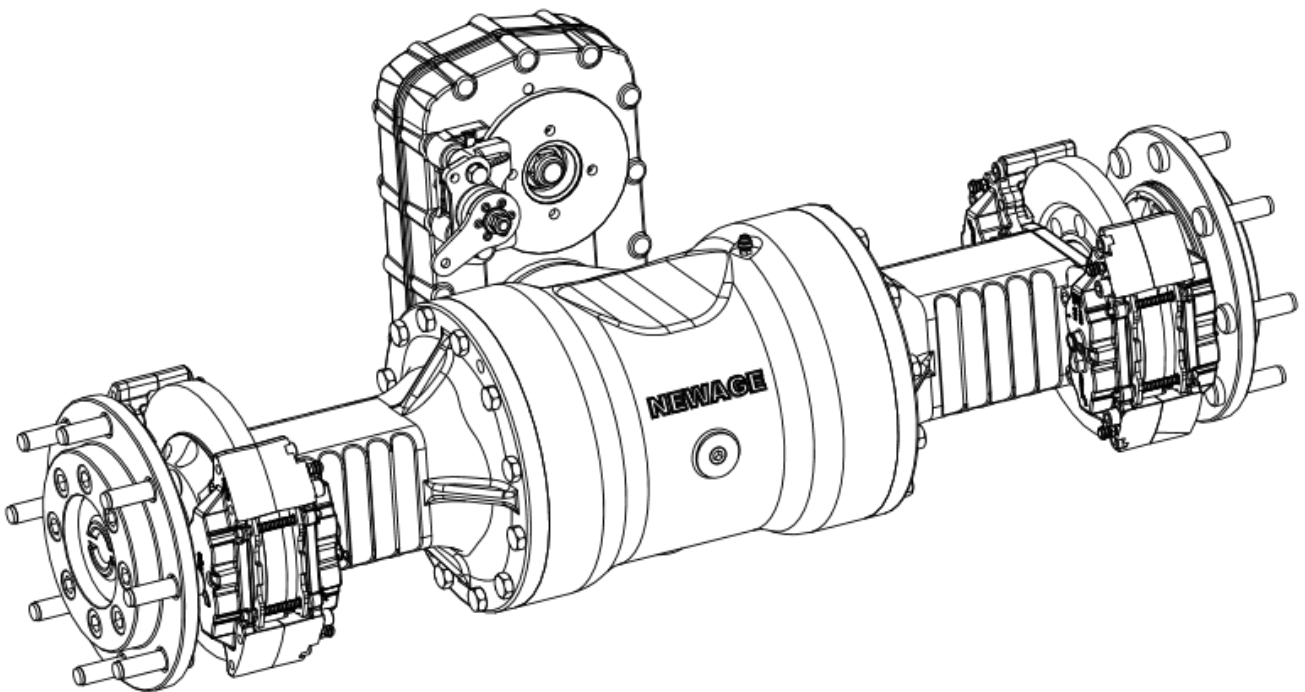


613 WORKSHOP MANUAL





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613 Service Manual

Issue: **4.2**

Created By: C.Reynolds

Updated Date: September 2018

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The following international symbols are used in this service manual:



WARNING! THIS SYMBOL WARNS OF POSSIBLE PERSONAL INJURY



CAUTION! THIS SYMBOL WARNS OF POSSIBLE DAMAGE TO TRANSMISSION

CONTENTS

INTRODUCTION	5
GENERAL DATA	5
Description	5
Specification	5
Installation Drawing	7
IDENTIFICATION	8
GENERAL SERVICE INFORMATION	9
Routine Maintenance	9
Lubricants	9
Greases	9
Brake Fluid	9
Liquid Sealant	9
Fasteners – Tightening Torque	10
Axle Backlash	10
Tooling	10
SERVICING AND REPAIRS – GENERAL	13
Seals	13
Bearings	13
Cleaning	13
INSPECTION	14
Main Case and Arms	14
Gears	14
Bearings	14
Threaded Parts	14
PROCEDURES	14
Section ‘A’ – Transfer Case Assembly	15
Removing and Servicing the Transfer Case Assembly	16
Reassembling the Transfer Case Assembly	16
Section ‘B’ – Main Case and Differential Assembly	17
Servicing the Main Case and Differential Assemblies	19
Removing the Differential	19
Servicing the Differential Assembly	19
Pinion Shimming Procedure	20
Section ‘C’ – Planet Carrier Assembly	21

Servicing the Planet Carrier Assemblies	22
Removing the Annulus Gear	22
Section 'D' – Axle Arm, Hub and Brake Assemblies	23
Servicing the Axle Arm, Hub and Brake Assemblies	24
Servicing the Brake Pad Assemblies	25
Section 'E' – Park Brake Assembly.....	26
Servicing the Park Brake Assembly	27
Replacing the Park Brake Caliper Pads.....	27
Section 'F' – Park Brake Overhaul	28
NOTE: THE PARTS ABOVE ARE NOT AVAILABLE INDIVIDUALLY AND ARE SHOWN FOR ILLUSTRATION PURPOSES ONLY EXCEPT FOR THE * E9.4 REPLACEMENT BRAKE LINING AND CARRIER ASSEMBLY SUPPLIED AS 613-2530-KIT.....	29
Mounting Procedure.....	29
Adjustment Procedure.....	29
Lining Replacement	29
SPARES KITS.....	31
Total 613 Spare Parts List.....	33
SPIRAL BEVEL GEAR TOOTH CONTACT.....	36
Correct Pattern.....	36
Incorrect Pattern	36
Appendix 1 – Park Brake	37
Appendix 2 – Service Brake.....	38
NOTES.....	39

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.

GENERAL DATA

Description

The 613 series axle is a triple reduction unit featuring a Hydraulic Disc Braking system.

The Transfer Casing houses the 1st reduction via three helical gears. The third output gear is meshed with the 2nd reduction Spiral Bevel Pinion and Crown Wheel driving a 4 Pinion Differential. Final drive is transmitted via the 3rd reduction in-board Planetary Assemblies. The Axle Shafts are fully floating (i.e. not subjected to wheel loads) with each Wheel Hub supported on opposed taper Roller Bearings.

Specification

Overall Ratio (:1)

10.1 / 13.2 / 15.8 / 19.7

Input Flange

Hardy Spicer (SAE) 1410

Axle Mountings

Cast Rib mounting Centres: 700mm (27.56in), 756.67mm (29.8in), 813.33mm (32.02in) or 870mm (34.25in) x 130mm (5.118in) across with cast rad 12.5mm (0.493in).

Wheel Fixing

8 studs M20 X 1.5 on 275.0mm (10.83") PCD OR 8 studs: 9/16" x 18 UNF-3A on 165.1mm (6.5") PCD

Maximum Dynamic Load Rating

5,500Kg (12100 lbs) based on 1,270mm (50") wheel track

Maximum Output Torque

Intermittent at both wheels 25,000Nm (18,437 lbft) based on 10.1:1

Maximum Vehicle Drawbar Pull

Stated 53,400N (12,000 lbf)

Service Brakes

Dual Caliper Hydraulic Disc Brakes per wheel, 268mm (10.55in) effective diameter x 30mm (1.181in) wide case rotor of 300mm (11.811in) diameter.

Max brake torque at both wheels

16,930Nm (12,485 lbft) at 1,500psi (103Bar)

Park Brake

Optional (disc mounted)

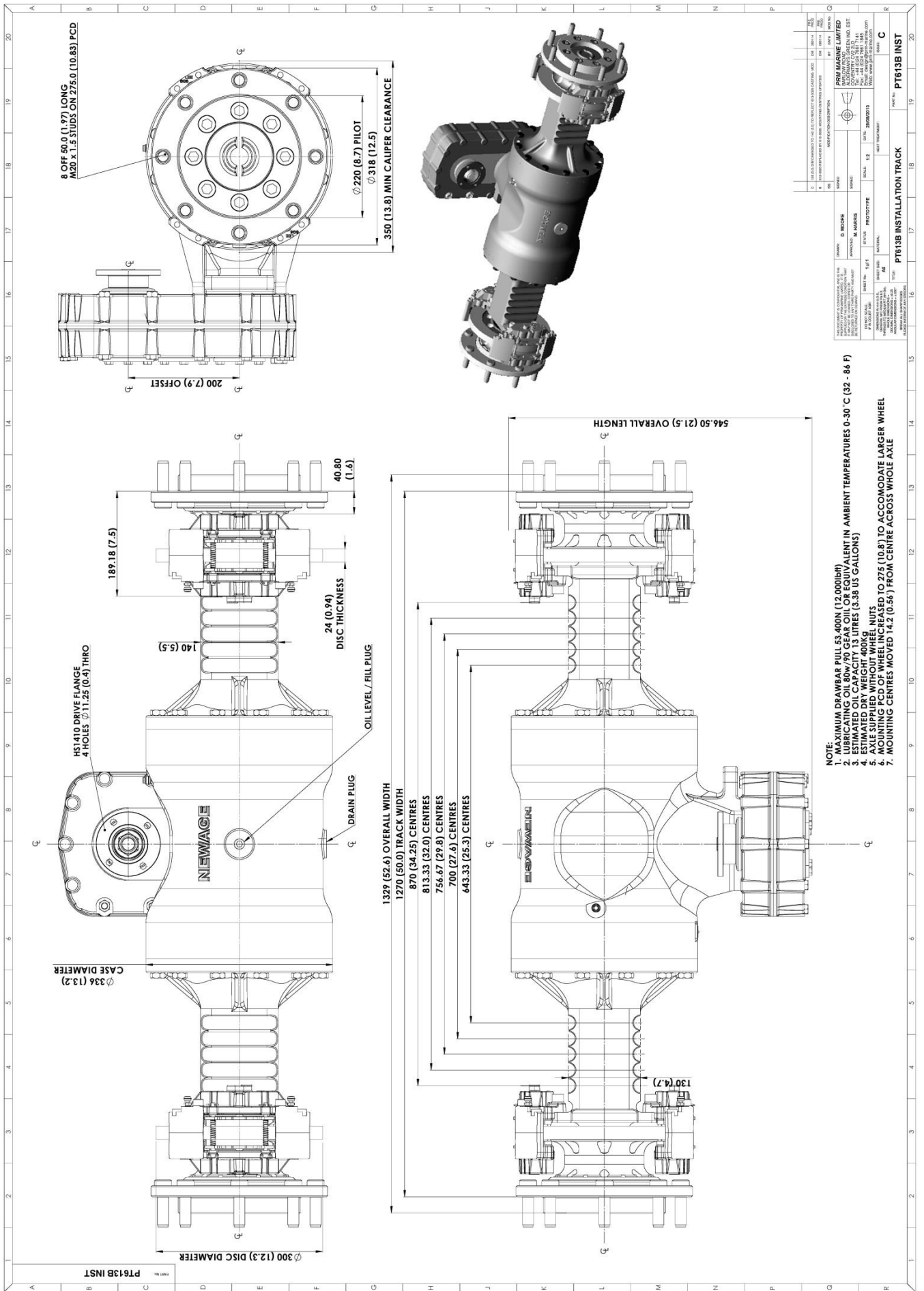
Approximate weight

410kg (904lb) dry weight

Oil Capacity

13.0 litres (3.38 US Gallons)

Installation Drawing



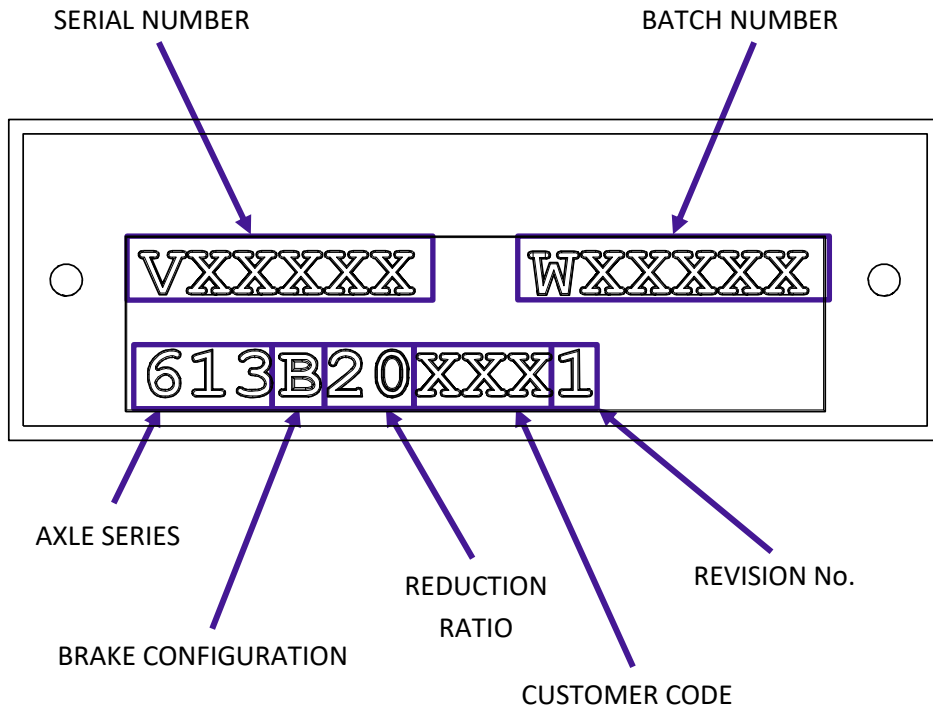
REV	DESCRIPTION	DATE	BY	CHKD
1	ISSUED FOR MANUFACTURE	2018-08-15	M. LAMERS	D. MOORE
2	REVISED TO INCLUDE 13 LITRE OIL CAPACITY	2018-08-15	M. LAMERS	D. MOORE
3	REVISED TO INCLUDE 10.81 OFFSET	2018-08-15	M. LAMERS	D. MOORE
4	REVISED TO INCLUDE 14.2 OFFSET	2018-08-15	M. LAMERS	D. MOORE
5	REVISED TO INCLUDE 130mm OFFSET	2018-08-15	M. LAMERS	D. MOORE

DESIGNER	D. MOORE	SCALE	1:2
DRAWN	M. LAMERS	DATE	2018-08-15
CHECKED	M. LAMERS	PROTOTYPE	
APPROVED	M. LAMERS	DATE	2018-08-15
ISSUED	M. LAMERS	DATE	2018-08-15

IDENTIFICATION

If spares are required, please quote the axle model, the vehicle/machine model and serial number from the blue plate. 613 Axles are produced in a variety of configurations for 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:



GENERAL SERVICE INFORMATION

Routine Maintenance

Check	Frequency
Axle Oil change	After initial 300 Hrs then every 1,000 Hrs
Axle Oil Level check	Monthly
Axle Shaft Bolts	Monthly
Brake Fluid change	Annually
Brake Fluid Level check	Monthly
Check Axle Arm/Main Case joint securing Bolts	Monthly
Check Wheel Hub Bearing adjustment	1,000 Hrs
Check Wheel Nut	Weekly
Visual check for oil leaks around joints and Seals	Weekly
Prop Shaft Nut	Monthly
Service Brake Mounting Bolts	Weekly

Lubricants

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

- 80W90 Gear oil for operation in ambient temperatures between 0°C and 30°C (32-86°F).

NOTE: An alternative engineering approved Gear oil may be used. Consult 'PRM Newage' before filling the axle.

The oil is added via the combined Filler/Level Plug positioned on the front of the axle Main Case. The Filler/Level Plug on the rear of the Transfer Case Assembly can also be used. **P80 OIL SEAL LUBRICANT** used when installing new Oil Seals.

Greases

Smear grease between Oil Seal lips and 'O' Rings at major overhauls, or whenever a repair to these areas is performed.

Only those greases shown below, their direct equivalents or alternative engineering approved grease must be used:

- Texaco Multifak EP2
- Moly Grease (to be used on the Spline Adaptor)

Brake Fluid

The Axle Brakes operate with the fluid specification:

- FMVSS 116 DOT 4, SAEJ1703 and ISO4925 Brake Fluid

NOTE: An ISO VG32 Mineral Hydraulic Fluid Should NOT be used under any circumstance.

Liquid Sealant

The Main Case/Axle Arm/Transfer Case/End Cover joint faces must be sealed with either of the following:

- Threebond 1207D Silicone Liquid Gasket

NOTE: An alternative engineering approved silicon sealant may be used.

Fasteners – Tightening Torque

Fastener	A/F (mm)	Torque (Nm)	Torque (lb.ft)
	Across Flats	Newton Metres	Pounds Force Feet
Main Case Assembly			
Axle Arm/Main Case Bolts (M16)	24	230	170
Axle Shaft/Wheel Hub Cap Bolts (M10)	8	100	74
Brake Caliper mounting Cap Bolts (M14)	12	220	162
Differential Bearing Carrier Cap Bolt (M10)	8	100	74
Differential assembly Nut (M12)	19	98	72
Differential Adjuster Cap Bolts (M6)	5	20	15
Differential Bearing Adjuster Housing – (Special Tool required)	---	20	15
Drain and Level Plug (1/2" BSP)	10	16	12
Hub Assembly Lock Nut (M80) – (Special Tool required for KM16 Nut see TOOLING) Speed Brace & Back off 1 Tab – see page 24	---		
Hub Adaptor/Axle Shaft Cap Bolt (M20)	17	339	250
Wheel Nuts (M20)	30	400-448	295-330
Transfer Box Assembly			
Coupling Nut (M24) + Loctite 243 (Input Flange and 613PB Park Brake Disc)	36		
Coupling Nut (M24) Drag Torque (Without upper gear in place)	36	1.9/2.5	1.4/1.8 (17/22 lb.in)
End Cover Bolts (M8)	13	30	22
Lower Pinion Nut + Loctite 243 (M24)	36	339	250
Park Brake Caliper Mounting Nut (1/2" UNF) (613PB Only)	3/4"	115	85
T'Case Mounting Cap Bolts (M10)	8	100	74
T'Case Assembly Bolt (M10)	17	56	41
T'Case Assembly Nut (M12) (613B Only)	19	98	72

Axle Backlash

Assembly	Pinion/Wheel	Drive Flange	P.C.D	Backlash
916-9820	916-2000 916-2010	613-2180 (HS1410) 613-2181 (HS1410) - (613PB ONLY)	95.24mm (3.750")	0.41/0.47mm (0.0161/0.0185")

Tooling

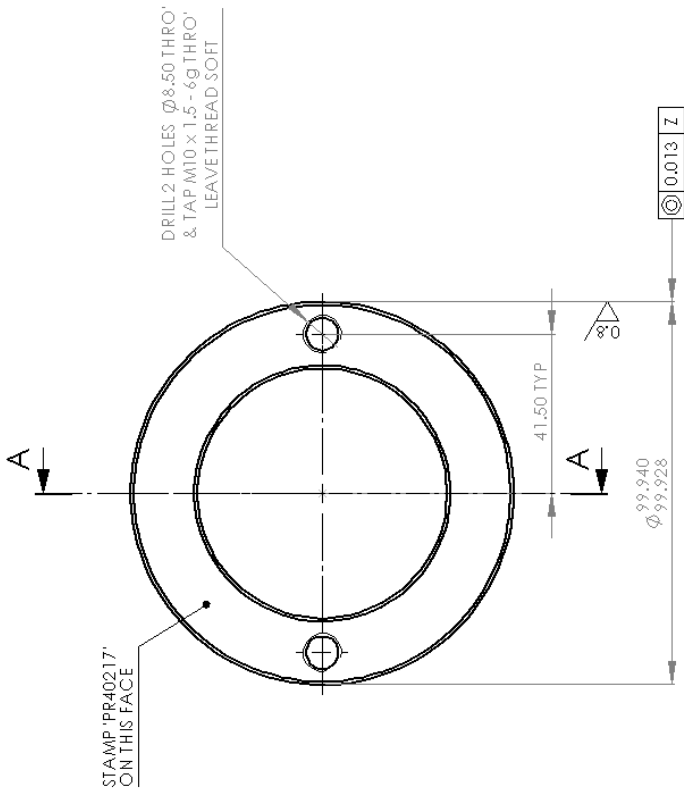
The following tooling is used to aid in the servicing of the axle. These are available from the Original Equipment Manufacturer.

PR40217 – Main Case/ Transfer Case alignment tool

PR40164 for backlash setting of Spiral Bevel Gear.

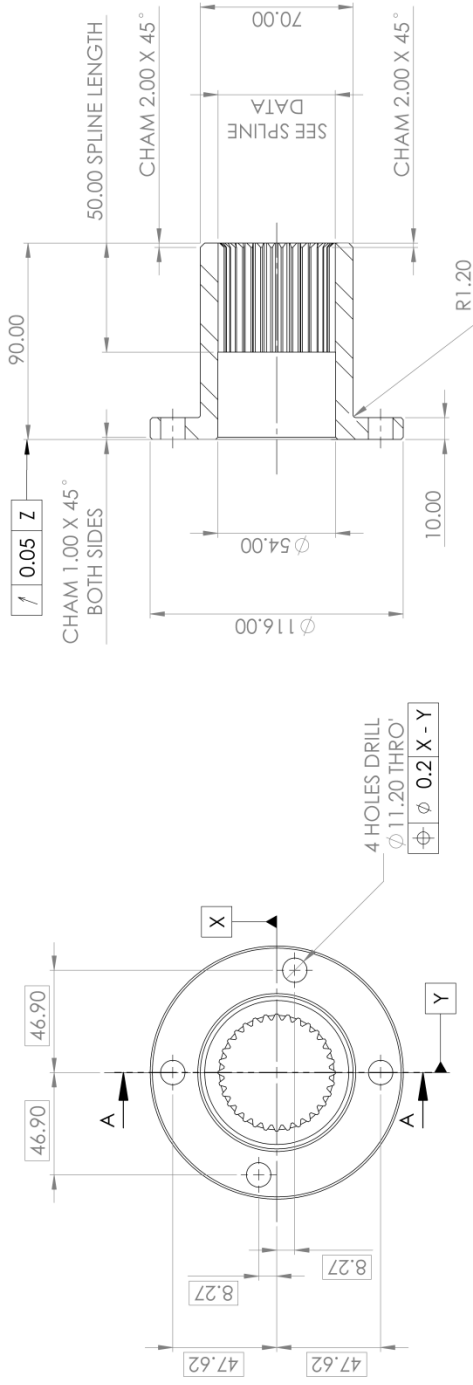
PART No: **PR40217**

CHAM 1.50 X 60.00° INC TYP
BOTH SIDES



DIMENSIONS IN MM U.O.S., GENERAL MC FINISH R8.3, THREDS TO MESH WITH 6H/6G, TOLERANCES UNLESS OTHERWISE SPECIFIED DECIMAL DIMENSIONS - ±0.25 ANGULAR DIMENSIONS - ±0.50° BREAK ALL SHARP EDGES ± 45° PLEASE INFORM OF ANY ERRORS		THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF NEWAGE TRANSMISSIONS LTD. IT IS NOT TO BE REPRODUCED OR DISCLOSED TO ANY THIRD PARTY AND MUST BE RETURNED ON DEMAND.		DRAWN: D. MOORE		SIGNED:		MOD No	
SHEET SIZE: A3		MATERIAL: SAE 8620 OR EN34 STEEL OR 16MnCr5		SHEET No: 1 of 1		STATUS: TOOLING		ISS	
DO NOT SCALE, IF IN DOUBT ASK!		DO NOT SCALE, IF IN DOUBT ASK!		APPROVED: M. HARRIS		SIGNED:		DATE	
HEAT TREATMENT: CASE HARDEN Rc 58-62 TO 0.4/0.6 CASE DEPTH		SCALE: 1:1		DATE: 10/04/2014		DATE		BY	
TITLE: 613 FRONT TRANSFER CASE & OUTPUT GEAR ALIGNMENT TOOL		PART No: PR40217		ISSUE: 1		PRIM MARINE LIMITED BARLOW ROAD COVENTRY CV2 2LD Tel: +44 (0)24 7661 7141 Fax: +44 (0)24 7661 1845 Email: design@prm-marine.com Web: www.prm-marine.com			

PART No: **PR40164**



INTERNAL INVOLUTE SPLINE DETAILS TO BS3550	
TYPE OF FIT	CLASS 2 FLAT ROOT SIDE
No. OF TEETH	20
DIAMETRAL PITCH	10/20
PRESSURE ANGLE	30°
BASE DIAMETER	43.99
PITCH CIRCLE DIAMETER	50.80
MAJOR DIAMETER	53.72/53.34
FORM DIAMETER	52.83
MINOR DIAMETER	48.39/48.26
MEASURING PIN DIAMETER	4.39
DIMENSION BETWEEN PINS	44.57/44.50
FILLET RAD	0.43
MATING PART	613-2920

- NOTES:
- INTERNAL SPLINE SAME AS 435-0060
 - MACHINE TO ∇ ALL OVER $\frac{3.2}{\sqrt{}}$

SECTION A-A

ISS	MODIFICATION DESCRIPTION	BY	DATE	MOD No

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 BARLOW ROAD
 COVENTRY
 CV2 2LD
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 Fax: +44 (0)24 7661 1845
 Email: design@prm-marine.com
 Web: www.prm-marine.com

SIGNED	DATE	SCALE
A. BROWN	12/11/13	1:2

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DO NOT SCALE, IF IN DOUBT ASK!

SHEET No: **1 of 1**

STATUS: **1:2**

DATE: **12/11/13**

DIMENSIONS IN mm, U.O.S., GENERAL MC FINISH Ra 6.3, THREADS TO MEDIUM FIT (6H/6g), HOLE DIMENSIONS = ± 11µm, DIMENSIONS BETWEEN PINS = ± 0.05, ANGULAR DIMENSIONS = ± 0.50°

BREAK ALL SHARP EDGES 0.5 x 45°

PLEASE INFORM OF ANY ERRORS

SHEET SIZE: **A3**

MATERIAL: **STEEL 08M40 (EN8) TO BS970**

HEAT TREATMENT:

ISSUE: **A**

TITLE: **613 BACKLASH FLANGE**

PART No: **PR40164**

SERVICING AND REPAIRS – GENERAL



WARNING: Before carrying out any service work always ensure that the engine/motor is switched off

Before removal of the Axle for repair or overhaul, carefully study the following procedures. Use proper hand tools, slings and hoists for the job. **WORK SAFELY**

Keep all work areas, tools and Axle clean. All oil should be drained into a suitable container. Wipe up any spilled oil or fluids to prevent accidents. Wear correct safety equipment i.e. safety glasses and safety shoes to guard against personal injury

IMPORTANT NOTICE: ONLY REMOVE BREATHER, OIL DRAIN PLUG OR OIL LEVEL PLUG ONCE THE AXLE IS AT AMBIENT TEMPERATURE. REMEMBER HOT OIL CAN CAUSE BURNS – WORK SAFELY.



CAUTION: The above operations should be carried out by suitably qualified personnel and strictly in accordance with the procedures detailed in the workshop manual.

Drawings showing all internal components are contained in the parts lists at the back of this manual.

Seals

Remove Oil Seals carefully to prevent damage if they are to be re-used, however to prolong the life of the axle, it is best to replace these items.

Bearings

If removing taper roller Bearings for re-use keep them in matched sets and protect all Bearings from contamination.

Cleaning



WARNING: If using cleaning solvents these can be toxic, flammable, a skin irritant or give off harmful fumes. Avoid prolonged contact, vapour inhalation, or smoking. Failure to take care can result in injury or death.

Rinse all metal parts in solvent to remove dirt, grease and oil.

Be careful to remove solvent from items before re-fitting.

INSPECTION

Main Case and Arms

Inspect for cracks. Check sealing surfaces for any imperfections, damage, etc. which will lead to oil leaks. Check all threads for damage.

Gears

Inspect for any chipped, broken or cracked gear teeth, also for any excessive wear i.e. progressive gear pitting.

Bearings

Inspect for any damage, progressive pitting or over-heating. Each time a Bearing is removed for inspection, or replacement it will be necessary to recalculate the required shim thickness to pre-load the Bearings correctly, see Procedures for more information.

Threaded Parts

Inspect for stripped or damaged threads.

PROCEDURES



CAUTION: When re-assembling the Axle all threaded fasteners must be tightened to the specified torques to prevent premature failure.

Some servicing operations can be carried out with the Axle still mounted to the vehicle (provided, of course, that there is sufficient space); an example of this is the replacement or repair of the brake assemblies. The repair or replacing the Differential, Layshaft or Arm assemblies however will require the complete removal of the Axle from the vehicle.

NOTE: All procedures listed assume the Motor / Drive has already been removed from the Axle where required. This should be removed as detailed below.

If the details outlined below are carefully followed no difficulty will be found in stripping and rebuilding the Axle. It is most important that all components are perfectly clean and in good condition before reassembly.

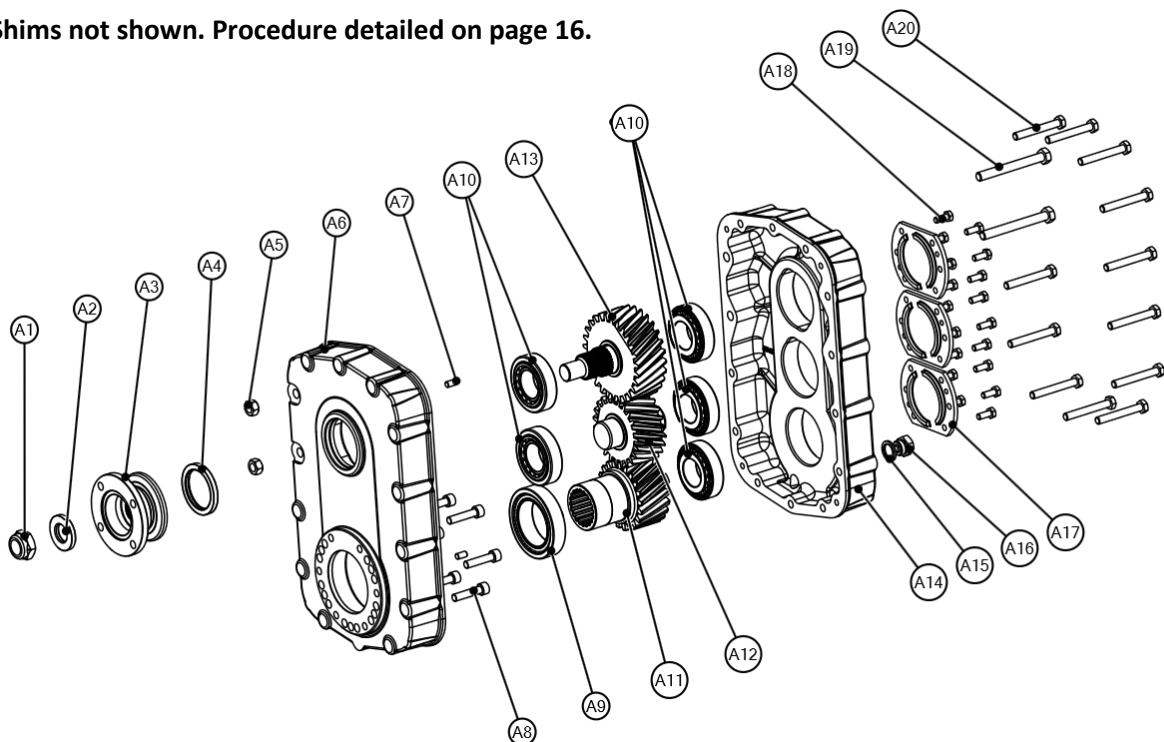


CAUTION: The Input Pinion, Primary Wheel and Output Wheel assemblies are supported by taper roller Bearings. Each time a Shaft is stripped for inspection, component repair or replacement it will be necessary to recalculate the number of Shims required to pre-load the Bearings correctly. Re-Shimming of the Axle is detailed under the Axle Shimming procedure.

Section 'A' – Transfer Case Assembly

Item	Part No	Qty	Description
A1	400-2200	1	M24 Nyloc Nut
A2	613-2191	1	Washer
A3	613-2180	1	Drive Flange (HS1410)
A4	0400561V	1	Oil Seal
A5	0051201	2	M12 Nut
A6	613-2300 613-2301	1	LH Transfer Case 19.7:1, 15.8:1 & 13.2:1 10.1:1 Only
A7	0210815	2	Dowel
A8	0081550	6	M10 Cap Bolt
A9	0540651	1	Taper Roller Bearing
A10	0540404	5	Taper Roller Bearing
A11	613-2340 613-2341	1	Output Gear 19.7:1, 15.8:1 & 13.2:1 10.1:1 Only
A12	613-2330 613-2331	1	Idler Gear 19.7:1, 15.8:1 & 13.2:1 10.1:1 Only
A13	613-2320 613-2321	1	Input Gear 19.7:1, 15.8:1 & 13.2:1 10.1:1 Only
A14	613-2310 613-2311	1	RH Transfer Case 19.7:1, 15.8:1 & 13.2:1 10.1:1 Only
A15	0201714	1	Bonded Washer
A16	CP1331	1	Magnetic Drain Plug
A17	613-2360	3	End Cover
A18	0040807P	18	M8 Bolt
A19	0041224	2	M12 Bolt
A20	0041018	12	M10 Bolt

NOTE: Shims not shown. Procedure detailed on page 16.



Removing and Servicing the Transfer Case Assembly

NOTE: This procedure details the Removal and Servicing of the 613B Transfer Case Assembly. For 613PB axles, the process stated in Section E (page 26) must be completed prior to starting this procedure.

1. Remove the Drain Plug (A16) and Bonded Washer (A15), and drain the oil into a tray placed under the axle main case.

NOTE: Oil capacity approx. 13 litres (3.38 US Gallons). Once fully drained, refit plug.

For the following steps, it is advisable to have the Transfer Case mounted in a horizontal position to retain the internals within the Transfer Case.

2. Remove Nut (A1) and Washer (A2). Gently pull the Drive Flange (A3) off of the Input Gear spline (A13). Examine the Oil Seal (A4) within the front Transfer Case (A6) bore for damage.
3. **613B ONLY** – Remove 4 Bolts (A18) and Upper End Cover (A17) using 2off M8 extraction holes.

NOTE: Keep the shims separate and note from where they came within the axle.

4. Remove 4 Bolts (A18) and remove the Lower End Cover (A17) using the 2off M8 extraction holes.
5. Remove 4 Bolts (A18) and remove the Middle End Cover (A17) using the 2off M8 extraction holes.
6. **613B ONLY** – Remove 2 Bolts (A19) and 2 Nuts (A5).
7. Remove 12 Bolts (A20).

NOTE: Bolts A19 are longer than A20 and so should be kept separate to avoid confusion during reassembly (613B only)

8. Remove the Transfer Case half (A14) using the 2off M10 extraction holes. Be careful not to drop the bearing cups from Input, Idler and Output Gears. Check the Bearing for signs of damage.
9. Remove the Input Gear, Idler Gear and Output Gear with their respective Bearing Cones.
10. Loosen and remove the 6 Bolts (A11) which clamp the Transfer Case to the Main Case.
11. The Transfer Case can then be retracted from the Main Case mounting along with the shims.
12. If the Oil Seals were damaged, drift out from inside of the Transfer Case bore.

Reassembling the Transfer Case Assembly

NOTE: This procedure assumes that the same parts have been reused. If any have been replaced, then Shim-ming for the Spiral Bevel Mounting and Bearing pre-load must be recalculated. This is detailed on page 16.

To reassemble the Transfer Case Assembly, follow the stated procedure in reverse order following steps found in Section B.

Clean the joint faces from the sealant and reapply the sealant on the Transfer Case, one half only, between and around the holes as a continuous bead.

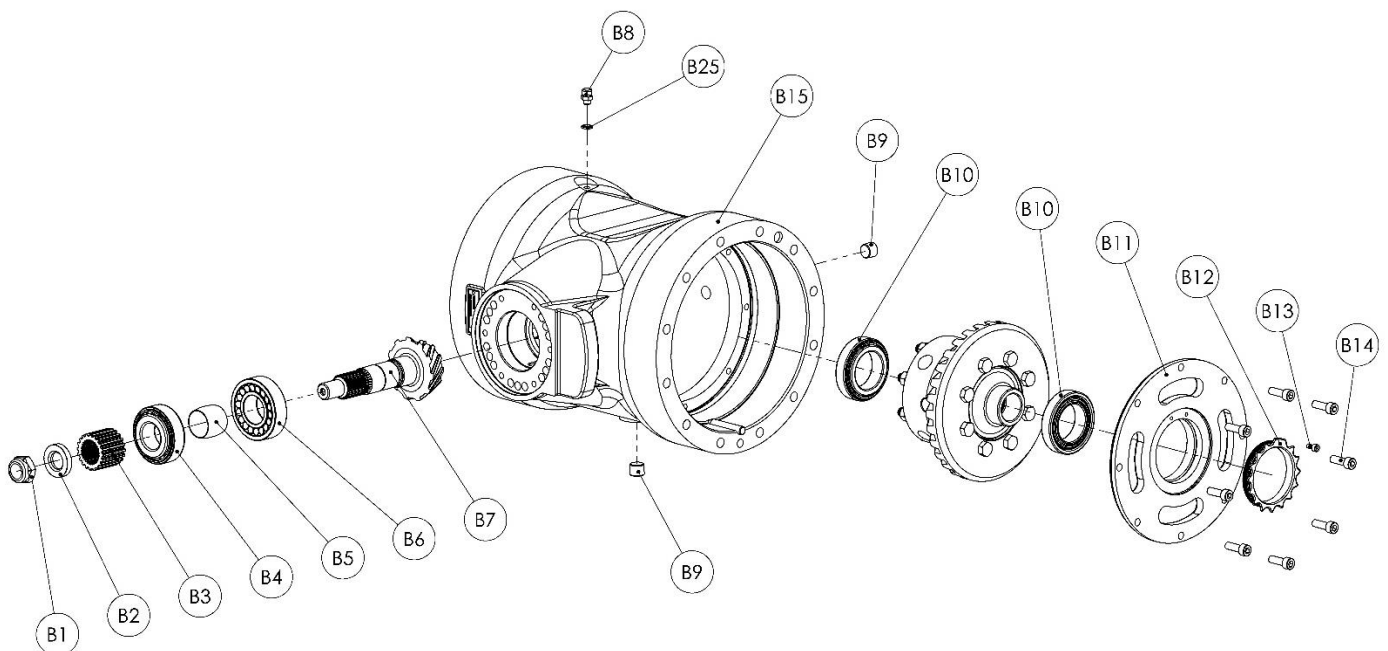
After one hour of setting, wipe the excess sealant around the perimeter of the case.

NOTE: Sealant on the Main Case/Transfer Case joint to be applied outboard of the holes in a continuous bead.

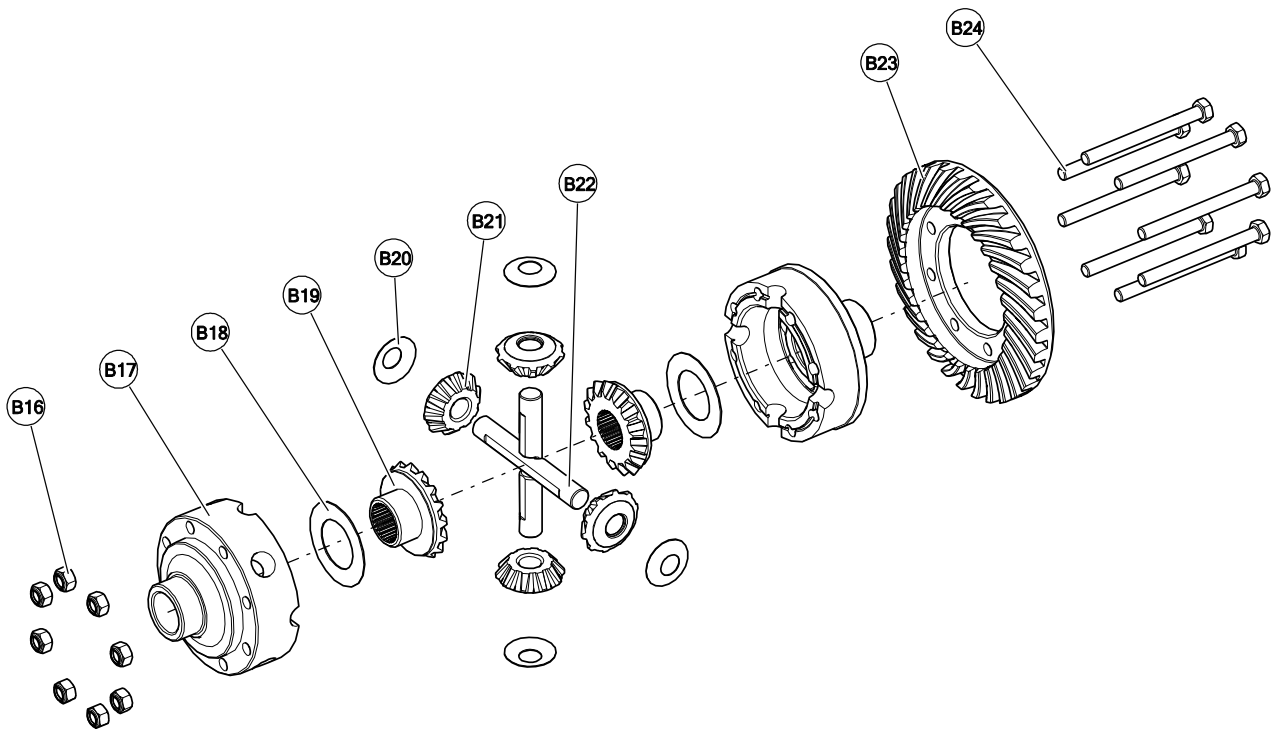
Backlash setting drag torque setting and Transfer Case shimming procedures can also be found in section B.

Section 'B' – Main Case and Differential Assembly

Item	Part No	Qty	Description
B1	400-2200	1	M24 Nyloc Nut
B2	613-2190	1	Washer
B3	613-2920	1	Spline Adaptor
B4	400-1050	1	Collapsible Spacer
B5	055CU024H	1	Taper Roller Bearing
B6	055C026U057	1	Taper Roller Bearing
B7	916-9820	1	Crown Wheel & Pinion Set
B8	CP1488	1	Breather
B9	0150250	2	Drain Plug & level plug
B10	0540552H	2	Taper Roller Bearing
B11	612-0731	1	Diff. Bearing Housing
B12	915-2151	2	Diff. Bearing Adjuster Nut
B13	0081312P	2	M6 Cap Bolt
B14	0081530	8	M10 Cap Bolt
B15	613-0010	1	Main Case



Item	Part No	Qty	Description
B16	007-0360	8	M12 Nyloc Nut
B17	612-9520	1	Differential Case
B18	915-2110	2	Thrust Washer
B19	915-2090	2	Differential Wheel
B20	915-2120	4	Thrust Washer
B21	915-2100	4	Differential Pinion
B22	915-2130	2	Spider
B23	916-9820	1	Crown Wheel & Pinion Set (Pinion not shown)
B24	0041225HT	8	M12 Bolt
B25	CP1224	1	Sealing Washer



Servicing the Main Case and Differential Assemblies

Removing the Differential

1. Remove the Axle Arm Assemblies – see Section D
2. Remove the Axle Arm planetary Assemblies and Sun Gear – see Section C
3. Remove the Transfer Case assembly – see Section A
4. Remove bolts (D18), Bearing Adjuster Nut Lock Screw (B13).
5. Unscrew and remove Adjuster Nuts (B12), 8off Bolts (B14) and Bearing Housing (B11) using extractor screw holes. The Differential is now free and can be retracted.



CAUTION: Great care must be taken when removing the Differential Assembly from Main Case. Any damage to the Crown Wheel Bearings could be detrimental to the axles' performance.



WARNING: The space constraints around the Differential are very tight. The Differential Assembly weighs 20Kg, so ensure that you have a good grip on the Diff Casing before attempting to remove the assembly from the case. Do not drop the Differential Bearing Cups.

Servicing the Differential Assembly

1. Remove Nuts (B16) and Bolts if necessary (B24). The Crown Wheel (B23) is now loose and the differential assembly will split into 2 halves. Turn the differential vertically to avoid dropping any internals.
2. Remove the Differential Spider 2off (B22) with the respective Differential Pinions (B21), Pinion Washers (B20), Wheels (B19) & Wheel Washers (B18).
3. Inspect all Differential Wheels (B19), Pinions (B21), Spiders (B22), Bearings (B10), Wheel Washers (B18) and pinion Washers (B20) for damage and wear, replace if necessary.
4. To assemble, reverse the above procedure.

NOTE: Markings on Differential Case must coincide.

5. If new Differential Bearings (B10) are fitted, it will be necessary to reset the Bearing pre-load and Crown Wheel/Pinion backlash.

Drag Torque for Bearings:

1. The Pinion Assembly should be fitted before the Crown wheel/ Differential Assembly are positioned.
2. Tighten the new Pinion Nut (B1), with a bead of Loctite on the male thread, until the new Collapsible Spacer (B4) collapses and the entire end float between the Pinion Bearings is taken up.
3. Spin over several times and check drag torque of 17/23 lbin is achieved.

NOTE: This procedure must be checked prior to carrying out any shimming procedures.

This must be carried out with the Crown Wheel/ Pinion (B7/B23) out of mesh.

Resetting Backlash:

- a. Refit Crown Wheel (B23), Differential Assembly (B16-B24), with Bearings (B10) also in Bearing Housing and secure Main Case bolts (B14). Screw new Differential Bearing Adjuster Nuts (B12) into position to remove all backlash from the gear mesh.
- b. Adjust the Nuts to move the Crown Wheel out of mesh to achieve a 0.47/0.55mm backlash using the PR40164 tool holes. (Detail drawing can be found in Appendix A)
- c. Tighten the Adjuster Nut (B12) opposite the Crown Wheel (B23) to 20Nm (15lbft) and fit new lock screw (B13) into hole in Adjuster Nut (B12). Check the opposing Bearing Adjuster Nut (B12) & tighten to 20Nm (15lbft). Lock in position using 1off Cap Screw (B13) tightened to 21Nm (15lbft).

Pinion Shimming Procedure

NOTE: The Shimming Procedure below assumes the Axle is stripped down following the above Service Procedures, and details the reassembly and shimming of the Spiral Bevel Pinion (B7), Input Gear (A13), Idler Gear (A12), Output Gear (A11) and Bevel Pinion (B23) Assemblies into the Main Case.

To Shim Bevel Pinion (example below):

If the Crown Wheel and Pinion (B23) or Pinion Head Bearing (B6) are replaced, the following procedure needs to be carried out for correct contact of the Bevel Gear set:

1. Note the new Spiral Bevel Pinion (B23) mounting distance (etched as MD) on the bottom of the head. (Assume for e.g. 115.00mm)
2. Measure the new overall width of the Pinion Head Bearing (B6). (assume 30.16mm)
3. Note the Main Case Constant, this is 146.07mm
4. The required Shim thickness can then be calculated by using the following method:-
=Case Constant – (Spiral Bevel Mounting Distance + Bearing Width).

Therefore Shims Required using data above:-
=Case Constant – (Mounting Distance + Bearing Width)
=146.07mm – (115.00mm +30.16mm)
=0.91mm required

To Shim Transfer Gears:

NOTE: The Bearings in the transfer case all have a max preload of 0.05mm which is added to the shim thickness.

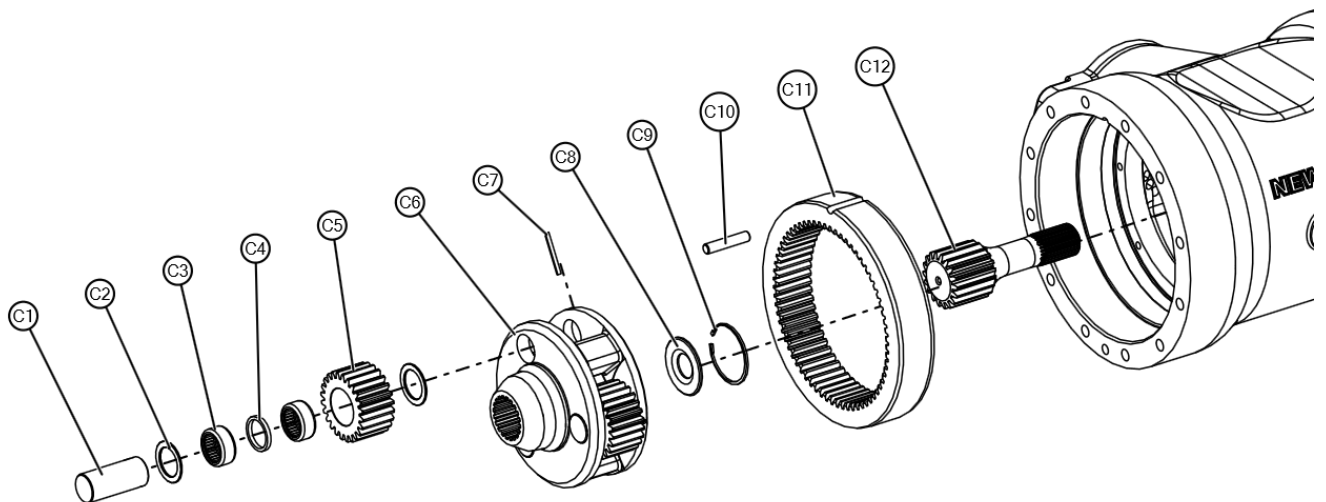
1. While LH Transfer Case half (A6) is fitted to the Main Case, position Input Gear (A13), Idler Gear (A12), Output Gear (A11) into position and check that they are seated correctly in the respective Bearing cups and & the Bearing Cones are pressed fully home prior to fitment.
2. The distance from the end of the Bearing Cup to the machined face of the RH Transfer Case (A14) should be measured (ensure all the end float is removed) and then the depth of the respective End Cover (A17) into the case should be measured & recorded
3. The Shim thickness can then be calculated using the following calculation:

=Distance of Bearing cup to machined face – Depth of End Cover + Preload (0.05mm)

Section 'C' – Planet Carrier Assembly

Item	Part No	Qty	Description
C1	612-0250	3	Planet Pin
C2	915-0270	6	Washer Thrust
C3	0564502	6	Needle Roller Bearing
C4	612-2560	3	Spacer
C5	612-0080 613-0080 614-0080	3	Planet Gear 19.7:1 Only 10.1:1 & 13.2:1 15.8:1 Only
C6	612-0060	1	Planet Carrier
C7	010-0030	3	Spring Pin
C8	400-1320	1	Spacer
C9	003-0120	1	Circlip
C10	0211620	1	Dowel
C11	612-0070 613-0070 614-0070	1	Annulus 19.7:1 Only 10.1:1 & 13.2:1 15.8:1 Only
C12	612-0091 613-0091 614-0091	1	Sun Gear 19.7:1 Only 10.1:1 & 13.2:1 15.8:1 Only

NOTE: Quantities stated per side (2 Assemblies per Axle)



Servicing the Planet Carrier Assemblies

NOTE: This procedure assumes the Axle has had both arms removed – see section D.

1. The Planet Carrier Assembly can now be removed from the Centre Casing. Take care not to withdraw the floating Sun Gear (C12).
2. Check the Planet Gears (C5) and the mating gear teeth on the Annulus (C11) and Sun Gear (C12) for damage and wear. The planet Gears (C5) should run free in the Planet Pins (C1), without excessive radial “play”. Replace if worn with the Needle Roller Bearing (C3).

NOTE: When servicing the Planet Assembly we recommend all three Planet Gears (C5), Planet Pins (C1), Needle Roller Bearings (C3), Spring Dowels (C7), Annulus (C11) & Sun Gear (C12) are replaced together as they are in constant mesh.

Dowels are replaced together.

3. To replace the Planet Gears, Pins or Bearings, drift each Spring Dowel (C7) through its hole, which locates the Planet Pins (C1) through the Planet Carrier (C6). Once the Dowels have been removed, lightly drift each Planet Pin (C1) through the Planet Gear (C5) and Planet Carrier (C6). Remove the loose Planet Gears (C5), Thrust Washers (C2) and Needle Roller Bearings (C3). Remove Circlip (C9), which secures the Spacer (C8).

NOTE: The Spacer (C8) is fitted with the large central chamfer facing outwards towards the Spline in the Planet Carrier (C6).

To reassemble:

1. Refit the Spacer & Circlip (C8 & C9) and slide the Needle Roller Bearings (C3) into the Planet Gears (C5). Fit the bottom Thrust Washer (C2) over the machined boss within the Planet Carrier (C6), place the planet Gear (C5) with the Needle Roller Bearing (C3) on top of the bottom Thrust Washer and from the underside gently tap the Planet pin (C1) through the Carrier (C6), bottom Thrust Washer (C2) & Planet Gear (C5).

NOTE:

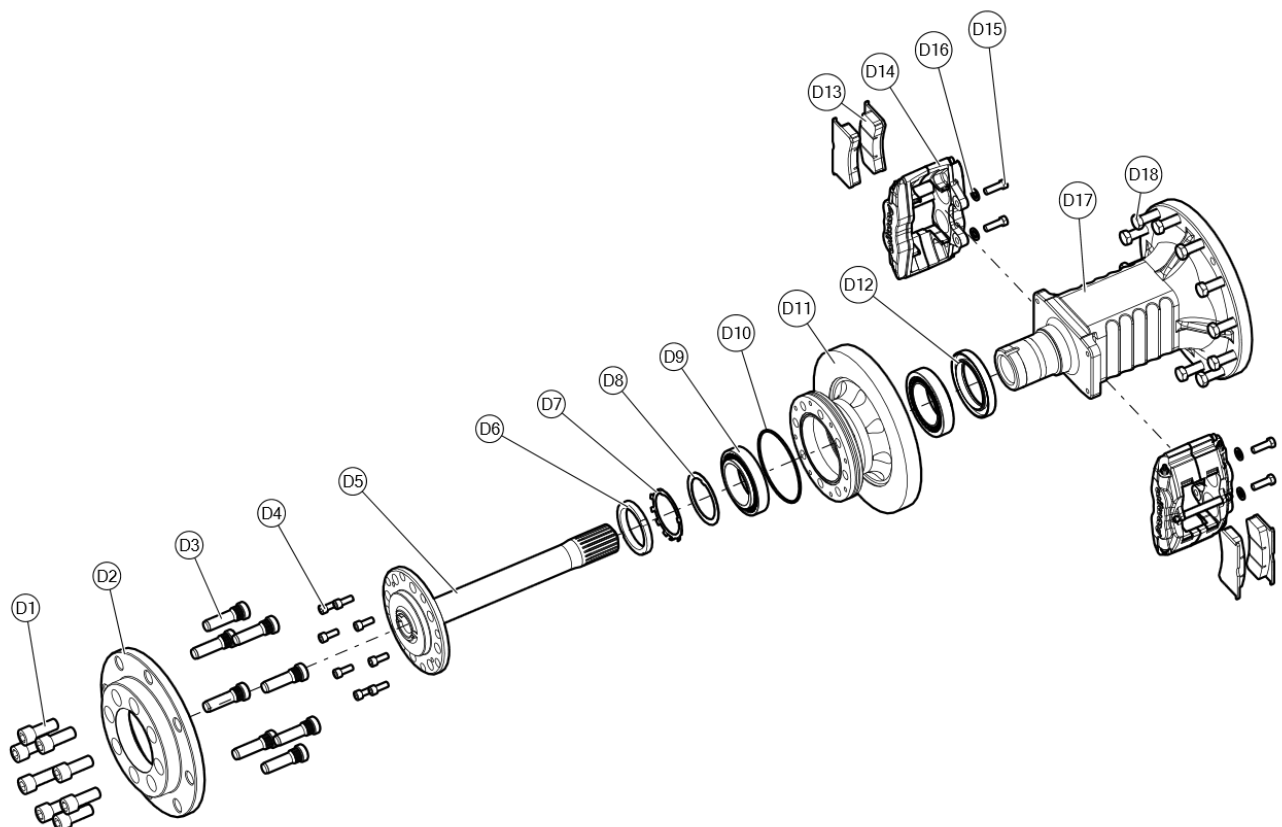
Removing the Annulus Gear

1. To remove Annulus (C11), use an extractor tool (PR40251 Appendix C) or pinch bars, located behind the Annulus (C11), in a scissor fashion to prise the Annulus clear of the case. Be careful not to damage the internal gear teeth.
2. To refit, reverse procedure ensuring that the Dowel (C10) is aligned with the slot at the bottom of the Annulus (C11).

Section 'D' – Axle Arm, Hub and Brake Assemblies

Item	Part No	Qty	Description
D1	0081845	8	M20 Cap Bolt
D2	612-0050	1	Hub Adaptor
D3	613-0450	8	M20 Wheel Stud
D4	0081525P	8	M10 Cap Bolt
D5	613-0100	1	Axle Shaft
D6	010N801	1	Lock Nut
D7	010W801	1	Lock Washer
D8	615-1440	1	Spacer
D9	0540803	2	Taper Roller Bearing
D10	0431343V	1	Viton "O" Ring
D11	613-0040	1	Wheel Hub
D12	613-2850	1	Hub Seal Viton
D13	612-2521-KIT	4	Brake Pad Set
D14	614-2501	2	Brake Caliper
D15	00816A40MZP	4	M14 Cap Bolt
D16	0191314	4	Lock Washer
D17	613-0020	1	Axle Arm
D18	0041614HTP	12	M16 Bolt
D19	007-0410	8	M20 x 1.5 Wheel Nut (NOT SHOWN)
D20	612-2660	4	Service Brake Pad Retaining Pin
D21	612-2670	4	Service Brake Pad Spring
D22	024M2516	4	Service Brake Pad Split Pin

NOTE: Quantities stated per side (2 Assemblies per Axle)



Servicing the Axle Arm, Hub and Brake Assemblies

The Hub assembly can be serviced with the Axle Arm still connected to the Main Case. Procedure is as follows:

1. Remove 8 off Bolts (D1) that secures the Hub Adaptor (D2) to the Wheel Hub/Brake Disc (D11).
2. Remove 8 off bolts (D4) that secure Axle Shaft (D5) to the Wheel Hub/Brake Disc (D11). Withdraw the Axle Shaft (D5) using the extraction screws & inspect the spline for damage & wear.
3. Remove Brake Calliper Bolts (D15) & and pull out the Brake Calliper radially from the Brake Disc. Heat will need to be applied to the bolts to break down Loctite compound.
4. Straighten locking tab ears on Lockwasher (D7), unscrew & remove the Lock Nut (D6) using a special tool. A gentle tap with a soft mallet on opposing sides of the Brake Disc will assist on pulling the assembly off the axle arm stub. Remove Lockwasher (D7) and Bearing Spacer (D8) from the keyway.
5. The Wheel Hub (D11) can now be withdrawn from the Axle Arm stub using a gentle tap from the mallet.

NOTE: Care must be taken not to drop the loose Bearing Cones from the stub arm axle.

6. Examine all Bearing 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.

7. The Bearing Cups (D9) can be drifted out of the Hub (D11) if they need replacing. When fitting new Bearing cups (D9) ensure that they are aligned squarely to the bores before pressing in.

NOTE: If the Rear Bearing (D9) is replaced Oil Seal (D12) will also need replacing.

8. To reassemble the Hub assembly, reverse the above procedure using a new Lockwasher (D7).
9. To adjust the Hub Bearings:
 - i. Tighten the Lock Nut (D6) to the tightening torque of 135 Nm (100 lb.ft). When checking the torque setting, rotate the Wheel Hub 3 turns in each direction to ensure the Bearings have "seated" correctly and recheck tightening torque. Repeat this procedure 3 times.
 - ii. Slacken the Lock Nut (D6) back a distance equal to 1 tab of the new Lock Washer (D7).
 - iii. Bend ear of Lock Washer over to secure the Nut.

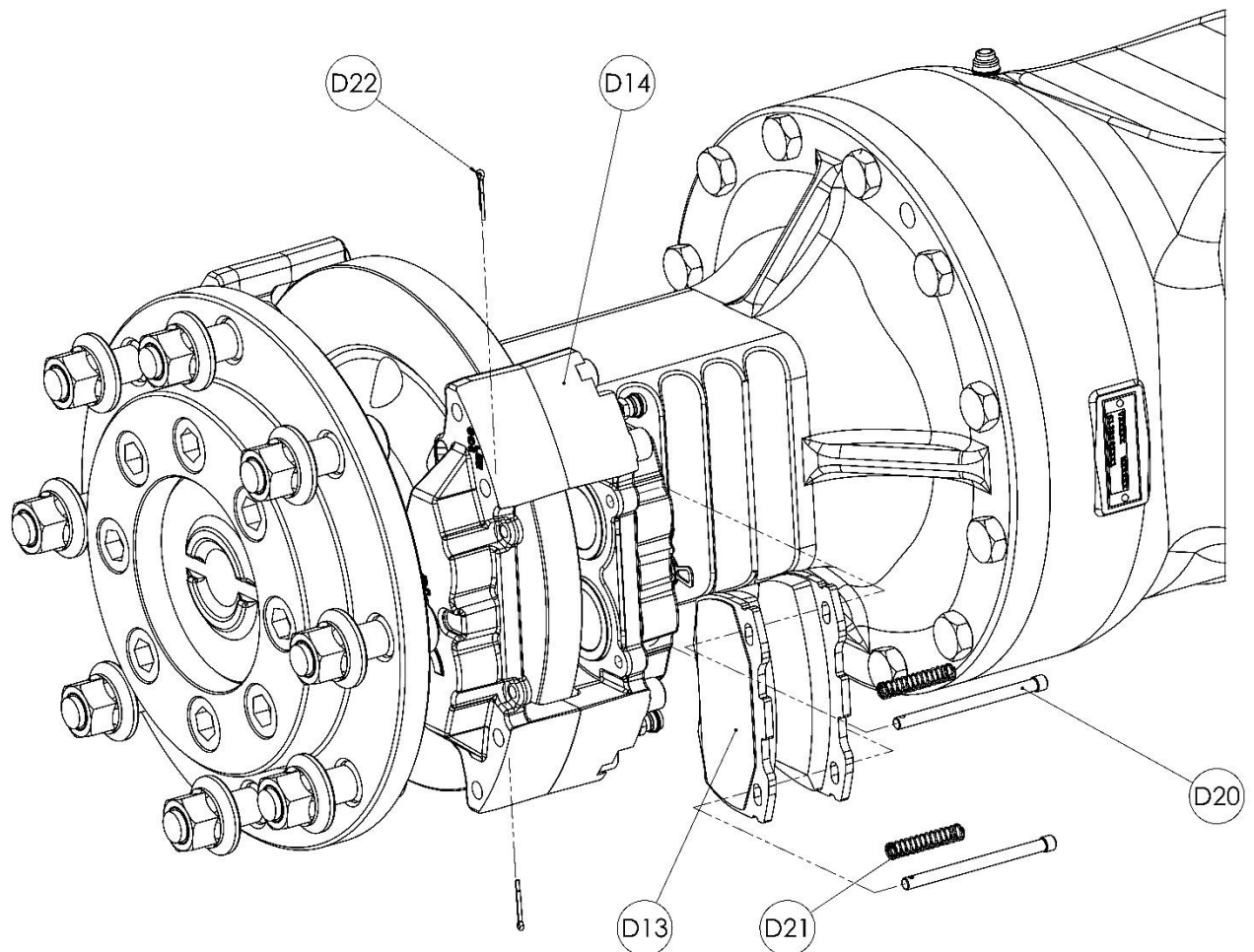
NOTE: Always use a new Lock Washer (D7).

Servicing the Brake Pad Assemblies

Each Brake Assembly consists of two fixed callipers per side (D14), so the Calliper needs to be removed to service the Pads.

1. Remove Calliper Guide pins (D20) & Spring (D21) which are secured with Spring Retainers or Split Pins (D22) and pull the Brake Pads (D13) away from the Axle Arms (D16).
2. Inspect for Pad wear and replace where necessary.

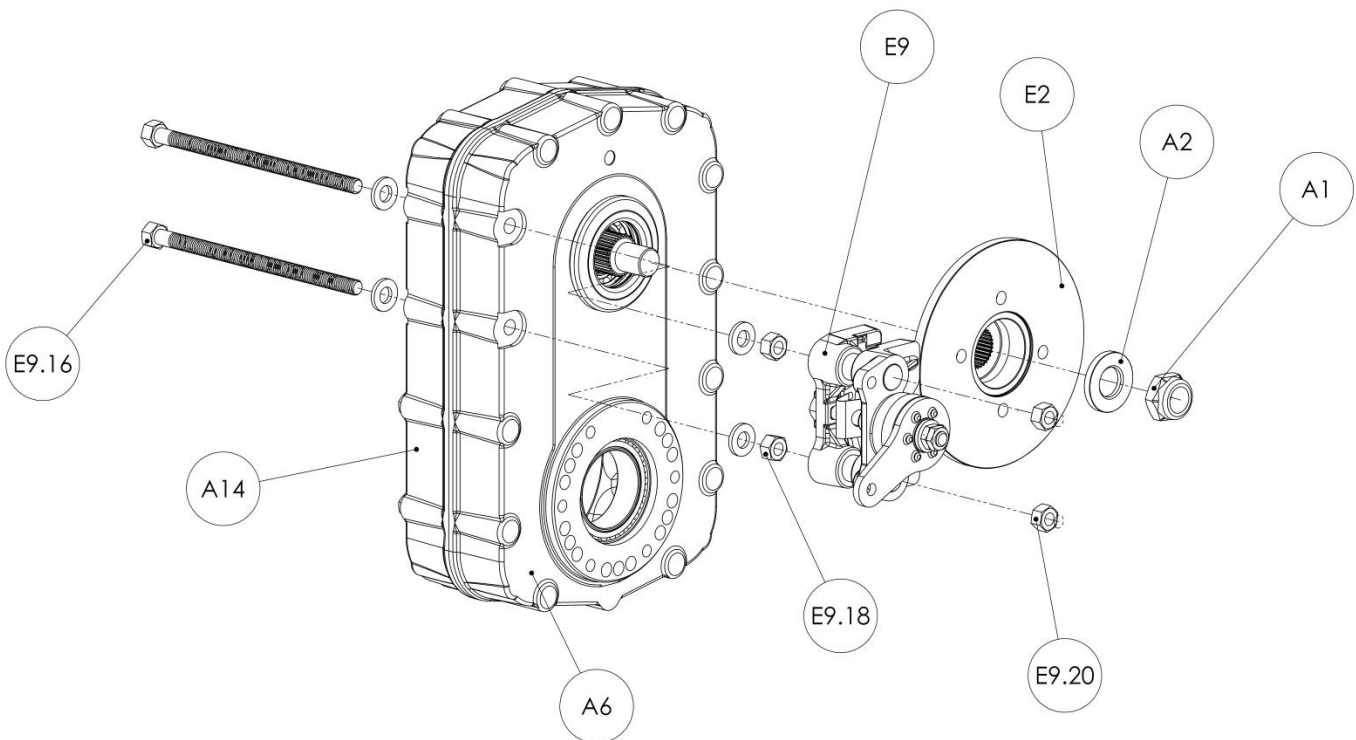
**NOTE: It is recommended to replace all the Brake Pads (D13) at the same time.
Always use a new Split Pin (D22).**



Section 'E' – Park Brake Assembly

NOTE: This only applies to 613PB specification axles. (Brake to Park Brake conversion detailed Below)

613-2510-KIT CONVERSION FROM "B" TO "PB" KIT (1 kit per axle)			
Item	Part No	Qty	Description
E9	613-2500	1	PARK BRAKE ASSEMBLY
E2	613-2181	1	PARK BRAKE DISC MOUNTING FLANGE
A1	400-2200	1	NUT M24 X 2.00
A2	613-2191	1	WASHER
E9.16	0010872HT	2	Screw ½" UNF x 9" Long



NOTE:

1. With Rotor "E2" in position, feed bolts "E9.16" with washers through the Transfer case clearance holes then fit another washer and nut "E9.18" the other side of the Transfer case on to the bolt together with the park brake "E9" in situ.
2. Screw the bolt all the way through the Transfer Case and Park Brake clearance holes and clamp the Transfer case using bolts "E9.16" and nuts "E9.18". Torque nut "E9.18" to 115 Nm (85 lb.ft)
3. With the park brake assembly Thread onto the Bolt (E9.16) the Locking Nuts (E9.20) until a 0.040" to 0.080" (1.00 mm to 2.00 mm) gap exists between the Sleeves (E9.19) and the Locking Nuts (E9.20).

Servicing the Park Brake Assembly

1. Remove the Nuts and Washers from the Park Brake Caliper Bolts (E1).
2. Slide the Bolt assembly through the Transfer Case (A6 & A14) and Caliper (E1) holes towards the back of the Axle. The Caliper (E1) is now free to be removed radially away from the Park Brake Disc (E2).

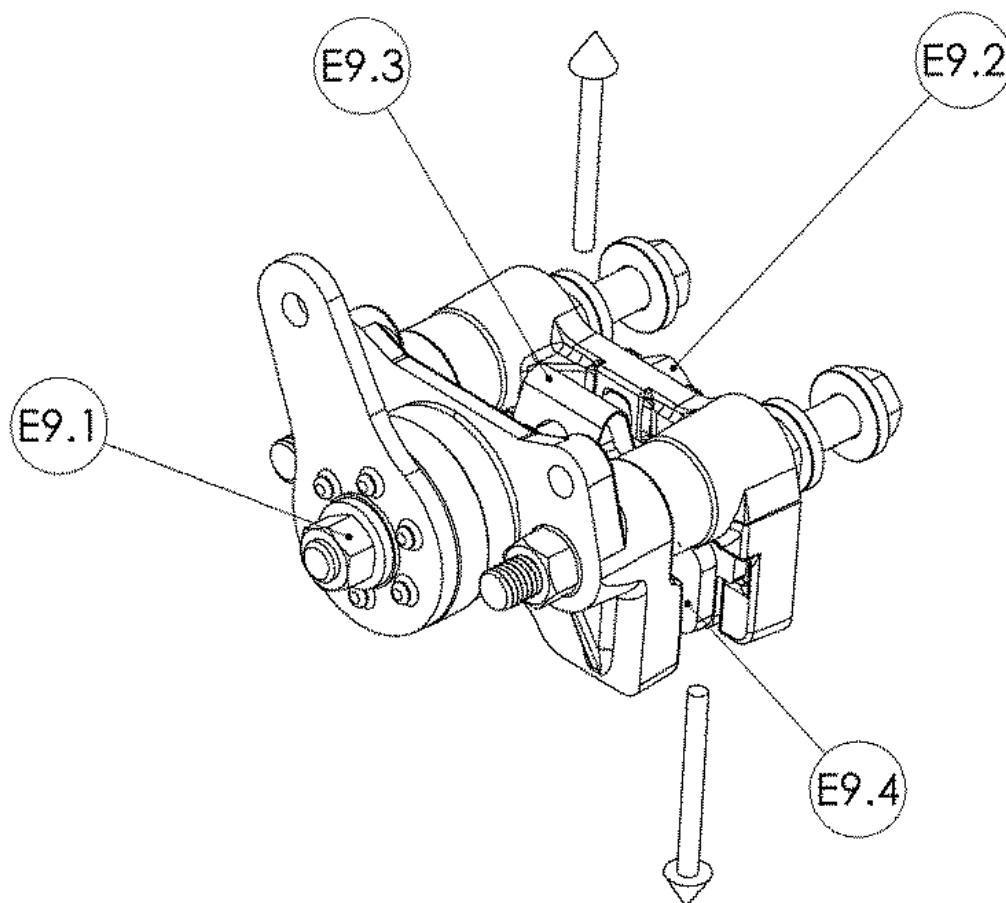
NOTE: These bolts are used to clamp the Transfer Case halves (A6 & A14) together and so removing these Bolts could potential cause minor oil seepage from the joint.

3. To gain access to the Oil Seal (A4), remove the Nut (A1), Flange Washer (A2) and Park Brake Flange (E2). Inspect the Oil Seal (A4) for any damage that could affect its performance.
4. To reassemble, follow procedure in reverse.



CAUTION: Great care must be taken when realigning the Park Brake Caliper with the Park Brake Disc. The Park Brake Caliper is self-aligning and so should have sufficient movement to slide along the Bolts.

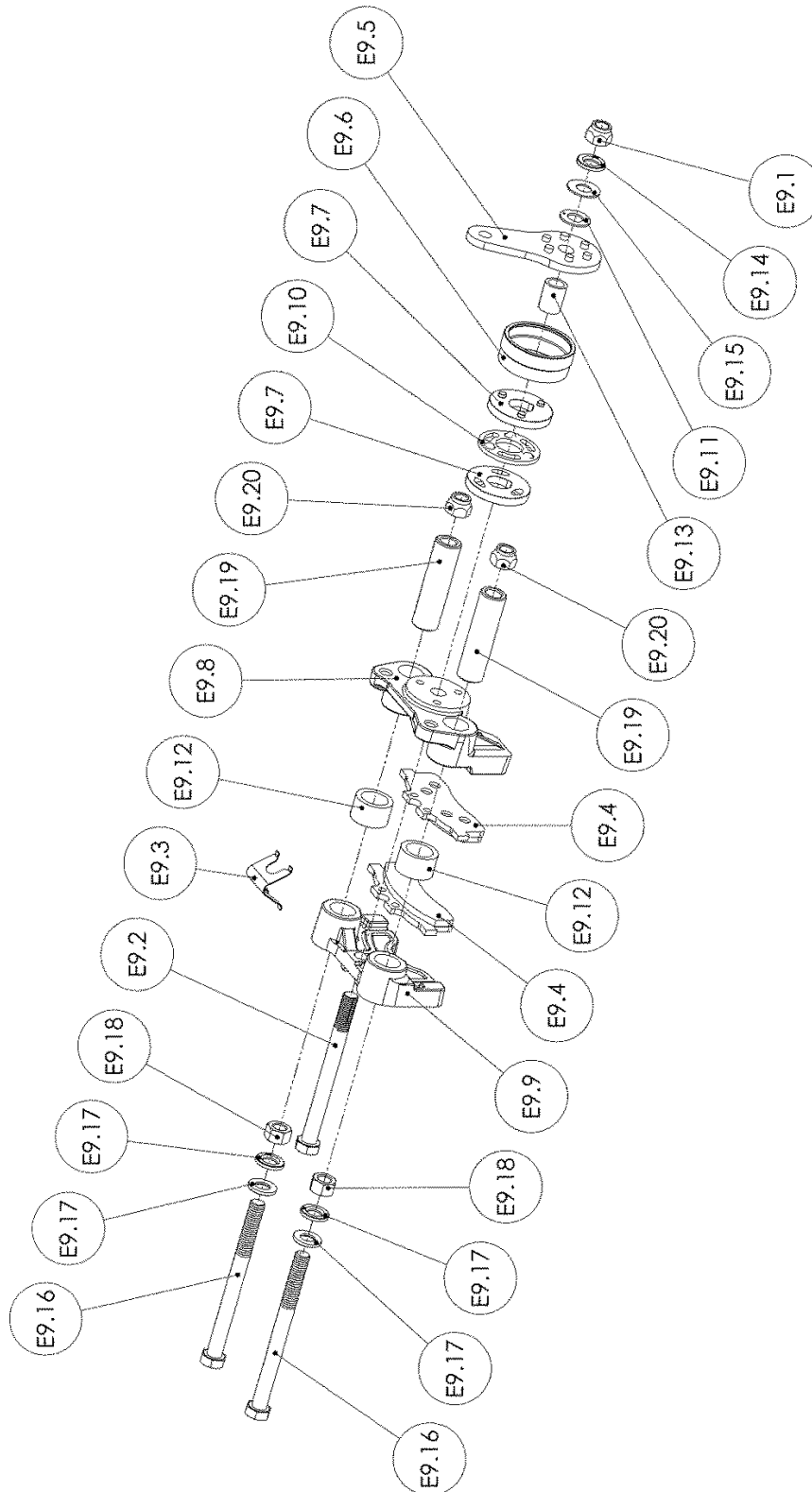
Replacing the Park Brake Caliper Pads



1. Loosen the Nut (E9.1) and slide the Bolt (E9.2) out through the Caliper body.
2. Remove the Spring (E9.3) once the Bolt (E9.2) has pass all the through the body.
3. The old Pads (E9.4) will slide out of the Caliper body.
4. Insert the new Pads and reposition the Spring (E9.3) so that it is reacting on the inside face of both Pads.
5. Reinsert the Bolt (E9.2) and tighten the Nut (E9.1).

Section 'F' – Park Brake Overhaul

The Park Brake assembly is a ball and ramp, sliding caliper brake designed for use as a Park Brake. The Park brake has an open caliper design to facilitate changing the linings, along with a retraction spring to reduce parasitic drag. It is sealed from the environment to provide a long and trouble free service life.



PARK BRAKE ASSEMBLY – PART No. 613-2500		
Item	Description	Qty
E9.1	NUT ½" X 20 UNF NYLOC	1
E9.2	BOLT ½" X 20 UNF X 5.5" LONG	1
E9.3	SPRING FLAT	1
E9.4 *	LINING AND CARRIER ASSEMBLY – Part No. 613-2530	2
E9.5	LEVER	1
E9.6	BOOT	1
E9.7	CAM	2
E9.8	TORQUE PLATE FRONT	1
E9.9	TORQUE PLATE REAR	1
E9.10	BALL/ RETAINER SUB ASSEMBLY	1
E9.11	GARLOCK THRUST BEARING	1
E9.12	SEAL SLEEVE	2
E9.13	ID SEAL	1
E9.14	WASHER HARDENED	1
E9.15	WASHER	1
E9.16	BOLT ½" X 13 UNC X 8.75" LONG	2
E9.17	WASHER	4
E9.18	NUT ½" X 13 UNC	2
E9.19	SPACER SLEEVE	2
E9.20	NUT ½" X 13 UNC NYLOC	2

NOTE: THE PARTS ABOVE ARE NOT AVAILABLE INDIVIDUALLY AND ARE SHOWN FOR ILLUSTRATION PURPOSES ONLY EXCEPT FOR THE * E9.4 REPLACEMENT BRAKE LINING AND CARRIER ASSEMBLY SUPPLIED AS 613-2530-KIT.

Mounting Procedure

1. Feed the Bolts (E9.16) together with a Washer (E9.17) through the Transfer Cases (A6 & A14).
2. Once just through the Case feed another Washer (E9.17), Nut (E9.18) and the Assembled Caliper (E9) pre- aligned with the Park Brake Disc (E5) and continue to tighten the Nut (E9.18) to clamp the Transfer Cases together.
3. Thread onto the Bolt (E9.16) the Locking Nuts (E9.20) until a 0.040" to 0.080" (1.00 mm to 2.00 mm) gap exists between the Sleeves (E9.19) and the Locking Nuts (E9.20).

Adjustment Procedure

1. Tighten Nut (E9.1) until firm contact is made between the Disc and the Linings. Torque to 11 N.m (8lbf.ft), making sure the Lever (E9.5) is in the correct operating position for application.
2. Back off Nut (E9.1) 4 to 5 flats and check that the Disc is free to rotate.

Lining Replacement

1. Replace both linings when either has worn to 2.3mm (0.090") remaining thickness.

2. Loosen the Nut (E9.1) enough to slide each of the Torque Plates (E9.8 & E9.9) away from the Disc and far enough to provide clearance to remove the old Carrier/ Lining assemblies (E9.4) and install new ones.
3. Collapse the Lining Reaction Spring (E9.3) and remove from the brake head assembly.
4. Slide the Torque Plates (E9.8 & E9.9) away from the Disc and move the Carrier/ Lining assemblies (E9.4) out of the pockets and remove from the Brake Head Assembly from the side.

NOTE: PRIOR TO THE INSTALLATION OF THE NEW LININGS IT IS RECOMMENDED THAT "ALFA 2000" GREASE (ANTI-SEIZE & LUBRICATING COMPOUND) MANUFACTURED BY CHEMTOOL BE APPLIED TO THE INTERFACE OF THE SLEEVE (E9.19) AND THE TORQUE PLATES (E9.8 & E9.9). AFTER GREASE HAS BEEN APPLIED SLIDE THE TORQUE PLATES BACK AND FORTH ON THE SLEEVE AS FAR AS POSSIBLE TO ENSURE THAT GREASE HAS BEEN INTRODUCED INTO THE BORES OF THE TORQUE PLATES

5. Install new Carrier/ Lining assemblies (E9.4) in each of the Torque Plates (E9.8 & E9.9)
6. Install Lining Reaction Spring (E9.3) into the Brake Head Assembly, making sure that the feet on the springs locate securely into the holes in both Carrier/ Lining assemblies (E9.4)
7. Adjust Brake as per the ADJUSTMENT PROCEDURE.

SPARES KITS

To ease the procurement of spares, we offer a catalogue of Kits that group common parts together to simplify the ordering process. These Kits are detailed below:

612-9630-KIT Differential Kit (1 Kit per axle)			
Item	Part No	Qty	Description
B16	007-0360	8	M12 Nyloc Nut
B17	612-9520	1	Differential Case
B18	915-2110	2	Thrust Washer
B19	915-2090	2	Differential Wheel
B20	915-2120	4	Thrust Washer
B21	915-2100	4	Differential Pinion
B22	915-2130	2	Spider
B24	0041225HT	8	M12 Bolt

612-9580-KIT (Uses 612-0070, 612-0080 & 612-0090) Planet Kit (2 Kits per axle)			
Item	Part No	Qty	Description
C1	612-0250	3	Planet Pin
C2	915-0270	6	Washer Thrust
C3	0564502	6	Needle Roller Bearing
C4	612-2560	3	Spacer
C5	612-0080	3	19.7:1 Only
	613-0080		10.1:1 & 13.2:1
	614-0080		15.8:1 Only
C6	612-0060	1	Planet Carrier
C7	010-0030	3	Spring Pin
C8	400-1320	1	Spacer
C9	003-0120	1	Circlip
C10	0211620	1	Dowel
C11	612-0070	1	19.7:1 Only
	613-0070		10.1:1 & 13.2:1
	614-0070		15.8:1 Only
C12	612-0090	1	19.7:1 Only
	613-0090		10.1:1 & 13.2:1
	614-0090		15.8:1 Only

NOTE: 613-9580-KIT (Uses 613-0070, 613-0080 & 613-0090)
614-9580-KIT (Uses 614-0070, 614-0080 & 614-0090)

613-2500-KIT Park Brake Conversion Kit (1 Kit Per Axle)			
Item	Part No	Qty	Description
	512-2520	1	Park Brake Assembly
	0010872HT	2	Screw ½" UNF x 9" Long

612-2521-KIT Service Brake Pad Kit (2 Kits Per Axle)			
Item	Part No	Qty	Description
D13	612-2521	1	Set of 4 Brake Pads
D16	0191314	4	Lock Washer
D20	024M2516	4	Split Pin
D15	00816A40MZP	4	M14 Cap Bolt
NOTE: "R" CLIP TO BE REMOVED FROM BRAKE ASSEMBLY & REPLACE WITH SPLIT PINS 024M2516			

612-2660-KIT Service Brake Pad Retaining Pin Kit (2 Kits per axle)			
Item	Part No	Qty	Description
D20	612-2660	4	Pad retaining Pin
D21	612-2670	4	Spring
D22	024M2516	4	Split Pin

613-2530-KIT Park Brake Pad Kit (1 Kit Per Axle)			
Item	Part No	Qty	Description
E9.4	613-2530	2	Park Brake Pads

613-0040-KIT Wheel Hub & Brake Rotor Kit (8 Studs M20 x 1.5 on 10.83" PCD (275mm)) (2 Kits Per Axle)			
Item	Part No	Qty	Description
D7	010W801	1	Lock Washer
D9	0540803	2	Taper Roller Bearing
D10	0431343V	1	Viton "O" Ring
D12	613-2850	1	Hub Seal
D11	613-0040	1	Wheel Hub

613-0041-KIT M20 X 1.5 Hub Adaptor & Stud Kit (2 Kits Per Axle)			
Item	Part No	Qty	Description
D2	612-0050	1	HUB ADAPTOR
D3	613-0450	8	WHEEL STUDS M20 X 1.5

613-0042-KIT 613 Wheel Seal and Brake Pad Kit (2 Kits Per Axle)			
Item	Part No	Qty	Description
D13	612-2521	4	Service Brake Pads
D10	0431343V	2	Viton "O" Ring
D12	613-2850	2	Hub Seal
D16	0191314	8	Lock Washer
D15	00816A40MZP	8	Cap Screw M14 x 40mm
D1	0081845	16	Cap Screw M20 x 45mm
D4	0081525	16	Cap Screw M10 x 25mm

Tooling			
Item	Part No	Qty	Description
-	PR40217	1	Main Case/ Transfer Case Alignment Tool
-	PR40164	1	613 Backlash Flange

Total 613 Spare Parts List

Item	Part No	Qty	Description
-	612-9630-KIT	1P/A	Differential Kit
-	612-9580-KIT	2P/A	Planet Carrier Kit 19.7:1
-	614-9580-KIT	2P/A	Planet Carrier Kit 15.8:1
B5	055CU024H	1	Taper Roller Bearing (pinion Tail)
D19	007-0410	16	Lug Nut
B3	613-2920	1	Pinion Sleeve
B7/B23	916-9820	1	Crown Wheel & Pinion
C12	612-0090	2	Sun Gear 19.7:1 Only
C12	613-0090	2	Sun Gear 10.1:1 and 13.2:1
C12	614-0090	2	Sun Gear 15.8:1 Only
C11	612-0070	2	Annulus 19.7:1 Only
C11	613-0070	2	Annulus 10.1:1 & 13.2:1
C11	614-0070	2	Annulus 15.8:1 Only
A4	0400561V	2	Coupling Seal
D10	0431343V	1	Viton "O" Ring

D12	613-2850	2	Hub Seal
D6	010N801	2	M80 Lock Nut
D7	010W801	2	Locking Washer
D8	615-1440	2	Spacer
D9	0540803	4	Taper Roller Bearing
D11	613-0040	2	Wheel Hub Brake Disc
A13	613-2320	1	1:1 Input Pinion (13.2, 15.8, 19.7:1)
A13	613-2321	1	0.77:1 Input Pinion (10.14:1)
A12	613-2330	1	1:1 Idler Gear (13.2, 15.8, 19.7:1)
A12	613-2331	1	0.77:1 Idler Gear (10.14:1)
A11	613-2340	1	1:1 Output Gear (13.2, 15.8, 19.7:1)
A11	613-2341	1	0.77:1 Output Gear (10.14:1)
A2	613-2191	1	Coupling Washer
A3	613-2180	1	Drive Flange
A7	0210815	2	Dowel
A14	613-2310	1	1:1 Transfer Case Rear (13.2, 15.8, 19.7:1)
A14	613-2311	1	0.77:1 Transfer Case Rear (10.14:1)
A19	0041224	2	M12 x 120mm Bolt
A20	0041018	12	M10 x 75mm Bolt
A8	0081550	6	M10 x 50mm Cap Bolt
B14	0081530	8	M10 X 30mm Cap Bolt
A18	0040807P	18	M8 x 20mm Hex Screw
A17	613-2360	3	End Cover
A16	CP1331	1	Level/Filler Plug
A15	0201714	1	Bonded Washer
B2	613-2190	1	Pinion Washer
A6	613-2300	1	1:1 Transfer Case Front (13.2, 15.8, 19.7:1)
A6	613-2301	1	0.77:1 Transfer Case Front (10.14:1)
-	0081312P	2	M6 x 12mm Cap Screw
B8	008-0070	1	Breather
B15	613-0010	1	Main Case
B12	915-2151	2	Adjuster Nut
B11	612-0731	1	Bearing Housing
B9	0150250	2	½ BSP Drain Plug Level
C10	0211620	2	Dowel
D14	614-2501	4	Brake Calliper
D16	0191314	8	Lock Washer
D17	613-0020	2	Axle Arm
D4	0081525P	8	M10 x 25mm Cap Screw
D5	613-0100	2	Axle Shaft

D3	613-0450	8	M20 x 1.5 Wheel Stud
D18	0041614HTP	24	M16 x 55 Bolt
E2	613-2181	1	Park Brake Disc
E1	613-2500	1	Park Brake Calliper
A5	0051201	2	Nut M12 Hex
D15	00816A40MZP	8	Cap Screw M14 x 40mm
D1	0081845	16	Cap Screw M20 x 45mm
A10	0540404	5	Transfer Gears Taper Bearing
B10	0540552H	2	Diff Assy Taper Bearing
A9	0540651	1	Transfer Gear Taper Bearing
-	057305A	9	Shim 0.002"
-	057305B	9	Shim 0.003"
-	057305C	9	Shim 0.010"
-	057340A	3	Shim 0.002"
-	057340B	3	Shim 0.003"
-	057340C	3	Shim 0.010"
-	250-0910	1	Oil Seal Cover
B4	400-1050	1	Spacer
D2	612-0050	2	Hub Adapter
-	CP1003	2	Serial Plate 3/16 Screw
E9.16	0010872HT	2	Special Bolt ½ UNF x 9" long
E9	512-2520	2	Park Brake Assy ref 419-9304

All spares are available from your local Newage distributor. Check our website to find your closest distributor.

Other spares are available upon request; however these may not be carried by the distributor as standard stock and may incur a delivery lead-time.

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.

Apply gear marking compound on both sides of 7 to 10 teeth on the Crown Wheel (B10). Whilst applying resistance to the Pinion (B10) rotate the Crown Wheel back and forth (Not Full revolutions) until a clear contact pattern is shown. Compare the contact pattern to the illustrations below and re-shim the Pinion Bearing bore in the Main Case (A3).

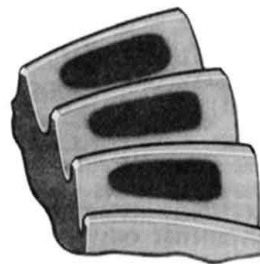
If the Taper Roller Pinion Bearing (B9) is Re-shimmed (B12) the backlash must be re-set between the Crown Wheel and Pinion (B10).

Go back and repeat all procedures in setting the backlash.

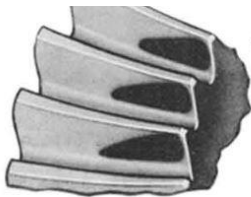
Correct Pattern



Ideal contact pattern
Correct shim
Correct backlash

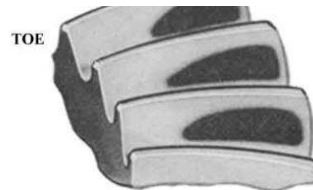


Incorrect Pattern

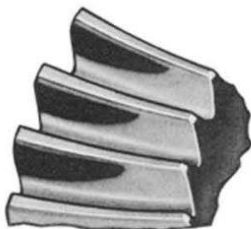


TOE

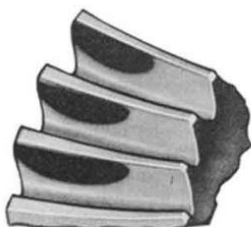
Backlash is correct
Add 0.004" shim



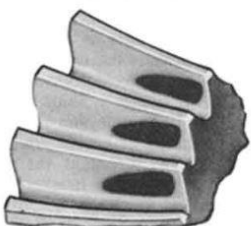
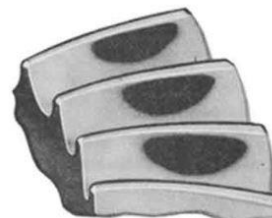
TOE



Backlash is correct
Subtract 0.004" shim



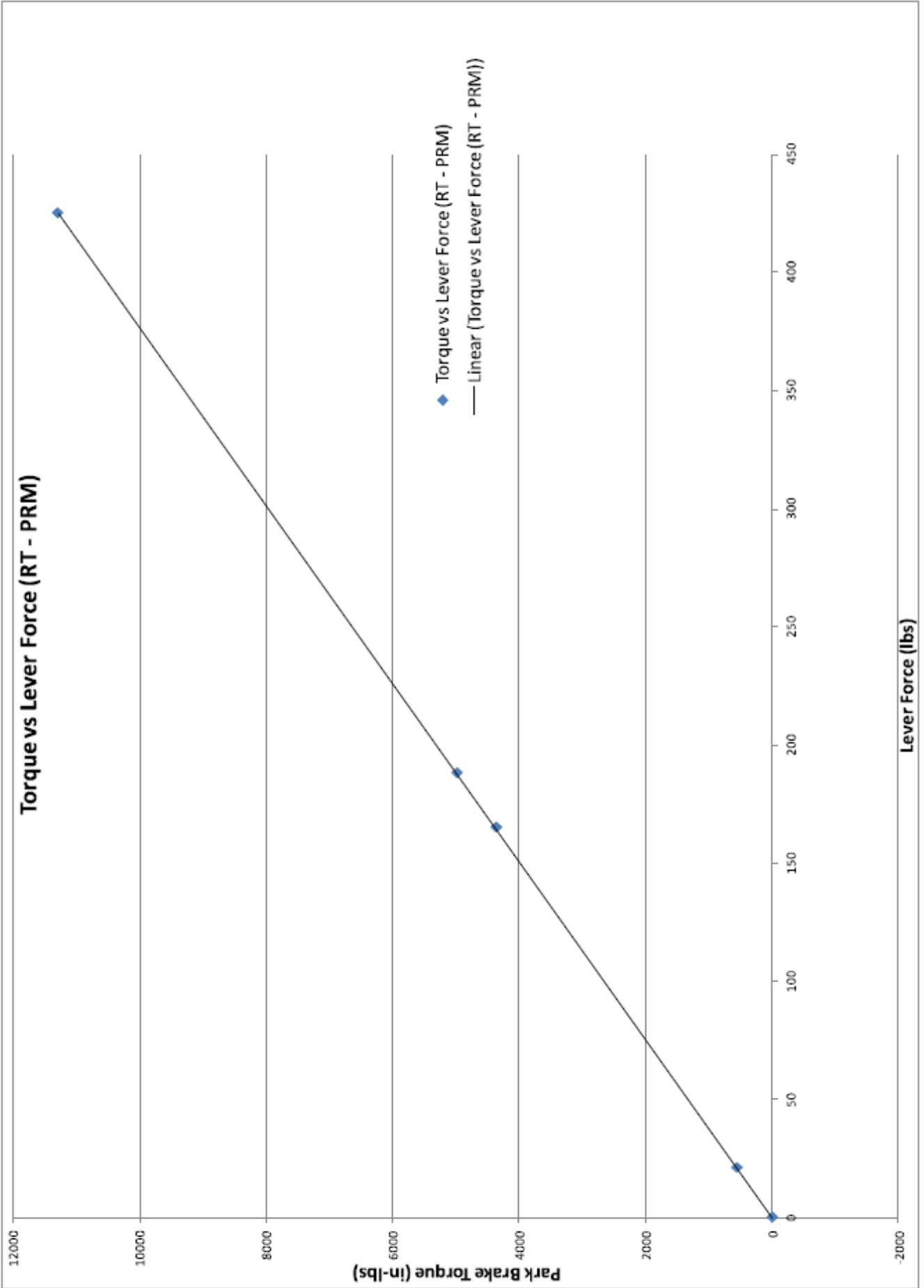
Shim is correct
Decrease backlash 0.004"



Shim is correct
Increase backlash 0.004"



Appendix 1 – Park Brake



Appendix 2 – Service Brake

