

Brake Performance—Rubber-Tired Earthmoving Machines

Foreword—This Document has also changed to comply with the new SAE Technical Standards Board format.

1. Scope—This SAE Standard applies to self-propelled, rubber-tired loaders, tractors, graders, backhoe loaders, tractor-scrappers, excavators, and dumpers as defined in SAE J1057 SEP88. Service, secondary and parking brake systems, and retarders are included.

1.1 Purpose—This document specifies brake system minimum performance and test criteria to enable uniform evaluation of the brake capability of earthmoving machines as defined in the scope.

2. References

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

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

SAE J1057 SEP88—Identification Terminology of Earthmoving Machines

2.1.2 ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 3450—Earthmoving machinery—Wheeled machines—Braking system performance requirements and test procedures

ISO 6165—Earthmoving machinery—Basic types—Vocabulary

ISO 7132—Earthmoving machinery—Dumpers—Terminology

3. Definitions

3.1 Rubber-Tired Earthmoving Machine—Wheeled machines as defined in SAE J1057 SEP88.

3.2 Brake Systems—All the components which participate in stopping and holding the machine. Such systems consist of a control, means of power transmission, brakes, and if the machine is so equipped, the retarder.

3.2.1 SERVICE BRAKE SYSTEM—The primary system used for stopping and holding the machine.

3.2.2 SECONDARY BRAKE SYSTEM—The system used for stopping the machine in the event of any single failure in the service brake system.

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3.2.3 **PARKING BRAKE SYSTEM**—A system used to hold a stopped machine in a stationary position.

3.2.4 **BRAKE SYSTEM COMPONENTS**

3.2.4.1 **Control**—The component directly activated by the operator to cause a force to be transmitted to the brake(s).

3.2.4.2 **Power Transmission Means**—All of the components between the control and the brake(s) which connect(s) them functionally.

3.2.4.3 **Brake(s)**—The component which directly applies a force to oppose movement of the machine. Brakes may, for example, be of friction, electrical, or fluid types.

3.2.4.4 **Retarder**—An energy absorption component normally used to control machine speed while descending grades.

3.3 **Common Component**—A component that performs a function in two or more brake systems.

3.4 **Machine Mass**—Operating mass of the machine up to that mass which includes the heaviest combination of equipment approved by the manufacturer of the machine; an operator of 75 kg; and with the machine fully fueled and serviced.

3.5 **Stopping Distance**—The distance traveled by the machine from the point on the test course at which the machine brake control actuation begins to the point where the machine is fully stopped.

3.6 **Mean Deceleration**—The average rate of change of the velocity of the machine, from the instant the brake control actuation begins until a full stop is achieved. It may be determined from the formula:

$$a = \left(\frac{V^2}{2L} \right) \quad (\text{Eq. 1})$$

where:

a = mean deceleration in meters/second squared

V = velocity in meters/second of the machine immediately prior to brake control actuation

L = Stopping distance in meters.

3.7 **Burnish**—A procedure to condition the frictional surfaces of the machine brake(s).

3.8 **Brake System Pressure**—The gas or hydraulic pressure available at the brake mechanism.

3.9 **Test Course**—The surface upon which the test is conducted.

3.10 **Cold Brakes**—Brakes shall be considered to be "cold" if any of the following conditions are met:

3.10.1 The brakes have not been actuated in the previous 1 h, except in accordance with 6.9.

3.10.2 The brakes have been cooled to 100 °C or less when measured on the brake disc or on the outside of the brake drum.

3.10.3 In the case of totally enclosed brakes, including oil-immersed brakes, the temperature measured on the outside of the housing is below 50 °C, or within the manufacturer's specifications.

4. Instrumentation

4.1 A means to measure and record these parameters within the specified accuracy are listed in Table 1:

TABLE 1—INSTRUMENT ACCURACY

Parameter	Instrument Accuracy Indicated Reading
Brake System Pressure	± 3.0%
Machine Speed	± 3.0%
Machine Mass	± 2.5%
Stopping Distance	± 1.0%
Brake Control Actuating Force	± 3.0%
Grade	± 1.0%

5. General Brake Requirements

5.1 **Required Brake Systems**—All machines shall be equipped with:

5.1.1 A service brake system

5.1.2 A secondary brake system

5.1.3 A parking brake system

5.2 **Common Components**—Brake systems may use common components; however, in the event of a failure of any single component other than a tire, the brake systems shall provide machine stopping capability meeting the secondary brake system performance requirements specified.

5.3 **Service Brake System**—All machines shall meet the service brake performance requirements (see 7.6 and 7.7).

5.3.1 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.

5.3.2 All tractor scrapers and dumpers shall have braked wheels on at least one axle of the prime mover and one axle of each trailing unit. All other machines shall have at least two braked wheels (one right hand and one left hand).

5.4 **Secondary Brake System**—All machines shall meet the secondary brake performance requirements (see 7.6 and 7.7).

5.5 **Parking Brake System**—After being applied, this system shall not be dependent upon an exhaustible energy source. The parking brake system may use common components with other brake systems provided the requirements of 7.5.2 or 7.5.3 are met.

5.6 **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.