

TABLE I.—STOPPING SEQUENCE

	Truck tractors	Single unit trucks and buses
Burnish .....	1	1
Stability and Control at GVWR (PFC 0.5) .....	2	N/A
Stability and Control at LLVW (PFC 0.5) .....	3	5
Manual Adjustment of Brakes .....	4	N/A
60 mph Service Brake Stops at GVWR (PFC 0.9) .....	5	2
60 mph Emergency Service Brake Stops at GVWR (PFC 0.9) .....	N/A	3

TABLE I.—STOPPING SEQUENCE—Continued

	Truck tractors	Single unit trucks and buses
Parking Brake Test at GVWR .....	6	4
Manual Adjustment of Brakes .....	7	6
60 mph Service Brake Stops at LLVW (PFC 0.9) .....	8	7
60 mph Emergency Service Brake Stops at LLVW (PFC 0.9) .....	9	8
Parking Brake Test at LLVW .....	10	9
Final Inspection .....	11	10

TABLE II—STOPPING DISTANCE IN FEET

Vehicle speed in miles per hour	Service brake				Emergency brake	
	PFC 0.9	PFC 0.9	PFC 0.9	PFC 0.9	PFC 0.9	PFC 0.9
	(1)	(2)	(3)	(4)	(5)	(6)
20 .....	32	35	38	40	83	85
25 .....	49	54	59	62	123	131
30 .....	70	78	84	89	170	186
35 .....	96	106	114	121	225	250
40 .....	125	138	149	158	288	325
45 .....	158	175	189	200	358	409
50 .....	195	216	233	247	435	504
55 .....	236	261	281	299	520	608
60 .....	280	310	335	355	613	720

Note: (1) Loaded and unloaded buses; (2) Loaded single unit trucks; (3) Unloaded truck tractors and single unit trucks; (4) Loaded truck tractors tested with an unbraked control trailer; (5) All vehicles except truck tractors; (6) Unloaded truck tractors.

TABLE III—BRAKE RETARDATION FORCE

Column 1 brake retardation force/GAWR	Column 2 brake chamber pressure, PSI
0.05 .....	20
0.12 .....	30
0.18 .....	40
0.25 .....	50
0.31 .....	60
0.37 .....	70
0.41 .....	80

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**§ 571.122 Standard No. 122; Motorcycle brake systems.**

S1. *Scope.* This standard specifies performance requirements for motorcycle brake systems.

S2. *Purpose.* The purpose of the standard is to insure safe motorcycle braking performance under normal and emergency conditions.

S3. *Application.* This standard applies to motorcycles.

S4. *Definitions.*

*Braking interval* means the distance measured from the start of one brake application to the start of the next brake application.

*Initial brake temperature* means the temperature of the hottest service brake of the vehicle 0.2 mile before any brake application.

TABLE IV [RESERVED]

TABLE V—BRAKE CHAMBER RATED VOLUMES

Brake Chamber type (nominal area of piston or diaphragm in square inches)	Column 1 full stroke (inches)	Column 2 rated volume (cubic inches)
Type 9 .....	1.75/2.10	25
Type 12 .....	1.75/2.10	30
Type 14 .....	2.25/2.70	40
Type 16 .....	2.25/2.70	46
Type 18 .....	2.25/2.70	50
Type 20 .....	2.25/2.70	54
Type 24 .....	2.50/3.20	67
Type 30 .....	2.50/3.20	89
Type 36 .....	3.00/3.60	135

*Skid number* means the frictional resistance of a pavement measured in accordance with American Society for Testing and Materials (ASTM) Method E-274-70 (as revised July, 1974) at 40 mph, omitting water delivery as specified in paragraphs 7.1 and 7.2 of that method.

*Stopping distance* means the distance traveled by a vehicle from the start of the brake application to the point where the vehicle stops.

*Split service brake system* means a brake system consisting of two or more subsystems actuated by a single control designed so that a leakage-type failure of a pressure component in a single subsystem (except structural failure of a housing that is common to all subsystems) shall not impair the operation of the other subsystem(s).

S5. *Requirements.* Each motorcycle shall meet the following requirements under the conditions specified in S6, when tested according to the procedures and in the sequence specified in S7. Corresponding test procedures of S7 are indicated in parentheses. If a motorcycle is incapable of attaining a specified speed, its service brakes shall be capable of stopping the vehicle from the multiple of 5 m.p.h. that is 4 m.p.h. to 8 m.p.h. less than the speed attainable in 1 mile, within stopping distances that do not exceed the stopping distances specified in Table 1.

S5.1 *Required equipment—split service brake system.* Each motorcycle shall have either a split service brake system or two independently actuated service brake systems.

S5.1.1 *Mechanical service brake system.* Failure of any component in a mechanical service brake system shall not result in a loss of braking ability in the other service brake system on the vehicle.

S5.1.2 *Hydraulic service brake system.* A leakage failure in a hydraulic service brake system shall not result in a loss of braking ability in the other service brake system on the vehicle. Each motorcycle equipped with a hydraulic brake system shall have the equipment specified in S5.1.2.1 and S5.1.2.2.

S5.1.2.1 *Master cylinder reservoirs.* Each master cylinder shall have a separate reservoir for each brake circuit, with each reservoir filler opening hav-

ing its own cover, seal, and cover retention device. Each reservoir shall have a minimum capacity equivalent to one and one-half times the total fluid displacement resulting when all the wheel cylinders or caliper pistons serviced by the reservoir move from a new lining, fully retracted position to a fully worn, fully applied position. Where adjustment is a factor, the worst condition of adjustment shall be used for this measurement.

S5.1.2.2 *Reservoir labeling.* Each motorcycle shall have a brake fluid warning statement that reads as follows, in letters at least three thirty-seconds of an inch high:

Warning: Clean filler cap before removing. Use only \_\_\_\_\_ fluid from a sealed container. (Inserting the recommended type of brake fluid as specified in 49 CFR 571.116, e.g., DOT 3.)

The lettering shall be:—

(a) Permanently affixed, engraved, or embossed;

(b) Located so as to be visible by direct view, either on or within 4 inches of the brake-fluid reservoir filler plug or cap; and

(c) Of a color that contrasts with its background, if it is not engraved or embossed.

S5.1.3 *Split service brake system.* In addition to the equipment required by S5.1.2 each motorcycle equipped with a split service brake system shall have a failure indicator lamp as specified in S5.1.3.1.

S5.1.3.1 *Failure indicator lamp.*

(a) One or more electrically operated service brake system failure indicator lamps that is mounted in front of and in clear view of the driver, and that is activated—

(1) In the event of pressure failure in any part of the service brake system, other than a structural failure of either a brake master cylinder body in a split integral body type master cylinder system or a service brake system failure indicator body, before or upon application of not more than 20 pounds of pedal force upon the service brake.

(2) Without the application of pedal force, when the level of brake fluid in a master cylinder reservoir drops to less than the recommended safe level specified by the manufacturer or to less

than one-half the fluid reservoir capacity, whichever is the greater.

(b) All failure indicator lamps shall be activated when the ignition switch is turned from the “off” to the “on” or to the “start” position.

(c) Except for the momentary activation required by S5.1.3.1(b), each indicator lamp, once activated, shall remain activated as long as the condition exists, whenever the ignition switch is in the “on” position. An indicator lamp activated when the ignition is turned to the “start” position shall be deactivated upon return of the switch to the “on” position unless a failure exists in the service brake system.

(d) Each indicator lamp shall have a red lens with the legend “Brake Failure” on or adjacent to it in letters not less than three thirty-seconds of an inch high that shall be legible to the driver in daylight when lighted.

S5.1.4 *Parking brake.* Each three-wheeled motorcycle shall be equipped with a parking brake of a friction type with a solely mechanical means to retain engagement.

S5.1.5 *Other requirements.* The brake system shall be installed so that the lining thickness of drum brake shoes may be visually inspected, either directly or by use of a mirror without removing the drums, and so that disc brake friction lining thickness may be visually inspected without removing the pads.

S5.2 *Service brake system—first (preburnish) effectiveness.*

S5.2.1 *Service brake system.* The service brakes shall be capable of stopping the motorcycle from 30 m.p.h. and 60 m.p.h. within stopping distances which do not exceed the stopping distances specified in Column I of Table I (S7.3.1).

S5.2.2 *Partial service brake system.* Each independently actuated service brake system on each motorcycle shall be capable of stopping the motorcycle from 30 m.p.h. and 60 m.p.h. within stopping distances which do not exceed the stopping distances specified in Column II of Table I (S7.3.2).

S5.3 *Service brake system—second effectiveness.* The service brakes shall be capable of stopping the motorcycle from 30 m.p.h., 60 m.p.h., 80 m.p.h., and the multiple of 5 m.p.h. that is 4 m.p.h. to 8 m.p.h. less than the speed attain-

able in 1 mile if this speed is 95 m.p.h. or greater, within stopping distances that do not exceed the stopping distances specified in Column III of Table I (S7.5).

S5.4 *Service brake system—fade and recovery.* These requirements do not apply to a motor-driven cycle whose speed attainable in 1 mile is 30 m.p.h. or less.

S5.4.1 *Baseline check—minimum and maximum pedal forces.* The pedal and lever forces used in establishing the fade baseline check average shall be within the limits specified in S6.10 (S7.6.1).

S5.4.2 *Fade.* Each motorcycle shall be capable of making 10 fade stops from 60 m.p.h. at not less than 15 f.p.s.p.s. for each stop (S7.6.2).

S5.4.3 *Fade recovery.* Each motorcycle shall be capable of making five recovery stops with a pedal force that does not exceed 400 Newtons (90 pounds), and a hand lever force that does not exceed 245 Newtons (55 pounds) for any of the first four recovery stops and that for the fifth recovery stop, is within, plus 89 Newtons (20 pounds) and minus 44 Newtons (10 pounds) of the fade test baseline check average force (S7.6.3), but not less than 0 Newtons (0 pounds).

S5.5 *Service brake system—final effectiveness.* These requirements do not apply to a motor-driven cycle whose speed attainable in 1 mile is 30 mph or less.

S5.5.1 *Service brake system.* The service brakes shall be capable of stopping the motorcycle in a manner that complies with S5.3 (S7.8.1).

S5.5.2 *Hydraulic service brake system—partial failure.* In the event of a pressure component leakage failure, other than a structural failure of either a brake master cylinder body in a split integral body type master cylinder system or a service brake system failure indicator body, the remaining portion of the service brake system shall continue to operate and shall be capable of stopping the motorcycle from 30 m.p.h. and 60 m.p.h. within stopping distances that do not exceed the stopping distances specified in Column IV of Table I (S7.8.2).

S5.6 *Parking brake system.* The parking brake system shall be capable of

holding the motorcycle stationary (to the limits of traction of the braked wheels), for 5 minutes, in both forward and reverse directions, on a 30 percent grade, with an applied force of not more than 90 pounds for a foot-operated system and 55 pounds for a hand-operated system (S7.9).

S5.7 *Service brake system—water recovery.*

S5.7.1 *Baseline check.* The pedal and lever forces used in establishing the water recovery baseline check average shall be within the limits specified in S6.10 (S7.10.1).

S5.7.2 *Water recovery test.* Each motorcycle shall be capable of making five recovery stops with a pedal force that does not exceed 400 Newtons (90 pounds), and hand lever force that does not exceed 245 Newtons (55 pounds), for any of the first four recovery stops, and that for the fifth recovery stop, is within, plus 89 Newtons (20 pounds) and minus 44 Newtons (10 pounds) of the water recovery baseline check average force (S7.10.2), but not less than 0 Newtons (0 pounds).

S5.8 *Service brake system design durability.* Each motorcycle shall be capable of completing all braking requirements of S5 without detachment of brake linings from the shoes or pad, detachment or fracture of any brake system components, or leakage of fluid or lubricant at the wheel cylinder, and master cylinder reservoir cover, seal, or retention device (S7.11).

S6 *Test conditions.* The requirements of S5 shall be met under the following conditions. Where a range of conditions is specified, the motorcycle shall be capable of meeting the requirements at all points within the range.

S6.1 *Vehicle weight.* Motorcycle weight is unloaded vehicle weight plus 200 pounds (including driver and instrumentation), with the added weight distributed in the saddle or carrier if so equipped.

S6.2 *Tire inflation pressure.* Tire inflation pressure is the pressure recommended by the manufacturer for the vehicle weight specified in paragraph S6.1.

S6.3 *Transmission.* Unless otherwise specified, all stops are made with the clutch disengaged.

S6.4 *Engine.* Engine idle speed and ignition timing settings are according to the manufacturer's recommendations. If the vehicle is equipped with an adjustable engine speed governor, it is adjusted according to the manufacturer's recommendation.

S6.5 *Ambient temperature.* The ambient temperature is between 32 °F. and 100 °F.

S6.6 *Wind velocity.* The wind velocity is zero.

S6.7 *Road surface.* Road tests are conducted on level roadway having a skid number of 81. The roadway is 8 feet wide for two-wheeled motorcycles, and overall vehicle width plus 5 feet for three-wheeled motorcycles. The parking brake test surface is clean, dry, smooth portland cement concrete.

S6.8 *Vehicle position.* The motorcycle is aligned in the center of the roadway at the start of each brake application. Stops are made without any part of the motorcycle leaving the roadway and without lockup of any wheel.

S6.9 *Thermocouples.* The brake temperature is measured by plug-type thermocouples installed in the approximate center of the facing length and width of the most heavily loaded shoe or disc pad, one per brake, as shown in Figure 1.

S6.10 *Brake actuation forces.* Except for the requirements of the fifth recovery stop in S5.4.3 and S5.7.2 (S7.6.3 and S7.10.2), the hand lever force is not less than 10 Newtons (2.3 pounds) and not more than 245 Newtons (55 pounds) and the foot pedal force is not less than 25 Newtons (5.6 pounds) and not more than 400 Newtons (90 pounds). The point of initial application of the lever forces is 1.2 inches from the end of the brake lever grip. The direction of the force is perpendicular to the handle grip on the plane along which the brake lever rotates, and the point of application of the pedal force is the center of the foot contact pad of the brake pedal. The direction of the force is perpendicular to the foot contact pad on the plane along which the brake pedal rotates, as shown in Figure 2.

S7. *Test procedures and sequence.* Each motorcycle shall be capable of meeting all the requirements of this standard when tested according to the procedures and in the sequence set forth

below without replacing any brake system part, or making any adjustments to the brake system other than as permitted in S7.4. A motorcycle shall be deemed to comply with S5.2, S5.3 and S5.5 if at least one of the stops specified in S7.3, S7.5 and S7.8 is made within the stopping distances specified in Table I.

**S7.1 Braking warming.** If the initial brake temperature for the first stop in a test procedure (other than S7.10) has not been reached, heat the brakes to the initial brake temperature by making up to 10 stops from 30 m.p.h. at a deceleration of not more than 10 f.p.s.p.s. On independently operated brake systems, the coldest brake shall be within 10 °F. of the hottest brake.

**S7.2 Pretest instrumentation check.** Conduct a general check of test instrumentation by making not more than 10 stops from a speed of not more than 30 m.p.h. at a deceleration of not more than 10 f.p.s.p.s. If test instrument repair, replacement, or adjustment is necessary, make not more than 10 additional stops after such repair, replacement or adjustment.

**S7.3 Service brake system—first (preburnished) effectiveness test.**

**S7.3.1 Service brake system.** Make six stops from 30 m.p.h. and then six stops from 60 m.p.h. with an initial brake temperature between 130 °F. and 150 °F.

**S7.3.2 Partial service brake system.** For a motorcycle with two independently actuated service brake systems, repeat S7.3.1 using each service brake system individually.

**S7.4 Service brake system—burnish procedure.** Burnish the brakes by making 200 stops from 30 m.p.h. at 12 f.p.s.p.s. The braking interval shall be either the distance necessary to reduce the initial brake temperature to between 130 °F. and 150 °F. or 1 mile, whichever occurs first. Accelerate at maximum rate to 30 m.p.h. immediately after each stop and maintain that speed until making the next stop. After burnishing adjust the brakes in accordance with the manufacturer's recommendation.

**S7.5 Service brake system—second effectiveness test.** Repeat S7.3.1. Then, make four stops from 80 m.p.h. and four stops from the multiple of 5 m.p.h. that is 4 m.p.h. to 8 m.p.h. less than the

speed attainable in 1 mile if that speed is 95 m.p.h. or greater.

**S7.6 Service brake system—fade and recovery test.** These requirements do not apply to a motor-driven cycle whose speed attainable in 1 mile is 30 m.p.h. or less.

**S7.6.1 Baseline check stops.** Make three stops from 30 m.p.h. at 10 to 11 f.p.s.p.s. for each stop. Compute the average of the maximum brake pedal forces and the maximum brake lever forces required for the three stops.

**S7.6.2 Fade stops.** Make 10 stops from 60 m.p.h. at not less than 15 f.p.s.p.s. for each stop. The initial brake temperature before the first brake application shall be between 130 °F. and 150 °F. Initial brake temperatures before brake applications for subsequent stops shall be those occurring at the distance intervals. Attain the required deceleration as quickly as possible and maintain at least this rate for not less than three-fourths of the total stopping distance for each stop. The interval between the starts of service brake applications shall be 0.4 mile. Drive 1 mile at 30 m.p.h. after the last fade stop and immediately conduct the recovery test specified in S7.6.3.

**S7.6.3 Recovery test.** Make five stops from 30 m.p.h. at 10 to 11 f.p.s.p.s. for each stop. The braking interval shall not be more than 1 mile. Immediately after each stop accelerate at maximum rate to 30 m.p.h. and maintain that speed until making the next stop.

**S7.7 Service brake system—reburnish.** Repeat S7.4 except make 35 burnish stops instead of 200 stops. Brakes may be adjusted after reburnish if no tools are used. These requirements do not apply to a motor-driven cycle whose speed attainable in 1 mile is 30 m.p.h. or less.

**S7.8 Service brake system—final effectiveness test.** These requirements do not apply to a motor-driven cycle whose speed attainable in 1 mile is 30 m.p.h. or less.

**S7.8.1 Service brake system.** Repeat S7.5 including S7.3.1.

**S7.8.2 Partial service brake system test.** Alter the service brake system on three-wheeled motorcycles to induce a complete loss of braking in any one subsystem. Determine the line pressure or pedal force necessary to cause the

brake system failure indicator to operate. Make six stops from 30 m.p.h. and then six stops from 60 m.p.h. with an initial brake temperature between 130 °F. and 150 °F. Repeat for each subsystem. Determine that the brake failure indicator is operating when the master cylinder fluid level is less than the level specified in S5.1.3.1(a)(2), and that it complies with S5.1.3.1(c). Check for proper operation with each reservoir in turn at a low level. Restore the service brake system to normal at completion of this test.

**S7.9 Parking brake test.** Starting with an initial brake temperature of not more than 150 °F., drive the motorcycle downhill on the 30 percent grade with the longitudinal axis of the motorcycle in the direction of the grade. Apply the service brakes with a force not exceeding 90 pounds to stop the motorcycle and place the transmission in neutral. Apply the parking brake by exerting a force not exceeding those specified in S5.6. Release the service brake and allow the motorcycle to remain at rest (to the limit of traction of the braked wheels) for 5 minutes. Repeat the test with the motorcycle parked in the reversed (uphill) position on the grade.

**S7.10 Service brake system—water recovery test.**

**S7.10.1 Baseline check stops.** Make three stops from 30 m.p.h. at 10 to 11 f.p.s.p.s. for each stop. Compute the average of the maximum brake pedal

forces and of the maximum brake lever forces required for the three stops.

**S7.10.2 Wet brake recovery stops.** Completely immerse the rear brake assembly of the motorcycle in water for 2 minutes with the brake fully released. Next completely immerse the front brake assembly of the motorcycle in water for 2 minutes with the brake fully released. Perform the entire wetting procedure in not more than 7 minutes. Immediately after removal of the front brake from water, accelerate at a maximum rate to 30 mi/h without a brake application. Immediately upon reaching that speed make five stops, each from 30 mi/h at 10 to 11 ft/s<sup>2</sup> for each stop. After each stop (except the last) accelerate the motorcycle immediately at a maximum rate to 30 mi/h and begin the next stop.

**S7.11 Final inspection.** Upon completion of all the tests inspect the brake system in an assembled condition, for compliance with the brake lining inspection requirements. Disassemble all brakes and inspect:

- (a) The entire brake system for detachment or fracture of any component.
- (b) Brake linings for detachment from the shoe or pad.
- (c) Wheel cylinder, master cylinder, and axle seals for fluid or lubricant leakage.
- (d) Master cylinder for reservoir capacity and retention device.
- (e) Master cylinder label for compliance with S5.1.2.2.

TABLE I—STOPPING DISTANCES FOR EFFECTIVENESS, FADE AND PARTIAL SYSTEM TESTS

Vehicle test speed, m.p.h.	Stopping distance, feet—Effectiveness tests			
	Preburnish effectiveness total system (S5.2.1)—I	Preburnish effectiveness partial mechanical systems (S5.2.2)—II	Effectiveness total system (S5.4) (SS5.7.1)—III	Effectiveness partial hydraulic systems (S5.7.2)—IV
15	13	30	11	25
20	24	54	19	44
25	37	84	30	68
30	54	121	43	97
35	74	165	58	132
40	96	216	75	173
45	121	273	95	218
50	150	337	128	264
55	181	407	155	326
60	216	484	185	388
65			217	455
70			264	527
75			303	606
80			345	689
85			389	778
90			484	872

TABLE I—STOPPING DISTANCES FOR EFFECTIVENESS, FADE AND PARTIAL SYSTEM TESTS—  
Continued

Vehicle test speed, m.p.h.	Stopping distance, feet—Effectiveness tests			
	Preburnish effectiveness total system (S5.2.1)—I	Preburnish effectiveness partial mechanical systems (S5.2.2)—II	Effectiveness total system (S5.4) (SS5.7.1)—III	Effectiveness partial hydraulic systems (S5.7.2)—IV
95 .....	.....	.....	540	971
100 .....	.....	.....	598	1076
105 .....	.....	.....	659	1188
110 .....	.....	.....	723	1302
115 .....	.....	.....	791	1423
120 .....	.....	.....	861	1549

TABLE II—BRAKE TEST SEQUENCE AND REQUIREMENTS

Sequence L.C.	Test procedure	Requirements
1. Instrumentation check .....	S7.2	.....
2. First (Preburnish) effectiveness test:		
(a) Service brake system .....	S7.3.1	S5.2.1
(b) Partial service brake system .....	S7.3.2	S5.2.2
3. Burnish procedure .....	S7.4	.....
4. Second effectiveness test .....	S7.5	S5.3
5. First fade and recovery test .....	S7.6	S5.4
6. Reburnish .....	S7.7	.....
7. Final effectiveness test:		
(a) Service brake system .....	S7.8.1	S5.5.1
(b) Partial service brake system .....	S7.8.2	S5.5.2
8. Parking brake test (three-wheeled motorcycles only) .....	S7.9	S5.6
9. Water recovery test .....	S7.10	S5.7
10. Design durability .....	S7.11	S5.8

