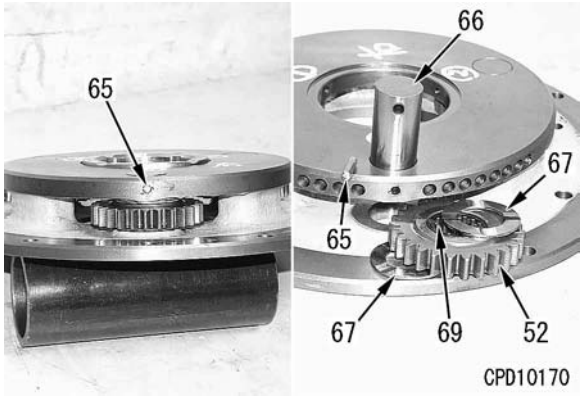
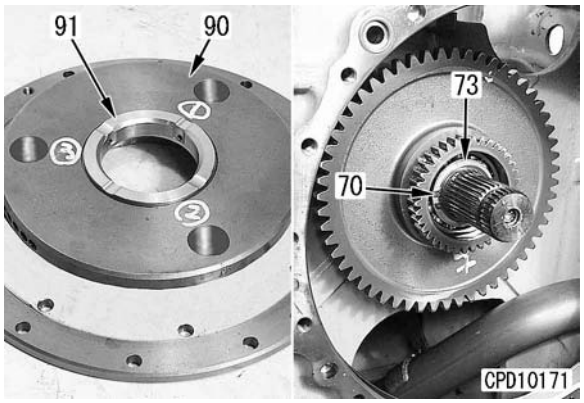


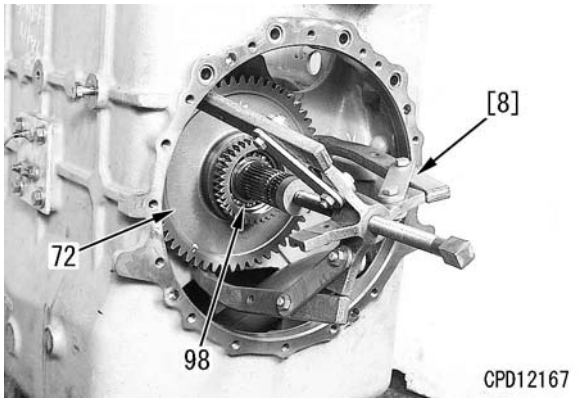
5) Remove bushing (91) from carrier (90).

8. **Sun gear**

1) Remove snap ring (70), then remove collar (73).

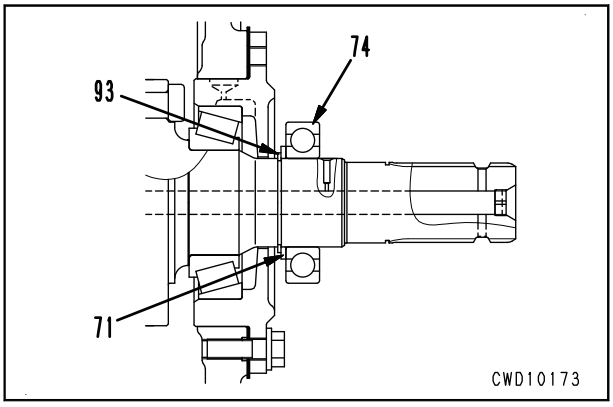


2) Using gear puller [8], remove sun gear (72) and bearing (98).



3) Using bearing race puller, remove bearing (74).
4) Remove collar (71).
5) Remove snap ring (93).

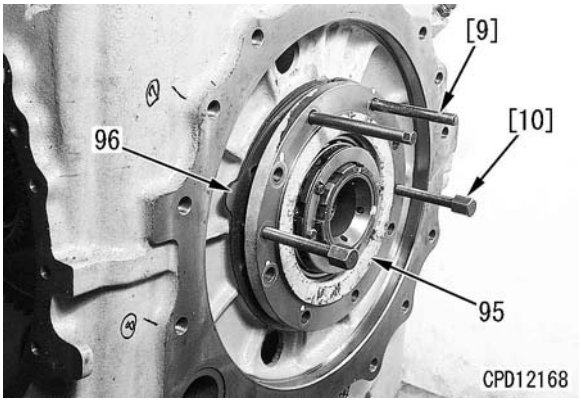
★ Right side of machine only



9. **Bevel pinion assembly**

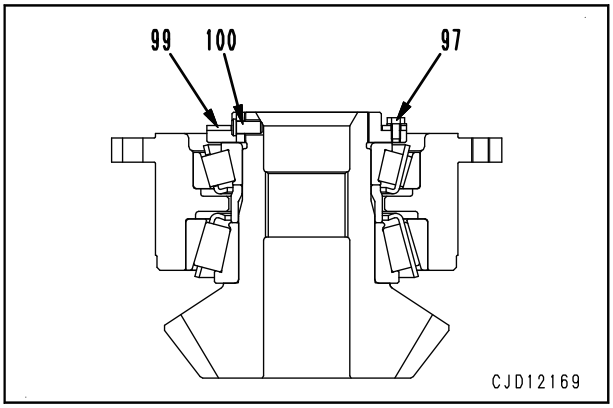
1) Remove the mounting bolts.
2) Using guide bolt [9] and forcing bolt [10], remove bevel pinion assembly (95) and shim (96).

★ Store shims after checking the number and thickness of the shims.

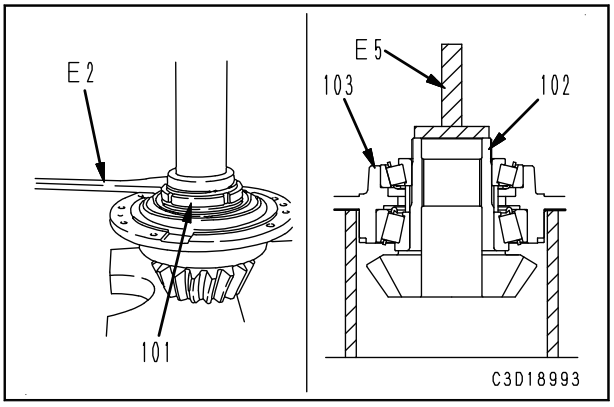


3) Assembly of bevel pinion

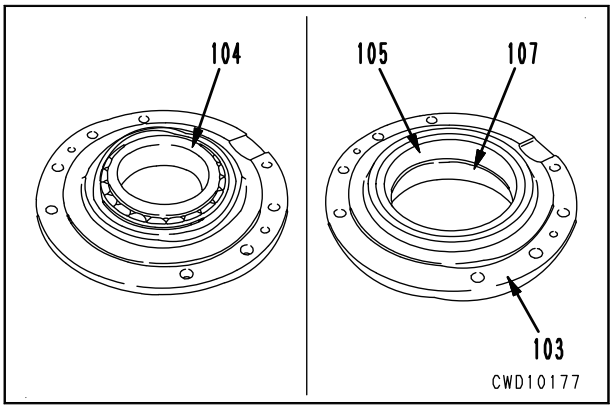
1] Remove bolt (97), then remove plate (99) and pin (100).



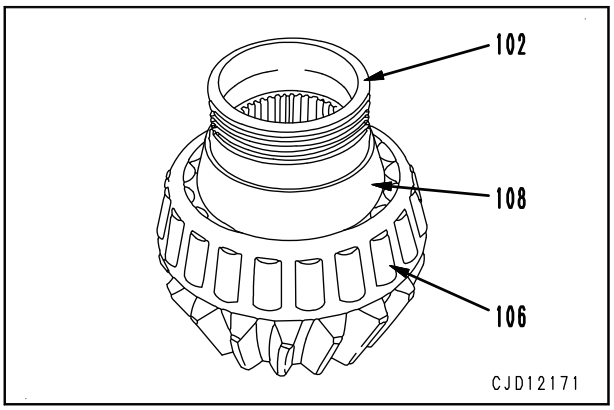
2] Hold the pinion with the press to keep the pinion from moving, remove nut (101) using tool **E2**.
3] Using tool **E5**, remove bevel pinion (102) from cage (103).



4] Remove bearing (104).
5] Remove outer races (105) and (107) from cage (103).



6] Remove bearing (106) and spacer (108) from bevel pinion (102).

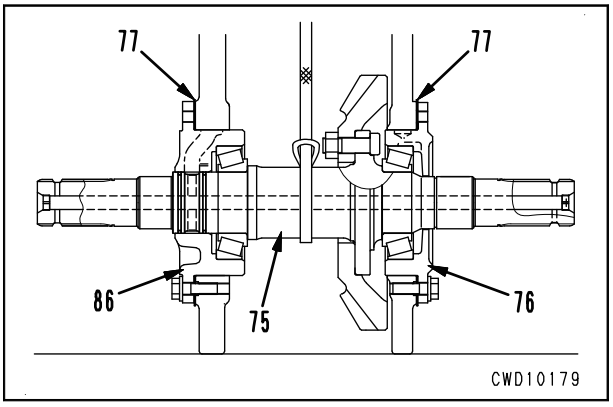


10. **Bevel gear shaft and bevel gear assembly**

1) Sling bevel gear and shaft assembly (75).
2) Remove cage assemblies (76) and (86).

★ Check and record the thickness, number and the mounting position of shims (77).

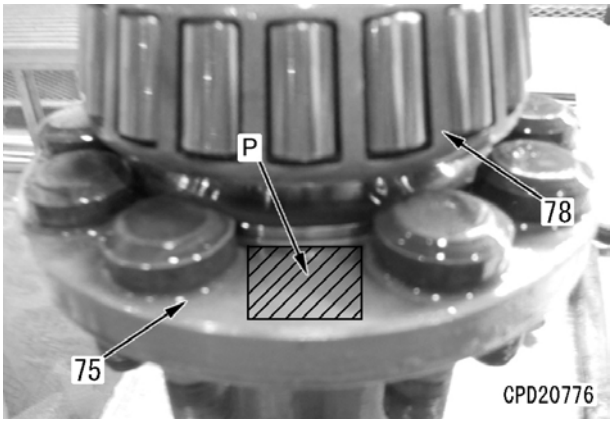
★ The right and left cages differ with each other, so mark them beforehand.

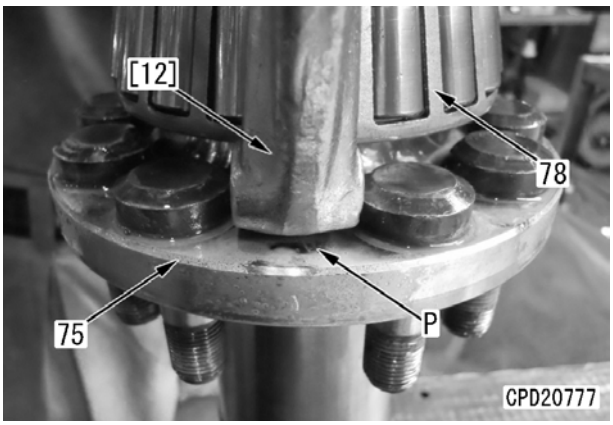


3) Move the bevel gear and shaft assembly (75) to the left. Using puller [12], remove bearing (78).

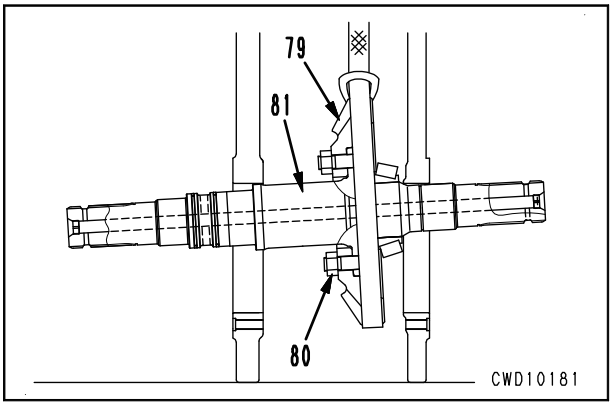
★ Apply the claw of the puller to the part (portion (P) where the bolt hole pitch is increases.

★ Remove only the bearing on the left side of the machine.

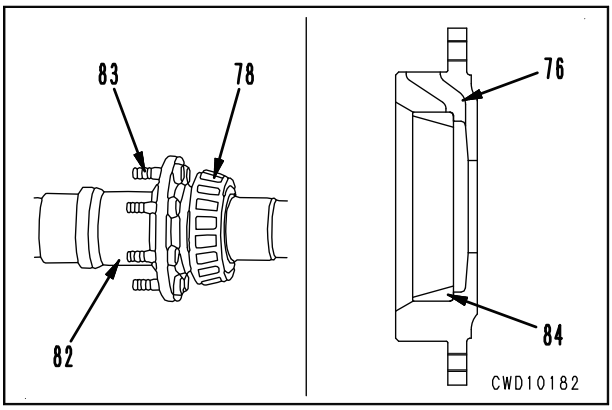




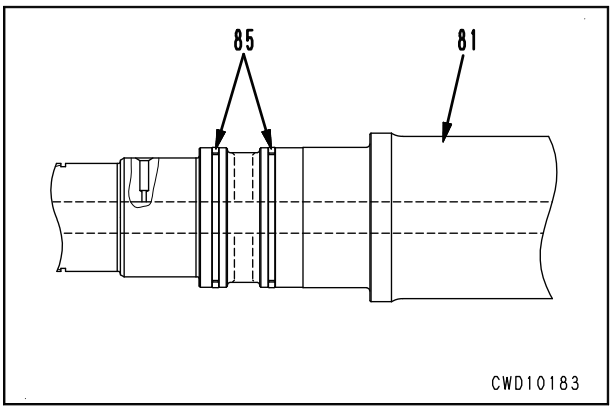
4) Sling bevel gear (79) and remove mounting nut (80). Remove bevel gear shaft assembly (81) by pulling it out toward the right side of the machine.



5) Remove bevel gear (78) from bevel gear shaft (82).
6) Remove bolt (83).
7) Remove outer race (84) from cage (76).



8) Remove seal ring (85) from bevel gear shaft (81).



Assembly

- **Precautions for assembly**

★ Clean all parts, and check them for dirt and damage before installing.

★ Drip power train oil (for details, see "List of lubricant and water") on the rotating part of the bearing and rotate it several times.

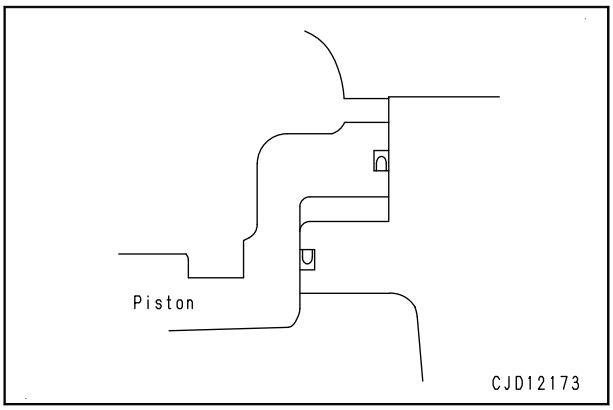
★ Apply power train oil (for details, see "List of lubricant and water") to the sliding surfaces before installing.

★ Apply grease (G2-L1) to the piston seal ring with its pressure-receiving side facing the housing and install it evenly.

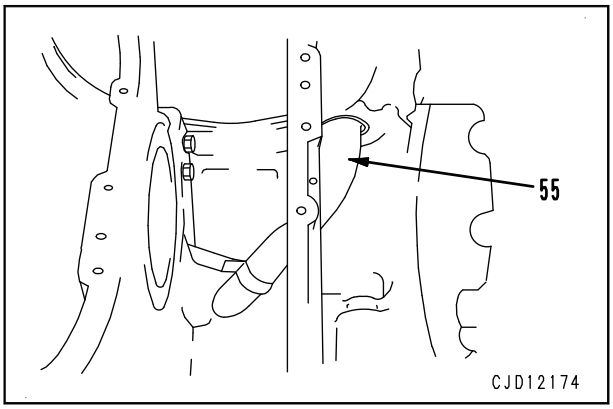
Rotation seal ring:

Fix the seal ring with grease (G2-LI) and install it, taking care that the seal ring will not be caught.

★ Check that the snap ring is fitted securely into the groove.



1. **Suction tube**
Install suction tube (55).



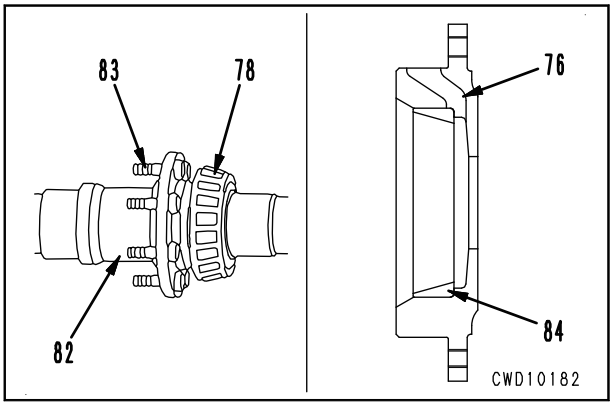
2. **Bevel gear shaft and bevel gear assembly**
1) Install bolt (83) to bevel gear shaft (82).
2) Heat bearing (78) with a bearing heater and shrink-fit it on the right side of the machine.

★ The heat treated hardness is lowered if the temperature of the bearing is increased too much. For this reason, never heat the bearing higher than 120 ° C .

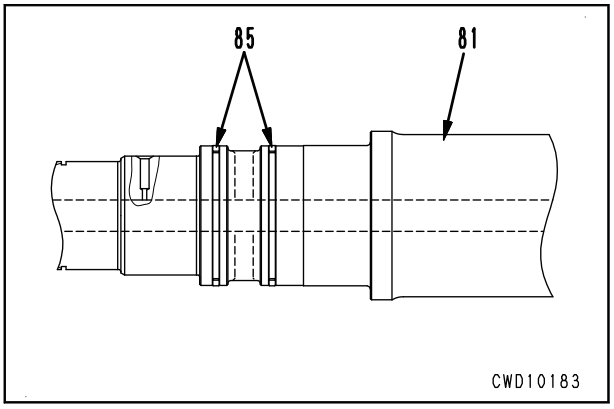
★ After installing the bearing, drip power train oil (for details, see "List of lubricant and water") on the rotating part of the bearing and rotate it several times.

★ Check that the clearance in the end surface of the bearing is not more than 0.03 mm.

3) Install outer race (84) to cages (76) and (86).

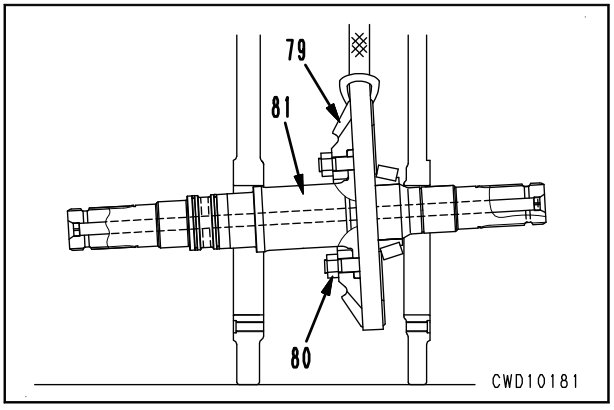


4) Install seal ring (85) to bevel gear shaft (81).



5) Insert bevel gear shaft (81) into bevel gear (79) being lifted at the case center from the right side of the machine.

★ Tighten mounting nut (80) temporarily.

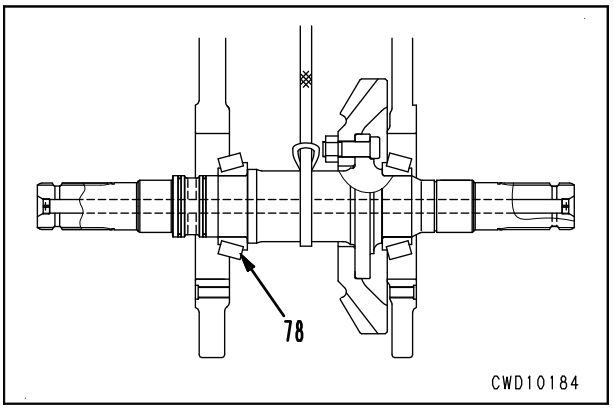


6) Heat bearing (78) with a bearing heater and shrink-fit it on the left side of the machine.

★ The heat treated hardness is lowered if the temperature of the bearing is increased too much. For this reason, never heat the bearing higher than 120 ° C .

★ After installing the bearing, drip power train oil (for details, see "List of lubricant and water") on the rotating part of the bearing and rotate it several times.

★ Check that the clearance in the end surface of the bearing is not more than 0.03 mm.



7) Install cages (76) and (86) to bevel gear and shaft assembly (75).

★ Note that the cages differ between the right and the left.

★ Insert shims (77) of the thickness and quantity checked when removed.

- Standard shim thickness: **1.5 mm**
- Available shim thickness: **0.2, 0.3, 0.5 mm**

Mounting bolt:

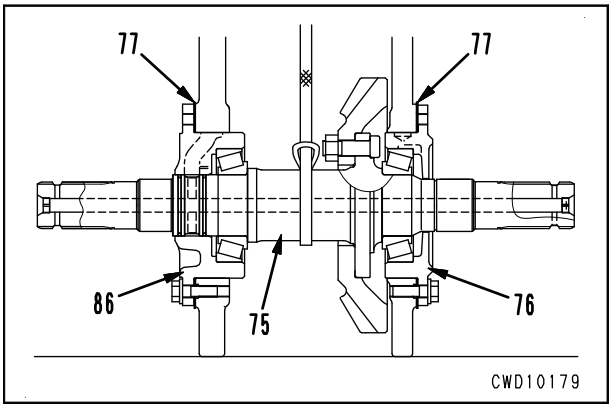
98 – 123 Nm {10 – 12.5 kgm}

8) Tighten the bevel gear mounting nut to the specified torque.

★ Lock the bevel gear by putting a plastic hammer into a space between the bevel gear and the case.

Mounting nut:

245 – 309 Nm{25 – 31.5 kgm}



9) Preload adjustment

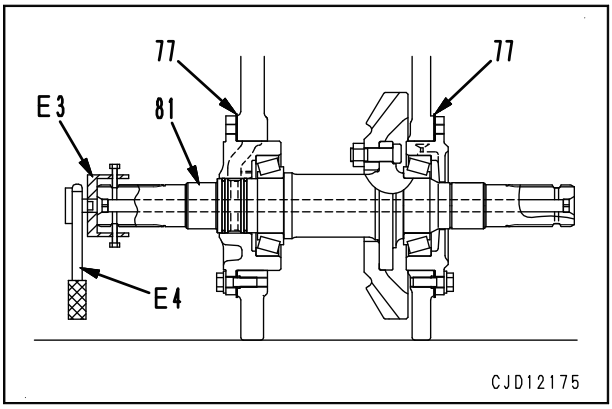
★ Make preload adjustment with the bevel pinion assembly removed.

1] Assemble the bevel gear and shaft assembly several times to allow the bearing to settle.

2] Fit tool **E3** to the end of bevel gear shaft (81) and measure the rotation torque using **E4** (torque wrench).

- Standard rotating torque : **10.3 to 14.7 Nm {1.05 to 1.50 kgm}**

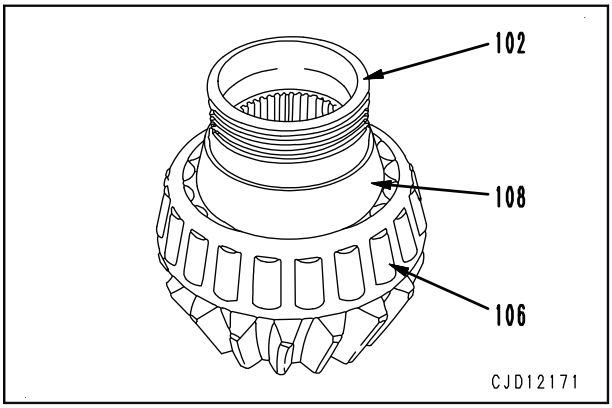
★ If the rotation torque is lower than the standard value, decrease the number of shims (77) in step 7). If it is higher than the standard value, increase the number of shims (77).

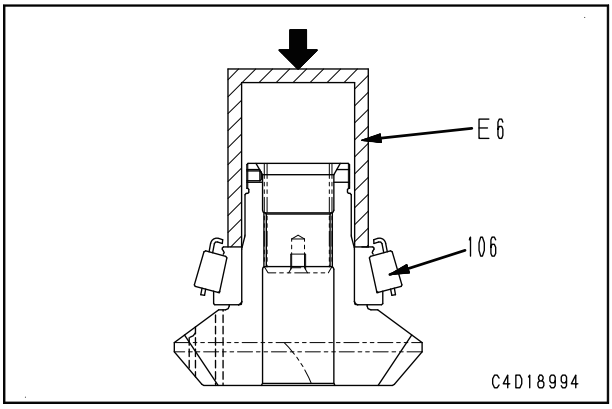


3. **Bevel pinion assembly**

1) Assembly of bevel pinion

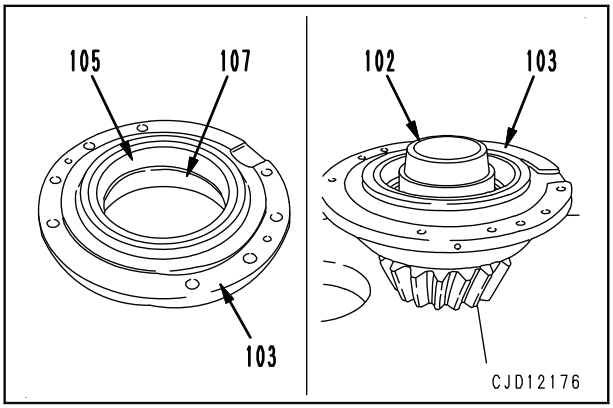
1] Using tool **E6**, press fit bearing (106) into bevel pinion (102) and install spacer (108).

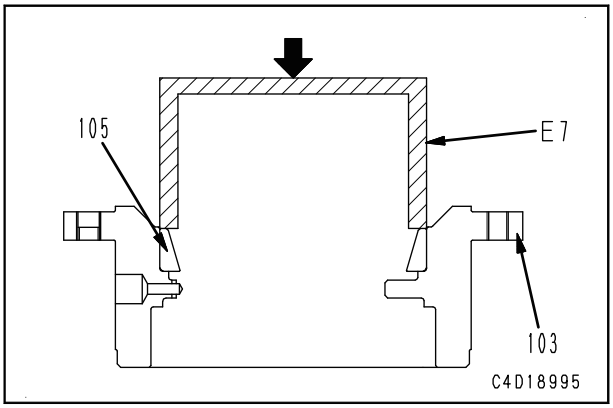


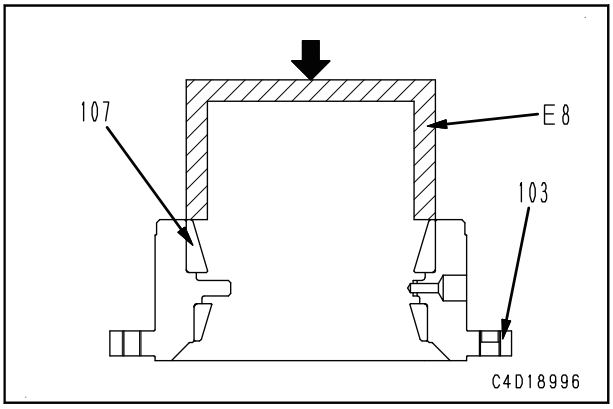


2] Use tools **E7** and **E8** to press fit outer race (105) and (107) into cage (103).

3] Place bevel pinion (102) on the press stand and set cage (103).







4] Using tool **E9**, press fit bearing (104) into cage (103).

5] Hold the pinion with the press to keep the pinion from moving, tighten lock nut (101) using tool **E2**.

Locknut:
Adhesive (LT-2)

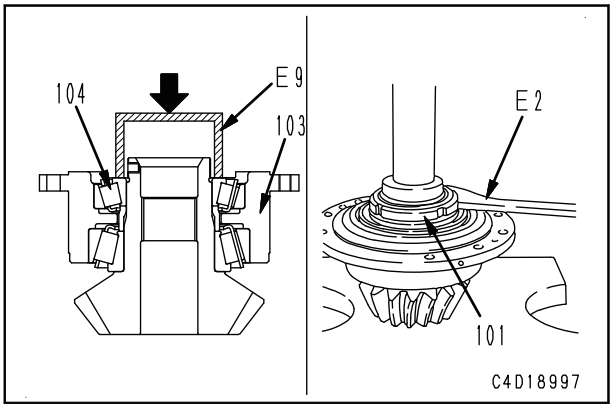
Locknut:
392 – 441 Nm {40 – 45 kgm}

6] After the nut is tightened, return the nut to the position where one of the eight holes in the nut for pins is aligned to one of the five holes in the pinion shaft fro pins.

★ Turn the nut back 0 to 9 ° .

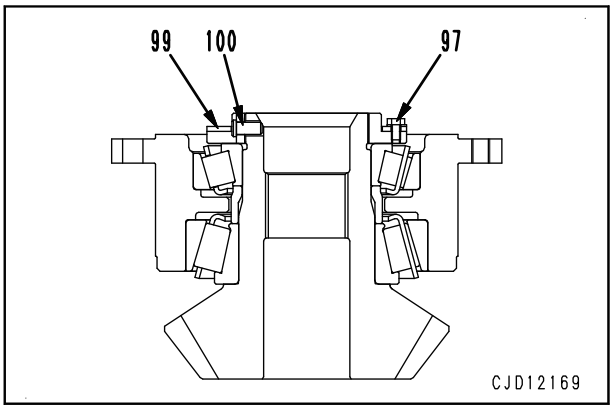
★ Tighten the nut while rotating the cage.

★ After tightening the nut, check that the bevel pinion rotates smoothly.



7] Install pin (100), install plate (99), and tighten bolt (97).

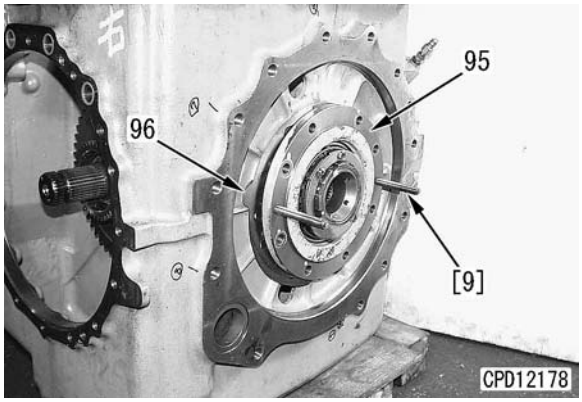
Bolt:
11.8 – 14.7 Nm {1.2 – 1.5 kgm}



2) Using guide bolt [9], install shim (96), and install bevel pinion assembly (95).

★ Insert shims of the thickness and quantity checked when removed.

- Standard shim thickness: **2 mm**
- Available shim thickness: **0.2, 0.3, 1.0 mm**



4. **Adjusting backlash and tooth contact**

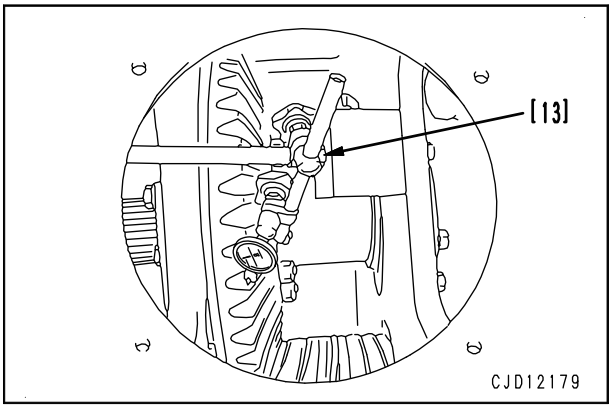
1) Adjusting backlash

Put the probe of dial gauge [13] in contact with the tip of the bevel gear teeth at right angles. Hold the bevel pinion in position, and read the measurement when the bevel gear is moved forward and backward.

★ Standard value for backlash: **0.2 to 0.28 mm**

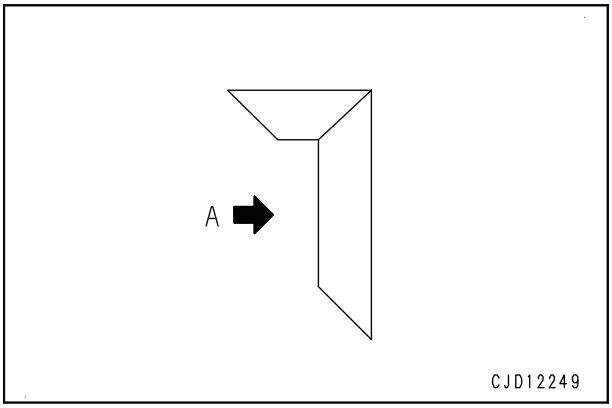
★ Measure the backlash at diagonal three points or more.

- If the measured backlash is out of the standard range, adjust it according to the following procedure:



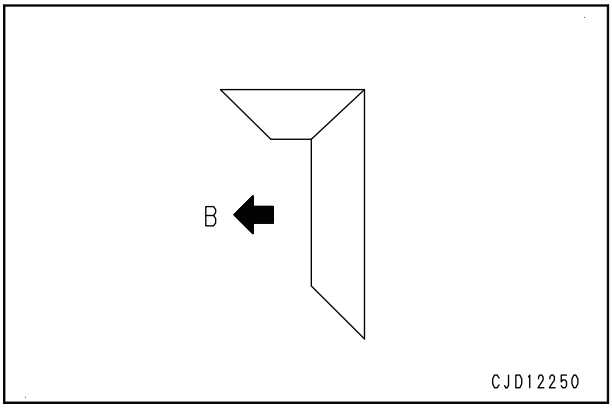
★ Adjust the backlash by increasing or decreasing on both sides. Do not change the total thickness of the right side and left side shims in order not to change the preload. (If the number of shims on one side is added, remove the same number of them on the other side. If the number of shims on one side is reduced, add the same number of them on the other side.)

- When backlash is too small
  Decrease the shims on the right side of the machine and add as many shims to the left side
  (to move the bevel gear in the direction of (**A**)).

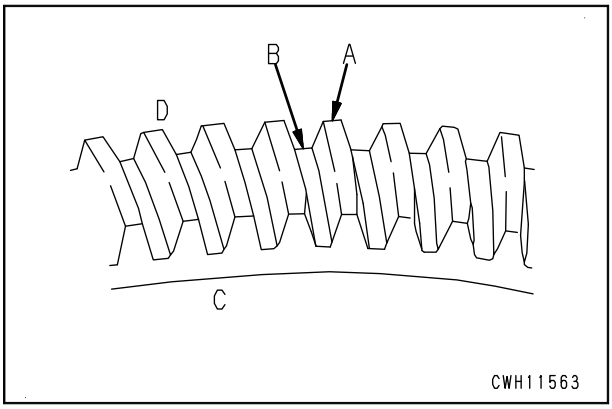


- When there is a big backlash:

Decrease the shims on the left side of the machine and add as many shims to the right side
(to move the bevel gear in the direction of (**B**)).



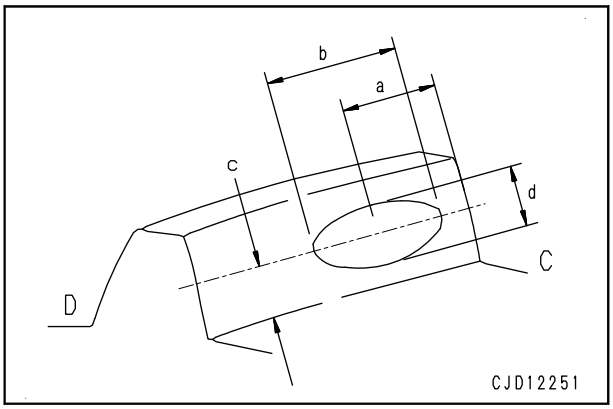
2) Adjusting tooth contact
Testing
Coat the bevel gear tooth surface slightly with red lead, then rotate the bevel gear back and forth to check the tooth contact pattern on the bevel gear.
1] Check that there is not a strong contact at addendum (**A**), dedendum (**B**), small end (**C**), or large end (**D**).



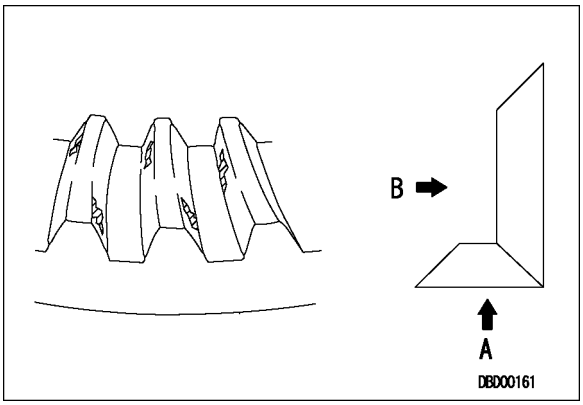
2] The values for the tooth contact are as follows:
(the standard value is based on the addendum of the bevel gear)
Center of tooth contact (**a**): 20 to 40% of tooth width
Width of tooth contact **(b):** 30 to 50% of tooth width
Center of tooth contact (**c):** 35 to 65% of tooth height
Width of tooth contact **(d):** 60 to 80% of tooth height

★ If the adjustment is made in this way, right tooth contact is ensured, when load is applied.

★ In the drawing below, (**C**) denote the small end and (**D**) denotes the large end.



Adjustment
If the result of the inspection shows that the tooth contact pattern is not proper, adjust again according to the following procedure.
1] If the bevel pinion is too far from the center line of the bevel gear, the tooth contact pattern is that the small end of the bevel gear tooth faces curved outward contact with the large end of the bevel gear tooth faces curved inward.
- Make adjustment in the following manner.
  Shift the bevel pinion in direction (**A**) by adjusting the shims on the bevel pinion side.
  Move the bevel gear in direction (**B**), then check the tooth contact pattern and backlash again.



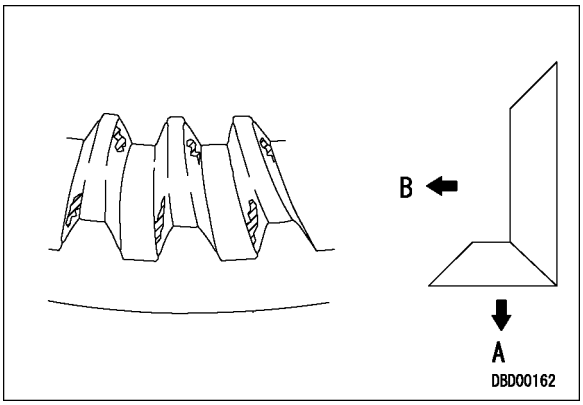
2] If the bevel pinion is too close to the center line of the bevel gear, the tooth contact pattern is that the large ends of the bevel gear tooth faces curved outward contact with the small ends of the bevel gear tooth faces curved inward.
- Make adjustment in the following manner.
  Shift the bevel pinion in direction (**A**) by adjusting the shims on the bevel pinion side.

Move the bevel gear in direction (**B**), then check the tooth contact pattern and backlash again.

★ Do not change the total number of the shims on both sides.

3] When adjustment is completed, tighten the mounting bolts of the cage and bevel pinion assembly to the specified torque.

For both of the mounting bolts of cage and bevel pinion assembly:
98 – 123 Nm {10 – 12.5 kgm}

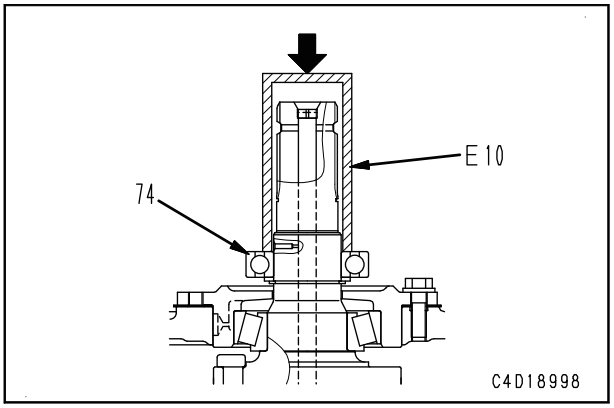


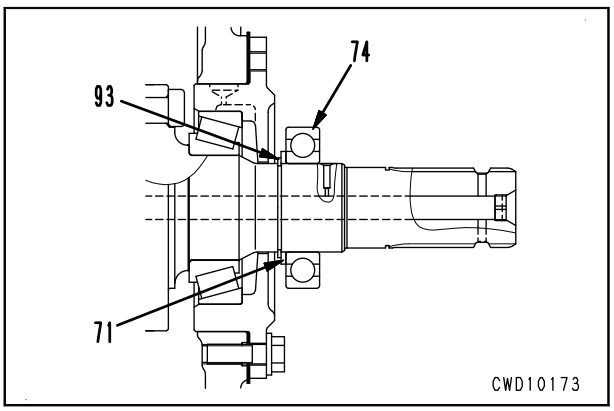
5. **Sun gear**

1) Install snap rings (93) to the shaft.

★ Right side of machine only

2) Install collar (71).
3) Using tool **E10**, install bearing (74).

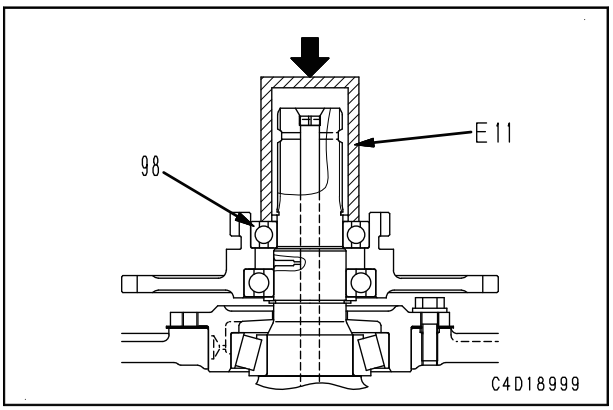


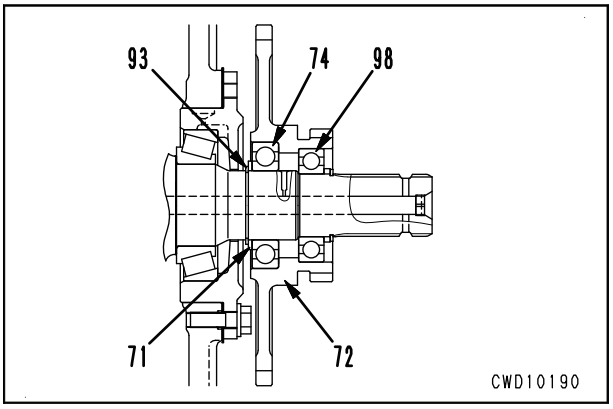


4) Install sun gear (72).

5) Using tool **E11**, press fit bearing (98).

★ Press fit the inner and outer races simultaneously.

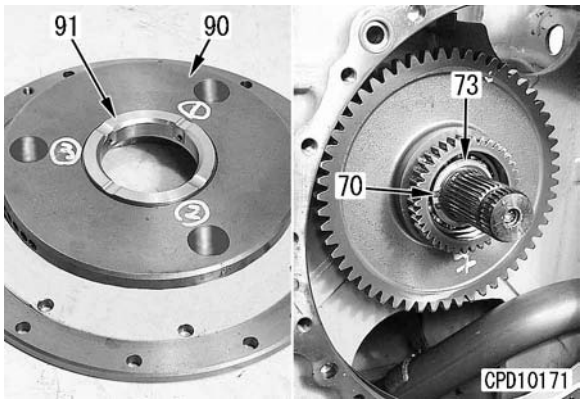




6) Fit collar (73) and install snap ring (70).

6. **Assembly of carrier**

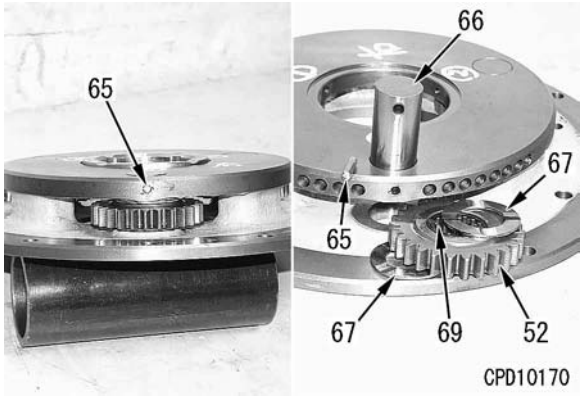
1) Install bushing (91) to carrier (90).



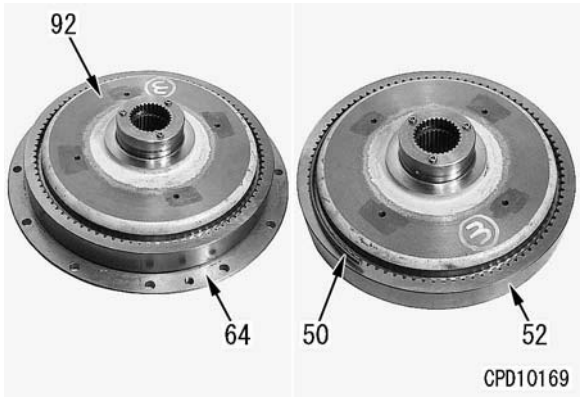
2) Install bearing (69) into gear (52), fit thrust washers (67) to top and bottom of the bearing, then set the gear to carrier.
3) Install shaft (66) , matching the inside of the thrust washers and bearing to the shaft hole of the carrier.

★ Align the roll pin holes accurately.

4) Install roll pin (65).

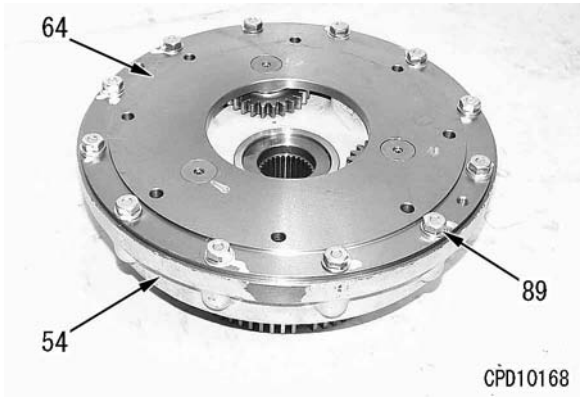


5) Set hub (92) to ring gear (52), and install snap ring (50).
6) Install hub (92) to carrier assembly (64).

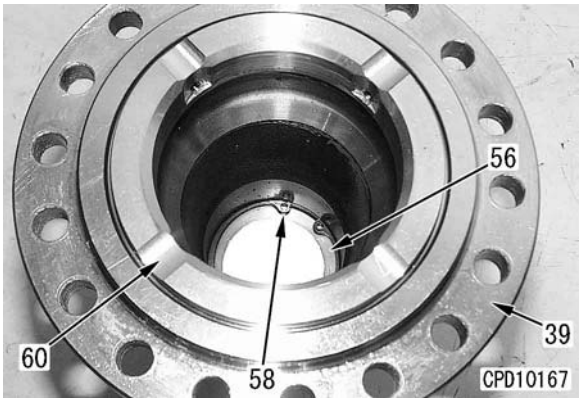


7) Install hub and carrier assembly (64) to hub (54) and install bolt (89).

Mounting bolt:
59 – 74 Nm {6 – 7.5 kgm}

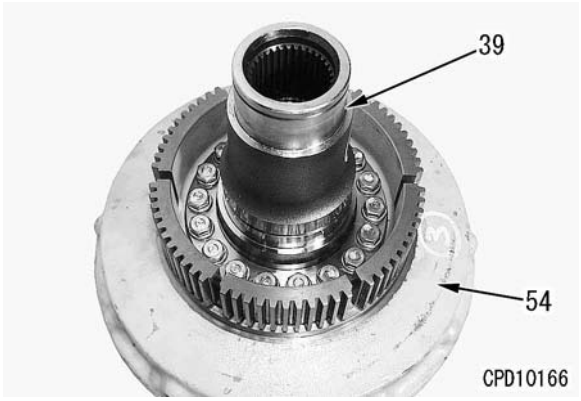


7. **Assembly of brake**
1) Install stopper (56) to the hub and install snap ring (58).
2) Install bushing (60) to hub (39).

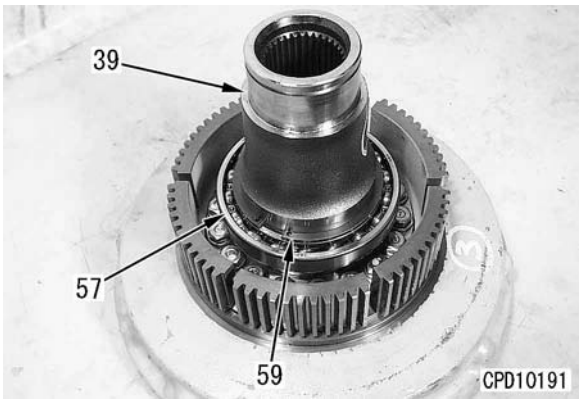


3) Install hub (39) to hub (54) and tighten 18 bolts.

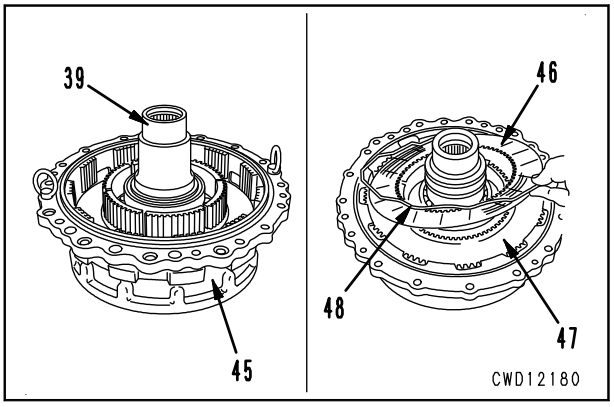
Mounting bolt:
59 – 74 Nm {6 – 7.5 kgm}



4) Install bearing (57) to hub (39).
5) Install snap ring (59).



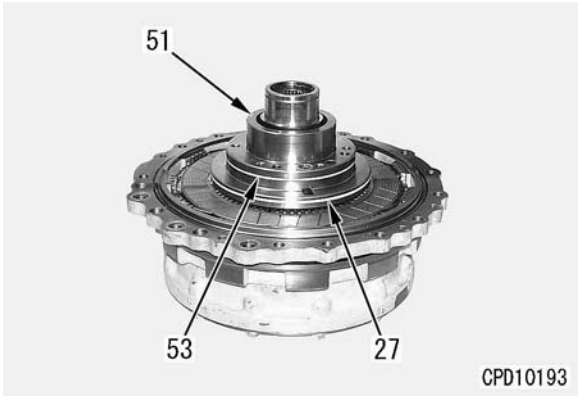
6) Set brake drum (45) to hub (39).
7) Install disc (46), plate (47), and spring (48).



8) Install cage (51) with seal rings (27) and (53).

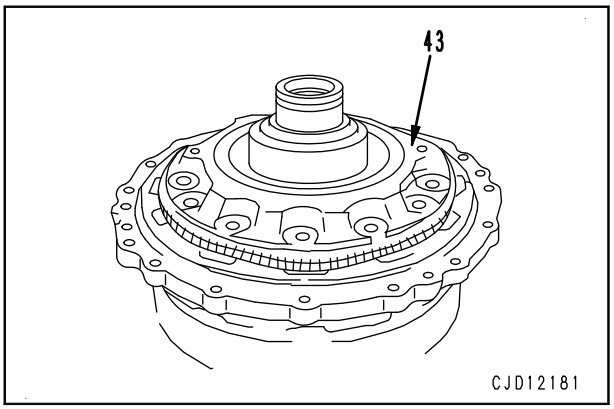
★ Align the oil hole in the cage and four oil holes in the drum by eye.

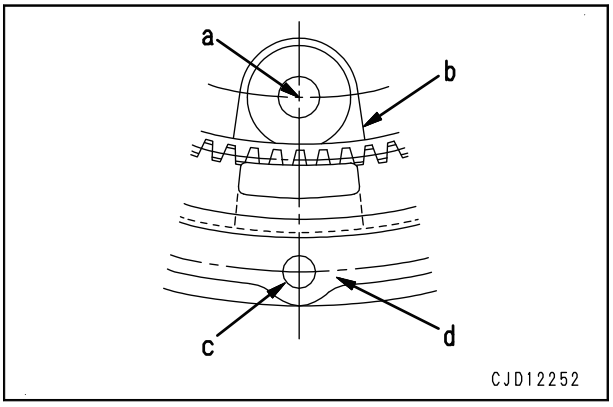
★ Press fit the cage into the outer race of the bearing.



9) Install the seal ring to piston (43).

10)Install piston (43), aligning matchmark (**a**) and 13.5 mm hole (**c**) in the drum.
(**b**): Spot facing of piston
(**d**): Opposite side of the drum side hole

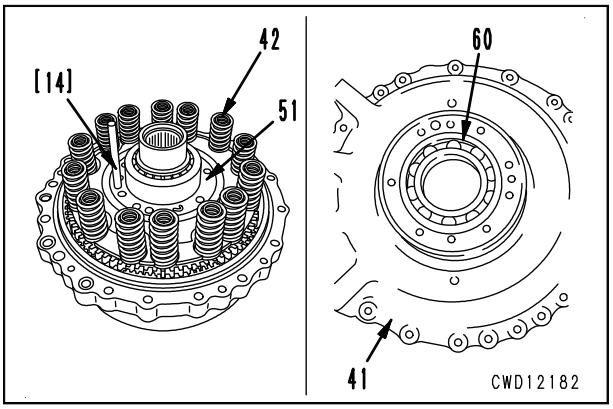




11)Install springs (42).

12)Install guide bolt [14]. to cage (51).

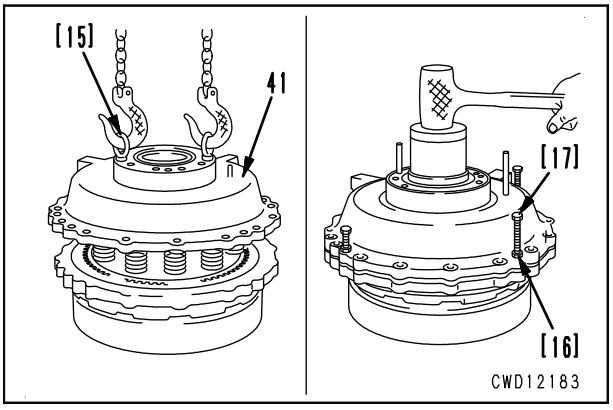
13)Install bearing (60) to cover (41).



14)Using eyebolt [15], align cover (41) with the guide bolt and set it.

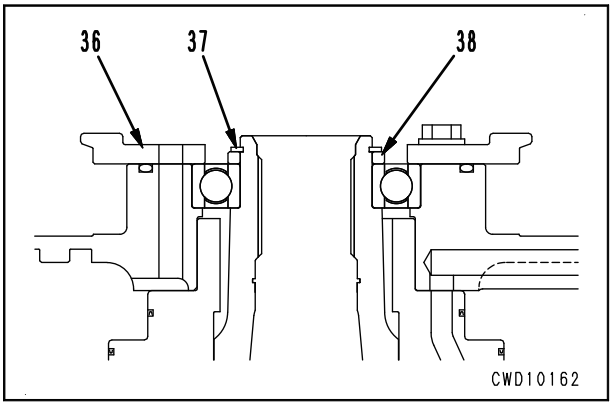
★ Check that the spring is fitted to the piston and case.

15)Press fit the inner race of the bearing to the hub assembly while compressing the spring with forcing screw [17] and nut [16].

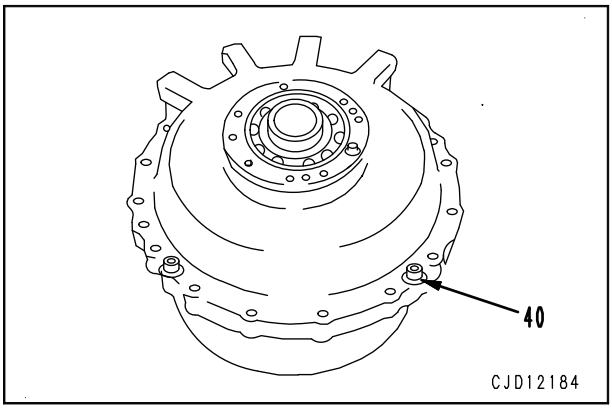


16)Fit spacer (38) and install snap ring (37).

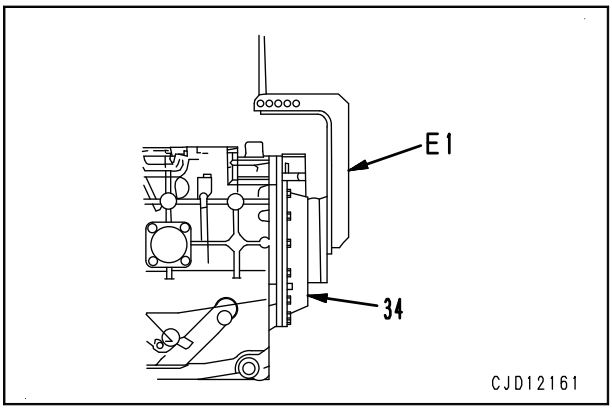
17)Install flange (36).



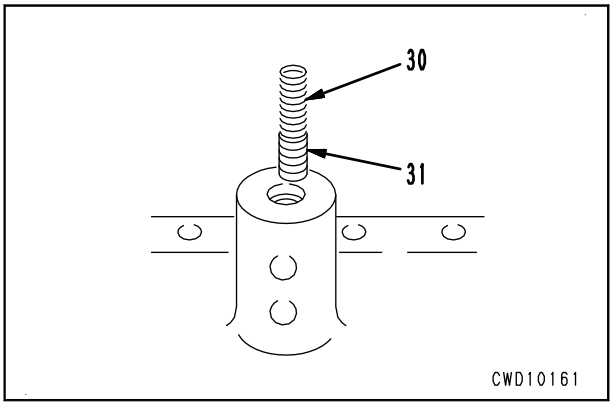
18)Remove the bolt and nut used to compress the spring and install four bolts (40).



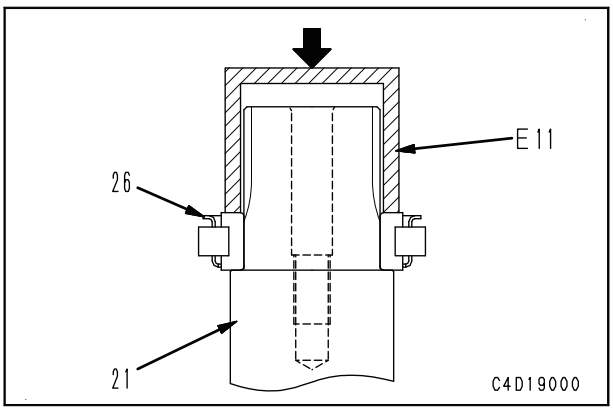
8. **Installation of brake and carrier assembly**
   1) Set the seal ring on the carrier so that it extends from the shaft uniformly.
   2) Using tool **E1**, install brake and carrier assembly (34).



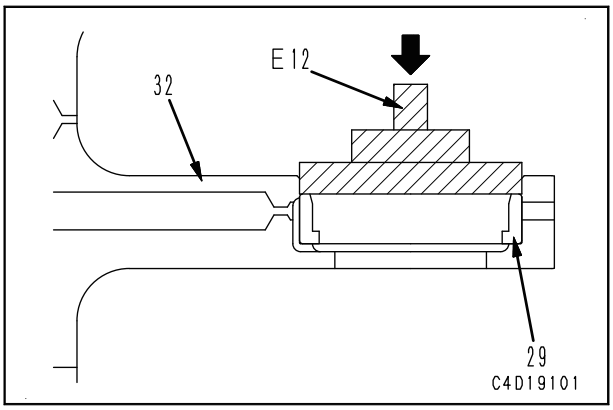
9. **Assembly of cover**
   1) Install valve (31) and spring (30) to the cover, then install the plug.

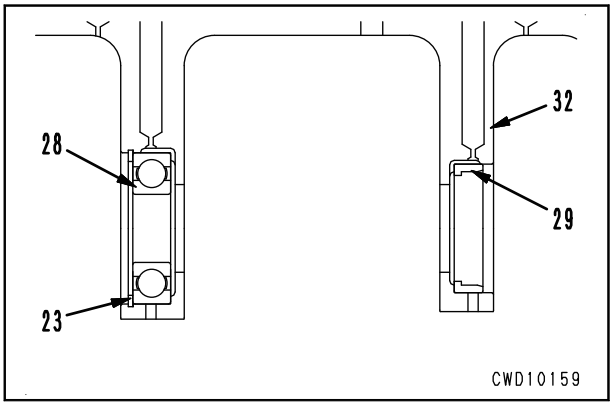


2) L.H. carrier drive gear
   1] Press fit bearing (26) to shaft (21) by using tool **E11**.

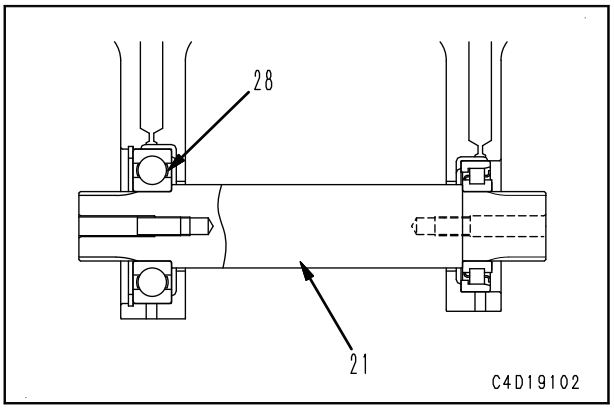


   2] Press fit outer race (29) to cover (32) by using tool **E12**.
   3] Using tool **E12**, press fit bearing (28) to cover (32) and install snap ring (23).



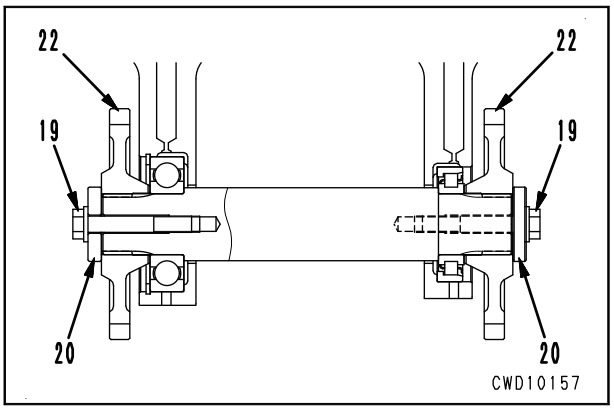


4] Press fit shaft (21) to the inner race side of bearing (28).



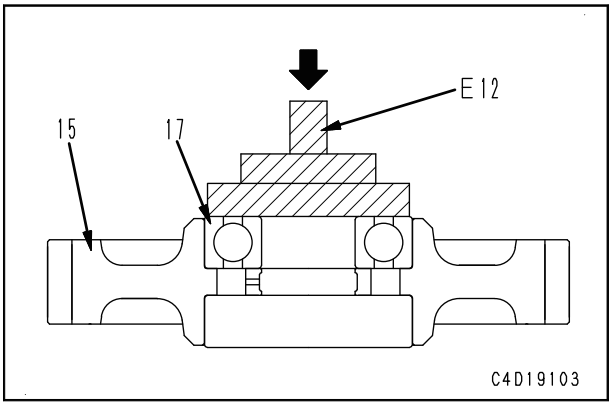
5] Install gear (22).
6] Install holder (20) and tighten bolt (19).

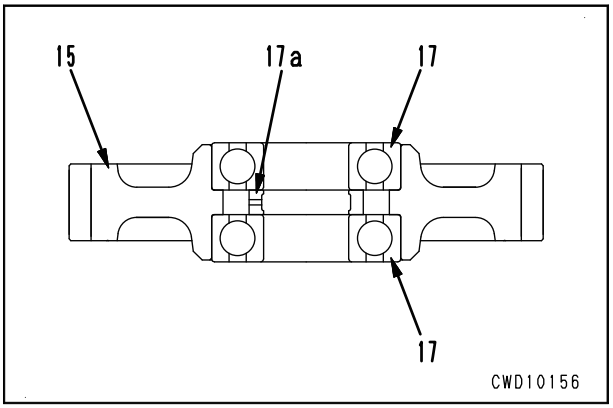
Mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}



3) Intermediate gear assembly

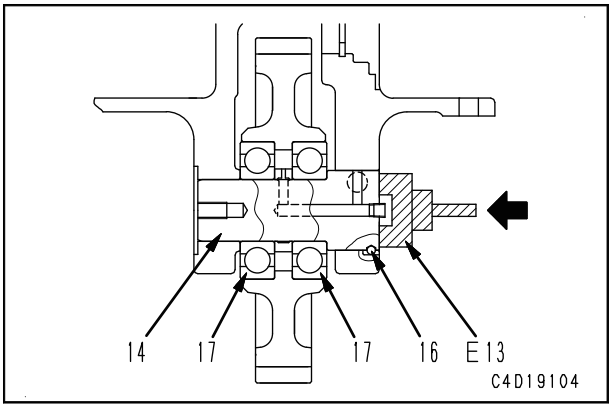
1] Using tool **E12**, press fit bearing (17) to gear (15) and install spacer (17a).





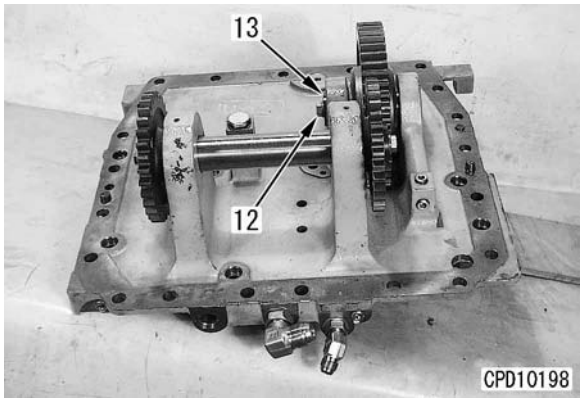
2] Using tool **E13**, press fit shaft (14) to the inner face side of bearing (17), during which time ball (16) is to be installed.

★ Adjust the position of the ball accurately before the shaft enters the cover.

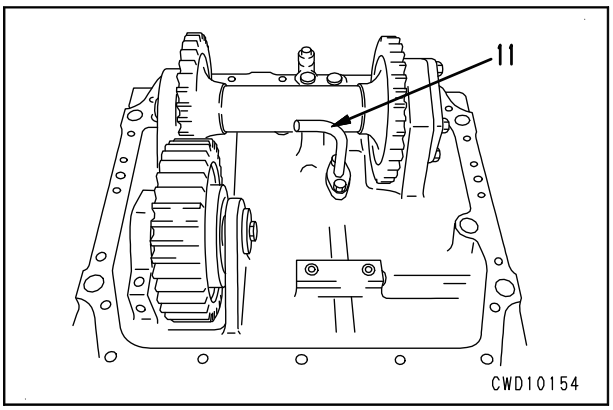


3] Install holder (13) and tighten bolt (12).

Mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}

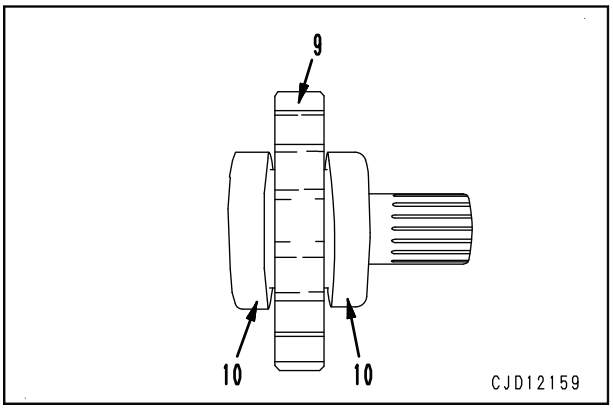


4] Install tube (11).

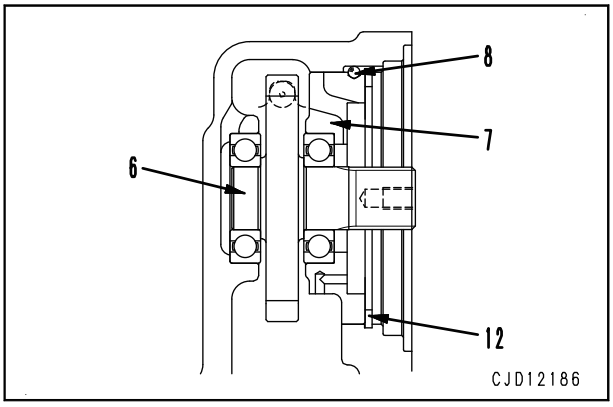


4) Input gear assembly

1] Install bearing (10) to gear (9).

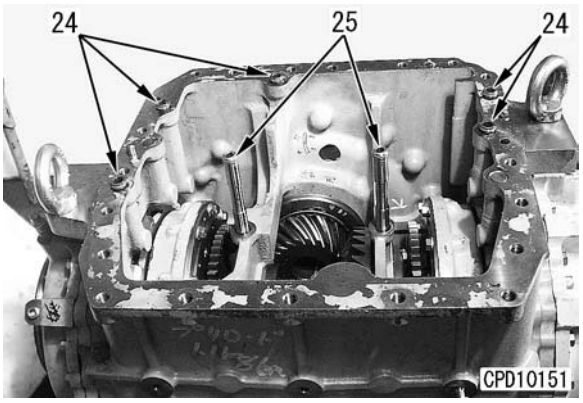


2] Install gear assembly (6).
3] Align the hole of ball (8) and install cage (7) and ball (8).
4] Install snap ring (12).



10. **Installation of cover assembly**

1) Install two sleeves (25) and five sleeves (24) to the HSS case.

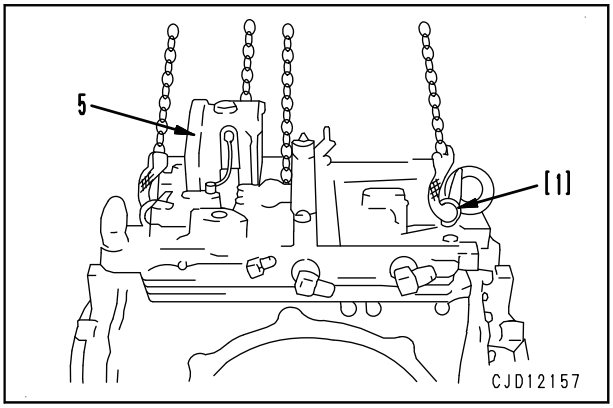


2) Using eyebolts [1], install cover assembly (5).

Cover mating face:
Liquid gasket (LG-6)

★ Apply gasket to both surfaces of the case and cover.

★ Apply the gasket continuously on the mating surface.



11. **Brake valve assembly**

Install brake valve assembly (4).

Mounting bolt:
44.1 – 53.9 Nm {4.5 – 5.5 kgm}