

Differential and Drive Gear Assembly

DIFFERENTIAL AND DRIVE GEAR ASSEMBLY

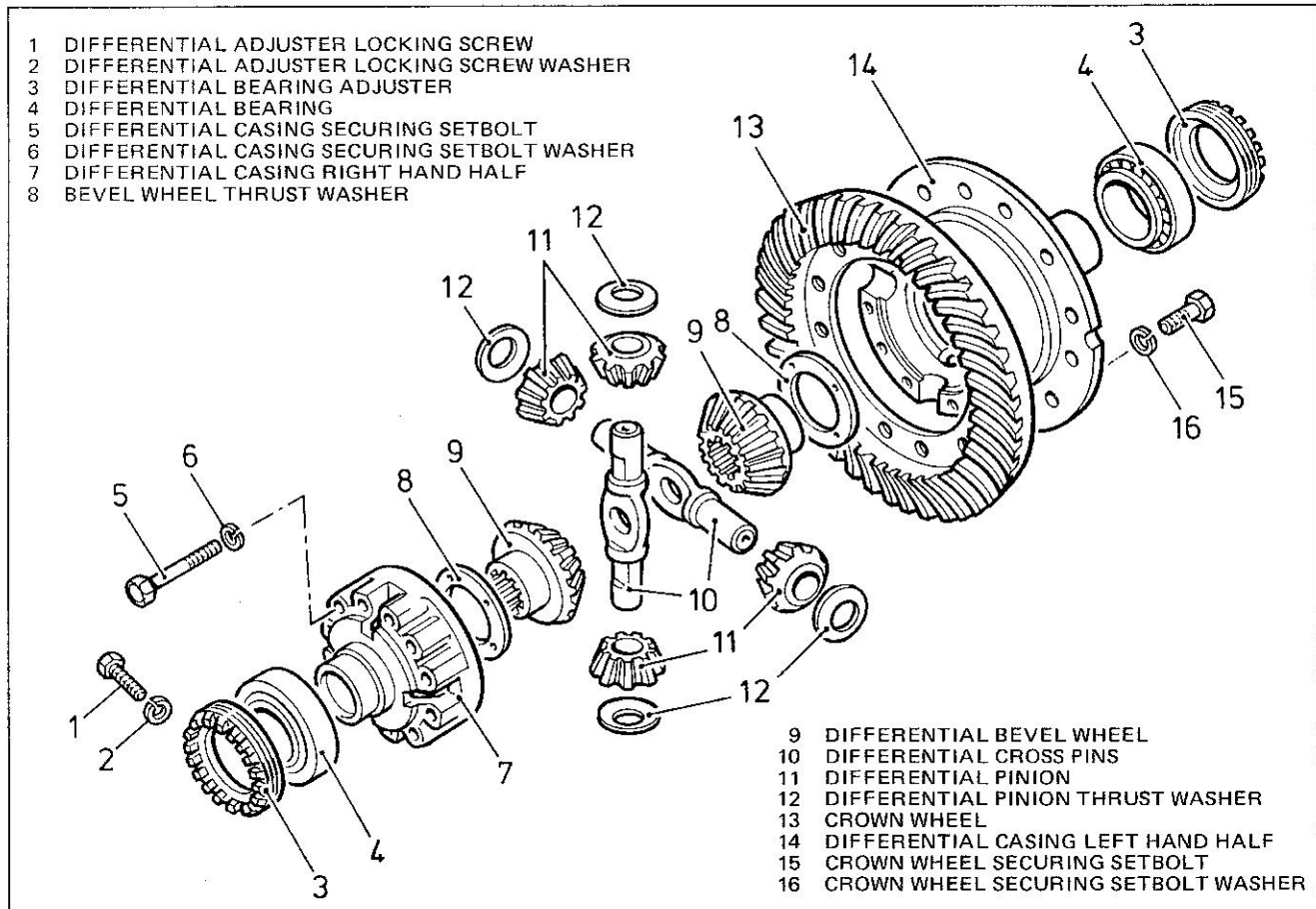


Fig. 8 Differential Assembly General Arrangement

To Remove*

Drain the oil from the rear axle.

Remove axle shafts (refer to sub-section H100).

Disconnect the propeller shaft from driver coupling and support the shaft.

Remove setbolts securing gear carrier to axle casing, allowing the differential and drive gear assembly to be withdrawn.

To Dismantle

Remove the bevel pinion (refer to sub-section H120).

Remove the differential bearing adjuster locking screws and spring washers from the bearing caps.

To ensure the bearing caps are refitted in their original position identify the bearing caps with centre dot marks.

Remove setbolts and spring washers securing the bearing caps and lift off the caps.

Release the thrust pad lockwasher and locknut. Screw back the thrust pad stud until the pad bears against the carrier inside wall.

Lift the differential assembly complete with crown wheel from the gear carrier. It may be necessary to 'rock' the assembly in order to break the fit. Under no circumstances are the bearing cups to be interchanged.

To remove the crown wheel securing setbolts, pre-heat in warm oil the crown wheel and tap it clear of the differential casing.

Check that the differential casing halves are marked to ensure reassembly in the same relative position. Remove the setbolts and spring washers and separate the casing halves. Lift out the differential pinions complete with cross pins and thrust washers, also the bevel wheels and thrust washers.

Remove the differential bearing cone and rollers from the casing boss using Churchill Tool, MS 47 with Adaptor Set, RG 4221B-15.

Remove split pin, nut, washers and bolt securing the bevel pinion pilot bearing in the gear housing. Drift out the bearing cone from the gear carrier casing.

Remove the thrust pad by unscrewing the stud to force off the pad.

Inspection and Overhaul

Bevel pinion inspection and overhaul is detailed in sub-section H120.

Examine the crown wheel for wear and defects, which if present, will require replacement of both crown wheel and bevel pinion as they are matched at manufacture.

Examine the bevel wheels for wear and damage of the gear teeth and splines which engage the axle shafts. Wear in the splines can be determined by using a new axle shaft as a gauge.

Examine the differential pinions for wear and damage of the gear teeth and scoring and wear of the bores. Any damage or wear will require component replacement.

Examine the pinion thrust washers for wear.

Examine the pinion cross pins for wear and scores.

Examine the inner faces of the differential casing halves for scoring. Any scoring will require replacement of both casing halves since they are matched pairs.

The differential bearings should be cleaned in white spirit and blown out using clean dry air ensuring the rollers and cage are not allowed to spin but are rotated slowly by hand. Examine the bearing assemblies for wear, pitting or damage and replace as necessary. Bearings that are to be reassembled must be lubricated with thin oil to prevent corrosion.

Renew the crown wheel thrust pad if worn.

Check all setbolts for stretching or damaged threads replacing as necessary.

To Reassemble

Smear the thrust washers, cross pins and rear faces of the differential pinions and bevel wheels lightly with grease.

Insert one bevel wheel complete with thrust washer into one half of the differential case. Fit two pinions complete with their thrust washers to each of the cross pins and place them into the case. Insert the remaining bevel wheel and thrust washer into the other half of the differential case.

Fit together the two halves of the differential casing ensuring the locating marks are aligned. Fit and torque load setbolts to 74.5 Nm (55 lbf. ft).

Ensure crown wheel rear face and mating face on the differential case are clean and free from burrs.

Pre-heat the crown wheel in warm oil and refit to the differential casing. Fit and torque load securing setbolts to 122 Nm (90 lbf. ft).

Apply a film of oil to the differential bearings to ease their fitment onto the differential case bosses. Ensure that any force required to fit the bearings correctly to abut their respective boss shoulders is applied to bearing cone, which is an interference fit on the boss. Ensure the bearing cups are refitted to their original positions.

Fit the bevel pinion pilot bearing cup complete with rollers and cage to the gear carrier, securing with washers, bolt, nut and split pin.

Screw the thrust pad stud into the gear carrier until the thrust pad can be fitted then screw back the stud until the pad bears against the gear carrier.

Place the differential and crown wheel assembly complete with bearing cups into the gear carrier. Locate the bearing adjusters in the gear carrier and install the bearing caps in their original positions. Fit the cap securing setbolts loosely.

Set the differential to a central position, allowing for the subsequent installation of the bevel pinion assembly and screw in the differential bearing adjusters, using a locally manufactured wrench to remove any slackness.

Differential and Drive Gear Assembly

Torque load the bearing cap setbolts to 237 Nm (175 lbf. ft) and ensure a bearing preload of 1.9 to 2.6 Nm (17 to 23 lbf. in) as follows:

- a) Attach the end of a piece of cord to the differential casing, wrapping the rest around the casing.
- b) Using a spring balance attached to the free end pull tangentially to the outer diameter of the casing (Fig. 9).
- c) With the assembly rotating (ie the static friction load being overcome) a reading of 2.5 to 3.4 Kg (5.5 to 7.5 lbf) should be obtained when the preload is correct.

Where the preload is incorrect slacken the appropriate cap setbolts and tighten up or slacken the bearing adjusters until the correct preload is obtained. Bearing preload checks should only be completed with the cap setbolts torque loaded to 238 Nm (175 lbf. ft).

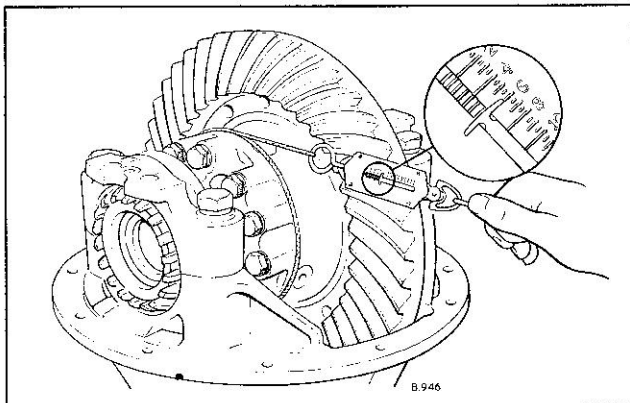


Fig. 9 Differential Pre-load Check

Fit the pinion assembly to the gear carrier and check the crown wheel to pinion teeth engagement as follows:

1 Backlash (Fig. 10)

- a) Check the backlash by using a magnetic base or Churchill Tool, 15-022A, to position a dial gauge to contact one of the crown wheel teeth.
- b) Whilst holding the driver coupling firm move the crown wheel throughout the range of free play in the gear teeth. Note the movement obtained.

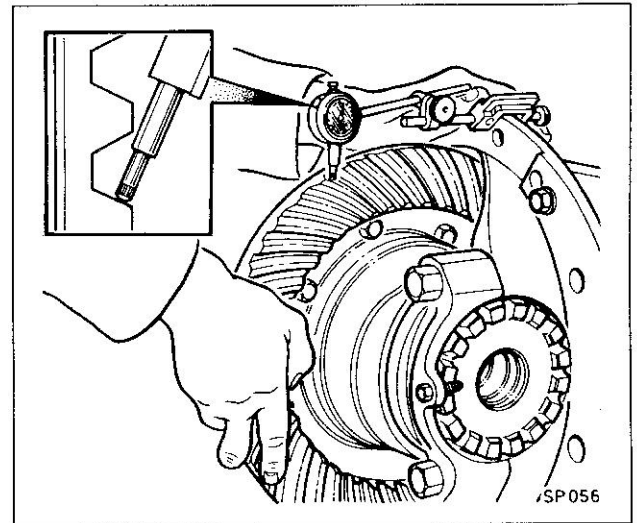


Fig. 10 Differential Backlash Check

- c) Repeat this procedure at four different places ensuring the backlash lies between 0.2 to 0.3 mm (0.009 to 0.012 in).

Backlash should be adjusted when necessary as follows:

- d) Excessive backlash. Slacken the bearing adjuster facing the crown wheel teeth and tighten the opposite adjuster by an equal amount.
- e) Insufficient backlash. Slacken the bearing adjuster behind the crown wheel and tighten the opposite adjuster by an equal amount.

Note: When adjusting the backlash, adjusters must be turned by equal and opposite amounts to ensure the differential bearing preload is not altered.

- f) Retorque the differential bearing cap setbolts to 237 Nm (175 lbf. ft) following each adjustment and before checking the backlash measurement.

2 Contact Profile (Fig. 11)

- a) To check the tooth contact pattern brush a thin coat of marking paste over a number of teeth around the crown wheel. (A suitable paste can be produced by mixing red lead and engine oil).

- b) Rotate the pinion in a clockwise direction whilst applying pressure to the crown wheel against the direction of rotation to produce a clear contact mark on the pinion.

Compare the pattern obtained with Fig. 11 and adjust where necessary as follows:

- c) Fig. 11.5 indicates insufficient tooth engagement and should be rectified by removal of shims from between the bevel pinion bearing sleeve and gear carrier.
- d) Fig. 11.4 indicates excessive tooth engagement and should be rectified by insertion of shims between the bevel pinion bearing sleeve and gear carrier.

Note: Alteration to the shimming will affect the backlash which should be rechecked as detailed in sub para 1a to 1f.

- e) Fig. 11.3 indicates insufficient backlash, if the mark should be on the opposite end of the tooth, ie the 'heel' excessive backlash is present. Adjustment should be carried out as detailed in sub-para 1a to 1f.
- f) Fig. 11.1 indicates correct engagement where the mark is square with the edges of the gear toe and extends for approximately threequarters of the tooth length.

With the adjustments correctly set, secure the differential bearing adjusters by installing the locking screws. Fit and torque load bevel pinion bearing sleeve setbolts to 74.5 Nm (55 lbf. ft).

Set the thrust pad to crown wheel clearance by screwing in the stud until the pad butts hard against the crown wheel in order to seat the pad correctly on the stud, then screw back the stud $\frac{1}{4}$ turn to obtain the required clearance of 0.38 Nm (0.015 in). Tighten the stud locknut ensuring the stud is not moved.

To Refit

To refit the differential and drive gear assembly reverse the removal procedure renewing the jointing compound Bostic 772. Torque load the gear carrier setbolts to 81 Nm (60 lbf. ft).

Refit axle shafts as detailed in sub-section 100.

Refill axle casing with recommended lubricant.

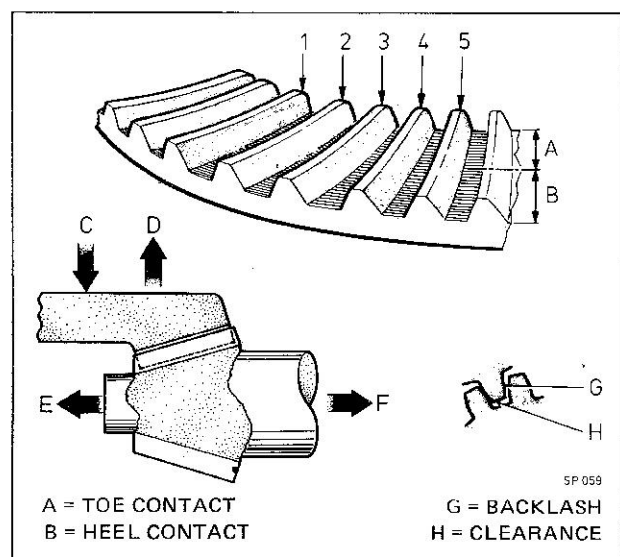


Fig. 11 Differential - Bevel Pinion Tooth Contact Markings

Marking	Fault	Remedy
1	Correct	None
2	Excessive backlash Crownwheel out too far	Move crownwheel in direction of arrow C, towards pinion
3	Insufficient backlash Crownwheel in too far	Move crownwheel in direction of arrow D, away from pinion
4	Toe contact. Pinion in too far	Move pinion in direction of arrow F by adding shims. Move crownwheel in direction C to maintain backlash
5	Heel contact. Pinion out too far	Move pinion in direction of arrow E by subtracting shims. Move crownwheel in direction D to maintain backlash