SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J45

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Brake System Test Procedure—Snowmobiles

1. ***Scope—***This SAE Recommended Practice establishes a uniform procedure for the level surface testing of hand-operated brake systems on recreational noncompetitive snowmobiles.

1.1 Purpose—This procedure offers a method of testing snowmobiles on turf. Turf is preferred over snow because test repeatability is more easily obtained. In addition, tests shall be conducted under winter conditions to ensure that the braking systems remain operative and that the vehicle has no undue tendency to lose stability, overturn, or swerve out of a test lane 1.2 m (4 ft) wider than the vehicle when the brakes are applied. The purpose of the document is to establish brake system capabilities with regard to deceleration or stopping distance versus applied brake lever force, as affected by vehicle speed, brake temperature, and usage.

2. ***References***

2.1 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

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

SAE J44—Service Brake System Performance Requirements—Snowmobiles
SAE J1282—Snowmobile Brake Control Systems

2.1.2 SSCC PUBLICATION—Available from Snowmobile Safety and Certification Committee, 271 Woodland Road, East Lansing, MI 48823.

SSCC 52—Snowmobile Brake Control Systems (Part of SSCC 11—Safety Standards for Snowmobile Product Certification)

3. ***Definitions***

3.1 Brake Lever Force—A steady force applied in a direction normal to the handle grip in the plane of rotation of the hand brake lever at a distance no more than 25.4 mm (1 in) from the end of the control lever. Refer to 5.3.3.

3.2 Deceleration—Average rate of change of vehicle speed during stopping time. Numerically equal to the initial vehicle speed divided by the stopping time. Does not denote instantaneous deceleration at some time during brake application.

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3.3 Average Deceleration—Refers to the average of the previous decelerations over the required number of tests.

3.4 Initial Vehicle Speed—Steady-state vehicle speed immediately prior to brake application.

3.5 Stop Interval— Distance or time between successive brake applications.

3.6 Stopping Distance—Distance vehicle travels from position where brake is applied to position where vehicle comes to a stop.

3.7 Stopping Time—Elapsed time between initial brake application and when vehicle comes to a stop.

3.8 Turf—A consistent and reasonably uniform grassy surface. In this context, does not include root structure.

4. Instrumentation—Instrumentation is required to make the following observations:

a. Brake lever force with an accuracy of ±5%.
b. Specified vehicle speed with an accuracy of ±3 km/h (±2 mph). [1]
c. Actual vehicle speed with an accuracy of ±2 km/h (±1 mph). [2]
d. Stop interval with an accuracy of ±0.1 km (±0.05 mile) on distance, ±5 s on time.
e. Stopping distance or stopping time with an accuracy of ±5%.
f. Current time with an accuracy of ±30 s.
g. Ambient temperature with an accuracy of ±0.5 °C (±1 °F).
h. Deceleration (optional)—may be useful as a guide or indicator.

5. General Instructions

5.1 Brake Assembly—Brakes shall be prepared and adjusted in accordance with the vehicle manufacturer's standard specifications.

5.2 Vehicle Test Weight—Tests shall be conducted with the vehicle loaded to a test weight as determined by Equations 1 or 2:

$$W = C + 75(\pm 2)S \qquad \text{(Eq. 1)}$$

where:

W = test weight, kg
C = curb weight, kg, which is the weight of the vehicle with standard equipment, including maximum capacity of fuel and oil with a total accuracy within ±2 kg
S = the vehicle's designed seating capacity

or

$$W = C + 165(\pm 5)S \qquad \text{(Eq. 2)}$$

1. For example, if a test calls for an initial vehicle speed of 32 km/h (20 mph), a speed less than 29 km/h (18 mph) or more than 35 km/h (22mph) is not acceptable.
2. For example, a recorded actual speed of 34 km/h (21 mph) should be accurate within ±2 km/h (±1 mph).

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where:

W = test weight, lb
C = curb weight, kg, which is the weight of the vehicle with standard equipment, including maximum capacity of fuel and oil with a total accuracy within ±5 lb
S = the vehicle's designed seating capacity

5.3 Test Conditions

5.3.1 TEST SURFACE—Tests shall be conducted on a substantially level (not to exceed ±1% grade), dry turf. The turf shall not exceed 76 mm (3 in) in height. The coefficient of sliding friction between the test surface and the loaded vehicle with its track locked should be established to be within the range of 0.55 to 0.75. When repeated testing results in visible deterioration of the test surface, testing should be moved to a new, unused area.

5.3.2 AMBIENT AIR TREATMENT—Ambient air temperature for all tests shall be between −7 and 27 °C (20 and 80 °F).

5.3.3 BRAKE LEVER FORCE—The brake force shall be applied in a manner equivalent to that shown in Figure 1. The effective brake lever force shall be applied at a point no more than 25.4 mm (1 in) from the end of the control lever in a direction normal to the hand grip and in the plane of rotation of the control lever.

5.3.4 TEST SPEED—Vehicles shall be tested at the specified speed for each test. If the specified speed cannot be obtained, the test speed shall be the greatest achievable speed evenly divisible by 8 km/h (5 mph). (For example: if 61 km/h (38 mph) is the maximum speed achievable, the test speed for the 64 km/h (40 mph) requirement would become 56 km/h (35 mph).) If the maximum achievable speed is less than 8 km/h, the test speed shall be 5 km/h (3 mph).

5.4 Test Observations

5.4.1 During all phases of testing, any unusual performance such as grab, noise, or track skid is to be noted and recorded. Also note and record any uncontrollable braking action causing the vehicle to lose stability, overturn, or swerve out of a test lane 1.2 m (4 ft) wider than the width of the vehicle.

5.4.2 Using stopping distance or stopping time as the test methods, deceleration shall be determined by Equations 3 and 4.

$$A = \frac{1.075\ V^2}{S} \quad \left(A = \frac{0.0386\ V^2}{S}\right) \qquad \text{(Eq. 3)}$$

or

$$A = \frac{1.466\ V}{T} \quad \left(A = \frac{0.278\ V}{T}\right) \qquad \text{(Eq. 4)}$$

where:

A = deceleration, m/s^2 (ft/s^2)
V = initial vehicle speed, km/h (mph)
S = stopping distance, m (ft)
T = stopping time, s

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6. Test Procedure—The test procedure shall conform to the following:

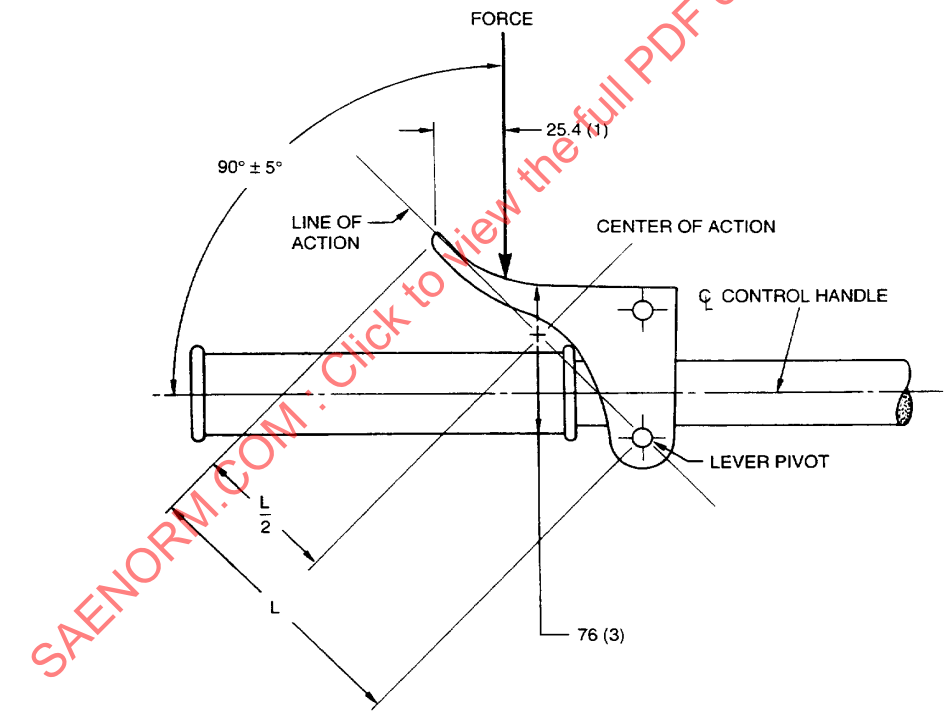
6.1 Preburnish Check

6.1.1 Apply 400 N (90 lb) to the brake lever and note any indication of component or assembly failure. Brake lever may yield or bottom on adjacent element after track is locked.

6.1.2 In order to allow for a general check of brakes, instrumentation, and vehicle operation, the following tests are to be run:

6.1.2.1 Conditions

a. Stops required—5
b. Stop interval—0.8 km (0.5 mile)
c. Initial vehicle speed—48 km/h (30 mph)
d. Brake lever force—Determine the brake lever force to obtain a deceleration of 3 m/s^2 (10 ft/s^2).



NOTE—DIMENSIONS ARE MM (IN)

FIGURE 1—BRAKE LEVER FORCE

6.2 Burnish Procedure—Continue preburnish stops until stable brake performance is achieved or 80% lining contact is obtained.

6.3 Effectiveness Test—Conduct the test and record the actual brake lever force and stopping distance or time for each initial vehicle speed. Stay alert for any hazardous condition which may cause the vehicle to lose stability due to track skid, overturn, or swerve out of the test lane.

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6.3.1 CONDITIONS

a. Stops required—4 at each speed
b. Stop interval—0.8 km (0.5 mile)
c. Initial vehicle speed—32 and 64 km/h (20 and 40 mph)
d. Brake lever force—As required to give not less than 6 m/s^2 (20 ft/s^2) or the minimum for a locked track. No more than 111 N (25 lb) of brake lever force may be applied at any time.

6.4 Water Test

6.4.1 PRELIMINARY PREPARATION—Perform wetting of brakes prior to the test.

a. Wetting time—5 min minimum.
b. Wetting procedure—Wet all friction elements of brake system with a fine water spray.

6.4.2 TEST—Start the test not more than 1 min after wetting brakes. Conduct the test under the following conditions and record stopping distance versus brake lever force.

6.4.2.1 Conditions

a. Stops required—1
b. Initial vehicle speed—32 km/h (20 mph)
c. Brake lever force—That previously established during the effectiveness test 6.3.1d.
d. Deceleration shall be at least 3 m/s^2 (10 ft/s^2).

6.5 Fade and Recovery Test

6.5.1 FADE TEST—Conduct the test under the following conditions and record brake lever force and stopping distance or time. If the time or distance measurements at every stop are not feasible due to course layout, it is permissible to limit measurements to every other stop providing the last stop is recorded. Also record the following:

a. Ambient air temperature at beginning of fade test.
b. Total elapsed time from end of the first fade stop to end of last fade stop.

6.5.1.1 Conditions

a. Stops required—10
b. Stop interval—1 min maximum
c. Initial vehicle speed—64 km/h (40 mph) or maximum vehicle speed, whichever is less
d. Cooling speed—Same as initial speed
e. Brake lever force—That previously established during the effectiveness test to give a deceleration of not less than 6 m/s^2 (20 ft/s^2) from 64 km/h (40 mph). If track locks before obtaining 6 m/s^2 (20 ft/s^2), then reduce the brake lever force to the maximum obtainable without locking the track.

6.5.2 RECOVERY TEST—Allow the brakes to cool and repeat effectiveness test at 64 km/h (40 mph).

6.6 Final Inspection—After completion of all previous tests, disassemble the brakes, inspect, and record all pertinent observations.

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