2 Hydraulic system - bleeding

Warning:
Brake fluid is poisonous; wash it off immediately and thoroughly in the case of skin contact, and seek immediate medical advice if any fluid is swallowed or gets into the eyes. Certain types of brake fluid are flammable, and may ignite when allowed into contact with hot components; when servicing any hydraulic system, it is safest to assume that the fluid is flammable, and to take precautions against the risk of fire as though it were gasoline. Brake fluid is also an effective paint stripper, and will attack plastics; if any is spilled, it should be washed off immediately, using copious quantities of fresh water. Finally, it is hygroscopic (it absorbs moisture from the air) - old fluid may be contaminated and unfit for further use. When topping-off or replacing the fluid, always use the recommended type, and ensure that it comes from a freshly-opened sealed container.

Warning:
On models with ABS (with or without ASC+T), if the high-pressure hydraulic system linking the master cylinder, hydraulic unit and accumulator (if equipped) has been disturbed, then bleeding of the brakes should be entrusted to a BMW dealer or other qualified repair shop. They will have access to the special service tester that is needed to operate the ABS modulator pump and bleed the high-pressure hydraulic system safely .

General

1 The correct operation of any hydraulic system is only possible after removing all air from the components and circuit; this is achieved by bleeding the system.

2 During the bleeding procedure, add only clean, unused brake fluid of the recommended type; never re-use fluid that has already been bled from the system. Ensure that sufficient fluid is available before starting work.

3 If there is any possibility of incorrect fluid being already in the system, the brake components and circuit must be flushed completely with uncontaminated, correct fluid, and new seals should be fitted to the various components.

4 If brake fluid has been lost from the system, or air has entered because of a leak, ensure that the fault is cured before continuing further.

5 Park the vehicle on level ground, switch off the engine and select first or reverse gear, then chock the wheels and release the parking brake.

6 Check that all lines and hoses are secure, fittings tight and bleed screws closed. Clean any dirt from around the bleed screws.

7 Unscrew the master cylinder reservoir cap, and fill the master cylinder reservoir to the MAX level line; install the cap loosely, and remember to maintain the fluid level at least above the MIN level line throughout the procedure, or there is a risk of further air entering the system.

8 There are a number of one-man, do-it-yourself brake bleeding kits currently available from motor accessory shops. It is recommended that one of these kits is used whenever possible, as they greatly simplify the bleeding operation, and reduce the risk of expelled air and fluid being drawn back into the system. If such a kit is not available, the basic (two-man) method must be used, which is described in detail below.

9 If a kit is to be used, prepare the vehicle as described previously, and follow the kit manufacturer's instructions, as the procedure may vary slightly according to the type being used; generally, they are as outlined below in the relevant sub-section.

10 Whichever method is used, the same sequence must be followed (paragraphs 11 and 12) to ensure the removal of all air from the system.

Bleeding sequence

11 If the system has been only partially disconnected, and suitable precautions were taken to minimize fluid loss, it should be necessary only to bleed that part of the system.

12 If the complete system is to be bled, then it should be done working in the following sequence:

A. Right-rear brake
B. Left-rear brake
C. Right-front brake
D. Left-front brake

Warning:
On models with ABS (with or without ASC+T), after bleeding, the operation of the braking system should be checked at the earliest possible opportunity by a BMW dealer or suitably-equipped specialist.

Basic (two-man) method

13 Collect a clean glass jar, a suitable length of plastic or rubber tubing which is a tight fit over the bleed screw, and a flare-nut wrench to fit the screw. The help of an assistant will also be required.

14 Remove the dust cap from the first screw in the sequence. Fit the wrench and tube to the screw, place the other end of the tube in the jar, and pour in sufficient fluid to cover the end of the tube.

15 Ensure that the master cylinder reservoir fluid level is maintained at least above the MIN level line throughout the procedure.

16 Have the assistant fully depress the brake pedal several times to relieve the power brake booster's vacuum and create hydraulic pressure, then hold it down on the final downstroke.

17 While pedal pressure is maintained, unscrew the bleed screw (approximately one turn) and allow the fluid (along with any air) to flow into the jar. The assistant must maintain pedal pressure until instructed to release it. When the flow slows, tighten the bleed screw again, have the assistant release the pedal slowly, and recheck the reservoir fluid level.

18 Repeat the steps in paragraphs 16 and 17 until the fluid emerging from the bleed screw is free from air bubbles. If the master cylinder has been drained and refilled, and air is being bled from the first screw in the sequence, allow about 5 seconds between cycles for the master cylinder passages to refill.

19 When no more air bubbles appear, tighten the bleed screw securely, remove the tube and wrench, and install the dust cap. Be careful not to over-tighten the bleed screw.

20 Repeat the procedure on the remaining screws in the sequence, until all air is removed from the system and the brake pedal feels firm.

Using a one-way valve kit

21 As their name implies, these kits consist of a length of tubing with a one-way valve installed, to prevent expelled air and fluid being drawn back into the system; some kits include a translucent container, which can be positioned so that the air bubbles can be more easily seen flowing from the end of the tube **(see illustration)** .

2.21 Bleeding a rear brake caliper using a one-way valve kit

22 The kit is connected to the bleed screw, which is then opened. The user returns to the driver's seat, depresses the brake pedal with a smooth, steady stroke, and slowly releases it; this is repeated until the expelled fluid is clear of air bubbles.

23 Note that these kits simplify work so much that it is easy to forget the master cylinder reservoir fluid level; ensure that this is maintained at least above the MIN level line at all times.

Using a pressure-bleeding kit

24 These kits are usually operated by the reservoir of pressurized air contained in the spare tire. However, note that it will probably be necessary to reduce the pressure to a lower level than normal; refer to the instructions supplied with the kit. **Note:** *BMW specifies that a pressure of 2 bar (29 psi) should not be exceeded.*

25 By connecting a pressurized, fluid-filled container to the master cylinder reservoir, bleeding can be carried out simply by opening each screw in turn (in the specified sequence), and allowing the fluid to flow out until no more air bubbles can be seen in the expelled fluid.

26 This method has the advantage that the large reservoir of fluid provides an additional safeguard against air being drawn into the system during bleeding.

27 Pressure- bleeding is particularly effective when bleeding difficult systems, or when bleeding the complete system at the time of routine fluid replacement.

All methods

28 When bleeding is complete, and firm pedal feel is restored, wash off any spilled fluid, tighten the bleed screws securely, and install their dust caps.

29 Check the brake fluid level in the master cylinder reservoir, and top-off if necessary (see Chapter 1).

30 Properly discard any brake fluid that has been bled from the system; it will not be fit for re-use.

31 Check the feel of the brake pedal. If it feels at all spongy, air must still be present in the system, and further bleeding is required. Failure to bleed the system satisfactorily after a reasonable repetition of the bleeding procedure may be due to worn master cylinder seals.