A ccording to IHS Automotive, the combined average age of all light vehicles on the road in the U.S. has climbed to 11.5 years, based on a snapshot of vehicles in operation (VIO) taken on January 1 of this year.

There are millions of older vehicles on the road today, and many of them are in need of brake service. This article deals with the brake hydraulic system. The collection of hoses, pipes, cylinders, fittings and pistons in the brake hydraulic system is responsible for taking the driver’s intention to slow down or stop the vehicle when he steps on the brake pedal and converting it into the power to overcome and control the vehicle’s kinetic energy and manage its speed.

Most of the components in the brake hydraulic system deliver tens of thousands of miles and decades of service, without requiring the slightest bit of attention from a vehicle owner or a service professional. But every part on a vehicle has a service life, and when a brake hydraulic component reaches the end of its service life and potentially fails, the consequences can be serious.

A thorough inspection of a vehicle’s brake hydraulic system requires far more than a road test. A vehicle’s brakes may feel okay at the pedal, but much more can be going on in areas that aren’t that easily seen or touched. So a thorough brake hydraulic system inspection must begin with a vehicle on a lift, with all of the wheels off the ground, which allows a technician to see and touch all of its components.

Let’s begin with the system’s brake fluid, which is absolutely essential to the safe operation of a brake system, yet it usually receives scant attention. Neglect can cause serious problems because polyglycol fluids (like conventional brake fluid) are hygroscopic, which means they readily absorb water vapor from the air. On average, water accumulates in the brake fluid of a brake system at a rate of 1% per year.

The condition of the master cylinder can reveal much about the general health of the brake hydraulic system. Dark, dirty brake fluid in the master cylinder reservoir probably means the system hasn’t been flushed for a long time. A low fluid level in the reservoir may indicate the presence of leaks elsewhere in the system. Any signs of dampness around the master cylinder indicate that it’s probably begun to leak, too.

A vehicle with 11½-year-old brake fluid now has brake fluid that contains almost 12% water. This gradual transformation may go unnoticed. The level in the master cylinder should normally drop over time, as the brake pads wear. But as the fluid accumulates water, the level may appear to stay pretty much unchanged. A casual glance at the master cylinder level might lead a technician to assume that all is well, as the level would appear within the “normal” range. But the fluid in the reservoir (and the rest of the system) would no longer be pure, unadulterated brake fluid.

Over time, even this relatively slow water accumulation is enough to lower the fluid’s boiling point, which can cause brake fade and diminished brake system performance. Under pressure when the brakes are applied, the accumulated water boils and turns to steam inside the brake system. Unlike liquid brake fluid, steam (like air) is compressible. The brakes fade because the steam momentarily lowers the pressure in the system.

Contaminated brake fluid also has a direct effect on the service life of other brake system components. Brake fluid that’s contaminated with water will cause all of the metal components of the system to rust and corrode from the inside out. This damage will be very difficult to detect with a visual inspection; a brake system with contaminated brake fluid may not reveal itself until components begin to fail.

Begin your inspection by checking the master cylinder. Master cylinders almost always have a reservoir on top, which provides a window into the rest of the hydraulic system. Is the brake fluid inside the reservoir dark and dirty looking? Does it look like it’s ever been changed? What you see inside the reservoir represents what’s probably in the rest of the system, or worse. If you’ve gotten there in time for a flush & fill, perhaps the rest of the service will enjoy a long and trouble-free existence. Perhaps not.

After you’ve inspected the reservoir, take a close look at the area around the master cylinder. Any dampness at the junction between the master cylinder and the brake booster would indicate the presence of a leak at the master cylinder’s rear seal. Also check for any signs of leakage at the brake line fittings that are attached to the master cylinder.
Perhaps more likely to occur is a problem inside the master cylinder that won’t be visible during a visual inspection. The master cylinder’s rubber seals move each time the brake pedal is applied or released. This movement causes wear between the seals and the master cylinder bore, which can cause a loss of hydraulic pressure. This type of internal leak won’t cause a loss of fluid, but it will cause a loss of brake system effectiveness.

The vehicle owner may have already noticed a problem with the master cylinder that’s manifested by a brake pedal that slowly sinks to the floor when applied with firm pressure. Or perhaps he’s complained that the vehicle just doesn’t seem to stop as well as it once did. In addition to worn master cylinder seals, this type of master cylinder failure may also be due to a corroded master cylinder bore caused by contaminated brake fluid that’s preventing an effective hydraulic seal between the seals and the bore.

Brake lines and other hydraulic system components can be visually inspected from the outside. In the case of brake lines, look for signs of physical damage. Perhaps a brake line has been dented or crimped due to an errant rock. More likely, damage will be caused by exposure to the elements. Here in the rust belt, rusted brake lines have a relatively common occurrence on older vehicles. Some vehicles have a reputation for brake line failure at an earlier age than others. This may be due to how the lines are routed, or the type of coating the lines originally received. Regardless, carefully inspect the metal lines anywhere they can be seen, paying closer attention to areas where they’re most vulnerable.Routing may place them in areas that hold moisture, road salt and debris, hastening brake line decline and failure.

Carefully inspect all brake hoses. Hoses are used wherever some degree of movement between brake system components is required. The most common example is between a stationary brake line on the frame and a brake caliper mounted on a suspension component. The brake hose allows the suspension to travel throughout its range of movement while maintaining hydraulic pressure to the caliper.

Check the brake hoses for signs of damage or cracks in the outer casing. Flexing a hose in a direction opposite its normal orientation will often reveal cracks that might otherwise be hidden. Brake hoses may also hide problems on the inside that won’t be visible from the outside. Internal layers may swell, blocking fluid movement, or a hose may become clogged with debris carried in contaminated brake fluid.

Because interior damage and deterioration may remain hidden, it may be best to consider the age of a brake hose, rather than its exterior appearance alone. All brake hoses are marked with an SAE code that indicates the original date of manufacture. There are no set manufacturer guidelines on how old a brake hose needs to be before it’s replaced. But if the hoses are more than 10 years old and the vehicle has already begun to experience other brake system problems, it would probably be wise to include new hoses in a repair estimate. When compared to their importance, their expense is relatively small.

Very little about the internal health of ABS components can be ascertained by a visual inspection. These expensive components are more likely to be damaged from the inside out, due to contaminated brake fluid. Most ABS systems begin every vehicle trip with a self-test. Sticking valves and seals, or other internal damage caused by contaminated fluid, will often be revealed during this self-test. The intention here is to reveal a failure before the system is called upon during a driving situation.

Carefully inspect the brake calipers. Look for damage to the external dust shield around the caliper piston’s circumference. The dust shield keeps dirt and moisture out, protecting the caliper piston and bore from damage. Caliper piston seal leaks are a relatively rare occurrence. Far more common is a caliper piston that has become stuck or binding, due to contaminated brake fluid. A stuck caliper piston will reveal itself when a vehicle pulls to one side under braking, or when the brake pads on one side of a vehicle have worn at a much more rapid rate than the corresponding pads on the other side. Caliper overhaul or replacement is the cure for this condition, combined with a thorough flush of the brake system and the installation of fresh brake fluid.

Some vehicles are still equipped with drum brakes (usually at the rear wheels), in which case they’ll be equipped with wheel cylinders to convert the hydraulic action of the brake system into the mechanical action required to apply the brake shoes. Look for signs of fluid leakage around the wheel cylinders. Peel back the outer dust boot and check for moisture inside the cylinder that would indicate that one or both of the wheel cylinder seals is leaking.

Old school methods called for honing a corroded cylinder, then installing new internal parts. Due to their relatively low cost, it may be more cost-effective (and possibly safer) to remove a leaking cylinder and replace it with a new one. Removing the brake line from an old wheel cylinder will also give you a chance to evaluate the condition of the brake lines. A brake line may look okay, but quickly crumble into rusty pieces when you attempt to loosen it with a line wrench.—Karl Seyfert

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