SAE International™

SURFACE VEHICLE STANDARD

SAE J2118

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Braking Performance—Asphalt Pavers

1. Scope

This SAE Standard specifies brake system performance and test criteria to enable uniform evaluation of the braking capability of self-propelled, rubber-tired and tracked asphalt pavers. Service, secondary, and parking brakes are included.

1.1 Application

This document applies to self-propelled, rubber-tired and tracked asphalt pavers as defined in 3.1 and to these same machines while in service.

1.2 Rationale

At the five-year review, a need was recognized to update SAE J2118 to increase the required brake system stopping and holding performance. It was also recognized that the scope of the document should be broadened to cover both rubber-tired and tracked asphalt pavers to provide one comprehensive document for these machines. In addition, some sections of the document have been revised and new sections added to improve the document by clarifying the use of hydrostatic drives as a service brake system and to make it consistent with other SAE braking documents.

2. References

2.1 Applicable Publication

The following publication forms a part of this specification to the extent specified herein.

2.1.1 ISO PUBLICATION

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 9248—Earthmoving machinery—Units for dimensions, performance, and capacities and their measurement accuracies

3. Definitions

3.1 Asphalt Paver

A self-propelled, rubber-tired or tracked construction machine specifically designed to receive, convey, distribute, profile, and compact paving material by the free-floating screed method.

3.2 Machine Mass

3.2.1 For stopping performance tests, the operating mass of the machine with the heaviest combination of screed (without any fixed screed extensions) and options approved by the manufacturer, with an operator of 75 kg, with the machine fully fueled and serviced, and with the hopper and feeder system empty.

3.2.2 For holding performance tests, the mass is the same as 3.2.1 except the machine hopper is to be filled with a volume of 1600 kg/m3 minimum density material equal to 67% of the hopper-struck capacity.

3.3 Brake Systems

All the components which combine together to stop and/or hold the machine. Such systems consist of the control(s), means of brake actuation, the brake(s), and all parts connecting the brake(s) to the tires or tracks.

3.3.1 SERVICE BRAKE SYSTEM

The primary system used for stopping and holding the machine.

3.3.2 SECONDARY BRAKE SYSTEM

The system used for stopping the machine in the event of any single failure in the service brake system.

3.3.3 PARKING BRAKE SYSTEM

The system used to hold a stopped machine in a stationary position.

3.4 Brake System Components

3.4.1 CONTROL

Component directly activated by the operator to cause a force to be transmitted to the brake(s).

3.4.2 BRAKE ACTUATION SYSTEM

All the components between the control(s) and the brake(s) which connect them functionally.

3.4.3 BRAKE

Component, which directly applies a force to oppose movement of the machine. Brakes, for example, may be friction, electrical, hydrostatic or other fluid types.

3.5 Common Component

A component that performs a function in two or more brake systems.

3.6 Back Throttling

The action of applying slight forward or reverse power to a hydrostatic machine to hold the machine stationary on a slope.

3.7 Stopping Distance

Distance traveled by the machine from the point on the test course at which the brake control actuation begins to the point on the test course where the machine is fully stopped.

4. General Brake System Requirements

4.1 Required Brake Systems

Machines shall be equipped with:

4.1.1 A service brake system.

4.1.2 A secondary brake system.

4.1.3 A parking brake system.

4.2 No brake system shall contain a disconnect such as a clutch or shiftable gearbox which allows disabling the brake(s) with the exception of 4.2.1 and 4.2.2 below.

4.2.1 A brake disconnect designed to allow movement of a disabled machine shall be able to be reapplied immediately or it must be in a location from which it can be operated from ground level.

4.2.2 A power-source disconnect designed for cold-weather starting which also disables the service or secondary brake system shall require application of the parking brake prior to disconnection.

4.3 Service Brake System

All machines shall meet the service brake performance requirements specified in 6.4.1 and 6.5.1.

4.3.1 If other systems are provided with power from the service brake system, any failure in these systems shall be considered the same as a failure in the service brake system.

4.4 Secondary Brake System

All machines shall meet the secondary brake performance requirements specified in 6.5.2.

4.5 Parking Brake System

All machines shall meet the parking brake performance requirements of 6.4.2.

4.5.1 After being applied, this system shall maintain the required parking performance despite any contraction of the brake parts or leakage of any kind. This system shall not be dependent upon an exhaustible energy source.

4.5.2 If the parking brake system is used as the secondary brake system, then the parking brake shall have dynamic stopping capability as defined in 6.5.2.

4.6 The previous systems may use common components. However, a failure of any single component shall not reduce the effectiveness of the machine's stopping capability to less than the secondary stopping performance, as defined in 6.5.2.

4.7 Brake System Controls

All brake system controls shall be capable of being applied from the operator's station. The secondary and parking brake system(s) control(s) shall be arranged so that they cannot be released from the operator's station after any application unless immediate reapplication can be made from the operator's station.

4.8 Warning Device (Stored Energy Sources)

If stored energy is used for the service brake system, that system shall be equipped with a warning device which activates before system energy drops below the greater of 50% of the manufacturer's specified maximum operating energy level or the level required to meet the secondary stopping requirements. The device shall readily attract the operator's attention by providing a continuing visual or audible warning. Gauges indicating pressure or vacuum do not meet this requirement.

5. Brake Test Criterion

5.1 Facilities and Instrumentation

5.1.1 The test course shall consist of a hard, dry surface (ground moisture may be present to the extent that it does not adversely affect the braking surface) with a well-compacted base. The approach will be of sufficient length, smoothness, and uniformity of grade to assure stabilized travel speed of the machine. The test course shall not have more than 3% grade at right angles to the direction of travel. Grade in the direction of travel shall be as specified for the test being conducted.

5.1.2 Instrumentation shall be provided to measure and record the test parameters within the accuracy specified in ISO 9248.

5.2 Test Requirements

5.2.1 Manufacturer's precautions shall be observed while conducting performance tests.

5.2.2 All parameters related to brake systems shall be within the machine manufacturer's specifications; that is, tire size and pressure, brake adjustment, warning-device actuation point, etc. All power-assist pressures shall be within the machine manufacturer's specification range. No manual adjustment(s) shall be made to the brake system during any one performance test.

5.2.3 MACHINE MASS

The machine is to be tested at the machine mass defined in 3.2 as specified for the test being conducted.

5.2.4 Stopping distance is to be measured in meters from the point at which the brake control application begins to the point at which the machine is at rest.

5.2.5 Stopping performance tests are to be conducted from maximum level surface machine speed per the machine manufacturer's specifications.

5.2.6 When the machine transmission provides a selection of gear ratios, the stopping tests shall be conducted with the transmission in the gear commensurate with the test speed specified. The powertrain may be disengaged prior to completing the stop.

5.2.7 The screed shall be carried in the transport position recommended by the manufacturer.

5.2.8 Immediately prior to a test, the machine shall be operated until the engine, transmission, and machine fluids are at normal operating temperature.

6. Performance Tests

6.1 Control Forces

Control forces needed by the operator to meet the required braking performance for the systems defined in Section 4 shall not exceed the values in Table 1:

TABLE 1—MAXIMUM CONTROL FORCES FOR BRAKE TESTS

Control Type	Maximum Force Applied N
Finger Grasp (flip levers and switches)	20
Hand Grasp	
Upwards	400
Downwards	300
Fore-Aft	300
Sideways	300
Foot Pedal (leg control)	600
Foot Treadle (ankle control)	350

6.2 System Recovery (if applicable)

With the machine stationary, the service brake system's primary power source shall have capability of delivering at least 70% of maximum brake pressure measured at the brakes when brakes are fully applied 20 times at 10 s intervals with the engine at maximum governed rpm.

6.3 Warning Device (Stored Energy System)

The service brake system energy shall be reduced by any suitable means. The warning device (see 4.6) shall activate before system energy drops below the greater of 50% of the manufacturer's specified maximum stored energy level or the level required to meet the secondary stopping requirements (see 6.5.2). The warning device shall activate prior to any automatic application of a secondary brake system.

6.4 Holding Performance

All machines shall be tested in both the forward and reverse directions on a test course as described in 5.1.1 with grade as specified as follows:

6.4.1 The service brake system shall be capable of holding the machine on a 30% grade. For machines using hydrostatic drives, back throttling may be used to meet this requirement.

6.4.1.1 For machines using hydrostatic drives as the service brake system, the grade holding requirement in 6.4.1 must be met in low (paving) speed range(s). An alternate minimum grade holding requirement of 20% may be met in high (travel) speed range(s) if the machine being tested is not capable of climbing a grade greater than 20% in high (travel) speed range(s). If the manufacturer chooses to meet this alternate requirement, a warning must be placed on the machine in clear view of the operator that the machine is restricted to a specific maximum grade in high (travel) speed range(s). Machines that can climb a grade greater that 20% in high (travel) speed range(s) must meet the 30% grade holding requirement in all speed ranges.

6.4.2 The parking brake system shall be capable of holding the machine on a 30% grade. The drivetrain(s) shall be disengaged.

6.4.3 If the tests in 6.4.1 and 6.4.2 are impractical, the tests may be carried out either:

6.4.3.1 On a tilt platform (a skid-resistant surface that may be inclined); or

6.4.3.2 By applying a pulling force to the machine with the transmission in neutral on a test course as described in 5.1.1 with no more than 1% grade in the direction of travel. The pulling force shall be applied horizontally near the ground to achieve a minimum force equivalent to the grades specified in 6.4.1 and 6.4.2. The equivalent force in Newtons is obtained from the equation, $F = 9.8 \times \text{Mass} \times \sin \alpha$, where α is the grade in degrees and Mass is in kilograms. The equivalent force is 2.82 times machine mass for a 30% grade and 1.92 times machine mass for a 20% grade.

6.4.4 Parking brake durability: If the parking brake system is also the secondary brake system then the parking brake system shall meet the static holding criteria following 5 dynamic stops from the maximum level speed with no adjustments to the parking brake. Cool down of the parking brake system is allowed between dynamic stops.