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Cooperative Engineering Program

SAE J360 OCT88

**Truck and Bus Grade
Parking Performance
Test Procedure**

SAE Recommended Practice
Revised October 1988

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Ø TRUCK AND BUS GRADE PARKING PERFORMANCE TEST PROCEDURE

1. PURPOSE:

This SAE Recommended Practice establishes a uniform procedure for determining the parking performance on a grade by the parking brake systems of new trucks and buses over 10 000 lb (4500 kg) gross vehicle weight rating intended for roadway use.

2. SCOPE:

This practice establishes methods to determine grade parking performance with respect to:

- 2.1 Ability of the parking brake system to lock the braked wheels.
- 2.2 The vehicle holding or sliding on the grade, fully loaded or unloaded.
- 2.3 Applied manual effort.
- 2.4 Unburnished or burnished brake lining friction conditions.
- 2.5 Down and up grade directions.

3. INTRODUCTION:

The ability to hold a vehicle stationary on a grade involves two performance factors: 1) overcoming the downhill grade force with the parking brake system by preventing rotation of the braked wheels, and 2) having sufficient weight on the braked wheels to prevent the vehicle from sliding on the roadway. By the use of this procedure, the manually applied input effort required to prevent braked wheel rotation can be measured and the stability of a vehicle parked on a grade can be observed.

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4. INSTRUMENTATION:

- 4.1 Force measuring device - 0 - 200 lb (0 - 890 N)
- 4.2 Decelerometer (0 - 1 G)
- 4.3 Temperature measuring device - 0 - 1000°F (0 - 540°C)
- 4.4 Stopwatch

5. TEST PREPARATIONS:

- 5.1 On the brakes applied by the parking brake system, use new lining and drums or discs of original equipment material and install in accordance with the vehicle manufacturer's specifications.
- 5.2 Parking brake assemblies and actuation systems are to be installed, lubricated, adjusted and inspected in accordance with the vehicle manufacturer's specifications.
- 5.3 The vehicle is to be tested in both the fully loaded and unloaded condition. For the purposes of this test procedure fully loaded shall be the manufacturer's gross vehicle weight rating (GVWR) distributed proportionately to individual axle weight ratings (GAWR's).

Unloaded shall be the fully serviced vehicle weight with no payload, with driver and observer on the front seat, and with test equipment. The sequence of testing may be arranged to suit the desired order of vehicle loading and unloading.

- 5.4 Tires are to be of the largest diameter specified for the vehicle, new or not more than 20% worn, and inflated to pressures specified by the vehicle manufacturer.

6. TEST NOTES:

- 6.1 Conduct the test on a dry, smooth Portland cement concrete surface (or other surface of equivalent coefficient of surface friction) that is free from loose materials and has a grade equal to or greater than any specified grade requirement for the test vehicle, as designated in SAE J293.
- 6.2 Brake drums or discs are to be within a temperature range of 40 - 150°F (4 - 66°C) during the test.
- 6.3 With variable input systems, conduct the test to establish the applied manual effort or pressure required to lock the braked wheels. With pressure-applied/mechanically locked actuators, make observations after releasing the application pressure.
- 6.4 With fixed input systems, determine the manual effort required to actuate the system control and observe whether the braked wheels lock or roll.

- 6.5 For vehicles having any equipment (such as driver-controlled interaxle differentials or multi-speed axles), which can be placed in or out of engagement by the driver so as to vary either the number of axles braked or the amount of torque imposed on the parking brake or brakes, conduct the test to determine parking performance under the condition that requires highest parking brake torque and under the condition that requires highest tire-to-road tractive force.
- 6.6 Parking brake systems employing service brakes or those employing non-service brakes for which the manufacturer provides the purchaser with a published burnish procedure need not be tested before burnishing because of the difficulty in obtaining reliable and repeatable preburnish data.
- 6.7 Vehicles equipped with parking brake systems employing cable or rod actuation of service brakes shall be allowed to roll off the grade after each data reading. This will improve repeatability of results by allowing realignment between axle and actuation parts and by removing system hysteresis.
- 6.8 Method of Conducting On-Grade Testing:
- 6.8.1 Place driver selected equipment (see 6.5) in desired condition.
- 6.8.2 Drive the test vehicle up the test grade, stop, and hold with the service brakes.
- 6.8.3 With vehicle declutched or transmission in neutral, allow the vehicle to creep very slowly under control of the service brakes. Slowly apply the parking brake and, as the parking brake energizes, slowly release the service brakes.
- 6.8.4 For variable input systems, record the minimum applied effort or pressure to lock the braked wheels. For fixed input systems, record the applied effort or pressure and observe if the braked wheels are rolling or locked. Observe vehicle stability and record whether vehicle holds for at least 5 min or slides on the grade.
- 6.8.5 Apply service brakes and release the parking brake and repeat test to obtain a minimum of three consistent readings. If the system is a cable or rod actuated service brake, remove vehicle from grade after each reading.
- 6.8.6 Repeat all steps in the down-grade position.
- 6.8.7 Repeat all steps for each test condition of driver selected equipment.

6.9 Data sheets should provide for recording the following data: loaded vehicle weight and items making up the weight, unloaded weight, braked axle weight, identification of equipment affecting braked weight, percent grade or grade angle, indication of whether or not brakes were burnished, direction of vehicle on the grade, condition of driver selected equipment, applied input effort, and observation of wheel roll or lock and vehicle hold or slide.

7. TEST PROCEDURE:

7.1 For vehicles with a parking brake system that does not utilize the service brakes:

7.1.1 Burnish parking brake in accordance with manufacturer's instructions to purchaser. If no instructions are provided, no burnish is to be performed.

7.1.2 Adjust the parking brake and its actuation system in accordance with the vehicle manufacturer's specifications.

7.1.3 Conduct unloaded vehicle test in accordance with 6.8.

7.1.4 Conduct loaded vehicle test in accordance with 6.8.

7.2 For vehicles with a parking brake system that utilizes friction elements of the service brake system:

7.2.1 Burnish the loaded vehicle in accordance with SAE J880.

7.2.2 Adjust the parking brake and its actuation system in accordance with the vehicle manufacturer's specifications.

7.2.3 Conduct loaded vehicle test in accordance with 6.8.

7.2.4 Conduct unloaded vehicle test in accordance with 6.8.

8. REPORTING OF PERFORMANCE:

8.1 Vehicle parking performance shall be expressed as the amount and type of effort or pressure applied to the parking brake system required to lock the braked wheels and whether the vehicle holds or slides on the grade for: a vehicle weight, a percent grade or grade angle, and the condition of driver-selected equipment. The applied effort or pressure shall be the higher value with respect to up and down grade directions. If pertinent to the parking performance, the items making up vehicle weight and their location should be reported.

The phi (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.

RATIONALE:

SAE J293 - Vehicle Grade Parking Performance Requirements
SAE J360 - Truck and Bus Grade Parking Performance Test Procedure
SAE J1452 - Trailer Grade Parking Performance Test Procedure

Proposed revisions to these standards respond to both the need for periodic updating (SAE J293 and J360 were last changed in June, 1972, and November, 1971 respectively) and the assignment of responsibility for these standards to the Truck and Bus Council. Thus, being no longer shared with passenger car/light truck/travel trailer vehicles governed by the Motor Vehicle Council, these standards are applicable only to vehicles with Gross Vehicle Weight ratings over 10 000 pounds.

The draft standards presented here are the harmonized results of Brake Systems Subcommittee and Brake Committee ballots over the past 22 months.

RELATIONSHIP OF SAE STANDARD TO ISO STANDARD:

Not applicable.

REFERENCE SECTION:

SAE J293 JUN72, Vehicle Grade Parking Performance Requirements
SAE J880 MAR85, Brake System Rating Test Code - Commercial Vehicles

APPLICATION:

This SAE Recommended Practice establishes a uniform procedure for determining the parking performance on a grade by the parking brake systems of new trucks and buses over 10 000 lb (4500 kg) gross vehicle weight rating intended for roadway use.

COMMITTEE COMPOSITION:

DEVELOPED BY THE SAE TRUCK AND BUS BRAKE SYSTEMS SUBCOMMITTEE:

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