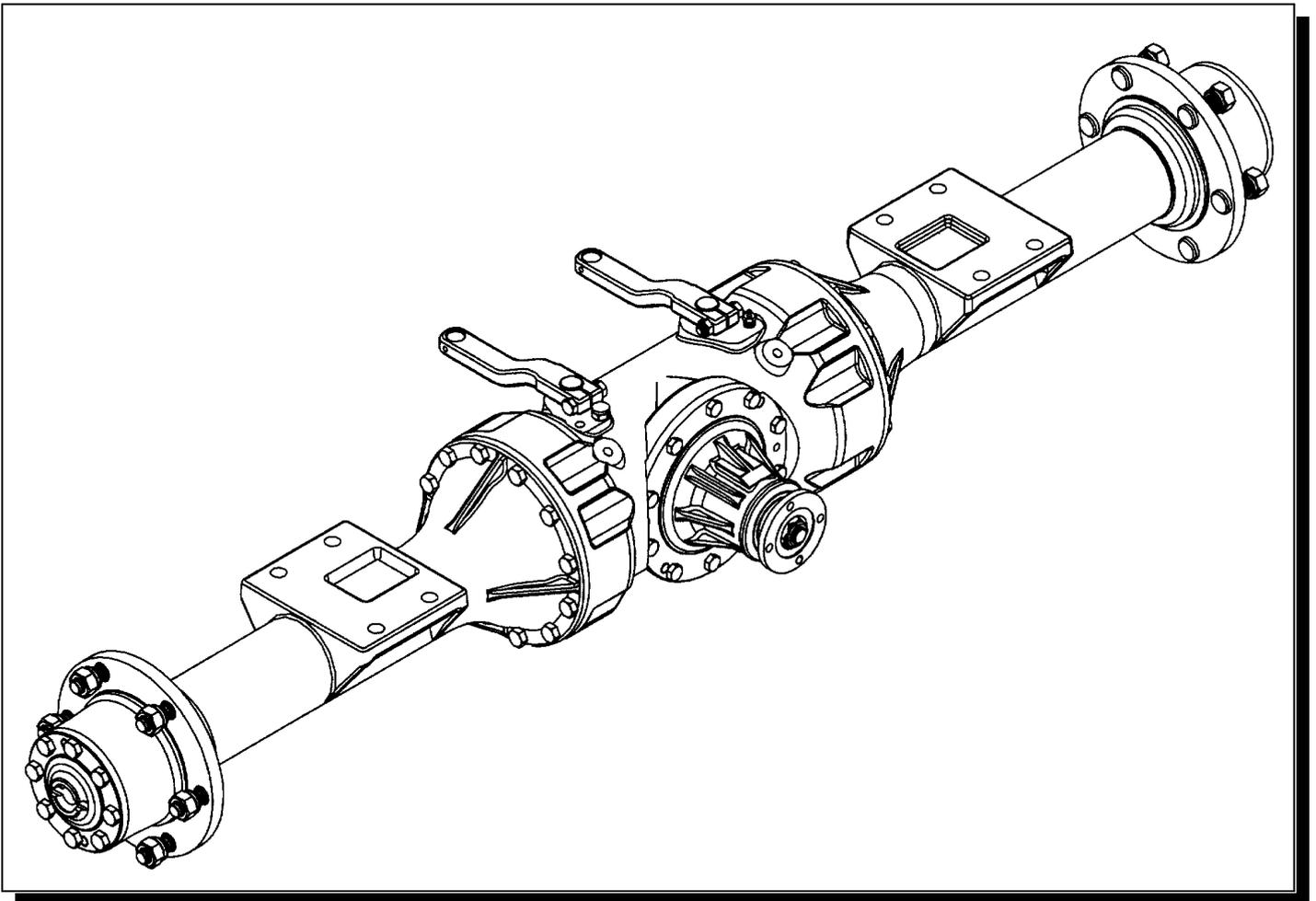


## SERVICE MANUAL

### 215 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

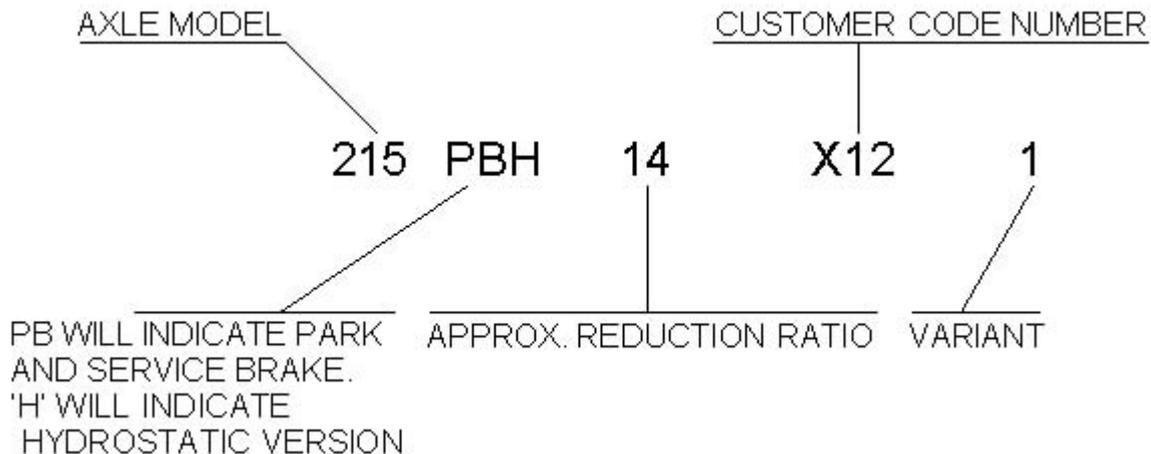
The 215 series axle is a double reduction unit, with oil immersed, multi-plate disc brakes.

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 3 litres (5.3 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 (SO 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 'Pinion Cartridge/Maincase' & 'Axle Arm/Maincase' joint faces must be sealed with any of the following:

- LOCTITE "595"
- HERMETITE "RED"

### 4.6 Fasteners - Tightening Torque

- |  |        |                               |
|--|--------|-------------------------------|
| • Differential assy. stud (M10)          | 56 Nm  | (42 lbf.ft)                   |
| • Differential assy. nut (M10)           | 56 Nm  | (42 lbf.ft)                   |
| • H/B End end cover cap bolts (M6)       | 28 Nm  | (20 lbf.ft)                   |
| • Differential brg. adjuster nuts        | 21 Nm  | (15 lbf.ft)                   |
| • Pinion cartridge-main case bolts (M10) | 56 Nm  | (42 lbf.ft)                   |
| • Axle arm-main case bolts (M10)         | 56 Nm  | (42 lbf.ft)                   |
| • Coupling nut (M20)                     | 340 Nm | (250 lbf.ft) Hydrostatic only |
| • Wheel nuts. 5/8" B.S.F.                | 245 Nm | (180 lbf.ft)                  |
| • Wheel nuts. 18mm                       | 270 Nm | (200 lbf.ft)                  |
| • Wheel hub bolts (M10)                  | 56 Nm  | (42 lbf.ft)                   |

#### 4.7 Axle Backlash Figures

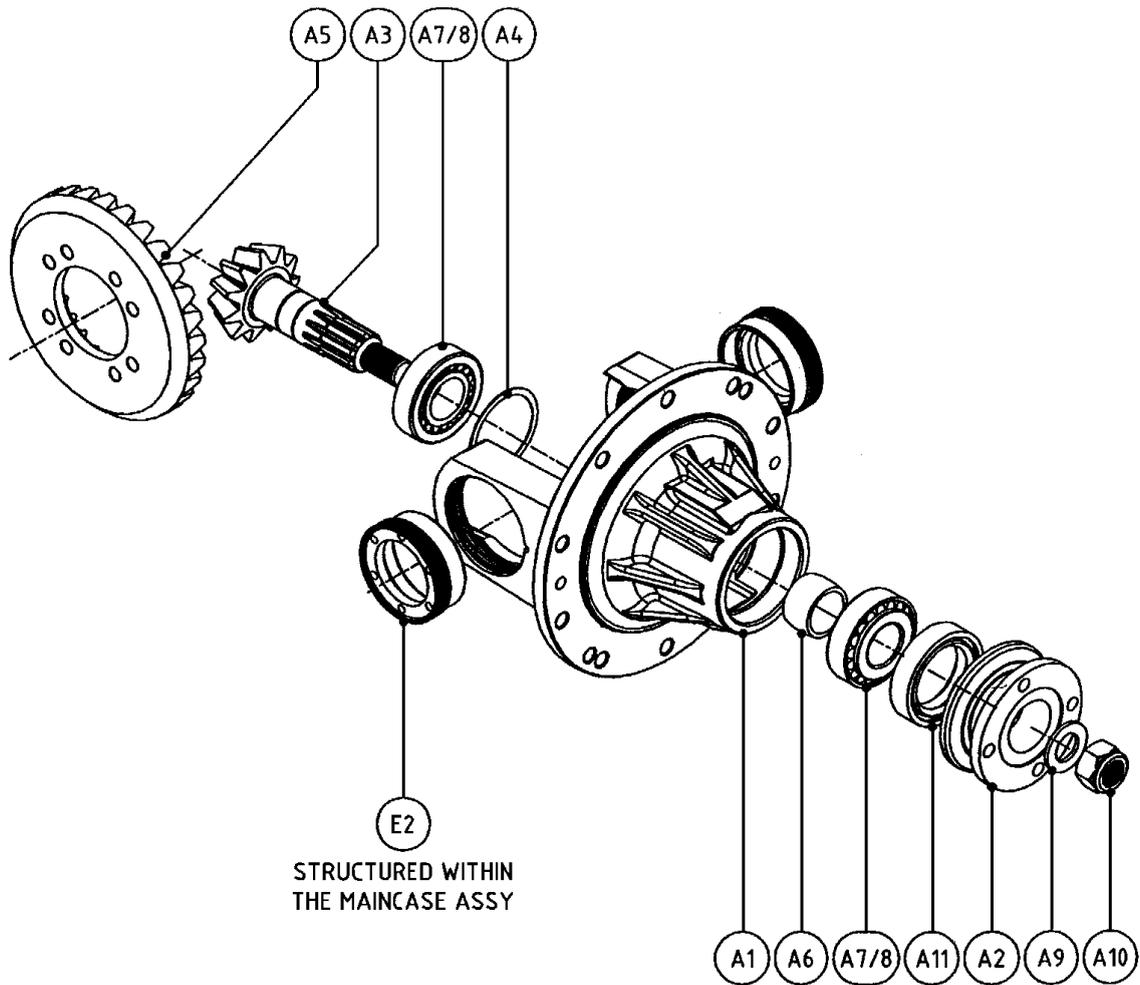
<u>Axles</u>	<u>Pin/wheel</u>	<u>Drive Flange</u>	<u>P.C.D.</u>	<u>Backlash</u>
Series (212, 215)	215-2000 200-2010	415-2180 (HS1310)	79.40	0.22-0.30
Assy - 215-9820		415-2181 (HS1310)	79.40	0.22-0.30
		416-2180 (HS1310 Metric)	79.40	0.22-0.30
		416-2181 (HS1310 Metric)	79.40	0.22-0.30
		418-2180 (HS1100)	69.86	0.19-0.26
		418-2181 (HS1100)	69.86	0.19-0.26
		419-2180 (HS1410)	95.30	0.26-0.36
		419-2181 (HS1410)	95.30	0.26-0.36
		420-2181 (DIN90)	74.50	0.21-0.28
		421-2180 (HS1410 Metric)	95.30	0.26-0.36
		417-2180 (DIN100)	84.00	0.23-0.32
		421-2181 (HS1410 Metric)	95.30	0.26-0.36
		417-2181 (DIN100)	84.00	0.23-0.32
		422-2180 (DIN120)	101.5	0.29-0.38

5 215 AXLE ASSEMBLIES

5.1 Section 'A' - Pinion Cartridge Assembly

Item	Qty	Description
A1	1	Input pinion cartridge
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	1	Spiral bevel wheel
A6	1	Spacer (collapsible for non-hydrostatics)
A7	2	Bearing cup
A8	2	Bearing cone
A9*	1	Plain washer
A10	1	Nut M20
A11*	1	Oil seal

(NB \* Not valid for hydrostatic version)



### Removing & Servicing the Pinion Cartridge Assembly

- 1 Remove the drain plug (E6) and drain the axle oil.
- 2 Remove both axle arms assy by removing bolts (F4). Withdraw the sun gear (F7). Remove 10 bolts (E3) around the pinion cartridge. Using the M10 extraction bolts (not supplied) remove the crown wheel/differential assembly through the pinion cartridge aperture.
- 3 Remove the pinion nut (A10) from the pinion shaft (A3), along with the washer (A9), and the coupling (A2).
- 4 Inspect the bearings (A7/A8) for wear and damage. If the inner bearing on the pinion shaft needs replacing, use a bearing puller to extract the cone, taking care not to damage the shims positioned behind the bearing cone. If the bearing cups or oil seals need replacing, they can be pressed or drifted out of the cartridge housing.
- 5 Unpein 2 adjuster nuts (E2) and remove. Differential assembly will now be free to remove from the pinion cartridge.

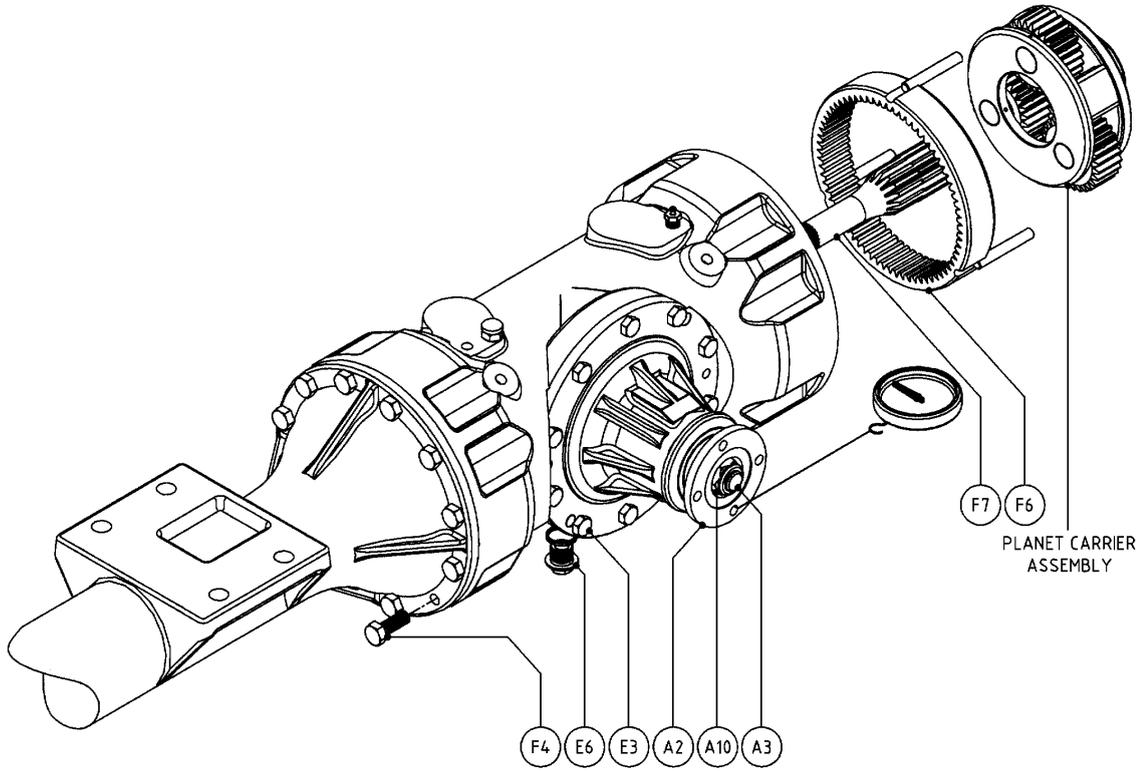
**IMPORTANT** – If any components are replaced a new collapsible spacer (A6) & pinion nut (A10) must be used and the crown wheel/pinion backlash will need checking – see Section F, "crown wheel/pinion set-up".

- 6 If the pinion (A3) or pinion head bearings (A7, A8) are replaced the following procedure needs to be carried out:

Record the following information of the current components fitted as follows:-

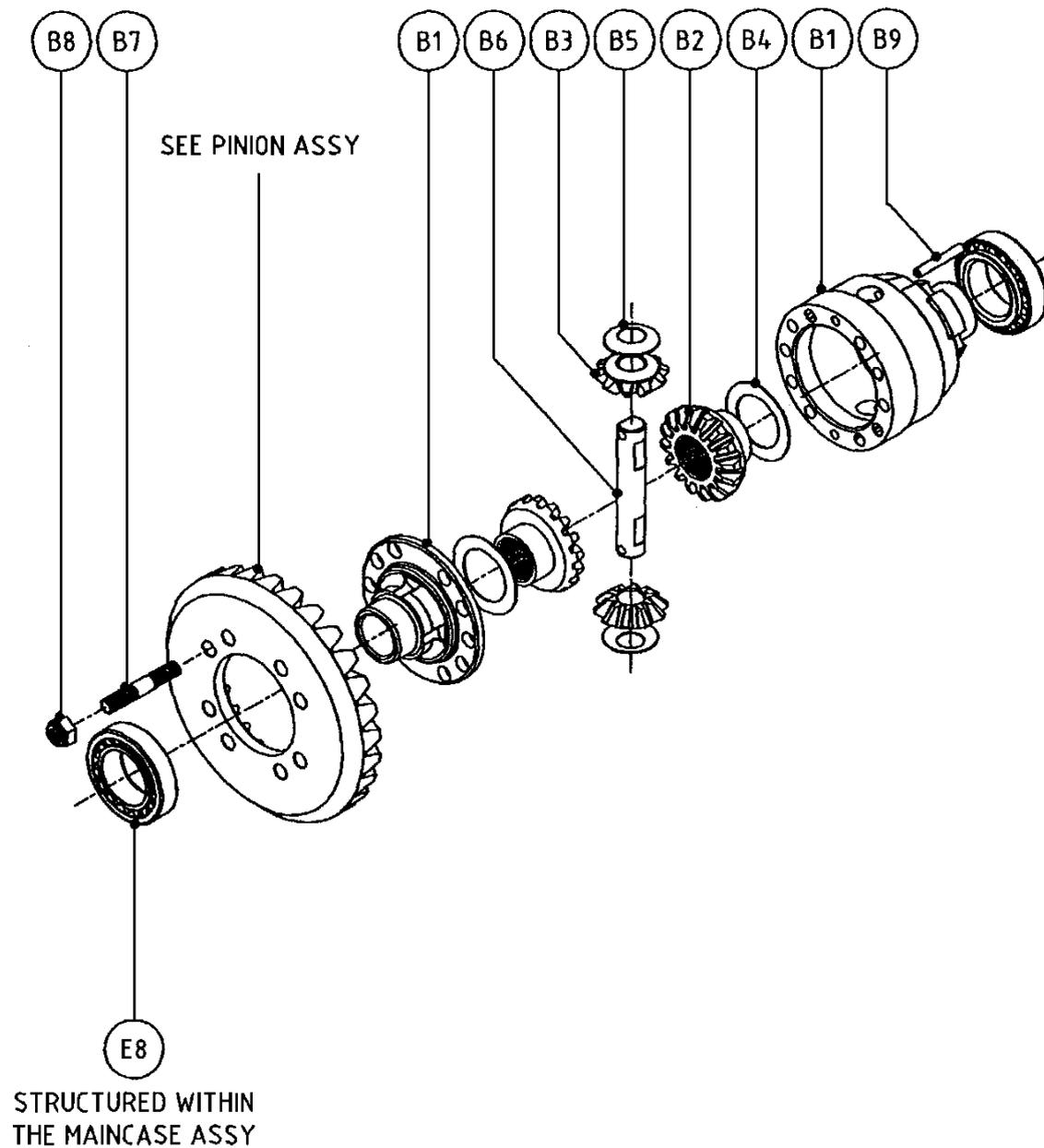
- (a) The new pinion (A3) mounting distance etched on the head.
- (b) The new overall bearing (A7, A8) width of pinion head bearing.
- (c) Pinion Cartridge (A1) mounting distance constant for 215 = 100.85mm.
- (d) Shim thickness (A4) = (100.85 -(a))-(b)

- 7 To assemble the unit, reverse the above procedure. Ensure the brake plates when fitted are aligned on the sun gear spline giving oil access through the holes.
- 8 Tighten the pinion nut (A10) until the 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).  
Note, the tightening torque should not be less than 245 Nm (180 lb.ft).
- 9 Continue to tighten the pinion nut until 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.
- 10 Refit the cartridge assembly into the main case ensuring the recommended sealing agent is uniformly applied to the flange faces and tighten to M10 bolts tightening torque.
- 11 Refill the axle with the recommended oil.



**5.2 Section 'B' - Differential Assembly**

<u>Item</u>	<u>Qty</u>	<u>Description</u>
B1	1	Diff case LH
	1	Diff case RH
B2	2	Diff wheel
B3	2	Diff pinion
B4	2	Thrust washer
B5	2	Thrust washer
B6	1	Diff spider (half)
B7	8	Stud M10
B8	8	Nyloc nut M10
B9	2	Spirol Pin 6mm



### Servicing the Crown Wheel & Pinion

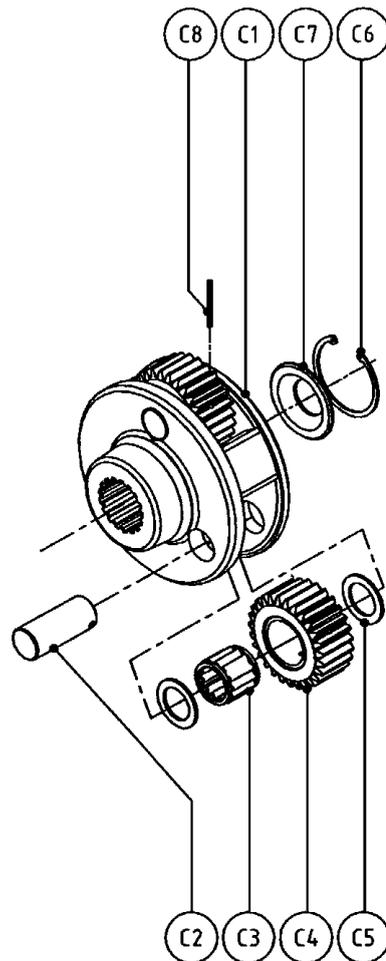
1. Remove the axle arm and sun gear - see Section A.
2. Remove the pinion cartridge assembly – see Section A.
3. The pinion cartridge/differential assembly can now be withdrawn through the pinion cartridge aperture.
4. Unpein and remove adjuster nuts (E2). The differential assembly is now free.
5. Remove nuts (B8). The crown wheel (A5) is now loose and the differential assembly will split into 2 halves.
6. Inspect all gears and bearings for damage and wear and replace if necessary.
7. To assemble reverse the above procedure.
8. If new differential bearings (E8) are fitted, it will be necessary to check the bearing pre-load and crown wheel/pinion backlash - see Section F.

### 5.3 Section 'C' - Planet Carrier Assembly

1. To gain access to the planet carrier assembly, remove the axle arm assy (F3) by removing the bolts (F4) around the flange connecting it to the centre casing. The axle shaft (F1) will now be exposed and the spline projecting from the axle arm should be examined for wear and damage. If it needs replacing see section A.
2. The planet carrier assembly can now be removed from the centre casing.
3. Check the planet gears and the mating gear teeth on the annulus and sun gear for damage and wear. If the latter needs replacing see section A.
4. The planet gears should run freely on the planet pins and without excessive radial "play".
5. To replace the planet gears, pins or bearings, drift the spring dowel (C8) which locates the planet pins (C2) into the planet carrier (C1), lightly drift the pins through the planet carrier.
6. Before reassembling the unit, remove the old spring dowels (C8) from the planet pins (C2), and fit new spring dowels (C8) after reassembling the unit.
7. Locate the planet carrier assembly back into the centre casing and fit the axle arm assy ensuring the recommended sealing agent is uniformly applied to the sealing faces.

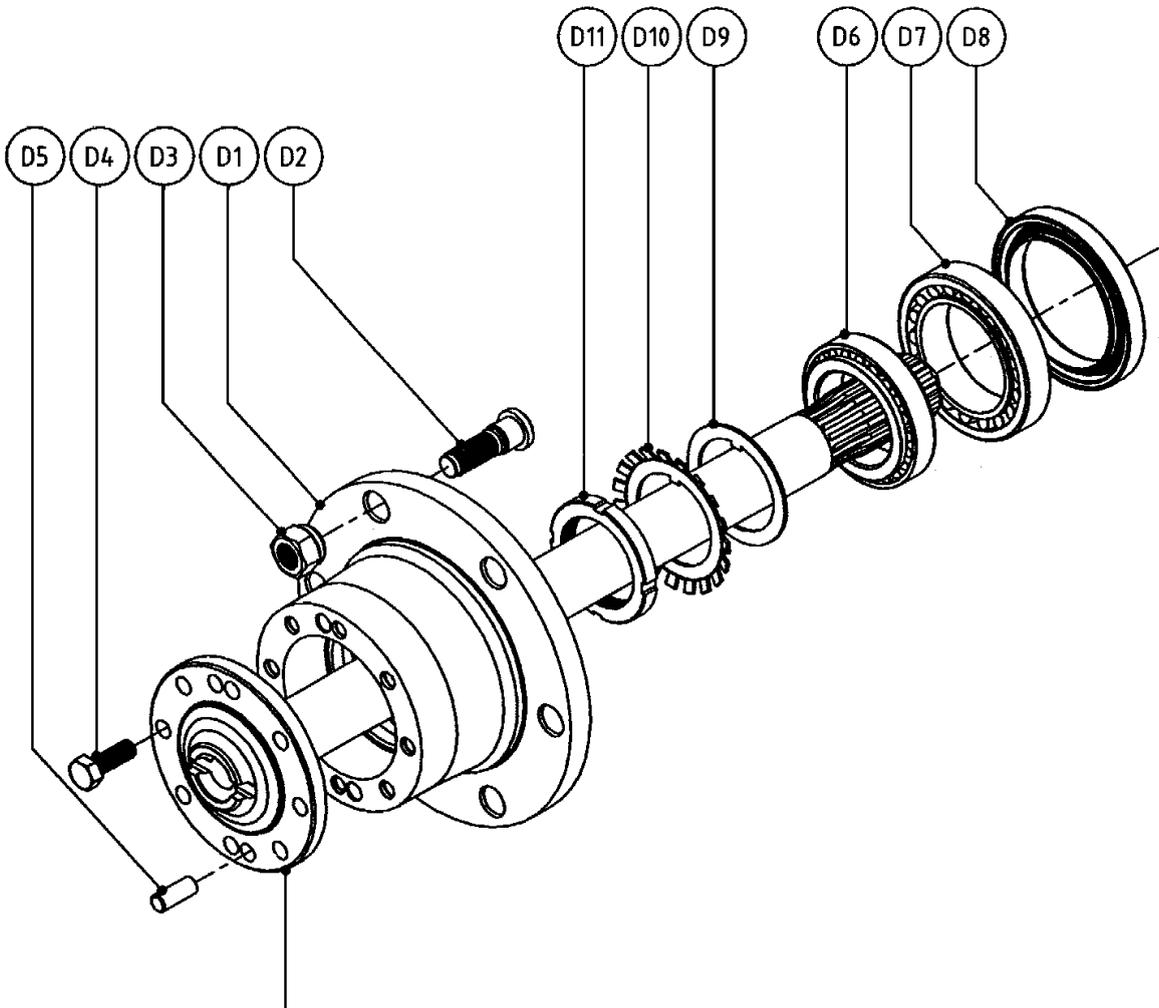
NOTE: When servicing planetary sets all three gears and bearings must be replaced.

<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**

<u>Item</u>	<u>Qty</u>	<u>Description</u>
D1	1	Hub (i.e. per side)
D2	5 (or 6)	Wheel stud
D3	5 (or 6)	Wheel nut
D4	8	Bolt M10 x 30mm
D5	2	Dowel pin
D6	1	Bearing
D7	1	Bearing
D8	1	Oil seal
D9	1	Spacer
D10	1	Lock washer
D11	1	Locknut



SEE GENERAL PARTS

### 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 off its support bearings.
4. Examine all bearings and oil seals for damage and wear and replace if necessary.
5. The bearing cups (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 rubbing surface. Apply "Loctite" grade 601 to both the arm and seal housing diameters only before assembly. Clean off any residual on fitment. Do not apply any to the oil seal diameter. This must be kept clean from any foreign ingress.
7. To reassemble the hub unit, reverse the above procedure using a new lockwasher (D10).  
Note: Fit a new locking tab washer (D10).
8. 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.
  - 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.

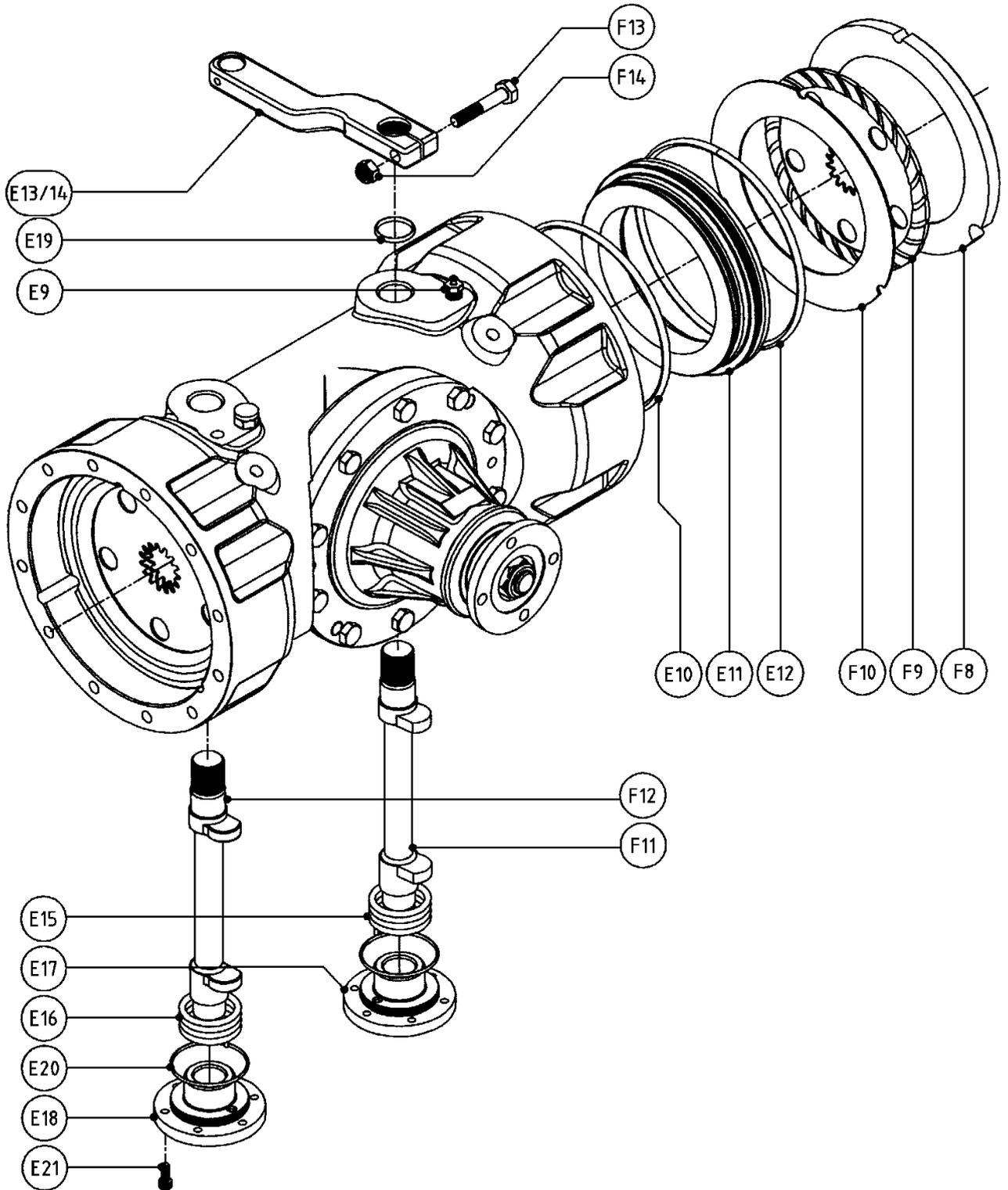
## 5.5 Section 'E' - Brake Assembly

(See Diagram on page 11)

<u>Item</u>	<u>Qty</u>	<u>Description</u>
E9	1	Bleed screw
E10	2	Piston 'O' ring
E11	2	Brake Piston
E12	2	Piston 'O' ring
E13/14	2	External operating lever
E15	1	RH return spring
E16	1	LH return spring
E17	1	RH hand brake cover
E18	1	LH hand brake cover
E19	2	Brake cam 'O' ring
E20	2	Brake cam 'O' ring
E21	12	M6 Cap head bolt
F8	2	Brake spacer plate
F9	4 (or 2)	Sintered brake disc
F10	4 (or 2)	Fixed brake plate
F11	1	RH Brake cam
F12	1	LH Brake cam
F13	2	Lever Clamp bolt
F14	2	Lever Clamp nut

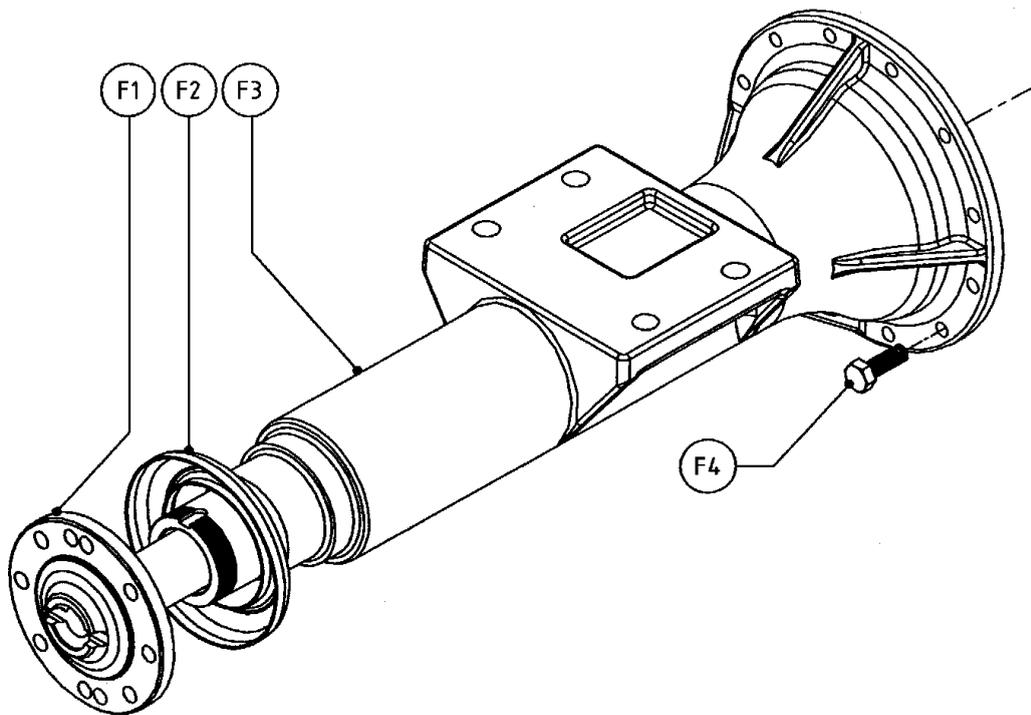
**IMPORTANT** – The axle brakes operate with a mineral hydraulic fluid ISO VG32 Specification. On no account must a "vegetable" based brake fluid (SAE J1703) be used.

- To gain access to the brakes, the procedure is the same as the planet carrier assembly – see Section C.
- Remove the annulus gear (F6) and brake spacer plate (F8). The oil immersed brake discs (F9) and the brake fixed plates (F10) can now be removed. Count the number of plates taken out as the quantity can vary with different axle specifications.
- 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 wear or heat discolouration on fixed plate.
- The brake piston (E11) can be removed from the cylinder and the seals (E10/E12) checked for damage and wear.
- 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.
- To remove hand brake operating lever (E13) loosen nut (F14) and bolt (F13) and withdraw from spline.
- Remove 6 M6 cap head bolts (E21) and withdraw cover (E18), spring (E16) and brake cam (F12).
- Repeat steps 6 and 7 for the opposite hand. **Note**. The cap, spring and brake cam are 'handed'.
- To reassemble, reverse the above procedure replacing brake cam 'O' rings (E19) and (E20).



### 5.6 Section 'F' - Axle Arm Assembly

<u>Item</u>	<u>Qty</u>	<u>Description</u>
F1	1	Axle shaft (i.e. per side)
F2	1	Oil seal shield
F3	1	Axle arm
F4	12	Arm to Maincase bolts



- 1 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 cleaned using Ambersil F10 Solvent and uniformly apply a continuous bead of the recommended sealing agent (see section 4.5).
- 3 Normally the axle arms only need removing to gain access to the components within the maincase, and therefore for further information see previous sections.

## 5.7 Section 'G' Hydrostatic Dropbox Assembly

(See Diagram on page 14)

<u>Item</u>	<u>Qty</u>	<u>Description</u>
G1	10	Bolt M12 x 45
G2	3	Bolt M12 x 70
G3	4	Stud M12
G4	4	Nut M12
G5	1	Bonded seal ½ BSP
G6	2	Dowel
G7	1	Bearing
G8	1	Bearing
G9	1	Roller bearing
G10	1	Blanking plate (for transit)
G11	1	Coupling
G12	1	Oil seal
G13	1	Drain plug ½ BSP
G14	10	Nut M10
G15	10	Stud
G16	1	Transfer case LH
G17	1	Transfer case RH
G18	1	Input pinion
G19	1	Input wheel

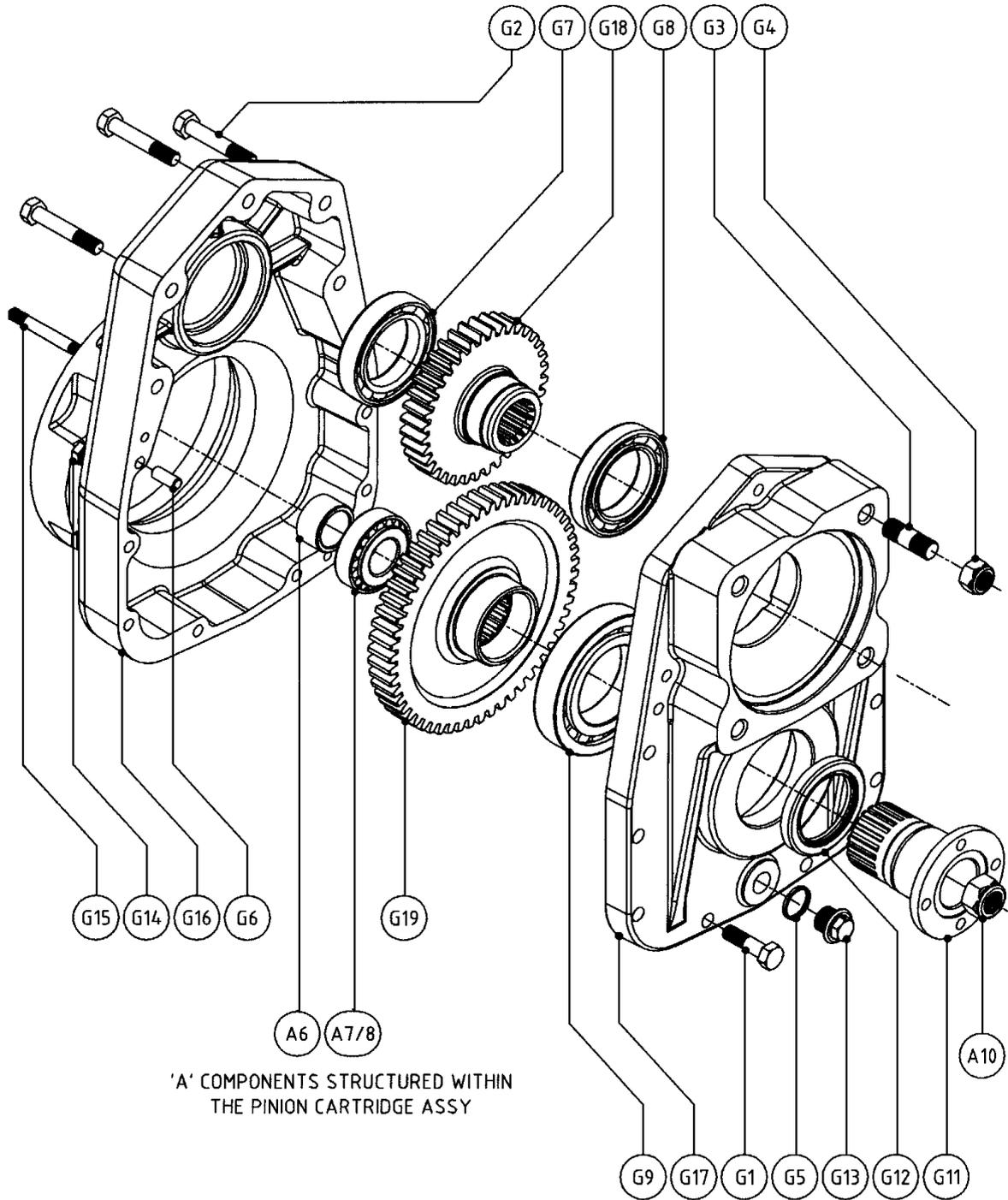
### Dis-assembly procedure.

1. Drain oil by removing drain plug (G13). Replace the plug when oil is drained.
2. Remove nut, (A10) and withdraw coupling (G11).
3. Remove 10 bolts, (G1) and 3 bolts (G2).
4. Using 2 case bolts in the extraction holes and tighten evenly until the 2 case halves split.
5. Remove RH case half (G17) which will expose the 2 gears.
6. Remove pinion (G18) and wheel (G19). Note that the bearings (G7/G8/G9) will still be fitted to the gears. Ensure bearing (A7/8) does not fall off spiral bevel pinion (A3).
7. Check for wear and damage on gears. Check for wear on the seal (G12) paying particular attention to the small circular spring. Remove if necessary.

### Re-assembly procedure.

1. Clean surface faces of case halves using Ambersil F10 Solvent and remove any remnants of old liquid sealant.
2. Replace if necessary seal (G12) and all bearings on the 2 gears before the next stage. Place input pinion (G18) locating bearing in small bore in LH case half (G16) and tap home with mallet.
3. Fit input wheel (G19) locating onto pinion spline and aligning mesh. Tap home with mallet.
4. Apply continuous bead of liquid sealant to LH case half (G16).
5. Fit RH case half (G17) locating on the 2 dowels (G6), ball bearing (G8) and roller bearing (G9).
6. Fit and secure 13 case bolts ((G1) 10 off bottom and (G2) 3 off top) and tighten to the specified torque.
7. Apply grease to seal (G12) and fit coupling, (G11) and nut (A10). Torque to the specified value.

8. Remember also to fill with the recommended oil to the correct level.



## 6 CROWN WHEEL AND PINION ASSEMBLY HYDROSTATIC VERSION

The crown wheel and pinion is assembled using special purpose tools and electronic measuring equipment. It is advisable, that in the unlikely event of failure or adjustment, the following actions should be taken:

1. Remove the drain plug (E6) and drain the axle oil from the maincase.
2. Follow dis-assembly procedure for hydrostatic dropbox on page 15.
3. Remove nuts (G14).
4. Remove L/H transfer case (G16).
5. Remove both axle arm assys by removing bolts (F4). Withdraw the sun gears (F7) only.
6. Using 2 M10 extraction bolts (not supplied) remove crown wheel/differential assy through the pinion cartridge aperture.
7. Unpein and remove 2 adjuster nuts (E2). Differential assembly will now be free to remove from the pinion cartridge (A1).
8. Gently tap pinion (A3) out of pinion cartridge bore and drift out bearing cups (A7).
9. NOTE: When refitting any of the following new components crown wheel (A5), pinion (A3), setting spacer (A6), pinion bearings (A7, A8) and shims (A4) the actions in item 10 need to be carried out.
10. Record the following information of the current components fitted as follows:-
  - a. The pinion (A3) mounting distance etched on the head.
  - b. The overall bearing (A7, A8) width of pinion head bearing.
  - c. Current shim (A4) thickness.
  - d. The pinion head bearing (A7, A8) depth from cup to cone.
  - e. The overall length of the bearing setting spacer (A6).
  - f. The pinion tail bearing (A7, A8) depth from cup to cone.
  - g. Overall distance measured, i.e  $a + b + c$ .

Record the following information of the new components fitted as follows:-

  - 'a' New pinion mounting distance etched on the head.
  - 'b'. New overall bearing (A7, A8) width of pinion head bearing.
  - 'c'. New shim (A4) thickness.
  - 'd.' New pinion head bearing (A7, A8) depth from cup to cone.
  - 'e' New overall length of the bearing setting spacer (A6).
  - 'f'. New pinion tail bearing (A7, A8) depth from cup to cone.
  - 'g'. Overall distance measured i.e  $'a' + 'b' + 'c'$ .
11. Record the above information excluding ('c') and ('e') for new components to be fitted.
12. Press or drift home pinion head bearing cone (A7, A8) onto pinion.
13. Calculate the old shim arrangement as follows:  $a + b + c = g$  (Note: use information from 10).
14. Calculate the new shim ('c'.) arrangement as follows:  $g - ('a' + 'b') = 'c'$
15. Calculate the new bearing setting spacer 'e' as follows:

- Record the difference in new 'c' and old c shims = 'X'  
if new 'c' is greater than old 'c' add 'X' if less than subtract 'X'.
  - Record the difference in new 'd' and old bearing d depth on tail bearing = 'Y'.  
If new 'd' is greater than old 'd' add 'Y' if less than subtract 'Y'.
  - Record the difference in new 'f' and old f bearing depth of cup to cone on pinion head  
= 'Z'. If new 'f' is greater than old f add 'Z' if less than subtract 'Z'
  - The new bearing setting spacer 'e' length is therefore solved by the equation  
'e' = e (old)  $\pm$  'X'  $\pm$  'Y'  $\pm$  'Z'. (Note: use information 10.)
16. Fit new shims (A4) of new thickness 'c' into pinion cartridge head bore and press or drift home new bearing cup (A7, A8) into bore trapping shims.
  17. Press new bearing cup (A7, A8) into pinion cartridge tail bore.
  18. Fit new bearing setting spacer (A6) of overall length 'e' over pinion diameter up to new bearing fitted at pinion head end.
  19. Drift bearing cone over pinion tail end.
  20. Refit new crown wheel to diff case and secure by tightening the new nyloc nuts to recommended tightening torque.
  21. Loosely screw new bearing adjusting nuts to retain diff assy in pinion cartridge.
  22. Clean maincase, pinion cartridge and transfer case joint face using recommended Ambersil F10 Solvent on joint face.
  23. Apply thin continuous bead of the recommended sealant to the maincase joint face and LH transfer case joint face.
  24. Fit crownwheel/differential assy. through pinion cartridge aperture.
  25. Fit LH transfer case over pinion cartridge and tighten new nyloc nuts to recommended tightening torque.
  26. Refit output wheel over pinion spline with inner part of the roller bearing fitted to the gear and outer fitted with RH transfer case.
  27. Refit input pinion with bearings fitted to LH transfer case half.
  28. Clean transfer case joint faces using recommended Ambersil F10 Solvent.
  29. Apply a thin continuous bead of the recommended sealant to the LH transfer case joint face.
  30. Refit the RH case, this will locate on the 2 dowels in one half of the case and will also contain one half of the cylindrical roller bearing and the oil seal.
  31. Tighten 13 bolts to the recommended tightening torque.
  32. Smear the recommended grease on input seal.
  33. Clean drive flange, oil seal diameter prior to fitment.
  34. Fit new nyloc nut and tighten to recommended torque.

35. Check the pinion assy is free to turn by hand prior to the next stage. Check pinion bearing drag torque min 1.92/2.49Nm(17/22lbin) and no end float exists in assy by using a dial test indicator on the drive flange, and applying hand pressure to record any movement, i.e. maximum permitted end float 0.025mm.  
If excessive end float exists on indicator increase the bearing setting spaces by the same amount. This will require a strip and rebuild to this stage.
36. Set crown wheel & pinion backlash (See data sheets for drive flange variants) using new adjuster nuts (E2) and tighten to 20Nm (15lbft) and tab into recess.
37. Refit sungears through brake plate into diff wheel splines.
38. Clean both axle arm and maincase joint faces with recommended Ambersil F10 solvent.
39. Apply a thin continuous bead of the recommended sealant to the maincase joints.
40. Tighten 24 new bolts to the recommended tightening torque.
41. Refit drain plugs and fill with the recommended axle oil

In the event of the pinion bearings and bearing setting spacer damage (with the pinion mounting distance only available) the preferred procedure would be to carry out the following procedure.

1. Repeat steps 1-10.
2. Record the following information of the current and new components as follows:
  - (a) Current fitted pinion (A3) mounting distance etched on head.
  - (b) New pinion (A3) mounting distance etched on head.
  - (c) The new overall width of the pinion head bearing (A7, A8).
  - (d) Note: 215 axle mounting distance constant = 100.85
  - (e). Shim thickness (A4).
  - (f) Difference in (a) & (b).

Note: Overall length of the slave setting spacer (A6) = 24.30.
3. Press or drift home the new pinion head bearing cone (A7, A8).
4. Calculate shims as follows:
 

Record the difference in (a) mounting distance and (b) mounting distance.  
If (a) is greater than (b) subtract the difference (f).  
If (a) is less than (b) add the difference (f).

For 215 axle use pinion cartridge mounting distance (d) = 63.50  
(e) = (d ± f) - c.
5. Fit new shims (A4) at new thickness (e) into pinion cartridge head bore and press or drift home bearing cup (A7, A8) into bore trapping shims.
6. Press new bearing cup (A7, A8) into pinion cartridge head bore.
7. Fit new slave bearing setting spacer (A6) of 24.30mm pre-determined length. This will enable end float to exist.
8. Follow points 19 to 22, 24 to 26, 28, 30, 31, 33, 34.

9. Attach a dial test indicator to drive flange and apply hand pressure in forward and reverse direction and check movement, i.e. end float and record movement.
10. Reverse the procedure up to 8.
11. Subtract the end float recorded from the slave bearing setting spacer (A6) =  $(24.30\text{mm} - 0.025\text{mm} - \text{end float})$  and fit new spacer of the calculated length.  
Note: 0.025mm subtracted to obtain pinion bearing pre-load.
12. Follow points 23 to 35, 37, 38, 39, 40 & 41 to rebuild the unit.

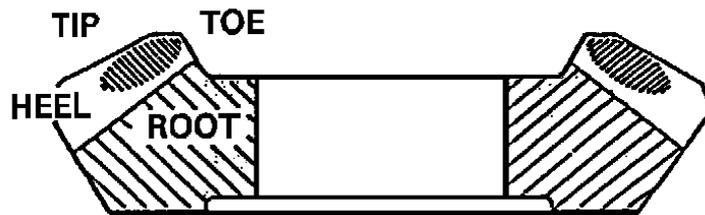
## 7 SPIRAL BEVEL GEAR TOOTH CONTACT

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:

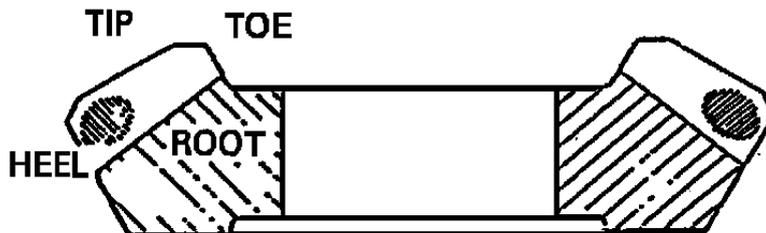
### 7.1 ERROR 1: Pinion too far out of mesh

#### Convex flank



Contact further to toe and tip than factory marking.

#### Concave flank

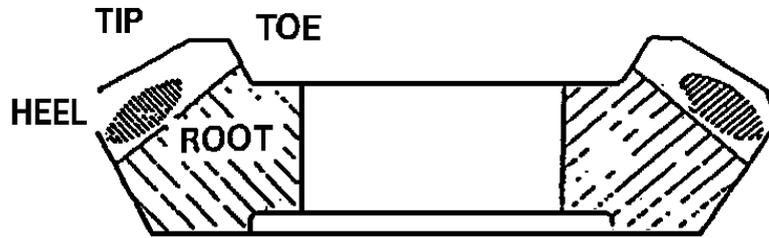


Contact further to heel and tip than factory marking.

**ACTION:** Recheck and decrease shims below pinion cartridge flange.

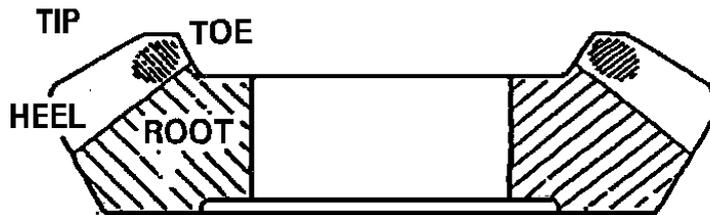
**7.2 ERROR 2: Pinion too far into mesh**

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.