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INTERNATIONAL
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SURFACE VEHICLE RECOMMENDED PRACTICE

An American National Standard

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(R) SERVICE BRAKE STRUCTURAL INTEGRITY TEST PROCEDURE—VEHICLES OVER 4500 KG (10 000 LB) GVWR

Foreword—This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

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

a. Truck and Bus—Over 4500 kg (10 000 lb) GVWR
b. Combination vehicle—Towing vehicle over 4500 kg (10 000 lb) GVWR

The test consists of two parts: a Structural Endurance Test followed by a Structural Ultimate Strength Test.

1.1 Purpose—The main purpose of the document 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 as follows 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.

2. References

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

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

SAE J2115—Brake Performance and Wear Test Code—Commercial Vehicle Inertia Dynamometer

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 FMVSS PUBLICATIONS—Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

FMVSS 105
FMVSS 121

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3. Equipment

3.1 Brake Apply Device—(Optional but recommended for hydraulic braked vehicles)

3.2 Calibrated Speedometer and Odometer

3.3 Service (Application) Pressure Gauges

3.4 Pedal Force Transducer (Hydraulic Brakes)

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 braked vehicle, brake amber pressure versus time for air brake vehicles.

3.9 Tire Pressure Gage

3.10 Wheel Alignment Equipment—(When steering and suspension system are also tested)

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, brake assemblies and fasteners 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 torque values. Record pertinent brake parameters and specifications.

4.3 Adjust brakes per manufacturer's specifications.

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

4.5 Vehicle test weight to be Gross Vehicle Weight Rating (GVWR) or Gross Combination Weight Rating (GCWR) within ±2%. Each axle should be loaded to the Gross Axle Weight Rating (GAWR) ±5%. However, if the sum of the GAWR exceeds the GVWR 5% or GCWR 5%, the load should be distributed over each axle in proportion to the GAWR/GAWR SUM ratios ±5%.

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 with a minimum of 6 mm (1/4 in) tread at all times during the test. Set tire pressure per manufacturer's specifications for GAWR.

4.7 Install plug-type thermocouple in the most heavily loaded shoe or outboard pad of each brake per SAE J2115.

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 Spike Brake Application

5.3.1 A spike brake application for hydraulic braked vehicles is accomplished by applying 890 N (200 lb) of force on the service brake control in less than 0.15 s. See Figure 1 for a typical spike brake application curve. Maintain pedal force of 890 N ± 89 N (200 lb ± 20 lb) after vehicle has stopped and is motionless.

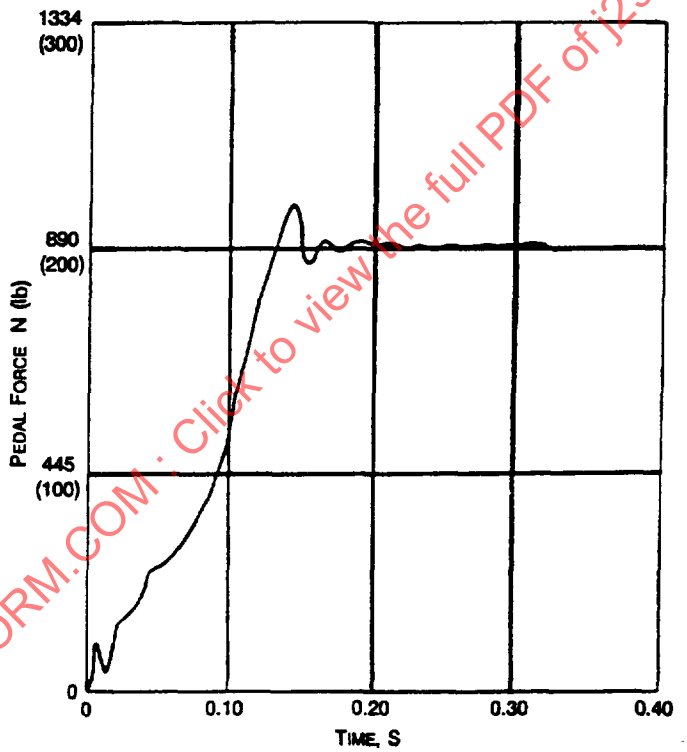

FIGURE 1—TYPICAL SPIKE BRAKE APPLICATION

5.3.2 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 413 kPa (60 psi) in no more than 0.45 s from the start of pedal movement.

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

5.5 Driving speed between all brake applications to be at the subsequent test speed +5/–0 km/h (+3/–0 mph). 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 stop.

a. Number of stops—10
b. Speed—48 km/h (30 mph)
c. Deceleration—3 mpsps (10 fpsps)
d. Interval—1.6 km (1 mile)

6.2 Burnish

6.2.1 Burnish the brakes by making 500 snubs between 64 km/h (40 mph) and 32 km/h (20 mph) at a deceleration rate of 3 mpsps (10 fpsps). Except where an adjustment is specified, after each brake application accelerate to 64 km/h (40 mph) and maintain that speed until making the next brake application at a point 1.6 km (1 mile) from the initial point of the previous brake application. If the vehicle cannot obtain a speed of 64 km/h (40 mph) in 1.6 km (1 mile), continue to accelerate until the vehicle reaches 64 km/h (40 mph) or until the vehicle has traveled 2.4 km (1.5 miles) from the initial point of the previous brake application, whichever occurs first.

6.2.2 The brakes may be adjusted three times during the burnish, in accordance with the manufacturer's recommendations. Manual and automatic adjustment brakes shall be manually adjusted after burnish at a lining temperature of less than 65 °C (150 °F).

6.2.3 Check brake and vehicle function by making three stops from 48 km/h (30 mph) at 3 mpsps (10 fpsps) and 93 °C ± 14 °C (200 °F ± 25 °F) for the hottest brake; record pedal force or line pressure.

6.2.4 For hydraulic brakes, make a service brake application at 667 N (150 lb) pedal force and hold for 30 s, or for air service brakes, make a full service application and hold for 3 min with the engine off. Record pedal position and service pressure at beginning and end of application.

6.3 Structural Endurance Test—Automatic adjustment may be disabled provided operational de-adjustment is prevented.

6.3.1 Perform 80 cycles of the following:

6.3.1.1 24 complete stops from 80 km/h (50 mph) at 3.7 mpsps (12 fpsps) deceleration at 4.8 km (3 mile) intervals.

6.3.1.2 1 reverse spike stop from 8 to 16 km/h (5 to 10 mph) estimated.

6.3.1.3 1 maximum effort (without wheel lock) stop from 80 km/h (50 mph).

6.3.2 Wheel slip brake control system cycling permitted if so equipped. All stops are with full rock-back. After the first, and after every 24th 3.7 mpsps (12 fpsps) stop, record line pressure, pedal force (hydraulic brake), deceleration rate, initial and final temperatures. Record driver comments on brake operation. Check brake adjustment if 3.7 mpsps (12 fpsps) cannot be maintained. Adjust brakes per manufacturer's specifications after 20, 40, 60, and 80 cycles. Record brake adjustments performed throughout the test.

6.3.3 Check brake and vehicle function by making three stops from 48 km/h (30 mph) at 3 mpsps (10 fpsps) and 93 °C ± 14 °C (200 °F ± 25 °F) for the hottest brake; record pedal force or line pressure.

6.3.4 For hydraulic brakes, make a service brake application at 667 N (150 lb) pedal force and hold for 30 s, or for air service brakes, make a full service application and hold for 3 min with the engine off. Record pedal position and service pressure at beginning and end of application.

6.4 Inspection 1

6.4.1 (Optional) Check and record wheel geometry of all axles.

6.4.2 Check and record torque of all brake fasteners.

6.4.3 Inspect all components of the brake system.

6.4.4 Reassemble and adjust brakes per manufacturer's specifications. Manual and automatic adjustment brakes are to be manually adjusted as specified at a lining temperature of less than 65 °C (150 °F). Automatic adjustment may be disabled provided operational de-adjustment is prevented.

6.5 Structural Ultimate Strength Test

6.5.1 Make fifty 32 to 0 km/h (20 to 0 mph) forward spike stops, each forward spike stop to be followed by a reverse spike stop from 8 to 16 km/h (5 to 10 mph) estimated. Initial brake temperature for each spike stop should be 93 °C ± 14 °C (200 °F ± 25 °F) for the hottest brake. All stops are with full rock-back.

6.5.2 Check brake and vehicle function by making three stops from 48 km/h (30 mph) at 3 mpsps (10 fpsps) and 93 °C ± 14 °C (200 °F ± 25 °F) for the hottest brake; record pedal force or line pressure.

6.5.3 For hydraulic brakes, make a service brake application at 667 N (150 lb) pedal force for hydraulic brakes and hold for 30 s, or for air service brakes, make a full service application and hold for 3 min with the engine off. Record pedal position and service pressure at beginning and end of application.

6.6 Inspection 2

6.6.1 (Optional) 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.

7. Notes

7.1 Marginal Indicia—The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

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