

**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

Air Force - 99

Military Coordinating Activity:
Army - AT

Review Activities:
Navy - YD

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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) gvw

Truck and bus: Over 10,000 lb (4500 kg) gvw

Combination of vehicles (towing vehicle over 10,000 lb (4500 kg) gvw)

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 assister 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 gvw—Load to vehicle manufacturer's rated gvw, 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.

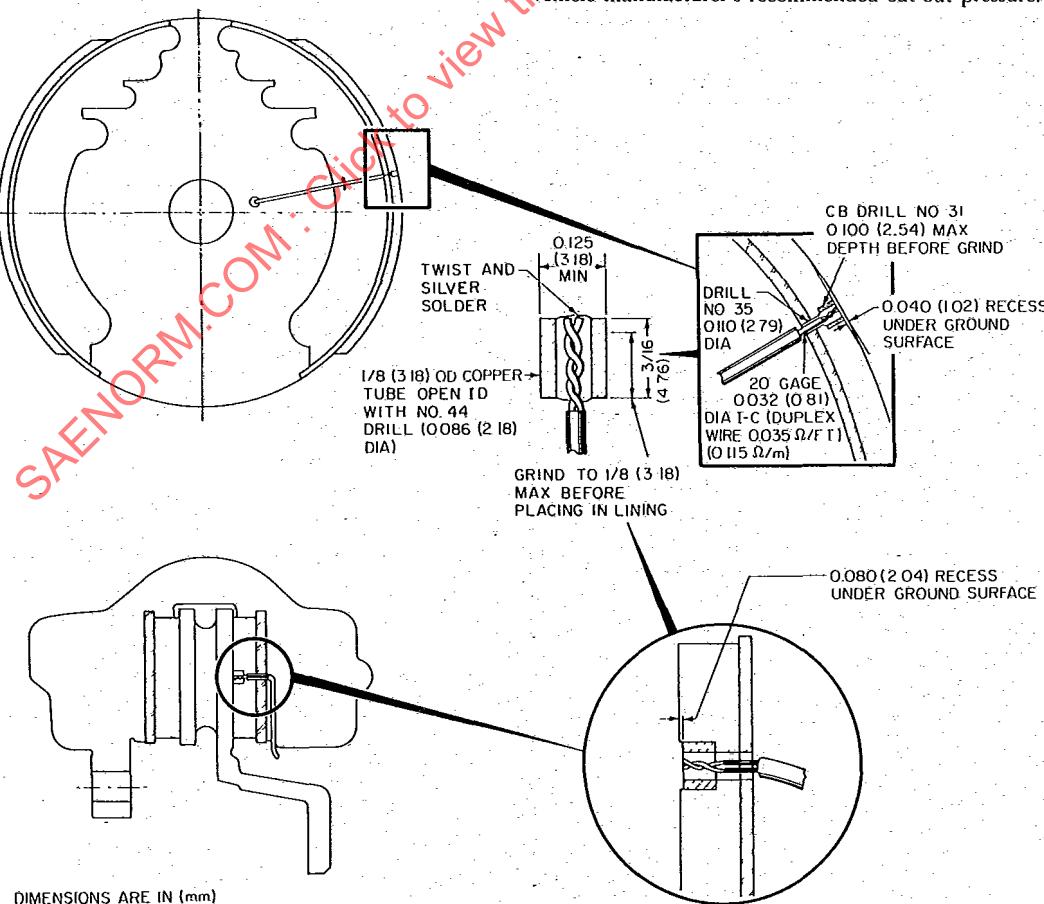


FIG. 1—TYPICAL PLUG THERMOCOUPLE INSTALLATIONS

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) gvw	Truck and Bus over 10,000 lb (4500 kg) gvw
Baseline Check —at 200 F (93.3 C)		
initial temperature:		
Speed, mph (km/h)	30-0 (48-0)	40-20 (64-32)
Deceleration, ft/s^2 (m/s^2)	15 (4.6)	10 (3)
No. of applications	3	3
Fade Test —starting at 200 F (93.3 C)		
initial temperature:		
Speed, mph (km/h)	60-0 (97-0)	40-20 (64-32)
Deceleration, ft/s^2 (m/s^2)	15 (4.6)	10 (3)
Time cycle (between applications)	1.0 min	30 s ^a
No. of applications	5	10 (tenth stop to be full stop)
Recovery Test		
Speed during test and after last fade stop, mph (km/h)	30 (48)	40 (64)
Deceleration, ft/s^2 (m/s^2)	15 (4.6)	10 (3)
Application, mph	30	40-20
Interval during test and after last fade stop, miles (m)	1.5 (2.4)	2.0 (3.2)
No. of applications, min	5	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	TRANSMISSION	AXLE	
ENGINE			WEIGHT	FRONT	REAR
WEIGHT - LOADED	LB (kg)	FRONT	LB (kg)	REAR	LB (kg)
EMPTY	LB (kg)	FRONT	LB (kg)	REAR	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 - FRONT _____ REAR _____ TRAILER _____					
CHAMBER TYPE AND AREA					
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) _____		
TRUCKS, BUSES, AND COMBINATION OF VEHICLES	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) _____		
EMERGENCY SYSTEM EFFECTIVENESS TEST	PREBURNISH	1ST	2ND		
TRUCKS AND BUSES	20 MPH (32 km/h)	FT (m) _____ LB (N) _____	FT (m) _____ LB (N) _____		
	EMPTY 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) _____	FT/s ² (m/s^2) _____ LB (N) _____		
	LOADED FT/s ² (m/s^2) _____ LB (N) _____	FT/s ² (m/s^2) _____ LB (N) _____	FT/s ² (m/s^2) _____ LB (N) _____		

TEST PHASE	TEST RESULTS	
EMERGENCY SYSTEM EFFECTIVENESS TEST	SYSTEM 1	SYSTEM 2
COMBINATION OF VEHICLES	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) _____
BRAKE EFFECTIVENESS DISTRIBUTION FOR AIR BRAKE VEHICLES USED IN COMBINATION IN INTER-CHANGE OPERATIONS	WEIGHT	TEST STOP
TRACTOR AND TRAILER	LB (N) _____	FT/s ² (m/s^2) _____
TRACTOR ONLY	LB (N) () %	FT/s ² (m/s^2) () %
TRAILER ONLY	LB (N) () %	FT/s ² (m/s^2) () %
FADE AND RECOVERY TESTS	INITIAL	SECOND
AVG BASELINE PF OR LP FADE STOPS	LB (N) PSI (Pa) LB (N) MAX PF % OF BASELINE	LB (N) PSI (Pa) LB (N) MAX PF % OF BASELINE
WATER RECOVERY TEST	LB (PSI) (N (Pa)) LB (PSI) (N (Pa))	
AVG BASELINE PF OR LP RECOVERY STOP 15	LB (PSI) (N (Pa)) LB (PSI) (N (Pa))	
STABILITY DURING EFFECTIVENESS TESTS	CONTROLLABLE BRAKING YES _____ NO _____	
FINAL INSPECTION	LINING INTEGRITY MECHANICAL INTEGRITY HYDRAULIC INTEGRITY YES _____ NO _____ YES _____ NO _____ 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/s^2 (3 m/s^2) 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.

PERFORMANCE SUMMARY SHEET NO. 2

BURNISH DATA

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

COMMENTS

OPERATIONAL TEST (2000 SNUBS TO MPH (km/h). ALTERNATE 7 AND 11 FT/S² (4.4m/s²).
1.0 MILE (1.6 km) HIGHEST GEAR TYPICAL MPH (km/h). 10 FT² (3 m²) IP - PT CHECKS

TEST MILES (km)	COLD		HOT	
	IP	PI	IP	PI
0 (0)	_____	_____	_____	_____
500 (844)	_____	_____	_____	_____
1000 (1602)	_____	_____	_____	_____
1500 (2414)	_____	_____	_____	_____
2000 (3219)	_____	_____	_____	_____

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

TEST MILES (km)	TRUCK, BUS, OR TRACTOR				TRAILER					
	LF	RF	LR		RR	RRR	LRF	RRF	LRR	RRR
			(LRF)	(RRF)						
0 (0)	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
500 (844)	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
1000 (1602)	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
1500 (2414)	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
2000 (3219)	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

COMMENTS

BURNISH		OPERATIONAL TEST		
FROM	TO	0- 500 MILES (0- 804 km)	FROM	TO
		500-1000 MILES (804-1602 km)	FROM	TO
		1000-1500 MILES (1602-2414 km)	FROM	TO
		1500-2000 MILES (2414-3219 km)	FROM	TO

FIG. 3—PERFORMANCE SUMMARY SHEET

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 $\frac{1}{2}$ mile (0.8 km) intervals recording the deceleration obtained under each of the following conditions:

1918
(a) All tractor and trailer brakes in use.
(b) Tractor brakes only in use.
(c) 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.~~

WEAR SUMMARY SHEET											
MAXIMUM LINING WEAR DATA (IN THOUSANDS OF AN INCH) (mm)											
2ND MEASUREMENT (OPTIONAL)											
TRUCK, BUS OR TRACTOR						TRAILER					
LF	RF	LR (LRF)	RR (RRF)	LRR	RRR	LF	RF	LR (LRR)	RR (RRR)	LRR	RRR
3RD MEASUREMENT											
LF	RF	LR (LRF)	RR (RRF)	LRR	RRR	LF	RF	LR (LRR)	RR (RRR)	LRR	RRR
AVERAGE LINING WEAR DATA (IN THOUSANDS OF AN INCH) (mm)											
2ND MEASUREMENT (OPTIONAL)											
TRUCK, BUS OR TRACTOR						TRAILER					
LF	RF	LR (LRF)	RR (RRF)	LRR	RRR	LF	RF	LR (LRR)	RR (RRR)	LRR	RRR
3RD MEASUREMENT											
LF	RF	LR (LRF)	RR (RRF)	LRR	RRR	LF	RF	LR (LRR)	RR (RRR)	LRR	RRR
DRUM WEAR (IN THOUSANDS OF AN INCH) (mm)											
2ND MEASUREMENT											
TRUCK, BUS OR TRACTOR						TRAILER					
LF	RF	LR (LRF)	RR (RRF)	LRR	RRR	LF	RF	LR (LRR)	RR (RRR)	LRR	RRR
3RD MEASUREMENT											
LF	RF	LR (LRF)	RR (RRF)	LRR	RRR	LF	RF	LR (LRR)	RR (RRR)	LRR	RRR
FINAL INSPECTION - LINING											
TRUCK, BUS, OR TRACTOR											
LF						RF					
LR (LRF)						RR (RRF)					
LRR						RRR					
TRAILER											
LF						RF					
LR (LRF)						RR (RRF)					
LRR						RRR					
FINAL INSPECTION - DRUMS											
TRUCK, BUS OR TRACTOR											
LF						RF					
LR (LRF)						RR (RRF)					
LRR						RRR					
TRAILER											
LF						RF					
LR (LRF)						RR (RRF)					
LRR						RRR					
OTHER											

FIG. 4—WEAR SUMMARY SHEET

SHOE LOCATION	DATA POINT	1ST MEASUREMENT		2ND MEASUREMENT (OPTIONAL)		3RD MEASUREMENT	
		DATE	ODO	DATE	ODO	DATE	ODO
		THICKNESS	THICKNESS	WEAR	THICKNESS	WEAR	
		DRUM SIDE	1				
2							
3							
BACKING PLATE SIDE	1						
	2						
	3						
	DRUM SIDE	1					
		2					
		3					
BACKING PLATE SIDE		1					
		2					
		3					

DRUM DATA: SURFACE FINISH: BEFORE _____ RMS
AFTER _____ RMS
DRUM DIAMETER: AFTER _____ IN (MM)
BEFORE _____ IN (MM)
WEAR _____ IN (MM)
RADIAL RUNOUT _____ IN (MM)
LATERAL RUNOUT _____ IN (MM)

Brake Adjustment:
DIAMETRICAL CLEARANCE _____ IN (MM)

SPRING DATA:
LOAD SPECIFIED _____ MEASURED _____

SHOE RETURN
ROLL DOWN
ADJUSTER

		1ST MEASUREMENT		2ND MEASUREMENT		3RD MEASUREMENT		
		DATE	DATE	DATE	DATE	DATE	DATE	
PAD LOCATION	DATA POINT	ODO	ODO	ODO	ODO	ODO	ODO	
		ORIGINAL THICKNESS	THICKNESS	WEAR	THICKNESS	WEAR	THICKNESS	WEAR
FRONT	INSIDE	1						
		2						
		3						
		4						
		INSIDE	1					
		2						
		3						
		4						
REAR	OUTSIDE	1						
		2						
		3						
		4						
		OUTSIDE	1					
		2						
		3						
		4						

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ROTOR DATA

SURFACE FINISH	THICKNESS	MAX	MIN
BEFORE	_____ mm	_____	_____
AFTER	_____ mm	_____	_____
INTERNAL SURFACE	IN mm	AVG. WEAR	IN mm

BURNISH													
200 SNUBS: 40-20 MPH, (64-32 km./h.), 10 FT s^2 (4 in s^2) IN NORMAL GEAR EVERY 2-TH APPLICATION: 40-20 MPH, (64-32 km./h.). 10 FT s^2 (4 in s^2) IN NORMAL GEAR INTERVAL: () 1.0 MILE (1.6 km.), () 1.5 MILE (2.4 km.)													
STOP NO.	APPLICATION PRESSURE, PSI (Pa) OR PEDAL FORCE, LB (N)	PEDAL TRAVEL, IN (mm)	BRAKE TEMPERATURES, F (C)										REMARKS
			TRUCK, BUS, OR TRACTOR					TRAILER					
			LF	RF	LRF	RRF	LRR	RRF	RRR	LRF	RRF	LRB	
25													
50													
75													
100													
125													
150													
175													
200													

FIG. 9—BURNISH SUMMARY SHEET

FIG. 12—FADE TEST SUMMARY SHEET

FIG. 10—EMERGENCY SYSTEM EFFECTIVENESS SUMMARY SHEET

Brake Effectiveness Distribution for Vehicle in Combination
42 PSI (290 kPa) AT 1/2 MILE (0.8 km) INTERVALS

FIG. 11—BRAKE EFFECTIVENESS DISTRIBUTION FOR VEHICLE IN COMBINATION