SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
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SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1707

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Service Maintenance of SAE J1703 and J1704 Brake Fluids in Motor Vehicle Brake Systems

1. *Scope*—This SAE Recommended Practice provides basic recommendations for dispensing and handling of SAE J1703 and J1704 Brake Fluids by Service Maintenance Personnel to assure their safe and effective performance when installed in or added to motor vehicle hydraulic brake actuating systems.

This document is concerned only with brake fluid and those system parts in contact with it. It describes general maintenance procedures that constitute good practice and that should be employed to help assure a properly functioning brake system. Recommendations that promote safety are emphasized. Specific step-by-step service instructions for brake maintenance on individual makes or models are neither intended nor implied. For these, one should consult the vehicle manufacturer's service brake maintenance procedures for the particular vehicle. Vehicle manufacturer's recommendations should always be followed.

2. *Reference*

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1703—Motor Vehicle Brake Fluid
SAE J1704—Borate Ester Based Brake Fluid

3. *Motor Vehicle Brake Fluid Requirements*

3.1 SAE Motor Vehicle Brake Fluid—SAE J1703 and J1704—These specifications cover motor vehicle brake fluids of the nonpetroleum type for use in the braking system of any motor vehicle, such as a passenger car, truck, bus or trailer. These fluids are not intended for use under arctic conditions.

3.2 Performance Requirements of Motor Vehicle Brake Fluids—While minimum anticipated atmospheric temperatures can generally be estimated, maximum operational brake fluid temperatures are a function of brake system design, service maintenance practices, variations in driving habits, and other factors which are difficult to evaluate. The motor vehicle manufacturer is best qualified to recommend the brake fluid type required in a specific motor vehicle brake actuating system. Whenever the vehicle manufacturer clearly specifies or otherwise indicates the brake fluid required, service maintenance personnel should use the brake fluid recommended by the vehicle manufacturer.

3.3 Effect of Contaminants Upon the Performance of Motor Vehicle Brake Fluids—Commercial brake fluids are susceptible to various types of contamination which can be detrimental to the performance and safety of brake actuating systems.

3.3.1 CONTAMINATION WITH PETROLEUM PRODUCTS—Due to the color and visual appearance of motor vehicle brake fluids, accidental or inadvertent contamination with petroleum products can occur, unless specific precautions are taken to prevent this type of contamination. Usually engine or transmission oils will partially separate from brake fluid when the percentage of such oil contamination is in excess of 1%. Petroleum distillates, cleaning solvents, or fabric cleaners are miscible with brake fluids in higher percentages before any visual separation occurs. Petroleum type contaminants will normally cause a visual cloudiness or opaque appearance when present in brake fluids.

"Hydraulic brake fluid" can be confused with service products identified as "hydraulic fluid," which may be a petroleum or a synthetic fluid having different chemical and physical properties and which are not intended for use in a motor vehicle brake system.

NOTE— Never use any hydraulic fluid either for motor vehicle brake fluid or in any part of the hydraulic brake system.

Petroleum products are rapidly and selectively absorbed by brake system rubber parts, resulting in a high degree of softening, dimensional swelling, and general deterioration of the functional properties of these rubber parts. This type of brake fluid contamination will result in unsafe braking action, and may be the direct cause of complete brake failure.

Do not use a brake fluid that is cloudy, opaque, an emulsion, separated into layers, or that contains drops of liquid. If petroleum contamination is suspected, dispose of fluid in accordance with all applicable laws and regulations.

3.3.2 CONTAMINATION WITH MISCELLANEOUS AUTOMOTIVE PRODUCTS—Many types of liquid automotive specialty products, solvents, and cleaners are used in service stations, garages, and other establishments where brake service or maintenance is performed. Contamination of motor vehicle brake fluid with any such products will result in a deterioration of many essential performance requirements of the brake fluids, causing improper brake action or actual brake failure.

3.3.3 WATER CONTAMINATION—SAE J1703 and J1704 motor vehicle brake fluids are hygroscopic and absorb moisture when exposed to the atmosphere and in service. Water contamination from any source including mechanical or accidental additions of free water, will appreciably lower the original boiling point of the brake fluid and increase its viscosity at low ambient temperatures. Water contamination may cause corrosion of brake cylinder bores and pistons, and may seriously affect the braking efficiency and safety of the brake actuating system.

3.3.4 CONTAMINATION WITH DIRT OR DUST—Dirt, moisture, and petroleum contaminants can enter the brake system from failure to clean the master cylinder cap before removing it to check the fluid level, or from careless handling of brake fluid or brake system parts in performing other maintenance or service operations. Dust, as well as moisture, can enter the brake system through damaged or improper cylinder boots or gasket seals.

Dirt and dust are abrasive and will score or scratch wheel cylinder seals and bores, resulting in fluid leakage or other operational problems which affect the braking efficiency and the safety of the motor vehicle brake system.

3.3.5 MIXING OF SAE J1703 MOTOR VEHICLE BRAKE FLUIDS—The mixing of different SAE J1703 and J1704 brake fluids will not adversely affect the brake actuating system, but it may adversely affect the resulting properties of the mixture.

4. Recommended Service Instructions for Handling and Dispensing Brake Fluid

4.1 Storage of Motor Vehicle Brake Fluid—Store brake fluid in a dry place at or below room temperature and separate this storage area from similar storage of petroleum products, automotive specialty products, or any fluid materials used for shop maintenance purposes.

Large capacity drum type containers require transfer of brake fluid to some intermediate dispensing container. This type of handling tends to promote or cause contamination. It is recommended that brake fluid be purchased and stocked in container sizes that permit direct transfer of brake fluid from the container to the brake system. It is strongly recommended that containers do not exceed 1 gal in capacity. Brake fluid stock should be rotated to prevent extended storage periods. For servicing the motor vehicle brake system, use SAE specification brake fluid that conforms to the SAE grade recommended by the vehicle manufacturer.

4.2 Dispensing Equipment—Due to the increased possibility of contamination of the brake fluid, the use of auxiliary dispensing equipment should be avoided. When commercial dispensing equipment is used for adding brake fluid to the motor vehicle brake system such equipment must be assigned for use only with brake fluids, must be clean, and must be mechanically designed to eliminate any possibility of contamination of the brake fluid with dirt, petroleum lubricants, or moisture from condensation or exposure to the atmosphere. Any new dispensing equipment should be flushed with the brake fluid and the fluid examined for contamination before placing the unit in service. When a pressure bleeder tank is used, it must be designed to prevent any possible aeration of the brake fluid. Normally, air pressure is applied to the fluid by a mechanism which employs a rubber diaphragm. It is important that the compressed air supply be clean and dry. Many rubber compounds are quite permeable to both air and moisture. Butyl rubber diaphragms have been found superior for this application and should be used.

4.3 Essential Safety Precautions—In the service maintenance of brake systems, the handling and dispensing of motor vehicle brake fluids must be controlled and regulated to avoid any accidental or inadvertent contamination of the brake fluid added to the brake system. The possible toxicity and environmental effects of motor vehicle brake fluid must be considered in terms of any applicable laws and regulations. Obtain Material Safety Data Sheet from manufacturer before handling and disposing of brake fluid. The following are essential specific precautions for handling and dispensing brake fluid:

4.3.1 Store brake fluid only in its original container and keep the container tightly closed. Do not puncture the container to provide a “breather hole.”

4.3.2 Before opening a brake fluid container, remove any dirt or other contamination from the top and other surfaces of the container.

4.3.3 When the brake fluid container is empty, dispose of the container in accordance with all local, state, and federal regulations. Do not reuse container for other liquids.

4.3.4 It is the best practice to pour the brake fluid directly from the original container to the brake system fill point. If the brake fluid is transferred from the original container to a dispenser, such dispensing equipment must be clean and dry and any unused brake fluid must not be poured back into the original brake fluid container. Discard fluid in accordance with local, state, and federal regulations.

4.3.5 Do not transfer brake fluid to a container or dispenser that has been used for oil, kerosene, gasoline, antifreeze, water cleaners, or any other liquids or chemicals. Do not transfer any material or product from a container or dispenser back into a brake fluid container.

4.3.6 In dispensing or storing brake fluids, use equipment that is specifically assigned for brake fluid and preferably used only in work areas assigned for servicing brake systems.

4.3.7 Do not reuse brake fluid from bleeding operations. Discard it in accordance with local, state, and federal regulations.

4.3.8 Do not spill brake fluid on brake linings or car finish. If spilled on brake lining, the best practice is to replace the lining. If spilled on car finish, do not wipe or rub, but immediately flush area with cold water.

4.3.9 Use only new brake fluid for flushing a brake system and then only in compliance with the vehicle manufacturer's service recommendations. Do not use flushing fluids, alcohol, or other solvents.

4.3.10 Whenever possible, clean new brake fluid should be used to clean brake parts. The use of alcohol for cleaning should be restricted to disassembled brake units and parts that can be visually inspected to determine freedom from alcohol contamination. Do not use alcohol for flushing assembled brake components or systems. Never use gasoline, kerosene, petroleum products, chlorinated or other type solvents to clean any brake system parts. Use only clean wipers or shop towels. Handle parts with clean and dry hands. Place brake parts on clean paper or clean lint-free cloths.

4.3.11 A clean and dry work area is essential in handling and dispensing brake fluid, in cleaning or handling brake parts, and for work on the brake system proper. Work should not be performed in the presence of air-borne dust, dirt, or water. Whenever possible, it is desirable to separate the area used for servicing or repairing the brake system from areas used for vehicle lubrication or other service or maintenance operations where brake fluid and brake system parts may be likely to become contaminated.

5. Recommended Service Procedures for Filling Brake Master Cylinders

5.1 Safety Precautions—The following are essential specific recommendations and procedures that are based upon acceptable service maintenance practices:

5.1.1 Before opening the master cylinder, clean the filler plug or cap and surrounding area to prevent dirt or grease from entering master cylinder reservoir. If necessary, use a wire brush and wipe area clean.

5.1.2 Do not open the master cylinder outdoors when it is raining or snowing. Do not open the master cylinder in an area where there is airborne dust or dirt that may deposit in the exposed reservoir.

5.1.3 Remove the filler plug or cap. Inspect the vent hole and clean if necessary. If the gasket shows evidence of deterioration or excessive leakage, replace it. If a reservoir sealing diaphragm is used, carefully remove and inspect the diaphragm. If the diaphragm shows evidence of deterioration or excessive leakage, replace the diaphragm with the proper part specified by the vehicle manufacturer. If diaphragm is extended, reset it.

5.1.4 Check the fluid level. Fill the master cylinder reservoir to the fluid level recommended by the vehicle manufacturer. Use brake fluid that conforms to the recommendation by the vehicle manufacturers. If the brake fluid level is below the master cylinder reservoir ports, air has been taken into the system. Frequently, the master cylinder reservoir can be refilled before the air has been forced into the brake lines and this air can be purged from the master cylinder by a few strokes on the brake pedal. When this procedure fails to restore brake pedal pressure and proper braking action, the brake system must be bled to removed trapped air as specified in Section 6.

5.1.5 Seal the master cylinder with the gasket and filler plug or cap. If the master cylinder is equipped with a diaphragm, carefully install it with clean hands or a clean dull tool, then replace the cover and tighten or otherwise seal completely.

5.1.6 Unless otherwise specified by the vehicle manufacturer, check the master cylinder fluid level at least every 6months. Some vehicles are equipped with brake master cylinders that have a brake fluid level indicator or warning device and should be filled when the addition of brake fluid is indicated.

Fluid level checks should be so conducted that no possible brake fluid contamination can occur. The addition of contaminated brake fluid to both reservoirs of a dual or tandem-type master cylinder will cause the failure of the braking system units.

6. Recommended Service Procedures for Bleeding Brake System

6.1 Objectives and Provisions for Bleeding—The pressure applied to a fluid or liquid at one point in a closed system will be transferred to any point in the system that the fluid reaches. By means of the motor vehicle hydraulic brake system, the driver's foot pressure is amplified into a hydraulic pressure which is transferred to the wheel cylinders and converted into a frictional braking force on the wheels. Effective pressure transmission is obtained because brake fluid is relatively incompressible. However, air or other gases can be compressed. Air that is dispersed in brake fluid, or otherwise entrapped in the brake system, is compressible and will cause erratic and unsafe braking action due to loss of brake pedal pressure. The brake system must be bled free of air for the proper functioning of the system.

The presence of air in the brake system is indicated by a "spongy" feeling of the brake pedal when the brakes are applied. The air must be removed from the system by a process called "brake bleeding" before the brakes will function efficiently and safely. The vehicle manufacturer has provided for bleeding through strategically located bleeder screws.

6.2 Bleeding the Motor Vehicle Hydraulic Brake System—Whenever a brake line, brake hose, or other component part of the hydraulic brake system has been disconnected or replaced, when the brake fluid in the system is replaced, or whenever the brake pedal action indicates the presence of air in the system, the brake system must be bled. There are two basic methods of supplying brake fluid for bleeding the brake system, the manual bleeding method and the pressure bleeding method. Both methods require opening and closing of bleeder screws for removal of air. In using either method, the bled fluid is discharged into a glass jar containing new brake fluid. This is done by means of a tube or hose attached to the bleeder screw and immersed in the brake fluid in the jar. The bled fluid is observed for the presence of air bubbles. Bleeding is completed when the expelled brake fluid is free of air bubbles.

The manual bleeding method is normally a two-man operation. It requires one operator to slowly press the brake pedal, actuating the master cylinder to supply brake fluid to the system. Simultaneously, the other operator bleeds the hydraulic brake system.

The pressure bleeding method requires one operator. A brake pressure bleeder is connected to the master cylinder to supply brake fluid under pressure to the system automatically as the operator bleeds the system.

No standardized service procedures for brake bleeding can cover all types of commercial brake systems. The car manufacturer's service instructions for the individual vehicle make and model must be specifically followed. For example, special bleeding sequences are essential for variations in brake design, type of master cylinder, and optional equipment such as power brakes, hydraulic clutch, hill holder, etc. The use of complex pressure control valves and sensing mechanisms in motor vehicle brake systems may require specific or special procedures for brake bleeding. To insure proper bleeding of any brake system, service personnel should follow the vehicle manufacturer's instructions. Failure to follow the vehicle manufacturer's instructions could result in a brake system malfunction.

6.3 General Safety Precautions for Bleeding the Motor Vehicle Brake System—These recommendations are generally applicable to all motor vehicles:

6.3.1 Clean all dirt and grease from and around the bleeder screws before opening.

6.3.2 Follow recommendations and procedures specified in 5.1 for additions of brake fluid to brake master cylinder.

6.3.3 Follow recommendations and applicable precautions, as specified in 4.3 for handling and dispensing brake fluid used in brake bleeding operations.

6.3.4 Check brake hose assembly for evidence of leakage, cracking, abrasions, cuts, or tears in the outer covering before bleeding the system. Replace any brake hose when inspection indicates hose damage.

6.3.5 End of bleeder hose must be completely immersed in brake fluid in the glass jar to permit observation of air bubbles and to prevent air from being returned to the system when the pressure is released.

6.3.6 If the brake fluid drained from the system in bleeding operations shows evidence of abrasive material, cloudiness or severe discoloration, excessive precipitates, or sedimentation, carefully inspect the entire brake system for excessive wear, corrosion, and seal damage. Follow the vehicle manufacturer's service instructions.

6.3.7 After bleeding the system, check for satisfactory brake pedal action.

6.3.8 Do not reuse brake fluid from bleeding operations. Discard it in accordance with local, state, and federal regulations.

7. General Maintenance and Service Recommendations for Motor Vehicle Brake System—Brake fluid is only one factor affecting the operational performance and safety of the brake system. Other components or materials in the brake system can adversely affect the performance of the brake fluid. The following general maintenance and service instructions are minimum recommendations for providing safe and efficient functional performance of the brake fluid. When either brake component parts or brake fluid require replacement in the system, recommendations and specific applicable precautions specified in 4.3, 5.1, and 6.3 should be followed.

7.1 Regular or Persistent Loss of Brake Fluid—Whenever the master cylinder requires frequent or abnormal additions of brake fluid, the brake system should be completely inspected for evidence of fluid leakage. If leakage cannot be completely stopped, the defective component part should immediately be removed and properly repaired or replaced.

7.2 Replacement of Brake Fluid in the Braking System—Brake fluids in the motor vehicle braking system can become contaminated. (See 3.3.) Whenever wheel cylinders and/or calipers are removed for inspection, reconditioning or replacement, or when contamination is suspected, it is strongly recommended that the system be flushed and refilled. Only clean dry brake fluid of the grade recommended by the vehicle manufacturer should be used for both of these procedures. Follow the vehicle manufacturer's recommendations for service brake maintenance and fluid changes. Periodic changes of fluid in aging vehicles are not recommended unless wheel cylinders and calipers are disconnected to prevent any dirt, sludge, or abrasive materials in the system from being flushed into them. Otherwise they may cause scoring or scuffing of pistons, bores, cups, or seals, with possible leakage and system failure. Whenever a change of brake fluid in the system is indicated in the interest of preventive maintenance or safety, and the vehicle manufacturer has not recommended a procedure for changing the brake fluid, the following is recommended:

7.2.1 With all wheel cylinders and calipers disconnected, and using new brake fluid of the type and grade recommended by the vehicle manufacturer, flush all brake lines and hoses.