SERVICE MANUAL

DATSUN 260Z
MODEL S30 SERIES

NISSAN

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION PD

PROPELLER SHAFT AND DIFFERENTIAL CARRIER

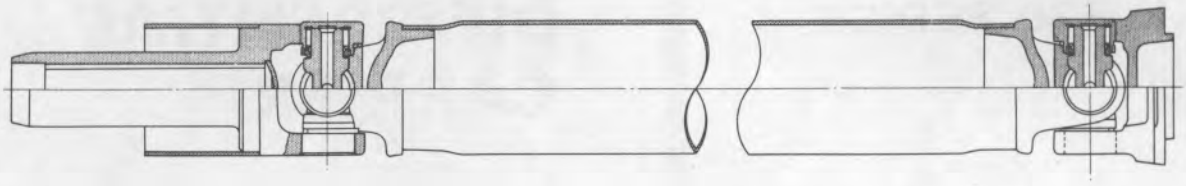
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PROPELLER SHAFT

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PD325

Fig. PD-1 Cross-sectional view of propeller shaft

DESCRIPTION

The propeller shaft is a 2-joint type.

The propeller shaft and universal joint assembly are carefully balanced during original assembly; that is, the dynamic unbalance is under 35 gr-cm (0.5 in-oz) at 5,800 rpm.

If the propeller shaft has to be reassembled, it must be done carefully so that the above limit is not exceeded. Therefore, when the car is to be undercoated, cover the propeller shaft and universal joints to prevent application of the undercoating material.

REMOVAL

1. Raise car on hoist.

Remove pre-muffler and main muffler securing bolts to free them from car body.

2. Scribe match marks both on propeller shaft and companion flange so that shaft can be reinstalled in the original position.
3. Draw out propeller shaft sleeve yoke from transmission by moving shaft rearward, passing it under rear axle.

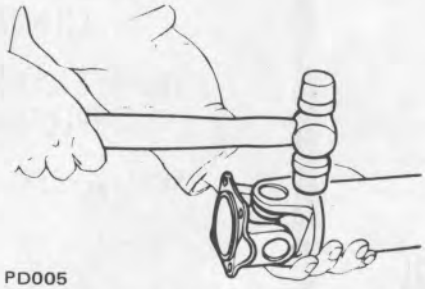
Watch for oil leakage from transmission rear end. Take proper action if oil leak is discovered.

Note: Remove propeller shaft carefully so as not to damage the spline, sleeve yoke or rear oil seal.

DISASSEMBLY

Generally, it is not desirable to disassemble propeller shaft because it is balanced as an assembly. Check movement of propeller shaft with journal, and if journal does not move smoothly, disassemble.

1. Clean journals with a suitable solvent.
2. Mark propeller shaft and journal so that the original combination can be restored during reassembly.
3. Remove snap ring with a standard screwdriver.
4. Lightly tap base of yoke with a hammer, and withdraw bearing race. See Figure PD-2.



PD005

Fig. PD-2 Removing bearing

INSPECTION

1. Check journal pin for dents or brinell marks, and yoke hole for signs of wear or damage.

Snap ring, bearing and seal ring should also be inspected to see if they are damaged, worn or deformed. Replace if necessary.

2. Check propeller shaft tube surface for dents or cracks. Change if necessary.

ASSEMBLY

To assemble, reverse the foregoing procedure using reference marks prescribed in "Removal" and "Disassembly" procedures.

New bearing need not be lubricated since it is lubricated for life. Fill joint with recommended multi-purpose grease whenever propeller shaft is overhauled.

Two opposite snap rings should be equal in thickness. Be sure that play is below 0.02 mm (0.0008 in).

Available snap rings

Thickness mm (in)	Color identification
2.00 (0.0787)	White
2.02 (0.0795)	Yellow
2.04 (0.0803)	Red
2.06 (0.0811)	Green
2.08 (0.0819)	Blue
2.10 (0.0827)	Light brown
2.12 (0.0835)	Unpainted
2.14 (0.0843)	Pink

Install and assemble components correctly so that joint moves with friction resistance of less than 15 kg-cm (13 in-lb).

INSTALLATION

To install, reverse the foregoing removal procedure.

Align propeller shaft with companion flange using reference marks prescribed in "Removal" procedure and tighten them with bolts.

Tightening torque:
2.5 to 3.2 kg-m
(18 to 23 ft-lb)

SERVICE DATA AND SPECIFICATIONS

Permissible dynamic unbalance	gr-cm (in-oz)	35 (0.5) at 5,800 rpm
Axial play of spider journal	mm (in)	Less than 0.02 (0.0008)
Journal swinging torque	kg-cm (in-lb)	Less than 15 (13)
Propeller shaft out-of-round	mm (in)	Less than 0.6 (0.024)
Tightening torque	kg-m (ft-lb)	
Propeller shaft to companion flange bolt		2.5 to 3.2 (18 to 23)

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Vibration at medium or high speed	Worn or damaged universal joint needle bearing.	Replace.
	Unbalance due to bent or dented propeller shaft.	Replace.
	Loose propeller shaft installation.	Retighten.
	Worn transmission rear extension bushing.	Replace.
	Undercoating or mud on the shaft causing unbalance.	Clean shaft.
	Tire unbalance.	Balance wheel and tire assembly.
	Balance weights missing.	Replace.
Knocking sound on propeller shaft while starting or noise while coasting.	Worn or damaged universal joint.	Replace.
	Worn sleeve yoke and main shaft spline.	Replace.
	Loose propeller shaft installation.	Retighten.
	Loose joint installation.	Adjust snap ring.
Scraping noise	Dust cover on sleeve yoke rubbing on transmission rear extension. Dust cover on companion flange rubbing on differential carrier.	Straighten dust cover to remove interference.

DIFFERENTIAL CARRIER

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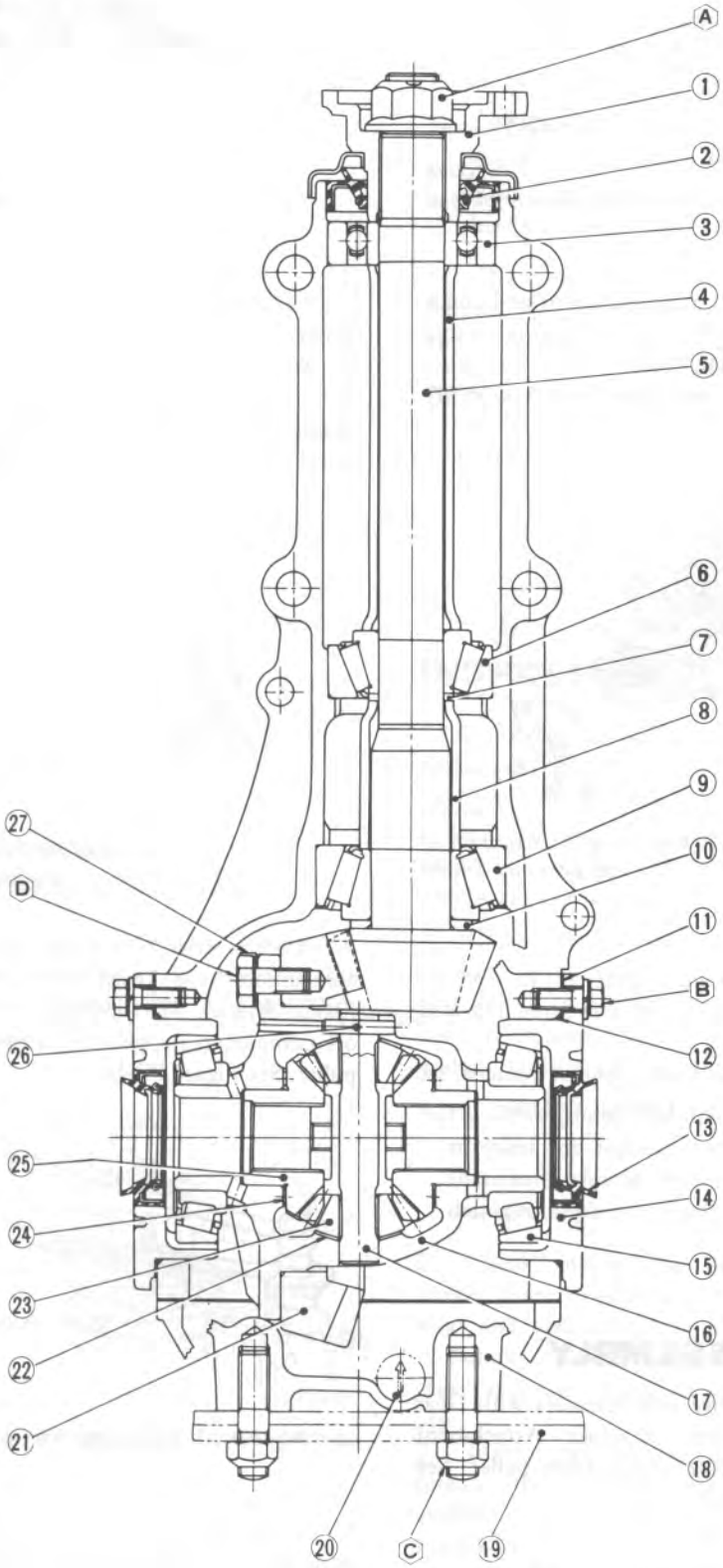
DESCRIPTION

The differential gear carrier assembly has a hypoid type drive pinion and ring gear set with a gear ratio of 3.364 for manual transmission models and 3.545 for automatic transmission models.

The drive pinion is mounted with one ball bearing and two tapered roller bearings which are preloaded by pinion bearing adjusting spacer and washer during assembly.

The drive pinion is positioned by a washer located between a shoulder of the drive pinion and the rear bearing.

The differential case is supported in the carrier by two tapered roller side bearings. These are preloaded by inserting shims between the carrier and the side retainers. The differential case assembly is positioned for proper ring gear-to-drive pinion backlash by varying these shims. The ring gear is bolted to the differential case. The case houses two side gears in mesh with two pinions mounted on a pinion shaft. The pinion shaft is anchored in the case by lock pin. The pinions and side gears are backed by thrust washers.



1 Companion flange
2 Oil seal
Supply multi-purpose grease to oil seal lip when assembling
3 Front pilot bearing
4 Front pilot bearing spacer
5 Drive pinion
6 Pinion front bearing
7 Pinion bearing adjusting washer
Adjust pinion bearing preload by selecting (7) and (8).
8 Pinion bearing adjusting spacer
9 Pinion rear bearing
10 Pinion height adjusting washer
11 Side retainer adjusting shim
Adjust side bearing preload and ring gear-to-drive pinion backlash by selecting (11).
12 O-ring
13 Oil seal
Supply multi-purpose grease to oil seal lip when assembling.
14 Side retainer
15 Side bearing
16 Differential case
17 Pinion mate shaft
18 Rear cover
19 Differential mounting member
20 Breather
21 Ring gear
22 Thrust washer
23 Pinion mate
24 Thrust washer
Adjust the pinion mate-to-side gear backlash (or the clearance between the rear face of side gear and thrust washer) to 0.1 to 0.2 mm (0.0039 to 0.0079 in) by (24)
25 Side gear
26 Lock pin
27 Lock strap

Tightening torque (T) of bolts and nuts kg-m (ft-lb)
(A) T : 17 to 20 (123 to 145)
(B) T : 0.9 to 1.2 (6.5 to 8.7)
(C) T : 7.5 to 9.5 (54 to 69)
(D) T : 7 to 8 (51 to 58)

PD317

Fig. PD-3 Cross-sectional view of differential carrier

REMOVAL

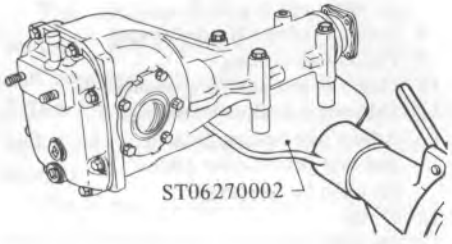
Service procedures are covered under Gear Carrier in Section RA. (Page RA-6).

PRE-DISASSEMBLY INSPECTION

Differential carrier should be inspected before any parts are removed from it.

These inspections are helpful in finding the cause of the problem and in determining necessary corrections.

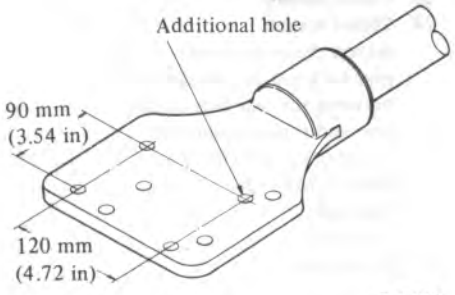
1. Using three 45 mm (1.77 in) spacers, mount carrier on Gear Carrier Attachment ST06270002.



PD326

Fig. PD-4 Mounting differential carrier

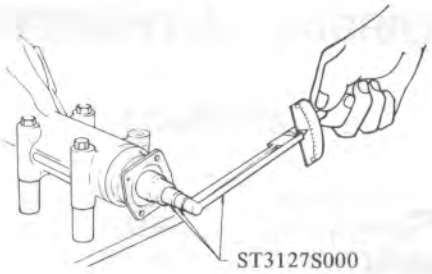
If the tool ST06270001 is used, drill an additional 14 mm (0.55 in) diameter hole on the position shown in Figure PD-5.



PD327

Fig. PD-5 Location of additional hole

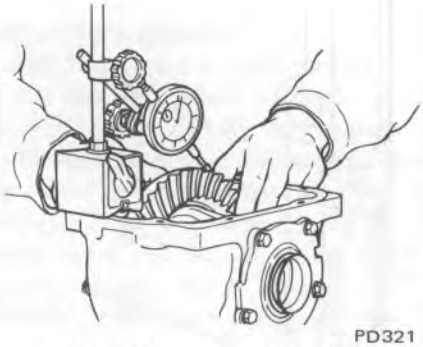
2. Visually inspect parts for wear or damage.
3. Rotate gears checking for any roughness which would indicate damaged bearings or chipped gears. Check gear teeth for scoring or signs of abnormal wear. Measure preload of drive pinion.



PD328

Fig. PD-6 Measuring pinion preload

4. Set up a dial indicator and check the backlash at several points around ring gear. Backlash should be within 0.1 to 0.2 mm (0.0039 to 0.0079 in).



PD321

Fig. PD-7 Measuring the backlash of ring gear and pinion

5. Check the gear tooth contact with a mixture of powdered red lead and oil.

For the tooth contact pattern, see page PD-12 – Contact Pattern.

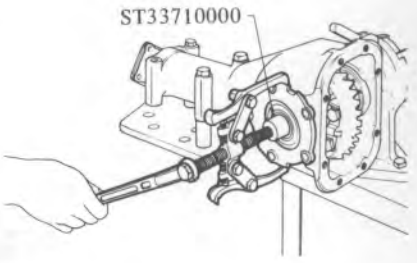
DISASSEMBLY

1. Remove side retainers with Gear Carrier Side Retainer Attachment ST33710000 and suitable puller. See Figure PD-8.

Notes:

a. Mark left and right side retainers before removal.

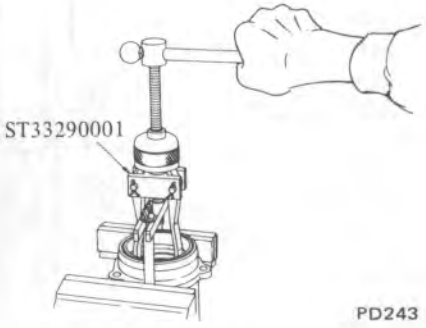
b. Be careful not to confuse left and right side retainers and shims during reassembly.



PD329

Fig. PD-8 Removing side retainer

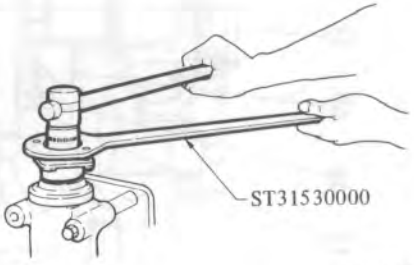
2. Extract differential case from carrier.
3. When replacing side bearing, extract bearing outer race from side retainer using Gear Carrier Oil Seal Puller ST33290001. See Figure PD-9.



PD243

Fig. PD-9 Removing side bearing outer race

4. Loosen drive pinion nut, holding companion flange with Drive Pinion Flange Wrench ST31530000 and pull off companion flange using a suitable puller. See Figure PD-10.



PD330

Fig. PD-10 Removing drive pinion nut

5. Extract drive pinion from carrier using a press. Take out drive pinion together with rear bearing inner race, bearing spacer and adjusting washers.
6. Remove oil seal.

Note: **Oil seal must not be reused.**

7. Remove pilot bearing together with pilot bearing spacer and front bearing inner race using Pilot Bearing Drift ST30650001.
8. Hold rear bearing inner race with Drive Pinion Rear Bearing Inner Race Puller ST30031000 and extract from drive pinion with a press. See Figure PD-11.

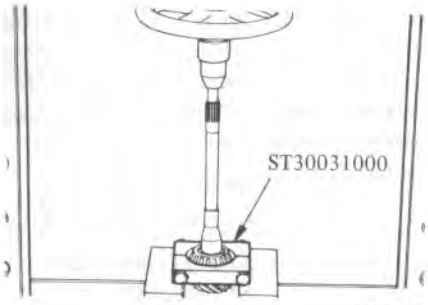


Fig. PD-11 Removing pinion rear bearing inner race

9. To remove front and rear bearing outer races, put a drift to race surface, and withdraw them by tapping the top of drift with a hammer.

DISASSEMBLY OF DIFFERENTIAL CASE

1. Extract bearing using Differential Side Bearing Puller ST3306S001 (set of ST33051001 and ST33061000). See Figure PD-12.

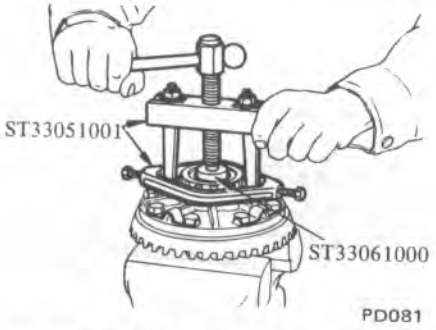


Fig. PD-12 Removing side bearing

Notes:

a. The puller should be handled with care in catching the edge of bearing inner race.

b. Be careful not to confuse the left and right hand parts.

2. Remove ring gear by unfolding lock strap and loosening ring gear bolts.

Note: Loosen bolts diagonally.

Punch off pinion mate shaft lock pin from ring gear side using Sold Punch ST23550001.

Note: Lock pin is caulked at pin hole mouth on differential case. Do not punch it off forcibly without checking how it is caulked.

4. Draw out pinion mate shaft and remove pinion mate gears, side gears and thrust washers.

Note: Put marks on gear and thrust washer so that they can be re-installed in their original positions from which they were removed.

INSPECTION

Thoroughly clean all disassembled parts, and examine them to see that they are worn, damaged or otherwise faulty, and how they are affected. Repair or replace all faulty parts, whichever is necessary.

1. Check gear teeth for scoring, cracking or chipping, and make sure that tooth contact pattern indicates correct meshing depth. If any fault is evident, replace parts as required.

Note: Drive pinion and drive gear are supplied for replacement as a set, therefore, should either part be damaged, replace as a set.

2. Check pinion gear shaft, and pinion gear for scores and signs of wear, and replace as required.

Follow the same procedure for side gears and their seats on differential case.

3. Inspect all bearing races and rollers for scoring, chipping or evidence of excessive wear. They should be in tiptop condition such as not worn and with mirror-like surfaces. Repalce if there is a shadow of doubt on their efficiency, as an incorrect bearing operation may result in noise and gear seizure.

If you need the information on "Visual Serviceability Standard for Taper Roller Bearing" refer to Section FA (page FA-5) for Inspection.

4. Inspect thrust washer faces. Small faults can be corrected with sandpaper. If pinion mate to side gear backlash (or the clearance between side gear and thrust washer) exceeds limits 0.1 to 0.2 mm (0.0039 to 0.0079 in), replace thrust washers.
5. Inspect carrier and differential case for cracks or distortion. If either condition is evident, replce faulty parts.
6. As a general rule, oil seal should be replaced at each disassembly.

ASSEMBLY AND ADJUSTMENT

Assembly can be done in the reverse order of disassembly. Adherence to the following directions for adjustment and usage of special tools enable to obtain a perfect differential operation.

PRECAUTIONS IN REASSEMBLY

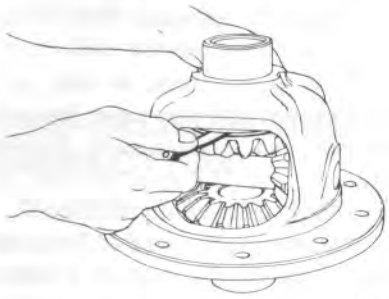
1. Arrange shims, washers and the like to install them correctly.
2. Thoroughly clean the surfaces on which shims, washers, bearings and bearing retainers are installed.
3. Apply gear oil when installing bearings.
4. Pack recommended multi-purpose grease cavity between lips when fitting oil seal.

ASSEMBLY OF DIFFERENTIAL GEAR CASE

1. Assemble pinion mates, side gears and thrust washers in differential case.
2. Fit pinion shaft to differential case so that it meets lock pin holes.
3. Adjust side gear-to-pinion mate backlash or adjust the clearance between the rear face of side gear and thrust washer. See Figure PD-13.

If above procedure is not effective with existing washer, try with other washers.

Normal backlash or clearance:
0.1 to 0.2 mm
(0.0039 to 0.0079 in)



PD023

Fig. PD-13 Measuring clearance

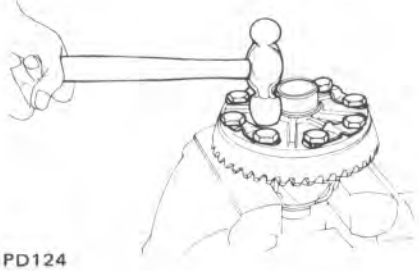
Side gear thrust washer

Thickness mm (in)
0.75 to 0.80 (0.0295 to 0.0315)
0.80 to 0.85 (0.0315 to 0.0335)
0.85 to 0.90 (0.0335 to 0.0354)

4. Lock pinion shaft lock pin using a punch after it is secured in place.
5. Apply oil to gear tooth surfaces and thrust surfaces and check that they turn properly.
6. Place ring gear on differential case and install bolts and lock washers.

Tightening torque:
7 to 8 kg-m
(51 to 58 ft-lb)

Notes:
a. Use only genuine ring gear bolts and new lock washers.
b. Tighten bolts in criss-cross fashion lightly tapping around bolt heads with a hammer. See Figure PD-14.



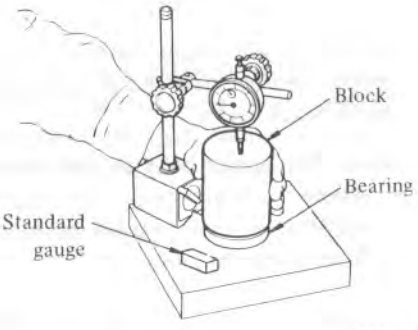
PD124

Fig. PD-14 Tapping bolt head

7. When replacing side bearing, measure bearing width with a standard gauge (20.00 mm thickness) and a weight block [about 2.5 kg (5.5 lb)] prior to installation. See Figure PD-15.

Standard bearing width:
20.00 mm

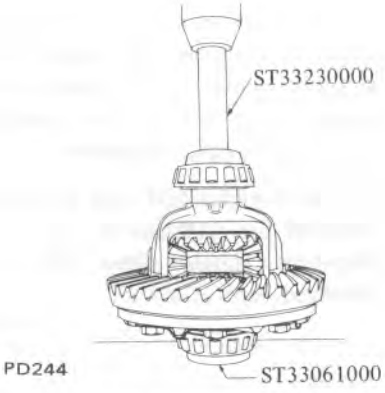
Bearing width is slightly smaller than 20.00 mm.



PD232

Fig. PD-15 Measuring bearing width

8. Press fit side bearing inner race on differential case with Gear Carrier Side Bearing Drift ST33230000 and Adapter ST33061000. See Figure PD-16.



PD244

Fig. PD-16 Installing side bearing inner race

9. Press fit side bearing outer race into side retainer with Drive Pinion Outer Race Drift Set ST30611000 and ST30621000.
10. Set new oil seal on side retainer with Oil Seal Drift ST33270000. Apply grease to cavity between seal lips.

ADJUSTMENT OF DRIVE PINION PRELOAD

Adjust drive pinion preload with spacer and washer between front and rear bearing inner races, regardless of thickness of pinion height adjusting washer.

This adjustment must be carried out without oil seal inserted.

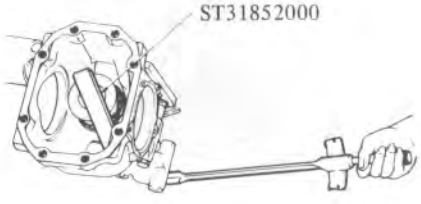
1. Press fit front and rear bearing outer races into gear carrier using Drive Pinion Outer Race Drift Set ST30611000, ST30612000 and ST30621000.

Front:	ST30611000 and ST30612000
Rear:	ST30611000 and ST30621000

2. Insert Dummy Shaft Spacer ST31851000, pinion height adjusting washer (use one of 3.09 to 3.27 thickness) and rear bearing inner race into Dummy Shaft ST31212000 to make convenient to adjust pinion height. See Figure PD-19.

Note: Reuse the old washer if it had normal tooth contact pattern in pre-disassembly check.

3. Fit drive pinion bearing spacer, washer, front bearing inner race, Dummy Shaft Collar ST31214000 and companion flange in that order on dummy shaft and tighten drive pinion nut to specified torque with Stopper ST31852000. See Figure PD-17.



PD184

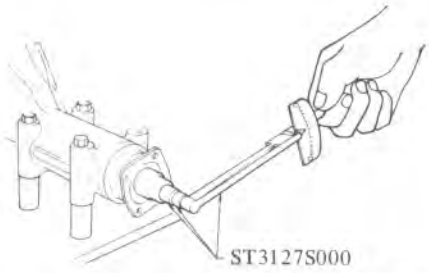
Fig. PD-17 Tightening drive pinion nut

Measure pinion bearing preload using Preload Gauge ST3127S000, and select washer and spacer that will provide required preload. See Figure PD-18.

Pinion bearing preload
(Without oil seal):
10 to 13 kg-cm
(8.7 to 11.4 in-lb)
At companion flange bolt hole:
2.9 to 3.8 kg
(6.4 to 8.4 lb)
Tightening torque of pinion nut:
17 to 20 kg-m
(123 to 145 ft-lb)

Notes:

a. **Replace bearing washer and spacer with thicker ones if pinion cannot be turned by hand while it is being tightened.**
b. **Preload of old bearing is the same value as that of a new bearing.**



PD328

Fig. PD-18 Measuring pinion preload

Pinion bearing adjusting spacer

Length mm (in)
52.20 (2.0551)
52.40 (2.0630)
52.60 (2.0709)
52.80 (2.0787)
53.00 (2.0866)
53.20 (2.0945)

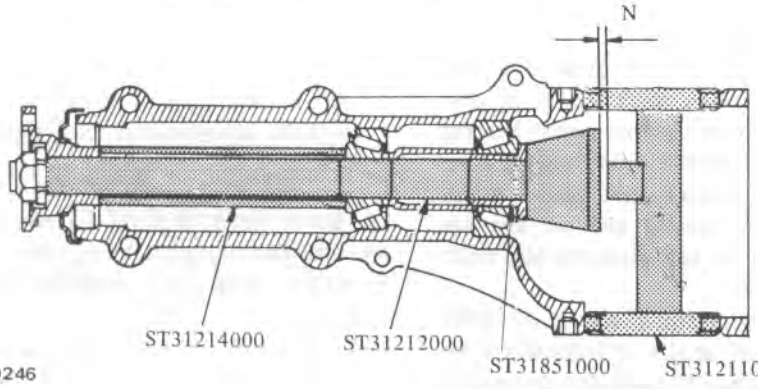
Pinion bearing adjusting washer

Thickness mm (in)
2.30 to 2.32 (0.0906 to 0.0913)
2.32 to 2.34 (0.0913 to 0.0921)
2.34 to 2.36 (0.0921 to 0.0929)
2.36 to 2.38 (0.0929 to 0.0937)
2.38 to 2.40 (0.0937 to 0.0945)
2.40 to 2.42 (0.0945 to 0.0953)
2.42 to 2.44 (0.0953 to 0.0961)
2.44 to 2.46 (0.0961 to 0.0969)
2.46 to 2.48 (0.0969 to 0.0976)
2.48 to 2.50 (0.0976 to 0.0984)
2.50 to 2.52 (0.0984 to 0.0992)
2.52 to 2.54 (0.0992 to 0.1000)
2.54 to 2.56 (0.1000 to 0.1008)
2.56 to 2.58 (0.1008 to 1.1016)
2.58 to 2.60 (0.1016 to 0.1024)

ADJUSTMENT OF DRIVE PINION HEIGHT

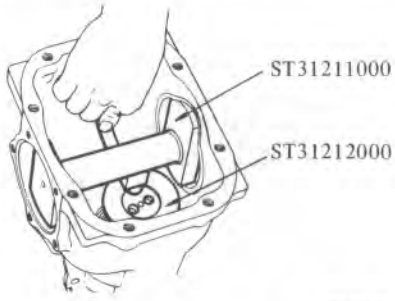
Adjust pinion height with washer located between rear bearing inner race and back of pinion gear.

1. Install Height Gauge ST31211000 on carrier with dummy shaft mounted. See Figure PD-19.
2. Measure the clearance (N) between the tip end of height gauge and the end surface of dummy shaft, using a thickness gauge. See Figure PD-20.



PD246

Fig. PD-19 Measuring the clearance



PD331

Fig. PD-20 Adjusting pinion height

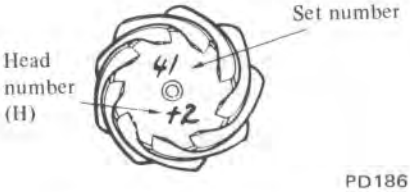
3. The thickness of drive pinion height adjusting washer can be obtained from the following formula:

$$T = W + N - [(H - D' - S) \times 0.01] - 0.2$$

Where,

T : Required thickness of rear bearing adjusting washers (mm).
W : Thickness of washers temporarily inserted (mm).
N : Measured value with thickness gauge (mm).
H : Figure marked on the drive pinion head. See Figure PD-21.
D' : Figure marked on the dummy shaft.
S : Figure marked on the height gauge.

Figures for H, D' and S are dimensional variations in a unit of 1/100 mm against each standard measurement.



PD186

Fig. PD-21 Variation number on drive pinion

Examples of calculation

Ex. 1 ---

W = 3.09 mm
N = 0.33 mm
H = +2, D' = −1, S = 0

$T = W + N - [(H - D' - S) \times 0.01] - 0.2$
$= 3.09 + 0.33 - [((+2) - (0)) \times 0.01] - 0.2$
$= 3.09 + 0.33 - [(2 + 1 - 0) \times 0.01] - 0.2$
$= 3.09 + 0.33 - [3 \times 0.01] - 0.2$
$= 3.09 + 0.33 - 0.03 - 0.2$
$= 3.19$ mm

The correct washer is 3.18 mm thick.

Ex. 2 ---

$W = 3.09$ mm
$N = 0.28$ mm
$H = -2$, $D' = +1$, $S = -1$

$T = W + N - [(H - D' - S) \times 0.01] - 0.2$
$= 3.09 + 0.28 - [((-2) - (+1) - (-1)) \times 0.01] - 0.2$
$= 3.09 + 0.28 - [(-2 - 1 + 1) \times 0.01] - 0.2$
$= 3.09 + 0.28 - [-2 \times 0.01] - 0.2$
$= 3.09 + 0.28 + 0.02 - 0.2$
$= 3.19$ mm

The correct washer is 3.18 mm thick.

Ex. 3 ---

$W = 3.09$ mm
$N = 0.45$ mm
$H = 0$, $D' = 0$, $S = 0$

$T = W + N - [(H - D' - S) \times 0.01] - 0.2$
$= 3.09 + 0.45 - [(0 - 0 - 0) \times 0.01] - 0.2$
$= 3.09 + 0.45 - [0 \times 0.01] - 0.2$
$= 3.09 + 0.45 - 0 - 0.2$
$= 3.34$ mm

The correct washer is 3.33 mm thick.

Note: If values signifying H, D' and S are not given, regard them as zero and compute. After assembly, check to see that tooth contact is correct. If not, readjust.
For the tooth contact pattern, see page PD-12 for Contact Pattern.

Pinion height adjusting washer

Thickness mm (in)
3.09 (0.1217)
3.12 (0.1228)
3.15 (0.1240)
3.18 (0.1252)
3.21 (0.1264)
3.24 (0.1276)
3.27 (0.1287)
3.30 (0.1299)
3.33 (0.1311)
3.36 (0.1323)
3.39 (0.1335)
3.42 (0.1346)
3.45 (0.1358)
3.48 (0.1370)
3.51 (0.1382)
3.54 (0.1394)
3.57 (0.1406)
3.60 (0.1417)
3.63 (0.1429)
3.66 (0.1441)

4. Fit determined pinion height adjusting washer in drive pinion, and press fit rear bearing inner race in it using Base ST30901000. See Figure PD-22.

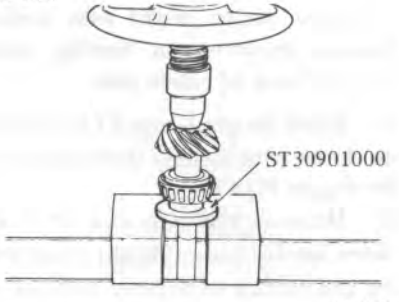


Fig. PD-22 Pressing rear bearing inner race

5. Lubricate pinion front and rear bearings. Install drive pinion in gear carrier into which drive pinion bearing spacer and washer, front bearing cone and front bearing pilot spacer, moreover, pilot bearing and oil seal are fitted. Fit oil seal using Oil Seal Drift ST30720000.
6. Fit companion flange on drive pinion, and secure it in position by tightening nut to specified torque confirming preload.

Tightening torque:
17 to 20 kg-m
(123 to 145 ft-lb)
Preload (with oil seal):
11 to 14 kg-cm
(9.5 to 12.2 in-lb)
At companion flange bolt hole:
3.2 to 4.1 kg
(7.1 to 9.0 lb)

Note: If drive pinion lock nut is worn, replace it.

ADJUSTMENT OF SIDE RETAINER SHIMS

1. If the hypoid gear set, carrier, differential case, side bearing or side bearing retainer has been replaced with new part, adjust the side bearing preload with adjusting shim. The required thicknesses of the left and right retainer shims can be obtained from the following formulas:

$T_1 = (A + C + G_1 - D) \times 0.01 + 0.76 - E$
$T_2 = (B + D + G_2) \times 0.01 + 0.76 - F$

Where,

T_1 : Required thickness of left side retainer shim (mm).
T_2 : Required thickness of right side retainer shim (mm).
A & B : Figure marked on the gear carrier. See Figure PD-24.
C & D : Figure marked on the differential case. See Figure PD-25.
E & F : These are differences in width of left or right side bearing against the standard width (20.0 mm).

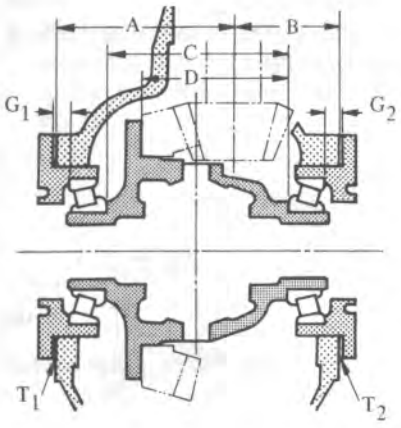
If bearing width is 19.88 mm, this figure will be as follows:

$20.00 - 19.88 = 0.12$ (mm)

G_1 & G_2 : Figure marked on the left or right side retainer. See Figure PD-26.

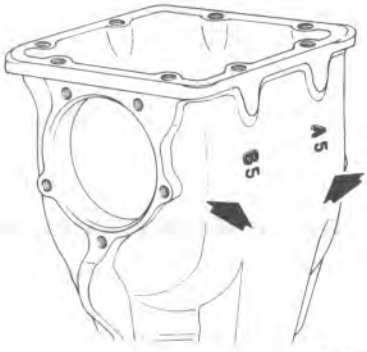
Figures for A, B, C, D, G_1 and G_2 are dimensional variations in a unit of 1/100 mm against each standard measurement.

To measure width of side bearing, see differential case assembly procedure.



PD093

Fig. PD-23 Thickness of left and right shims



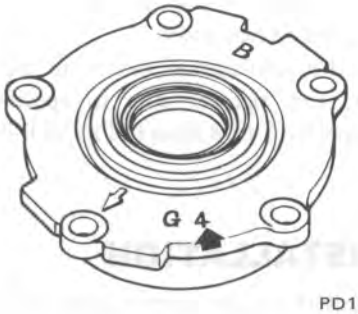
PD332

Fig. PD-24 A & B figures



PD188

Fig. PD-25 C & D figures



PD189

Fig. PD-26 G1 & G2 figures

Side retainer adjusting shim

Thickness mm (in)
0.05 (0.0020)
0.07 (0.0028)
0.10 (0.0039)
0.20 (0.0079)
0.50 (0.0197)

Examples of calculation

Ex. 1 ---

A = 5, B = 5, C = 3, D = 3

G_1 = 4, G_2 = 1, E = 0.11 mm
F = 0.15 mm

Left side:

$T_1 = (A + C + G_1 - D) \times 0.01 + 0.76 - E$
$= (5 + 3 + 4 - 3) \times 0.01 + 0.76 - 0.11$
$= 9 \times 0.01 + 0.76 - 0.11$
$= 0.09 + 0.76 - 0.11$
$= 0.74$

The correct shims are as follows:

Thickness		Quantity	
0.07	x	2	= 0.14
0.10	x	1	= 0.10
0.50	x	1	= 0.50
Total thickness			= 0.74

Right side:

$T_2 = (B + D + G_2) \times 0.01 + 0.76 - F$
$= (5 + 3 + 1) \times 0.01 + 0.76 - 0.15$
$= 9 \times 0.01 + 0.76 - 0.15$
$= 0.09 + 0.76 - 0.15$
$= 0.70$

The correct shims are 0.20 plus 0.50 mm thick.

Ex. 2 ---

A = 2, B = 3, C = 0, D = 3
G_1 = 2, G_2 = 3, E = 0.20 mm
F = 0.17 mm

Left side:

$T_1 = (A + C + G_1 - D) \times 0.01 + 0.76 - E$
$= (2 + 0 + 2 - 3) \times 0.01 + 0.76 - 0.20$
$= 1 \times 0.01 + 0.76 - 0.20$
$= 0.01 + 0.76 - 0.20$
$= 0.57$

The correct shims are 0.07 plus 0.50 mm thick.

Right side:

$T_2 = (B + D + G_2) \times 0.01 + 0.76 - F$
$= (3 + 3 + 3) \times 0.01 + 0.76 - 0.17$
$= 9 \times 0.01 + 0.76 - 0.17$
$= 0.09 + 0.76 - 0.17$
$= 0.68$

The correct shims are as follows:

Thickness		Quantity	
0.07	x	4	= 0.28
0.20	x	2	= 0.40
Total thickness			= 0.68

Note: If values signifying A, B, C, D, G_1 and G_2 are not given, regard them as zero and compute.
After assembly, check to see that preload and backlash are correct. If not, readjust.

2. Install differential case assembly in gear carrier in reverse order of disassembly.
3. Fit given shims and O-ring in both side retainers, and install retainers in carrier with Gear Carrier Side Retainer Guide ST33720000 (See Figure PD-27), with the arrow mark on retainer positioned as shown in Figure PD-28.

Note: When installing retainers, ensure that side bearing outer races are not damaged by roller.

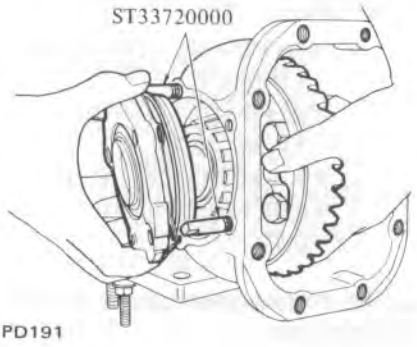


Fig. PD-27 Installing side retainer

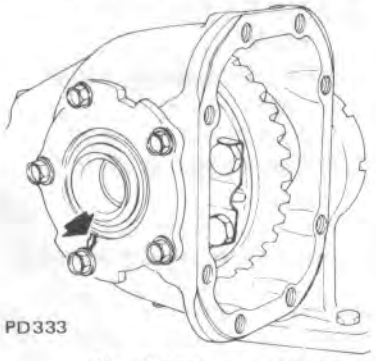


Fig. PD-28 The arrow mark on retainer

4. Measure ring gear-to-drive pinion backlash with a dial indicator and adjust it to 0.1 to 0.2 mm (0.0039 to 0.0079 in). See Figure PD-29.

If it is below the specified value, move shim from right to left. If it is over it, move it inversely.

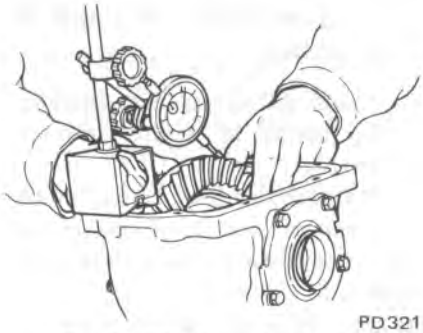


Fig. PD-29 Measuring backlash of ring gear and pinion

5. At the same time, check side bearing preload. Bearing preload should be 12 to 20 kg-cm (10.4 to 17.3 ft-lb) of rotating torque at companion flange [3.5 to 5.8 kg (7.7 to 12.8 lb) at companion flange bolt hole].

If preload is not in accordance with this specification, adjust it with side retainer shims.

Incidentally a decrease or increase in thickness of shims causes change in ring gear-to-pinion backlash.

Thus, check for proper backlash.

6. Check and adjust the tooth contact pattern of ring gear and drive pinion.

(1) Thoroughly clean ring and drive pinion gear teeth.

(2) Paint ring gear teeth lightly and evenly with a mixture of powdered red lead and oil of a suitable consistency to produce a contact pattern.

(3) Rotate pinion through several revolutions in the forward and reverse direction until a definite contact pattern is developed on ring gear.

(4) If contact pattern is incorrect, readjust thickness of adjust shim.

Be sure to completely wipe off red lead upon completion of adjustment.

(5) Incorrect teeth contact pattern can be adjusted in the following manner.

Contact pattern

a. Heel contact

To correct, increase thickness of pinion height adjusting washer in order to bring drive pinion close to ring gear. See Figure PD-30.

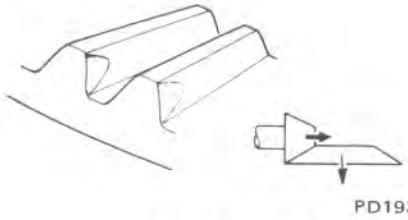


Fig. PD-30 Heel contact

b. Toe contact

To correct, reduce thickness of pinion height adjusting washer in order to make drive pinion move away from ring gear. See Figure PD-31.

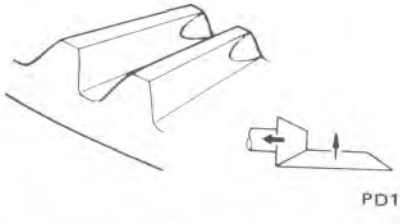


Fig. PD-31 Toe contact

c. Flank contact

Adjust in the same manner as in b. See Figure PD-32.

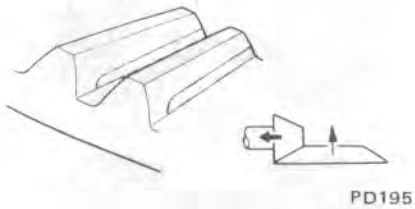


Fig. PD-32 Flank contact

d. Face contact

Adjust in the same manner as in a. See Figure PD-33.

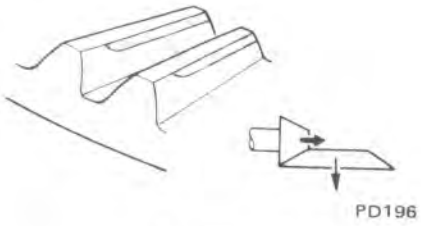


Fig. PD-33 Face contact

e. Correct tooth contact

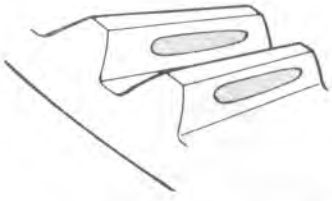


Fig. PD-34 Correct contact

Note: Change in thickness of adjusting washer is accompanied by change in backlash. Check it when installing gear.

7. Install rear cover.

8. Fit differential mounting member, and tighten nuts to specified torque of 6 to 8 kg-m (43 to 58 ft-lb).

INSTALLATION

Install in the reverse order of removal. Refer to Section RA (Page RA-7) for Installation.

Notes:

a. **When installing gear carrier on front mounting member, be sure to use spacer between them. See Figure PD-35.**

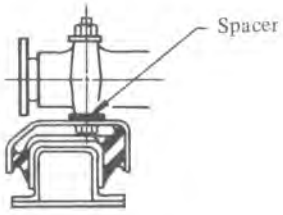


Fig. PD-35 Front mounting spacer

b. **Oil quantity: 1 liter (1 U.S.qt., ⅞ Imp.qt., use API GL-5)**

REPLACEMENT OF OIL SEALS

Replacement of oil seals with differential gear carrier assembly installed on the car.

FRONT OIL SEAL

Procedures are as follows:

1. Drain gear oil.
2. Raise the rear end of car and support it with safety stands.
3. Remove pre-muffler and main muffler securing bolts to free them from car body.
4. Detach propeller shaft.
5. Remove bolts securing rear stabilizer to front mounting, and free stabilizer from car body.
6. Remove drive pinion nut, holding companion flange with Drive Pinion Flange Wrench ST31530000.
7. Extract companion flange with a suitable puller.
8. Remove oil seal with Gear Carrier Oil Seal Puller ST33290001.
9. Set new oil seal in position with Gear Carrier Oil Seal Drift ST30720000. Apply grease to cavity between seal lips.
10. Fit companion flange on drive pinion, and secure it in position by tightening nut to specified torque confirming the following preload, with Drive Pinion Flange Wrench ST31530000.

Tightening torque of
Pinion nut:
17 to 20 kg-m
(123 to 145 ft-lb)
Pinion bearing preload
(with oil seal):
11 to 14 kg-cm
(9.6 to 12.2 in-lb)
At companion flange bolt hole:
3.2 to 4.1 kg
(7.1 to 9.0 lb)

11. Reinstall rear stabilizer, propeller shaft and muffler in reverse order of removal, and fill up gear oil.

SIDE OIL SEAL

Side oil seal is replaced as follows:

1. Disconnect drive shaft on the wheel side.
2. Remove side yoke fixing bolt, and extract side yoke together with drive shaft.

Note: Be careful not to damage side yoke and oil seal when removing.

3. Remove oil seal with Oil Seal Puller ST33290001.
4. Set in new oil seal with Oil Seal Drift ST33270000.

Note: Apply grease to cavity between oil seal lips.

5. Install side yoke together with drive shaft to differential gear carrier assembly, tighten side yoke fixing bolt to specified torque with torque wrench. See Figure PD-00.

Tightening torque:
3.2 to 4.3 kg-m
(23 to 31 ft-lb)

Note: Be careful not to damage side yoke and oil seal when installing.

6. Join drive shaft with companion flange of rear axle shaft and tighten connecting bolt to specified torque.

Tightening torque:
5 to 6 kg-m (36 to 43 ft-lb)

Note: Check O-ring of side yoke fixing bolt. If necessary, remove universal joint spider located at the side yoke side, and replace O-ring. Refer to Section PD (Page PD-2) for Disassembly and Assembly.

SERVICE DATA AND SPECIFICATIONS

Type		R180
Gear ratio (number of teeth)		
Manual transmission models		3.364 (37/11)
Automatic transmission models		3.545 (39/11)
Material of carrier		Malleable cast-iron
Drive pinion preload adjusted by		Washer
Drive pinion		
Preload	kg-cm (in-lb)	
(without oil seal)		10 to 13 (8.7 to 11.3)
(with oil seal)		11 to 14 (9.5 to 12.2)
At companion flange bolt hole	kg (lb)	
(without oil seal)		2.9 to 3.8 (6.4 to 8.4)
(with oil seal)		3.2 to 4.1 (7.1 to 9.0)
Thickness of pinion height adjusting washer	mm (in)	3.09 (0.1217) 3.39 (0.1335) 3.12 (0.1228) 3.42 (0.1346) 3.15 (0.1240) 3.45 (0.1358) 3.18 (0.1252) 3.48 (0.1370) 3.21 (0.1264) 3.51 (0.1382) 3.24 (0.1276) 3.54 (0.1394) 3.27 (0.1287) 3.57 (0.1406) 3.30 (0.1299) 3.60 (0.1417) 3.33 (0.1311) 3.63 (0.1429) 3.36 (0.1323) 3.66 (0.1441)
Length of pinion bearing adjusting spacer	mm (in)	52.20 (2.0551) 52.40 (2.0630) 52.60 (2.0709) 52.80 (2.0787) 53.00 (2.0866) 53.20 (2.0945)
Thickness of pinion bearing adjusting washer	mm (in)	2.30 to 2.32 (0.0906 to 0.0913) 2.32 to 2.34 (0.0913 to 0.0921) 2.34 to 2.36 (0.0921 to 0.0929) 2.36 to 2.38 (0.0929 to 0.0937) 2.38 to 2.40 (0.0937 to 0.0945) 2.40 to 2.42 (0.0945 to 0.0953) 2.42 to 2.44 (0.0953 to 0.0961) 2.44 to 2.46 (0.0961 to 0.0969) 2.46 to 2.48 (0.0969 to 0.0976) 2.48 to 2.50 (0.0976 to 0.0984) 2.50 to 2.52 (0.0984 to 0.0992) 2.52 to 2.54 (0.0992 to 0.1000) 2.54 to 2.56 (0.1000 to 0.1008) 2.56 to 2.58 (0.1008 to 0.1016) 2.58 to 2.60 (0.1016 to 0.1024)

Side gear and pinion mate

Thickness of side gear thrust washer	mm (in)	0.75 to 0.80 (0.0295 to 0.0315) 0.80 to 0.85 (0.0315 to 0.0335) 0.85 to 0.90 (0.0335 to 0.0354)
Pinion mate-to-side gear backlash (or clearance between side gear and thrust washer)	mm (in)	0.1 to 0.2 (0.0039 to 0.0079)

Ring gear

Ring gear-to-drive pinion backlash	mm (in)	0.1 to 0.2 (0.0039 to 0.0079)
Thickness of side retainer adjusting shim	mm (in)	0.05 (0.0020) 0.07 (0.0028) 0.10 (0.0039) 0.20 (0.0079) 0.50 (0.0197)
Side bearing standard width	mm	20.00

Oil capacity (about)	liter (U.S.qt., Imp.qt.)	1.0 (1, ⅞)

Adjusting methods

Variation numbers expressed by	mm (x 0.01)
Dummy shaft	Use
Drive pinion adjusting formula	$T = W + N - [(H - D' - S) \times 0.01] - 0.2$
Side bearing adjsuting formula	$T1 = (A + C + G1 - D) \times 0.01 + 0.76 - E$ $T2 = (B + D + G2) \times 0.01 + 0.76 - F$

Tightening torque kg-m (ft-lb)

Drive pinion nut	17 to 20	(123 to 145)
Ring gear bolt	7 to 8	(51 to 58)
Side retainer bolt	0.9 to 1.2	(6.5 to 8.7)
Side yoke fixing bolt	3.2 to 4.3	(23 to 31)
Rear cover fixing bolt	1.9 to 2.6	(14 to 19)
Rear cover to rear mounting member lock nut	7.5 to 9.5	(54 to 69)
Differential carrier to front mounting Insulator fixing bolt	6 to 8	(43 to 58)
Companion flange to propeller shaft fixing bolt	2.5 to 3.2	(18 to 23)
Oil drain and filler plug	4 to 6	(29 to 43)

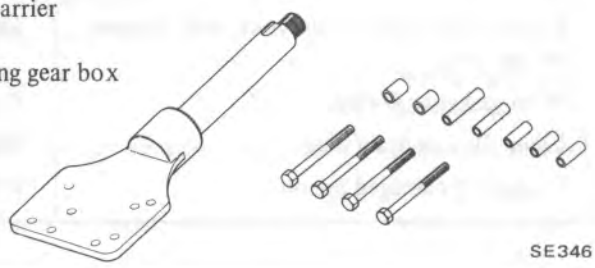
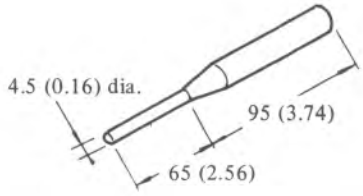
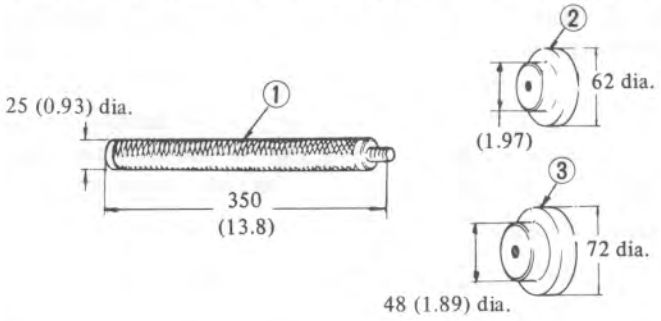
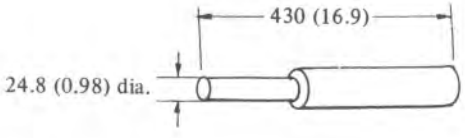
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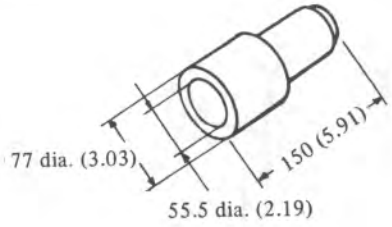
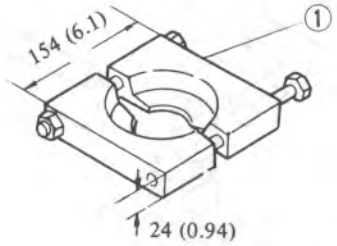
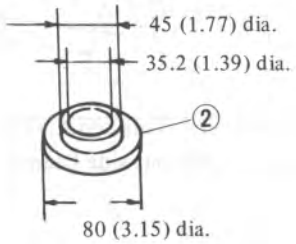
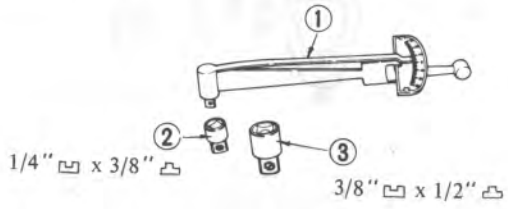
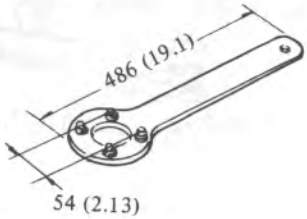
When gear carrier is suspected causing noise, it is advisable to make a thorough test to determine whether the noise originates in the tires, road surface, exhaust, universal joint, propeller shaft, wheel bearings, engine, transmission, or gear carrier. Noise which originates in other places cannot be corrected by adjustment or replacement of parts in the rear axle assembly.

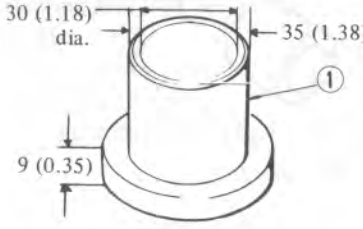
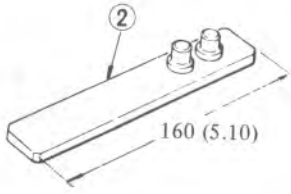
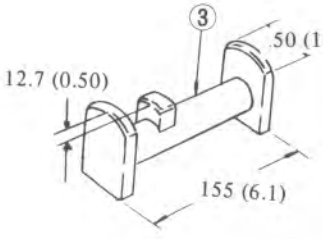
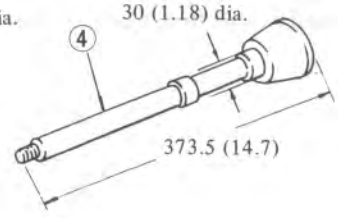
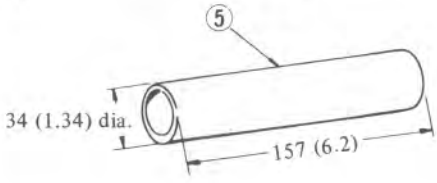
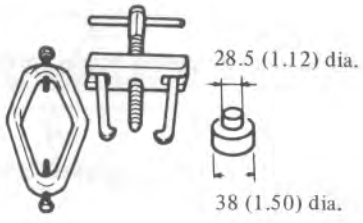
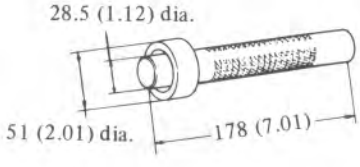
Condition	Probable cause	Corrective action
Noise during driving and/or coasting	Shortage of oil.	Supply gear oil. Rebuild gear carrier if necessary.
	Incorrect tooth contact between ring gear and drive pinion.	Adjust tooth contact or replace the hypoid gear set.
	Incorrect backlash between ring gear and drive pinion.	Adjust backlash or replace the hypoid gear set if necessary.
	Seized or damaged ring gear and drive pinion.	Replace the hypoid gear set.
	Seized, damaged or broken drive pinion bearing.	Replace the pinion bearing and faulty parts.
	Seized, damaged or broken side bearing.	Replace the side bearing and faulty parts.
	Loose bolts or nuts fixing ring gear side retainers, etc.	Tighten to specified torque, and replace faulty parts.
Noise on turns.	Seized, damaged or broken side and pinion gears.	Replace faulty parts.
	Seized, damaged or broken side gear and pinion thrust washer.	Replace faulty parts.
	Pinion gears too tight on their shaft.	Replace faulty parts.
	Interference between side yoke and differential case.	Repair the part responsible for interference, or replace the side yoke and differential case.
Knocking sound during starting or gear shifting	Excessive backlash. Incorrect backlash of ring gear-to-drive pinion or side gear-to-pinion gear.	Adjust backlash.
	Worn gears or case.	Replace worn parts.
	Worn side yoke and side gear spline.	Replace worn parts.
	Pinion bearing under preload.	Adjust preload.
	Loose drive pinion nut.	Repair or replace.
	Loose bolts or nuts fixing ring gear, side retainers, etc.	Tighten or replace if necessary.
Seizure or breakage.	Shortage of oil or use of unsuitable oil.	Replace faulty parts.
	Excessively small backlash.	Adjust backlash and replace as required.
	Incorrect adjustment of bearings or gears.	Replace faulty parts.
	Severe service due to excessive loading, improper use of clutch.	Replace faulty parts.
	Loose bolts and nuts, such as ring gear bolts.	Replace faulty parts.

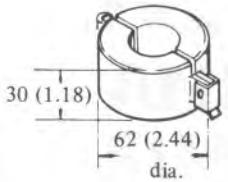
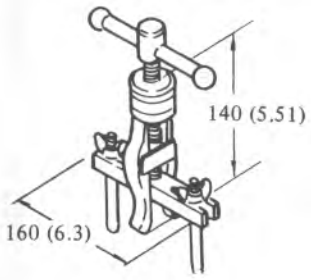
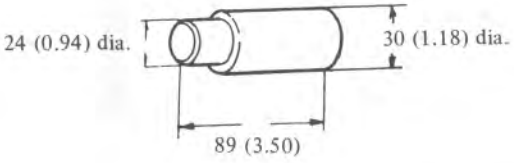
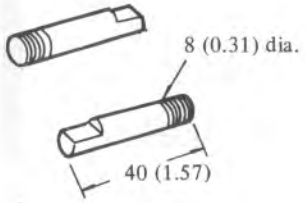
Condition	Probable cause	Corrective action
Oil leakage.	Worn-out, damaged or improperly driven front oil seal, or bruised, dented or abnormally worn slide face of companion flange.	Replace the faulty oil seal. Ammend the affected flange with sandpaper or replace if necessary.
	Worn, damaged or improperly driven side oil seal, or bruised, dented or abnormally worn slide yoke.	Treat as above.
	Loose bolts such as side yoke, side retainer or rear cover.	Tighten the bolts to specified torque.
	Worn gasket or O-ring.	Replace faulty parts with new ones.
	Loose filler or drain plug.	Tighten the plug.
	Clogged or damaged breather.	Repair or replace.

SPECIAL SERVICE TOOLS

No.	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or Figure No.
1.	ST06270002 Gear carrier attachment	This attachment is used with engine stand (ST0501S000). Strut and steering gear box mounting holes are provided with engraved identification marks. "D" for gear carrier "S" for strut "G" for steering gear box  SE346	S30 610	Fig. PD-4
2.	ST23550001 Solid punch	This tool is used to drive out lock pin of pinion mate shaft.  	S30 610 710 620	Page PD-7
3.	Drive pinion outer race drift set ① ST30611000 Bar ② ST30612000 Adapter (front) ③ ST30621000 Adapter (rear)	These tools are used when assembling drive pinion bearing outer race.  	S30 610 W610 710 620 B210 S30 610 W610 710 620 B210 S30	Page PD-8
4.	ST30650001 Pilot bearing drift	Used to pull out front pilot bearing. After drive pinion has been pulled, insert this tool from behind the gear carrier case, and apply it onto pinion front bearing inner race. Then press out pinion front bearing inner race, front pilot bearing spacer and pilot bearing.  	S30 610	Page PD-7

No.	Tool number & tool name	Description (Unit: mm (in))	For use on	Reference page or Figure No.
5.	ST30720000 Gear carrier front oil seal drift	This tool is used to drive in front oil seal without damaging it.  	S30 610 W610 710 620	Page PD-10 Page PD-13
6.	ST3090S000 Drive pinion rear inner bearing puller set ① ST30031000 Puller	This assembly clamps rear bearing inner race and pulls it out by a hydraulic press. Before insertion, place another drift facing inner race, and then press-fit.  	S30 610 W610 710 B210	Fig. PD-11 Fig. PD-22
	② ST30901000 Base	 	S30	
7.	ST3127S000 Preload gauge ① GG91030000 Torque wrench ② HT62940000 Socket adapter ③ HT62900000 Socket adapter	This tool is used to measure pinion bearing preload.  	All models	Fig. PD-6 Fig. PD-18
8.	ST31530000 Drive pinion flange wrench	This tool is used to hold the flange to ease the operation of tightening and loosening drive pinion nut.  	S30 610 W610 710 620	Fig. PD-10 Page PD-13

No.	Tool number & tool name	Description (Unit: mm (in))	For use on	Reference page or Figure No.
9.	ST3185S000 Drive pinion setting gauge set	These tools are used to adjust the pinion height.	S30	Page PD-8 Fig. PD-17 Fig. PD-19 Fig. PD-20
	① ST31851000 Spacer		S30	
	② ST31852000 Stopper		S30	
	③ ST31211000 Height gauge		S30 610	
	④ ST31212000 Dummy shaft		S30 610	
	⑤ ST31214000 Collar		S30 610	
10.	ST3306S001 Diff. side bearing puller set ST33051001 Body ST33061000 Adapter	This tool is used to pull out side bearing. 	S30 610 710 620	Fig. PD-7 Fig. PD-16
11.	ST33230000 Diff. side bearing drift	Use of this tool makes it possible to drive in bearing without damaging it. 	S30 610 710 620	Fig. PD-16

No.	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or Figure No.
12.	ST33270000 Gear carrier oil seal drift	This tool is used when driving in oil seal. Using this drift completely eliminates the possibility of damaging oil seal.  	S30 610	Page PD-8 Page PD-13
13.	ST33290001 Gear carrier oil seal puller	This tool is used to pull out oil seal from gear carrier. This tool also enables removal of side bearing outer race from retainer without damaging it.  	All models	Fig. PD-9 Page PD-13
14.	ST33710000 Gear carrier side retainer attachment	This tool is used to hold the puller drive shaft when removing side retainer by the puller.  	S30 610	Fig. PD-8
15.	ST33720000 Gear carrier side retainer guide	This guide bolt is used when attaching retainer to gear carrier. Use of this tool prevents damaging O-ring and helps smooth the operation.  	S30 610	Fig. PD-27