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

LAND SEA AIR SPACE

TECHNICAL REPORT J843b

BRAKE SYSTEM ROAD TEST CODE—PASSENGER CAR—SAE J843b

SAE Recommended Practice

Report of Brake Committee approved January 1963 and last revised January 1969.

Scope—This SAE Recommended Practice establishes a uniform procedure for the level road test of the brake systems of all classes of passenger cars.

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

1. Deceleration versus input, as affected by vehicle speed, brake temperature, and usage.
2. Brake system integrity.
3. Stopping ability during emergency or inoperative power assist conditions.
4. Water recovery characteristics.

Section A—Instrumentation—

Line pressure or pedal force gage.
Decelerometer (U-tube or equivalent).
Direct reading temperature instrument.
Speedometer (calibrated).
Odometer (calibrated).
Thermometer—ambient (or ambient sensitive thermocouple).
Stopmeter (fifth wheel, distance only).

Optional Instrumentation—

Pedal travel gage.
Solenoid stop counter.
Stop watch.

Section B—Installation Details—

1. Friction Material Preparation—Attach and finish friction material per vehicle 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,

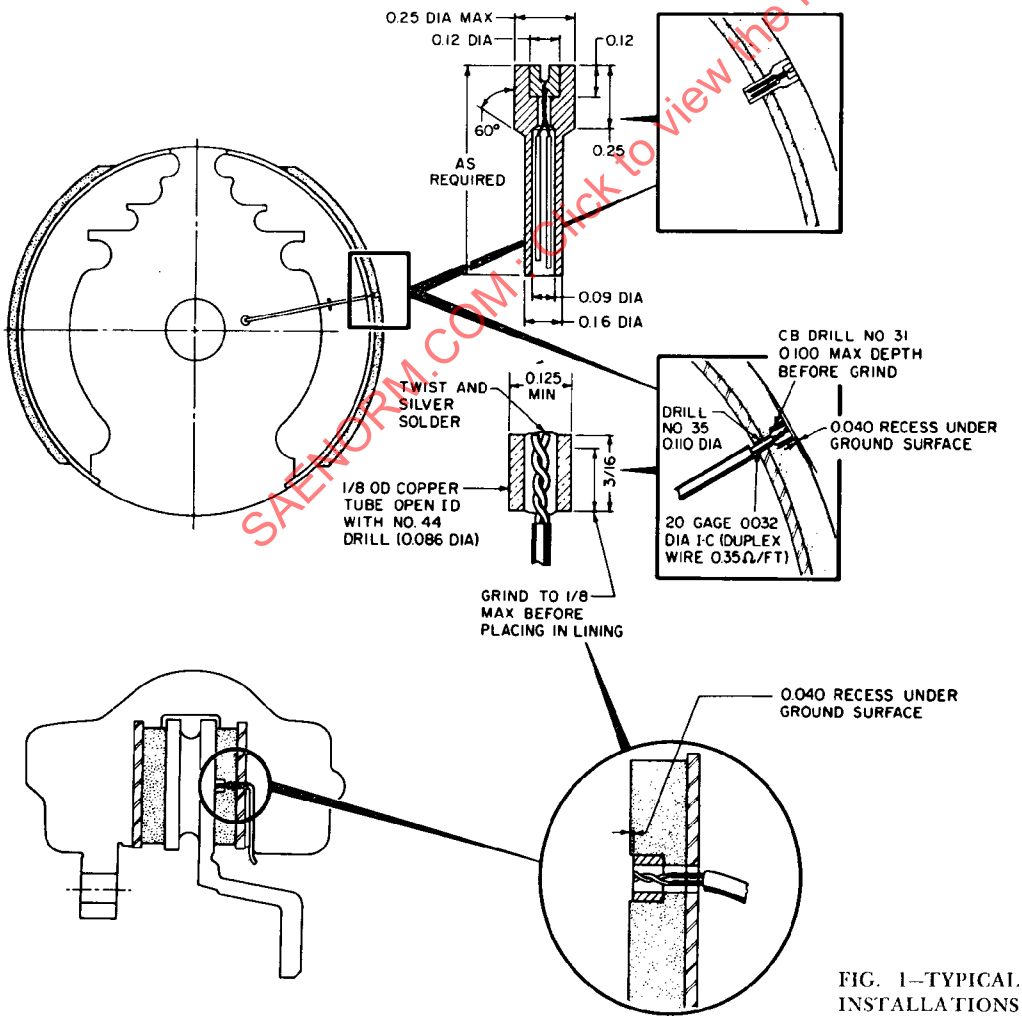

FIG. 1—TYPICAL PLUG TYPE THERMOCOUPLE INSTALLATIONS

approximately one-half the width of the lining in depth and as close to the shoe rim as possible.

All thermocouples to be located in approximate center of the most heavily loaded shoe, one per brake.

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

4. Brake Assembly—Brakes to be prepared in accordance with vehicle manufacturer's specification with special attention to required load characteristics on all brake springs. Adjust brakes to manufacturer's specifications.

5. Vehicle Test Weight—Vehicle manufacturer's recommended axle test loading[1] to be maintained throughout full test procedure.

Section C—Test Procedure—

TEST NOTES—(1) Effectiveness, fade and recovery test stops shall be conducted on a substantially level (not to exceed a ±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. (2) During all phases of this procedure, any unusual performance such as wrap-up or noise characteristics are to be noted and recorded. Note any uncontrollable braking action causing the vehicle to pull or swerve out of a 12 ft wide roadway lane. (3) "Initial brake temperature" defined as 0.2 mile before stop (average temperature of brakes on hottest axle), brakes off. (4) If brakes require warming to prescribed temperature, use burnish procedure and shorten interval if necessary. (5) Because variations in ambient temperature have a significant effect on test results, fade and recovery tests must be conducted within a range of ambient temperature of 40-90 F. (6) Decelerations used in the various fade, recovery, or warmup procedures refer to values at which the decelerometer is held approximately constant during the stop by varying the input pressure. (7) Deceleration and line pressure (pedal force) readings shall not be taken below 5 mph.

1. Preburnish Check—In order to allow for a general check of instrumentation, brakes, and vehicle function, the following stops are to be run: 10 stops, 30-0 mph, 10 fpsps, 1 mile interval, 40 mph cooling speed in normal driving gear.

Record—Maximum line pressure (pedal force).

NOTE: Assuming instrumentation, brakes and vehicle are functioning satisfactorily, proceed immediately with First Effectiveness Test.

2. First (Preburnish) Effectiveness Test—Initial brake temperature, 200 F before each application.

Stop Speed—30 mph and 60 mph (full stops in neutral).

Increments—Curve to be defined to point of incipient skid by adequate number of points.

Record—Deceleration and line pressure (pedal force) and method of brake application (that is, machine or manual). When using manual method, full stops to be defined by maximum line pressure (pedal force) and deceleration. Also note, at the appropriate stop, which wheel or wheels skidded.

3. Burnish—

Stop speed—40-0 mph.

Stop deceleration—12 fpsps (in normal driving gear).

Stop interval—As required to achieve 250 F "initial brake temperature,"[2] or a maximum of 1 mile. NOTE: The 1 mile maximum must be observed even though the initial temperature exceeds 250 F.

Cooling speed—40 mph (moderate acceleration to cooling speed).

Stops required—200.

Optional—Inspect and/or adjust brakes after burnish cycle. Record if either operation is performed.

4. Emergency Brake System Test—This test can be run separately. It need not necessarily be run after Section C, item 3. If run separately, brakes are to be burnished per Section C, item 3.

Initial brake temperature—150 F before each stop.

Procedure—With one-half of system open to the atmosphere, determine the pedal force to cause failure warning system to operate. Determine the pedal force required to provide minimum stopping distance. The maximum pedal force must not exceed 200 lb. Stops are to be made in normal driving gear from 60 mph without leaving a 12 ft lane. Repeat the procedure with only the other half of the system open to the atmosphere.

Record—Pedal force required to actuate failure warning system, maximum pedal force, minimum deceleration, and stopping distance for each failure mode.

[1] Normally curb +600 lb for vehicles of four or more passengers.
[2] See Test Notes, item 3.

5. Inoperative Power System Test—This test can be run separately. It need not necessarily be run after Section C, item 4. If run separately, brakes are to be burnished per Section C, item 3.

Initial brake temperature—150 F.

Procedure—With primary source of power inoperative and its reserve depleted, determine the pedal force required to provide minimum stopping distance. The maximum pedal force must not exceed 200 lb. Stops are to be made in normal driving gear from 60 mph without leaving a 12 ft lane.

Record—Maximum pedal force, minimum deceleration, and stopping distance.

6. Second Effectiveness Test—Repeat item 2, Section C, except add 80 mph stop speed.

7. First Fade and Recovery Test—

(a) BASELINE CHECK STOPS—

Initial brake temperature—150 F before each stop.

Stops required—3.

Stop speed—30-0 mph.

Stop deceleration—10 fpsps (in normal driving gear).

Record—Maximum line pressure (pedal force).

(b) FADE—

Initial brake temperature—150 F before first stop.

Stops required—10.

Stop speed—60-0 mph.

Stop deceleration—15 fpsps (in normal driving gear) or maximum obtainable at 200 lb pedal force (or equivalent line pressure).

Stop interval—0.4 mile.

Cooling speed—60 mph.

Acceleration to cooling speed—Immediate to maximum.

Record—Maximum line pressure (pedal force) and deceleration (if 15 fpsps cannot be held). Initial brake temperature before every stop, all brakes. Ambient air temperature at beginning of run. Total elapsed time from end of the first fade stop to end of the last fade stop—to maintain a check on driver consistency and car performance.

NOTE: Drive 1 mile at 40 mph after last fade stop and make first recovery stop.

(c) RECOVERY—

Stops required—12 minimum.

Stop speed—30-0 mph.

Stop deceleration—10 fpsps (in normal driving gear), or maximum obtainable at 200 lb pedal force (or equivalent line pressure).

Stop interval—1 mile.

Cooling speed—40 mph.

Rate of acceleration to cooling speed—Moderate.

Record—Maximum line pressure (pedal force) and deceleration (if 10 fpsps cannot be held). Initial brake temperatures before every stop, all brakes.

8. First Effectiveness Spot Check—

Initial brake temperature—200 F before each stop.

Stops required—2.

Stop speed—60-0 mph.

Stop deceleration—15 fpsps (in normal driving gear).

Record—Maximum line pressure (pedal force).

9. First Reburnish—Repeat Section C, item 3, except 35 stops required.

10. Second Fade and Recovery Test—Repeat Section C, item 7, except 15 fade stops required.

11. Second Effectiveness Spot Check—Repeat Section C, item 8.

12. Second Reburnish—Repeat Section C, item 9.

13. Final Effectiveness Test—Repeat Section C, item 6.

14. Final Inspection—Disassemble all brakes, inspect and record all pertinent observations.

15. Water Recovery Test—This test can be run separately. It need not necessarily be run after Section C, item 14. If run separately, brakes are to be burnished per Section C, item 3.

(a) BASELINE CHECK STOPS—

Initial brake temperature—150 F before each stop.

Stops required—3.

Stop speed—25-0 mph.

Stop deceleration—8 fpsps (in normal driving gear).

Record—Maximum line pressure (pedal force) for each stop.

(b) WETTING OF BRAKES—

Wetting time—2 minutes minimum.

Wetting procedure—With the brakes fully released, wet all brakes thoroughly by slowly driving through a trough of suitable depth or equivalent method. Start recovery stops not more than 1 minute after wetting brakes. Do not exceed 25 mph prior to recovery stops.

VEHICLE: MAKE _____ MODEL _____ YEAR _____
ENGINE _____ TRANSMISSION _____ AXLE _____
WEIGHT _____LB FRT WT. +_____LB RR WT. +_____LB BALLAST= ____ LB TEST WT.
GENERAL DATA _____
BRAKES: FRONT-SIZE _____ TYPE _____ CYL DIA _____
REAR-SIZE _____ TYPE _____ CYL DIA _____
LINING-FRONT _____ REAR _____
DRUM (ROTOR) TYPE-FRONT _____ REAR _____
MASTER CYL DIA _____ PEDAL RATIO _____ POWER BRAKE: YES ____NO ____TYPE _____
TEST INFORMATION: THERMOCOUPLE INSTALLATION METHOD _____
SPECIAL EQUIPMENT _____
TESTED BY _____ LOCATION _____ DATE _____

TEST PHASE	TEST RESULTS
PREBURNISH CHECK	LB PF
EFFECTIVENESS TESTS 30 MPH AT 20 FPSPS 60 MPH AT 20 FPSPS 80 MPH AT 20 FPSPS	1st 2nd 3rd ____ ____ ____ LB PF ____ ____ ____ LB PF ____ ____ ____ LB PF
EMERGENCY BRAKE TEST WARNING SYSTEM ACTUATION 60 MPH STOPPING DISTANCE	TYPE: POWER MANUAL FRT___RR___LB PF FRT___FT___LB PF RR___FT___LB PF
INOPERATIVE POWER SYSTEM TEST 60 MPH STOPPING DISTANCE	____FT____LB PF
FIRST FADE AND RECOVERY TEST FADE STOPS 1-4 RECOVERY STOPS 1-5 RECOVERY STOPS 6-12	___ . ___ . ___ . ___ LB ___FPSPS BY____ LB ___LB PF MAX

TEST PHASE	TEST RESULTS
PREBURNISH CHECK	LB PF
SECOND FADE AND RECOVERY TEST FADE STOPS 1-8 RECOVERY STOPS 1-5 RECOVERY STOPS 6-12	___ . ___ . ___ . ___ . ___ . ___ . ___ . ___ LB PF ____FPSPS BY ___LB ___LB PF MAX
STABILITY DURING EFFECTIVENESS TESTS	CONTROLLABLE BRAKING BELOW 20 FPSPS: YES____ NO_____
FINAL INSPECTION LINING INTEGRITY MECHANICAL INTEGRITY HYDRAULIC INTEGRITY	YES___ NO____ YES___ NO____ YES___ NO____
WATER RECOVERY TEST AVERAGE BASELINE PF RECOVERY STOPS 4-6 RECOVERY STOPS 7-14 RECOVERY STOP 15	AVERAGE BASE ___ LB PF ____ LB PF MAX ____ LB PF MAX ____ LB PF FROM BASE

COMMENTS _____
REPORTED BY _____ DATE _____

FIG. 2—GENERAL DATA AND SUMMARY SHEET

VEHICLE _____
TESTED BY _____
DATE _____

SECOND EFFECTIVENESS
200F IBT EACH APPLICATION

30 MPH IN NEUTRAL		60 MPH IN NEUTRAL	
PF-LP	FPSPS	PF-LP	FPSPS
SKID			
60 MPH IN NEUTRAL			
PF-LP	FPSPS		
SKID		SKID	

FIRST RECOVERY
30-0 MPH, 10 FPSPS IN GEAR,
1 MILE INTERVAL AT 40 MPH

STOP	FRT. IBT	RR. IBT	PF-LP	COMMENTS
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

FIRST BASELINE CHECK
30-0 MPH, 10 FPSPS IN GEAR, 150F IBT

STOP	PF-LP	COMMENTS
1		
2		
3		

FIRST EFFECTIVENESS SPOTCHECK
60-0 MPH, 15 FPSPS IN GEAR, 200F IBT

STOP	PF-LP	COMMENTS
1		
2		

FIRST FADE
60-0 MPH, 15 FPSPS IN GEAR,
0.4 MILE INTERVAL, 150F IBT FIRST STOP

AMBIENT ____F TIME FOR 10 STOPS____SEC

STOP	FRT. IBT	RR. IBT	PF-LP	COMMENTS
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

FIRST REBURNISH
40-0 MPH, 12 FPSPS IN GEAR,
250F IBT EACH STOP BUT 1 MILE MAX INTERVAL

STOP	PF-LP	COMMENTS
1		
10		
25		
35		

SECOND BASELINE CHECK
30-0 MPH, 10 FPSPS IN GEAR, 150F IBT

STOP	PF-LP	COMMENTS
1		
2		
3		

GENERAL COMMENTS _____

FIG. 4—SECOND EFFECTIVENESS AND FIRST FADE DATA SHEET

VEHICLE _____
TESTED BY _____
DATE _____

INPUT CORRELATION
ENGINE IDLING IN NEUTRAL

PEDAL FORCE - PF	LINE PRESSURE - LP

PREBURNISH CHECK
30-0 MPH, 10 FPSPS IN GEAR, 1 MILE INTERVAL

STOP	PF-LP	COMMENTS
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

BURNISH
40-0 MPH, 12 FPSPS IN GEAR
250F IBT EACH STOP BUT 1 MILE MAX INTERVAL

STOP	PF-LP	COMMENTS
1		
20		
40		
60		
80		
100		
120		
140		
160		
180		
200		

EMERGENCY BRAKE SYSTEM
60-0 MPH IN GEAR
150F IBT EACH APPLICATION

MODE	PF TO ACTUATE WARNING SYSTEM

MODE	PF-LP	FEET

FIRST (PREBURNISH) EFFECTIVENESS
200F IBT EACH APPLICATION

30 MPH IN NEUTRAL		60 MPH IN NEUTRAL	
PF-LP	FPSPS	PF-LP	FPSPS
SKID		SKID	

INOPERATIVE POWER SYSTEM
60-0 MPH IN GEAR
150F IBT EACH APPLICATION

PF-LP	FEET	COMMENTS

GENERAL COMMENTS _____

FIG. 3—INITIAL EFFECTIVENESS, EMERGENCY BRAKE, AND INOPERATIVE POWER SYSTEM DATA SHEET

VEHICLE _____
TESTED BY _____
DATE _____

SECOND FADE
60-0 MPH, 15 FPSPS IN GEAR,
0.4 MILE INTERVAL, 150F IBT FIRST STOP

AMBIENT F TIME FOR 15 STOPS SEC

STOP	FRT. IBT	RR. IBT	PF-LP	COMMENTS
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

SECOND RECOVERY
30-0 MPH, 10 FPSPS IN GEAR,
1 MILE INTERVAL AT 40 MPH

STOP	FRT. IBT	RR. IBT	PF-LP	COMMENTS
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

SECOND EFFECTIVENESS SPOTCHECK
60-0 MPH, 15 FPSPS IN GEAR, 200F IBT

STOP	PF-LP	COMMENTS
1		
2		

SECOND REBURNISH
40-0 MPH, 12 FPSPS IN GEAR
250F IBT EACH STOP BUT 1 MILE MAX INTERVAL

STOP	PF-LP	COMMENTS
1		
10		
25		
35		

FINAL EFFECTIVENESS
200F IBT EACH APPLICATION

30 MPH IN NEUTRAL		80 MPH IN NEUTRAL	
PF-LP	FPSPS	PF-LP	FPSPS
SKID			
60 MPH IN NEUTRAL			
PF-LP	FPSPS		
SKID		SKID	

FIG. 5—SECOND FADE, RECOVERY AND FINAL EFFECTIVENESS DATA SHEET