1. Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Issue Date</th>
<th>Author</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22/11/2016</td>
<td>M. O’Driscoll</td>
<td>Initial Release</td>
</tr>
</tbody>
</table>

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3. Important Information

This manual applies to SIBS® 2, 3 and 4 wheel-end brake systems (equipped with pad wear indicators) fitted to light vehicles being operated in a harsh mining environment. The manual details how to service the SIBS® system correctly to ensure optimum safety and performance. All information contained in this manual is based on the latest SIBS® product information available at the time of publication.

This manual should be read in conjunction with the appropriate vehicle manual for further information on removal and installation of any standard OEM components.

While every effort has been made to address all aspects of installation and servicing, please advise Advanced Braking of any omissions or suggestions on how this manual may be improved.

Advanced Braking Pty Ltd reserves the right to change the manual at any time without prior notice.

The most up to date version of the manual can be obtained by contacting the ABT Customer Service Manager.

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### 4. Terminology

<table>
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<th>Term</th>
<th>Description</th>
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<tr>
<td><strong>ABS</strong></td>
<td>Anti-lock braking system</td>
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<tr>
<td><strong>ATF</strong></td>
<td>Automatic transmission fluid</td>
</tr>
<tr>
<td><strong>Emergency Brake</strong></td>
<td>Brakes automatically applied in an emergency</td>
</tr>
<tr>
<td><strong>EMMA™</strong></td>
<td>Electronically Modulated Mechanically Applied</td>
</tr>
<tr>
<td><strong>OEM</strong></td>
<td>Original equipment manufacturer</td>
</tr>
<tr>
<td><strong>Park Brake</strong></td>
<td>Brakes applied independently of the service brake</td>
</tr>
<tr>
<td><strong>PWI</strong></td>
<td>Pad wear indicator</td>
</tr>
<tr>
<td><strong>Service Brake</strong></td>
<td>Brakes applied when driving via the foot pedal</td>
</tr>
<tr>
<td><strong>SIBS®</strong></td>
<td>Sealed Integrated Braking System</td>
</tr>
<tr>
<td><strong>SIBS® Cooling Fluid</strong></td>
<td>Specially formulated cooling fluid for use in SIBS® brakes</td>
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5. Service Schedule

The following table shows the recommended service intervals for SIBS® 2, 3 and 4 wheel-end brake systems (equipped with pad wear indicators) fitted to vehicles being operated in a harsh mining environment. ABT recommends each site undertake a review of the service intervals and adjust to suit their specific conditions. Vehicles included in this service schedule are Toyota Landcruiser, Toyota Hilux, Ford Ranger and Isuzu NPS.

<table>
<thead>
<tr>
<th>Frequency</th>
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<tr>
<td>Pre-Start Check</td>
<td>Daily</td>
</tr>
<tr>
<td>Minor Service</td>
<td>Monthly or every 5,000 km or every 100 hours (whichever occurs first)</td>
</tr>
<tr>
<td>Major Service: Rear</td>
<td>When rear brake pad wear reaches minimum (as indicated by the pad wear indicator)</td>
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The pre-start check involves a quick check of the fluid levels and confirms proper brake system operation.

The minor service involves a general system inspection and replacement of the SIBS® cooling fluid in the wheel-ends.

The major service is conducted to replace worn brake pads and a system inspection and replacement (where necessary) of the SIBS® brake parts to ensure continued reliable operation of the SIBS® brake.
6. **Pre-Start Check**

1. Check brake master cylinder reservoir level. If low, top up with DOT3 brake fluid and check system for leaks.
2. Check SIBS® pump reservoir level. If low, top up with ATF Dexron III and check system for leaks.
3. With the doors closed, engine running and driver’s seat belt connected, press the E-Stop button:
   a. The brake status light on the SIBS® control unit should be solid red.
   b. The park brake should be applied.
4. Twist and release the E-Stop button:
   a. The brake status light should flash red momentarily and then change to solid green.
   b. The park brake should now be released.
5. Check the park/emergency brake applies when (Note: interlock connections c, d and e):
   a. The E-Stop is pressed.
   b. The ignition is switched to the ‘ACC’ position.
   c. The door is opened (door ajar warning light should display on control unit).
   d. The driver seatbelt is released (seatbelt warning light should display on control unit).
   e. The engine is stalled (low oil pressure warning light should display on control unit).
6. Check the service brake (foot brake) firmly applies the brake.
7. Carry out park brake performance test:
   a. Ensure the test is carried out on a level surface, with no obstructions in front of the vehicle.
   b. With engine running at normal operating temperature
      - Apply SIBS park/emergency brake
      - Depress clutch
      - Engage third gear low range (Landcruiser and NPS) or second gear low range (Hilux and Ranger)
      - Do not press footbrake
      - Do not rev engine (engine should be idling as normal)
      - Slowly release clutch
      - Allow the engine rpm to slowly reduce until either the engine stalls or the vehicle rolls forward
      - Vehicle must stall without the vehicle driving through the brake
8. If the vehicle drives through the brake a Major Service must be performed.
7. **Minor Service (100hrs)**

1. Check the brake fluid level in the master cylinder. Top up if necessary.

2. Check service brake units for leaks:
   a. Engine running
   b. Press the brake pedal firmly for 30 seconds
   c. The pedal should not drop

3. Check the fluid level in the SIBS® EMMA™ pump reservoir. Top up if necessary.

4. Check SIBS® pump for leaks:
   a. Engine running
   b. Twist and release the E-stop button to release the park/emergency brake
   c. The brake should remain released for 30 seconds
   d. The alarm should remain silent and the pump should not recharge

5. Check hydraulic lines for cracks or damage.

6. Check the breather hose for cracks or damage.

7. Check the expansion chamber filler breather caps are clear.

8. Check all electrical connectors and wiring for damage or corrosion.

9. Ensure the vehicle battery is in good working order.

10. Check rear brake pad wear:
    a. Apply the park brake.
    b. Remove the protective cap on the pad wear indicator (found on the spring cover).
    c. The plunger should project out from the gland fitting.
    d. The distance the plunger projects shows the remaining brake pad wear available. (New pads = 2mm approx.).

![Figure 1: Rear pad wear indicator schematic.](image)

11. If the brake pads have worn beyond the wear limit, then a major service must be completed.
12. Drain and discard the SIBS® cooling fluid from each wheel-end brake.
   a. At least 800 mL of SIBS® cooling fluid should be found in each wheel-end. Check for leaks if this amount is not found.
   b. The SIBS® oil should drain freely from the brake. If it comes out in a “glug, glug” fashion ensure there is no blockage in the SIBS® breather line.
   c. Dispose of used SIBS® cooling fluid responsibly in accordance with regulatory and environmental legislation.
13. Refit the drain plug with a new sealing washer.
14. Refill the wheel-end up to the level plug (fill to spill). 1 litre of SIBS® cooling fluid is required for each wheel-end.
15. Conduct a “vehicle pre-start check”.
8. **Major Service – Rear**

1. Check service brake and park brake systems for leaks.
2. If leaks are present replace damaged seals where necessary during the major service.
3. Repair/replace damaged parts where necessary during the major service.
4. Remove the rear wheels.
5. Remove the 3x tapered plugs and 1x pad wear indicator from the spring cover.
6. Fit 4x retractor bolts into the spring cover until they begin to retract the pistons.
7. Loosen the retractor bolts until there is approximately 2mm gap to the spring cover.
8. A short test is required to check the integrity of the springs in the EMMA brake. Assistance is required for this test.
9. While the EMMA brake is applying/releasing observe the movement of the retractor bolts.
10. The 4 x retractor bolts should move in and out simultaneously.
11. If the retractor bolts move simultaneously then the spring integrity check is complete. Skip to step 14.
12. If the retractor bolts appear to be moving unevenly then check the following:
   a. While the brake is releasing (the pump is running) one or more bolts moves quickly out at the beginning of the pump cycle and is then followed by the remaining retractor bolts moving slowly as the pump cycle continues and then finishes
   b. While the brake is applying (fluid dumping back to reservoir) the slow-moving bolt/bolts from the previous test move back into the spring cover first and are then followed by the remaining bolt/bolts
13. If the retractor bolts behave as explained in step 12 then the spring covers must be removed to visually check the springs.
14. With the brake released retighten the retractor bolts. Then apply the brake.
15. Remove the axle shaft.
16. Remove the hub nut. The hub can now either be removed or left in place and removed with the rest of the brake.
17. Remove and discard 2x housing bolts on opposite sides of the brake housing.
18. Attach 2x guide pins.
19. Remove and discard the remaining 10x housing bolts.
20. Carefully separate the inner and outer housings using guide pins to assist. 2x guide pins may assist with disassembly. The outer housing, hub, rotor and outer pads should remain as one assembly.
21. Stand the brake assembly on a clean bench.
22. Sit the outer housing, rotor and hub assembly face down on the hub studs.
23. Remove the rotor from the outer assembly, clean and inspect.
   a. Inspect the rotor and hub splines for wear. Check for movement between the rotor and hub. If there is movement between the splines of the mating components the rotor should be replaced.
   b. Inspect the rotor friction surface. If there are signs of scouring covering more than 50% of the surface the rotor should be replaced.
   c. Measure the thickness of the friction surface using a micrometer at four evenly spaced position around the rotor. If thickness is below 14.0 mm the rotor should be replaced.

24. Remove and discard the inner and outer brake pads.

25. Remove the hub from the outer housing and clean.
26. Remove all seals from the hub and discard.
27. Remove 2x bearings from the hub, clean and inspect.
   a. If bearings show any sign of wear they should be replaced.
   b. Grease the bearings with a high temperature bearing grease (Castrol LMX recommended).
   c. Install the inner bearing into the hub. Set the outer bearing aside for installation onto the vehicle.
28. Inspect all hub studs, dowel pins and grease nipple. Replace if showing any signs of thread damage or corrosion.
29. Pack the hub with a high temperature bearing grease (Castrol LMX recommended).
30. Fit new hub seal and v-seals to hub.
31. Remove the ScotSeal from the outer housing and discard.
32. Clean the outer housing and inspect for damage or wear.
33. Install a new ScotSeal into the outer housing.
34. Push the outer housing onto the hub.
35. Install the outer brake pads in the outer housing ensuring correct orientation.
36. Install the rotor onto the hub spline ensuring correct orientation.
37. Remove the housing O-ring from the inner housing and discard.
38. If the piston seals need to be replaced (ref. step 1 and 2), remove the pistons now.
39. Clean the inside of the inner housing with parts cleaner.
40. Ensure the piston seals avoid contamination during cleaning process in cases where the pistons have not been removed.
41. If the EMMA springs passed the integrity test as per steps 8 to 11 and do not require a visual inspection, skip to step 69.
42. Disconnect the service brake line, the park/emergency brake hydraulic line, the breather line and ABS sensor (if connected) from the brake.
43. Remove the 4 nuts that hold the brake onto the axle.
44. Lift the inner brake assembly clear from the axle. The inner housing may need to be tapped with a copper mallet to free it from the axle.
45. Inspect the mounting studs. Replace if showing signs of damage or corrosion. If replacing studs:
   a. Ensure the mating parts of the housing and seal carrier are clean and free of debris.
   b. Apply a light smear of Loctite® 515 on the mating surface of the seal carrier and under the head of each stud as it is pushed into place. Note that the heads of the studs are ‘D’ shaped and need to be orientated correctly.
   c. Using spacers, attach 4x mounting nuts and tighten to 15 Nm.
46. Inspect all fittings for damage or corrosion and replace if necessary.
47. Inspect the inner seal carrier. Buff the seal surface with a fine wet & dry (600 – 1000 grit) if it shows signs of wear or replace if necessary.
48. Remove the 10x spring cover bolts and discard.
49. Loosen the 4x retractor bolts progressively and in sequence no more than 3x full turns at a time until completely removed. Retain the retractor bolts for later use.
50. Remove the spring cover.
51. Remove and discard spring cover gasket.

52. Remove the disc springs and inspect each one for signs of excessive wear or cracking. If there are any cracked springs, then all 24x springs must be replaced.

53. If there are no cracked springs clean all thoroughly and set aside.

54. If the piston seals need to be replaced (ref. step 1 and 2), remove the pistons now.

55. Clean the exposed areas of the park/emergency pistons.

56. Ensure the piston seals avoid contamination during cleaning process in cases where the pistons have not been removed.

57. Clean the inner housing and spring cover.

58. Lubricate all disc springs with a high-pressure grease (Castrol LMM recommended) and reinstall on the park/emergency pistons. There is 6x springs per piston all stacked in series.

59. Install a new spring cover gasket and refit spring cover.

60. Install 10x spring cover bolts and washers finger-tight.

61. Reinstall the retractor bolts and torque to 80 Nm.
62. Install and torque all spring cover bolts progressively and in sequence (one full turn at a time) to ensure that the spring cover does not distort or crack, torque to 60 Nm. Ensure each bolt is torqued twice.

63. Clean the axle flange and spindle to remove any grease, dirt and gasket remains. If the flange is damaged or corroded it must be cleaned thoroughly with abrasive paper.

64. Apply Loctite® 515™ directly to the axle flange face.

65. Each brake unit is stamped with its corresponding position on the vehicle and must be installed accordingly:
   a. LH = Left Hand
   b. RH = Right Hand

66. Fit the SIBS® inner brake assembly unit over the stub axle. Align the mounting holes and locate the housing evenly and firmly against the axle flange.

67. Fit 4x new brake mounting nuts. Washers/spacers may be required with some kits.

68. Torque the brake mounting nuts to 80 Nm in a diagonal pattern. Repeat this procedure 3x over a 5-minute period.

69. Check the condition of the wheel bearing seal running surface. If the surface shows signs of degradation (e.g. corrosion or wear) repair using a speed-sleeve (part no: 99242 to suit Ø62mm max.).

70. Fit a new housing O-ring into the groove around the circumference of the inner housing.

71. Install the inner brake pads in the inner housing ensuring correct orientation.

72. Carefully fit the outer housing, hub and rotor assembly to the inner housing. 2x guide pins may assist with fitment.
73. Fit the 12x M10 bolts and torque to 50 Nm in sequence. Ensure each bolt is torqued twice.

![Housing bolt torque sequence.](image)

74. Fit the outer wheel bearing and retaining collar and adjust to Toyota specifications.

75. Fill the cavity behind the V-lip seal with a high temperature bearing grease (Castrol LMX recommended) via the grease nipple located on the hub face. Do not over-grease the V-lip cavity.

76. Install the axle half shafts in accordance to Toyota manual specifications and top up the differential oil as required.

77. Remove the 4x retractor bolts from the spring cover.

78. Fit the pad wear indicator to the lowest piston:
   a. Screw the pad wear indicator piston into the lowest piston thread and torque to 15 Nm.
   b. Apply Loctite 222 to the gland fitting on the thread that attaches to the spring cover only.
   c. Fit the gland fitting over the piston and screw this into the spring cover. Torque to 15Nm.
   d. Fit the stainless steel protective cover and fibre washer to the gland fitting.
   e. Fit 3x supplied tapered plugs to seal the remaining holes in the spring cover. Use an anti-seize or a low strength thread locker on the threads to prevent the plugs seizing in the spring cover. The hex sockets may be filled with silicone or similar to aid future removal.

79. Remove the SIBS® cooling fluid fill plug.

80. Fill the SIBS® brake unit with new SIBS® cooling fluid and refit the fill plug with a new copper washer. Approximately 1 litre of SIBS® cooling fluid is required per brake unit.

81. Repeat for the opposing brake unit.

82. Inspect all the park/emergency brake hydraulic hoses and replace as required.

83. Replace all rear breather hoses.

84. Flush the pump reservoir with new ATF Dexron III and then fill to level window.

85. Prime the SIBS® pump by running intermittently (no more than 10 seconds at a time) until full hydraulic pressure is reached and the motor stops running automatically.
   a. To run the pump and release the EMMA™ brake, twist the red pushbutton on the control unit clockwise.
   b. To release hydraulic pressure and engage the EMMA™ brake, press the red operator pushbutton.
c. While performing this priming process, ensure the EMMA™ reservoir is constantly topped up to prevent the pump from running dry.

86. Bleed the park/emergency brake system using the bleed screws on the rear brakes.

87. Remove any clamps on the rear service line.

88. Flush the master cylinder with DOT 3 brake fluid.

89. Bleed the rear service brake system of air.

90. Check that there are no leaks from the system.

91. Install wheels and torque all wheel nuts progressively and in sequence. Ensure each bolt is torqued twice.
   a. Steel rims: 210 Nm
   b. Alloy rims: 130 Nm

92. Conduct a “vehicle pre-start check”.