

# Comprehensive maintenance procedures

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iABS-1 brakes (All BMW Motorrad R-series  
and K-series models, 2004 to 2007)

Edition 2.1 (June 2020)

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## 2. TABLE OF CONTENTS

1. COPYRIGHT AND LIMITATION OF LIABILITY .....	2
2. HAZARDOUS CONDITION WARNINGS .....	4
3. REPORTING MISTAKES.....	5
4. APPLICABILITY .....	6
5. INTRODUCTION.....	7
6. WORKSHOP TOOLS AND CONSUMABLES .....	8
7. BRAKE MAINTENANCE PROCEDURES .....	9
7.1. Topping up the brake fluid levels.....	9
7.2. Initial disassembly.....	9
7.3. Preparation .....	9
7.4. Bleeding used fluid from the brake calipers.....	9
7.5. Bleeding the wheel circuits .....	10
7.6. Bleeding the control circuits.....	13
7.7. Checking and adjusting the brake micro-switches .....	16

### 3. HAZARDOUS CONDITION WARNINGS

This manual was produced by independent enthusiasts, without access to BMW Motorrad factory resources. It cannot describe all possible technical scenarios in respect of all i-ABS1-equipped motorcycles.

Always exercise caution and common sense when working on your motorcycle.



#### **FIRE AND EXPLOSIVE HAZARDS**

Do not do the procedures in this manual if there are sparks, naked flames, sources of heat, or incandescent materials in the vicinity. If any fuel lines are disconnected and/or fuel tanks are removed, fuel vapour (which is both flammable and explosive) will be released.



#### **DANGEROUS CHEMICALS**

Do the procedures in this manual only in a well-ventilated area. Petrol contains chemicals that may cause physical and genetic harm. If you feel faintness or nausea, immediately move away from your work and into an open, well-ventilated area.



#### **BRAKE FAILURE**

It is strongly recommended that the procedures in this manual be done only by persons with advanced knowledge of motor vehicles. In particular, knowledge of workshop safety principles and current hydraulic braking system trends is essential.

All tools, consumables and work areas used to do the procedures in this manual must be perfectly clean. Anti-lock braking systems can be badly affected by dirt and dust. Even minute foreign particles can cause braking system malfunctions.



#### **INCOMPATIBLE FLUIDS**

Only use ethylene glycol-based DOT 4 brake fluids.

Do not use silicone-based fluids such as DOT 5, or mineral-based hydraulic fluids for BMW clutches in the brake circuits. These fluids will destroy rubber parts in the braking system, possibly causing catastrophic brake failure.

## 4. REPORTING MISTAKES

You can help improve this document.

If you find any mistakes, or if you know of ways to improve the procedures that are given, please E-mail your suggestions to the author at [technicwrite@gmail.com](mailto:technicwrite@gmail.com).

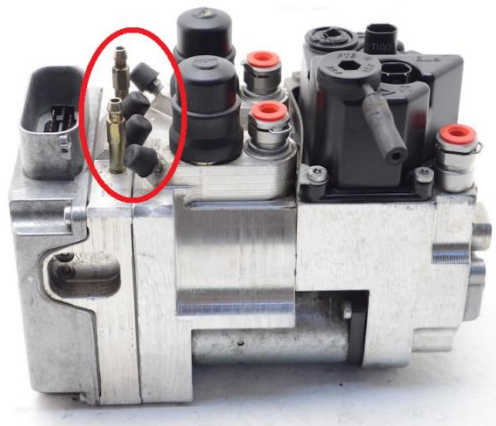
## 5. APPLICABILITY

This manual is specifically applicable to i-ABS1 (also known as *Integral ABS version 1*, or *EVO*)-equipped BMW Motorrad R-series and K-series models manufactured between 2004 and 2007.

This manual can also be used as a reference guide for earlier BMW motorcycles that have the i-ABS1 anti-lock braking system, such as late-model R1150 and R1200C boxer twins, and late-model K1200LT.

This manual is *not* applicable to earlier-model BMW motorcycles with ABSII anti-lock braking systems, or to later-model BMW motorcycles with non-servo-assisted integral ABS systems. For repair and maintenance instructions applicable to i-ABS2 and later systems, please refer to the appropriate manual by the same author.

To find out if this manual is applicable to your ABS system, look at your motorcycle's ABS pressure regulator module. This manual is applicable if the module has *six* fluid bleed nipples (i-ABS1 regulator, below).



This manual is *not* applicable if the regulator has no fluid bleed nipples (i-ABS2 regulator, below, left), or has *two* fluid bleed nipples (ABSII regulator, below, right).



## 6. INTRODUCTION

If you are reading this guide, you may need to work on your motorcycle's brake system for one or more of the following reasons:

- You need to do a routine (twelve-monthly) flush and bleed of the motorcycle's hydraulic braking circuits.
- One or more hydraulic braking components have been repaired or replaced, and you need to flush and bleed the motorcycle's hydraulic braking circuits.

This manual shows the flush, bleed and workshop check procedures for BMW motorcycles with the electrically assisted i-ABS1 braking system. This system features an unusually complex pressure regulator with a built-in electric servo pump. This braking system provides full braking power and anti-lock functionality whenever the ignition is switched on and the system has completed its self-check procedure.

By most accounts, the i-ABS1 system is generally reliable. However, the servo-assisted brakes are time-consuming to work on, need specialised knowledge to maintain, have a low level of built-in redundancy and a narrow margin for error, and are expensive to repair if the pressure regulator malfunctions or fails.

There is also a common misconception that maintenance and repair of i-ABS1 brakes cannot be done by ordinary owners or enthusiasts. As will be demonstrated, this notion is false. Although electronic checking of the system needs specialised diagnostic equipment, any competent enthusiast with experience of hydraulic brakes should not find these tasks unusually difficult.

No matter what motorcycle you are working on, you will need easy access to the ABS pressure regulator, both external brake fluid reservoirs, and all brake calipers. If you do not know how to remove and replace components on the motorcycle, instructions can be found in the relevant BMW Motorrad, Haynes or Clymer workshop manual.

## 7. WORKSHOP TOOLS AND CONSUMABLES

Before starting the work described in this document, you will need the following:

- Depending on the amount of brake fluid that needs to be bled, you will need 500 ml to 1 litre of DOT 4 ethylene glycol-based brake fluid.
- 1x 8mm Allen wrench.
- 1x 7mm ring set spanner.
- 1x 8 mm ring set spanner.
- 1x large flat screwdriver.
- Approximately one metre of clear glycol-resistant 5mm IØ plastic hose.
- 1x suitable plastic container for waste brake fluid.
- 1x large veterinary syringe. These are available from vets, and medical-supply retailers. If you cannot find one, you can use a turkey baster (from a supermarket) or a rubber enema bulb (from a pharmacy).
- 1x T30 Torx wrench.
- 1x T45 Torx wrench.
- 1x large plastic bucket filled with a strong solution of dishwashing liquid and clean, warm water.
- 1x large-handled soft-bristled brush.



## 8. BRAKE MAINTENANCE PROCEDURES

### 8.1. Topping up the brake fluid levels

On i-ABS1 brake systems, the fluid levels in the control-circuit (handlebar, and right-hand rear frame) brake fluid reservoirs do not drop as the brake pads wear. Instead, the 'fluid gap' is taken up by the wheel-circuit fluid reservoirs that are part of the ABS pressure regulator.

Do not attempt to top up the control-circuit or wheel-circuit brake fluid levels as the brake pads wear. Brake systems in good condition do not 'use up' fluid. The fluid levels will return to normal when worn brake pads are exchanged for new pads.

### 8.2. Initial disassembly

Before doing any of the procedures in this manual, do the following tasks:

1. Park the motorcycle out of doors. Place it on its centre stand, or on a workshop stand.
2. Remove the seat, and all plastic or metal panels and protective covers that block access to the ABS pressure regulator. On 2004-onward R-series motorcycles, remove the fuel tank. If you do not know how to do these procedures, instructions can be found in the BMW, Haynes or Clymer workshop manual for your motorcycle model.
3. Remove the rubber bleed-nipple caps from all bleed nipples on the brake calipers and ABS pressure regulator. There are six bleed nipple caps on the ABS regulator, and one cap on each brake caliper.
4. Clean the ABS pressure regulator, brake calipers, and surrounding areas with a strong solution of dishwashing liquid in warm water. Rinse well with clean water and allow to dry.

### 8.3. Preparation

1. Place the motorcycle on its centre stand, or on a workshop stand.
2. Remove all traces of water and dirt around all brake fluid filler caps and bleed nipples.
3. Bleed the used fluid from the brake calipers as shown in the next section.

### 8.4. Bleeding used fluid from the brake calipers

1. Connect the 5mm IØ plastic hose to the bleed nipple of the left front caliper. Route the other end of the hose into the waste fluid container.
2. Remove the brake pad locating-pin safety wire clip.
3. Using a T30 Torx wrench, remove the brake pad centering pin.

4. Remove the stainless steel anti-rattle spring.
5. Open the bleed nipple on the left front caliper by half a turn.

**WARNING**

Do not use penetrating oils or similar lubricants to free seized brake fluid bleed nipples.

Petroleum-based lubricants that enter the braking system will damage rubber parts, possibly causing catastrophic brake failure.

6. Gently insert the blade of the flat screwdriver between one of the brake pads and the caliper pistons. Alternating between pistons, slowly force the pistons into the caliper until the pistons cannot travel any further.

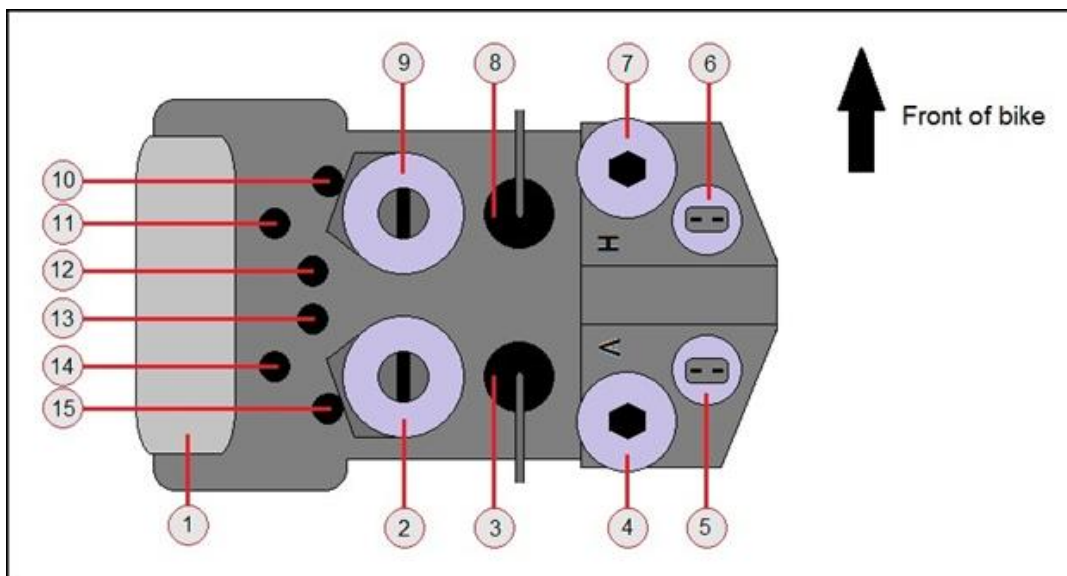
**CAUTION**

Do not insert the screwdriver blade between the brake pad and brake disc.

- The used fluid in the caliper will be forced through the hose and into the waste container.
7. Repeat the step above for the other side of the caliper.
  8. Close bleed nipple on the left front caliper.
  9. Carefully inspect both brake pads for wear. If any pads have worn down to the level of their wear-indicator grooves, replace all front brake pads as a set.
  10. Repeat the above procedure from step 1, for the right front brake caliper.
  11. Repeat the above procedure from step 1, for the rear brake caliper.
  12. Re-install the brake pads and their retaining hardware into the relevant brake calipers.
  13. Bleed used fluid from the wheel circuits as shown in the next section.

## 8.5. Bleeding the wheel circuits

1. Carefully inspect the ABS pressure regulator. Note the positions of the front circuit fluid reservoir cap (4, below) and rear circuit fluid reservoir cap (7, below).



### NOTE

The front circuit reservoir cap is marked *V* for *Vorderrad* (Front wheel). The rear circuit reservoir cap is marked *H* for *Hinterrad* (Rear wheel).

2. Use the 8mm Allen key to remove the front wheel-circuit fluid reservoir cap (marked *V*).
3. Note the white, horizontal plastic level mark, just inside the reservoir housing (below). Under normal conditions, with all brake pads for the relevant circuit at full thickness, the brake fluid level must be just over this mark.



4. Open a new, sealed container of DOT 4 brake fluid.
5. Slowly add brake fluid to the reservoir until the fluid level is approximately 5mm from the top of the reservoir cap threads. Do not pour brake fluid in a way that introduces air bubbles into the ABS regulator.



### IMPORTANT

If air bubbles are visible in the brake fluid, allow the motorcycle to stand for approximately half an hour until the bubbles rise to the top of the fluid.

6. The bleed nipples on the brake caliper are likely to have 'seated' in place, and may be difficult to open. Using the ring end of the 7mm ring set spanner, turn the bleed nipple on the left front brake caliper anti-clockwise just enough to break the seal, and then gently 'nip' it closed.
7. Connect the 5mm IØ plastic hose to the bleed nipple of the left front caliper. Route the other end of the hose into the waste fluid container.

**TIP**

The i-ABS1 braking system consumes much electrical power when it operates. If the motorcycle's battery is not in excellent condition and fully charged, it is recommended that you connect an intelligent battery charger to the motorcycle's battery terminals before proceeding.

Alternatively, select Neutral and run the engine to provide power.

8. Turn on the motorcycle's ignition and kill switches.
  - The braking system will initialise.
  - You should hear a short, sharp 'whirr' from the ABS pressure regulator within four seconds of turning on the ignition switch. This is the sound of the regulator performing a diagnostic self-check.
  - If you do not hear the 'whirr', have a BMW dealer run a diagnostic check of the braking system. Alternatively, check for brake-system fault codes with a [Hex GS-911](#).
9. Familiarise yourself with the different levels of power at which the servo pump can operate.
  - i. Squeeze the front brake lever until the servo pump begins to operate.
  - ii. Squeeze the brake lever progressively harder. Note the change in servo pump pitch and volume until, when maximum effort is applied at the lever, the pump stops operating. You will soon be familiar with the different servo power levels.
  - iii. Release the brake lever.
10. Squeeze the front brake lever just enough for the servo pump to begin to operate. At the same time, open the bleed nipple on the left front caliper.

**CAUTION**

Do not 'pump' the lever, and do not exceed half of the lever's total travel.

- Fluid will flow from the bleed nipple.

11. Adjust the fluid flow by gently increasing and decreasing pressure on the brake lever.

**CAUTION**

Do not allow the fluid level to fall more than 5mm below the white, horizontal plastic level mark just inside the reservoir housing. If the fluid level drops lower than this, add more brake fluid.

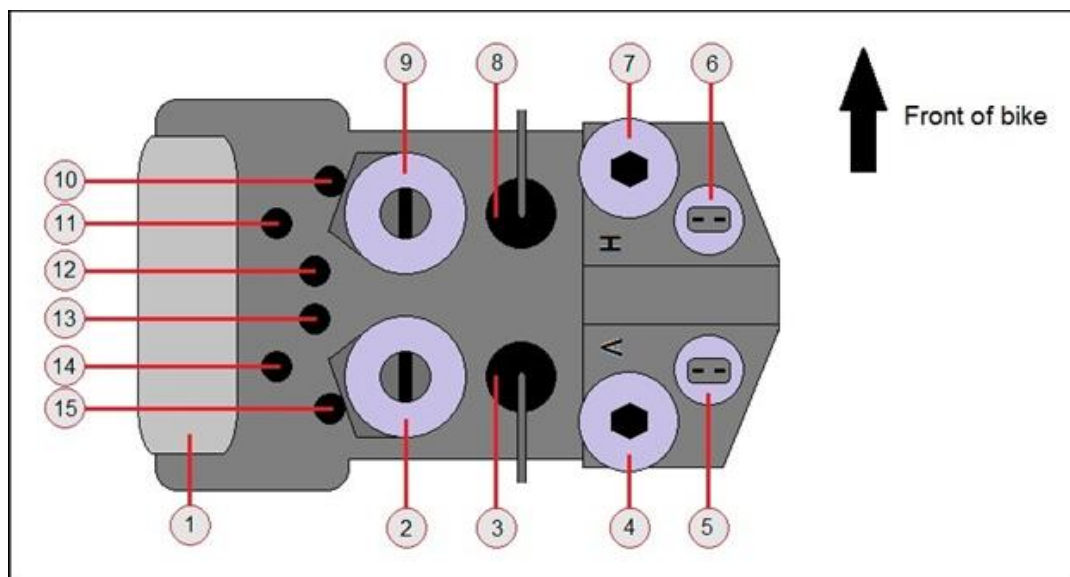
12. Continue circulating fresh brake fluid through the front brake circuit until the fluid coming from the left front caliper bleed nipple is identical in appearance to new fluid. There must be no trace of fluid darkening, loose debris or air bubbles. If any of these are visible, continue adding and bleeding new fluid until they disappear.
13. Close the bleed nipple on the left front caliper.
14. Repeat the bleed procedure for the right front caliper.
15. Inspect the *V* reservoir fluid level. The fluid level should be just above the white plastic level marking. If the level is too low, slowly fill the reservoir with fresh fluid. If too high, draw off the waste fluid using the syringe, and dispose of the waste fluid.
16. Replace the front wheel-circuit (*V*) fluid reservoir cap.
17. Repeat the entire wheel-circuit bleed procedure from step 1 for the rear (*H*) wheel circuit and rear brake caliper.
18. Remove any fluid spills by flushing the brake calipers, and the area around the ABS pressure regulator, with a generous amount of clean water.
19. Turn on the ignition switch.
20. Gently squeeze the front brake lever to no more than half its travel, then release the lever. Repeat until all brake pads are seated against their brake discs, and brake resistance feels normal.
21. Turn off the ignition switch.
22. Check and, if needed, top up the brake fluid levels in the *V* and *H* wheel-circuit fluid reservoirs.
23. Ensure that the *V* and *H* fluid filler caps are closed and tightened.
24. Bleed used fluid from the control circuits, as shown in the next section.

## 8.6. Bleeding the control circuits

The bleed procedure for the front and rear control circuits is nearly identical. This section contains a 'universal' control-circuit bleed procedure, with differences between front and rear circuits highlighted where needed.

You do not need to switch the motorcycle's ignition on for this procedure.

1. Identify and familiarise yourself with the target components on the ABS pressure regulator, as seen in the figure below.



1. ABS ECU interface multi-plug
2. Front brake metering cylinder
3. Front brake caliper connecting line
4. Front-circuit brake fluid reservoir cap.
5. Front circuit reservoir low-level warning sensor
6. Rear circuit reservoir low-level warning sensor
7. Rear-circuit brake fluid reservoir cap.
8. Rear brake caliper connecting line
9. Rear brake metering cylinder
10. Rear metering cylinder bleed nipple
11. Rear control circuit bleed nipple
12. Front integral circuit bleed nipple
13. Rear integral circuit bleed nipple
14. Front control circuit bleed nipple
15. Front metering cylinder bleed nipple



### TIP

Before bleeding the control circuits, disconnect the ABS ECU interface multi-plug (1. above) from the ABS pressure regulator. This will allow easy access to all six bleed nipples.

Do not turn on the ignition switch while the ECU interface multi-plug is disconnected.

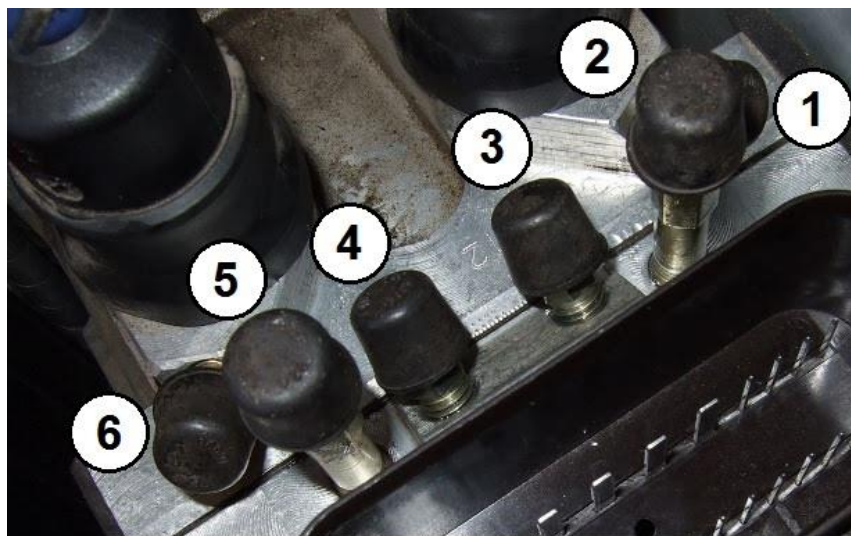
2. Remove the relevant brake fluid reservoir cap.



**IMPORTANT**

Safely remove the front brake fluid reservoir cap by pressing the two securing tabs just under the cap inward, and turning the cap counter-clockwise.

3. Use the syringe to draw off all used brake fluid from the relevant brake fluid reservoir. Dispose of the waste fluid.
4. Fill the fluid reservoir to the FULL mark with fresh DOT 4 brake fluid.
5. Use a permanent marker to write on the ABS pressure regulator body, marking each of the bleed nipples from 1 to 6 as seen below. Note the orientation of the bleed nipples in relation to the multi-plug connector.



6. When bleeding brake fluid from each of the nipples:
  - i. Make sure that the relevant control-circuit reservoir is filled to the FULL mark with fresh DOT 4 brake fluid.
  - ii. Connect the 5mm IØ plastic hose to the relevant bleed nipple. Route the other end of the hose into the waste fluid container.
  - iii. Press the relevant brake lever, opening the relevant bleed nipple at the same time.
  - iv. Close the bleed nipple, letting go of the brake lever shortly after the nipple is fully closed.
  - v. Flush until the brake fluid coming from the nipple is clean and clear.
7. For the front circuit, bleed fluid from the nipples in the sequence 1, 2, 4, 1, re-filling with fluid through the handlebar reservoir. (Note that fluid must be bled from the front metering-cylinder nipple a second time after completing the control-circuit bleed.)
8. For the rear circuit, bleed fluid from the nipples in the sequence 6, 5, 3, 6, re-filling with fluid through the right-hand rear frame

reservoir. (Note that fluid must be bled from the rear metering-cylinder nipple a second time after completing the control-circuit bleed.)

9. Make sure the front and rear control circuit fluid reservoirs are both filled with brake fluid to the FULL mark. Do not overfill the fluid reservoirs.
10. Re-install the brake fluid reservoir caps.
11. Reconnect the ABS ECU control interface multi-plug to the ABS pressure regulator.
12. Test the ability of the braking system to hold pressure by doing the steps that follow:
  - i. Turn on the motorcycle's ignition and kill switches.
  - ii. Confirm that you hear the 'whirr' from the ABS pressure regulator within four seconds of turning on the ignition switch.
  - iii. Press the front brake lever. Increase pressure on the lever until the 'whirr' from the ABS pressure regulator stops.
  - iv. Hold the lever at this position. There must be no loss of resistance over time. If lever resistance decreases, check for fluid leaks or a faulty pressure regulator.
  - v. Repeat step 12 above for the rear brake.
13. Check, and if needed, adjust the brake micro-switches as shown in the next section.

## 8.7. Checking and adjusting the brake micro-switches

On i-ABS1 braking systems, it is extremely important that the micro-switches installed on the front and rear brake levers are correctly adjusted. These micro-switches perform a number of safety-critical functions.

- As on any other motorcycle, they actuate the brake light.
- During each ABS self-check, they provide a 'No-load' signal (in other words, a signal that the brakes are not being operated) to the motorcycle's body-control module and ABS ECU. The ABS system does a diagnostic self-check by comparing 'No-load' hydraulic pressure with the pressure measured when the system tests the servo pump.

If 'No-load' signals are not received, the ABS system will not complete the diagnostic self-check, and will enter 'Limp-home' mode. Servo assistance and anti-lock functionality will not be available, the brakes will need much greater pressure to operate, and the ABS warning light on the instrument display will continue to flash.

If the ignition switch is turned on, the ABS diagnostic self-check has been successfully completed, and the rider operates any of the brake levers,



the relevant micro-switches complete a circuit that activates the pressure regulator's servo pump, allowing power-assisted braking.

Check and adjust the brake micro-switches by doing the steps that follow:

1. Turn on the motorcycle's ignition and kill switches. Do not press the front or rear brake levers, and do not allow the motorcycle to roll forward or back.
  - You should hear a short, sharp 'whirr' from the ABS pressure regulator within four seconds of turning on the ignition switch. This is the sound of the regulator performing a diagnostic self-check.
2. Check the motorcycle's instrument display. If you see a '**LAMP R!**' warning, check the brake light bulb.



#### NOTE

If there is a '**LAMP R!**' warning, but the brake light seems to be working normally, test both filaments of the rear running-light/brake-light bulb for continuity. One of the bulb's two filaments may be blown.

3. If you do not hear the 'whirr', press and release the front, then rear, brake levers while watching the brake light.
  - The brake light should come on when the lever is pressed, and go out immediately when the lever is released.
  - If the brake light does not go out when a brake lever is released, the relevant brake micro-switch may be badly adjusted.
4. Adjust brake micro-switches by doing the steps that follow:
  - i. Check that the front and rear brake levers are both pivoting freely and easily through their entire range of movement. A dirty, badly lubricated, seized or over-tightened lever pivot or damaged lever may cause the micro-switch to remain 'On' even if it is correctly adjusted.
  - ii. Find the fastener that holds the micro-switch in place (on front brakes, it is an Allen-head grub screw). Loosen the fastener until the micro-switch can move more-or-less freely.
  - iii. With the brake lever at rest, move the micro-switch in, and then out, in relation to the brake lever.
    - You should hear a faint 'click' each time the switch contacts open and close.
    - Remember that the brake switches are normally-closed (NC) switches. This means their default switch contact position (with the brake lever at rest) is closed. With both switches in their 'rest' positions, the brake light should be off.

- 
- iv. With the relevant brake lever in its rest position, move the micro-switch until the brake light goes out.
  - v. Tighten the relevant fastener to hold the micro-switch in the correct position.
  - vi. Test the micro-switch by pressing the brake lever.
    - The brake light should come on when the lever travels only a few millimetres, and go out immediately when the lever is released.
  - vii. Do a final check by turning the ignition switch off, then turning it on again.
    - If the taillight remains at half-brightness, and you hear the self-diagnostic 'whirr' from the ABS pressure regulator within four seconds of turning on the ignition switch, the brake micro-switches are correctly adjusted.