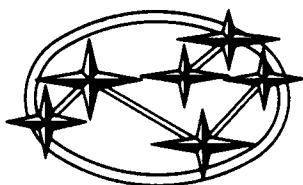


SUBARU

1988



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MECHANISM AND FUNCTION

Propeller Shaft

The propeller shaft is of three-joint type to accommodate high-speed operations. The joint is provided with shell-cup bearings which do not require maintenance.

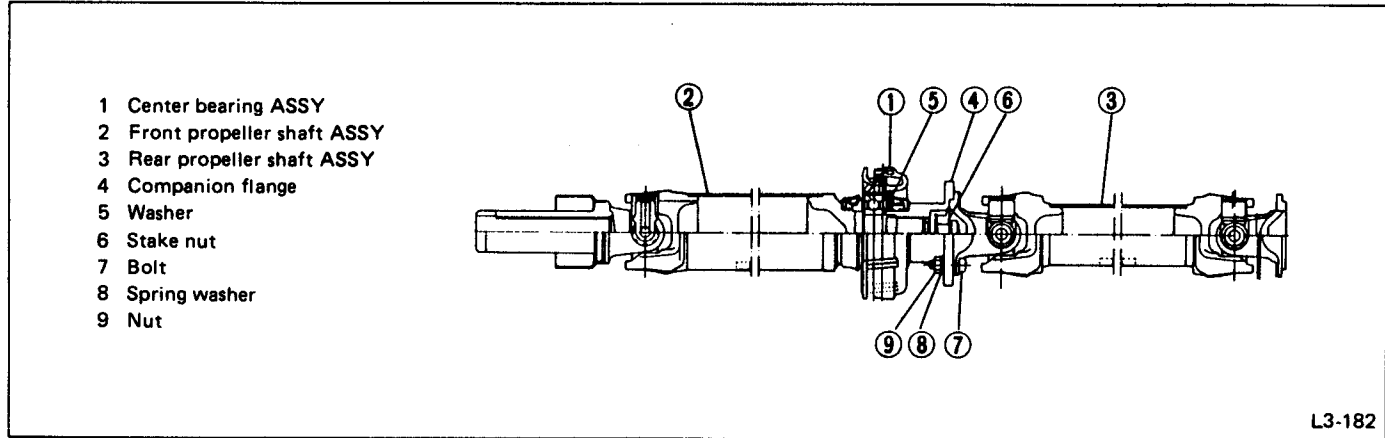


Fig. 1

A hypoid drive gear with a nominal diameter of 160 mm (6.30 in) is used and the drive pinion shaft is supported on three bearings, the bearing preload being adjusted by a selective spacer and washer. The drive pinion height is adjusted by selecting washers located at the drive pinion neck using Dummy Shaft and Gauge.



- | | | | |
|----|----------------------------------|----|------------------------------|
| 1 | Drive pinion nut | 14 | Differential case |
| 2 | Companion flange | 15 | Side gear |
| 3 | Front oil seal | 16 | Side gear thrust washer |
| 4 | Pilot bearing | 17 | Pinion mate gear |
| 5 | Spacer | 18 | Pinion mate gear washer |
| 6 | Front bearing | 19 | Pinion mate shaft |
| 7 | Bearing preload adjusting washer | 20 | Pinion shaft lock pin |
| 8 | Bearing preload adjusting spacer | 21 | Side bearing |
| 9 | Rear bearing | 22 | Side bearing retainer |
| 10 | Pinion height adjusting washer | 23 | Side bearing retainer O-ring |
| 11 | Drive pinion | 24 | Side bearing retainer shim |
| 12 | Differential carrier | 25 | Rear cover |
| 13 | Drive gear | 26 | Rear cover gasket |

Fig. 2

Limited Slip Differential (LSD)

Outline

The LSD (Limited Slip Differential) is installed on the rear differential of four-wheel drive vehicles, improving running performance on rough roads. It permits the inner and outer wheels to rotate different amounts when turns are made, just as in general differentials. In addition, the LSD provides the following features:

- 1) When one front and one rear wheel, diagonal to each other, slip on snow-covered roads and driving force cannot be delivered, or when one rear wheel is caught in a ditch and runs idle, the LSD delivers strong torque to the other wheel so that the vehicle can run normally.
- 2) Even if the vehicle bumps with one rear wheel off the road such as when driving on rough terrain, gravel or snow-covered roads, the LSD assures easy straightforward drivability by its limited differential function.

The LSD uses two units of friction clutch to join the right and left rear axle shafts to the differential case, and is built into the differential case.

- a. Even though a noise may be heard while steering, it is not faulty.
- b. Never turn on the engine while the tire on one side is jacked up as the vehicle may start to move.
- c. If the tire on one side is in the mud and the tire is spinning, the vehicle can get out of the mud by depressing the accelerator pedal. To keep the engine running at a high speed adversely affects the LSD and should be avoided.
- d. If, in an emergency, a different sized tire (temporary tire, etc.) is used for the rear tire, it adversely affects the LSD. It is necessary to replace that tire with the same sized tire immediately.

Structure

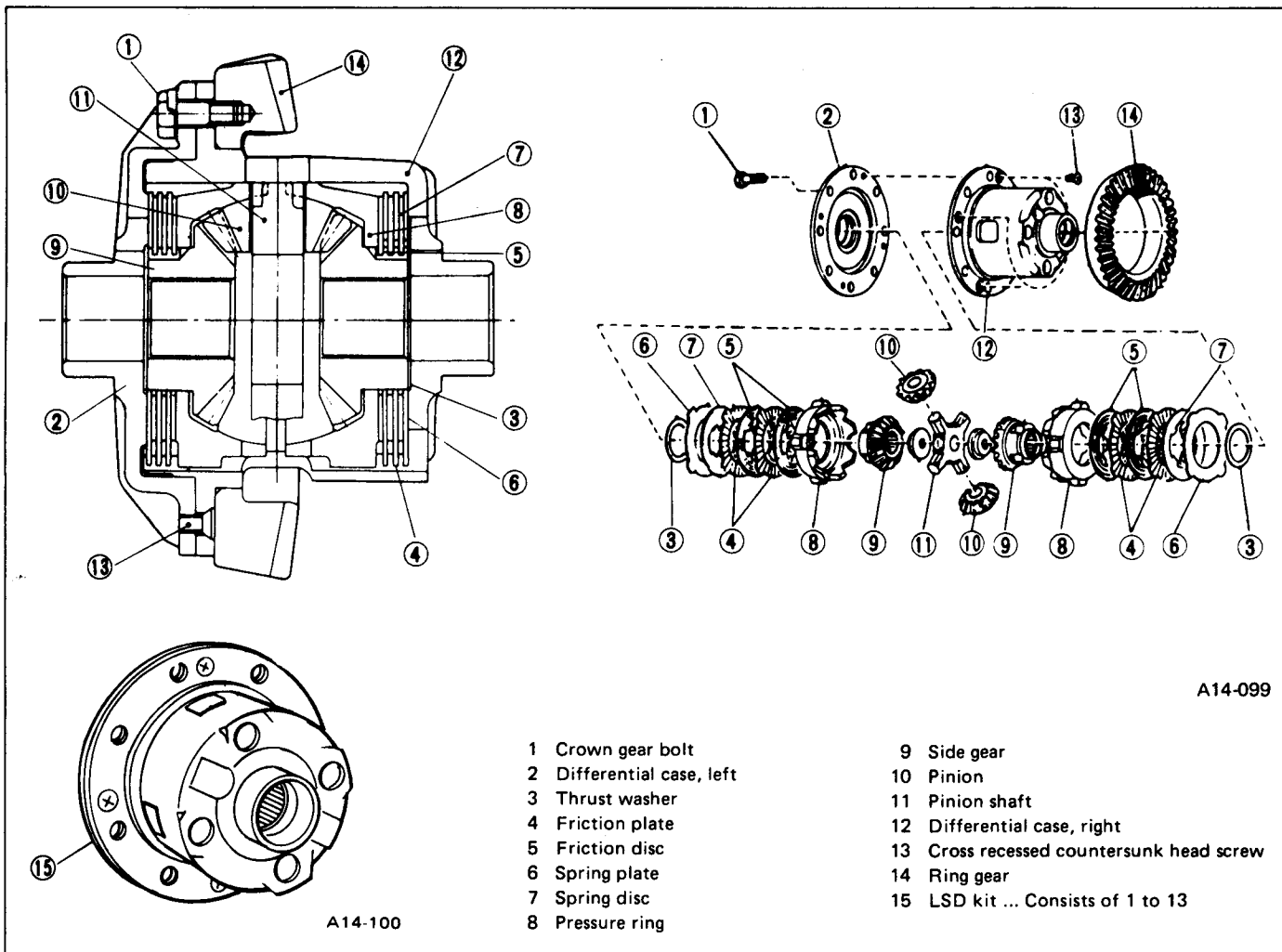


Fig. 3

The LSD uses the type called "LOK-O-MATIC" and consists of V-shaped cams and a multiple disc clutch.

The cross pinion shaft ⑪ with V-shaped cams at the tips is supported by the V-shaped grooves provided in the pressure ring ⑧. The pressure ring ⑧ is fitted into the grooves in the differential case ⑫ by means of four peripheral lugs so that it can slide in the axial direction. Further, the pinions ⑩ and side gear ⑨ are meshed with one another inside the pressure ring.

The friction plates ④ and spring plate ⑥, each having four peripheral lugs to be fitted into the differential case ⑫, and the friction discs ⑤ and spring disc ⑦, each having four inner lugs to be fitted on the side gear ⑨ are placed alternately as shown in figure so that they can slide in the axial direction. All these parts are combined to form a clutch.

The spring plate ⑥ and spring disc ⑦ function as a coned disc spring and produce initial torque. To adjust the axial clearance, the thrust washers ③ are inserted between the side gears ⑨ and differential cases ② and ⑫. With this arrangement, thrust of the side gears is prevented from acting on the pressure ring.

Torque of the differential case is delivered to the pressure ring linked to the differential case through four lugs and thus they turn together. When the pressure ring is going to rotate in the direction of the arrows in Fig. 4, torque is transmitted to the pinion shaft supported by the V-shaped cams, and the pressure ring receives its reaction force. This reaction force pushes the pressure ring open right and left and acts as the pressing load in the multiple disc clutch.

$$P = F \cot \theta$$

Since θ is constant, the clutching load P is proportional to F or the torque of the differential case.

2) OPERATIONS IN VARIOUS RUNNING CONDITIONS

1) When right and left wheels turn at equal speed

During normal straight-road driving where the right and left wheels run at an equal speed, the differential case and side gears rotate together, just as in conventional differentials. As a result, driving torque is transmitted equally to the right and left side gears.

Operation

1) PRINCIPLE OF OPERATION

The load required for the clutch to couple the differential case with the side gears is produced on the contact surfaces between the V-shaped cams of the pinion shaft and the pressure rings' V-shaped cuts. This load is proportional in size to the torque transmitted from the differential case.

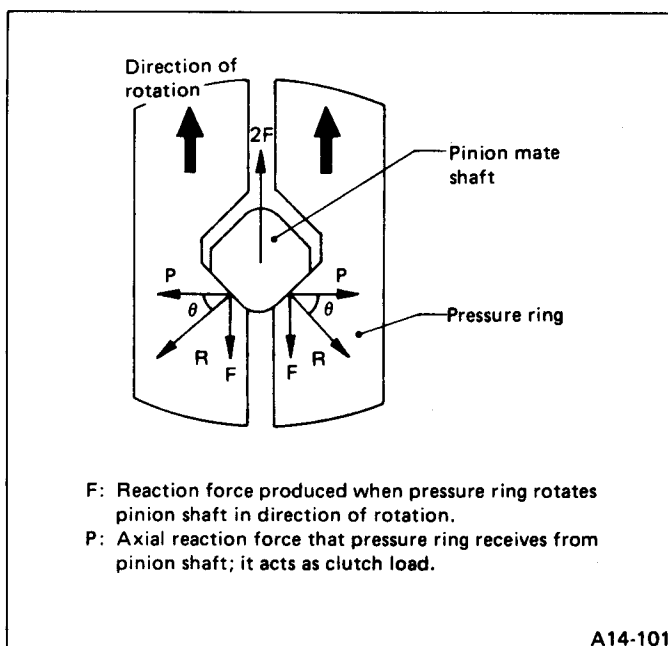


Fig. 4

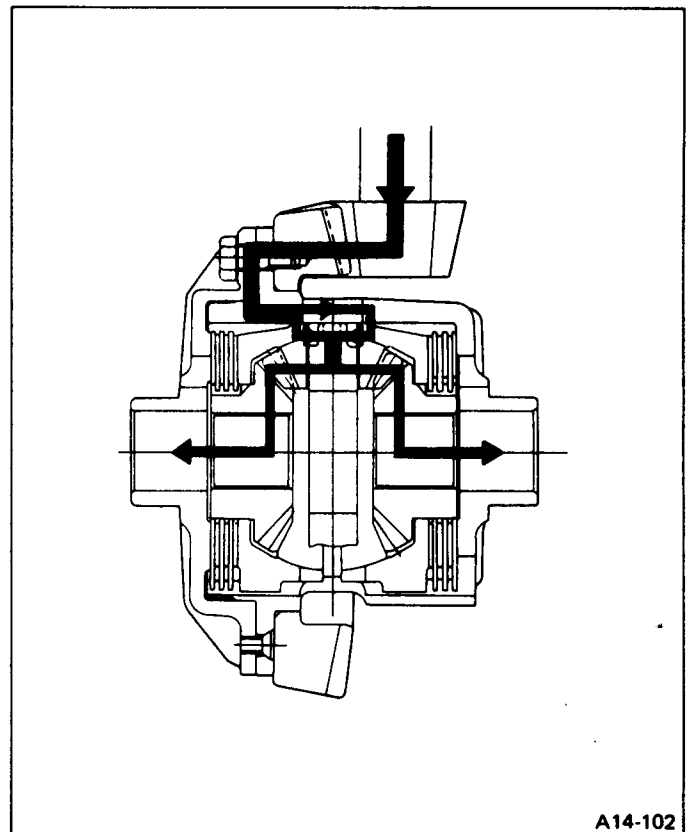


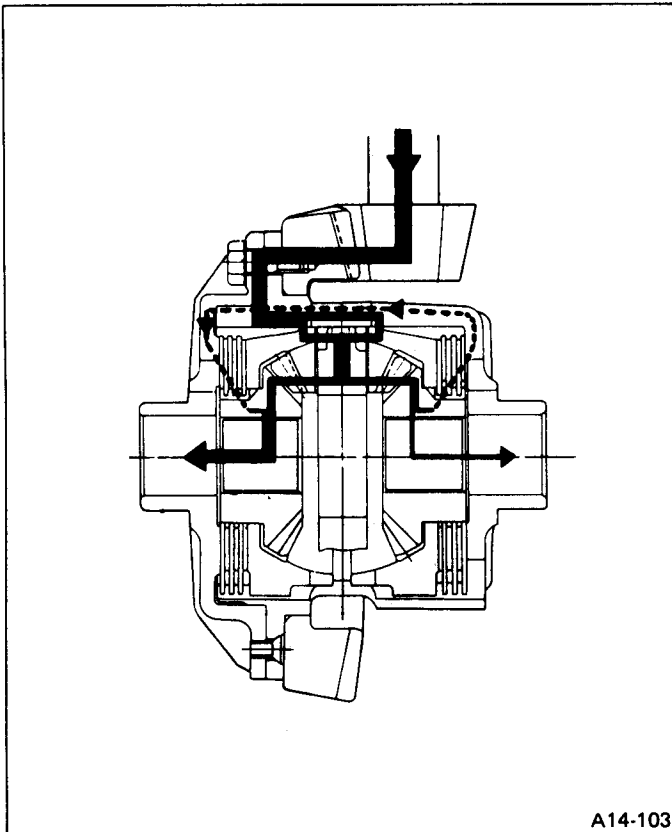
Fig. 5

2) When right and left wheels turn at different speeds

In conventional differentials, if one wheel slips in the mud, it causes a considerable decrease in the friction between the wheel and road surface and therefore in the transfer torque.

The conventional differential always delivers the same amount of torque to each wheel. If one wheel slips, the other wheel loses driving torque.

On the other hand, in the limited slip differential, if the right wheel slips, as shown in Fig. 6, the right side gear tends to turn faster than the differential case. However, because the clutch holds the right side gear in a braked state, a portion of torque is transmitted from the right side gear to the differential case through the clutch, as shown by the broken line. In the other nonslipping wheel, while the left side gear rotates at low speed, the differential case turns at high speed. Thus, torque is delivered from the differential case to the left side gear through the clutch.



A14-103

Fig. 6

As a result, in addition to the torque delivered to the left side gear from the pinions, an additional amount of torque is transmitted to the left side gear which flows from the right side gear via the clutch, differential case, left clutch and left side gear in the order named. Given that torque in the direction in which the differential case turns is plus and that in the reverse direction is minus, the amount of torque delivered to the low-speed wheel, T_L , is calculated by:

$$T_L = (+ \text{ Side gear torque}) + (+ \text{ Clutch torque}) = T_D + T_C$$

The amount of torque delivered to the high-speed wheel, T_S , is given by:

$$T_S = (+ \text{ Side gear torque}) + (- \text{ Clutch torque}) = T_D - T_C$$

Therefore, more torque is transmitted to the slower turning wheel than to the faster wheel.

Torque Ratio of Right to Left Wheels

If one wheel slips, it causes a difference between the slipping and non-slipping wheels in the amount of torque transmitted to them. However, the torque ratio between the two wheels in this case is constant and called a "transfer ratio". This transfer ratio is expressed by the following equation:

$$R_t = \frac{T_L}{T_S}$$

R_t : Transfer ratio

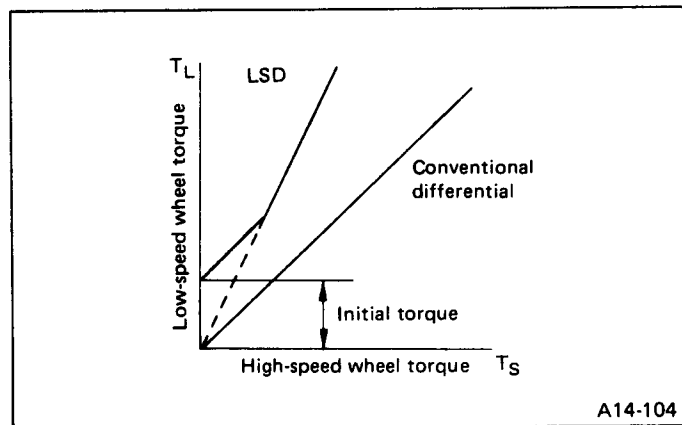
T_L : Low-speed wheel torque

T_S : High-speed wheel torque

Transfer ratio is indicated by a value based on the ratio of the low-speed wheel torque to the high-speed wheel torque.

Because the conventional differential delivers an equal amount of torque to each wheel, the transfer ratio R_t is 1.

In LSD, the transfer ratio, $1 < R_t < \infty$, can be obtained by selecting the clutch coefficient that determines the torque amount of the clutch.



A14-104

Fig. 7

Oil

Use only genuine SUBARU LSD oil to obtain the best performance from the LSD.

SUBARU LSD oil
(Showa Sekiyu LSD oil #90)
Part No. 003304300

Service Procedures for LSD

The component parts of LSD kit (See Fig. 3) are not available as piece parts.

Therefore, it is not recommended to disassemble LSD kit.

SPECIFICATIONS AND SERVICE DATA

SPECIFICATIONS

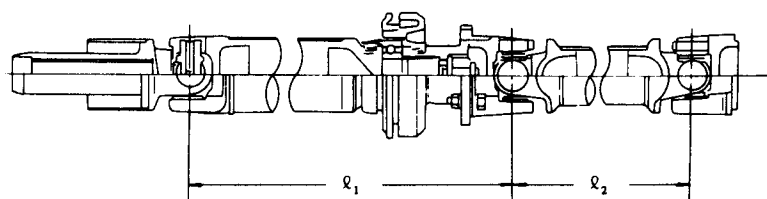
● Rear final reduction gear ratio

Engine model	1800	2700	
		AT	MT
Type of gear	Hypoid		
Gear ratio (Number of gear teeth)	3.700 (37/10)	3.700 (37/10)	3.900 (39/10)

● Propeller shaft

Engine model		1800	2700
Type		Standard 3-joint type	Vibration-proof, 3-joint type
Joint-to-joint length mm (in)	1st shaft, ℓ_1	621 (24.45)	621 (24.45) ... MT 501 (19.72) ... AT
	2nd shaft, ℓ_2	744 (29.29)	
Outside dia. of tube x thickness mm (in)	1st shaft	63.5 x 1.6 (2.500 x 0.063)	
	2nd shaft	50.8 x 2.3 (2.000 x 0.091)	
Sleeve yoke	Type	Involute spline	
	O.D. x No. of teeth x module	25 mm (0.98 in) x 24 x 1.0	

Standard 3-joint type



L3-075

Fig. 8

Vibration-proof, 3-joint type

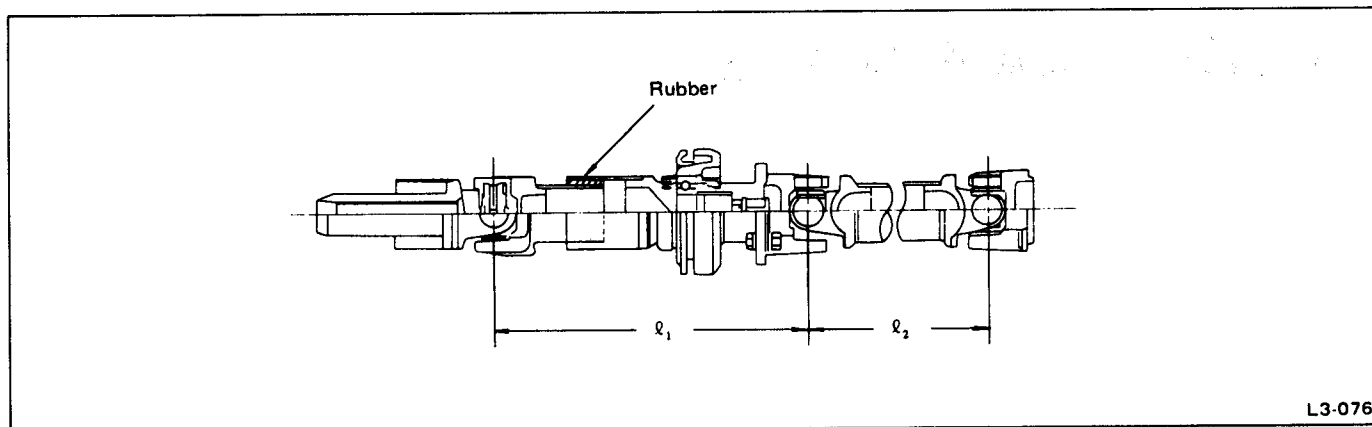


Fig. 9

• Drive shaft

Engine model	Joint size	Shaft dia. D	Distance between boots, L
1800	82AC	22 mm (0.87 in)	223.5 mm (8.80 in)
2700	87AC	22.2 mm (0.874 in)	223.2 mm (8.79 in)

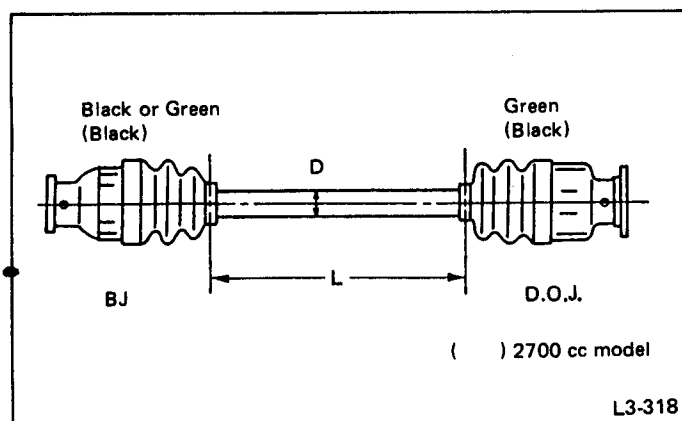


Fig. 10

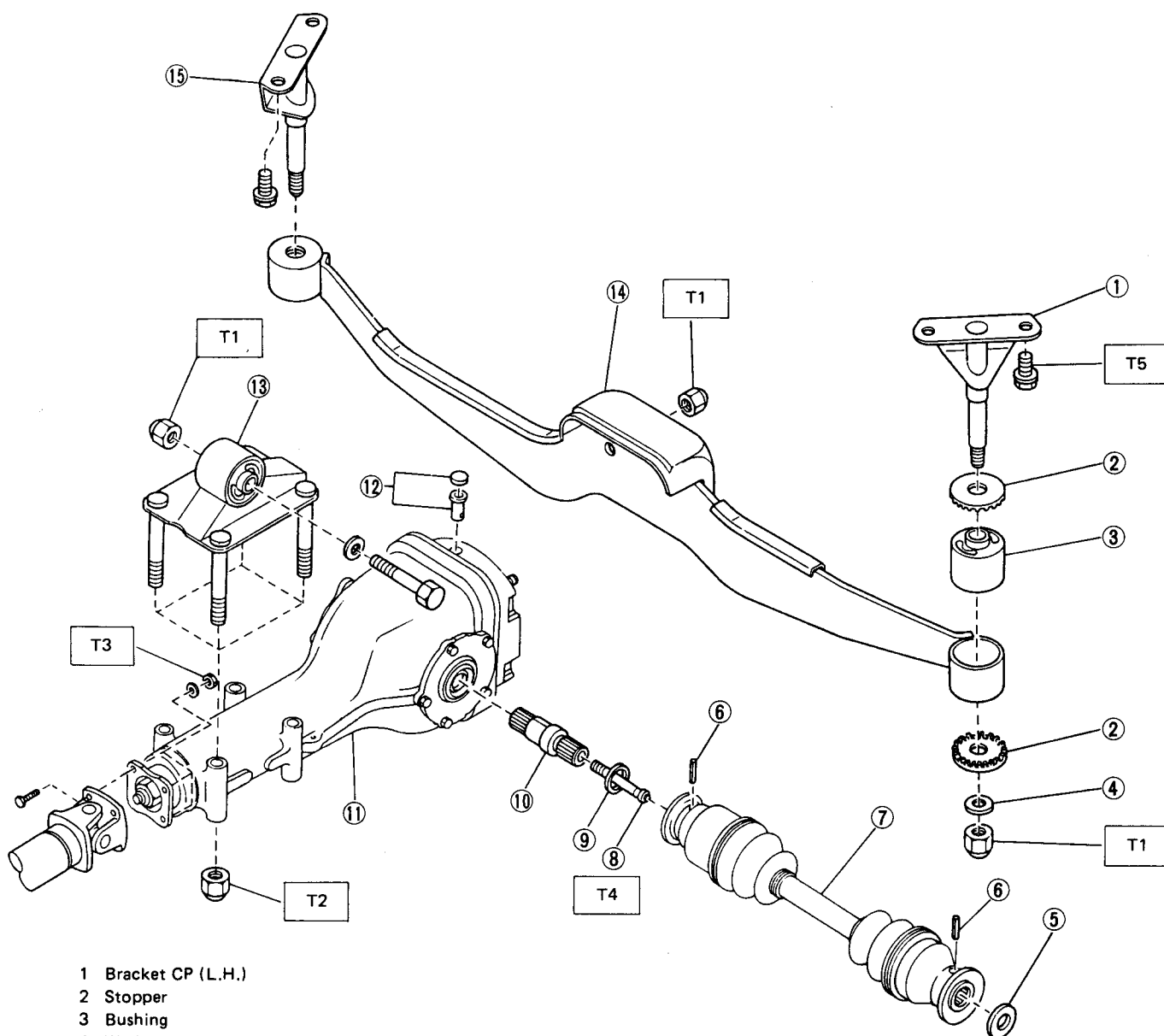
SERVICE DATA

Rear differential	Front & rear bearing preload at companion flange bolt hole	New bearing	19.6 – 28.4 N (2.0 – 2.9 kg, 4.4 – 6.4 lb)
		Used bearing	8.34 – 16.67 N (0.85 – 1.7 kg, 1.87 – 3.75 lb)
	Preload adjusting washer length	Part No.	
		383705200	2.59 mm (0.1020 in)
		383715200	2.57 mm (0.1012 in)
		383725200	2.55 mm (0.1004 in)
		383735200	2.53 mm (0.0996 in)
		383745200	2.51 mm (0.0988 in)
		383755200	2.49 mm (0.0980 in)
		383765200	2.47 mm (0.0972 in)
		383775200	2.45 mm (0.0965 in)
		383785200	2.43 mm (0.0957 in)
		383795200	2.41 mm (0.0949 in)
		383805200	2.39 mm (0.0941 in)
		383815200	2.37 mm (0.0933 in)
		383825200	2.35 mm (0.0925 in)
		383835200	2.33 mm (0.0917 in)
		383845200	2.31 mm (0.0909 in)
	Preload adjusting spacer length	Part No.	
		383695201	56.2 mm (2.213 in)
		383695202	56.4 mm (2.220 in)
		383695203	56.6 mm (2.228 in)
		383695204	56.8 mm (2.236 in)
		383695205	57.0 mm (2.244 in)
		383695206	57.2 mm (2.252 in)
	Pinion height adjusting washer thickness	Part No.	
		383495200	3.09 mm (0.1217 in)
		383505200	3.12 mm (0.1228 in)
		383515200	3.15 mm (0.1240 in)
		383525200	3.18 mm (0.1252 in)
		383535200	3.21 mm (0.1264 in)
		383545200	3.24 mm (0.1276 in)
		383555200	3.27 mm (0.1287 in)
		383565200	3.30 mm (0.1299 in)
		383575200	3.33 mm (0.1311 in)
		383585200	3.36 mm (0.1323 in)
		383595200	3.39 mm (0.1335 in)
		383605200	3.42 mm (0.1346 in)
		383615200	3.45 mm (0.1358 in)
		383625200	3.48 mm (0.1370 in)

Rear differential (continued)		383635200	3.51 mm (0.1382 in)
		383645200	3.54 mm (0.1394 in)
		383655200	3.57 mm (0.1406 in)
		383665200	3.60 mm (0.1417 in)
		383675200	3.63 mm (0.1429 in)
		383685200	3.66 mm (0.1441 in)
	Side gear to thrust washer clearance		0.1 – 0.2 mm (0.004 – 0.008 in)
	Side gear thrust washer thickness	Part No.	
		383445201	0.75 – 0.80 mm (0.0295 – 0.0315 in)
		383445202	0.80 – 0.85 mm (0.0315 – 0.0335 in)
		383445203	0.85 – 0.90 mm (0.0335 – 0.0354 in)
	Side bearing standard width		20.00 mm (0.7874 in)
	Side bearing retainer shim thickness	Part No.	
		383475201	0.20 mm (0.0079 in)
		383475202	0.25 mm (0.0098 in)
		383475203	0.30 mm (0.0118 in)
		383475204	0.40 mm (0.0157 in)
		383475205	0.50 mm (0.0197 in)
	Drive gear to drive pinion backlash		0.10 – 0.20 mm (0.0039 – 0.0079 in)
	Drive gear runout on its back surface	Limit	0.05 mm (0.0020 in)
	Oil capacity		0.8ℓ (1.7 US pt, 1.4 Imp pt)

COMPONENT PARTS

Rear Differential Mounting System



- 1 Bracket CP (L.H.)
- 2 Stopper
- 3 Bushing
- 4 Washer
- 5 Packing
- 6 Spring pin
- 7 Drive shaft ASSY
- 8 Bolt CP
- 9 Packing
- 10 Spindle
- 11 Differential ASSY
- 12 Breather cap
- 13 Bracket ASSY
- 14 Differential mount member ASSY
- 15 Bracket CP (R.H.)

Tightening torque: N·m (kg·m, ft·lb)

- T1: 69 – 78 (7 – 8, 51 – 58)
 T2: 44 – 54 (4.5 – 5.5, 33 – 40)
 T3: 24 – 32 (2.4 – 3.3, 17 – 24)
 T4: 31 – 36 (3.2 – 3.7, 23 – 27)
 T5: 39 – 49 (4 – 5, 29 – 36)

Fig. 11

Propeller Shaft and Drive Shaft

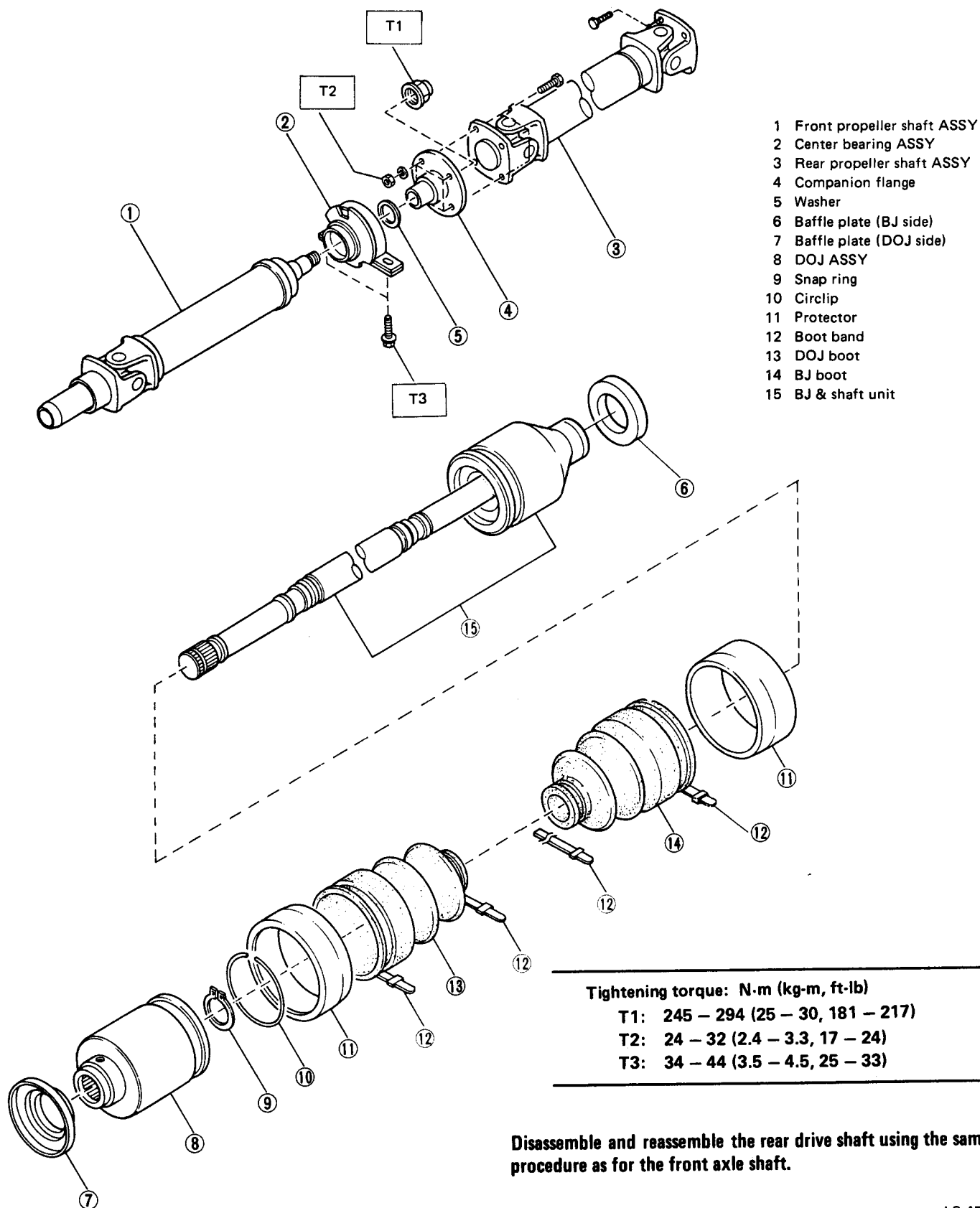
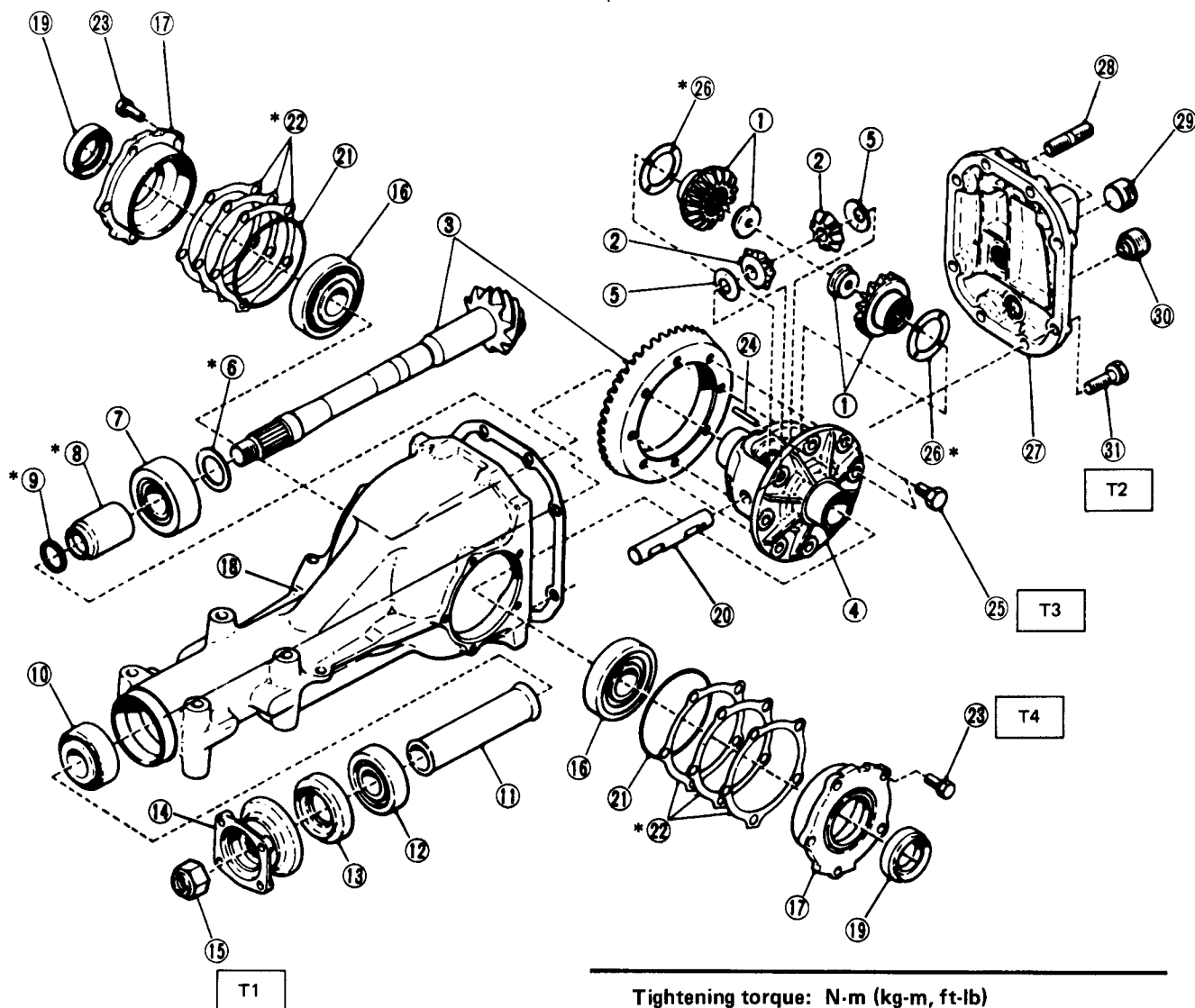


Fig. 12

Disassemble and reassemble the rear drive shaft using the same procedure as for the front axle shaft.

Rear Differential Assembly

* Selective parts



Tightening torque: N·m (kg·m, ft·lb)

T1: 167 – 196 (17.0 – 20.0, 123 – 145)

T2: 19 – 25 (1.9 – 2.6, 14 – 19)

T3: 93 – 113 (9.5 – 11.5, 69 – 83)

T4: 9 – 12 (0.9 – 1.2, 6.5 – 8.7)

- 1 Side gear
- 2 Pinion mate gear
- 3 Pinion crown gear set
- 4 Differential case
- 5 Pinion mate gear washer
- *6 Pinion height adjusting washer
- 7 Rear bearing
- *8 Bearing preload adjusting spacer
- *9 Bearing preload adjusting washer
- 10 Front bearing
- 11 Spacer

- 12 Pilot bearing
- 13 Front oil seal
- 14 Companion flange
- 15 Self-locking nut
- 16 Side bearing
- 17 Side bearing retainer
- 18 Differential carrier
- 19 Side oil seal
- 20 Pinion mate shaft
- 21 Side bearing retainer O-ring
- *22 Side bearing retainer shim

- 23 Bolt (8x20x14 mm)
- 24 Pinion shaft lock pin
- 25 Bolt (11x18x11 mm)
- *26 Side gear thrust washer
- 27 Rear cover
- 28 Stud bolt
- 29 Plug
- 30 Plug CP
- 31 Bolt (10x30x18 mm)

Fig. 13

L3-848

SERVICE PROCEDURE

Propeller Shaft

Check the following points with propeller shaft installed in vehicle.

1) Joints and connections

Check for looseness.

2) Splines and bearing locations

(1) Turn propeller shaft by hand to see if abnormal free play exists at splines. Also move yokes to see if abnormal free play exists at spiders and bearings.

(2) Turn rear wheels by hand to check for "runout" of propeller shaft.

REMOVAL

1) Remove the four bolts which hold propeller shaft to rear differential.

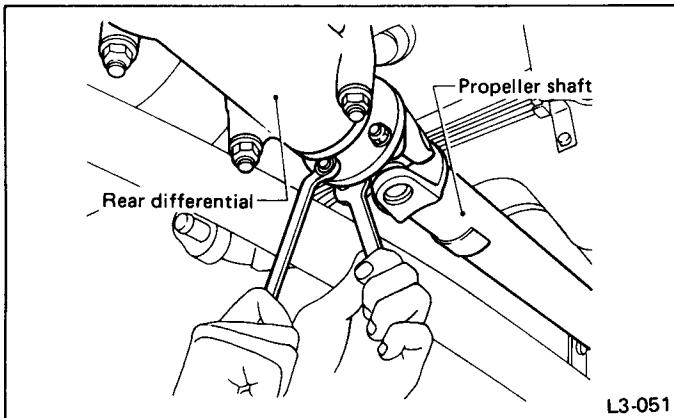


Fig. 14

2) Remove the two bolts which hold center bearing to car body.

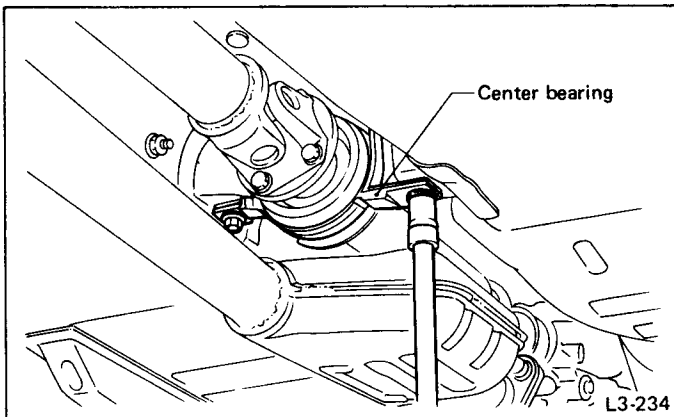


Fig. 15

3) Remove propeller shaft from transmission.

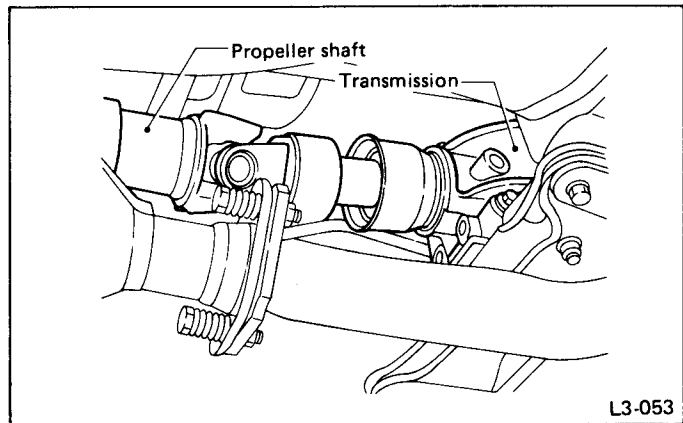


Fig. 16

a. Be sure to use an empty oil can to catch oil flowing out when removing propeller shaft.

b. Be sure not to damage oil seals and the frictional surface of sleeve yoke.

c. Be sure to plug the opening in transmission after removal of propeller shaft.

DISASSEMBLY

Before removing center bearing, check its condition. If it does not operate smoothly or if there is any free play or leakage, remove as follows:

1) Put aligning marks on affected parts.

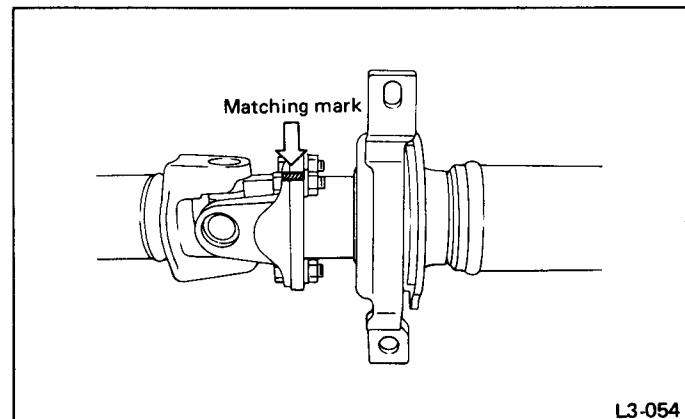


Fig. 17

2) Remove bolts which hold front propeller shaft to rear propeller shaft.

- 3) Place companion flange in a vise and remove stake nut.

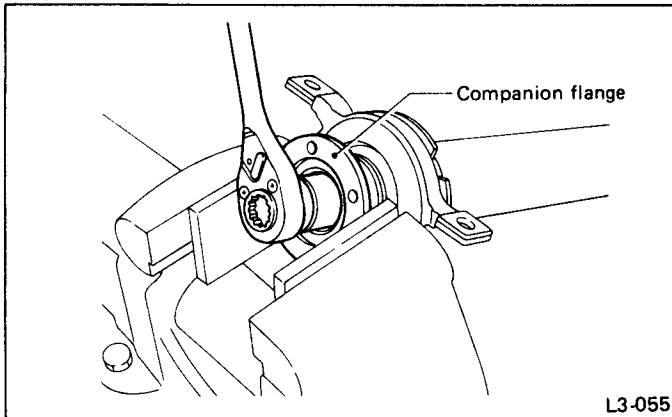


Fig. 18

Be sure not to hold propeller shaft pipe portion in the vise.

- 4) Drive out companion flange with a puller or press.

Before disassembling, put aligning mark on affected parts.

- 5) Lightly tap the head of front shaft with a copper hammer until center bearing is removed.

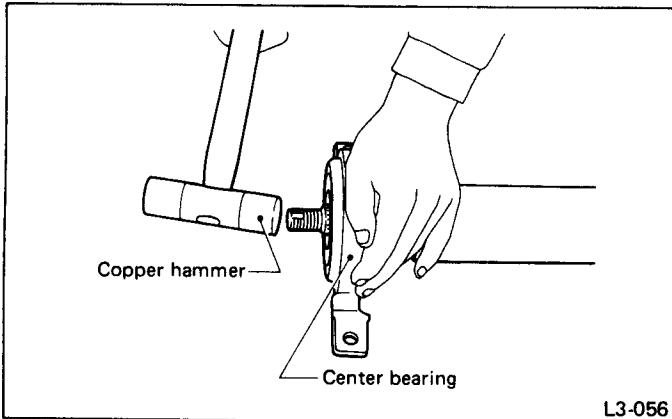


Fig. 19

Be careful not to damage the thread portion.

INSPECTION

Check the following and replace faulty parts if necessary.

- Tube surfaces for dents or cracks
- Splines for deformation or abnormal wear
- Tubes for runout exceeding 0.6 mm (0.024 in)

Measure runout with a dial gauge at the center of front and rear shaft tubes.

- Joints for unsmooth operation or abnormal noise
- Center bearing for free play, noise or unsmooth operation
- Oil seals for abnormal wear or damage

INSTALLATION

- 1) Install center bearing onto front propeller shaft.
- 2) Install washer to center bearing.

Apply a coat of grease to both surfaces of washer before installation.

Recommended grease:

Molybdenum disulfide grease

- 3) Align marks and install companion flange.
- 4) Tighten stake nut until center bearing is set in position.

Be sure to install new stake nut.

Tightening torque:

245 – 294 N·m (25 – 30 kg·m, 181 – 217 ft-lb)

Stake the nut after tightening.

- 5) Align marks and connect front and rear shafts.

Tightening torque:

24 – 32 N·m (2.4 – 3.3 kg·m, 17 – 24 ft-lb)

- 6) Insert sleeve yoke into transmission and attach center bearing to car body.

Tightening torque:

34 – 44 N·m (3.5 – 4.5 kg·m, 25 – 33 ft-lb)

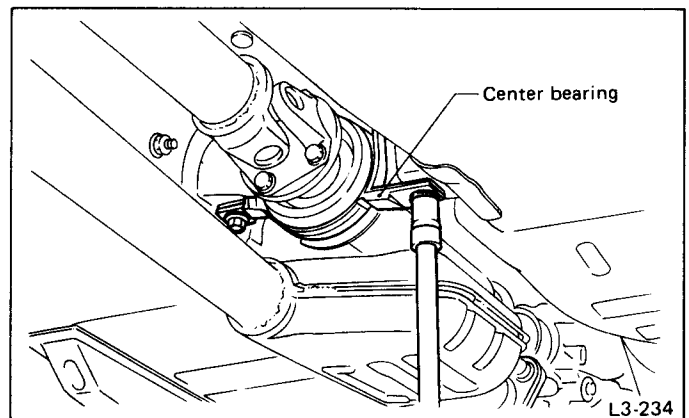


Fig. 20

- 7) Connect flange yoke and rear differential.

Tightening torque:

24 – 32 N·m (2.4 – 3.3 kg·m, 17 – 24 ft·lb)

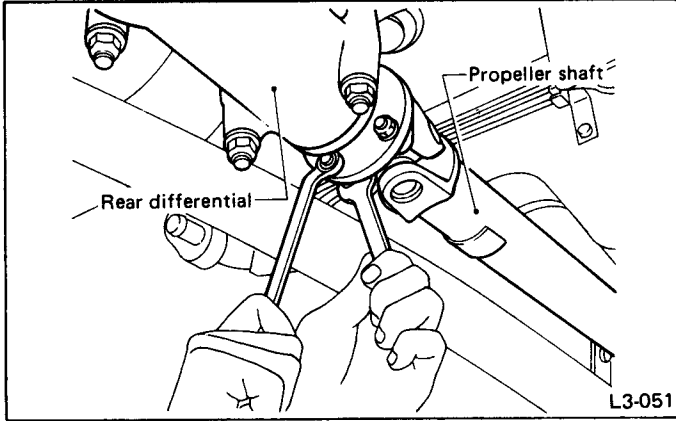


Fig. 21

- 5) Remove self-locking nut while holding companion flange with FLANGE WRENCH (398427700).

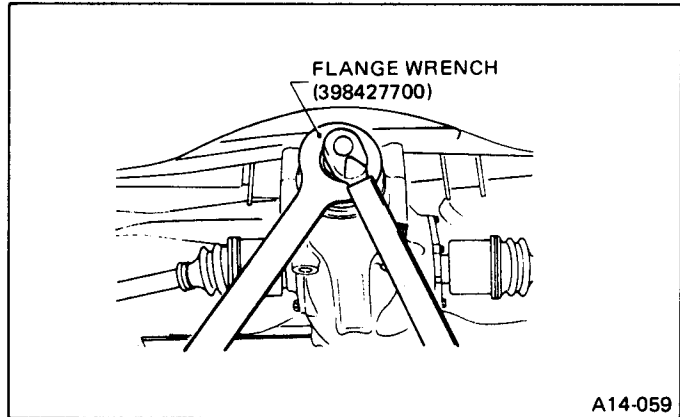


Fig. 23

- 6) Extract companion flange with a puller.

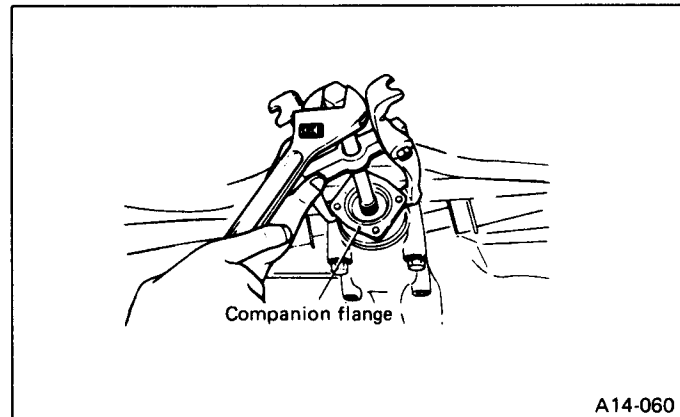


Fig. 24

On-Car Services

REPLACING FRONT OIL SEAL

- 1) Drain gear oil.
- 2) Jack up rear wheels and support the vehicle body with rigid racks.
- 3) Detach propeller shaft from companion flange.
- 4) Measure turning resistance of companion flange.

Measure turning resistance after making sure that the companion flange turns smoothly.

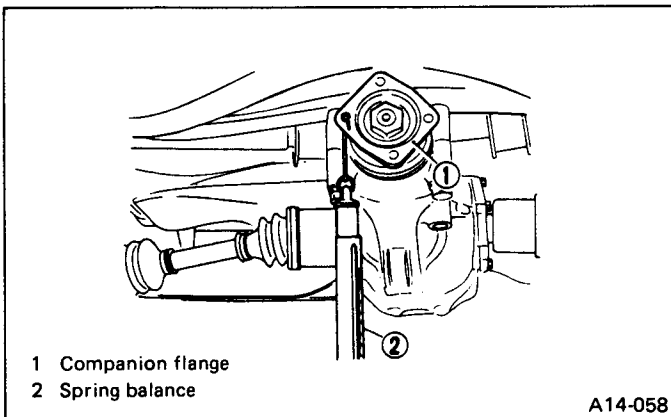


Fig. 22

- 7) Remove oil seal.

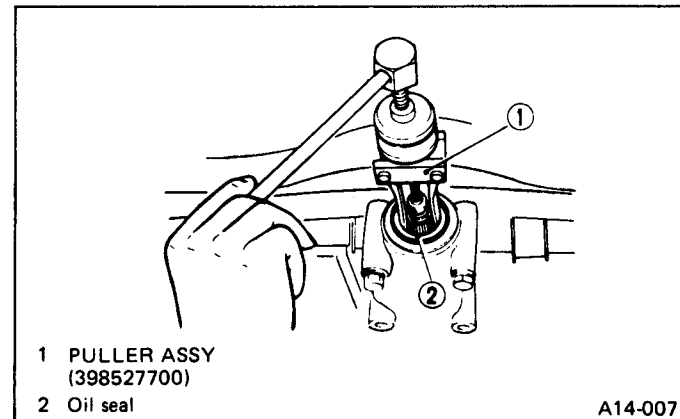


Fig. 25

- 8) Fit a new oil seal.

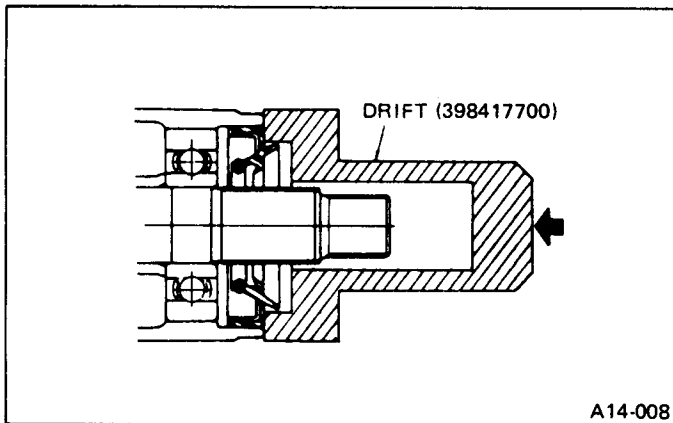


Fig. 26

- 9) Install companion flange.
 10) 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)

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

REPLACING SIDE OIL SEAL

- 1) Remove two bolts which fix the upper portion of shock absorber to the body in unladen condition.
- 2) Loosen both wheel nuts.
- 3) Jack up the vehicle and support it with rigid racks.
- 4) Remove wheels.
- 5) Drive out spring pins of BJ and DOJ by using 6 mm (0.24 in) diameter of steel rod.

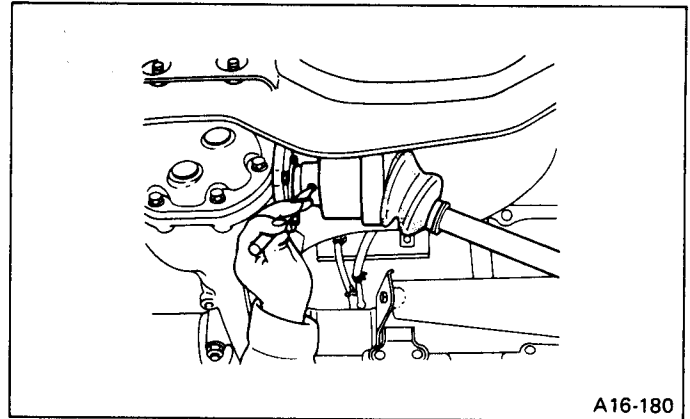


Fig. 27

- 6) Detach BJ from spindle of trailing arm with trailing arm lowered fully and detach DOJ from differential spindle and then remove drive shaft ASSY.
- 7) Loosen differential spindle set bolt by using WRENCH (925560000) and remove spindle with packing.
- 8) Remove oil seal.

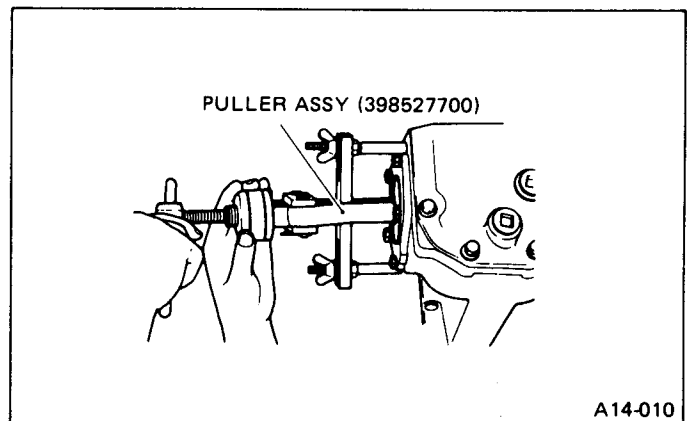


Fig. 28

- 9) Drive in a new oil seal with DRIFT (398437700)

Apply chassis grease between the oil seal lips.

- 10) Reassembling procedure hereafter is the reverse of the disassembly.

IDENTIFICATION OF REAR DIFFERENTIALS

Using the different rear differential ASSY causes the drive line and tires to "drag" or emit abnormal noise when 4WD is selected.

When replacing a rear differential ASSY, select the correct one according to the following table.

Gear ratio	Identification mark	Part number	Label stuck on rear differential
3.700	WL	722011012	<div> PART NUMBER 722011012 GEAR RATIO 3.700 ● FUJI HEAVY INDUSTRIES LTD. WL </div>
3.700 (With LSD)	WM	722011002	<div> LSD GEAR RATIO 3.700 PART NO. 722011002 デフオイルは SAE 75W LSDオイル を0.8ℓ注入して下さい。 [use SUBARU LSD OIL] capacity 0.8ℓ (1.7 uspt 1.4 imppt) ● FUJI HEAVY INDUSTRIES LTD. WM </div>
* 3.900	WP	622006022	<div> PART NUMBER 622006022 GEAR RATIO 3.900 ● FUJI HEAVY INDUSTRIES LTD. WP </div>
* 3.900 (With LSD)	WR	22011GA022	<div> LSD GEAR RATIO 3.900 PART NO. 22011GA022 デフオイルは SAE 75W LSDオイル を0.8ℓ注入して下さい。 [use SUBARU LSD OIL] capacity 0.8ℓ (1.7 uspt 1.4 imppt) ● FUJI HEAVY INDUSTRIES LTD. WR </div>

* 2700 cc model

Fig. 29

Location of painted
identification code

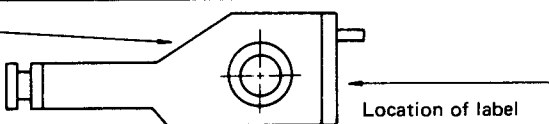


Fig. 30

L3-059

Location of label

L3-849

GEAR RATIOS OF REAR DIFFERENTIALS

Engine model	MT	AT	Rear differential
1800	3.700	3.700	WL or WM
2700	3.900	3.700	WL, WM, WP or WR

If the painted identification code cannot be read clearly or if the label is torn off, its type can be determined as follows:

CHECKING FOR LSD OR NON-LSD

1) Set the selective 4WD and full-time 4WD (AT) models in the FWD mode. Turn the diff. lock switch of the full-time 4WD (MT) model to OFF.

To set the full-time 4WD (AT) model in the FWD mode, install a spare fuse in the FWD fuse holder located in front of the strut on the left side of the engine compartment.

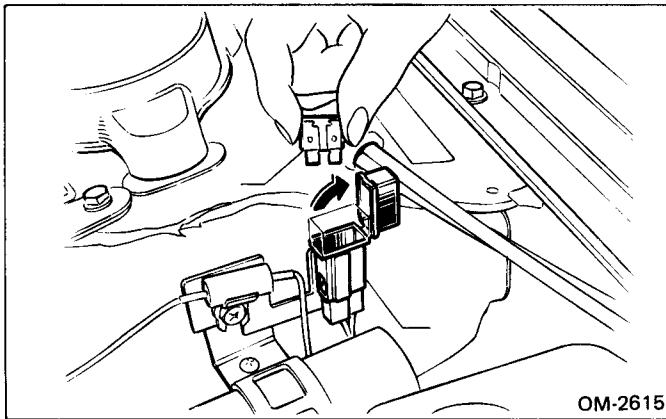


Fig. 31

- 2) Raise one or both rear wheels with a jack.
- 3) Manually turn tire to check for rotating condition of tire.
 - When one wheel is raised:
 - Tire turns smoothly Non-LSD
 - Tire turns but requires considerable effort LSD
 - When both wheels are raised:
 - Both tires turn in opposite direction to each other Non-LSD
 - Both tires turn in the same direction LSD

CHECKING FOR GEAR RATIOS

Work procedures differ between LSD and non-LSD, as follows:

1) LSD

- (1) Set the selective 4WD and full-time 4WD (AT) models in the FWD mode. Turn the diff. lock switch of the full-time 4WD (MT) model to OFF.

To set the full-time 4WD (AT) model in the FWD mode, install a spare fuse in the FWD fuse holder located in front of the strut on the left side of the engine compartment.

- (2) Raise both rear wheels, not one wheel.
- (3) Mark both tire and propeller shaft with a piece of chalk so that the number of tire rotations can be counted.
- (4) Slowly and exactly turn the tire ten complete rotations to see how many turns the propeller shaft makes. If propeller shaft makes 37 turns, gear ratio is 3.700. If it makes 39 turns, gear ratio is 3.900.

2) Non-LSD

- (1) Set the selective 4WD and full-time 4WD (AT) models in the FWD mode. Turn the diff. lock switch of the full-time 4WD (MT) model to OFF.

To set the full-time 4WD (AT) model in the FWD mode, install a spare fuse in the FWD fuse holder located in front of the strut on the left side of the engine compartment.

- (2) Raise only right rear wheel. (If both left and right wheels are raised, keep the left one stationary.)
- (3) Mark the tire's lowest position and the propeller shaft with a piece of chalk so that the number of tire rotations can be counted exactly.
- (4) Slowly turn the tire clockwise until propeller shaft rotates exactly 6 complete turns. At this point, check the location of the chalk mark on the tire. If the mark is at position "A" in the figure below, gear ratio is 3.700; if it is at "B", gear ratio is 3.900.

If the above procedures are followed, rear differential can also be identified as to its type and other related information.

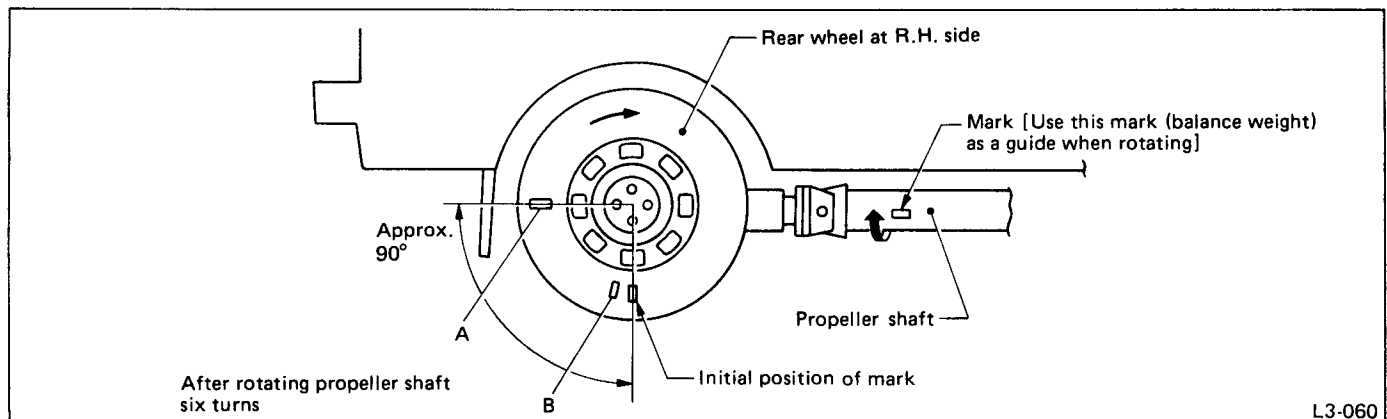


Fig. 32

L3-060

Rear Differential Assembly

DISMOUNTING

- 1) Remove the two bolts which hold the upper end of shock absorber to car body. Car should be in an unloaded condition.
- 2) Loosen wheel nuts on left and right wheels.
- 3) Raise car with a jack and support it with a rigid rack.

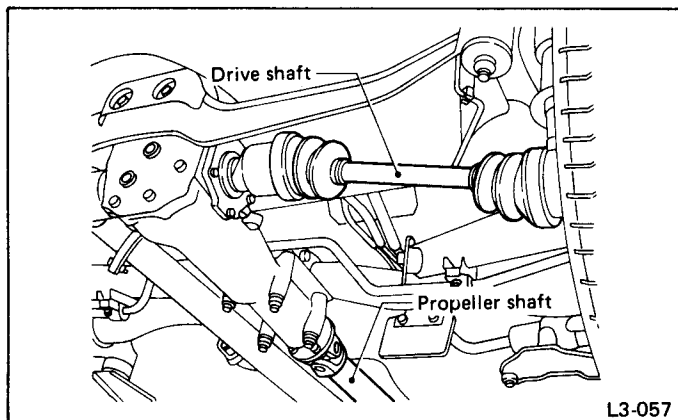


Fig. 33

- 4) Remove wheels.
- 5) Remove spring pins from DOJ and BJ with a 6 mm (0.24 in) diameter of steel rod. Next, lower trailing arm ASSY all the way; remove BJ from spindle on the trailing arm side first, then DOJ on the differential side. Remove drive shaft ASSY.
- 6) Remove propeller shaft ASSY.
 - a. Prepare an oil can and cap since the transmission oil flows out from the extension at removing propeller shaft ASSY.
 - b. When removing propeller shaft ASSY, pay attention not to damage the sliding surfaces of rear drive shaft (extension) spline, oil seal and sleeve yoke.
 - c. Insert the cap into the extension to prevent transmission oil from flowing out immediately after removing the propeller shaft ASSY.
- 7) Support differential assembly with jack and remove two self-locking nuts at the center of differential mount member ASSY.
- 8) Remove four self-locking nuts fixing differential ASSY to bracket ASSY (F).
- 9) Dismount differential ASSY by lowering jack.

DISASSEMBLY

- 1) Inspection before disassembling
To detect real cause of trouble, inspect the following items before disassembling.
(Refer to "ASSEMBLY" for inspection procedures.)
 - (1) Tooth contact of hypoid drive gear and pinion, and backlash.
 - (2) Runout of drive gear at its back surface.
 - (3) Turning resistance of drive pinion.
- 2) Disassembling
 - (1) Set ATTACHMENT (398217700) on vise and install the differential assembly to Attachment.

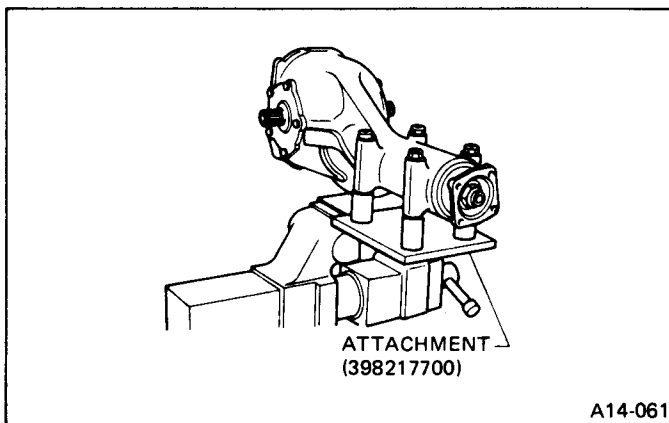


Fig. 34

- (2) Drain gear oil by removing plug.
- (3) Remove spindles by loosening bolts with WRENCH (925560000).
- (4) Remove rear cover by loosening retaining bolts.

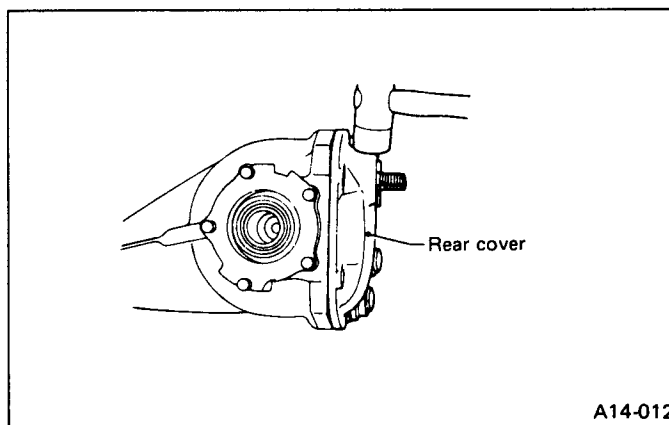


Fig. 35

- (5) Mark right and left side bearing retainers in order to identify them at reassembly. Remove side bearing retainer attaching bolts, set ATTACHMENT (398457700) 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.

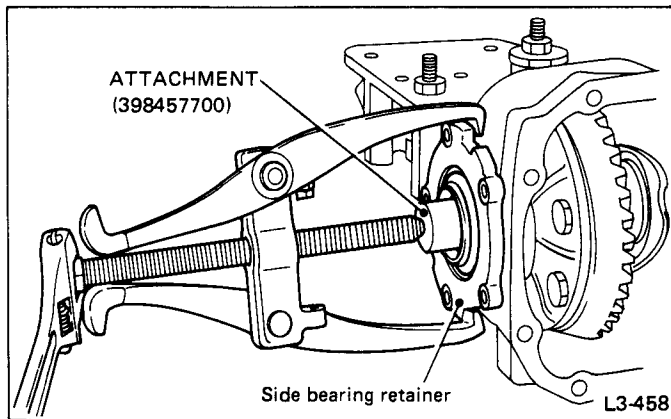


Fig. 36

(6) Pull out differential case.

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

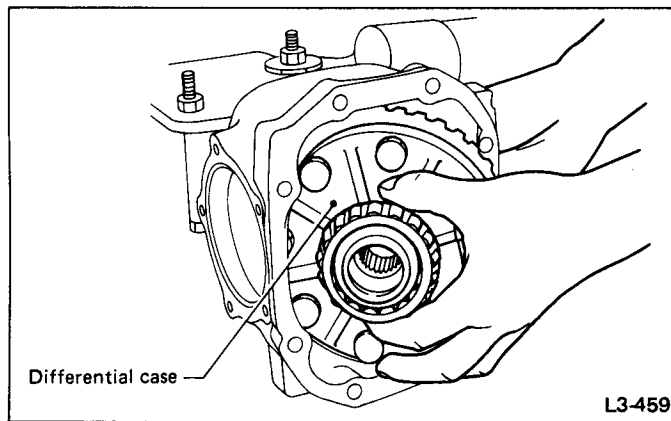


Fig. 37

(7) When replacing side bearing, pull bearing cup from side bearing retainer.

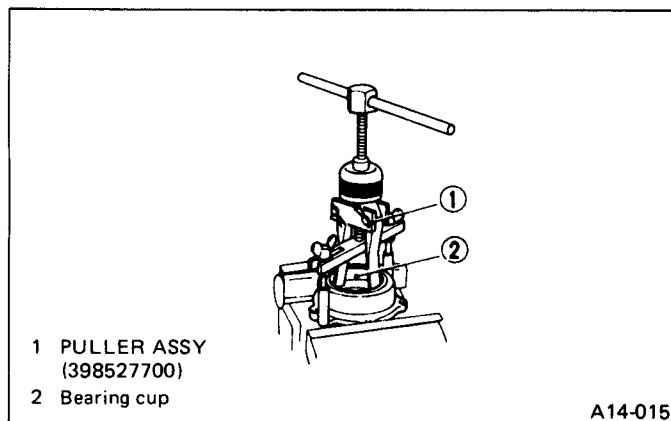


Fig. 38

(8) Extract bearing cone with PULLER SET (399527700).

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.

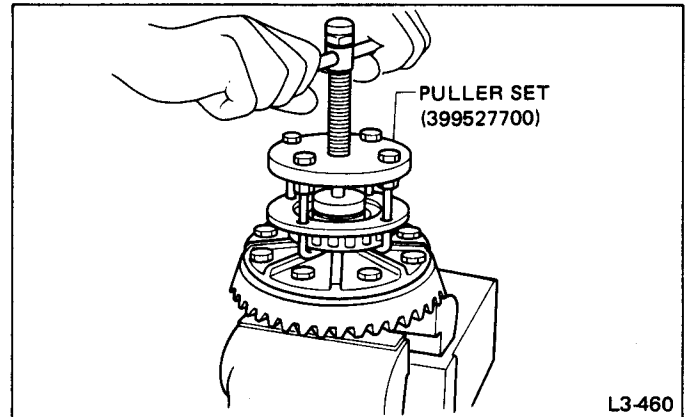


Fig. 39

(9) Remove drive gear by loosening drive gear bolts.

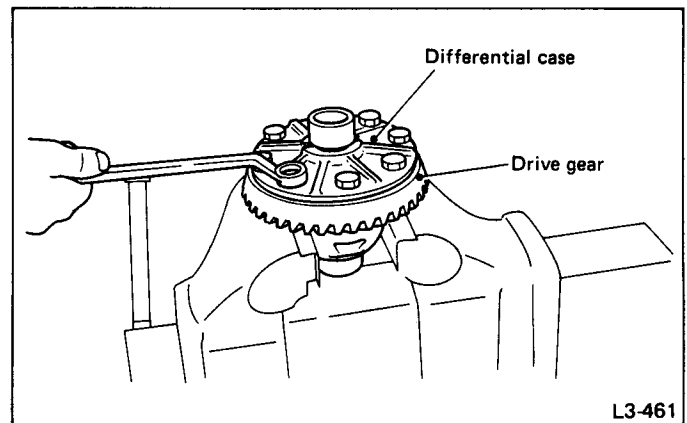


Fig. 40

(10) Drive out pinion shaft lock pin from drive gear side.

The lock pin is staked at the pin hole end on the differential case; do not drive it out forcibly before unstaking it.

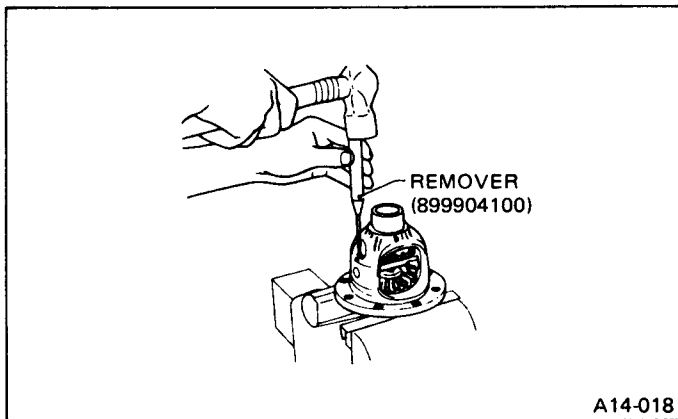


Fig. 41

- (11) Draw out pinion mate shaft and remove pinion mate gears, side gears and thrust washers.

The gears as well as thrust washers should be marked or kept separated left and right, and front and rear.

- (12) Hold companion flange with FLANGE WRENCH (398427700) and remove drive pinion nut.
 (13) Extract the companion flange with a puller.
 (14) 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.

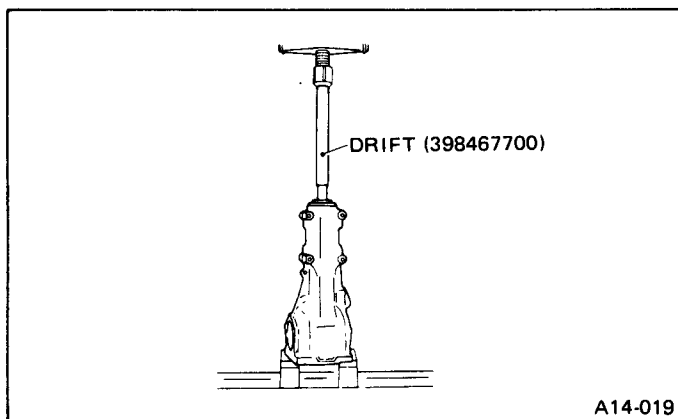


Fig. 42

- (15) Remove rear bearing cone from drive pinion by supporting cone with REPLACER (398517700).

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

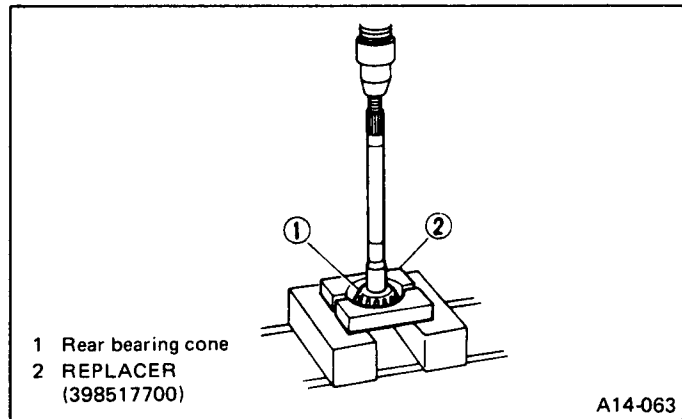


Fig. 43

- (16) Remove front oil seal from differential carrier.
 (17) Remove pilot bearing together with front bearing cone.

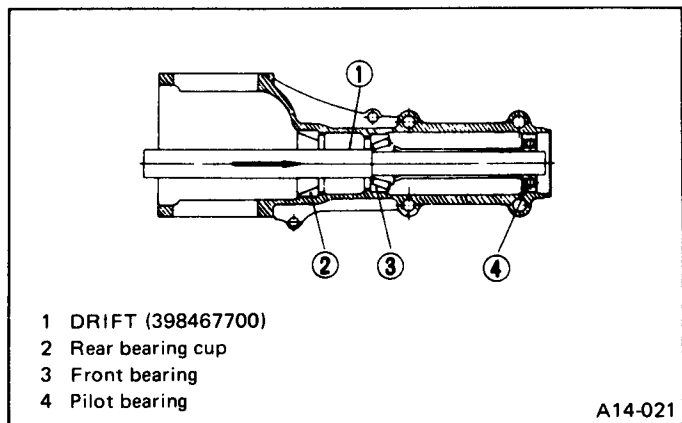


Fig. 44

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

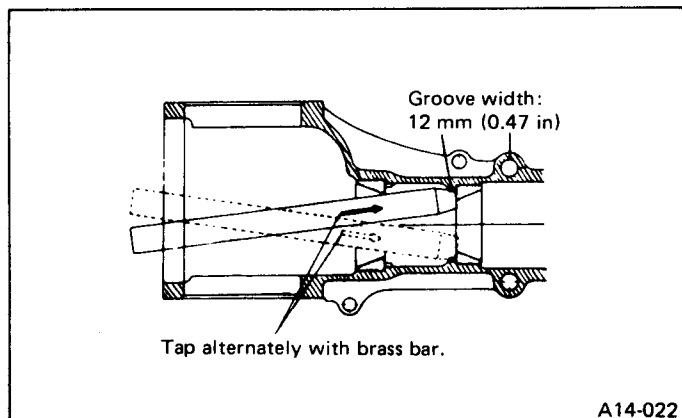


Fig. 45

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) Side gear and pinion mate gear
 - (1) Replace if crack, score, or other defects are evident on tooth surface.
 - (2) Replace if thrust washer contacting surface is worn or seized. Slight damage of the surface can be corrected by oil stone or the like.
- 3) Bearing

Replace if seizure, peeling, wear, rust, dragging during rotation, abnormal noise or other defect is evident.
- 4) Thrust washers of side gear and pinion mate gear

Replace if seizure, flaw, abnormal wear or other defect is evident.
- 5) Oil seal

Replace if deformed or damaged, and at every disassembling.
- 6) Differential carrier

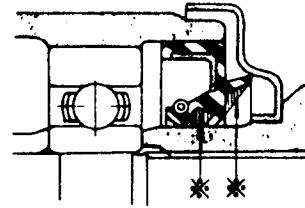
Replace if the bearing bores are worn or damaged.
- 7) Differential case

Replace if its sliding surfaces are worn or cracked.
- 8) Companion flange

Replace if the oil seal lip contacting surfaces have flaws.

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.



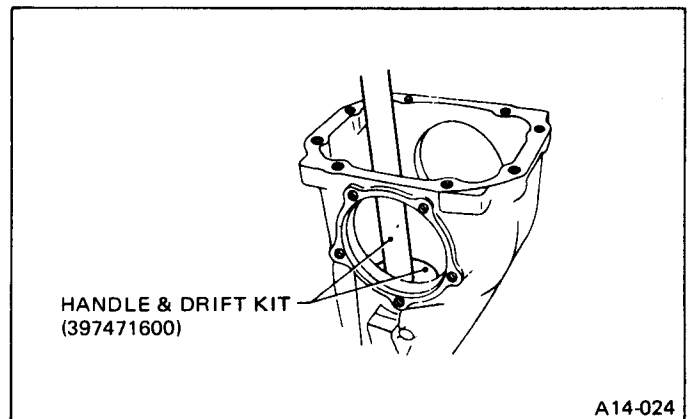
A14-023

Fig. 46

- 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.



A14-024

Fig. 47

- (2) Insert DUMMY SHAFT (398507702) with pinion height adjusting washer and rear bearing cone fitted on it into carrier.

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

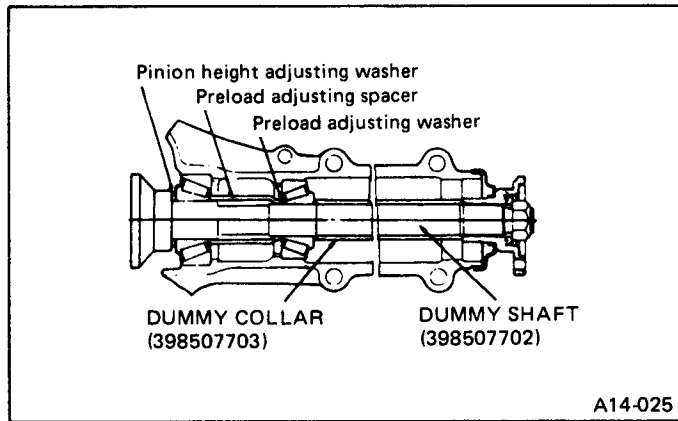


Fig. 48

(3) Then, install preload adjusting spacer and washer, front bearing cone, DUMMY COLLAR (398507703), 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 (398507704) as illustrated here.

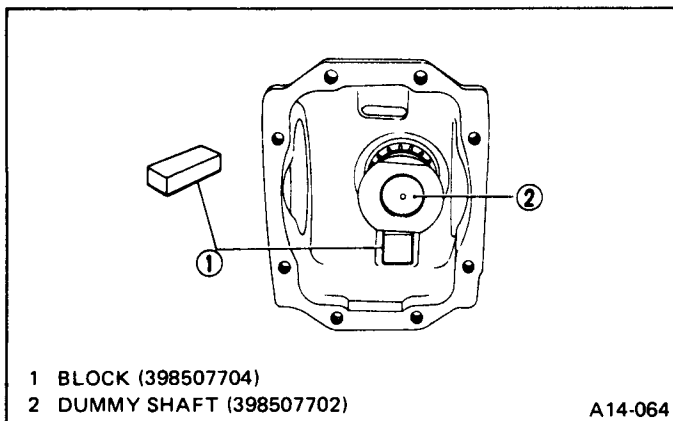


Fig. 49

Torque (Drive pinion nut):
167 – 196 N·m (17.0 – 20.0 kg·m, 123 – 145 ft·lb)

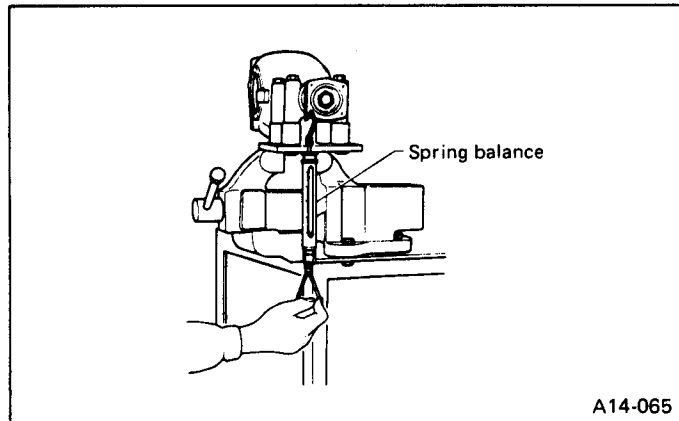


Fig. 50

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 washer

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 spacer

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.

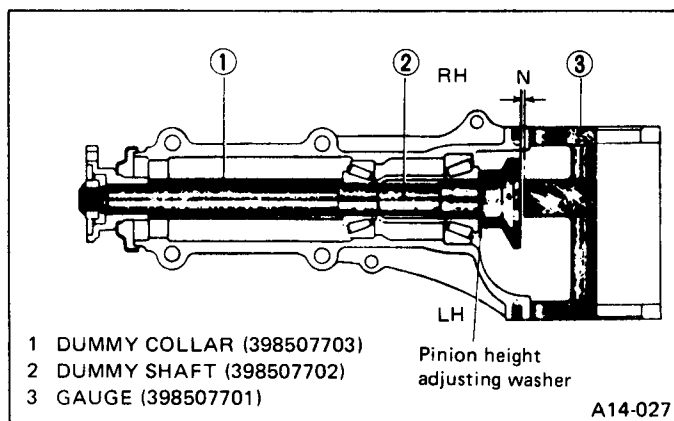


Fig. 51

- (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)

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

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

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

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 (398177700).

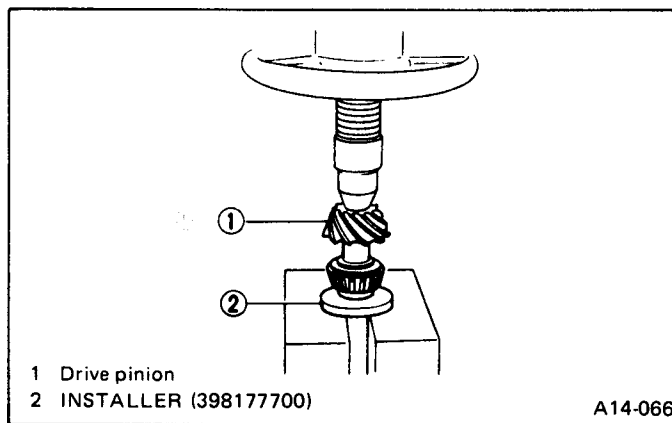


Fig. 52

- 5) Insert drive pinion into differential carrier, install the previously selected preload adjusting spacer and washer.
6) Press-fit front bearing cone into carrier.

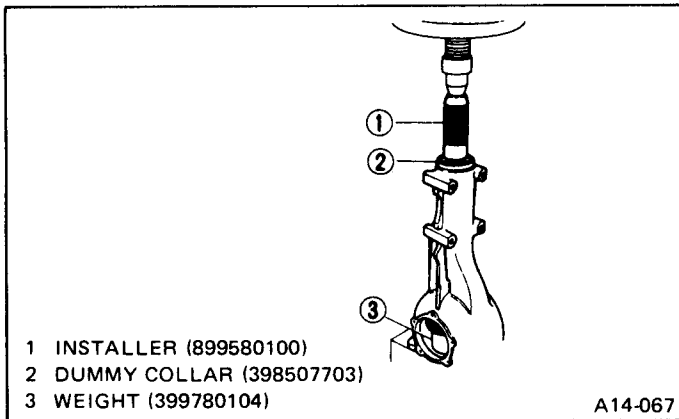


Fig. 53

7) Insert spacer, then press-fit pilot bearing with WEIGHT (399780104) and INSTALLER (899580100).

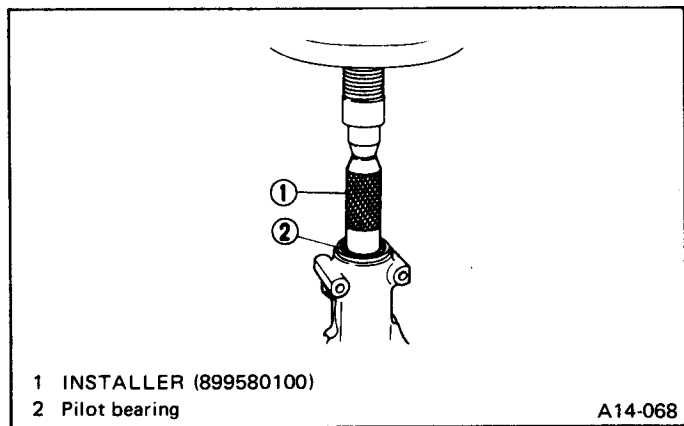


Fig. 54

8) Fit a new oil seal with DRIFT (398417700).

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

9) Press-fit companion flange with INSTALLER (899874100) and WEIGHT (399780104).

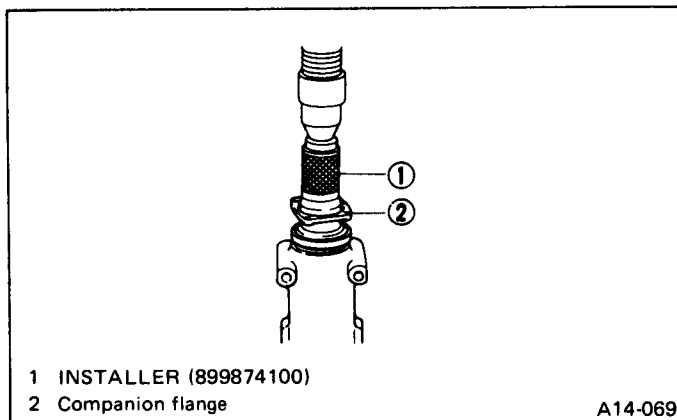


Fig. 55

10) Install self-locking nut.

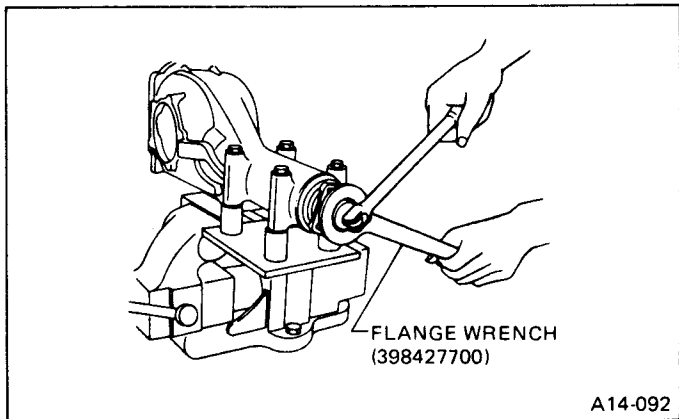


Fig. 56

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 washer

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.

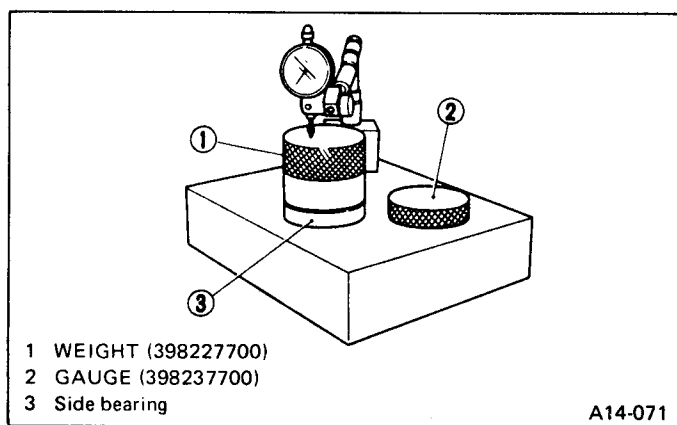
(5) Install drive gear on differential case.

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 (398227700) and GAUGE (398237700).

Standard bearing width:**20.00 mm (0.7874 in)**

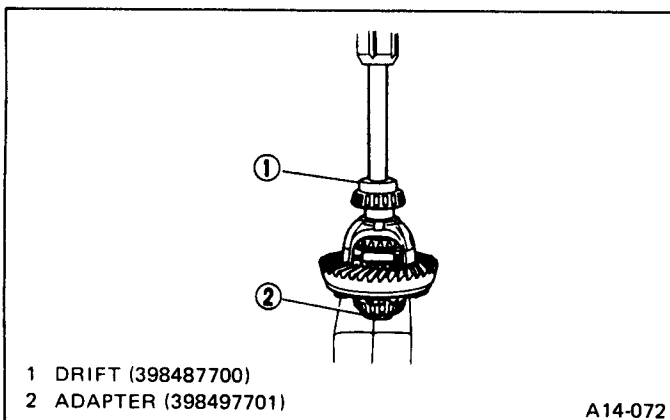
Set the dial gauge needle to zero, using a standard bearing or block of specified height in advance.



A14-071

Fig. 57

13) Press side bearing cone onto differential case with DRIFT (398487700) and ADAPTER (398497701) included in PULLER SET (399527700).



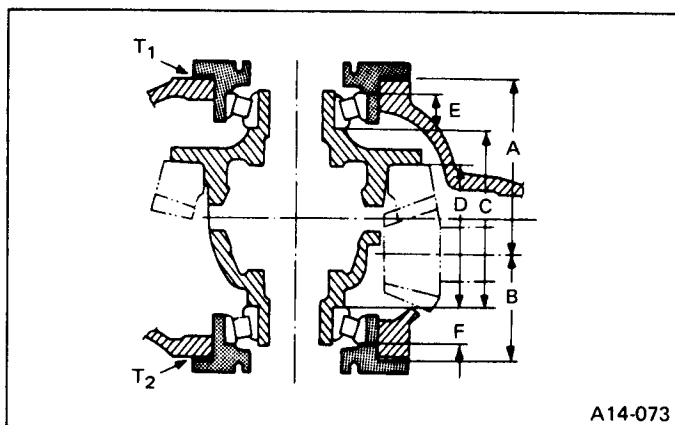
A14-072

Fig. 58

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.



A14-073

Fig. 59

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

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

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

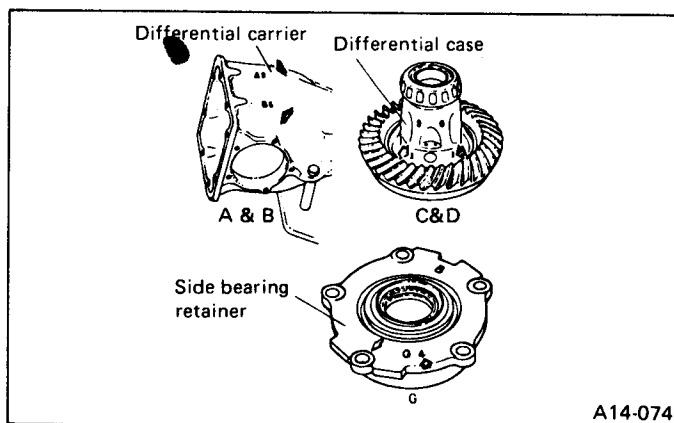
A & B : Number marked on differential carrier.

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.



A14-074

Fig. 60

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, G₁ = 4, G₂ = 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, G₁ = 2, G₂ = 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.

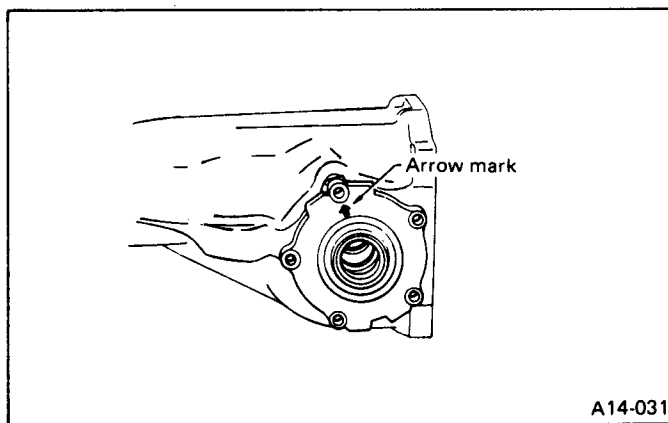


Fig. 61

(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)

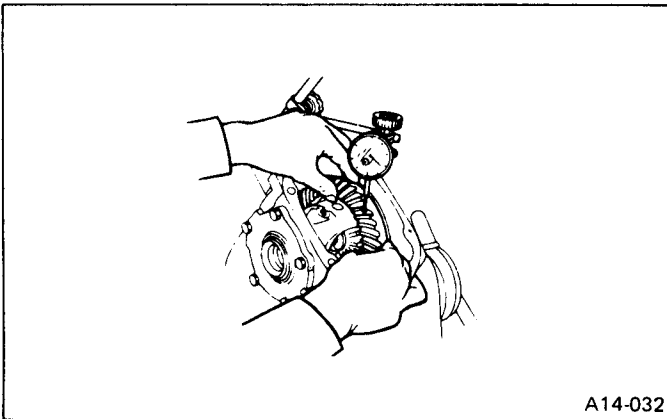


Fig. 62

(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)

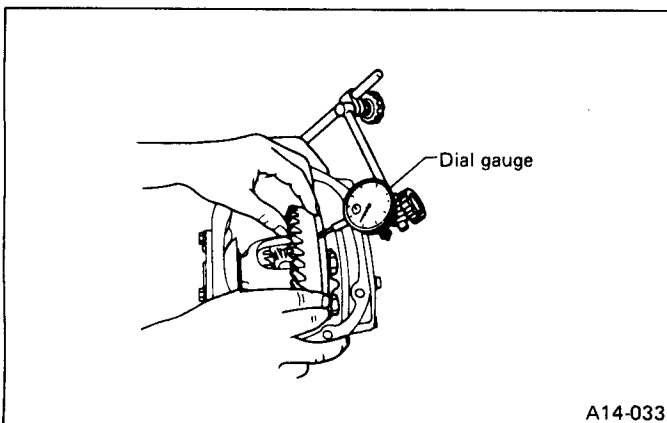


Fig. 63

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)

MOUNTING

1) Raise differential ASSY using a jack. Remount the differential assembly by temporarily tightening four self-locking nuts at the front and two self-locking nuts at the rear.

2) Install other parts in the reverse order of dismounting.

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

Oil capacity:

0.8ℓ (1.7 US pt, 1.4 Imp pt)

TOOTH CONTACT PATTERN

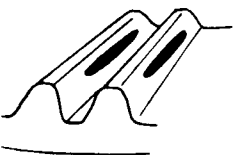

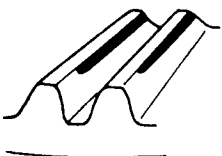
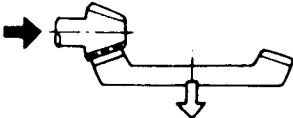

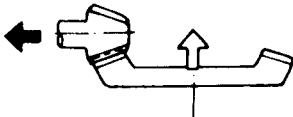

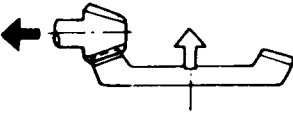

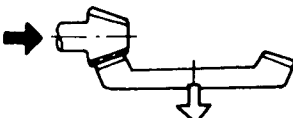
Condition	Contact pattern	Adjustment
<p>Correct tooth contact</p> <p>Tooth contact pattern slightly shifted toward toe under no load rotation. (When loaded, contact pattern moves toward heel.)</p>		
<p>Face contact</p> <p>Backlash is too large.</p>	 <p>This may cause noise and chipping at tooth ends.</p>	 <p>Increase thickness of drive pinion height adjusting washer in order to bring drive pinion closer to drive gear center.</p>
<p>Flank contact</p> <p>Backlash is too small.</p>	 <p>This may cause noise and stepped wear on surfaces.</p>	 <p>Reduce thickness of drive pinion height adjusting washer in order to move drive pinion away from drive gear.</p>
<p>Toe contact</p>	 <p>Contact area is small. This may cause chipping at toe ends.</p>	 <p>Adjust as for flank contact.</p>
<p>Heel contact</p>	 <p>Contact area is small. This may cause chipping at heel ends.</p>	 <p>Adjust as for face contact.</p>

Fig. 64

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TROUBLESHOOTING

Rear Differential

Symptom and possible cause	Remedy
Oil leakage	
<ul style="list-style-type: none"> Worn, scratched, or incorrectly seated front or side oil seal. Scored, battered, or excessively worn sliding surface of companion flange. Clogged or damaged air breather. Loose bolts on differential spindle or side retainer, or incorrectly fitted O-ring. Loose rear cover attaching bolts or damaged gasket. Loose oil filler or drain plug. Wear, damage or incorrectly fitting for spindle, side retainer and oil seal. 	<p>Repair or replace.</p> <p>Clean, repair or replace.</p> <p>Tighten bolts to specified torque. Replace O-ring.</p> <p>Tighten bolts to specified torque. Replace gasket and apply liquid packing.</p> <p>Retighten and apply liquid packing.</p> <p>Repair or replace.</p>
Seizure	
Seized or damaged parts should be replaced, and also other parts should be thoroughly checked for any defect and should be repaired or replaced as required.	
<ul style="list-style-type: none"> Insufficient backlash for hypoid gear. Excessive preload for side, rear, or front bearing. Insufficient or improper oil used. 	<p>Readjust or replace.</p> <p>Readjust or replace.</p> <p>Replace seized part and fill with specified oil to specified level.</p>
Damage	
Damaged parts should be replaced, and also other parts should be thoroughly checked for any defect and should be repaired or replaced as required.	
<ul style="list-style-type: none"> Improper backlash for hypoid gear. Insufficient or excessive preload for side, rear, or front bearing. Excessive backlash for differential gear. Loose bolts and nuts such as drive gear bolt. Damage due to overloading. 	<p>Replace.</p> <p>Readjust or replace.</p> <p>Replace gear or thrust washer.</p> <p>Retighten.</p> <p>Replace.</p>
Noises when starting or shifting gears	
Noises may be caused by differential ASSY, universal joint, wheel bearing, etc. Find out what is actually making noise before disassembly.	
<ul style="list-style-type: none"> Excessive backlash for hypoid gear. Excessive backlash for differential gear. Insufficient preload for front or rear bearing. Loose self-locking nut. Loose bolts and nuts such as side bearing retainer attaching bolt. 	<p>Readjust.</p> <p>Replace gear or thrust washer.</p> <p>Readjust.</p> <p>Tighten to specified torque.</p> <p>Tighten to specified torque.</p>

Symptom and Possible cause	Remedy
Noises when cornering	
<ul style="list-style-type: none"> • Damaged differential gear. • Excessive wear or damage of thrust washer. • Broken pinion mate shaft. • Seized or damaged side bearing. 	Replace. Replace. Replace. Replace.
Gear noises Since noises from engine, muffler, transmission, propeller shaft, wheel bearings, tires, and body are sometimes mistaken for noises from differential ASSY, be careful in checking them. Inspection methods to locate noises include coasting, accelerating, cruising, and jacking up all four wheels. Perform these inspections according to condition of trouble. When listening to noises, shift gears into four wheel drive and fourth speed position, trying to pick up only differential noise.	
<ul style="list-style-type: none"> • Improper tooth contact of hypoid gear. • Improper backlash for hypoid gear. • Scored or chipped teeth of hypoid gear. • Seized hypoid gear. • Improper preload for front or rear bearings. • Seized, scored, or chipped front or rear bearing. • Seized, scored, or chipped side bearing. • Vibrating differential carrier. 	Readjust or replace hypoid gear set. Readjust. Replace hypoid gear set. Replace hypoid gear set. Readjust. Replace. Replace. Replace.

Propeller Shaft

Trouble and possible cause	Remedy
Vibration of propeller shaft Vibration is caused by propeller shaft during operation and is transferred to vehicle body. Generally vibration increases in proportion to vehicle speed.	
<ul style="list-style-type: none"> • Worn or damaged universal joint needle bearing. • Unbalanced propeller shaft due to bend or dent. • Loose installation of propeller shaft. • Worn or damaged center bearing and damaged center mounting rubber. 	Replace. Replace. Retighten. Replace.
Tapping when starting and noise while cruising, caused by propeller shaft.	
<ul style="list-style-type: none"> • Worn or damaged universal joint. • Worn spline of sleeve yoke. • Loose installation of propeller shaft. • Loose installation of joint. • Worn or damaged center bearing and damaged center mounting rubber. 	Replace. Replace. Retighten. Adjust snap ring. Replace.

Vibration while cruising may be caused by an unbalanced tire, improper tire inflation pressure, improper wheel alignment, etc.