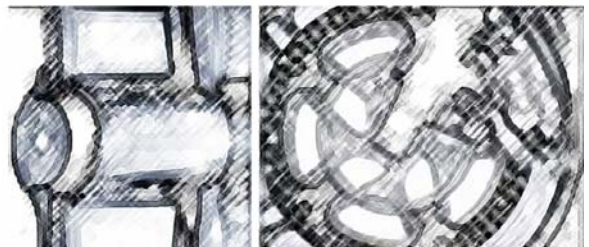
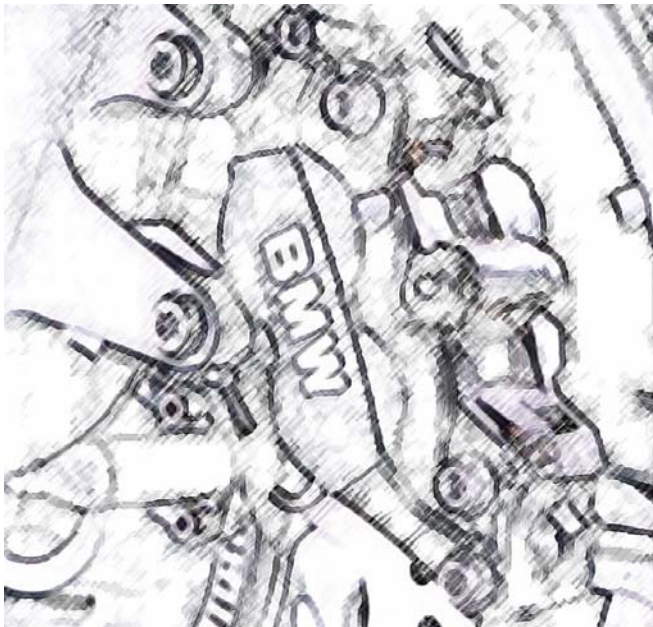


## **BMW Integral ABS Systems**

### **Flushing and Bleeding 101**



*by* **Dana E. Hager & Charles B. Gilman**

*editorial support and review by* **Brian D. Curry**

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Second Edition

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The author(s) have described how they made the parts/ tooling. The construction was based on their experience, knowledge, skills and available materials and tools. Our experience, knowledge and skills maybe and likely are different from any potential users of the information here. Users may not have the material and tools we had available. What was, or is, obvious to us and so not described, may not be apparent to potential users at all. Therefore, they/ we assume no liability for any damage or injury caused by any errors or omissions in this description. Please consult the OEM maintenance manual before doing any work. Use at your own risk.

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# Tools Needed

- 1) Needle Nose Pliers
- 2) #2 Phillips Screwdriver
- 3) Torx Sockets T30 and T45



- 4) 7mm & 8mm wrench
- 5) 19mm Open-end Wrench
- 6) 1/8" Punch and Hammer

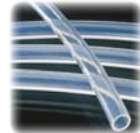


- 7) Torque Wrench  
20 – 100Nm (15-75 ft.lb.)

- 8) Turkey Baster  
Any supermarket should have one of these, check in the cooking and baking section. Use this to draw off the old brake fluid during the service.



- 9) Plastic Hose  
~4 feet of clear hose, 3/16" ID.



- 10) Bleed Screw  
You will need one to bleed the front right brake caliper on some bikes. This goes in place of the grub screw that covers the fill/ bleed assembly. This is also needed for the clutch circuit. Consider getting and installing SpeedBleeders® for the stock brake bleeders.



- 11) Filling Adaptor - See Article:  
*BMW Integral ABS System*  
*Wheel Circuit Reservoir Filling Adapter*



- 12) Waste Brake Fluid Container

- 13) Wooden Dummy New Brake Pad Blocks- See Article:  
*BMW Integral ABS System*  
*Wheel Circuit Reservoir Filling Adapter*



- 14) DOT 4 Brake Fluid  
You will need approximately 1 liter (3 – 12oz bottles).



- 15) Brake Cleaner Spray

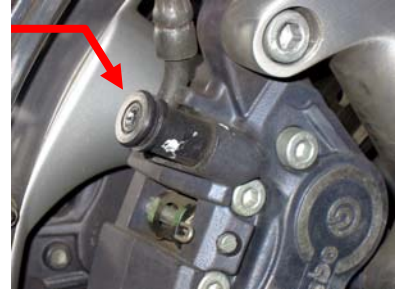
- 16) Shop Towels or equivalent absorbent material(s)





# Right Front Brake Caliper / Clutch Filler Adapter

On some models BMW has installed a filling adapter on the right-hand front brake caliper instead of a standard bleed screw. This is the same adapter you will find when bleeding and flushing the clutch circuit.



1) Remove the cover (grub screw) with the appropriate sized hex key. This allows access to the check valve ball fitting.



2) Carefully insert a 10mm x 1.0 bleed screw into the filling adapter. The bleed screw will only catch by a few threads and you may experience some difficulty getting a good seal. Follow the procedure for bleeding the Front Wheel Circuit.

3) When finished flushing the front wheel circuits remove the bleed screw and replace the cover (grub screw).



4) I recommend replacing the entire filling adapter with a 10mm x 1.0 bleed screw or SpeedBleeder® to ease servicing.



Some BMW OEM bleed screws have been found to have a flat on the seating surface. You may need to file an identical flat onto the SpeedBleeder to insure a good seal.



# Front Wheel Circuit – *Front Calipers and Control Circuit*

Please consult the OEM manual for procedures needed to remove any accessories, bodywork and/ or parts necessary to access the ABS Pressure Modulator and Reservoirs.

Follow the following sequence for flushing and bleeding the front brake calipers.



**BRAKE FLUID DESTROYS PAINT. DO NOT ALLOW ANY BRAKE FLUID TO COME INTO CONTACT WITH PAINTED PARTS.**

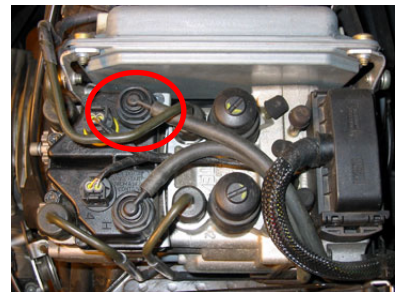
- 1) Place the bike on the center stand.
- 2) Carefully check the left and right front brake discs for damage and scoring. Measure their thickness at several points with a micrometer.



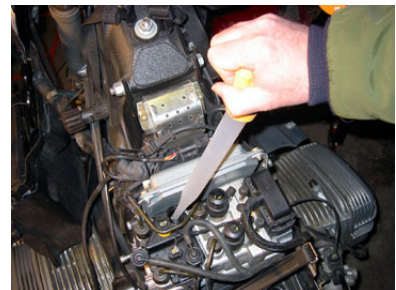
**Brake disc wear limits:**

Front & Rear .....4.5mm (0.177 in)

- 3) Place a shop towel around the **front wheel circuit** reservoir and over painted parts to catch any brake fluid spills.
- 4) Remove front wheel circuit reservoir cap (19mm open-end wrench) with vent line. All of the fittings are plastic, be careful, don't break them. They become brittle with age.



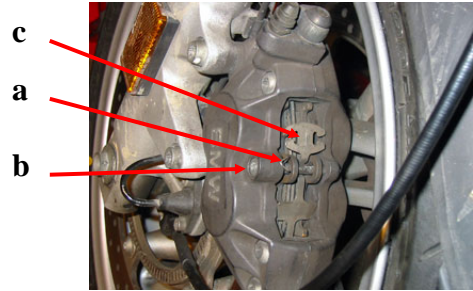
- 5) Using the turkey baster draw off the old brake fluid from the front wheel circuit reservoir.



- 6) Confirm the O-ring is on the filling adapter cap. Thread the filling adapter into the front wheel circuit reservoir. Do not demonstrate your strength. Hand tighten just enough to prevent leakage.

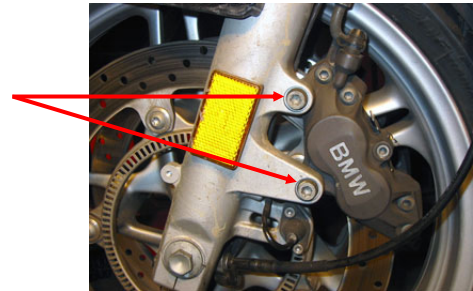


- 7) Remove the front left caliper brake pads:
- a) Remove the safety clip.
  - b) Remove the retaining pin.
  - c) Remove the flat spring (*note arrow direction*).
  - d) Remove the brake pads.



DO NOT SQUEEZE THE BRAKE LEVER WHILE THE PADS ARE OUT AND THE WOOD BLOCKS ARE NOT INSTALLED. DAMAGE TO PISTONS AND CALIPER COULD RESULT.

- 8) Remove the front left caliper.



- 9) Clean and inspect the caliper.

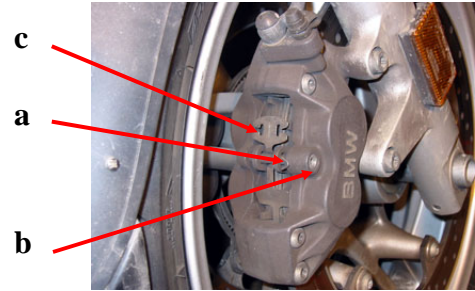


- 10) Slowly but firmly push the pistons back into the left front caliper.  
11) Insert the wooden dummy new brake pad blocks into the caliper.



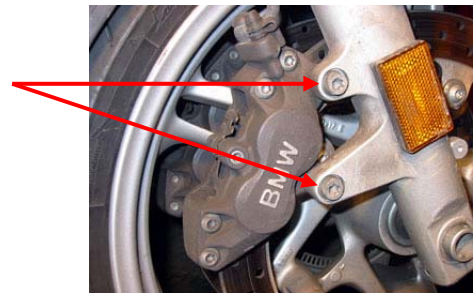
12) Remove the front right caliper brake pads:

- a) Remove the safety clip.
- b) Remove the retaining pin.
- c) Remove the flat spring (*note arrow direction*).
- d) Remove the brake pads.



**DO NOT SQUEEZE THE BRAKE LEVER WHILE THE PADS ARE OUT AND THE WOOD BLOCKS ARE NOT INSTALLED. DAMAGE TO PISTONS AND CALIPER COULD RESULT.**

13) Remove the front right caliper.



14) Clean and inspect the caliper.



15) Slowly but firmly push the pistons back into the right front caliper.

16) Insert the wooden dummy new brake pad blocks into the caliper.





- 17) Add new **DOT 4** brake fluid to the filling adapter until it is approximately half full. Fill slowly to avoid creating any air bubbles. Allow time for the air to escape out of the front wheel circuit reservoir. (Air can be trapped by the filling adapter stem, cap and O-ring.)



- 18) Connect the clear plastic hose from the brake fluid waste container to the left front caliper bleed screw.



- 19) Make sure that the wooden blocks are inserted into the calipers properly before proceeding.

- 20) Turn on the ignition and allow the ABS to initialize.



- 21) Very gently squeeze the handbrake lever until the pump just starts to operate. (This pressurizes the system.)



**BRAKE FLUID LEVEL **MUST NOT** GO BELOW THE TOP OF THE FILL ADAPTER STEM. YOU COULD GET AIR INTO THE SYSEEM.**

- Open the bleed screw on the left front caliper. Note the color of the brake fluid exiting.
- Maintain filling adapter brake fluid level above the stem. Vary the brake pressure and fluid velocity by brake lever pressure.
- Continue brake fluid flow until it runs the same color as the new fluid and bubble free.
- Close the bleed nipple snug while brake fluid is flowing to prevent air from entering the wheel caliper.



**Note:** If you are using *SPEED BLEEDERS®* just release the brake lever. The built in check valve automatically closes preventing air entering the system.



22) Remove the clear plastic hose from the left front caliper bleed screw. Wipe up any brake fluid.

23) Tighten the bleed screw. Don't put the cap on at this point. At the end flush all the bleed screw connections with water to dilute the brake fluid left and let the areas dry, then put on the caps. The thought is to get rid of all the hygroscopic brake fluid that will encourage corrosion if left.



24) Connect the hose on the waste container to the right front caliper bleed screw.

See section "**Right Front Brake Caliper Filler Adapter**" if your bike is equipped with the factory fill adapter.



25) Fill the funnel with new **DOT 4** brake fluid until it is approximately half full. Fill slowly to avoid creating any air bubbles.



26) Turn on the ignition and allow the ABS to initialize.

27) Very gently squeeze the handbrake lever until the pump just starts to operate.

- a) Open the bleed screw on the right front caliper. Note the color of the brake fluid exiting.
- b) Maintain filling adapter brake fluid level above the stem. Vary the brake pressure and fluid velocity by brake lever pressure.
- c) Continue brake fluid flow until it runs the same color as the new fluid and bubble free.
- d) When the second calipers discharge brake fluid has the same appearance as new fluid, gradually release the lever pressure and **carefully continue pumping while monitoring filling adapter level until the brake fluid level just disappears from view into the ABS control module**. Close and snug the bleed screw with brake fluid flowing preventing air entering the system.



28) Turn off the ignition.

29) Remove the hose from the right front caliper and wipe up any brake fluid that may be present.

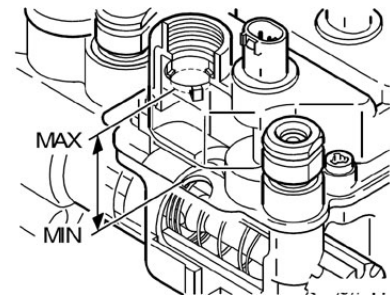
30) Tighten the bleed screw. Don't put the cap on at this point. At the end flush all the bleed screw connections with water to dilute the brake fluid left and let the areas dry, then put on the caps. The thought is to get rid of all the hygroscopic brake fluid that will encourage corrosion if left.



31) Remove the filling adapter from the front wheel circuit reservoir.

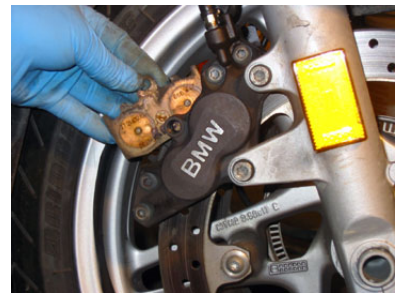
32) Adjust the brake fluid level using the clean turkey baster in the front wheel circuit until one of the three fingers just touches the brake fluid surface. (You may need to draw off and fill to get the right level.)

33) Reinstall the plastic front wheel circuit reservoir cap with drain hose and hand tighten.



34) Remove the wooden blocks and reinstall the front left and right calipers.

35) Install the front brake pads both left and right. Refer to the OEM manual and torque to the specified values.



36) Turn on the ignition and allow ABS to initialize.



37) Slowly squeeze the brake lever to reseat the pads against the discs.

38) Turn off the ignition.

39) This completes the front wheel circuits.



# Rear Wheel Circuit – *Rear Caliper and Control Circuit*

Follow the following sequence for flushing and bleeding the rear brake caliper.

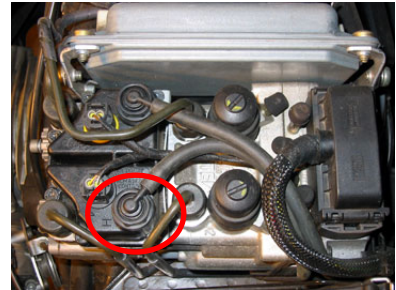
- 1) Carefully check the rear brake disc for damage and scoring. Measure the thickness at several points with a micrometer.

**Brake disc wear limits:**

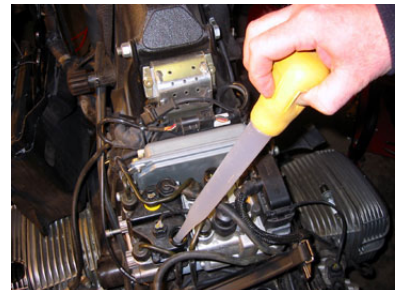
Front & Rear .....4.5mm (0.177 in)



- 2) Place a shop towel around the **rear wheel circuit** reservoir and over painted parts to catch any brake fluid spills.
- 3) Remove rear wheel circuit reservoir cap (19mm wrench) with vent line. All of the fittings are plastic, be careful, don't break them. They become brittle with age.



- 4) Use the turkey baster draw off the old brake fluid from the rear wheel circuit reservoir.



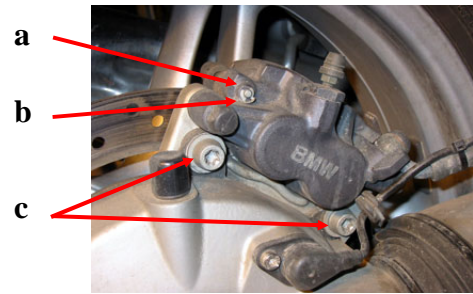
- 5) Confirm the O-ring is on the filling adapter. Thread the filling adapter into the rear wheel circuit reservoir. Do not demonstrate your strength. Hand tighten just enough to prevent leakage.





6) Remove the rear caliper:

- a) Remove the safety clip.
- b) Drive out the retaining pin.
- c) Remove caliper bolts.



7) Remove the rear brake pads.

- a) After you remove the brake pads, note the flat spring inside the caliper position and direction.



**DO NOT PRESS THE BRAKE PEDAL WHILE THE PADS ARE OUT AND THE WOOD BLOCKS ARE NOT INSTALLED. DAMAGE TO PISTONS AND CALIPER COULD RESULT.**



8) Clean and inspect the caliper and rubber protective boots.



9) Slowly but firmly push the pistons back into the rear caliper.

10) Insert the wooden dummy new brake pad blocks into the caliper.





- 11) Add new **DOT 4** brake fluid to the filling adapter until it is approximately half full. Fill slowly to avoid creating any air bubbles. Allow time for the air to escape out of the rear wheel circuit reservoir. (Air can be trapped by the filling adapter stem, cap and O-ring.)



- 12) Connect the clear plastic hose from the brake fluid waste container to the rear caliper bleed screw.



- 13) Make sure the wooden blocks are inserted into the caliper properly before proceeding.



- 14) Turn on the ignition and allow the ABS to initialize.

- 15) Very gently press the footbrake pedal until the pump just starts to operate. (This pressurizes the system.)



**BRAKE FLUID LEVEL MUST NOT GO BELOW THE TOP OF THE FILL ADAPTER STEM. YOU COULD GET AIR INTO THE SYSTEM.**

- Open the bleed nipple on the rear caliper. Note the color of the brake fluid exiting.
- Maintain filling adapter brake fluid level above the stem. Vary the break pressure and fluid velocity by break pedal pressure.
- Continue break fluid flow until it runs the same color as the new fluid and bubble free.
- When the discharge brake fluid has the same appearance as new fluid, gradually release the lever pressure and **carefully continue pumping while monitoring filling adapter level until the brake fluid level just disappears from view into the ABS control module**. Close and snug the bleed screw with brake fluid flowing preventing air entering the system.



**Note:** If you are using **SPEED BLEEDERS®** you will not need to worry about closing the bleed nipple before you stop pumping. The built in check valve automatically closes and prevents any air from reentering the system.

16) Remove the clear plastic hose from the rear caliper bleed screw. Wipe up any brake fluid.

17) Tighten the bleed screw. Don't put the cap on at this point. At the end flush all the bleed screw connections with water to dilute the brake fluid left and let the areas dry, then put on the caps. The thought is to get rid of all the hygroscopic brake fluid that will encourage corrosion if left.

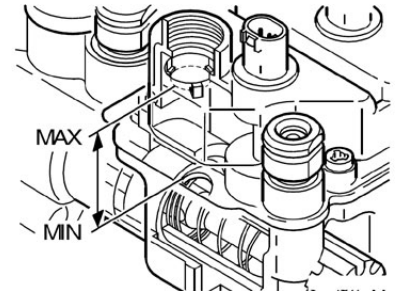


18) Turn off the ignition.

19) Remove the filling adapter from the rear wheel circuit reservoir.

20) Adjust the brake fluid level using the clean turkey baster in the front wheel circuit until one of the three fingers just touches the brake fluid surface. (You may need to draw off and fill to get the right level.)

21) Reinstall the plastic rear wheel circuit reservoir cap with drain hose and hand tighten



22) Remove the wooden blocks and reinstall the rear brake pads.

23) Install the rear brake caliper. Refer to the OEM manual and torque to the specified values.



24) Turn on the ignition and allow ABS to initialize.



25) Slowly press the rear footbrake pedal to reset the pads against the discs.

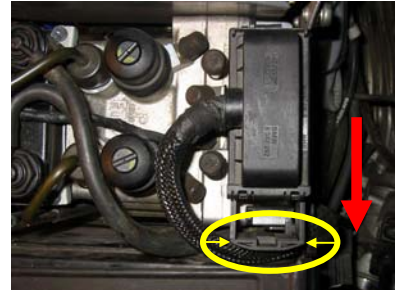
26) Turn off the ignition.

27) This completes the rear wheel circuit.



## Rear Control Circuit – Rear Footbrake Lever and Reservoir

- 1) Remove the **ABS control module** connector to access the bleed screws. Pull the latch to the bike rear. This unlocks the connector. Place a shop towel over the connector.
- 2) Place a shop towel around the rear footbrake reservoir and over any painted parts to catch any drips.
- 3) Carefully unscrew the reservoir cap. Remove the reservoir cap and rubber diaphragm.



**BRAKE FLUID DESTROYS PAINT. DO NOT ALLOW ANY BRAKE FLUID TO COME INTO CONTACT WITH PAINTED PARTS.**

- 4) Use the turkey baster to draw off the old brake fluid from the rear control reservoir. Using shop towels, wipe out any sediment in the reservoir bottom.
- 5) Fill the rear control reservoir with fresh **DOT 4** brake fluid.
- 6) The procedure step below will be repeated for several bleed points. (Pictured and annotated) Connect the clear plastic hose on the brake fluid waste container to the appropriate bleed screw for that step on the **ABS control module**.



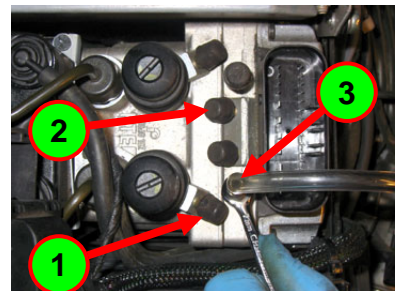
Flush the rear control circuits as follows:

- a) Do not press the rear brake pedal more than  $\frac{1}{2}$  of its travel, slowly press the rear break pedal.
- b) At the same time open the appropriate bleed screw and allow brake fluid to flow into the waste container.
- c) Before releasing the pedal close the bleed screw. This prevents air from entering the system.
- d) Repeat for each circuit until the brake fluid looks like the new fluid and is free of air bubbles.



**DO NOT ALLOW TO ENTER THE SYSTEM. KEEP THE RESERVOIR FILLED ABOVE THE HOSE CONNECTION**

- #1 – rear metering cylinder
- #2 – rear integral circuit
- #3 – rear control circuit
- #1 – rear metering cylinder (*for the second time*)



- 7) As each control circuit is completed, remove the hose from the bleed screw and clean up any brake fluid that may have spilled. When all control circuits have been completed, replace the protective rubber caps. (Order: #1, #2, #3 and #1 2<sup>nd</sup> time).
- 8) Fill the rear control reservoir to the correct level. Clean up any spilled brake fluid. Install the rubber diaphragm and gently hand tighten the cover.
- 9) This completes the rear control circuits.





# Front Control Circuit – Front Handbrake Lever and Reservoir

- 1) Set the handbrake lever adjustment wheel to the #4 position.
- 2) Place a shop towel around the front brake reservoir and over any painted parts to catch any drips. Note the front control reservoir level before the old brake fluid is removed.
- 3) Remove the four #2 phillips screws. Carefully lift off the reservoir cap. Then remove the rubber diaphragm. Do not use anything sharp to remove the cap or diaphragm. Sharp objects can damage the sealing surface.



**BRAKE FLUID DESTROYS PAINT. DO NOT ALLOW ANY BRAKE FLUID TO COME INTO CONTACT WITH PAINTED PARTS.**

- 4) Use the turkey baster to draw off the old brake fluid from the front control reservoir. Using shop towels, wipe out any sediment in the reservoir bottom.
- 5) Fill the front control reservoir with fresh **DOT 4** brake fluid.
- 6) The procedure step below will be repeated for several bleed points. (Pictured and annotated) Connect the clear plastic hose on the brake fluid waste container to the appropriate bleed screw for that step on the **ABS control module**.

Flush the front control circuits as follows:

- a) Do not squeeze the front brake lever more than ½ of its travel. Slowly squeeze the front brake lever.



**DO NOT SQUEEZE RAPIDLY. IF YOU DO YOU WILL SPRAY BRAKE FLUID OUT OF THE RESERVOIR ONTO THE PAINT.**

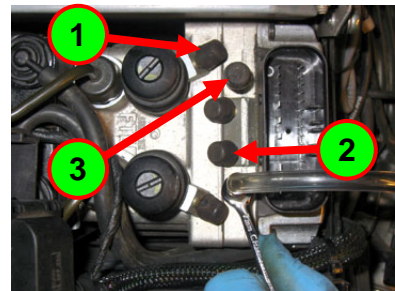
- b) At the same time open the appropriate bleed screw and allow brake fluid to flow into the waste container.
- c) Before releasing the lever close the bleed screw. This prevents air from entering the system.
- d) Repeat for each circuit until the brake fluid looks like the new fluid and is free of air bubbles.



**DO NOT ALLOW TO ENTER THE SYSTEM. KEEP THE RESERVOIR FILLED ABOVE THE CYLINDER FILL POINT.**

- #1 – front metering cylinder
- #2 – front integral circuit
- #3 – front control circuit
- #1 – front metering cylinder (*for the second time*)

- 7) As each control circuit is completed, remove the hose from the bleed screw and clean up any brake fluid that may have spilled. When all control circuits have been completed, replace the protective rubber caps. (Order: #1, #2, #3 and #1 2<sup>nd</sup> time).

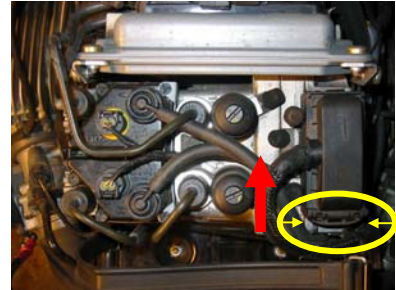




- 8) Fill the front control reservoir to the correct level. Clean up any spilled brake fluid. Install the rubber diaphragm and cover. Replace and tighten the four #2 phillips cover retaining screws.



- 9) Install the **ABS control module** connector and lock the connector. (Listen for the click/ snap.)



- 10) This completes the front control circuits.