

REAR DIFFERENTIAL

DIFFERENTIALS

4. Rear Differential

A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.
- 3) Move the select lever or gear shift lever to "N".
- 4) Release the parking brake.
- 5) Loosen the wheel nuts.
- 6) Jack-up the vehicle and support it with sturdy racks.
- 7) Remove the wheels.
- 8) Remove the rear exhaust pipe and muffler.

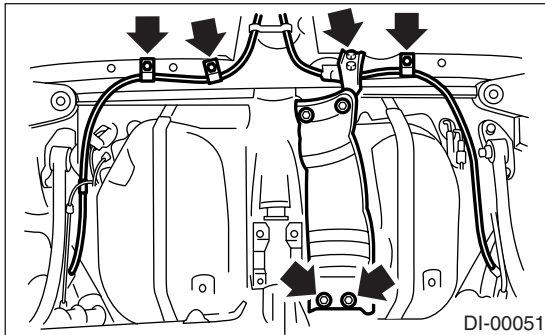
Non-turbo model

<Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> and <Ref. to EX(H4SO)-9, REMOVAL, Muffler.>

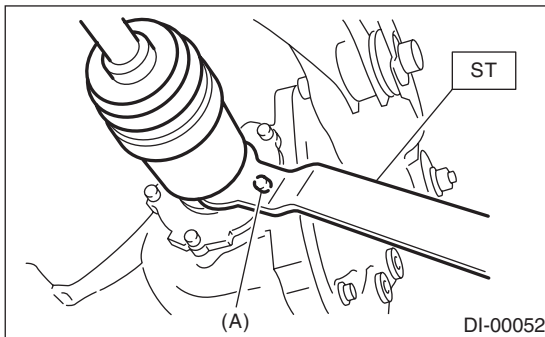
Turbo model

<Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> and <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>

- 9) Remove the propeller shaft. <Ref. to DS-15, REMOVAL, Propeller Shaft.>
- 10) Remove the clamps and bracket of parking brake cable.

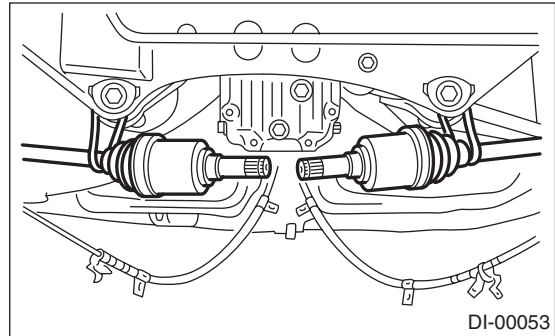


- 11) Remove the DOJ of rear drive shaft from rear differential using ST. <Ref. to DI-35, REPLACEMENT, Rear Differential Side Oil Seal.>
ST 28099PA100 DRIVE SHAFT REMOVER

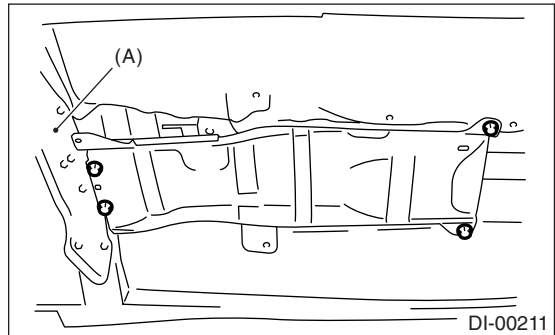


(A) Bolt

- 12) Secure the rear drive shaft to rear crossmember using wire.

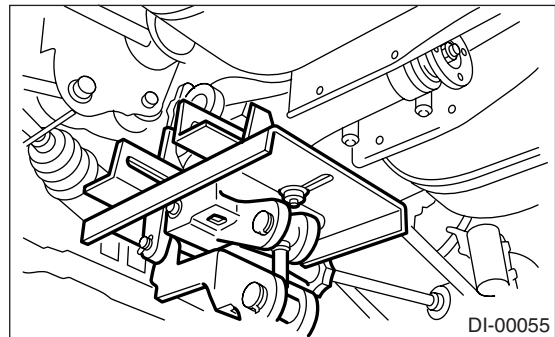


- 13) Remove the lower differential bracket.

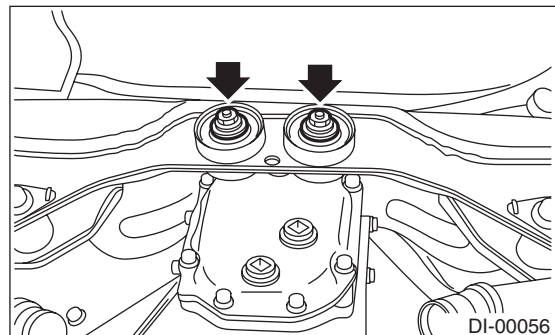


(A) Lower bracket

- 14) Support the rear differential with transmission jack.



- 15) Remove the self-locking nuts and bolts.

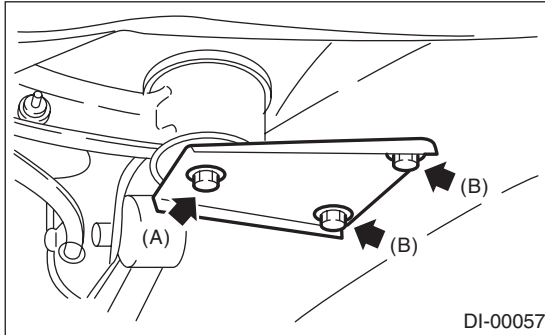


16) Remove the bolts which secure rear differential front member to body.

Loosen the bolt A first, then remove the bolts B.

NOTE:

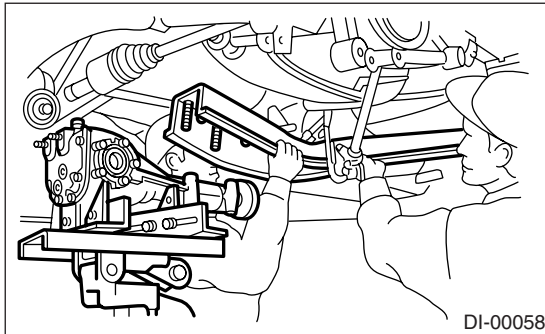
Support the front member with use of a helper to prevent it from dropping.



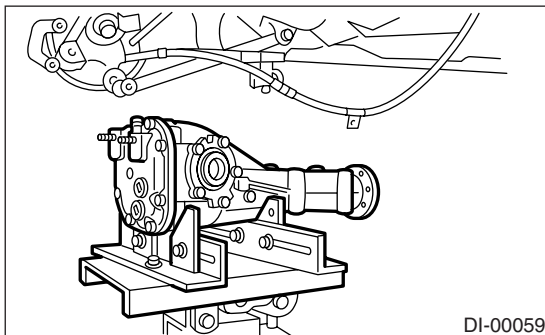
(A) Bolt A
(B) Bolt B

17) Remove the bolt A.

18) While slowly lowering the transmission jack, move the rear differential forward and remove front member and rear differential from body.



19) Remove the rear differential from front member.



B: INSTALLATION

Install in the reverse order of removal.

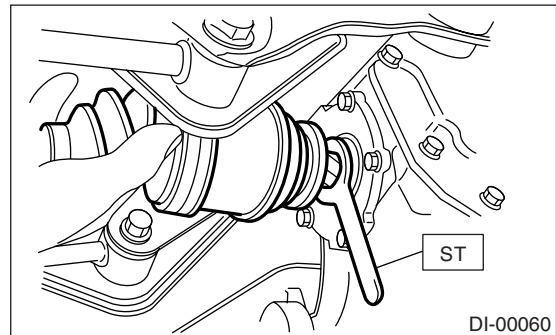
1) Position the front member on body by passing it under the parking brake cable and securing to rear differential.

NOTE:

When installing the rear differential front member, do not confuse the installation sequence of the upper and lower stoppers.

2) Install the DOJ of drive shaft into rear differential. <Ref. to DI-35, REPLACEMENT, Rear Differential Side Oil Seal.>

ST 28099PA090 SIDE OIL SEAL PROTECTOR



3) Installing procedure hereafter is in the reverse order of removal.

4) After installation, fill the differential carrier with gear oil to the filler plug level. <Ref. to DI-16, Differential Gear Oil.>

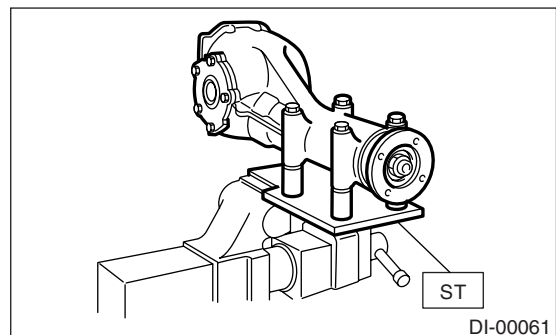
C: DISASSEMBLY

To detect the real cause of trouble, inspect the following items before disassembling.

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

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

ST 398217700 ATTACHMENT



2) Drain the gear oil by removing the plug.

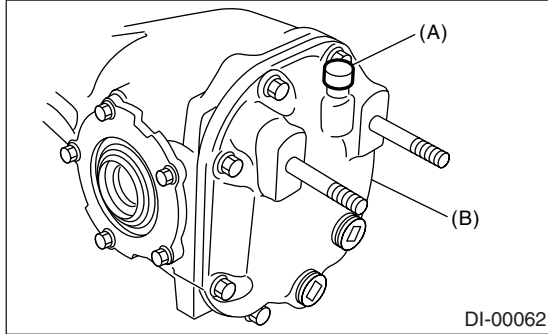
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3) Remove the air breather cap.

NOTE:

- Do not attempt to remove the air breather cap unless necessary.
- When removing the air breather cap, replace the air breather cap with a new one.

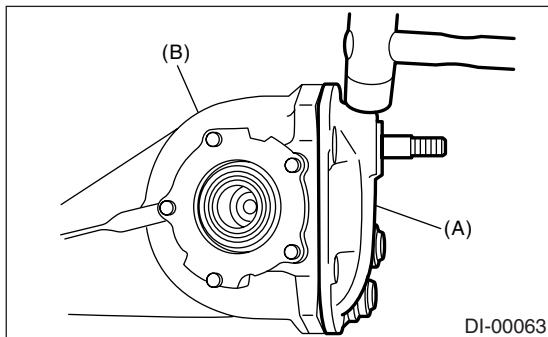


- (A) Air breather cap
- (B) Rear cover

4) Remove the rear cover by loosening the retaining bolts.

NOTE:

Remove it by tapping with plastic hammer.



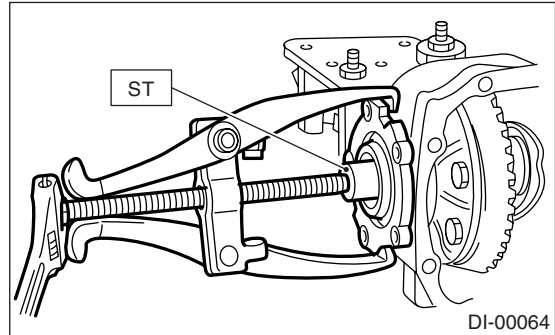
- (A) Rear cover
- (B) Differential carrier

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

NOTE:

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

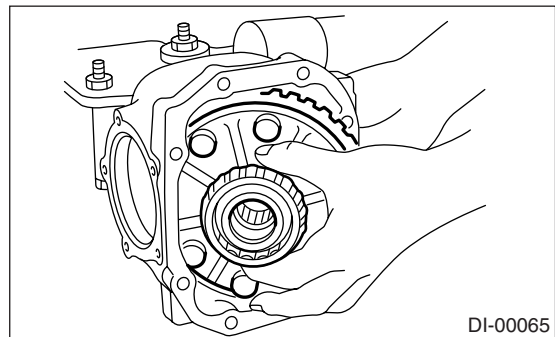
ST 398457700 ATTACHMENT



6) Pull out the differential case assembly from differential carrier.

NOTE:

Be careful not to hit the teeth against the case.

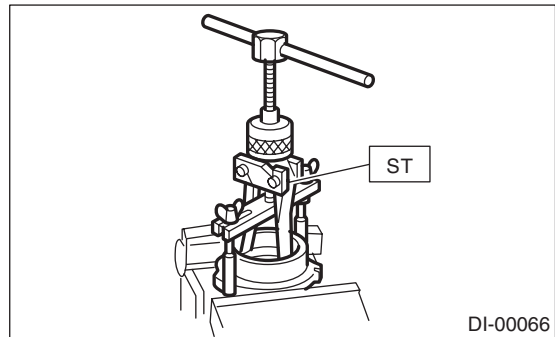


7) Remove the O-ring from side bearing retainer.

8) Remove the oil seal from side bearing retainer. <Ref. to DI-35, REPLACEMENT, Rear Differential Side Oil Seal.>

9) Pull the bearing cup from side bearing retainer using ST.

ST 398527700 PULLER ASSY

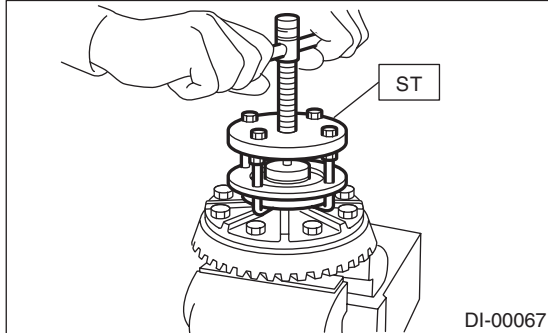


10) Extract the bearing cone with ST.

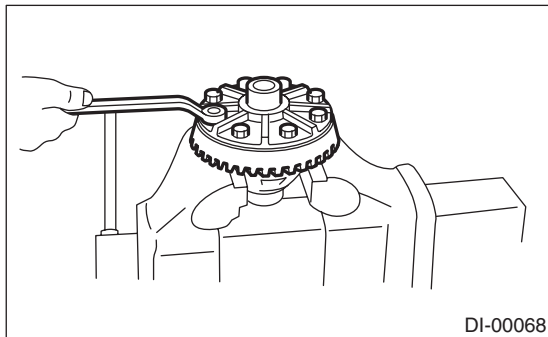
NOTE:

- Set the puller so that its claws catch the edge of bearing cone.
- Never mix up the right and left hand bearing races and cones.

ST 399527700 PULLER SET



11) Remove the hypoid driven gear by loosening the hypoid driven gear bolts.

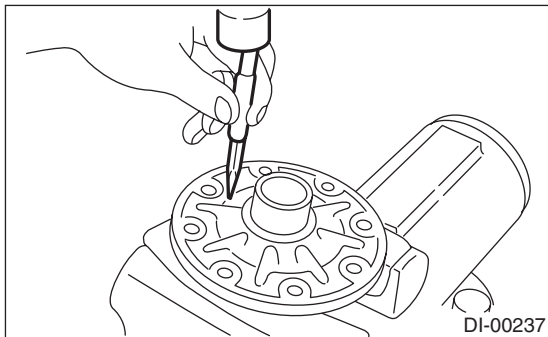


12) Drive out the pinion shaft lock pin from hypoid driven gear side. (Without LSD)

NOTE:

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

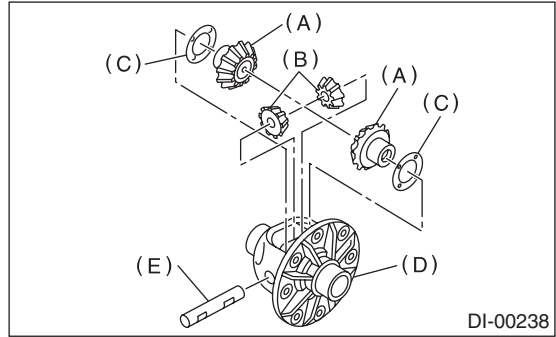
ST 899904100 STRAIGHT PIN REMOVER



13) Draw out the pinion mate shaft and remove the pinion mate gears, side gears and thrust washers. (Without LSD)

NOTE:

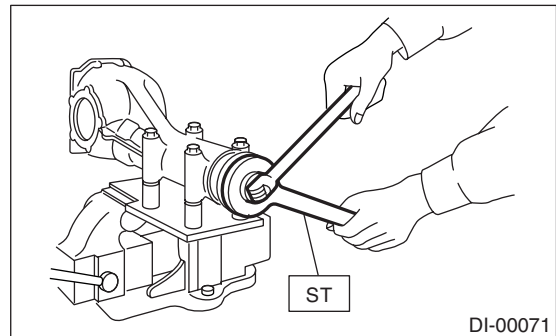
The gears as well as thrust washers should be marked or kept separated right and left, front and rear.



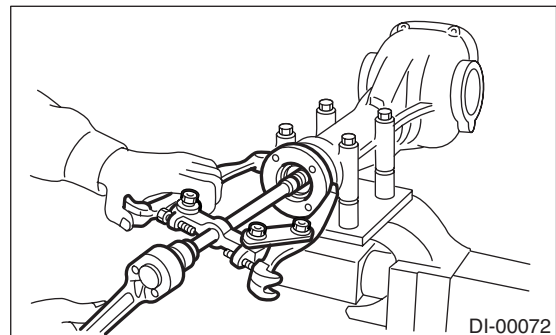
- (A) Side gear
- (B) Pinion mate gear
- (C) Thrust washer
- (D) Differential case
- (E) Pinion mate shaft

14) Hold the companion flange with ST and remove the drive pinion nut.

ST 498427200 FLANGE WRENCH



15) Extract the companion flange with a puller.



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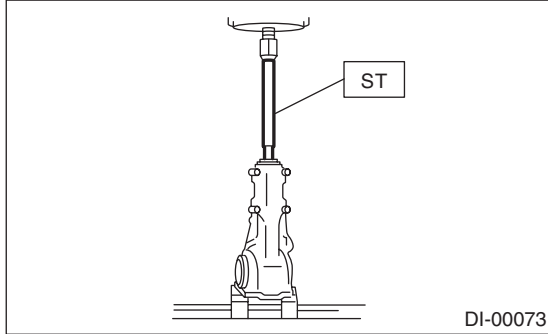
DIFFERENTIALS

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

NOTE:

Hold the drive pinion so as not to drop it.

ST 398467700 DRIFT

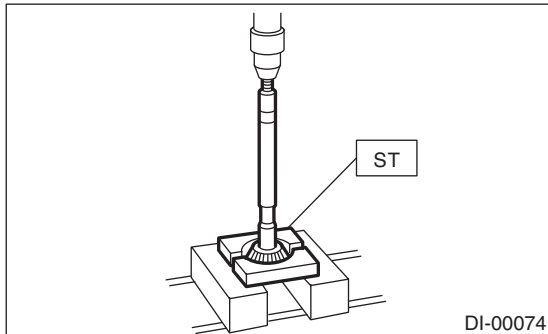


17) Remove the rear bearing cone from drive pinion by supporting the cone with ST.

NOTE:

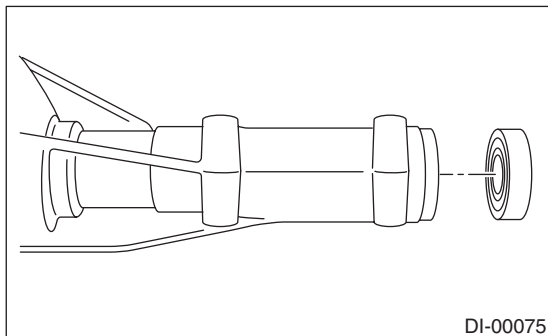
Place the replacer so that its center-recessed side faces the pinion gear.

ST 398517700 REPLACER



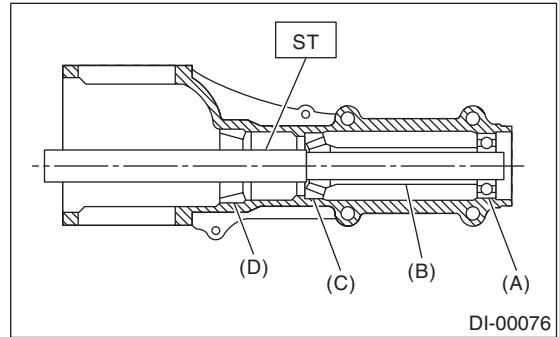
18) Remove the front oil seal from differential carrier using ST.

ST 398527700 PULLER ASSY



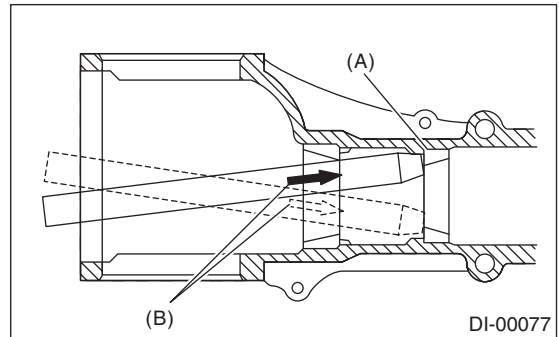
19) Remove the pilot bearing together with front bearing cone using ST.

ST 398467700 DRIFT



- (A) Pilot bearing
- (B) Spacer
- (C) Front bearing
- (D) Rear bearing cup

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



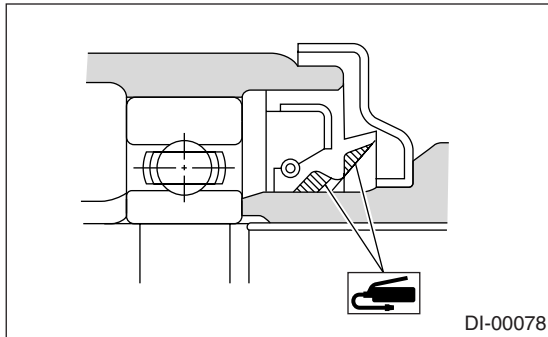
- (A) 2 cutouts along diagonal lines
- (B) Hit out alternately with brass bar.

D: ASSEMBLY

NOTE:

- Assemble in the reverse order of disassembling.
- Check and adjust each part during assembly.
- Keep the shims and washers in order, so that they are not improperly installed.
- Thoroughly clean the surfaces on which the shims, washers and bearings are to be installed.
- Apply gear oil when installing the bearings and thrust washers.
- Be careful not to mix up the right and left hand races of the bearings.
- Use a new O-ring and gasket.

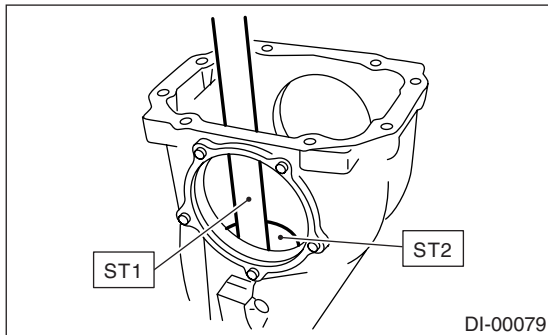
- Replace the oil seal with a new one at every disassembly. Apply chassis grease between the lips when installing the oil seal.



1) Adjusting preload for front and rear bearings
Adjust the bearing preload with spacer and washer between front and rear bearings. Pinion height adjusting washer are not affected by this adjustment. The adjustment must be carried out without oil seal inserted.

(1) Press the rear bearing race (rear) into differential carrier using ST1 and ST2.

ST1 398477701 HANDLE
ST2 398477703 DRIFT 2



(2) Using ST1 and ST2, install the rear bearing race (front) to differential carrier.

ST1 398477701 HANDLE
ST2 398477702 DRIFT

(3) Insert the ST1 into carrier with pinion height adjusting washer and rear bearing cone fitted onto it.

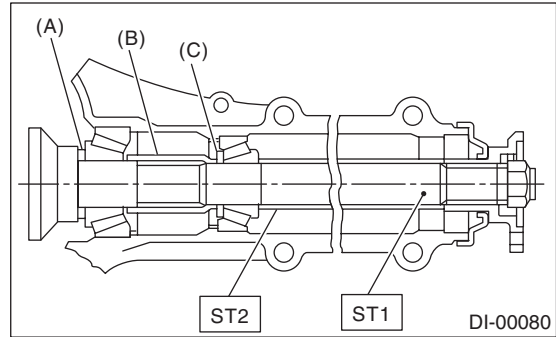
NOTE:

- Re-use the used washer if not deformed.
- Use a new rear bearing cone.

(4) Then install the preload adjusting spacer and washer, front bearing cone, ST2, companion flange, and washer and drive pinion nut.

ST1 398507702 DUMMY SHAFT

ST2 398507703 DUMMY COLLAR



- (A) Pinion height adjusting shim
- (B) Preload adjusting spacer
- (C) Preload adjusting washer

(5) Turn the ST1 with hand to make it seated, and tighten the drive pinion nut while measuring the preload with spring balance. Select the preload adjusting washer and spacer so that the specified preload is obtained when nut is tightened to the specified torque.

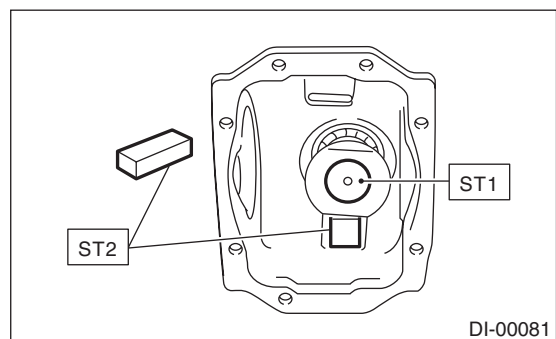
NOTE:

- Use a new lock nut.
- Be careful not to give excessive preload.
- When tightening the drive pinion nut, lock ST2 with ST1 as shown in the figure.

ST1 398507704 BLOCK
ST2 398507702 DUMMY SHAFT

Tightening torque:

181 N·m (18.5 kgf·m, 134 ft·lb)

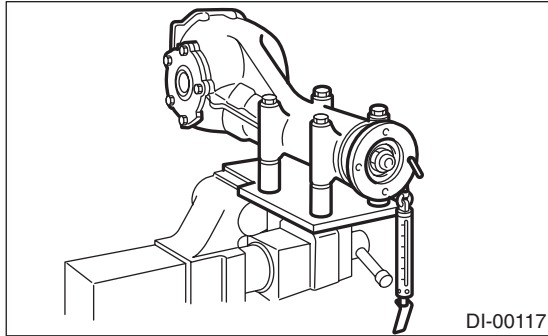


Front and rear bearing preload

For new bearing:
18.1 — 38.8 N (1.8 — 4.0 kgf, 4.1 — 8.7 lb)
at companion flange bolt hole

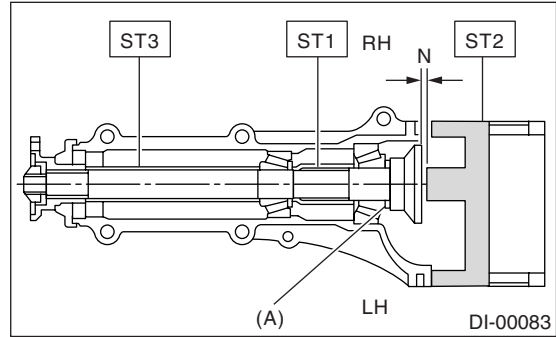
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DI-00117

ST3 398507703 DUMMY COLLAR



DI-00083

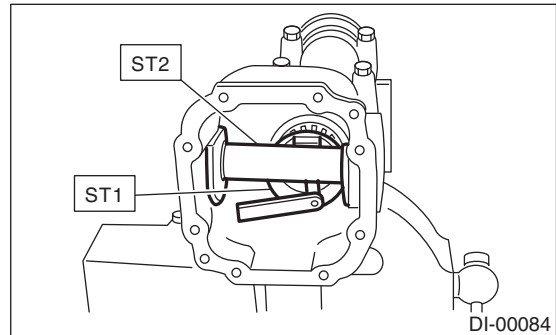
(A) Pinion height adjusting shim

(2) Measure the clearance N between the end of ST2 and end surface of ST1 by using a thickness gauge.

NOTE:

Make sure there is no clearance between the case and ST2.

ST1 398507702 DUMMY SHAFT
ST2 398507701 DIFFERENTIAL CARRIER GAUGE



DI-00084

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

$$T = T_o + N - (H \times 0.01) - 0.20 \text{ mm (0.0079 in)}$$

NOTE:

Use copies of this page.

Preload adjusting washer	Part No.	Thickness 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)

2) Adjusting drive pinion height

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

(1) Install the ST2.

NOTE:

At this time, install a pinion height adjusting shim which is temporarily selected or the same as that used before. Measure and record the thickness.

ST1 398507702 DUMMY SHAFT
ST2 398507701 DIFFERENTIAL CARRIER GAUGE

T	Thickness of pinion height adjusting shim mm (in)	
T _o	Thickness of shim temporarily inserted mm (in)	
N	Reading of thickness gauge mm (in)	
H	Figure marked on drive pinion head	
Memo:		

(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 shim 383605200.

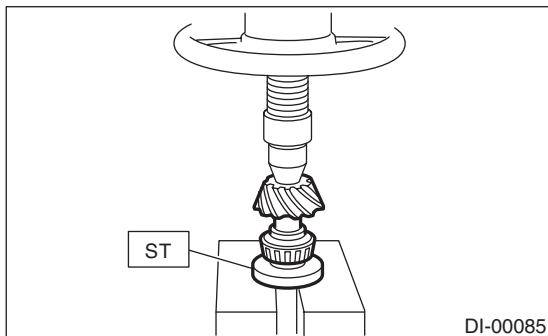
Pinion height adjusting shim	
Part No.	Thickness mm (in)
383495200	3.09 (0.1217)
383505200	3.12 (0.1228)
383515200	3.15 (0.1240)
383525200	3.18 (0.1252)
383535200	3.21 (0.1264)
383545200	3.24 (0.1276)
383555200	3.27 (0.1287)
383565200	3.30 (0.1299)
383575200	3.33 (0.1311)
383585200	3.36 (0.1323)
383595200	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)

CAUTION:

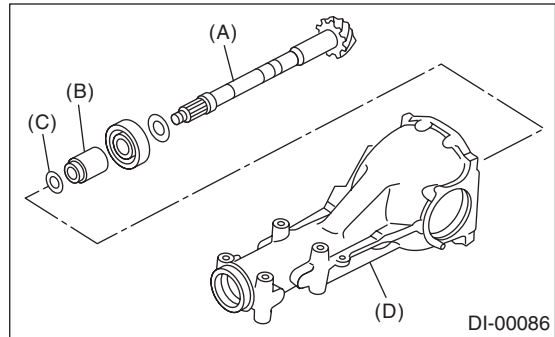
Remove the ST1, 2 and 3.

3) Install the selected pinion height adjusting shim on drive pinion, and press the rear bearing cone into position with ST.

ST 398177700 INSTALLER



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



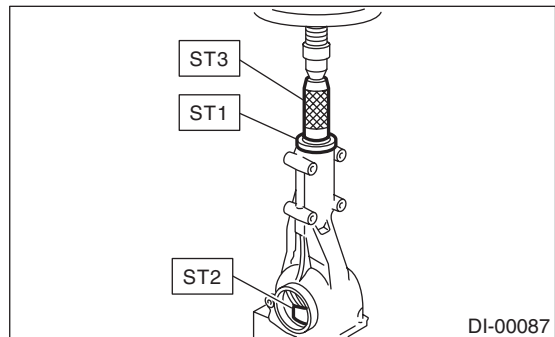
- (A) Drive pinion
- (B) Bearing adjusting spacer
- (C) Washer
- (D) Differential carrier

5) Press-fit the front bearing cone into case with ST1, ST2 and ST3.

ST1 398507703 DUMMY COLLAR

ST2 399780104 WEIGHT

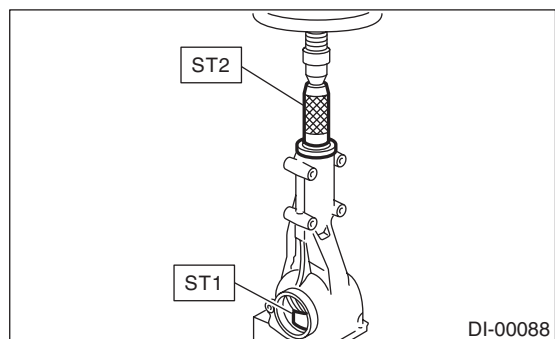
ST3 899580100 INSTALLER



6) Insert the spacer, then press-fit the pilot bearing with ST1 and ST2.

ST1 399780104 WEIGHT

ST2 899580100 INSTALLER



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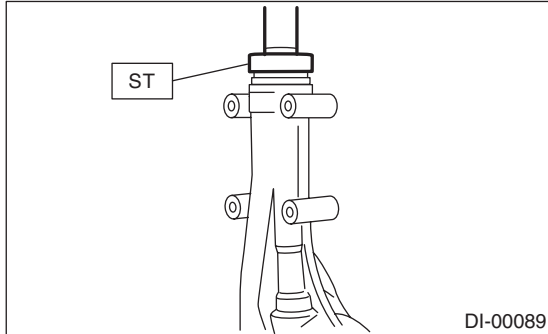
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7) Fit a new oil seal with ST.

NOTE:

- Press-fit until the end of oil seal is 1 mm (0.04 in) inward from end of carrier.
- Apply grease between the oil seal lips.

ST 498447120 INSTALLER



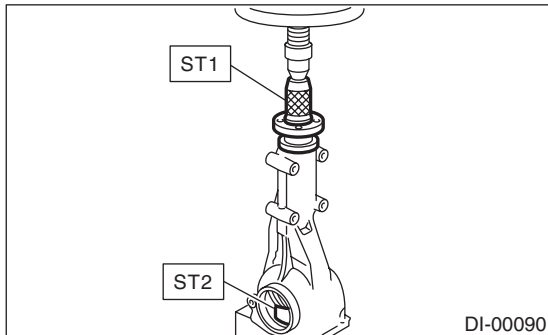
8) Press-fit the companion flange with ST1 and ST2.

NOTE:

Be careful not to damage the bearing.

ST1 899874100 INSTALLER

ST2 399780104 WEIGHT



9) Install the self-locking nut. Then tighten it with the ST.

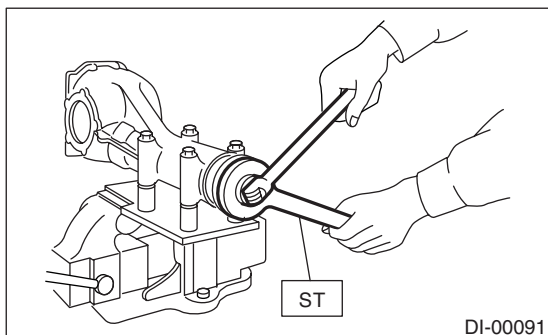
ST 498427200 FLANGE WRENCH

CAUTION:

Use the new self locking nuts.

Tightening torque:

181 N·m (18.5 kgf·m, 134 ft·lb)

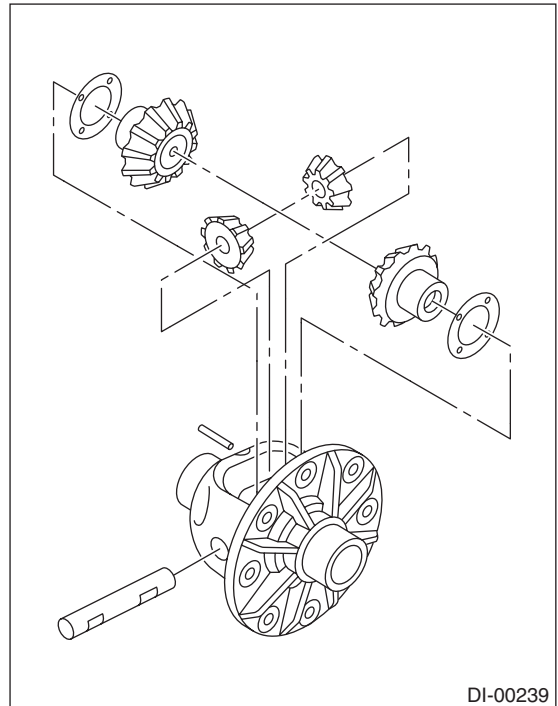


10) Assembling differential case

Install the side gears and pinion mate gears, with their thrust washers and pinion mate shaft, into differential case. (Without LSD)

NOTE:

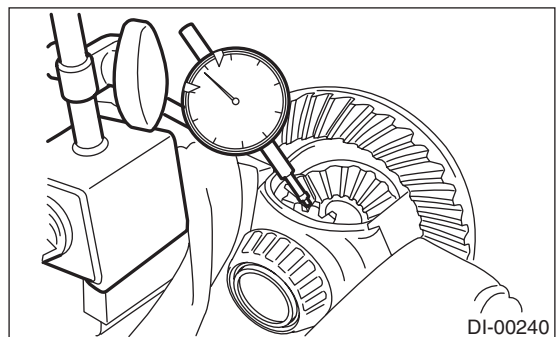
- Apply gear oil on both sides of the washer and on the side gear shaft before installing.
- Insert the pinion mate shaft into the differential case by aligning the lock pin holes.



(1) Measure the side gear backlash.

Side gear back clearance:

0.10 — 0.20 mm (0.0039 — 0.0079 in)



(2) Adjust the backlash as specified by selecting the side gear thrust washer.

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 inserting the pinion shaft lock pin into differential case, stake both sides of the hole to prevent pin from falling off.

11) Install the hypoid driven gear on differential case.

NOTE:

Before installing the bolts, apply Lock Tite to bolt threads.

Lock Tite:

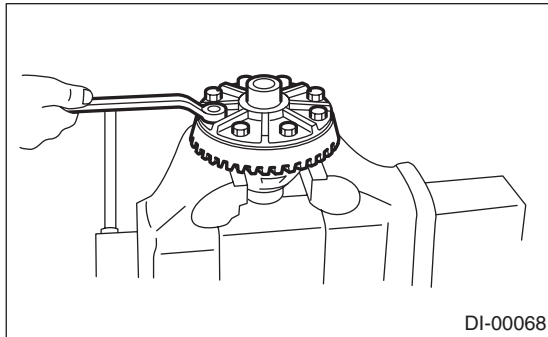
THREE BOND 1324 (Part number: 004403042) or equivalent

NOTE:

Tighten diagonally while tapping the bolt heads.

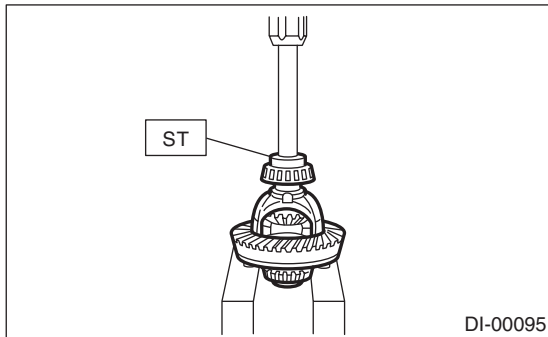
Tightening torque:

105 N·m (10.7 kgf·m, 77.4 ft·lb)



12) Press the side bearing onto differential case with ST.

ST 398237700 DRIFT



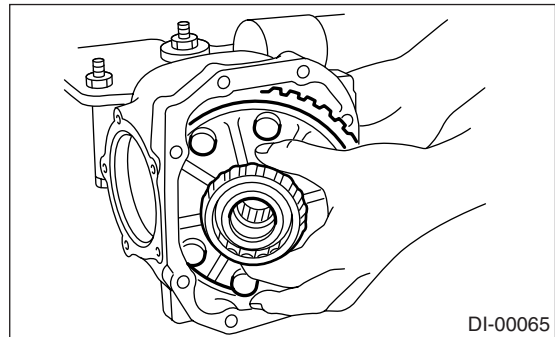
13) Press the side bearing cone into side bearing retainer using ST.

ST 398487700 DRIFT

14) Adjusting side bearing retainer shims

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

(2) Install the differential case assembly into differential carrier in the reverse order of disassembly.



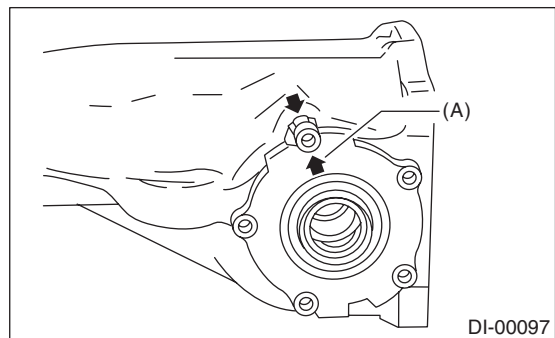
(3) Install the side retainer shims to the right and left retainers from which they were removed.

NOTE:

- Replace the broken or corroded side retainer shim with a new one of same thickness.
- Replace the broken or cracked O-ring with new one.

Side bearing retainer shim	
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)

(4) Align the arrow mark on differential carrier with the mark on side retainer during installation.



(A) Arrow mark

REAR DIFFERENTIAL

DIFFERENTIALS

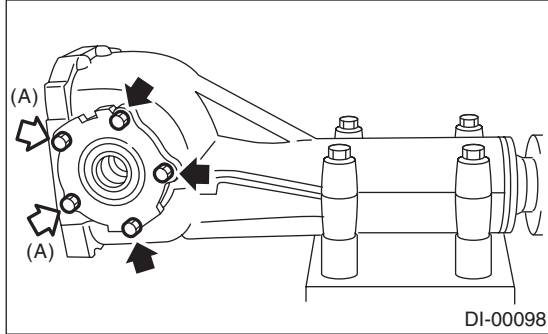
(5) Tighten the side bearing retainer bolts.

Lock Tite:

THREE BOND 1105 (Part No. 004403010) or equivalent

Tightening torque:

10.3 N·m (1.05 kgf-m, 7.6 ft-lb)



(A) Positioning bolt

(6) Measure the hypoid driven gear-to-drive pinion backlash. Set the magnet base on differential carrier. Align the contact point of dial gauge with tooth face of hypoid driven gear, and move the hypoid driven gear while holding drive pinion still. Read the value indicated on dial gauge.

If the backlash is not within specification, adjust the side bearing retainer shim as follows.

When backlash is more than 0.2 mm (0.0079 in):

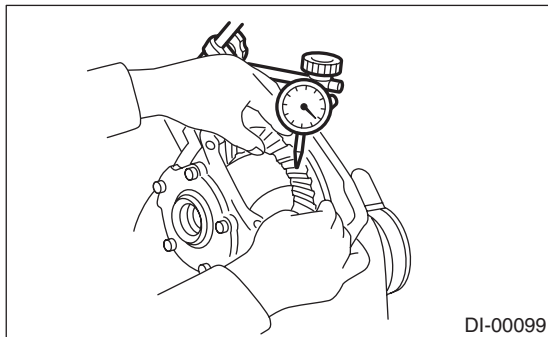
Reduce shim thickness of behind hypoid driven gear, and increase shim thickness of hypoid driven gear side.

When backlash is less than 0.1 mm (0.0039 in):

Increase shim thickness of behind hypoid driven gear, and reduce shim thickness of hypoid driven gear side.

Backlash:

0.10 — 0.20 mm (0.0039 — 0.0079 in)



(7) If the total preload is not within specification, adjust the thickness of side bearing retainer shims, increasing/reducing by an even amount at a time.

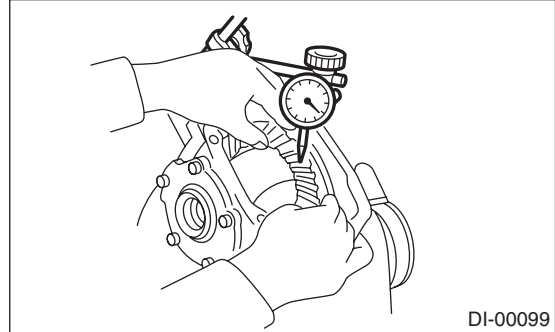
Turning resistance increase:

20.7 — 54.4 N (2.1 — 5.5 kgf, 4.7 — 12.2 lb)

15) Re-check the hypoid driven gear-to-pinion backlash.

Backlash:

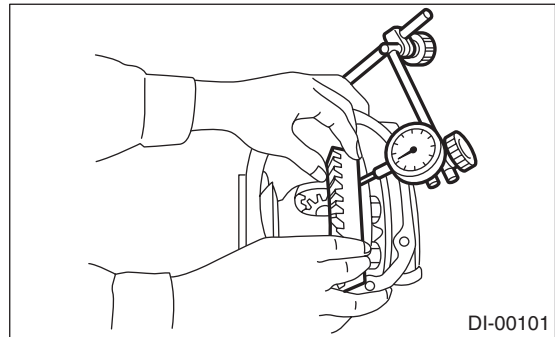
0.10 — 0.20 mm (0.0039 — 0.0079 in)



16) Check the hypoid driven gear runout on its back surface, and make sure that pinion and hypoid driven gear rotate smoothly.

Limit of runout:

Less than 0.05 mm (0.0020 in)



17) Checking and adjusting tooth contact of hypoid driven gear

(1) Apply an even coat of red lead on both sides of three or four teeth on the hypoid driven gear. Check the contact pattern after rotating the hypoid driven gear several revolutions back and forth until a definite contact pattern appears on the hypoid driven gear.

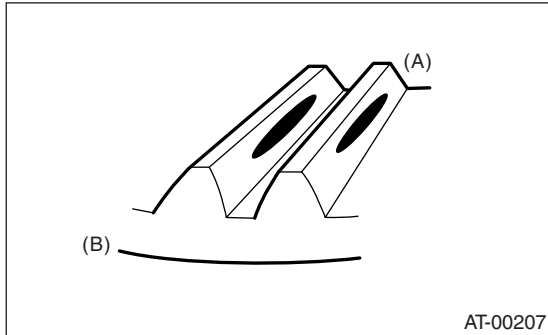
(2) When the contact pattern is incorrect, readjust according to the instructions given in "TOOTH CONTACT PATTERN".

NOTE:

Be sure to wipe off red lead completely after adjustment is completed.

- Correct tooth contact

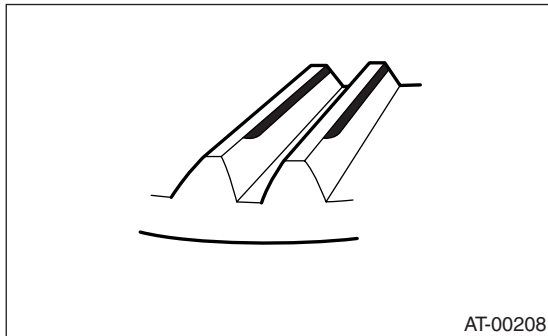
Checking item: Tooth contact pattern is slightly shifted toward to toe side under no-load rotation. (When loaded, contact pattern moves toward heel)



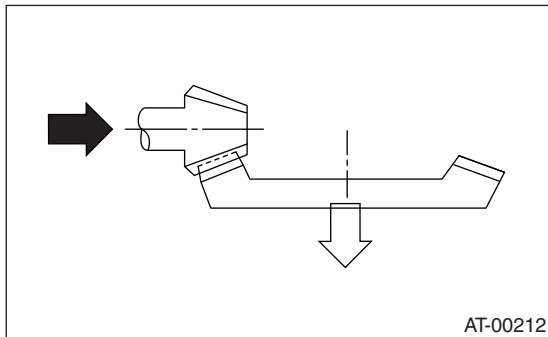
- (A) Toe side
- (B) Heel side

- Face contact

Checking item: Backlash is too large. Contact pattern

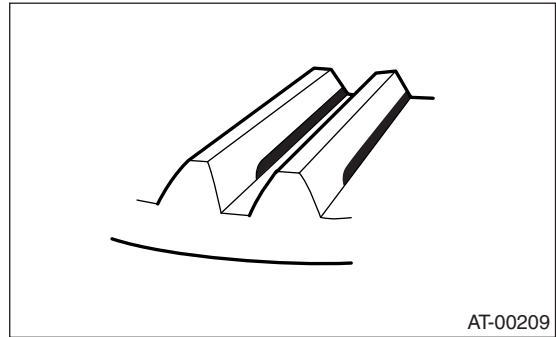


Corrective action: Increase thickness of drive pinion height adjusting shim in order to bring drive pinion close to hypoid driven gear.

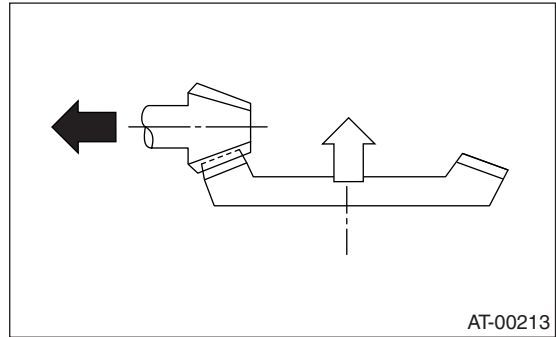


- Flank contact

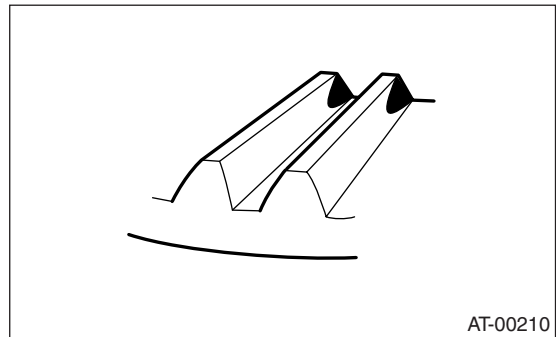
Checking item: Backlash is too small. Contact pattern



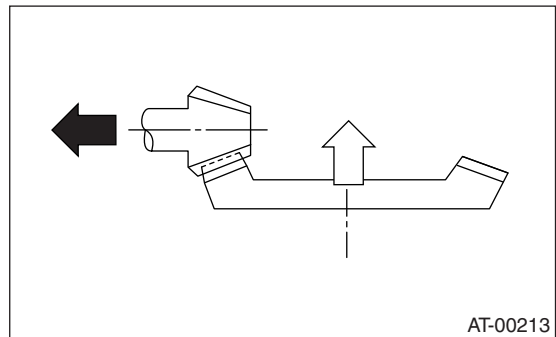
Corrective action: Reduce thickness of drive pinion height adjusting shim in order to move drive pinion away from hypoid driven gear.



- Toe contact (Inside end contact)
- Checking item: Contact area is small. Contact pattern**



Corrective action: Reduce thickness of drive pinion height adjusting shim in order to move drive pinion away from hypoid driven gear.



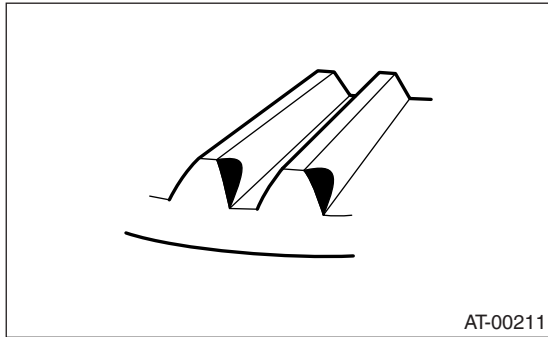
REAR DIFFERENTIAL

DIFFERENTIALS

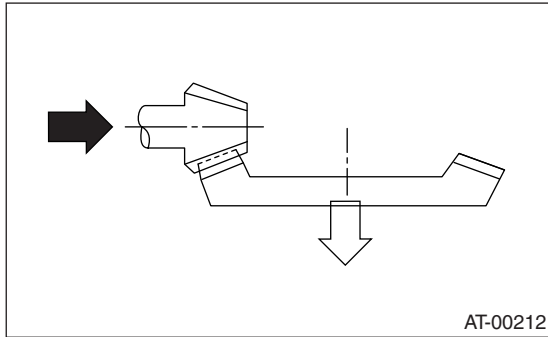
- Heel contact (Outside end contact)

Checking item: Contact area is small.

Contact pattern



Corrective action: Increase thickness of drive pinion height adjusting shim in order to bring drive pinion close to hypoid driven gear.



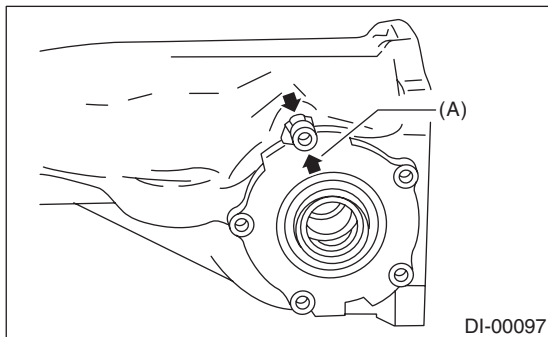
18) If proper tooth contact is not obtained, once again adjust the drive pinion height by changing RH and LH side bearing retainer shims and the hypoid gear backlash.

19) Remove the right and left side bearing retainers.

20) Install the right and left side bearing retainer, O-rings and side bearing retainer shims.

21) Install the oil seals to the right and left side bearing retainers. <Ref. to DI-35, REPLACEMENT, Rear Differential Side Oil Seal.>

22) Align the arrow mark on differential carrier with the mark on side retainer during installation.



(A) Arrow mark

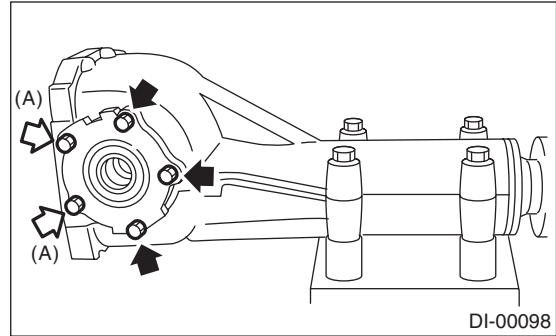
23) Tighten the side bearing retainer bolts.

Lock Tite:

THREE BOND 1105 (Part No. 004403010) or equivalent

Tightening torque:

10.3 N·m (1.05 kgf·m, 7.6 ft·lb)

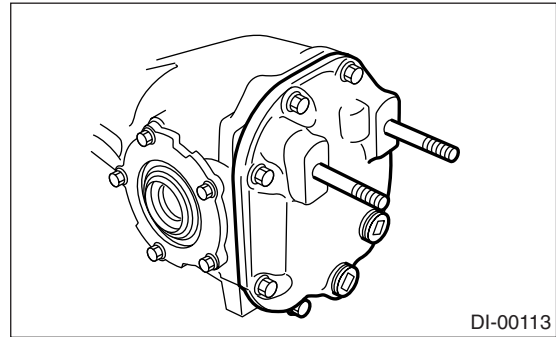


(A) Positioning bolt

24) Install the new gasket and rear cover and tighten the bolts to specified torque.

Tightening torque:

29 N·m (3.0 kgf·m, 21.7 ft·lb)



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) Hypoid driven gear and drive pinion

- 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.

- 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

- Replace if crack, score, or other defects are evident on tooth surface.

- 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, noise or other defect is evident.

4) Oil seal

Replace if deformed or damaged, and at every disassembling.

5) Differential carrier

Replace if the bearing bores are worn or damaged.

6) Differential case

Replace if its sliding surfaces are worn or cracked.

7) Companion flange

Replace if the oil seal lip contacting surfaces have flaws.

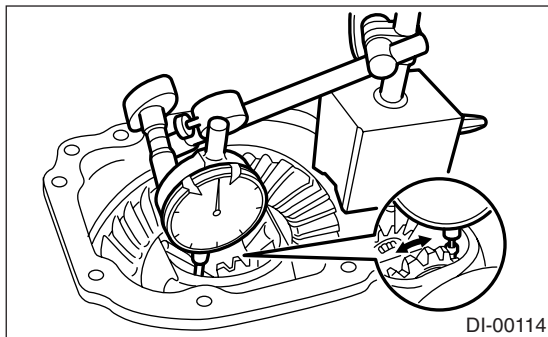
1. SIDE GEAR BACKLASH

Using a dial gauge, check the backlash of the side gear.

Side gear backlash:

0.1 — 0.2 mm (0.004 — 0.008 in)

If the side gear backlash is not within the specification, adjust clearance as specified by selecting the side gear thrust washer.



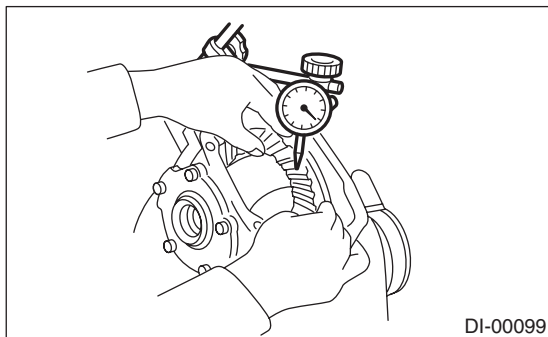
2. HYPOID DRIVEN GEAR BACKLASH

Using a dial gauge, check the backlash of the hypoid driven gear.

Hypoid driven gear backlash:

0.1 — 0.2 mm (0.004 — 0.008 in)

If the hypoid driven gear backlash is not within the specification, adjust the side bearing preload or repair if necessary.



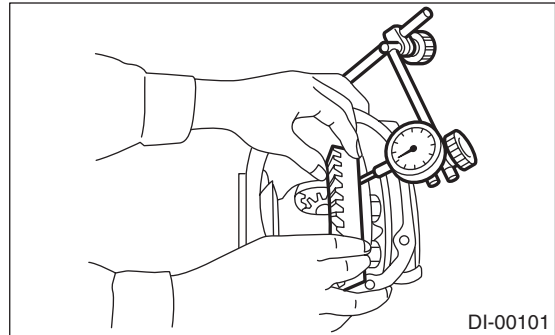
3. HYPOID DRIVEN GEAR RUNOUT

Using a dial gauge, check the hypoid driven gear runout.

Hypoid driven gear runout:

Less than 0.05 mm (0.0020 in)

If the hypoid driven gear runout exceeds 0.05 mm (0.0020 in), replace the hypoid driven gear.



4. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

Inspect the tooth contact between hypoid driven gear and driven pinion. <Ref. to DI-22, ASSEMBLY, Rear Differential.>

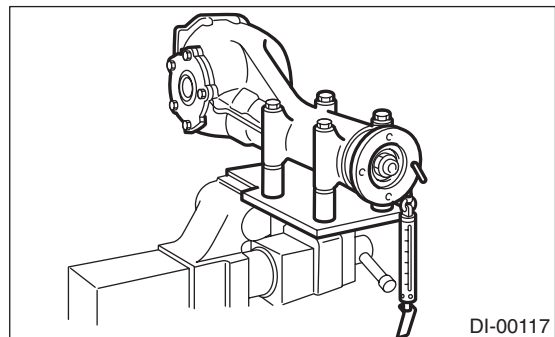
5. TOTAL PRELOAD

Using a gauge, check the turning resistance increase.

Turning resistance increase:

20.7 — 54.4 N (2.1 — 5.5 kgf, 4.7 — 12.2 lb)

If the increase of resistance is not within the specification, adjust the side bearing retainer shims.



F: ADJUSTMENT

1. SIDE GEAR BACKLASH

Adjust the side gear backlash.

<Ref. to DI-22, ASSEMBLY, Rear Differential.>

2. HYPOID DRIVEN GEAR BACKLASH

Adjust the hypoid driven gear backlash.

<Ref. to DI-22, ASSEMBLY, Rear Differential.>

3. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

Adjust the tooth contact between hypoid driven gear and drive pinion gear.

<Ref. to DI-22, ASSEMBLY, Rear Differential.>

4. TOTAL PRELOAD

Adjust the side bearing shim.

<Ref. to DI-22, ASSEMBLY, Rear Differential.>