DIFFERENTIAL BACKLASH MEASUREMENT/ADJUSTMENT

id051700665400

Preparation Before Servicing

1. Print out the measurement/adjustment value input sheet. (See MEASUREMENT/ADJUSTMENT VALUE INPUT SHEET [FW6A-EL].)(See MEASUREMENT/ADJUSTMENT VALUE INPUT SHEET [FW6AX-EL].)

Note
- When performing the measurement/adjustment, input the measured and calculated values into the measurement/adjustment value input sheet.
- When performing the other measurements/adjustments, if the measurement/adjustment value input sheet has been printed out, use the printed sheet.

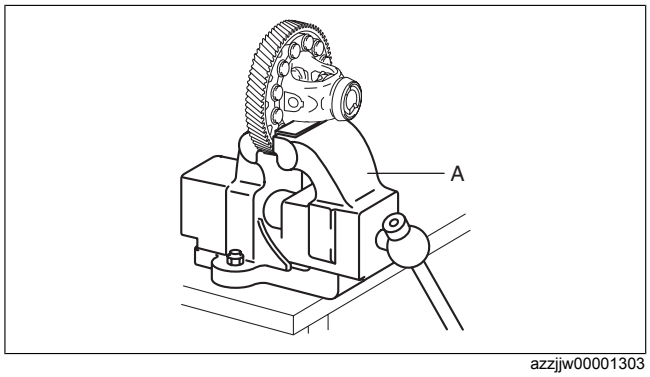
Differential Backlash Measurement

Note
- Measure the tooth play (gap) between the side gear and pinion gear as the differential backlash.

1. Secure the ring gear and differential in a vise.

Caution
- **Insert a protective plate between the vise and the part so as not to damage the part.**

A : Vise



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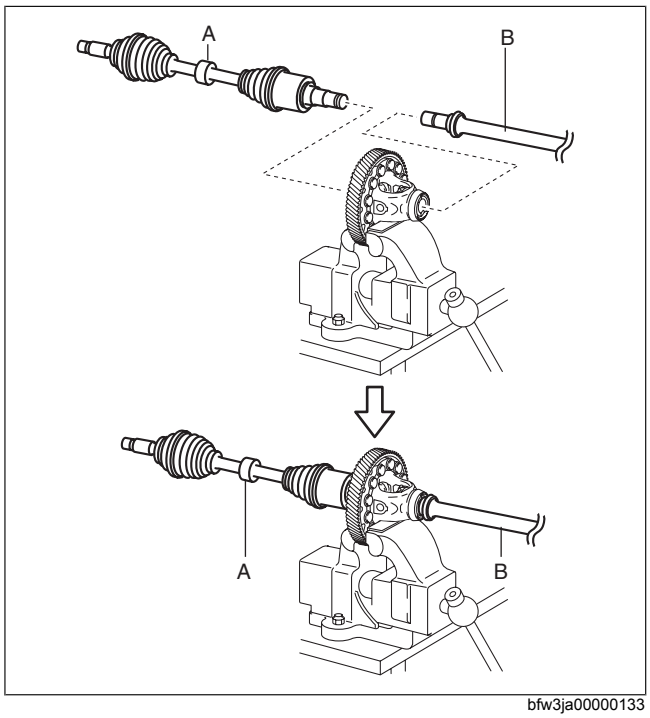
2. Assemble the drive shaft and joint shaft to the ring gear and differential.

Caution
- **Because the drive shaft (LH) clip is not required for the differential backlash measurement, do not assemble it.**

A : Drive shaft (LH)

B : Joint shaft or drive shaft (RH)



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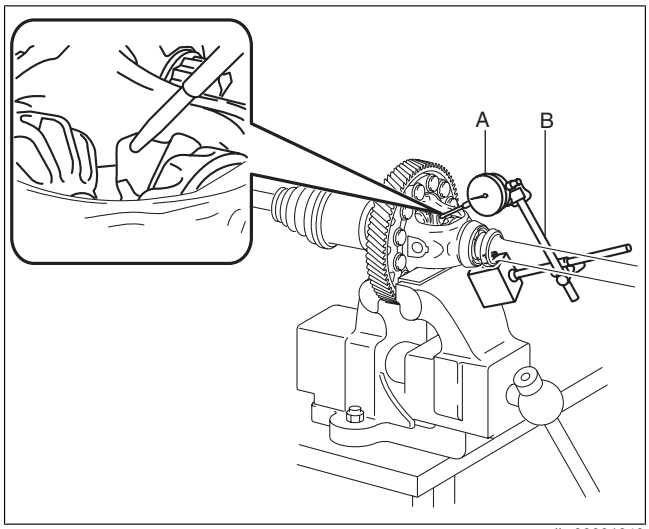
3. Set the dial gauge and magnetic stand as shown in the figure.

Caution
- **To reduce error during the backlash measurement, set the dial gauge so that it is perpendicular to the teeth of the pinion gear.**

A : Dial gauge

B : Magnetic stand



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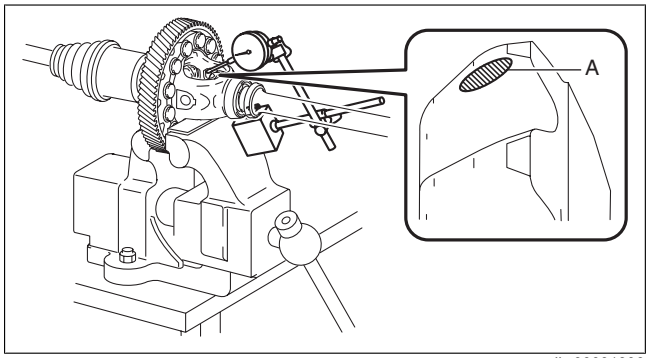
4. Set the dial gauge end to the pinion gear teeth.

Caution
- **To reduce error during the backlash measurement, set the dial gauge end to within the area shown in the figure.**

A : Area in which dial gauge end is set



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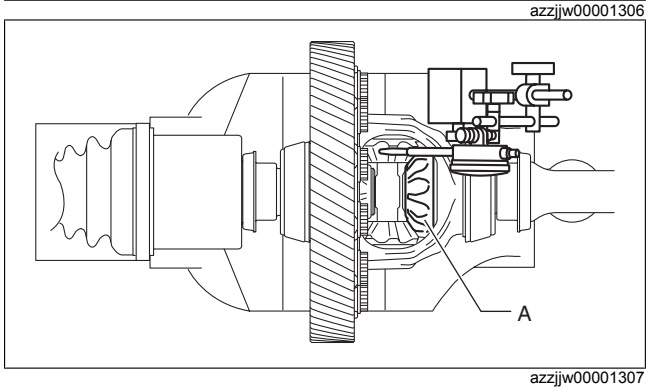
5. Secure the side gear on the front side by hand.

A : Secure by hand



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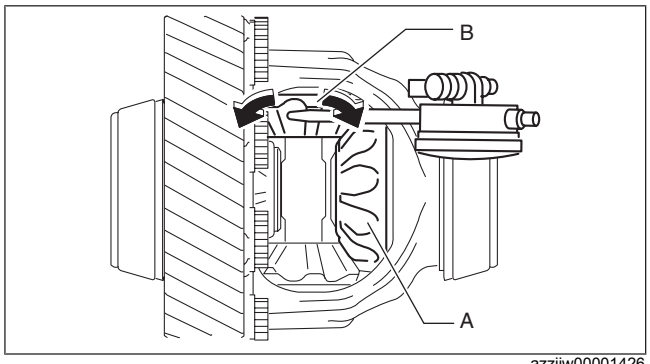
6. Move the pinion gear with the dial gauge that has been set by hand and measure the backlash.

Caution
- **Because a difference occurs in the backlash measurement value if the secured side gear moves, move the pinion gear by hand so that the secured side gear does not move.**

A : Secure by hand
B : Move the pinion gear by hand such that the secured side gear does not move.

7. Input the measured side gear on the front side and pinion gear backlash into the measurement/ adjustment value input sheet.

Note
- Input into section A in the measurement/ adjustment value input sheet.



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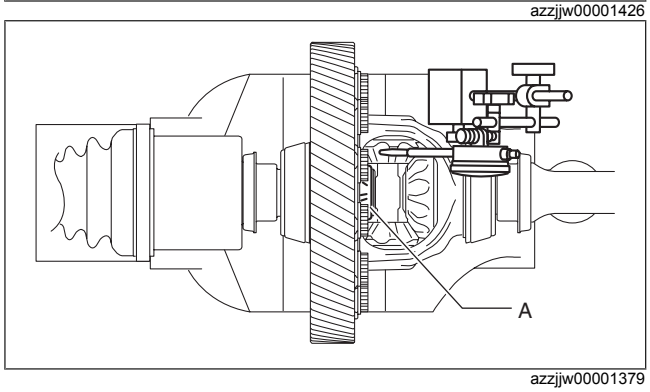
8. Secure the side gear on the rear side by hand.

A : Secure by hand



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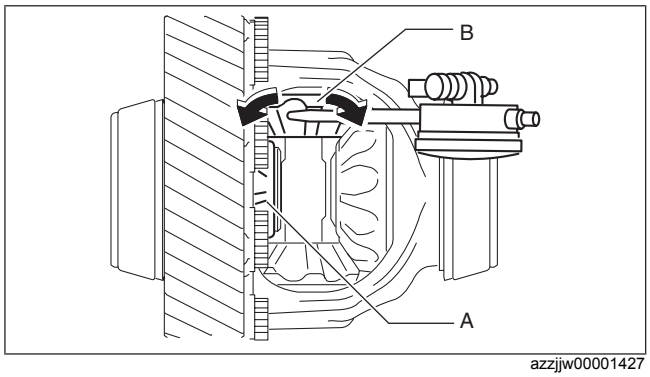
9. Move the pinion gear with the dial gauge that has been set by hand and measure the backlash.

Caution
- **Because a difference occurs in the backlash measurement value if the secured side gear moves, move the pinion gear by hand so that the secured side gear does not move.**

A : Secure by hand
B : Move the pinion gear by hand such that the secured side gear does not move.

10. Input the measured side gear on the rear side and the pinion gear backlash into the measurement/ adjustment value sheet.

Note
- Input into section B in the measurement/ adjustment value sheet.



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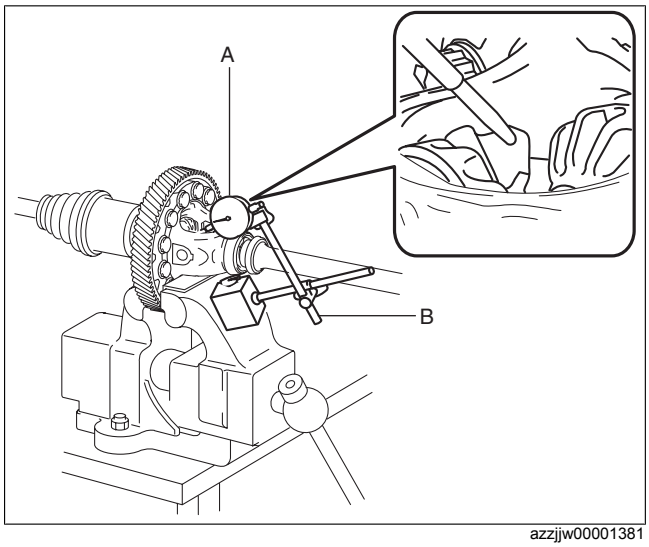
11. Set the dial gauge and magnetic stand to the pinion gear on the opposite side.

Caution
- **To reduce error during the backlash measurement, set the dial gauge so that it is perpendicular to the teeth of the pinion gear.**

A : Dial gauge

B : Magnetic stand



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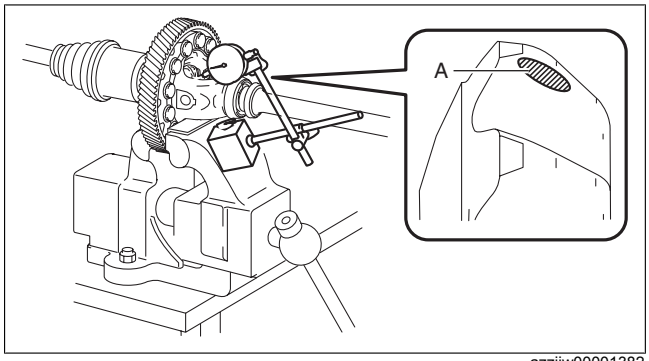
12. Set the dial gauge end to the pinion gear teeth.

Caution

- **To reduce error during the backlash measurement, set the dial gauge end to within the area shown in the figure.**

A : Area in which dial gauge end is set



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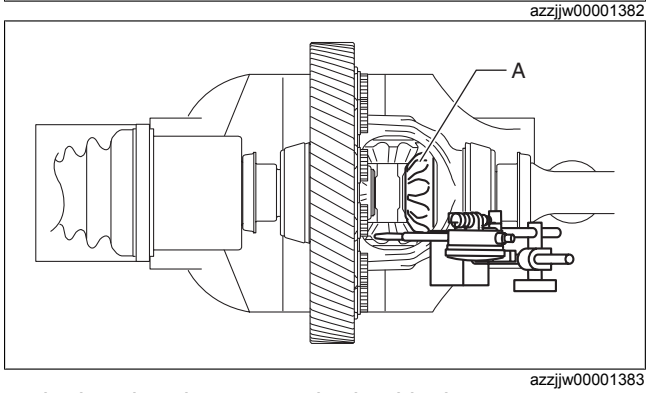
13. Secure the side gear on the front side by hand.
A : Secure by hand



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14. Move the pinion gear with the dial gauge that has been set by hand and measure the backlash.

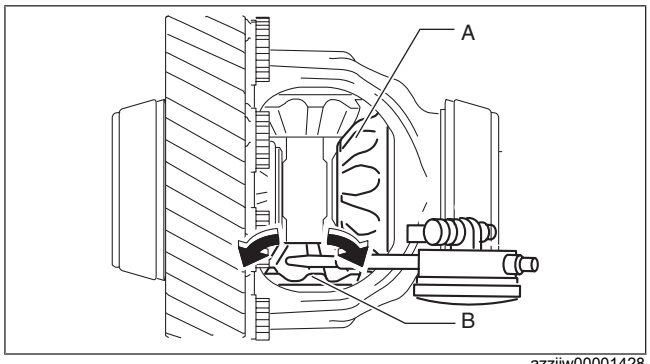
Caution

- **Because a difference occurs in the backlash measurement value if the secured side gear moves, move the pinion gear by hand so that the secured side gear does not move.**

A : Secure by hand
B : Move the pinion gear by hand such that the secured side gear does not move.

15. Input the measure side gear on the front side and the pinion gear backlash into the measurement/ adjustment value sheet.

Note
- Input into section A in the measurement/ adjustment value sheet.



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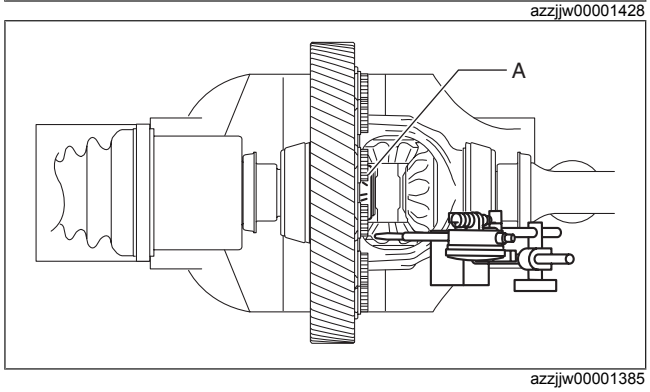
16. Secure the side gear on the rear side by hand.

A : Secure by hand



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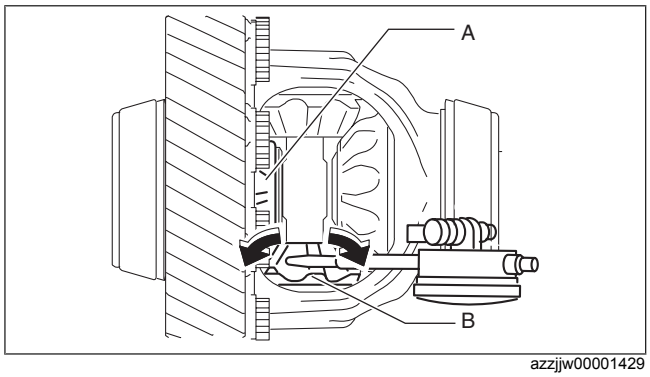
17. Move the pinion gear with the dial gauge that has been set by hand and measure the backlash.

Caution
- **Because a difference occurs in the backlash measurement value if the secured side gear moves, move the pinion gear by hand so that the secured side gear does not move.**

A : Secure by hand
B : Move the pinion gear by hand such that the secured side gear does not move.

18. Input the measured side gear on the rear side and the pinion gear backlash into the measurement/ adjustment value sheet.

Note
- Input into section B in the measurement/ adjustment value sheet.



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19. Calculate the average value of the measured side gear on the front side and the pinion gear backlash.
20. Input the average value of the calculated side gear on the front side and the pinion gear backlash into the measurement/adjustment value sheet.

Note
- The average value of the calculated side gear on the front side and the pinion gear backlash is the differential backlash on the front side.

21. Calculate the average value of the measured side gear on the rear side and the pinion gear backlash.
22. Input the average value of the calculated side gear on the rear side and the pinion gear backlash into the measurement/adjustment value sheet.

Note
- The average value of the calculated side gear on the rear side and the pinion gear backlash is the differential backlash on the rear side.

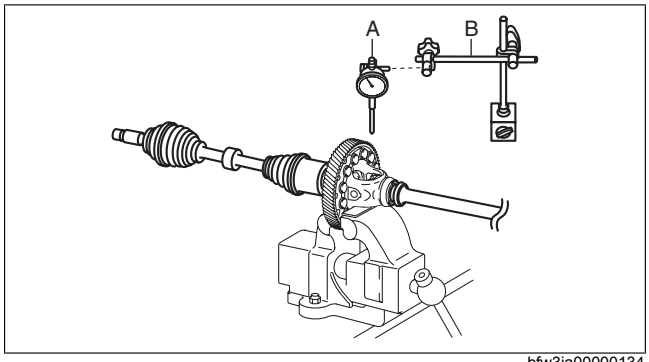
23. Verify that the differential backlash on the front side and the differential backlash on the rear side satisfy the specification.

Specification
0.030—0.150 mm {0.0012—0.0059 in}

- If not within the specification, perform the differential backlash adjustment. (See Differential Backlash Adjustment.)
- If it exceeds the specification even if the thrust washer with a thickness of 0.95 mm {0.037 in}, which is the thickest, is assembled after performing the differential backlash adjustment, disassemble the ring gear and differential and replace the differential gear case with a new one.
  (See RING GEAR AND DIFFERENTIAL DISASSEMBLY [FW6A-EL].)(See RING GEAR AND DIFFERENTIAL DISASSEMBLY [FW6AX-EL].)
  (See RING GEAR AND DIFFERENTIAL ASSEMBLY [FW6A-EL].)(See RING GEAR AND DIFFERENTIAL ASSEMBLY [FW6AX-EL].)

24. Remove the dial gauge and magnetic stand.
A : Dial gauge

B : Magnetic stand



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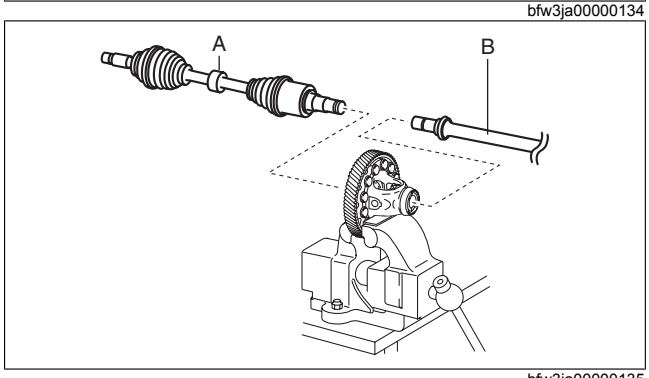
25. Remove the drive shaft and joint shaft.
A : Drive shaft (LH)

B : Joint shaft or drive shaft (RH)



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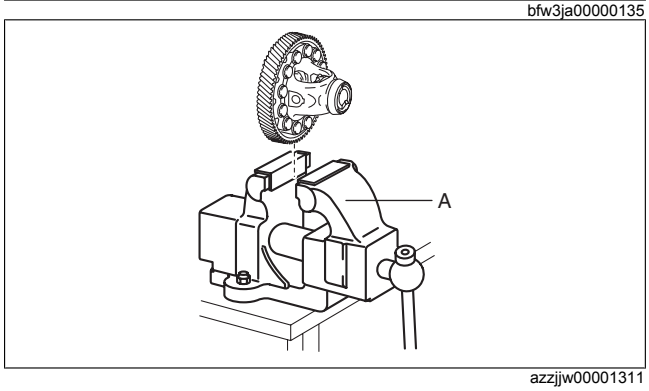
26. Remove the ring gear and differential from the vise.
A : Vise



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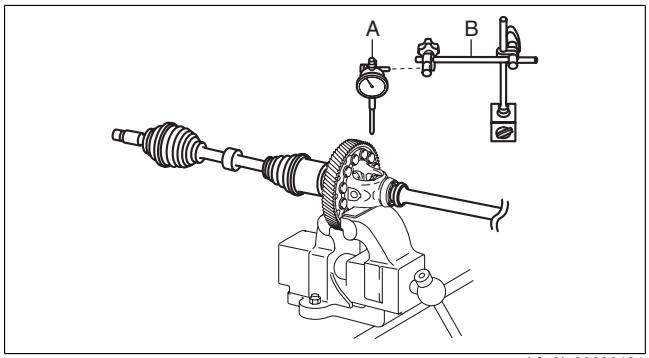
Differential Backlash Adjustment

1. Remove the dial gauge and magnetic stand.

A : Dial gauge

B : Magnetic stand



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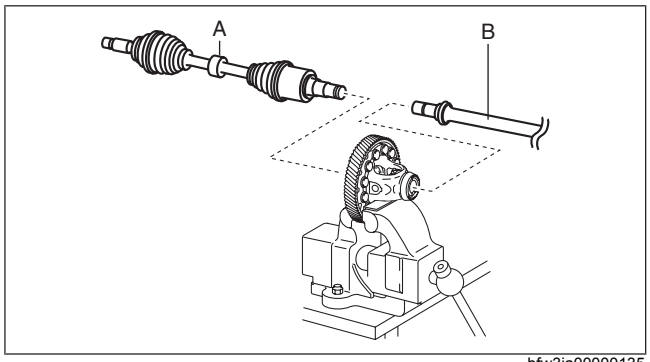
2. Remove the drive shaft and joint shaft.
A : Drive shaft (LH)

B : Joint shaft or drive shaft (RH)



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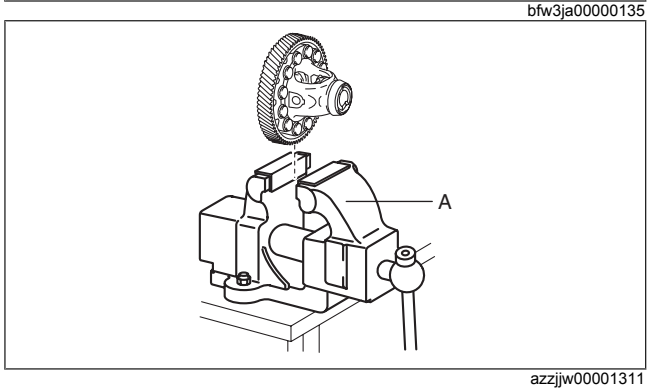
3. Remove the ring gear and differential from the vise.
A : Vise



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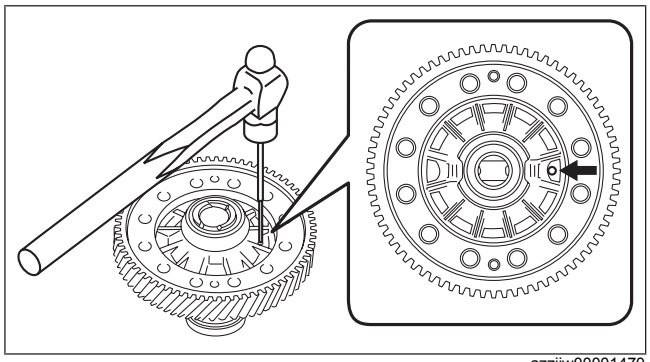
4. Remove the roll pin shown in the figure using a pin punch.

Note
- Use a pin punch with an end outer diameter of 3 mm {0.119 in} or more, and within 4 mm {0.157 in} and an end length of 50 mm {2.0 in} or more.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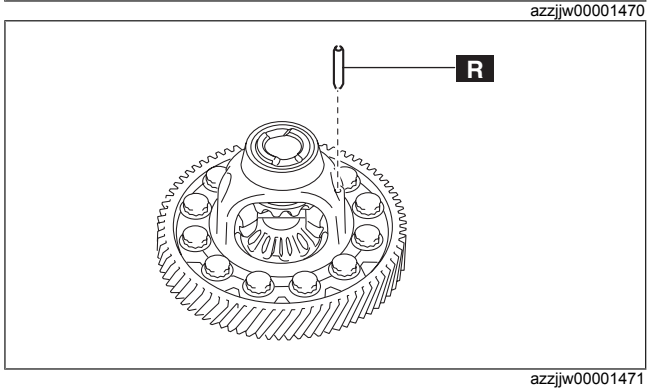

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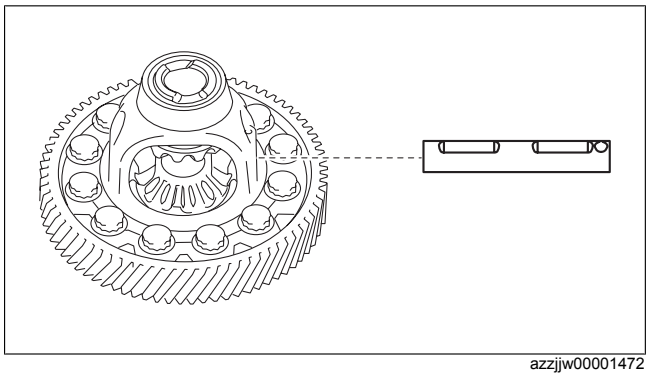
5. Remove the pinion shaft.



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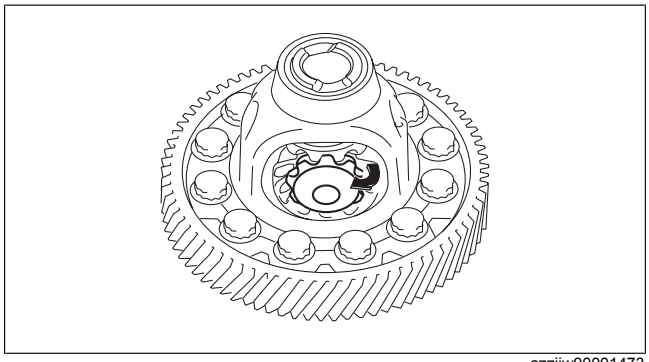
6. Remove the pinion gears using the following procedure:
   (1) Rotate the pinion gears as shown in the figure.



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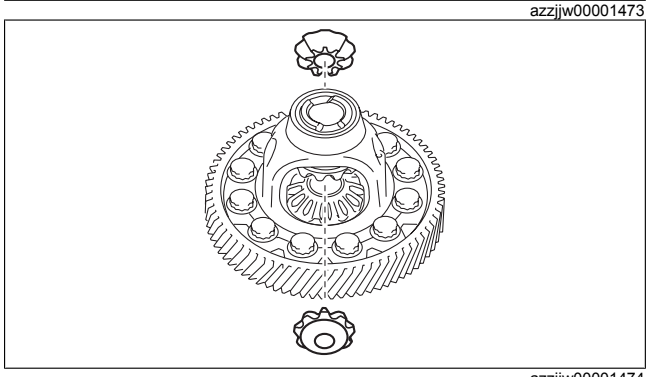
   (2) Remove the pinion gears.



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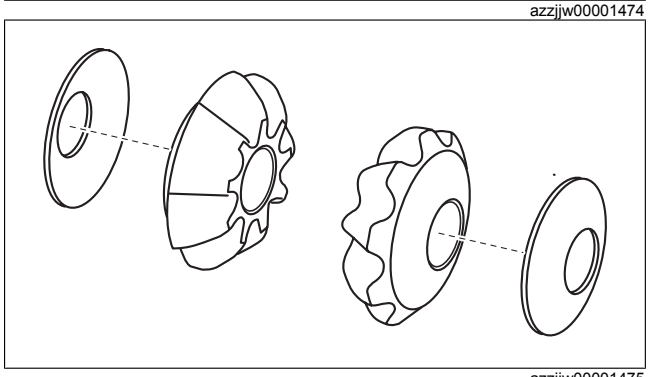
7. Remove the thrust washers from the pinion gears.



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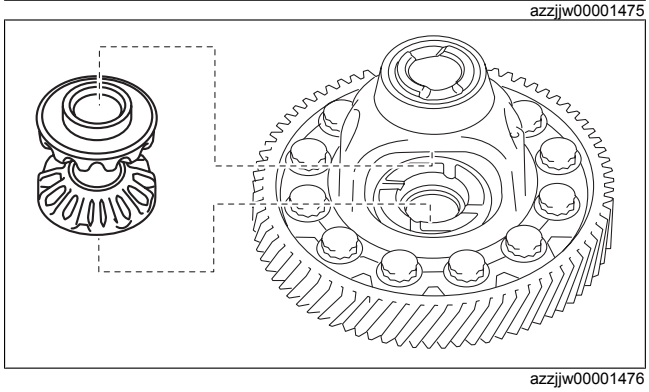
8. Remove the side gears.



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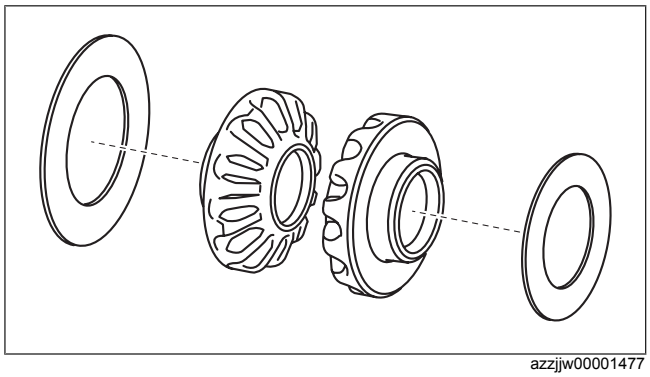
9. Remove the thrust washers from the side gears.
10. Measure the thickness of the removed thrust washers from the side gears.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Note
- Recommended measuring instrument: Micrometer

11. Input the measured thrust washer thickness into the measurement/adjustment value input sheet.
12. Perform the following calculation to calculate the differential backlash gap.

Note
- The differential backlash gap is the difference between the differential backlash and the median value of the differential backlash specification.

Differential backlash gap on front side = C - J
C: Differential backlash on front side
J: Median value of differential backlash specification (0.090 mm {0.00354 in})

Note
Example
C: Differential backlash on front side is 0.165 mm {0.00650 in}
Differential backlash gap on front side = 0.165 mm {0.00650 in} - 0.090 mm {0.00354 in} = 0.075 mm {0.00295 in}

Differential backlash gap on rear side = D - J
D: Differential backlash on rear side
J: Median value of differential backlash specification (0.090 mm {0.00354 in})

Note
Example
D: Differential backlash on rear side is 0.155 mm {0.00610 in}
Differential backlash gap on rear side = 0.155 mm {0.00610 in} - 0.090 mm {0.00354 in} = 0.065 mm {0.00256 in}

13. Input the differential backlash gap into the measurement/adjustment value sheet.
14. Perform the following calculation to calculate the gap in the thrust washer thickness.

Note
- The gap in the thrust washer thickness is the difference between the removed thrust washer thickness and the optimum thrust washer thickness.
- If the thrust washer thickness is thickened 0.1 mm {0.00394 in}, the differential backlash decreases approx. 0.08 mm {0.00315 in}.

Thrust washer thickness gap on front side = K × 0.1 mm {0.00394 in} / 0.08 mm {0.00315 in}
K: Differential backlash gap on front side

Note
Example
K: Differential backlash gap on front side is 0.075 mm {0.00295 in}
Thrust washer thickness gap on front side = 0.075 mm {0.00295 in} × 0.1 mm {0.00394 in} / 0.08 mm {0.00315 in} = 0.094 mm {0.00369 in}

Thrust washer thickness gap on rear side = L × 0.1 mm {0.00394 in} / 0.08 mm {0.00315 in}
L: Differential backlash gap on rear side

Note
Example
L: Differential backlash gap on rear side is 0.065 mm {0.00256 in}
Thrust washer thickness gap on rear side = 0.065 mm {0.00256 in} × 0.1 mm {0.00394 in} / 0.08 mm {0.00315 in} = 0.081 mm {0.00320 in}

15. Input the calculated thrust washer thickness gap into the measurement/adjustment value sheet.

16. Perform the following calculation to calculate the optimum thrust washer thickness.
Optimum thrust washer thickness on front side = H + M
H: Thickness of removed thrust washer on front side
M: Thrust washer thickness gap on front side

Note
Example
H: Thickness of removed thrust washer on front side is 0.810 mm {0.03189 in}
M: Thrust washer thickness gap on front side is 0.094 mm {0.00369 in}
Thickness of optimum thrust washer on front side = 0.810 mm {0.03189 in} + 0.094 mm {0.00369 in} = 0.904 mm {0.03559 in}

Thickness of optimum thrust washer on rear side = I + N
I: Thickness of removed thrust washer on rear side
N: Thrust washer thickness gap on rear side

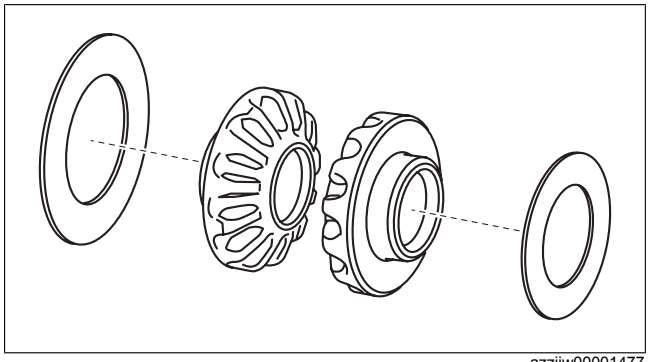
Note
Example
I: Thickness of removed thrust washer on rear side is 0.795 mm {0.0313 in}
N: Thrust washer thickness gap on rear side is 0.081 mm {0.00320 in}
Thickness of optimum thrust washer on rear side = 0.795 mm {0.0313 in} + 0.081 mm {0.00320 in} = 0.876 mm {0.03449 in}

17. Input the calculated optimum thrust washer thickness into the measurement/adjustment value sheet.
18. Select the nearest thrust washer for the calculated optimum thrust washer thickness from the following table:

Caution
- **Select the same thickness of the thrust washers on the front and rear sides**
  If the thrust washers of the same thickness are assembled on the front and rear sides, measure the differential backlash again, and if the measurement value does not satisfy the specification, thrust washers of varied thickness on the front and rear sides is alright.

Selected thrust washer thickness
0.95 mm {0.037 in}
0.90 mm {0.035 in}
0.85 mm {0.033 in}
0.80 mm {0.031 in}
0.75 mm {0.030 in}

19. Assemble the selected thrust washers to the side gears.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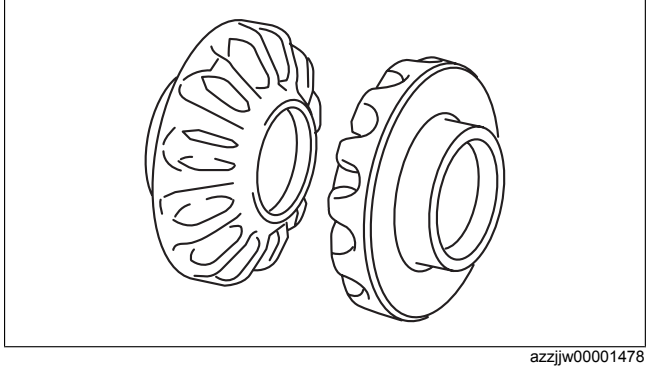
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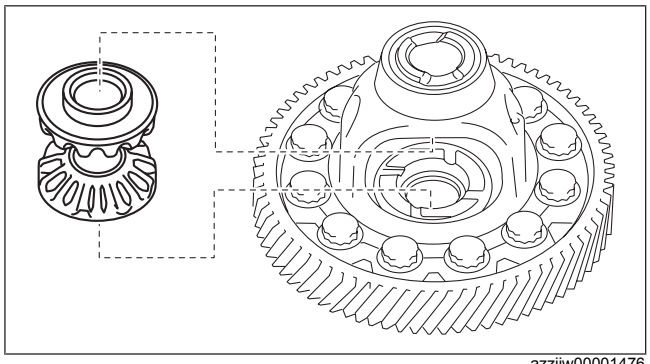
20. Assemble the side gears which have the thrust washers assembled to them.



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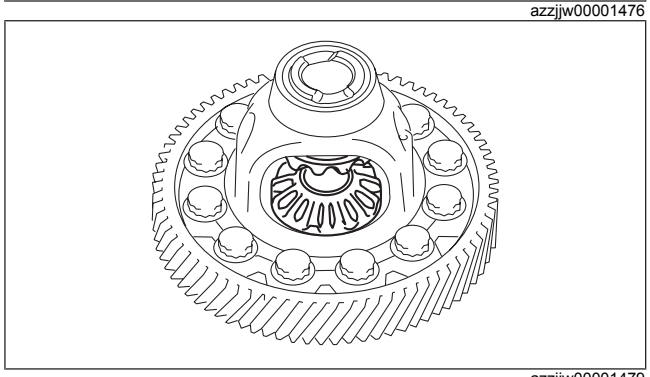

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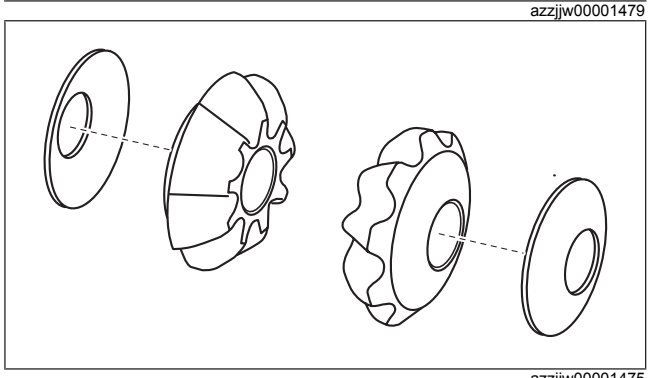
21. Assemble the thrust washers to the pinion gears.



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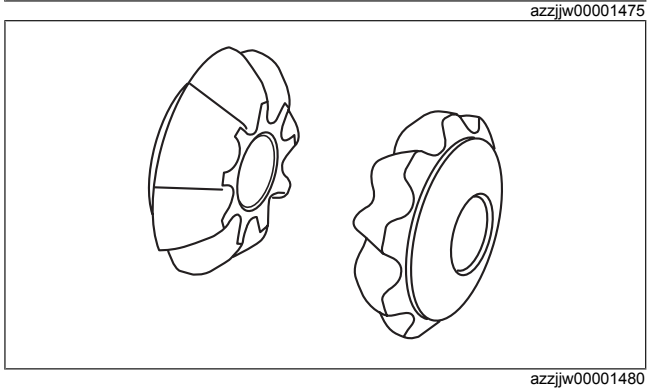

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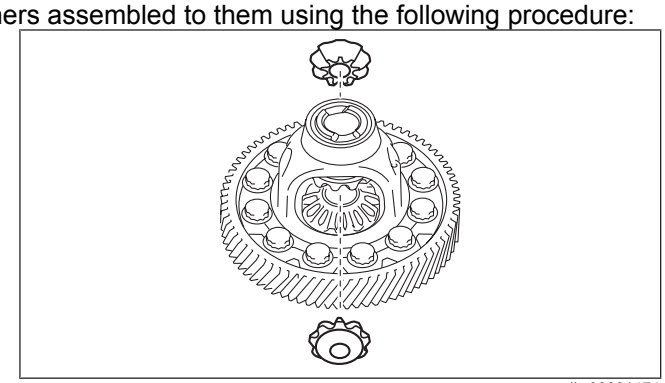
22. Assemble the pinion gears which have the thrust washers assembled to them using the following procedure:
    (1) Assemble the pinion gears which have the thrust washers assembled to them.



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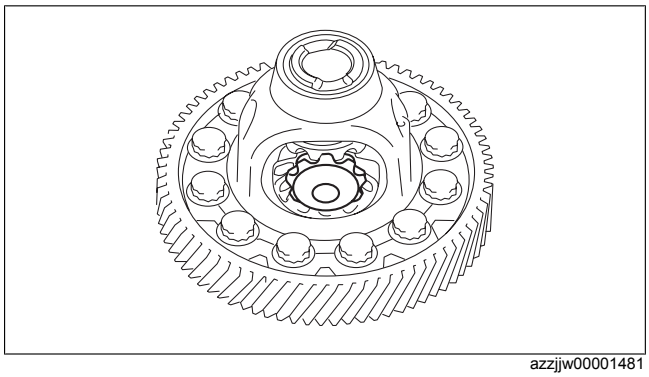
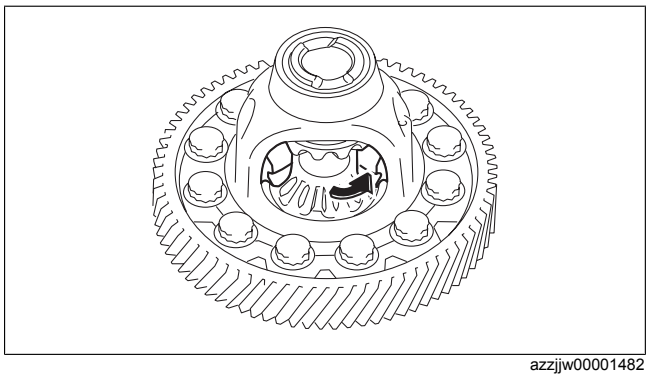


azzjjw00001481

(2) Rotate the pinion gears so that the pinion shaft holes of the differential gear case and the pinion gears are aligned as shown in the figure.

Note

- If the pinion shaft holes of the differential gear case and the pinion gears are not aligned, remove the pinion gears, change the side gears combination, and reassemble.



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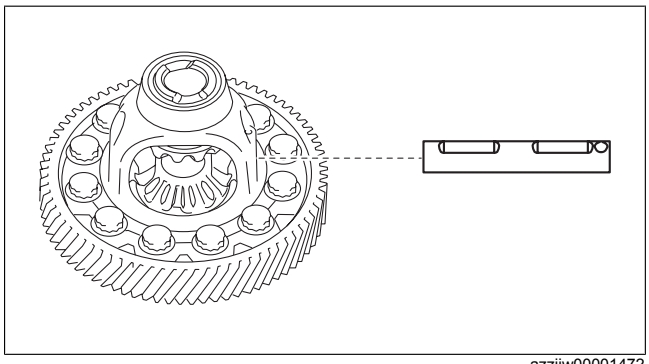
23. Assemble the pinion shaft.

Caution

- **Assemble the pinion shaft so that the roll pin holes of the differential gear case and the pinion shaft are aligned.**



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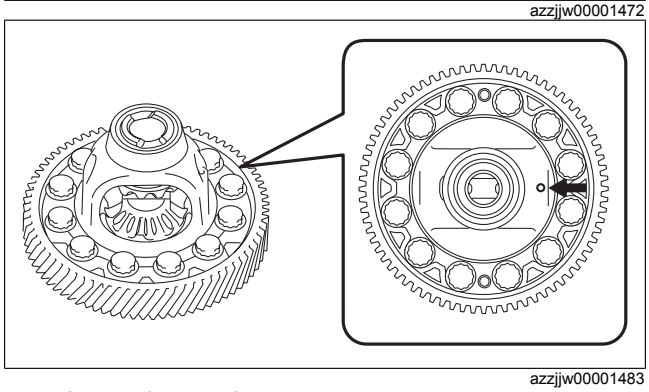

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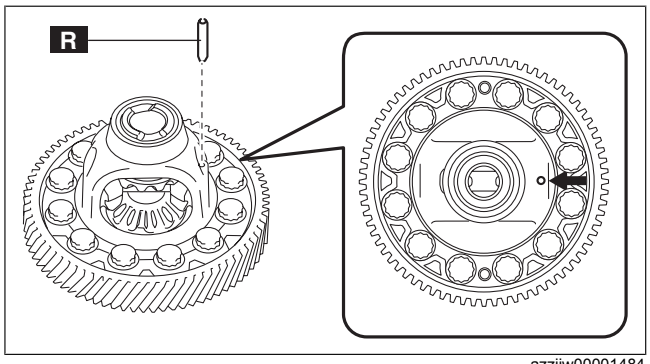
24. Assemble a new roll pin to the position shown in the figure using a pin punch.

Caution
- **Assemble so that the end gap of the roll pin is positioned in the direction shown in the figure.**

Note
- Use a pin punch with an end outer diameter of 5 mm {0.197 in} or more, and within 8 mm {0.314 in}.



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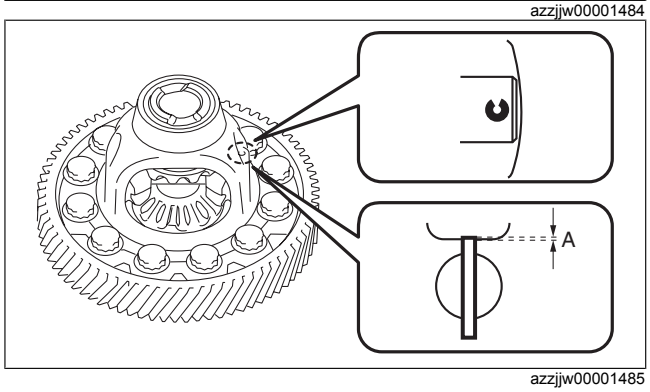
A : –0.5—0.5 mm {–0.01—0.01 in}

25. Perform the differential backlash measurement.
    (See Differential Backlash Measurement.)



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