BRAKE FLUSH MACHINE

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of U.S. patent application Ser. No. 11/265,820, which was filed on Nov. 3, 2005.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is related in general to the field of automotive maintenance systems. In particular, the invention consists of a brake flush machine that allows sequential flushing of a vehicle's brake lines and anti-lock braking system ("ABS").

2. Description of the Prior Art

Anti-lock brake system (ABS) design utilizes multiple hydraulic passageways and valving that restricts fluid movement. This means that fluid flowing through the system will be limited and may take excessive time to properly flush the system. The pressure that can be exerted on the system is limited by the master cylinder reservoir adapter. The adapter connects the pressurized fluid from a brake flush machine to the master cylinder reservoir to the brake system. Most reservoirs are a composite or plastic material and cannot be exposed to pressures above 20 psi without deforming the shape of the reservoir and causing leakage. Most brake flush machines limit master cylinder reservoir pressure to 12-18 psi to prevent leakage. The low pressure also makes removing brake fluid contamination more difficult.

In addition, the fluid does not move through each wheel system equally, but it will take the path of least resistance. Some brake flush machines flush all the wheels at the same time. A machine designed to flush all the wheels at the same time may experience an unequal system flush. This means that one part of the system may experience minimal fluid flow, which will not provide a proper flush.

Isolated flush machines isolate different parts of the system to control fluid flow. This allows the machine to force fluid though the more restrictive circuits. The downside is that the flush time is lengthened because the flow is isolated to a part of the system and not all the wheels at the same time. A properly isolated flush could take 2-3 times longer to move the same amount of fluid as an all-wheel flush, keeping in mind that the all-wheel flush also experiences an unequal system flush.

Empirical testing using Strip Dip7 brake fluid test strips has shown that it takes approximately 2 gallon of brake fluid flushed equally through the system at sufficient pressure and flow to attain a proper flush to remove contaminants. Most all wheel flush machines use 2 gallon fluid container and operate for 10-12 minutes. The last minute or two of the cycle removes whatever fluid is left in the container and dumps it into the waste container so that the service uses 2 gallon of brake fluid each time. This does not mean the 2 gallon of brake fluid was flushed through the system, but only that 2 gallon of brake fluid was consumed. The actual flush may have used 1 quart of fresh fluid and the other quart was dumped into the waste. The reason this is done is to complete the flush within the allotted time period and consume 2 gallon of brake fluid per service regardless of the quality of flush.

There is also a low/no pressure area in many master cylinder designs that is isolated from the normal fluid pathway during a flush. This leaves an area of old fluid that can contaminate the new brake fluid after the flush has been performed. Even if 2 gallon of brake fluid is flushed through the system, the isolated low pressure area can contaminate the brake fluid once the brake pedal is depressed a few times. Depressing and holding the brake pedal exposes the new fluid to the low pressure area. This has been demonstrated again by the use of FASCAR7 Strip Dip brake fluid test strips. A candidate vehicle was tested with Strip Dip7, demonstrating a FASCAR7 rating of 100. The brake flush was performed using ½ gallon of brake fluid using proper sequencing and isolation and the brake fluid was immediately tested after the service, which results in a FASCAR7 rating of 0. The vehicle is then driven in which the brake pedal is depressed several times during normal braking and a Strip Dip7 retest is performed, which results in a FASCAR7 rating of 25. It is not a problem with the test strip, but the low/no pressure area was not cleaned during the flush process and the old fluid contaminated the rest of the system.

To attain a proper brake system flush, approximately ½ gallon of brake fluid must be flushed through the system at sufficient pressure, circuit isolation, and flow to remove contaminates. In addition, the low/no pressure area of the master cylinder must be exposed to fluid flow to flush that portion of the system to prevent future contamination. An isolated brake flush machine could take as long as 30 minutes to properly introduce ½ gallon of brake fluid sequentially through the system, while current all wheel flush machines operate for 10-12 minutes and waste the unused fluid. Each brake flush machine design has severe design flaws, first is the time to perform service or, second, the quality of the service performed.

There are different classifications and standards for brake fluid, D.O.T. 3, 4, 5, and 5.1 (synthetic). D.O.T. 3, 4, and 5.1 brake fluids can be mixed together and perform to at least the minimum specification of the primary fluid. The seals in the brake system are compatible with these fluids. D.O.T. 5 is a silicone based fluid and cannot be mixed with any other type of brake fluid and will void many original equipment brake part warranties if used in a vehicle. D.O.T. 5 is primarily used for off-road use like racing and in motorcycle brake systems.

In addition, there are several manufacturers of brake fluids in the same D.O.T. class that have varying performance criteria. Many original equipment manufacturers have their own formulation of brake fluid. Therefore, it is desirable to have a brake flush machine that can be used with various manufacturers' specifications of brake fluid. It is therefore important for the brake flush machine to be able to purge the brake flush machine with fluid used in the last service and prime the brake flush machine with the desired fluid for the next service. This feature gives the user the ability to service a variety of vehicles each with the original equipment manufacturer's brand of brake fluid.

Most late model anti-lock braking systems ("ABS") require the use of a scan tool to properly bleed and flush the brake system. There are no current brake flush machines that allow the user to use a scan tool while the automated brake flush is performed. It is therefore desirable to have an interface which allows the user to perform various bleed/flush tasks as prompted by the scan tool.

Accordingly, it is desirable to have a brake flush system that primes brake fluid into a brake flush machine's bleed/flush lines in a manner that removes air and different types of fluid from these bleed lines and introduces the correct type of brake fluid. Additionally, it is desirable to have a system of sequentially flushing various bleed lines and ABS systems. It is also desirable to have an easy-to-use interface such as a graphical user interface or combination of graphic symbols or letters, lights, lamps, LEDs, buzzers, and speakers. A method of quickly connecting and disconnecting bleed lines and pre-