Adjustment of the differential - Bevel gear pair

Fig. Differential - Bevel gear pair

Preparations for adjustments

1. All the procedures described in this chapter must be carried out following renewal of the transmission casing, differential support flanges, bevel gear pair, differential housing or the support bearings of the pinion and differential.

   Install bearing assembly (2) on pinion shaft (1).

   - When handling bearing (2), take care not to invert the inner races. During assembly of bearing (2) on pinion shaft (1), rotate the outer race to help seat the rollers.
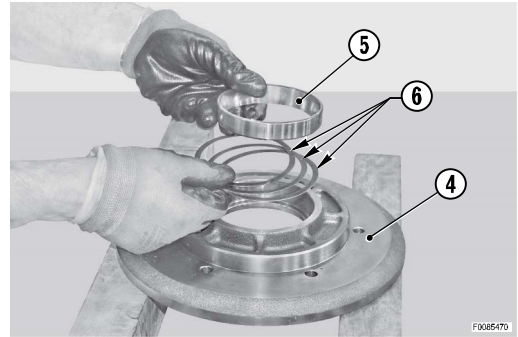   Bearing: Transmission oil

2.

   Install a service bush "A" on the pinion shaft (1) (example: Ø 65 x Ø 50 x Ø 20) and provisionally tighten the new nut (3).
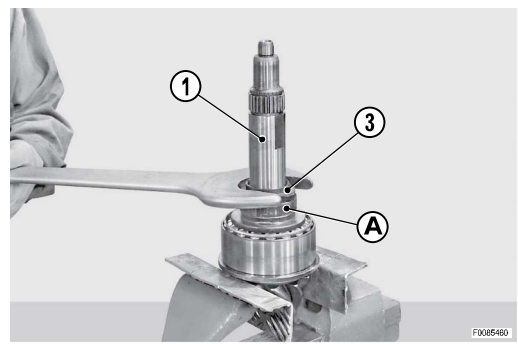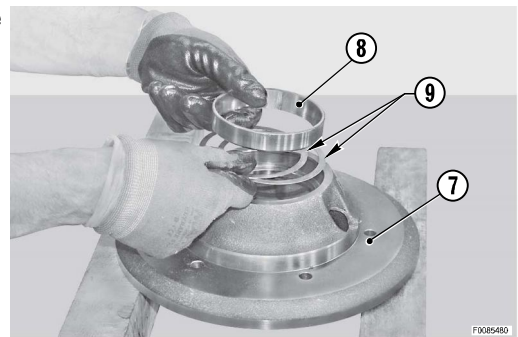
3.

Remove the outer race of bearing (5) and relative shims (6) from flange (4) on the crown wheel side.

  o Note the thickness "S" of shim pack (6) (e.g., 0.80 mm).

4.

Remove the outer race of bearing (8) and shims (9) from flange (7) on the opposite side to the crown wheel.
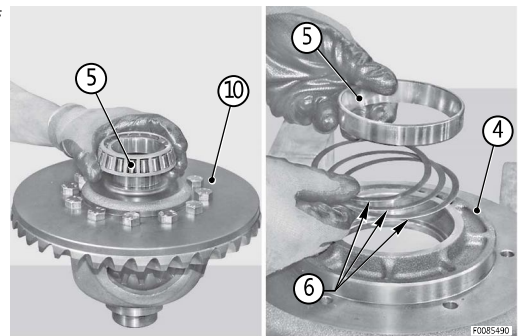

5.

Heat bearing inner race (5) to 80 °C and install it on the crown wheel side of differential (10).

  o Check that the bearing seats against the shoulder on the differential.

Install the outer race of bearing (5) in crown wheel side flange (4), with shim pack (6) approximately 0.5 mm less than the measured dimension "S".

  o **Example:**
  o Measured dimension = 0.80 mm
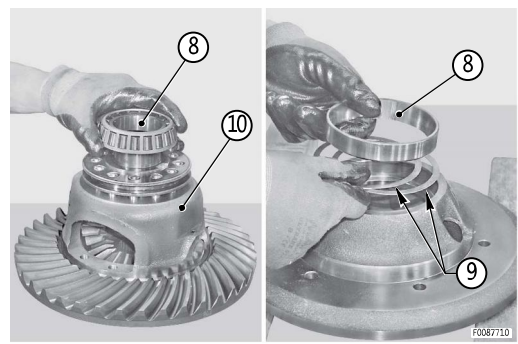   Thickness of shim pack (6) to be installed: 0.30 mm

6.

Heat the inner race of bearing (8) to approx. 80 °C and install on differential (10) on the side opposite to the crown wheel.

  o Check that bearing (8) seats against the shoulder on the differential.
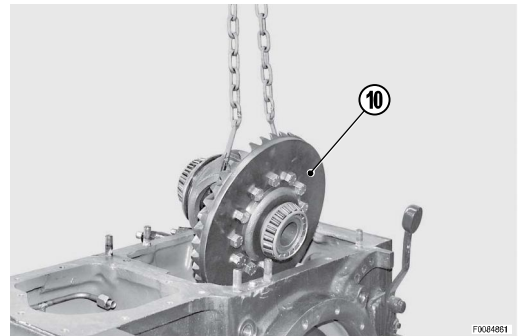
Install the outer race of bearing (8) and a 1.00 mm thick shim pack (9) on flange (7) on the opposite side to the crown wheel.

7.

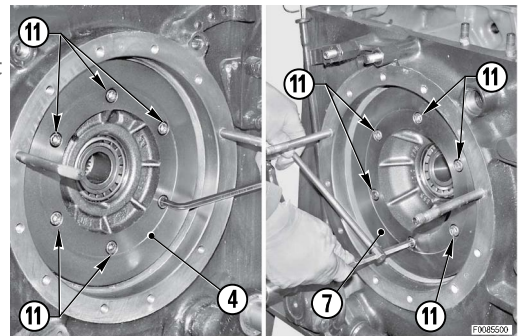## Adjustment of the differential bearings preload

Locate complete differential (10) in the transmission casing.

1.

Install the flanges (4) and (7) and secure in position with screws (11).

- While tightening screws (11), rotate the differential unit to help seat the bearings.
  Bearings: Transmission oil
 Screws: 32-40 Nm (23.6-29.5 lb.ft.)

2.

Position a dial gauge with magnetic stand "A" on the crown wheel side of differential carrier (4) and set it to zero on the end face of the differential while simultaneously forcing the differential with lever "B" towards the opposite side.

Force the differential towards the crown wheel side and measure end float "G".

- If the end float is zero, adjust shim pack (9) on the opposite side to the crown wheel to 0.70 mm and repeat the procedure to measure end float "G".
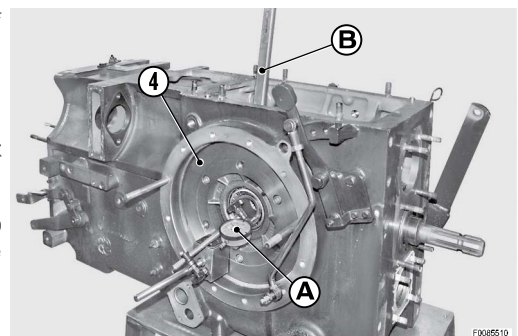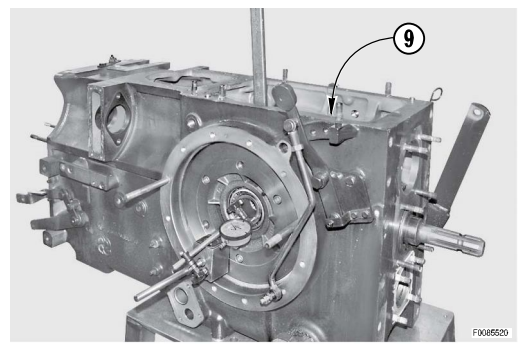

3.

Add 0.10 mm to the measured end float value "G" and round up to the nearest 0.05 mm to determine the shim thickness to be added under the outer ring of bearing (8) on the opposite side to the crown wheel.
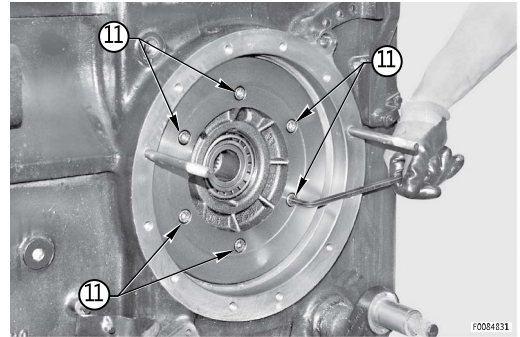
Example:

- Measured value: 0.28 mm

Nominal value: 0.28 + 0.10 = 0.38 mm
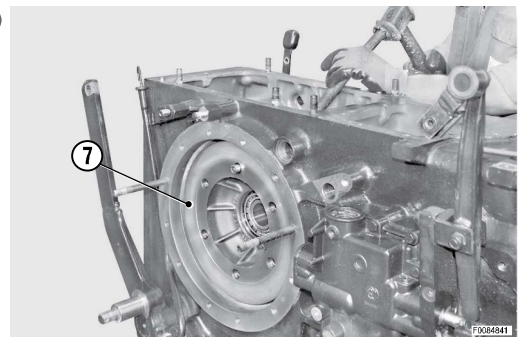Actual shim thickness to be added: 0.40 mm

4.

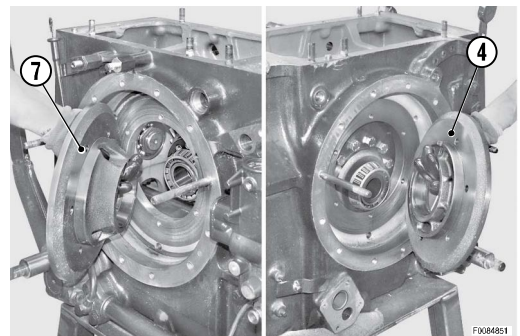Remove screws (11) on both sides, leaving just one in position for safety.

5.

Using a suitable drift made of soft material, separate differential flanges (4) and (7) from the transmission casing.

6.

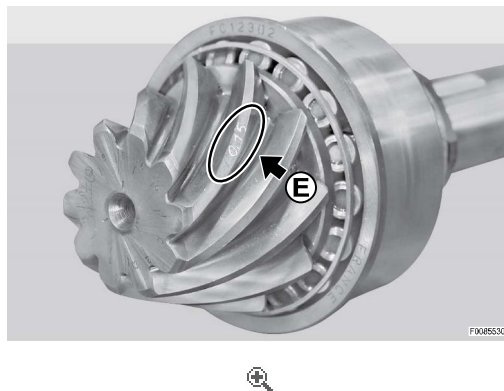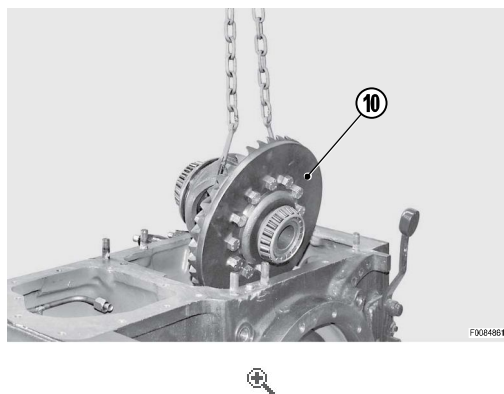Remove last screw (11) and remove flanges (4) and (7).

7.

Attach differential (10) to a hoist and remove it.
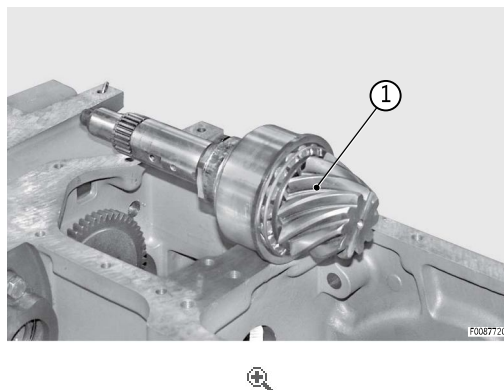
8.

Adjustment of the pinion position

Make a note of the value "E" stamped on one of the teeth of pinion (1).
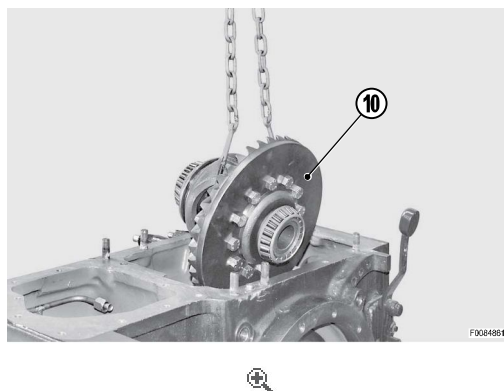
- In this example: + 0.15 mm

1.

Install pinion (1) without shims (12) in the transmission casing.

2.

Locate complete differential (10) in the transmission casing

3.

Install the flanges (4) and (7) and secure in position with screws (11).

- Screws: 32-40 Nm (23.6-29.5 lb.ft.)
  While tightening screws (11), check for the presence of clearance between the differential and pinion (1). If the differential is seated against the pinion, adjust the shim packs installed under the outer races of the bearings so as to reduce the thickness of the pack on

the crown wheel side and increase the thickness of the pack on the opposite side by the same amount.
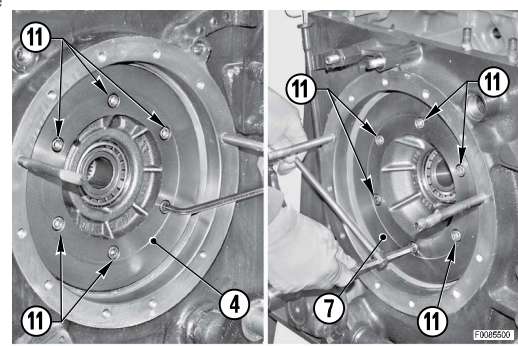
4.

Use a feeler gauge to measure the distance "D" between the end face of pinion (1) and the Ø 174 section of differential (10) (in this example 4.85).

Calculate dimension "R" by adding dimension "E" previously read on the tooth of pinion (1) to the design value of 4.00 mm.

If the value "E" is positive, as in the case reported in the figure, it should be added to the design value of 4.00 mm:

  o R= 4.00 + "E" i.e. R= 4.00 + 0.15 = 4.15

If "E" is negative, subtract it from the design value of 4.00 mm
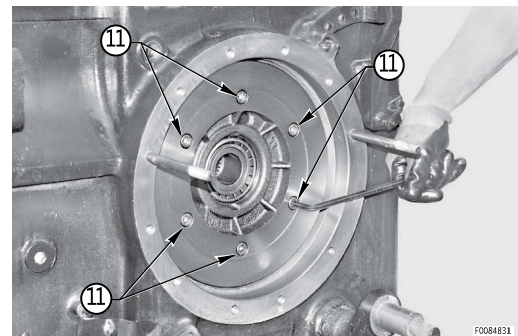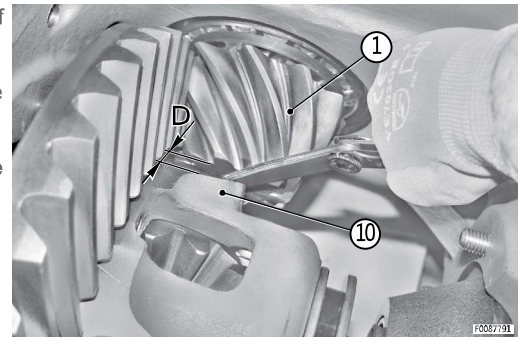
  o R= 4.00 - "E" i.e. R= 4.00 - 0.15 = 3.85

If the measured value "D" differs from the calculated value "R", calculate the difference between "D" and "R". The resulting value "S" is the shim thickness to be installed under bearing (2) of pinion (1).

Formula: S = D - R
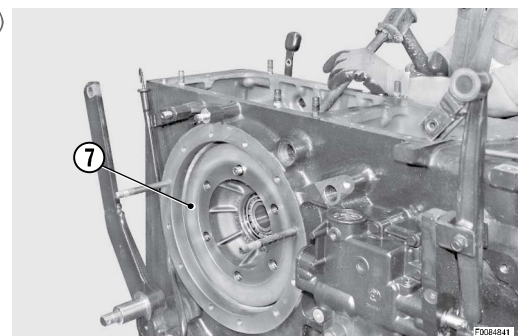
5.   o which in our example gives: S = 4.85 - 4.15 = 0.70 mm

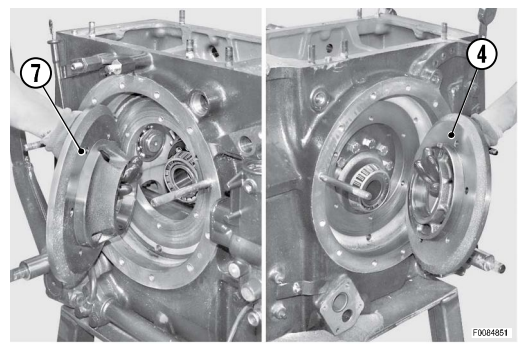Remove screws (11) on both sides, leaving just one in position for safety.

6.

Using a suitable drift made of soft material, separate differential flanges (4) and (7) from the transmission casing.
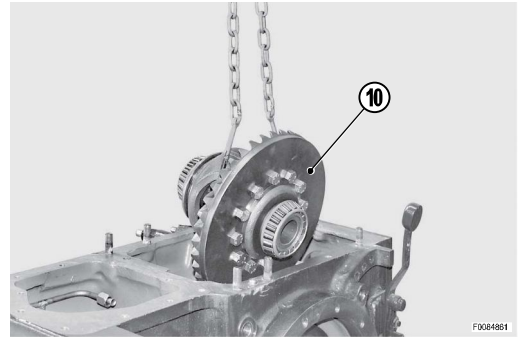

7.

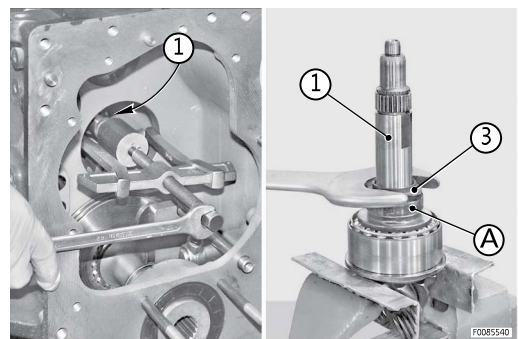Remove last screw (11) and remove flanges (4) and (7).

8.

Attach differential (10) to a hoist and remove it.

9.

Using a puller, remove pinion (1) complete with the transmission casing.

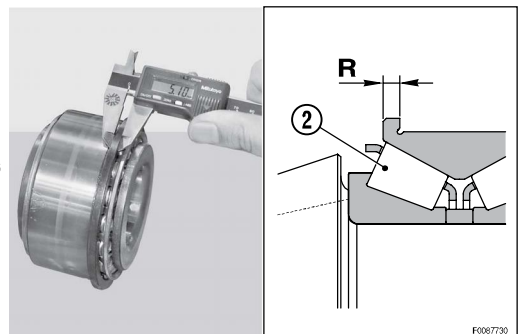Remove ringnut (3) and service spacer "A" from pinion shaft (1).

10.

Measure dimension "R" of the shoulder of bearing (2).

Example:

- "R" = 4.96 mm

Install pinion (1) and shim pack (12) of the previously calculated thickness "S", reversing the removal procedure.

11.

Secure pinion (1) in position with suitable circlip (13) selected from the available sizes.

Select circlip (13) by applying the following formula:

Circlip thickness:

- Fixed dimension "K" = 9.5 mm
  Shim thickness = "S"
  Dimension "R" = 4.96 mm (valid measurements: 4.90-5.00mm)

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