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**Minimum Performance Criteria for
Brake Systems for Off-Highway,
Rubber Tired, Self-Propelled
Scrapers—SAE J319c**

SAE Recommended Practice
Last Revised September 1975

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MINIMUM PERFORMANCE CRITERIA FOR BRAKE SYSTEMS FOR OFF-HIGHWAY, RUBBER TIRED, SELF-PROPELLED SCRAPERS – SAE J319c

SAE Recommended Practice

Report of Construction and Industrial Machinery Technical Committee approved November 1967 and last revised September 1975.

1. **SCOPE**—Minimum performance criteria for service braking systems, emergency stopping systems and parking systems for off-highway, rubber-tired, self-propelled scrapers are provided in this SAE Recommended Practice.

2. PURPOSE

2.1 To define minimum braking system performance for in-service vehicles.

NOTE: This is not a design standard.

2.2 To provide test criteria by which vehicle braking system compliance may be verified.

3. BRAKING SYSTEMS

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

3.2 **Emergency Stopping System**—The system used for stopping a vehicle in the event of any single failure in the service braking system.

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

3.4 **Common Components**—The above braking system may use common components. However, a failure of a common component shall not reduce the effectiveness of the vehicle's stopping capability below the emergency stopping performance as defined in paragraph 4.2.1.

4. BRAKING SYSTEM PERFORMANCE

4.1 **Service Braking System**—All vehicles shall have braked wheels on at least one axle of the prime mover and one axle of each scraper.

4.1.1 **Stopping Performance**—The service braking system, when tested in accordance with section 5 shall stop the vehicle within the distance specified in Table 1.

4.1.2 **Holding Performance**—The service braking system shall have capability equivalent to holding the vehicle stationary on a 25% dry swept concrete grade under conditions as specified in section 5. This criterion shall apply to both forward and reverse directions.

4.1.3 **System Recovery**—With the vehicle stationary, the service braking system's primary power source shall have capability of delivering at least 70% of maximum brake pressure measured at the brakes when the brakes are fully applied twelve (12) times at the rate of four (4) applications per minute with the engine at maximum governed rpm.

4.1.4 **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 **Emergency Stopping System**—All vehicles shall be equipped with an emergency stopping system.

4.2.1 **Stopping Performance**—The emergency stopping system when tested in accordance with section 5, shall stop the vehicle within the distances shown in parenthesis in Table 1.

4.2.2 **Emergency Brake Application**—The emergency system shall be capable of being applied by a person seated in the driver's seat. The system shall be arranged so that it cannot be released from the driver's seat after any application unless immediate reapplication can be made from the driver's seat to stop the vehicle, or combination of vehicles.

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

4.3 **Parking System**—All vehicles shall be equipped with a parking system capable of being applied by a person seated in the driver's seat.

4.3.1 **Parking System Performance**—The parking system shall have capability equivalent to holding the vehicle stationary on a 15% dry swept concrete grade under all conditions of loading. This criterion shall apply to both forward and reverse directions.

4.3.2 **Remain Applied**—The parking system when applied shall maintain the parking performance in compliance with paragraph 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 The test course shall consist of a clean swept, level, dry concrete or other specified surface of adequate length to conduct the test. The approach will be of sufficient length, smoothness, and uniformity of grade to assure stabilized travel speed of the vehicle. The braking surface shall not have over 1% grade in the direction of travel, or no more than 3% grade at right angles to the direction of travel.

5.1.2 An instrument to measure the stopping distance with an accuracy of $\pm 1\%$.

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

5.1.4 A means of determining the vehicle weight.

5.1.5 A means for measuring the braking system energy level.

5.1.6 A means for measuring the braking system actuation effort.

5.2 Test Requirements

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

5.2.2 Test vehicle to be loaded to the manufacturer's gross vehicle weight rating and distribution.

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

5.2.4 Stopping tests to be conducted from a speed of not less than 32 km/h (20 mph) or maximum speed if less than 32 km/h (20 mph).

5.2.5 Stopping test shall be conducted with the transmission in the gear commensurate with the speed required in paragraph 5.2.4. The power train may be disengaged prior to completing the stop.

5.2.6 Auxiliary retarders shall not be used in the test unless the retarder is simultaneously actuated by the applicable brake system control.

5.2.7 Maximum allowable efforts to actuate braking systems as defined in section 3 are 90.7 kg (200 lb) for a foot operated system, and 54.4 kg (120 lb) for a hand operated system.

TABLE 1—BRAKE PERFORMANCE REQUIREMENTS

SI (METRIC) UNITS

Vehicle Weight, kg	Vehicle Speed, kph			
	24	32	40	48
Service Brake Maximum Stopping Distance—Metres (Emergency Brake Maximum Stopping Distance—Metres)				
Up to 23,000	10.9 (26.7)	17.6 (45.8)	26.4 (69.4)	36.4 (98.2)
Over 23,000 to 46,000	14.2 (31.2)	22.1 (51.5)	31.8 (77.0)	43.0 (107.3)
Over 46,000 to 68,000	17.6 (35.8)	26.7 (57.6)	37.3 (84.2)	49.7 (116.1)
Over 68,000	20.9 (40.0)	30.9 (63.3)	43.0 (91.8)	56.4 (125.2)