SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J108

REAF. NOV2007

Issued 1969-07
Reaffirmed 2007-11

Superseding J108 JAN2000

Brake System Road Test Code—Motorcycles

1. ***Scope***—This SAE Recommended Practice establishes a uniform procedure for the level road test of the brake systems of all classes of motorcycles intended for highway use.

1.1 **Purpose**—The purpose of the recommended practice is to establish brake system capabilities with regard to:

1. Deceleration or stopping distance versus input, as affected by vehicle speed, brake temperature, and usage
2. Lining characteristics
3. Drum characteristics

2. ***References***—There are no referenced publications specified herein.

3. ***Section A - Instrumentation***

Line pressure of pedal and lever force gauges
Decelerometer
Direct reading temperature instrument
Speedometer (calibrated)
Odometer (calibrated)
Thermometer - ambient (or ambient sensitive thermocouple)
Optional Instrumentation

Pedal travel gauge
Stopmeter (“fifth wheel,” distance only or shot marker)
Solenoid stop counter
Stopwatch

TO PLACE A DOCUMENT ORDER:
Tel: 877-606-7323 (inside USA and Canada)
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

4. Section B - Installation Details

1. Friction Material Preparation—Attach and finish friction material per manufacturer's specifications.
2. Thermocouples—Install the desired type of thermocouples in each brake. Any one of the following installations may be used:

   a. Plug type. See Figure 1.

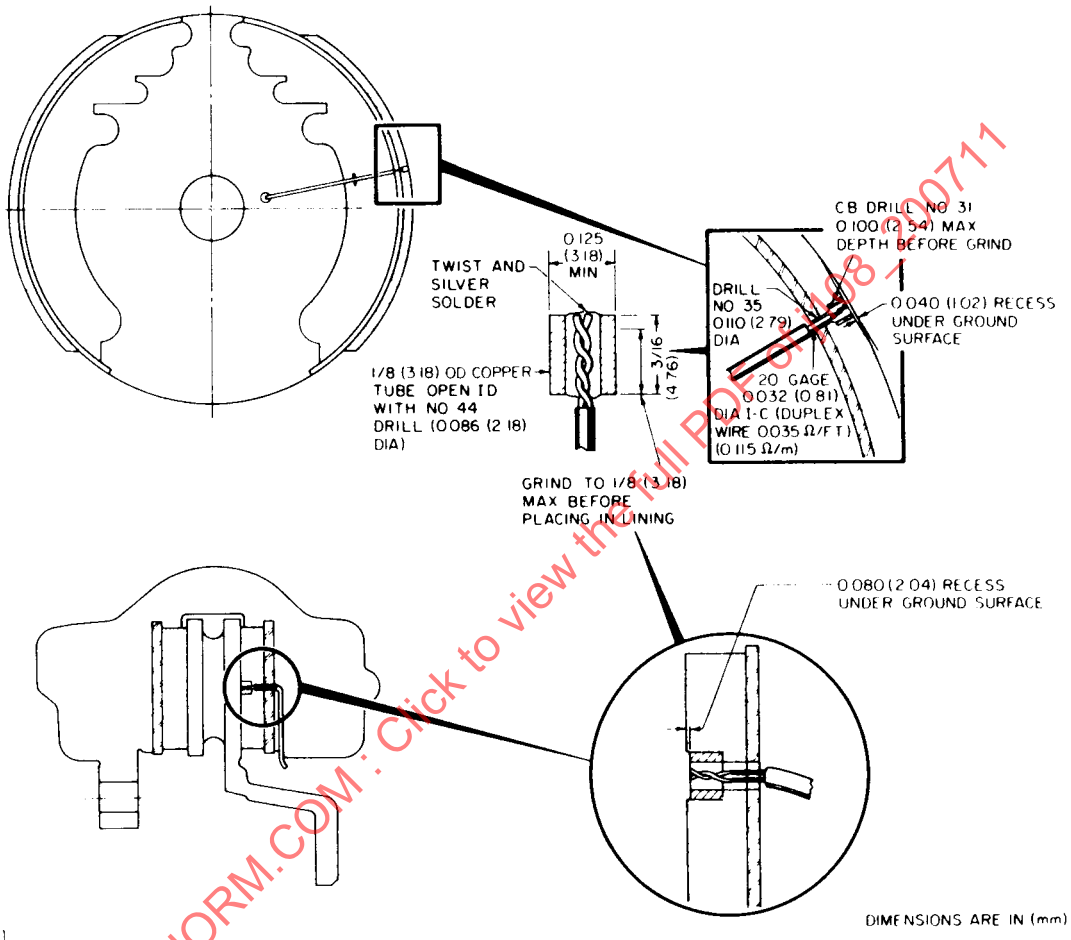

FIGURE 1—TYPICAL PLUG TYPE THERMOCOUPLE INSTALLATION

   b. Web-rim junction type, welded or otherwise, in intimate contact with the brake shoe near the web-rim junction.
   c. Thermocouple inserted in a hole drilled from the lining edge, approximately one-half the width of the lining in depth and as close to the shoe rim as possible.

   All thermocouples are to be located in the approximate center of the most heavily loaded shoe, one per brake (two per brake on double-leading shoe brake).

3. Brake Drum or Rotor—Surface finish and dimensional characteristics (with special emphasis on runout of rubbing surface) of brake drums or rotor shall be in accordance with manufacturer's specifications for each test.

4. Brake Assembly—Brakes shall be prepared in accordance with manufacturer's specifications with special attention to required load characteristics on all brake springs. Adjust brakes to manufacturer's specifications.
5. Vehicle Test Weight—Vehicle test weight (W) in pounds shall be determined by the following formula for all tests:

$$W = C + 150S + P \quad \text{(Eq. 1)}$$

For the Effectiveness Test, the test weight for two-wheeled machines designed to carry more than one person may be determined by the following formula:

$$W = C + 200 \text{ lb} \quad \text{(Eq. 2)}$$

where:

C = curb weight which is the weight in pounds of the vehicle with standard equipment, including maximum capacity of fuel and oil
S = vehicle's designed seating capacity
P = manufacturer's specified payload for three-wheeled motorcycle only

6. Test Conditions

   a. Test Course—Effectiveness, fade and recovery test stops shall be conducted on a substantially level (not to exceed ±1% grade), dry, smooth, hard-surfaced roadway of Portland cement concrete (or other surface with equivalent coefficient of surface friction) that is free from loose materials. Also, guides to indicate 12 ft wide roadway lane shall be provided on the test course.
   b. Ambient Air Temperature—Ambient air temperature at fade and recovery tests shall be between 40 and 90 °F.
   c. Applied Point and Direction of Lever Force and Pedal Force—As shown in Figure 2, the point of application of the lever force shall be one 1.2 in from the end of the brake lever grip and the direction of the force shall be perpendicular, on the plane along which the brake lever rotates, to the handle grip. The point of application of the pedal force shall be the center of the foot contact pad of the brake pedal and the direction of the force shall be perpendicular, on the plane along which the brake pedal rotates, to the foot contact pad.
   d. Test Speed—Vehicles shall be tested at the specified speed for each test. Those vehicles which cannot obtain the specified speed shall be driven at not less than 4 mph nor more than 8 mph below the practical maximum speed with the second number in the speed figure being either 5 or 0. (For example: If 69 mph is the maximum speed, the test speed for the 70 mph requirement would be 65 mph.)

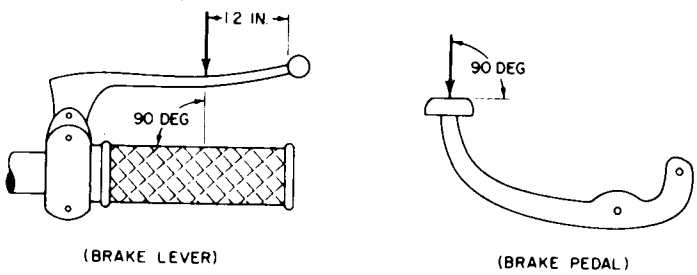

FIGURE 2—

7. Test Procedure

   a. During all phases of this procedure, any unusual performance such as grab, noise characteristics, or wheel skid are to be noted and recorded. Note any uncontrollable braking action causing the vehicle to lose stability, to overturn, or to swerve out of a 12 ft wide roadway lane.
   b. If brakes require warming to prescribed temperature, use the burnish procedure and shorten interval if necessary.
   c. All stops shall be made with the clutch disengaged, or in neutral.
   d. Brake input on the tests other than preburnish check and effectiveness test shall conform to the prescribed value and be held constant during the brake operation.
   e. When a recording decelerometer is used, deceleration shall be determined by the average of four measurements, which are made at the four points dividing the braking time into five equal portions.
   f. When stopping distance is used, deceleration may be determined by the following formula:

$$a = \frac{1.075\ V^2}{S} \qquad \text{(Eq. 3)}$$

   where:

   V = velocity, mph
   S = stopping distance, ft

   g. Initial brake temperature is defined as that of the highest reading thermocouple taken 0.1 mile before stop with the brakes released.

5. Section C - Test Procedure—The test procedure shall conform to the following:

1. Preburnish Check

   a. Brake Operational Check—In order to allow for a general check of brakes, instrumentation, and vehicle operation, the following steps are to be run:

      Conditions:

      Stops Required—10
      Stop Interval—0.5 mile
      Initial Speed—30 mph
      Cooling Speed—30 mph
      Brake Input—Establish brake input to give a deceleration of 10 fpsps

   b. Establishing Brake Input Proportioning—Assuming the above-mentioned test is performed satisfactorily, establish brake input proportioning to be used in the succeeding tests, except effectiveness tests, according to the following procedures. (If one pedal or lever operates all brakes, this step may be omitted.)

      1. Conduct stopping tests at 50 mph (or maximum vehicle speed if 50 mph is not obtainable) with a brake temperature for each brake between 100 and 175 °F before each stop.
      2. The stopping tests should be conducted with the rear brake alone and then the front brake alone. The lever or pedal inputs shall be 5 lb for the first stop and increased at increments not exceeding 10 lb on succeeding stops until sufficient plotting data are obtained. Care should be taken to avoid wheel skid. The average or steady deceleration or total stopping distance shall be measured for each stop.
      3. This information shall then be plotted as deceleration versus pedal and hand lever pressure.
      4. This plot shall then be used to determine the appropriate brake control input force to achieve a 60/40 front to rear retardation proportioning.

2. First Effectiveness Test—Conduct the test and record actual brake input and deceleration at each initial speed. Stay alert for any hazardous condition which may cause the vehicle to lose stability due to wheel skid, to overturn, or to swerve out of the specified width roadway lane.

   a. Conditions for Simultaneous Braking with Both Front and Rear Wheels

      Initial Speed—20, 30, 50, 70 mph
      Initial Brake Temperature (each stop)—100 to 175 °F
      Brake Input—Increase brake input for each initial speed until wheel skid occurs on the rear wheel. Take the front wheel as close to skid as possible

   b. Individual Braking with One Wheel (omit if only one brake control operates all brakes)—Repeat previous test procedure using first the front wheel brake and then the rear wheel brake with conditions the same as in Section C, item 2(a).

3. Burnish Test—Conduct the test under the following conditions and record deceleration versus brake input. After completion of the test, inspect brake system for any unusual condition. Check to make sure that approximately 80% or more lining contact is obtained before proceeding with Second Effectiveness Test. If the lining contact is not satisfactory, repeat Burnish Test. Readjust brakes.

   Stops Required—200 (minimum)
   Initial Speed—30 mph
   Cooling Speed—Same as initial speed
   Initial Brake Temperature (each stop)—150 °F ±10 °F
   Stop Interval—As required to achieve 150 °F ±10 °F initial brake temperature, or a maximum of 1 mile. The 1 mile maximum must be observed even though the initial temperature exceeds 150 °F ±10 °F. In this case, record the initial brake temperature for the 25th, 50th, 100th, 150th, and 200th stop.
   Brake Input—Establish brake input to give a deceleration of 12 fpsps.

4. Second Effectiveness Test—Repeat Section C, item 2—First Effectiveness Test.
5. First Fade and Recovery Test

   a. Baseline Check Stops—Conduct the test under the following conditions, measure deceleration versus input, and record observations:

      Stops Required—3
      Initial Speed—50 mph
      Initial Brake Temperature (each stop)—100 to 175 °F
      Brake Input—Establish brake input to give a deceleration of 15 fpsps

   b. Fade Test—Conduct the test under the following conditions and record deceleration versus brake input. Also, record the following:

      1. Temperatures of all brakes at the end of every stop.
      2. Ambient air temperature at beginning of Fade Test.
      3. Total elapsed time from end of the first fade stop to end of last fade stop.

      Conditions:

      Stops Required—10
      Stop Interval—0.25 mile
      Initial Speed—50 mph
      Cooling Speed—Same as initial speed
      Initial Brake Temperature—First stop only, 150 °F ±10 °F
      Brake Input—Establish brake input to give a deceleration of 15 fpsps for first stop. Use these input forces on all 10 fade stops
      Accelerate to cooling speed moderately.

4. Drive the vehicle for 1 mile at cooling speed after last fade stop and then perform the Recovery Test.

c. Recovery Test—Conduct the test under the following conditions and record deceleration versus brake input. Record, at the same time, observations on the following items:

1. Temperatures of all brakes at the end of each stop.
2. Ambient air temperature at beginning of Recovery Test.
3. Total elapsed time from end of the first recovery stop to end of last recovery stop.

Conditions:

Stops Required—12 (minimum)
Stop Interval—0.5 mile
Initial Speed, Cooling Speed, Brake Input—Same as specified in Section C, item 5(b) - Fade Test
Accelerate to cooling speed moderately

6. First Effectiveness Spot Check—Conduct the test under the following conditions and record deceleration versus brake input:

Stops Required—2
Initial Speed—50 mph
Initial Brake Temperature (each stop)—100 to 175 °F.
Brake Input—Brake input to be the same as in Section C, item 5(a) - Baseline Check Stops

7. First Reburnish—Repeat Section C, item 3—Burnish Test, except:

Stops Required—35 (minimum)

8. Second Fade and Recovery Test—Repeat Section C, item 5—First Fade and Recovery Test.
9. Second Effectiveness Spot Check—Repeat Section C, item 6—First Effectiveness Spot Check.
10. Second Reburnish—Repeat Section C, item 7 - First Reburnish.
11. Final Effectiveness Test—Repeat Section C, item 2 - First Effectiveness Test.
12. Final Inspection—After completion of tests 1 through 11, disassemble all brakes; inspect and record all pertinent observations.
13. Water Recovery Test—Reassemble brakes (Final Inspection).

a. Baseline Check Stops—Conduct the test under the following conditions, measure deceleration versus brake input, and record observations.

Conditions:

Stops Required—3
Initial Speed—25 mph
Initial Brake Temperature (each stop)—100 to 175 °F
Brake Input—Establish brake input to give a deceleration of 8 fpsps

b. Water Recovery Test

1. Preliminary Preparations—Perform wetting of brakes prior to the test.

Wetting Time—2 minutes minimum
Wetting Procedure—Wet all brakes thoroughly by slowly rolling through a trough sufficiently deep to wet the brakes.
Start recovery stops not more than 1 minute after wetting brakes. Do not exceed initial speed prior to recovery stop.