Technical Report Preprint

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J843a

Brake System Road Test Code - Passenger Car - SAE J843a

SAE Recommended Practice

Report of the Brake Committee approved January 1963 and last revised September 1965.

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 pedal force 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 (fifth wheel, distance only)
Solenoid stop counter
Stop watch

SECTION B - INSTALLATION DETAILS

1. FRICTION 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. (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 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 manufacturers' specifications.

4. BRAKE ASSEMBLY - Brakes to be prepared in accordance with manufacturers' specification with special attention to required load characteristics on all brake springs. Adjust brakes to manufacturers' specifications.

5. VEHICLE TEST WEIGHT - Vehicle manufacturers' recommended axle test loading* -- 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 0.1 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.

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.

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.

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

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 initial, sustained, and final line pressure (pedal force) or deceleration (final reading not to include tail-end wrap-up). Also note, at the appropriate stop, which wheel or wheels skidded.

3. BURNISH

Stop speed - 40-0 mph.

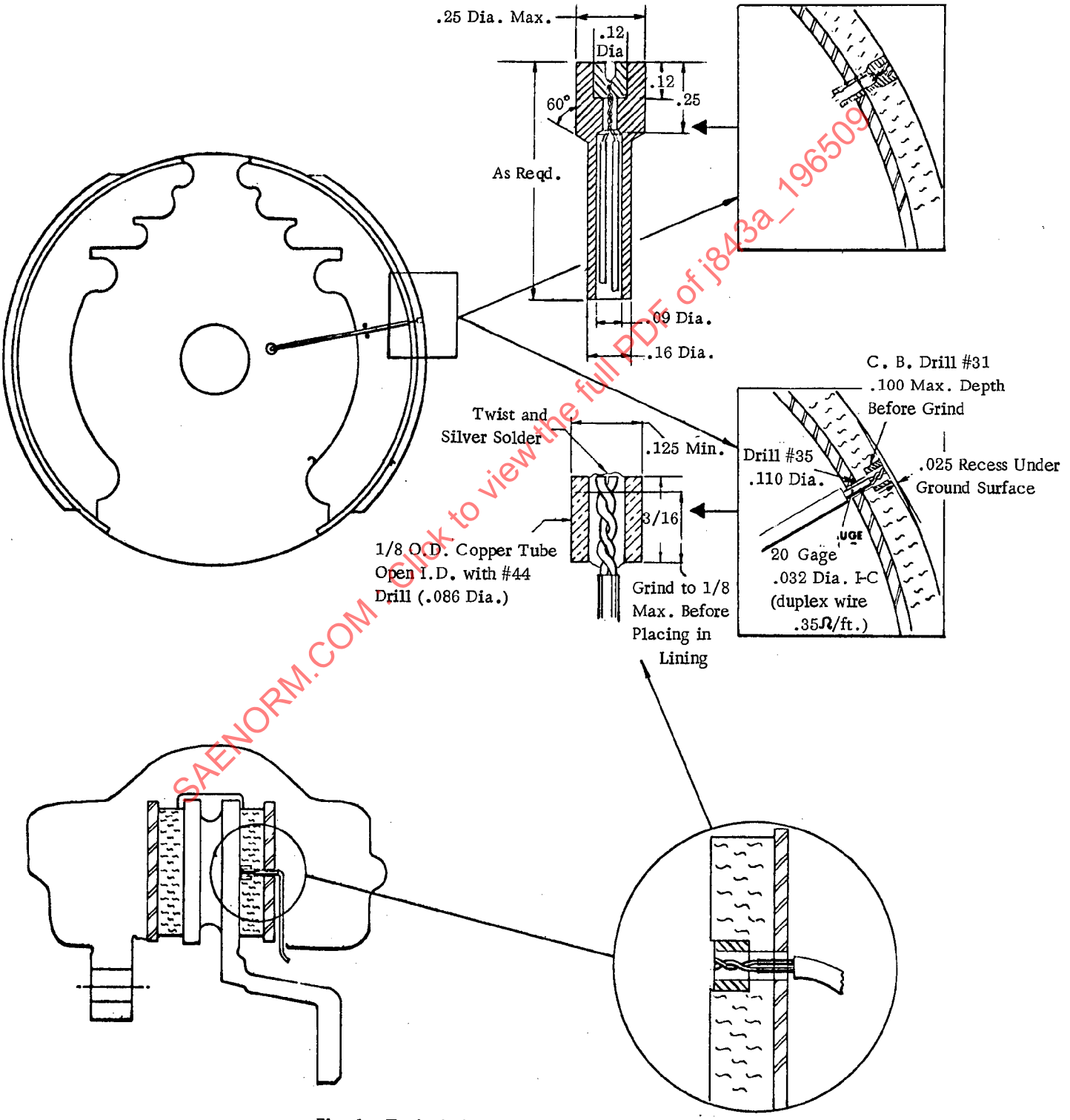

Fig. 1 - Typical plug type thermocouple installations

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

Stop interval - As required to achieve 250 F "initial brake temperature"*, 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. SECOND EFFECTIVENESS TEST - Repeat item 2, Section C, except add 80 mph stop speed.

5. FIRST FADE AND RECOVERY TEST

a. Baseline Check Stops -

Initial brake temperature - 200 F before each stop.

Stops required - 3

Stop speed - 30-0 mph.

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

Record - Sustained line pressures (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 miles.

Cooling speed - 60 mph.

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

Record - Initial, maximum and final line pressures (pedal forces) and decelerations (if 15 fpsps cannot be held). Final readings should be read at 10 mph. Initial brake temperatures 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 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).

Stop interval - 1 mile.

Cooling speed - 40 mph.

Rate of acceleration to cooling speed - moderate.

Record - Initial and sustained line pressures (pedal forces) and decelerations (if 10 fpsps cannot be held). Initial brake temperatures before every stop, all brakes.

6. 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 - Initial, sustained and final line pressures (pedal forces) - (final not to include tail-end wrap-up).

7. FIRST REBURNISH - Repeat item 3, Section C, except 35 stops required.

8. SECOND FADE AND RECOVERY TEST - Repeat item 5, Section C, except 15 stops required.

9. SECOND EFFECTIVENESS SPOT CHECK - Repeat item 6, Section C.

10. SECOND REBURNISH - Repeat item 7, Section C.

11. FINAL INFECTIVENESS TEST - Repeat item 4, Section C.

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

13. OPTIONAL WATER RECOVERY TEST -

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 - Initial and final line pressures (pedal forces) for each stop.

b. Wetting of Brakes -

Wetting time - 2 minutes minimum.

Wetting procedure - 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.

c. Water Recovery Stops -

Stop speed - 25-0 mph.

Speed between stops - 25 mph.

Stop deceleration - 8 fpsps (in normal driving gear) or maximum obtainable at 200 lb pedal force (or equivalent line pressure).

Stop interval - 0.5 mile.

Stops required - 15.

Record - Initial and final line pressures (pedal forces) for each stop and deceleration (if 8 fpsps cannot be held).

SECTION D - REPORT FORMS AND GRAPH SHEETS

General Data Sheet, Fig. 2.

Preburnish, First and Second Effectiveness Test Data Sheet, Fig. 3.

First Fade and Recovery Test Data Sheet, Fig. 4.

Second Fade, Recovery and Final Effectiveness Data Sheet, Fig. 5.

Final Inspection and Water Recovery Test Data Sheet, Fig. 6.

Sample of Layout of Effectiveness Test Graph Coordinates, Fig. 7.

Sample of Layout of Fade and Recovery Test Graph Coordinates, Fig. 8.

*See Test Notes, item 3.

Vehicle _____
Tested by _____
Date _____

VEHICLE YEAR _____ MAKE _____ MODEL _____
ENGINE _____ TRANSMISSION _____ AXLE _____
WEIGHT: _____lb front + _____lb rear + _____ lb ballast= _____lb GVW
WHEEL & TIRE SIZE _____ TC INSTALLATION _____
BRAKES FRONT: TYPE _____ SIZE _____ CYL.DIA. _____
REAR: TYPE _____ SIZE _____ CYL.DIA. _____
LINING: FRONT _____ REAR _____
POWER BRAKE _____ MASTER CYL.SIZE _____ PEDAL RATIO _____
TEST INFORMATION TESTED BY _____ LOCATION _____
START: ODOM. _____ DATE _____ FINISH: ODOM. _____ DATE _____

SUMMARY OF PERFORMANCE

PREBURNISH CHECK _____lb PEDAL FORCE (PF) FOR 30 MPH STOP @ 10 FPSPS

EFFECTIVENESS

	30 MPH		60 MPH		80 MPH	
	PF@20fpsps	SKID DECEL.	PF@20fpsps	SKID DECEL	PF@20fpsps	SKID DECEL.
FIRST	lb	fpsps	lb	fpsps	lb	fpsps
SECOND	lb	fpsps	lb	fpsps	lb	fpsps
FINAL	lb	fpsps	lb	fpsps	lb	fpsps

FADE & RECOVERY

	FADE STOPS		RECOVERY STOPS	
	1 THRU 4	1 THRU 8	1 THRU 5	6 THRU 12
FIRST	lb max.PF	lb max.PF	fpsps min. by 200 lb	lb max.PF
SECOND	lb max.PF	lb max.PF	fpsps min. by 200 lb	lb max.PF

AMBIENT TEMP. RANGE DURING FADE TESTS _____ F TO _____F.

FINAL INSPECTION _____
FRICTION MATERIAL CONDITION _____
DRUM (OR ROTOR) CONDITION _____
MECHANICAL COMPONENT CONDITION _____
HYDRAULIC COMPONENT CONDITION _____

WATER RECOVERY _____lb PF BASELINE CHECK FOR 25 MPH @ 8 FPSPS
_____lb PF ON 15th RECOVERY STOP
_____% VARIATION BETWEEN BASELINE AND 15th RECOVERY STOP

GENERAL COMMENTS _____

Fig. 2 - General 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 mi. int.

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

FIRST (PREBURNISH) EFFECTIVENESS
200F IBT each application

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

BURNISH
40-0 mph, 12 fpsps in gear, 250F IBT each stop but 1 mi max. int.

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

SECOND 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. 3 - Preburnish, first and second effectiveness test data sheet