ABT

ADVANCED BRAKING TECHNOLOGY

FAILSAFE WORKSHOP MANUAL

TOYOTA HILUX

1. Revision History

Revision	Issue Date	Author	Comments
1	24 Jun 2015	J. Leighton	Initial Release
2	29 Jul 2015	J. Leighton	Sections 5, 7, 8, 10, 11, 13 and 17 added. Sections 12, 14, 15, 16 and 19 updated.
3	29 Nov 2018	M. Cornelius	Added sections 19-27. Updated sections 16-18, 28

2. Table of Contents

3. Important Information

This manual applies to the fourth generation ABT™ Failsafe for the Toyota HiLux. The manual details how to install 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.

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

Street Address: Advanced Braking Pty Ltd
19 Creative Street
Wangara WA 6065
AUSTRALIA

Postal address: 19 Creative Street
Wangara WA 6065
AUSTRALIA

E-mail: sales@advancedbraking.com

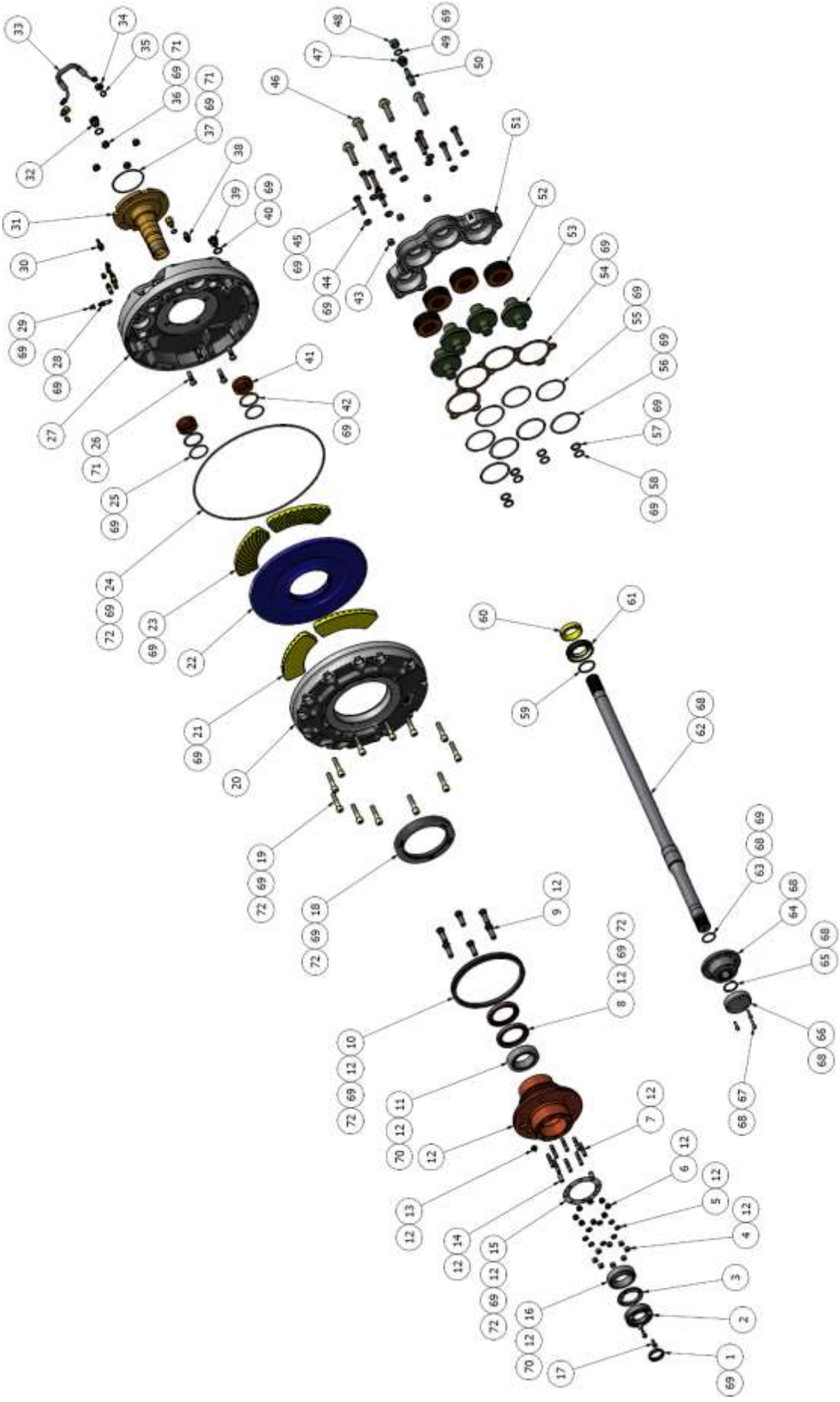
Website: www.advancedbraking.com

Phone: +61 (08) 9302 1922

4. Terminology

ABS	Anti-lock braking system
ATF	Automatic transmission fluid
DPS	Door proximity system
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™ "Blend 20"	Specially formulated cooling fluid for use in ABT™ Failsafe and Failsafe Emergency brakes

5. Exploded Views & Parts Lists - Rear Brake Assembly

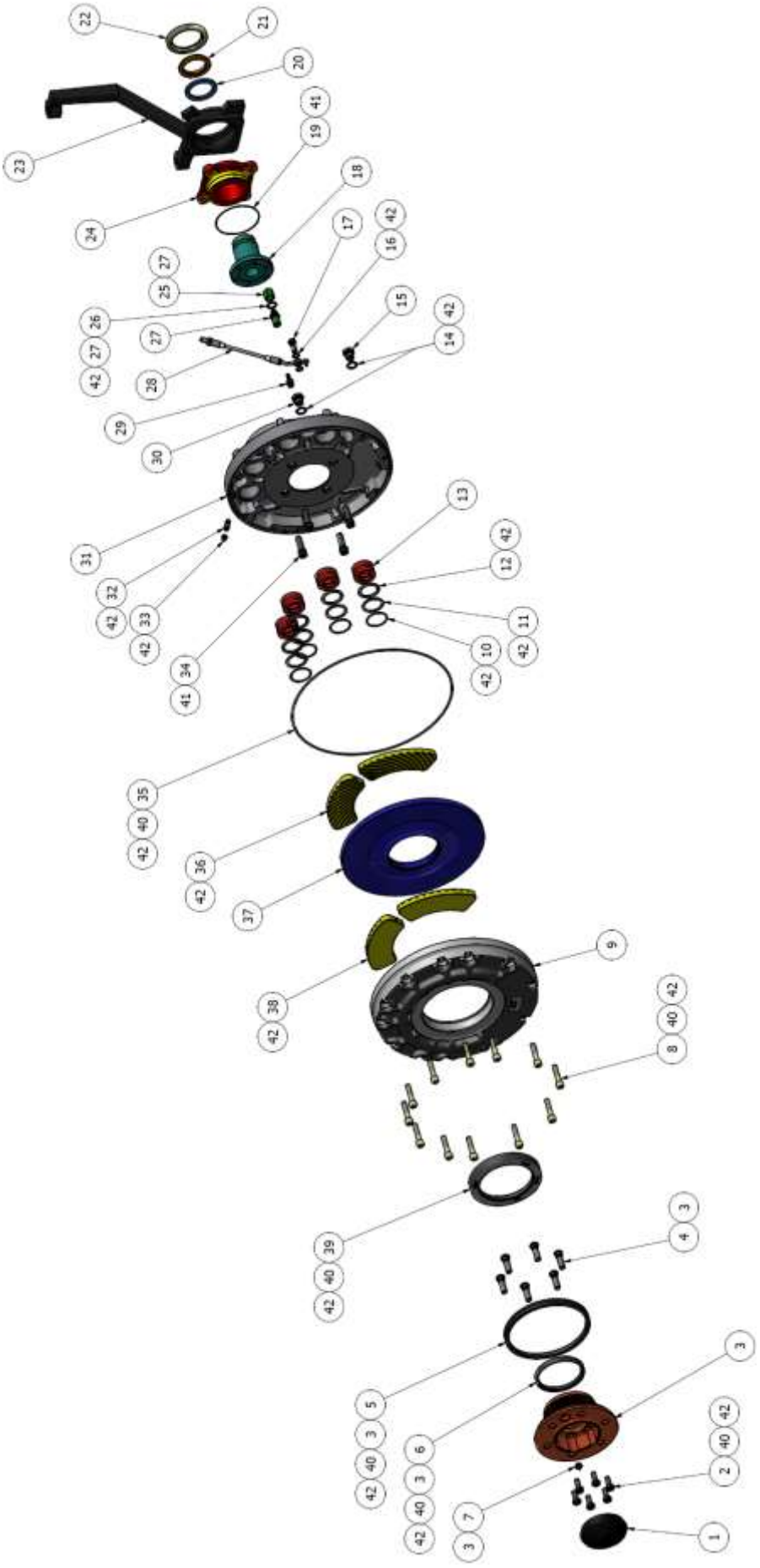


ITEM	PART NO.	DESCRIPTION	QTY/KIT (2 BRAKES)	TORQUE (Nm)
1	25-9010	SEAL OIL REAR AXLE	2	-
2	25-9008	NUT LOCK REAR HUB	2	60
3	25-9007	PLATE REAR AXLE LOCK NUT	2	-
4	25-9006	NUT DRIVE STUD	16	35
5	25-9004	WASHER DRIVE STUD	16	-
6	25-9005	WASHER CONE DRIVE STUD	16	-
7	25-9003	STUD DRIVE AXLE	16	65
8	31-4001	SEAL HUB	4	-
9	45-2011	STUD WHEEL	12	-
10	31-4000	SEAL V-LIP	2	-
11	31-6001	BEARING WHEEL INNER	2	-
12	45-4004	HUB ASSEMBLY REAR	2	-
13	31-5008	NIPPLE GREASE	2	10
14	30-3000	PIN DOWEL	4	-
15	45-2006	GASKET REAR AXLE - HUB	2	-
16	31-6000	BEARING WHEEL OUTER	2	-
17	25-9009	SCREW LOCK NUT	4	5
18	25-2049	SEAL CASSETTE HOUSING	2	-
19	30-0003	BOLT HOUSING	24	50
20	45-2000	HOUSING OUTER REAR LH	1	-
	45-2001	HOUSING OUTER REAR RH	1	-
21	24-2860	BRAKE PAD - ACW	4	-
22	25-2000	ROTOR	2	-
23	24-2850	BRAKE PAD – CW	4	-
24	31-2006	O-RING HOUSING	2	-
25	31-2005	O-RING SERVICE WIPER REAR	4	-
26	45-9000	STUD MOUNTING REAR BRAKE	8	-

27	45-5009	HOUSING INNER REAR LH W/PINS	1	-
	45-5010	HOUSING INNER REAR RH W/PINS	1	-
28	31-5001	BLEED NIPPLE	8	15
29	31-9000	CAP BLEED NIPPLE	8	-
30	31-5025	CONNECTOR HOSE BREATHER	2	15
31	45-2005	SPINDLE REAR AXLE	2	-
32	25-2038	FILL PLUG	2	20
33	25-4025	LINK HOSE SERVICE BRAKE	2	15
34	31-5026	CONNECTOR PIPE SERVICE BRAKE	6	20
35	30-2004	WASHER SEALING COPPER	6	-
36	45-9001	NUT MOUNTING REAR BRAKE	8	70
37	45-9003	O-RING SPINDLE REAR AXLE	2	-
38	31-5000	CONNECTOR HOSE EMMA	2	20
39	25-2039	DRAIN PLUG	2	20
40	30-2003	WASHER SEALING COPPER	4	-
41	25-2025	PISTON SERVICE REAR	4	-
42	31-2004	O-RING SERVICE PRIMARY REAR	4	-
43	31-5004	PLUG SPRING COVER	6	-
44	30-2000	WASHER SPRING COVER	20	-
45	30-0001	BOLT SPRING COVER	20	60
46	30-0028	RETRACTOR BOLT	8	80
47	25-2041	GLAND PAD WEAR INDICATOR	2	15
48	25-2042	CAP PAD WEAR INDICATOR	2	10
49	30-2005	WASHER SEALING PAD WEAR INDICATOR	2	-
50	25-2040	PLUNGER PAD WEAR INDICATOR	2	15
51	25-2008	SPRING COVER LH	1	-
	25-2009	SPRING COVER RH	1	-
52	31-0002	DISC SPRING	48	-
53	25-2006	PISTON EMMA	8	-

54	25-2061	GASKET SPRING COVER	2	-
55	31-2003	BACK-UP RING EMMA LARGE	8	-
56	31-2002	O-RING EMMA LARGE	8	-
57	31-2000	O-RING EMMA SMALL	8	-
58	31-2001	BACK-UP RING EMMA SMALL	8	-
59	45-9004	SNAP RING	2	-
60	45-9005	RETAINER ROTOR ABS	2	-
61	45-9006	ROTOR ABS	2	-
62	45-2007	SHAFT AXLE REAR	2	-
63	31-2013	O-RING SHAFT AXLE	2	-
64	45-2008	DRIVE FLANGE REAR AXLE	2	-
65	31-3000	CIRCLIP REAR AXLE	2	-
66	45-2009	CAP HUB REAR AXLE	2	-
67	30-0015	BOLT CAP HUB REAR AXLE	6	5
68	45-4005	SHAFT AXLE ASSEMBLY REAR	2	-
69	45-5006	KIT SERVICE REAR SET SIBS 4	1	-
70	25-5004	KIT WHEEL BEARING PAIR	1	-
71	45-5007	KIT MOUNTING REAR SET SIBS 4	1	-
72	45-5008	KIT INSPECTION BRAKE PAIR	1	-

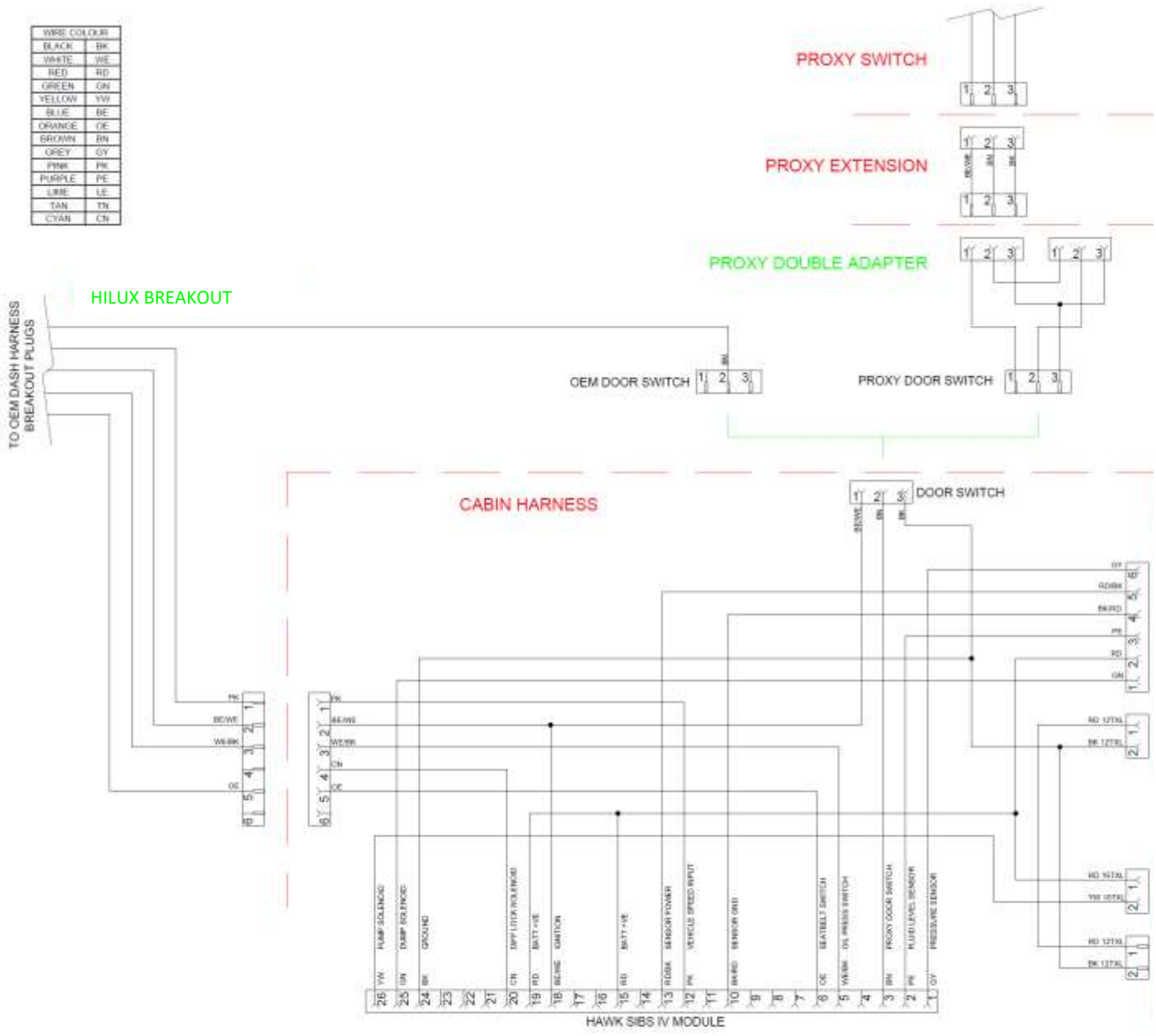
6. Exploded Views & Parts Lists - Front Brake Assembly

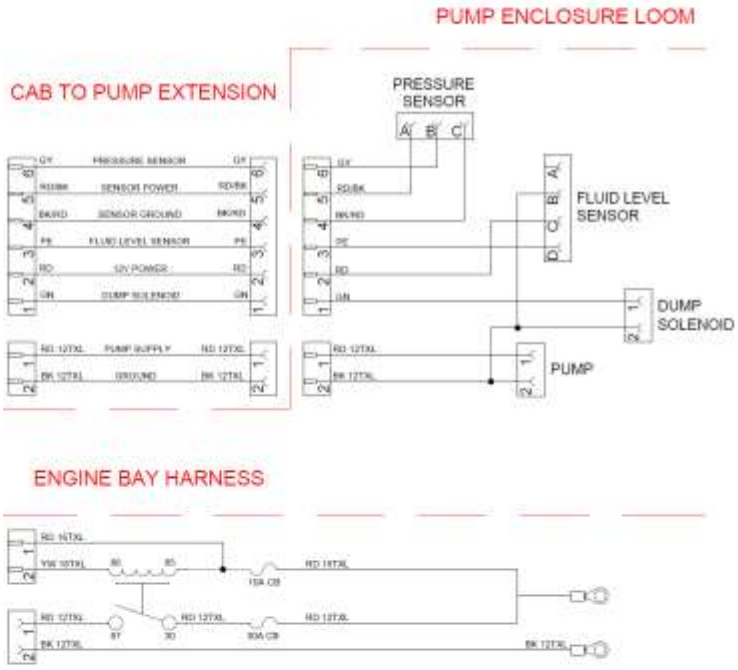


ITEM	PART NO.	DESCRIPTION	QTY/KIT (2 BRAKES)	TORQUE (Nm)
1	45-9014	CAP FRONT AXLE	2	-
2	30-0018	BOLT COUPLING MOUNT	12	55 – 60
3	45-4010	COUPLING SPLINED FRONT ASSEMBLY	2	-
4	45-2011	STUD WHEEL	12	-
5	31-4008	SEAL V-LIP OUTER	2	-
6	31-4009	SEAL V-LIP INNER	2	-
7	31-5008	NIPPLE GREASE	2	10
8	30-0014	BOLT HOUSING	24	50
9	45-2019	HOUSING OUTER FRONT LH	1	-
	45-2020	HOUSING OUTER FRONT RH	1	-
10	31-2010	O-RING WIPER SERVICE FRONT	8	-
11	31-2009	BACK-UP RING SERVICE FRONT	8	-
12	31-2008	O-RING PRIMARY SERVICE FRONT	8	-
13	25-2024	PISTON SERVICE FRONT	8	-
14	30-2003	WASHER SEALING COPPER	4	-
15	25-2039	DRAIN PLUG	2	20
16	30-2004	WASHER SEALING COPPER	4	-
17	31-5009	BOLT BANJO	2	20
18	45-2014	HUB FRONT	2	-
19	31-2017	O-RING INNER HOUSING	2	-
20	45-9010	ROTOR ABS FRONT	2	-
21	45-9011	SPACER FRONT AXLE BEARING	2	-
22	45-9013	DUST SEAL FRONT AXLE HUB	2	-
23	45-2015	KNUCKLE FRONT ABS LH MODIFIED	1	-
	45-2016	KNUCKLE FRONT ABS RH MODIFIED	1	-
24	45-2017	BEARING FRONT KNUCKLE MODIFIED	2	-
25	25-2055	CAP PAD WEAR INDICATOR	2	10

26	30-2005	WASHER SEALING PAD WEAR INDICATOR	2	-
27	25-4028	PAD WEAR INDICATOR ASSEMBLY FRONT	2	15
28	25-4026	BRAKE HOSE FRONT	2	20
29	31-5025	CONNECTOR HOSE BREATHER	2	10
30	25-2038	FILL PLUG	2	20
31	45-5003	HOUSING INNER FRONT LH W/PINS	1	-
	45-5004	HOUSING INNER FRONT RH W/PINS	1	-
32	31-5001	BLEED NIPPLE	2	15
33	31-9000	CAP BLEED NIPPLE	2	-
34	45-2018	BOLT MOUNTING FRONT BRAKE	8	135
35	31-2006	O-RING HOUSING	2	-
36	24-2860	BRAKE PAD - ACW	4	-
37	25-2000	ROTOR	2	-
38	24-2850	BRAKE PAD – CW	4	-
39	25-2049	SEAL CASSETTE HOUSING	2	-
40	45-5005	KIT INSPECTION BRAKE PAIR FRONT	1	-
41	45-5002	KIT MOUNTING FRONT SET SIBS 4	1	-
42	45-5000	KIT SERVICE FRONT SET SIBS 4	1	-

7. Wiring Diagram




PUMP ENCLOSURE LOOM
CAB TO PUMP EXTENSION
PRESSURE SENSOR
A
B
C
FLUID LEVEL SENSOR
DUMP SOLENOID
PUMP
ENGINE BAY HARNESS

8. Installation – Rear Brakes

1. Ensure all OEM Toyota rear brake equipment has been removed from the vehicle:
   a. Remove both rear brake assemblies.
   b. Remove the two hydraulic brake lines across the rear axle.
   c. Remove the handbrake lever and handbrake cable.
2. Clean the axle flange to remove any grease, dirt and oil. If the flange is damaged or corroded it must be cleaned thoroughly with abrasive paper.

Figure 1: Prepare axle flange.

3. Fit a new O-ring seal to the axle flange

Figure 2: Fit new O-ring seal to axle flange.

4. Inspect the oil seal inside the axle tube for signs of damage or wear. Replace if required.

5. Fit the circlip into the groove in the axle shaft.

6. Assemble the ABS pulse wheel and collar onto the axle shafts. The trigger wheel should be pressed up to the circlip.

Figure 3: Fit ABS pulse wheel to axle.

Figure 4: Press ABS pulse wheel up to circlip.

7. Insert the axle shaft into the axle tube taking care not to damage the internal oil seal. Ensure that the shaft is engaged fully within the differential spider gear and that the ABS trigger wheel runs correctly in line with the sensor

8. Using a suitable lifting hoist, remove the ABT™ Failsafe wheel-end assembly from its packaging.

9. 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

10. Remove the 4x brake mounting nuts and washers.

11. Fit the ABT™ Failsafe brake unit over the stub axle. Align the mounting holes and locate the housing evenly and firmly against the axle flange.

Figure 5: Carefully fit brake assembly over stub axle.

12. Fit the 4x brake mounting nuts that were previously removed.

13. Torque the brake mounting nuts to 70 Nm in a diagonal pattern. Repeat this procedure twice.

Figure 6: Torque brake mounting bolts.

14. Fit the axial compression O-ring to the groove located inboard of the half shaft spline.

Figure 7: Fit O-ring to groove on axle shaft.

15. Fit a new gasket to the wheel bearing end cap.

16. Fit the axle drive flange to the spline at the outer end of the axle half shaft and fit the retaining circlip. An M8 bolt may be screwed into the end of the axle and pulled to preload the O-ring whilst the circlip is fitted.

17. Fit the tapered collets, spring washers and M8 retaining nuts; torque to 33 Nm.

Figure 8: Fit the axle drive flange.

18. Fit the hub cap and secure with 3x screws; torque to 5 Nm.

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

20. Fit the pad wear indicator to the lowest piston:

    a. Screw the pad wear indicator piston into the lowest piston thread and torque to 10 Nm.

    b. Fit the stainless steel gland fitting over the piston and screw this into the spring cover.

    c. Fit the stainless steel protective cover and fibre washer to the gland fitting.

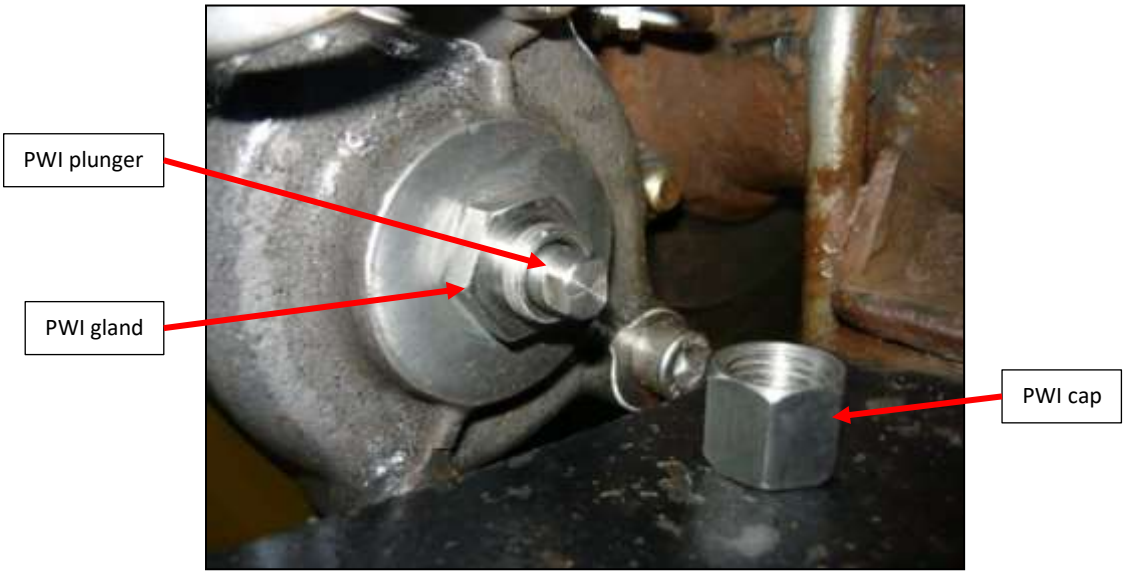


Figure 9: Pad wear indicator install in spring cover.

21. Fit 3x supplied tapered plugs to seal the remaining holes in the spring cover. The hex sockets may be filled with silicon to aid future removal.

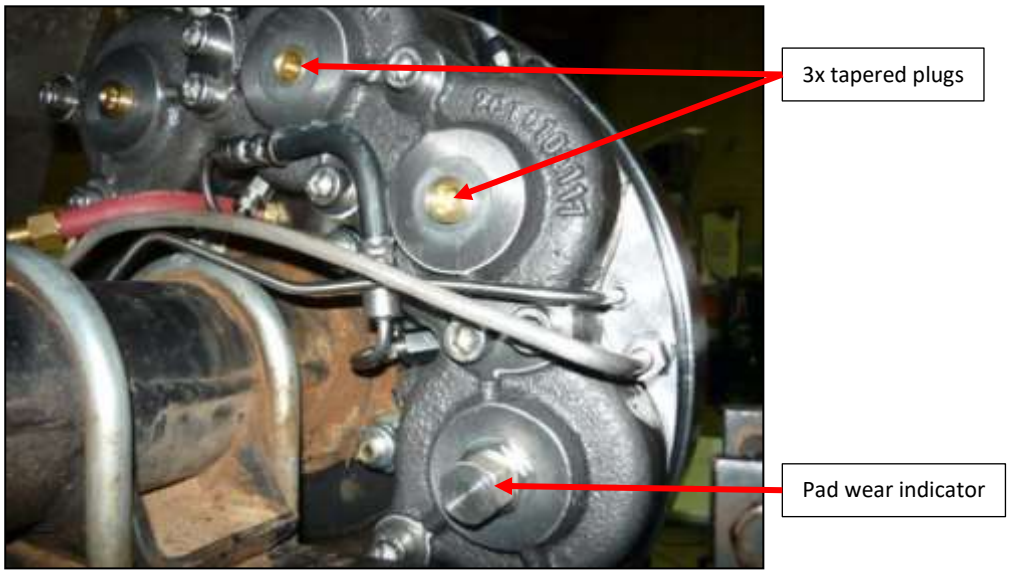


Figure 10: ABT™ Failsafe brake unit.

22. Remove the ABT™ “Blend 20” cooling fluid fill plug.

23. Fill the ABT™ Failsafe brake unit with new ABT™ “Blend 20” cooling fluid and refit the fill plug with a new copper washer. Approximately 1 litre of ABT™ “Blend 20” cooling fluid is required per brake unit.

24. Repeat for the opposing brake unit.

25. Fit the expansion chambers:

    a. There is one expansion chamber per brake unit.

    b. Mount the expansion chambers as high as possible in a protected location on the vehicle. ABT recommends mounting between the cab and the tray.

    c. Secure using the supplied mounting hardware.

26. Run lengths of breather hose between the expansion chambers and their corresponding brake units.

    a. Route the breather hose from the brake units, along the axle to the diff centre, up to the tray and then forward to the back of the cab.

    b. Route the hose away from the exhaust and any moving components. Allow extra length for axle articulation.

    c. Protect areas of the hose that may abrade using spiral guard.

    d. Ensure ABT™ “Blend 20” fluid can easily drain back into the brake units.

    e. Secure the hose using supplied P-clips.

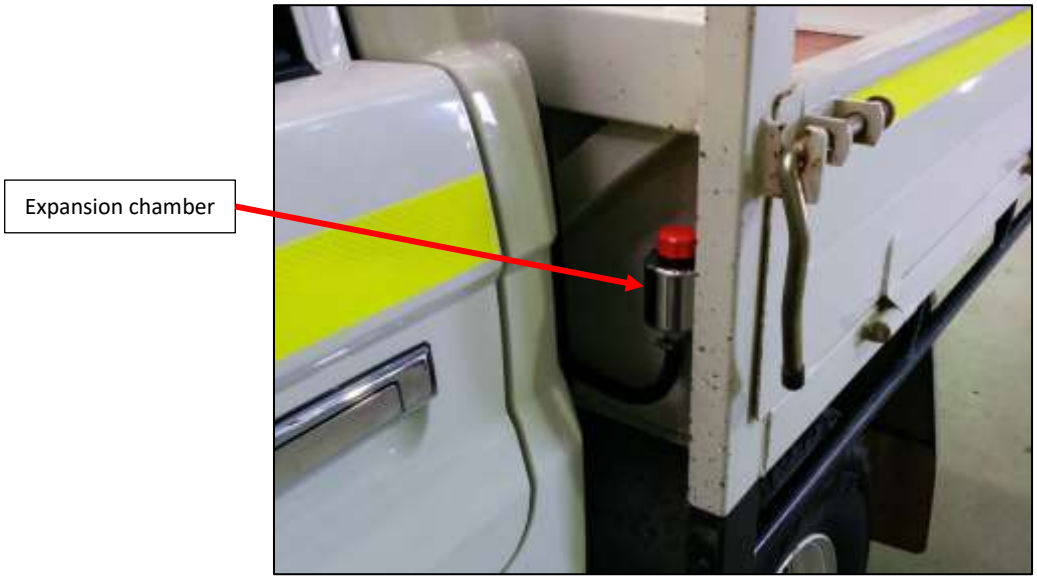


Figure 11: Expansion chamber mounted between cab and tray.

Figure 12: Expansion chamber.

9. Installation – Front Brakes

1. Ensure all OEM Toyota front brake equipment has been removed from the vehicle:
   a. Remove the front ABS sensors.
   b. Remove the front brake assemblies.
   c. Remove the front steering knuckles.

Figure 13: Remove OEM front brake equipment.

2. Each brake unit is stamped with its corresponding position on the vehicle and must be installed accordingly.
   a. FLH = Front Left Hand
   b. FRH = Front Right Hand

Figure 14: Identify correct brake unit to be fitted.

3. Install the suspension upper arm and secure with the nut; torque to 110 Nm and lock using the cotter pin.

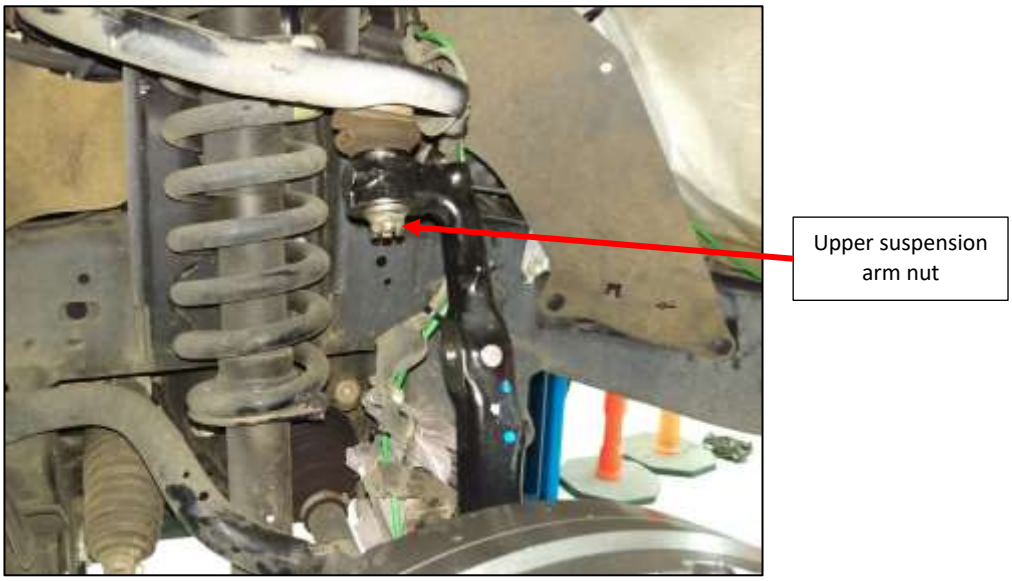


Figure 15: Install suspension upper arm.

4. Slide the axle into the housing ensuring the splines are properly aligned and engaged.

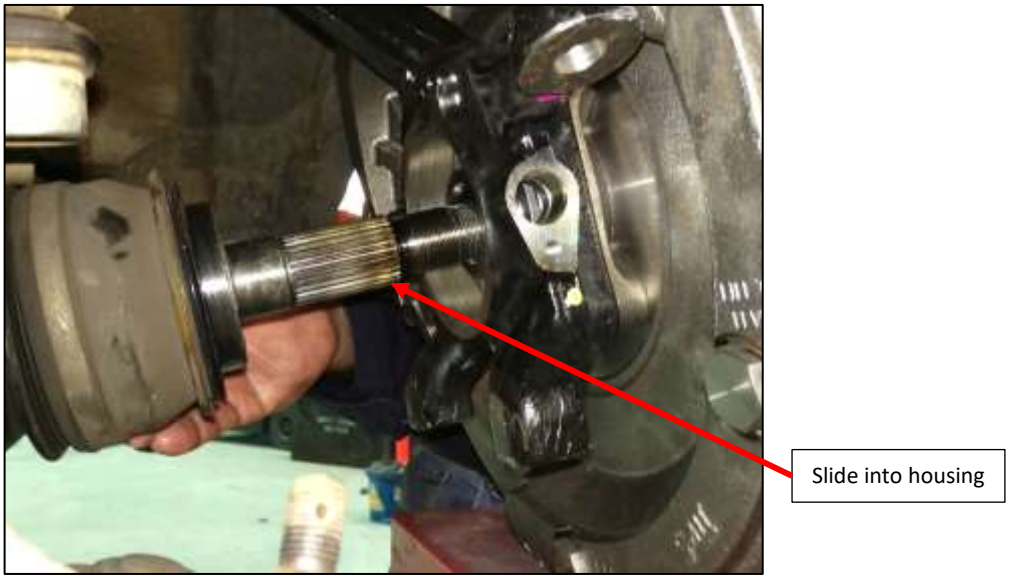


Figure 16: Slide axle into housing.

5. Install the suspension lower arm and secure with 2x bolts; torque to 160 Nm and lock using the cotter pins.

Figure 17: Install suspension low arm.

6. Install the tie rod end and secure with the nut; torque to 91 Nm and lock using the cotter pin.

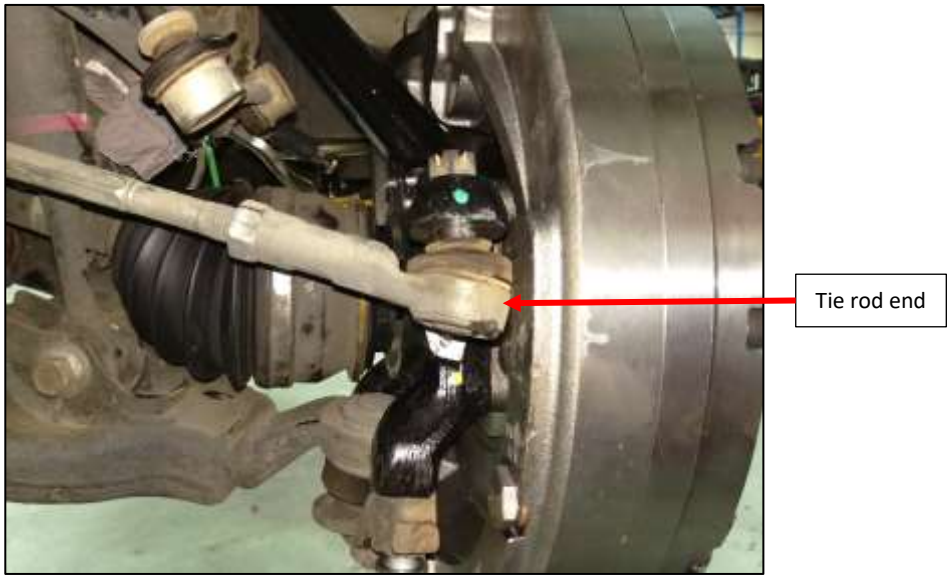


Figure 18: Install tie rod end.

7. Install the front stabiliser link and secure with the nut; torque to 70 Nm.

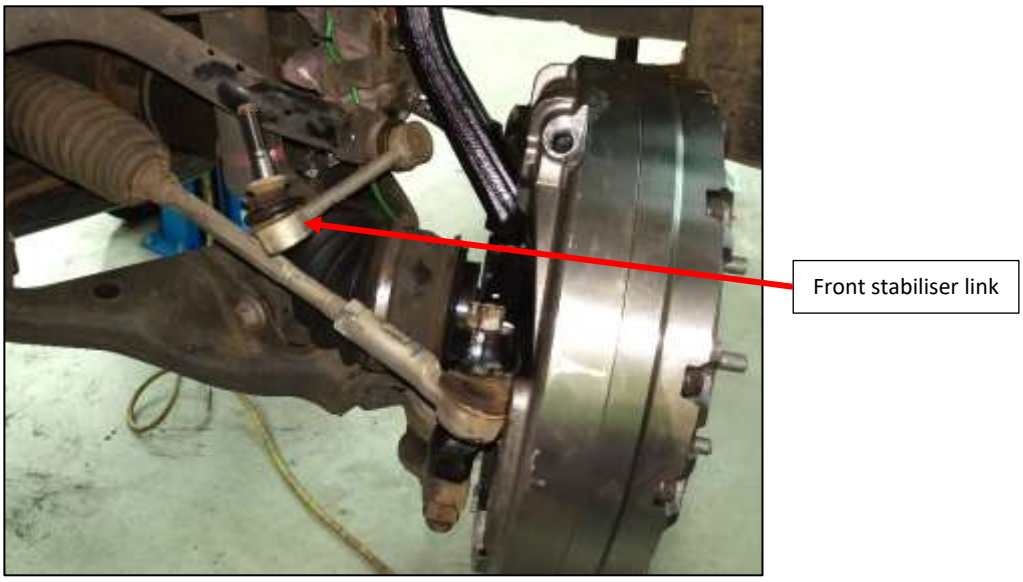


Figure 19: Install front stabliser link.

8. Install the hub nut; torque to 235 Nm.

9. Install the adjusting cap and lock using the cotter pin.

Figure 20: Install hub nut and adjusting cap.

10. Install the front axle hub grease cap.

11. Connect the upgraded hydraulic hoses to the original mounting points and to the ABT™ Failsafe front brake using the new banjo bolts and sealing washers provided; torque to 20 Nm.

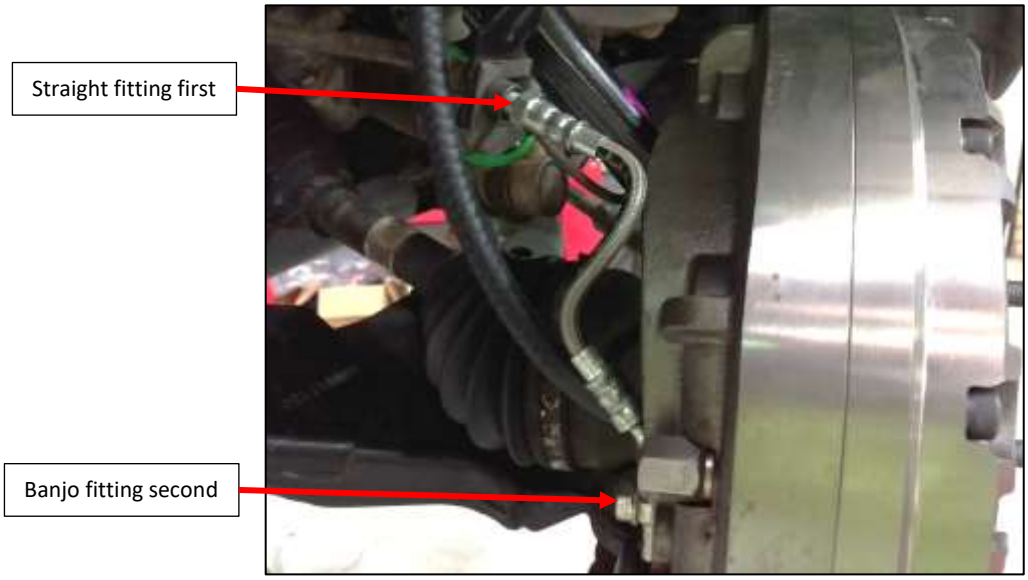


Figure 21: Install upgraded brake hoses.

12. Install the ABS sensor and secure using the bolt; torque to 10 Nm.

13. Connect the 2x clamps; torque to 8 Nm.

14. Install the speed sensor wire harness to the steering knuckle with the bolt; torque to 13 Nm.

Figure 22: Install ABS sensor.

15. 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.

Figure 23: Grease V-seal cavity.

16. Remove the ABT™ “Blend 20” cooling fluid fill plug.

17. Fill the ABT™ Failsafe brake unit with new ABT™ “Blend 20” cooling fluid and refit the fill plug with a new copper washer. Approximately 1 litre of ABT™ “Blend 20” cooling fluid is required per brake unit.

18. Repeat for the opposing wheel-end.

19. Mount the expansion chambers above the wheel-ends at suitable locations within the engine bay.

20. Run a length of breather hose from the bottom barb of the expansion chambers down to the barb fitting on each brake unit. Ensure there are no bends or kinks. Ensure the wheel can turn from lock to lock without any interference.

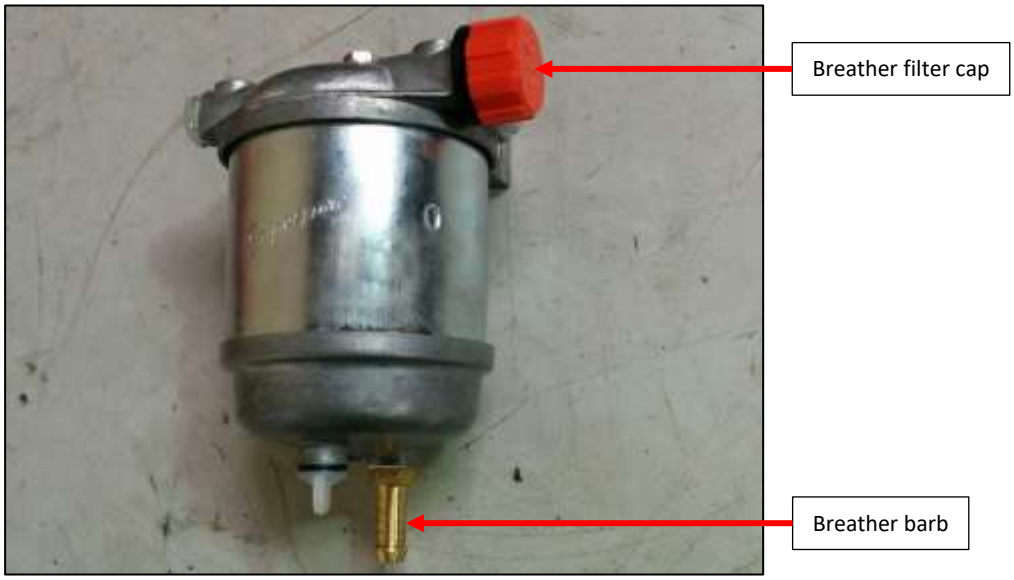


Figure 24: Mount the expansion chamber in the engine bay.

Figure 25: Breather barb on inner housing.

10. Installation – Hydraulic System

1. Mount the ABT™ Failsafe pump enclosure in a suitable location on the vehicle.
   a. On single-cabs mount the pump behind the driver's seat using the supplied bracket.
   b. On dual-cabs mount the pump under the tray behind the rear right wheel using the supplied bracket.
   c. Drill the vehicle body as required and mount the ABT™ Failsafe pump using provided mounting hardware.

Figure 26: ABT™ Failsafe pump enclosure.

2. Mount the park/emergency brake tee-union on the top of the rear differential.
3. Connect one end of the park/emergency brake hydraulic hose to the bulkhead fitting at the rear of the pump enclosure.
4. Route the other end of the hydraulic hose down to the tee-union on the rear axle and connect. Secure the hose along the chassis using supplied P-clips.

5. Fit the rear RH service brake line.

    a. Connect one end of the RH service brake line to the rear axle tee-union and the other end to the inlet on the RH brake unit.

    b. Secure the brake line using the OEM P-clip.

6. Fit the rear RH park/emergency brake hydraulic hose.

    a. Connect one end of the RH park/emergency brake hydraulic hose to the tee-union on the rear axle.

    b. Connect the other end to the inlet on the RH brake unit.

Figure 27: Brake lines routed to rear RH brake unit (facing front of vehicle).

7. Fit the rear LH service brake line.
    a. Connect one end of the LH service brake line to the rear axle tee-union and the other end to the inlet on the LH brake unit.
    b. Secure the brake line using the OEM P-clips.
8. Fit the rear LH park/emergency brake hydraulic hose.
    a. Connect one end of the LH park/emergency brake hydraulic hose to the tee-union on the rear axle.
    b. Route the hydraulic hose across the rear axle and connect to the inlet on the LH brake unit.
    c. Use the supplied bracket to route the hose around the damper.
    d. Secure the hydraulic hose along the rear axle using P-clips. Ensure the hose will not contact any moving suspension components.

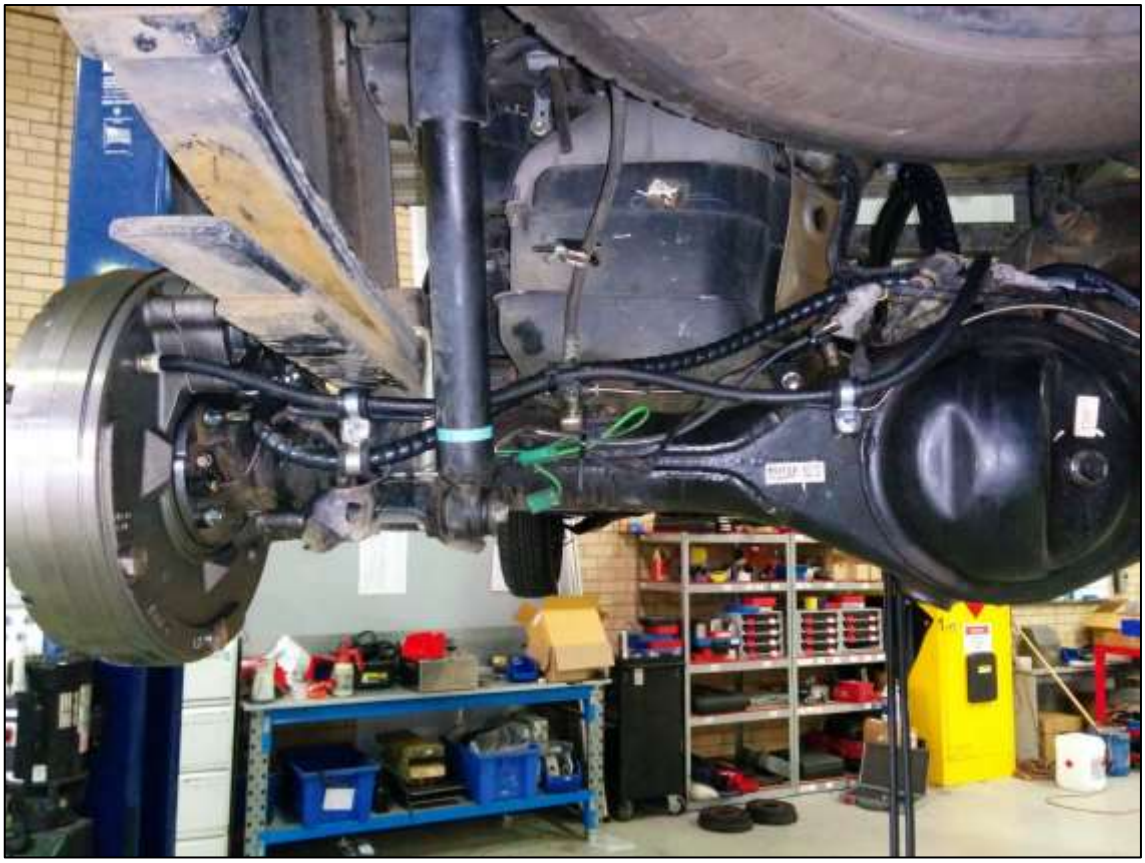


Figure 28: Brake lines routed to rear LH brake unit (facing front of vehicle).

11. Installation – Electrical System

1. Isolate the vehicle battery.
2. Do not test the control system functions until the system is fully installed as this may confuse the control unit while learning – details on control unit setup can be found in section 13.
3. Mount the control unit to the dash:
    a. Remove the vehicle radio.
    b. Mount the ABT™ Failsafe control unit on the dash using the provided bracket. Position so that bracket is central on the dash and aligned with the vehicle axis. 4x holes will need to be drilled.
    c. For LH drive vehicles the control unit bracket can be reversed so that it is always facing the vehicle operator.

Figure 29: ABT™ Failsafe control unit mounted on dash.

4. Fit the ABT™ Failsafe cabin harness:
    a. Remove the glove box, seats and vinyl floor mats.
    b. Connect cabin harness branch to the rear of the control unit by passing up through the dash. A hole will need to be drilled in the dash to achieve this.
    c. Route the harness down behind the dash to the passenger side of the transmission tunnel.
    d. Route the cabin harness along the transmission tunnel and connect to the pump enclosure. Some vehicles may require an extension harness to reach the pump enclosure, this should be provided with the kit.
    e. Secure the harness where necessary using P-clips.

5. Fit the vehicle interface harness:

   a. Remove the shroud around the instrument cluster by removing the screw at the top.

   b. Remove the vehicle instrument cluster by removing 3x retaining screws and disconnecting 2x multi-plugs at the rear.

Figure 30: Instrument cluster retaining screws.

   c. Connect the Deutsch end of the vehicle interface harness to the 6 pin connector on the ABT™ Failsafe cabin harness located behind the radio.

   d. Route the harness toward the cavity at the rear of the instrument cluster.

   e. Identify the 40-pin connector protruding from the top left side of the instrument cluster.

Figure 31: Instrument cluster multi-plug.

f. Connect the vehicle interface harness between the white 40-pin connector and the connector and the rear of the instrument cluster.

Figure 32: Connect the vehicle interface harness between the instrument cluster and 40-pin white OEM plug.

6. Fit the OEM door harness (optional):

   a. The OEM door harness is part of the vehicle interface harness – simply connect the additional 3-pin Deutsch connector to the ABT™ Failsafe cabin harness behind the radio.

7. Fit the engine bay harness:

   a. Connect the engine bay harness to the 2x 2-pin connectors on the cabin harness located beside the passenger foot well.

   b. Route the engine bay harness through the grommet in the passenger foot well and into the engine bay.

   c. Route the engine bay harness through the engine bay and connect the red wires to the positive battery terminal via the eyelet.

   d. Connect the black wire to a vehicle earth point via the eyelet.

   e. Secure the relay using the vehicle battery bracket.

   f. Secure the harness where necessary using P-clips.

8. Fit the door proximity harness (optional):

   a. Connect the door proxy harness to the 3 pin connector on the cabin harness (the OEM door connector may need to be unplugged first).

   b. Dependent on how many doors have been specified will affect the number of proximity switches included in the harness.

   c. Drill Ø12mm holes in the door pillars to mount the proximity switches. Suggested location is 100mm below the door hinge mounting bolt and 25mm from the edge of the door seal.

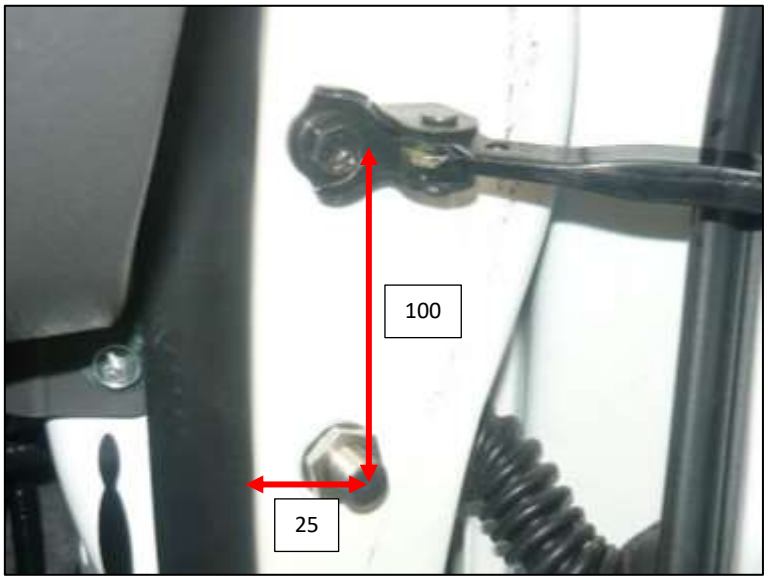


Figure 33: Proximity switch mounting location on A-pillar.

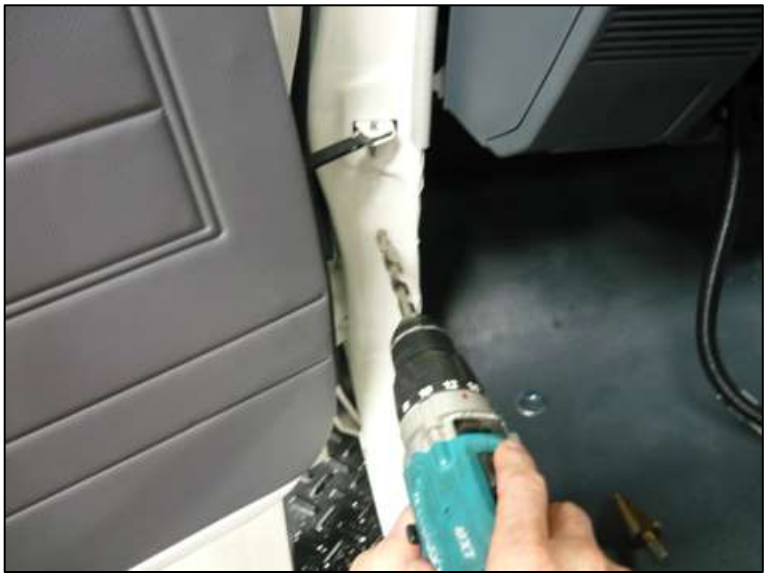


Figure 34: Drill A-pillar to mount proximity switch.

d. Secure the proximity switch to the door pillar such that there is a 1.0 mm gap between the tip of the proximity switch and door frame when the door is closed.

Figure 35: Secure proximity switch with locknuts and route harness.

e. Run the extensions and connect to the proximity switches.

f. For every proximity switch to be added, an additional Y-split harness must be installed.

9. Replace the instrument cluster, radio, glove box, seats, mats and all vehicle trim.

12. Pre-Service Inspection

1. Install wheels and torque all wheel nuts progressively and in sequence to 105 Nm. Ensure each bolt is torqued twice.
2. Top up all reservoirs with the specified fluids.
   a. Use DOT 3 brake fluid for the brake master cylinder (service system).
   b. Use ATF Dexron III for the ABT™ Failsafe pump reservoir (park/emergency system).

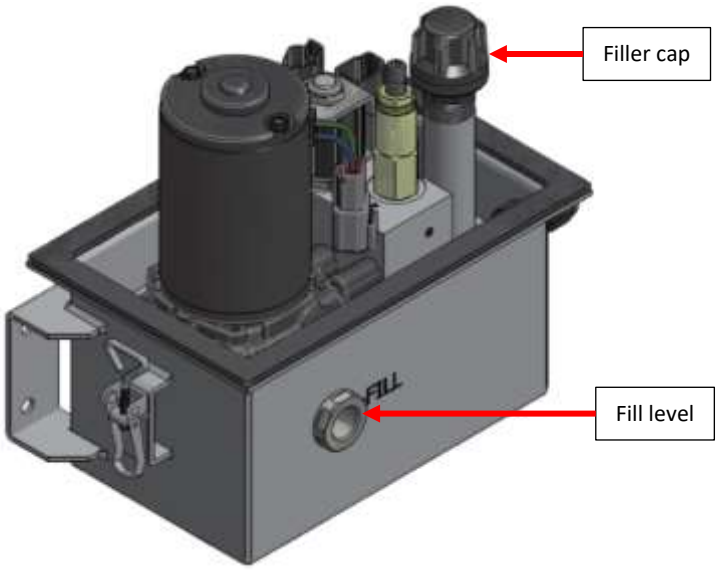


Figure 36: ABT™ Failsafe pump enclosure with lid removed.

3. Ensure the battery is in good condition – this is critical to ensure correct programming of the control unit.
4. Reconnect the vehicle battery to power the vehicle and ABT™ Failsafe system.

5. Bleed the service brake system:

   a. Connect a clear vinyl tube onto the service brake bleed nipple and the other into a clean container of brake fluid.

   b. Slowly pump the brake pedal several times.

   c. While an assistant presses on the brake pedal, loosen the bleed nipple until fluid runs out then close the nipple.

   d. Repeat this process until there are no more air bubbles in the fluid. Ensure the master cylinder reservoir is kept topped up during the procedure.

   e. The service brake system should be bled in the following sequence:

      i. LPSV (this is the highest point apart from the master cylinder in the system).

      ii. 2x bleed nipples on rear left hand brake (wheel end with the longest hydraulic line).

      iii. 2x bleed nipples on rear right hand brake.

      iv. 1x bleed nipple on front left hand brake.

      v. 1x bleed nipple on front right hand brake.

Figure 37: Service brake bleed screws for front brake (left) and rear brake (right).

6. Bleed the park/emergency brake system:
    a. Twist and release the red E-stop button on the control unit.
    b. If the control system detects air in the system on first release, it will enter bleed mode – this is indicated by the brake status light flashing green – system pressure will be limited to 100 psi.
    c. With the E-stop released, thoroughly bleed the brake system by opening and closing the park/emergency system bleed nipples until the fluid runs through clearly with no air bubbles. Ensure the pump reservoir is topped up regularly during the procedure.
    d. Once the system is bled, apply and then release the park/emergency brake again – if the system has been sufficiently bled then the brake status light should be solid green with the brake is released.

Figure 38: Park/emergency brake bleed screws on rear brake.

7. Affix the ABT™ Failsafe caution label to the inside top corner of the windshield on the driver's side.
8. Complete a vehicle pre-start check.
9. If the vehicle is to be used on public roads it will require approval for road use.
    a. New and unregistered vehicles can be fitted with a second stage manufacturer plate.
    b. Used and already registered vehicles can be fitted with an aftermarket modification plate.
    c. Please contact ABT customer service for details regarding ABT™ Failsafe equipped vehicles requiring approval.

13. Controller Setup

1. Ensure the battery is fully charged and in good working condition before connecting the ABT™ Failsafe controller.
2. Activate all connected interlocks and check function:
   a. To activate the door interlock – open and close a vehicle door.
   b. To activate the seat belt interlock – connect and disconnect the driver's seatbelt.
   c. To activate the stall interlock – switch the ignition off, wait for 5 seconds, then start the engine, run for 10 seconds and then switch the engine off again.
   d. The corresponding warning light on the control unit should display when each interlock is activated (note: interlock warning lights are only displayed when ignition is on).
3. Set the HSI speed threshold:
   a. After releasing the brake for the first time the green HSI light will begin flashing – this indicates the HSI speed threshold needs to be set.
   b. The HSI system overrides the door, stall and seatbelt interlocks when the vehicle is travelling at speeds above the HSI threshold – this is designed to prevent unintended brake application at high speeds.
   c. Start the engine, release the brakes and accelerate the vehicle up to the desired HSI threshold speed (ABT recommends 40 km/h).
   d. While maintaining this speed, press and hold the grey button on the control unit for 3 seconds – the control unit will beep twice to confirm the speed has been accepted.
   e. If HSI is not required, simply complete the above procedure with the vehicle is stationary.

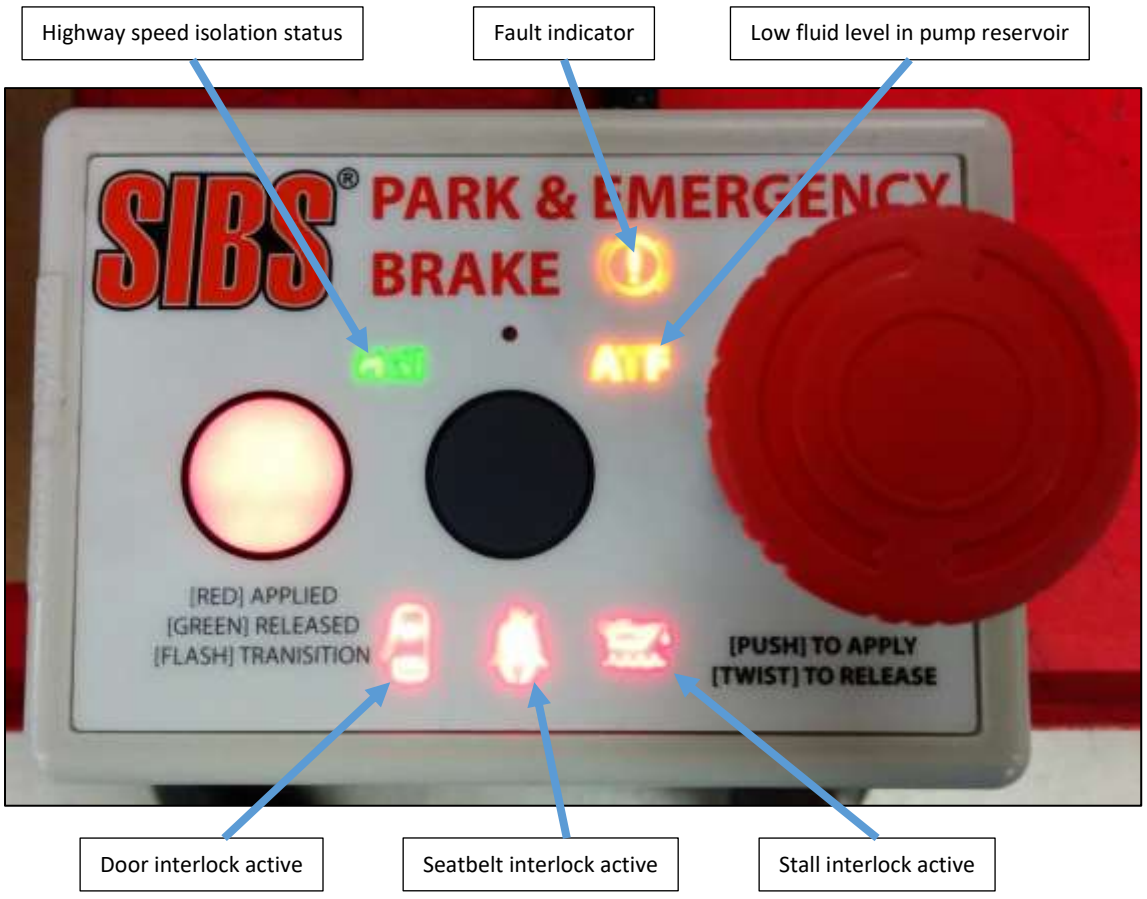


Figure 39: ABT™ Failsafe control unit warning lights

14. Service Schedule

The following table shows the recommended service intervals for ABT™ Failsafe brake systems 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.

	Frequency
Pre-Start Check	Daily
Minor Service	Monthly or every 5,000 km (whichever occurs first)
Major Service: Rear	When rear brake pad wear reaches minimum or every 2 years (whichever occurs first)
Major Service: Front	When front brake pad wear reaches minimum or every 2 years (whichever occurs first)

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 ABT™ “Blend 20” cooling fluid in the wheel-ends.

The major service is conducted to replace worn brake pads and as a preventative maintenance activity to ensure continued reliable operation of the ABT™ Failsafe brake. During the major service new seals are fitted throughout the brake and any worn components are replaced.

15. 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 ABT™ Failsafe 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 ABT™ Failsafe 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:
    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. Drive the vehicle at 10 km/h. Press the E-Stop button. The vehicle must stop within 5 metres or within 3 seconds.

16. Minor Service

1. Check brake units for leaks.
2. Check ABT™ Failsafe pump for leaks.
3. Check hydraulic lines for leaks or damage.
4. Check the breather hose for cracks or damage.
5. Check the expansion chamber filler breather caps are clear.
6. Check all electrical connectors and wiring for damage.
7. 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.

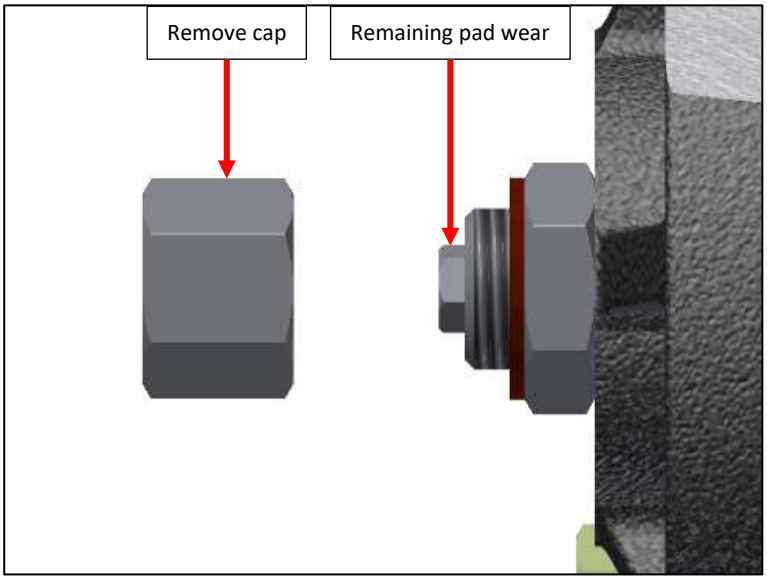


Figure 40: Rear pad wear indicator schematic.

8. Check front brake pad wear (if applicable):
    a. Apply the service brake.
    b. Remove the protective cap on the pad wear indicator.
    c. Push the plunger into the brake until it stops.
    d. The plunger should project out of the gland fitting.
    e. The distance the plunger projects shows the remaining brake pad wear available.

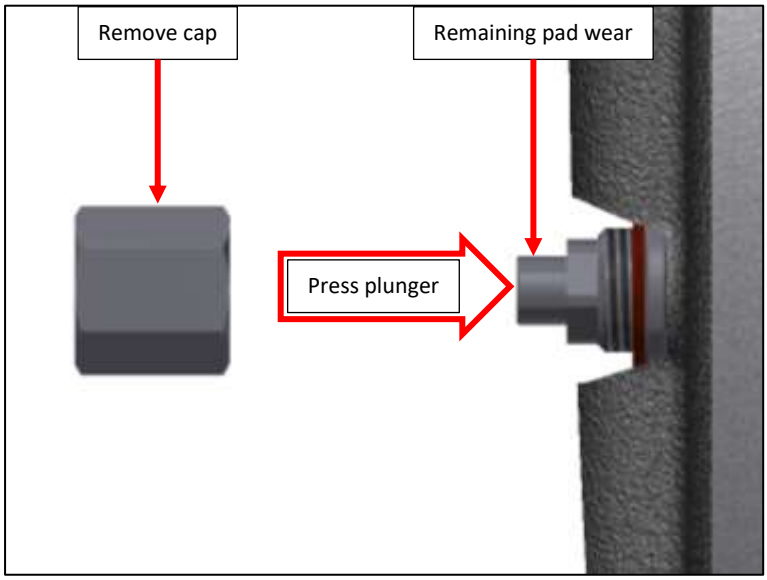


Figure 41: Front pad wear indicator schematic.

9. If the brake pads have worn beyond the wear limit, then a major service must be completed.
10. Remove 3x tapered plugs, recoat each one with anti-seize and refit them. Silicon should be placed in the hex socket to aid future removal.
11. Drain and discard the ABT™ “Blend 20” cooling fluid from each wheel-end brake.
    a. At least 800 mL of ABT™ “Blend 20” cooling fluid should be found in each wheel-end. Check for leaks if this amount is not found.
    b. The ABT™ “Blend 20” cooling fluid should drain freely from the brake. If it comes out in a “glug, glug” fashion ensure there is no blockage in the ABT™ Failsafe breather line.
    c. Dispose of used ABT™ “Blend 20” cooling fluid responsibly in accordance with regulatory and environmental legislation.
12. Refit the drain plug with a new sealing washer.
13. Refill the wheel-end up to the level plug (fill to spill). Approximately 1 litre of ABT™ “Blend 20” cooling fluid is required per brake unit.
14. Conduct a “vehicle pre-start check”.

17. 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 (section 25 EMMA piston seals and section 26 service piston seals).
3. Repair/replace damaged parts where necessary during the major service.
4. Test the EMMA springs and pistons (section 19).
5. Disassemble the brake (section 20 - Rear).
6. Perform a rotor service (section 21).
7. Perform a hub bearing and seal change (section 22).
8. Perform a pad change, seal change and housing service (section 23).
9. If the springs need to be replaced, perform a replacement now (section 24).
10. Assemble the brake (section 27 - Rear).
11. Conduct a “vehicle pre-start check”.

18. Major Service – Front

1. Check service brake system for leaks.
2. If leaks are present replace damaged seals where necessary during the major service (section 26).
3. Repair/replace damaged parts where necessary during the major service.
4. Disassemble the brake (section 20 - Front).
5. Perform a rotor service (section 21).
6. Perform a hub bearing and seal change (section 22).
7. Perform a pad change, seal change and housing service (section 23).
8. Assemble the brake (section 27 - Front).
9. Conduct a “vehicle pre-start check”.

19. EMMA Piston Test Procedure

1. Remove the 3x tapered plugs and 1x pad wear indicator from the spring cover. Refer to exploded view for more detail.
2. Operate the brake to check for fluid or grease washout. Any substances being ejected from the holes indicates a failed EMMA piston seal which will need to be replaced.
3. Fit 4x retractor bolts into the spring cover and torque to 80 Nm. Alternatively, while the system is active retract the pistons and wind in the retractor bolts in.
4. Loosen the retractor bolts until there is approximately 2mm gap to the spring cover.
5. A short test is required to check the integrity of the springs in the EMMA brake. Assistance is required for this test.
6. While the EMMA brake is applying/releasing observe the movement of the retractor bolts.
7. The 4 x retractor bolts should move in and out simultaneously.
8. If the retractor bolts move simultaneously then the spring integrity check is complete.
9. 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.
10. If the retractor bolts behave as explained in step 9 then the spring covers must be removed to visually check the springs.
11. With the brake released retighten the retractor bolts.

20. Service Disassembly Procedure

A. Rear

1. Remove the rear wheels.
2. Remove the ABS sensor from the brake housing.
3. Clamp the rear brake lines.
4. Remove the 3x tapered plugs and 1x pad wear indicator from the spring cover. Refer to exploded view for more detail.
5. Fit 4x retractor bolts into the spring cover and torque to 80 Nm. Alternatively, while the system is active retract the pistons and wind in the retractor bolts in.
6. Drain and discard the ABT™ “Blend 20” cooling fluid from each wheel-end brake.
    a. At least 800 mL of ABT™ “Blend 20” cooling fluid should be found in each rear wheel-end. Check for leaks if this amount is not found.
    b. The ABT™ “Blend 20” cooling fluid should drain freely from the brake. If it comes out in a “glug, glug” fashion ensure there is no blockage in the ABT™ Failsafe breather line.
    c. Dispose of used ABT™ “Blend 20” cooling fluid responsibly in accordance with regulatory and environmental legislation.
7. Disconnect the service brake line, the park/emergency brake hydraulic line and the breather line from the brake.
8. Remove the hub cap.
9. Remove the axle drive flange by removing the 8x nuts and collets. Discard the gasket.
10. Remove the 4 nuts that hold the brake onto the axle.
11. Lift the brake clear from the axle using a suitable lifting hoist.
12. Remove the hub lock nut, plate and outer wheel bearing.
13. Stand the brake assembly to be serviced on a clean bench.

Figure 42: Outer housing, rotor and hub assembly.

14. Remove and discard 12x housing bolts on opposite sides of the brake housing.

15. Carefully separate the inner and outer housings. 2x guide pins may assist with disassembly. The outer housing, hub, rotor and outer pads should remain as one assembly.

Figure 43: Separate inner and outer housings.

B. Front

1. Remove the front wheels.
2. Remove the ABS sensor from the brake housing (if applicable).
3. Clamp the front brake lines.
4. Drain and discard the ABT™ “Blend 20” cooling fluid from each wheel-end brake.
    a. At least 600 mL of ABT™ “Blend 20” cooling fluid should be found in each rear wheel-end. Check for leaks if this amount is not found.
    b. The ABT™ “Blend 20” cooling fluid should drain freely from the brake. If it comes out in a “glug, glug” fashion ensure there is no blockage in the ABT™ Failsafe breather line.
    c. Dispose of used ABT™ “Blend 20” cooling fluid responsibly in accordance with regulatory and environmental legislation.
5. Remove the hub cap.
6. Remove the 6x socket head cap screws inside the hub.
7. Remove the outer hub section from the brake assembly.
8. Remove and discard all 12x housing screws.
9. Carefully separate the inner and outer housings. 2x guide pins may assist with disassembly. The outer housing, hub, rotor and outer pads should remain as one assembly.
10. Stand the brake assembly on a clean bench, sit the outer housing, rotor and hub assembly face down on the hub studs.

21. Rotor Replacement Procedure

1. Disassemble the outer housing according to section 20.
2. Remove the rotor from the outer assembly, clean and inspect.
3. Inspect the rotor and hub splines for wear.
4. Check for movement between the rotor and hub. If there is excessive movement between the splines of the mating components the rotor should be replaced.
5. Inspect the rotor friction surface. If there are signs of scouring covering more than 50% of the surface the rotor should be replaced.

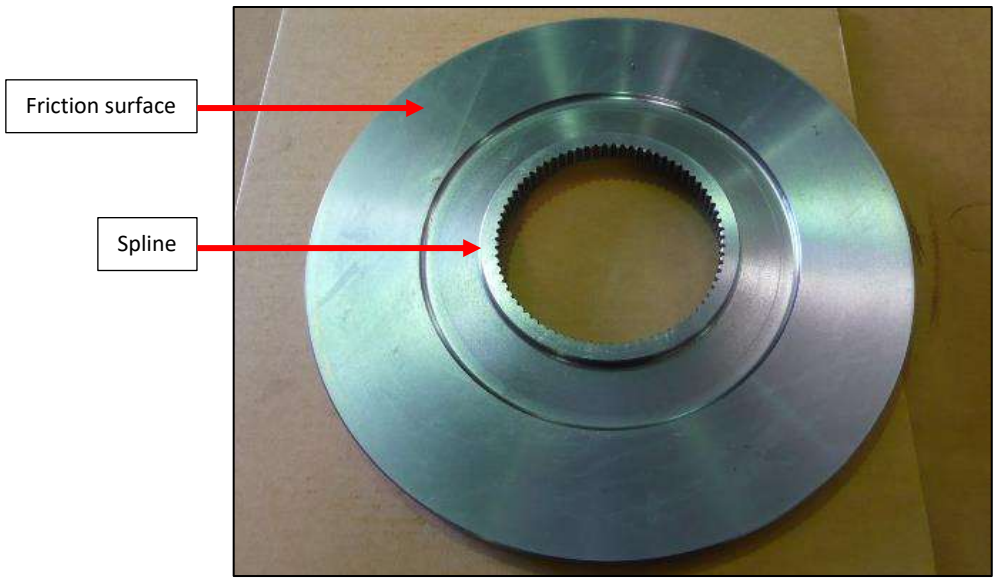


Figure 44: Rotor.

6. 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.

22. Wheel Bearing and Hub Seal Replacement Procedure

1. Disassemble the outer housing according to section 20.
2. Remove the hub from the outer housing.
3. Remove the V-seal and shaft seals from the hub and discard.
4. Remove 2x bearings from the hub, clean and inspect, if bearings show any sign of wear they should be replaced.
5. Using a punch push out the outer bearing races from the hub.
6. Clean the hub removing any grease and dirt.
7. Inspect all wheel studs, axle studs, dowel pins and grease nipple. Replace if showing any signs of thread damage or corrosion.

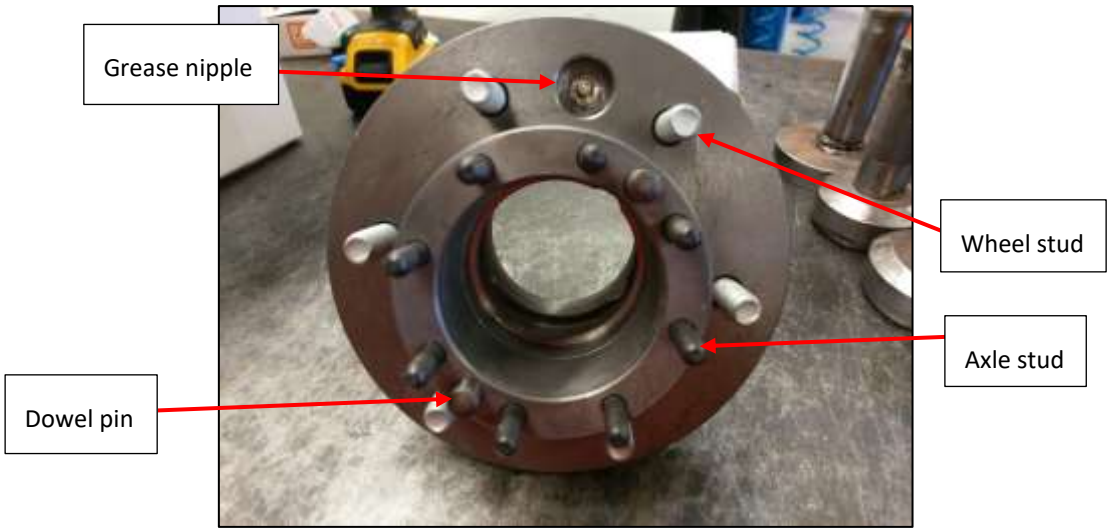


Figure 45: Hub

8. Before inserting the new bearings put a smear of grease around the inside of the hub.
9. Remove the outer races from the inner and outer bearings and using a large pushing tool push each of the outer races into position until they are seated on the lip.

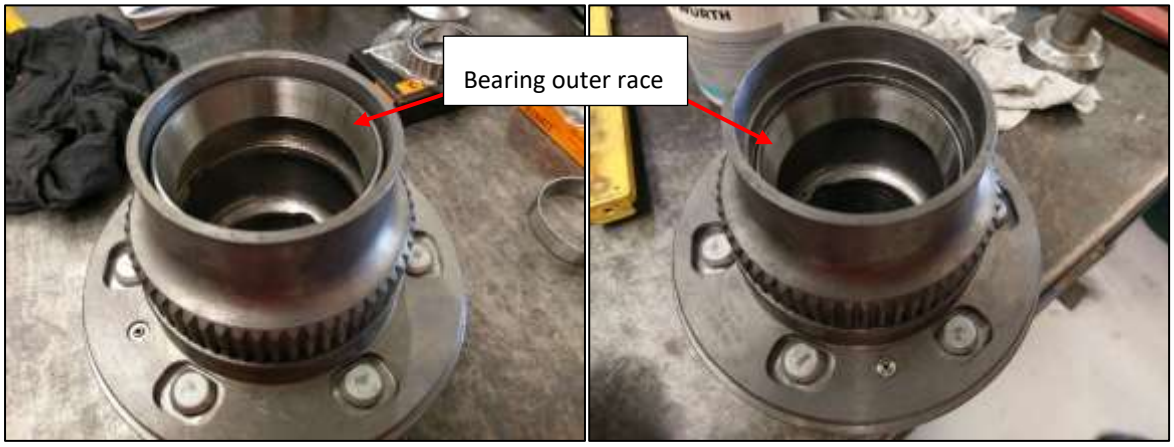


Figure 46: Bearing outer race in loose (left) and seated (right)

10. Grease the bearings with a high temperature bearing grease (Castrol LMX recommended).
11. Install the inner bearing into the hub. Set the outer bearing aside for installation onto the vehicle.
12. Pack the hub with a high temperature bearing grease (Castrol LMX recommended).

13. Install the first shaft seal on top of the inner bearing with the open side facing towards the bearing, push it into place with a large pushing tool.

14. Install the second shaft seal with the open side facing upwards, push it into place with a large pushing tool.

15. Put a small amount of grease around inside of the shaft seals and pack inside the top seal with grease.

Figure 47: First shaft seal in (left) Both shaft seals in (right)

16. Give the V-seal a gentle stretch and install it on the outside of the hub.

Figure 48: V-seal installed

23. Pad Change, Seal Change and Housing Inspection

1. Disassemble the outer housing according to section 20.
2. Remove and discard the inner and outer brake pads.
3. Remove the cassette seal from the outer housing and discard.
4. Clean the outer housing and inspect for damage or wear.
5. Install a new cassette seal into the outer housing.
6. Push the outer housing onto the hub.
7. Install the outer brake pads in the outer housing ensuring correct orientation.

Figure 49: Brake pad position

8. Install the rotor onto the hub spline ensuring correct orientation.

Figure 50: Rotor orientation

9. Remove the housing O-ring from the inner housing and discard.
10. Set aside a new inner housing O-ring and inner brake pads for installation during assembly procedure.
11. Note: For front brakes skip to the next section.
12. Disconnect the service brake line, the park/emergency brake hydraulic line, the breather line and ABS sensor (if connected) from the brake.
13. Remove the 4 nuts that hold the brake onto the axle.
14. 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.
15. Inspect the mounting studs. Replace if showing signs of damage or corrosion.
16. If the Studs need replacing:
    a. Punch out the old studs. 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.
17. Inspect all fittings for damage or corrosion and replace if necessary.
18. Remove the service link pipe. Clean, inspect and replace if required.
19. Remove and discard the stub axle oil seal.
20. 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.

24. Spring Replacement Procedure

1. Disassemble the outer housing according to section 20.
2. Remove the 10x spring cover bolts and discard.
3. 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.
4. Remove the spring cover.
5. Remove and discard spring cover gasket.
6. 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.
7. If there are no cracked springs clean all thoroughly.

Figure 51: Spring stack

8. Perform an EMMA piston seal replacement now. (Section 26).
9. 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.

Figure 52: Lubricated springs on the pistons

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

Figure 53: Spring cover in place with gasket

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

12. Reinstall the retractor bolts and torque to 80 Nm.

13. 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.

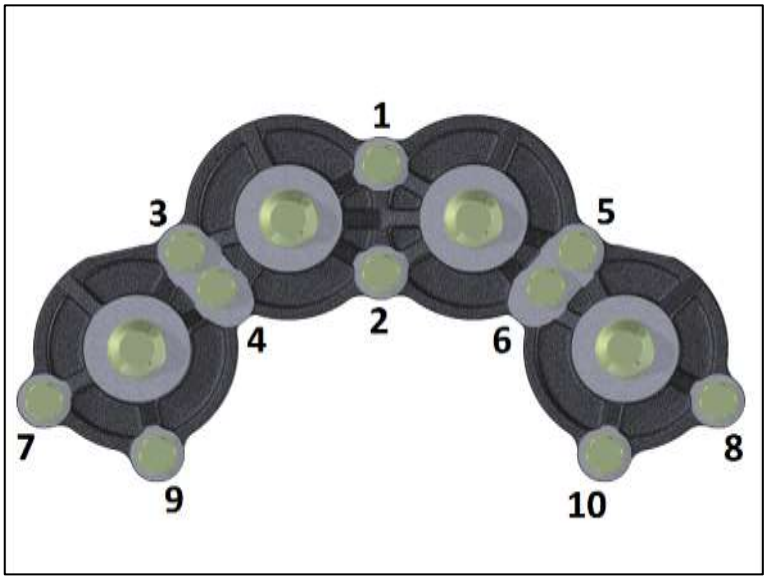


Figure 54: Spring cover bolt torque sequence.

25. Piston and Piston Seal Replacement Procedure

1. Follow steps 1-10 in section 24 to remove piston cover and springs.
2. Remove the pistons from the bore. A slide hammer may assist in removal.
3. Remove the piston O-ring seals and backup rings.
4. Clean the pistons with parts cleaner.
5. Inspect the pistons for damage, if there are signs of pitting and corrosion in the O-ring grooves the pistons should be replaced.
6. Apply a light smear of silicone grease to the pistons where the O-ring is seated (Parker Super O Lube recommended).
7. Attach the piston seals to the pistons. Ensure the O-rings and back-up washers are installed in the correct position and not twisted.

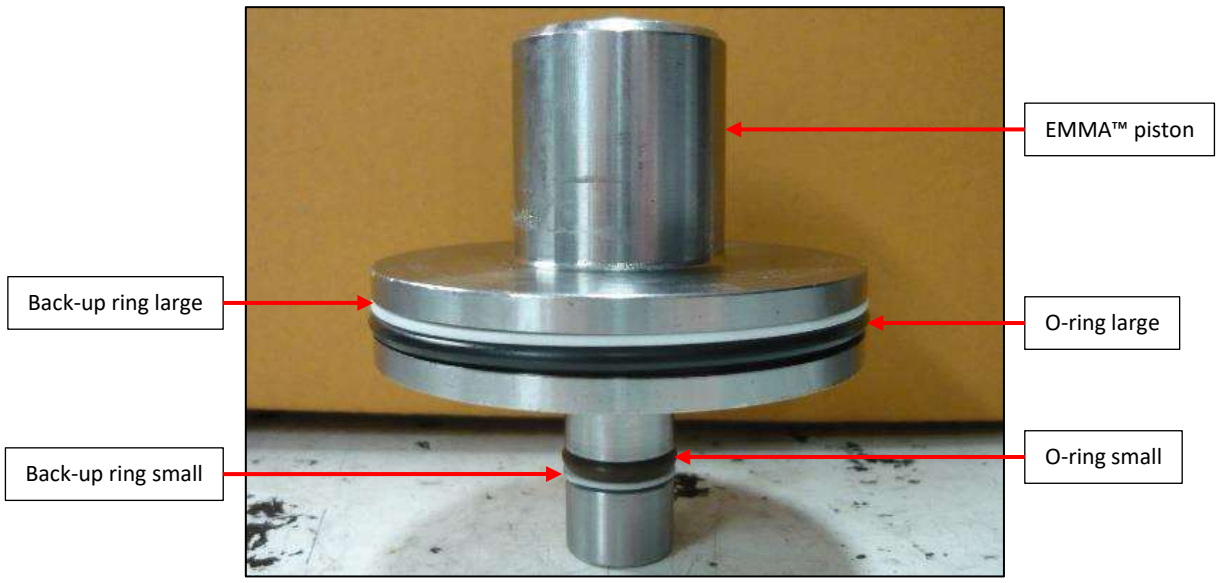


Figure 55: EMMA piston with seals installed.

8. Clean the exposed areas of the EMMA pistons in cases where the pistons have not been removed.
9. Ensure the piston seals avoid contamination during cleaning process.
10. Clean the inner housing and spring cover. Inspect both for damage.
11. Wipe the piston bores dry and apply a small amount of silicone grease in the piston bore.
12. Install any pistons that were previously removed.

Figure 56 – Pistons installed in position

13. Follow steps 12-16 in section 24 to reassemble piston springs and spring covers.

26. Piston and Piston Seal Replacements Procedure

1. Disassemble the outer housing according to section 20.
2. Remove the pistons from the bore. A slide hammer may assist in removal.
3. Remove the piston O-ring seals.
4. Inspect each of the pistons for damage.
5. Clean the pistons with parts cleaner.
6. Apply a light smear of silicone grease to the piston O-ring seals.
7. Attach the piston seals to the pistons. Ensure O-rings are installed in the correct position and not twisted.

Figure 57: Piston O-ring positions

8. Clean the inside of the inner housing with parts cleaner. Clean the piston bores thoroughly.
9. Ensure the piston seals avoid contamination during cleaning process in cases where the pistons have not been removed.
10. Wipe the piston bores dry and install any pistons that were previously removed. Pistons should be installed with the flat end inward. Apply pressure to the piston until it slides fully into place.

Figure 58: Pistons installed

27. Service Assembly and Bleed Procedure

A. Rear

1. 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.).
2. Fit a new housing O-ring into the groove around the circumference of the inner housing.
3. Install the inner brake pads in the inner housing ensuring correct orientation.
4. Carefully fit the outer housing, hub and rotor assembly to the inner housing. 2x guide pins may assist with fitment.
5. Fit the 12x M10 bolts and torque to 50 Nm in sequence. Ensure each bolt is torqued twice.

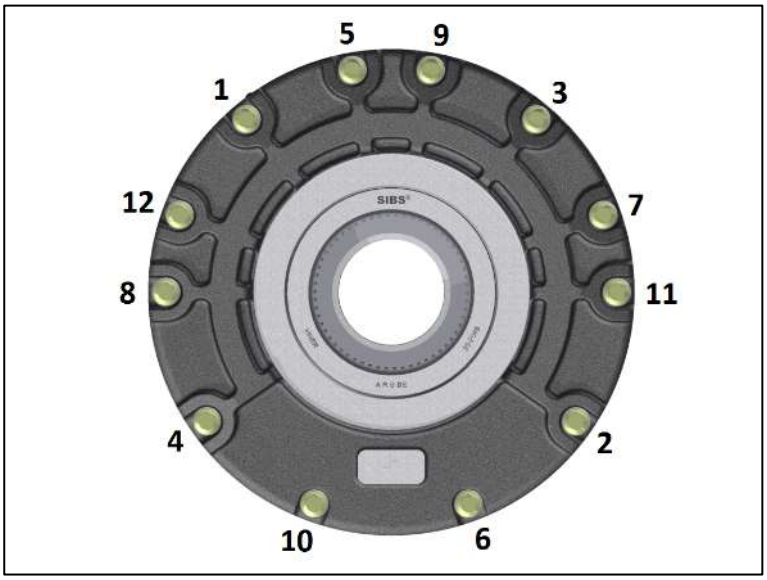


Figure 59: Housing bolt torque sequence.

6. Remove and discard the sealing O-ring from the axle flange.
7. 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.
8. Apply a light smear of silicone grease (Parker Super O Lube recommended) to the new axle flange O-rings and fit them to the axle flange.
9. Fit the outer bearing, locking plate and hub lock-nut onto the stub axle. Do not torque yet.
10. 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
11. Fit the ABT™ Failsafe brake assembly unit over the stub axle. Align the mounting holes and locate the housing evenly and firmly against the axle flange.
12. Fit 4x new brake mounting nuts. Washers/spacers may be required with some kits.
13. Torque the brake mounting nuts to 60 Nm in a diagonal pattern. Repeat this procedure 3x over a 5-minute period.
14. Torque and adjust the hub nut to Toyota specifications.
15. 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.

16. Fit a new stub axle oil seal and top up the differential oil as required.

17. Fit a new drive flange gasket and re-install the drive flange. Secure using the tapered collets, spring washers and M8 retaining nuts; torque to 33 Nm.

18. Fit the circlip to the groove in the end of the axle.

19. Fit the hub cap using 3x fasteners. torque to 5 Nm.

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

21. Fit the pad wear indicator to the lowest piston:

    a. Screw the pad wear indicator plunger 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 cap and fibre washer to the gland fitting.

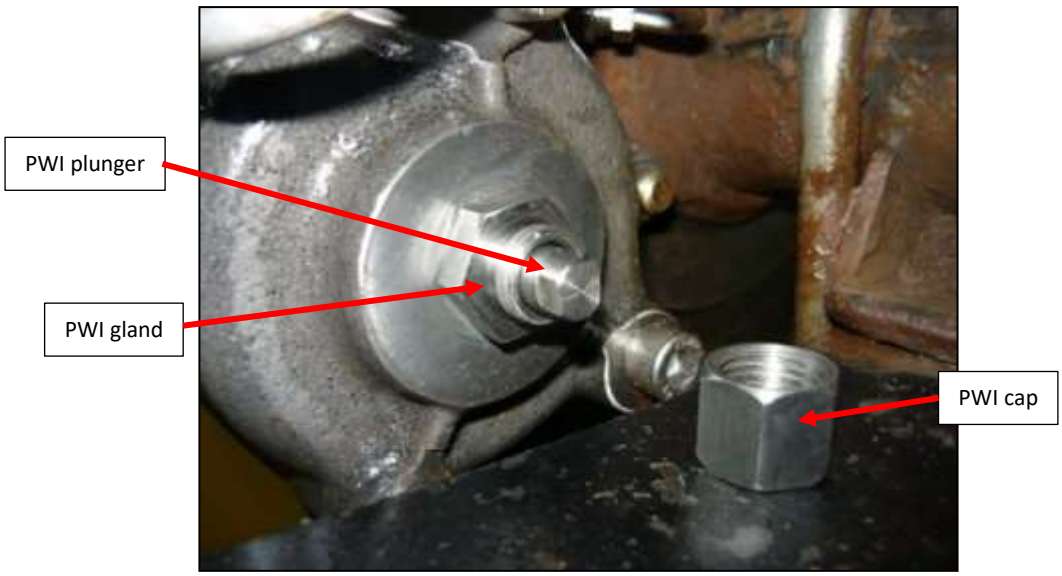


Figure 60: Pad wear indicator install in spring cover.

    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.

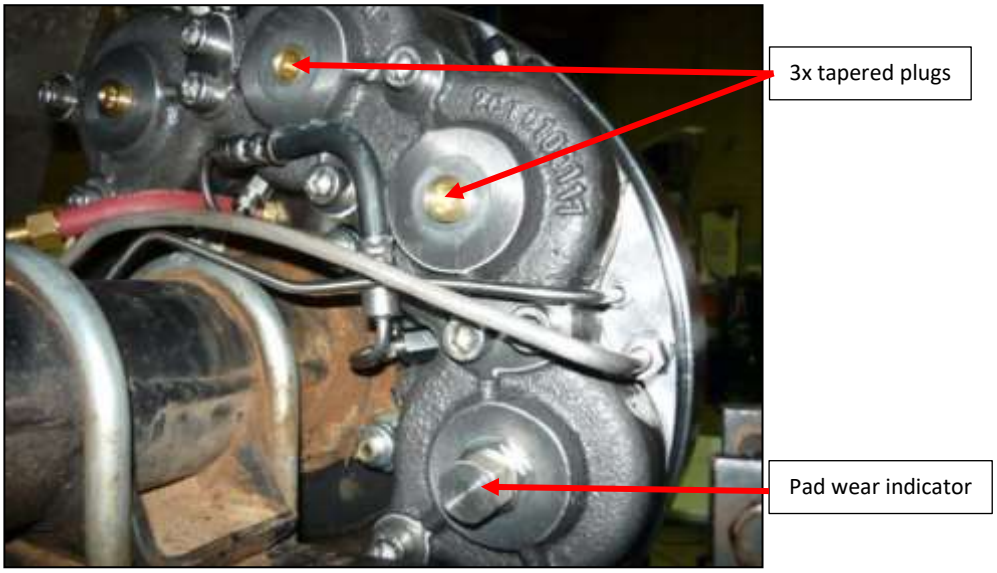


Figure 61: ABT™ Failsafe brake unit.

22. Remove the ABT™ “Blend 20” cooling fluid fill plug.
23. Fill the ABT™ Failsafe brake unit with new ABT™ “Blend 20” cooling fluid and refit the fill plug with a new copper washer. Approximately 1 litre of ABT™ “Blend 20” cooling fluid is required per rear brake unit.
24. Repeat for the opposing brake unit.
25. Inspect all the park/emergency brake hydraulic hoses and replace as required.
26. Replace all rear breather hoses.
27. Flush the pump reservoir with new ATF Dexron III and then fill to level window.
28. Prime the ABT™ Failsafe 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.
29. Bleed the park/emergency brake system using the bleed screws on the rear brakes.
30. Remove any clamps on the rear service line.
31. Flush the master cylinder with DOT 3 brake fluid.
32. Bleed the rear service brake system of air.
33. Check that there are no leaks from the system.
34. Install wheels and torque all wheel nuts progressively and in sequence to 105 Nm. Ensure each bolt is torqued twice.

B. Front

1. Non-ABS models: Inspect the inner seal carrier and replace if there are any signs of wear or damage.
2. 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.).
3. Fit a new housing O-ring into the groove around the circumference of the inner housing.
4. Install the inner brake pads in the inner housing ensuring correct orientation.
5. Carefully fit the outer housing, hub and rotor assembly to the inner housing. 2x guide pins may assist with fitment.
6. Install the 6x socket head cap screws and torque to 60 Nm. Ensure each bolt is torqued twice.
7. Fit the 12x M10 bolts and torque to 50 Nm in sequence. Ensure each bolt is torqued twice.

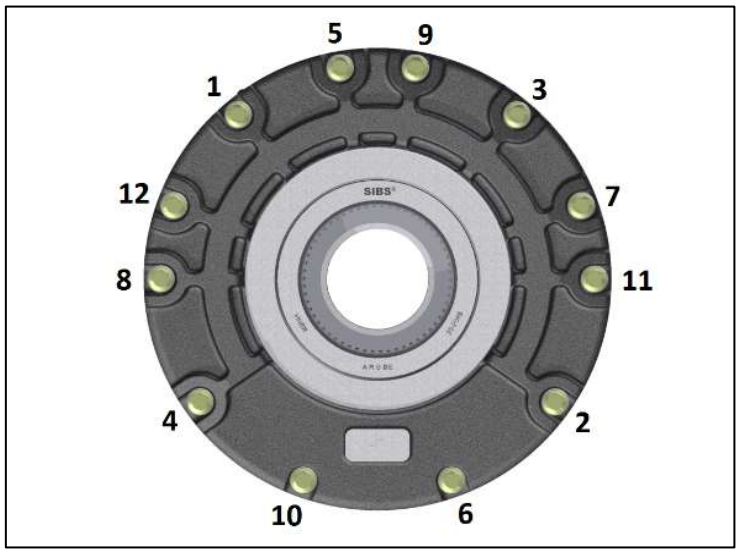


Figure 62: Housing bolt torque sequence.

8. Fit the hub nut, adjusting cap and cotter pin as described in the Toyota manual.
9. 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.
10. Remove the ABT™ “Blend 20” cooling fluid fill plug.
11. Fill the ABT™ Failsafe brake unit with new ABT™ “Blend 20” cooling fluid and refit the fill plug with a new copper washer. Approximately 800 ml of ABT™ “Blend 20” cooling fluid is required per front brake unit.
12. Replace the sealing washers on the banjo bolt connection on the inner housing.
13. Repeat for the opposing brake unit.
14. Inspect all the brake hydraulic hoses and replace as required.
15. Replace all front breather hoses.
16. Remove any clamps on the front service line.
17. Flush the master cylinder with DOT 3 brake fluid.
18. Bleed the front service brake system of air.
19. Check that there are no leaks from the system.
20. Install wheels and torque all wheel nuts progressively and in sequence to 105 Nm. Ensure each bolt is torqued twice.

28. Troubleshooting

1. Problem
    a. Possible cause
        i. Solution

2. Fault light on control unit flashing.
    a. 2x flashes then rest – low battery fault (below 11V)
        i. Charge vehicle battery
        ii. Fault will self-clear when battery voltage is above 11V
    b. 3x flashes then rest – control unit PCB too hot
        i. Remove any sources of heat that could be causing the control unit to overheat
        ii. Fault will self-clear when the PCB temperature drops below a certain level.
    c. 4x flashes then rest - park/emergency brake took too long to release – operation aborted.
        i. Check pump reservoir level is not too low. If low check system for leaks.
        ii. Possible air in system causing slow release. Bleed park/emergency brake system.
        iii. Pump motor has is too hot and has lost effectiveness – allow to cool to ambient.
        iv. Cycle ignition to clear the fault from the control unit.
    d. 5x flashes then rest – pump relay fault
        i. Ensure wiring is not causing a short or open circuit to pump relay.
        ii. Check pump relay for correct function – replace if required.
        iii. Cycle ignition to clear the fault from the control unit.
    e. 6x flashes then rest – dump valve fault
        i. Ensure wiring is not causing a short or open circuit to dump valve.
        ii. Check dump valve for correct function – replace if required.
        iii. Cycle ignition to clear the fault from the control unit.
    f. 7x flashes then rest – diff lock solenoid fault
        i. Diff lock not fitted for Hilux – check for interference with 6 pin connector behind radio.
        ii. Cycle ignition to clear the fault from the control unit.
    g. 8x flashes then rest – pressure sensor fault
        i. Ensure wiring is not causing a short or open circuit to pressure sensor.
        ii. Check pressure sensor for correct function – replace if required.
        iii. Cycle ignition to clear the fault from the control unit.

3. ATF warning light on control unit on.
    a. Vehicle parked on steep incline causing sensor to read incorrect fluid level.
        i. Park vehicle on flat surface and check ATF warning light if off.
    b. Low fluid level in ABT™ Failsafe pump reservoir.
        i. Top up reservoir with ATF Dexron III and check system for leaks.
4. Brake status LED is solid green and control unit is not responding.
    a. Control unit is in 'ABT™ Failsafe 3' mode.
        i. Conduct a master reset of the control unit by holding the manual release button and cycling the E-stop button 3 times within 5 seconds. All lights on the control unit will flash once to confirm reset was successful and all settings have been cleared.
5. Brake pedal soft/spongy
    a. Air in the service brake system
        i. Bleed the brakes
    b. Brake rotors binding on splines
        i. Crimp off brake hoses to isolate offending brake.
        ii. Strip wheel end & inspect.
6. Brake pedal hard/excessive force required to operate brakes/reduced braking performance.
    a. Pads and rotor surface glazed.
        i. Change ABT™ "Blend 20" cooling fluid and perform dry deglaze procedure if required.
    b. ABT™ "Blend 20" cooling fluid contaminated with brake fluid, ATF or grease.
        i. Remedy any leaks then change ABT™ "Blend 20" cooling fluid and perform dry deglaze procedure if required.
    c. Vacuum system leak.
        i. Inspect vacuum hoses, connections and booster for leaks.
7. Pedal goes slowly to floor with light application.
    a. Master cylinder bypassing internally.
        i. Strip and inspect. Replace cylinder or install overhaul kit.
    b. Leak in brake lines/hoses or fittings.
        i. Inspect brake lines and hoses for leaks.
        ii. Ensure stainless fittings and bleed nipples are seated correctly. Tighten or replace as required.
    c. Brake seals bypassing internally.
        i. Strip brake and inspect service piston seals. Replace with new piston seal kit.

8. Brakes drag/brakes not fully releasing after operation.
    a. Booster/master cylinder out of adjustment.
        i. Adjust booster output pushrod.
    b. EMMA™ piston seals bypassing or service piston seals contaminated & swollen preventing them from retracting.
        i. Locate which wheel end is affected (which wheel is dragging) or inspect rear brakes for ATF leakage around rear of spring cover.
        ii. Strip brake and inspect components. Replace seals as required.
    c. Insufficient hydraulic pressure to release EMMA™ brake.
        i. Place vehicle on hoist and release EMMA™ brake. Check to see if one or both wheels are dragging.
        ii. If both sides: Carryout pressure check in EMMA™ circuit, should be 850psi, if pressure is insufficient change pressure switch. If pressure still low, EMMA™ pump may be at fault.
        iii. If only on one side: strip wheel-end & inspect.
9. Vehicle pulls to one side during braking.
    a. Generally due to reduced effectiveness in one brake (brake steer). Vehicle will pull to the side with the more effective front brake. Usually caused by front brake issue.
        i. If running OEM front brakes refer to Toyota manual.
        ii. If running ABT™ Failsafe front brakes check seized or sticking service pistons.
        iii. Strip wheel ends and inspect service pistons & seals.
        iv. Note: service brake seals can deteriorate (swell) if outer Viton seal fails allowing ABT™ “Blend 20” cooling fluid to come in contact with brake seal. Replace seals.
    b. ABT™ “Blend 20” cooling fluid contaminated with brake fluid, ATF or grease.
        i. Remedy any leaks then change ABT™ “Blend 20” cooling fluid and perform dry deglaze procedure if required.
10. Brakes shudder as vehicle slows to a stop.
    a. Old/overused ABT™ “Blend 20” cooling fluid.
        i. Change ABT™ “Blend 20” cooling fluid.
    b. Brakes are cold.
        i. Complete 3x medium/hard stops to warm brake.
        ii. If shudder persists after more than first three brake applications, change ABT™ “Blend 20” cooling fluid and perform dry deglaze procedure if required.
11. ABT™ Failsafe park/emergency brake applies unexpectedly.
    a. Faulty wiring causing intermittent loss of continuity.
        i. Inspect/test 12 volt ignition switched & 12 volt constant supply. Ensure all connections are clean, secure and free of corrosion.
        ii. Check door switches.
        iii. Check seatbelt switches.
        iv. Check oil-pressure switches.

12. ABT™ Failsafe park/emergency brake is poor. Brake not holding on inclines.
    a. Brake pads and/or rotor worn.
        i. Check pad wear indicators. If pads below wear limit conduct a major service.
13. ABT™ Failsafe park/emergency brake slow to apply
    a. Brake pads worn.
        i. Check pad wear indicators. If pads below wear limit conduct a major service.
    b. ABT™ Failsafe relief valve set too high.
        i. Adjust to desired application speed by loosening locknut and turning adjusting screw out. Adjust ½ turn at a time & test.
14. ABT™ Failsafe pump runs intermittently during service (brake status light flashes red and beeps occasionally).
    a. Minor leak in park/emergency brake system
        i. Check all hydraulic hoses and connections for signs of leaking ATF.
        ii. Strip brake and check emergency/park brake piston seals and bores. Replace as required.
15. Pump does not run (ABT™ Failsafe park/emergency brake does not release).
    a. Check interlocks are not preventing brake release
        i. Close all doors, fasten driver's seatbelt, start vehicle engine.
    b. Loss of power to ABT™ Failsafe control unit (indicated by lack of brake status LED).
        i. Check all fuses. If blown identify cause and repair.
    c. Loss of power to ABT™ Failsafe pump.
        i. Check all fuses. If blown identify cause and repair.
        ii. Check function of relay mounted at vehicle battery. Replace if required.
        iii. Check for continuity of wiring from battery to pump motor and relay to control unit.
    d. Faulty pump motor.
        i. Replace pump motor.
16. ABS light illuminated on the dash.
    a. ABS sensor is deformed or damaged.
        i. Remove the ABS sensor and check for deformation or damage. Replace if required.
        ii. Perform an EMMA piston test.
    b. Failsafe Brake overheated.
        i. Leave the brake to cool. Perform an EMMA piston test.
    c. General vehicle faults.
        i. Refer to the Toyota manual.