

NOTICE OF
VALIDATION

VALIDATION NOTICE 1
4 April 1990 for
SAE J786A
March 1978

SAE J786A, adopted on 30 September 1981, has been reviewed and determined to be current.

Custodians:
Army - AT

Military Coordinating Activity:
Army - AT

Air Force - 99

Review Activities:
Navy - YD

FSC 2530

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BRAKE SYSTEM ROAD TEST CODE—TRUCK, BUS, AND COMBINATION OF VEHICLES—SAE J786a

SAE Recommended Practice

Report of Brake Committee approved March 1962 and last revised by Brake Committee and Automotive Safety Committee May 1971. Editorial change March 1978.

1. Scope—This SAE Recommended Practice establishes a uniform procedure for the level road test of the brake systems of new trucks, buses, and combination of vehicles designed for roadway use and falling in the following classifications:

- Light trucks and buses: 6001–10,000 lb (2700–4500 kg) gv
- Truck and bus: Over 10,000 lb (4500 kg) gv
- Combination of vehicles (towing vehicle over 10,000 lb (4500 kg) gv)

2. Purpose—The purpose of this practice is to establish a uniform test procedure to determine capabilities with regard to:

2.1 Service brake system deceleration in feet per second per second (fpsps) versus input as affected by vehicle speed, brake temperature, water exposure, and usage.

2.2 Emergency brake system stopping ability.

2.3 Lining characteristics and life.

2.4 Drum and rotor characteristics and life.

2.5 Effectiveness distribution for vehicles in combinations.

3. Instrumentation

3.1 Application pressure gage.

3.2 Reserve pressure gage (when applicable).

3.3 Line pressure or pedal force gage.

3.4 Pedal travel gage (manual and assistor hydraulic systems only).

3.5 Decelerometer.

3.6 Stopmeter (fifth wheel or equivalent distance measuring device).

3.7 Pyrometer.

3.8 Stop counter.

3.9 Tachometer (optional).

3.10 Speedometer.

3.11 Thermometer (for ambient).

3.12 Stop watch.

4. Test Preparations

4.1 Shoe and Lining Assembly—Attach and finish friction material to vehicle manufacturer's specifications.

Measure overall thickness of lining and shoe rim or plate at fixed reference points. Use a minimum of three readings on each side of drum brake shoes and one at each corner of disc brake shoes to establish lining wear.

4.2 Thermocouples—Install the plug type of thermocouple shown in Fig. 1 in each brake. Thermocouple shall be located in approximate center of the more heavily loaded shoe, one per brake.

4.3 Brake Drum or Rotor and Hub Assembly—New drums or rotors are recommended for each test, with surface finish in accordance with manufacturer's specifications, and careful attention to insure uniform surface finish from test to test. Radial and lateral runouts are to be held to vehicle manufacturer's specifications, checked, and recorded. Make and record the necessary measurements for wear determination.

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

4.5 Load to Specified Test gv—Load to vehicle manufacturer's rated gv, unless otherwise specified. For performance tests, the term "empty" means driver, observer, and required instrumentation with all ballast or payload removed.

4.6 Emergency Brake System—The emergency brake system may consist of either: (a) that portion of the service brake system which remains operative in the event of a single hydraulic or air component failure except for parts common to a divided system, or (b) an auxiliary brake system, whichever is applicable.

If desired, appropriate valves and piping may be installed to facilitate the introduction and cancellation of simulated failures in those service brake systems in which a partial service system constitutes the emergency system. The installation must be such that fluid or air is released freely to atmospheric pressure from the point of simulated failure.

4.7 For those vehicles which are equipped with power (air or hydraulic) or power assisted brake actuation, the reserve pressure is not to exceed the vehicle manufacturer's recommended cut-out pressure.

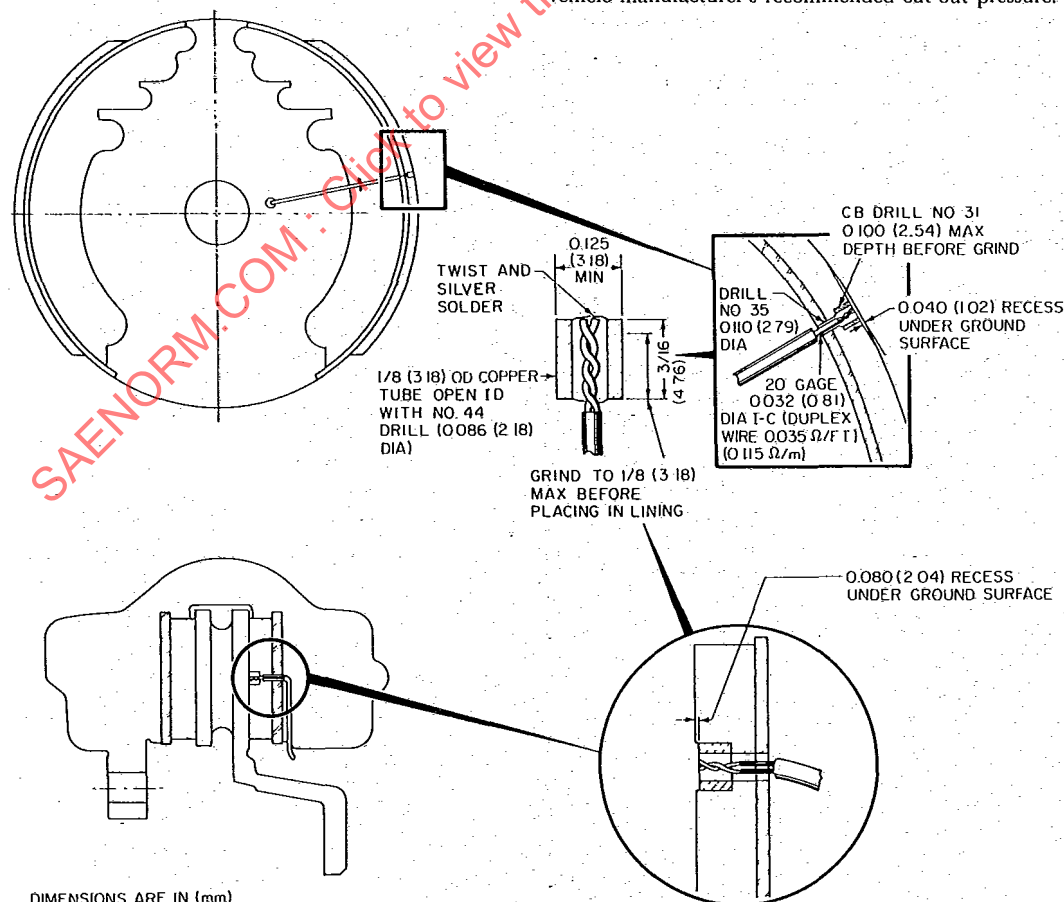


FIG. 1—TYPICAL PLUG THERMOCOUPLE INSTALLATIONS

5. Test Procedure

5.1 First Measurements—See paragraph 4.

5.2 General Test Notes

5.2.1 Effectiveness, fade, and recovery test stops shall be conducted on a substantially level (not to exceed a $\pm 1\%$ grade), dry, smooth, hard-surfaced roadway of Portland cement concrete (or other surface with equivalent of coefficient of surface friction) that is free from loose materials.

5.2.2 During all phases of this procedure, any unusual performance or noise characteristics are to be noted and recorded.

5.2.3 Temperature readings are defined as "initial," meaning 0.2–0.1 mile (0.3–0.2 km) before stop, brake off, and "final," meaning as soon as possible after stop, brake on.

5.2.4 Note any uncontrollable braking action causing the vehicle to swerve or pull out of a 12 ft (3.7 km) wide roadway lane.

5.2.5 Decelerations used refer to values at which the decelerometer reading is held approximately constant during the stop by varying the pedal force or application pressure.

5.2.6 The term "baseline" is defined as the average of initial and final pedal forces or application pressures of all check stops or applications prior to heat fade or water recovery tests.

5.2.7 EFFECTIVENESS (CURVE) TEST NOTES—All effectiveness tests are to be conducted at suitable increments of application pressure or pedal force to define clearly the deceleration versus application pressure or pedal force curve from brake engagement to wheel slide or maximum available application pressure. Three stops are permitted, if necessary to establish ability to achieve performance requirement. Record application pressure or pedal force, deceleration (ft/s^2 or m/s^2), and stopping distance (feet or meters).¹ Record pedal travel on manual and assistor type systems.

A "Spot Effectiveness Test" is an abbreviated curve based on only two or three preselected application pressures or pedal forces.

A "Cold Curve" is defined as 200 F (93.3 C) initial brake temperature before each stop, average temperature of brakes on hottest axle.

¹System application and braking distance as defined by SAE J656g (September, 1973).

TABLE 1—INITIAL FADE AND RECOVERY TESTS

	Light Trucks and Buses 6001–10,000 lb (2700–4500 kg) gvwr	Truck and Bus over 10,000 lb (4500 kg) gvwr
Baseline Check—at 200 F (93.3 C) initial temperature: Speed, mph (km/h) Deceleration, ft/s^2 (m/s^2) No. of applications	30–0 (48–0) 15 (4.6) 3	40–20 (64–32) 10 (3) 3
Fade Test—starting at 200 F (93.3 C) initial temperature: Speed, mph (km/h) Deceleration, ft/s^2 (m/s^2) Time cycle (between applications) No. of applications	60–0 (97–0) 15 (4.6) 1.0 min 5	40–20 (64–32) 10 (3) 30 s ^a 10 (tenth stop to be full stop)
Recovery Test Speed during test and after last fade stop, mph (km/h) Deceleration, ft/s^2 (m/s^2) Application, mph Interval during test and after last fade stop, miles (m) No. of applications, min	30 (48) 15 (4.6) 30 1.5 (2.4) 5	40 (64) 10 (3) 40–20 2.0 (3.2) 10

^aIn the event that the test vehicle is incapable of obtaining this cycle, then a longer time cycle not exceeding 1.0 min should be established and standardized to guarantee uniform temperature results from test to test. The specified 200 F (93.3 C) initial temperature, for fade snub 1, is included for the same reason of standardization.

A "Hot Curve" is defined as 300 F (149 C) initial brake temperature before each stop, average temperature of brakes on hottest axle.

All stops are made without engine retardation.

5.3 Preburnish Check—Make 10 stops from 20 mph (32 km/h) at a minimum deceleration of 14 ft/s^2 (4.3 m/s^2) and 1.0 mile (1.6 km) intervals.

GENERAL DATA AND SUMMARY REPORT FORM			
VEHICLE: MAKE _____ MODEL _____ YEAR _____			
ENGINE _____ TRANSMISSION _____ AXLE _____			
WEIGHT - LOADED _____ LB (kg) FRONT _____ LB (kg) REAR _____ LB (kg) TRAILER _____ LB (kg)			
WEIGHT - EMPTY _____ LB (kg) FRONT _____ LB (kg) REAR _____ LB (kg) TRAILER _____ LB (kg)			
TIRES - SIZE _____ MAKE _____ MANUFACTURER'S DESIGNATION _____			
GENERAL DATA			
BRAKES: FRONT - SIZE _____ TYPE _____			
REAR - SIZE _____ TYPE _____			
TRAILER - SIZE _____ TYPE _____			
DRUM (ROTOR) TYPE - FRONT _____ REAR _____ TRAILER _____			
HYDRAULIC BRAKE DATA -			
POWER TYPE _____ MODEL _____ DIA _____ STROKE _____			
MASTER CYL _____ DIA _____ STROKE _____			
PEDAL RATIO _____ AVAIL. TRAVEL _____ PRESSURE AT RUNOUT _____			
AIR BRAKE DATA -			
CHAMBER TYPE AND AREA _____ FRONT _____ REAR _____ TRAILER _____			
SLACK ADJUSTER (LEVER ARM) LENGTH _____			
CAM RADIUS OR WEDGE RATIO _____			
TEST INFORMATION - SPECIAL EQUIPMENT _____			
TESTED BY _____ LOCATION _____ DATE _____			
TEST PHASE	TEST RESULTS		
PREBURNISH CHECK	FT/S ² (m/s ²) MINIMUM AT _____ LB (N)		
EFFECTIVENESS TEST	PREBURNISH	1ST	2ND
LIGHT TRUCKS AND BUSES	20 MPH (32 km/h) EMPTY	_____ FT (m) _____ LB (N)	_____ FT (m) _____ LB (N)
	LOADED _____ FT (m) _____ LB (N)	_____ FT (m) _____ LB (N)	_____ FT (m) _____ LB (N)
	60 MPH (97 km/h) EMPTY	_____ FT/S ² (m/s ²) _____ LB (N)	_____ FT/S ² (m/s ²) _____ LB (N)
	LOADED _____ FT (m) _____ LB (N)	_____ FT/S ² (m/s ²) _____ LB (N)	_____ FT/S ² (m/s ²) _____ LB (N)
EFFECTIVENESS TEST	PREBURNISH	1ST	2ND
	20 MPH (32 km/h)	_____ FT (m) _____ LB (N)	_____ FT (m) _____ LB (N)
	50 MPH (80 km/h) OR MAX ATTAINABLE	_____ FT/S ² (m/s ²) _____ LB (N)	_____ FT/S ² (m/s ²) _____ LB (N)
	_____ FT/S ² (m/s ²) _____ LB (N)	_____ FT/S ² (m/s ²) _____ LB (N)	_____ FT/S ² (m/s ²) _____ LB (N)
EMERGENCY SYSTEM EFFECTIVENESS TEST	SYSTEM 1		SYSTEM 2
	20 MPH (32 km/h)		_____ FT (m) _____ LB (N)
	EMPTY _____ FT (m) _____ LB (N)		_____ FT (m) _____ LB (N)
	LOADED _____ FT (m) _____ LB (N)		_____ FT (m) _____ LB (N)
TRUCKS, BUSES, AND COMBINATION OF VEHICLES	20 MPH (32 km/h)		_____ FT (m) _____ LB (N)
	EMPTY _____ FT (m) _____ LB (N)		_____ FT (m) _____ LB (N)
	50 MPH (80 km/h) OR MAX ATTAINABLE		_____ FT/S ² (m/s ²) _____ LB (N)
	_____ FT/S ² (m/s ²) _____ LB (N)		_____ FT/S ² (m/s ²) _____ LB (N)
FADE AND RECOVERY TESTS	INITIAL		SECOND
	LB (N)		LB (N)
	PSI (Pa)		PSI (Pa)
	_____ LB (N) MAX PF		_____ LB (N) MAX PF
WATER RECOVERY TEST	AVG BASELINE PF OR LP		_____ LB (PSI) (N (Pa))
	RECOVERY STOPS		_____ LB (PSI) (N (Pa))
	RECOVERY STOPS		_____ LB (PSI) (N (Pa))
	RECOVERY STOPS		_____ LB (PSI) (N (Pa))
STABILITY DURING EFFECTIVENESS TESTS	CONTROLLABLE BRAKING		
	YES _____ NO _____		
	YES _____ NO _____		
	YES _____ NO _____		
FINAL INSPECTION	LINING INTEGRITY		
	MECHANICAL INTEGRITY		
	HYDRAULIC INTEGRITY		
	YES _____ NO _____		
COMMENTS: _____			
REPORTED BY _____ DATE _____			

FIG. 2—GENERAL DATA AND SUMMARY REPORT FORM

5.4 Preburnish Effectiveness—Conduct cold curves under the following conditions:

Light trucks and buses	20 and 60 mph (32 and 97 km/h) loaded
Truck, bus, and combination of vehicles	20 mph (32 km/h) loaded 20 and 50 mph (32 and 80 km/h) or maximum attainable under 50 mph (80.5 km/h) loaded

5.5 Burnish—Make at least 200 brake snubs, not less than 50 in a series, from 40 to 20 mph (64 to 32 km/h) at 10 ft/s² (3 m/s²) in normal gear range. Accelerate to 40 mph at moderate acceleration after each snub and drive 40 mph (64 km/h) between snubs.

At every 25th application (minimum), make a full stop from 40 mph (64 km/h), recording all required data on application pressure or pedal force, pedal travel, initial and final brake temperatures.

Application intervals:

Light trucks and buses	1.0 mile (1.6 km)
Truck, bus, and combination of vehicles	1.5 miles (2.4 km)

5.6 First Effectiveness Test—(See paragraph 5.2.) Adjust brakes to specifications. Conduct cold curves under the following conditions:

Light trucks and buses	20 mph (32 km/h) empty and loaded 60 mph (97 km/h) empty and loaded
Truck, bus, and combination of vehicles	20 mph (32 km/h) loaded 50 mph (80 km/h) or maximum attainable under 50 mph (80 km/h) loaded

NOTE: Emergency system effectiveness tests (paragraph 5.7) may be interspersed in the above tests to minimize vehicle loading and unloading.

5.7 Emergency System Effectiveness Test

5.7.1 NOTE: Three stops are permitted, if necessary to establish ability to achieve performance requirement.

5.7.2 Make cold spot check stops with each partial (emergency) brake system or with the auxiliary system, as may be applicable, as follows:

Light trucks and buses	20 mph (32 km/h) empty and loaded 60 mph (97 km/h) empty and loaded
Truck, bus, and combination of vehicles	20 mph (32 km/h) loaded 50 mph (80 km/h) or maximum attainable under 50 mph (80 km/h) loaded

Record stopping distance, deceleration, application pressure, and pedal force.

5.8 Brake Effectiveness Distribution for Vehicles in Combinations—

Make one warmup stop from 40 mph (64 km/h) with all brakes in operation at intermediate application pressure from the service brake valve (42 psi (290 kPa) for air brake vehicles used in interchange). Next, make three stops from 20 mph (32 km/h) at the same application pressure at 1/2 mile (0.8 km) intervals recording the deceleration under each of the following conditions:

- All tractor and trailer brakes in use.
- Tractor brakes only in use.
- Trailer brakes only in use.

NOTE: Brake effectiveness balance is accomplished when the ratio of deceleration of each vehicle in the combination to the deceleration of the combination is the same as the ratio of the weight of each vehicle to the total weight of the combination.

5.9 Initial Fade and Recovery Tests (not applicable to combinations of vehicles)

NOTE: All applications during baseline, fade, and recovery tests are made without engine retardation.

PERFORMANCE SUMMARY SHEET NO. 2

BURNISH DATA

INPUT PRESSURE	PEDAL TRAVEL	INITIAL	TYPICAL TEMPERATURE BALANCE FOR 40 MPH (64 km/h) STOP (HOT)							
			TRUCK, BUS, OR TRACTOR				TRAILER			
			LF	RF	RR (LRF)	RR (RRF)	LRF	RRF	LRR	RRR
START										
MAXIMUM										
FINAL										

COMMENTS

OPERATIONAL TEST (2000 SNUBS TO MPH (km/h), ALTERNATE 7 AND 11 FT/S² (3.0 m/s²), 1.0 MILE (1.6 km) HIGHEST GEAR) TYPICAL MPH (km/h), 10 FT/S² (3.0 m/s²) IP - PT CHECKS

TEST MILES (km)	COLD		HOT	
	IP	PI	IP	PI
0 (0)				
500 (804)				
1000 (1609)				
1500 (2414)				
2000 (3219)				

TYPICAL TEMPERATURE BALANCE FOR A MPH (km/h) STOP (HOT)

TEST MILES (km)	TRUCK, BUS, OR TRACTOR				TRAILER			
	LF	RF	RR (LRF)	RR (RRF)	LRF	RRF	LRR	RRR
0 (0)								
500 (804)								
1000 (1609)								
1500 (2414)								
2000 (3219)								

COMMENTS

BURNISH FROM TO

OPERATIONAL TEST

0-500 MILES (0-804 km) FROM TO

500-1000 MILES (804-1609 km) FROM TO

1000-1500 MILES (1609-2414 km) FROM TO

1500-2000 MILES (2414-3219 km) FROM TO

FIG. 3—PERFORMANCE SUMMARY SHEET

WEAR SUMMARY SHEET

MAXIMUM LINING WEAR DATA (IN THOUSANDS OF AN INCH) (mm)

TRUCK, BUS, OR TRACTOR				TRAILER			
LF	RF	RR (LRF)	RR (RRF)	LRF	RRF	LRR	RRR

AVERAGE LINING WEAR DATA (IN THOUSANDS OF AN INCH) (mm)

TRUCK, BUS, OR TRACTOR				TRAILER			
LF	RF	RR (LRF)	RR (RRF)	LRF	RRF	LRR	RRR

DRUM WEAR (IN THOUSANDS OF AN INCH) (mm)

TRUCK, BUS, OR TRACTOR				TRAILER			
LF	RF	RR (LRF)	RR (RRF)	LRF	RRF	LRR	RRR

FINAL INSPECTION - LINING

TRUCK, BUS, OR TRACTOR

LF RF RR (LRF) RR (RRF) LRF RRF LRR RRR

TRAILER

LF RF RR (LRF) RR (RRF) LRF RRF LRR RRR

FINAL INSPECTION - DRUMS

TRUCK, BUS, OR TRACTOR

LF RF RR (LRF) RR (RRF) LRF RRF LRR RRR

TRAILER

LF RF RR (LRF) RR (RRF) LRF RRF LRR RRR

OTHER

FIG. 4—WEAR SUMMARY SHEET

SIDE RETURN
ROLL DOWN
ADJUSTER

LATERAL SURF T _____ IN (0.00) AVG WFAK _____ IN (0.00)

TEST COMMENTS

FIG. 9—BURNISH SUMMARY SHEET

FIG. 10-EMERGENCY SYSTEM EFFECTIVENESS SUMMARY SHEET

FIG. 12—FADE TEST SUMMARY SHEET

FIG. 11—BRAKE EFFECTIVENESS DISTRIBUTION FOR VEHICLE
IN COMBINATION