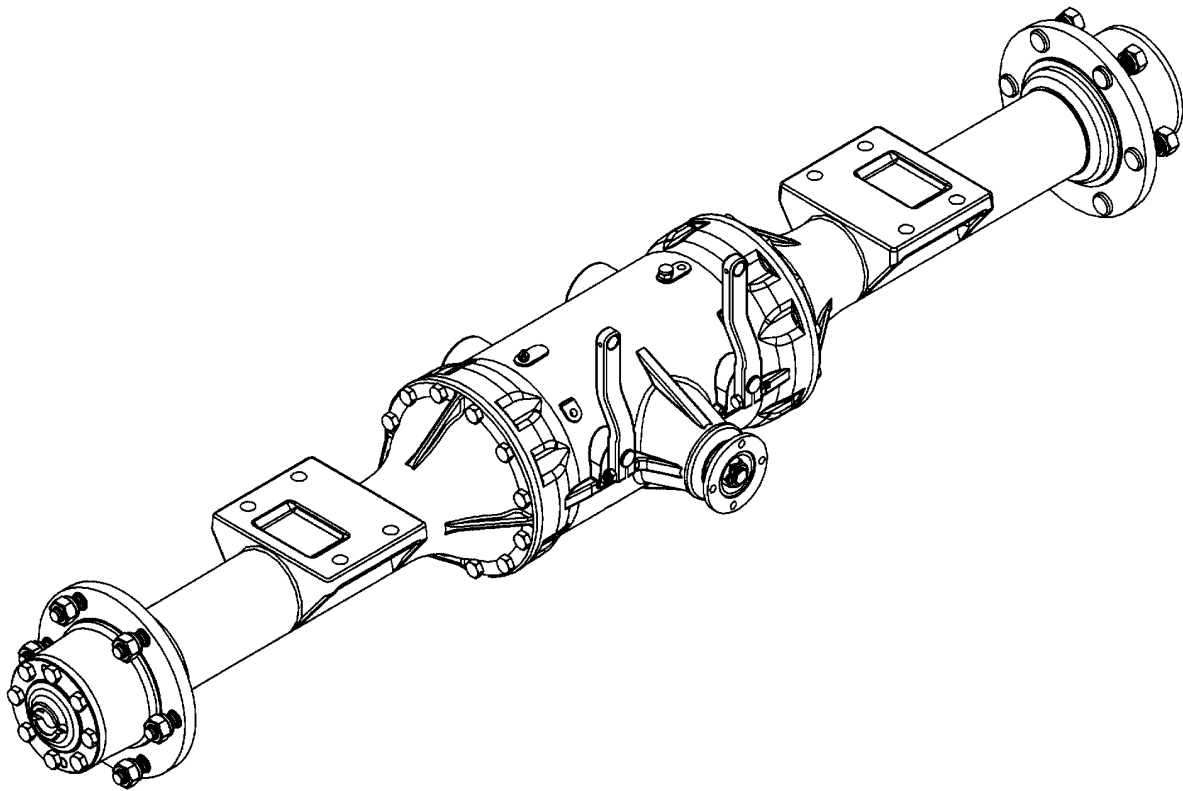


SERVICE MANUAL

615 Series Axle



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1 INTRODUCTION

Spare parts for Newage axles may only be obtained from the original equipment manufacturer and not directly from Newage. Always quote your vehicle/machine serial number and axle serial number – see section titled 'Identification.'

If possible, the repair/service should be carried out in a clean environment. Where this is not possible and the work must be completed on site, appropriate measures must be taken to ensure that dirt or foreign matter does not enter the unit. Newage axles are designed to operate in the arduous conditions found in the construction industry; providing they are maintained regularly they will provide the service our customers expect from Newage products.

2 GENERAL DESCRIPTION

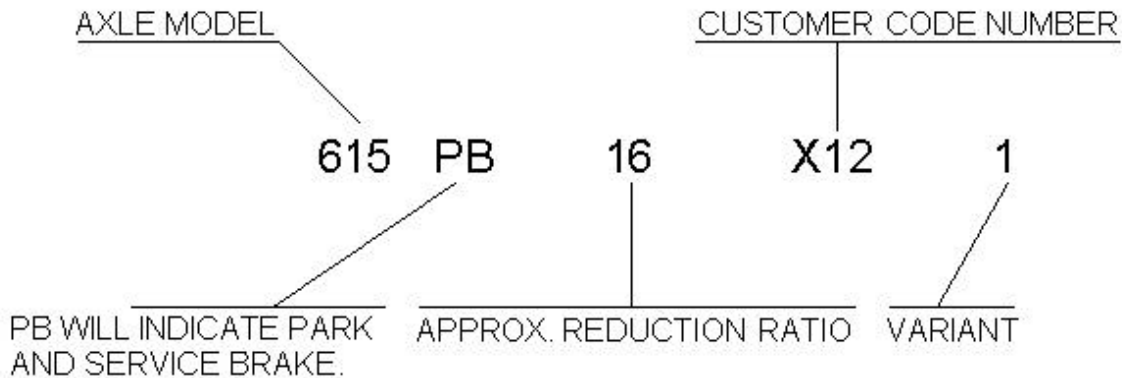
The 615 series axle is a double reduction unit, with oil immersed, multi-plate disc brakes.

The centre casing houses the 1st reduction spiral bevel pinion and crown wheel (fixed to a 4 pinion differential), the oil immersed brakes and the 2nd reduction planetary assembly. The axle shafts are fully floating (i.e. not subjected to wheel loads) with the wheel hubs supported on opposed tapered roller bearings.

3 IDENTIFICATION

If spares are required, please quote the axle series and the vehicle/machine model and serial number. Newage axles are produced with a variety of track widths, mounting centres, wheel hub centres, ratios and input couplings to suit individual customer requirements, therefore it is important to identify the axle correctly

The part number allocated to each axle describes the basic specification as below.



4 GENERAL SERVICE INFORMATION

4.1 Routine Maintenance

- Check for oil leaks around joints and seals: Weekly
- Check wheel nut tightness: Weekly
- Check wheel hub bearing adjustment: 1,000 hours
- Check axle Arm/Maincase joint securing bolts: Monthly
- Check Half Shaft bolts: Monthly
- Check Prop-Shaft Nuts: Monthly

4.2 Lubricants

Only those lubricants shown below, or their direct equivalents must be used.

- MOBIL FLUID 422

The oil is added via the combined filler/level plug positioned in the rear of the axle maincase (Approximate oil capacity of 11.4 litres (20.1 pints)).

4.3 Greases

Pack the gaps between oil seal lips at major overhauls, or whenever a repair to these areas is performed.

- CASTROL SPHEEROL L-EP2

4.4 Brake Fluid – IMPORTANT

The axle brakes operate with a mineral hydraulic fluid (ISO VG32). On no account must a "vegetable" based brake fluid (SAE J1703) be used.

Whenever the brakes are serviced it is essential that the cylinder bores, pistons and seals are clean before assembly, and may be lightly coated with one of the mineral based fluids shown below.

- MOBIL DTE24

4.5 Liquid Sealant

The 'Axle Arm/Maincase' joint faces must be sealed with any of the following:

- LOCTITE "595"
- HERMETITE "RED"

4.6 Fasteners – Tightening Torque

- | | | |
|---|-------------|---------------------------------------|
| • Differential assy. bolt (M10) Grade 10 | 77 Nm | (56 lb.ft) |
| • Differential assy. nut (M10) Grade 10 | 77 Nm | (56 lb.ft) |
| • Diff. bearing carrier shoulder bolt (M10) | 61 Nm | (45 lb.ft) |
| • Handbrake end cover cap bolts (M6) | 10 Nm | (8 lb.ft) |
| • Diff. Bearing carrier tab washer bolts (M6) | 10 Nm | (8 lb.ft) |
| • Differential bearing adjuster nuts | 21 Nm | (15 lb.ft) |
| • Axle arm-main case bolts (M12) | 96 Nm | (71 lb.ft) |
| • Coupling nut (M20) Drag Torque | 1.92/2.48Nm | (17/22 lb.in) after collapsing spacer |
| • Wheel nuts. 7/8" B.S.F. | 407 Nm | (300 lb.ft) |
| • Wheel nuts. 18mm | 270 Nm | (200 lb.ft) |
| • Axle shaft/Wheel hub bolts (M14) | 156 Nm | (115 lb.ft) |

4.7 Axle Backlash Figures

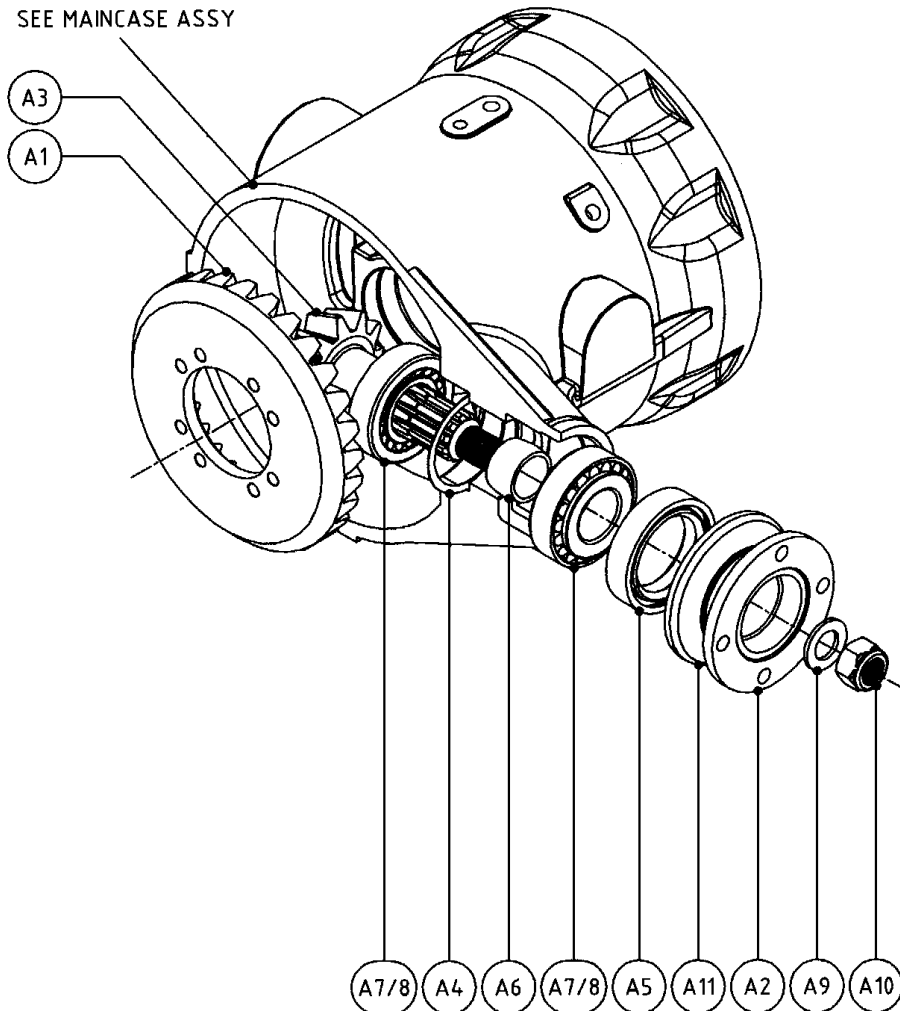
<u>Axles</u>	<u>Pin/wheel</u>	<u>Drive Flange</u>	<u>P.C.D.</u>	<u>Backlash</u>
Series (615) Assy 618-9820	618-2000 618-2010	615-2180 (HS 1410)	95.30	0.31-0.39
		617-2180 (HS1410 Metric)	95.30	0.31-0.39
		618-2180 (HS 1510)	120.66	0.39-0.47
		915-2180 (1480 Yoke)	108.05	0.47-0.55
Assy 619-9820	619-2000 619-2010	615-2180 (HS1416)	95.30	0.31-0.39
		617-2180 (HS1410 Metric)	95.30	0.31-0.39
		618-2180 (HS 1510)	120.66	0.39-0.47
		915-2180 (1480 Yoke)	108.05	0.47-0.55

5 615 AXLE ASSEMBLIES.

5.1 Section 'A' - Crown wheel and Pinion Assembly

<u>Item</u>	<u>Qty</u>	<u>Description</u>
A1	1	Spiral bevel wheel
A2	1	Input drive flange
A3	1	Spiral bevel pinion
A4	As required	Shim 0.25mm
	As required	Shim 0.3mm
	As required	Shim 0.4mm
A5	2	Seal
A6	1	Collapsible spacer
A7	2	Bearing cup
A8	2	Bearing cone
A9	1	Plain washer
A10	1	Nut M20
A11	1	Seal cover

SECTIONAL VIEW
SEE MAINCASE ASSY



Removing & Servicing the Crown Wheel and Pinion.

1. Remove the drain plug (E6) and drain the axle oil.
2. Remove both axle arm assembly's by removing 12 bolts per side (F4, page 17). Withdraw the planet carrier assy (see Section C), and sun gear (F7).
3. Remove annulus (F6) using extractor tool or pinch bars.
4. Remove the brake spacer plate (F8) and the other brake components (F9 & F10). See Section E. Use pinch bars at the back of the brake piston (E11) to extract.
5. Unscrew and remove 4 shoulder screws (E9) and extract the Diff. Bearing Carrier (E3) through the bore of the Maincase (E1). Feed Diff and crown wheel assembly through bore of the Maincase.

IMPORTANT: It is essential that a protective sleeve is used over the parts being withdrawn through the bore to prevent damage to the piston location bore. Failure to observe this procedure will result in a loss of brake efficiency or complete brake failure.

6. To remove tab washers (E4) securing the diff housing, release the two screws 2 screws (E23) from Diff adjusting nut (E2)
7. Unscrew brg. adjuster nuts (E2) and push brg. cups (E8) out of bores.
8. While reacting against drive flange to prevent it from turning release the nut (A10) and remove the washer (A9) from the pinion shaft (A3). Remove the flange (A2). Using a soft drift remove the pinion taking care not to damage the teeth.
9. Inspect the bearings (A7/A8) for wear and damage. If replacing the inner bearing on the pinion head, use a bearing puller to extract the cone. Discard collapsible Spacer (A6). Drift out Brg; Cups (A7/8) from the main case bore, taking care not to loose shims (A4) located behind the Brg; cup of the pinion head bore.

IMPORTANT: Once dismantled it is necessary to reset the pinion backlash to ensure the correct meshing of the crown wheel / pinion. Always use new collapsible spacer (A6) and a new nut (A10). See section "F" for the crown wheel / pinion setting up procedure.

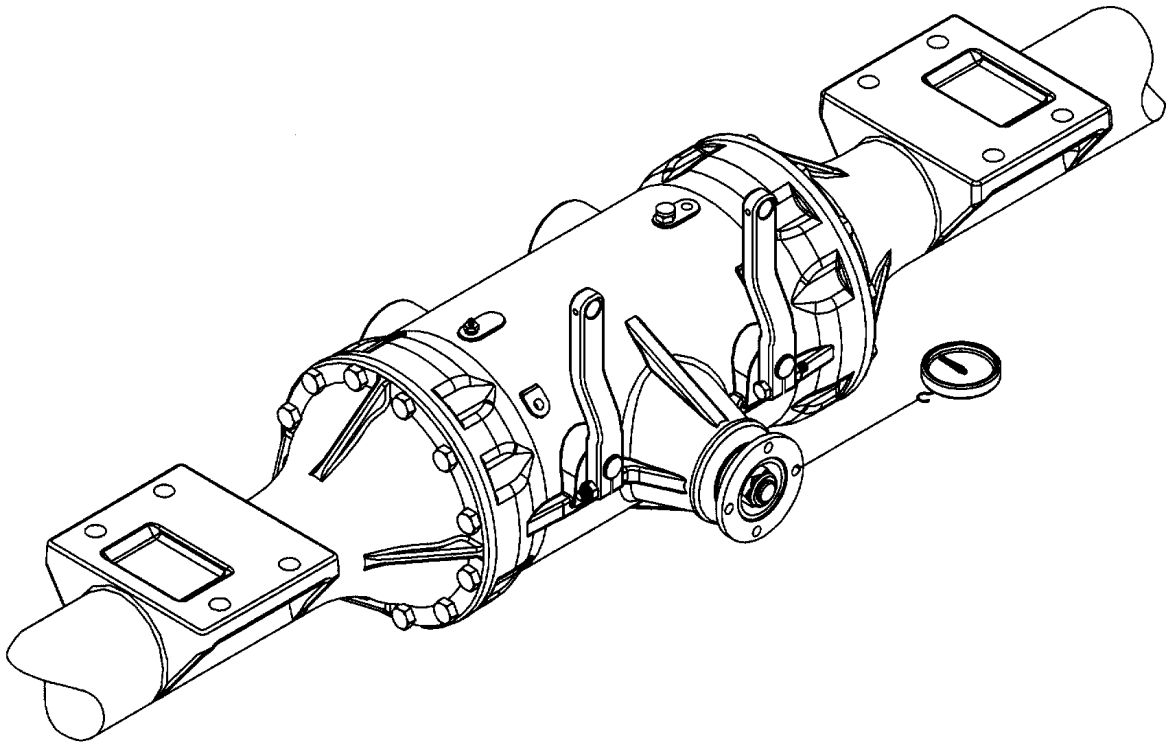
10. Record the following information of the original components, in the following sequence.
 - (a) The pinion (A3) mounting distance etched on the head.
 - (b) The overall bearing width of pinion head bearing, (A7, A8).
 - (c) The shim thickness (A4).
 - (d) = (a) + (b) + (c).
11. If replacing the pinion (A3) or pinion head bearings (A7, A8) the following procedure needs to be carried out. Record the following information of the new components to be fitted as follows:-
 - (e) The pinion (A3) mounting distance etched on the head.
 - (f) (e) + (f)
 - (g) The new shim thickness (A4) to be determined.
12. New shimming:

$$\text{Shim thickness} = \text{Old pinion head Brg; \& shim} - \text{New pinion head Brg} \quad (h) = (d) - (g)$$

12. To assemble the unit, reverse the above procedure, and proceed as follows.
13. Pinion assy. must be fitted before crown wheel/diff assy. Tighten the new pinion nut (A10) until the new spacer (A6) collapses and all the end float between the pinion bearings is taken up. Drag torque 1.92/2.48Nm. (17/22 lb.in). Spin over several times and recheck torque.

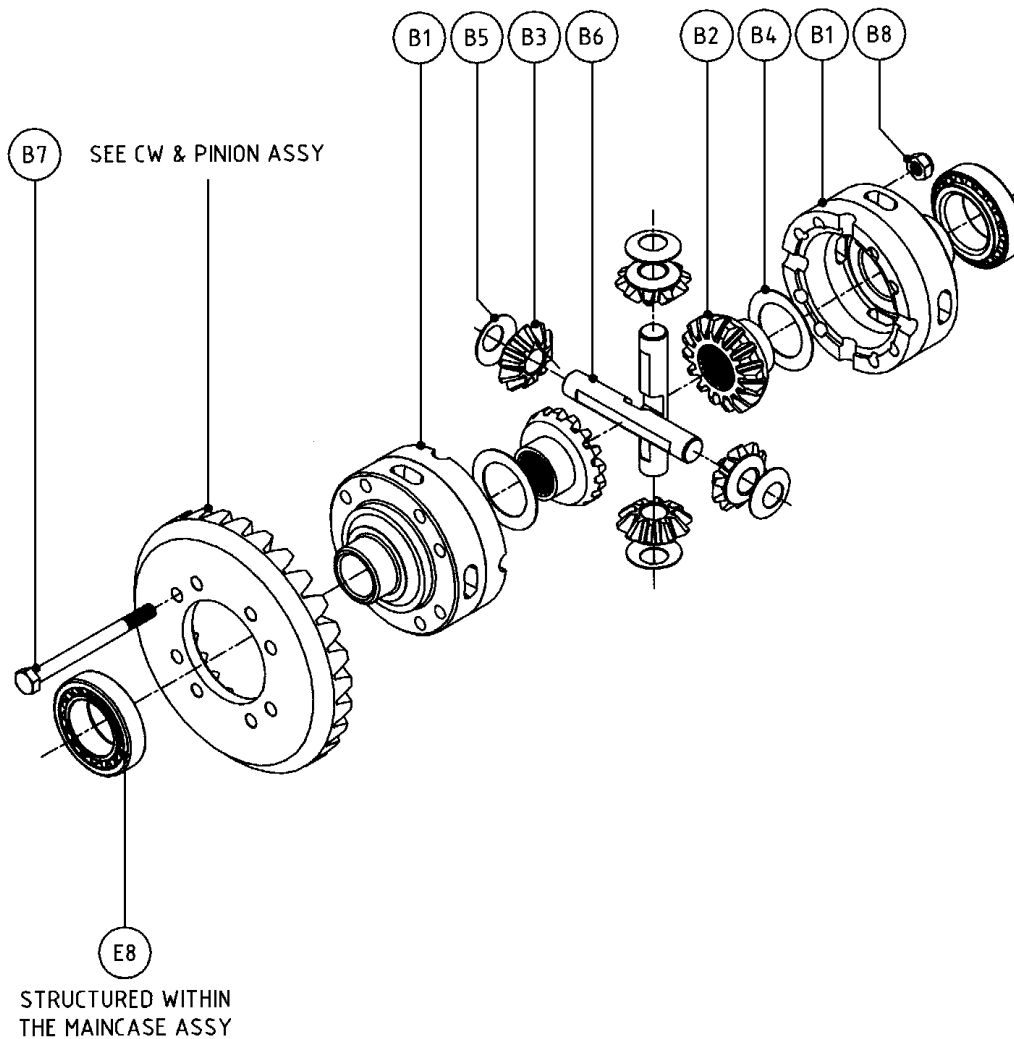
Note, the tightening torque to collapse the spacer should not be less than 245 Nm (180 lb.ft).

This equates to a pre-load of 59-98N (13.2-22lbf) for new bearings, or 29.5-59N (6.6-13.2lbf) for used bearings is obtained. The pre-load is measured by binding a piece of string around the coupling (A2) and measuring the load to turn the coupling with a spring balance – see drawing below. This must be carried out with the crown wheel/pinion mesh disengaged.
14. Fit diff bearing cups (E8) into the maincase (E1) and diff Brg; carrier (E3). Screw Brg; adjuster nut (E2) loosely to retain Brg; cups in housing bores.
15. It is advisable to stand maincase on its end with the brg. cup (E8) on the bottom. Lower differential assembly complete with crown wheel through main bore until the bottom bearing (E8) seats in the bearing cup (E8). **See para 5 on page 5.**
16. Fit Diff. Bearing Carrier (E3) so that the 2 tapped holes for locating screws are towards the brake feed holes on the maincase. **This is important as it will allow good oil circulation to other internal components.** Ensure that the shoulder screw holes align with the holes in the maincase. Apply silicone sealant to under the head prior to fitment of the shoulder screw (E9) and repeat three times. Torque to the recommended figure.
17. Insert bearing cone through Diff. Bearing Carrier (E3) and loosely fit bearing adjuster nut (E2).
18. Position Maincase (E1) so bore is horizontal.
19. Adjust both bearing nuts (E2) to obtain the required pinion & wheel backlash. Tighten to the recommended tightening torque. See section 4-7.
20. Locate two new tab washers (E4) to both adjusting nuts (E2) fit two screws (E23) and tighten to the recommended torque.
21. Ensure all joints are clean and free of the original jointing compound and reseal. Locate each axle arm assembly on the dowels positioned in the main case, refit the 12 bolts (F4) and tighten to recommended tightening torque.
22. Refit drain plug (E6) and refill to the correct level with recommended oil.



5.2 Section 'B' - Differential Assembly

Item	Qty	Description
B1	1	Diff case LH
	1	Diff case RH
B2	2	Diff wheel
B3	2	Diff pinion
B4	2	Thrust washer
B5	4	Thrust washer
B6	2	Diff spider (half)
B7	8	Bolt M10
B8	8	Nyloc nut M10



Servicing the Differential Assembly

Note: This procedure assumes the axle is stripped down to main case assembly only.

1. To remove the annulus (F6) using an extractor tool or pinch bars located behind the annulus in a scissor fashion.
2. Remove the brake spacer plate (F8) and the brake components (F9, F10). See Section E. Using pinch bars at the back of the brake piston (E11) to extract.
5. Remove the 4 shoulder screws (E9) and extract the Diff. Bearing Carrier (E3) through the bore of the Maincase (E1). Feed Diff and crown wheel assembly through bore of the Maincase.
Note: See para 5 page 5.
6. Remove 2 screws (E23) securing the diff Brg; housing, tab washer (E4) to the diff Brg; adjuster nut (E2).
7. Unscrew brg. adjuster nuts (E2) and push Brg; cups (E8) out of bores.
8. Remove the 8 nuts & bolts (B7, B8). The crown wheel (A5) can now be drifted off diff case. The assembly will split into 2 halves. Taking care not to lose internal components.
9. Inspect all gears, bearings and spider for damage and wear. Replace if necessary.
10. To reassemble reverse the procedure.

Important: Great care must be taken when refitting the reassembled diff back into the main. Clearance is very limited and to avoid personal injury it is advisable lower the fully assembled diff into the case using a sling made from strong twine.

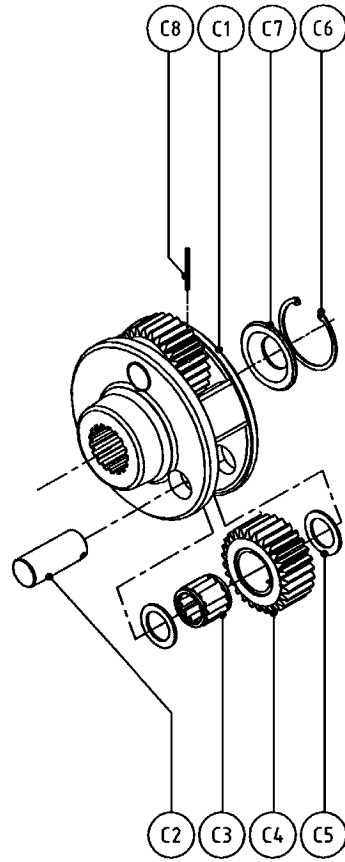
Note: To reset the back lash see page 5 taking note of para 5 also.

5.3 Section 'C' - Planet Carrier Assembly

Note: This procedure assumes the axle is stripped down to the main assembly only, with planetary Remaining in place.

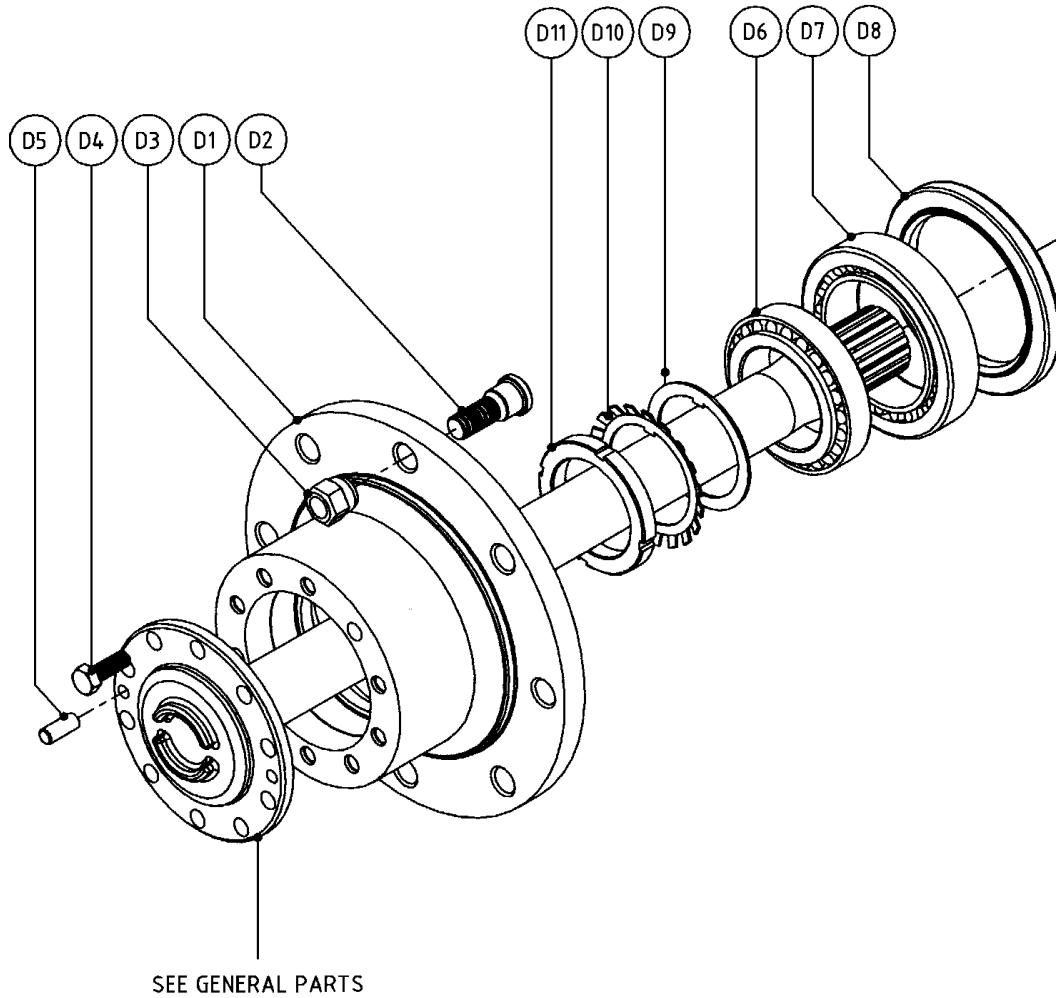
1. The planet carrier assembly can now be removed from the centre casing. Take care not to withdraw the floating sun gear.
2. Check the planet gears and the mating gear teeth on the annulus and sun gear for damage and wear. The planet gears should run free in the planet pins, without excessive radial "play" Replace if worn. Note: When servicing the planet assembly we recommend all three gears and bearings are replaced. See section A.
3. To replace the planet gears, pins or bearings, drift the spring dowel (C8) which locates the planet pins (C2) through the planet carrier (C1), lightly drift the planet pins through the planet carrier. Remove the loose planet gears (C4), thrust washer (C5) and planet Brgs; (C3). Remove circlip (C6) which secures the spacer (C7). **Note: the spacer (C7) is fitted with the chamfer facing outwards.**
4. Remove the old spring dowels (C8) from the planet carrier (C1).
5. To reassemble: Replace the spacer & circlip (C6, C7) fit the planet Brgs; (C3) into planet gears. (C4) locate the bottom thrust washer, place the planet gear on top of the thrust washer and from the underside gently tap the planet pin through the carrier, thrust washer & planet gear. **Note: when you begin this procedure it is important that the cross in the planet pin is aligned with the cross hole in the planet carrier.** When part way through fit the top thrust washer and continue to drift the planet pin all the way through the carrier until it is flush.
6. Secure by fitting new spring dowel (C8) and pin over the hole in the planet carrier to prevent the spring dowel from drifting out of position.
7. Check for free rotation of the planet gears.
8. To refit to the main case, engage the spline of the sun gear (F). Mesh the planet gears with the annulus (F6) and push into position.

<u>Item</u>	<u>Qty</u>	<u>Description</u>
C1	1	Planet carrier
C2	3	Planet pin
C3	3	Needle bearing
C4	3	Planet gear
C5	6	Thrust washer
C6	1	Circlip
C7	1	Spacer
C8	3	Spring dowel



5.4 Section 'D' - Hub Assembly

Item	Qty	Description
D1	1	Hub (i.e.per side)
D2	8	Wheel stud
D3	8	Wheel nut
D4	10	Bolt M10 x 30mm
D5	2	Dowel pin
D6	1	Bearing
D7	1	Bearing
D8	1	Hub seal
D9	1	Spacer
D10	1	Lock washer
D11	1	Locknut



Servicing the Hub Assembly

The hub assembly can be serviced with the axle arm still connected to the maincase. Procedure is as follows:-

1. Remove bolts (D4) that secures the axle shaft (F1) to the hub and withdraw the shaft. Inspect the spline form for damage and wear. (Flat on hub is provided to aid extraction).
2. Straighten locking tab ears on lockwasher (D10), undo lock nut (D11) remove lockwasher (D10) and bearing spacer (D9).
3. The hub (D1) can now be withdrawn from the axle arm stub. Care must be taken not to drop the loose brg. cone.
4. Examine all Brg; cups & cones for wear or damage replace as necessary.

Note: We recommend the hub oil seals are always changed when the hub has been removed.

5. The bearing cup (D6 & D7) can be drifted out of the hub (D1) if they need replacing. When fitting new cups (D6 & D7) ensure that they are aligned squarely to the bores before pressing in.
Note: If the brg. (D7) is replaced oil seal (D8) will also need replacing.

6. If the oil seal shield (F2) needs replacing it can be drifted off the axle arm. When drifting on the replacement, care must be taken not to damage the oil seal running diameter.

Before refitting the seal housing ensure all of the original sealant is removed, this may require use of a solvent. Apply "Loctite" grade 601 to both the to seal housing location point of the arm, and to the seal housing diameter immediately prior to reassembly. Ensure the seal diameter is free from dirt and damage.

7. Prior to reassembly of the hub Brgs; apply a recommended quality grease to ensure the Brgs; are lubricated on the initial start up.
8. To reassemble the hub assembly, clean off the original silicone sealant with a solvent. Reapply a continuous bead of silicone sealant, and reseal the axle shaft joint to the hub using the same silicone sealant, reverse the above procedure using a new lockwasher (D10).
9. Note: To adjust the hub bearings.
 - Tighten the lock nut (D11) to a torque of 140 Nm (100 lb.ft). When checking the torque setting turn the wheel hub a few turns in each direction to ensure the bearings have "seated" correctly and recheck tightening torque. Repeat this procedure 3 times.
 - Slacken the nut back a distance equal to 2 tabs of the lock washer (D10).
 - Bend ear of lock washer over to secure the nut.

5.5 Section 'E' - Axle Maincase Assembly

(See Diagram on page 16)

<u>Item</u>	<u>Qty</u>	<u>Description</u>
E1	1	Maincase
E2	2	Bearing Adjustment Nut
E3	1	Diff. bearing carrier
E4	2	Lock plate
E5	1	Breather
E6	2	Drain plug
E7	2	Bonded seal
E8	2	Bearing cup
	2	Bearing cone
E9	4	Shoulder screw
E10	1	O-ring small
E11	1	Brake piston
E12	1	O-ring large
E13	1	Bleed valve.
E14	2	Hand brake operation lever
E15	1	Break level return spring
E16	1	Break level return spring
E17	1	Handbrake lever cover RH
E18	1	Handbrake lever cover LH
E19	2	Handbrake lever 'O' ring
E20	2	Handbrake lever 'O' ring
E21	12	Screw M6
E22	2	Brake lever bush
E23	4	Screw M6

IMPORTANT: The axle brakes operate with a mineral hydraulic fluid ISO VG32 Specification.

DO NOT USE "Vegetable" based brake fluid (SAE J1703) should not be used.

- To gain access to the brakes, the procedure is the same as previously described in section B
- When removing the brake plates count them as the number can vary with axle models.

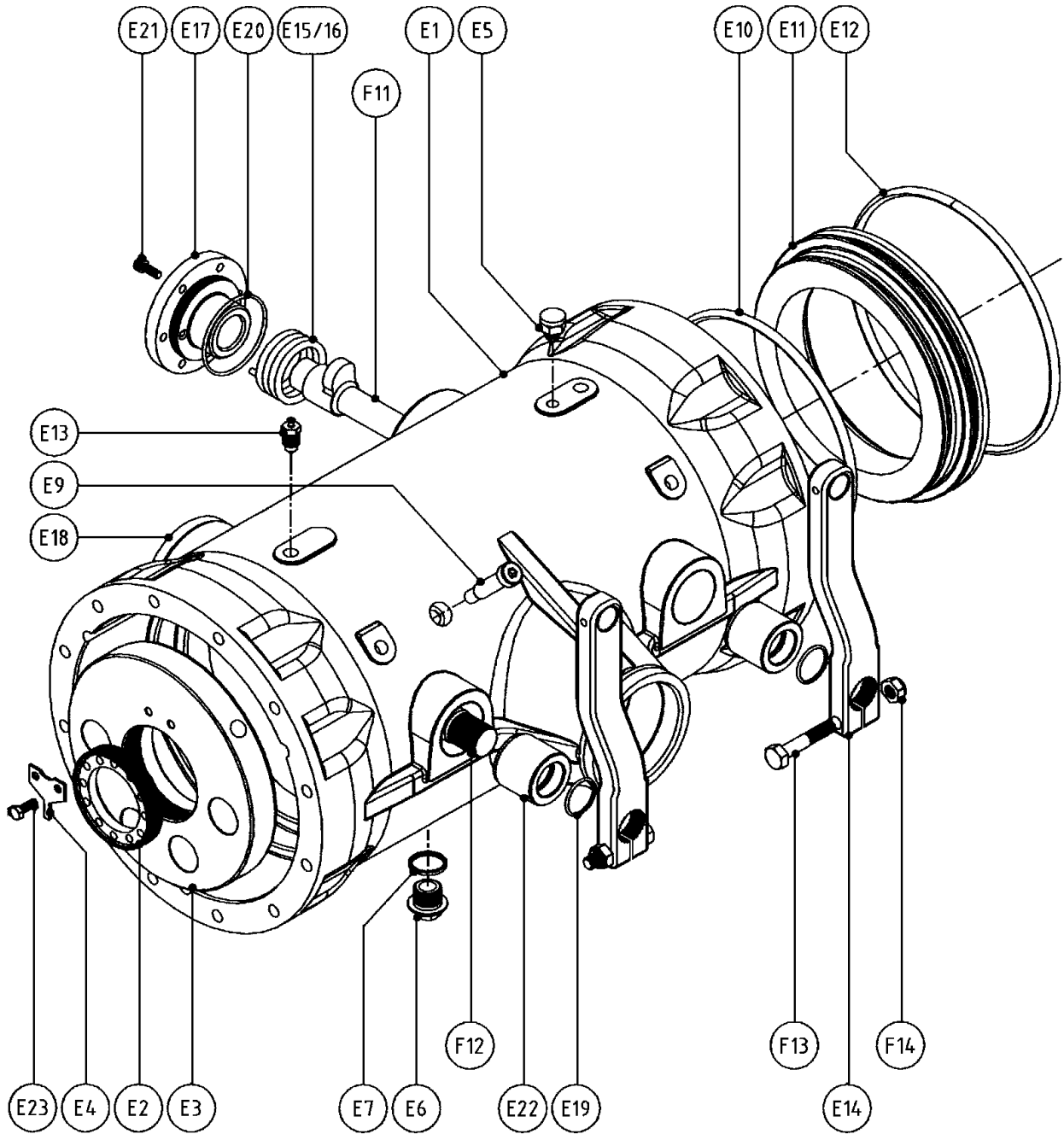
Under normal operating conditions the brakes should last several years. The condition of the brakes can be checked as follows:-

- Sintered brake disc (F9) – not less than 4mm thickness.
 - Fixed brake plate (F10) – not less than 2mm thickness. Check for uneven surface wear or heat discolouration on fixed plate.
- The brake piston (E11) can be gently removed from the cylinder using pinch bars in a scissor fashion locating them behind the piston. Check "o" rings (E10/E12) for wear or damage.

Note: All brake components must be free of damage & remain clean at all times, if in doubt change the appropriate parts.

- To reassemble, reverse the above procedure. Ensure that piston bores are clean and the brake plates are assembled on the sun gear spline (F7) with the oil feed holes in the sintered plates correctly aligned for oil circulation.
- To remove hand brake operating lever (E14) loosen nut (F14) and bolt (F13) and gently drift the lever from spline.
- Remove 6 M6 cap head bolts (E21) per side and withdraw cover (E18), spring (E16) and brake lever LH or RH (F12).
- Repeat steps 6 and 7 for the opposite hand. **Note. The cap, spring and brake lever are 'handed', and on rebuild must be fitted to the same side of the axle.**

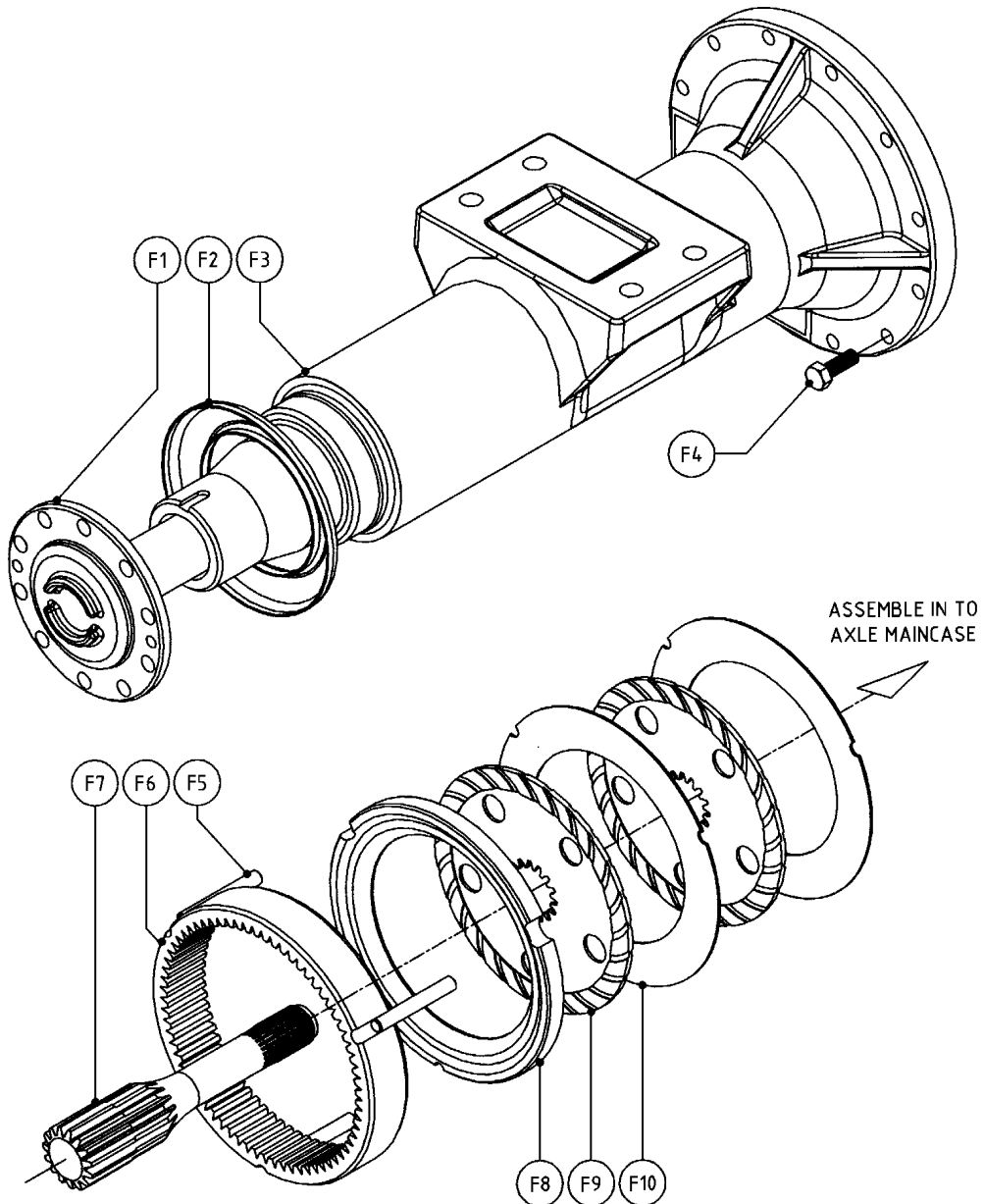
9. Check the condition of the brake lever bush (E22) bore. If this requires replacing drift it through the main case. Ensure the replacement is fitted square.
10. To reassemble, reverse the above procedure replacing the brake lever bush "o" rings (E19, E20) with the brake lever bush (E20).



NOTE: 'F' COMPONENTS ARE STRUCTURED
WITHIN THE GENERAL PARTS

5.6 Section 'F' - General parts

Item	Qty	Description
F1	2	Axle shaft
F2	2	Cover wheel hub seal
F3	2	Axle arm
F4	24	Bolt M12
F5	6	Dowel pin.
F6	2	Annulus
F7	2	Sun gear
F8	2	Brake spacer plate
F9	4	Brake disc
F10	4	Brake plate
F11	1	Brake lever RH
F12	1	Brake lever LH
F13	2	Bolt M10
F14	2	Nyloc Nut M10



SAFETY: Prior to removal of an axle arm we recommend that lifting tackle is available, due to the weight of the associated components.

- 1 Making sure the weight is fully supported, remove the bolts (F4) around the flange of the axle arm connecting it to the maincase and withdraw the axle arm (F3).

Note this can be done with or without the hub assembly fitted to the arm.

2. Before refitting the axle arm, ensure the mating faces on the axle arm flange and centre case are clean and free of damage. Apply a continuous bead of the recommended sealing agent (see section 4.5).
3. Refill with see page ? to the correct level.

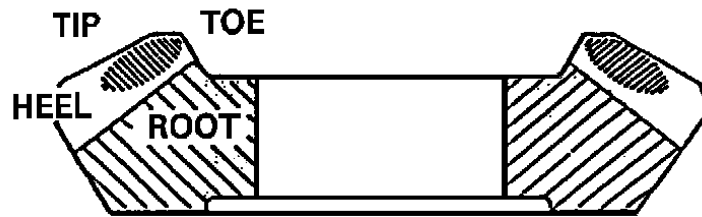
6 SPIRAL BEVEL GEAR TOOTH CONTACT

Contact may vary, but generally is approximately in the tooth centre, equi-spaced between root and tip. The marking may be towards toe on some gears on both flanks, or marking crossed slightly i.e. towards toe on convex flank and heel on concave flank or vice versa.

If, compared to the factory tooth contact, the contact appears as shown below, then corrective action should be taken as follows:

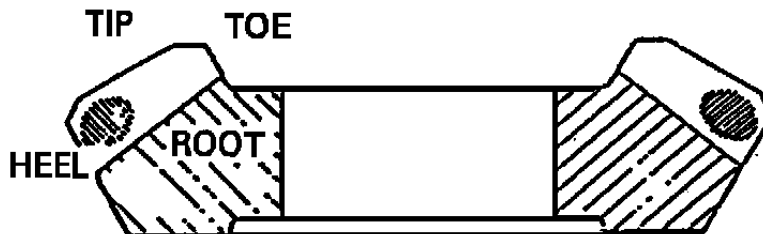
6.1 ERROR 1: Pinion too far out of mesh

Convex flank



Contact further to toe and tip than factory marking.

Concave flank

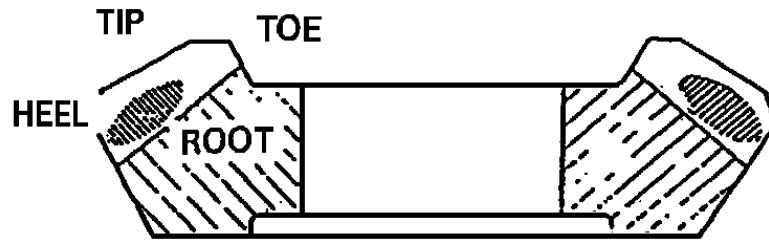


Contact further to heel and tip than factory marking.

ACTION: Recheck and decrease shims below pinion cartridge flange.

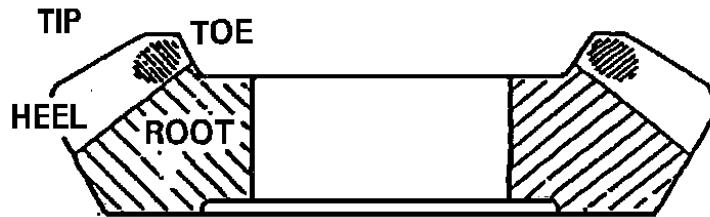
6.2 ERROR 2: Pinion too far into mesh

Convex flank



Contact further to heel and root rather than factory marking.

Concave Flank



Contact further to toe and root than factory marking.

ACTION: Recheck and increase shims below pinion cartridge flange.