Minimum Performance Criteria for Braking Systems for New Off-Highway Dumpers — SAE J1224

SAE Recommended Practice
Approved April 1978

THIS IS A PREPRINT WHICH IS SUBJECT TO REVISIONS AND CORRECTIONS. THE FINAL VERSION WILL APPEAR IN THE 1979 EDITION OF THE SAE HANDBOOK.

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LAND SEA AIR SPACE

PREPRINT

MINIMUM PERFORMANCE CRITERIA FOR BRAKING SYSTEMS FOR NEW OFF-HIGHWAY DUMPERS—SAE J1224

SAE Recommended Practice

Report of Off-Road Machinery Technical Committee approved April 1978. Rationale statement available.

1. Scope—Minimum performance criteria for service braking systems, secondary stopping systems, and parking systems for newly manufactured dumpers are provided in this recommended practice. This practice is not intended for in-service machines. Refer to the Addendum for machine identification.

2. Purpose

2.1 To define minimum braking system performance for newly manufactured machines.

2.2 To provide test criteria by which machine braking system performance may be verified.

3. Braking Systems—All machines shall be equipped with the following systems:

3.1 Service Braking System—The system of any type used for stopping and holding the machine.

3.2 Secondary Stopping System—The system used for stopping in the event of any single failure in the service braking system.

3.3 Parking System—A system to hold a stopped machine stationary.

Note: The above braking systems may use common components. However, a failure of a common component shall not reduce the effectiveness of the stopping capability of the machine below the secondary stopping performance as defined in Section 4.2.1.

4. Braking Systems Performance

4.1 Service Braking System

4.1.1 Stopping Performance—The service braking system, when tested in accordance with Section 5, shall stop and hold the machine stationary within the distance specified in Table 1.

4.1.2 System Recovery—With the machine stationary, the primary power source of the service braking system shall have capability of delivering at least 70% of maximum brake pressure measured at the brakes when the brakes are fully applied twelve times at the rate of four applications per minute with the engine at maximum governed rpm.

4.1.3 Warning Device—The service braking system using stored energy shall be equipped with a warning device which actuates before system energy drops below 50% of the manufacturer's specified maximum operating energy level.

The device shall be readily visible and/or audible to the operator, and provide a continuous warning. Gages indicating pressure or vacuum shall not be acceptable to meet these requirements.

4.2 Secondary Stopping System

4.2.1 Stopping Performance—The secondary stopping system when tested in accordance with Section 5 shall stop the machine within the distance shown in Section 5.2.5.2.

4.2.2 Application—The secondary system shall be capable of being applied by a person seated in the operator's seat. The system shall be arranged so that it cannot be released from the operator's seat after any application unless immediate reapplication can be made from the operator's seat to stop the machine.

4.2.2.1 In addition to the manual control, the secondary stopping system may also be applied automatically. If an automatic secondary stopping system is used, the automatic application shall occur after the warning device is actuated.

4.3 Parking System

4.3.1 Parking System Performance—The parking system shall have capability to hold the machine stationary in the forward and reverse directions in accordance with Section 5.1.1.2.

4.3.2 Application—The parking system shall be capable of being applied by a person seated in the operator's seat. The system shall be arranged so that it cannot be released from the operator's seat after any application unless immediate reapplication can be made from the operator's seat to hold the machine.

4.3.3 Remain Applied—The parking system when applied shall maintain the parking performance in compliance with Section 4.3.1 despite any contraction of the brake parts, exhaustion of the source of energy, or leakage of any kind.

5. Brake Test Criteria

5.1 Facilities and Instrumentation

5.1.1 Test Courses—Safety precautions should be observed in selection of the test sites.

5.1.1.1 Service and Secondary Brake Test Course—The test course shall consist of a surface which provides a rolling resistance not greater than 2%, of adequate length to conduct the test on a 9–10% downgrade in the direction of machine travel. The approach shall be of sufficient length, smoothness, and uniformity to assure reaching the test speed of the machine. The braking surface shall not have more than 3% grade at right angles to the direction of travel.

5.1.1.2 Parking Brake Test Course—The test course shall consist of a surface on a 15% grade which provides a rolling resistance not greater than 2%. The braking surface shall not have more than 3% grade at right angles to the direction of machine travel.

5.1.2 An instrument with an accuracy of ±1% to measure the stopping distance.

5.1.3 A means to measure the test speed with an accuracy of ±5% of actual speed.

5.1.4 A means for determining the machine mass (weight) with an accuracy of ±2%.

5.1.5 A means for measuring the braking system energy source level with an accuracy of ±5%.

5.1.6 A means for measuring the force required by the operator to actuate the braking system with an accuracy of ±5%.

5.2 Test Requirements

5.2.1 All tests are to be conducted with the applicable system fully charged.

TABLE 1—SERVICE SYSTEM STOPPING DISTANCE

Machine Speed—km/h			
24	32	40	48
Maximum Average Stopping Distance—Metres			
24	43	68	97

Machine Speed—mph			
15	20	25	30
Maximum Average Stopping Distance—Feet			
81	143	224	323

The 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.

5.2.2 The test machine is to be loaded to the manufacturer's gross machine weight rating and distribution.

5.2.3 Stopping distance is to be measured in metres (feet) from the point at which the brake control of the machine is applied to the point at which the machine is stopped.

5.2.4 Brakes must be burnished and adjusted to the machine and brake manufacturers' recommended procedure if required.

5.2.5 Stopping Tests for Compliance

5.2.5.1 Service Braking System–Stopping tests shall be conducted from a machine speed of 48 km/h (30 mph) or manufacturer's designed maximum speed if less than 48 km/h (30 mph). The stopping distance shall be the average of five successive stops at 10–20 min intervals between stops. No single stop shall exceed 1.13 times the stopping distance shown on Table 1 for the appropriate speed. The service brakes must be functionally operable after completion of the test.

5.2.5.2 Secondary Stopping System–A single test shall be conducted from a machine speed of 24 km/h (15 mph). The stopping distance shall not exceed 60 m (200 ft).

5.2.6 Stopping tests shall be conducted with the transmission in the gear commensurate with the speed required in Sections 5.2.5.1 and 5.2.5.2.

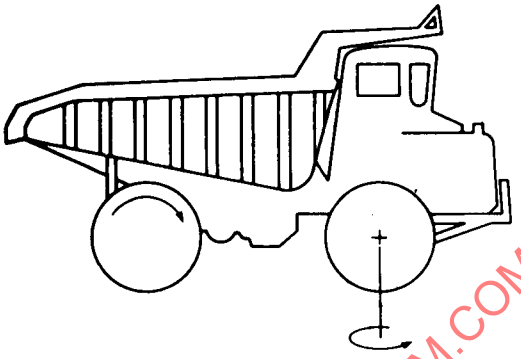
5.2.7 Auxiliary retarders shall not be used in the service braking tests. On machines so equipped, it is permissible to use the auxiliary retarder prior to, and during the secondary stopping system test. An auxiliary retarder is an energy absorbing device normally used to control the speed of the machine while descending grades.

5.2.8 Maximum allowable operator forces to actuate braking systems as defined in Section 3 are 670 N (150 lb) for a foot-operated system, and 400 N (90 lb) for a hand-operated system.

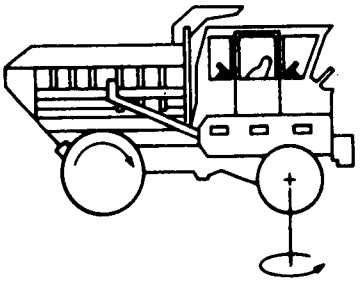
ADDENDUM

MACHINE IDENTIFICATION

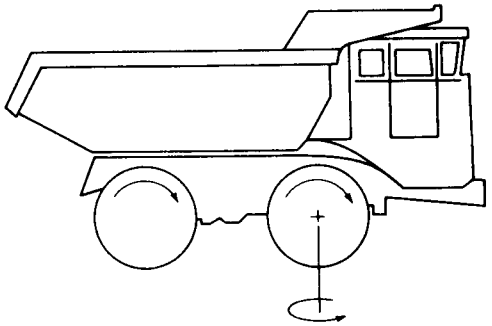
Dumper Definition–A self-propelled vehicle, having an open cargo body, designed to transport and dump or spread material. Loading is done by means external of the dumper. Dumpers include the following types as illustrated below.



TWO AXLES, REAR-AXLE DRIVE



TWO AXLES, REAR-AXLE DRIVE, TWO-WAY SEAT AND CONTROLS



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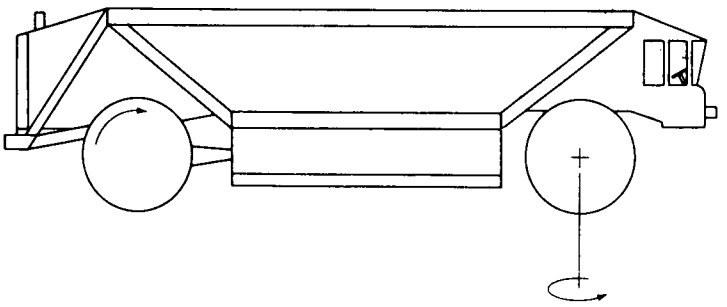

TWO AXLES, REAR ENGINE AND DRIVE