SOCIETY OF AUTOMOTIVE ENGINEERS, INC. • TWO PENNSYLVANIA PLAZA • NEW YORK, NEW YORK 10001

LAND SEA AIR SPACE

TECHNICAL REPORT J108

BRAKE SYSTEM ROAD TEST CODE—MOTORCYCLES AND MOTOR-DRIVEN CYCLES—SAE J108

SAE Recommended Practice

Report of Motorcycle Committee and Brake Committee approved July 1969.

Scope—This SAE Recommended Practice establishes a uniform procedure for the level road test of the brake systems of all classes of two-wheeled motorcycles and motor-driven cycles.

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

1. Deceleration in feet per second per second (fpsps) or stopping distance versus input, as affected by vehicle speed, brake temperature, and usage.
2. Lining characteristics.
3. Drum characteristics.

Section A—Instrumentation

Line pressure of pedal and lever force gages.
Decelerometer (U-tube or equivalent).
Direct reading temperature instrument.
Speedometer (calibrated).
Odometer (calibrated).
Thermometer—ambient (or ambient sensitive thermocouple).

Optional Instrumentation

Pedal travel gage.
Stopmeter ("fifth wheel," distance only or shot marker).
Solenoid stop counter.
Stopwatch.

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 Fig. 1.

(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

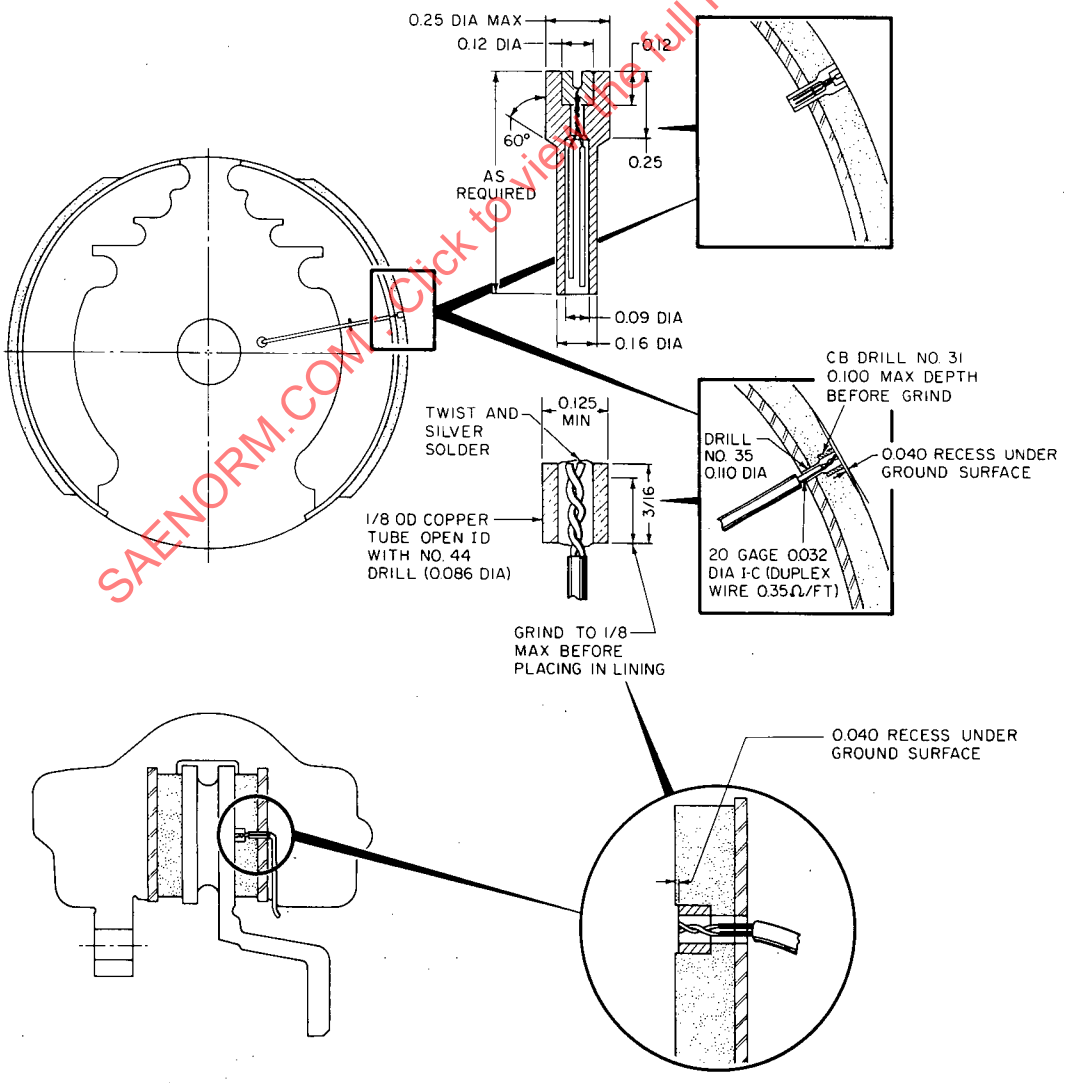

FIG. 1—TYPICAL PLUG TYPE THERMOCOUPLE INSTALLATION

most heavily loaded shoe, one per brake (two per brake on double-leading shoe brake).

3. Brake Drum (or Rotor) and Hub Assembly—New drums (or rotors) are recommended for each test. Surface finish, dimensional characteristics (with special emphasis on runout of rubbing surface) to be in accordance with manufacturer's specifications.

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:

$$W = C + 150\ S$$

For the Effectiveness Test, the test weight may be determined by the following formula:

W = C + 200 lb for machines designed to carry more than one person

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

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 6 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 Fig. 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 3 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.)

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 6 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.

(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:

$$a = \frac{1.075\ V^2}{S}$$

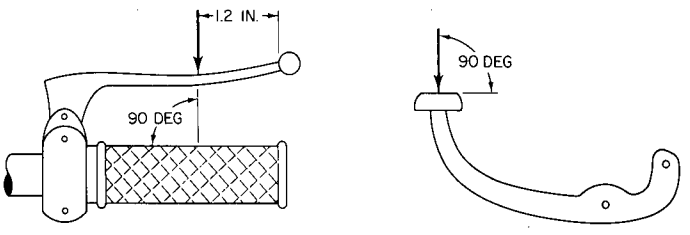

FIG. 2

where:

V = velocity, mph

S = stopping distance, ft

(g) Initial brake temperature is defined as 0.1 mile before stop, brakes off (temperature of brakes on hottest axle).

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

1. Preburnish 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 a deceleration of 10 fpsps.

(a) Establishing Brake Input—Assuming the above-mentioned test is performed satisfactorily, establish brake input to be used in the succeeding tests, except effectiveness tests, according to the following procedure:

(1) Conduct stopping tests at 50 mph or maximum vehicle speed 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 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 lever force to be used for any pedal pressure, using the relationship of 60% for the front and 40% for the rear because of weight transfer.

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 a 6 ft wide 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)—100-175 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—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 ± 10 F.

Stop interval—As required to achieve 150 ± 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 ± 10 F. In this case, conduct the test at that particuar temperature.

Brake Input—Establish brake input as described in Section C, item 1—Preburnish Check, 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 brake input, and record observations:

Stops required—3.

Initial speed—50 mph.

Initial brake temperature (each stop)—100-175 F.

Brake input—Establish brake input as described in Section C, item 1—Preburnish Check, to give a deceleration of 15 fpsps.

(b) Fade Test—Conduct the test under the following conditions and