Service Brake Structural Integrity Test Procedure—Vehicles Over 10 000 lb (4500 kg) GVWR—SAE J294

SAE Recommended Practice
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LAND SEA AIR SPACE

PREPRINT

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Report of Brake Committee approved July 1972. Editorial change March 1978.

1. Scope—This SAE Recommended Practice establishes a method of evaluating the structural integrity of the brake system of all new trucks, buses, and combination of vehicles designed for roadway use and falling in the following classifications:

Truck and bus: Over 10,000 lb (4500 kg) gvwr.

Combination of Vehicles: Towing vehicle over 10,000 lb (4500 kg) gvwr.

2. Purpose—The main purpose of the practice is to evaluate the structural integrity of a vehicle's braking system. However, other areas, such as the steering or suspension system, may also be evaluated during the test provided that the criteria and procedure detailed below are not modified in any way. For repeatability, it is recommended that a brake apply device be utilized whenever possible, since it would eliminate the variations in application times and efforts of different operators.

3. Equipment

3.1 Brake apply device (optional but recommended for hydraulic braked vehicles).

3.2 Calibrated speedometer and odometer.

3.3 Reserve pressure gage (when applicable).

3.4 Pedal force transducer.

3.5 Stop counter.

3.6 Decelerometer (U tube or equivalent).

3.7 Ambient temperature gage.

3.8 Recording equipment: pedal force versus time for hydraulic brake vehicles, brake chamber pressure versus time for air brake vehicles.

3.9 Tire pressure gage.

3.10 Wheel alignment equipment.

3.11 Torque wrench.

3.12 Direct reading temperature instrument (brake lining temperature).

4. Test Preparation

4.1 Calibrate instrumentation as required and note calibration on data sheet.

4.2 Install new brake drums and/or rotors and brake assemblies to the manufacturer's specifications, except all brake fasteners shall be at minimum specified torque on one side of the vehicle and at maximum specified torque on the other side. Record values.

4.3 Adjust brakes per manufacturer's specifications.

4.4 Check wheel geometry of all axles and adjust to manufacturer's mean specifications and record.

4.5 Vehicle test weight to be gvwr or gcwr ±2%. Normally, each axle should be loaded to the maximum axle system weight rating. However, if the sum of the maximum axle system weight ratings exceeds the gvwr or gcwr, the load would normally be distributed over each axle in proportion to the Gross Axle System Weight Rating.

4.6 Install the tires and wheels offered by the manufacturer which produce the largest moment of inertia effect for the vehicle. Tires must be in good condition. Set tire pressure per manufacturer's specifications for vehicle test weight specified in this recommended practice.

4.7 Install plug-type thermocouples in each brake (see SAE J786a (March, 1978)). All thermocouples shall be located in approximate center of the most heavily loaded shoe (where appropriate), one per brake.

4.8 For those vehicles which are equipped with power (air or hydraulic) or power assist brake actuation, the reserve pressure should be set at the vehicle manufacturer's maximum recommended cut-out pressure.

5. General Notes

5.1 All tests are to be conducted on a substantially level (not to exceed a ±1% grade), dry, smooth, hard surfaced roadway of Portland cement concrete (or other surface with equivalent coefficient of surface friction) that is free from loose materials.

5.2 Where vehicles are equipped with a wheel slip brake control system as standard equipment, the control system should be operational during the test. If wheel slip brake control system is optional, it is recommended that the vehicle be tested to this procedure both with and without the wheel slip brake control system installed.

5.3 A spike brake application for hydraulic braked vehicles is accomplished by applying a pedal force of 200 lb (890 N) (100 lb (445 N) overshot permitted) while recording pedal force versus time. Rate of pedal force apply shall be 2500 lb/s (11 kN/s). To achieve this rate, instantaneous rates can vary from 1000 to 4000 lb/s (4–17 kN/s).[1] At least 160 lb (712 N) of the 200 lb (890 N) force shall be within this tolerance. See Fig. 1 for a typical spike brake application curve. Maintain pedal force until vehicle has stopped.

5.3.1 A spike brake application for air brake vehicles is accomplished by a full pedal application such that the air pressure build up at all service brake chambers or air to hydraulic converters reaches 60 psi (413 kPa) in no more than 0.25 s from the start of the pedal movement.

5.4 "Spike" brake applications are to be made in neutral or with clutch disengaged.

5.5 Driving speed between "spike" brake applications to be at the subsequent test speed. Acceleration to all test speeds is to be moderate.

5.6 During all phases of this procedure, note and record any unusual braking or handling characteristics of the vehicle, including excessive pedal travel, brake noise, and wheel slide.

6. Procedure

6.1 Preburnish Check—In order to allow for a general check of instrumentation, brakes, and vehicle function, the following stops are to be run noting pedal force or line pressure for each stop.

No. of Stops—10.

Speed—30–0 mph (48 km/h).

Deceleration—10 ft/s² (3 m/s²).

Interval—1 mile (1.6 km).

6.2 Preburnish "Spike" Brake Application

6.2.1 Make one "spike" brake application from 20 mph (32 km/h) and immediately drive 1 mile (1.6 km) and make another "spike" brake application from 30 mph (48 km/h).

6.2.2 Check brakes and vehicle function by making a stop from 30 mph (48 km/h) at 10 ft/s² (3 m/s²). Note pedal force or line pressure.

6.3 Burnish—Make at least 200 brake snubs at intervals of 1.5 miles (2.4 km), not less than 50 in a series, from 40 to 20 mph (64–32 km/h) at 10 ft/s² (3 m/s²) in normal gear range. Accelerate to 40 mph (64 km/h) at moderate acceleration after each snub and drive 40 mph (64 km/h) between snubs. At every 25th application (minimum), make a full stop from 40 mph (64 km/h), recording all required data on application pressure or pedal force, pedal travel, initial and final brake temperatures.

6.4 Structural Test—This test must be conducted. Make at least 40 20–0 mph (32–0 km/h) forward spike stops, each forward spike stop to be followed by a reverse spike stop from 5–10 mph (8–16 km/h) (estimated). Initial brake temperature for each spike stop should be 200 ±50 F (93.3 ±10 C).

6.5 Optional Endurance Test—This test may be conducted after paragraph 6.4. Make a series of complete stops from 50–0 mph (80–0 km/h) at 3 mile (4.8 km) maximum intervals at maximum deceleration not to exceed 18 ft/s² (5.5 m/s²) (include full rock-back)[1] without sustained wheel lock. (Wheel slip brake control system cycling permitted.) The length of the test series should be based on an evaluation of the most severe intended vehicle usage.

At the first, and at every 25th stop, record line pressure, pedal force (when applicable), and final temperature.

6.6 Inspection

6.6.1 Check and record wheel geometry of all axles.

6.6.2 Check and record torque of all brake fasteners.

6.6.3 Inspect all components of the brake system.

The ϕ symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

[1] Although tolerances of 1000–4000 lb/s (4–17 kN/s) may appear too broad, actual test curves both manual and machine applied, show that instantaneous slopes do vary considerably. Furthermore, 40 lb (178 N) of the 200 lb (890 N) pedal force has been exempted from this rate in order to accommodate the typical dip in the curve, as well as miscellaneous sort duration spikes. Thus, it is intended that the basic slope of the curve should be 2500 lb/s (11 kN/s) for 160 lb (712 N) of the 200 lb (890 N) force. However, slight deviations in the curve must be tolerated in order to achieve this rate.