ADVANCED BRAKING TECHNOLOGY

OPERATOR'S MANUAL FAILSAFE EM (DRIVELINE)

BOOKLET TO REMAIN IN THE VEHICLE

1. Revision History

Revision	Issue Date	Author	Comments
1	21 May 2020	M. O'Driscoll	Initial release HV19 only
2	8 Jul 2020	M. O'Driscoll	All Failsafe EM driveline

2. Table of Contents

3. Terminology

ABS	Anti-lock braking system
ATF	Automatic transmission fluid
DPS	Door proximity system
EM	Emergency
Emergency Brake	Brakes automatically applied in an emergency
EMMA™	Electronically Modulated Mechanically Applied
HSI	Highway speed isolation
OEM	Original equipment manufacturer
Park Brake	Brakes applied independently of the service brake
PWI	Pad wear indicator
Service Brake	Brakes applied when driving via the foot pedal
ABT™ Failsafe	Wheel end mounted fully sealed brake with SAHR
ABT™ Cooling Fluid	Specially formulated cooling fluid for use in ABT™ Failsafe and Failsafe Emergency brakes

4. ABT™ Failsafe Controller

1. E-stop button
   a. The ABT™ Failsafe Park and Emergency Brake is engaged and released via the red E-stop button.
   b. To engage the brakes, push the red E-stop button.
   c. To release the brakes, twist the red E-stop button clockwise, approximately 15° and allow it to spring outwards (the ignition must be on, doors closed, seatbelt connected and engine running). The hydraulic pump will then activate and release the park brake.
2. Brake status LED
   a. When the brake status LED is solid red the brakes are applied.
   b. When the brake status LED is flashing red the brakes are in the process of applying or releasing. A pulsing audible alert accompanies the flashing LED to indicate the brakes are in transition.
   c. When the brake status LED is solid green the brakes are released.
3. Manual override button
   a. The manual override button enables the operator to override any interlocks preventing the brake from releasing.
   b. To operate, press and hold the manual override button. While the manual override button is depressed the brake can be released using the E-stop.
   c. A constant alarm tone will indicate the manual override button is overriding one of the interlocks. In this instance, as soon as the button is released, the brakes will apply.
4. Fault code LED
   a. The fault code LED only illuminates if a fault is detected in the system. Please refer to the troubleshooting section in the workshop manual for further details.
5. Highway speed isolation LED
   a. The highway speed isolation system (HSI) is designed to prevent unintended brake application at high speeds.
   b. When the vehicle is travelling above a pre-determined speed the HSI system will become active – this is indicated by the illumination of the green HSI LED.

c. While the HSI system is active, any interlocks attempting to apply the brake will be overridden – this will be indicated by a constant alarm tone.

d. The HSI system does not override the ignition interlock or E-stop button.

6. ATF LED

   a. The amber ATF LED will illuminate if the fluid level in the ABT™ Failsafe pump reservoir drops below minimum.

7. Door interlock LED *(if connected)*

   a. The red door ajar LED will illuminate when the ignition is on and a vehicle door is open.

   b. While this LED is illuminated the brake will be applied (unless manual override or HSI is active).

8. Seat belt interlock LED *(if connected)*

   a. The red seatbelt LED will illuminate when the ignition is on and the driver's seatbelt is disconnected.

   b. While this LED is illuminated the brake will be applied (unless manual override or HSI is active).

9. Stall interlock LED *(if connected)*

   a. The red low engine oil pressure LED will illuminate when the ignition is on and the vehicle engine is not running.

   b. While this LED is illuminated the brake will be applied (unless manual override or HSI is active).

5. Important Failsafe Em Brake Information

1. **The brake is intended as an emergency brake only for use in the event of a service brake system failure. The system is not designed as an additional service brake.**
2. **The brake also acts as an additional parking brake.**
3. **Do not perform dynamic stops unless in an emergency situation. If the brake is used in an emergency situation it is recommended to strip and inspect the brake and diff components.**
4. **The ABT™ Failsafe Emergency driveline brake is not designed as a vehicle retarder and should only be used in the case of an emergency.**
5. ***The ABT™ Failsafe Emergency Driveline Brake Systems HV19, LV21 and MV16 are designed for "off highway" use. Whilst it is possible to operate the vehicle with the brake attached at highway speeds without damage, unintended application of the brake will rapidly and effectively arrest the vehicle. ABT™ recommends that the brake is disabled for highway use or when the vehicle is to be driven above speeds of 60kph by installing the supplied retractor bolts. This recommendation applies to delivery of the vehicle to site and any other extended "on highway" or "above speeds of 60kph" use.***

WARNING:	
	Before operating the vehicle on a mine site, the retractor bolts **MUST** be removed and replaced with plugs and pad wear indicator. Power to the control box **MUST** be restored.

IMPORTANT:
Ensure the ABT™ Failsafe caution and warning labels are attached to a prominent position on the windshield.

IMPORTANT:
Ensure the Control Box Tag is attached to the Control Box if the brake has been made inoperable due to the fitment of retractor bolts. While retractor bolts are fitted the Failsafe Emergency control system must be made inoperable by disconnecting the control box on the dash or by removing the main fuses from the battery power harness.

5.1. Decommissioning the ABT Failsafe Brake

1. This procedure applies to delivery of the vehicle to site and any other extended "on highway" or "above speeds of 60kph" use.
2. Tools required:
    - 8mm hex socket (for taper plugs)
    - 22mm socket/spanner (for pad wear indicator gland)
    - 8mm socket/spanner (for pad wear indicator plunger)
    - 19mm socket/spanner (for retractor bolts)

WARNING:	
	This work must be carried out on a level surface and with the vehicle secured appropriately to prevent any unintended vehicle movement.

3. Ensure all loose dirt is removed from around the brake spring covers to prevent contamination of the springs.
4. Remove and keep the threaded plugs (5x on HV19 or 3x on LV21 and MV16) from the spring covers.

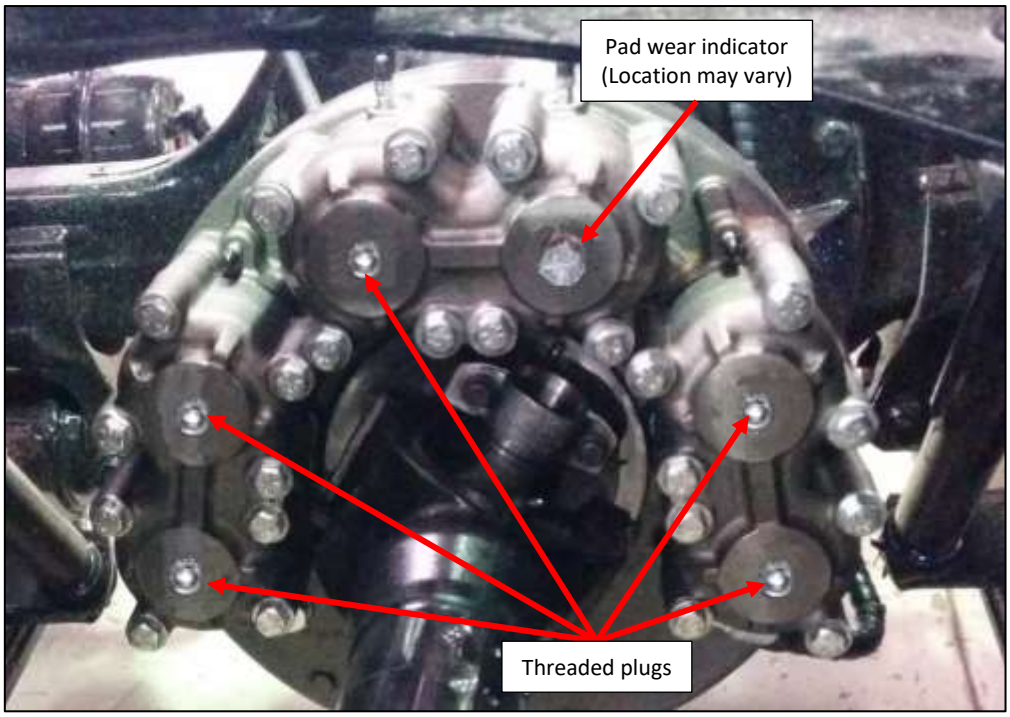

Fig 1: Failsafe Emergency brake threaded plugs and pad wear indicator (HV19 shown).

5. Remove and keep the pad wear indicator cap, sealing washer and gland together.

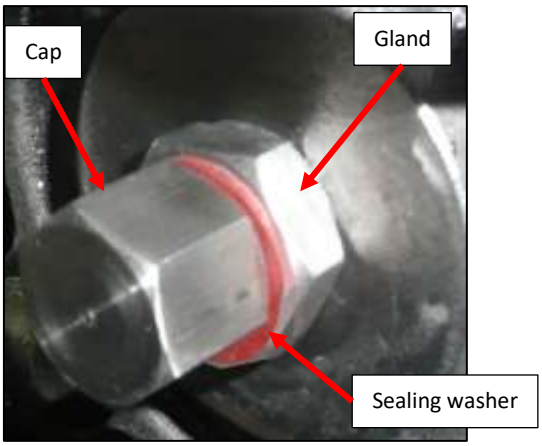

Fig 2: Pad wear indicator cap, sealing washer and gland.

6. Remove and keep the pad wear indicator plunger.

Fig 3: Pad wear indicator plunger.

7. Install the retractor bolts (6x on HV19 or 4x on LV21 and MV16) with hardened washers into the pistons.

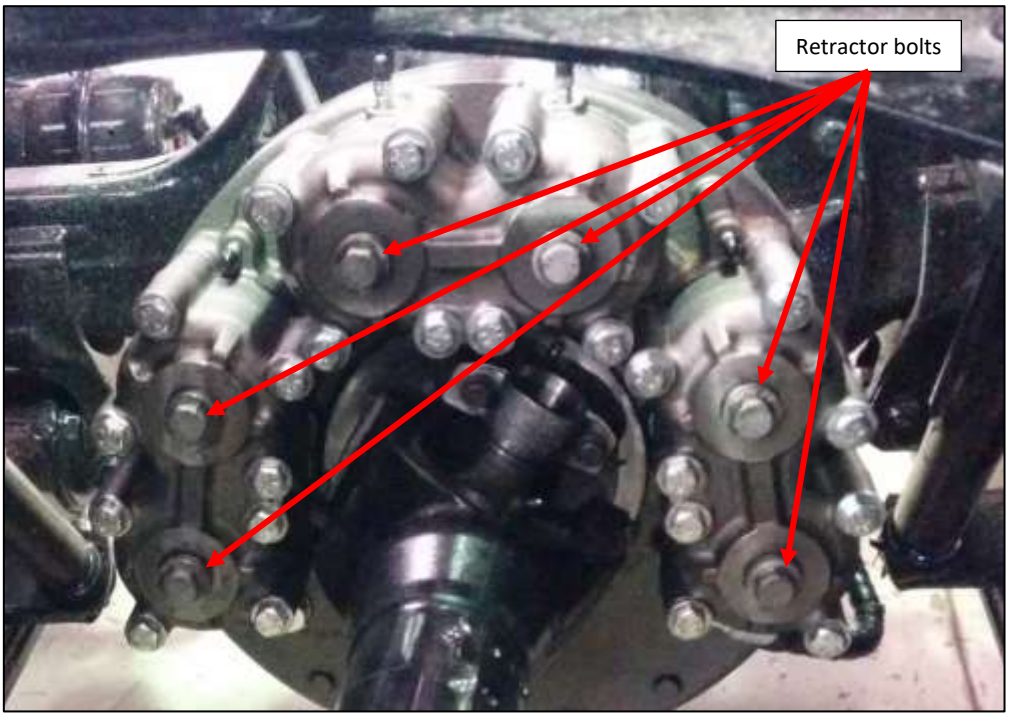

Fig 4: Failsafe Emergency brake piston retractor bolts (HV19 shown).

Note: To assist with attaching the retractor bolts the Failsafe EM brake may be released during this operation.

a. Installing the retractor bolts with the Failsafe EM brake released:

- Wind the bolts, with washers attached, into the pistons by hand.
- Tighten hand tight.
- Ensure they are fully secured with a spanner or socket.
- The brake may now be applied.

b. Installing the retractor bolts with the Failsafe EM brake applied:

- Apply grease to both sides of the hardened washers if possible.
- Wind the bolts, with washers attached, into the pistons by hand.
- Tighten hand tight.
- Continue to tighten the bolts with a spanner or socket.
- Torque the bolts (130 – 150 Nm on HV19 and MV16 or 80 – 100 Nm on LV21).

8. The retractor bolts are now preventing the Failsafe EM brake from applying.

WARNING:	
	The Failsafe EM brake control unit power must now be disconnected to prevent unintended application of the vehicle power divider (interaxle diff lock) on trucks with tandem rear axle sets.

9. The Failsafe EM control system may be made inoperable in either of the following two ways:

a. Disconnect the Failsafe EM brake control box on the dash.

b. Remove and keep the Failsafe EM brake main fuses from the battery power harness.

Fig 5: Failsafe EM control box and power connections.

IMPORTANT:
The threaded plugs, pad wear indicator parts and fuses should be retained in the vehicle.

5.2. Commissioning the ABT Failsafe Brake

1. This procedure applies to operating the vehicle on a mine site.
2. Tools required:
    - 8mm hex socket (for taper plugs)
    - 22mm socket/spanner (for pad wear indicator gland)
    - 8mm socket/spanner (for pad wear indicator plunger)
    - 19mm socket/spanner (for retractor bolts)

WARNING:	
	This work must be carried out on a level surface and with the vehicle secured appropriately to prevent any unintended vehicle movement.

3. Connect the Failsafe EM brake main harness to the control box (see Fig 5).
4. Check the Failsafe EM brake fuse holders and install the fuses if necessary (see Fig 5).
5. Ensure all loose dirt is removed from around the brake spring covers to prevent contamination of the springs.
6. Remove and keep the retractor bolts (6x on HV19 or 4x on LV21 and MV16) with hardened washers from the pistons (see Fig 4).

Note: To assist with removing the retractor bolts the Failsafe EM brake may be released during this operation.

7. Wipe any grease from around the holes in the spring covers.
8. Reapply the brake.
9. Apply Loctite Silver Grade Anti-seize to the threads of the taper plugs to assist with future removal.
10. Attach taper plugs (5x on HV19 or 3x on LV21 and MV16) to the spring covers, leaving one of the upper-most holes for the pad wear indicator (see Fig 1).
11. Torque threaded plugs to 10Nm.
12. Silicone may be used to fill the socket head of the taper plugs to prevent dirt ingress.
13. Attach the pad wear indicator plunger to the piston inside the remaining hole in the spring cover (see Fig 1 & 3).
14. Torque plunger to 15 Nm.
15. Apply Loctite 222 to the pad wear indicator gland.
16. Attach the pad wear indicator gland, sealing washer and cap over the plunger onto the spring housing (see Fig 1 & 2).
17. Torque pad wear indicator gland to 15 Nm.
18. Ensure gland is threaded fully into the spring cover (see Fig 2).
19. Carry out a Pre-Start check.

IMPORTANT:
The retractor bolts and washers should be retained in the vehicle.

6. Pre-Start Check

1. Check ABT™ Failsafe pump reservoir level. If low, top up with ATF Dexron III and check system for leaks.

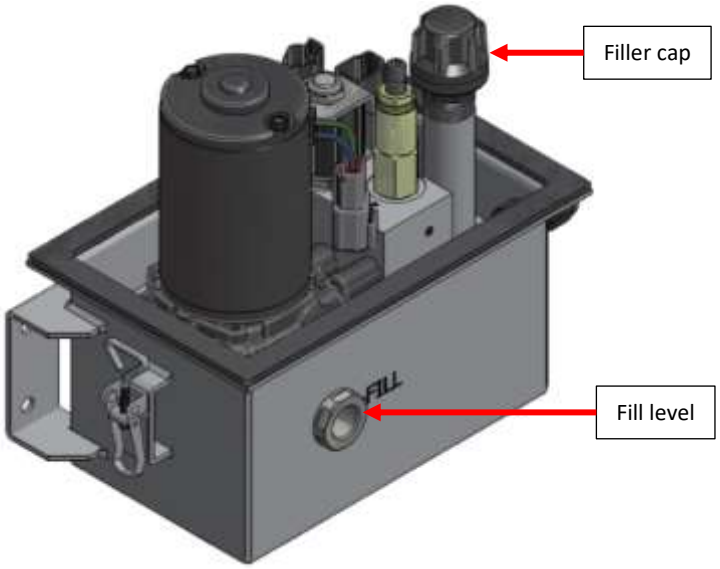

Fig 6: ABT™ Failsafe pump enclosure with lid removed.

2. With the doors closed, engine running, and driver's seat belt connected, press the E-Stop button:
   a. The brake status light on the ABT™ Failsafe Emergency control unit should be solid red.
   b. The park brake should be applied.
3. 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.
4. Check the Failsafe EM brake applies when *(Note: optional interlock connections c, d and e if connected)*:
   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).
5. Carry out Failsafe EM 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 ABT™ Failsafe Emergency brake
      - Depress clutch
      - Engage third gear low range
      - 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

c. If the vehicle is equipped with an automatic gearbox:

- Engage drive on the gear selector
- Slowly drive the vehicle (5 – 10 km/h)
- Apply ABT™ Failsafe Emergency brake
- The vehicle must stop within 5 metres or 3 seconds

6. If the vehicle drives through the brake a Major Service must be performed.

IMPORTANT:
The Pre-Start check does not replace visual inspection of the pad wear indicators.

7. Failsafe Brake Cooling Fluid Change Procedure

1. This is required every 100 working hours or 5,000 km to help reduce brake pad wear extending the life of the brake.
2. Tools required:
    - 22mm socket/spanner (for fill/level plug and drain plug)

WARNING:	
	This work must be carried out on a level surface and with the vehicle secured appropriately to prevent any unintended vehicle movement.

IMPORTANT:
It is recommended to wear appropriate PPE when handing oil and cooling fluid.

3. Drain and discard the ABT™ Failsafe brake cooling fluid from the driveline brake.

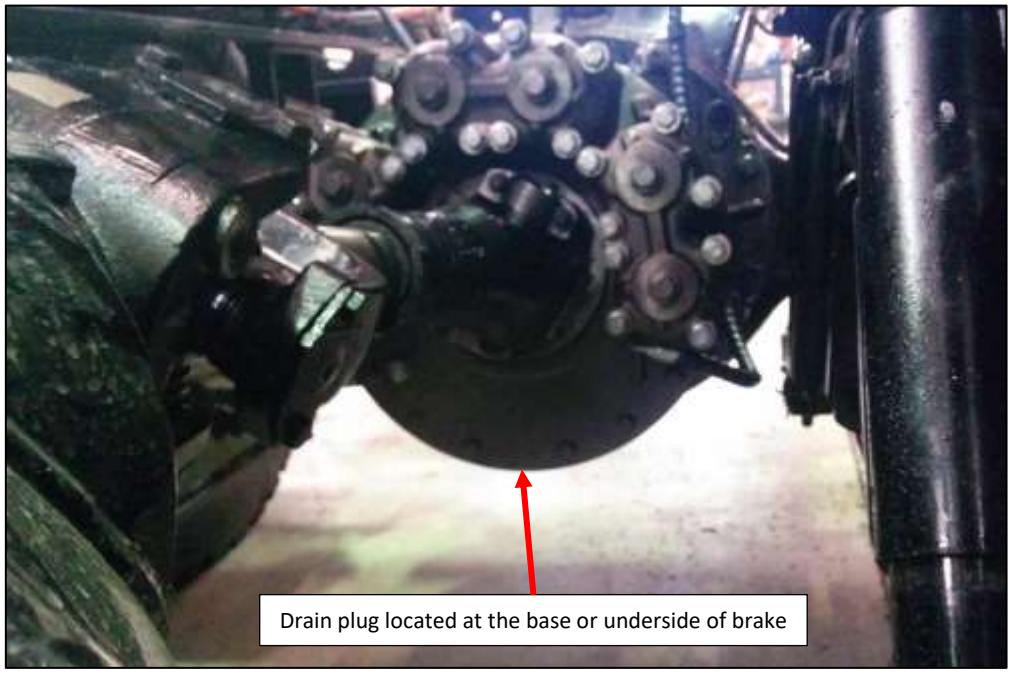

Fig 7: Failsafe Emergency brake drain plug (HV19 shown).

4. At least 600 ml of ABT™ Failsafe brake cooling fluid should be found in the brake. Check for leaks if this amount is not found.
5. The cooling fluid should drain freely from the brake. If it comes out in a "glug, glug" fashion ensure there is no blockage in the breather line.
6. Dispose of used ABT™ "Blend 20" cooling fluid responsibly in accordance with regulatory and environmental legislation.
7. Refit the drain plug with a new sealing washer.

8. Refill the brake up to the level plug (fill to spill). Approximately 800 ml of ABT™ "Blend 20" cooling fluid is required.

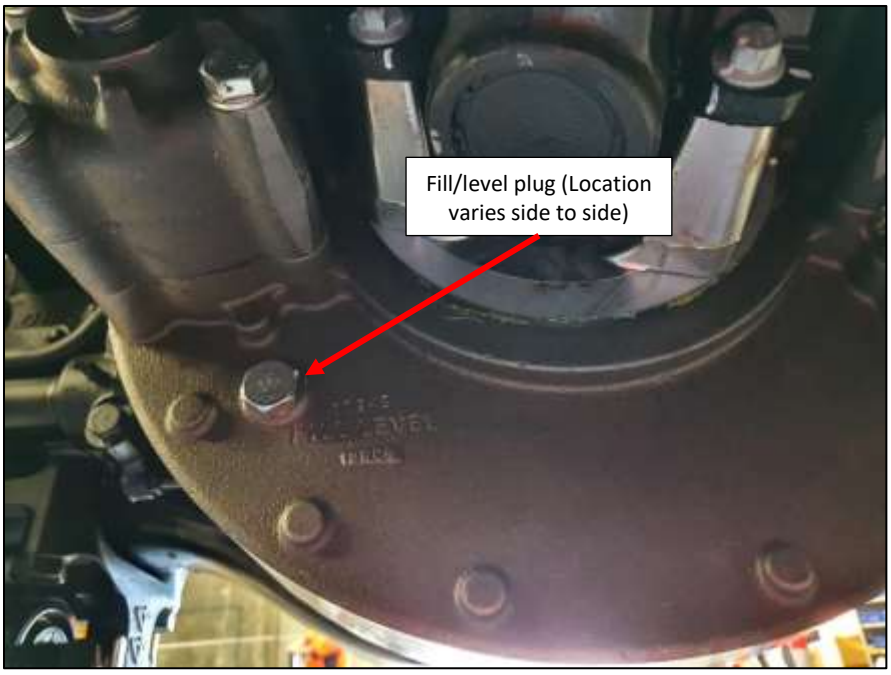

Fig 8: Failsafe Emergency brake fill/level plug (HV19 shown).

9. Conduct a pre-start check.

8. Failsafe Brake Pad Wear Check

1. This check is required every 100 working hours or 5,000 km.
2. Tools required:
    - 19mm socket/spanner (for pad wear indicator cap)

WARNING:	
	This work must be carried out on a level surface and with the vehicle secured appropriately to prevent any unintended vehicle movement.

3. Apply the ABT™ Failsafe EM driveline brake.
4. Remove the protective cap on the pad wear indicator (see Fig 1, 2 & 9).
5. The plunger should project out from the gland fitting (see Fig 9).
6. The distance the plunger projects shows the remaining brake pad wear available. (New pads = 2mm approx.).
7. Refit the protective cap and sealing washer.

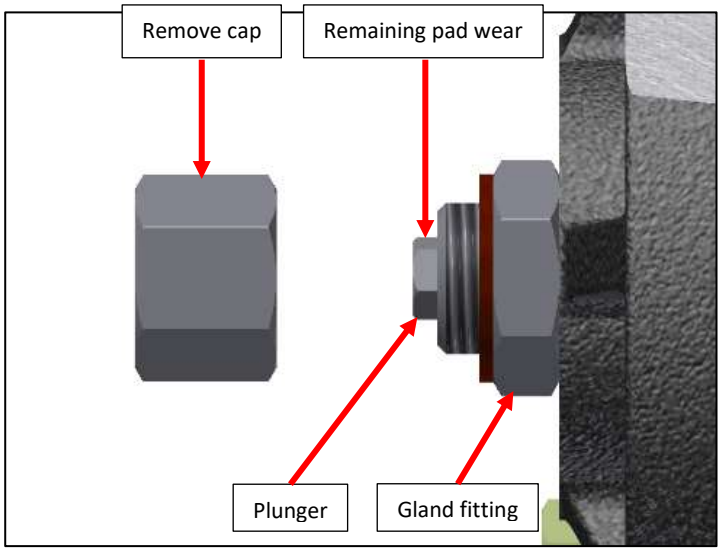

Fig 9: Rear pad wear indicator schematic.

8. If the brake pads have worn beyond the wear limit, then a major service must be completed.

9. About this Booklet and ABT™

This manual applies to the fourth generation ABT™ Failsafe. The manual details how to operate the ABT™ Failsafe system correctly to ensure optimum safety and performance. All information contained in this manual is based on the latest ABT™ Failsafe product information available at the time of publication.

While every effort has been made to address all aspects of operation, 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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