



FAILSAFE WORKSHOP MANUAL

TOYOTA LANDCRUISER



1. Revision History

Revision	Issue Date	Author	Comments
1	30 Jan 2015	J. Leighton	Initial Release
2	03 Feb 2015	J. Leighton	Sections 5, 9 and 17 added. Section 15 updated.
3	14 May 2015	J. Leighton	Sections 7, 8, 9, 11 and 18 updated.
4	20 July 2016	M. O'Driscoll	Section 14 updated (Major service interval extended).
5	31 Jan 2017	M. O'Driscoll	Sections 8, 9, 10, 14, 15, 16, 17 and 18 updated.
6	09 Feb 2017	M. O'Driscoll	Section 8 added. Section 11 (hydraulic installation) updated.
7	27 Nov 2018	M. Cornelius	Added sections 10, 21-29, Updated sections 9, 11-14, 18-20, 30

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3. Important Information

This manual applies to the fourth generation ABT™ Failsafe for the Toyota Landcruiser. 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.

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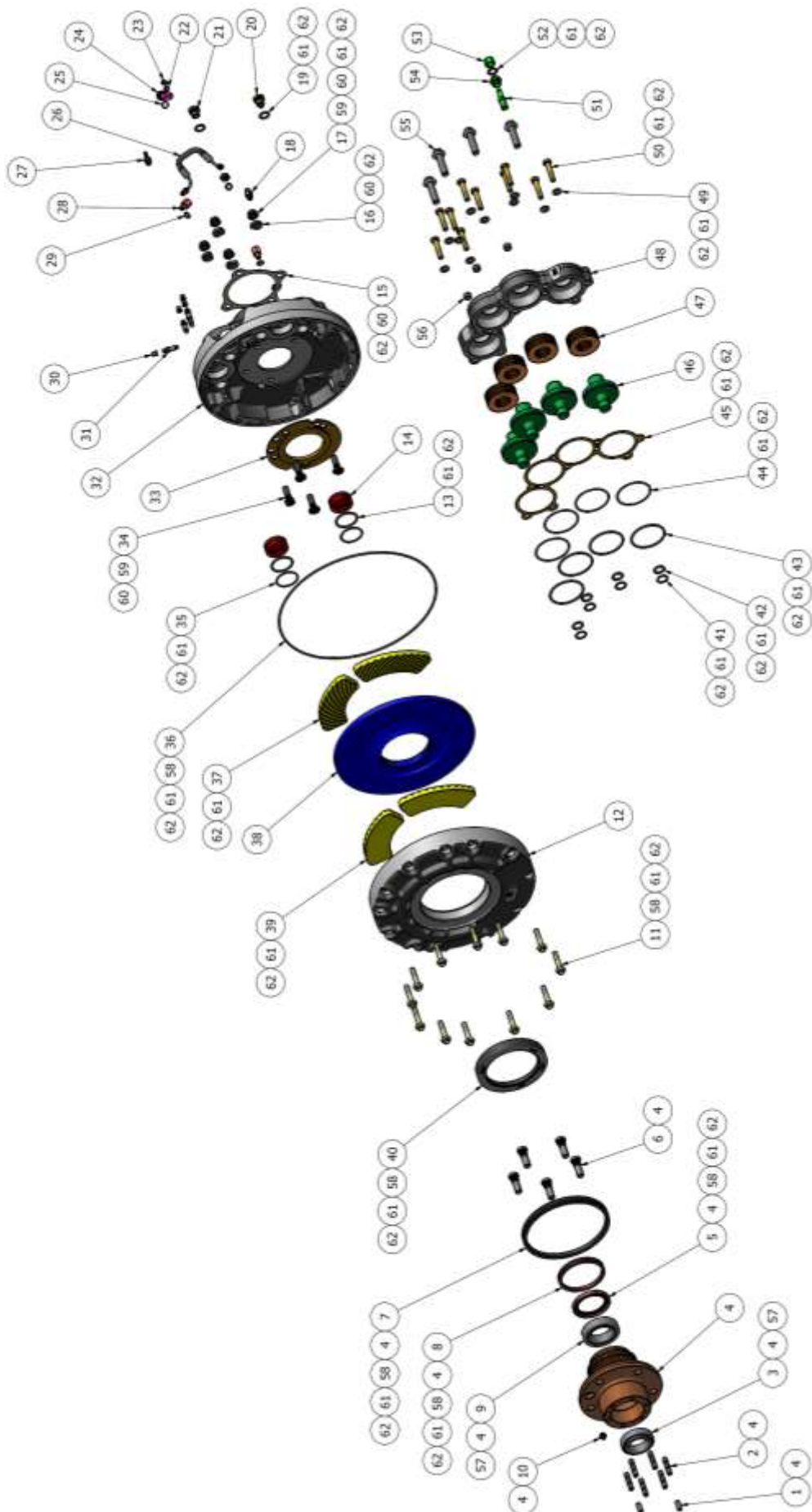
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4. Terminology

ABS	Anti-lock braking system
ESC	Electronic stability control
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)
			OEM DISC BRAKES	OEM DRUM BRAKES	
1	30-3000	PIN DOWEL	4	4	-
2	25-9001	STUD AXLE DRIVE	12	12	17
	-	NUT AXLE DRIVE	12	12	35
3	31-6000	BEARING WHEEL OUTER	2	2	-
4	25-4000	HUB ASSEMBLY REAR DISC	2	0	-
	25-4001	HUB ASSEMBLY REAR DRUM	0	2	-
5	31-4001	SEAL HUB	2	2	-
6	25-9002	STUD WHEEL	10	10	-
	-	NUT WHEEL	10	10	210
7	31-4000	SEAL V-LIP OUTER	2	2	-
8	31-4002	SEAL V-LIP INNER	2	2	-
9	31-6001	BEARING WHEEL INNER	2	2	-
10	31-5008	NIPPLE GREASE	2	2	11
11	30-0003	BOLT HOUSING	24	24	50
12	25-2012	HOUSING OUTER LH	1	1	-
	25-2013	HOUSING OUTER RH	1	1	-
13	31-2004	O-RING SERVICE PRIMARY REAR	4	4	-
14	25-2025	PISTON SERVICE REAR	4	4	-
15	25-2050	GASKET SPINDLE REAR DRUM	0	2	-
16	25-2047	SPACER MOUNTING REAR DRUM	0	8	-
17	25-9000	NUT MOUNTING REAR BRAKE	8	8	80
18	31-5000	CONNECTOR HOSE EMMA	2	2	20
19	30-2003	WASHER SEALING COPPER	4	4	-
20	25-2039	DRAIN PLUG	2	2	20
21	25-2038	FILL PLUG	2	2	20
22	30-2001	WASHER PLUG ABS HOLE	2	2	-
23	30-0004	BOLT PLUG ABS HOLE	2	2	11

24	25-2046	PLUG ABS SENSOR HOLE	2	2	-
25	31-2007	O-RING PLUG ABS HOLE	2	2	-
26	25-4025	LINK HOSE SERVICE BRAKE	2	2	15
27	31-5025	CONNECTOR HOSE BREATHER	2	2	15
28	31-5026	CONNECTOR PIPE SERVICE BRAKE	6	6	20
29	30-2004	WASHER SEALING COPPER	6	6	-
30	31-9000	CAP BLEED NIPPLE	8	8	-
31	31-5001	BLEED NIPPLE	8	8	15
32	25-5031	HOUSING INNER REAR LH DISC W/PINS	1	0	-
	25-5032	HOUSING INNER REAR RH DISC W/PINS	1	0	-
	25-5033	HOUSING INNER REAR LH DRUM W/PINS	0	1	-
	25-5034	HOUSING INNER REAR RH DRUM W/PINS	0	1	-
33	25-2029	SEAL CARRIER INNER REAR DISC	2	0	-
	25-2030	SEAL CARRIER INNER REAR DRUM	0	2	-
34	25-2058	STUD MOUNTING REAR BRAKE	8	8	-
35	31-2005	O-RING SERVICE WIPER REAR	4	4	-
36	31-2006	O-RING HOUSING	2	2	-
37	24-2850	BRAKE PAD – CW	4	4	-
38	25-2000	ROTOR	2	2	-
39	24-2860	BRAKE PAD - ACW	4	4	-
40	25-2049	SEAL CASSETTE HOUSING	2	2	-
41	31-2001	BACK-UP RING EMMA SMALL	8	8	-
42	31-2000	O-RING EMMA SMALL	8	8	-
43	31-2002	O-RING EMMA LARGE	8	8	-
44	31-2003	BACK-UP RING EMMA LARGE	8	8	-
45	25-2061	GASKET SPRING COVER	2	2	-
46	25-2006	PISTON EMMA	8	8	-
47	31-0002	DISC SPRING	48	48	-
48	25-2008	SPRING COVER LH	1	1	-

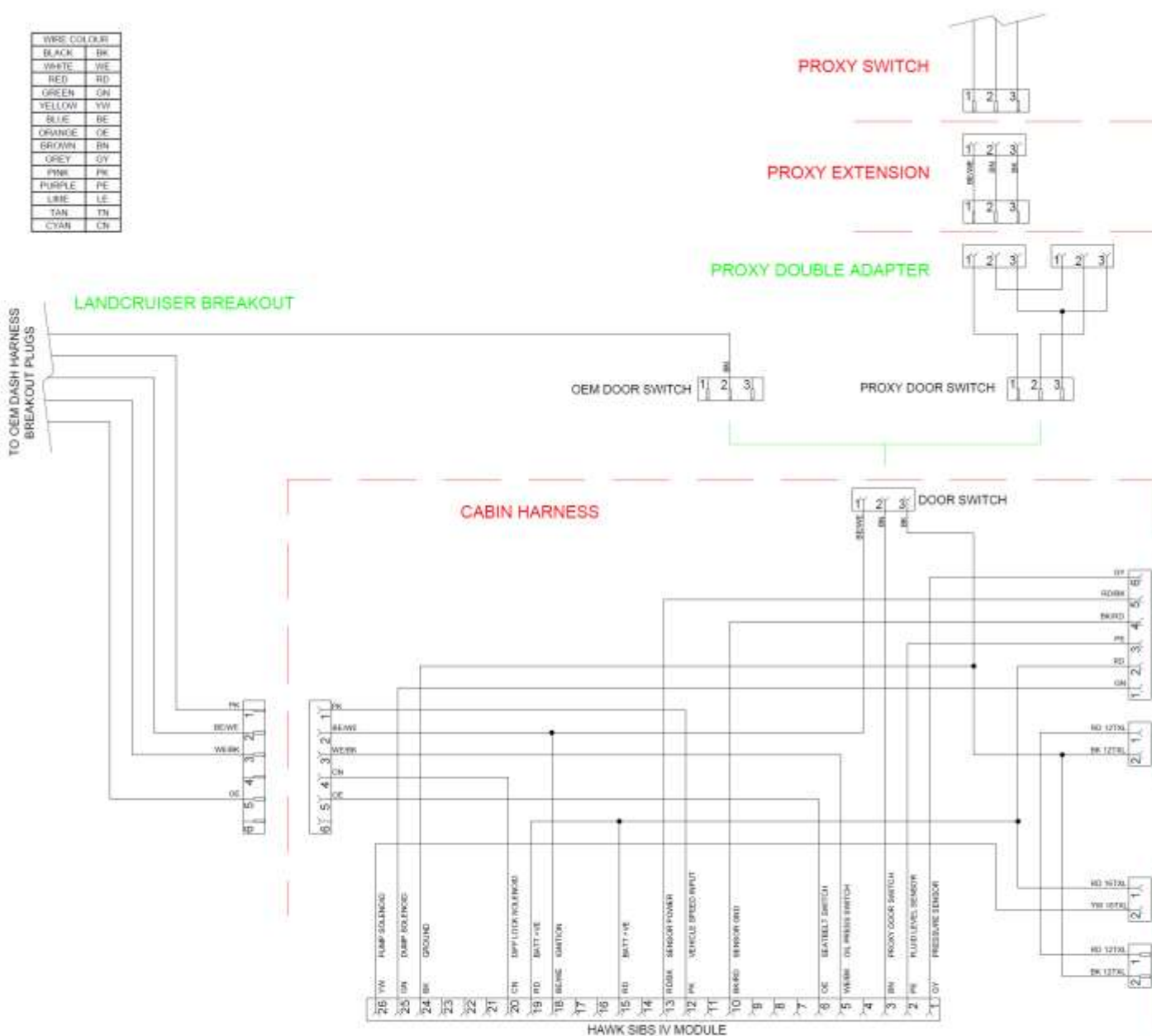
	25-2009	SPRING COVER RH	1	1	-
49	30-2000	WASHER SPRING COVER	20	20	-
50	30-0001	BOLT SPRING COVER	20	20	60
51	25-2040	PLUNGER PAD WEAR INDICATOR	2	2	15
52	30-2005	WASHER SEALING PAD WEAR INDICATOR	2	2	-
53	25-2042	CAP PAD WEAR INDICATOR	2	2	10
54	25-2041	GLAND PAD WEAR INDICATOR	2	2	15
55	30-0028	RETRACTOR BOLT	8	8	80
56	31-5004	PLUG SPRING COVER	6	6	10
57	25-5004	KIT WHEEL BEARING PAIR	1	1	-
58	25-5029	KIT INSPECTION BRAKE PAIR	1	1	-
59	25-5005	KIT MOUNTING REAR SET DISC	1	0	-
60	25-5006	KIT MOUNTING REAR SET DRUM	0	1	-
61	25-5000	KIT SERVICE REAR SET DISC	1	0	-
62	25-5001	KIT SERVICE REAR SET DRUM	0	1	-

ITEM	PART NO.	DESCRIPTION	QTY/KIT (2 BRAKES)		TORQUE (Nm)
			OEM ABS BRAKES	OEM NON-ABS BRAKES	
1	30-3000	PIN DOWEL	4	4	-
2	25-9001	STUD AXLE DRIVE	12	12	17
	-	NUT AXLE DRIVE	12	12	35
3	31-6000	BEARING WHEEL OUTER	2	2	-
4	25-4018	HUB ASSEMBLY FRONT ABS	2	0	-
	25-4019	HUB ASSEMBLY FRONT	0	2	-
5	31-4003	SEAL HUB	2	2	-
6	25-9002	STUD WHEEL	10	10	-
	-	NUT WHEEL	10	10	210
7	31-4000	SEAL V-LIP OUTER	2	2	-
8	31-4002	SEAL V-LIP INNER	2	2	-
9	31-6001	BEARING WHEEL INNER	2	2	-
10	31-5008	NIPPLE GREASE	2	2	10
11	30-0003	BOLT HOUSING	24	24	50
12	25-2012	HOUSING OUTER LH	1	1	-
	25-2013	HOUSING OUTER RH	1	1	-
13	31-2010	O-RING SERVICE WIPER FRONT	8	8	-
14	31-2009	BACK-UP RING SERVICE FRONT	8	8	-
15	31-2008	O-RING SERVICE PRIMARY FRONT	8	8	-
16	25-2024	PISTON SERVICE FRONT	8	8	-
17	30-2003	WASHER SEALING COPPER	4	4	-
18	25-2039	DRAIN PLUG	2	2	20
19	25-2051	GASKET SPINDLE FRONT ABS	2	0	-
	25-2052	GASKET SPINDLE FRONT	0	2	-
20	30-2004	WASHER SEALING COPPER	4	4	-
21	31-5009	BOLT BANJO	2	2	20
22	25-2055	CAP PAD WEAR INDICATOR	2	2	10

23	30-2005	WASHER SEALING PAD WEAR INDICATOR	2	2	-
24	25-4028	PAD WEAR INDICATOR ASSEMBLY FRONT	2	2	15
25	25-4053	BRAKE HOSE FRONT	2	2	-
26	31-9002	CLIP RETAINING BRAKE HOSE	2	2	-
27	25-2036	BRACKET BRAKE HOSE FRONT LH	1	1	-
	25-2037	BRACKET BRAKE HOSE FRONT RH	1	1	-
28	25-4027	BRAKE HOSE FRONT KNUCKLE	2	2	-
29	25-2026	SPACER FRONT BRAKE	2	0	-
30	31-5025	CONNECTOR HOSE BREATHER	2	2	-
31	25-2038	FILL PLUG	2	2	20
32	25-5035	HOUSING INNER FRONT LH ABS W/PINS	1	0	-
	25-5036	HOUSING INNER FRONT RH ABS W/PINS	1	0	-
	25-5037	HOUSING INNER FRONT LH W/PINS	0	1	-
	25-5038	HOUSING INNER FRONT RH W/PINS	0	1	-
33	31-5001	BLEED NIPPLE	2	2	15
34	31-9000	CAP BLEED NIPPLE	2	2	-
35	25-2027	LOCK TAB FRONT ABS	4	0	-
	25-2028	SEAL CARRIER INNER FRONT	0	2	-
36	25-2035	BOLT MOUNTING FRONT BRAKE ABS	16	0	50
	25-2034	BOLT MOUNTING FRONT BRAKE	0	16	50
37	31-2006	O-RING HOUSING	2	2	-
38	24-2850	BRAKE PAD – CW	4	4	-
39	25-2000	ROTOR	2	2	-
40	24-2860	BRAKE PAD - ACW	4	4	-
41	25-2049	SEAL CASSETTE HOUSING	2	2	-
42	25-5004	KIT WHEEL BEARING PAIR	1	1	-
43	25-5030	KIT INSPECTION BRAKE PAIR FRONT ABS	1	0	-
44	25-5029	KIT INSPECTION BRAKE PAIR	0	1	-
45	25-5007	KIT MOUNTING FRONT SET ABS SIBS 4	1	0	-

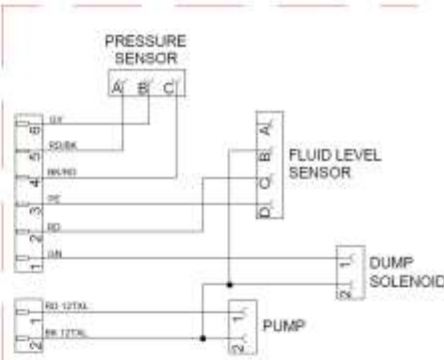
46	25-5008	KIT MOUNTING FRONT SET SIBS 4	0	1	-
47	25-5002	KIT SERVICE FRONT SET ABS SIBS 4	1	0	-
48	25-5003	KIT SERVICE FRONT SET SIBS 4	0	1	-

7. Wiring Diagram

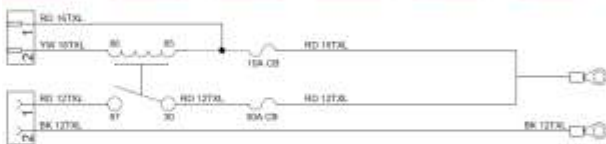


PUMP ENCLOSURE LOOM

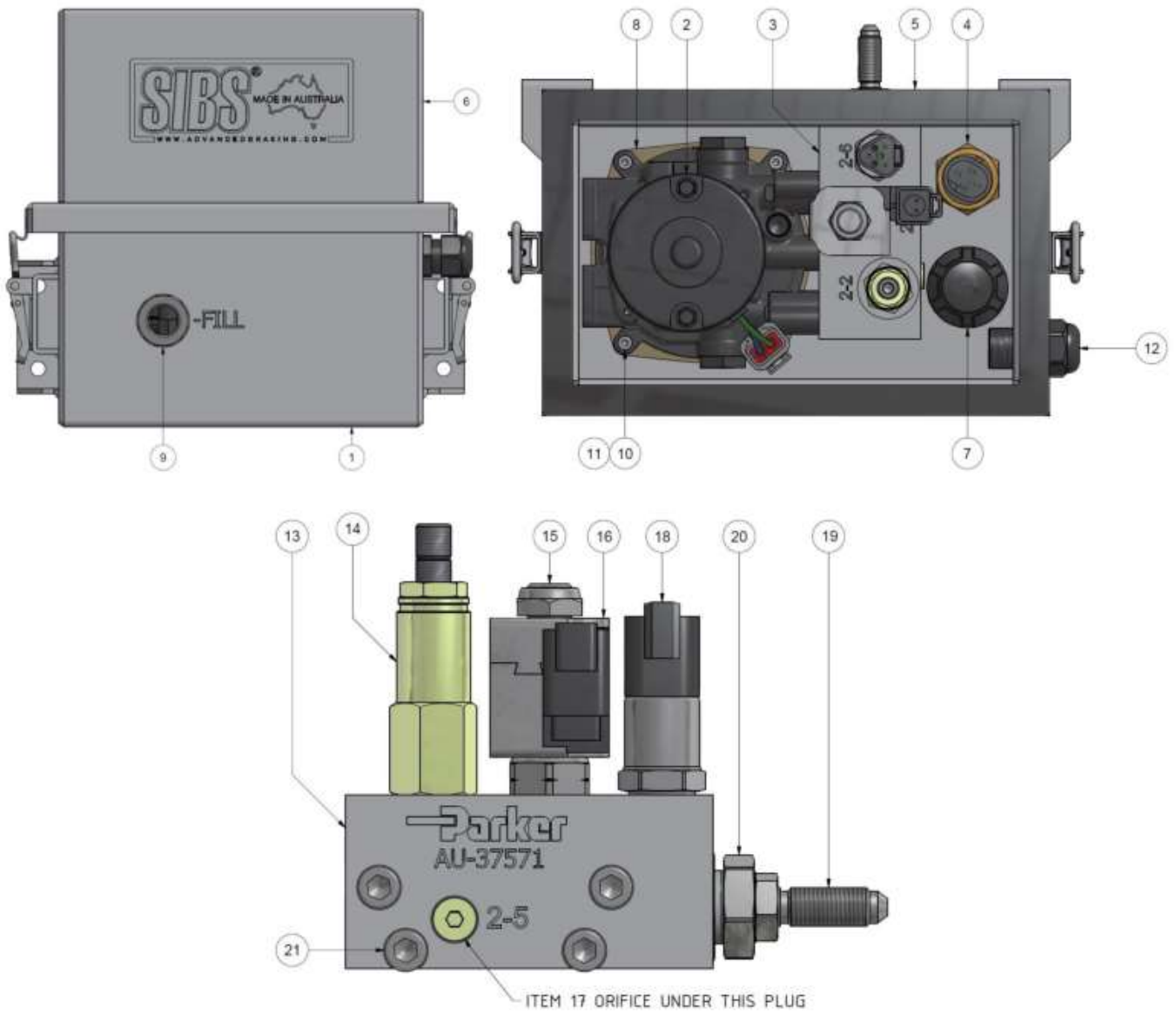
CAB TO PUMP EXTENSION



ENGINE BAY HARNESS



8. Pump Hardware Parts List



ITEM	PART NO.	DESCRIPTION	QTY/KIT
1	18-9015	ENCLOSURE BASE/RESERVOIR	1
2	18-9026	POWER UNIT 12V (PUMP + ADAPTER + MOTOR)	1
3	18-9014	MANIFOLD ASSEMBLY 12V	1
4	18-9027	LEVEL SENSOR	1
5	18-9028	ENCLOSURE GASKET	1
6	18-9028	ENCLOSURE LID	1
7	18-9024	FILL CAP	1
8	18-9029	POWER UNIT GASKET	1
9	18-9030	LEVEL WINDOW	1
10	18-9031	SCREW POWER UNIT	4
11	18-9032	WASHER SPRING POWER UNIT	4
12	18-9033	CABLE GLAND	1
13	18-9034	MANIFOLD BLOCK	1
14	18-9035	RELIEF VALVE	1
15	18-9036	SOLENOID VALVE	1
16	18-9021	COIL 12V	1
17	18-9037	ORIFICE 0.5mm	1
18	18-9017	PRESSURE SENSOR	1
19	18-9038	BULKHEAD FITTING	1
20	18-9039	ADAPTER FITTING MANIFOLD TO BULKHEAD	1
21	18-9040	SCREW MANIFOLD BLOCK	4
22	18-4033	MANIFOLD O-RING SEAL KIT	1

9. 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 15.
3. Remove the vehicle radio.
4. Remove the trim around the instrument cluster.
5. Remove the vehicle instrument cluster by removing (4x) retaining screws and disconnecting (2x) multi-plugs at the rear.



Figure 1: Instrument cluster retaining screws.

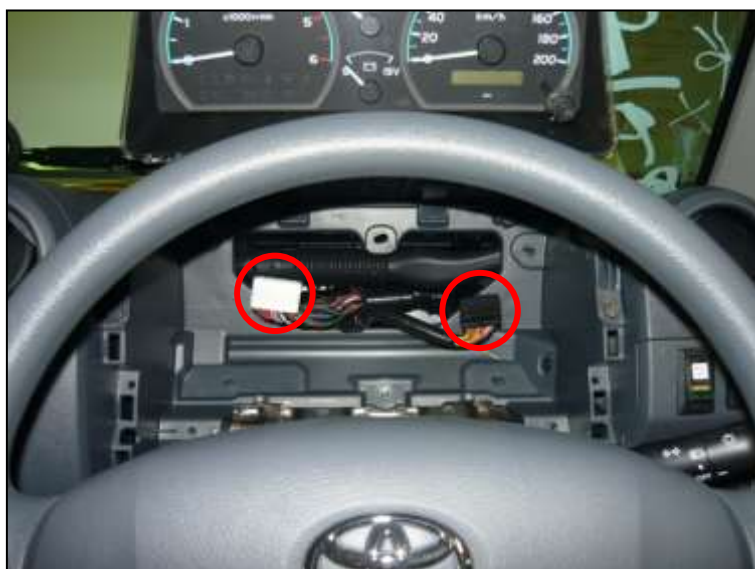


Figure 2: Instrument cluster multi-plugs.

6. Remove the glove box and RH seat.
7. Fit the engine bay harness (See description label on harness):
 - a. Route the engine bay harness through the grommet in the engine bay and into the passenger side. In order to thread the harness through the grommet the connectors need to be removed from the ABT harness. Note the orientation of the pins in the connectors. Push the harness through until just before the heat shrink.



Figure 3: Engine bay entrance

- b. Replace the connectors.
 - 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 cable ties and P-clamps.
8. Mount the control unit to the dash:
- a. 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.
 - b. For LH drive vehicles the control unit bracket can be reversed so that it is always facing the vehicle operator.



Figure 4: ABT™ Failsafe control unit mounted on dash.

9. Fit the ABT™ Failsafe cabin harness:
 - a. 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.
 - b. Route the harness down behind the dash to the passenger side of the transmission tunnel.
 - c. Connect the cabin harness to the engine bay harness which is located beside the passenger foot well.
 - d. Route the cabin harness along the transmission tunnel to the location of 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.
10. 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.
11. 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 $\varnothing 12.5\text{mm}$ holes in the door pillars to mount the proximity switches. Suggested location is on the raised circular pad in the A-pillar for front doors.



Figure 5: Proximity switch mounting location on A-pillar.



Figure 6: 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 7: Secure proximity switch with locknuts and route harness.

- e. Run the extension through the dashboard and connect to the proximity switches.
 - f. For every proximity switch to be added, an additional Y-split harness must be installed.
12. Fit the vehicle interface harness:
- a. Connect the Deutsch end of the vehicle interface harness to the 6 pin connector on the ABT™ Failsafe cabin harness located behind the radio. Remove any unneeded circuits, isolate and insulate. The Following wires correspond to the stated functions:
 - i. Orange – seat belt
 - ii. White with black stripe – Oil pressure
 - iii. Pink – Speed
 - iv. Blue with white stripe – Ignition (Do not disconnect)

- b. Route the harness toward the cavity at the rear of the instrument cluster.
- c. Connect the vehicle interface harness between the white 28-pin connector and the connector and the rear of the instrument cluster.



Figure 8: Connect the vehicle interface harness between the instrument cluster and 28-pin white OEM plug.

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

10. Installation – ABT™ Failsafe Pump

1. Mount the ABT™ Failsafe pump enclosure in a suitable location on the vehicle.
 - a. Remove the bulkhead nut from the pipe fitting on the rear of the pump.
 - b. On single-cabs mount the pump behind the right hand seat (driver's seat in RHD vehicles) using the supplied brackets.
 - i. If possible, place the smaller bracket on the outside of the cab and use it as a template for the required holes.
 - ii. If the vehicle has a tray then the distances between holes needs to be measured, marked and drilled from the inside.

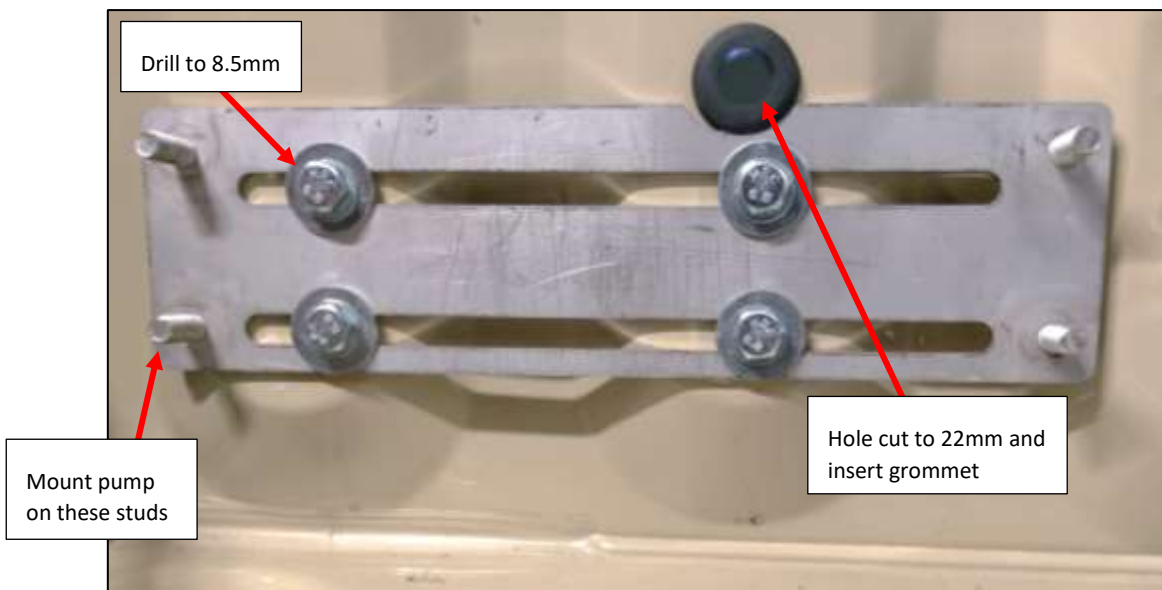


Figure 9: ABT™ Failsafe pump enclosure single cab (shown behind drivers seat RHD vehicle).

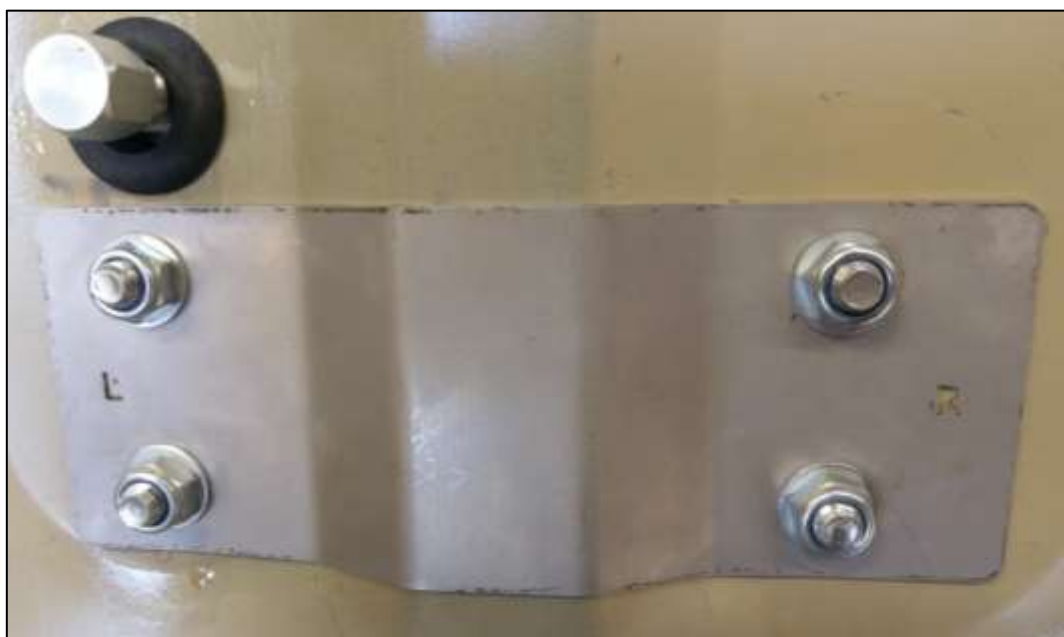


Figure 10: Exterior bracket mount

- c. On dual-cabs mount the pump under the tray behind the rear right wheel using the supplied bracket.



Figure 11: ABT™ Failsafe pump enclosure dual cab.

- d. On troop carriers mount the pump inside the vehicle using the supplied free-standing bracket (the straight bulkhead union at the rear of the pump enclosure must be replaced with the supplied right angle bulkhead union).

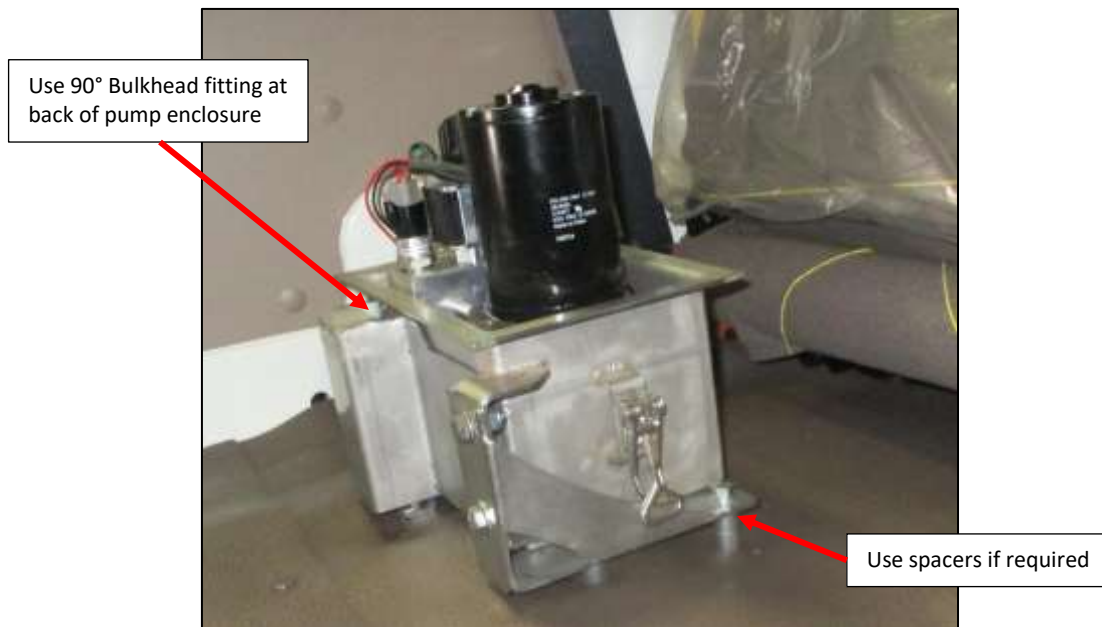


Figure 12: ABT™ Failsafe pump enclosure troop carrier (mounted to floor behind front seats).

- e. Drill the vehicle body as required and mount the ABT™ Failsafe pump using provided mounting hardware.
 f. Plug in the loose cabin harness connectors into the pump loom.
 g. Replace the seat.

11. 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 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.



Figure 13: Clean axle flange and prepare gasket face.

3. 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.
4. Using a suitable lifting hoist, remove the ABT™ Failsafe wheel-end assembly from its packaging.
5. Half fill the hub cavity with high temperature bearing grease (Castrol LMX recommended).
6. 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
7. Remove and keep the 4x brake mounting nuts and spacers (where supplied).
8. Remove the brake link pipe.



Figure 14 - Brake link pipe.

9. For disk brakes Apply Loctite® 515™ directly to the axle flange face.



Figure 15: Apply Loctite® 515™ to axle flange.

10. For drum brakes a gasket must be applied between the axle flange and the brake unit:
 - a. Apply Loctite® 515™ to both sides of the gasket.

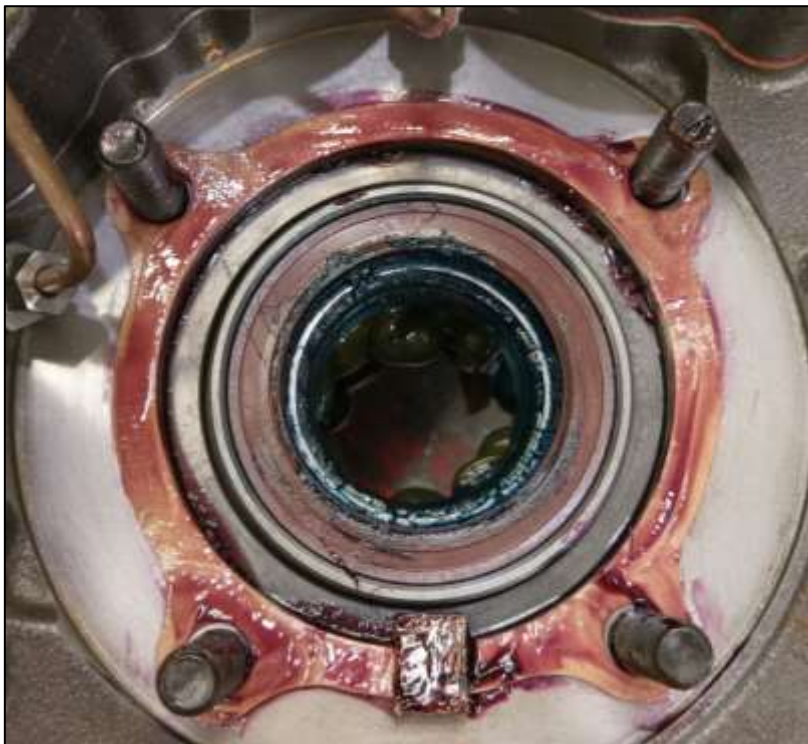


Figure 16: gasket placed in the correct location.

- b. Place the gasket onto the brake unit making sure the cork is facing outwards and is in the right orientation.
 - c. Apply Loctite® 515™ to the slot of the axle flange. When fitting make sure the cork fits correctly into the slot.



Figure 17: Cork part of the gasket in the slot.

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 18: Carefully fit brake assembly over stub axle.

12. Fit the 4x brake mounting nuts (and spacers) that were previously removed.
13. Torque the brake mounting nuts to 80 Nm in a diagonal pattern. Repeat this procedure 3x over a 5 minute period.

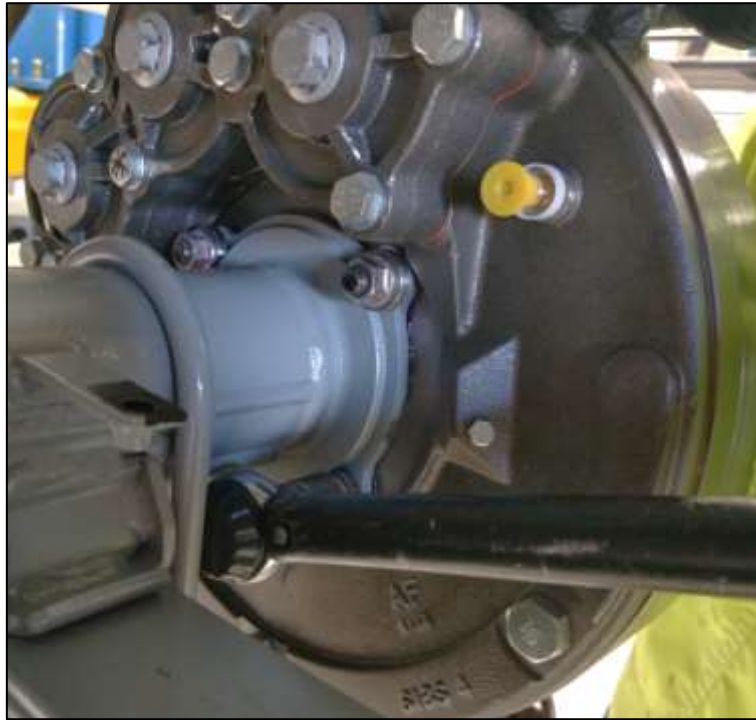


Figure 19: Torque brake mounting bolts.

14. Fit the outer wheel bearing and retaining collar and adjust to Toyota specifications.
15. Replace the brake link pipe (refer to Figure 14 for orientation).
16. Pack the V-lip seal with a high temperature bearing grease (Castrol LMX recommended) and push it into position.



Figure 20: Fit V-lip seal over hub.

17. Install the axle half shafts in accordance to Toyota manual specifications and top up the differential oil as required.
18. Remove the 4x retractor bolts from the spring cover.
19. 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 567 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.
- 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 21: Pad wear indicator install in spring cover.

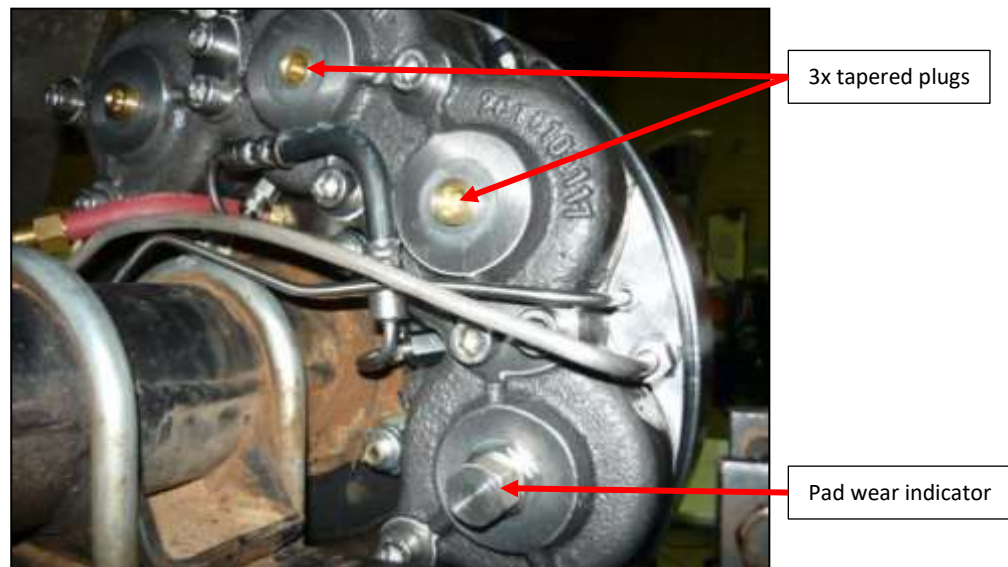


Figure 22: ABT™ Failsafe brake unit.

20. Remove the ABT™ “Blend 20” cooling fluid fill plug.
21. 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.
22. Repeat for the opposing brake unit.
23. Fit the rear 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 to the chassis cross-member above the rear axle.

- c. Fit the expansion chambers with the 90° fittings at the top and the straight fittings at the bottom. The 90° fittings should be facing towards the side of the vehicle that is away from the exhaust.
- d. Secure using the supplied mounting plate and fasteners.

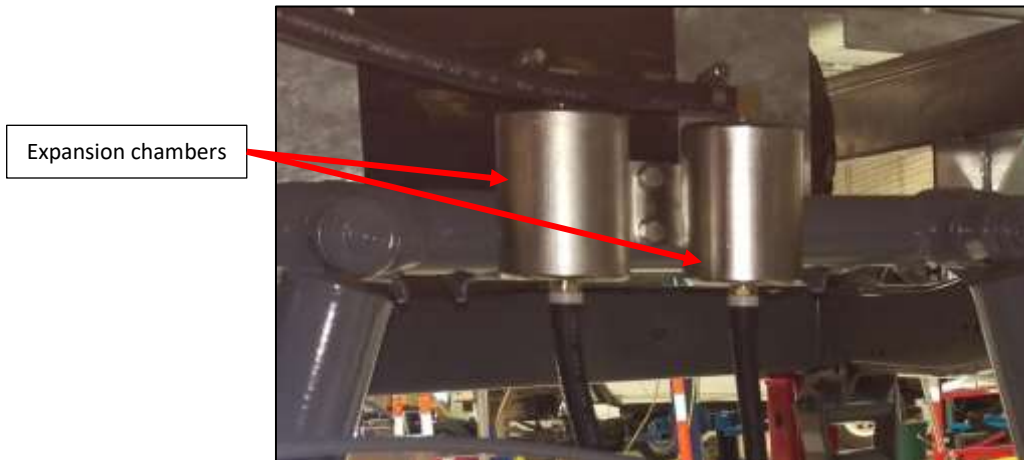


Figure 23: Expansion chamber mounted above diff centre.

- 24. Run lengths of breather hose between the brake units and the opposite expansion chambers (left to right and right to left)
 - a. Route the breather hose from the brake units, along the axle to the diff centre, up to the expansion chambers.
 - b. Route the hose away from the exhaust and any moving components. Allow extra length for axle articulation. Cut hose to desired length.
 - 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.

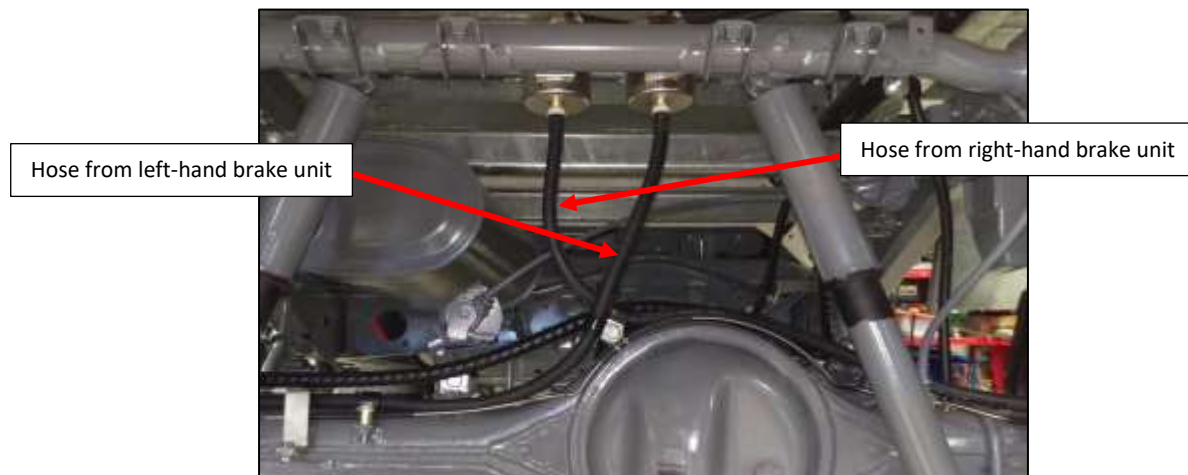


Figure 24: Breather hose routing along rear axle.

- f. Attach the remaining lengths of breather hose to the top of the expansion chambers.
- g. Route the hoses to the side of the chassis that is away from the exhaust.
- h. Follow the chassis rail to the back of the cab.
- i. Secure the hose along the chassis rail.
- j. Route the hose up behind the cab and cut to desired length.

- k. Attach the breather cap and barbed fitting to the end of each hose.
- l. Secure to the front of the tray/well body with p-clips.



Figure 25: Beather caps screwed to the tray.

25. Fit the ABS sensors (if equipped):
 - a. Remove the ABS harness from the OEM bracket on the rear differential.
 - b. Remove the OEM ABS sensor connector by cutting the cable as close to the connection as possible, this will ensure there is enough cable length to install the new sensor in the ABT™ Failsafe brake.
 - c. Slide 40mm of heat shrink over the ABS cable and fit the supplied Deutsch connector. Ensure the Deutsch pins are fitted to the Deutsch plug correctly:
 - i. White cable goes to pin 1
 - ii. Black cable goes to pin 2.

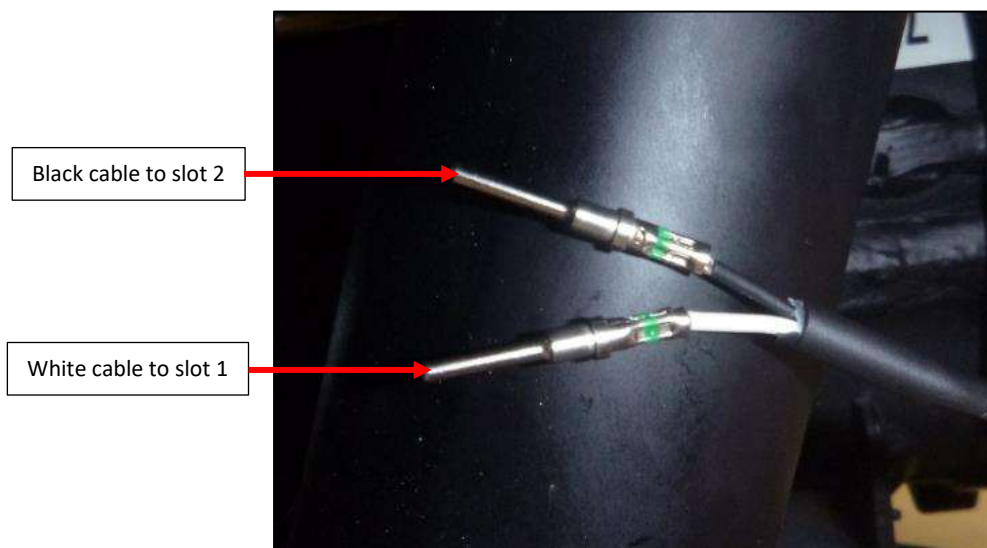


Figure 26: ABS harness pins.



Figure 27: ABS harness connector.

- d. Use a heat gun to heat the shrink wrap so it closes over the end of the Deutsch connector.
- e. Insert ABS sensor assembly into the ABT™ Failsafe brake housing and secure with the original mounting bolt removed from the OEM brakes, torque to 10 Nm.
- f. Ensure each sensor is installed in the correct wheel end or the ABS will not function:
 - i. Sensor with a white stripe on the cable should be installed in the left-hand brake housing.
 - ii. Sensor with a yellow stripe on the cable should be installed in the right-hand brake housing.



Figure 28: ABS harness installed in LH ABT™ Failsafe brake.

- g. Mount the Deutsch connector bracket using the original ABS connector mounting point.
- h. Secure the connection using Denso tape.
- i. Repeat for the opposite wheel-end.

12. Installation – Front Brakes

1. Ensure all OEM Toyota front brake equipment has been removed from the vehicle:
 - a. Remove both front brake assemblies.
 - b. Remove the two flexible hydraulic hoses from the front brakes to the OEM hard brake lines.
2. 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
3. Remove the 12x M10 bolts from around the circumference of the outer housing.
4. Lift the outer housing and brake rotor away from the inner housing.
5. Clean the axle stubs and shafts to remove any traces of grease and dirt.
6. Install the 2x guide pins provided.



Figure 29: cleaned axle flange.

7. Smear both sides of a new gasket with Loctite® 515™.
8. Install the gasket with the cork filler fitted into the drain slot.

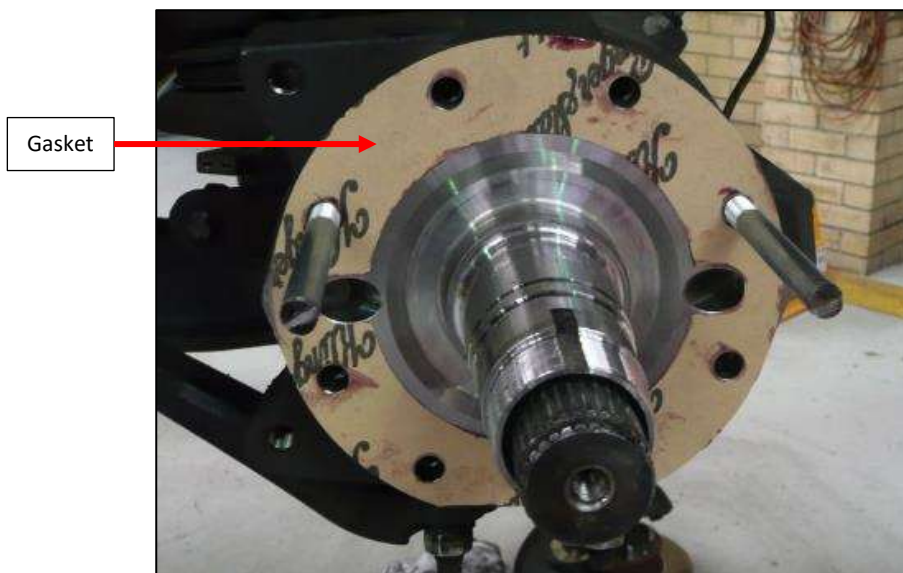


Figure 30: Gasket installed

9. Apply Loctite® 515™ flange sealant to the underside of the 8x M10 brake mounting screw heads.
10. Bolt the inner housing onto the stub axle flange with the 6x M10 brake mounting screws. Ensure the lock tabs are in position.
11. Remove the 2x guide pins and attach the 2x remaining mounting screws.
12. Torque the 8x brake mounting screws in a star pattern to 60 Nm. Repeat this process 3x times over a 5 minute period.
13. Bend over the lock tabs to secure the 8x brake mounting bolts.



Figure 31: Install mounting bolts

14. Install the inner brake pads in the inner housing ensuring correct orientation. A location pin on the brake pads will assist.



Figure 32: brake pads installed

15. Ensure the hub inner lip seal is lubricated with wheel bearing grease.
16. Carefully fit the outer housing, hub and rotor assembly to the inner housing on the vehicle. 2x guide pins (not provided) may assist with fitment.



Figure 33: mounting the outer housing

17. Fit the 12x M10 bolts and torque to 50 Nm in sequence. Ensure each bolt is torqued twice.

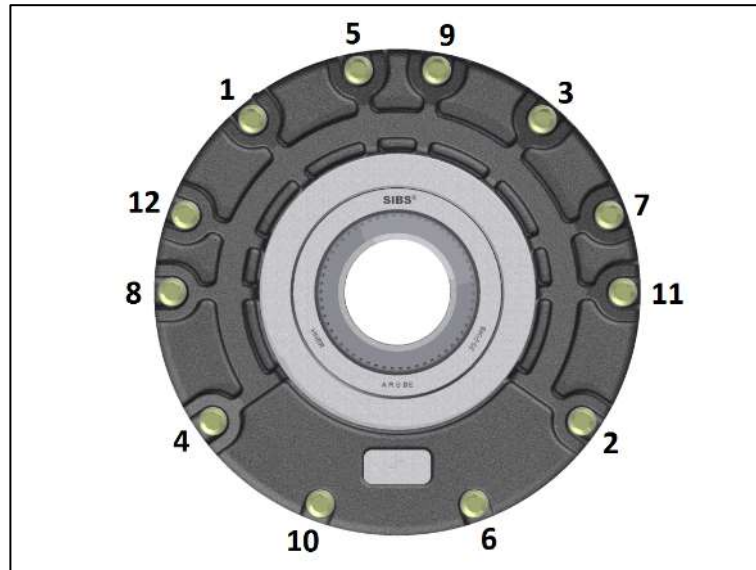


Figure 34: Housing bolt torque sequence.

18. Half fill the wheel bearing cavity in the hub with a high temperature bearing grease (Castrol LMX recommended).
19. Fit the wheel bearing and locking hub as described in the Toyota manual.
20. 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.
21. Fit the ABS sensors (if equipped) and secure using the OEM bolt, torque to 10 Nm.



Figure 35: ABS sensor

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 800 ml of ABT™ “Blend 20” cooling fluid is required per front brake unit.
24. Connect the hydraulic hoses to the original mounting points on the chassis and to the ABT™ Failsafe front brake using the new banjo bolts and sealing washers provided.



Figure 36: Hydraulic hoses

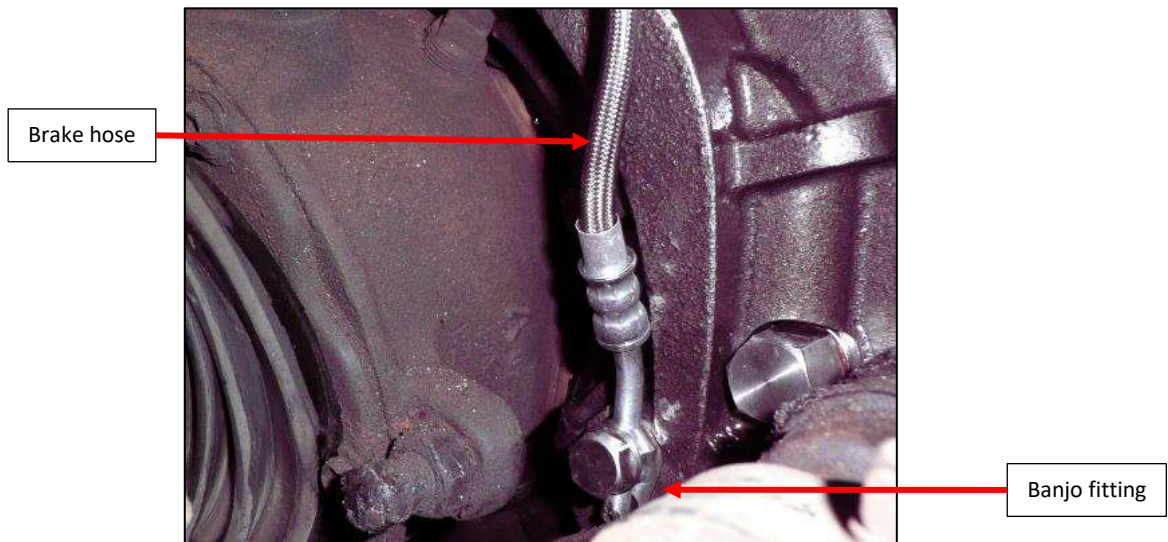


Figure 37: Banjo fitting

- 25. Repeat for the opposing wheel-end.
- 26. Mount the expansion chambers above the wheel-ends at suitable locations within the engine bay.



Figure 38: expansion chamber in the engine bay

27. Run a length of breather hose from the bottom of the expansion chambers down to the barb fitting on each brake unit. Ensure there are no bends, kinks or low point in the hose. Ensure the wheel is able to turn from lock to lock without any interference.

13. Installation – Hydraulic System

1. Mount the park/emergency brake tee-union.
 - a. On vehicles with a single brake line to the rear axle. Mount the tee-union on the rear axle using the same fasteners as the service brake tee-union.

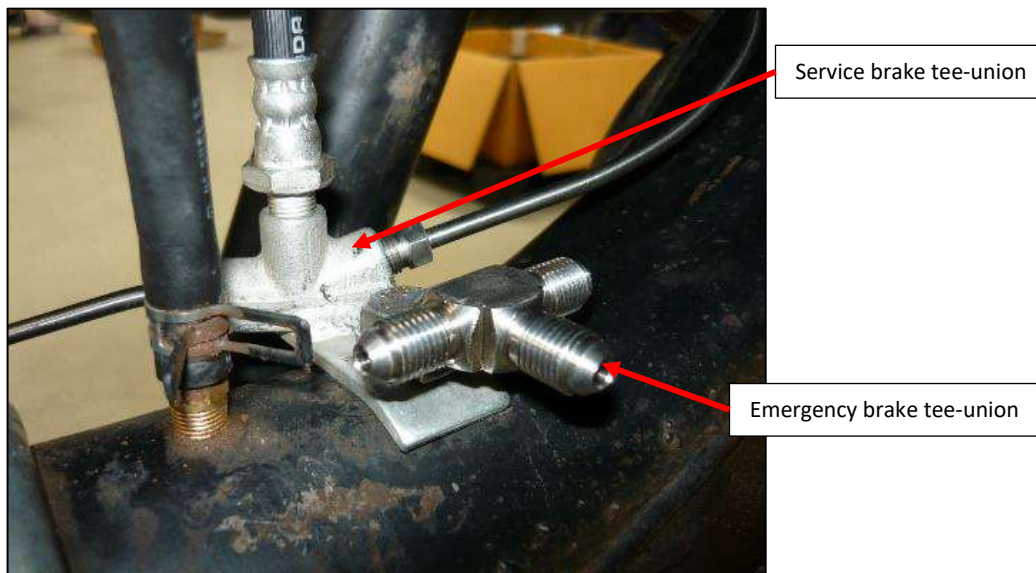


Figure 39: Park/emergency brake tee-union beside service brake tee-union.

- b. On vehicles with two brake lines to the rear axle (vehicles equipped with electronic stability control). Mount the tee-union on the front of the bracket that holds the brake lines.

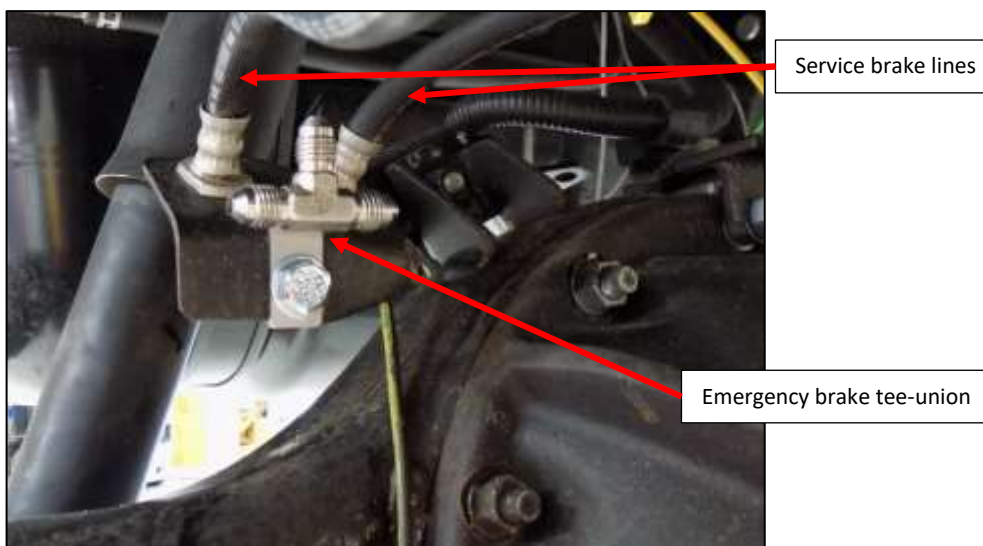


Figure 40: Park/emergency brake tee-union on bracket with brake lines (vehicles equipped with ESC).

- c. On vehicles fitted with a differential lock, mount the tee-union on top of the differential lock on the casing bolt on top of the locker itself.



Figure 41: Differential lock tee-union location

2. Connect one end of the park/emergency brake hydraulic hose to the bulkhead fitting at the rear of the pump enclosure.
3. Route the other end of the hydraulic hose down to the centre of the tee-union on the rear axle and connect. Secure the hose along the chassis using supplied P-clips and brackets.
4. Fit the RH service brake tubes.
 - a. On vehicles with a single brake line to the rear axle. Connect one end of the RH service brake tube to the rear axle tee-union and the other end to the inlet on the RH brake unit.
 - b. On vehicles with two brake lines to the rear axle (vehicles equipped with electronic stability control). Connect one end of the RH service brake tube to the RH service brake line and the other end to the inlet on the RH brake unit.
 - c. Secure the brake line using the OEM P-clip.
5. Fit the 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 42: Brake lines routed on to RH brake unit (facing rear of vehicle).

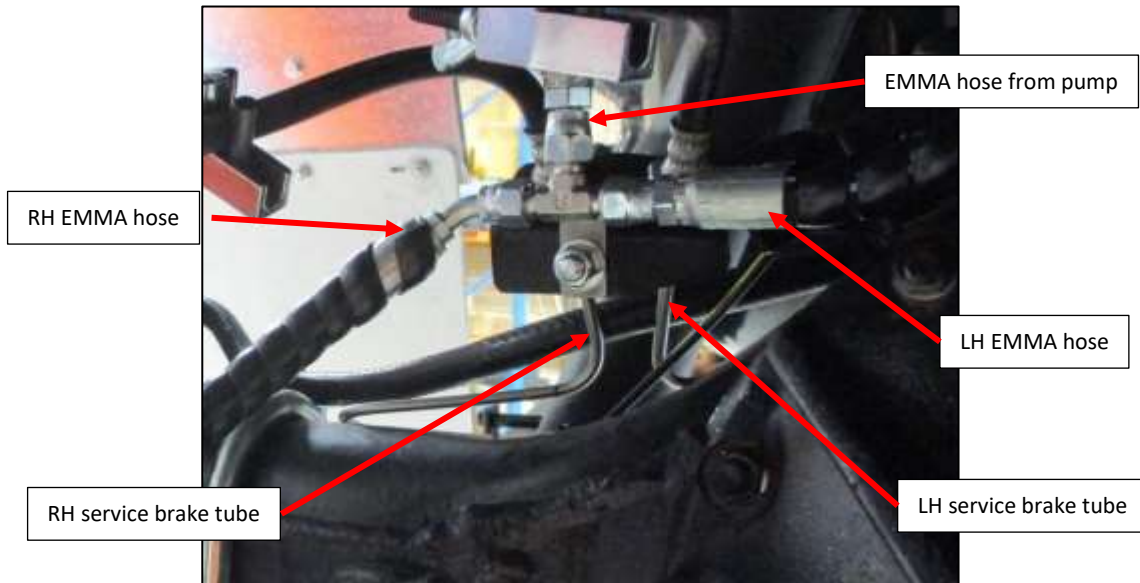


Figure 43: Brake and EMMA lines routed on to brake units (facing rear of vehicle equipped with ESC).



Figure 44: Brake lines routed on to RH brake unit (facing front of vehicle).

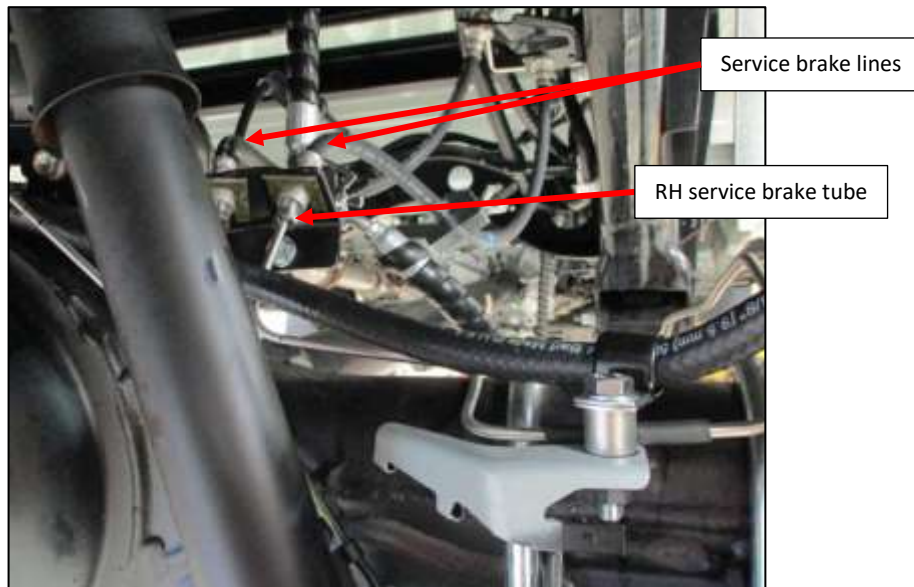


Figure 45: Brake lines routed on to RH brake unit (facing front of vehicle equipped with ESC).

6. Fit the 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. On vehicles with two brake lines to the rear axle (vehicles equipped with electronic stability control). Connect one end of the LH service brake tube to the LH service brake line and the other end to the inlet on the LH brake unit.
 - c. Secure the brake line using the OEM P-clips.
7. Fit the 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 46: Brake lines routed on to LH brake unit (facing rear of vehicle).



Figure 47: Brake lines routed on to LH brake unit (facing front of vehicle).

14. Installation – Bleeding and Safety

1. 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).

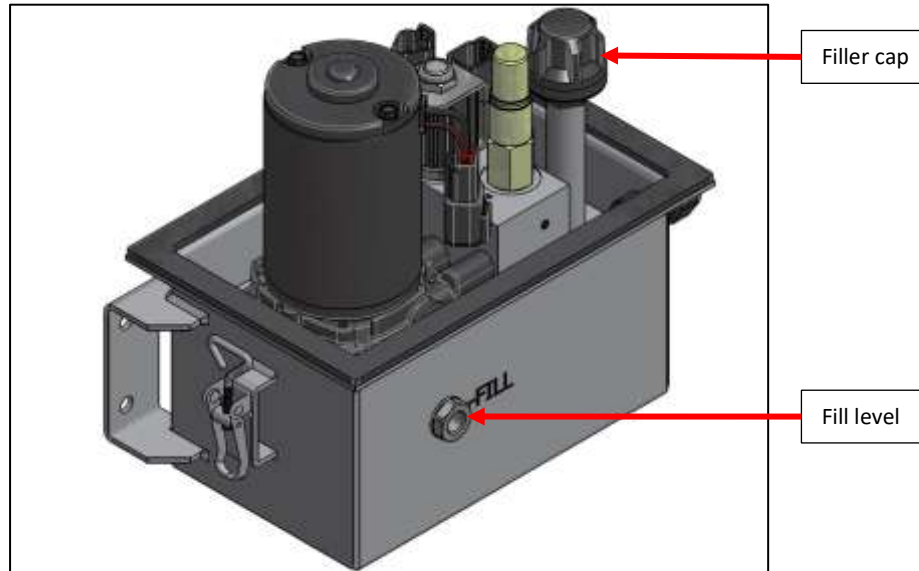


Figure 48: ABT™ Failsafe pump enclosure with lid removed.

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

4. 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.

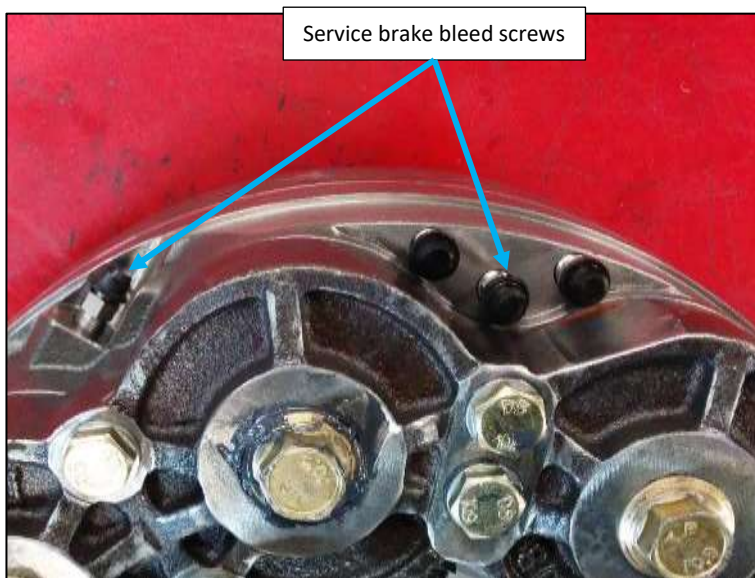


Figure 49: Service brake bleed screws.

5. 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 50: Park/emergency brake bleed screws.

6. Affix the ABT™ Failsafe caution label to the inside top corner of the windshield on the driver's side.
7. Affix the ABT™ Failsafe on the door near the ridge on both sides.



Figure 51: Labels to be affixed

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.

15. Control System Setup

1. Ensure the battery is fully charged and in good working condition before connecting the ABT™ Failsafe controller.
2. With the vehicle engine running, twist and release the red E-stop button to release the brakes - the system will automatically detect the correct brake release pressure during its first release.
3. Activate all connected interlocks and check functions:
 - 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).
4. 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 52: ABT™ Failsafe control unit warning lights

16. 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 or every 100 hours (whichever occurs first)
Major Service: Rear	When rear brake pad wear reaches minimum (as indicated by the pad wear indicator)

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 involves a system inspection and replacement of any worn components to ensure continued reliable operation of the ABT™ Failsafe braking system.

17. 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 (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).
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 ABT™ Failsafe park/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
8. If the vehicle drives through the brake a Major Service must be performed.

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

18. 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 ABT™ Failsafe EMMA™ pump reservoir. Top up if necessary.
4. Check ABT™ Failsafe pump for leaks:
 - a. Engine running
 - b. Twist and release the E-stop button to release the park/emergency brake
 - c. Release the brake 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.).
 - e. Refit the protective cap and fibre washer.

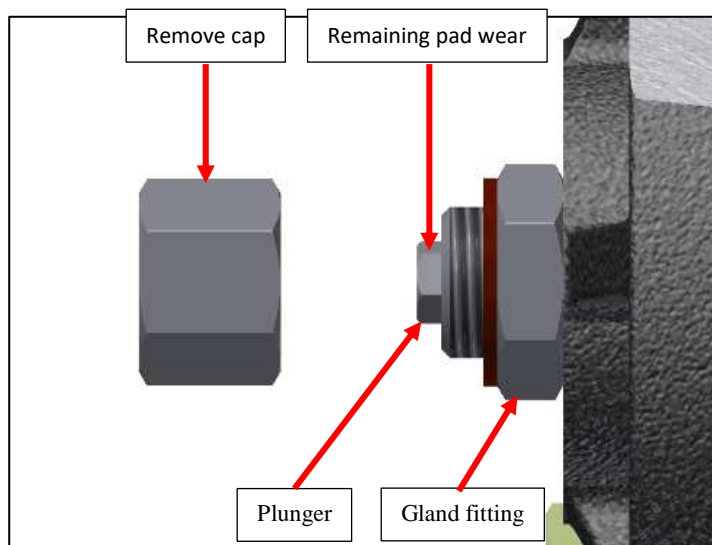


Figure 53: Rear pad wear indicator schematic.

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

12. 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.
13. 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.
14. Refit the drain plug with a new sealing washer.
15. Refill the wheel-end up to the level plug (fill to spill). 1 litre of ABT™ “Blend 20” cooling fluid is required for each rear wheel-end.
16. 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. (New pads = 4mm approx.).
 - f. Refit the protective cap and fibre washer.

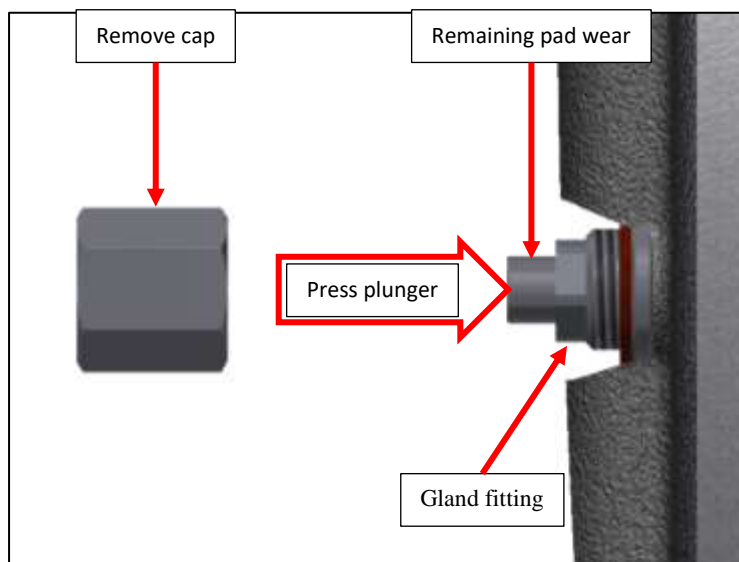


Figure 54: Front pad wear indicator schematic.

17. If the brake pads have worn beyond the wear limit, then a major service must be completed.
18. 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 front 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.
19. Refit the drain plug with a new sealing washer.
 20. Refill the wheel-end up to the level plug (fill to spill). 800 ml of ABT™ “Blend 20” cooling fluid is required for each front wheel-end.
 21. Conduct a “vehicle pre-start check”.

19. 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 27 EMMA piston seals and section 28 service piston seals).
3. Repair/replace damaged parts where necessary during the major service.
4. Test the EMMA springs and pistons (section 21).
5. Disassemble the brake (section 22 - Rear).
6. Perform a rotor service (section 23).
7. Perform a hub bearing and seal change (section 24).
8. Perform a pad change, seal change and housing service (section 25).
9. If the springs need to be replaced, perform a replacement now (section 26).
10. Assemble the brake (section 29 - Rear).
11. Conduct a “vehicle pre-start check”.

20. 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 28).
3. Repair/replace damaged parts where necessary during the major service.
4. Disassemble the brake (section 22 - Front).
5. Perform a rotor service (section 23).
6. Perform a hub bearing and seal change (section 24).
7. Perform a pad change, seal change and housing service (section 25).
8. Assemble the brake (section 29 - Front).
9. Conduct a “vehicle pre-start check”.

21. 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.

22. Service Disassembly Procedure

A. Rear

1. Remove the rear wheels.
2. Clamp the rear brake lines.
3. Remove the 3x tapered plugs and 1x pad wear indicator from the spring cover. Refer to exploded view for more detail.
4. 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.
5. 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.
6. Remove the axle shaft.
7. Remove the hub nut. The hub can now either be removed or left in place and removed with the rest of the brake.
8. Remove and discard 2x housing bolts on opposite sides of the brake housing.
9. Attach 2x guide pins.
10. Remove and discard the remaining 10x housing bolts.
11. 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 55: Separate inner and outer housings.

12. Stand the brake assembly on a clean bench, sit the outer housing, rotor and hub assembly face down on the hub studs.



Figure 56: Outer housing, rotor and hub assembly.

B. Front

1. Remove the front wheels.
2. Clamp the front brake lines.
3. 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.
4. Remove the hub cap.
5. Remove the hub nut. The hub can now either be removed or left in place and removed with the rest of the brake.
6. Remove and discard 2x housing bolts on opposite sides of the brake housing.
7. Attach 2x guide pins.
8. Remove and discard the remaining 10x housing bolts.
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.

23. Rotor Replacement Procedure

1. Disassemble the outer housing according to section 22.
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.

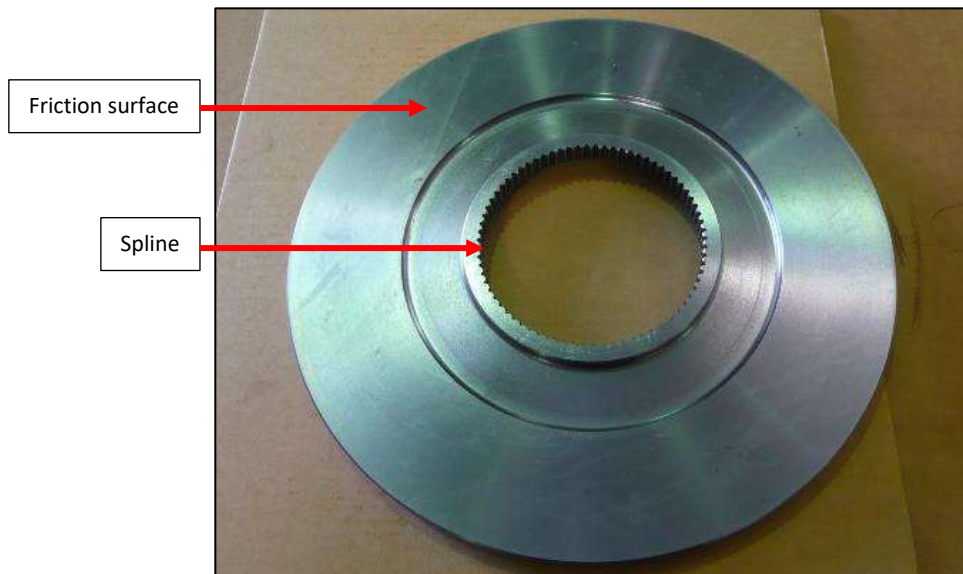


Figure 57: Rotor.

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.

24. Wheel Bearing and Hub Seal Replacement Procedure

1. Disassemble the outer housing according to section 22.
2. Remove the hub from the outer housing.
3. Remove the V-seal and shaft seal 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 58: 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 59: 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 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. Put a small amount of grease around inside of the shaft seal.



Figure 60: Shaft seal installed

15. Install the inner V-seal, the square edges of the seal should be seated on the hub.
16. Give the outer V-seal a gentle stretch and install it on the outside of the hub.

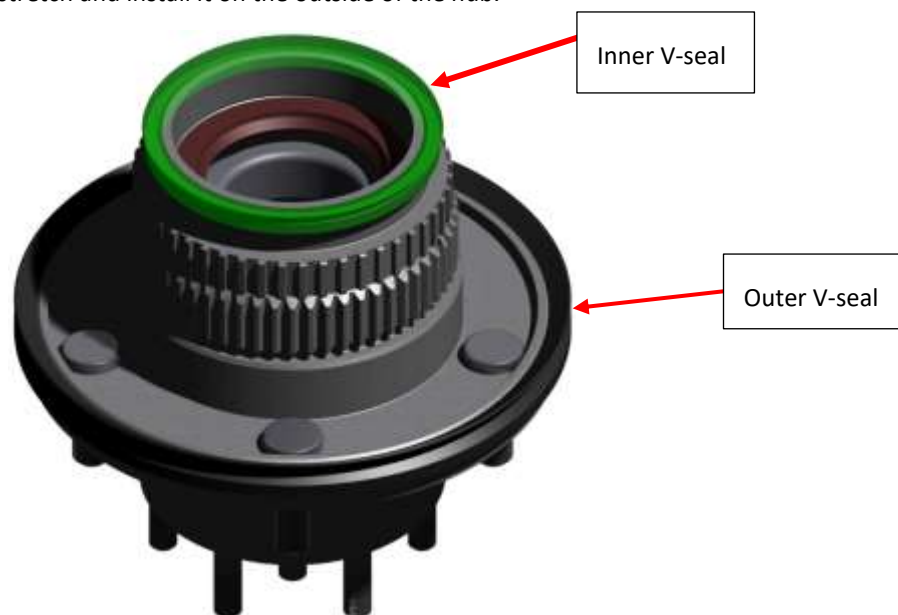


Figure 61: V-seals installed

25. Pad Change, Seal Change and Housing Inspection

1. Disassemble the outer housing according to section 22.
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 62: Brake pad position

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



Figure 63: 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:
- Punch out the old studs. Ensure the mating parts of the housing and seal carrier are clean and free of debris.
 - 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.
 - 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 and discard the stub axle oil seal.
19. 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.

26. Spring Replacement Procedure

1. Disassemble the outer housing according to section 22.
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 64: Spring stack

8. Perform an EMMA piston seal replacement now. (Section 27).
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 65: Lubricated springs on the pistons

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



Figure 66: 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.

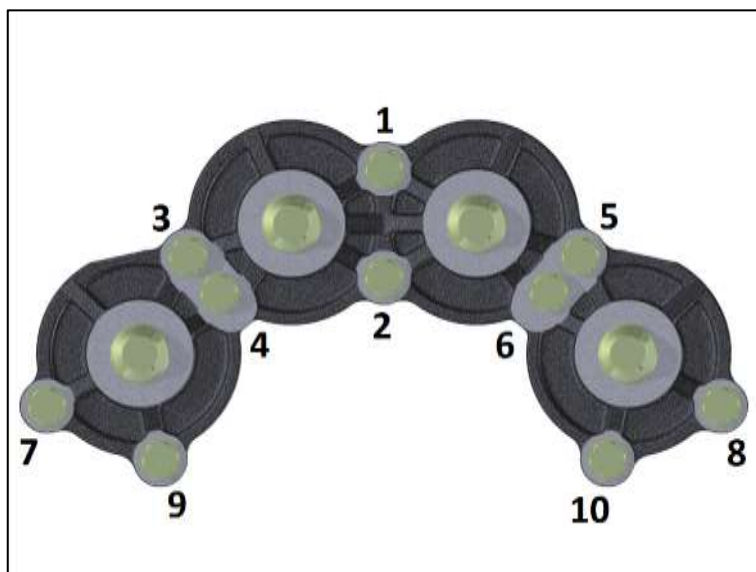


Figure 67: Spring cover bolt torque sequence.

27. EMMA Piston and Piston Seal Replacement Procedure

1. Follow steps 1-10 in section 26 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 are not twisted.

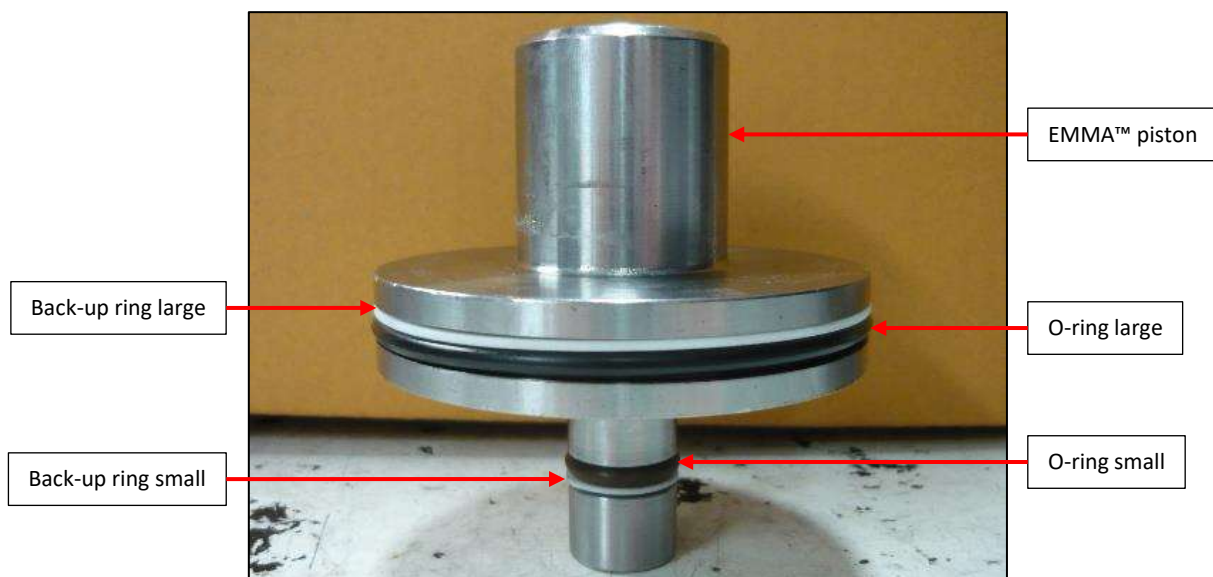


Figure 68: EMMA piston with seals installed.

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 69 – Pistons installed in position

13. Follow steps 12-16 in section 26 to reassemble piston springs and spring covers.

28. Service Piston and Piston Seal Replacements Procedure

1. Disassemble the outer housing according to section 22.
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 are not twisted.



Figure 70: 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 71: Pistons installed

29. Service Assembly and Bleed Procedure

A. Rear

1. 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.
2. Apply Loctite® 515™ directly to the axle flange face.
3. 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
4. Fit the ABT™ Failsafe inner brake assembly unit over the stub axle. Align the mounting holes and locate the housing evenly and firmly against the axle flange.
5. Fit 4x new brake mounting nuts. Washers/spacers may be required with some kits.
6. Torque the brake mounting nuts to 80 Nm in a diagonal pattern. Repeat this procedure 3x over a 5-minute period.
7. 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 $\varnothing 62\text{mm}$ max.).
8. Fit a new housing O-ring into the groove around the circumference of the inner housing.
9. Install the inner brake pads in the inner housing ensuring correct orientation.
10. Carefully fit the outer housing, hub and rotor assembly to the inner housing. 2x guide pins may assist with fitment.
11. Fit the 12x M10 bolts and torque to 50 Nm in sequence. Ensure each bolt is torqued twice.

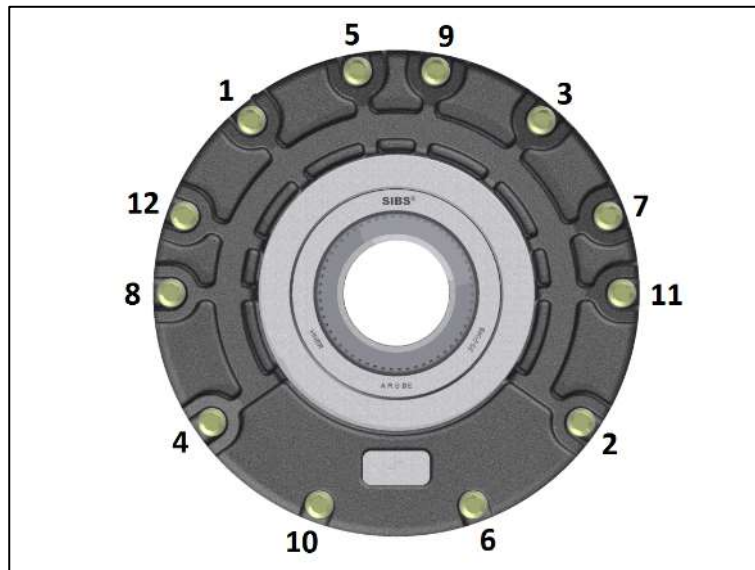


Figure 72: Housing bolt torque sequence.

12. Fit the outer wheel bearing and retaining collar and adjust to Toyota specifications.
13. 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.
14. Fit a new stub axle oil seal.
15. Install the axle half shafts in accordance to Toyota manual specifications and top up the differential oil as required.
16. Remove the 4x retractor bolts from the spring cover.

17. 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.

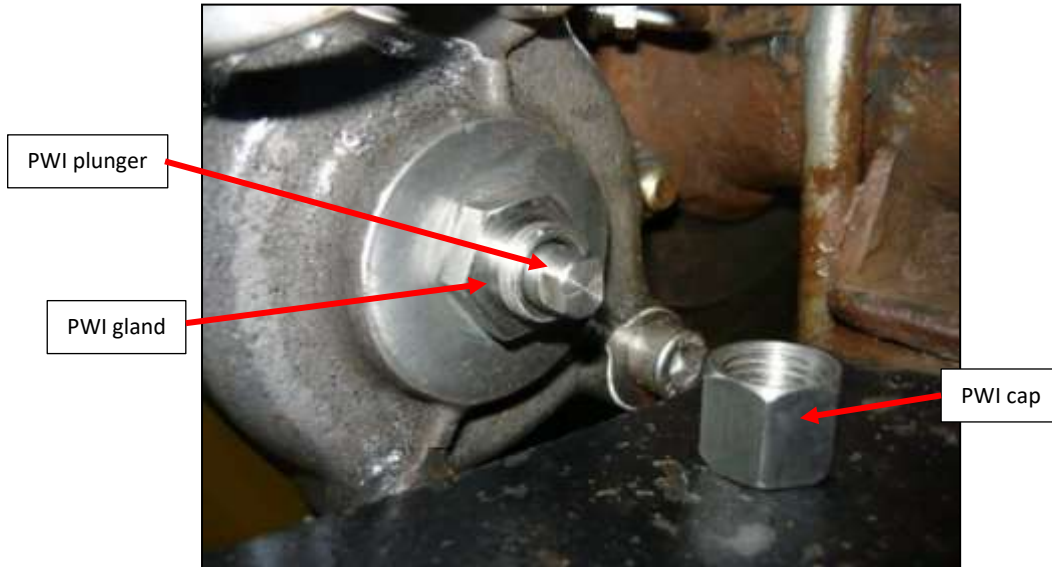


Figure 73: Pad wear indicator install in spring cover.

- 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.

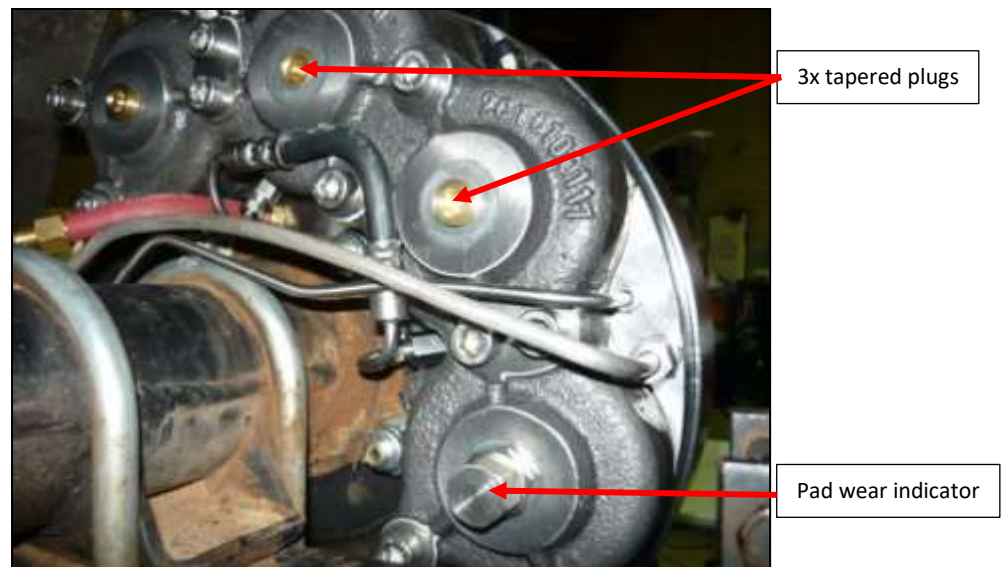


Figure 74: ABT™ Failsafe brake unit.

18. Remove the ABT™ “Blend 20” cooling fluid fill plug.
19. 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.
20. Repeat for the opposing brake unit.

21. Inspect all the park/emergency brake hydraulic hoses and replace as required.
22. Replace all rear breather hoses.
23. Flush the pump reservoir with new ATF Dexron III and then fill to level window.
24. 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.
25. Bleed the park/emergency brake system using the bleed screws on the rear brakes.
26. Remove any clamps on the rear service line.
27. Flush the master cylinder with DOT 3 brake fluid.
28. Bleed the rear service brake system of air.
29. Check that there are no leaks from the system.
30. 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

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 $\varnothing 62\text{mm}$ 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. Fit the 12x M10 bolts and torque to 50 Nm in sequence. Ensure each bolt is torqued twice.

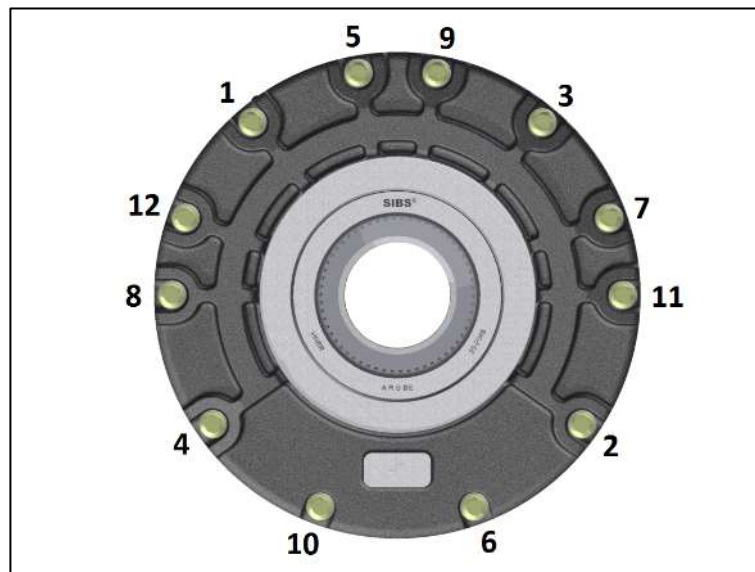


Figure 75: Housing bolt torque sequence.

7. Fit the outer wheel bearing and retaining collar and adjust to Toyota specifications.
8. 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.
9. Remove the ABT™ “Blend 20” cooling fluid fill plug.
10. 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.
11. Repeat for the opposing brake unit.
12. Inspect all the front brake hydraulic hoses and replace as required.
13. Replace all front breather hoses.
14. Remove any clamps on the front service line.
15. Flush the master cylinder with DOT 3 brake fluid.
16. Bleed the front service brake system of air.
17. Check that there are no leaks from the system.
18. 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

30. Troubleshooting

1. Problem

- a. Possible cause
 - i. Solution

1. 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 Landcruiser – 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.

2. 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.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
- 8. 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 the 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.
- 9. 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.
- 10. 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.
- 11. 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.
- 12. 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.
- 13. 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.
- 14. 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.
- 15. 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.