

2. Rear Differential

A: ON-CAR SERVICE

1. FRONT OIL SEAL

- 1) Disconnect the ground cable from battery.
- 2) Move the selector lever to "N".
- 3) Release the parking brake.
- 4) Drain gear oil.
- 5) Jack up rear wheels and support the vehicle body with rigid racks.
- 6) Remove propeller shaft from body.
[Refer to "Propeller Shaft".]

Wrap metal parts (installed at the rubber boot center DOJ) with a cloth or rubbered material to prevent it from damage by interference with adjacent metal parts.

- 7) Measure turning resistance of companion flange.
Measure turning resistance after making sure that the companion flange turns smoothly.

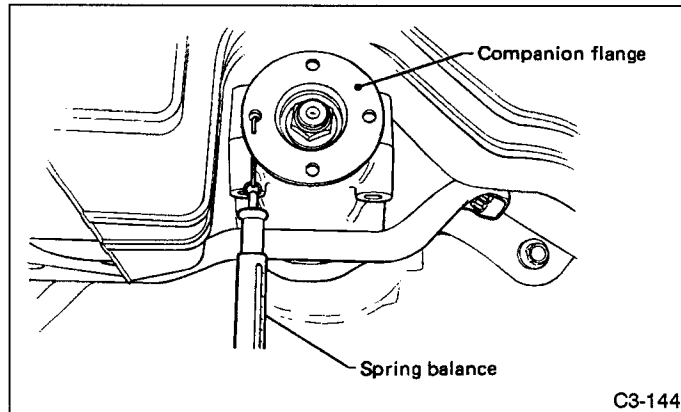


Fig. 24

- 8) Remove self-locking nut while holding companion flange with FLANGE WRENCH.

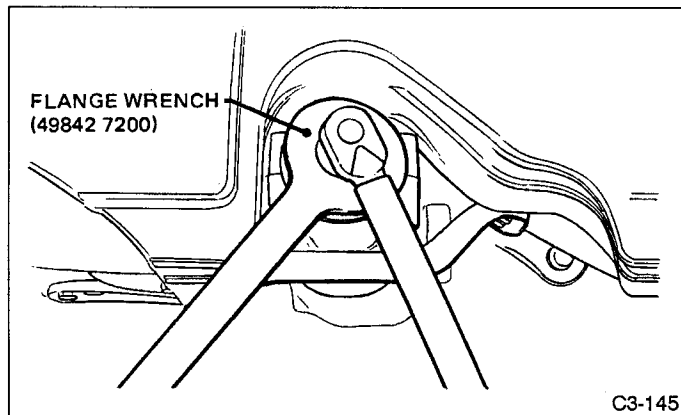


Fig. 25

- 9) Extract companion flange with a puller.
- 10) Remove oil seal.

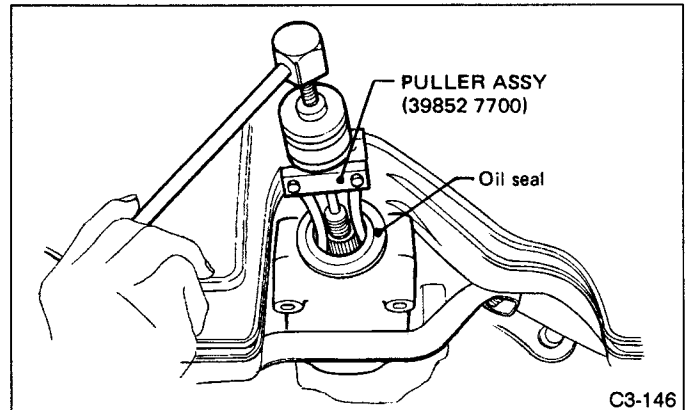


Fig. 26

- 11) Fit a new oil seal.

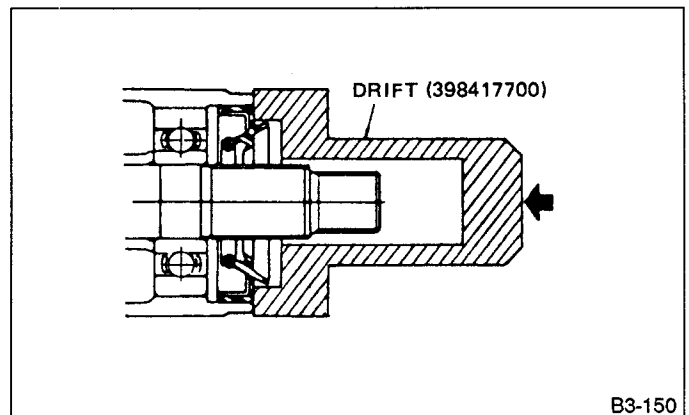


Fig. 27

- 12) Install companion flange.
- 13) Tighten self-locking nut within the specified torque range so that the turning resistance of companion flange becomes the same as that before replacing oil seal.

Torque (Drive pinion nut):

167 — 196 N·m

(17.0 — 20.0 kg-m, 123 — 145 ft-lb)

- 14) Reassembling procedure hereafter is the reverse of the disassembling.

2. SIDE OIL SEAL

- 1) Disconnect the ground cable from battery.
- 2) Move the selector lever to "N".
- 3) Release the parking brake.
- 4) Loosen wheel nuts.
- 5) Jack up the vehicle and support it with rigid racks.
- 6) Remove the wheels.
- 7) Remove the rear exhaust pipe.

For removal of the rear exhaust pipe, refer to "2-9 EXHAUST SYSTEM" [W5A0].

- 8) Remove the DOJ of rear drive shaft from the rear differential.

- (1) Remove the ABS sensor cable clamp and parking brake cable guide from the trailing link.

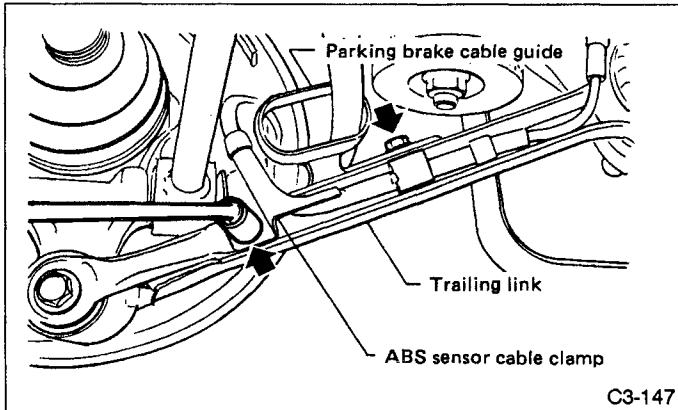


Fig. 28

- (2) Remove the parking brake cable clamp from the rear sub frame.

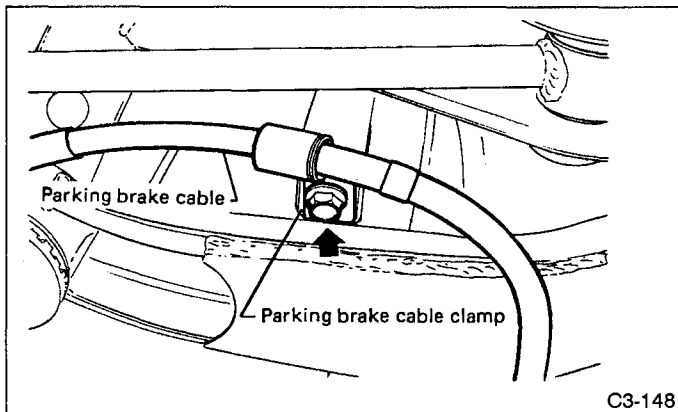


Fig. 29

- (3) Remove the rear stabilizer link.

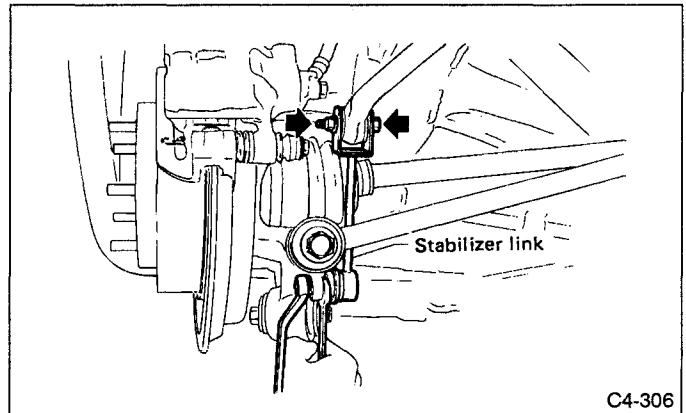


Fig. 30

- (4) Remove the brake hose clamps from rear strut.

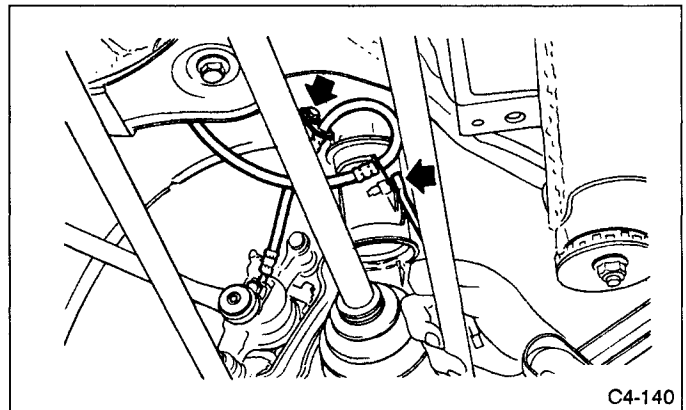


Fig. 31

- (5) Remove the bolts which secure the trailing link to the rear housing.

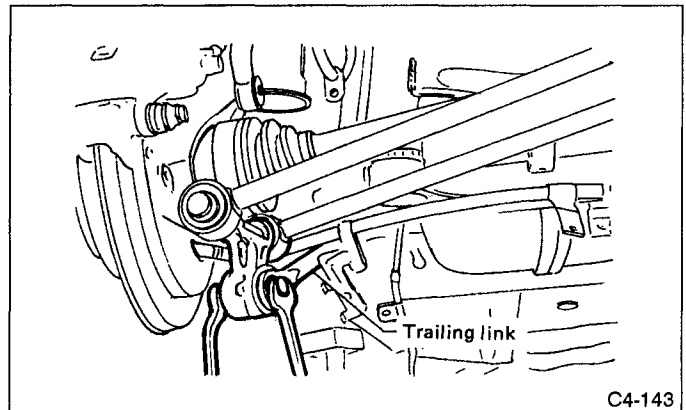


Fig. 32

(6) Remove the bolts which secure the front and rear lateral link to the rear housing.

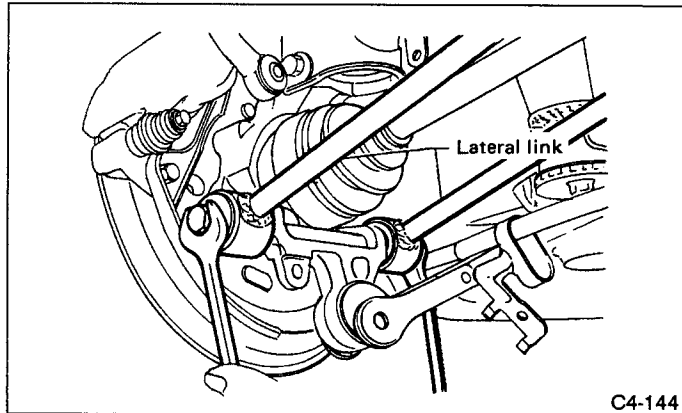


Fig. 33

(7) Remove the DOJ from the rear differential by using the DRIVE SHAFT REMOVER.

Special tool:

DRIVE SHAFT REMOVER (28099PA100)

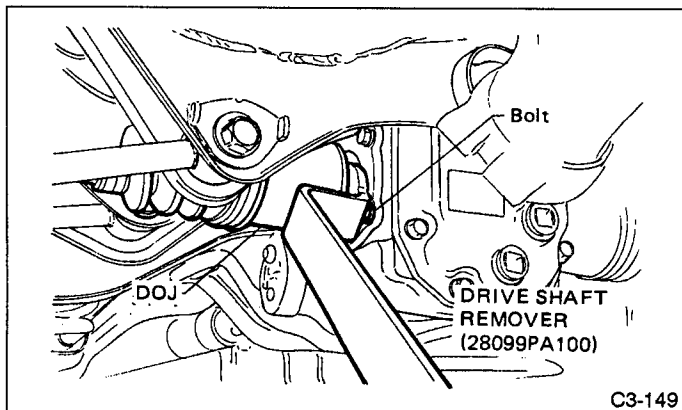


Fig. 34

When removing DOJ from rear differential using remover, fit remover to the bolt as shown in Fig. 35 so as not to damage side bearing retainer.

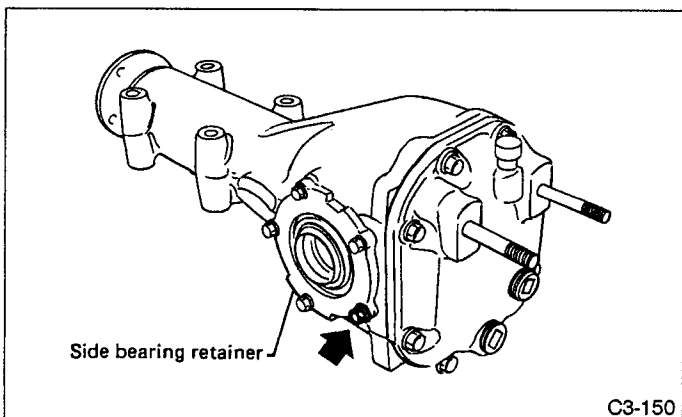


Fig. 35

9) Secure rear drive shaft to rear sub frame using wire.

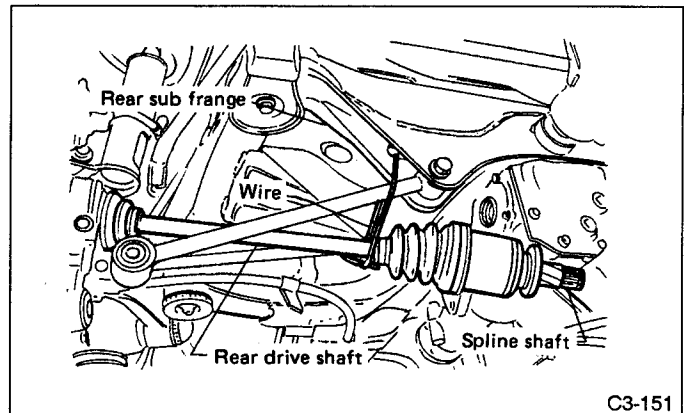


Fig. 36

The LH side spline shaft circlip only comes out together with the shaft. RH side circlip is fitted inside the rear differential, and it need not be removed.

10) Remove the side oil seal.

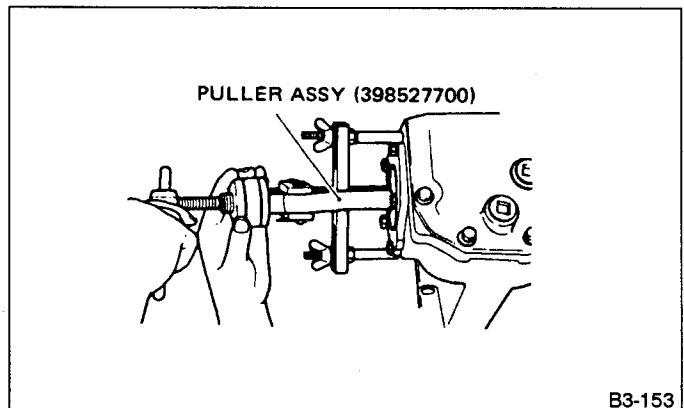


Fig. 37

11) Drive in a new side oil seal with DRIFT. Apply chassis grease between the oil seal lips.

Special tool:

DRIFT (398437700)

12) Insert the DOJ into rear differential. Before inserting, replace the circlip at the end of the LH spline shaft with a new one.

For replace of circlip, refer to "4-2 WHEEL AND AXLES.

(1) Install the side oil seal protector to rear differential.

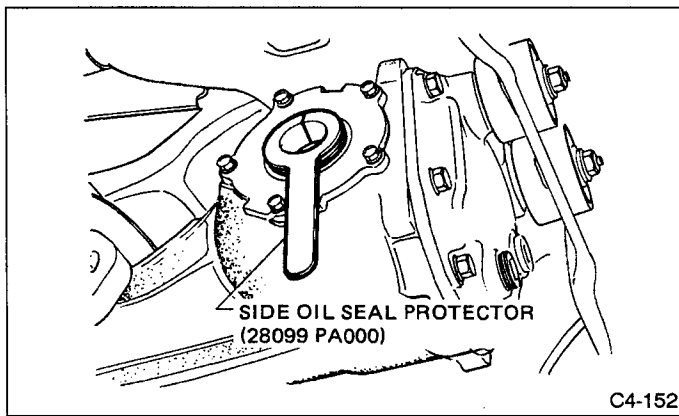


Fig. 38

(2) Insert the spline shaft until the spline portion is inside the side oil seal.

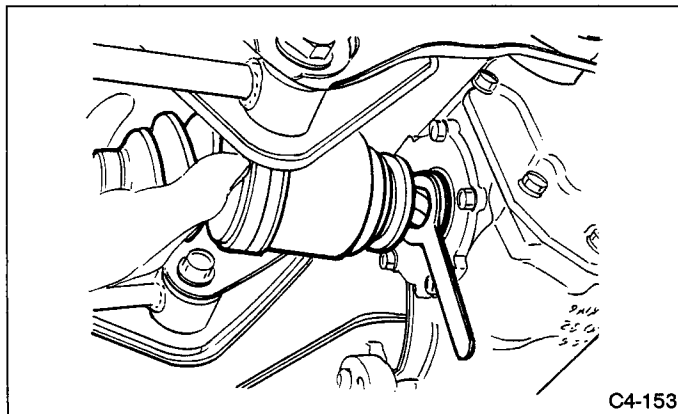


Fig. 39

(3) Remove the side oil seal protector.

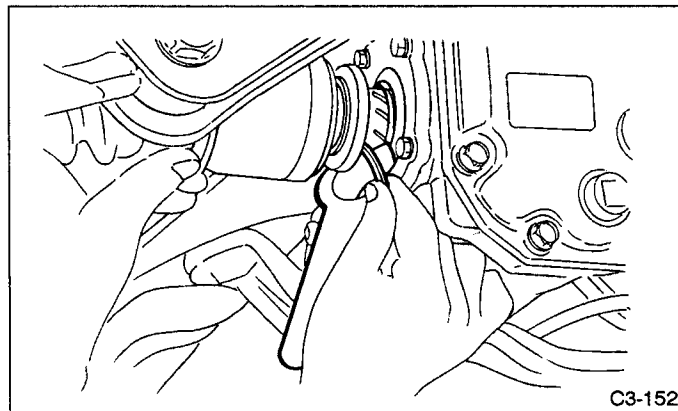


Fig. 40

(4) Completely insert DOJ into rear differential by pressing rear housing.

Check that oil seal lip is not folded over inward.

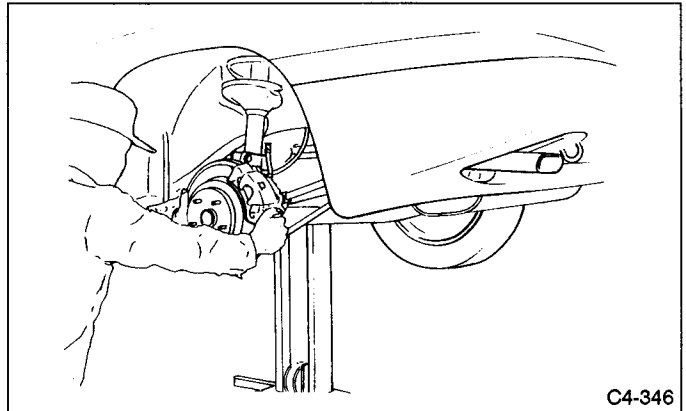


Fig. 41

13) Reassembling procedure hereafter is the reverse of the disassembling.

For installation of rear suspension parts, refer to "4-1 SUSPENSION".

B: IDENTIFICATION

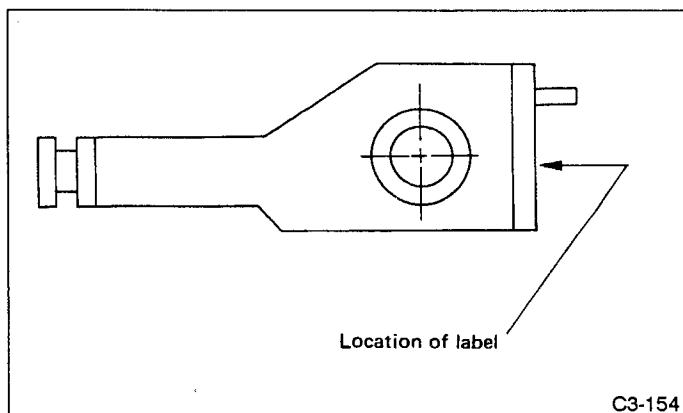
When replacing the rear differential ASSY, select the correct rear differential ASSY.

Using an incorrect rear differential ASSY causes the drive line and wheels to "drag" or emit abnormal noise.

Gear ratio	Part number	Label stuck on rear differential
3.545	27011AA242	PART NUMBER 27011AA242 VISCOUS LSD GEAR RATIO 3.545 ● FUJI HEAVY INDUSTRIES LTD

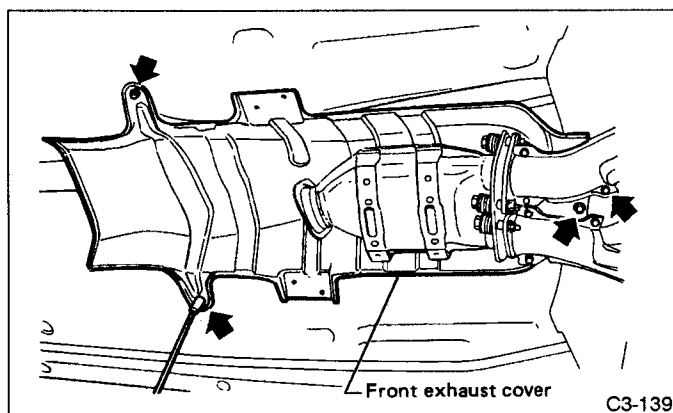
C3-153

Fig. 42



C3-154

Fig. 43



C3-139

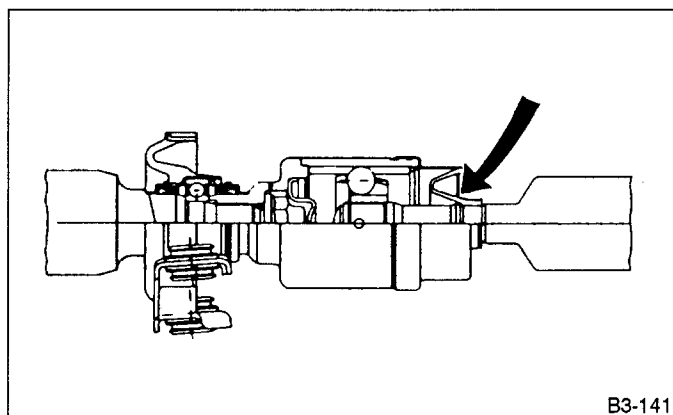
Fig. 44

C : REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Move the selector lever to "N".
- 3) Release the parking brake.
- 4) Loosen wheel nuts.
- 5) Jack up the vehicle and support it with rigid racks.
- 6) Remove the wheels.
- 7) Remove the rear exhaust pipe.
- 8) Remove the front exhaust cover.

9) Remove the propeller shaft from body.
[Refer to "Propeller Shaft".]

a. Wrap center DOJ with a cloth or rubbered material to prevent rubber boot from damage.



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Fig. 45

b. Prepare an oil can and cap since the transmission oil flows out from the extension at removing propeller shaft.

c. When removing propeller shaft, pay attention not to damage the sliding surfaces of rear drive shaft (extension) spline, oil seal and sleeve yoke.

d. Insert the cap into the extension to prevent transmission oil from flowing out immediately after removing the propeller shaft.

10) Remove the DOJ of rear drive shaft from the rear differential.

For removal of DOJ from the rear differential, refer to "3-4 AWD SYSTEM" [W2A2].

11) Secure rear drive shaft to rear sub frame using wire.

12) Remove the rear differential ASSY from body.

(1) Remove the four bolts which secure the bracket to the rear differential member.

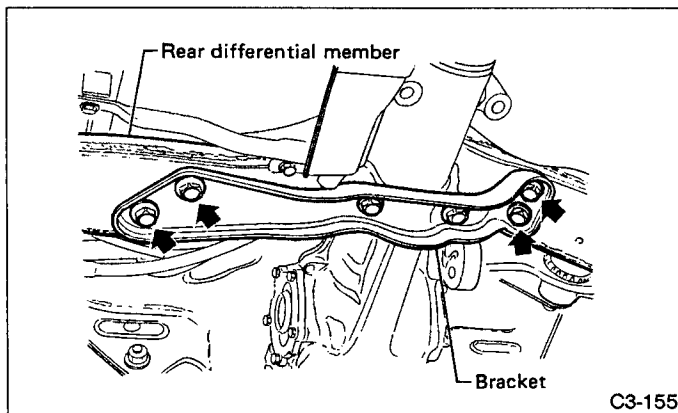


Fig. 46

(2) Support the rear differential with transmission jack.

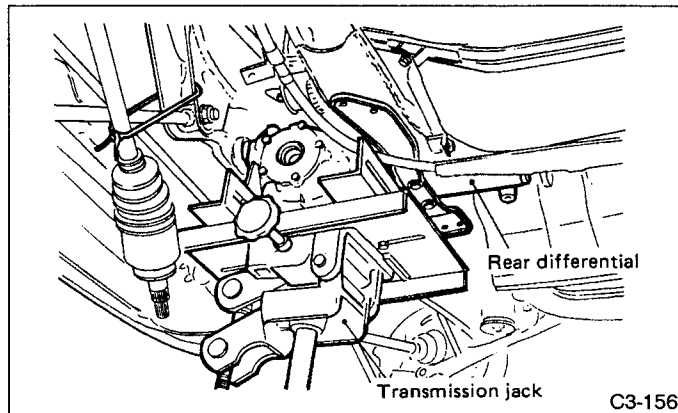


Fig. 47

(3) Remove the two bolts which secure the bracket and rear differential to rear differential member.

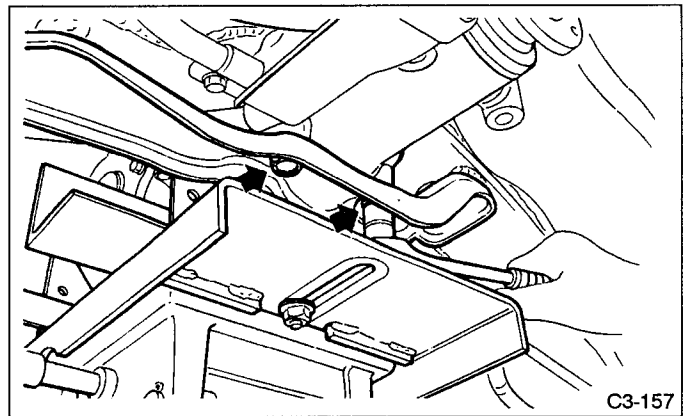


Fig. 48

(4) Remove the self locking nuts which connect the rear differential to the rear sub frame.

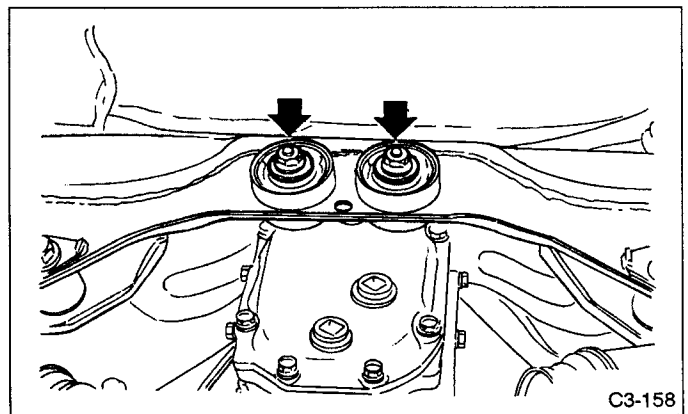


Fig. 49

(5) While slowly lowering transmission jack, move the rear differential forward and remove bolts from the rear sub frame.

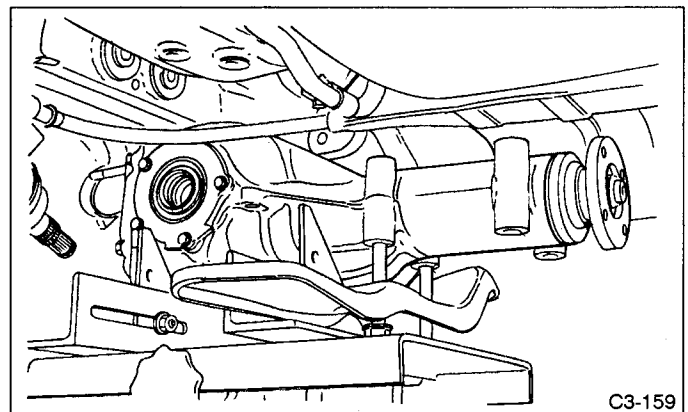


Fig. 50

Do not tilt the rear differential, or rear differential gear oil will spill out.

(6) Remove the rear differential ASSY from body.

D: DISASSEMBLY

To detect real cause of trouble, inspect the following items before disassembling. (Refer to "ASSEMBLY" for inspection procedures.)

- Tooth contact of hypoid drive gear and pinion, and backlash
- Runout of drive gear at its back surface
- Turning resistance of drive pinion

1) Set ATTACHMENT on vise and install the differential assembly to Attachment.

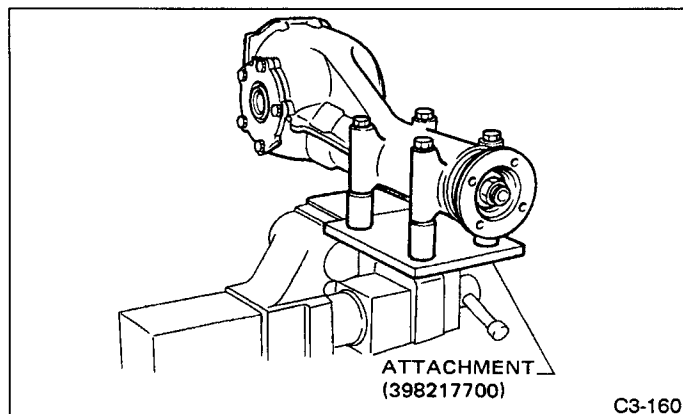


Fig. 51

- 2) Drain gear oil by removing plug.
- 3) Remove rear cover by loosening retaining bolts.

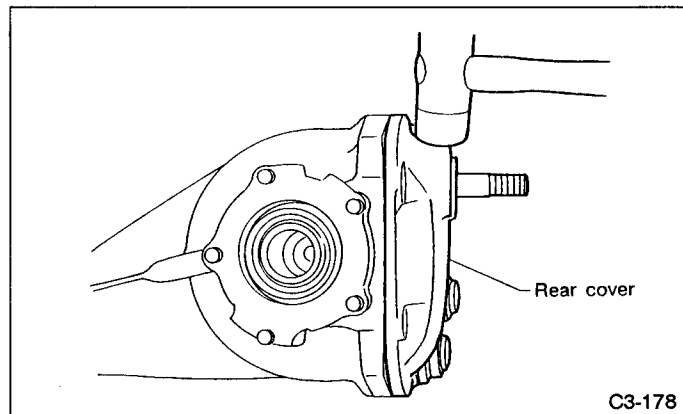


Fig. 52

4) Make right and left side bearing retainers in order to identify them at reassembly. Remove side bearing retainer attaching bolts, set ATTACHMENT to differential case, and extract right and left side bearing retainers with a puller.

Each shim, which is installed to adjust the side bearing preload, should be kept together with its mating retainer.

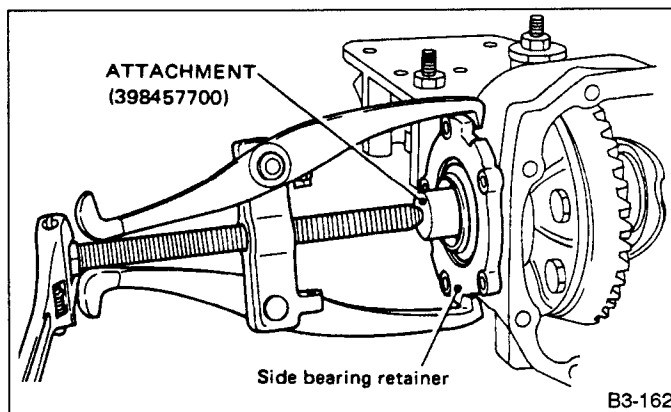


Fig. 53

5) Pull out differential case.

Be careful not to permit the teeth to contact the case.

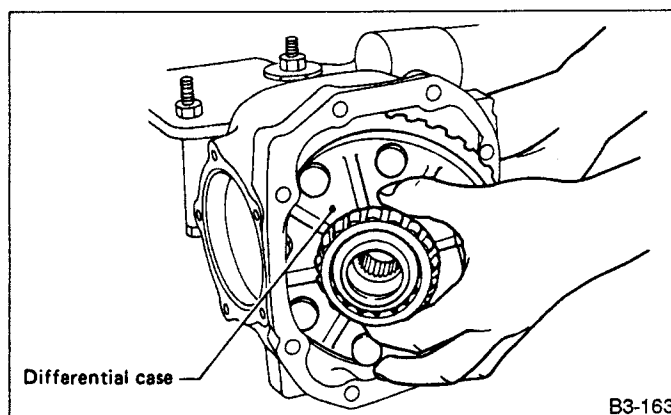


Fig. 54

6) When replacing side bearing, pull bearing cup from side bearing retainer.

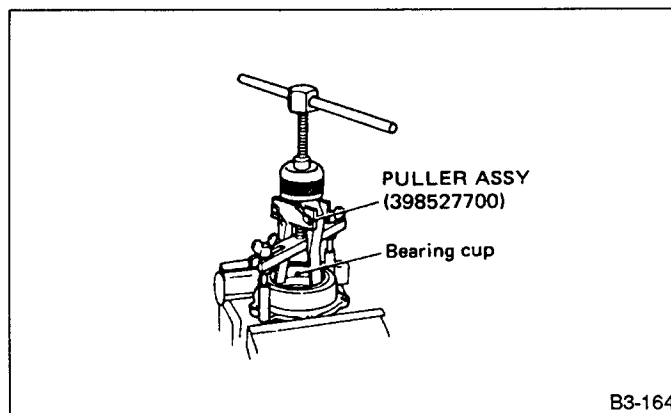


Fig. 55

7) Extract bearing cone with PULLER SET.

- a. Set Puller so that its claws catch the edge of the bearing cone.
- b. Never mix up the right and left hand bearing cups and cones.

Do not attempt to disassemble the parts unless necessary.

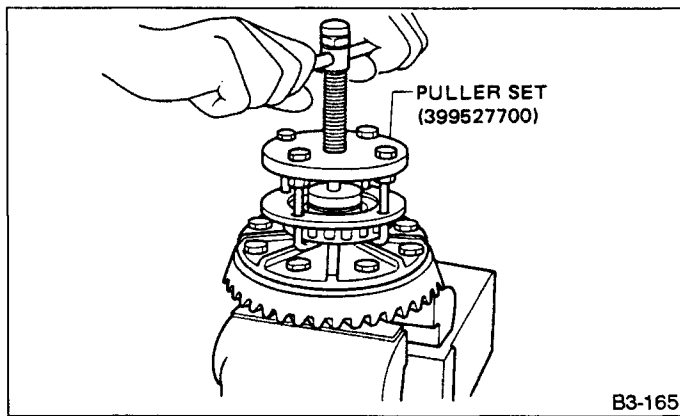


Fig. 56

8) Remove drive gear by loosening drive gear bolts.

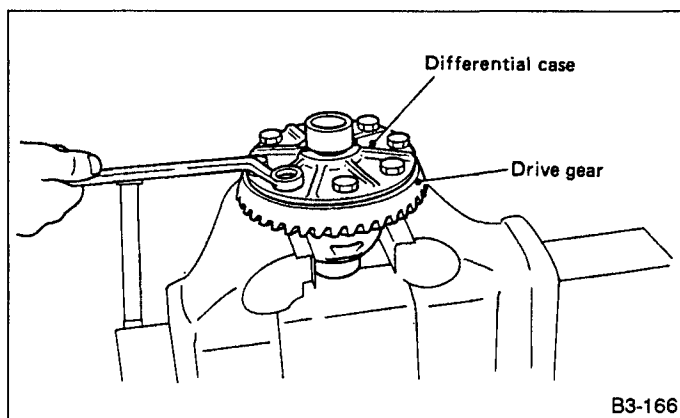


Fig. 57

Further disassembling is not allowed.

9) Hold companion flange with FLANGE WRENCH and remove drive pinion nut.

10) Extract the companion flange with a puller.

11) Press the end of drive pinion shaft and extract it together with rear bearing cone, preload adjusting spacer and washer.

Hold the drive pinion so as not to drop it.

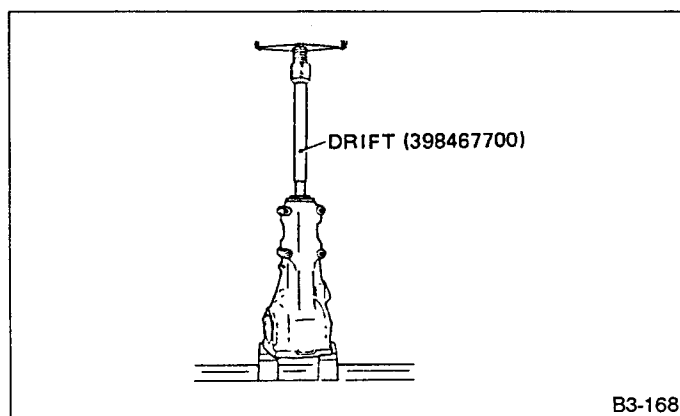


Fig. 58

12) Remove rear bearing cone from drive pinion by supporting cone with REPLACER.

Place the replacer so that its center-recessed side faces the pinion gear.

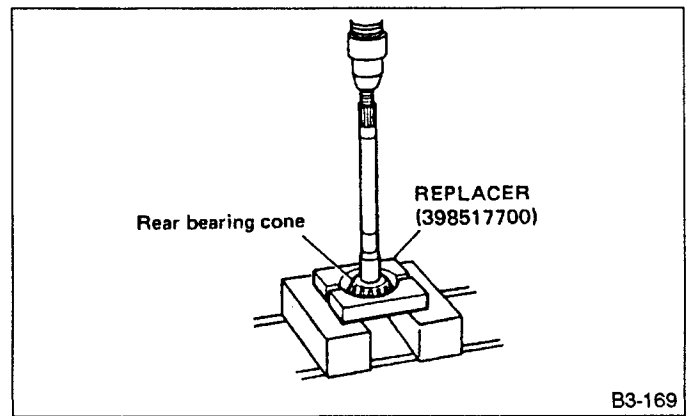


Fig. 59

13) Remove front oil seal from differential carrier.

14) Remove pilot bearing together with front bearing cone.

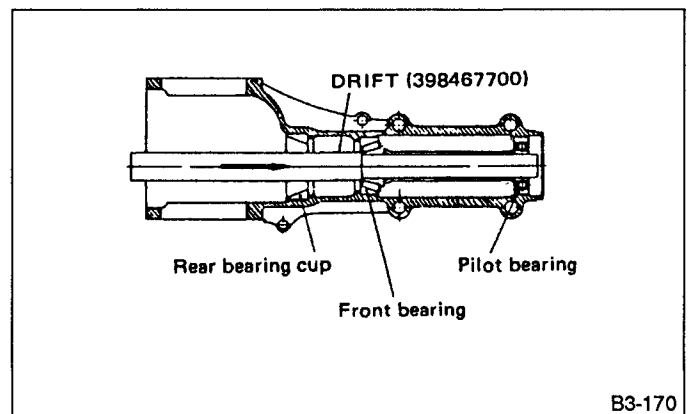


Fig. 60

15) When replacing bearings, tap front bearing cup and rear bearing cup in this order out of case by using a brass bar.

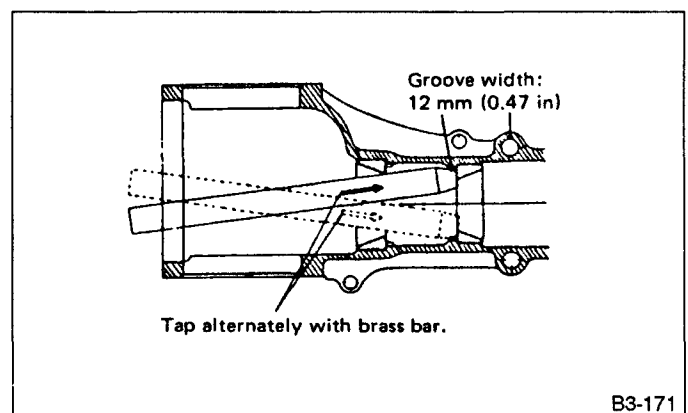


Fig. 61

E: INSPECTION

Wash all the disassembled parts clean, and examine them for wear, damage, or other defects. Repair or replace defective parts as necessary.

1) Drive gear and drive pinion

(1) If abnormal tooth contact is evident, find out the cause and adjust to give correct tooth contact at assembly. Replace the gear if excessively worn or incapable of adjustment.

(2) If crack, score, or seizure is evident, replace as a set. Slight damage of tooth can be corrected by oil stone or the like.

2) Bearing

Replace if seizure, peeling, wear, rust, dragging during rotation, abnormal noise or other defect is evident.

3) Oil seal

Replace if deformed or damaged, and at every disassembling.

4) Differential carrier

Replace if the bearing bores are worn or damaged.

5) Differential case

Replace if its sliding surfaces are worn or cracked.

6) Companion flange

Replace if the oil seal lip contacting surfaces have flaws.

F: ASSEMBLY

1) Precautions for assembling

(1) Assemble in the reverse order of disassembling. Check and adjust each part during assembly.

(2) Keep the shims and washers in order, so that they are not misinstalled.

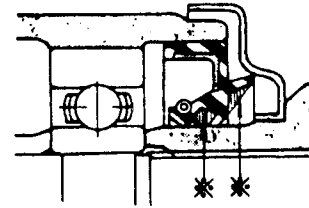
(3) Thoroughly clean the surfaces on which the shims, washers and bearings are to be installed.

(4) Apply gear oil when installing the bearings and thrust washers.

(5) Be careful not to mix up the right and left hand cups of the bearings.

(6) Replace the oil seal with new one at every disassembly. Apply chassis grease between the lips (*) when installing the oil seal.

(7) Do not reuse old gaskets. Install new ones.



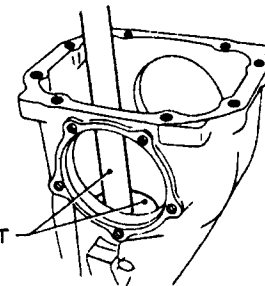
B3-172

Fig. 62

2) Adjusting preload for front and rear bearings.

Adjust the bearing preload with spacer and washer between front and rear bearings. Pinion height adjusting washer has nothing to do with this adjustment. The adjustment must be carried out without oil seal.

(1) Press front and rear bearing cups into differential carrier.

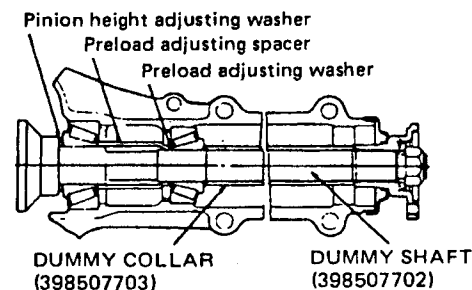


B3-173

Fig. 63

(2) Insert DUMMY SHAFT with pinion height adjusting washer and rear bearing cone fitted on it into case.

Reuse the used washer if they show normal tooth contact pattern when checked before disassembly.



B3-174

Fig. 64

(3) Then, install preload adjusting spacer and washer, front bearing cone, DUMMY COLLAR, companion flange, washer and drive pinion nut.

(4) Turn Dummy Shaft with hand to make it seated, and tighten drive pinion nut while measuring the preload with spring balance as shown in the figure. Select preload adjusting washer and spacer so that the specified preload is obtained when nut is tightened to the specified torque.

- a. Be careful not to give excessive preload.
- b. When tightening the drive pinion nut, lock Dummy Shaft with BLOCK as illustrated here.

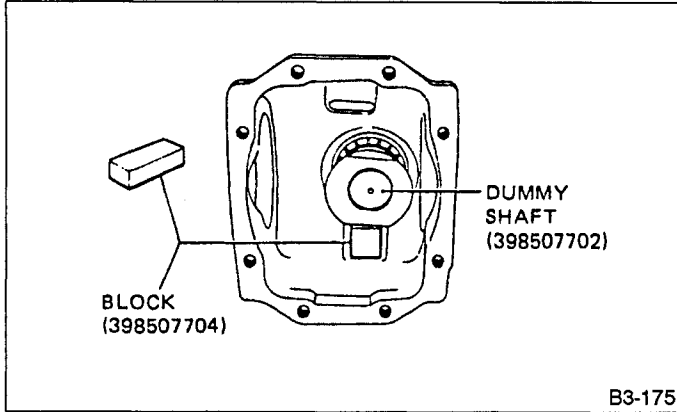


Fig. 65

Torque (Drive pinion nut):

167 — 196 N·m (17.0 — 20.0 kg-m, 123 — 145 ft-lb)

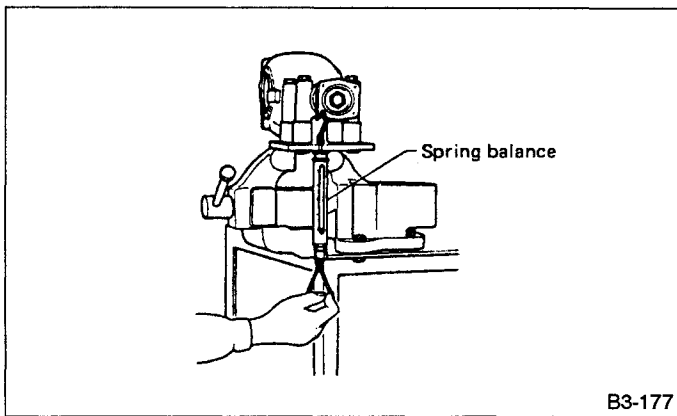


Fig. 66

Front & rear bearing preload

For new bearing:
19.6 — 28.4 N (2.0 — 2.9 kg, 4.4 — 6.4 lb)
at companion flange bolt hole

For used bearing:
8.34 — 16.67 N (0.85 — 1.7 kg, 1.87 — 3.75 lb)
at companion flange bolt hole

Preload adjusting washers

Part No.	Length mm (in)
383705200	2.59 (0.1020)
383715200	2.57 (0.1012)
383725200	2.55 (0.1004)
383735200	2.53 (0.0996)
383745200	2.51 (0.0988)
383755200	2.49 (0.0980)
383765200	2.47 (0.0972)
383775200	2.45 (0.0965)
383785200	2.43 (0.0957)
383795200	2.41 (0.0949)
383805200	2.39 (0.0941)
383815200	2.37 (0.0933)
383825200	2.35 (0.0925)
383835200	2.33 (0.0917)
383845200	2.31 (0.0909)

Preload adjusting spacers

Part No.	Length mm (in)
383695201	56.2 (2.213)
383695202	56.4 (2.220)
383695203	56.6 (2.228)
383695204	56.8 (2.236)
383695205	57.0 (2.244)
383695206	57.2 (2.252)

3) Adjusting drive pinion height

Adjust drive pinion height with washer installed between rear bearing cone and the back of pinion gear.

- (1) Install Dummy Shaft, Collar and Gauge, as shown in the figure, and apply the specified preload on the bearings. (Refer to 2.) Adjusting preload for front and rear bearings.

At this time, install a pinion height adjusting washer which is temporarily selected or the same as that used before.

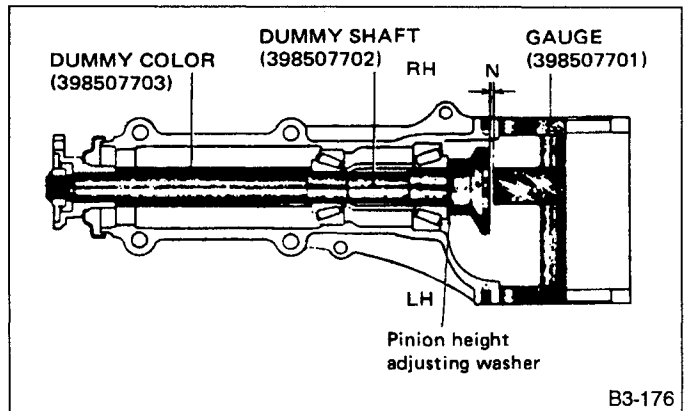


Fig. 67

(2) Measure the clearance N between the end of Gauge and the end surface of Dummy Shaft by using a thickness gauge.

Make sure there is no clearance between the case and Gauge.

(3) Obtain the thickness of pinion height adjusting washer to be inserted from the following formula, and replace the temporarily installed washer with this one.

$$T = T_o + N - (H \times 0.01) - 0.20 \text{ (mm)}$$

where

T = Thickness of pinion height adjusting washer (mm)

T_o = Thickness of washer temporarily inserted (mm)

N = Reading of thickness gauge (mm)

H = Figure marked on drive pinion head

(Example of calculation)

$$T_o = 2.20 + 1.20 = 3.40 \text{ mm}$$

$$N = 0.23 \text{ mm } H = +1,$$

$$T = 3.40 + 0.23 - 0.01 - 0.20 = 3.42$$

Result: Thickness = 3.42 mm

Therefore use the washer 383605200.

Pinion height adjusting washers

Part No.	Thickness mm (in)
383495200	3.09 (0.1217)
383505200	3.12 (0.1228)
383515200	3.15 (0.1240)
383525200	3.18 (0.1252)
383535200	3.21 (0.1264)
383545200	3.24 (0.1276)
383555200	3.27 (0.1287)
383565200	3.30 (0.1299)
383575200	3.33 (0.1311)
383585200	3.36 (0.1323)
383595200	3.39 (0.1335)
383605200	3.42 (0.1346)
383615200	3.45 (0.1358)
383625200	3.48 (0.1370)
383635200	3.51 (0.1382)
383645200	3.54 (0.1394)
383655200	3.57 (0.1406)
383665200	3.60 (0.1417)
383675200	3.63 (0.1429)
383685200	3.66 (0.1441)

4) Install the selected pinion height adjusting washer on drive pinion, and press the rear bearing cone into position with INSTALLER.

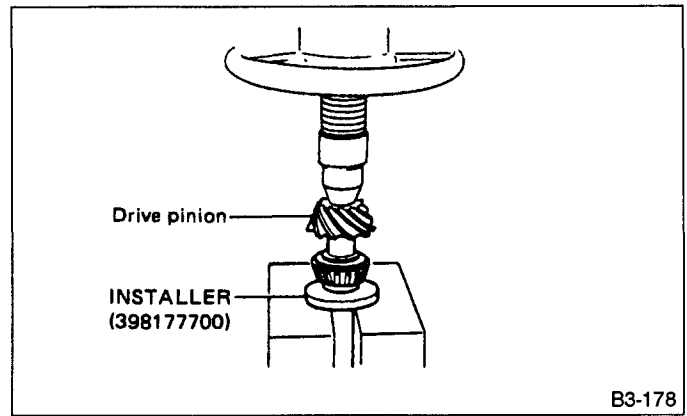


Fig. 68

5) Insert drive pinion into differential carrier, install the previously selected preload adjusting spacer and washer.

6) Press-fit front bearing cone into case.

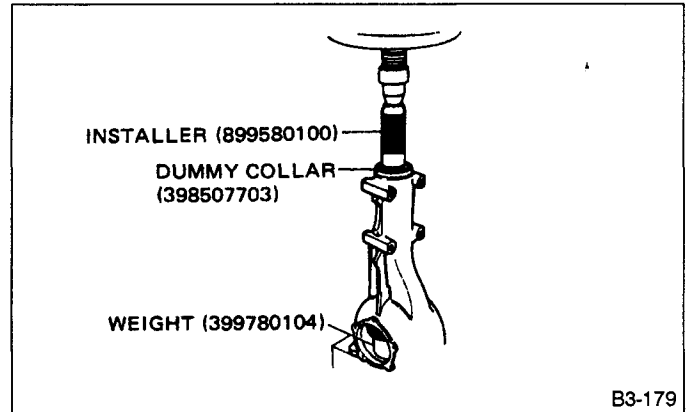


Fig. 69

7) Insert spacer, then press-fit pilot bearing with WEIGHT and INSTALLER.

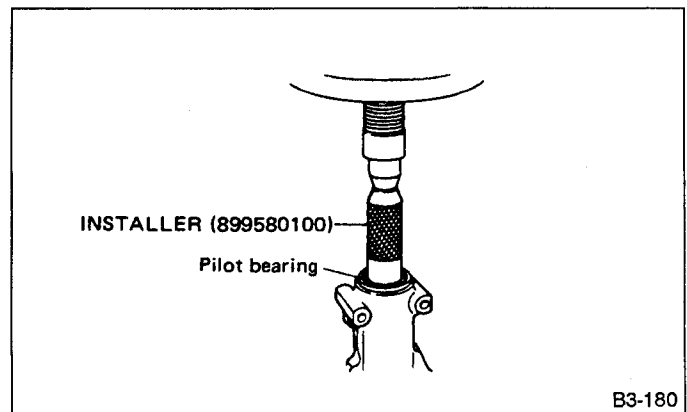


Fig. 70

8) Fit a new oil seal with DRIFT.

Apply grease between the oil seal lips. (Refer to 1.)
Precautions for assembling.

Special tool:
DRIFT (398417700)

9) Press-fit companion flange with INSTALLER and WEIGHT.

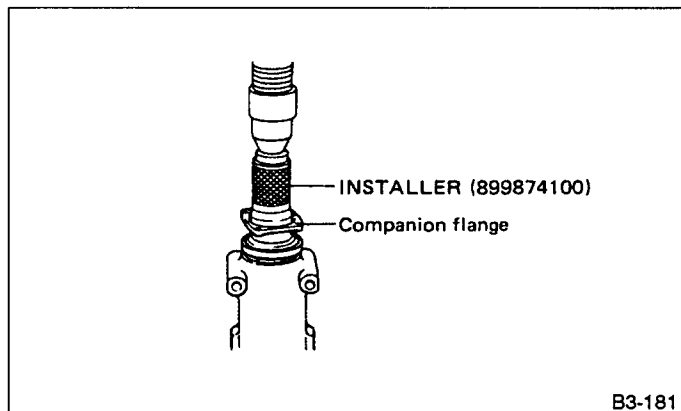


Fig. 71

10) Install self-locking nut with washer.

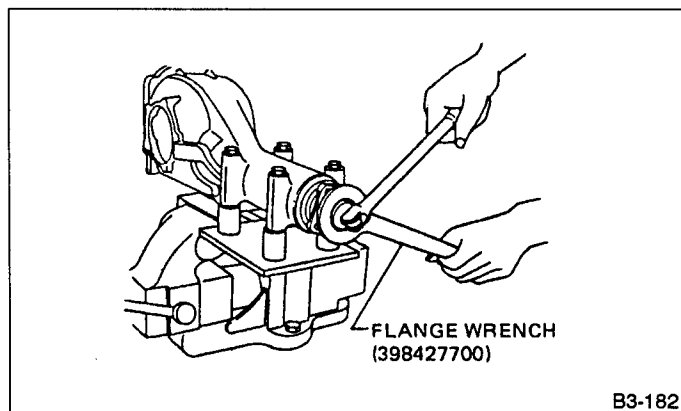


Fig. 72

Torque (Drive pinion nut):
167 — 196 N•m (17.0 — 20.0 kg-m, 123 — 145 ft-lb)

11) Assembling differential case

Install side gears and pinion mate gears, with their thrust washers and pinion mate shaft, into differential case.

Apply gear oil on both sides of the washer and on the side gear shaft before installing.

Insert the pinion mate shaft into the differential case by aligning the lock pin holes.

- (1) Measure the clearance between differential case and the back of side gear.
- (2) Adjust the clearance as specified by selecting side gear thrust washer.

Side gear back clearance:
0.1 — 0.2 mm (0.004 — 0.008 in)

Side gear thrust washers

Part No.	Thickness mm (in)
383445201	0.75 — 0.80 (0.0295 — 0.0315)
383445202	0.80 — 0.85 (0.0315 — 0.0335)
383445203	0.85 — 0.90 (0.0335 — 0.0354)

(3) Check the condition of rotation after applying oil to the gear tooth surfaces and thrust surfaces.

(4) After driving in pinion shaft lock pin, stake the both sides of the hole to prevent pin from falling off.

(5) Install drive gear on differential case.

Torque (Drive gear bolt):
93 — 113 N•m (9.5 — 11.5 kg-m, 69 — 83 ft-lb)

Tighten diagonally while tapping the bolt heads.

12) Before installing side bearing, measure the bearing width by using a dial gauge, WEIGHT and GAUGE.

Standard bearing width:
20.00 mm (0.7874 in)

Set the dial gauge needle to zero, using a standard bearing or block of specified height in advance.

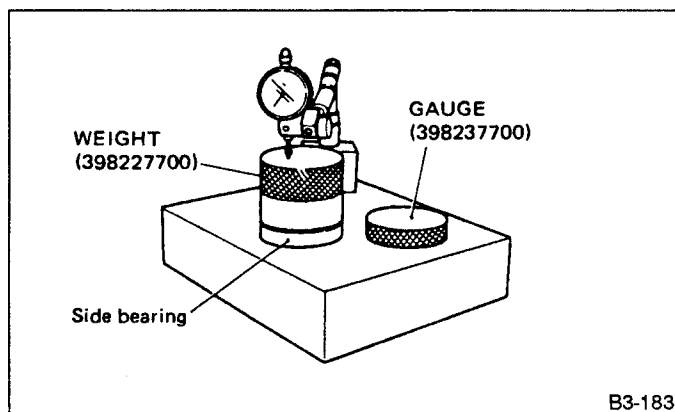


Fig. 73

13) Press side bearing cone onto differential case with DRIFT and ADAPTER included in PULLER SET (399527700).

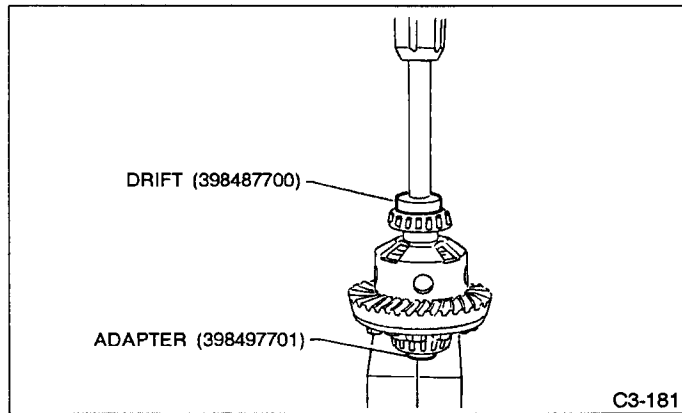


Fig. 74

14) Adjusting side bearing retainer shims

(1) The drive gear backlash and side bearing preload can be determined by the side bearing retainer shim thickness.

(2) When replacing differential case, differential carrier, side bearing and side bearing retainer, obtain the right and left retainer shim thickness from the following formulas.

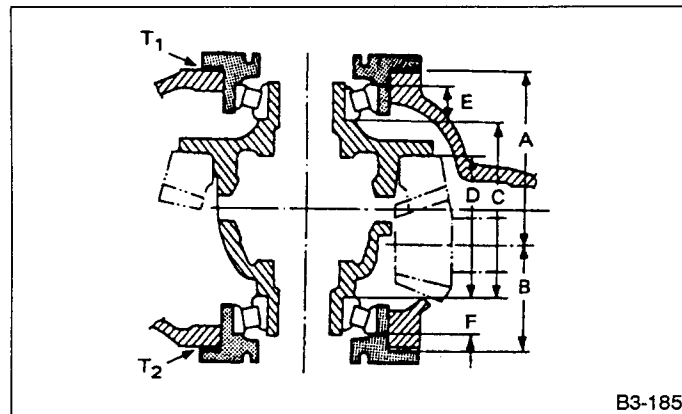


Fig. 75

$$T_1 \text{ (Left)} = (A + C + G_1 - D) \times 0.01 + 0.76 - E \text{ (mm)}$$

$$T_2 \text{ (Right)} = (B + D + G_2) \times 0.01 + 0.76 - F \text{ (mm)}$$

T_1 & T_2 : Thickness of left and right side bearing retainer shim (mm)

A & B : Number marked on differential carrier.

C & D : Number marked on differential case.

E & F : Difference of width of left and right side bearing from standard width 20.0 mm, expressed in a unit of 0.01 mm. For example, if the bearing measured width is 19.89 mm, value of E or F is as follows.
 $20.00 - 19.89 = 0.11$ (E or F)

G_1 & G_2 : Number marked on side bearing retainer.

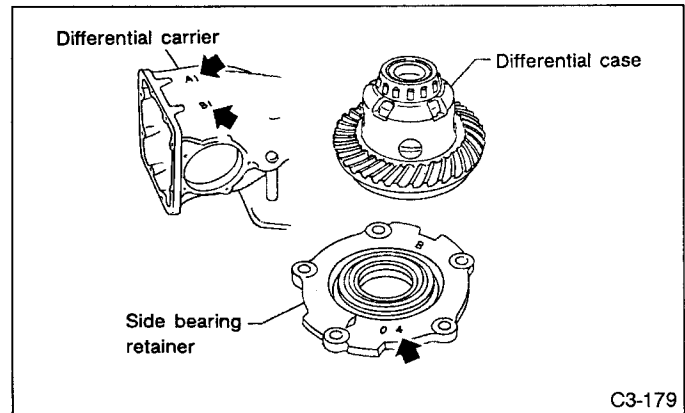


Fig. 76

If a number is not marked, regard it as zero.
Use several shims to obtain the calculated thickness.

Side bearing retainer shims

Part No.	Thickness mm (in)
383475201	0.20 (0.0079)
383475202	0.25 (0.0098)
383475203	0.30 (0.0118)
383475204	0.40 (0.0157)
383475205	0.50 (0.0197)

Example of calculation

Ex. 1

A = 5, B = 5, C = 3, D = 3, $G_1 = 4$, $G_2 = 1$,
 E = 0.10 mm, F = 0.15 mm

Left side

$$\begin{aligned} T_1 &= (A + C + G_1 - D) \times 0.01 + 0.76 - E \\ &= (5 + 3 + 4 - 3) \times 0.01 + 0.76 - 0.10 \\ &= 0.09 + 0.76 - 0.10 = 0.75 \text{ mm} \end{aligned}$$

The correct shims are as follows

Thickness	Q'ty	
0.25	x 1	= 0.25
0.50	x 1	= 0.50
Total shim thickness = 0.75 mm		

Right side

$$\begin{aligned} T_2 &= (B + D + G_2) \times 0.01 + 0.76 - F \\ &= (5 + 3 + 1) \times 0.01 + 0.76 - 0.15 \\ &= 0.09 + 0.76 - 0.15 \\ &= 0.70 \text{ mm} \end{aligned}$$

The correct shims are as follows

Thickness	Q'ty	
0.20	x 1	= 0.20
0.50	x 1	= 0.50
Total shim thickness = 0.70 mm		

Ex. 2

A = 2, B = 3, C = 0, D = 3, $G_1 = 2$, $G_2 = 3$,
 E = 0.22 mm, F = 0.10 mm

Left side

$$\begin{aligned} T_1 &= (A + C + G_1 - D) \times 0.01 + 0.76 - E \\ &= (2 + 0 + 2 - 3) \times 0.01 + 0.76 - 0.22 \\ &= 0.01 + 0.76 - 0.22 \\ &= 0.55 \text{ mm} \end{aligned}$$

The correct shims are as follows

Thickness Q'ty

0.25 x 1 = 0.25

0.30 x 1 = 0.30

Total shim thickness = 0.55 mm

Right side

$$\begin{aligned} T_2 &= (B + D + G_2) \times 0.01 + 0.76 - F \\ &= (3 + 3 + 3) \times 0.01 + 0.76 - 0.10 \\ &= 0.09 + 0.76 - 0.10 \\ &= 0.75 \text{ mm} \end{aligned}$$

The correct shims are as follows

Thickness Q'ty

0.25 x 1 = 0.25

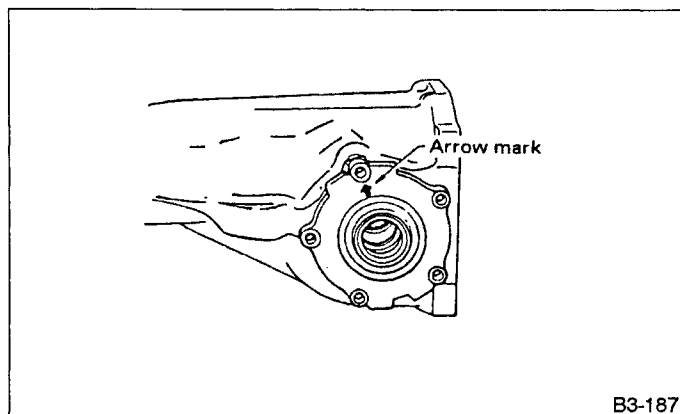
0.50 x 1 = 0.50

Total shim thickness = 0.75 mm

(3) Install the differential case ASSY into differential carrier in the reverse order of disassembling.

(4) Fit the selected shims and O-ring on side bearing retainer and install them on differential carrier with the arrow mark on the retainer directed as shown in Figure.

Be careful that side bearing cup is not damaged by bearing roller.



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Fig. 77

(5) Tighten side bearing retainer bolts.

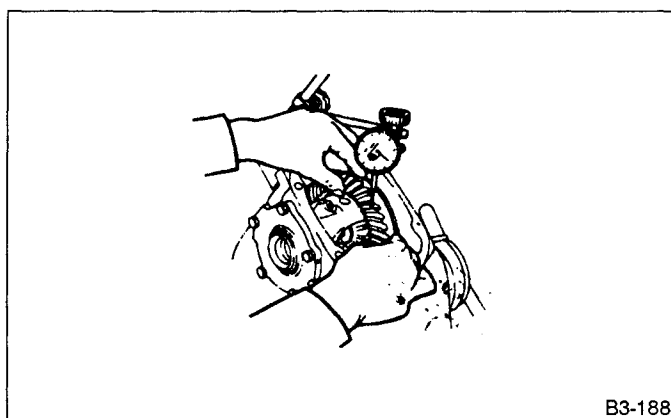
On vehicle with LSD, apply a coat of Three Bond 1215 (P/N 004403007) to threads.

Torque (Side bearing retainer):

9 — 12 N·m (0.9 — 1.2 kg-m, 6.5 — 8.7 ft-lb)

(6) Measure the drive gear-to-drive pinion backlash. If the reading is not within the specified range, correct by decreasing the shim thickness on one side and increasing the shim thickness on the other side the same amount. Total shim thickness must be the same to maintain proper preload.

Backlash: 0.10 — 0.20 mm (0.0039 — 0.0079 in)



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Fig. 78

(7) At the same time, measure the turning resistance of drive pinion. Compared with the resistance when differential case is not installed, if the increase of the resistance is not within the specified range, readjust side bearing retainer shims.

Turning resistance increase:

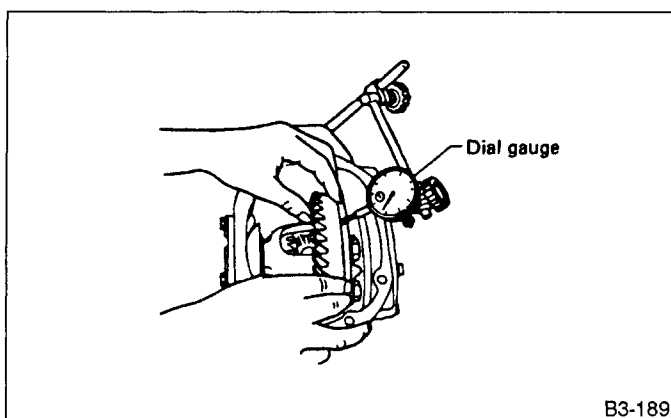
0.1 — 0.6 N·m (1 — 6 kg-cm, 0.9 — 5.2 in-lb)

(8) Recheck drive gear-to-pinion backlash after readjusting shims.

(9) Check the drive gear runout on its back surface, and make sure pinion and drive gear rotate smoothly.

Limit of runout:

0.05 mm (0.0020 in)



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Fig. 79

15) Checking and adjusting tooth contact of drive gear.

(1) Paint evenly both sides of three or four teeth on drive gear with red lead. Check the contact pattern after rotating drive gear several revolutions back and forth until definite contact pattern develops on drive gear.

(2) When the contact pattern is incorrect, readjust according to the instructions given in "Tooth contact pattern".

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

(3) After completing the above adjustment, install oil seal in side bearing retainer.

a. Use DRIFT (398437700) to press the oil seal into position.

b. Apply chassis grease between the oil seal lips.

(4) Install rear cover.

Torque (Rear cover bolt):

19 — 25 N•m (1.9 — 2.6 kg-m, 14 — 19 ft-lb)

G: INSTALLATION

To install, reverse the removal sequence.

1) Install the rear differential ASSY to body.

2) Insert the DOJ of rear drive shaft into the rear differential.

For installation of the DOJ, refer to "3-4 AWD SYSTEM" [W2A2].

3) Install other parts in the reverse order of removal.

4) After installation fill differential carrier with gear oil to the upper plug level.

Apply fluid packing to plug.

Fluid packing:

Three-bound 1205 or equivalent

Oil capacity:

0.8 ℓ (0.8 US qt, 0.7 Imp qt)
