FIGURE 7.1 Brake fluid can absorb moisture from the air even through plastic, so many experts recommend that brake fluid be purchased in metal containers, if possible.

FIGURE 7.2 Brake fluid absorbs moisture from the air at the rate of about 2% per year. As the brake fluid absorbs water, its boiling temperature decreases.
FIGURE 7.3 This Ford Escape requires DOT 4 as stated on the cap of the master cylinder.

FIGURE 7.4 DOT 5 brake fluid is used mostly in motorcycles because if spilled, it will not hurt painted surfaces.

FIGURE 7.5 Both rubber sealing cups were exactly the same size. The cup on the left was exposed to mineral oil. Notice how the seal greatly expanded.
FIGURE 7.6 If the brake fluid is black in color, it should be replaced.

FIGURE 7.7A A brake fluid test strip is being used to test the condition of the brake fluid.

FIGURE 7.7B The color of the test strip is then compared with a chart on the package, which indicates the condition and if the fluid should be replaced.
FIGURE 7.8 An electronic tester that measures the boiling temperature of the brake fluid is useful to help determine if the brake fluid needs to be replaced.

FIGURE 7.9 The master cylinder piston seals are usually constructed from EPDM rubber, and the diaphragm of the vacuum power brake booster is usually made from SBR.

FIGURE 7.10 Cross-sectional view of a typical drum brake wheel cylinder. Most wheel cylinder boots and cups are either SBR or EPDM rubber.
FIGURE 7.11 Exploded view of a typical disc brake caliper. Both the caliper seal and dust boot are constructed of EPDM rubber.

FIGURE 7.12 Steel brake tubing is double walled for strength and plated for corrosion resistance.

FIGURE 7.13 The rust-prone states are areas where snow and the use of salt contribute to the brake line rust.
FIGURE 7.14 Because of the slight difference in flare angle, double-flare fitting seals cause a wedging action.

FIGURE 7.15 An ISO fitting, also called a ball or bubble flare.

FIGURE 7.16A Double flaring the end of a brake line. Clamp the line at the correct height above the surface of the clamping tool using the shoulder of the insert as a gauge.
FIGURE 7.16B Double flaring the end of a brake line. The insert is pressed into the end of the tubing. This creates the first bend.

FIGURE 7.16C Double flaring the end of a brake line. Remove the insert and use the pointed tool to complete the overlap double flares.

FIGURE 7.16D Double flaring the end of a brake line. The completed operation as it appears while still in the clamp.
FIGURE 7.17A Making an ISO flare requires a special tool. Select the proper size forming mandrel.

FIGURE 7.17B Making an ISO flare requires a special tool. Clamp the tubing flush with the split die and place the mandrel into the tool.

FIGURE 7.17C Making an ISO flare requires a special tool. Thread the tool handle in until the mandrel pilot seats into the tubing.
FIGURE 7.17D Making an ISO flare requires a special tool. Close the tool valve and pump the handle until the mandrel seats in the die.

FIGURE 7.17E Making an ISO flare requires a special tool. The strong hydraulic pressure forms the ISO flare.

FIGURE 7.18 The coils in the brake line help prevent cracks caused by vibration.
**FIGURE 7.19** Armored brake line is usually used in the location where the line may be exposed to rock or road debris damage.

**FIGURE 7.20** A tube bender being used to bend a brake line.

**FIGURE 7.21** A tubing cutter is the preferred tool to use to cut brake line because it leaves a clean edge.
**FIGURE 7.22** Flexible brake hoses are used between the frame or body of the vehicle and the wheel brakes.

**FIGURE 7.23A** Typical flexible brake hose showing the multiple layers of rubber and fabric.

(a)

**FIGURE 7.23B** The inside diameter (ID) is printed on the hose (3 mm).

(b)
FIGURE 7.24 Typical flexible brake hose faults. Many faults cannot be seen, yet can cause the brakes to remain applied after the brake pedal is released.

TORN INNER LINING restricts FLOW and MAY ACT as a VALVE

HOSE FITTING

FITTING LEAKAGE forms a BUBBLE

FIGURE 7.25 Flexible brake hose should be carefully inspected for cuts or other damage, especially near sections where the brake hose is attached to the vehicle.

FIGURE 7.26 Whenever disconnecting or tightening a brake line, always use the correct size flare-nut wrench. A flare-nut wrench is also called a tube-nut wrench or a line wrench.