

BRAKE SYSTEM ROAD TEST CODE-PASSENGER CAR-SAE J843

Recommended Practice

Report of the Brake Committee approved January 1963.

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

SECTION A - INSTRUMENTATION

Line pressure or equivalent gage

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 (5th wheel, distance only)

Solenoid stop counter

SECTION B - INSTALLATION DETAILS

1. **FRICITION MATERIAL PREPARATION** -- Attach and finish friction material per manufacturers' specifications.

2. **THERMOCOUPLES** -- Install the desired type of thermocouples in each brake. Any one of the following installations may be used:

(a) Plug type, set in the lining and ground flush with the lining surface.

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

3. **BRAKE DRUM (OR DISC) AND HUB ASSEMBLY** -- New drums (or discs) recommended for each test. Surface finish, dimensional characteristics (with special emphasis on runout or rubbing surface) to be in accordance with manufacturers' specifications.

4. **BRAKE ASSEMBLY** -- Brakes to be prepared in accordance with manufacturers' specification with special atten-

tion to required load characteristics on all brake springs. Adjust brakes to manufacturers' specifications.

5. **VEHICLE TEST WEIGHT** -- As specified by vehicle manufacturer* (distributed as passenger load) -- 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 $\pm 1\%$ grade), dry, smooth, hard-surfaced road 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. (3) "Initial brake temperature" defined as 0.1 mile before stop, brake off. (4) If brakes require warming to prescribed 200 F use burnish procedure and shorten intervals if necessary. (5) Because variations in ambient temperature have a significant effect on test results, care should be taken in comparing data from tests run at two extremes of ambient temperature.

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.

Optional Preburnish Effectiveness Test

Stop speed -- 30 mph (full stops, in neutral).

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

Brake control temperature -- 200 F (average temperature of brakes on hottest axle) before each application.

Record -- Deceleration and line pressure (pedal force) and method of brake application (i.e., machine or manual). When using manual method, full stops to be defined by initial, sustained, and final line pressure (pedal force) or deceleration (final reading not to include tail-end wrap-up).

NOTE: Assuming instrumentation, brakes, and vehicle are functioning satisfactorily, proceed immediately with burnish phase.

2. BURNISH

Stop speed -- 40-0 mph.

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

Stop interval -- 1 mile.

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

Stops required -- 200 minimum.

Optional -- Inspect and/or adjust brakes after burnish cycle. Record if either operations are performed.

*Normally curb + 600 lb for 4-6 passenger vehicles.

3. FIRST EFFECTIVENESS TEST

Stop speeds -- 30, 60, 80** and 100** mph (full stops, in neutral).

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

Brake control temperature -- 200 F (average temperature of brakes on hottest axle) before each application.

Record -- Deceleration and line pressure (pedal force) and method of brake application (i.e., machine or manual). When using manual method, full stops to be defined by initial, sustained, and final line pressure (pedal force) or deceleration (final reading not to include tail-end wrap-up).

4. FIRST FADE AND RECOVERY TEST

A. Baseline Check Stops

Stop speed -- 30-0 mph.

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

Brake control temperature -- 200 F (average temperature of brakes on hottest axle) before each stop.

Stops required -- 3.

Record -- Sustained line pressure (pedal force).

B. Fade

Stop speed -- 60-0 mph.

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

Stop interval -- 0.4 miles.

Cooling speed -- 60 mph.

Stops required -- 10 unless pedal is floored or 200 lb pedal effort is reached for two consecutive stops.

Brake control temperature -- 200 F (average temperature of brakes on hottest axle) before first stop.

Acceleration to cooling speed -- Immediate and maximum (except not to exceed 8 fpsps).

Record -- Initial, maximum and final line pressure (pedal force). Final should be read at 10 mph. "Initial brake temperature", every stop, all brakes. Ambient air temperature at beginning of run. Total elapsed time from end of the first fade stop to end of last fade stop -- to maintain a check on driver consistency, car performance, and so on.

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

C. Recovery

Stop speed -- 30 mph.

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

Stop interval -- 1 mile.

Cooling speed -- 40 mph.

Rate of acceleration to cooling speed -- moderate.

Stops required -- 12 minimum.

Record -- Sustained line pressure (pedal force). "Initial brake temperature", every stop, all brakes.

5. EFFECTIVENESS SPOT CHECK

Stop speed -- 60-0 mph.

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

Brake control temperature -- 200 F (average temperature of brake on hottest axle) before each stop.

Stops required -- 2.

**These speeds are optional, 80 and/or 100 mph check(s) may be replaced by 5 mph below top speed checks.

Record -- Initial sustained and final line pressure (pedal force) -- (final not to include tail-end wrap-up).

6. FIRST REBURNISH

Stop speed -- 40-0 mph.

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

Stop interval -- 1 mile.

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

Stops required -- 35.

7. SECOND FADE AND RECOVERY TEST -- Repeat First Fade and Recovery Test (Item 4, Section C) except run 15 fade stops instead of 10.

8. SECOND EFFECTIVENESS SPOT CHECK -- Repeat Item 5.

9. SECOND REBURNISH -- Repeat First Reburnish Run (Item 6).

10. FINAL EFFECTIVENESS TEST -- Repeat Item 3.

11. FINAL INSPECTION -- Disassemble all brakes, inspect and record all pertinent observations.

SECTION D -- REPORT FORMS AND GRAPH SHEETS

General Data Sheet, Fig. 1

Burnish and First Effectiveness Data Sheet, Fig. 2

First Fade and Recovery Test Data Sheet, Fig. 3

Second Fade and Recovery Test Data Sheet, Fig. 4

Final Effectiveness Data Sheet, Fig. 5

Sample of Layout of Effectiveness Test Graph Coordinates, Fig. 6

Sample of Layout of Fade and Recovery Test Graph Coordinates, Fig. 7

VEHICLE	
TEST NO.	SHEET OF
TEST CONDUCTED FROM: DATE _____ ODOMETER _____ TO: DATE _____ ODOMETER _____	
TEST LOCATION: _____	
VEHICLE: YEAR _____ MAKE _____ MODEL _____ CO. NO. _____	ENGINE _____ TRANSMISSION _____
WEIGHT: _____ lb FRONT CURB WEIGHT _____ lb REAR CURB WEIGHT _____ lb TEST WEIGHT _____	
GENERAL	
BRAKES: Size - Front _____ Rear _____	Type - Front _____ Rear _____
Lining - Front _____ Rear _____	
Wheel Cylinder - Front _____ in. Dia. _____ Rear _____ in. Dia. _____	
BRAKE DRUM TYPE _____	
MASTER CYLINDER SIZE _____ in. Dia. PEDAL RATIO _____	
POWER BRAKE TYPE _____	
WHEEL SIZE _____ TIRE SIZE _____	
THERMOCOUPLE INSTALLATION METHOD _____	
SPECIAL EQUIPMENT _____	
COMMENTS	
PREBURNISH CHECK (DATE _____ OD _____)	
BURNISH (DATE _____ START OD _____)	
OPTIONAL AFTER BURNISH INSPECT AND ADJUST (DATE _____ OD _____)	
OPTIONAL INSPECT AND ADJUST AFTER FIRST FADE AND RECOVERY (DATE _____ OD _____)	
FIRST CONTINUED BURNISH (DATE _____ START OD _____)	
OPTIONAL INSPECT AND ADJUST AFTER SECOND FADE AND RECOVERY (DATE _____ OD _____)	
SECOND CONTINUED BURNISH RUN (DATE _____ START OD _____)	
FINAL INSPECTION (DATE _____ OD _____)	
COMPLETE PROCEDURE REQUIRED _____ MAN HR AND _____ MILES TO COMPLETE	

Fig. 1 - General data sheet

OPTIONAL BURNISH EFFECTIVENESS TEST				FIRST EFFECTIVENESS TEST			
LINE PRESSURE (PEDAL EFF.)	DECEL- (BRATION)	COMMENT	LINE PRESSURE (PEDAL EFF.)	DECEL- (BRATION)	COMMENT		
30 MPH			30 MPH				
START			START				
OD			OD				
FINISH			FINISH				
OD			OD				
DATE			DATE				
AMB F			AMB F				
BURNISH (DATA OPTIONAL)							
13 FT/SEC ²	DECEL- LINE		50 MPH				
1 MILE INTERVAL	STOP BRATION PRESSURE	COMMENT	START				
40 MPH	NO. FT/SEC ² (PEDAL EFF.)		OD				
COOLING SPEED	10 12		FINISH				
500 STOPS/MINUTES	80 12		OD				
START	30 12		DATE				
OD	40 12		AMB F				
FINISH	80 12						
OD	70 12		MPH				
DATE	80 12		START				
	90 12		OD				
AMBIENT	100 12		FINISH				
TEMP RANGE	110 12		OD				
F TO F	120 12		DATE				
	130 12		AMB F				
	140 12						
	150 12		MPH				
	160 12		START				
	170 12		OD				
	180 12		FINISH				
	190 12		OD				
	200 12		DATE				
			AMB F				
GENERAL COMMENT:							
DRIVER				OBSERVER			

Fig. 2 - Burnish and first effectiveness data sheet

SECOND EFFECTIVENESS TEST				GENERAL TEST COMMENTS:
LINE PRESSURE (PEDAL EFF.)	DECEL- (ACTION)	COMMENT		
30 MPH				
START				
OD				
FINISH				
OD				
DATE				
AMB F				
40 MPH				
START				
OD				
FINISH				
OD				
DATE				
AMB F				
50 MPH				
START				
OD				
FINISH				
OD				
DATE				
AMB F				
60 MPH				
START				
OD				
FINISH				
OD				
DATE				
AMB F				
70 MPH				
START				
OD				
FINISH				
OD				
DATE				
AMB F				
80 MPH				
START				
OD				
FINISH				
OD				
DATE				
AMB F				
90 MPH				
START				
OD				
FINISH				
OD				
DATE				
AMB F				
DRIVER				OBSERVER

Fig. 4 - Second fade and recovery test data sheet

BASELINE CHECK				1. PSI (lb)				2. PSI (lb)			
30 MPH	10 FT/SEC ²	3. PSI (lb)	AVERAGE	PSI (lb)	30 MPH	10 FT/SEC ²	3. PSI (lb)	AVERAGE	PSI (lb)		
FADE	AMBIENT TEMP F DATE	FADE CYCLE TIME	MINUTES								
40 MPH	STOP LINE PRESSURE BRAKE TEMP	AVERAGE BRAKE TEMP	COMMENT								
16 FT/SEC ²	NO. (PEDAL EFF.) LF RF LR RR FRONT RR										
0.4 MILE INTERVAL	1										
	2										
	3										
	4										
	5										
	6										
	7										
	8										
	9										
	10										
	11										
	12										
	13										
	14										
	15										
	16										
RECOVERY	1										
30 MPH	2										
10 FT/SEC ²	3										
1.0 MILE INTERVAL	4										
	5										
	6										
	7										
	8										
	9										
	10										
	11										
	12										
EFFECTIVENESS	1. PSI (lb)	2. PSI (lb)	AVERAGE	PSI (lb)							
SPOT CHECK	COMMENT										
40 MPH											
15 FT/SEC ²											
GENERAL COMMENT:											
DRIVER				OBSERVER							

Fig. 3 - First fade and recovery test data sheet

BASELINE CHECK				1. PSI (lb)				2. PSI (lb)			
30 MPH	10 FT/SEC ²	3. PSI (lb)	AVERAGE	PSI (lb)	30 MPH	10 FT/SEC ²	3. PSI (lb)	AVERAGE	PSI (lb)		
FADE	AMBIENT TEMP F DATE	FADE CYCLE TIME	MINUTES								
40 MPH	STOP LINE PRESSURE BRAKE TEMP	AVERAGE BRAKE TEMP	COMMENT								
15 FT/SEC ²	NO. (PEDAL EFF.) LF RF LR RR FRONT RR										
0.4 MILE INTERVAL	1										
	2										
	3										
	4										
	5										
	6										
	7										
	8										
	9										
	10										
	11										
	12										
	13										
	14										
	15										
	16										
RECOVERY	1										
30 MPH	2										
10 FT/SEC ²	3										
1.0 MILE INTERVAL	4										
	5										
	6										
	7										
	8										
	9										
	10										
	11										
	12										
EFFECTIVENESS	1. PSI (lb)	2. PSI (lb)	AVERAGE	PSI (lb)							
SPOT CHECK	COMMENT										
40 MPH											
15 FT/SEC ²											
GENERAL COMMENT:											
DRIVER				OBSERVER							

Fig. 5 - Final effectiveness data sheet