) Install the differential flange and eight of the cap screws. Torque the cap screws to 25 N·m (18 ft-lb). The nineth capscrew is used to secure the dial gauge bracket.

(d) Install Dial Gauge Bracket VW387, Extension Plate 50 mm VW385/17, a dial gauge and a dial gauge extension that is approximately 85 mm long, see Figure 27.

(e) Move the carrier up as far as it will go and note the axial play reading (example reading: 1.30 mm).

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

Preload requirement (constant value)	0.30 mm
Dial gauge reading (example only)	+ 1.30 mm
Total shim thickness (S Total)	1.60 mm

(g) Select shims of the correct thickness. Figure 28 lists available shims.

(h) Remove the dial gauge, dial gauge bracket, and the extension plate and differential flange.

(j) Using a brass drift and hammer, tap the carrier bearing race from the differential flange.

(k) Install shims of the correct thickness in the flange.

(m) Using thrust Piece VW472/1, press the carrier bearing race into the flange.

3.4.3.6 Carrier turning torque measurement -

(a) Lubricate the differential carrier bearings with hypoid gear oil.

(b) Place the crown gear and carrier in the differential housing and install the differential flange. Torque the cap screws to 25 N·m (18 ft-lb).

(c) Install Split Sleeve VW521/8, Adapter VW521/4 and a torque gauge with a range of 0 to 600 N·cm, see Figure 29, and measure the turning torque. If new bearings have been installed, 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).

(d) Remove split sleeve VW521/8 and Adapter VW521/4.

3.4.3.7 Install the pinion shaft - See Figure 3 and proceed as follows:

(a) Remove the differential flange (8) and carrier (49).

NOTE: Fitting Sleeve (Matra 3063) must be installed on pinion shaft to prevent dislodging the spring from the seal.

(b) Place Fitting Sleeve 3063 on the pinion shaft (31) and insert the shaft into the differential housing (5). Remove the sleeve.

(c) Place a block of wood that is about 14 cm tall in the differential housing to support the pinion, see Figure 30.

(d) Heat the pinion shaft outer bearing (39) to about 120°C and install the bearing on the end of the pinion shaft (31).

(e) Drive the bearing fully home with Driving Sleeve 30-100, see Figure 31.

(f) Install the propeller shaft drive flange (41) and pinion shaft nut (40).

(g) Tighten the pinion shaft nut to obtain a turning torque of 280 to 320 N·cm (24.7 to 28.3 in-lb).

3.4.3.8 Pinion adjustment (S3) -

(a) Loosen the lock screw and adjust the setting ring of the universal measuring bar, VW385/1, to 65 mm. Tighten the lock screw, see Figure 32.

(b) See Figure 32 and assemble the universal measuring bar as follows:

i Install dial gauge extension VW-385/20 (3 mm) on Measuring Rod 30 mm VW385/14.

ii Install Measuring Rod VW385/14 on Measuring Bar VW385/1.

iii Set the Master Gauge VW385/30 to "Ro", which is 53.15 mm, see Figure 33.

iv Place the master gauge on the measuring bar and set the dial gauge to zero.

v Install the dial gauge fully in the end of the measuring bar. Extract the gauge 4 mm and lock it.

vi Remove Master Gauge VW385/30 from the measuring bar.

vii Install the two Centring Discs VW385/3.

(c) Move the adjustable Centring Disc VW385/3 inward.

(d) Install End Gauge Plate VW385/31 on the end of the pinion, see Figure 34.

(e) Insert Measuring Bar VW385/1 through the differential housing and install the differential flange and four cap screws, see Figure 35. Ensure the dial setting is not disturbed during installation.

(f) Move the second Centring Disc VW385/3 outward with the adjustable centring ring until the measuring bar will just turn by hand.

(g) Turn the measuring bar until the dial gauge pin contacts the End Gauge Plate VW385/31 on the pinion and the dial gauge shows maximum deflection (in red figures).

(h) Note the counter-clockwise reading (example reading: 1.60 mm).

(j) Calculate the shim thickness for the pinion adjustment, S3, where S3 = e - r ("e" is the dial gauge reading at maximum deflection and "r" is the deviation marked on the crown gear, see Figure 33). Note the following example:

e	1.60 mm
r	- 0.42 mm
S3	1.18 mm

(k) See Figure 36 for a list of shims that are available for S3 and choose shims that will provide the correct thickness.

(m) Remove the differential flange, measuring bar and pinion end gauge plate.

(n) Remove the nut and propeller shaft drive flange and press out the pinion shaft.

(p) Remove the outer bearing.

(q) Remove the inner bearing race with Thrust Pad MATRA 3061 and Driving Sleeve 30-100.

(r) Install the adjusting shims (S3) and bearing race with Thrust Pad 3062, Arbor 2050 and Threaded Spindle VW517. Install the Rubber "O" ring on the pinion shaft.

(s) Install fitting sleeve MATRA 3063 on the pinion shaft to protect the seal. Install the pinion shaft in the differential housing and remove the fitting sleeve. Install the spacer sleeve on the pinion shaft. Install pinion shaft outer bearing, see 3.4.3.7(c) to (e).

(t) Grease new propeller shaft drive flange seals and drive in the seals, one at a time, with Seal Installer MATRA 3027, see Figure 37. Use end "A" of Installer for the inner oil seal and end "B" for the outer oil seal. Apply grease at the points shown in Figure 38. Ensure the spring side of each seal faces in towards the crown gear and carrier.

CAUTION

Tighten the pinion shaft nut slowly and check the turning torque frequently. If the turning torque is exceeded, the spacer sleeve must be replaced. If a sleeve has been compressed too much, it is no longer usable.

(u) Install the propeller shaft drive flange and pinion nut, and Retainer MATRA 3028, tighten the pinion nut to obtain a turning torque of 280 to 320 N·cm (24.7 to 28.3 in-lb) and lock the collar of the nut, see Figure 39.

(v) Check dimension "r", see Figure 33:

i Turn the pinion several times in both directions.

ii Install the Universal Measuring Bar VW385/1 and differential flange and check the measurement. If the correct shims have been installed, the dial gauge counter-clockwise reading will be the same as deviation "r", which is marked on the crown gear to within ± 0.04 mm.

3.4.3.9 Crown gear backlash adjustment (S1 and S2) -

(a) Install the crown gear and carrier in the differential housing.

(b) Install the differential flange and eight cap screws. Torque the cap screws to 25 N·m (18 ft lb).

(c) Turn the propeller shaft drive flange several times in both directions to seat the carrier bearings.

(d) Install Dial Gauge Bracket VW387, Lever VW388, Adapter VW521/4, Split Sleeve VW521/8, dial gauge and 6-mm extension VW382/10, see Figure 40. Ensure the square end of the extension is farthest from adapter.

(e) Adjust Measuring Lever VW388 to 79 mm from Adapter VW 521/4 to the end.

(f) Turn the Adapter VW 521/4 counter-clockwise slightly and set the dial gauge to zero. Without moving the pinion shaft, turn Adapter VW 521/4 clockwise and read the backlash. Note the reading.

(g) Repeat the measurement another three times, turning the crown gear through 90° each time.

NOTE: If the difference between any of the four backlash readings is greater than 0.06 mm, either the crown gear is not installed correctly, or the crown gear and pinion are defective. Ensure the crown gear is installed correctly and, if necessary, install a new crown gear and pinion.

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

First reading	0.68 mm
Second reading	0.70 mm
Third reading	0.70 mm
Fourth reading	0.68 mm
Total	2.76 mm

Average backlash = 2.76 ÷ 4 = 0.69 mm

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

S Total	1.60 mm
Average backlash	- 0.69 mm
	0.91 mm
Required final backlash	+ 0.15 mm
S2	1.06 mm

(k) Choose shims of the correct thickness for S2. Figure 28 lists those shims that are available for S2.

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

S Total	1.60 mm
S2	- 1.06 mm
S1	0.54 mm

(n) Chose shims of the correct thickness for S1. Figure 41 lists available shims for S1.

(p) Remove the differential flange and the crown gear and carrier from the differential housing.

(q) Using a brass drift and hammer, remove the carrier bearing race and shims from the differential flange.

(r) Place the newly selected shims for S2 in the differential flange and press in the race with Thrust Piece VW472/1.

(s) Using a brass drift and hammer, remove the carrier bearing race from the differential housing.

(t) Place the newly selected shims for S1 in the differential housing and press in the bearing race with Needle Bearing Drift VW295 and Thrust Pad VW511.

(u) Check the crown gear backlash:

i Install the 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 Dial Gauge Bracket VW387, Lever VW388, Adapter VW521/4, Split Sleeve VW521/8, dial gauge and extension, see Figure 40.

iv Measure the crown gear backlash four times. Start the measurement at a different point each time. The backlash must be between 0.10 to 0.20 mm each time and the difference between any of the four readings must not be greater than 0.06 mm.

(v) Remove the tools.

3.4.3.10 Drive flange adjustment.- Between the drive flange and the differential lock gear, 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 carrier bearing to the outer edge of the differential flange, see Figure 42. Allow for the thickness of the straight edge when measuring.

(b) Choose a shim of the correct thickness for Dimension "A". Figure 43 lists available shims.

(c) Remove the cap screw from the differential flange and remove the flange.

(d) Remove the carrier from the differential housing.

(e) Install the shim and differential lock gear on the carrier.

3.4.3.11 Differential lock gear adjustment.-

(a) Install setting shims in the left end of the carrier. 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 left drive flange and centre bolt and tighten the bolt.

(c) Lift up on the nut and side gear in the carrier and measure the gap between the drive flange and the shoulder of the differential lock gear, see Figure 44.

(d) See Figure 45 and choose a shim that is the correct thickness. More than one shim may be required.

(e) Remove the drive flange and setting shims from the carrier.

(f) Install the newly selected shims in the end of the carrier.

(g) Install the left drive flange and centre bolt and measure the gap between the drive flange and shoulder of the differential lock gear. The gap should be 0.20 to 0.50 mm.

3.4.3.12 Assemble the differential flange.- see Figure 3 and proceed as follows:

(a) Mount the flange (8) in a vise.

(b) Place the magnet (22) on the flange and tap in the spring pin (23).

(c) Place the selector fork (17) on the sliding collar (25) and place the fork and collar in the flange. Ensure the shoulder at the top of the fork faces towards the bearing race in the flange.

(d) Insert the selector shaft (16) into the flange from the bearing race side. Ensure the small splined end of the shaft enters first.

(e) Install the snap rings (15 and 18) on the end of the selector shaft.

(f) Place a new seal (19) 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 46.

(g) Insert the detent (12) and spring (11) into the flange housing and install the plug (9) and seal (10).

(h) Install the extension shaft (14) and differential lock sending unit (13).

3.4.3.13 Install the differential flange.- see Figure 3 and proceed as follows:

(a) Remove the left drive flange and lock gear from the differential. Install the differential in the differential housing.

(b) Apply sealing compound and install the flange assembly (8) on the differential housing (5)

(c) Install nine new cap screws and torque to 25 N·m (18 ft-lb).

(d) Install the differential lock gear (24) on the carrier (49) and into the sliding collar (25). Ensure the shoulder of the gear faces towards the carrier.

3.4.3.14 Install the drive flange oil seals and drive flange (left side).

(a) Grease and install two new oil seals with Seal Installer 3025, see Figure 47. Ensure the spring side of each seal faces inward, towards the crown gear and carrier. Use end "A" of installer to install the inner oil seal and end "B" for the outer oil seal.

(b) Insert the drive flange. Ensure the flange engages in the sliding collar.

(c) Install the centre bolt and torque the bolt to 25 N·m (18 ft-lb).

3.4.3.15 Install the differential lock lever

(a) Place the differential lock lever on the selector shaft.

(b) Rotate the shaft to the centre detent.

(c) Rotate the drive flange so that two of the bolt holes and the differential flange retaining bolt are in a straight line.

(d) Place ruler along the vertical line made by the two bolt holes and the edge of the differental flange retaining bolt, and measure the distance from the vertical line to a centre line on the lever, see Figure 48. The distance from the centre line on the lever to the straight edge of the ruler should be 25 mm. Rotate the lever on the splines in the required direction until the correct measurement is obtained.

(e) Install the securing bolt, flat washers and nut. Torque the nut to 20 N.m (15 ft-lb).

3.4.3.16 Install the drive flange oil seal (right side).- Grease and install a new oil seal with Seal Installer 3024, see Figure 49. Ensure the lips of the seal face inward, towards the crown gear and carrier. Use end "A" of installer to install the seal.

3.4.3.17 Install the drive flange (right side)

(a) Install the drive flange.

(b) Install the drive flange centre bolt and torque the bolt to 25 N·m (18 ft-lb).

3.5 Rebuild standards.- Table IV lists the rebuild standards to be followed when rebuilding the VW005.B differential.

3.6 Torque standards.- Table V lists the torque standards to be used when rebuilding the VW005.B differential.

3.7 Special tools.- Table VI lists the special tools to be used when rebuilding the VW005.B differential. Refer to figures for tool identification.

3.8 Break-in and performance check.- Each rebuilt differential shall be subjected to a break-in and performance check as specified here-in.

(a) Fill the differential with 1.6 litres of MIL-L-2105 lubricating oil, gear, multi-purpose Grade 80W90.

(b) Hand turn the propeller shaft flange at least five complete revolutions to ensure there is no binding and to ensure all components are coated with lubricant.

(c) Power the differential in both directions under various loads for 30 minutes.

(d) Engage and disengage the rear differential lock while the differential is stationary and while being powered under low speeds in both directions.

3.8.1 Any malfunctions or unusual noises shall be corrected. In the event of a major malfunction, a penalty run shall be performed after correction.

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 satisfaction 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 differential assembly shall be masked prior to the following painting procedure:

(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 differential assembly shall be preserved in the following manner.

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

(b) Place the differential lock lever in the disengaged position.

(c) 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 MIL-B-131 and seal with tape adhesive, pressure sensitive, water resistant to 43-GP-3M.

(d) The differential lock switch and the vent tube shall be sealed with tape adhesive, pressure sensitive, water resistant to 43-GP-3M.

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

(a) Name of firm or workshop that rebuilt the differential;

(b) Day, month and year of differential rebuild; and

(c) Firm or workshop order number.

5.3.1 The differential 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 differential assembly into the shipping and storage container, the container shall be inspected and the following steps performed as required:

(a) Remove any dents and patch any holes.

(b) Paint the container with one coat of primer to 1-GP-84 and one coat of enamel paint Olive Drab 503-321 to 1-GP-12.

(c) Replace the preformed packaging.

5.3.3 The differential assembly shall be placed on the preformed packaging in the container.

5.3.4 The "Seal-Propeller Shaft" (Figure 2 Item No. 32) in its original packaging shall be placed in the container with the differential.

5.3.5 Sufficient dessicant-bagged activator to MIL-D-3464 shall be placed in the container to prevent condensation,

5.3.6 An indicator-moisture NSN 6685-00-618-1822, MRN 2155 shall be placed in the container and then the top half of the preformed packaging inserted and the lid installed.

5.3.7 The lid shall be held in place with a metal band and secured with a nut and bolt. A Wire Seal 34 x 8 x 3 x 26 GA shall be affixed to the metal band.

5.4 Marking.- The shipping and storage container shall have the following stencilled on the circumference in two locations 180° degrees apart:

(a) METHOD J PACK
PACKED WITH DEHYDRATING AGENT
DO NOT OPEN UNTIL READY FOR USE

(b) REUSABLE CONTAINER DO NOT DESTROY - CF PROPERTY
NSN 2520-21-894-1405
DIFFERENTIAL ASSY-REAR-ILTIS
MRN 183 500 040 A
QTY - 1 EA
WT-148 lb
CU-6.015 FT

(c) Date of differential rebuild.

(d) Name of rebuild contractor or workshop.

(e) Work order number of contractor or workshop.

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 specified in the contract.

6.4 Returnable parts.- All components not meeting standards shall be returned to DND through the Quality Assurance Authority.

Table I Rear differential components

Figure	Item	NSN	MRN	Description	Qty
1	1	2520-21-896-4754	B 183 525 053 A	Housing - Differential	1
1	2	5365-12-166-4321	111 301 127 E	Plug	1
1	5	2520-12-175-3373	183 525 095	Breather Tube	1
1	6	4730-21-896-4723	N 016 027 5	Plug - (M14 x 1.5)	1
1	7	5330-12-173-3050	084 311 719	Seal	1
1	8	5360-21-896-6232	014 311 641 A	Spring	1
1	9	2520-21-896-2457	014 311 621 A	Detent	1
1	10	2520-21-896-4758	005 409 131 C	Flange - Differential	1
1	11		N 010 332 4	Scr. - Hex. Hd. (M8 x 32)	9
1	12	2520-21-896-4796	005 409 473 B	Fork - Selector	1
1	13	5330-12-173-3049	019 301 457	Seal	1
1	14	5365-12-156-4999	N 042 363 1	Circlip (16 x 1.5)	1
1	15	5315-21-896-2718	N 013 344 2	Pin - Spring (4 x 30)	1
1	16	2520-21-896-4753	084 301 143 A	Magnet	1
1	17	4730-21-896-4726	N 016 161 1	Plug (M18 x 1.5)	1
1	18	4730-12-175-5449	113 301 141 B	Plug	1
1	19	2520-21-896-4797	005 409 475 B	Shaft - Selector	1
1	20	5365-21-895-4917	N 012 404 1	Circlip (21 x 1.2)	1
1	21	5305-21-142-8501	N 010 388 3	Scr. - Hex. Hd. (M8 x 90)	1
1	22	2520-21-894-1406	183 525 355 A	Flange - Left Shaft	1
1	23	5330-12-174-1353	005 409 256	Seal - Inner	1

Table I Rear differential components (cont'd)

Figure	Item	NSN	MRN	Description	Qty
1	24	5330-12-174-1352	005 409 255	Seal - Outer	1
1	25	2520-21-896-4765	005 409 715	Collar - Sliding	1
1	26	2520-21-896-4768	016 409 741	Gear - Diff. Lock	1
1	27	5930-21-895-9743	016 941 521	Switch - Diff. Lock	1
1	28	5315-21-898-4047	857 525 137	Extension - Diff. Lock Switch	1
1	29	5306-21-893-8760	N 010 247 8	Scr. - Hex. Hd. (M8 x 35)	1
1	30	5310-12-183-9645	N 011 525 13	Washer - Flat (8.4 x 16 x 1.6)	2
1	31	2520-21-894-1403	183 525 479	Lever Ass'y - Locking	1
1	32	5310-21-893-8728	N 011 184 3	Nut - Hex. Elastic (M8)	1
2	1	2520-21-896-4757	005 409 121 C	Carrier - Differential	1
2	2	5306-21-896-2605	088 409 135 A	Scr. - Hex. Hd.	10
2	3	3110-21-896-6523	018 409 123	Bearing - Roller	1
2	4	5365-21-895-4929	005 409 385	Shim (0.15)	1
2	4	5365-21-895-4930	005 409 385 A	Shim (0.20)	1
2	4	5365-21-895-4931	005 409 385 B	Shim (0.25)	1
2	4	5365-21-895-4932	005 409 385 C	Shim (0.50)	1
2	4	5365-21-895-4933	005 409 385 D	Shim (0.80)	1
2	4	5365-21-895-4934	005 409 385 E	Shim (1.00)	1
2	4	5365-21-895-4935	005 409 385 F	Shim (1.50)	1
2	5	5330-12-174-1850	005 409 399	Seal - Flange Shaft	1
2	6	2520-21-894-1401	005 409 375 A	Ring - Splash	1

Table I Rear differential components (cont'd)

Figure	Item	NSN	MRN	Description	Qty
2	7	2520-21-894-1400	005 409 343	Shaft - Flange	1
2	8	5305-12-142-8470	N 010 395 2	Scr. - Hex. Hd. (M8 x 110)	1
2	9	5315-21-896-2719	005 409 177	Pin - Diff. Pinion Gears	1
2	10	5310-21-896-2652	011 519 215	Washer - Thrust (0.50)	1
2	10	5310-21-896-2648	088 409 249	Washer - Thrust (0.60)	1
2	10	5310-21-896-2655	088 409 249 A	Washer - Thrust (0.70)	1
2	10	5310-21-896-2656	088 409 249 B	Washer - Thrust (0.80)	1
2	11	2520-21-896-4766	005 498 081	Gear Set - Pinion and Side	1
2	12	5365-12-179-4374	091 517 189	Washer - Thrust	2
2	13	5310-21-893-8697	087 409 373	Nut - Flanged	2
2	14	5310-21-896-2657	183 525 293	Washer (0.3)	1
2	14	5310-21-896-2658	183 525 293 A	Washer (0.6)	1
2	14	5310-21-896-2659	183 525 293 B	Washer (0.9)	1
2	15	2520-21-896-4756	183 525 143	Gear Set - Crown and Pinion	1
2	16	5310-21-896-2649	005 409 737	Washer (0.3)	1
2	16	5310-21-896-2650	005 409 737 A	Washer (0.6)	1
2	16	5310-21-896-2651	005 409 737 B	Washer (0.9)	1
2	17	5365-21-895-4919	005 409 381	Shim (0.15)	1
2	17	5365-21-895-4920	005 409 381 A	Shim (0.20)	1
2	17	5365-21-895-4921	005 409 381 B	Shim (0.25)	1

Table I Rear differential components (cont'd)

Figure	Item	NSN	MRN	Description	Qty
2	17	5365-21-895-4922	005 409 381 C	Shim (0.55)	1
2	17	5365-21-895-4923	005 409 381 D	Shim (0.60)	1
2	17	5365-21-895-4924	005 409 381 E	Shim (0.65)	1
2	17	5365-21-895-4925	005 409 381 F	Shim (0.80)	1
2	17	5365-21-895-4926	005 409 381 G	Shim (1.35)	1
2	17	5365-12-895-4927	005 409 381 H	Shim (1.50)	1
2	17	5365-21-895-4928	005 409 381 J	Shim (1.65)	1
2	18	3110-21-896-6522	005 409 123	Bearing - Taper Roller	1
2	19	5315-21-896-2717	N 013 319 1	Pin - Spring (5 x 36)	1
2	20	3110-21-896-6526	183 525 261	Bearing - Taper Roller	1
2	21	5365-21-895-4940	183 525 231	Shim (0.95)	1
2	21	5365-21-895-4941	183 525 231 A	Shim (1.00)	1
2	21	5365-21-895-4942	183 525 231 B	Shim (1.05)	1
2	21	5365-21-895-4943	183 525 231 C	Shim (1.10)	1
2	21	5365-21-895-4944	183 525 231 D	Shim (1.15)	1
2	21	5365-21-895-4945	183 525 231 E	Shim (1.20)	1
2	21	5365-21-895-4946	183 525 231 F	Shim (1.25)	1
2	21	5365-21-895-4947	183 525 231 G	Shim (1.30)	1
2	21	5365-21-895-4948	183 525 231 H	Shim (1.35)	1
2	21	5365-21-895-4949	183 525 231 J	Shim (1.40)	1
2	21	5365-21-895-4950	183 525 231 K	Shim (1.45)	1
2	21	5365-21-895-4951	183 525 231 L	Shim (1.50)	1

Table I Rear differential components (cont'd)

Figure	Item	NSN	MRN	Description	Qty
2	21	5365-21-895-4952	183 525 231 M	Shim (1.55)	1
2	22	5330-12-173-3055	183 525 217	Seal - Pinion Shaft	1
2	23	5365-21-895-4953	183 525 267	Sleeve - Spacer	1
2	24	2520-21-896-4795	183 525 233	Ring - Spacer	1
2	25	5310-12-175-6322	014 311 379	Nut - Hex	1
2	26	2520-21-894-1402	183 525 385	Flange Ass'y - Drive	1
2	27	2520-21-896-4764	183 525 397	Plate - Splash	1
2	28	5330-12-174-1851	005 409 278	Seal - Shaft Outer	1
2	29	5330-12-173-3056	005 409 277	Seal - Shaft Inner	1
2	30	5330-12-173-3057	N 900 682 01	"O"-Ring (25 x 4)	1
2	31	3110-21-896-6525	087 409 551 A	Bearing - Taper Roller	1
2	32	5330-12-179-3693	183 521 141	Seal	1
2	33	5330-21-896-7041	B 183 598 001 A	Seal Set - Differential	1

Table II Mandatory parts replacement

Figure	Item	NSN	MRN	Description	Qty
1	7	5330-12-173-3050	084 311 719	Seal	1
1	8	5360-21-896-6232	014 311 641 A	Spring	1
1	9	2520-21-896-2457	014 311 621 A	Detent	1
1	11		N 010 332 4	Scr. - Hex. Hd. (M8 x 32)	9
1	13	5330-12-173-3049	019 301 457	Seal	1
1	15	5315-21-896-2718	N 013 344 2	Pin - Spring (4 x 30)	1
1	21	5305-21-142-8501	N 010 388 3	Scr. - Hex. Hd. (M8 x 90)	1
1	23	5330-12-174-1353	005 409 256	Seal - Inner	1
1	24	5330-12-174-1352	005 409 255	Seal - Outer	1
1	27	5930-21-895-9743	016 941 521	Switch - Diff. Lock	1
1	28	5315-21-898-4047	857 525 137	Extension - Diff. Lock Switch	1
1	29	5306-21-893-8760	N 010 247 8	Scr. - Hex. Hd. (M8 x 35)	1
1	30	5310-12-183-9645	N 011 525 .13	Washer - Flat (8.4 x 16 x 1.6)	2
1	32	5310-21-893-8728	N 011 184 3	Nut - Hex. Elastic (M8)	1
2	2	5306-21-896-2605	088 409 135 A	Scr. - Hex. Hd.	10
2	4	5365-21-895-4929	005 409 385	Shim (0.15)	1
2	4	5365-21-895-4930	005 409 385 A	Shim (0.20)	1
2	4	5365-21-895-4931	005 409 385 B	Shim (0.25)	1
2	4	5365-21-895-4932	005 409 385 C	Shim (0.50)	1
2	4	5365-21-895-4933	005 409 385 D	Shim (0.80)	1

Table II Mandatory parts replacement (cont'd)

Figure	Item	NSN	MRN	Description	Qty
2	4	5365-21-895-4934	005 409 385 E	Shim (1.00)	1
2	4	5365-21-895-4935	005 409 385 F	Shim (1.50)	1
2	5	5330-12-174-1850	005 409 399	Seal - Flange Shaft	1
2	6	2520-21-894-1401	005 409 375 A	Ring - Splash	1
2	8	5305-12-142-8470	N 010 395 2	Scr. - Hex. Hd. (M8 x 110)	1
2	10	5310-21-896-2652	011 519 215	Washer - Thrust (0.50)	1
2	10	5310-21-896-2648	088 409 249	Washer - Thrust (0.60)	1
2	10	5310-21-896-2655	088 409 249 A	Washer - Thrust (0.70)	1
2	10	5310-21-896-2656	088 409 249 B	Washer - Thrust (0.80)	1
2	12	5365-12-179-4374	091 517 189	Washer - Thrust	2
2	14	5310-21-896-2657	183 525 293	Washer (0.3)	1
2	14	5310-21-896-2658	183 525 293 A	Washer (0.6)	1
2	14	5310-21-896-2659	183 525 293 B	Washer (0.9)	1
2	16	5310-21-896-2649	005 409 737	Washer (0.3)	1
2	16	5310-21-896-2650	005 409 737 A	Washer (0.6)	1
2	16	5310-21-896-2651	005 409 737 B	Washer (0.9)	1
2	17	5365-21-895-4919	005 409 381	Shim (0.15)	1
2	17	5365-21-895-4920	005 409 381 A	Shim (0.20)	1
2	17	5365-21-895-4921	005 409 381 B	Shim (0.25)	1
2	17	5365-21-895-4922	005 409 381 C	Shim (0.55)	1
2	17	5365-21-895-4923	005 409 381 D	Shim (0.60)	1
2	17	5365-21-895-4924	005 409 381 E	Shim (0.65)	1

Table II Mandatory parts replacement (cont'd)

Figure	Item	NSN	MRN	Description	Qty
2	17	5365-21-895-4925	005 409 381 F	Shim (0.80)	1
2	17	5365-21-895-4926	005 409 381 G	Shim (1.35)	1
2	17	5365-21-895-4927	005 409 381 H	Shim (1.50)	1
2	17	5365-21-895-4928	005 409 381 J	Shim (1.65)	1
2	19	5315-21-896-2717	N 013 319 1	Pin - Spring (5 x 36)	1
2	21	5365-21-895-4940	183 525 231	Shim (0.95)	1
2	21	5365-21-895-4941	183 525 231 A	Shim (1.00)	1
2	21	5365-21-895-4942	183 525 231 B	Shim (1.05)	1
2	21	5365-21-895-4943	183 525 231 C	Shim (1.10)	1
2	21	5365-21-895-4944	183 525 231 D	Shim (1.15)	1
2	21	5365-21-895-4945	183 525 231 E	Shim (1.20)	1
2	21	5365-21-895-4946	183 525 231 F	Shim (1.25)	1
2	21	5365-21-895-4947	183 525 231 G	Shim (1.30)	1
2	21	5365-21-895-4948	183 525 231 H	Shim (1.35)	1
2	21	5365-21-895-4949	183 525 231 J	Shim (1.40)	1
2	21	5365-21-895-4950	183 525 231 K	Shim (1.45)	1
2	21	5365-21-895-4951	183 525 231 L	Shim (1.50)	1
2	21	5365-21-895-4952	183 525 231 M	Shim (1.55)	1
2	22	5330-12-173-3055	183 525 217	Seal - Pinion Shaft	1
2	23	5365-21-895-4953	183 525 267	Sleeve - Spacer	1
2	25	5310-12-175-6322	014 311 379	Nut - Hex	1
2	28	5330-12-174-1851	005 409 278	Seal - Shaft Outer	1

Table II Mandatory parts replacement (cont'd)

Figure	Item	NSN	MRN	Description	Qty
2	29	5330-12-173-3056	005 409 277	Seal - Shaft Inner	1
2	30	5330-12-173-3057	N 900 682 01	"O"-Ring (25 x 4)	1
2	32	5330-12-179-3693	183 521 141	Seal	1
2	33	5330-21-896-7041	B 183 598 001 A	Seal Set - Differential	1

Table III Components for cleaning and inspection

Item*	Description	Item	Description
2	Right Drive Flange	32	Pinion Shaft Inner Bearing
4	Filler Plug	33	Pinion Shaft Inner Bearing Race
5	Differential Housing	34	Pinion Adjusting Shim(s)
6	Breather Hose Fitting	37	Spacer Ring
7	Plug	38	Pinion Shaft Outer Bearing Race
8	Flange Assembly	39	Pinion Shaft Outer Bearing
9	Detent Plug	41	Propeller Shaft Drive Flange
13	Sending Unit	45	Crown Gear Adjusting Shim(s)
14	Extension Shaft	46	Differential Carrier Bearing Race
15	Snap Ring	47	Differential Carrier Bearing
16	Selector Shaft	49	Carrier
17	Selector Fork	50	Shim
18	Snap Ring	51	Pinion Gear
20	Lock Lever	52	Thrust Washer
21	Shim(s)	53	Side Gear
22	Magnet	54	Left Drive Flange Shim(s)
24	Differential Lock Gear	55	Nuts
25	Sliding Collar	57	Differential Carrier Bearing
28	Left Drive Flange	58	Pin
30	Grown Gear	59	Differential Carrier Bearing Race
31	Pinion Shaft	60	Crown Adjusting Shim(s)
		61	Drain Plug

* See Figure 3 for Item identification.

Table IV Rebuild standards

Description	Standard
Pinion Oil Seal to shoulder of larger diameter	20 mm
Differential Side Gears Axial Play	0.00 - 0.10 mm
Carrier Bearing Preload S Total (S1 plus S2)	0.30 mm
Carrier Turning Torque (new bearings - min)	250 N.cm (22.1 in-lb)
(used bearings - min)	30 N.cm (2.6 in-lb)
Pinion Adjustment (S3) Deviation "r" -	"r" ± 0.04 mm
Pinion Turning Torque	280 - 320 N.cm (24.7 - 28.3 in-lb)
Crown Gear Backlash	0.10 - 0.20 mm
Maximum Difference Between Four Backlash Readings	0.06 mm
Drive Flange to Differential Lock Gear	0.20 - 0.50 mm
Differential Lock Lever Adjustment	25 mm

Table V Torque standards

Description	N·m	ft-lb
Crown Gear to Carrier	100	74
Differential Flange to Differential Housing	25	18
Drive Flange Centre Bolt (right and left)	25	18
Differential Lock Lever	20	15

Table VI Special tools

Figure	Nomenclature	MRN	Use
5	Puller	KUKKO 44-2	Removing Large Carrier Bearing
5	Press Pad	MATA 40-105	Removing Carrier Bearings
6	Puller	OTC 1025	Removing Small Carrier Bearing
8	Retainer	MATRA 3028	Removing Propeller Shaft Drive Flange
9	Remover/Installer	VW 391	Removing Propeller Shaft Drive Flange
10	Parting Appliance	KUKKO 17-1	Removing Inner Bearing From Pinion Shaft
11	Extractor Hook	VW 771/37	Removing Pinion Shaft Oil Seal
11	Sliding Hammer	VW 771	Removing Pinion Shaft Oil Seal
12	Internal Puller	KUKKO 21-7	Removing Pinion Shaft Outer Race Removing Carrier Bearing Race
12	Puller	KUKKO 22-2	Removing Pinion Shaft Outer Race Removing Carrier Bearing Race
13	Thrust Pad	MATRA 3061	Removing Pinion Shaft Inner Race
13	Driving Sleeve	MATRA 30-100	Removing Pinion Shaft Inner Race Installing Pinion Shaft Outer Bearing
16	Sleeve	MATRA 40-21	Installing Small Carrier Bearing
17	Tube	VW 415A	Installing Large Carrier Bearing
17	Thrust Plate	VW 447i	Installing Large Carrier Bearing
19	Thrust Piece	VW 472/1	Installing Carrier Bearing Race Into Differential Flange
20	Thrust Pad	VW 511	Installing Carrier Bearing Race Into Differential Housing
20	Needle Bearing Drift	VW 295	Installing Carrier Bearing Race Into Differential Housing
21	Thrust Pad	MATRA 3062	Installing Pinion Shaft Inner Bearing Race Installing Pinion Shaft Outer Bearing Race
21	Arbor	MATRA 2050	Installing Pinion Shaft Inner Bearing Race
21	Threaded Spindle	VW 517	Installing Inner and Outer Pinion Shaft Bearing Races
24	Pressure Plate	MATRA 30-205	Installing Pinion Shaft Outer Bearing Race
22	Mandrel	VW 551	Installing Pinion Shaft Oil Seal
25	Tube - 50 mm Dia	VW 519	Installing Pinion Shaft Inner Bearing
25	Thrust Plate	VW 401	Installing Pinion Shaft Inner Bearing

Table VI Special tools (cont'd)

Figure	Nomenclature	MRN	Use
27	Dial Gauge Bracket	VW 387	To Hold Dial Gauge
27	End Plate 50 mm	VW 385/17	Checking Carrier Axial Play
27	Dial Gauge Ext. 85 mm		Check Carrier Axial Play
29	Split Sleeve	VW 521/8	Checking Carrier Turning Torque Checking Crown Gear Backlash
29	Adapter	VW 521/4	Checking Carrier Turning Torque Checking Crown Gear Backlash
29	Torque Gauge 0-600 N.cm		Checking Carrier Turning Torque Checking Pinion Turning Torque
	Sleeve	MATRA 3063	Installing Pinion Shaft
32	Universal Measuring Bar	VW 385/1 Dial Gauge V35.1	Checking Pinion Adjustment
30	Dial Gauge Ext. 3 mm	VW 385/20	Checking Pinion Adjustment
32	Measuring Rod 30 mm	VW 385/14	Checking Pinion Adjustment
32	Universal Master Gauge	VW 385/30	Checking Pinion Adjustment
32	Centering Discs	VW 385/3	Checking Pinion Adjustment
34	End Gauge Plate Adjustable Measuring	VW 385/31	Checking Pinion Adjustment
40	Lever	VW 388	Checking Crown Gear Backlash
37	Seal Installer	MATRA 3027	Installing Propeller Shaft Drive Flange Seal
40	Dial Gauge Ext. 6 mm	VW 382/10	Checking Crown Gear Backlash
46	Tube - 28 mm Dia	VW 421	Installing Selector Shaft Seal
47	Seal Installer	MATRA 3025	Installing Drive Flange Seals
49	Seal Installer	MATRA 3024	Installing Right Drive Flange Seals

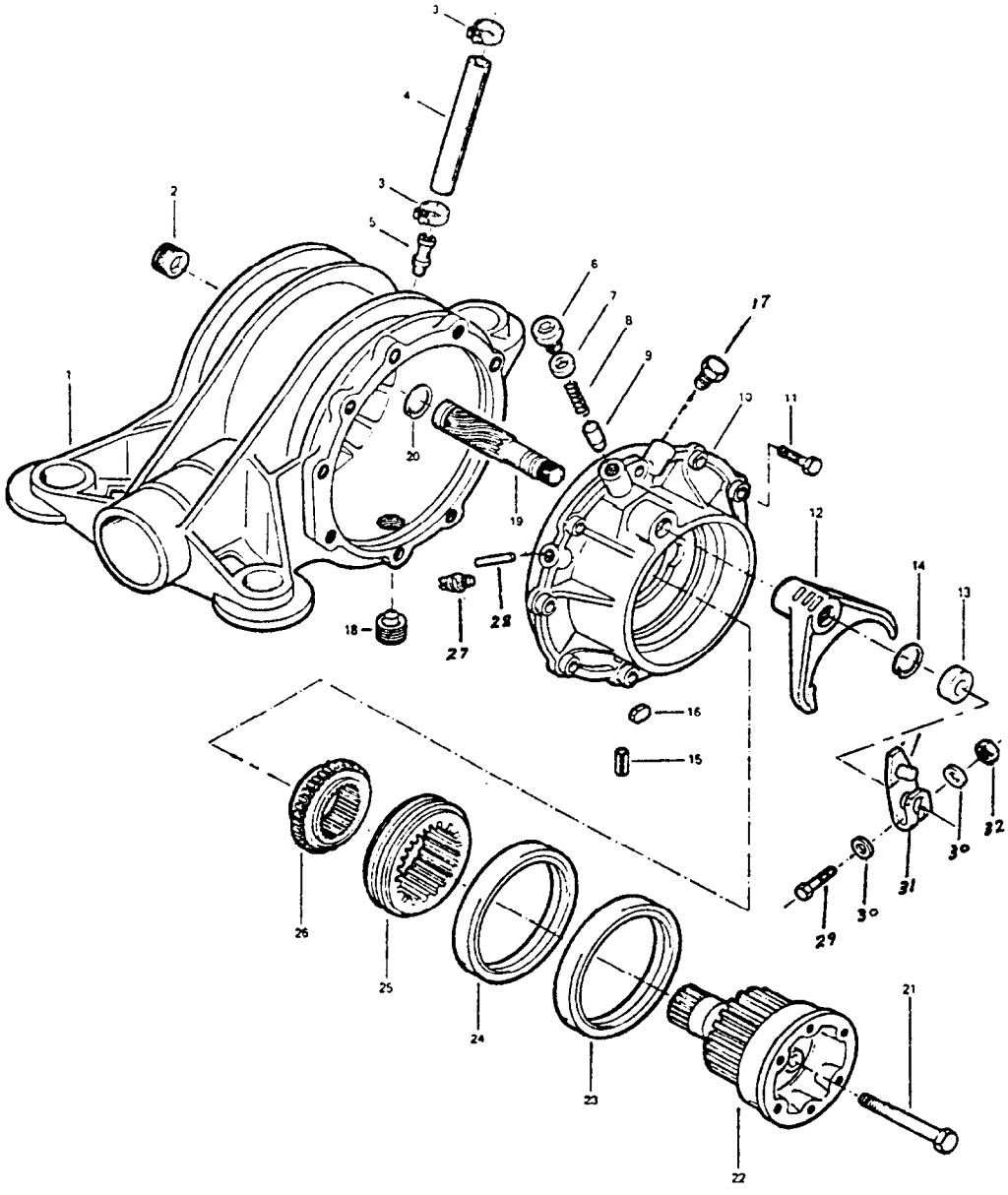


Figure 1 Housing and Cover for Rear Differential

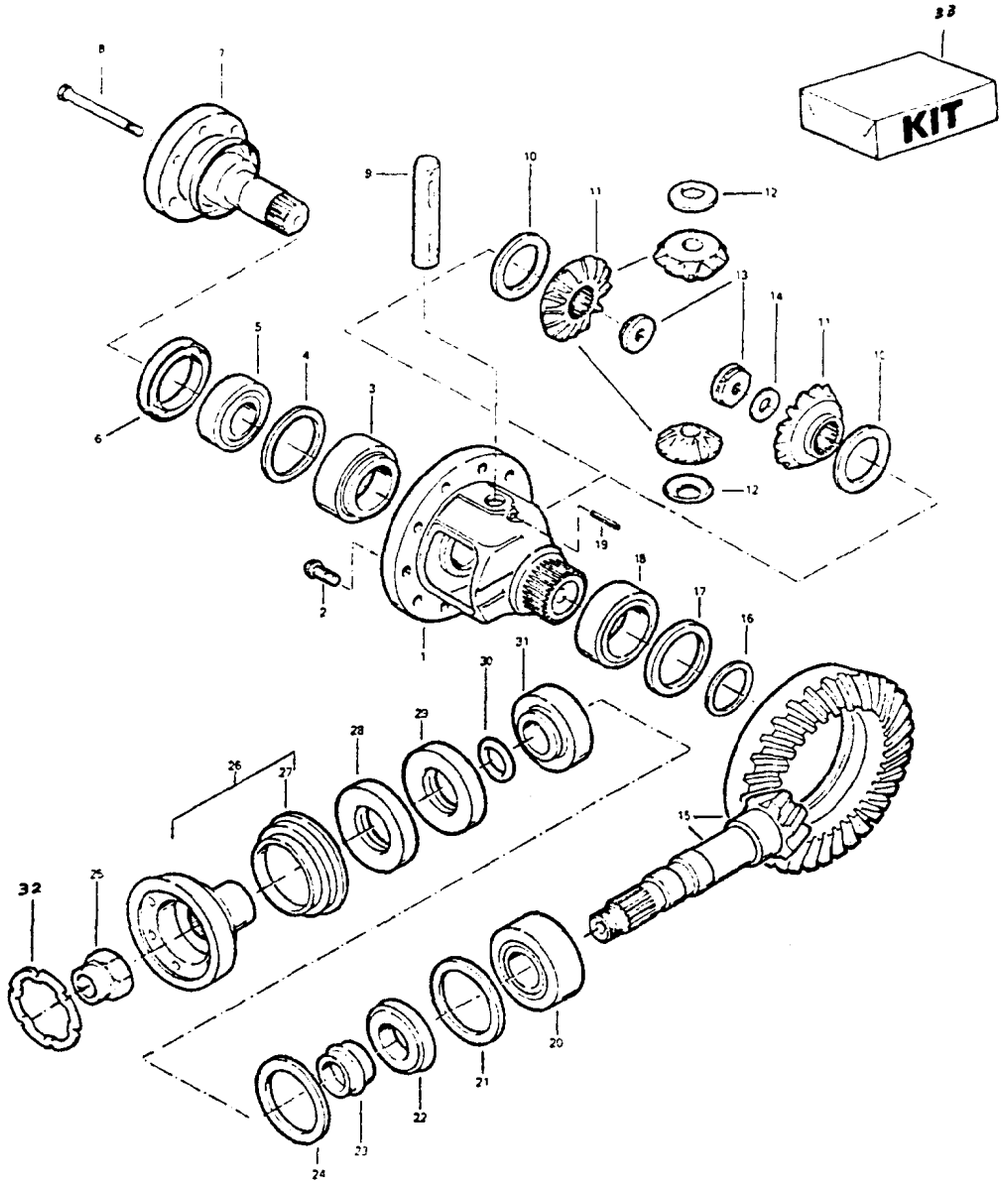
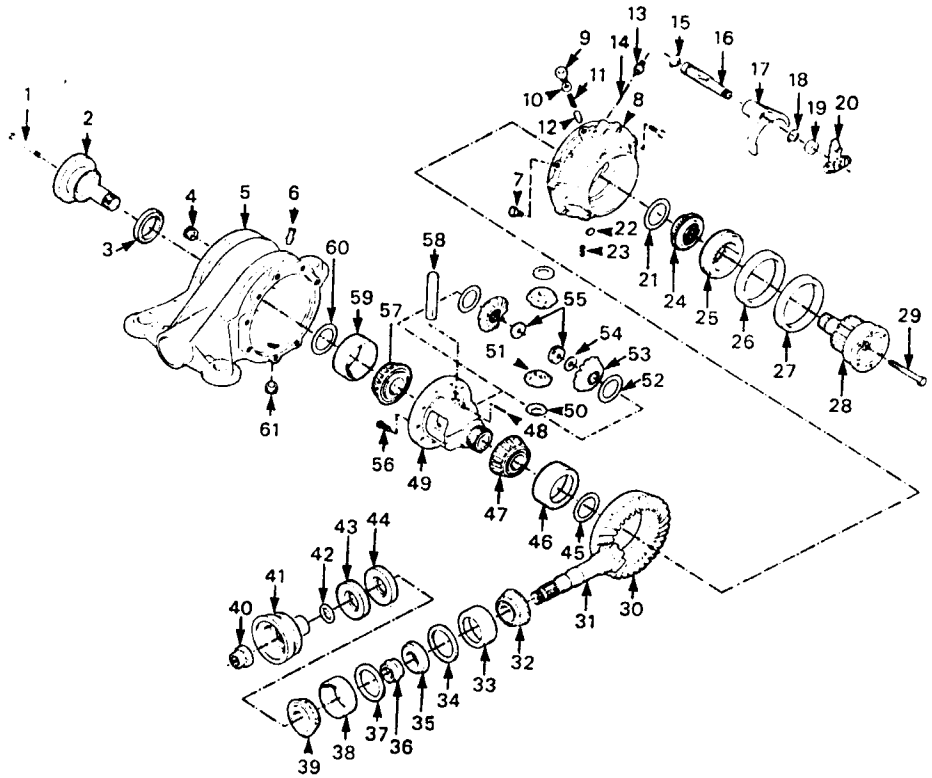
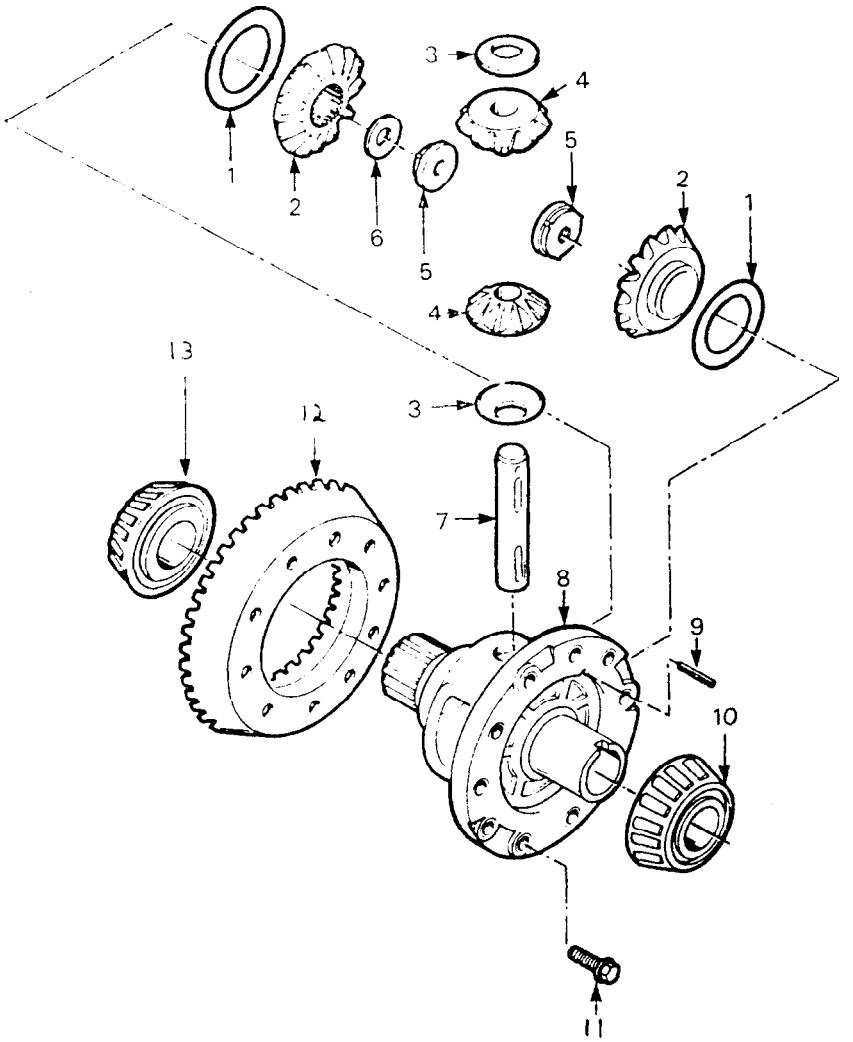


Figure 2 Rear Differential



1. Centre Bolt
2. Right Drive Flange
3 Drive Flange Oil Seal - R/H
4. Filler Plug
5. Differential Housing
6. Breather Hose fitting
7. Plug
8. Flange Assembly
9. Detent Plug
10. Seal
11. Spring
12. Detent
13. Sending Unit
14. Extension Shaft
15. Snap Ring
16. Selector Shaft
17. Selector Fork
18. Snap Ring
19. Oil Seal
20. Lock Lever
21. Shim(s)
22. Magnet
23. Spring Pin
24. Differential Lock Gear
25. Sliding Collar
26. Inner Drive Flange Oil Seal
27. Outer Drive Flange Oil Seal
28. Left Drive Flange
29. Centre Bolt
30. Crown Gear
31. Pinion Shaft
32. Pinion Shaft Inner Bearing
33. Pinion Shaft Inner Bearing Race
34. Pinion Adjusting Shim(s)
35. Pinion Shaft Oil Seal
36. Spacer Sleeve
37. Spacer Ring
38. Pinion Shaft Outer Bearing Race
39. Pinion Shaft Outer Bearing
40. Pinion Shaft Nut
41. Propeller Shaft Drive Flange
42. O-Ring
43. Oil Seal - Outer
44. Oil Seal - Inner
45. Crown Gear Adjusting Shim(s)
46. Differential Carrier Bearing Race
47. Differential Carrier Bearing
48. Srping Pin
49. Carrier
50. Thrust Washer
51. Pinion Gear
52. Shim
53. Side Gear
54. Left Drive Flange Shim(s)
55. Nut
56. Cap Screw
57. Differential Carrier Bearing
58. Pin
59. Differential Carrier Bearing Race
60. Crown Adjusting Shim(s)
61. Drain Plug

Figure 3 Rear Differential Assembly



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

Figure 4 Crown Gear and Carrier Assembly

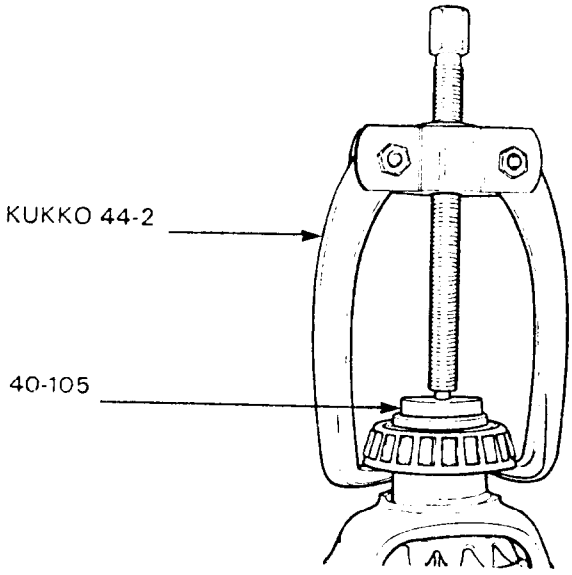


Figure 5 Removal of Large Carrier Bearing

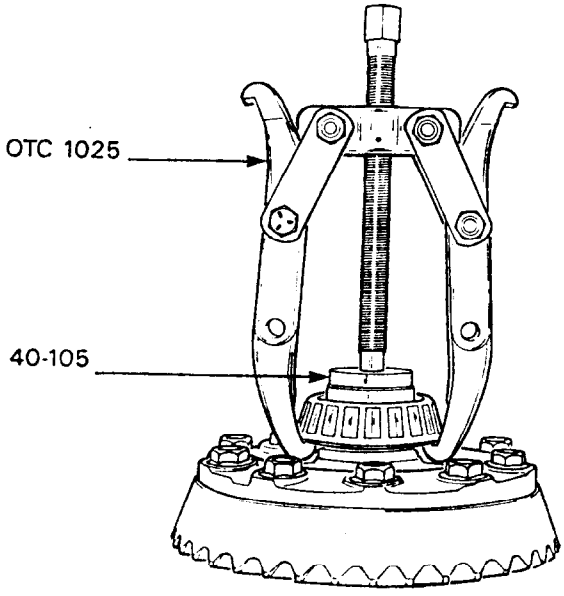


Figure 6 Removal of Small Carrier Bearing

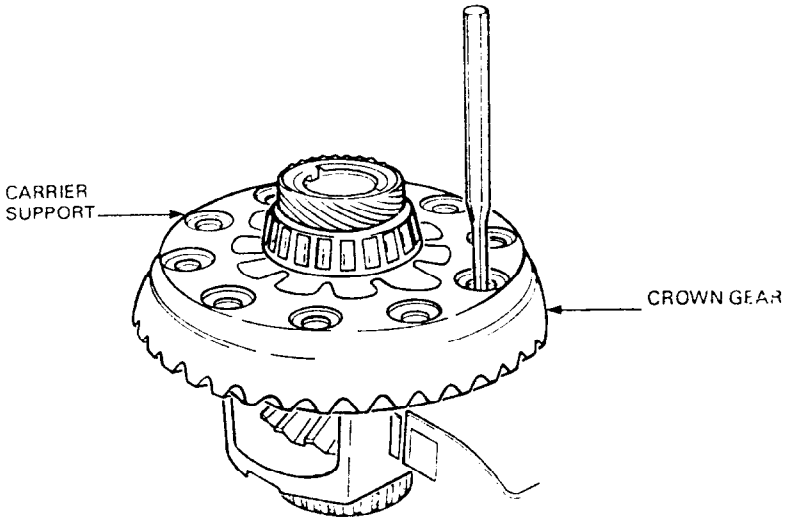


Figure 7 Removal of Crown Gear from Carrier

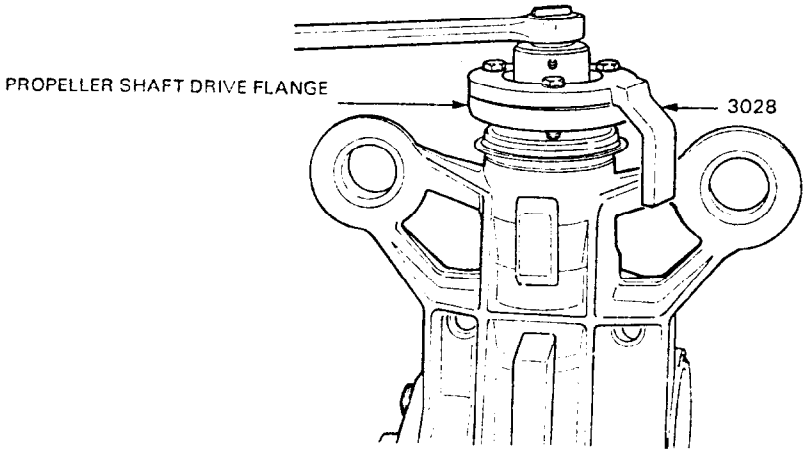


Figure 8 Removal of Pinion Shaft Nut

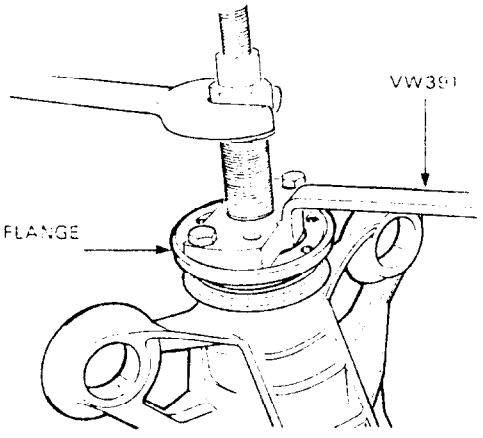


Figure 9 Removal of Propeller Shaft Drive Flange

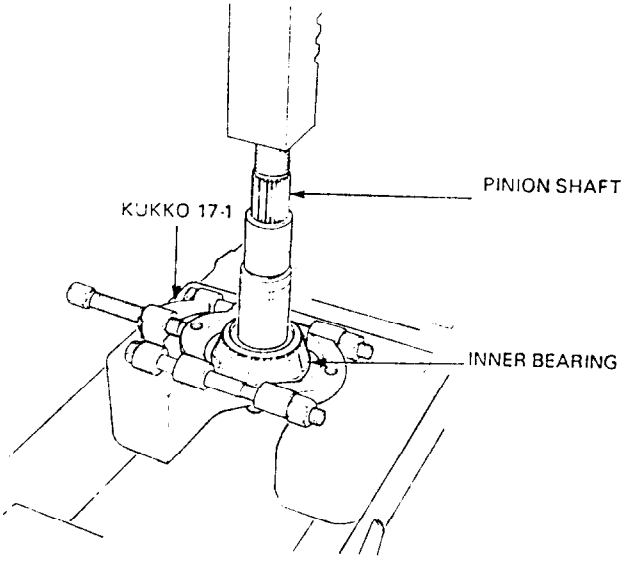


Figure 10 Removal of Inner Bearing from Pinion Shaft

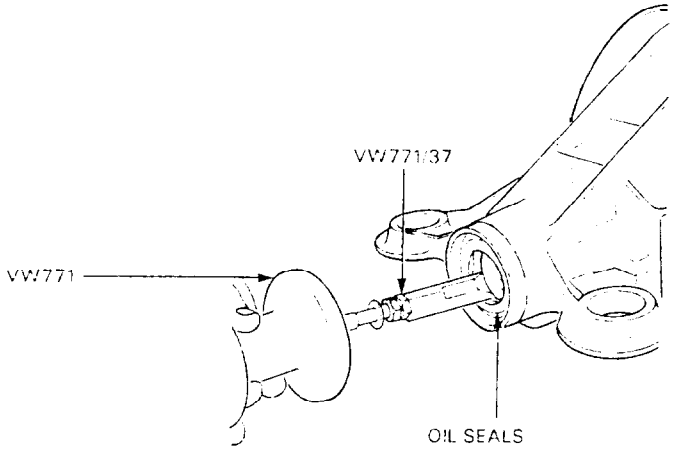


Figure 11 Removal of Propeller Shaft Drive Flange Oil Seals

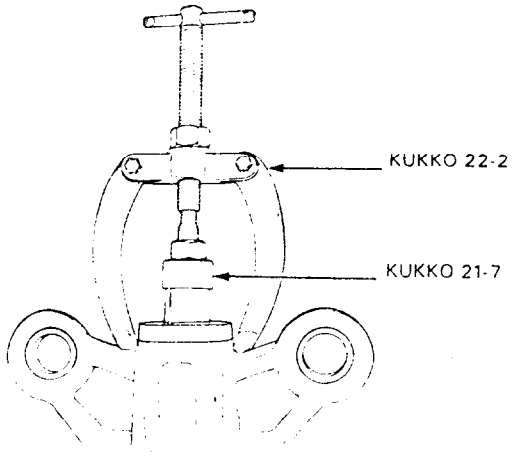


Figure 12 Removal of Pinion Shaft Outer Race and Spacer Ring

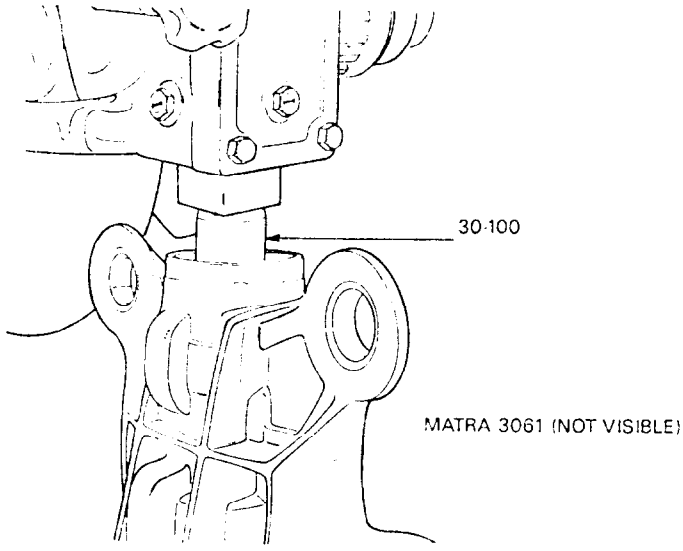


Figure 13 Removal of Pinion Shaft Inner Bearing Race and Shims

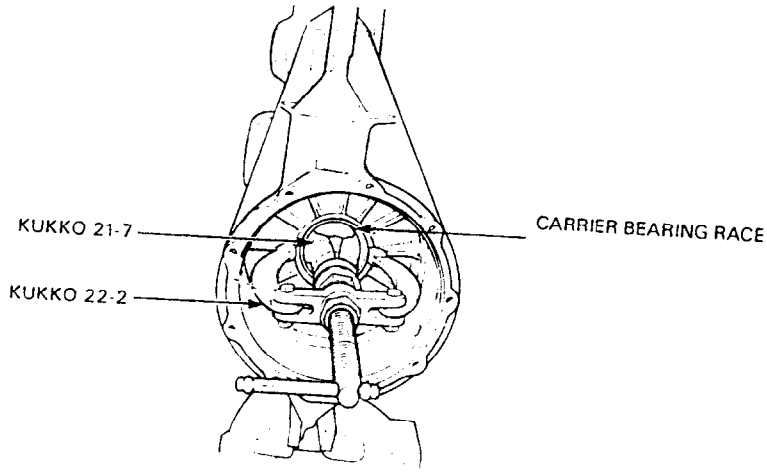
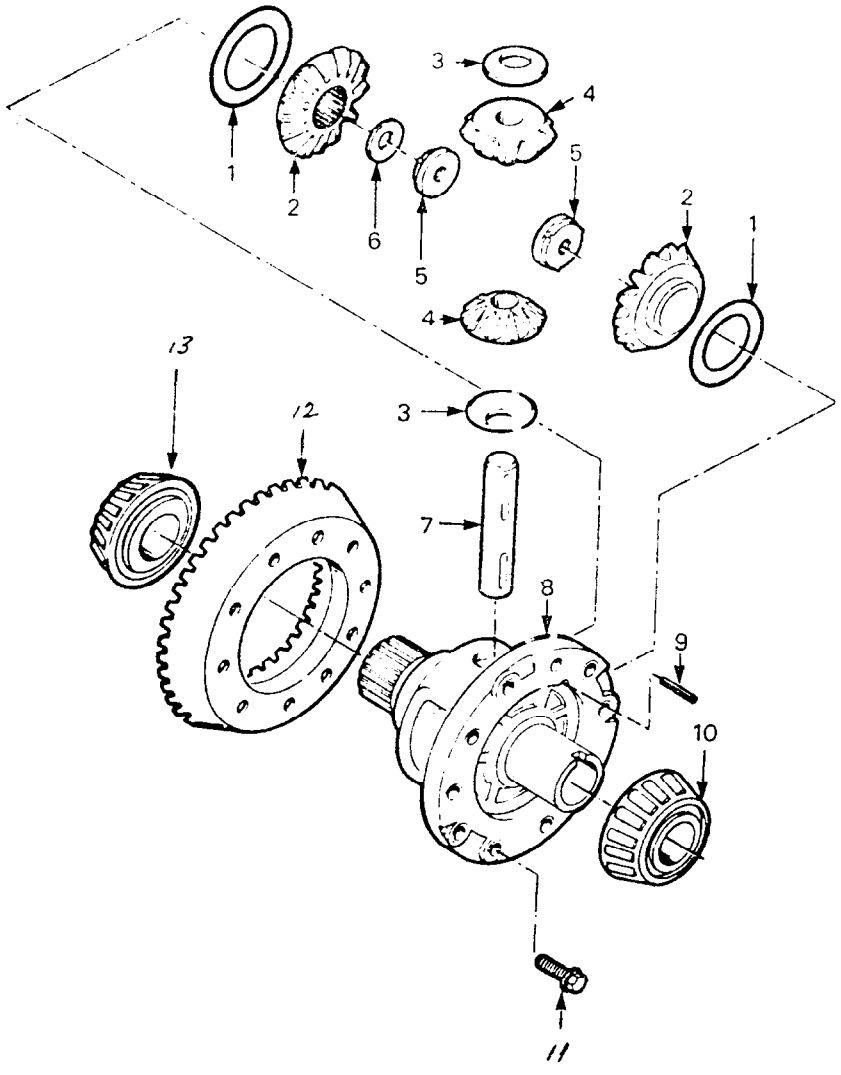


Figure 14 Removal of Carrier Bearing Race and Shims



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

Figure 15 Crown Gear and Carrier Assembly

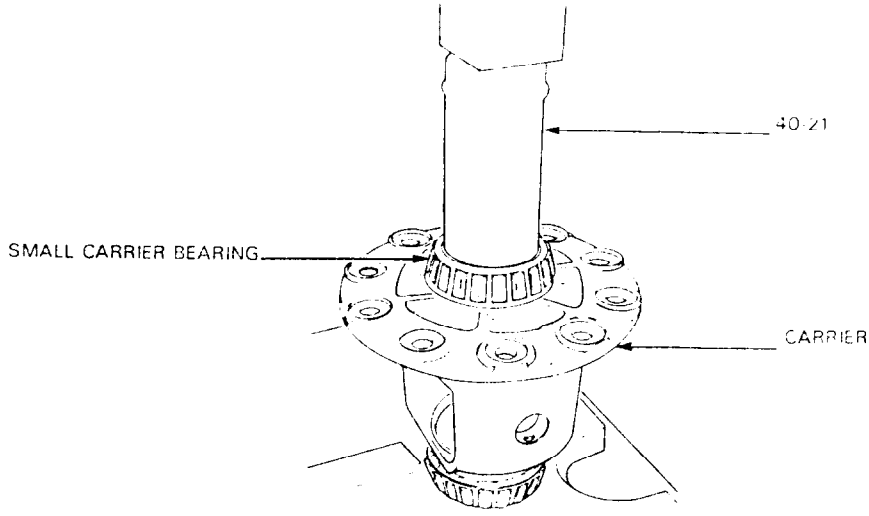


Figure 16 Installation of Small Carrier Bearing

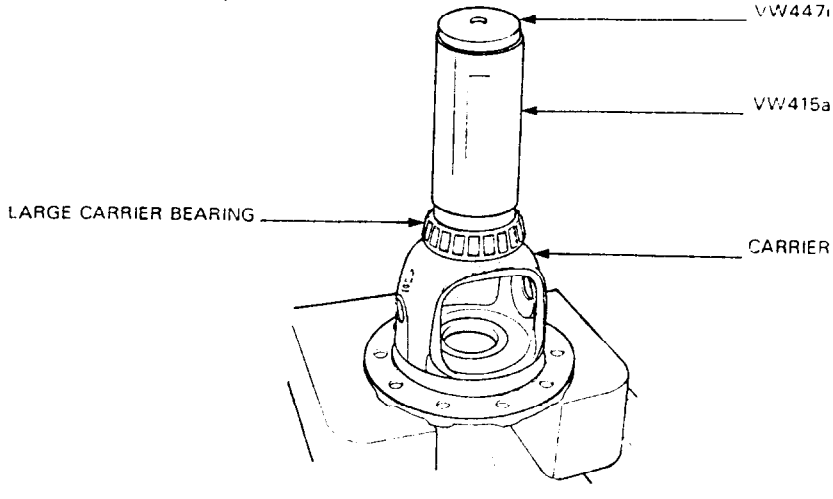


Figure 17 Installation of Large Carrier Bearing

MFR PART NO	THICKNESS (MM)
B 011 519 215	0.50
B 088 409 249	0.60
B 088 409 249 A	0.70
B 088 409 249 B	0.80

Figure 18 Shims Available for Side Gears

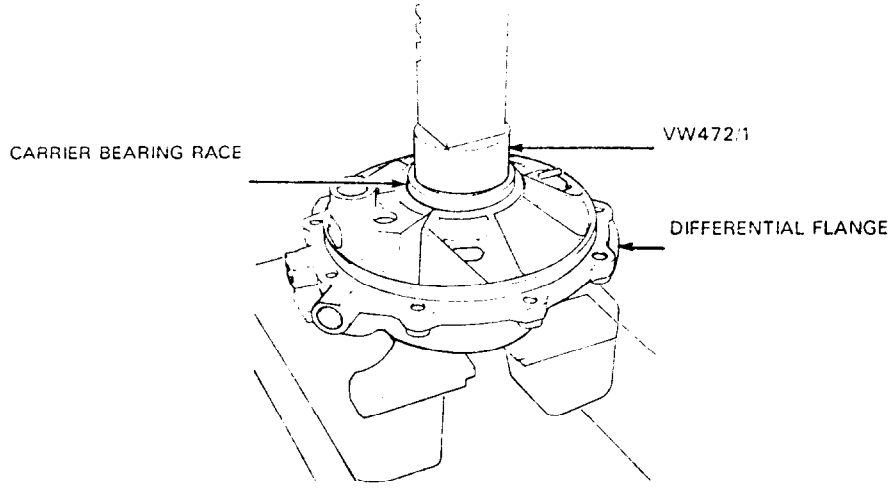


Figure 19 Installation of Carrier Bearing Race in Differential Flange

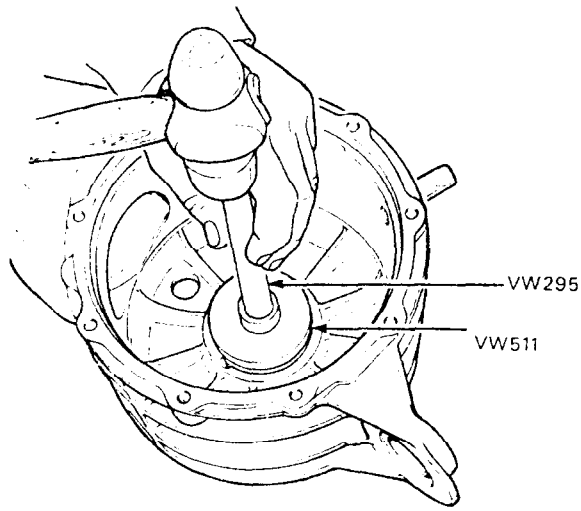


Figure 20 Installation of Carrier Bearing Race in Differential Housing

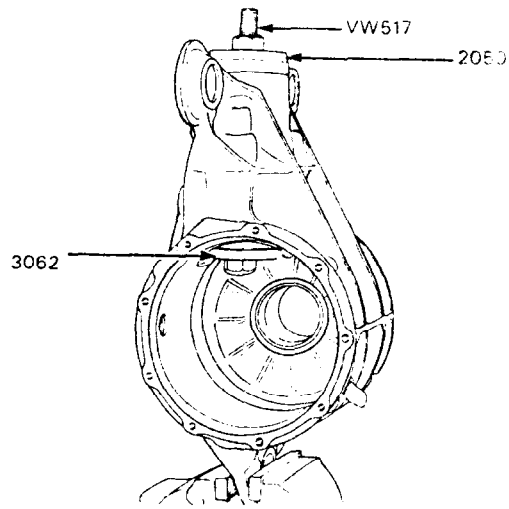


Figure 21 Installation of Pinion Shaft Inner Bearing Race in Differential Housing

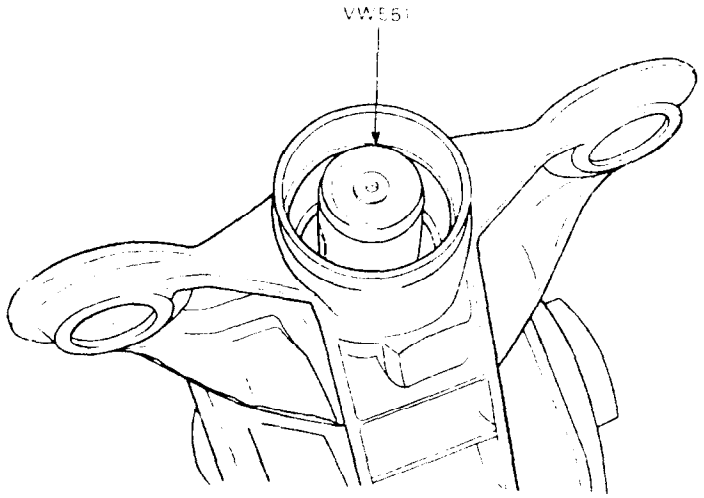


Figure 22 Installation of Pinion Shaft Oil Seal

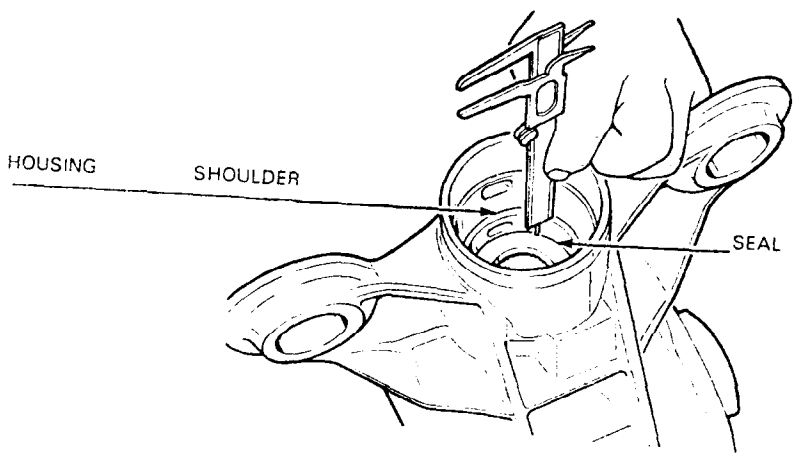


Figure 23 Measurement of Distance Between Housing Bearing Shoulder and Pinion Shaft Seal

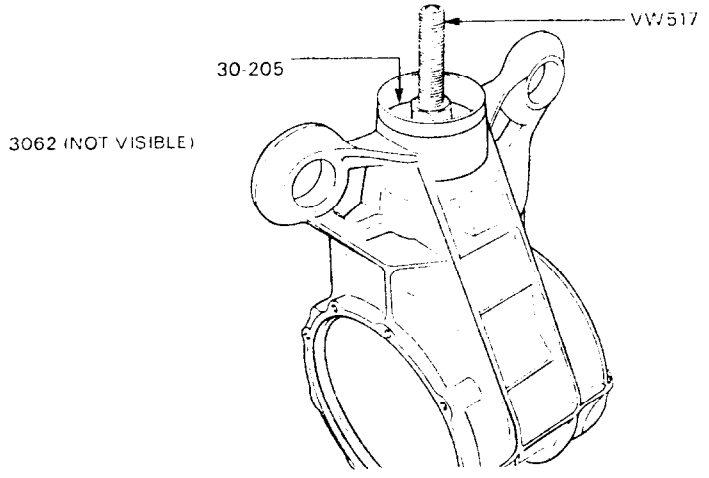


Figure 24 Installation of Pinion Shaft Outer Bearing Race

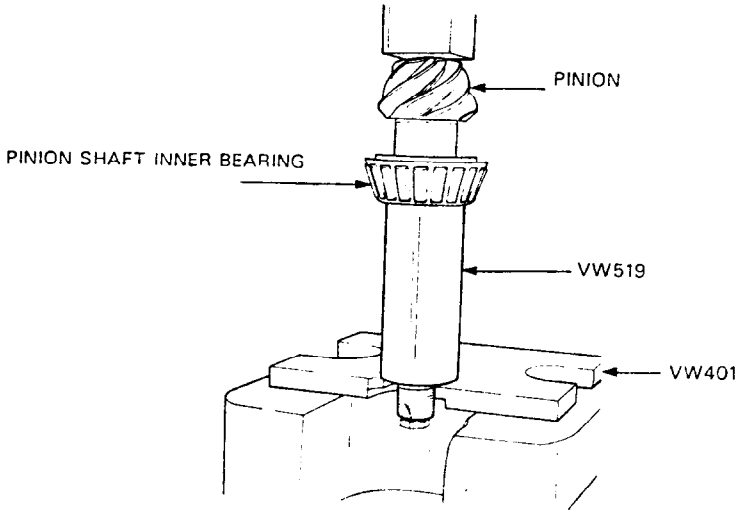


Figure 25 Installation of Pinion Shaft Inner Bearing

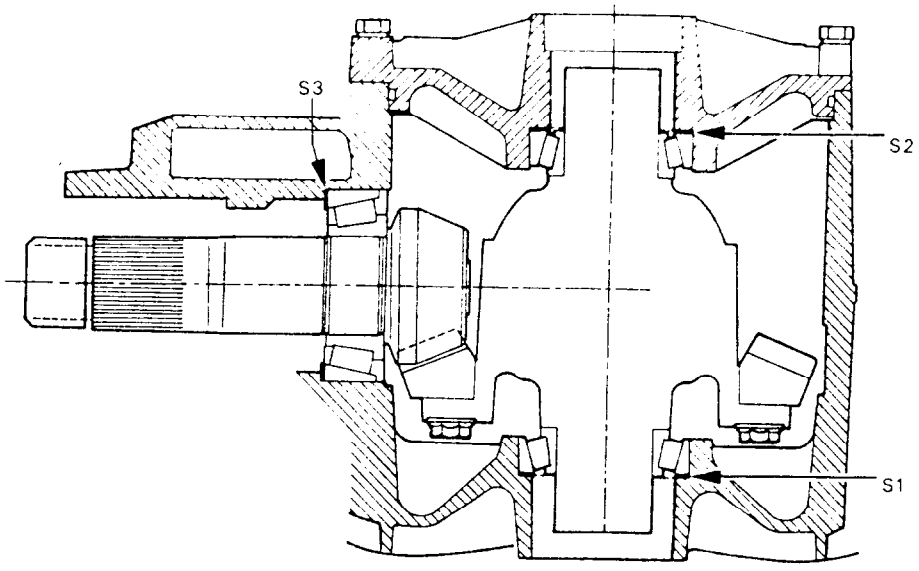


Figure 26 Location and Identification of Crown Gear and Pinion Adjusting Shims (Rear Differential)

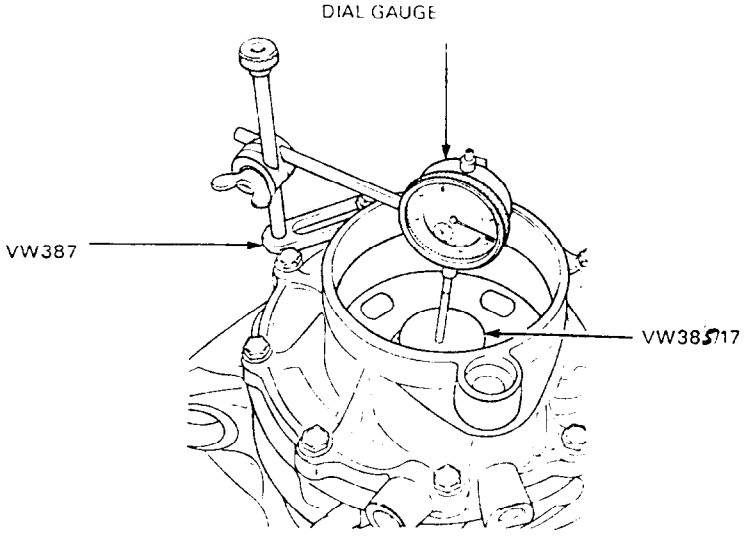


Figure 27 Measurement of Carrier Axial Play

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 28 Shims for S Total and S2 (Rear Differential)

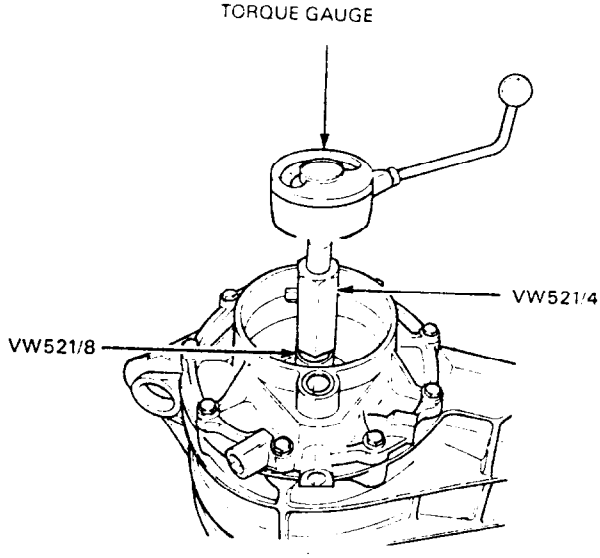


Figure 29 Measurement of Carrier Turning Torque

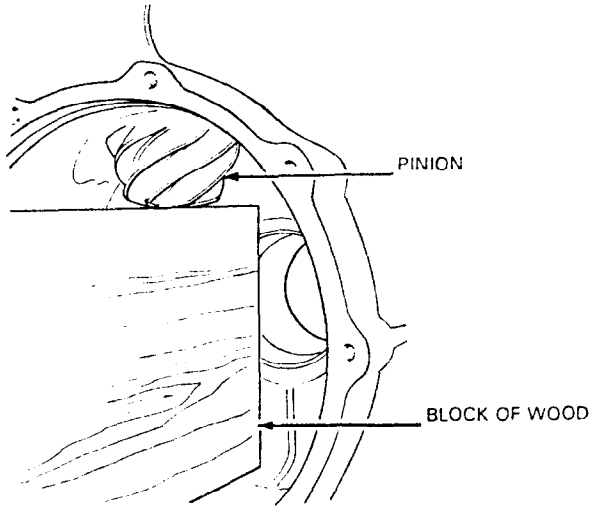


Figure 30 Block of Wood Supporting Pinion

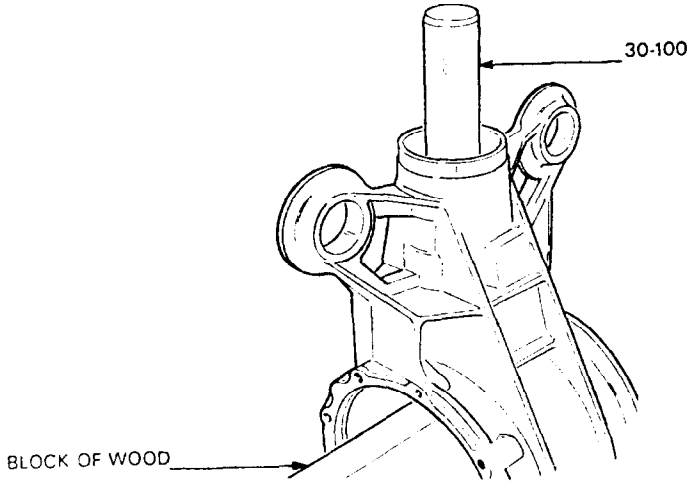


Figure 31 Installation of Outer Bearing on Pinion Shaft

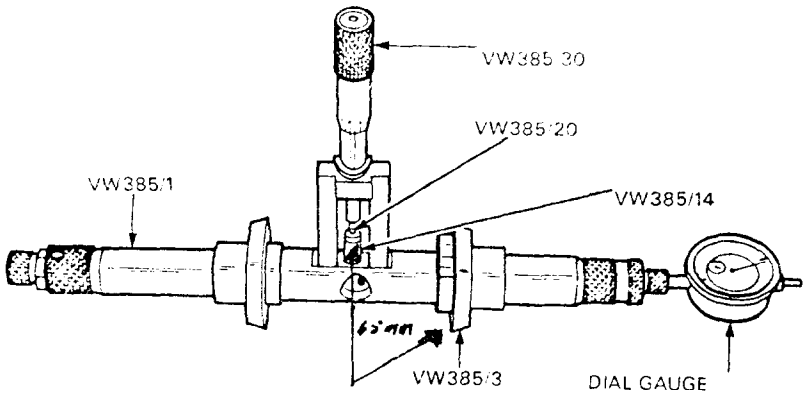
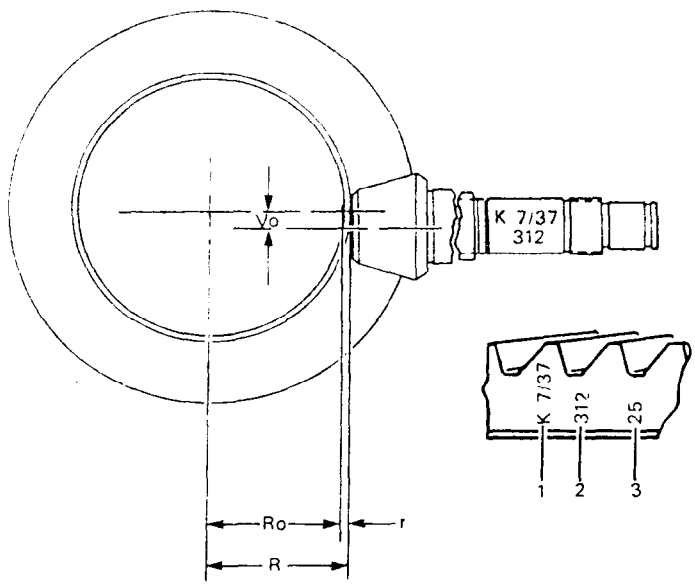


Figure 32 Universal Measuring Bar



1 - Identification "K 7/37" means Klingelnberg crown gear/pinion, ratio 7:37.
2. - Index number (312) of matched set.
3 - Deviation "r" measured against master gauge of special machine used in production. Deviation "r" is always given in 1/100 mm. Example "25" means r = 0.25 mm.
Ro - Length of master gauge used in special test machine. "Ro" = 53.15 mm
R - Actual distance between centre axis of crown wheel and face of pinion with pinion in position for quietest running for this particular matched set.
Vo - Hypoid Offset = 35 mm.

Figure 33 Crown Gear and Pinion Adjustments and Identification Markings (Rear Differential)

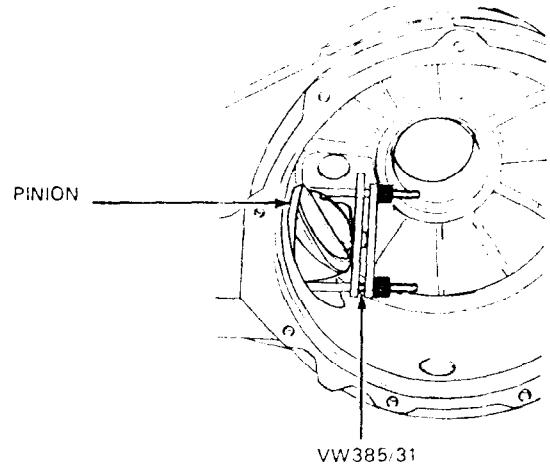


Figure 34 End Gauge Plate Installed on Pinion

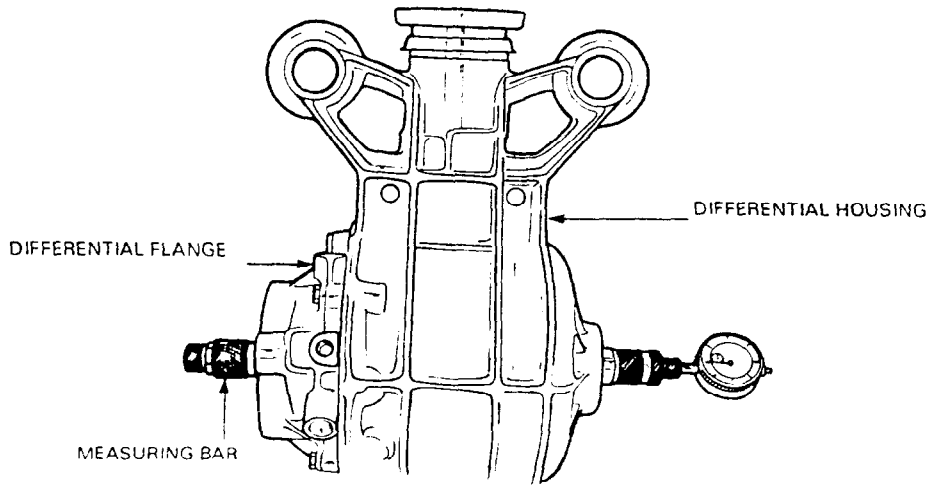


Figure 35 Universal Measuring Bar Installed in Rear Differential

Mfr Part No	Thickness (mm)
B 183 525 231	0.95
B 183 525 231 A	1.00
B 183 525 231 B	1.05
B 183 525 231 C	1.10
B 183 525 231 D	1.15
B 183 525 231 E	1.20
B 183 525 231 F	1.25
B 183 525 231 G	1.30
B 183 525 231 H	1.35
B 183 525 231 J	1.40
B 183 525 231 K	1.45
B 183 525 231 L	1.50
B 183 525 231 M	1.55

Figure 36 Shims for Pinion Adjustment S3

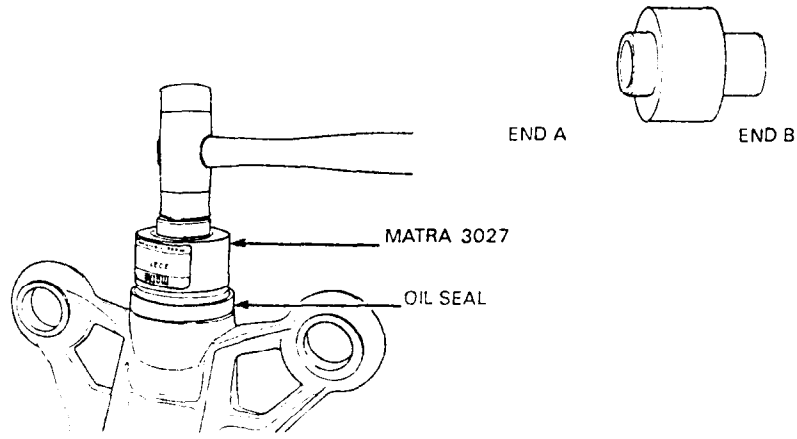


Figure 37 Installation of Propeller Shaft Drive Flange Oil Seals

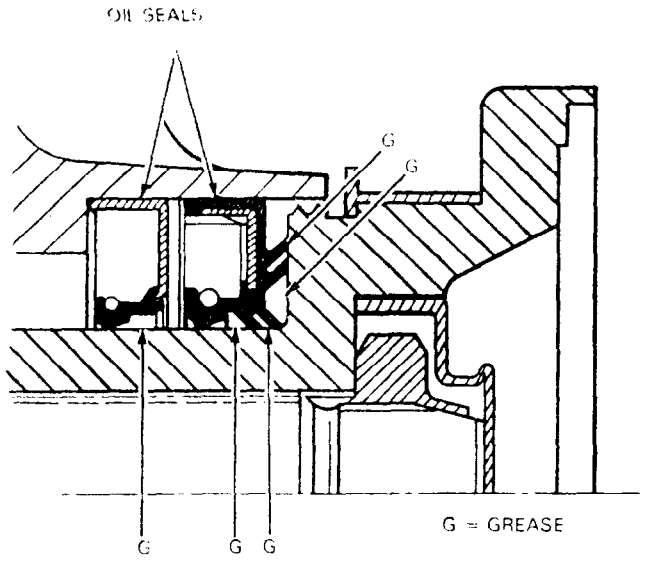


Figure 38 Grease Points for Propeller Shaft Drive Flange Oil Seals

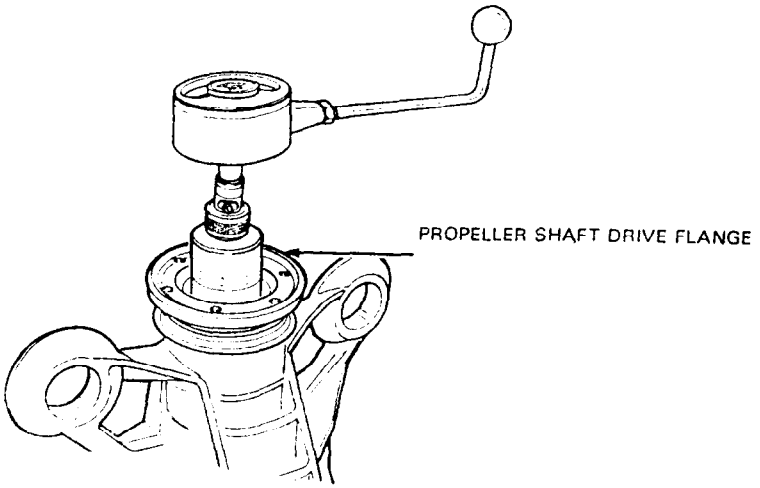


Figure 39 Measurement of Pinion Shaft Turning Torque

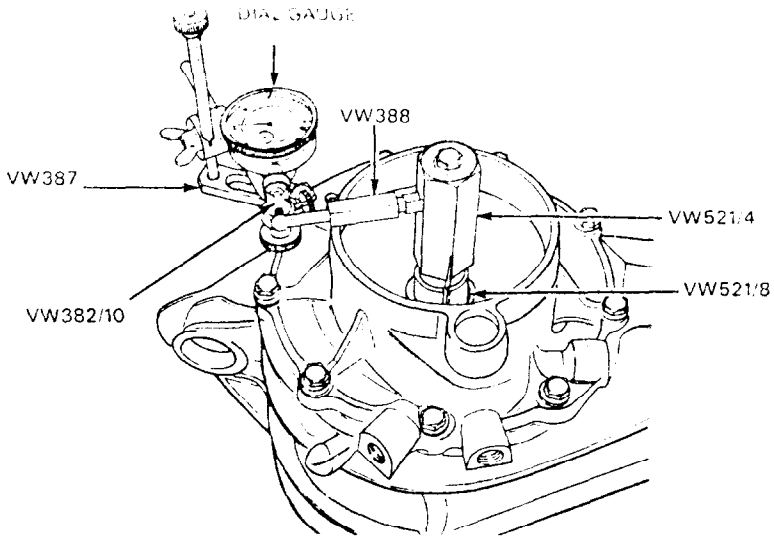


Figure 40 Crown Gear Backlash Measurement

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

Figure 41 Shims for S1 (Rear Differential)

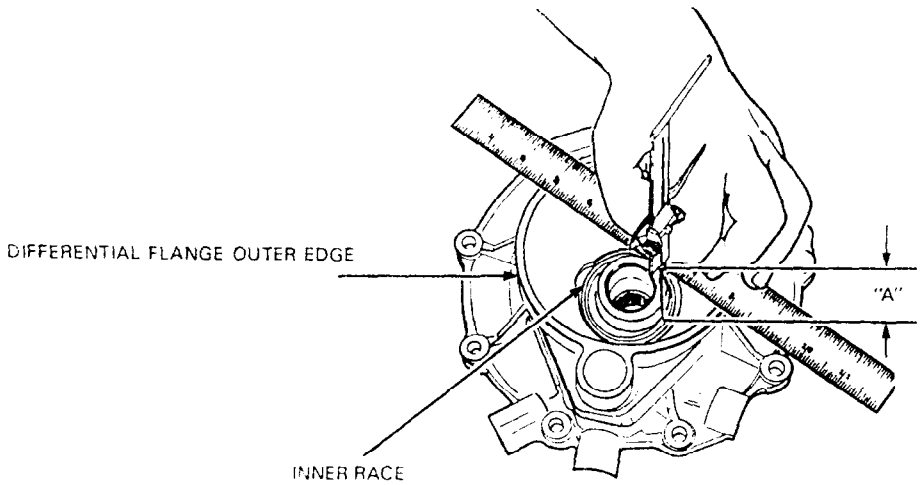


Figure 42 Measurement for Drive Flange Shim Thickness

Dimension "A"	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 43 Shims for Dimension "A"

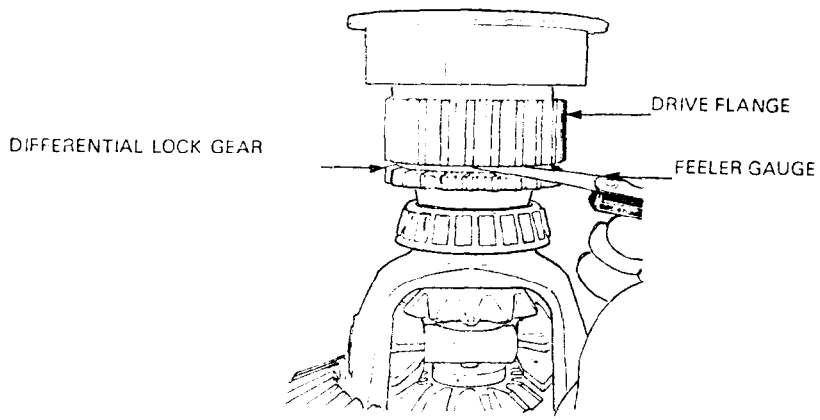


Figure 44 Measurement of Gap Between Drive Flange and Lock Gear Shoulder

Gap	Shim Thickness	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 A
1.49 to 1.20	0.90	B 183 525 293 B

Figure 45 Shims to Adjust The Drive Flange

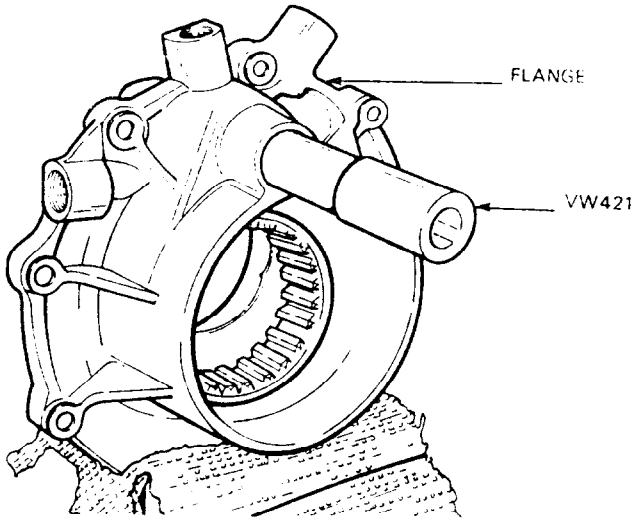


Figure 46 Installation of Selector Shaft Oil Seal

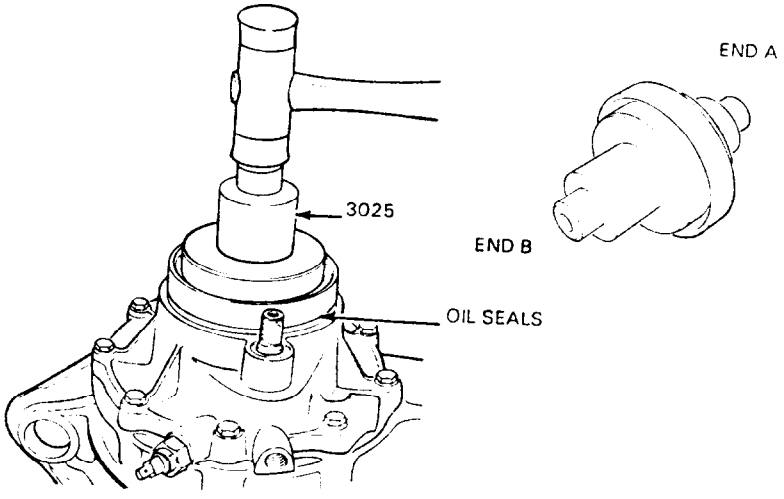


Figure 47 Installation of Left Drive Flange Oil Seals

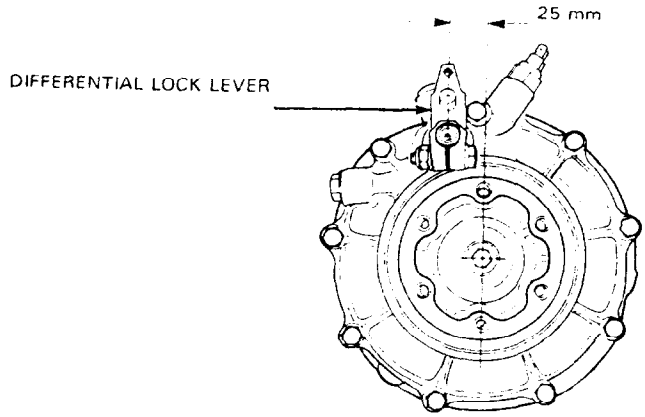


Figure 48 Differential Lock Lever Adjustment

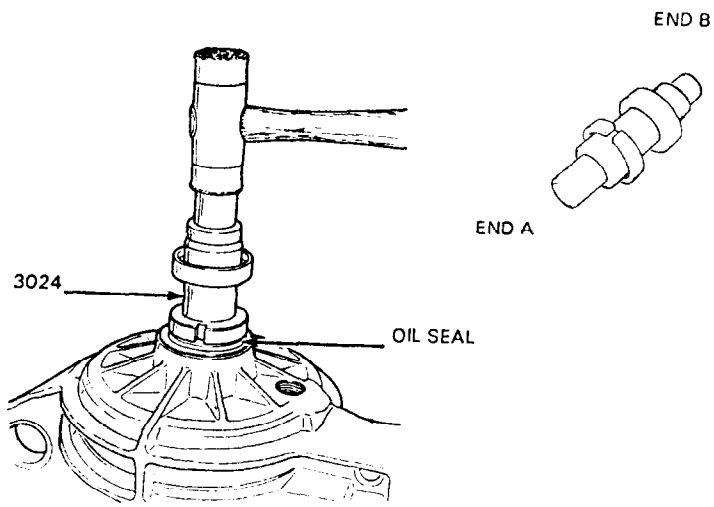


Figure 49 Installation of Right Drive Flange Oil Seal