SAE International™ SURFACE VEHICLE STANDARD

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Walk-Along Work Machines—Braking Systems—Performance Requirements and Test Procedures

1. ***Scope***—This SAE Standard specifies minimum performance and test criteria for brake systems to enable uniform assessment of the braking capability of walk-along self-propelled work machines with a mass greater than 115 kg. Service and parking brake systems are covered by this document.

2. ***References***

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

2.1.1 ISO PUBLICATIONS—Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002.

ISO 6014—Earth-moving machinery—Determination of ground speed
ISO 6016—Earth-moving machinery—Methods of measuring the masses of whole machines, their equipment and components

3. ***Definitions***—For the purposes of this document, the following definitions apply:

3.1 Walk-Along Work Machine—Self-propelled wheeled or crawler machine controlled by a walking operator.

3.2 Brake System—All the components which combine together to stop and/or hold the machine. Such system consists of a control, means of brake actuation, and the brake(s).

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

3.2.2 PARKING BRAKE SYSTEM—The system used to hold a stopped machine stationary.

3.2.3 BRAKE(S)—Component(s) which applies a force to oppose movement of the machine. Brakes may, for example, be of friction, electrical, hydrostatic, or other fluid types.

3.3 Machine Mass—The maximum operating mass of a machine as specified by the manufacturer of the machine. (Ref. ISO 6016)

3.4 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 stationary.

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3.5 Maximum Machine Level Surface Speed—Machine speed determined in accordance with ISO 6014, or equivalent.

4. General Requirements

4.1 A means which satisfies the service brake and parking brake requirements shall be provided for stopping and holding the machine.

4.2 Ground drive systems which satisfy the braking requirements in 6.1 and 6.2 of this document are acceptable as the braking means.

4.3 The brake system shall not contain a disconnect such as a clutch or shiftable gear box which allows the brake(s) to be disabled unless the disconnect control is at the operator's position and it can be immediately reengaged during machine movement.

4.4 Brake Controls

4.4.1 GENERAL—The brake system(s) controls shall be capable of being applied by the operator from the normal operating position.

4.4.2 CONTROL FORCE—The force to actuate the brake control shall not exceed 20 N for finger (flip levers and switches) actuation and 220 N for hand grasp actuation.

5. Test Conditions

5.1 Manufacturers precautions shall be observed while carrying out performance tests.

5.2 The test course shall consist of a hard, dry surface with a well-compacted base and a slope no greater than 3% transversely. The slope in the direction of travel shall be as specified for the test being conducted.

5.3 The test machine mass shall be as specified in 3.3.

5.4 The test machine shall be configured for operating in the transport position as recommended by the manufacturer.

5.5 Immediately prior to the tests, the machine shall be operated until the brake and drive systems are at normal operating temperature.

6. Test and Performance Criteria

6.1 Service Brake

6.1.1 REQUIREMENTS—A means shall be provided for stopping and holding the machine's motion in both forward and reverse directions.

6.1.2 PROCEDURE

6.1.2.1 *Stopping*—The machine shall be tested at maximum forward and maximum reverse speeds. When testing a machine equipped with separate clutch and brake controls, the clutch shall be disengaged simultaneously with brake engagement. The test course shall be as described in 5.2 with no more than 1% slope in the direction of travel.

6.1.2.2 *Holding*—The machine shall be tested on a 25% slope, or if less, the maximum slope the machine can ascend. An alternate test method is to apply a pulling force to the stationary machine on a level surface with the service brake system applied. The pulling force shall be applied horizontally below the center of gravity to achieve a minimum force equivalent to the slope (for a slope of 25%, the equivalent force in Newtons is 2.38 times the machine mass in kg.).

6.1.2.3 *Acceptance*—The braking system shall stop the machine from its maximum forward and reverse speeds in a distance of not more than 0.2 m for each kilometer per hour travel speed and shall hold the machine stationary on a 25% slope, or if less, the maximum slope the machine can ascend.

6.2 Parking Brake

6.2.1 REQUIREMENTS—A means shall be provided for holding the machine stationary unless it can be manually turned perpendicular to a 20% slope. The parking brake may be in combination with the service brake. After being applied, the system shall not be dependent upon an exhaustible energy source. If the ground drive system serves as the parking brake, actuation of a control with the engine off shall not result in machine movement on the test slope unless it can be immediately reapplied and stop the machine. If chocks are used to meet parking brake requirements, instructions for their use and storage on the machine must be provided.

6.2.2 PROCEDURE—The machine shall be positioned on a 20% slope with the parking brake system applied. An alternate test method is to apply a pulling force to the stationary machine on a level surface with the parking brake system applied. The pulling force shall be applied horizontally below the center of gravity to achieve a minimum force equivalent to the 20% slope (the equivalent force in Newtons is 1.92 times the machine mass in kg.).

6.2.3 ACCEPTANCE—The parking brake system shall hold the machine stationary with the engine off and the ground drive in neutral (if applicable) in both forward and reverse directions.

7. Test Report

7.1 The test report shall contain the following information:

a. reference to this document
b. type of machine
c. model and serial number of the test machine
d. mass of the machine as tested
e. manufacturer's approved maximum machine mass
f. tire or track size
g. description of the brakes
h. type of brake system
i. slope of the test course or force applied
j. results of all brake tests
k. force levels applied to the controls
l. machine maximum level surface speed
m. date test was performed
n. signature of person performing the test
o. manufacturer of machine

PREPARED BY THE SAE OPERATOR PROTECTION BRAKING COMMITTEE

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