

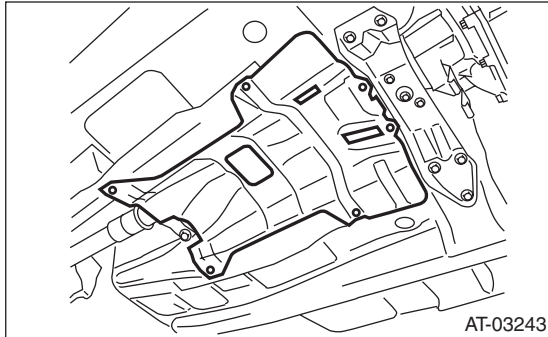
Rear Differential (VA-type)

DIFFERENTIALS

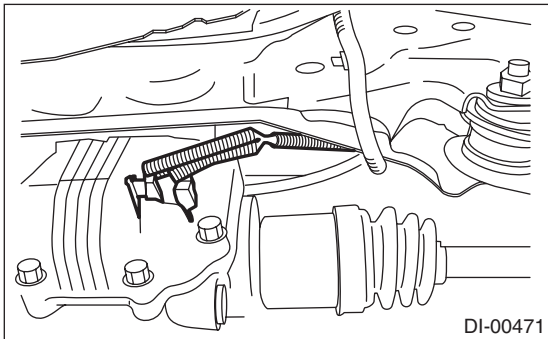
4. Rear Differential (VA-type)

A: REMOVAL

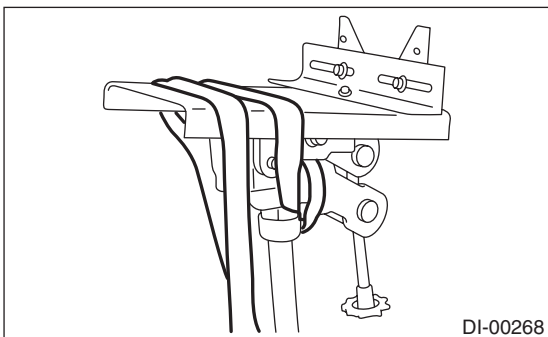
- 1) Disconnect the ground cable from the battery.
- 2) Release the parking brake.
- 3) Jack-up the vehicle.
- 4) Remove the rear exhaust pipe and muffler.
<Ref. to EX(H6DO)-6, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-8, REMOVAL, Muffler.>
- 5) Remove the heat shield cover.



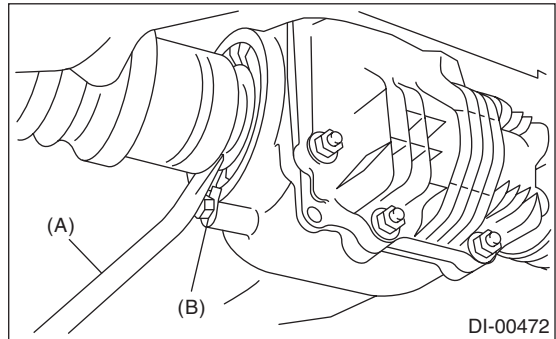
- 6) Remove the propeller shaft.
<Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 7) Remove the connector from the rear differential oil temperature switch.



- 8) Prepare the transmission jack and band.

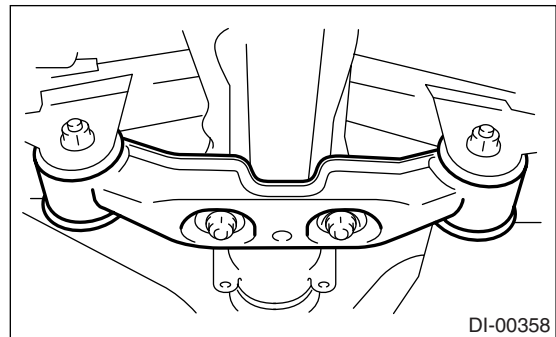


- 9) Remove the DOJ of rear drive shaft from rear differential.

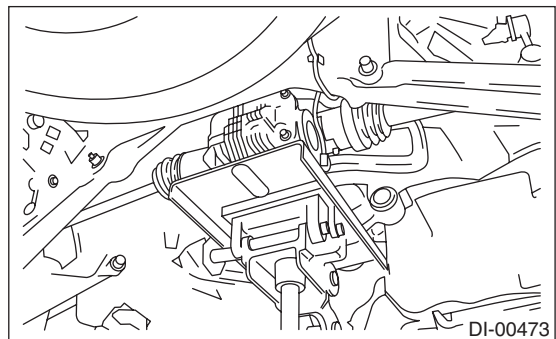


- (A) Tire lever
(B) Bolt

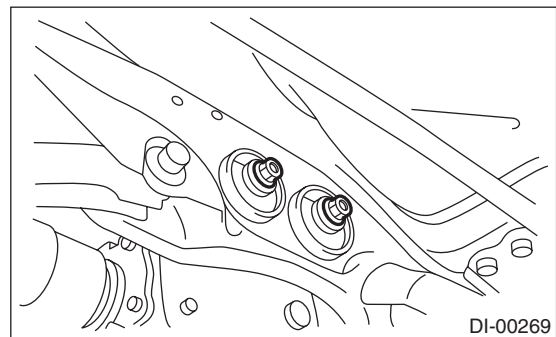
- 10) Remove the nuts which hold the rear differential front member.



- 11) Support the rear differential with the transmission jack.



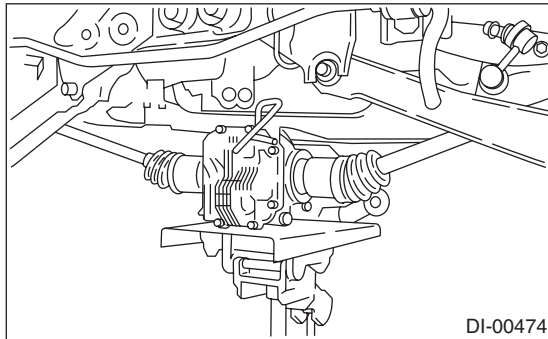
- 12) Loosen the self-lock nuts which hold the rear differential to rear crossmember.



- 13) Remove the rear differential front member.
- 14) Secure the rear differential using band.
- 15) Remove the self-lock nuts which hold the rear differential to rear crossmember.
- 16) Remove the air breather hose from the sub frame.
- 17) Remove the rear differential stud bolt from rear crossmember bushing.

NOTE:

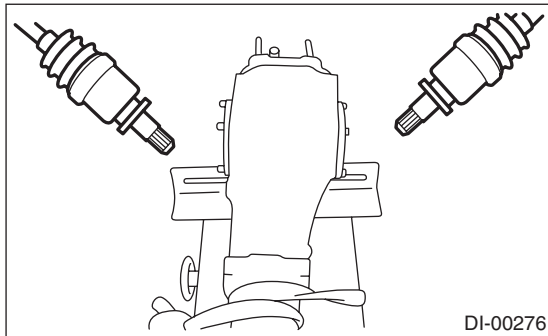
When removing the stud bolt, carefully adjust the angle and location of transmission jack and jack stand, if necessary



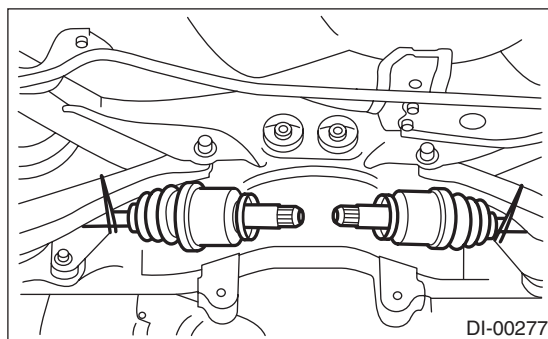
- 18) Pull out the axle shaft from rear differential.

NOTE:

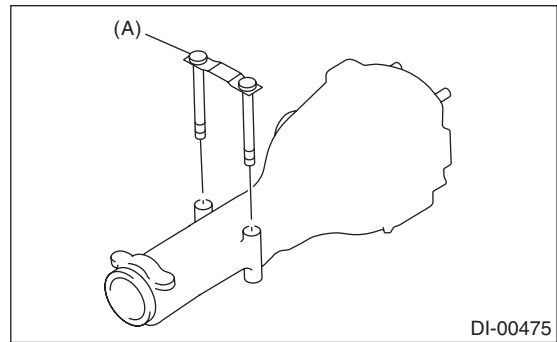
If it is difficult to remove the axle shaft from rear differential, remove it using tire lever.



- 19) Lower the transmission jack.
- 20) Secure the rear drive shaft to lateral link using wire.



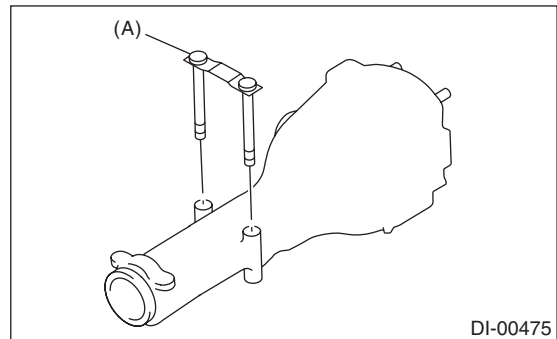
- 21) Remove the rear differential member plate from rear differential.



(A) Rear differential member plate

B: INSTALLATION

- 1) Insert the rear differential member plate into rear differential.



(A) Rear differential member plate

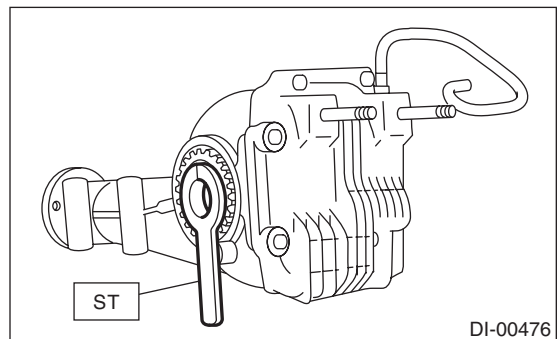
- 2) Set the rear differential to transmission jack.

NOTE:

Secure the rear differential to transmission jack using band.

- 3) Install the ST to rear differential.

ST 28099PA090 OIL SEAL PROTECTOR

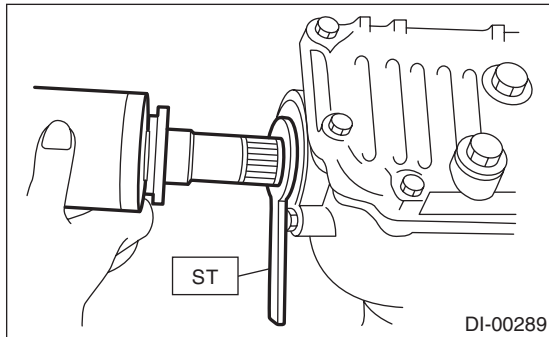


Rear Differential (VA-type)

DIFFERENTIALS

4) Insert the spline shaft until the spline portion comes inside the side oil seal.

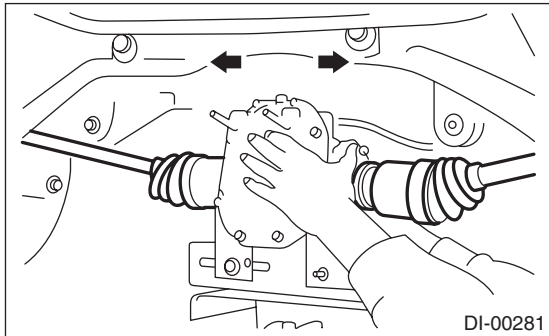
ST 28099PA090 OIL SEAL PROTECTOR



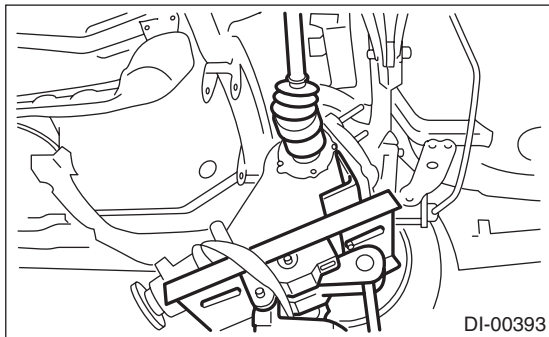
5) Remove ST from rear differential.

ST 28099PA090 OIL SEAL PROTECTOR

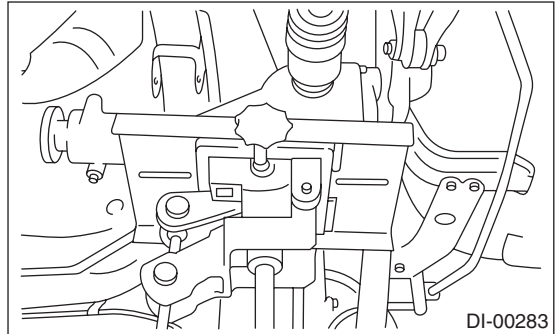
6) Push the rear differential to insert the axle shaft into rear differential.



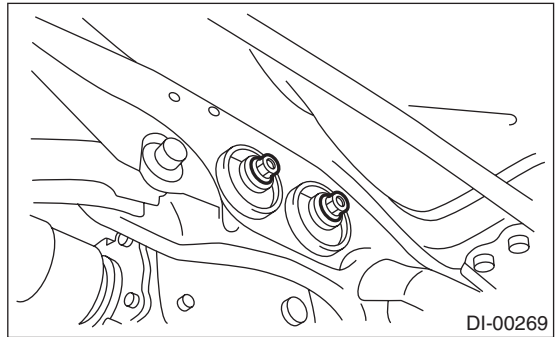
7) Adjust the transmission jack, if necessary, and insert the rear differential stud bolt into rear crossmember bushing properly.



8) After inserting the rear differential stud bolt into the rear crossmember bushing, lift up the transmission jack and align the rear differential to its attachment position.



9) Tighten a new self-locking nut temporarily to rear crossmember.



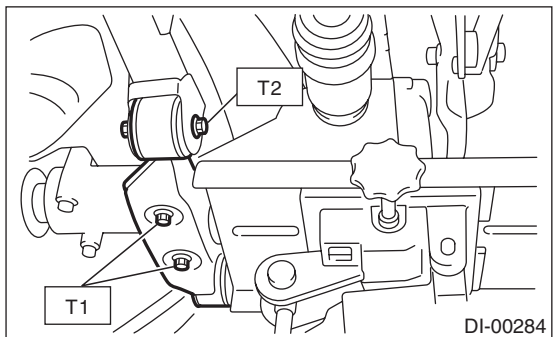
10) Remove the band from rear differential. Lift up the rear differential until the rear differential is separated from the transmission jack.

11) Install the rear differential front member with a new self-locking nut.

Tightening torque:

T1: 65 N·m (6.6 kgf-m, 48 ft-lb)

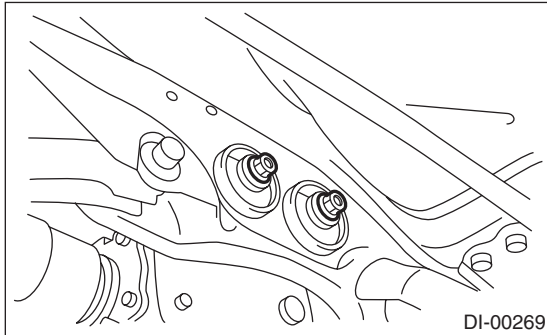
T2: 110 N·m (11.2 kgf-m, 81 ft-lb)



12) Tighten the self-locking nut.

Tightening torque:

70 N·m (7.1 kgf-m, 51 ft-lb)



13) Lower the transmission jack.

14) Install the air breather hose to the sub frame.

15) Install the propeller shaft.

<Ref. to DS-11, INSTALLATION, Propeller Shaft.>

16) Install the heat shield cover.

17) Install the rear exhaust pipe and muffler.

C: DISASSEMBLY

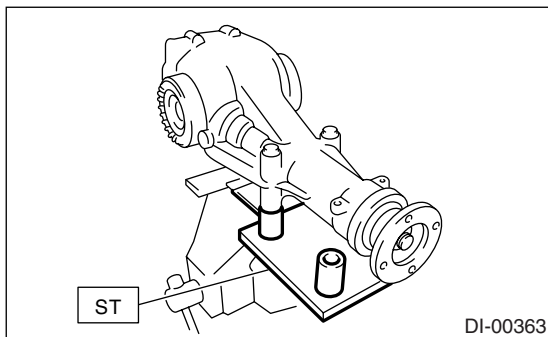
To detect the real cause of trouble, inspect the following items before disassembling.

- Tooth contact and backlash between hypoid driven gear and drive pinion
- Total preload of drive pinion

1) Remove the air breather hose.

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

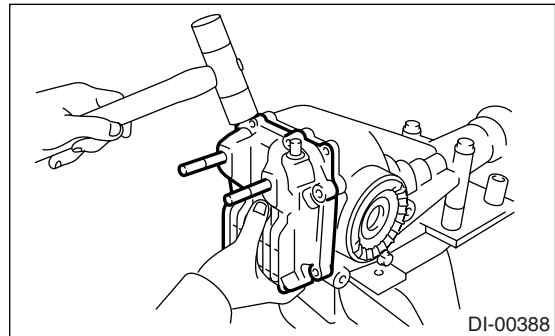
ST 398217700 ATTACHMENT SET



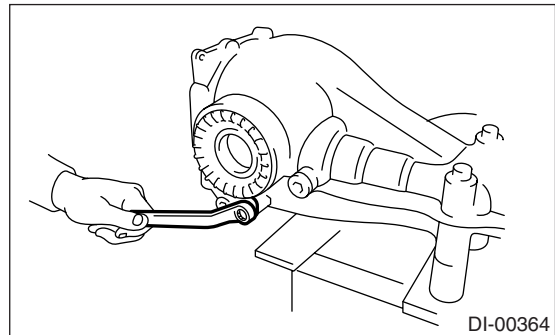
3) Drain the gear oil by removing the plug.

4) Remove the rear differential oil temperature switch.

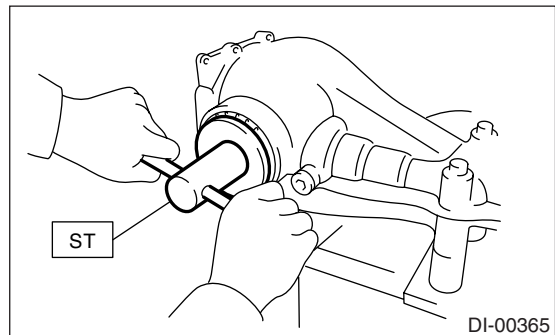
5) Remove the rear cover by loosening retaining bolts.



6) Remove the lock plate RH and LH.



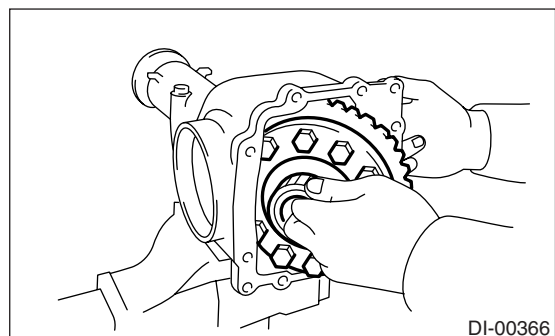
7) Remove the holder RH and LH with ST.
ST 18630AA010 WRENCH ASSY



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

NOTE:

Be careful so that the teeth do not hit against the case.



Rear Differential (VA-type)

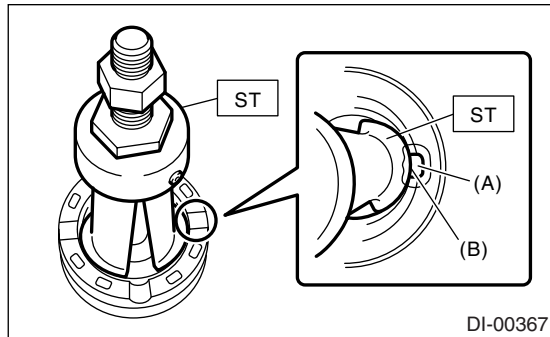
DIFFERENTIALS

9) Remove the bearing race from holder RH and LH with ST and press.

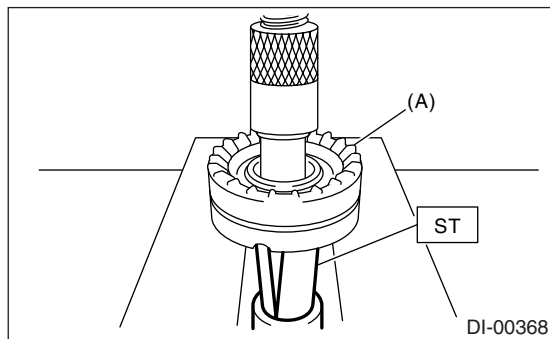
ST 18758AA000 PULLER

NOTE:

- Make sure the bolt of puller turn manually.
- Set the puller so that its claws catch the groove of holder.



- (A) Groove
(B) Claw

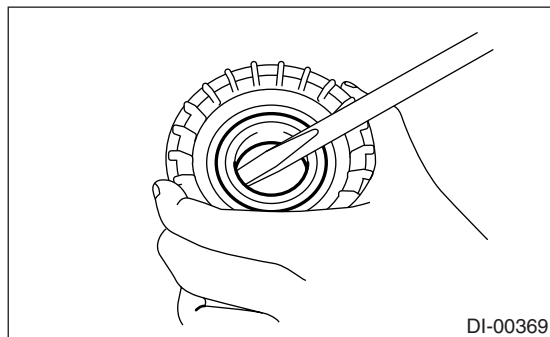


- (A) Holder

10) Remove the oil seal from holder RH and LH using screwdriver.

NOTE:

Perform this operation only when changing oil seal.



11) Extract the bearing cone with ST1, ST2 and ST3

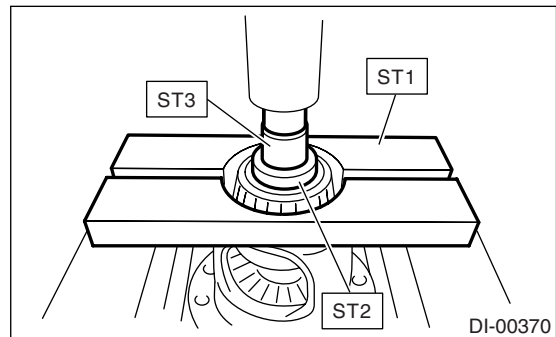
NOTE:

- Do not attempt to disassemble the parts unless necessary.
- Never mix up the RH and LH bearing races and cones.

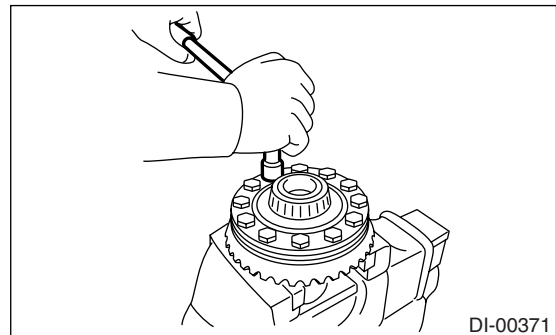
ST1 498077000 REMOVER

ST2 399520105 SEATS

ST3 899864100 REMOVER

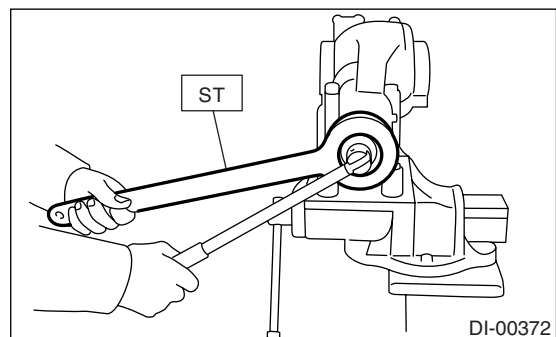


12) Remove the hypoid driven gear by loosening hypoid driven gear bolts.

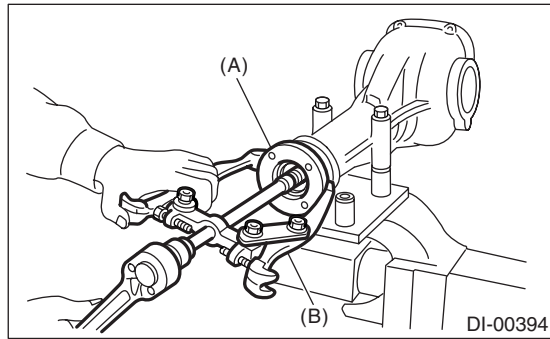


13) Remove the self-locking nut while holding the companion flange with ST.

ST 498427200 FLANGE WRENCH



14) Extract the companion flange with a puller.



- (A) Companion flange
(B) Puller

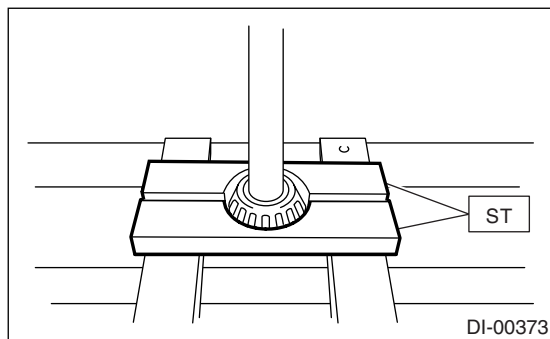
15) Removes the drive pinion shaft.

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

NOTE:

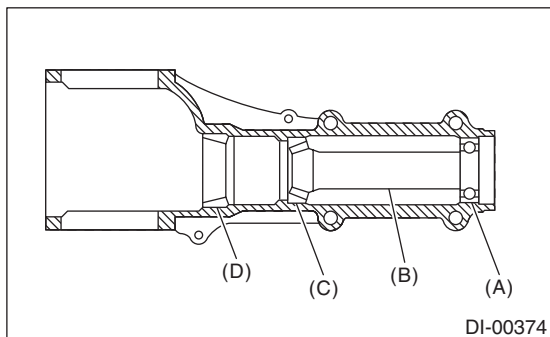
Place the replacer so that its center-recessed side faces the pinion gear.

ST 398517700 REPLACER



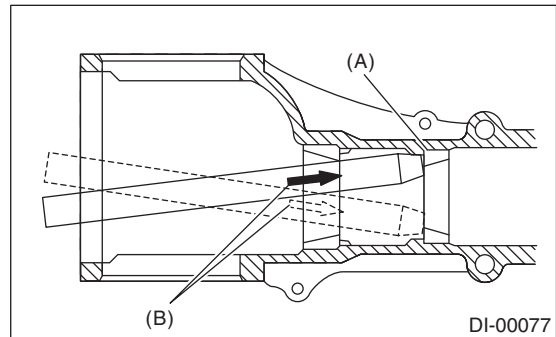
17) Remove the front oil seal from differential carrier using screwdriver.

18) Remove the pilot bearing, front bearing cone and collar.



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

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

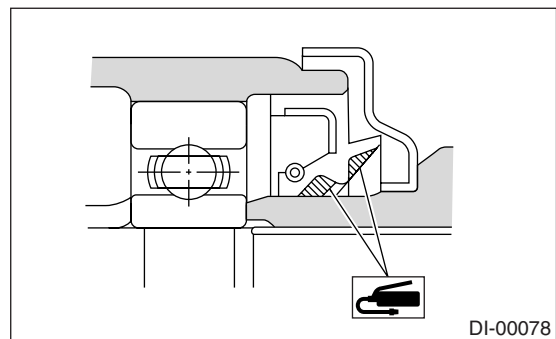


- (A) 2 cutout portions along diagonal lines
(B) Tap alternately with brass bar.

D: ASSEMBLY

NOTE:

- Assemble in the reverse order of disassembly.
- Check and adjust each part during assembly.
- Use a new gasket.
- 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 RH and LH bearing races.
- Replace the oil seal with a new one at every disassembly. Apply grease to the lips when installing the oil seal.
- Be careful not to mix up the differential oil seal RH and LH.



Rear Differential (VA-type)

DIFFERENTIALS

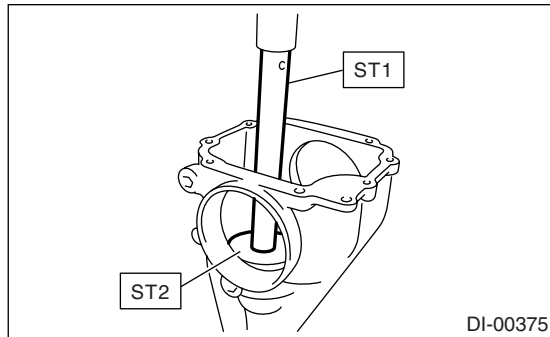
1) Adjusting preload for front and rear bearings

Adjust the bearing preload between front and rear bearings with collar and washer. Pinion height adjusting washer is not affected by this adjustment. The adjustment must not be carried out with oil seal inserted.

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

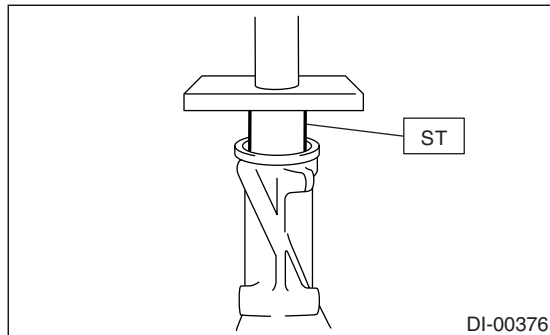
ST1 398477701 HANDLE

ST2 398477703 DRIFT 2



(2) Using the ST, install the front bearing race to the differential carrier.

ST 499277200 INSTALLER



(3) Insert the front bearing cone.

NOTE:

Use new front bearing cone.

(4) Measure and record the thickness of pinion adjust washer.

NOTE:

If tooth contact (drive pinion, hypoid driven gear) is normal in the inspection before disassembling, verify that the washer is not deformed, and then re-use the used washer.

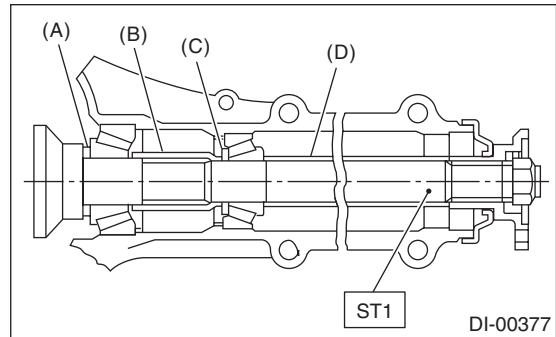
(5) Insert the ST1 into carrier with the pinion height adjusting washer and rear bearing cone fitted onto it.

NOTE:

Use new rear bearing cone.

(6) Install the preload adjusting collar & washer, front bearing cone, collar, companion flange, and washer & self-locking nut.

ST1 18678AA000 DUMMY SHAFT



- (A) Pinion height adjusting washer
- (B) Preload adjusting collar
- (C) Preload adjusting washer
- (D) Collar

(7) Turn ST1 by hand to seat the bearing, and measure the initial load and initial torque with a spring scale while tightening the selflocking nut. Select the preload adjusting washer and collar so that the specified preload is obtained when nut is tightened to the specified torque.

NOTE:

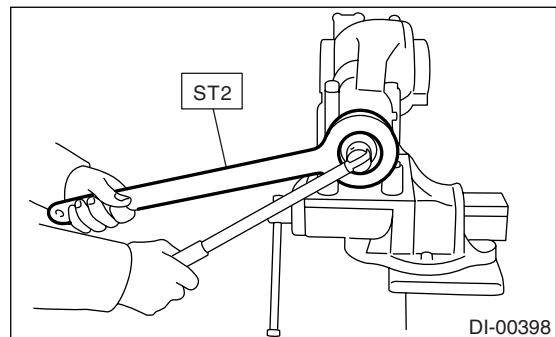
- Use a new self-locking nut.
- Be careful not to give excessive preload.
- When tightening the self-locking nut, lock companion flange with ST2 as shown in the figure.
- Measure the preload in direction of tangent to the flange.

ST1 18678AA000 DUMMY SHAFT

ST2 498427200 FLANGE WRENCH

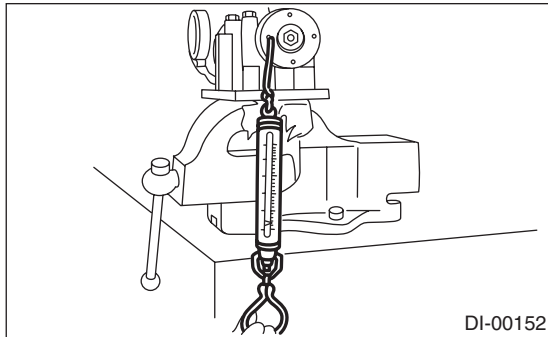
Tightening torque:

191 N·m (19.5 kgf-m, 141 ft-lb)



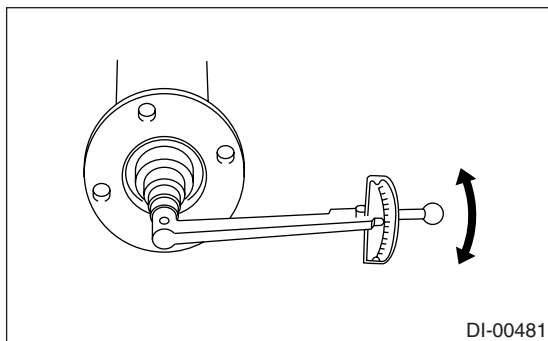
Initial load:

12.7—32.2 N (1.3—3.28 kgf, 2.9—7.24 lb)



Initial torque:

0.48 — 1.22 N·m (0.045—0.124 kgf·m, 0.32—0.9 ft·lb)



Preload adjusting washer	
Part No.	Thickness mm (in)
38336AA430	1.500 (0.0591)
38336AA440	1.513 (0.0596)
38336AA450	1.525 (0.0600)
38336AA460	1.538 (0.0606)
38336AA470	1.550 (0.0610)
38336AA480	1.563 (0.0615)
38336AA490	1.575 (0.0620)
38336AA500	1.588 (0.0625)
38336AA510	1.600 (0.0630)
38336AA520	1.613 (0.0635)
38336AA530	1.625 (0.0640)
38336AA540	1.638 (0.0645)
38336AA550	1.650 (0.0650)
38336AA560	1.663 (0.0655)
38336AA570	1.675 (0.0659)
38336AA580	1.688 (0.0665)
38336AA590	1.700 (0.0669)
38336AA600	1.713 (0.0674)
38336AA610	1.725 (0.0679)
38336AA620	1.738 (0.0684)
38336AA630	1.750 (0.0689)
38336AA640	1.763 (0.0694)
38336AA650	1.775 (0.0699)

Preload adjusting collar	
Part No.	Length mm (in)
31454AA250	51.05 (2.010)
31454AA260	51.25 (2.018)
31454AA270	51.35 (2.022)
31454AA280	51.45 (2.026)
31454AA290	51.55 (2.030)
31454AA300	51.65 (2.033)
31454AA310	51.75 (2.037)
31454AA320	51.85 (2.041)
31454AA330	52.05 (2.049)

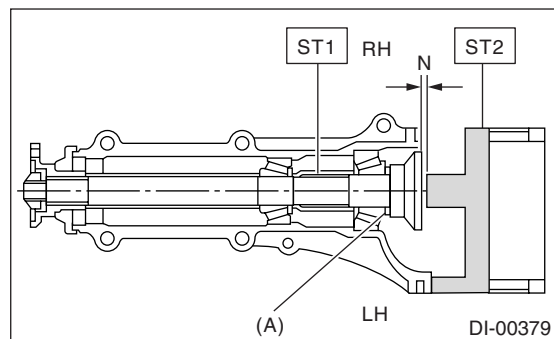
2) Adjusting drive pinion height:

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

(1) Install the ST2.

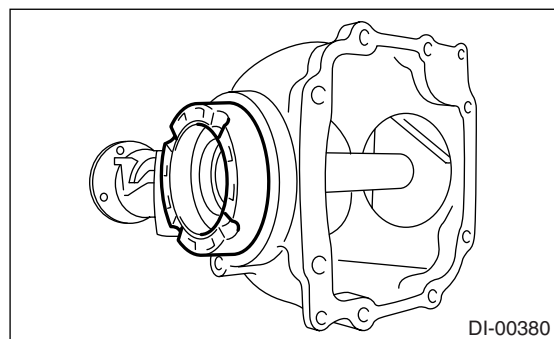
ST1 18678AA000 DUMMY SHAFT

ST2 18831AA010 DIFFERENTIAL CARRIER GAUGE



(A) Pinion height adjusting washer

(2) Install the side holder LH to the left side of the differential carrier in reverse direction.



Rear Differential (VA-type)

DIFFERENTIALS

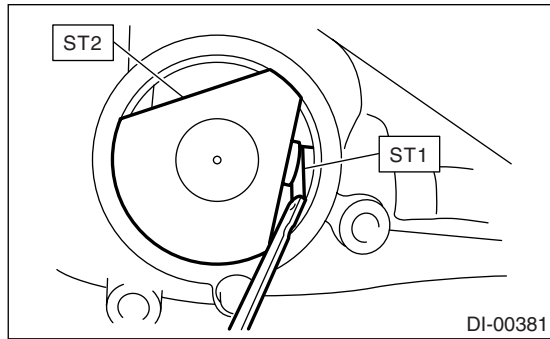
- (3) Measure the clearance N between the end of ST2 and the end surface of ST1 by using a thickness gauge.

NOTE:

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

ST1 18678AA000 DUMMY SHAFT

ST2 18831AA010 DIFFERENTIAL CARRIER GAUGE



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

NOTE:

Adjust it using the 0 — 3 washers.

$$T = T_o + N - 0.05 \text{ mm (0.0020 in)}$$

T	Thickness of pinion height adjusting washer mm (in)	
T _o	Thickness of washer temporarily inserted mm (in)	
N	Clearance of thickness gauge mm (in)	
Memo:		

(Example of calculation)

$$T_o = 0.15 \text{ mm (0.0020 in)}$$

$$N = 0.1 \text{ mm (0.0039 in)}$$

$$T = 0.15 \text{ mm (0.0020 in)} + 0.1 \text{ mm (0.0039 in)} - 0.05 \text{ mm (0.0020 in)} = 0.2 \text{ mm (0.0079 in)}$$

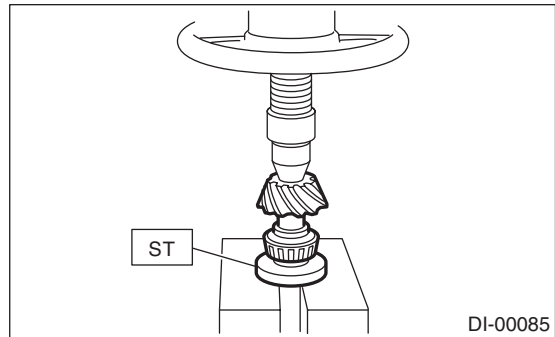
Result: Thickness = 0.2 mm (0.0079 in)

Therefore use part number 32295AA370.

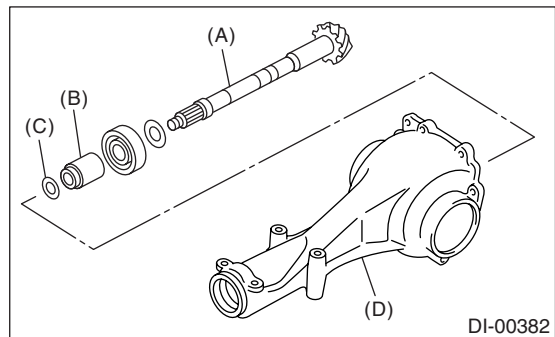
Pinion height adjusting washer	
Part No.	Thickness mm (in)
32295AA350	0.150 (0.0059)
32295AA360	0.175 (0.0069)
32295AA370	0.200 (0.0079)
32295AA380	0.225 (0.0089)
32295AA390	0.250 (0.0098)
32295AA400	0.275 (0.0108)

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

ST 398177700 INSTALLER



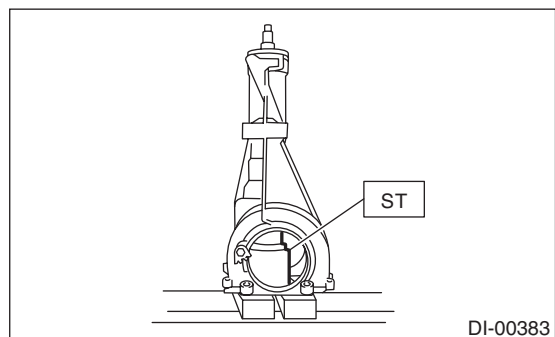
- 4) Insert the drive pinion into the differential carrier, and install the preselected bearing preload adjusting collar and washer.



- (A) Drive pinion
(B) Bearing preload adjusting collar
(C) Bearing preload adjusting washer
(D) Differential carrier

- 5) Set ST and differential carrier to the press and install the front bearing cone.

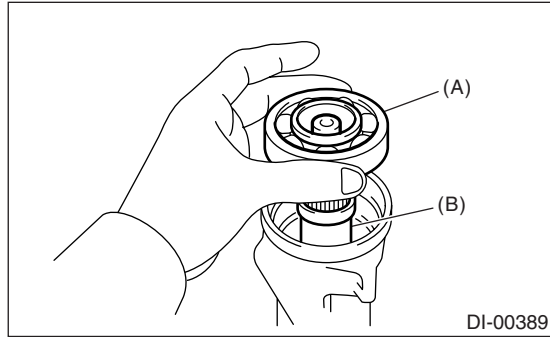
ST 399780104 WEIGHT



NOTE:

Set the carrier to the press until the companion flange is installed.

6) Insert the collar, then install the pilot bearing.



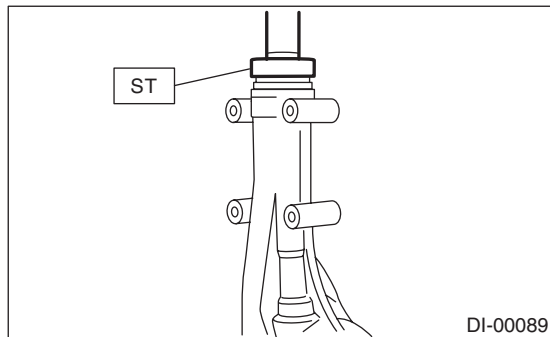
- (A) Pilot bearing
- (B) Collar

7) Fit a new oil seal with ST.

NOTE:

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

ST 499277200 INSTALLER

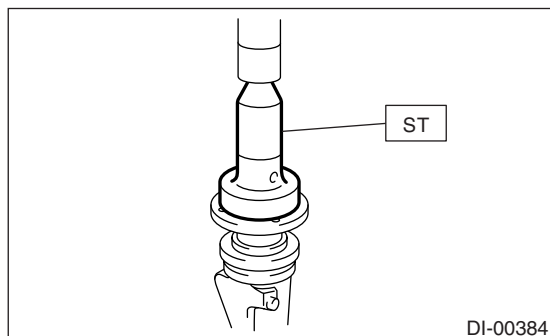


8) Press-fit the companion flange with ST.

NOTE:

Be careful not to damage the bearing.

ST 899874100 INSTALLER



9) Apply Lock-Tite to the drive pinion shaft screw threads and on the new nut seat.

Lock Tite:

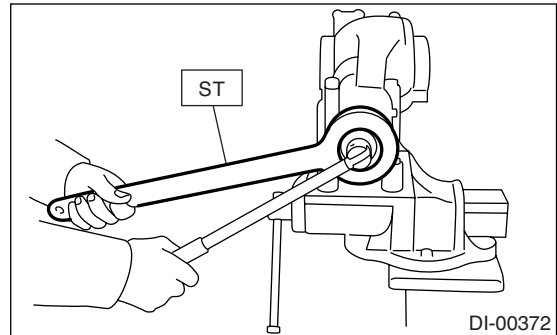
THREE BOND 1324 (Part No. 004403042)

10) Attach the nut and use the ST to fix the companion flange in place, then tighten.

ST 498427200 FLANGE WRENCH

Tightening torque:

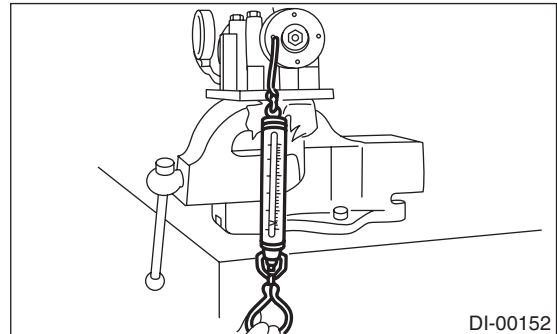
191 N·m (19.5 kgf-m, 141 ft-lb)



11) Measure the initial torque and initial load.

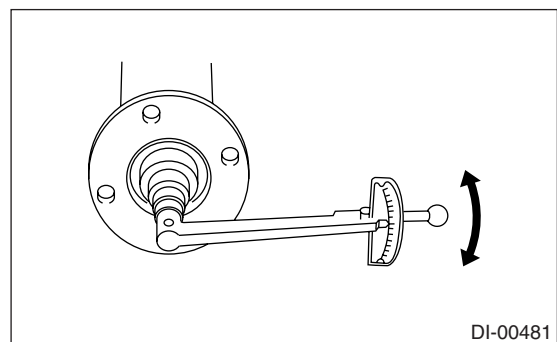
Initial load:

12.7—32.2 N (1.3—3.28 kgf, 2.9—7.24 lb)



Initial torque:

0.48 — 1.22 N·m (0.045—0.124 kgf-m, 0.32—0.9 ft-lb)



Rear Differential (VA-type)

DIFFERENTIALS

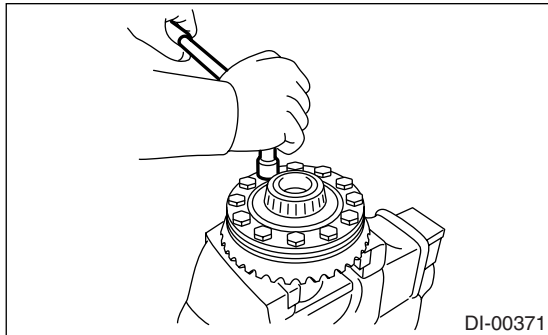
12) Install the hypoid driven gear to differential case.

NOTE:

- Tighten diagonally while tapping the bolt heads.
- Set a cushioning such as wooden block, aluminum plate or shop cloth between vise and differential case if the side gear comes into contact with vise.

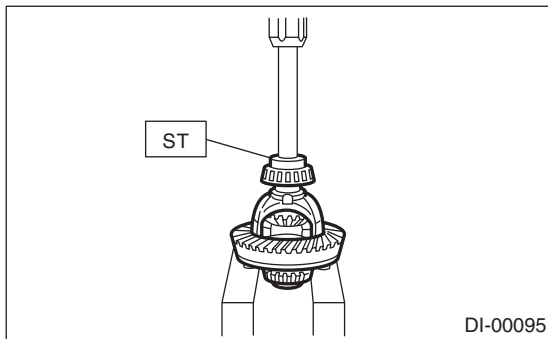
Tightening torque:

62 N·m (6.3 kgf-m, 45.6 ft-lb)



13) Press the side bearing into differential case using ST.

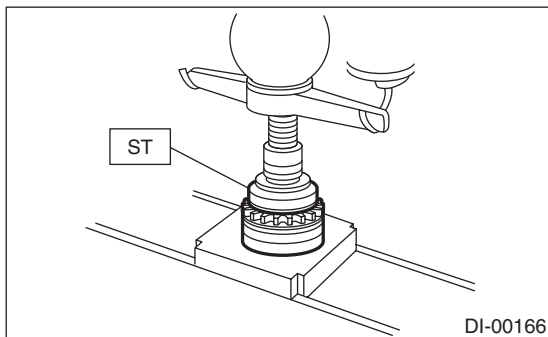
ST 398487700 DRIFT



14) Assemble holders.

(1) Install the new oil seal into holder RH and LH.

ST 498447100 INSTALLER

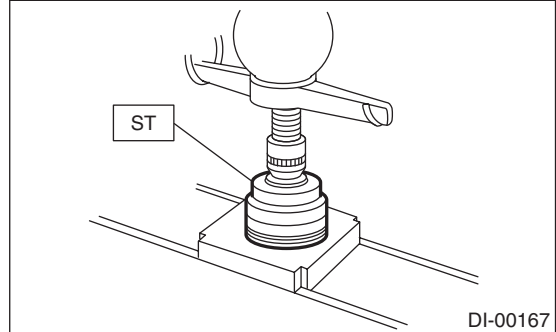


(2) Install the bearing race into holder RH and LH.

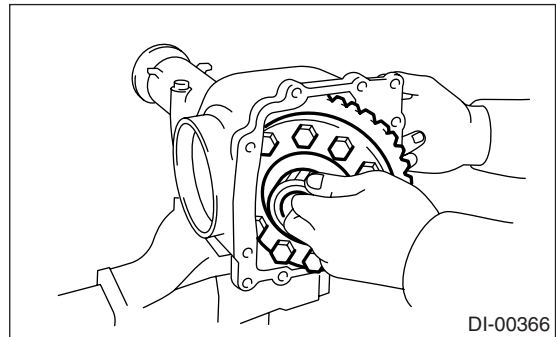
ST 398177700 INSTALLER

CAUTION:

Make sure that the RH and LH oil seals, bearing outer races and cones are properly assembled.



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

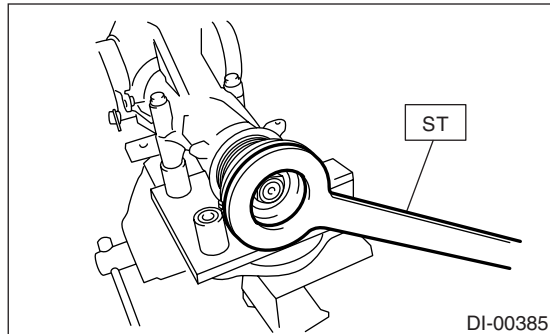


(4) Temporarily tighten the side holders RH and LH in differential carrier to install.

15) Perform the backlash adjustment between the hypoid driven gear and drive pinion, and preload adjustment of differential side bearing.

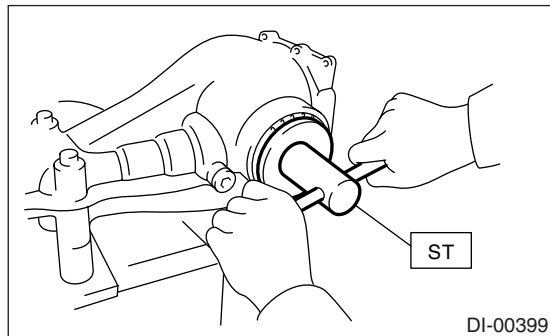
(1) Turn the drive pinion with ST for better fitting of differential side bearing.

ST 498427200 FLANGE WRENCH



(2) Screw in the side holder LH until light contact is made with ST.

ST 18630AA010 WRENCH



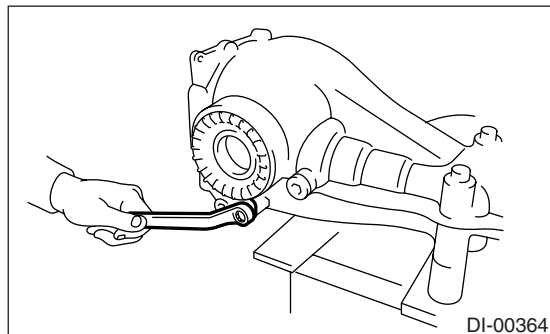
(3) Back off the holder on the hypoid driven gear side by approx. 1 and 1/2 teeth, and tighten the other side holder by approx. 2 teeth (amount that the hypoid driven gear is turned back (1 and 1/2) + 1/2 teeth).

[Back off amount of side (hypoid driven gear side) holder + 1/2 tooth.] This + 1/2 tooth gives preload.

(4) Temporarily tighten the lock plate.

NOTE:

Turn over the lock plate to shift the holder by 1/2 tooth.



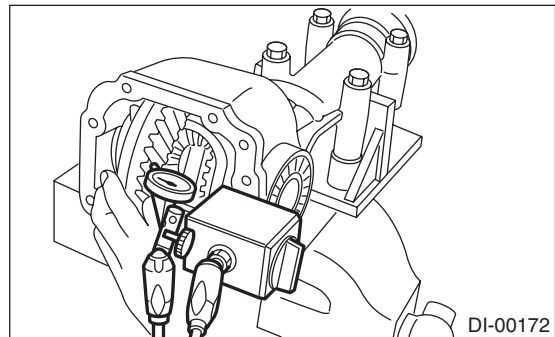
(5) Measure the hypoid driven gear-to-drive pinion backlash. Set the magnet base on differential carrier. Align the contact point of dial gauge with tooth face of hypoid driven gear, and move hypoid driven gear while holding drive pinion still. Read the value indicated on dial gauge.

NOTE:

If measured value of backlash is not within the specified range, repeat the procedures for pinion driven gear set backlash adjustment and the differential side bearing preload adjustment.

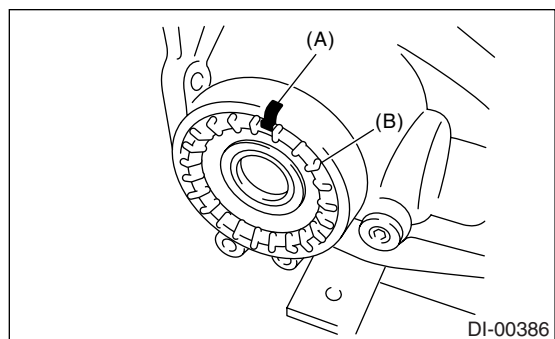
Backlash:

0.10 — 0.15 mm (0.0039 — 0.0059 in)



16) Put alignment marks on both the differential carrier and holder. Remove the holder side at a time.

Replace them in the original position after inserting an O-ring and applying grease to the threaded portion.



(A) Alignment mark

(B) Holder

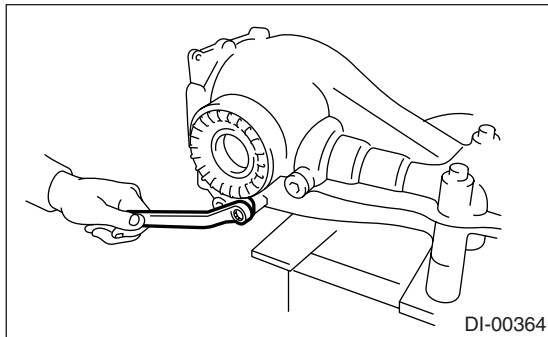
Rear Differential (VA-type)

DIFFERENTIALS

17) Tighten the bolt of lock plate to specified torque.

Tightening torque:

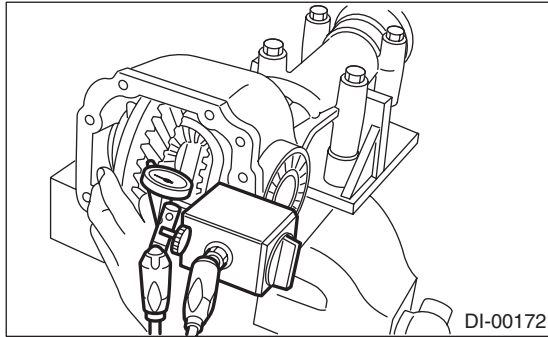
25 N·m (2.5 kgf-m, 18.1 ft-lb)



18) Recheck the hypoid driven gear to pinion backlash.

Backlash:

0.10 — 0.15 mm (0.0039 — 0.0059 in)



19) Checking and adjusting the 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.

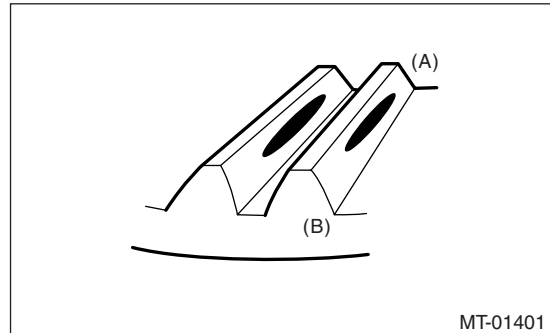
(2) When the contact pattern is not correct, re-adjust.

NOTE:

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

- Correct tooth contact

Check item: Tooth contact pattern is slightly shifted towards the toe side under no-load rotation. (When driving it will move toward the heel side.)



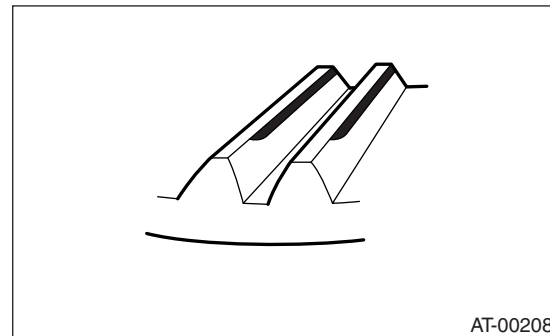
(A) Toe side

(B) Heel side

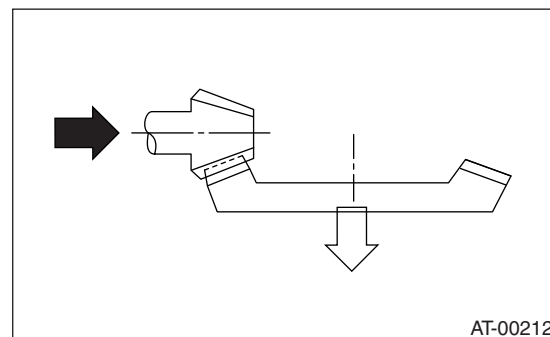
- Face contact

Check item: Backlash is too large.

Contact pattern



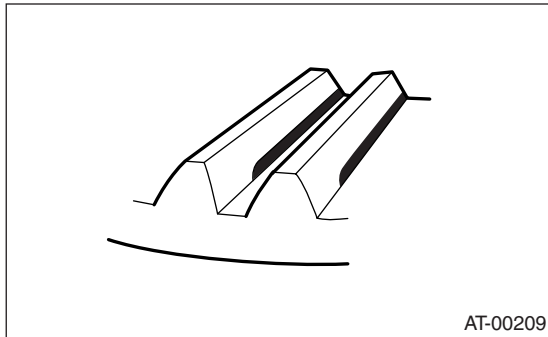
Corrective action: Increase thickness of drive pinion height adjusting washer in order to bring drive pinion close to hypoid driven gear.



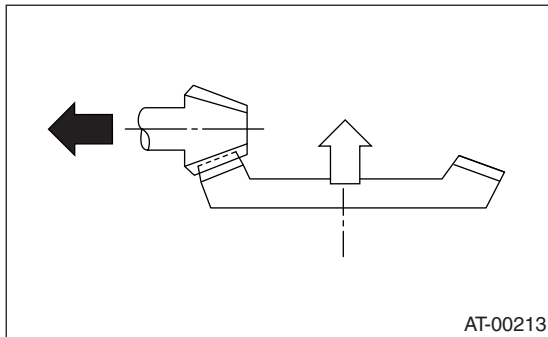
- Flank contact

Check item: Backlash is too small.

Contact pattern



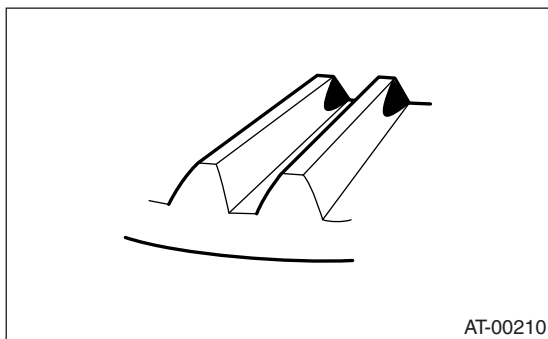
Corrective action: Reduce the thickness of pinion height adjusting washer according to the procedure for bringing drive pinion away from hypoid driven gear.



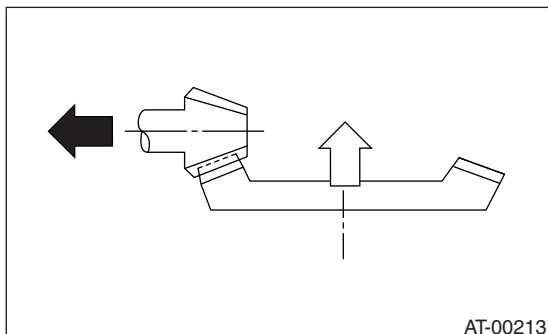
- Toe contact (inner side contact)

Check item: Teeth contact area is too small.

Contact pattern



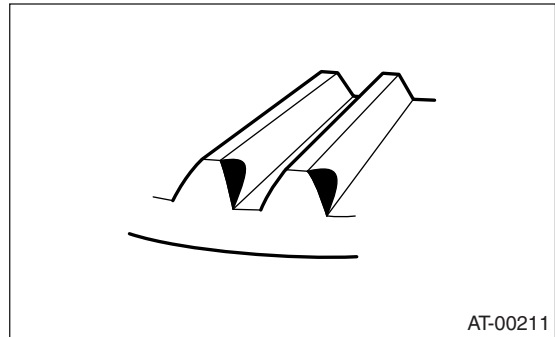
Corrective action: Reduce the thickness of pinion height adjusting washer according to the procedure for bringing drive pinion away from hypoid driven gear.



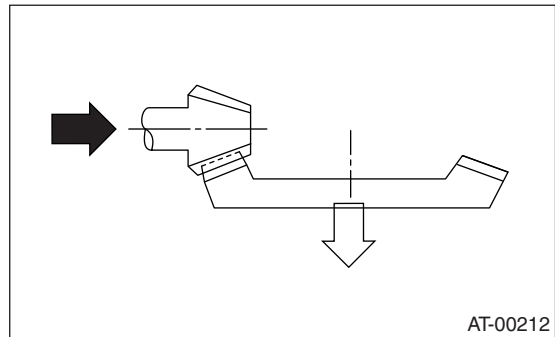
- Heel contact (outside end contact)

Check item: Teeth contact area is too small.

Contact pattern



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

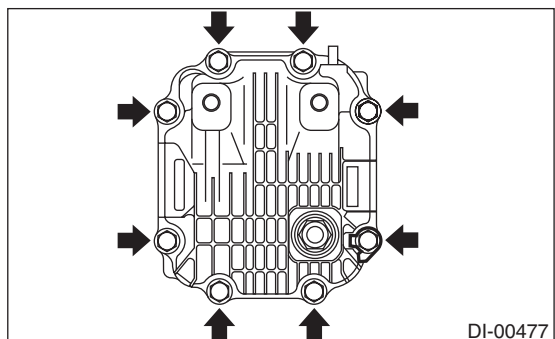


20) If proper tooth contact is not obtained, once again adjust the drive pinion height and the differential side bearing preload (already mentioned) and the hypoid gear backlash.

21) Attach a new gasket, rear cover, and ground stay to the differential carrier.

Tightening torque:

34 N·m (3.5 kgf-m, 25.1 ft-lb)



22) Using new gaskets, install the rear differential oil temperature switch.

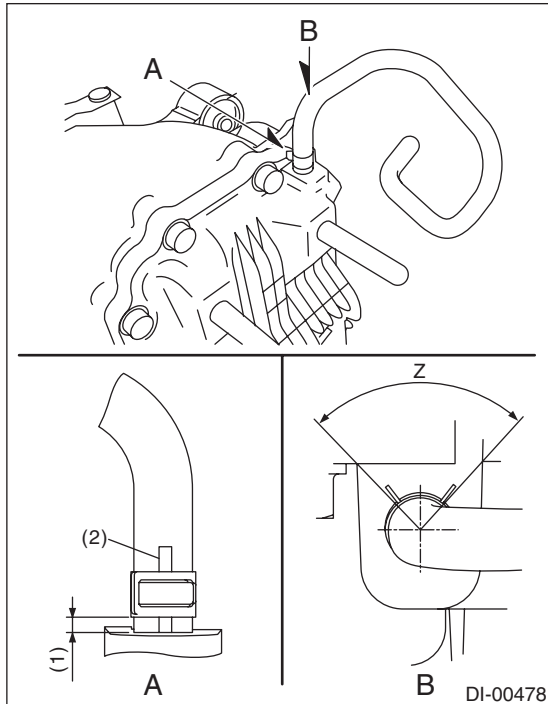
Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)

Rear Differential (VA-type)

DIFFERENTIALS

23) Affix with the attachment clip so that the white marking of the hose is within the range of Z (87°).



(1) 0 — 1 mm (0 — 0.04 in)

(2) Marking

E: INSPECTION

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

1) Hypoid driven gear and drive pinion

- If there is evidently an abnormal tooth contact, find out the cause and adjust until the teeth contact correctly. Replace the gear if there is an excessive worn or an incapable adjustment.
- If crack, cutout or seizure is found, replace the parts as a set. Slight damage of some teeth can be corrected by oil stone or the like.

2) Side gear and pinion mate gear

- Replace the differential case assembly if cracks, scoring or other defects are evident on tooth surface.

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 contact surface shows cracking.

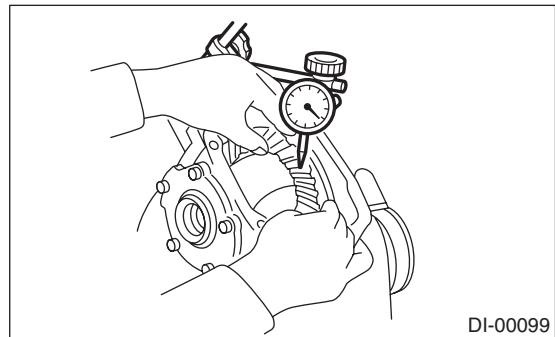
1. HYPOID DRIVEN GEAR BACKLASH

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

Hypoid driven gear backlash:

0.10 — 0.15 mm (0.0039 — 0.0059 in)

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



2. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

Inspect the tooth contact between the hypoid driven gear and drive pinion. <Ref. to DI-19, ASSEMBLY, Rear Differential (VA-type).>

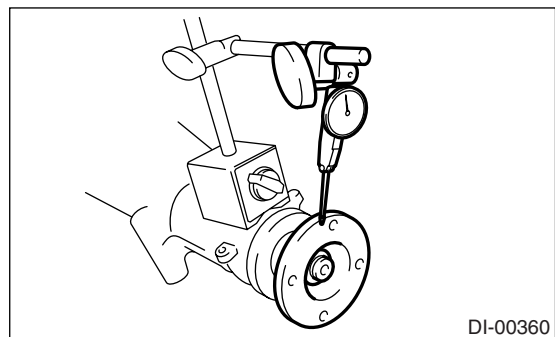
3. COMPANION FLANGE

1) If rust or dirt is attached to the companion flange, remove them.

2) Set a dial gauge at a companion flange surface (mating surface of propeller shaft and companion flange), and then measure the companion flange runout.

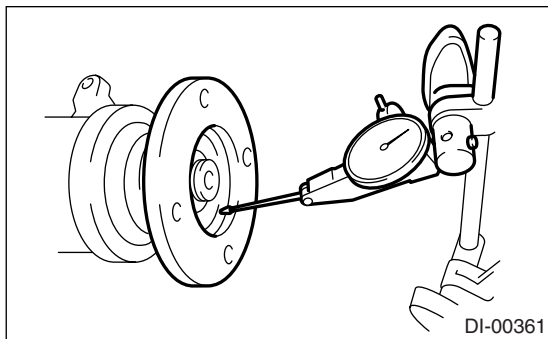
Limit of runout:

0.08 mm (0.003 in)



3) Set the gauge inside of the companion flange, and measure the runout.

Limit of runout:
0.08 mm (0.003 in)



4) If either runout exceeds the limit, move the phase of companion flange and drive pinion 90° each, and find the point where the runout will be within the limit.

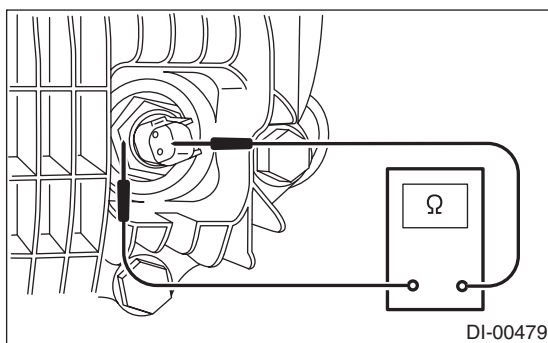
5) If the runout exceeds the limit when changing the phase, replace the companion flange and re-check the runout.

6) If the runout exceeds the limit after replacing the companion flange, the drive pinion may be assembled incorrectly or bearing is faulty.

4. REAR DIFFERENTIAL OIL TEMPERATURE SWITCH

Inspect the continuity of the rear differential oil temperature switch.

Specified resistance	Criteria
Less than 1 Ω	Normal
1 M Ω or more	Replacement



F: ADJUSTMENT

1. HYPOID DRIVEN GEAR BACKLASH

Adjust hypoid driven gear backlash.

<Ref. to DI-19, ASSEMBLY, Rear Differential (VA-type).>

2. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

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

<Ref. to DI-19, ASSEMBLY, Rear Differential (VA-type).>