



Braking into the Future...



SEALED INTEGRATED BRAKING SYSTEM (SIBS<sup>®</sup>)

FITMENT, SERVICE MANUAL & STANDARD OPERATING PROCEDURE FOR RETROFIT TO...

**TOYOTA Land Cruiser 70 Series** (Australia models)

# **WORKSHOP MANUAL**

## **SIBS<sup>®</sup> II REAR BRAKE SYSTEM**

## Revision History

Revision	Issue Date	Author	Comments
01	30-NOV-2010	D. Spencer	Initial Release
01B	14-DEC-2010	D. Spencer	Section 10 re-written + Corrections
01C	14-JAN-2011	D. Spencer	Section 7 added for Highway Speed Isolation
01D	28-MAR-2011	D. Spencer	Exploded view & BOM updates
01E	04-MAY-2011	D. Spencer	Revised Axle Lines; Sections 5.4 and 5.5 Door Interlock connection; Sections 6.13 and 6.14
01F	24-JUN-2011	D. Spencer	Updated wiring diagrams. Sections 6.4 and 6.5

Figure 1: Revision History

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## About This Manual

This manual applies to the second generation Sealed Integrated Braking System (**SIBS**<sup>®</sup> II) for the **TOYOTA LANDCRUISER 70 series** (post March 2007 models). The manual details how to install and configure the SIBS<sup>®</sup> II correctly to ensure optimum safety and performance. While every effort has been made to address all aspects of the installation, please advise Advanced Braking of any omissions or suggestions on how this manual may be improved.

## Web Page

The most up to date version of the manual can be obtained by contacting ABT Customer Services Manager or downloaded from the web page; [www.advancedbraking.com](http://www.advancedbraking.com)

To access the latest manual, select **Technical** from the top drop down menu and then select the relevant manual.

To access the latest **Technical Bulletins** browse the list at the bottom of the Technical page.

## Terminology

<b>SIBS</b> <sup>®</sup>	Sealed Integrated Braking System
<b>EMMA</b> <sup>™</sup>	Electronically Modulated Mechanically Applied
<b>SIBS</b> <sup>®</sup> Fluid	Specially formulated cooling fluid for use in SIBS brakes
<b>Service Brake</b>	Brakes applied when driving via the foot pedal
<b>Park Brake</b>	Brakes applied independently of the service brake
<b>Emergency Brake</b>	Brakes automatically applied in an emergency
<b>PWI</b>	Pad Wear Indicator
<b>HSI</b>	Highway Speed Isolation

## Contact Information

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While every attempt is made to ensure that the information in this manual is correct, no liability can be accepted by the authors for loss, damage or injury caused by any errors in, or omissions from, the information given.

## Important Information

### Ownership of SIBS<sup>®</sup> II

The SIBS<sup>®</sup> Patent and Trademarks are owned by Advanced Braking Pty Ltd.

### Manual Information

This manual has been prepared to support customers, maintenance personnel and operators of SIBS<sup>®</sup> II. It is necessary that the manual is read and understood to ensure that the product is installed, operated and maintained correctly.

This manual provides instructions for the retrofitting, installation and maintenance of the **SIBS<sup>®</sup> II** system on **Toyota Land Cruiser 70 Series** (post March 2007 models). All information contained in this manual is based on the latest SIBS<sup>®</sup> product information available at the time of publication. Advanced Braking Pty Ltd reserves the right to change the manual at any time without prior notice.

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

### Vehicle Details

The 70 Series Toyota Land Cruiser vehicles are available in the following variants:

- **71 Series** (Short Wheel Base)
- **76 Series** (4 door Wagon)
- **78 Series** (Troop Carrier)
- **79 Series** (Cab Chassis or Utility).

Two engines are available:

- **1VD** (V8 Turbo Diesel) for Australian markets
- **1HZ** (I6 Diesel) for remaining markets.

Check the vehicle model number (located on the under bonnet VIN plate) to ascertain full specification of your vehicle. Vehicles sold in Australia have a '**Q**' within the model number (e.g. VDJ79R-TJMRS**Q**3). Please note that '**G**' spec vehicles are not covered in the scope of this manual due to the different rear axle configuration.

**VDJ  
Series**

**78 Series** – Troop Carrier with VDJ engine ('Q' spec)  
Air scoop on bonnet indicates 1VD V8 diesel motor.

**HZJ 79  
Series**

**79 Series** – Well Body Utility ('G' Spec.)  
No bonnet air-scoop indicates 1HZ 6 cylinder motor.

**VDJ 79  
Series**

**79 Series** – Cab Chassis with VDJ engine ('Q' spec)  
Air scoop on bonnet indicates 1VD V8 diesel motor.

## Installation of SIBS<sup>®</sup> II Brakes

SIBS II<sup>®</sup> must be installed by a qualified tradesperson who has been trained for this purpose by ABT; this is a requirement for ADR compliance of the vehicle. Specific experience in the installation of braking systems and electromechanical experience is also a prerequisite for the installation of SIBS II<sup>®</sup>.

## Safety Labels

Advanced Braking Pty Ltd provides customers with Safety Labels that are required to be placed prominently in any vehicle fitted with SIBS<sup>®</sup>. Refer to Section 9 for information about the labels.

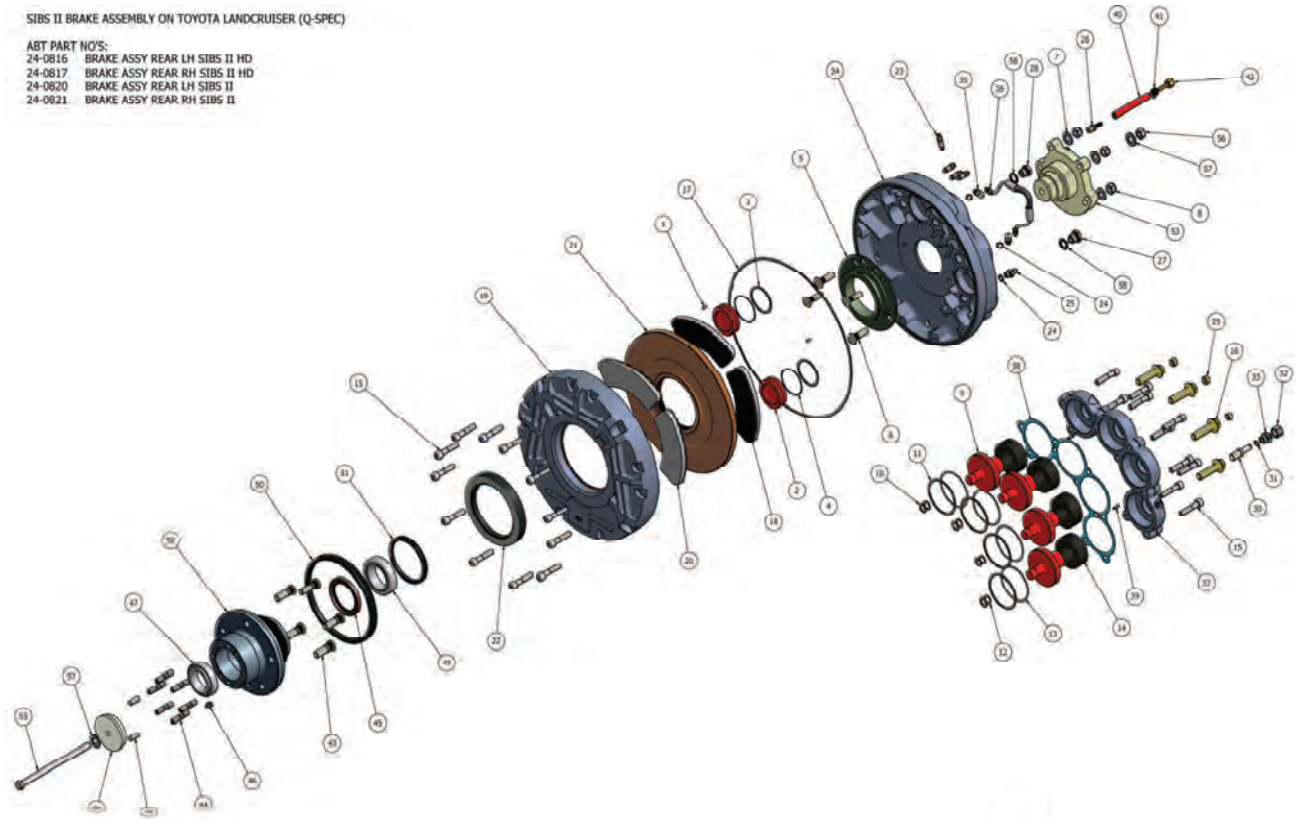
## Storage of SIBS<sup>®</sup> II Brakes

All SIBS<sup>®</sup> units are protected against corrosion and may be stored for **up to 3 months** before installation. Plugs are fitted in the brake fluid inlet ports of housings and should be kept in place during storage and shipment to prevent corrosion.

Any SIBS<sup>®</sup> that remain unfitted for a period longer than 3 months must be inspected thoroughly before use. Please remove all silica gel sachets from the brake assemblies prior to installation.

# 1. General

## 1.1. Introduction



**Figure 2:** Exploded view of SIBS<sup>®</sup> II Rear Brake

The latest generation, **Sealed Integrated Braking System (SIBS<sup>®</sup> II)** is detailed above as an exploded view; **Figure 2**.

The SIBS<sup>®</sup> II brake is a fully enclosed, single rotor, high-speed wet disc brake providing greater safety, reliability and durability than a conventional dry brake in a compact package. The grooves in the SIBS<sup>®</sup> pads are orientated to efficiently remove the oil from the pad-rotor interface and maximise the available friction.

The SIBS<sup>®</sup> II brake is simple to install, simple to operate and increases braking safety and reliability significantly. It utilises conventional actuation and can be applied to any rotary equipment, large or small, industrial or automotive, on or off road.

The SIBS<sup>®</sup> II brake incorporates a Service Brake, a Park Brake and an Emergency Brake into a single brake package. SIBS<sup>®</sup> is an Australian invention with a worldwide patent.

The sealed design of the SIBS<sup>®</sup> II braking system allows the brake to perform consistently every time in the world's harshest environments. The units require minimal maintenance throughout their life and are designed to handle the most demanding braking applications. **Figure 3** shows a conventional dry disc brake compared to **Figure 4** showing the SIBS<sup>®</sup> II brake.





**Figure 3:** Conventional OE dry disc and rotor



**Figure 4:** SIBS<sup>®</sup> II fully sealed wet brake

## 1.2. More About SIBS<sup>®</sup> II

Your SIBS<sup>®</sup> II brake set comprises of two individual rear brakes. Each fully sealed brake consists of a sliding rotor, specially designed braking pads and a quantity of specifically formulated SIBS<sup>®</sup> Cooling Fluid. Since the brake is fully sealed, there is no ingress of foreign debris such as dirt or water and likewise no brake dust is released into the atmosphere or ground water system, especially important for personnel safety in confined environments such as mines.

The rear brake assemblies provide the service brake, EMMA<sup>™</sup> park brake and a failsafe emergency brake.

All service pistons are actuated by the brake master cylinder and the EMMA<sup>™</sup> pistons are applied by disc springs and released by hydraulic pressure from a standalone electro-hydraulic pump unit. This system is referred to as an **Electronically Modulated, Mechanically Applied (EMMA<sup>™</sup>)** fail safe braking mechanism.

## 2. Installation Tools Required

### 2.1. Special Tools – Rear SIBS<sup>®</sup> II

The following equipment is required for the installation of a full SIBS brake set together with routine maintenance and adjustment of the braking system.



**Figure 5:** Dowel/ Guide Pins

Fabricate from M10 x 1.5 studding

Only required when stripping the brake.



**Figure 6:** Bearing Installation Tools

Toyota P/N; **09608-35014**



**Figure 7:** Rear Axle Bearing Lock Nut Wrench

Toyota P/N; **09509-25011**



**Figure 8:** LSPV Gauge Set

Toyota P/N; **09709-29018**



**Figure 9:** Insertion Tool and M8 Inserts  
Front brakes only – Textron P/N; 39006-28035



**Figure 10:** SIBS<sup>®</sup> II lifting eye (P/N; 24-2870).



**Figure 11:** Lifting hoist



**Figure 12:** Step drill



**Figure 13:** Vehicle hoist

### 3. Pre-Installation Inspection

Remove the SIBS<sup>®</sup> II brake units from their packaging and carefully check that the kit contains all parts listed on the delivery document. Familiarise yourself with each part and understand where it should be fitted. Keep parts and work area clean at all times.

**WARNING:**



The internal components of a SIBS<sup>®</sup> II unit must not be contaminated with any external material/ substance - this may adversely affect its operation and reliability. Should parts become contaminated, clean thoroughly with a product such as Wurth<sup>®</sup> Brake Clean.

#### 3.1. Recommendations

- Inspect each brake and supplied items against the packing list included in the shipment.
- Ensure all items are included as described.
- Ensure all components remain in their original packaging until required for assembly.
- Ensure vehicle stub shafts are clean, free from rust, dirt and corrosion. It is recommended that repair sleeves are fitted to the axle seal running faces.
- Thoroughly read this manual and familiarise yourself with the tools required; familiarise yourself also with the parts of the brake and the process required to fit each brake and the control system.
- Ensure complete cleanliness of all brake components and the working environment around the vehicle.
- Ensure no contamination of the brake assemblies occurs during installation.
- Follow the points in the manual as described, if you are not sure check the manual or contact ABT Customer Service.
- Ensure a lifting table or hoist is used to move and position the brakes.

#### 3.2. Your SIBS<sup>®</sup> II Kit



Figure 14: SIBS<sup>®</sup> II Installation Kit

## 4. Pre-Installation Checks

### 4.1. Preparation

Ensure all tools, equipment and brake components are readily available. Before starting the installation, check the following:

- 1) The battery is disconnected.
- 2) The vehicle is standing safely on a suitable vehicle hoist.
- 3) The original TOYOTA rear brake equipment has been removed from the vehicle:
  - a. Remove both rear brake assemblies
  - b. Remove the two hydraulic pipes across the axle – from the tee piece to the brake housings
  - c. Remove the hand brake lever and the hand brake cable, use a 13mm ring spanner to remove hand brake cable from the lever mechanism.

**Note:** The grommet removed from the firewall when running the EMMA™ harness into the cabin (Section 6) should be re-used to plug the hole in the cabin floor left after removing the hand brake lever.

- 4) The required amount of SIBS® fluid is available (1 litre per wheel end).
- 5) A drain pan is available.

### 4.2. Installation and Setup Sequence

The following section details the recommended sequence for fitment of the SIBS® II kit;

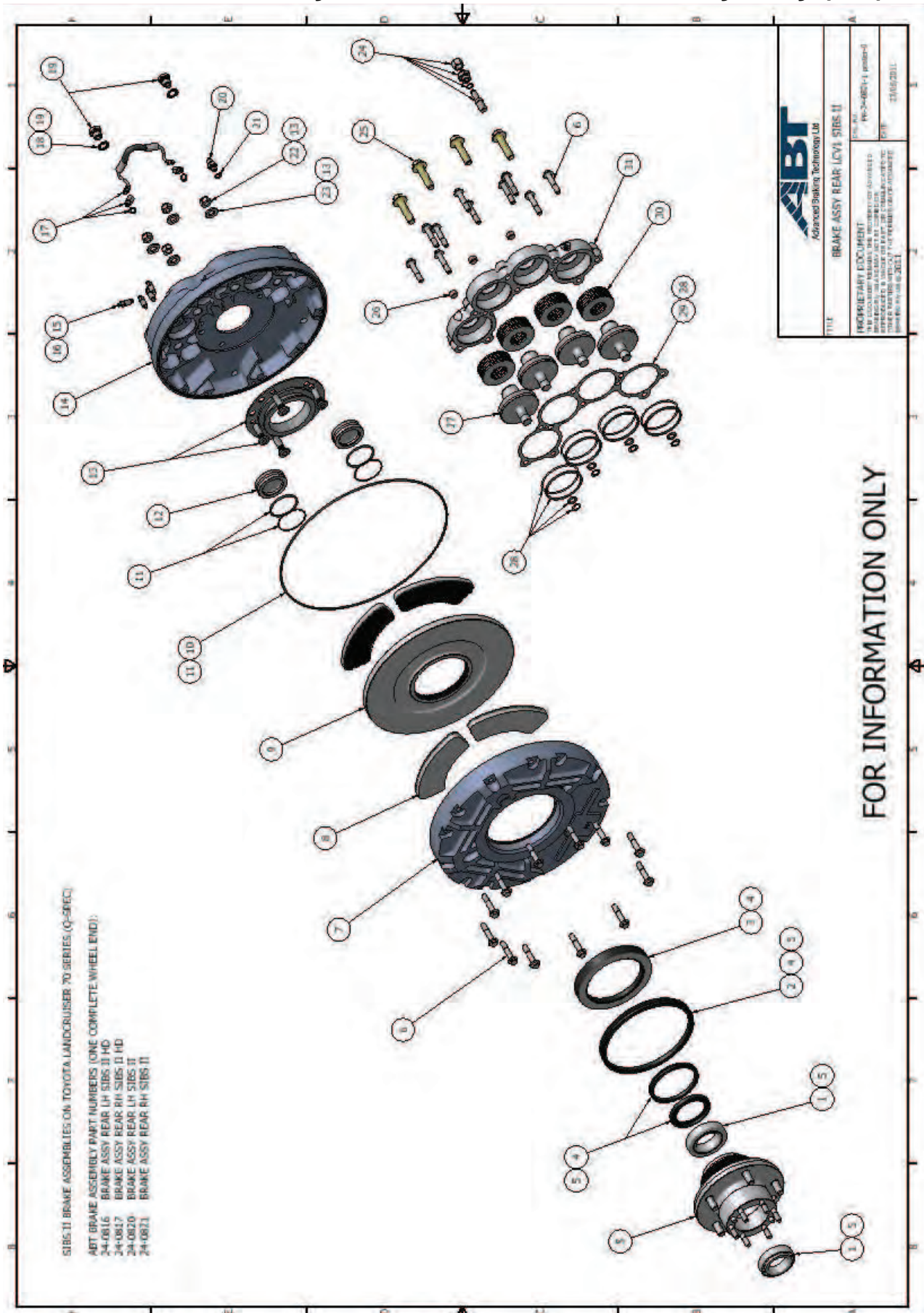
- 1) Rear housing (left and right)
- 2) Rear Expansion Chambers
- 3) EMMA™ Engine Bay Pump Assembly (under the bonnet)
- 4) EMMA™ Control Box and Cabin Harness (inside Cabin)
- 5) Bleeding of the EMMA™ system
- 6) Bleeding of the service brake system

Drawing **24-0817** (Section **4.3**) shows an exploded view of a SIBS® wheel end for the **Standard Duty & Heavy Duty SIBS®** variants.

**NOTE:**

Refer to Appendix for complete SIBS® Product and Spare Parts List

### 4.3. Rear Brake Assy; SIBS® II Standard & Heavy Duty (HD)



## 4.4. Rear Brake Assy; Parts List:

### 24-0820/ 21 – (Standard Duty) & 24-0816/ 17 (Heavy Duty) - Parts List


ITEM	PART NO.	DESCRIPTION	COMMENTS	QTY/BRAKE
1	24-5020	KIT WHEEL BEARING LCV1 (one brake)	includes inner & outer wheel bearing	1
2	15-1200	SEAL V-LIP		1
3	15-1470	SEAL HOUSING	housing seal	1
4	24-5023	KIT SEAL HUB LCV1 (one brake)	includes hub seal, 2 x v-seals & housing seal	1
5	24-0107	HUB ASSY REAR	complete assy includes bearings, seals & studs	1
6	24-2871	SCREW HOUSING HTSS M10x1.5x50	suits housing and spring cover	22
7	24-1733	HOUSING OUTER LH	left hand assembly	1
	24-1743	HOUSING OUTER RH	right hand assembly	1
8	24-4953	KIT BRAKE PAD (one brake)	contains 4 x pads (2 x cw & 2 x acw)	1
9	15-2630	ROTOR BRAKE		1
10	15-1080	O-RING HOUSING		1
11	24-5021	KIT SEAL SERVICE REAR LCV1 (one brake)	includes housing o-ring & service piston o-rings	1
12	24-2040	PISTON SERVICE BRAKE REAR		2
13	24-5025	KIT BRAKE MOUNTING REAR SIBS II (one brake)	includes seal carrier, studs, washers & nuts	1
14	24-5034	HOUSING INNER REAR LH W/DOWELS	left hand inner housing with dowel pins	1
	24-5033	HOUSING INNER REAR RH W/DOWELS	right hand inner housing with dowel pins	1
15	15-1151	BLEED NIPPLE		4
16	15-1380	BLEED NIPPLE CAP	protective cap for bleed nipple	4
17	24-5026	KIT LINK PIPE ASSEMBLY SIBS II (one brake)	includes link pipe, adaptors & copper washers	1
18	24-5030	KIT SEAL FILL/DRAIN PLUG SIBS II	pack of 20	0.1
19	24-5027	KIT FILL/DRAIN PLUG SIBS II (one brake)	includes fill plug, drain plug & dowty seals	1
20	02-6019	CONNECTOR JIC MALE SST		1
21	15-1890	WASHER COPPER		1
22	15-2250	NUT LOCK RR SPINDLE MOUNT		4
23	15-3070	WASHER FLAT HARDENED M12		4
24	24-5031	KIT PAD WEAR INDICATOR SIBS II (one brake)	suits standard spring pack	1
	24-5024	KIT PAD WEAR INDICATOR SIBS II HD (one brake)	suits heavy duty spring pack	1
25	15-2530	RETRACTOR BOLT		4
26	01-5085	PLUG 3/8 BSPT BRASS SOCKET HEAD		3
27	24-2010	PISTON PARK BRAKE		4
28	24-5022	KIT SEAL PARK BRAKE (one brake)	includes o-rings, buw's & gasket	1
29	24-2880	GASKET SPRING COVER SIBS II		1
30	15-3750	DISC SPRING 3mm	suits standard spring pack	32
	10-2030	DISC SPRING 4mm	suits heavy duty spring pack	24
31	24-2852	COVER PARK BRAKE LH	left hand assembly	1
	24-2851	COVER PARK BRAKE RH	right hand assembly	1

## 5. Fitting Procedure - SIBS<sup>®</sup> II Rear Brakes

Verify that the pre-installation checks in **Section 4** have been completed prior to this section.

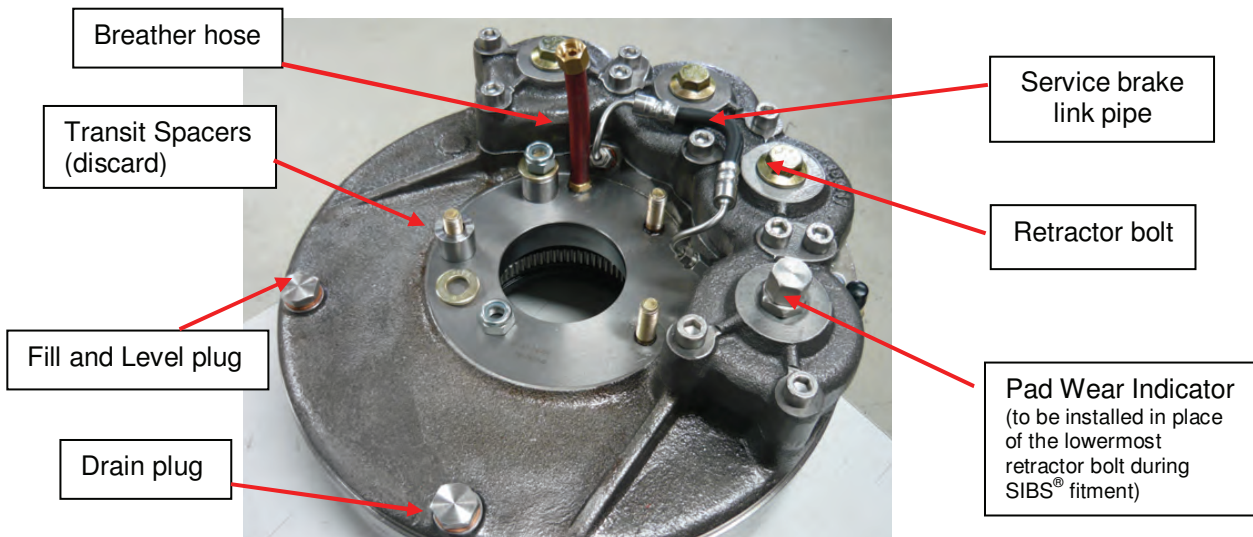
### 5.1. Rear Brake Assemblies (Left & Right hand side)

**Description:** The SIBS<sup>®</sup> II rear brake assemblies mount directly to the stub shafts of the Toyota Land Cruiser rear axle to replace the Original Equipment (OE) dry disc brake assemblies. This section details the fitment procedure for the rear brake assemblies.


<b>WARNING:</b>	
	To avoid injury and/ or damage to the components, ensure that the 4 retractor bolts are in place before commencing work on the rear brakes. <b>Note:</b> When the retractor bolts are in place, the park brake is disabled. Ensure that wheel chocks are firmly in place and that the vehicle is secure.

**5.1.1.** The rear brake assemblies are supplied with M14 retractor bolts fitted to the spring cover. The bolts retract the EMMA™ pistons and keep the springs compressed during shipment and assembly. The vehicle should **not** be driven until the retractor bolts have been removed.

**5.1.2.** Fit the red breather hose onto the hose connector on the inner brake housing; **Figure 15.**



**Figure 15:** Rear housing assembly

<b>NOTE:</b>	
	The housing is stamped with its position on the vehicle and must be installed accordingly. <b>LHR</b> Left Hand Rear <b>RHR</b> Right Hand Rear

**5.1.3.** Clean the axle flange, and spindle, removing all grease, dirt and any gasket remnants; **Figure 16.**



**5.1.4.** If the axle flange is in as new condition, apply Loctite<sup>®</sup> 515 directly to the axle flange face; **Figure 17**. If the axle flange is damaged or pitted apply Loctite<sup>®</sup> 515 to both sides of an OE Toyota rear spindle gasket and install on to the rear spindle.

**NOTE:**

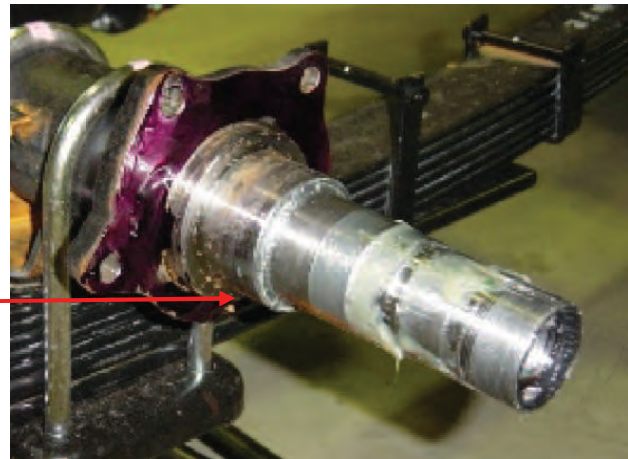


1. If the flange is corroded or dirty it must be cleaned thoroughly with abrasive paper. The gasket can be omitted if the vehicle is new or if the axle flange is in an “as new” condition, in this case **Loctite<sup>®</sup> 515** may be applied directly to the axle flange. **Silicon sealants should not be used.**
2. Check the condition of the wheel bearing seal running surface. If the surface shows signs of degradation (e.g. corroded or worn) repair using a speed-sleeve (ABT P/N: **15-1284**).



Prepare with a fine rotary wire brush

Inspect condition of wheel bearing seal running surface

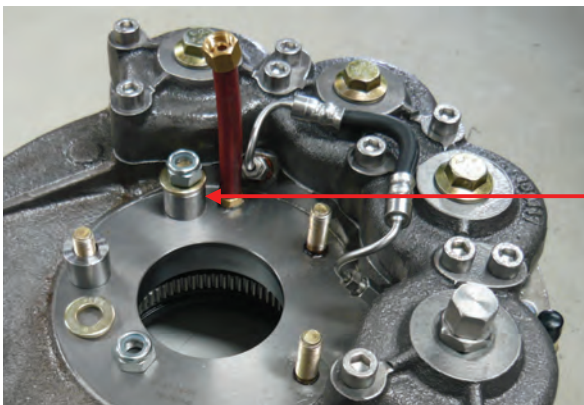


**Figure 16:** Prepared gasket face

**Figure 17:** Loctite<sup>®</sup> 515 applied to axle flange.

**5.1.5.** Pack the hub with grease. Use Castrol LMX (or similar Lithium Complex Grease suitable for wheel bearings). Grease the outer bearing ready for installation. Take care not to allow the grease inside the brake as this will affect braking.

**5.1.6.** Remove the four spacers from the SIBS<sup>®</sup> mounting studs. Retain these for preparation of service exchange assemblies.




Spacers (P/N; **24-2867**)

**Figure 18:** Remove 4 x transit spacers (24-2867).

## 5.2. Fitting the SIBS<sup>®</sup> II brake - Hub Complete

5.2.1. Using a suitable lifting hoist, lift the SIBS<sup>®</sup> wheel end assembly from its packaging using the lifting eye; P/N; **24-5032**. The housing bolt torque is **51Nm** (Socket head) or **61Nm** (Hex head).

NOTE:	
	Prior to offering the brake and hub assembly to the axle, check the inner bearing cone (component with the rollers) has not become dislodged from the bearing cup (outer race) during transit. Manually adjust the bearing cone if required.

5.2.2. Fit the SIBS<sup>®</sup> II unit over the stub axle. Align the mounting holes and locate the housing evenly and firmly against the axle flange; **Figure 22**.



**Figure 19:** SIBS<sup>®</sup> II assembly being removed from box using hoist and lifting eye



**Figure 20:** Housing fitted complete with hub using lifting hoist and lifting eye.



**Figure 21:** SIBS<sup>®</sup> II lifting eye, ABT P/N: 24-2870

5.2.3. Fit the 4 wheel end washers and retaining locknuts to the SIBS<sup>®</sup> II mounting studs at the rear of the flange and torque to **81 Nm** (60 ft-lb) in a diagonal pattern. This procedure should be repeated **three times over a 5 minute period**, allowing the anaerobic sealant to distribute evenly and set; **Figure 23**.



**Figure 22:** Fitting the housing & hub complete



**Figure 23:** Secure the SIBS<sup>®</sup> II housing (81Nm)

5.2.4. Continue to Section 5.3.6.

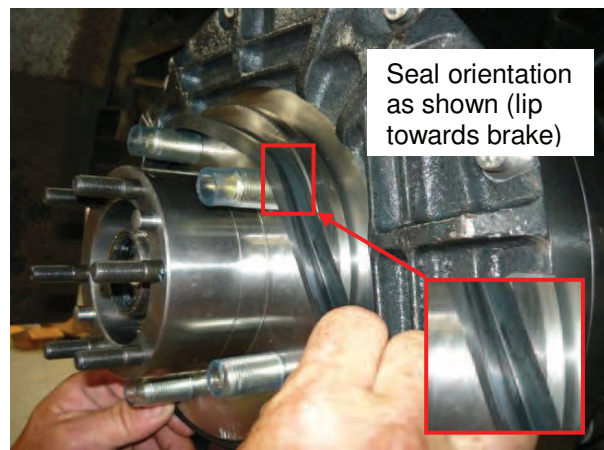
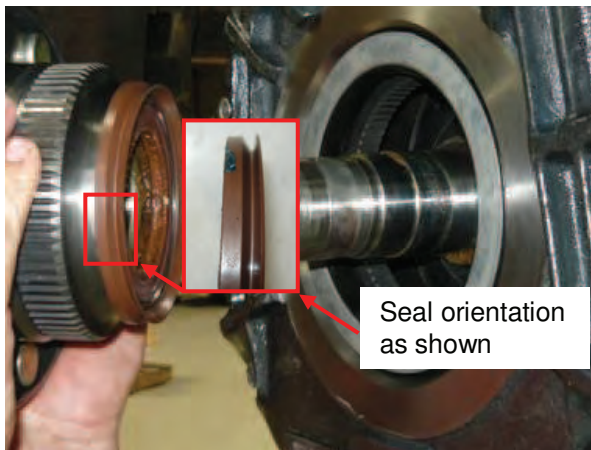
### 5.3. Fitting the SIBS<sup>®</sup> II brake - Hub Separate

**5.3.1.** Fit the SIBS<sup>®</sup> II unit over the stub axle. Align the mounting holes and locate the housing evenly and firmly against the axle flange; **Figure 22**.


**5.3.2.** Fit the 4 wheel end washers and retaining locknuts to the SIBS<sup>®</sup> II mounting studs at the rear of the flange and torque to **81 Nm** (60 ft-lb) in a diagonal pattern. This procedure should be repeated **three times over a 5 minute period**, allowing the anaerobic sealant to distribute and set; **Figure 23**.

**5.3.3.** Fit the inner V-seal seal to the hub as shown in; **Figure 24**.

**5.3.4.** Install the hub assembly by lifting over the axle shaft and engaging the hub splines into the centre of the brake rotor. Take care not to damage the rear bearing cartridge seal against the axle shaft during this operation.



**Figure 24:** Inner V-seal installed before hub fitment **Figure 25:** Outer V-lip seal installation

<b>CAUTION:</b>	
	<p>Ease the inner hub seal over the stub axle with extreme caution to avoid damaging the seal lip. Lubricate the seal with wheel bearing grease prior to assembly. Ensure that no bearing grease or differential oil enters the SIBS<sup>®</sup> as this will reduce braking efficiency.</p>

**5.3.5.** Tap the hub assembly fully home using a plastic or hide mallet if required.

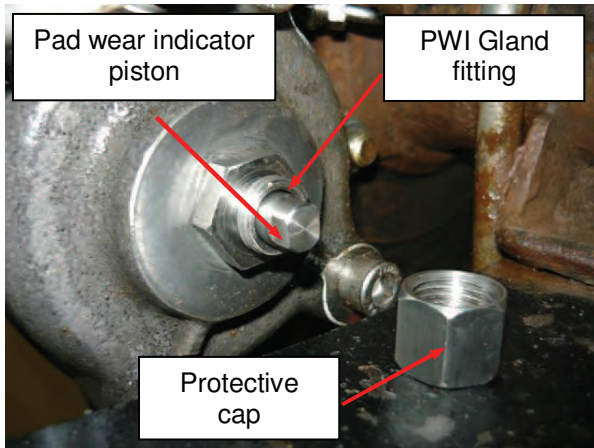
**5.3.6.** Fill the wheel bearing cavity with a high temperature, lithium soap EP bearing grease and fit the outer wheel bearing and retaining collar in accordance with the Toyota manual and specifications detailed therein.

**5.3.7.** Fit the outer hub V-seal; **Figure 25**. The thin lip is fitted toward the brake and square edge on the hub.

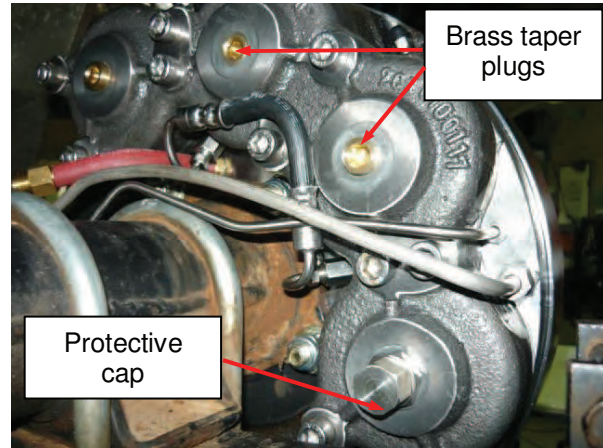
**5.3.8.** Fill the cavity behind the V-seal using the grease nipple located on the hub face. A high temperature, Lithium soap EP bearing grease should be used to prevent washout. Fill the cavity until grease begins to appear from behind the V-seal and repeat this procedure every 1/4 turn of the hub for one full revolution.

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

**5.3.10.** Remove the lowermost retractor bolt and screw the pad wear indicator piston into the piston thread (Torque; **10 Nm**); **Figure 26**. Use Loctite<sup>®</sup> Silver Grade Anti-Seize on the thread.



**Figure 26:** Fit the pad wear indicator



**Figure 27:** PWI located on lowermost piston

**5.3.11.** Fit the Stainless Steel gland fitting over the piston; **Figure 26** and screw this into the spring cover housing. Fit the Stainless Steel protective cover (P/N; **24-2869**) to prevent ingress of water and debris; **Figure 27**.

**5.3.12.** Fit the supplied brass tapered plugs (P/N; **01-5085**) to seal the remaining 3 retractor bolt holes using Loctite<sup>®</sup> Silver Grade Anti-Seize on the threads; **Figure 27**. The hex sockets may be filled with silicone to aid future removal.

**5.3.13.** Ensure the drain plug; **Figure 15**, is tight and remove the fill plug. Fill the housing to the fill plug level with new SIBS<sup>®</sup> fluid and refit the fill plug and washer.

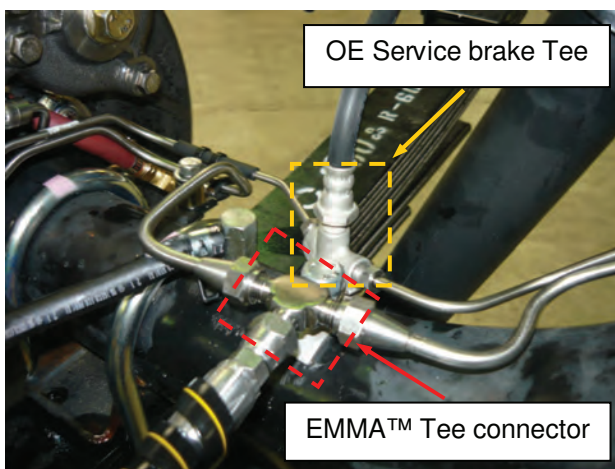
**5.3.14.** Repeat this process for the opposing wheel end.

## 5.4. Rear Service and EMMA™ Brake Lines

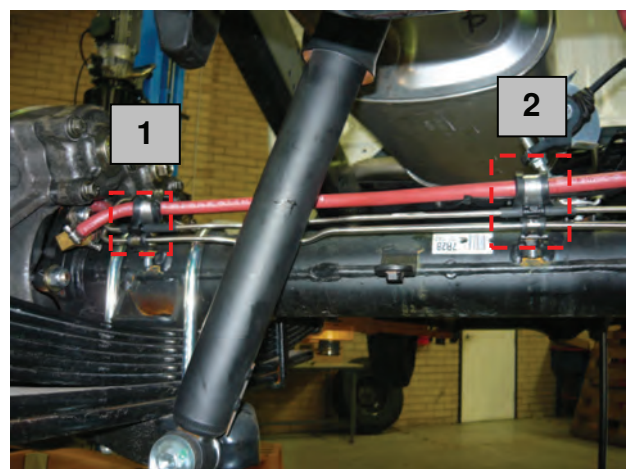
**Description:** There are two sets of Stainless Steel lines to be fitted across the rear axle. The thin lines (3/16") replace the standard steel Toyota service brake lines to provide greater corrosion resistance. The second set of larger lines (1/4") carry the ATF fluid used by the EMMA™ pump to release the park brake.

**5.4.1.** Using a 10mm spacer, fit the rear axle EMMA™ Tee piece adapter (P/N; **02-6018**) above the Toyota service brake Tee connector on the RH axle tube; **Figure 28**.

**5.4.2.** Replace the OE cross axle service brake lines with the Stainless Steel lines supplied with the SIBS<sup>®</sup> II kit (P/N's; **24-2817** and **24-6010**) using the P-clips and mounting spacers provided; **Figure 29**.

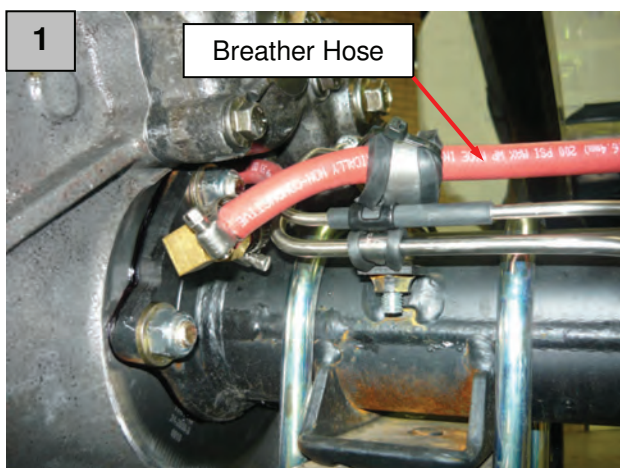


**Figure 28:** SIBS<sup>®</sup> II Tee piece and RH service line

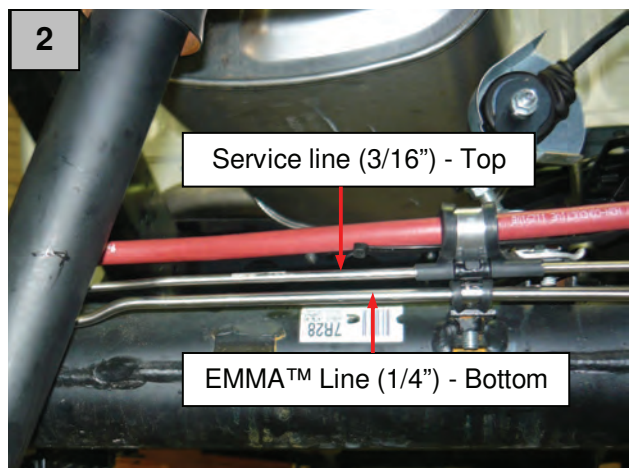


**Figure 29:** Cross axle service line to LH brake

**5.4.3.** Position the RH and LH Stainless EMMA™ brake lines (P/N's; **24-3210** and **24-3211**) across the rear axle and secure both the lines to the OE mounting points. The spacers should be used to separate the lines; **Figure 30** and **Figure 31**.



**Figure 30:** Mounting position 1 - LH lines



**Figure 31:** Mounting position 2 - LH lines

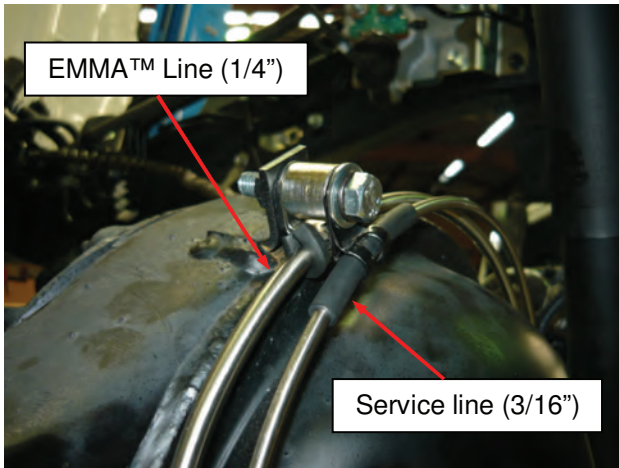


Figure 32: Mounting position 3 - LH lines



Figure 33: Mounting position 3 - LH lines

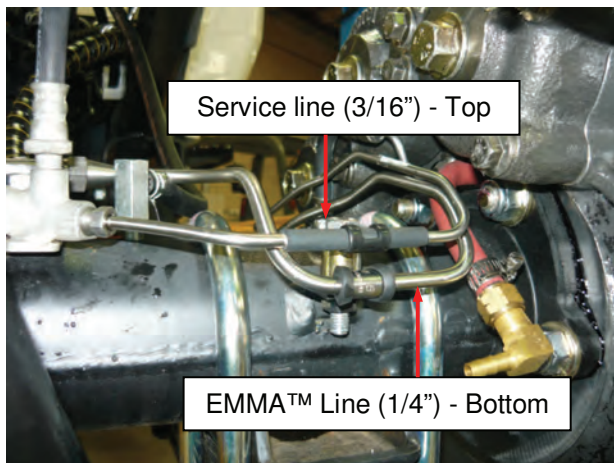


Figure 34: Mounting position - RH lines



Figure 35: Mounting position - RH lines

**NOTE:**




Stainless Steel brake lines are harder and less malleable than conventional steel or copper brake lines. Stainless Steel lines may require a higher torque to be applied at the unions in order to seat properly and provide a robust seal.

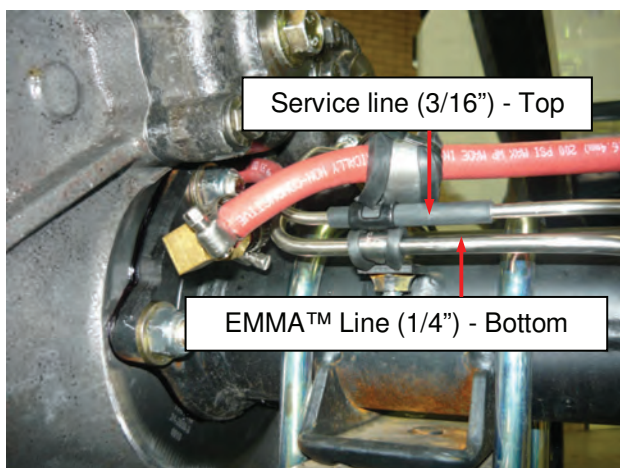
## 5.5. Rear Expansion Chambers & Breather

**Description:** The rear expansion chambers connect to each SIBS<sup>®</sup> II wheel end and collect the vapours produced by each brake as the SIBS<sup>®</sup> fluid is heated during braking. The system prevents pressure build up due to heat and also the dynamics of the rotor assembly. The system is allowed to breath via a cartridge filter.

**5.5.1.** Connect the red SIBS<sup>®</sup> breather hoses to the red wheel end stub hoses using the 90 degree brass hose unions; **Figure 36** and **Figure 37**. The 90 degree unions ensure the breather hose is not in the path of the axle bump stop.

**5.5.2.** Attach the breather hose to the Toyota axle mounting points using the P-clips and spacers provided; **Figure 38** and **Figure 39**.

<b>IMPORTANT:</b>	
	Do not attach any hoses to the suspension dampers or any moving suspension parts.



**Figure 36:** 90 degree brass breather fitting (LH).



**Figure 37:** 90 degree brass breather fitting (RH).




**Figure 38:** Avoid hose contact with LH damper.



**Figure 39:** Breather routing at rear differential.

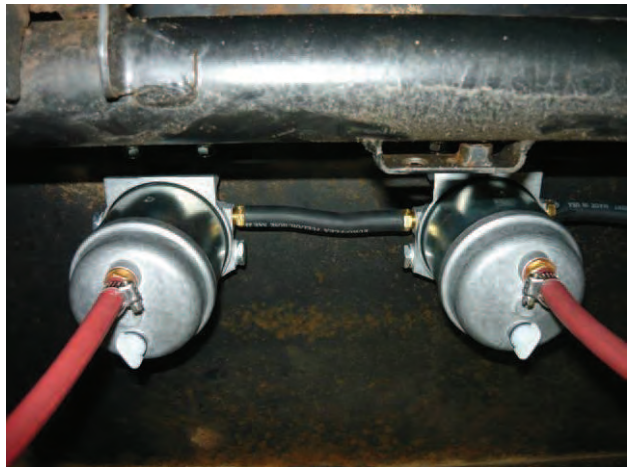
5.5.3. Mount the SIBS<sup>®</sup> expansion chambers as high as possible. Drill the vehicle body as required and mount the expansion chambers using the M8 x 70 or M8 x 35 mounting hardware as appropriate for the vehicle body section; **Figure 40**.

NOTE:	
	<p>Ensure that the selected mounting position allows full travel and articulation of the axle. Breather pipes should cross over; left hose to right breather. This avoids bending or kinking of the hose as the axle floats and also avoids tension on hoses; <b>Figure 40</b>.</p>

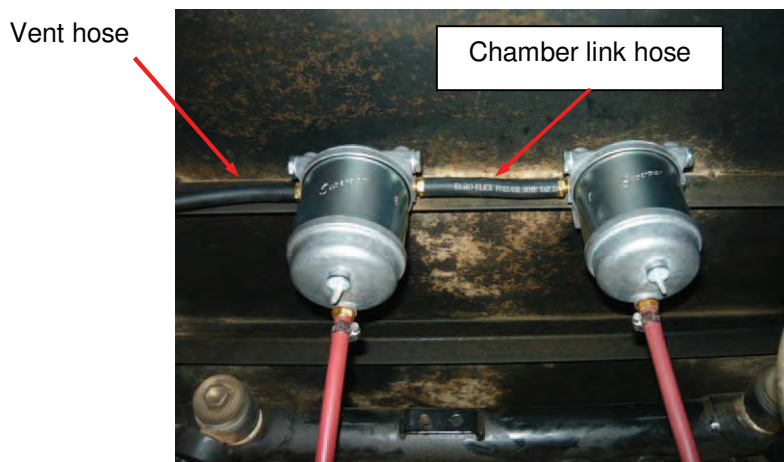
5.5.4. Fit a length of the 5/16" ID black hose to the top barbs of both rear expansion chambers at position No. 2. Join with the 5/16" barb tee piece supplied with the kit; **Figure 41** and **Figure 42**.



**Figure 40:** HZJ/ VDJ 79 Series mounting location (looking vertically).



**Figure 41:** Fit the black breather link hose (viewed from below)



**Figure 42:** HZJ/ VDJ 79 Series mounting location.

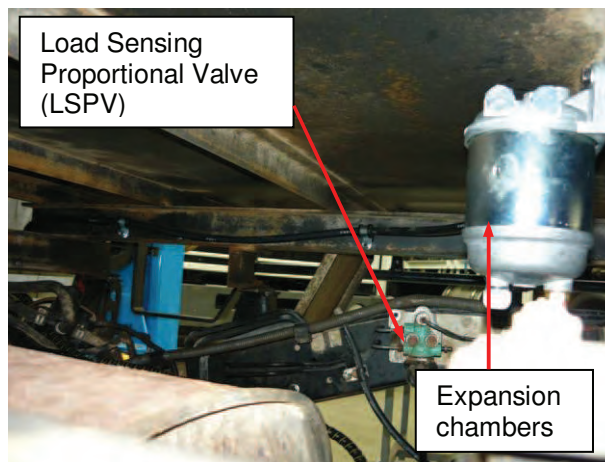


- 5.5.5. Route the vent line along the chassis rail securing with P-clips; **Figure 43.**
- 5.5.6. Route vertically at the front RH corner of the tray; **Figure 44.**
- 5.5.7. Fit the vent filter pot bracket in a raised position on the front face of the tray; **Figure 45.**
- 5.5.8. Fit the vent hose to the bottom barb of the vent filter pot and secure the pot within the 50 mm saddle mounting bracket; **Figure 45.**

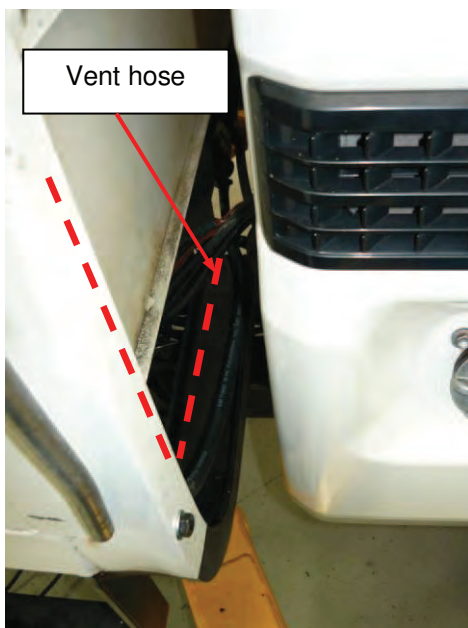
**IMPORTANT:**



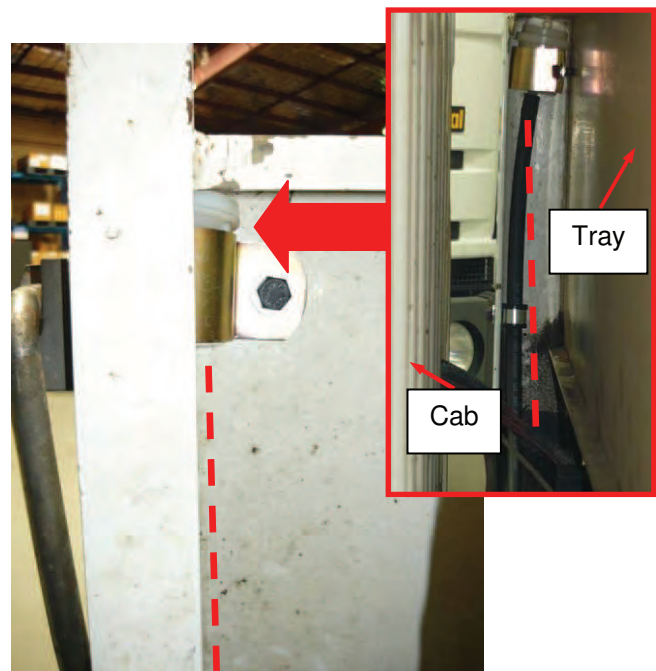
Working upwards from the brake to the bottom of the chamber, check that the red hoses have not formed any U shaped bends that could hold fluid. Blockage of the breather may allow pressure to build within each brake resulting in premature seal failure.



**Figure 43:** HZJ/ VDJ 79 Series mounting location.



**Figure 44:** HZJ/ VDJ 79 Series mounting location.



**Figure 45:** Fit the black breather link hose

## 5.6. Hydraulic Installation

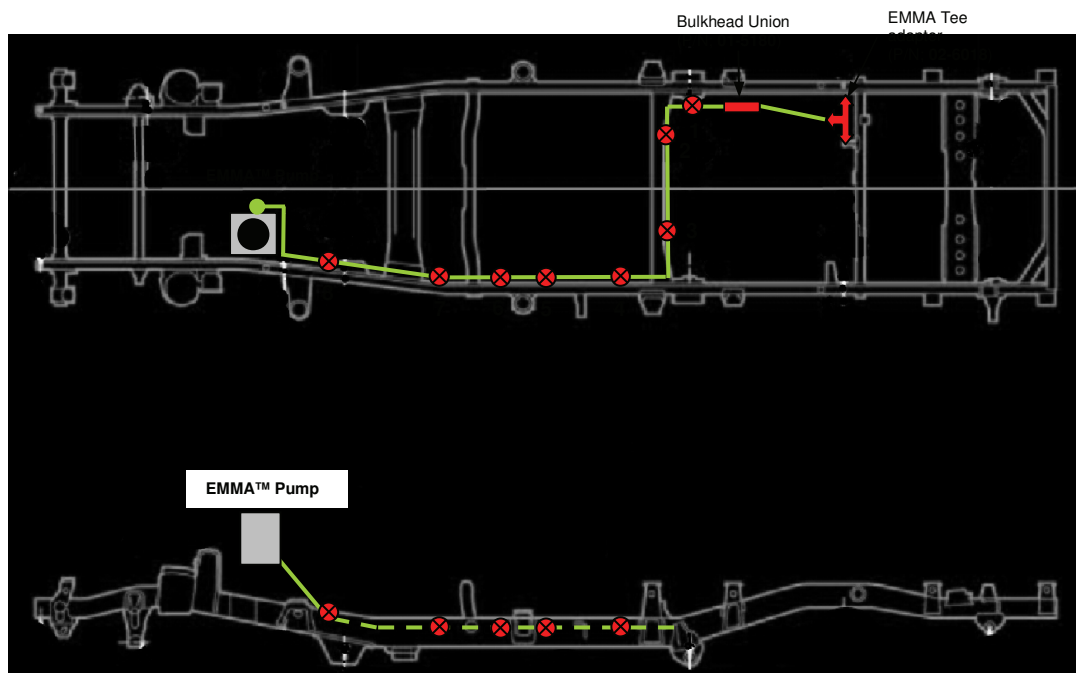
**Description:** This section details the installation of the hydraulic supply hoses along the vehicle chassis. The hoses run from the EMMA™ pump at the front of the vehicle to the rear axle mounted Tee piece connecting the left and right hand wheel ends.

5.6.1. Fit the EMMA™ Supply Hose (Hose 2) to the axle Tee adapter (P/N; 02-6018) **Figure 48.**

5.6.2. Fit the bulkhead union and locknut (P/N; 01-5180) on the RH chassis rail; **Figure 49.**


## 5.7. EMMA Hose Routing (HZJ)

Route the EMMA™ Supply Line (Hose 1) along the RH chassis rail and cross to the left chassis rail using first available cross member (behind gear box - HZJ) to continue forward and connect to EMMA™ pump unit via the LH inner wheel arch. Fit P-clips at the locations indicated below.



⊗ P-clip mounting locations

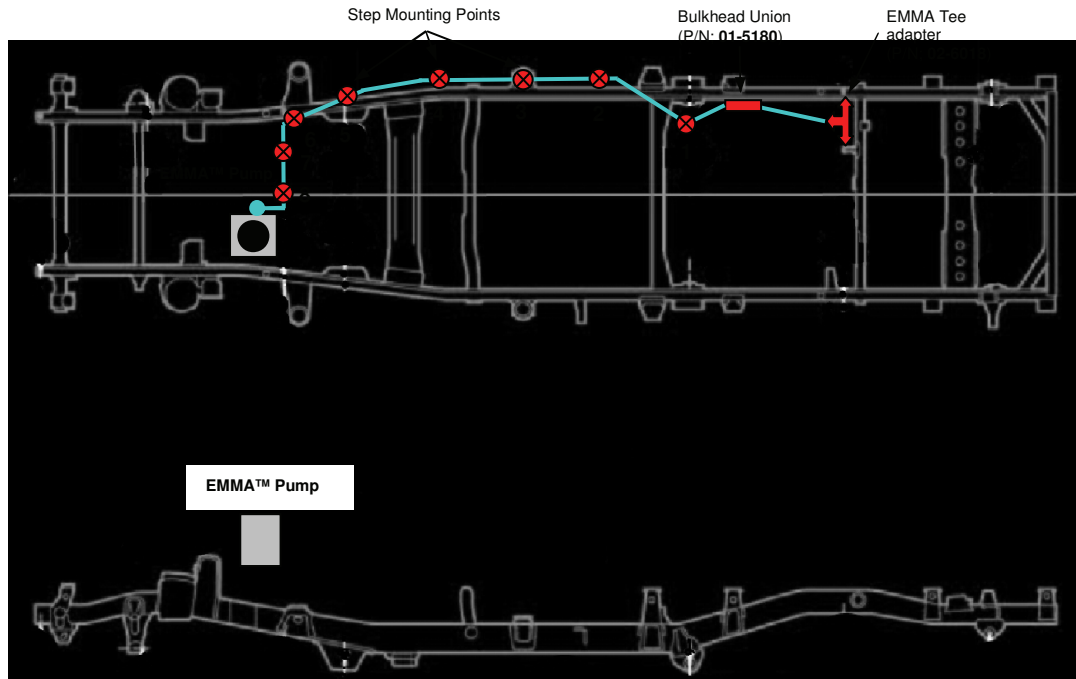
**Figure 46:** HZJ Hose Routing

<b>NOTE:</b>	
	The Spiral Guard should be removed in the area of each P-clip to allow a secure grip on the hose and prevent fretting; <b>Figure 98.</b>

### 5.8. EMMA Hose Routing (VDJ)


5.8.1. Clamp the pipe at the intervals indicated using the 8mm P-clips provided.

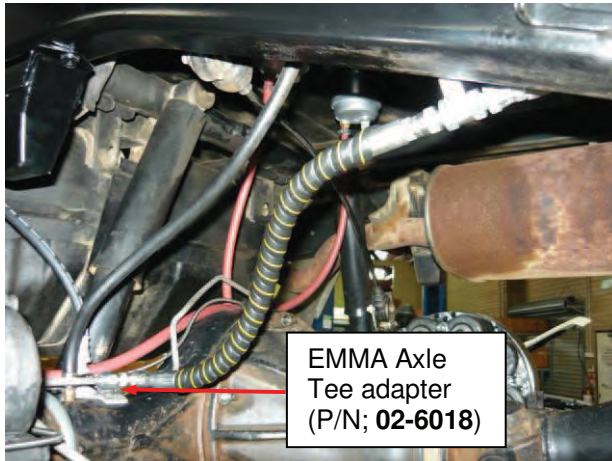
5.8.2. Run the EMMA™ Supply Line the full length of the RH chassis rail on the outer face using the x3 step mounts to affix the x3 P-clips (2, 3 and 4) labelled below. For positions 5 & 6 use drill through the panels adjacent to the seam weld and secure with M6 fasteners. Enter the under bonnet area via the triangular opening located in the inner wheel arch. The line is then taken across the bulkhead to the EMMA™ pump.



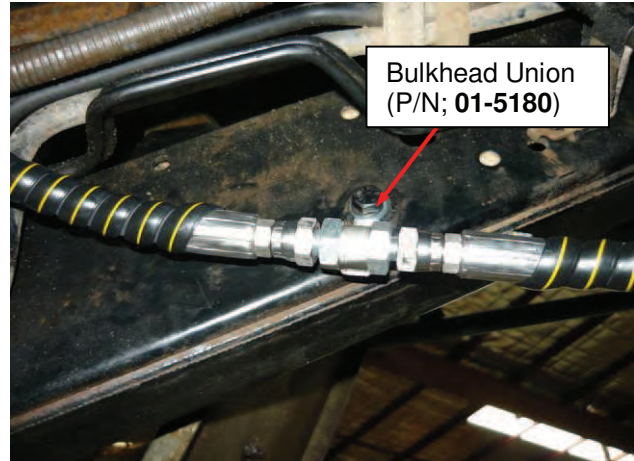
⊗ P-clip mounting locations

Figure 47: VDJ Hose Routing

<b>NOTE:</b>	
	The Spiral Guard should be removed in the area of each P-clip to allow a secure grip on the hose and prevent fretting; <b>Figure 98</b> .



**Figure 48:** Fit link hose to the EMMA™ axle Tee



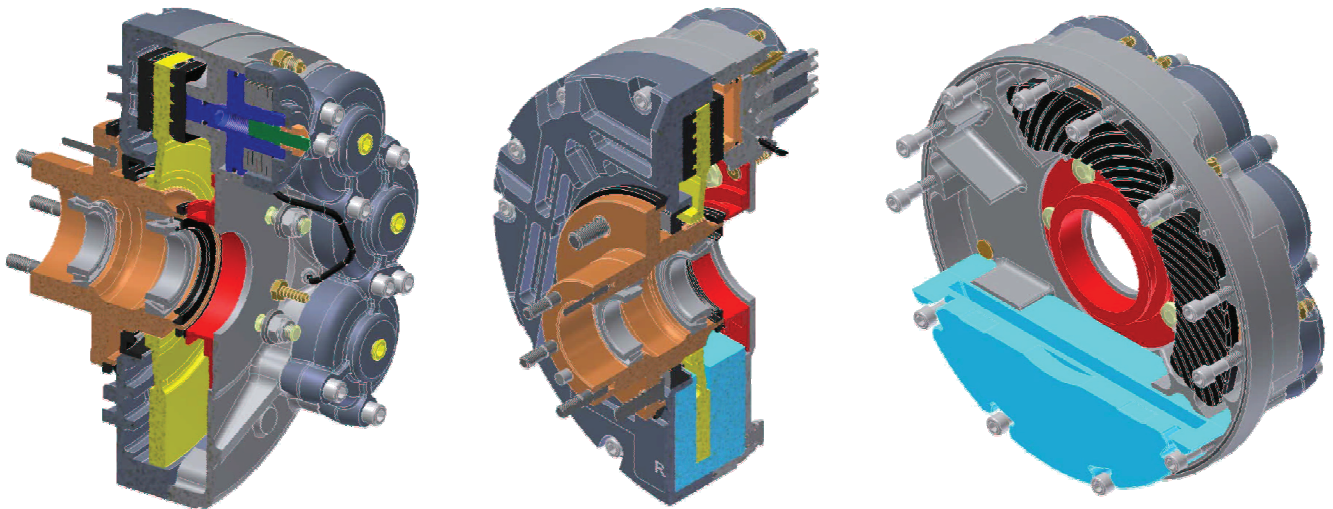
**Figure 49:** Fit the bulkhead union and locknut

**5.8.3.** Tighten all hydraulic supply lines ensuring all hoses are free from stress and twists. Hoses should be positioned to allow smooth axle articulation and be positioned to avoid contact or abrasion against other parts of the vehicle.

## 6. Fitting Procedure - EMMA™ Brake System

### 6.1. About the EMMA™ Park & Emergency Brake System

**Description:** The EMMA™ system operates on the rear SIBS® brakes independently from the applied service brakes. When the EMMA™ brakes are applied, braking force is transmitted to the pads via disc springs acting on specially designed pistons. To release the brakes, the spring force is countered by hydraulic pressure acting on the opposite side of the piston. For an exploded view of the main EMMA™ system components, see Sections 6.7 and 6.9.



### 6.2. Park & Emergency Control Box

**Description:** The SIBS® II operator interface; **Figure 50** offers a series of new visual and audible features which are now triggered and communicated directly to the operator based on the Park and Emergency brake system pressure. This is achieved through the addition of a “Low” pressure switch fitted alongside the high pressure switch on the EMMA™ pump unit.



Figure 50: SIBS® II operator interface

The control box now offers improved reliability through the use of electronic circuitry and the entire wiring harnesses can be installed rapidly using pre-wired industry standard Deutsch® connections. Deutsch® connectors and sealed conduit used for the wiring harnesses provide IP67 environmental protection and result in a system installation that is even more robust to the rigours of underground mine operation.

An optional **Highway Speed Isolation (HSI)** system may also be specified for SIBS® II. This allows the emergency brake interlock features to be disabled above 40km/h to prevent the risk of unintended brake application at speed. This optional system is “plug and play” and integrates directly with the SIBS® II control interface and wiring harness. This section details the operation and installation of the SIBS® II control system.

### 6.3. SIBS® II Control Hardware – Parts List

ITEM	PART NO.	SUB PART NO.	DESCRIPTION	QTY/ KIT
1	02-0091	02-0090	CONTROL BOX/ BRACKET ASSY LCV1 - SIBS® II	1
2		02-7074	HARNESS - CABIN CONTROL - SIBS® II	1
3		02-7075	HARNESS - EMMA PUMP CONTROL - SIBS® II	1
5		02-7077	SKT - DEUTSCH JUMPER DT4 - SIBS® II	1
6		02-7078	PLUG - DEUTSCH BLANKING DT4 - SIBS® II	1
		02-7089	SKT - DEUTSCH BLANKING DT2 - SIBS® II	1
7		02-7079	HARNESS - POWER BOX - SIBS® II	1
8		02-7080	HARNESS - POWER BOX EXT - SIBS® II	1
9	02-0095	02-7076	HARNESS - EMMA PUMP POWER - SIBS® II	1
10		02-7094	HARNESS - FUSE EMMA PUMP SIBS II	1
11		02-7101	HARNESS - EMMA PUMP POWER DIODED SIBS II	1
12	02-0092	02-7081	HARNESS - AXLE MANIFOLD - SIBS® II HSI	1
13		02-7082	HARNESS - HIGHWAY SPEED ISOLATION CONTROL - SIBS® II HSI	1
14		02-7085	CONTROL MODULE - HIGHWAY SPEED ISOLATION - SIBS® II HSI	1

6.4. SIBS® II Electrical Wiring Diagram (Non HSI)

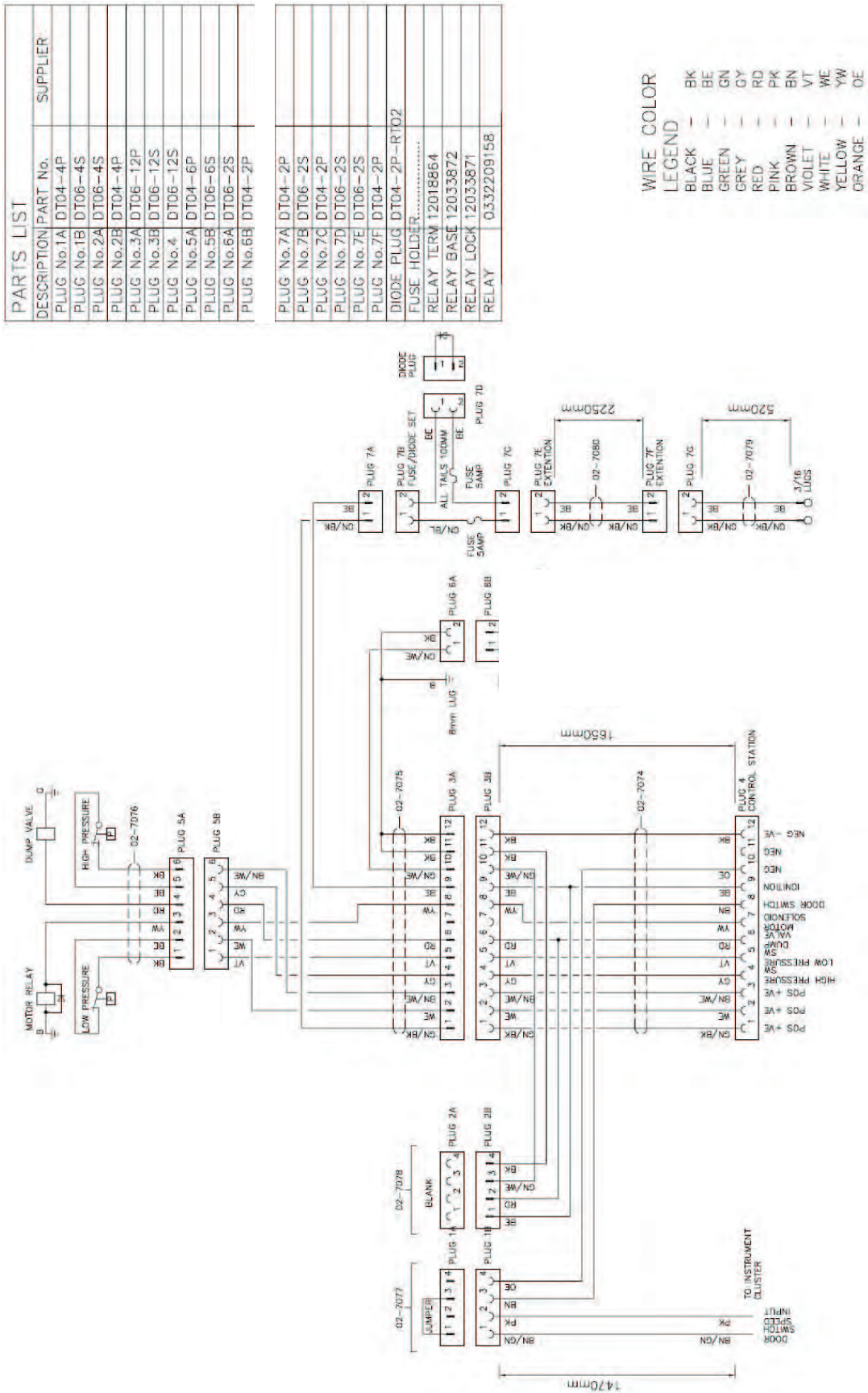


Figure 51: SIBS® II – Non HSI Electrical Wiring Diagram

### 6.5. SIBS® II Electrical Wiring Diagram (HSI)

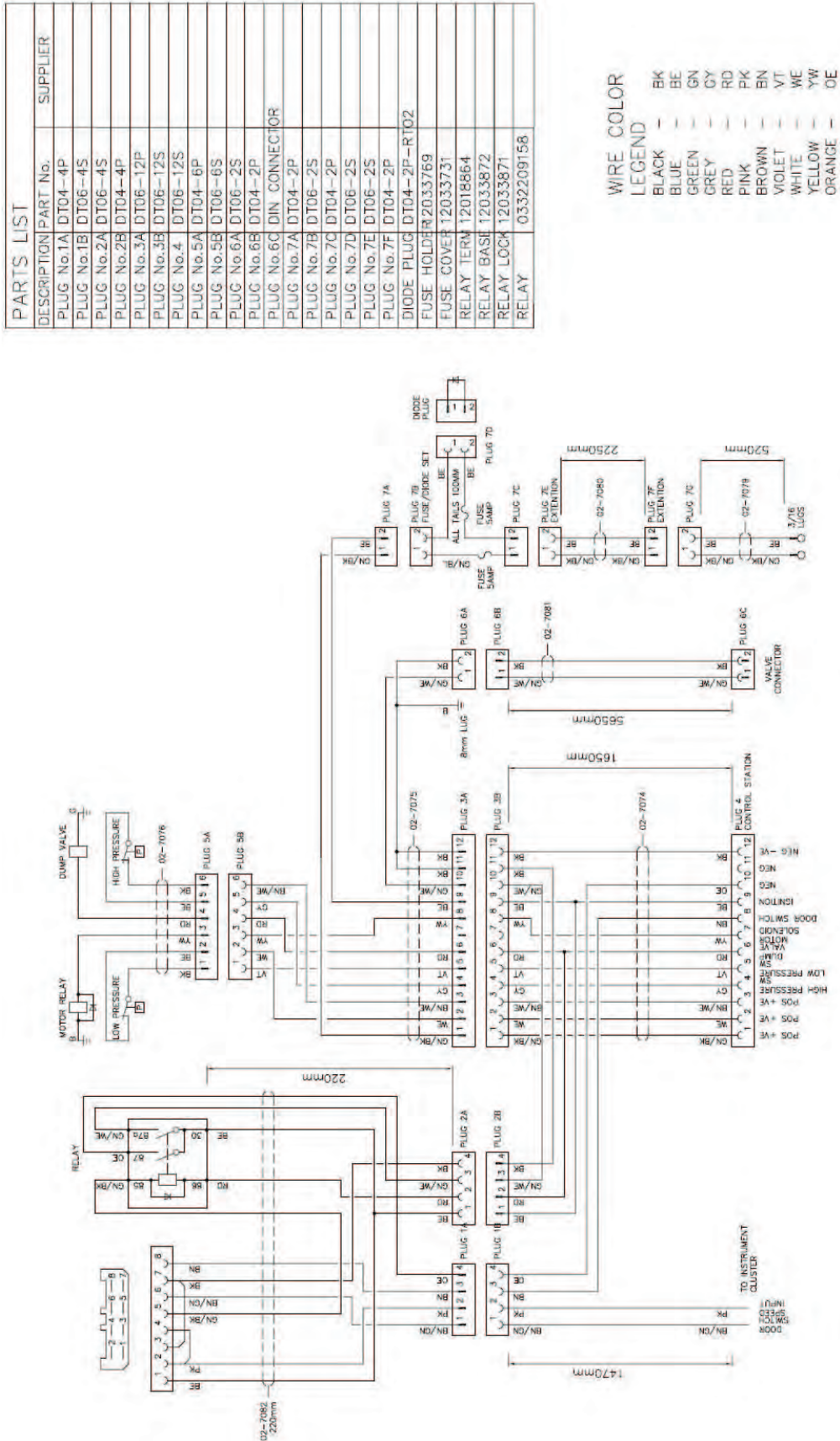


Figure 52: SIBS® II – HSI Electrical Wiring Diagram



### 6.6. EMMA™ Pump Familiarisation:

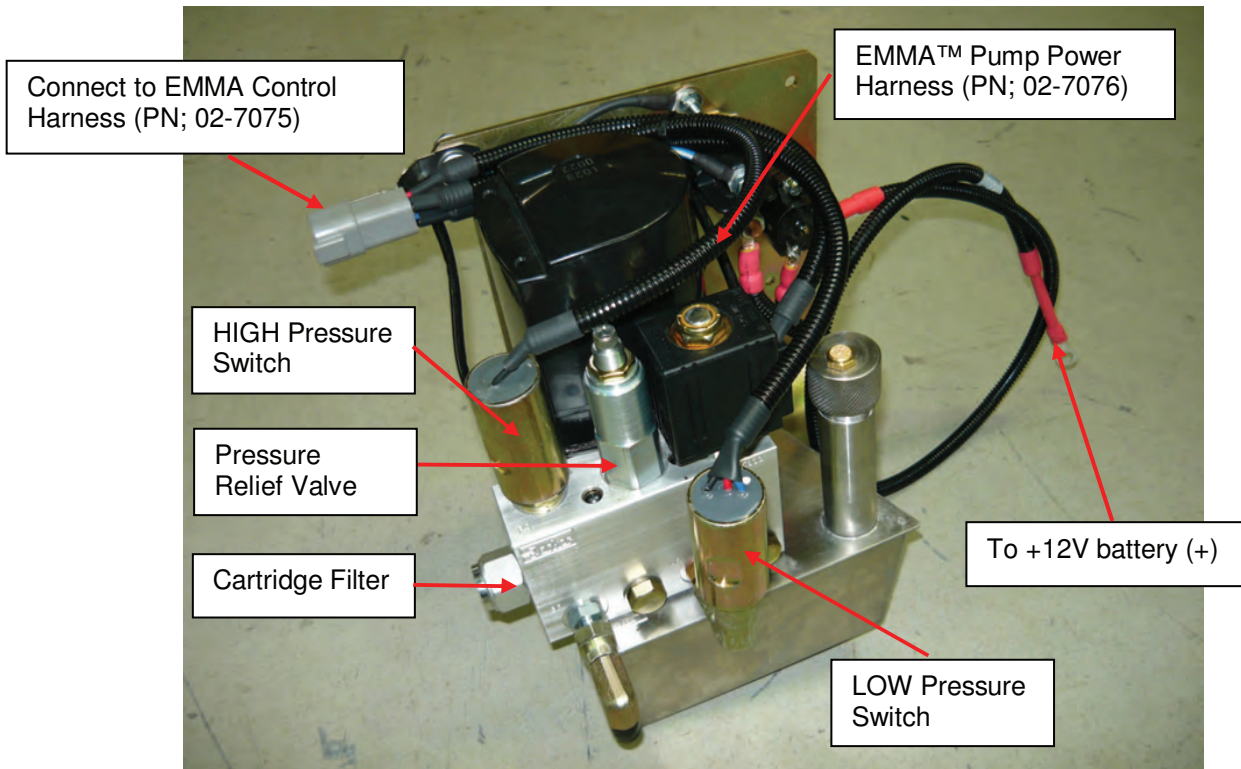


Figure 53: SIBS® II EMMA™ Pump Assembly

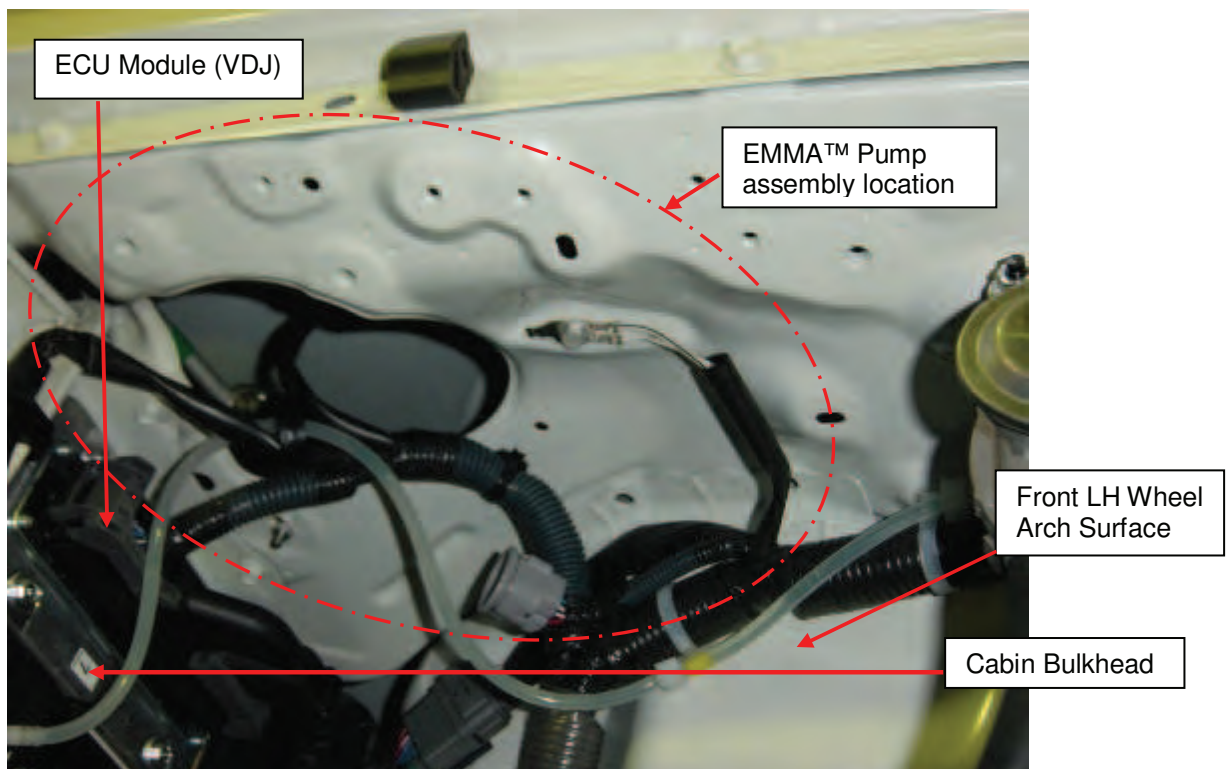
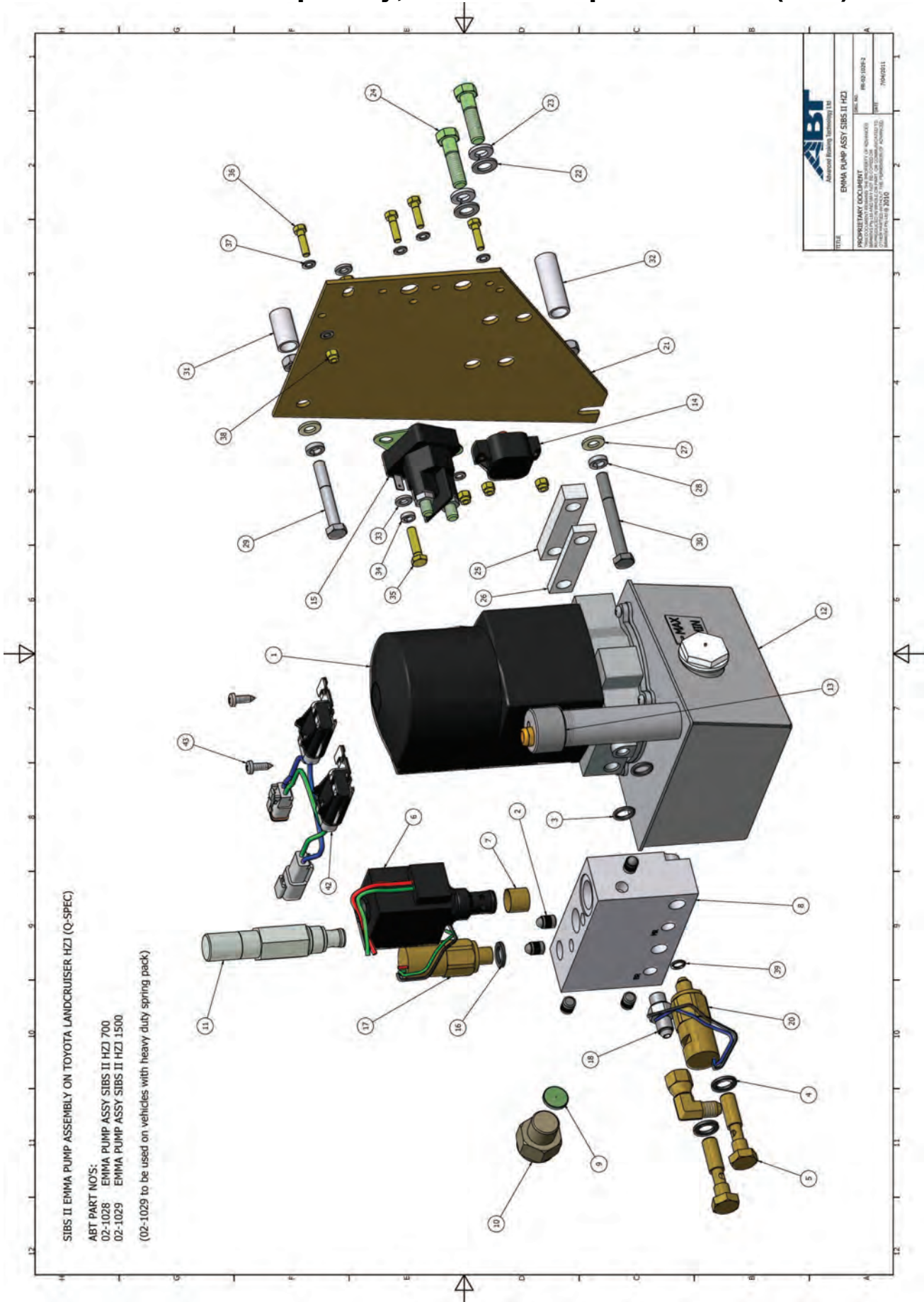


Figure 54: EMMA™ Pump mounting location - LH Rear corner of engine bay

6.7. EMMA™ Pump Assy; 02-1029 - Exploded View (HZJ)



### 6.8. EMMA™ Pump Assy; 02-1029 - Parts List (HZJ)

ITEM	PART NO.	DESCRIPTION	COMMENTS	QTY/BRAKE
1	02-1026	PUMP EMMA MARINE MOTOR	Marine Grade Pump Unit with plastic reservoir	1
2	01-5070	PLUG EXPANDER DIA 9mm		5
3	01-2072	O-RING #111 ID10.77 x 2.62 SECT		2
4	01-4045	SEAL DOWTY 7/16"		2
5	01-5032	BANJO BOLT HEX HD 7/16"-20 x 2" LG		2
6	02-6004	SVB	Solenoid valve, coil & screen complete	1
	02-7033	SOLENOID COIL 12VDC EMMA	Coil only 12V	1
7	02-6012	SCREEN	Screen only	1
8	02-6015	ASM EMMA MANIFOLD		1
9	01-5072	ORIFICE PLUG DIA 0.018	Included in 01-5071	1
10	01-5071	FILTER ELEMENT		1
11	02-6020	RELIEF VALVE (-10 DA)		1
12	02-0088	RESERVOIR ASSY STAINLESS	Includes Cap w/dipstick (02-0089)	1
13	02-0089	CAP ASSY RESERVOIR STAINLESS		1
14	02-7010	CIRCUIT BREAKER 40A		1
15	02-7053	RELAY 12V 100A/400A		1
16	01-5033	DOWTY WASHER 1/4" BSP		1
17	02-7005	PRESSURE SWITCH 700psi	High pressure switch on 02-1028	1
	02-7027	PRESSURE SWITCH 1500psi	High pressure switch on 02-1029	1
18	24-3188	CONNECTOR MALE 7/16" UNO - 7/16" JIC		1
19	02-6008	ELBOW 7/16" JIC MF		1
20	02-7086	PRESSURE SWITCH NC 40psi FALLING	Low pressure switch	1
21	10-718	LCV1 PLATE MOUNTING, EMMA PUMP ASSY TLC 75,78,79		1
22	01-3007	WASHER FLAT DIA 10		2
23	01-3132	SPRING WASHER DIA 10		2
24	01-3297	SCREW HEX HD 3/8" X 16 UNC X 1 1/2"LG		2
25	02-2005	SPACER EMMA PUMP		1
26	02-2020	SPACER PUMP AM MTG		1
27	01-3045	WASHER FLAT DIA 8		2
28	01-3016	WASHER SPRING DIA 8		2
29	01-3071	SCREW HEX HD M8 x 1.25 x 55LG		1
30	01-3034	SCREW HEX HD M8 x 1.25 x 70LG		1
31	10-593	SPACER 12 x 28LG		1
32	10-594	SPACER 12 x 46LG		1
33	01-3199	WASHER FLAT DIA 6		2
34	01-3158	WASHER SPRING DIA 6		1
35	01-3190	SCREW HEX HD M6 x 1.0 x 25LG		1
36	01-3191	SCREW HEX HD M5 x 0.8 x 20LG		4
37	01-3248	WASHER FLAT DIA 5		6
38	01-3195	NUT NYLOC M5x0.8		4
39	01-2131	O-RING SAE ID8.89 X 1.78SECT		1
40	01-3033	NUT HEX M8 x 1.25		2
41	01-3124	NUT HEX M6 X 1.0		1
42	02-7094	HARNESS FUSE EMMA PUMP SIBS II		1
43	01-3419	SCREW PAN PHILLIPS SELF DRILLING 4.8 x 16LG		2
44	02-7076	HARNESS EMMA PUMP POWER SIBS II		1

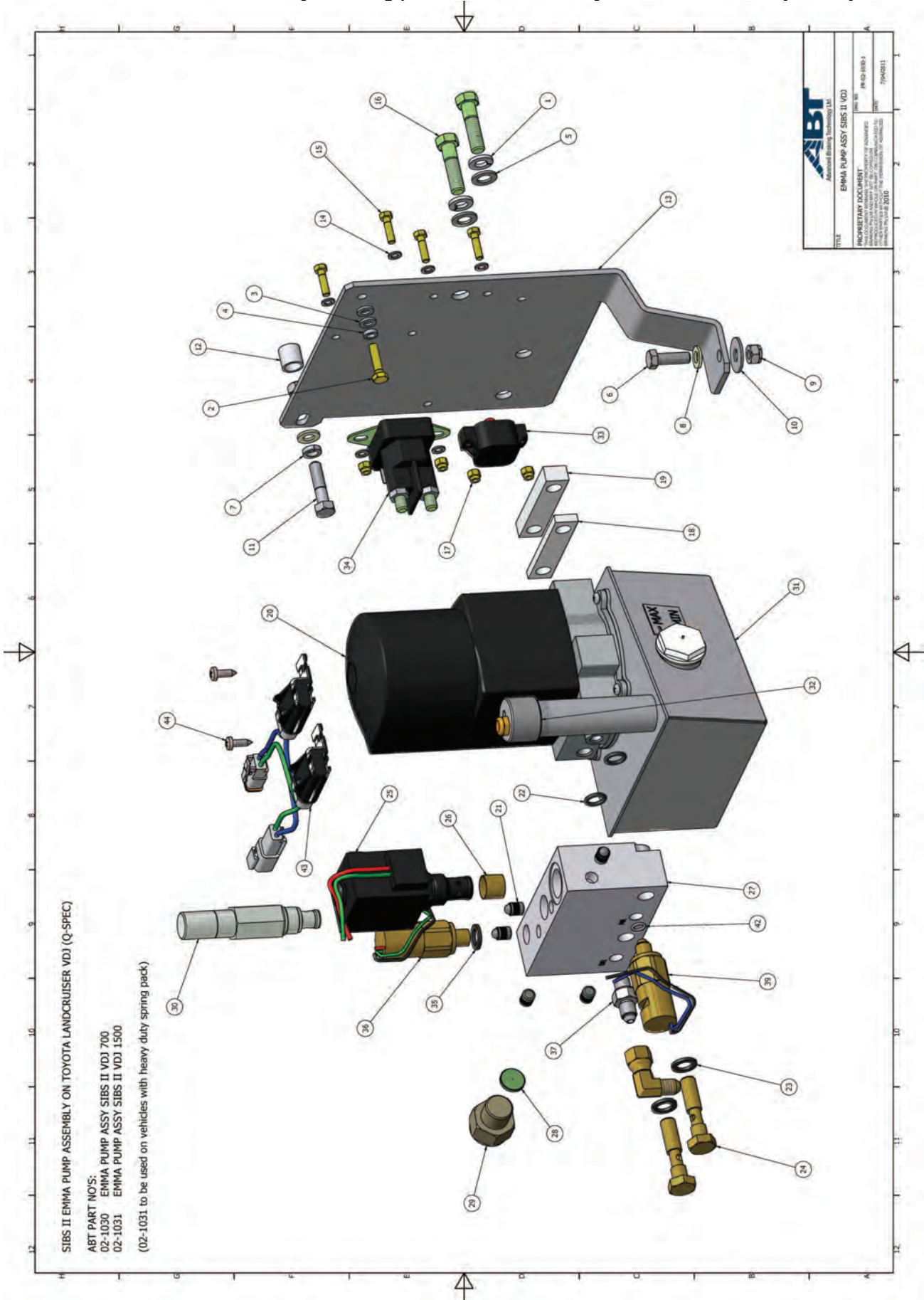
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**NOTE:**



Refer to Appendix for complete SIBS® Product and Spare Parts List

6.9. EMMA™ Pump Assy; 02-1030 - Exploded View (VDJ)



SIBS II EMMA PUMP ASSEMBLY ON TOYOTA LANDCRUISER VDJ (Q-SPEC)  
 ABT PART NOS:  
 02-1030 EMMA PUMP ASSY SIBS II VDJ 700  
 02-1031 EMMA PUMP ASSY SIBS II VDJ 1500  
 (02-1031 to be used on vehicles with heavy duty spring pack)

### 6.10. EMMA™ Pump Assy; 02-1030 - Parts List (VDJ)


ITEM	PART NO.	DESCRIPTION	COMMENTS	QTY/BRAKE
1	01-3132	SPRING WASHER DIA 10		2
2	01-3190	SCREW HEX HD M6 x 1.0 x 25LG		1
3	01-3199	WASHER FLAT DIA 6		2
4	01-3158	WASHER SPRING DIA 6		1
5	01-3007	WASHER FLAT DIA 10		2
6	01-3274	SCREW HEX HD M8 x 1.25 x 25LG (12 A/F)		1
7	01-3016	WASHER SPRING DIA 8		1
8	01-3045	WASHER FLAT DIA 8		2
9	01-3261	NUT NYLOC M8 X 1.25		1
10	01-3301	WASHER REPAIR M8 x 25 OD		1
11	01-3032	SCREW HEX HD M8 x 1.25 x 35LG		1
12	02-2007	SPACER 12 x 15LG		1
13	24-2827	BRACKET MOUNTING EMMA UNIT VDJ79R		1
14	01-3248	WASHER FLAT DIA 5		6
15	01-3191	SCREW HEX HD M5 x 0.8 x 20LG		4
16	01-3297	SCREW HEX HD 3/8" X 16 UNC X 1 1/2"LG		2
17	01-3195	NUT NYLOC M5x0.8		4
18	02-2020	SPACER PUMP AM MTG		1
19	02-2005	SPACER EMMA PUMP		1
20	02-1026	PUMP EMMA MARINE MOTOR	Marine Grade Pump Unit with plastic reservoir	1
21	01-5070	PLUG EXPANDER DIA 9mm		5
22	01-2072	O-RING #111 ID10.77 x 2.62 SECT		2
23	01-4045	SEAL DOWTY 7/16"		2
24	01-5032	BANJO BOLT HEX HD 7/16"-20 x 2" LG		2
25	02-6004	SVB	Solenoid valve, coil & screen complete	1
	02-7033	SOLENOID COIL12VDC EMMA	Coil only 12V	1
26	02-6012	SCREEN	Screen only	1
27	02-6015	ASM EMMA MANIFOLD		1
28	01-5072	ORIFICE PLUG DIA 0.018	Included in 01-5071	1
29	01-5071	FILTER ELEMENT		1
30	02-6020	RELIEF VALVE (-10 DA)		1
31	02-0088	RESERVOIR ASSY STAINLESS	Includes Cap w/dipstick (02-0089)	1
32	02-0089	CAP ASSY RESERVOIR STAINLESS		1
33	02-7010	CIRCUIT BREAKER 40A		1
34	02-7053	RELAY 12V 100A/400A		1
35	01-5033	DOWTY WASHER 1/4" BSP		1
36	02-7005	PRESSURE SWITCH 700psi	High pressure switch on 02-1030	1
	02-7027	PRESSURE SWITCH 1500psi	High pressure switch on 02-1031	1
37	24-3188	CONNECTOR MALE 7/16" UNO - 7/16" JIC		1
38	02-6008	ELBOW 7/16" JIC MF		1
39	02-7086	PRESSURE SWITCH NC 40psi FALLING	Low pressure switch	1
40	01-3033	NUT HEX M8 x 1.25		1
41	01-3124	NUT HEX M6 X 1.0		1
42	01-2131	O-RING SAE ID8.89 X 1.78SECT		1
43	02-7094	HARNESS FUSE EMMA PUMP SIBS II		1
44	01-3419	SCREW PAN PHILLIPS SELF DRILLING 4.8 x 16LG		2
45	02-7076	HARNESS EMMA PUMP POWER SIBS II		1

**P/N: 02-6014**
**NOTE:**


Refer to Appendix for complete SIBS® Product and Spare Parts List

### 6.11. EMMA™ Pump Installation:

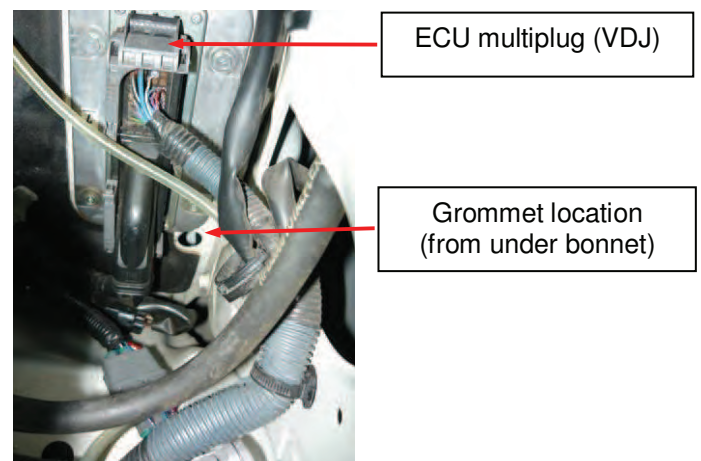
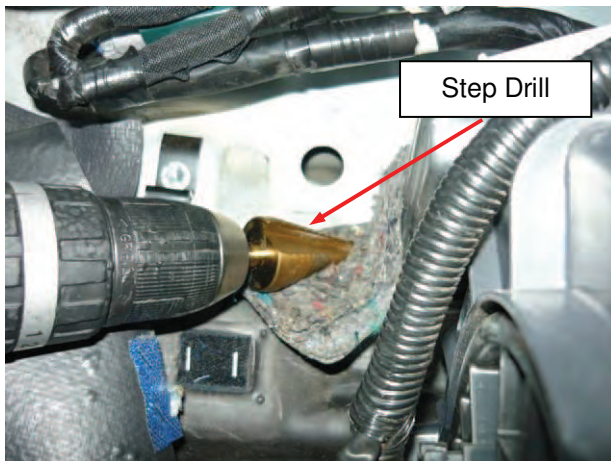
**Description:** This section details the process for installing the electro hydraulic pump that releases the Park and Emergency brake. The pump is located under the bonnet and is controlled by the Control Box.

<b>IMPORTANT:</b>	
	<p>The vehicle electrical system must be disabled before starting the EMMA™ installation.</p> <p><b>Operation of the pump at this time may cause injury or damage to equipment.</b></p> <p>Disconnect the Earth (-ve) terminal from the vehicle battery.</p> <p>Some operations in the following procedure require the use of power tools; ensure the appropriate safety precautions are taken.</p>

6.11.1. Remove the grommet located on the LH (passenger side) foot well. Re-use the grommet to plug the hole in the cabin floor from removing the hand brake cable.

6.11.2. Using a step drill, enlarge the hole to 30mm; **Figure 55**.

6.11.3. Retain the original grommet and use this to fill the handbrake cable hole.



**Figure 55:** Passenger foot well grommet location.

**Figure 56:** EMMA™ control harness P/N; **02-7075**

6.11.4. Feed the 3 Deutsch® plugs of harness P/N; **02-7075**; **Figure 57** through the 30mm bulkhead hole; **Figure 58**.



Figure 57: EMMA™ control harness P/N; 02-7075

Figure 58: Feed plugs through the bulkhead

6.11.5. Fit the harness grommet into the bulkhead hole; **Figure 59** and **Figure 60**.

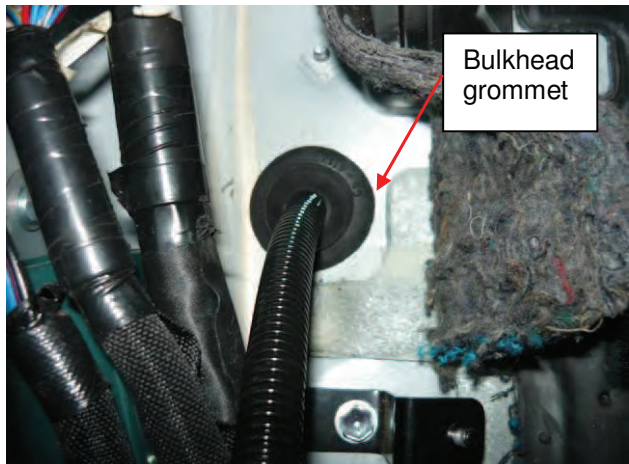
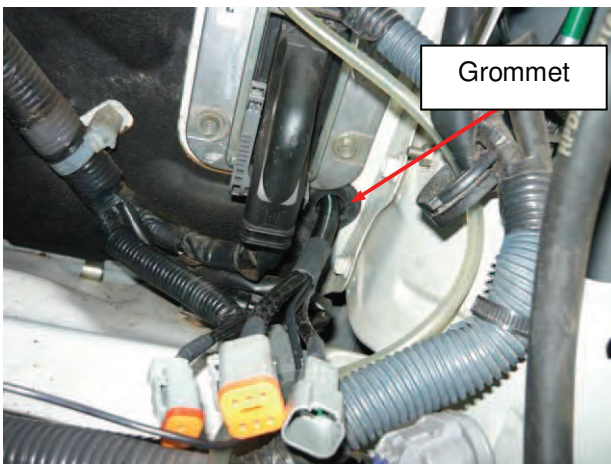


Figure 59: Installed grommet from under bonnet

Figure 60: Installed grommet viewed from foot well.

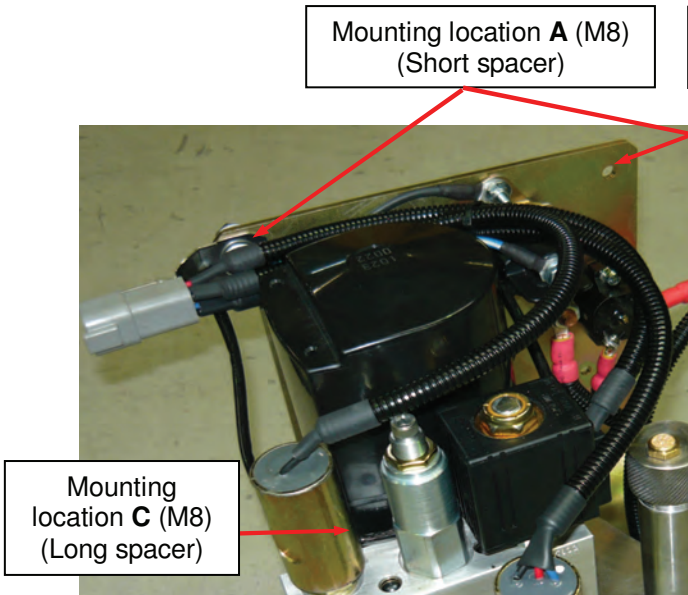
6.11.6. Place the EMMA™ pump unit in position within the engine bay and fit loosely using the short mounting spacer provided for location **A**; **Figure 61** and **Figure 62**.

6.11.7. Fit the M8 mounting bolt through the earthing terminal (Green cable) and Deutsch<sup>®</sup> plug mounting clip.

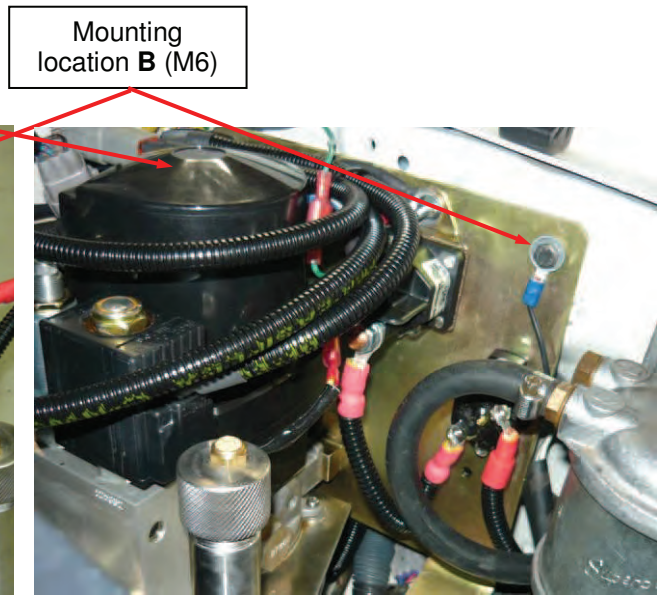
6.11.8. Fit the M6 mounting bolt in location **B** together with the relay and black earthing terminal.

6.11.9. Fit the remaining lower M8 bolt together with the longer spacer to the lower mounting location.

6.11.10. Apply Denso tape to all exposed electrical terminals and connections.



**Figure 61:** EMMA™ mounting locations



**Figure 62:** Installation locations



## 6.12. SIBS<sup>®</sup> II Harness Assemblies

**Description:** The SIBS<sup>®</sup> II system uses an all new series of wiring harnesses to support the additional functions of the new system. Please note that due to the additional functionality of SIBS<sup>®</sup> II and latest electronic control hardware, SIBS<sup>®</sup> II harnesses are not backward compatible with original SIBS<sup>®</sup> systems, likewise original SIBS<sup>®</sup> harnesses are not forward compatible with SIBS<sup>®</sup> II. The following table details the SIBS<sup>®</sup> II harnesses, vehicle requirements and system options;

	ABT P/N	Description	HZJ		VDJ	
			STD	HSI	STD	HSI
CONTROL BOX ASSY - SIBS II 02-7084	02-7084	CONTROL BOX ASSY - SIBS II	☑	☑	☑	☑
HARNESS ASSY KIT - SIBS II 02-0091	02-7074	HARNESS - CABIN CONTROL - SIBS II	☑	☑	☑	☑
	02-7075	HARNESS - EMMA PUMP CONTROL - SIBS II	☑	☑	☑	☑
	02-7076	HARNESS - EMMA PUMP POWER - SIBS II	☑	☑	☑	☑
	02-7077	PLUG - DEUTSCH JUMPER - SIBS II	☑	☑	☑	☑
	02-7078	SOCKET - DEUTSCH BLANKING - SIBS II	☑	☑	☑	☑
	02-7079	HARNESS - POWER BOX - SIBS II	☑	☑	☑	☑
HARNESS - POWER BOX EXT - SIBS II 02-7080	02-7080	HARNESS - POWER BOX EXT - SIBS II	☐	☐	☑	☑
HARNESS ASSY HSI KIT - SIBS II 02-0092	02-7081	HARNESS - AXLE MANIFOLD - SIBS II HSI	☐	☑	☐	☑
	02-7082	HARNESS - HIGHWAY SPEED ISOLATION CONTROL - SIBS II HSI	☐	☑	☐	☑
	02-7085	CONTROL MODULE - HIGHWAY SPEED ISOLATION - SIBS II HSI	☐	☑	☐	☑

6.12.1. Become familiar with the component parts of the SIBS<sup>®</sup> II harness; **Figure 63**.

6.12.2. Ensure that the Jumper Plug and Blanking Socket are fitted; **Figure 64** and **Figure 65** if the Highway Isolation System has not been specified. The system will not function correctly without the jumper plug fitted.

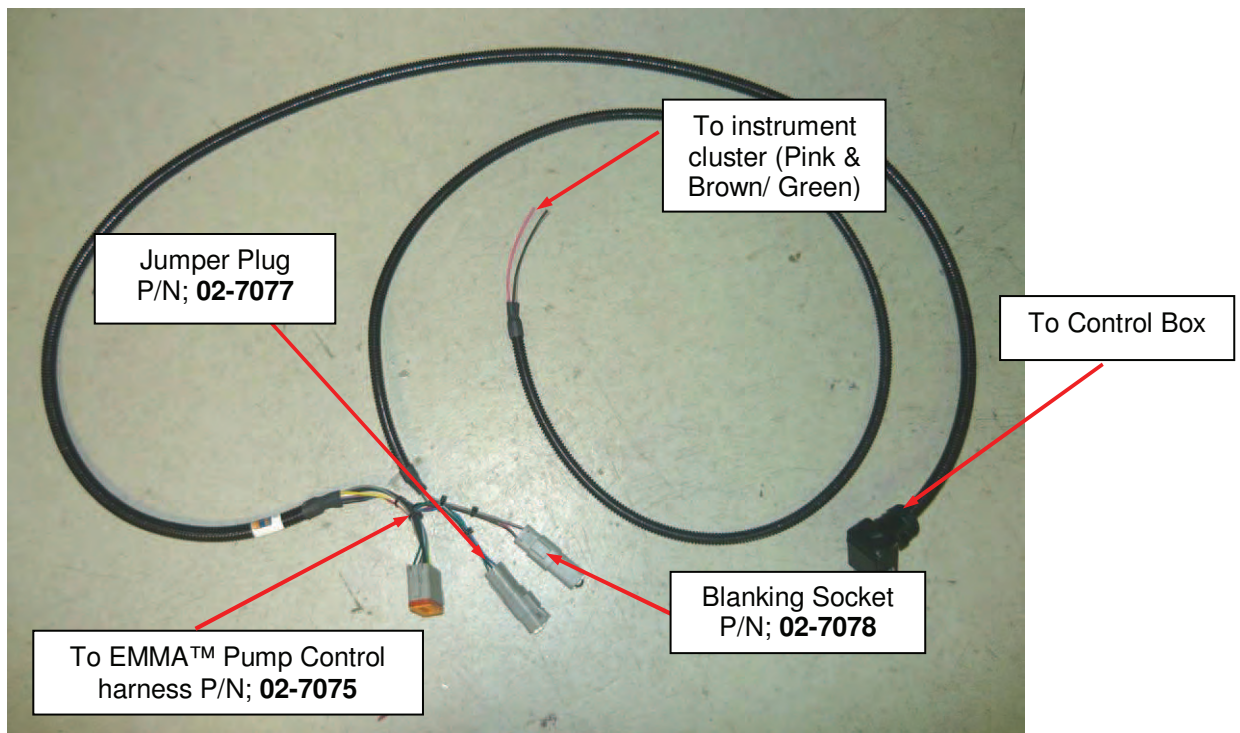


Figure 63: P/N; 02-7074 Cabin Control Harness



**Figure 64:** Jumper Plug and Blanking Socket - Non HSI applications.

**Figure 65:** Jumper Plug P/N; 02-7077

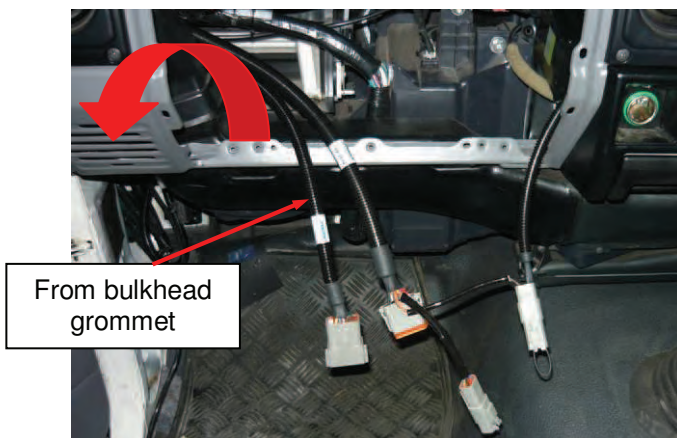
6.12.3. Remove the glove box door and inner sleeve liner

6.12.4. Remove the plastic kick panel in the passenger foot well

6.12.5. Remove the plastic cover located between the dash board and in the LH corner of the windscreen.

6.12.6. Remove the instrument cluster.

6.12.7. Locate the **EMMA™ Control harness** P/N; 02-7075 that was previously fed through the bulkhead and route the 12 pin connector from the grommet up and into the back of the glove box; **Figure 66**.



**Figure 66:** Route harness into rear of the glove box

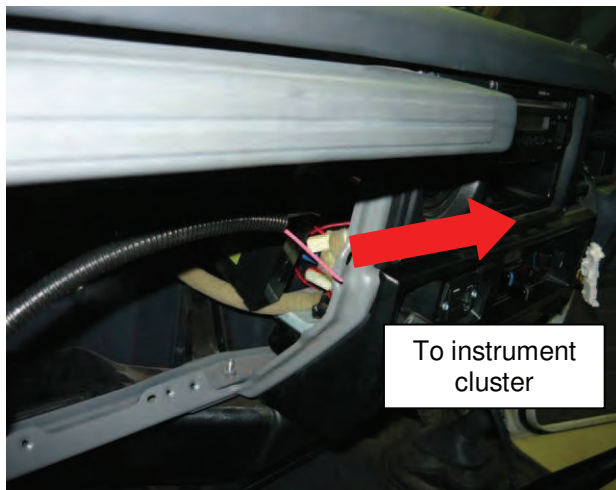


**Figure 67:** Cabin control harness fed into glove box

6.12.8. Feed the cabin control harness P/N; **02-7074** into the glove box from the front aperture leaving the connection plugs visible; **Figure 67**.

6.12.9. The branch containing the Pink and Brown/ Green cables should be routed behind the dashboard to the instrument cluster; **Figure 68**.

6.12.10. The large 12 core branch of the harness should be routed up to the surface of the dashboard via the gap at the LH corner of the windscreen; **Figure 69**.



**Figure 68:** Instrument cluster harness branch



**Figure 69:** 12 core control box harness branch

6.12.11. Fit the control box connector plug. The pins should be fitted into the 90 degree Deutsch plug as follows:

Pin #	Cable Colour
Pin 1	GN BK
Pin 2	WE
Pin 3	BN WE
Pin 4	GY
Pin 5	VT
Pin 6	RD
Pin 7	YW
Pin 8	BN
Pin 9	BE
Pin 10	OE
Blank	Empty
Pin 12	BK

GN = Green  
 BK = Black  
 WE = White  
 BN = Brown  
 GY = Grey  
 VT = Violet  
 RD = Red  
 YW = Yellow  
 BE = Blue  
 OE = Orange

**6.12.12.** For HZJ vehicles, fit the control box and bracket to the vehicle dashboard using x3 self drilling screws. The control box should be angled so as to be directly in the operators' line of vision in the seated position and within easy arms reach.

**6.12.13.** For post 2009 VDJ, remove the radio and fit the control box using M5 screws, Nylocs and penny washers on the underside of the plastic dashboard.

**IMPORTANT:**



Do not fit the control box to the padded part of the dashboard on HZJ. Ensure the ignition is OFF and do not connect the Control Box to the harness until the electrical installation is complete.

**6.12.14.** For HZJ vehicles, fit the control box harness clips to the dashboard using the self-drilling screws provided; **Figure 71**. It is recommended that 4 clips be equi-spaced along the windscreen edge of the dashboard to securely retain the harness; **Figure 72**.



**Figure 70:** Control box connector plug



**Figure 71:** Fit clips using self drilling screws



**Figure 72:** Equi-space the harness clips (HZJ)



**Figure 73:** Push the harness into the dashboard recess (2009 > VDJ)

**6.12.15.** For post 2009 VDJ vehicles, the harness can be secured in the recess between the windscreen and the dashboard without the need for clips.

### 6.13. Door Interlock - HZJ Land Cruiser

6.13.1. Remove the instrument cluster and locate the centre (blue) multi-plug to the rear; **Figure 74**.

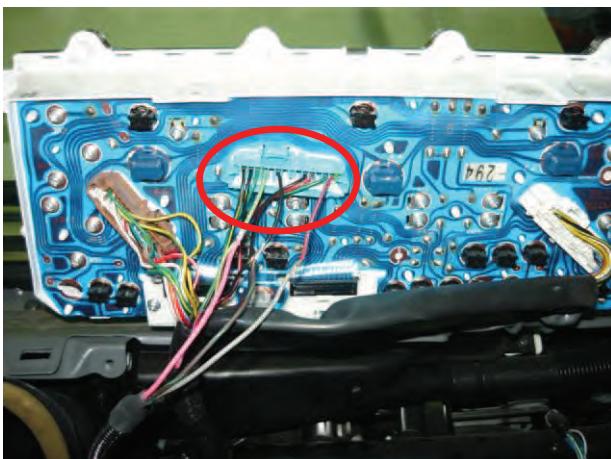
6.13.2. Locate the Black (Bk) **Door Switch** cable and remove a 10mm section of the protective insulation. The OE wiring harness should not be cut.

6.13.3. Solder splice a diode from the Brown/ Green cable of the SIBS<sup>®</sup> II harness into the Black cable.

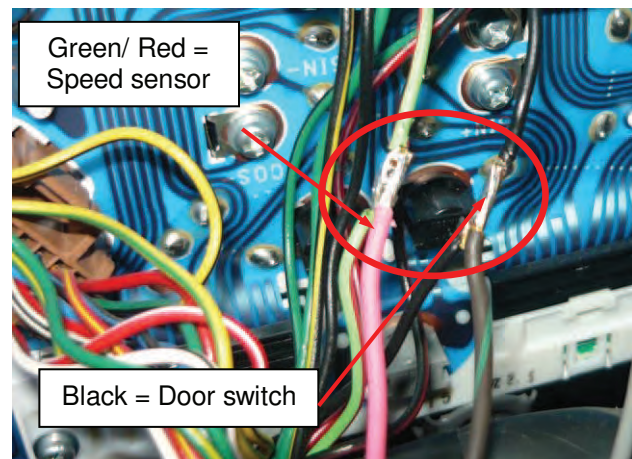
6.13.4. On completion of a secure joint, use self-amalgamating insulation tape to ensure the joint and second diode is completely insulated; **Figure 75**.

6.13.5. Locate the Green/ Red (Gn/ Rd) **Speed** input cable within the centre blue multi-plug and remove a 10mm section of the protective insulation, again, the OE wiring harness should not be cut.

6.13.6. Solder splice the Pink (Pk) **Speed Pick-up** cable from the SIBS<sup>®</sup> II harness into the Green/ Red cable. On completion of a secure joint, use self-amalgamating insulation tape to ensure the joint is completely insulated; **Figure 76**.



**Figure 74:** Instrument cluster multi-plug



**Figure 75:** Solder splice the door switch diode and speed sensor cables.



**Figure 76:** Use self-amalgamating insulation tape to seal the joint.



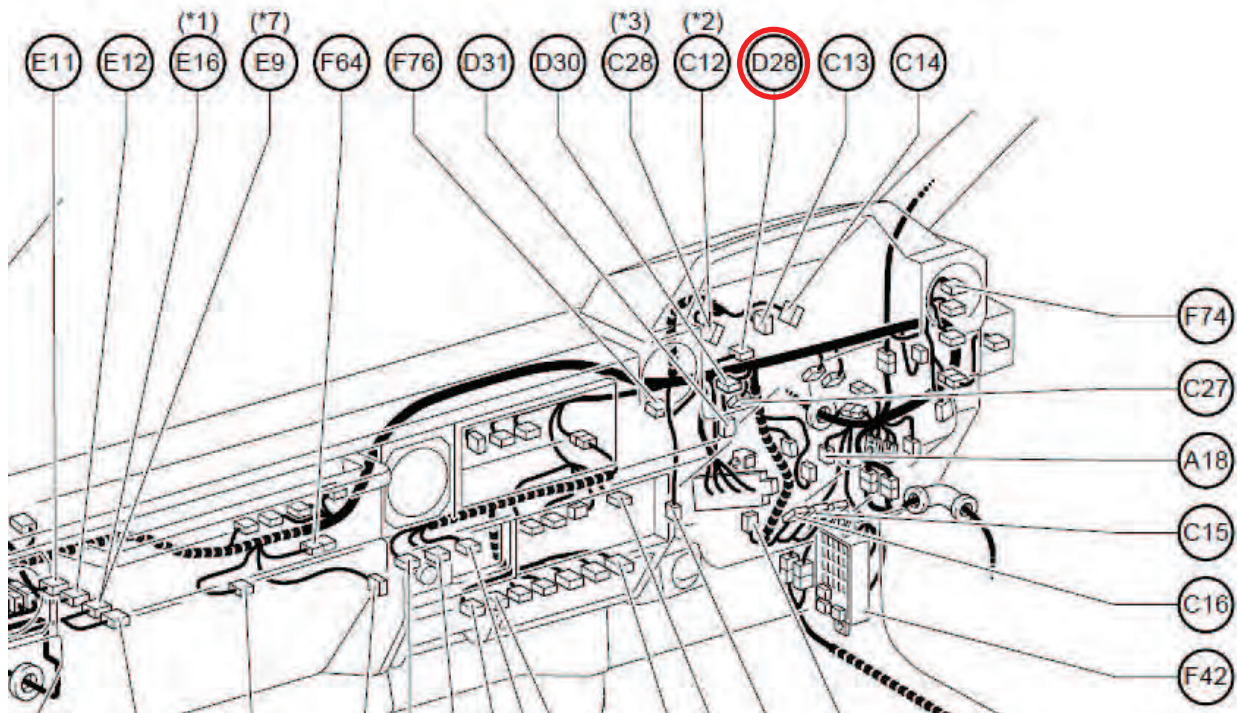
**Figure 77:** Connect the 12 pin Cabin Control harness within the glove box.

## 6.14. Door Interlock – 2007 > 2009 VDJ Land Cruiser

6.14.1. Locate Diode D28 behind the instrument cluster; **Figure 78** and **Figure 79**.

6.14.2. Locate the Black (Bk) and Black/ White (Bk/ We) **Door Switch** cables and remove a 10mm section of the protective insulation. The OE wiring harness should not be cut.

Position of Parts in Instrument Panel <RHD Before Jul. 2009 Production>



**Figure 78:** Location of Diode D28 – VDJ 2007 > 2009

### IMPORTANT



The door interlock must be connected across diode D28 in order for the feature to activate correctly from all doors. Attempting to connect at the instrument cluster will result in activation from the passenger door only.

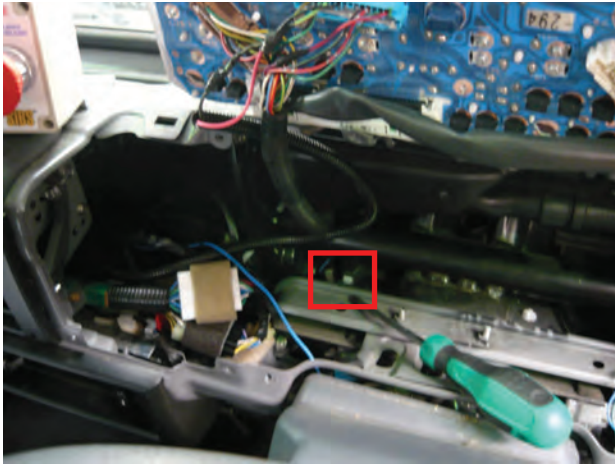
6.14.3. Solder splice the first diode branch of the Brown/ Green (Bn/ Gn) cable from the SIBS<sup>®</sup> II harness into the Black (Bk) cable of D28; **Figure 80**.

6.14.4. Solder splice the second diode from the Brown/ Green cable of the SIBS<sup>®</sup> II harness into the Black/ White (Bk/ We) cable of D28; **Figure 80**.

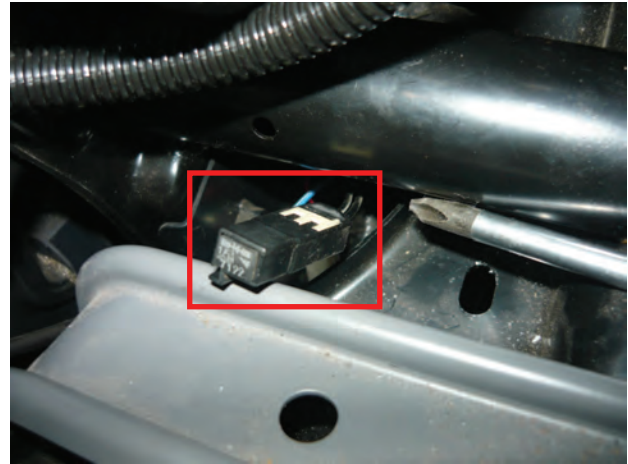
### IMPORTANT



The OE cables should not be cut or compromised. Strip and remove 10mm of the cable sheath and solder the diodes from the Brown/ Green SIBS<sup>®</sup> II cable to the bared sections of OE cables.

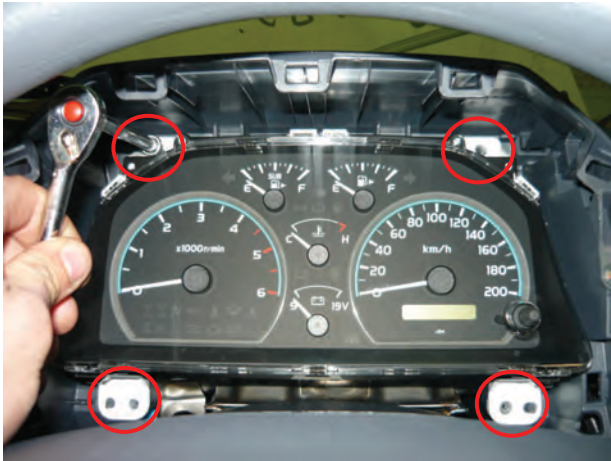


**Figure 79:** Location of Diode D28 – Exit point from main harness behind dashboard.

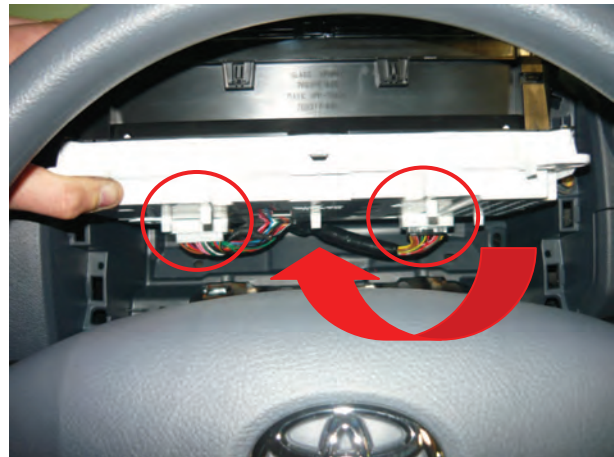


**Figure 80:** Diode D28 – Connect to Black (Bk) and Black/ White (Bk/ We) cables.

### 6.15. Door Interlock - Post 2009 VDJ Land Cruiser



**Figure 81:** Use self amalgamating insulation tape to seal the joint.



**Figure 82:** Disconnect the x2 multi-plugs and remove the cluster.

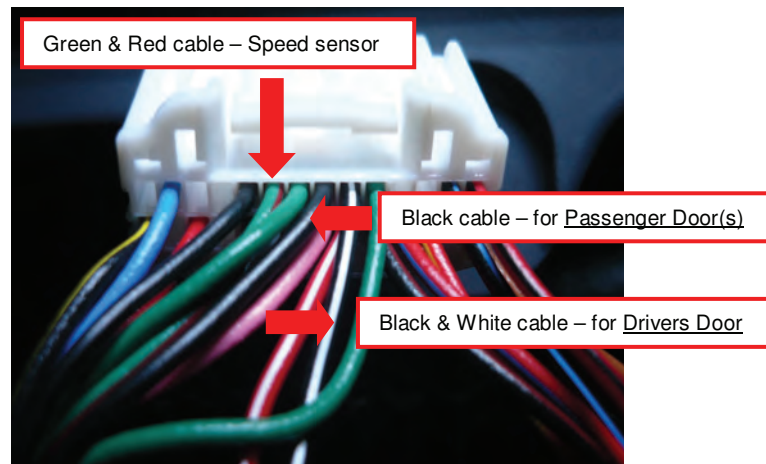
6.15.1. Remove the four 10mm retaining screws from the instrument cluster; **Figure 81**

6.15.2. Disconnect the two multi-plugs to allow the cluster to be removed; **Figure 82.**

6.15.3. Take the white multi-plug on the left side of the cluster and locate the Black (Bk) and Black/ White (Bk/We) cables; **Figure 83** and **Figure 84.**



**Figure 83:** Take the LH multi-plug.




**Figure 84:** Locate the Black and Black/ White cables for the door interlock.

6.15.4. Solder splice the first diode branch of the Brown/ Green (Bn/ Gn) cable from the SIBS<sup>®</sup> II harness into the Black (Bk) cable at the multi-plug; **Figure 85.**

6.15.5. Solder splice the second diode branch into the Black and White (Bk/ We) cable; **Figure 85.**



<b>IMPORTANT</b>	
	<p>The OE cables should not be cut or compromised. Strip and remove 10mm of the cable sheath and solder the diodes from the Brown/ Green SIBS<sup>®</sup> II cable to the bared sections of OE cables.</p>



**Figure 85:** Solder splice into the Black and Black/ White multi-plug cables.



**Figure 86:** Insulate the joints with self-amalgamating insulation tape.

**6.15.6.** Insulate the newly soldered joints with self-amalgamating insulation tape to ensure robust insulation and protection of the soldered joint; **Figure 86**.

**6.15.7.** Solder splice the Pink (Pk) **Speed Pick-up** cable from the SIBS<sup>®</sup> II harness into the Green/ Red cable. On completion of a secure joint, use self-amalgamating insulation tape to ensure the joint is completely insulated; **Figure 76**

**6.15.8.** Refit the multi-plugs into the instrument cluster and make good by refitting the cluster and surrounding fascia. See TBN-053 for further detail if required.

**6.15.9.** Refit the kick panel in the passenger foot well.

**6.15.10.** Refit the plastic cover located between the dash board and in the LH corner of the windscreen.

**6.15.11.** Moving back to the glove box connect the 12 pin Deutsch plug; **Figure 77** and carefully conceal the harness connections together with any excess wiring into the recess at the rear of the glove box cavity.

**6.15.12.** Refit the glove box liner and the door.

**6.15.13.** Locate the Power Box harness P/N; **02-7079**; **Figure 87**.



**Figure 87:** Power Box harness; P/N; 02-7079



**Figure 88:** Connect the Power Box harness into the Cabin Control harness.

**6.15.14.** Connect the power box harness into the matching 2 way Deutsch connector passed through the bulkhead as part of the Cabin Control harness; **Figure 88.**

**6.15.15.** Remove the cover from the Toyota power box as shown in **Figure 89** and insert the Green/ Black (Gn/ Bk) and Blue (Be) cables with ring connectors through the base of the box.

**6.15.16.** Connect the **Green/ Black** cable to the **12V Constant** terminal within the power outlet box; **Figure 90.**

**6.15.17.** Connect the **Blue** cable to the **12V Ignition** terminal within the power outlet box; **Figure 90.**

**6.15.18.** Replace the cover on the box and refit the box to its metal slide bracket.

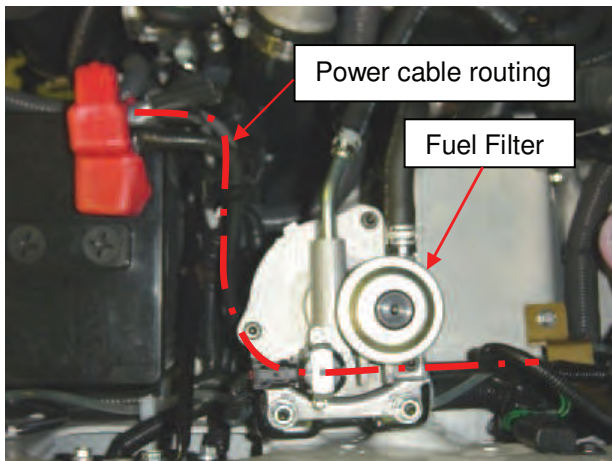
**6.15.19.** Route the main power cable from the EMMA™ pump assembly, along the inner wing and connect this directly to the positive terminal of the vehicle battery; **Figure 91.** Restrain as appropriate to prevent vibration; **Figure 92.**



**Figure 89:** Fit the SIBS<sup>®</sup> power cables into the Toyota power outlet box.



**Figure 90:** Connect the 12V constant and 12V ignition supply cables.



**Figure 91:** Connect the EMMA™ power cable directly to the battery +ve terminal.



**Figure 92:** Main power cable securely clipped to OE Toyota harness.

**6.15.20.** The control box may now be connected inside the vehicle; **Figure 93.**



**Figure 93:** Connected Control Box

### 6.16. SIBS<sup>®</sup> II Operator Interface:



Figure 94: SIBS<sup>®</sup> II Operator Interface


#### 6.16.1. SIBS<sup>®</sup> II - Standard Operation:

The SIBS<sup>®</sup> II control unit functions as follows:

- The EMMA™ park brake is engaged and released by operating the red “**Operator Button**” while ignition is switched **ON**.
- To engage the brakes, push the red “**Operator Button**”.
- To release the brakes, twist the red “**Operator Button**” clockwise, approximately 15° and allow it to spring outwards.
- The hydraulic pump will then activate and **Release** the park brake.

#### 6.16.2. SIBS<sup>®</sup> II - Manual Release Operation:

If the vehicle brakes need to be released when no ignition key is available, push and hold the “**Manual Release**” push button. While the “**Manual Release**” button is depressed, normal operation of the park brake is possible using the red “**Operator Button**”.

<b>NOTE:</b>	
	The brake will automatically re-apply as soon as the “Manual Release” push button is released. The Manual Release is an emergency override function only.

### 6.16.3. Emergency Operation of SIBS<sup>®</sup> II:

Emergency operation of the EMMA™ brake will occur in the following scenarios:

- The **red** "Operator Button" is **PUSHED**
- Electrical **POWER IS LOST**
- Hydraulic **PRESSURE IS LOST**
- The **IGNITION IS SWITCHED OFF**
- A **DOOR IS OPENED**

### 6.16.4. Emergency Brake Reset:

The braking system must be reset after an emergency application. This is signified by a 5 second alarm tone. To reset, the red "**Operator Button**" must be pushed in with the ignition turned **ON** and then released to disengage the brake.

- Ensure the **Ignition** is **ON**.
- **PUSH** the **red** "Operator Button" with the ignition switched **ON**.
- To **RELEASE** the brakes, **TWIST** the **red** "Operator Button" **CLOCKWISE** and allow it to spring outwards.
- The brake will now operate in its **STANDARD** operation mode once again.

**6.16.5. SIBS<sup>®</sup> II – 3 Modes of Operation:**

The 3 critical operating states of the braking system are clearly communicated to the operator via LED and audible indicators. The 3 states of the brake are communicated as follows:

- 1 When the **GREEN** LED is **ON**, the brakes are **RELEASED**; Figure 95.



Figure 95: Brake RELEASED indication

- 2 When the **RED** LED is **Flashing**, the brakes are in the process of **APPLYING** or **RELEASING**; Figure 96. A pulsing audible alert accompanies the flashing red LED to signify that the brake is in transition between the applied and released state.



Figure 96: Brake TRANSITION indication

- 3 When the **RED** LED is **ON**, the brakes are **APPLIED**; Figure 97.



Figure 97: Brake APPLIED indication

**CAUTION:**

In the event of an electrical failure, hydraulic failure or a door interlock being activated, the emergency brake will be applied.

When an interlock has been activated a constant tone will be heard from the alarm for a period of 5 seconds. This indicates to the operator that the emergency braking system has been applied due either to an emergency situation or breach of operating procedure such as opening the door whilst the vehicle is in motion.

The red “Operator Button” must be pushed in this situation to reset the system for normal operation.

**Note: An optional speed lockout system may be specified for SIBS<sup>®</sup> II to prevent unintended brake application above a predetermined vehicle speed (i.e. for highway vehicles).**

## 6.17. Bleeding the Service and EMMA™ systems:

6.17.1. Re-connect the battery and remove the isolation from the vehicle.

6.17.2. Fill the EMMA™ Reservoir with **ATF Dexron III** fluid.



Figure 98: Fit P-clips as shown

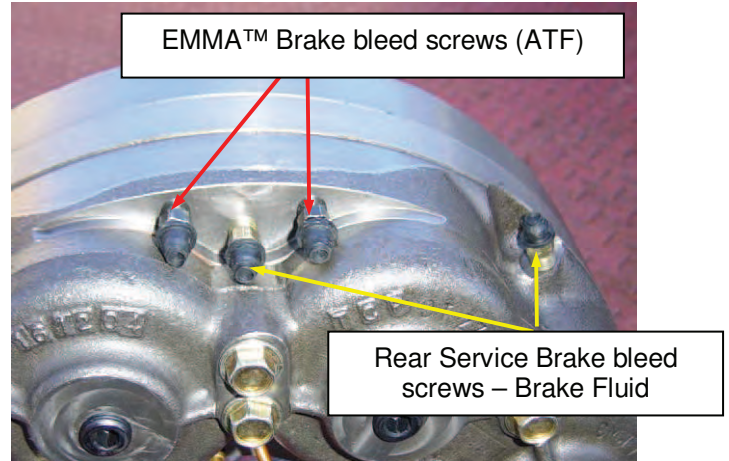


Figure 99: Bleed screw locations – Rear Housing

6.17.3. Prime the EMMA™ pump by running intermittently (for no more than 10 seconds at a time) until full hydraulic pressure is reached and the motor stops running automatically.

6.17.4. To release the EMMA™ brake, rotate the red pushbutton anticlockwise, to engage the EMMA™ brake press the red operator pushbutton. While performing this priming process, ensure the EMMA™ reservoir is constantly topped up to prevent the pump from running dry.

6.17.5. Bleed the EMMA™ system using the bleed screws on the rear brakes; **Figure 99**. While the EMMA™ brake is released (pressurised), open and close the bleed nipples to release all traces of entrained air from the system. When the system is fully bled, top up the EMMA™ ATF reservoir.

**IMPORTANT:**



Failure to purge air from the EMMA™ system may cause damage to the hydraulic system. The EMMA™ pump is designed for **intermittent** use only; when bleeding do not run continuously for more than 10 seconds.

6.17.6. Check the level of brake fluid in the master cylinder – whilst bleeding this should not fall below 1/3 full.

**IMPORTANT:**



Use only SAE J1703 or FMVSS No. 116 DOT 3 brake fluid

6.17.7. Remove any clamps on the rear service line.



**6.17.8.** Bleed the air from the LPSV first, as this is the highest point (apart from the master cylinder) in the system; then proceed to the wheel cylinder with the longest hydraulic line – the rear left hand brake. Bleed each rear SIBS<sup>®</sup> II unit using the **two service brake bleed nipples on each brake** as shown in: **Figure 99**.

**6.17.9.** To bleed the service brake system of air:

- 6.17.9.1. Connect a clear vinyl tube onto the bleed nipple and the other into a clean container of brake fluid
- 6.17.9.2. Slowly pump the brake pedal several times
- 6.17.9.3. While an assistant presses on the brake pedal, loosen the bleed nipple until fluid runs out then close the nipple
- 6.17.9.4. Repeat this process until there are no more air bubbles in the fluid.

**IMPORTANT:**



It is essential that the LSPV is bled as part of the SIBS installation. Failure to bleed the LSPV will result in poor brake performance and brake pedal feel.

**6.17.10.** Check that there are no leaks from the system.

**6.17.11.** You are now ready to test the vehicle.

**NOTE:**



After a short period of running the pedal feel and travel should be virtually indistinguishable from the OEM brakes.

When first installed the pedal travel on a SIBS<sup>®</sup> II brake set will be slightly more than the OEM Toyota brakes. Over a short period of time ~ 1-2days, this will improve as the brakes bed in and the service piston o-rings find their shape.

## 7. Highway Speed Isolation Fitment (Optional)

### 7.1. Highway Speed Isolation (HSI) Operation

**Description:** The Highway Speed Isolation feature (where fitted) is activated when the vehicle reaches a speed  $\geq 40$  km/h. This feature disarms the SIBS<sup>®</sup> interlock features to eliminate any risk of unintended application of the emergency brake at speed (i.e. due to a door opening or sudden hydraulic fluid loss). The intervention of the HSI feature is indicated by illumination of a small green LED indicator on the control box. The system has 2 states of operation;

- 1 When the **GREEN** LED is **illuminated**, the HSI system is **Active** and interlock functions are **Disabled**; **Figure 100**.



Highway Speed Isolation (HSI) indicator **ON**

Figure 100: Highway Speed Isolation ACTIVE

- 2 When the **GREEN** LED is **off**, the HSI system is **Disabled** and the SIBS II interlock functions are **Active**; **Figure 101**.



Highway Speed Isolation (HSI) indicator **OFF**

Figure 101: Highway Speed Isolation DISABLED

Fitment of the Highway Speed Isolation (HSI) system is achieved with an optional kit; ABT P/N; **02-0092**. The kit consists of a hydraulic solenoid manifold to be mounted on the rear axle and supplementary electrical hardware that is “plug and play” with the standard SIBS<sup>®</sup> II electrical harness kit.

## 7.2. HSI Hydraulic Installation

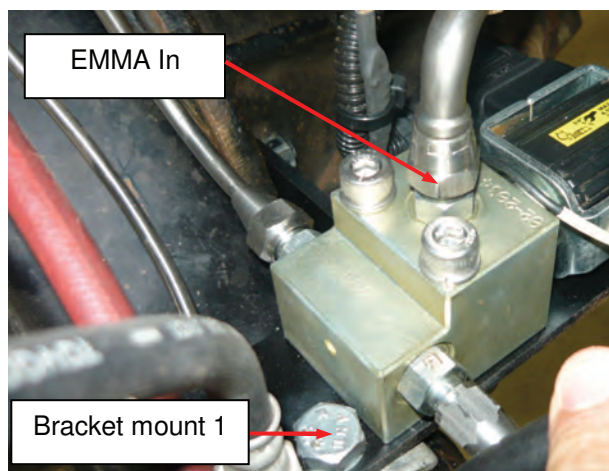
**Description:** The HSI solenoid assembly replaces the standard EMMA™ Tee adapter mounted on the rear axle. At speeds  $\geq 40$  km/h, the solenoid is activated and powered closed. Closure of the solenoid retains the release pressure in the rear axle brake lines and in so doing prevents unexpected application of the brakes at speed should a sudden hydraulic system failure occur. The emergency brake will apply only when the vehicle speed has reached a safe application speed of  $<40$  km/h unless the operator overrides the system using the Emergency stop button.

**7.2.1.** Fit the axle solenoid manifold; P/N: **02-2034** to the mounting bracket using the hardware provided. Ensure that spring washers are located beneath the cap head bolts to prevent vibration from loosening the bolts.

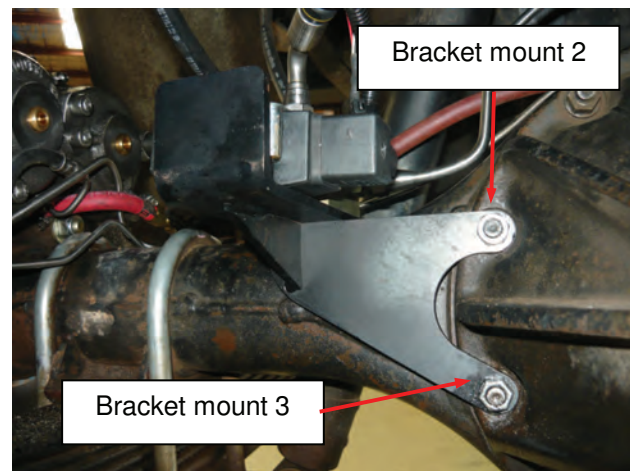
**7.2.2.** Fit the axle solenoid mounting bracket to the rear axle using the mounting point on top of the axle tube; **Figure 102** and the two radial mounting points on the rear differential housing; **Figure 103**.

**7.2.3.** Fit the incoming EMMA line to the top of the solenoid manifold; **Figure 102**.

**7.2.4.** Fit the LH and RH EMMA brake lines to the respective unions on each side of the manifold.



**Figure 102:** HSI manifold installation



**Figure 103:** HSI mounting bracket

### 7.3. HSI Electrical Installation

**Description:** The HSI system uses a two channel speed control module to monitor vehicle speed and door position. This data is used to control activation of the door and solenoid interlocks. Vehicle speed is detected from the vehicle hall sensor located on the output shaft of the transfer case and is picked up via the pink (Pk) cable connected into the instrument cluster. At speeds  $\geq 40$  km/h the control module closes/ energises the rear axle solenoid and opens/ disables the door interlock circuit.

**7.3.1.** Locate the harness blanking and jumper plugs on the standard SIBS<sup>®</sup> II harness. These are located behind the glove compartment; **Figure 104** and **Figure 105**.

**7.3.2.** Remove the blanking and jumper plug.

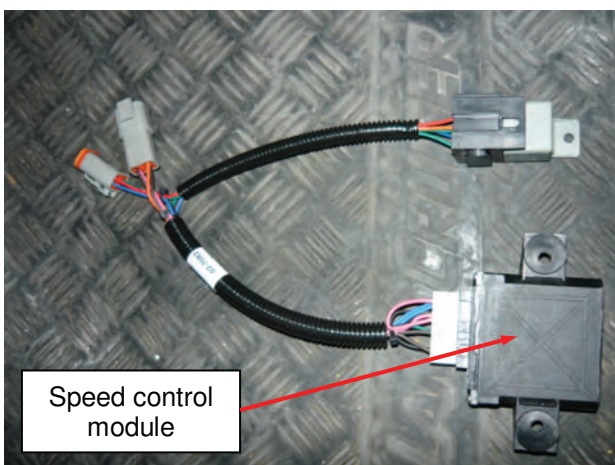


**Figure 104:** HSI connections

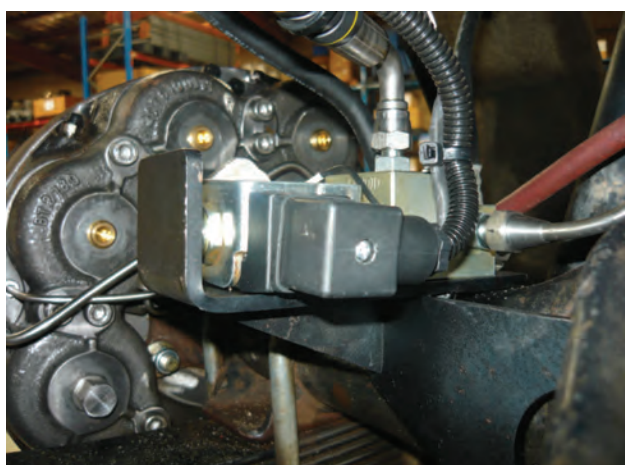


**Figure 105:** Remove blanking plug and jumper

**7.3.7.** Select HSI harness P/N; **02-7082** and plug into the Standard SIBS<sup>®</sup> II vehicle harness. The additional HSI harness contains a switching relay and a twin channel speed control module; **Figure 106**.



**Figure 106:** HSI control harness



**Figure 107:** HSI solenoid plug

**7.3.8.** Once connected, re-locate the additional HSI harness components behind the glove box sleeve and refit the glove box trim.

**7.3.9.** Move to the under bonnet area and locate the spare 2 pin Deutsch connector on the harness connecting the EMMA™ pump. Remove the cover plug and connect harness P/N; **02-7081**.

**7.3.10.** Route the harness along the chassis following the EMMA hose to the solenoid located on the rear axle.

**7.3.11.** Secure the electrical cabling to avoid damage and abrasion whilst ensuring sufficient slack remains at the solenoid end to allow for articulation of the axle.

**7.3.12.** Connect the HSI plug to the solenoid in the orientation shown in; **Figure 107**.

### 7.4. Setting the HSI Intervention Speed

**Description:** The HSI intervention speed can be adjusted to accommodate differing site speed limit requirements, vehicle wheel sizes and drivetrain ratios. Inside the HSI speed controller module is an LED display and a series of buttons that allow the switch to be adjusted for a higher or lower input signal frequency.

7.4.1. Locate the speed control module, P/N; **02-7085** and remove the x4 small Phillips head screws on the multi-plug face. Slide off the cover.

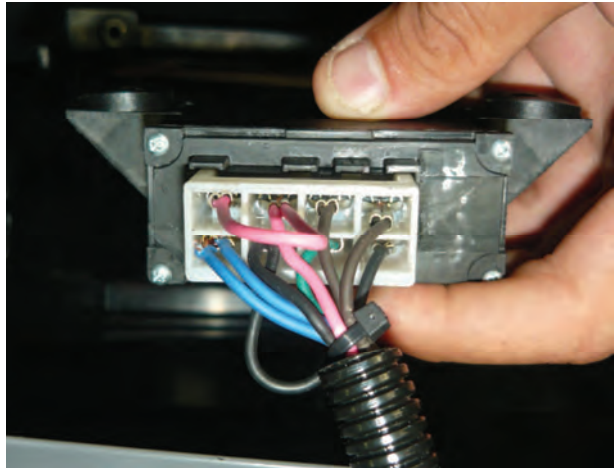
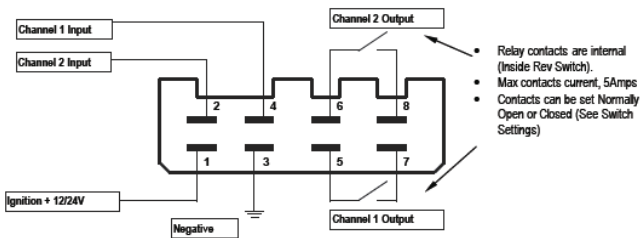


Figure 108: HSI control module multi-plug detail

Figure 109: HSI solenoid plug multi-plug

7.4.2. The function of the dip switches within the control module are detailed in; **Figure 110** and **Figure 111**.

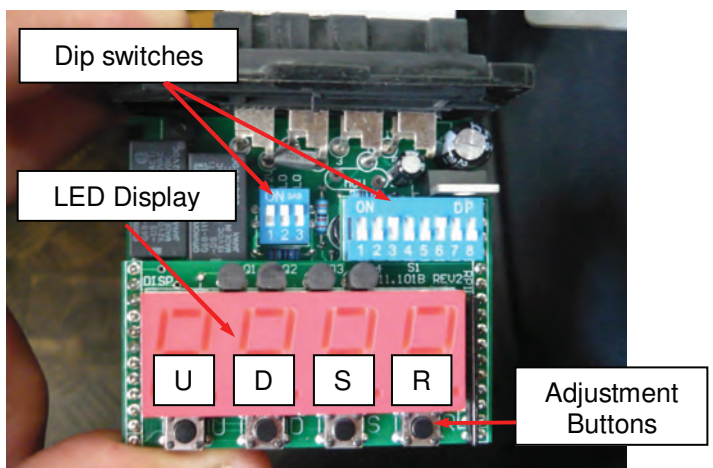
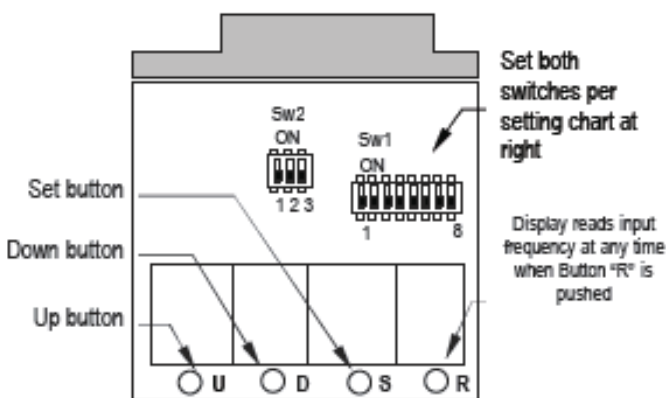


Figure 110: HSI control module diagram

Figure 111: HSI module display and adjustment

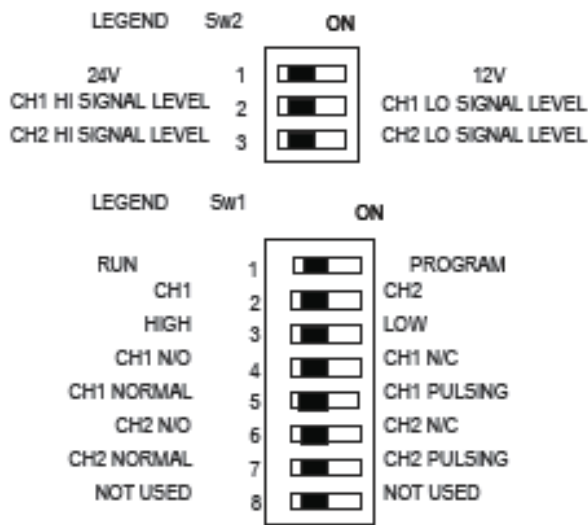


Figure 112: HSI dip switch setting chart

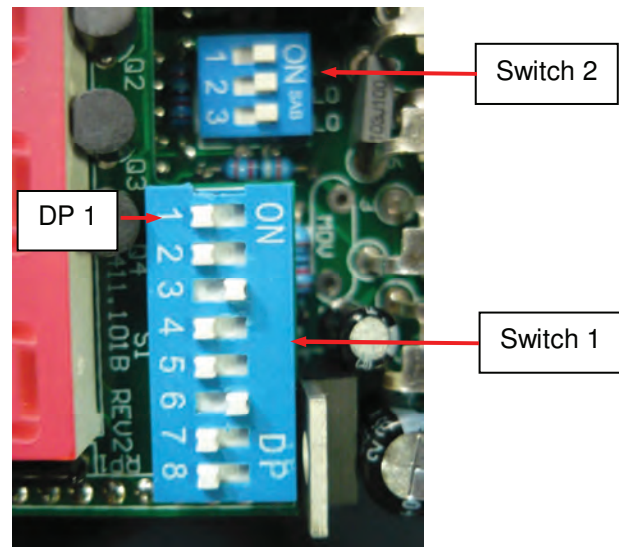


Figure 113: HSI dip switch positions - Standard setup

7.4.3. Prior to making any adjustments, the dip switches should be positioned as shown in **Figure 113** for standard operation.

7.4.4. To adjust, raise the rear of the vehicle and remove the roadwheels.

7.4.5. Set **Switch 1 - DP 1** to “PROGRAM” mode.

<b>NOTE:</b>	
	When in “PROGRAM” mode if a button is not pressed within 30 seconds, the module will revert back to “RUN” mode. Turn DP 1 OFF then ON again to re-enter “PROGRAM” mode.


7.4.6. Run the vehicle drivetrain at the desired switching speed and press button “R” to display the frequency produced by the vehicle speed sensor.


7.4.7. With **DP 2** in “CH1” position and **DP 3** in “HIGH” position (see **Figure 112**), set the rising speed frequency using the “U” (Up) and “D” (Down) buttons.

7.4.8. When satisfied with the selected speed, press “S” to store the setting. The display will flash once to confirm (if the display does not flash, the setting is invalid – the HIGH or rising speed set point must be higher than the LOW or falling speed set point).

7.4.9. Set **DP 3** to the “LOW” position and set the secondary switching point for falling speed.


7.4.10. Repeat the above procedure for channel 2 by switching **DP 2** to the “CH2” position and working once again from paragraph 7.4.7. The stored values must be identical to those stored for **CH1**.

<b>NOTE:</b>	
	The “LOW” setting for each channel must be set at least 5% lower than the “HIGH” setting to provide switching hysteresis a prevent switching overlap.

<b>IMPORTANT:</b>	
	Ensure all set values have been correctly stored by cycling through each of the <b>4 set points</b> . These are <b>CH1 LOW/ CH1 HIGH</b> and <b>CH2 LOW/ CH2 HIGH</b> .

**7.4.11.** Run the vehicle through the set speed to verify that switching occurs at the desired point. This is identified by a “clicking” of the relay and illumination of the small green LED within the control box.

**7.4.12.** When all settings are complete and have been verified as “stored”, return **DP 1** switch to the “**RUN**” position.

<b>IMPORTANT:</b>	
	Remember to revert Switch 1 back to the “RUN” position before closing the box.

**7.4.13.** Replace the control module cover and secure the HSI harness components in the glove compartment.

**7.4.14.** Replace the vehicle trim.



## **8. Verification Checks and Tests**

### **8.1. Verification Checks**

On completion of installation of the SIBS<sup>®</sup> II kit the following should be checked:

- ATF Level in EMMA<sup>™</sup> pump reservoir
- ATF leakage at hydraulic unions
- Brake fluid level
- Brake fluid leakage
- Differential oil level
- Correct function of the control interface
- Effective service brake performance confirmed by a series of low speed stops
- Effective Park and Emergency brake performance by a series of low speed stops
- Actuation of the brake upon opening a door (whilst vehicle is stationary)
- Function of HSI system

### **8.2. Testing of the Service Brake**

**8.2.1.** Ensure that the foot pedal has the correct level of travel as specified in the Toyota manual and the pedal feel is firm. Pump the pedal several times to ensure that pedal feel is consistent and does not drop away under sustained foot pressure.

**8.2.2.** Starting from low speeds (~10 Kph) test the service brake operation, bringing the vehicle to a complete stop. Ensure there is no binding of the service brake (vehicle should roll).

### **8.3. Testing of EMMA<sup>™</sup> Brake**

**8.3.1.** Check for correct engagement of the EMMA<sup>™</sup> brake

**8.3.2.** With the EMMA<sup>™</sup> parking brake released, use the service brakes to hold the vehicle stationary on an incline/ decline.

**8.3.3.** Apply the parking brake.

**8.3.4.** Release the service brakes. The vehicle should remain stationary. Check for correct release of EMMA<sup>™</sup> brake.

**8.3.5.** With the EMMA<sup>™</sup> brake engaged and the vehicle held stationary on an incline/ decline, release the EMMA<sup>™</sup> brakes. Ensure that there is no binding and the EMMA<sup>™</sup> brake fully releases and vehicle should begin to roll.

**8.3.6.** Use the service brakes to halt the vehicle.

## 8.4. Test for correct function of the Control Box

### 8.4.1. Test for correct function of the LED's and audible alert.

- When the **GREEN** LED is **ON**, the brakes are **RELEASED**.
- When the **RED** LED is **Flashing**, the brakes are in the process of **APPLYING** or **RELEASING**. A pulsing audible alert accompanies the flashing red LED to signify that the brake is in transition between the applied and released state.
- When the **RED** LED is **ON**, the brakes are **APPLIED**.
- With the door open and/ or the ignition key removed, press and hold the **GREEN** button whilst turning the **RED** button. All interlocks will be overridden and the brakes will **RELEASE**. The brakes will re-apply when the **GREEN** button is released.
- With the **HSI** option fitted, the small **green** LED will illuminate at **40km/h**.



Figure 114: Control box fascia

## 8.5. Adjustment of EMMA™ Relief Valve

**Description:** *The rate at which the EMMA™ Relief Valve applies can be adjusted to increase or reduce the speed of park brake actuation to compensate for pad wear. This section describes the setting procedure.*

**NOTE:**

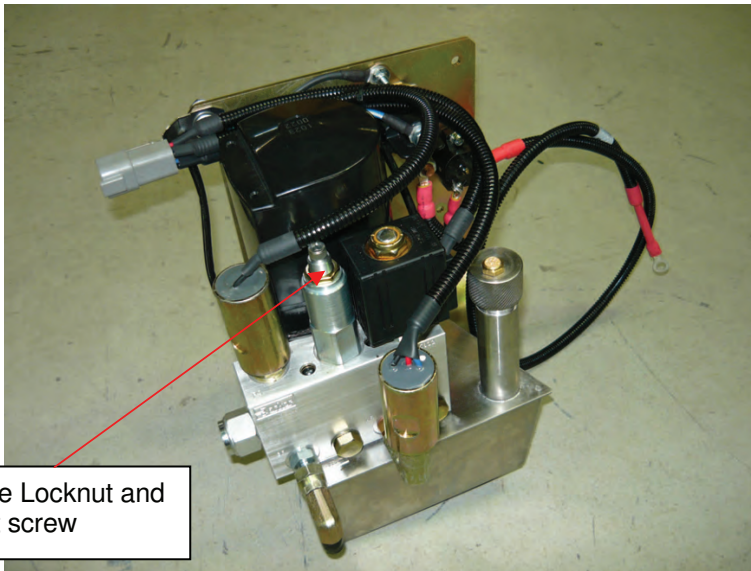


If the door is opened (or power/ hydraulic pressure is lost) during normal driving conditions, the EMMA™ control unit will dump pressure to the relief valve setting. The remaining pressure will bleed down via an orifice bringing the vehicle to rest.

**8.5.1.** The relief valve is initially set to ~ **350psi**. If the EMMA™ brake comes on too rapidly, increase the relief valve setting. If there is a considerable delay before the EMMA™ brake applies, reduce the relief valve setting; **Figure 115**.

**8.5.2.** Use the following procedure to adjust the relief valve setting:

- Loosen the locking nut
- Turn adjusting screw only ¼ of a turn at time:
  - **CLOCKWISE** to **INCREASE** Relief Valve Pressure Setting.
  - **ANTI-CLOCKWISE** to **REDUCE** Relief Valve Pressure Setting.
- Re-test the vehicle.



Relief Valve Locknut and adjustment screw

**Figure 115:** EMMA™ Pump Relief Valve

**WARNING:**



It is not recommended to operate a vehicle at high speed with the minimum pressure setting on the relief valve, as full EMMA™ brake application at high speed will cause the rear wheels to lock.

## 8.6. Weight of SIBS<sup>®</sup> Brakes

The additional mass of the SIBS<sup>®</sup> brakes should be accounted for when calculating the available payload for a vehicle.

**8.6.1.** The additional weight of SIBS<sup>®</sup> compared to OE disc brakes is as follows:

Weight - SIBS <sup>®</sup> Rear Brake	<b>52.0 kg</b>
Weight - OEM Rear Disc Brake	<b>22.0 kg</b>
Additional Weight of SIBS <sup>®</sup> (Rear)	<b>30.0 kg</b>


## 9. Safety

### 9.1. Pre-Service Inspection

9.1.1. The SIBS braking system is supplied with two OPERATOR CAUTION labels; **Figure 116** and should be fitted as shown below. The purpose of these labels is to advise the operator of the minimum maintenance and legislative requirements.



Figure 116: "Operator Caution" label

<b>IMPORTANT:</b>	
	The two Operator Caution labels supplied with your SIBS <sup>®</sup> should be placed in the recommended locations. These labels alert driver and service personnel that the vehicle is equipped with an advanced SIBS <sup>®</sup> braking system.

9.1.2. The recommended location for placement of the caution labels is shown in **Figure 117** and **Figure 118**.



Figure 117: "Operator Caution" label on windscreen.



Figure 118: "Operator Caution" label under bonnet.

9.1.3. Alternative placement locations are shown in **Figure 119**, **Figure 120** and **Figure 121** for “Operator Caution” labels if the recommended locations shown previously are inaccessible.



**Figure 119:** “Operator Caution” label on glove box.



**Figure 120:** “Operator Caution” label on driver’s sun visor.



**Figure 121:** “Operator Caution” label under bonnet.

## 10. Servicing

SERVICING SHOULD BE CARRIED OUT AT THE RECOMMENDED INTERVALS AND RECORDED IN THE SERVICE RECORD; **Section 13**

### 10.1. Correct fluid use for the SIBS<sup>®</sup> II braking system

Pump Reservoir – **Use only Automatic Transmission Fluid** (ATF, DEXRON III)

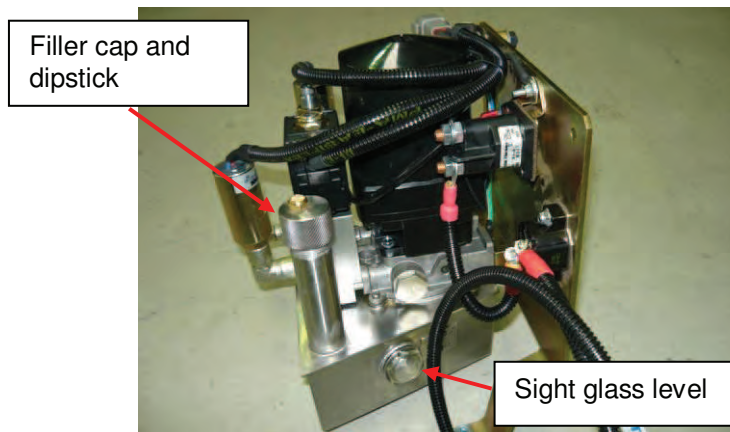


Figure 122: EMMA™ Pump ATF Reservoir

SIBS<sup>®</sup> Wheel End – **Use only SIBS<sup>®</sup> Cooling Fluid**



Figure 123: SIBS<sup>®</sup> wheel unit (Rear)

**Master Cylinder – Use only DOT 3 Brake Fluid as recommended by Toyota**



**Figure 124:** Master cylinder reservoir(s)

## 10.2. Handling and disposal of SIBS<sup>®</sup> Fluid

**10.2.1.** Refer to SIBS<sup>®</sup> Cooling Fluid **Material Safety Data Sheet** in **Section 12** for handling instructions.

**10.2.2.** Always wear gloves when handling SIBS<sup>®</sup> components and SIBS<sup>®</sup> fluid.

**10.2.3.** SIBS<sup>®</sup> fluid must be disposed of responsibly in accordance with all Regulatory and Environmental legislation.

## 10.3. Changing the SIBS<sup>®</sup> Fluid

**10.3.1.** Drain the SIBS<sup>®</sup> fluid by removing the drain plug located at the lower edge of the SIBS wheel end and allowing the fluid to drain into a suitable pan for appropriate disposal.

**10.3.2.** Before refilling with SIBS<sup>®</sup> Fluid, ensure that the drain plug has been cleaned and fitted with a new copper washer.

**10.3.3.** Remove the upper fill/ level plug and add new SIBS<sup>®</sup> fluid until the plug level is reached (1 litre).

**10.3.4.** The fill plug should be fitted with a new copper washer.

**10.3.5.** Dispose of used SIBS<sup>®</sup> fluid responsibly in accordance with all Regulatory and Environmental legislation.

**WARNING:**



The use of any fluid other than SIBS<sup>®</sup> Fluid will void the warranty and may cause brake failure resulting in injury or death.

The brakes must be drained and filled with new SIBS<sup>®</sup> Fluid if they remain totally immersed in water for lengthy periods.



## **SIBS**<sup>®</sup> II Maintenance Schedule

The maintenance intervals described below are for SIBS<sup>®</sup> II rear only brakes on Toyota Land Cruiser vehicles. Service intervals are dependent on vehicle use and operating conditions. The service regime described below is designed for vehicles operating in harsh mining environments, however ABT recommends each site undertake a review of the intervals and adjusts accordingly. Contact ABT for further information.

### **10.4. Every 250hrs – Monthly Service**

#### **Inspection:**

- 10.4.1.** Remove the rear wheels.
- 10.4.2.** Check the EMMA<sup>™</sup> pump for leaks.
- 10.4.3.** Check the fluid level in the reservoir and top up with ATF as required.
- 10.4.4.** Check all wiring for signs of rubbing, breakage and corrosion.
- 10.4.5.** Check all electrical connections are secure and corrosion free
- 10.4.6.** Check door switches.
- 10.4.7.** Check brake fluid reservoir level at the master cylinder and top up as required.
- 10.4.8.** Check the Pad Wear indicators by removing the protective cap to view the PWI plunger. With the Park brake applied, the plunger should project out of the gland fitting. The distance by which the the plunger projects directly relates to the remaining pad wear available. When the plunger is flush with the gland fitting the pads must be replaced.

#### **Maintenance:**

- 10.4.9.** Drain SIBS<sup>®</sup> fluid into a measuring jug. If the volume is less than 800ml per brake, check for external leaks around the brake housings and internal leaks within the differential housing and wheel hub.
- 10.4.10.** Check the SIBS<sup>®</sup> breather lines and expansion chambers – if the breather lines and expansion chambers are blocked the SIBS fluid will drain out of the housing in a ‘glug-glug’ fashion. Ensure there are no ‘U-bends’ in the breather lines.
- 10.4.11.** Refit the drain plug using a new sealing washer.
- 10.4.12.** Refill the brake with SIBS<sup>®</sup> fluid to the level plug and refit the drain plug using a new sealing washer.
- 10.4.13.** Grease the V-seal (grease nipple located on the front face of the hub). Lubricate with a grease gun using a high temperature, Lithium soap based grease until grease begins to appear from behind V-seal. Repeat this procedure every ¼ turn of the hub for one full revolution.

**10.4.14.** Check the EMMA™ pump for correct operation. Ensure brake release and brake application times are not excessive. Adjust the pressure relief valve if required (see **Section 8.5**)

**10.4.15.** Replace the road wheels and test drive. Check for correct operation of both the Service and EMMA™ brakes. Bleed brakes if necessary.

**NOTE:**

For optimum performance of SIBS<sup>®</sup> brakes, perform at least one hard stop per day from a speed of around 40km/h. This helps prevent pad glazing on vehicles operating at low speeds.

## 10.5. Every 2,000 hrs – 8 Months

### Inspection:

10.5.1. Perform the 250 hour service and inspections.

### Maintenance:

10.5.2. Remove the rear wheels.

10.5.3. Fit the retractor bolts to the rear SIBS<sup>®</sup> II brakes. For ease of fitment turn on the ignition and release the EMMA<sup>™</sup> brake using the control box in the cabin (the doors must be closed to facilitate this procedure).

10.5.4. Loosen the two hydraulic connections to the brake.

10.5.5. Remove the long red breather hose at the 90 degree elbow close to the brake.

10.5.6. Remove the axle shafts and rear bearing adjustment nuts.

10.5.7. At this point the lifting eye (P/N; **24-2870**) can be installed to the outer housing. Loosen and remove the 4 x mounting locknuts. Using a suitable lifting hoist, take the weight of the SIBS<sup>®</sup> and remove the complete assembly from the axle. The inner housing may need to be tapped with a copper mallet to free it from the axle.

In the absence of a hoist and lifting eye, the brake may be removed as follows:

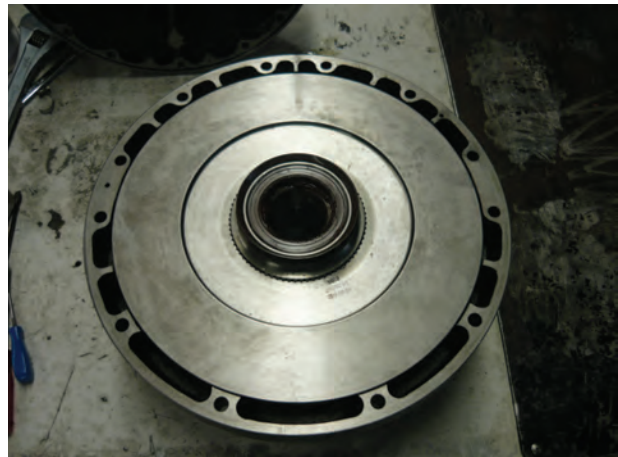
10.5.8. Remove two housing bolts from the brake assembly and replace with two guide bolts; **Figure 125**.

10.5.9. Remove the ten remaining housing bolts. These bolts must be renewed.

10.5.10. Remove the outer housing, hub and rotor as one assembly. Ensure the inner brake pads remain in the inner housing during this operation; **Figure 125**.



**Figure 125:** Use guide pins to support withdrawal of outer housing



**Figure 126:** Inspect rotor surface and splines for wear

10.5.11. To install a service exchange rear assembly, refer to Section 5 for procedure.

**CAUTION:**

**HEAVY!** Care should be taken when removing outer housing, hub and rotor assembly. Follow the correct procedures and ensure appropriate lifting tools are used.

- 10.5.12.** Flush the EMMA™ fluid from the tank and hoses.
- 10.5.13.** Replace the axle link hose.
- 10.5.14.** Install a new EMMA™ filter element (P/N; **01-5071**) into the manifold.
- 10.5.15.** Bleed the EMMA™ system.
- 10.5.16.** Perform the 250 hour service
- 10.5.17.** Check the EMMA™ pump for correct operation. Ensure brake release and brake application times are not excessive. Adjust the pressure relief valve if required (see **Section 8.5**)
- 10.5.18.** Replace the road wheels and test drive.
- 10.5.19.** Check for correct operation of both the Service and EMMA™ brakes.

## 10.6. Preparing Service Exchange Units:

**10.6.1.** Separate the two housings and the hub. Use guide dowels to assist. Remove the outer housing, hub, rotor and outer pads as one assembly from the inner housing after removing the 12 housing bolts.

**10.6.2.** Inspect the housing bolts for stretching, corrosion and damage to the heads. Replace as required.

**10.6.3.** Remove the rotor from the outer assembly and wash with a cleaning agent. (Würth® Brake Cleaner is recommended).

**10.6.4.** Inspect the rotor surface and splines for wear; **Figure 126** and **Figure 127**.

10.6.4.1. The rotor friction surface should be inspected and changed if there are signs of scouring covering more than 50% of the surface.

10.6.4.2. Measure the thickness of the friction surface using a micrometer at 4 evenly spaced positions around the rotor. Discard the rotor if the thickness is below 14mm.

10.6.4.3. Place the rotor back on the hub and check for any movement between hub and rotor. Replace the rotor if there is any movement between the splines of the two mating components

**10.6.5.** Remove the hub from the outer housing. Clean the outer housing with brake cleaner.

**10.6.6.** Remove all seals and bearings from the hub. Clean the bearings thoroughly and inspect for signs of wear. Replace as required. Grease the bearings using Castrol LMX (or similar Lithium Complex Grease suitable for wheel bearings).

**IMPORTANT:**



Molybdenum Disulphide greases are not suitable for wheel bearings and should not be used.

**10.6.7.** Inspect all hub studs, dowel pins and grease nipple. Replace if showing any signs of thread damage or corrosion.

**10.6.8.** Clean the hub thoroughly before installing the bearing races and the inner wheel bearing seal.

**10.6.9.** Pack the hub with grease.

**10.6.10.** Install the wheel bearing v-seal.

**10.6.11.** Remove the inner and outer brake pads. Make a note of which pocket each pad was removed from. Mismatching may cause loss of brake efficiency, accelerated wear and/ or increased pedal stroke; **Figure 128**. Treat brake pads carefully to avoid damaging the friction material. Clean with brake cleaner.



**Figure 127:** Inspect the hub splines for wear



**Figure 128:** Note the position and orientation of each brake pad.

**10.6.12.** Measure the thickness of the brake pads.

Minimum recommended pad thickness for rear SIBS II:

- **12mm** for rear brakes with **HEAVY DUTY** spring pack
- **13mm** for rear brakes with **STANDARD DUTY** spring pack

**IMPORTANT:**



Brake pad thickness on the rear is critical. If pads less than the minimum recommended thickness are used it will result in reduced performance of the EMMA™ brake system.

**10.6.13.** If the brake pads are less than minimum recommended thickness they must be replaced. When replacing the pads it is recommended that all pads in the brake assembly and all pads in the opposing brake assembly be replaced (both LH and RH rear). This will ensure that braking force remains even.

**10.6.14.** Remove the housing O-ring from the inner housing and discard.

**10.6.15.** Remove the service pistons from the inner housing. Remove the O-rings from the pistons and clean and inspect the pistons. Inspect o-rings for damage, but do not reuse.

**10.6.16.** Apply a light smear of silicone grease to the new Viton and EPDM O-rings (Parker Super O Lube is recommended) and fit them to the pistons. Refer to **Figure 129** and **Figure 130**.



**Figure 129:** Service piston, EPDM O-ring (large) and Viton Wiper O-ring (small)



**Figure 130:** Service piston, EPDM O-ring (large) and Viton Wiper O-ring (small)

**10.6.17.** Remove the service link pipe and associated fittings. Clean, inspect and replace as required.

**10.6.18.** Remove the four bleed nipples. Clean, inspect and replace as required.

**10.6.19.** Clean the inside of the inner housing with brake cleaner. Clean the piston bores thoroughly.

**10.6.20.** Inspect the inner seal carrier (P/N; 24-2865). This item shouldn't need replacing. Buff the seal surface with a fine wet & dry (600 – 1000 grit) if it shows signs of wear.

**10.6.21.** Inspect the mounting studs (P/N; 24-2855) for damage or corrosion. If replacing the studs:

- 10.6.21.1. Ensure the mating parts of the housing and seal carrier are clean and free of debris.
- 10.6.21.2. 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.

**10.6.22.** Insert the pistons (large EPDM O-ring first) into the piston bores. Apply pressure to the piston until it slides fully into place.

**10.6.23.** Remove the retractor bolts. Remove the spring cover bolts progressively and in sequence (one full turn at a time) to ensure the spring cover does not bend or crack.

**10.6.24.** Remove the spring cover. Remove the Bellville springs making a note of the stacking sequence for reinstallation as this is critical to the performance of the EMMA™ brake – refer to the figures overleaf.

**10.6.25.** Remove the EMMA™ pistons with a slide hammer. Remove and discard all O-rings and back-up washers.

10.6.26. Remove spring cover gasket.

10.6.27. Clean the EMMA™ pistons thoroughly. Inspect the O-ring grooves for pitting and corrosion. Clean the EMMA™ piston bores.

10.6.28. Apply a light smear of silicone grease to the new Viton and EPDM O-rings (Parker Super O Lube recommended) and fit these to the pistons along with the back-up washers. Ensure they are in the correct orientation. Refer to **Figure 131**.



**Figure 131:** EMMA™ Piston O-rings and back-up rings assembled.

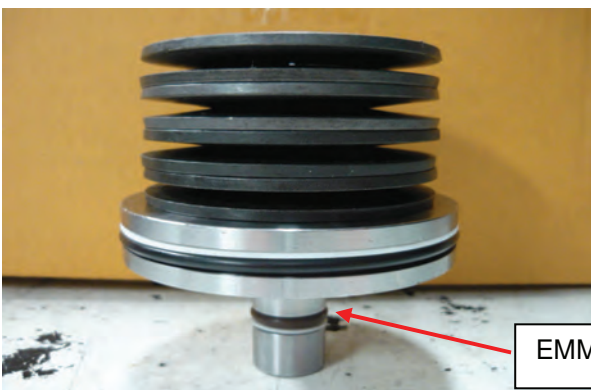
10.6.29. Refit the EMMA™ pistons. Reinstall Bellville springs in the order they were removed. Refer to **Figure 132** and **Figure 133**. **Ensure the springs are well greased.**

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

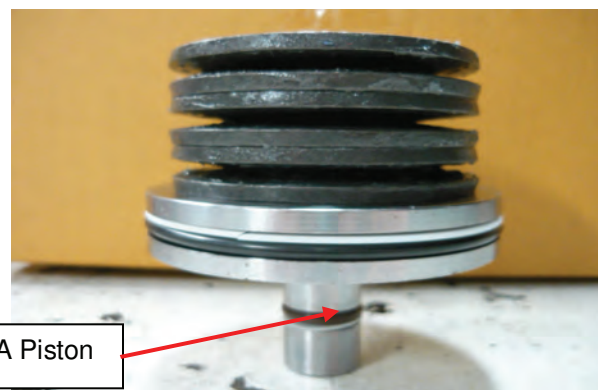
10.6.31. Inspect the spring cover bolts for stretching, corrosion and damage to the heads. Replace as required.

10.6.32. Install the spring cover bolts progressively and in sequence (one full turn at a time) to ensure that the spring cover does not distort. Torque to **61Nm**.

10.6.33. Reinstall the retractor bolts. The EMMA™ pistons should retract until they are flush with the inside of the inner housing.



**Figure 132:** Belville springs – Standard Duty (8 x 3.0mm springs)- Stack as shown.



**Figure 133:** Belville springs – Heavy Duty (6 x 4.0mm springs) – Stack as shown.



**10.6.34.** Torque all spring cover bolts progressively and in sequence (one full turn at a time) to ensure that the spring cover does not bent or crack. Torque to **61 Nm**.

**10.6.35.** Remove the Scotseal (15-1470) from the outer housing. Clean the outer housing and inspect for damage or wear.

**10.6.36.** Install a fresh Scotseal into the outer housing.

To assemble the brake:

**10.6.37.** Take the inner housing assembly – complete with pistons and Belleville springs. Ensure the retractor bolts are installed

**10.6.38.** Fit 2 x alignment dowels into the housing and place this vertically on a bench with the spring cover down.

**10.6.39.** Place the hub on the bench with the studs facing downwards.



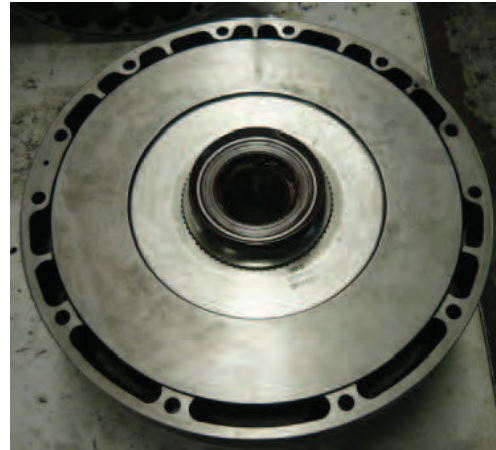
**Figure 134:** Orientation of inner housing assembly on the bench.



**Figure 135:** Fit the alignment dowels (P/N; 24-2883)

**10.6.40.** Take the correct handed outer housing (with ScotSeal installed) and push this over the spline on the hub.

**10.6.41.** Check the seals – wheel bearing seal and inner v-seal – as well as the inner bearing are in position.



**Figure 136:** Outer housing and hub assembly on the bench.

**Figure 137:** Engage the rotor on the hub spline

**10.6.42.** Install the brake pads into the two housings.

**10.6.43.** Place the rotor over the hub; **Figure 137.**

**10.6.44.** Locate the dowel holes on the outer housing. Stand the outer housing assy. up and align with the inner housing. Slide the two housings together using the alignment dowels to assist.



**Figure 138:** Slide housings together using the alignment dowels to assist.

**Figure 139:** Install the lifting eye (P/N; 24-2870) in place of the top two housing bolts.

**10.6.45.** Install the 10 of the 12 housing bolts – leave the top two - and tighten to **61Nm**.

**10.6.46.** Install the lifting eye and assemble the brake; **Figure 139.**

**10.6.47.** Prepare the axle and install the brake as shown in Section 5.

**IMPORTANT:**



**SERVICING SHOULD BE CARRIED OUT AT THE RECOMMENDED INTERVALS AND BE FULLY LOGGED IN THE SERVICE HISTORY; Section 13.**

## 10.7. Recommended Parts Holding

### 10.7.1. Recommended Parts Holding (for every 10 vehicles in operation).

Qty	Description	ABT P/N
40L	SIBS <sup>®</sup> Cooling Fluid 'BLEND 20' (20 Litres)	00-3321
2	Filter Element	01-5071
1	Pressure Switch (700psi) (used on STANDARD DUTY)	02-7005
1	Pressure Switch (1500psi) (used on HEAVY DUTY)	02-7027
1	Pressure Switch (40psi)	02-7086
2	Relay 12V (100A/ 400A)	02-7053
8	Bleed Nipple (M10x1.0) Stainless Steel	15-1151
5	Scotseal	15-1470
1.25m	Breather hose ¼" ID	15-4361
72 (6x12)	Bolt Housing (12 required per brake assy)	24-2871
8	Kit – Fill/ Drain Plug	24-5027
1	Kit – Seal Fill/ Drain Plug	01-3406
8 (2 x 4)	Retractor Bolt (EMMA™ Piston)	15-2530
4	Rotor – TLC	15-2630
2	Hose 1 – Hydraulic EMMA™ Supply (HZJ)	24-3208
2	Hose 1 – Hydraulic EMMA™ Supply (VDJ)	24-3212
2	Hose 2 – Hydraulic EMMA™ Supply	24-3209
1	Hydraulic EMMA™ RH – Rear (Stainless)	24-3210
1	Hydraulic EMMA™ LH – Rear (Stainless)	24-3211
1	Control box	02-7084
1	Harness Assy. Kit	02-0092

### 10.7.2. Repair Kits Holding (for every 10 vehicles in operation).

Qty	Description	ABT P/N
4	Wheel Bearing Kit for One Brake, LCV1	24-5020
4	Seal Kit for One Rear Brake, LCV1 (Service Pistons Only)	24-5021
2	Seal Kit for One Rear Brake, LCV1 (EMMA™ Pistons Only)	24-5022
8	Kit Brake Pads for one Brake (Front or Rear)	24-4953
4	Kit Mounting for One Rear Brake (Disc), LCV1	24-5025

# 11. Troubleshooting

<b>SIBS® &amp; EMMA™ TROUBLESHOOTING GUIDE</b>		
<b>Issue/ Description</b>	<b>Possible Cause</b>	<b>Solution</b>
<b>Brake pedal soft/ spongy</b>	Air in the service brakes	Bleed the brakes
	Leak in the service brake system	Inspect for leaks
	Booster/ master cylinder out of adjustment.	Adjust booster output pushrod according to Toyota manual.
<b>Brake pedal hard/ excessive force required to operate brakes/ reduced braking performance</b>	Pads and/ or rotor surface contaminated.	Change SIBS® fluid and perform Optimum Performance Procedure.
	Booster/ master cylinder out of adjustment.	Adjust booster output pushrod according to Toyota manual.
	Blockage in hydraulic system	Inspect for kinks in brake pipes and hoses. Bleed brakes and check that fluid flows freely from all brakes.
	Vacuum system leak	Inspect vacuum hoses, connections and booster for leaks.
<b>Pedal goes slowly to floor with light application.</b>	Master cylinder bypassing internally.	Strip and inspect. Replace cylinder or install overhaul kit.
<b>Brakes drag/ brakes not fully releasing after operation</b>	Booster/ master cylinder out of adjustment	Adjust booster output pushrod
	Internals of brake incorrect – e.g pads oversize or service piston cocked over	Locate which brake is affected – use infrared thermometer to locate hottest brake. Strip brake and measure components. Inspect for piston cocked over.

**SIBS® & EMMA™ TROUBLESHOOTING GUIDE**

Issue / Description	Possible Cause	Solution
	EMMA™ piston leaking	Locate which rear brake is affected by inspecting rear brakes for loss of ATF and/ or using infrared thermometer to determine hottest brake. Strip brake, measure components and check for oversized pads or rotor. Inspect for leaking EMMA piston, change seals as required.
	Insufficient hydraulic pressure to release EMMA™ brakes	Put vehicle on hoist and release EMMA™ brake. Check for free spinning hubs. One side or both? If both sides: check pressure in EMMA™ circuit should be > 700psi (Standard Duty) >1500psi (Heavy Duty), if pressure is insufficient, change pressure switch. If only on one side: check hydraulic hoses for kinks (change as required); strip brake, measure components and check for oversized pads or rotor.
<b>Vehicle pulls to one side during braking</b>	Generally due to reduced effectiveness in one brake; 'brake steer'. Vehicle will pull to the side with the more effective front brake.	If vehicle is fitted with rear only SIBS®: refer to Toyota manual for OE brakes. Check for a seized caliper or piston in affected brake.
	Kinked or damaged front brake hose.	Inspect hoses and change as required. Check affected brake is getting fluid by bleeding brake and checking brake fluid flow is similar in both brakes.
	Seized pistons	Strip brake and inspect pistons. Change seals.
	Surface contamination of pads and rotor of affected brake.	Change SIBS® fluid and perform Optimum Performance Procedure. If pulling or hard pedal returns, inspect brakes for grease contamination.

<b>SIBS® &amp; EMMA™ TROUBLESHOOTING GUIDE</b>		
<b>Issue / Description</b>	<b>Possible Cause</b>	<b>Solution</b>
<b>Brakes shudder at the end of a braking event</b>	Indicates additive package of oil is depleted. First occurs on 'cold' brake applications.	If shudder persists after more than first three brake applications, change SIBS® fluid and perform Optimum Performance Procedure
<b>Excessive corrosion of fasteners</b>	Environment	Consider use of corrosion resistant kits. Contact ABT for details
<b>Failure of CV joints and steering bearings</b>	Environment	Consider use of front end upgrade components: greasable CV joint, split rubber boots for back of knuckle, knuckle bash plates. Refer to TBN-034. Contact ABT for more information

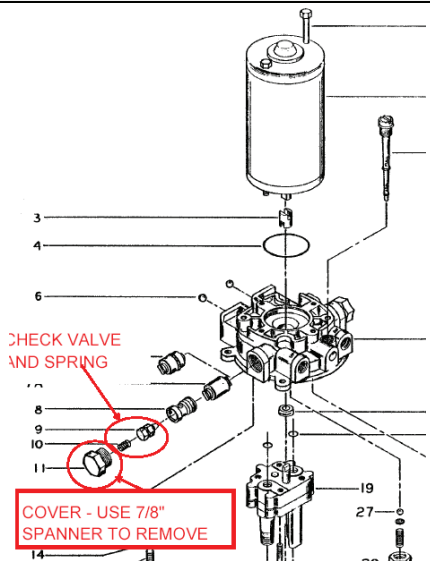
**SIBS® & EMMA™ TROUBLESHOOTING GUIDE**

Issue / Description	Possible Cause	Solution
<b>Fail Safe EMMA™ Brake System</b>		
<b>EMMA™ brake will not release</b>	Door is not closed properly or door switch has failed – if door interlock is fitted. Hint: Check control box for RED/ GREEN LED – if this is not illuminated the system may not be armed as the interlock is activated.	Close door. Inspect/ replace the door switch.
<b>EMMA™ brake engages unexpectedly.</b>  <b>Note: Door <u>should not</u> be opened whilst operating the vehicle.</b>	Check door interlock	Close door. Inspect/ replace door switch.
<b>Control box not functioning – no LED indicators.</b>	Electrical continuity lost/ control box malfunction.	Check for good earth continuity on EMMA™ pump bracket. Check connections to Toyota power outlet box. Replace control box.
<b>Reduced park brake (EMMA™) performance</b>	Hydraulic fluid slow to release	Adjust relief valve to reduce delay in EMMA brake application Inspect and clean EMMA™ filter.
	Brake pads worn	Strip rear brakes. Measure pads and replace pads or install shims – contact ABT for shim kit.
<b>Failure of EMMA™ hose</b>	Rubbing of hose.	Check routing of hoses. Use Spiral guard where some rubbing cannot be avoided, refer to manual for correct recommended hose routing. Consider installing Heavy Duty Hoses – contact ABT for details.

<b>SIBS® &amp; EMMA™ TROUBLESHOOTING GUIDE</b>		
<b>Issue / Description</b>	<b>Possible Cause</b>	<b>Solution</b>
	Impact damage	Check routing of hoses. Use Spiral guard where some rubbing cannot be avoided, refer to manual for correct recommended hose routing. Consider installing Heavy Duty Hoses – contact ABT for details.
	Failure occurs to long supply hose between axle tee piece and chassis mount	Install Heavy Duty Hoses. If problem persists contact ABT.
<b>EMMA™ brake slow to engage</b>	Blocked or partially blocked EMMA™ filter	Inspect and replace
	Relief valve set too high	Adjust as per Section 8.5
	Kinked hose	Inspect and replace
<b>Pump runs but brakes to not release</b>	Leak in system – failed hydraulic hose or leak inside brake.	Check fluid level in hydraulic tank – if it is falling inspect for leaks. Change hoses as required. If leaking inside brake is suspected – disconnect & plug the hydraulic supply hose to <u>one</u> side and see if problem is removed, restore connection and inspect other side. If leak is inside the brake – remove and rebuild as per Section 8.6.
	Solenoid valve not closing path back to tank.	Check coil for correct operation – valve can be heard to ‘click’ when coil is energised. Inspect solenoid valve for correct operation – remove and inspect for valve or seat damage.
	Pump internal relief valve bypassing	Pump internal check valve bypassing. Remove valve and clean. Check valve is located on pump body beneath 7/8” hex plug – note check valve used is on the <u>firewall</u> side of the pump. See Section 6.6 and the following schematic.



**SIBS® & EMMA™ TROUBLESHOOTING GUIDE**

Issue / Description	Possible Cause	Solution
		
	Pump worn – not developing sufficient pressure	Replace pump. Note consider EMMA™ service exchange – refer TBN-041.
<p><b>Pump does not run when brake release called for. Control box functioning normally.</b></p>	<p>Note: Ensure control box is functioning correctly – hold down 'Manual Release' button and operate with red 'operator button'</p>	
	Relay fault	Check continuity of relay when EMMA™ brake release is called for thin red wire to relay should be +12V.
	Circuit breaker tripped	<p><b>Note: circuit breakers are installed to protect the system. Chock the vehicle before re-setting circuit breaker as pump may run &amp; release the EMMA™ brake unexpectedly.</b></p> <p>Check battery and circuit breaker cables are energised.</p>
Pressure switch faulty	Check function of pressure switch: remove blue and grey wires from Deutsch® connector and short out wires on harness side – if pump runs then pressure switch has failed OPEN. If no change then pressure switch is not at fault.	

SIBS <sup>®</sup> & EMMA <sup>™</sup> TROUBLESHOOTING GUIDE		
Issue / Description	Possible Cause	Solution
	Pump motor failed	Check power is getting to pump – blue/white wire of pump. Check earth to pump. Replace hydraulic unit if pump has failed. Note: consider service exchange for EMMA <sup>™</sup> unit, refer TBN-041.
<b>Pump runs and does not shut off</b>  <b>Note: pump is designed for intermittent use only. Shut pump off after ~10s to prevent damage.</b>	Brakes release – pump can be heard to strain and will relieve pressure via internal relief valve.	Pressure switch failed closed. System generates more than minimum required pressure (~700psi/ 1500psi for Heavy Duty). Check function of switch by removing blue and black wires of pressure switch from the Deutsch connector – this should shut pump off. If switch is found to be faulty remove and replace.
	Brakes partially release – solenoid valve not functioning	Check coil for correct operation – valve can be heard to ‘click’ when coil is energised. Inspect solenoid valve for correct operation – remove and inspect for valve or seat damage.
	Brakes do not release – pump internal check valve by-passing.	Remove valve and clean. Check valve is located on pump body beneath 7/8” hex plug – note check valve used is on the <u>firewall</u> side of the pump.

# 12. Material Safety Data Sheet

Material Safety Data Sheet																
Page: 1 of 4																
Issue Date : July 2009																
Issued by ABT																
Product Name : <b>SIBS COOLING FLUID</b>																
Classified as hazardous according to criteria of NOHSC																
<b>1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY</b>																
Product Name	SIBS COOLING FLUID - BLEND 70															
Product Use	Coolant for Sealed Integrated Braking System															
Company Name	ADVANCED BRAKING PTY LTD (ABT)															
Address	PO Box 1177, Osborne Park WA 6916															
Emergency Tel.	AUSTRALIA															
Telephone Number/Fax	Tel : +61 8 9373 4800 Fax: +61 8 9201 9906															
<b>2. COMPOSITION/INFORMATION ON INGREDIENTS</b>																
Ingredients	<table border="1"> <thead> <tr> <th>Name</th> <th>CAS</th> <th>Proportion</th> </tr> </thead> <tbody> <tr> <td>Liquid Hydrocarbons</td> <td></td> <td>80-90 %</td> </tr> <tr> <td>Paraffins &amp; Naphthenes</td> <td></td> <td></td> </tr> <tr> <td>Ingredients determined</td> <td>Not required</td> <td>Balance</td> </tr> <tr> <td colspan="3">Not to be hazardous</td> </tr> </tbody> </table>	Name	CAS	Proportion	Liquid Hydrocarbons		80-90 %	Paraffins & Naphthenes			Ingredients determined	Not required	Balance	Not to be hazardous		
Name	CAS	Proportion														
Liquid Hydrocarbons		80-90 %														
Paraffins & Naphthenes																
Ingredients determined	Not required	Balance														
Not to be hazardous																
<b>3. HAZARDS IDENTIFICATION</b>																
Classified as hazardous according to WHSC criteria. Not classified as dangerous goods according to the ADG Code.																
<p>Sick Phrases H65 Harmful; may cause Lung Damage if swallowed.</p> <p>Safety Phrases S62 If swallowed, do not induce vomiting; seek medical advice immediately and show this container or label.</p>																
<b>4. FIRST AID MEASURES</b>																
Inhalation	Remove the source of contamination or move the victim to fresh air. Ensure airways are clear and have qualified person give oxygen through a facemask if breathing is difficult. If irritation develops and persists, seek medical attention.															
Ingestion	DO NOT induce vomiting. Immediately wash out mouth with water. Seek immediately medical attention.															
Skin	Remove contaminated clothing. Wash gently and thoroughly with water and non-abrasive soap. Ensure contaminated clothing is washed before re-use or discard. If irritation develops, seek medical attention.															
Eye	If contact with the eye(s) occur, wash with copious amounts of water; holding eyelids(s) open. Take care not to rinse contaminated water into the non-affected eye. If irritation develops and persists, seek medical attention.															
First Aid Facilities	Eye wash and normal washroom facilities.															
Advice to Doctor	Treat symptomatically.															
Other Information	For advice, contact a Poisons Information Centre (Phone eg Australia 131 126; New Zealand 0800 764 766) or a doctor (at once).															
<b>5. FIRE FIGHTING MEASURES</b>																
Extinguishing Media	Water fog, carbon dioxide, foam or dry chemical. Do NOT use water jets. Cool fire exposed containers with water spray.															
Specific Hazards	Combustible Cl liquid. Fire-exposed container may rupture/explode.															
Hazardous Combustion Products	Under fire conditions this product may emit toxic and/or irritating fumes including oxides of carbon.															
Precautions in connection with Fire	Self-Contained Breathing Apparatus (S.C.B.A) and full protective clothing should be worn to minimise exposure.															
<b>6. ACCIDENTAL RELEASE MEASURES</b>																

Figure 140: Page 1 of SIBS<sup>®</sup> MSDS

# Material Safety Data Sheet

Page: 2 of 4

Issue Date : July 2009		Issued by ABT
<b>Product Name : SIBS COOLING FLUID</b>		
Classified as hazardous according to criteria of NOHSC		
Remove all sources of ignition. Increase ventilation. Evacuate all unnecessary personnel. Wear full protective equipment and clothing to minimise exposure. If possible contain the spill. Place inert, non combustible, absorbent material onto spillage. Use clean non-sparking tools to collect the material and place into a suitable labelled container. If large quantities of this material enter the waterways contact the Environmental Protection Authority, or your local Waste Management Authority.		
<b>7. HANDLING AND STORAGE</b>		
<b>Handling</b>	Repeated or prolonged contact with this material should be avoided in order to lessen the possibility of skin disorders. It is essential that all who come into contact with this material maintain high standards of personal hygiene i.e. washing hands prior to eating, drinking or going to the toilet. Build-up of mists in the working atmosphere must be prevented.	
<b>Storage</b>	Combustible C1 liquid for storage and handling purposes. Store in a cool, dry, well-ventilated area, out of direct sunlight. Avoid sparks, flames, and other ignition sources. Store away from incompatible materials such as materials that support combustion (oxidising materials). Reference should be made to Australian Standard AS1940- The storage and handling of flammable and combustible liquids.	
<b>8. EXPOSURE CONTROLS, PERSONAL PROTECTION</b>		
<b>Exposure Limits</b>	No exposure standards have been established for this material by the National Occupational Health And Safety Commission (NOHSC).	
<b>Respiratory Protection</b>	Avoid breathing of vapours or mists. Where ventilation is inadequate and vapours or mists are generated the use of an approved respirator with filter complying with AS/NZS 1715 and AS/NZS 1716 is recommended; however final choice of appropriate breathing protection is dependent upon actual airborne concentrations and the type of breathing protection required will vary according to individual circumstances. Expert advice may be required to make this decision. Reference should be made to Australian Standards AS/NZS 1715- Selection, Use and Maintenance of Respiratory Protective Devices; and AS/NZS 1716- Respiratory Protective Devices.	
<b>Eye Protection</b>	Safety glasses with side shields, goggles as appropriate recommended. Final choice of appropriate eye/face protection will vary according to individual circumstances i.e. methods of handling or engineering controls and according to risk assessments undertaken. Eye protection should conform with Australian/New Zealand Standard AS/NZS 1137 - Eye Protectors for Industrial Applications.	
<b>Hand Protection</b>	Wear gloves of impervious material. Final choice of appropriate gloves will vary according to individual circumstances i.e. methods of handling or according to risk assessments undertaken. Reference should be made to AS/NZS 2161.1: Occupational protective gloves - Selection, use and maintenance.	
<b>Body Protection</b>	Wear appropriate clothing including chemical resistant apron where clothing is likely to be contaminated. It is advisable that a local supplier of personal protective clothing is consulted regarding the choice of material.	
<b>Eng. Controls</b>	Natural ventilation should be sufficient, however where vapours or mists are generated the use of a local exhaust ventilation system (drawing vapours/mists away from workers breathing zone) is recommended.	
<b>Other Information</b>	No biological limit allocated.	
<b>9. PHYSICAL AND CHEMICAL PROPERTIES</b>		
<b>Appearance</b>	Clear and bright liquid	
<b>Melting Point</b>	Not available.	
<b>Boiling Point</b>	238-257°C	
<b>Solubility in Water</b>	Immiscible	
<b>Specific Gravity (H2O=1)</b>	0.827 @ 15°C	
<b>pH Value</b>	Not applicable	
<b>Vapour Pressure</b>	3 Pa @ 20°C	
<b>Viscosity</b>	8 cSt @ 40°C 1.3 cSt @ 100°C	

Figure 141: Page 2 of SIBS® MSDS

## Material Safety Data Sheet

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Issue Date : July 2009		Issued by ABT
<b>Product Name : SIBS COOLING FLUID</b>		
Classified as hazardous according to criteria of NOHSC		
<b>Flash Point</b>	185°C (opened cup)	
<b>Flammability</b>	Classified as a Class C1 (COMBUSTIBLE LIQUID) for the purpose of storage and handling, in accordance with the requirements of AS1940. Remove all sources of heat and ignition.	
<b>Ignition Temperature</b>	222°C (ASTM E-659)	
<b>Flammable Limits UEL</b>	Not available.	
<b>Flammable Limits LFL</b>	Not available.	
<b>10. STABILITY AND REACTIVITY</b>		
<b>Stability</b>	Stable under normal conditions.	
<b>Hazardous Polymerization</b>	Will not occur.	
<b>Materials to Avoid</b>	Strong oxidising agents.	
<b>Hazardous Decomposition Products</b>	Thermal decomposition and combustion produce noxious fumes containing oxides of carbon.	
<b>Hazardous Reaction</b>	Reacts with oxidising agents.	
<b>Conditions to Avoid</b>	Heat, direct sunlight, open flames or other sources of ignition.	
<b>11. TOXICOLOGICAL INFORMATION</b>		
<b>Toxicology Information</b>	No toxicity data is available for this material.	
<b>Inhalation</b>	May cause irritation to the mucous membrane and upper airways, where material is heated and is used in poorly ventilated areas. Symptoms may include headache, dizziness and nausea.	
<b>Ingestion</b>	Harmful-may cause lung damage if swallowed. Subsequent to ingestion or vomiting, small amounts of liquid aspirated into the respiratory system may cause severe pulmonary injury that may lead to death. May also cause irritation to the gastrointestinal system. Symptoms may include nausea, vomiting, diarrhoea and abdominal pain.	
<b>Skin</b>	May cause irritation in contact with the skin, which may result in redness and itchiness, possibly leading to dermatitis.	
<b>Eye</b>	May cause eye irritation, resulting in redness, stinging and excessive tearing.	
<b>Chronic Effects</b>	Prolonged or repeated contact with this material may result in skin irritation possibly leading to dermatitis.	
<b>12. ECOLOGICAL INFORMATION</b>		
No ecological data is available for this material.		
<b>Environ. Protection</b>	Avoid contaminating waterways, drains, sewers, or ground.	
<b>Mobility</b>	No data available for this specific product.	
<b>Persistence/ Degradability</b>	No data available for this specific product.	
<b>Bioaccumulation</b>	No data available for this specific product.	
<b>Ecotoxicity</b>	No data available for this specific product.	
<b>13. DISPOSAL CONSIDERATIONS</b>		
Dispose of waste according to federal, E.P.A. and state regulations. Ensure conformity with all applicable regulations.		
<b>14. TRANSPORT INFORMATION</b>		
Not classified as a Dangerous Good according to the Australian Code for the Transport of Dangerous Goods by Road and Rail.		
<b>U.N. Number</b>	None Allocated	
<b>Proper Shipping Name</b>	None Allocated	
<b>DG Class</b>	None Allocated	

Figure 142: Page 3 of SIBS<sup>®</sup> MSDS

## Material Safety Data Sheet

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Issue Date : July 2009		Issued by ABT
Product Name :- <b>SIBS COOLING FLUID</b>		
Classified as hazardous according to criteria of NOHSC		
<b>Hazchem Code</b>	None Allocated	
<b>Packing Group</b>	None Allocated	
<b>15. REGULATORY INFORMATION</b>		
<b>Risk Phrase</b>	R55 Harmful: may cause lung damage if swallowed.	
<b>Safety Phrase</b>	S62 If swallowed, do not induce vomiting; seek medical advice immediately and show this container as label.	
<b>Poisons Schedule</b>	S5	
<b>Hazard Category</b>	Harmful	
<b>Packaging &amp; Labelling</b>	Labelling requirements of the Standard for Uniform Scheduling of Drugs and Poisons do not apply to a poison that is packed and sold solely for industrial, laboratory or manufacturing purposes; however is labelled in accordance with the National Occupational Health and Safety Commission's 'National Code of Practice for the Labelling of Workplace Substances'.	
<b>16. OTHER INFORMATION</b>		
<b>SDS History</b>	MSDS Creation: January 2005 (InfoFile No. LP082); revised July 2009 (Company details updated; reviewed to NOHSC:2011(2003) & released by ABT...End Of MSDS...	

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