(g) Remote pickup broadcast station or system logs and records may be kept at any location convenient to the licensee: *Provided*, Such log and records shall be readily available for inspection by a duly authorized representative of the Commission upon request. Logs and records shall be retained for a period of two years.

§ 74.482 Station identification.

(a) Except for stations licensed pursuant to § 74.435, the Commission will assign a call sign for each remote pickup broadcast station or system and, for systems, the licensee shall assign a unit designator to each station in the system. The station or system call sign, and unit designator where appropriate, shall be transmitted by the station at the beginning and end of each period of operation. A period of operation may consist of a single continuous transmission or a series of intermittent transmissions pertaining to a single event.

(b) In cases where a period of operation is of more than one hour duration identification of remote pickup broadcast stations participating in the operation shall be made at approximately one-hour intervals. Identification transmissions during operation need not be made when to make such transmission would interrupt a single consecutive speech, play, religious service, symphony, concert, or any type of production. In such cases, the identification transmissions shall be made at the first interruption in the program continuity and at the conclusion thereof. Hourly identification may be accomplished either by transmission of the station or system call sign and unit designator assigned to the individual station or identification of an associated broadcasting station or network with which the remote pickup broadcast station is being used.

(c) In cases where an automatic relay station is a part of the circuit, the call sign of the relay transmitter may be transmitted automatically by the relay transmitter or by the remote pickup broadcast base or mobile station that actuates the automatic relay station.

APPENDIX A

COMMENTS

Sinclair Stations (Sinclair)
A. Earl Cullum, Jr. and Associates (Cullum)
Readex Electronics, Inc. (Readex)
Vega Division of Setco (Vega)
National Association of Manufacturers (NAM)
Atlantic Richfield Co. (Atlantic)
WHME Broadcasting (WHME)
Wheatstone Bridge Engineering Co. (Wheatstone)
Tall Texas Radio (KOKE)
Comrex Corp. (Comrex)
Paul Schuett (Schuett)
Association of Federal Communications Consulting Engineers (AFCCE)
Marti Electronics, Inc. (Marti)
Mountain Broadcasting, Inc. (Mountain)
National Association of Business and Educational Radio (NABER)
American Broadcasting Companies, Inc. (ABC)
National Broadcasting Co. (NBC)
Association for Broadcast Engineering Standards, Inc. (ABES)
Special Industrial Radio Service Associations, Inc. (SIRSA).
Utilities Telecommunications Council (UTC)
Central Committee of The American Petroleum Institute (Central Committee)
WBEN, Inc. (WBEN)
CBS, Inc. (CBS)
National Association of Broadcasters (NAB)
The Hearst Corp. (WBAL–TV)
Mutual Boradcasting System, Inc. (Mutual)

REPLY COMMENTS

National Association of Business and Educational Radio (NABER)
CBS, Inc. (CBS)
Utilities Telecommunications Council (UTC)
Central Committee of the American Petroleum Institute (Central Committee)

[FR Doc.76-20538 Filed 7-16-76;8:45 am]

PART 78—CABLE TELEVISION RELAY SERVICES

Cable Television Relay Service (CARS)

By the Executive Director: 1. A review of the Cable Television Relay Service (CARS) Rules, Part 78 of the Commission's rules and regulations, has disclosed that several requirements can properly be relaxed and that certain clarifications are appropriate.

2. In establishing procedures to implement the National Environmental Policy Act of 1969, we did not deem it necessary to repeat the text of such procedures throughout all of our rules governing construction of radio stations. We consider it appropriate, however, to direct the attention of applicants for CARS construction permits to the procedures contained in Subpart I of Part 1 of the Commission's rules, and we are amending § 78.15 accordingly.

3. CARS licensees using antenna structures which require air navigation markings must comply with the provisions of Part 17 of the Rules (Construction, Marking, and Lighting of Antenna Structures). Sections 78.63 and 78.69 refer a CARS licensee to the requirements contained in Part 17. For the convenience of station licensees and to eliminate unnecessary cross-references, we are amending §§ 78.63 and 78.69 to include therein the pertinent requirements of Part 17 concerning antenna structures used by CARS stations.

4. Presently, § 78.69 of the rules requires CARS licensees to record the date and time of the beginning and end of each period of operation of each transmitter. The rule is burdensome for those licensees whose stations operate unattended, pursuant to § 78.53. To remove this unnecessary burden, we are amending § 78.69 to eliminate this recordkeeping requirement at stations which are operated unattended.

5. We are also amending the rules as to equipment changes which require prior Commission authorization. Presently, pursuant to § 78.109, a CARS licensee or permittee must file a formal application to replace a station's transmitter, except for replacement with an identical transmitter. Since transmitters made by different manufacturers often have nearly the same emission characteristics, we believe that a licensee or permittee may change transmitters and still maintain proper operation of the station. Accordingly, we shall allow CARS licensees and permittees to replace a transmitter provided that there is no change in the type of modulation or in the authorized operating power (antenna input power), and further provided that the emission bandwidth is not increased beyond the authorized bandwidth. Licensees and permittees are reminded, however, that the Commission must be notified of such changes pursuant to § 78.109(b), and that a transmitter must meet the requirements of § 78.107(b).

6. Section 78.109 also requires a formal application to change a CARS station's transmitter control system. We believe that this procedure is unnecessary and that a notification prior to the change is all that is needed. Accordingly, we shall not require a formal application for a change in a CARS station's control system, and we are deleting such requirement from § 78.109. However, we believe that prior notice is appropriate, and we are therefore amending §§ 78.51 and 78.53 of the rules to require notification to the Commission at least ten days prior to a change in a station's control system to either remote control or unattended operation. Such notification must include the presently required showing as to how the licensee or permittee will comply with the requirements of §§ 78.51 or 78.53. We are retaining the right to notify a licensee or permittee not to make a change in a station's control system, or to cancel, suspend, or change the date of commencement of such remote control or unattended operation, when such action appears to be in the public interest, convenience, or necessity.

7. The Commission has received a number of informal inquires as to whether a change in polarization of an emitted signal requires prior Commission authorization. The polarization of signals has a significant effect on the potential interference between stations, and, in issuing CARS authorizations, we specifically designate the polarization for each channel. Thus, a change in a signal's polarization is, in fact, a change in the assigned frequency. To clarify this point, we are amending § 78.109(a)(7) to include a change in polarization as a change which requires prior Commission authorization.

8. Section 78.113 requires CARS licensees to make frequency measurements to insure compliance with our frequency tolerance requirements, with the measurements being made at intervals of no more than one month. The requirement of a monthly measurement is more stringent than similar requirements in the Broadcast Auxiliary Service and in the Private Operational-Fixed Service, which provide for annual measurements. We no longer believe that a monthly test is needed to insure compliance with our frequency tolerance requirements. Accordingly, we are amending § 78.113 to require frequency measurements upon initial installation of a transmitter, on an annual basis thereafter, and when any change is made in a transmitter which may affect the carrier frequency or the stability thereof.

9. Authority for the attached amendments is contained in 47 U.S.C. 151, 152, 301, 303, and 307; and in § 0.231(d) of the Commission's rules. Inasmuch as the amendments ordered are nonsubstantive editorial revisions of the Commission's rules and regulations, impose no new requirements, and are intended only to relax or clarify existing requirements, compliance with the prior notice, procedural and effective date provisions of the Administrative Procedure Act, 5 U.S.C. 553, would serve no useful purpose and is unnecessary.

10. Accordingly, *It is ordered*, That effective July 29, 1976, Part 78 of the Commission's rules and regulations is amended as set forth below.

(Secs. 1, 2, 301, 303, 307, 48 Stat., as amended, 1064, 1081, 1082, 1083; 47 U.S.C. 151, 152, 301, 303, 307)

Adopted: July 14, 1976.

Released: July 16, 1976.

FEDERAL COMMUNICATIONS COMMISSION,
R. D. LICHTWARDT,
Executive Director.

Part 78 of Chapter I of Title 47 of the Code of Federal Regulations is amended in the following manner:

1. Section 78.15 is revised by adding paragraph (c) to read as follows:

§ 78.15 Contents of applications.

* * * * *

(c) CARS applicants for construction permits or modifications of construction permits must follow the procedures prescribed in Subpart I of Part 1 of this chapter (§§ 1.1301 through 1.1319) unless Commission action authorizing construction of a CARS station would be a minor action within the meaning of Subpart I of Part 1.

2. Section 78.15(a) is revised and (c) is added to read as follows:

§ 78.51 Remote control operation.

(a) A CARS station may be operated by remote control: *Provided*, That such operation is conducted in accordance with the conditions listed below: *And provided further*, That the Commission, in Washington, D.C., is notified at least 10 days prior to the beginning of such operation and that such notification is accompanied by a detailed description showing the manner of compliance with the following conditions:

* * * * *

(c) The Commission may notify the licensee or permittee not to commence remote control operation, or to cancel, suspend, or change the date of the beginning of such operation as and when such action may appear to be in the public interest, convenience, or necessity.

3. Section 78.53(a) is revised and (c) is added to read as follows:

§ 78.53 Unattended operation.

(a) A CARS station other than a CARS pickup station may be operated unattended: *Provided*, That such operation is conducted in accordance with the conditions listed below: *And provided further*, That the Commission, in Washington, D.C., is notified at least 10 days prior to the beginning of such operation and that such notification is accompanied by a detailed description showing the manner of compliance with the following conditions:

* * * * *

(c) The Commission may notify the licensee or permittee not to commence unattended operation, or to cancel, suspend, or change the date of the beginning of such operation as and when such action may appear to be in the public interest, convenience, or necessity.

4. Section 78.63, headnote and text, are revised to read as follows:

§ 78.63 Inspection and maintenance of tower marking and associated control equipment.

The licensee or permittee of any CARS station which has an antenna structure required to be painted or illuminated pursuant to the provisions of section 303(q) of the Communications Act of 1934, as amended, and/or Part 17 of this chapter, shall operate and maintain the tower marking and associated control equipment in accordance with the following:

(a) The tower lights shall be observed at least once each 24 hours, either visually or by observing an automatic and properly maintained indicator designed to register any failure of such lights, to insure that all such lights are functioning properly as required; or, alternatively, there shall be provided and properly maintained an automatic alarm system designed to detect any failure of the tower lights and to provide indication of such failure to the licensee.

(b) Any observed or otherwise known failure of a code or rotating beacon light or top light not corrected within thirty minutes, regardless of the cause of such failure, shall be reported immediately by telephone or telegraph to the nearest Flight Service Station or office of the Federal Aviation Administration. Further notification by telephone or telegraph shall be given immediately upon resumption of the required illumination.

(c) All automatic or mechanical control devices, indicators, and alarm systems associated with the tower lights shall be inspected at intervals not to exceed three months, to insure that such apparatus is functioning properly.

(d) Red obstruction lighting shall be exhibited from sunset to sunrise unless otherwise specified in the instrument of station authorization.

(e) All towers shall be cleaned or repainted as often as is necessary to maintain good visibility.

5. Section 78.69, headnote and text, are revised to read as follows:

§ 78.69 Station records.

Each licensee or permittee of a CARS station shall maintain records showing the following:

(a) For all attended or remotely controlled stations, the date and time of the beginning and end of each period of transmission of each channel;

(b) For all stations, the date and time of any unscheduled interruptions to the transmissions of the station, the duration of such interruptions, and the causes thereof;

(c) For all stations, the results and dates of the frequency measurements made pursuant to § 78.113 and the name of the person or persons making the measurements;

(d) For all stations, when service or maintenance duties are performed, which may affect a station's proper operation, the responsible operator shall sign and date an entry in the station's records, giving:

(1) Pertinent details of all transmitter adjustments performed by the operator or under the operator's supervision;

(2) The operator's name and address and the class, serial number, and expiration date of the operator's license. This information, so long as it remains unchanged, is not required to be repeated in the case of a person who is regularly employed as operator on a full-time basis at the station.

(e) When a station in this service has an antenna structure which is required to be illuminated, appropriate entries shall be made as follows:

(1) The time the tower lights are turned on and off each day, if manually controlled.

(2) The time the daily check of proper operation of the tower lights was made, if an automatic alarm system is not employed.

(3) In the event of any observed or otherwise known failure of a tower light:

(i) Nature of such failure.

(ii) Date and time the failure was observed or otherwise noted.

(iii) Date, time, and nature of the adjustments, repairs, or replacements made.

(iv) Identification of Flight Service Station (Federal Aviation Administration) notified of the failure of any code or rotating beacon light not corrected within 30 minutes, and the date and time such notice was given.

(v) Date and time notice was given to the Flight Service Station (Federal Aviation Administration) that the required illumination was resumed.

(4) Upon completion of the 3-month periodic inspection required by § 78.63 (c):

(i) The date of the inspection and the condition of all tower lights and associated tower lighting control devices, indicators, and alarm systems.

(ii) Any adjustments, replacements, or repairs made to insure compliance with the lighting requirements and the date such adjustments, replacements, or repairs were made.

(f) For all stations, station record entries shall be made in an orderly and legible manner by the person or persons competent to do so, having actual knowledge of the facts required, who shall sign the station record when starting duty and again when going off duty.

(g) For all stations, no station record or portion thereof shall be erased, obliterated, or willfully destroyed within the period of retention required by rule. Any necessary correction may be made only by the person who made the original entry who shall strike out the erroneous portion, initial the correction made, and show the date the correction was made.

(h) For all stations, station records shall be retained for a period of not less than 2 years. The Commission reserves the right to order retention of station records for a longer period of time. In cases where the licensee or permittee has notice of any claim or complaint, the station record shall be retained until such claim or complaint has been fully satisfied or until the same has been barred by statute limiting the time for filing of suits upon such claims.

6. Section 78.109(a) is amended by revising paragraphs (a)(1), (a)(5), and (a)(7) to read as follows:

§ 78.109 Equipment changes.

(a) * * *

(1) Any increase in emission bandwidth beyond that authorized;

* * * * *

(5) Any change in the type of modulation;

* * * * *

(7) Any change in frequency assignment, including polarization;

* * * * *

7. Section 78.113 is amended by revising paragraph (a) to read as follows:

§ 78.113 Frequency monitors and measurements.

(a) The licensee or permittee of each station shall employ a suitable procedure to determine that the carrier frequency of each transmitter is maintained within the tolerance prescribed in § 78.111 at all times. This determination shall be made, and the results thereof entered in the station records: when a transmitter is initially installed; when any change is made in a transmitter which may affect the carrier frequency or the stability thereof; or in any case at intervals not exceeding one year.

* * * * *

[FR Doc.76-20730 Filed 7-16-76;8:45 am]

Title 49—Transportation

SUBTITLE A—OFFICE OF THE SECRETARY OF TRANSPORTATION

[OST Docket No. 1, Amdt. I-113]

PART 1—ORGANIZATION AND DELEGATION OF POWERS AND DUTIES

Correction

In FR Doc. 75-25436, appearing at page 43901, in the issue for Wednesday, September 24, 1975, and corrected at page 20172, in the issue for Monday, May 17, 1976, "§ 1.47(k)", should be "§ 1.47(j)".

CHAPTER V—NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

[Docket Nos. 75-07; 75-16; Notices 03, 09]

PART 571—FEDERAL MOTOR VEHICLE SAFETY STANDARDS

Republication of Brake System Standards

STANDARD NOS. 105-75 AND 121

This notice republishes in their entirety Standard No. 105-75, *Hydraulic Brake Systems*, and Standard No. 121, *Air Brake Systems*, because the number and complexity of recent amendments to these standards may have created confusion for some interested persons.

Standard No. 105-75 (49 CFR 571.105-75) was issued September 1972 (37 FR 17970, September 2, 1972) and has been amended numerous times since issuance. Although an up-to-date and complete text of the standard appears each year in the republished Code of Federal Regulations, several complex amendments have been made to the standard in the past year that are not reflected in the most recent up-to-date text. To assist interested persons who must be certain of the text's provisions, the agency herewith publishes the standard in its entirety. Interested persons are advised that amendments of Standard No. 105-75 may occur in the future, although no proposals are outstanding at this time.

In a related matter, General Motors Corporation has brought to the agency's attention an inadvertent deletion of one sentence from one section of Standard No. 105-75. A statement was added to the text of S5.1.5.2(a)(2) to permit an interim increase in permissible control force for the fifth wet recovery stop (40 FR 24525, June 9, 1975). Inadvertently, this sentence was deleted from S5.1.5.2(a)(2) in a subsequent rulemaking action (40 FR 42872, September 17, 1975), although the preamble to the notice made clear that "The new wording in no way modifies the meaning of S5.1.4(a)(2) and S5.1.5.2(a)(2)." To correct this omission, the sentence appears in this publication. It has been moved to S5.1.5.2(a)(1) because it concerns the maximum pedal force limit in that section, rather than the minimum pedal force limit in S5.1.5.2(a)(2) where it appeared in the past.

Standard No. 121 (49 CFR 571.121) was issued in February 1971 (36 FR 3817, February 27, 1971) and has also been amended numerous times since issuance. Several amendments have occurred since the most recent publication of the standard in its entirety. For the reasons cited with regard to Standard No. 105-75, the agency herewith publishes the standard in its entirety. Interested persons are advised that three proposals to amend the standard are outstanding (40 FR 45200, October 1, 1975) (40 FR 56920, December 5, 1975) (41 FR 20706, May 20, 1976) and that amendments to the text of the standard may be made in the future.

It has also been noted that a clarification could be made to the language of S3 of the standard that excludes until September 1, 1977, vehicles that combine with other vehicles to form auto transporters. The temporary exclusion was added to the standard in January 1975 (40 FR 1246, January 7, 1975). To make the effect of that action more clear, the language in the second sentence of the text "or to any vehicle which" is changed in this republication to read "or that". This modification of the language has no effect on the requirements of this standard and notice and opportunity to comment are therefore found to be unnecessary.

In consideration of the foregoing, Standard No. 105-75 (49 CFR 571.105-75) and Standard No. 121 (49 CFR 571.121) are republished to read as set forth below.

(Sec. 103, 119, Pub. L. 89-563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegations of authority at 49 CFR 1.50 and 49 CFR 501.8.)

Issued on June 30, 1976.

ROBERT L. CARTER,
Associate Administrator,
Motor Vehicle Programs.

§ 571.105-75 Standard No. 105-75; Hydraulic brake systems (Effective Jan. 1, 1976).

S1. *Scope.* This standard specifies requirements for hydraulic service brake and associated parking brake systems.

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

S3. *Application.* This standard applies to passenger cars equipped with hydraulic service brake systems, and to school buses manufactured on and after October 12, 1976, with hydraulic service brake systems.

S4. *Definitions.* "Antilock system" means a portion of a service brake system that automatically controls the degree of rotational wheel slip at one or more road wheels of the vehicle during braking.

"Backup system" means a portion of a service brake system, such as a pump, that supplies energy, in the event of a primary brake power source failure.

"Brake power assist unit" means a device installed in a hydraulic brake system that reduces the operator effort required to actuate the system, and that if inoperative does not prevent the operator from braking the vehicle by a continued application of muscular force on the service brake control.

"Brake power unit" means a device installed in a brake system that provides the energy required to actuate the brakes, either directly or indirectly through an auxiliary device, with the operator action consisting only of modulating the energy application level.

"Hydraulic brake system" means a system that uses hydraulic fluid as a medium for transmitting force from a service brake control to the service brake, and that may incorporate a brake power assist unit, or a brake power unit.

"Initial brake temperature" means the average temperature of the service

brakes on the hottest axle of the vehicle 0.2 mi before any brake application.

"Lightly loaded vehicle weight" means:

(a) For vehicles with a GVWR of 10,000 lb or less, unloaded vehicle weight plus 300 lb. (including driver and instrumentation);

(b) For vehicles with a GVWR greater than 10,000 lb, unloaded vehicle weight plus 500 lb (including driver and instrumentation).

"Parking mechanism" means a component or subsystem of the drive train that locks the drive train when the transmission control is placed in a parking or other gear position and the ignition key is removed.

"Pressure component" means a brake system component that contains the brake system fluid and controls or senses the fluid pressure.

"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 wate rdelivery as specified in paragraphs 7.1 and 7.2 of that method.

"Snub" means the braking deceleration of a vehicle from a higher reference speed to a lower reference speed that is greater than zero.

"Speed attainable in 2 mi" means the speed attainable by accelerating at maximum rate from a standing start for 2 mi on a level surface.

"Spike stop" means a stop resulting from the application of 200 lbs of force on the service brake control in 0.08 s.

"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 two or more subsystems) shall not impair the operation of any other subsystem.

"Stopping distance" means the distance traveled by a vehicle from the point of application of force to the brake control to the point at which the vehicle reaches a full stop.

"Variable proportioning brake system" means a system that automatically adjusts the braking force at the axles to compensate for vehicle static axle loading and/or dynamic weight transfer between axles during deceleration.

S5 *Requirements.*

S5.1 *Service brake system.* Each vehicle shall be capable of meeting the requirements of S5.1.1 through S5.1.6, under the conditions specified in S6, when tested according to the procedures and in the sequence set forth in S7. Except as noted in S5.1.1.2 and S5.1.1.4, if a vehicle is incapable of attaining a speed specified in S5.1.1, S5.1.2, S5.1.3, or S5.1.6, its service brakes shall be capable of stopping the vehicle from the multiple of 5 mph, that is 4 to 8 mph less than the speed attainable in 2 miles, within distances that do not exceed the corresponding distances specified in table II. If a vehicle is incapable of attaining a speed specified in S5.1.4 in the time or distance interval set forth, it shall be tested at the highest speed attainable in the time or distance interval specified.

S5.1.1 *Stopping distance.* The service brakes shall be capable of stopping each vehicle in four effectiveness tests within the distances, and from the speeds specified below.

S5.1.1.1 In the first (preburnished) effectiveness test, the vehicle shall be capable of stopping from 30 mph and 60 mph within the corresponding distances specified in column I of table II.

S5.1.1.2 In the second effectiveness test, the vehicle shall be capable of stopping from 30 and 60 mph within the corresponding distances specified in column II of table II. If the speed attainable in 2 miles is not less than 84 mph, a passenger car shall also be capable of stopping from 80 mph within the correspondent distance specified in column II of table II.

S5.1.1.3 In the third effectiveness test the vehicle shall be capable of stopping at lightly loaded vehicle weight from 60 mph within the corresponding distance specified in column III of table II.

S5.1.1.4 In the fourth effectiveness test, a vehicle with a GVWR of 10,000 pounds or less shall be capable of stopping from 30 and 60 mph within the corresponding distances specified in Column I of Table II. If the speed attainable in 2 miles is not less than 84 mph, a passenger car shall also be capable of stopping from 80 mph within the corresponding distance specified in Column I of Table II.

If the speed attainable in 2 miles is not less than 99 mph, a passenger car shall, in addition, be capable of stopping from the applicable speed indicated below, within the corresponding distance specified in Column I of Table II.

Speed attainable in 2 miles (mph)	*Required to stop from (mph)*
Not less than 99 but less than 104	95
104 or more	100

S5.1.2 *Partial failure.* S5.1.2.1 In vehicles manufactured with a split service brake system, in the event of a rupture or leakage type of failure in a single subsystem, other than a structural failure of a housing that is common to two or more subsystems, the remaining portion(s) of the service brake system shall continue to operate and shall be capable of stopping a vehicle from 60 mph within the corresponding distance specified in Column IV of Table II.

S5.1.2.2 In vehicles not manufactured with a split service brake system, in the event of any one rupture or leakage type of failure in any component of the service brake system the vehicle shall, by operation of the service brake control, be capable of stopping 10 times consecutively from 60 mph within the corresponding distance specified in Column IV of Table II.

S5.1.3 *Inoperative brake power assist unit or brake power unit.* A passenger car equipped with one or more brake power assist units shall meet the requirements of either S5.1.3.1, S.5.1.3.2, or S5.1.3.4 (chosen at the option of the manufacturer), and a passenger car equipped with one or more brake power units shall meet the requirements of either S5.1.3.1, S.5.1.3.3, or S5.1.3.4 (chosen at the option of the manufacturer). A vehicle other than a passenger car shall meet the requirements of S5.1.3.1.

S5.1.3.1 The service brakes on a vehicle equipped with one or more brake power assist units or brake power units, with one such unit inoperative and depleted of all reserve capability, shall be capable of stopping a vehicle from 60 mph within the corresponding distance specified in column IV of table II.

S5.1.3.2 *Brake power assist units.* The service brakes on a vehicle equipped with one or more brake power assist units, with one such unit inoperative, shall be capable of stopping a vehicle from 60 mph:

(a) In six consecutive stops at an average deceleration for each stop that is not lower than that specified in column I of table III, when the inoperative unit is not initially depleted of all reserve capability; and

(b) In a final stop, at an average deceleration that is not lower than 7 fpsps (equivalent stopping distance 554 feet) when the inoperative unit is depleted of all reserve capability.

S5.1.3.3 *Brake power units.* The service brakes of a vehicle equipped with one or more brake power units with an accumulator-type reserve system, with any one failure in any one unit shall be capable of stopping the vehicle from 60 mph—

(a) In 10 consecutive stops at an average deceleration for each stop that is not lower than that specified in column II of table III, when the unit is not initially depleted of all reserve capability; and

(b) In a final stop, at an average deceleration that is not lower than 7 fpsps (equivalent stopping distance 554 feet) when the failed element of the unit is depleted of all reserve capability.

S5.1.3.4 *Brake power assist and brake power units.* The service brakes of a vehicle equipped with one or more brake power assist units or brake power units with a backup system, with one brake power assist unit or brake power unit inoperative and depleted of all reserve capability and with only the backup system operating in the failed subsystem, shall be capable of stopping the vehicle from 60 mph in 15 consecutive stops at an average deceleration for each stop that is not lower than 12 fpsps (equivalent stopping distance 323 feet).

S5.1.4 *Fade and recovery.* The service brakes shall be capable of stopping each vehicle in two fade and recovery tests as specified below.

S5.1.4.1 The control force used for the baseline check stops or snubs shall be not less than 10 pounds, nor more than 60 pounds, except that the control force for a vehicle with a GVWR of 10,000 pounds or more may be between 10 pounds and 90 pounds.

S5.1.4.2 (a) Each vehicle with GVWR of 10,000 lbs or less shall be capable of making 5 fade stops (10 fade stops on the second test) from 60 mph at a deceleration not lower than 15 fpsps for each stop, followed by 5

fade stops at the maximum deceleration attainable from 5 to 15 fpsps.

(b) Each vehicle with a GVWR greater than 10,000 pounds shall be capable of making 10 fade snubs (20 fade snubs on the second test) from 40 mph to 20 mph at 10 fpsps for each snub.

S5.1.4.3(a) Each vehicle with a GVWR of 10,000 pounds or less shall be capable of making five recovery stops from 30 mph at 10 fpsps for each stop, with a control force application that falls within the following maximum and minimum limits:

(1) A maximum for the first four recovery stops of 150 pounds, and for the fifth stop, of 20 pounds more than the average control force for the baseline check; and

(2) A minimum of—

(A) The average control force for the baseline check minus 10 pounds, or

(B) The average control force for the baseline check times 0.60,

whichever is lower (but in no case lower than 5 pounds).

(b) Each vehicle with a GVWR of more than 10,000 pounds shall be capable of making five recovery snubs from 40 mph to 20 mph at 10 fpsps for each snub, with a control force application that falls within the following maximum and minimum limits:

(1) A maximum for the first four recovery snubs of 150 pounds, and for the fifth snub, of 20 pounds more than the average control force for the baseline check (but in no case more than 100 pounds); and

(2) A minimum of—

(A) The average control force for the baseline check minus 10 pounds, or

(B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds).

S5.1.5 *Water recovery.* The service brakes shall be capable of stopping each vehicle in a water recovery test, as specified below.

S5.1.5.1 The control force used for the baseline check stops or snubs shall be not less than 10 pounds, nor more than 60 pounds, except that the control force for a vehicle with a GVWR of 10,000 pounds or more may be between 10 and 90 pounds.

S5.1.5.2(a) After being driven for 2 minutes at a speed of 5 mph in any combination of forward and reverse directions through a trough having a water dept of 6 inches, each vehicle with a GVWR of 10,000 pounds or less shall be capable of making five recovery stops from 30 mph at ten fpsps for each stop with a control force application that falls within the following maximum and minimum limits:

(1) A maximum for the first four recovery stops of 150 pounds, and for the fifth stop, of 45 pounds more than the average control force for the baseline check (but in no case more than 90 pounds, except that the maximum control force for the fifth stop in the case of a vehicle manufactured before September 1, 1976, shall be not more than plus 60 pounds of the average control force for the baseline check (but in no case more than 110 pounds).

(2) A minimum of—

(A) The average control force for the baseline check minus 10 pounds, or

(B) The average control force for the baseline check times 0.60,

whichever is lower (but in no case lower than 5 pounds).

(b) After being driven for 2 minutes at a speed of 5 mph in any combination of forward and reverse directions through a trough having a water depth of 6 inches, each vehicle with a GVWR of more than 10,000 pounds shall be capable of making five recovery stops from 30 mph at 10 fpsps for each stop with a control force application that falls within the following maximum and minimum limits:

(1) A maximum for the first four recovery stops of 150 pounds, and for the fifth stop, of 60 pounds more than the average control force for the baseline check (but in no case more than 110 pounds); and

(2) A minimum of—

(A) The average control force for the baseline check minus 10 pounds, or

(B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds).

S5.1.6 *Spike stops.* Each passenger car shall be capable of making 10 spike stops from 30 mph, followed by 6 effectiveness (check) stops from 60 mph, at least one of which shall be within a corresponding stopping distance specified in column I of table II.

S5.2 *Parking brake system.* Each vehicle shall be manufactured with a parking brake system of a friction type with a solely mechanical means to retain engagement, which shall under the conditions of S6, when tested according to the procedures specified in S7, meet the requirements specified in S5.2.1, S5.2.2, or S5.2.3 as appropriate, with the system engaged—

(a) In the case of a passenger car, with a force applied to the control not to exceed 125 pounds for a foot-operated system and 90 pounds for a hand-operated system; and

(b) In the case of a school bus, with a force applied to the control not to exceed 150 pounds for a foot-operated system and 125 pounds for a hand-operated system.

S5.2.1 Except as provided in S5.2.2, the parking brake system on a vehicle with a GVWR of 10,000 pounds or less shall be capable of holding the vehicle stationary (to the limit of traction on the braked wheels) for 5 minutes in both a forward and reverse direction on a 30 percent grade.

S5.2.2 A vehicle of a type described in S5.2.1 at the option of the manufacturer may meet the requirements of S5.2.2.1, S5.2.2.2, and S5.2.2.3 instead of the requirements of S5.2.1 if:

(a) The vehicle has a transmission or transmission control which incorporates a parking mechanism, and

(b) The parking mechanism must be engaged before the ignition key can be removed.

S5.2.2.1 The vehicle's parking brake and parking mechanism, when both are engaged, shall be capable of holding the vehicle stationary (to the limit of traction of the braked wheels) for 5 minutes, in both forward and reverse directions, on a 30 percent grade.

S5.2.2.2 The vehicle's parking brake, with the parking mechanism not engaged, shall be capable of holding the vehicle stationary for 5 minutes, in both forward and reverse directions, on a 20 percent grade.

S5.2.2.3 With the parking mechanism engaged and the parking brake not engaged, the parking mechanism shall not disengage or fracture in a manner permitting vehicle movement, when the vehicle is impacted at each end, on a level surface, by a barrier moving at 2½ mph.

S5.2.3 The parking brake system on a vehicle with a GVWR greater than 10,000 pounds shall be capable of holding the vehicle stationary for 5 minutes, in both forward and reverse directions, on a 20 percent grade.

S5.3 *Brake system indicator lamp.* Each vehicle shall have one or more brake system indicator lamps, mounted in front of and in clear view of the driver, which meet the requirements of S5.3.1 through S5.3.5. However, the options provided in S5.3.1(a) shall not apply to a vehicle manufactured without a split service brake system; such a vehicle shall, to met the requirements of S5.3.1(a), be equipped with a warning indicator that activates under the conditions specified in S5.3.1(a)(4). This warning indicator shall, instead of meeting the requirements of S5.3.2. through S5.3.5, activate (while the vehicle remains capable of meeting the requirements of S5.1.2.2 and the ignition switch is in the "on" position) a continuous or intermittent audible signal and a flashing warning light, displaying the words "STOP—BRAKE FAILURE" in block capital letters not less than one-quarter of an inch in height.

S5.3.1. An indicator lamp shall be activated when the ignition (start) switch is in the "on" ("run") position and whenever any of conditions (a), (c), or (d) occur, or, at the option of the manufacturer, whenever any of conditions (b), (c), or (d) occur:

(a) A gross loss of pressure (such as caused by rupture of a brake line but not by a structural failure of a housing that is common to two or more subsystems) due to one of the following conditions (chosen at the option of the manufacturer):

(1) Before or upon application of a differential pressure of not more than 225 lb/in² between the active and failed brake system measured at a master cylinder outlet or a slave cylinder outlet.

(2) Before or upon application of 50 pounds of control force upon a fully manual service brake.

(3) Before or upon application of 25 pounds of control force upon a service brake with a brake power assist unit.

(4) When the supply pressure in a brake power unit drops to a level not less than one-half of the normal system pressure.

(b) A drop in the level of brake fluid in any master cylinder reservoir compartment to less than the recommended safe level specified by the manufacturer or to one-fourth of the fluid capacity of that reservoir compartment, whichever is greater.

(c) A total functional electrical failure in an antilock or variable proportioning brake system.

(d) Application of the parking brake.

S5.3.2 All indicator lamps shall be activated as a check of lamp function either when the ignition (start) switch is turned to the "on" (run) position when the engine is not running, or when the ignition (start) switch is in a position between "on" (run) and "start" that is designated by the manufacturer as a check position. However, in vehicles equipped with an automatic transmission, the activation as a check of lamp function is not required when the transmission shift lever is in a forward or reverse drive position.

S5.3.3 Each indicator lamp activated due to a condition specified in S.5.3.1 shall remain activated as long as the condition exists, whenever the ignition (start) switch is in the "on" (run) position, whether or not the engine is running.

S5.3.4 When an indicator lamp is activated it may be steady burning or flashing.

S5.3.5 Each indicator lamp shall have a lens labeled in letters not less than ⅛-inch high, which shall be legible to the driver in daylight when lighted. The lens and the letters shall have contrasting colors, one of which is red. If a single common indicator is used, the lens shall be labeled "Brake". If separate indicator lamps are used for one or more of the various functions described in S5.3.1(a) to S5.3.1(d), the lens shall include the word "Brake" and appropriate additional labeling (use "Brake Pressure," "Brake Fluid" for S.5.3.1(a) and S5.3.1 (b)) except that if a separate parking indicator lamp is provided, the single word "Park" may be used. An anti-lock system may have a separate lens labeled "Antilock", in letters not less than one-eighth of an inch high, which shall be legible to the driver in daylight when lighted, if the indicator is used only for the antilock system. The lens and the letters shall have contratsing colors, one of which is yellow.

S5.4 *Reservoirs.*

S5.4.1 *Master cylinder reservoirs.* A master cylinder shall have a reservoir compartment for each service brake subsystem serviced by the master cylinder. Loss of fluid from one compartment shall not result in a complete loss of brake fluid from another compartment.

S5.4.2 *Reservoir capacity.* Reservoirs, whether for master cylinders or other type systems, shall have a total minimum capacity equivalent to the fluid displacement resulting when all the wheel cylinders or caliper pistons serviced by the reservoirs move from a new lining, fully retracted position (as adjusted initially to the manufacturer's recommended setting) to a fully worn, fully applied position, as determined in accordance with S7.18(c) of this standard. Reservoirs shall have completely separate compartments for each subsystem except that in reservoir systems utilizing a portion of the reservoir for a common supply to two or more subsystems, individual partial compartments shall each have a minimum volume of fluid equal to at least the volume displaced by the master cylinder piston servicing the subsystem, during a full stroke of the piston. Each brake power unit reservoir servicing only the brake system shall have a minimum capacity equivalent to the fluid displacement required to charge the system piston(s) or accumulator(s) to normal operating pressure plus the displacement resulting when all the wheel cylinders or caliper pistons serviced by the reservoir or accumulator(s) move from a new lining fully retracted position (as adjusted initially to the manufacturer's recommended setting) to a fully worn, fully applied position.

S5.4.3 *Reservoir labeling.*—Each vehicle shall have a brake fluid warning statement that reads as follows, in letters at least one-eighth 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.

S5.5 *Antilock and variable proportioning brake systems.* In the event of failure (structural or functional) in an antilock or variable proportioning brake system the vehicle shall be capable of meeting the stopping distance requirements specified in S5.1.2 for service brake system partial failure.

S5.6 *Brake system integrity.* Each vehicle shall be capable of completing all performance requirements of S5 without—

(a) Detachment or fracture of any component of the braking system, such as brake springs and brake shoe or disc pad facing, other than minor cracks that do not impair attachment of the friction facing. All mechanical components of the braking system shall be intact and functional. Friction facing tearout (complete detachment of lining) shall not exceed 10 percent of the lining on any single frictional element.

(b) Any visible brake fluid or lubricant on the friction surface of the brake, or leakage at the master cylinder or brake power unit reservoir cover, seal and filler openings.

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

S6.1 *Vehicle weight.*

S6.1.1 Other than tests specified at lightly loaded vehicle weight in S7.7, S7.8, and S7.9, the vehicle is loaded to its GVWR such that the weight on each axle as measured at the tire-ground interface is in proportion to its GAWR, except that the fuel tank is filled to any level from 100 percent of capacity (corresponding to full GVWR loading) to 75 percent of capacity. However, if the weight on any axle of a vehicle at lightly loaded vehicle weight exceeds the axle's proportional share of the gross vehicle weight rating, the load required to reach GVWR is placed so that the weight on that axle remains the same as a lightly loaded vehicle weight.

S6.1.2 For the applicable tests specified in S7.7, S7.8, and S7.9, vehicle weight is lightly loaded vehicle weight, with the added weight distributed in the front passenger seat area in passenger cars and in the area adjacent to the driver's seat in buses.

S6.2 [Reserved]

S6.3 *Tire inflation pressure.* Tire inflation pressure is the pressure recommended by the vehicle manufacturer for the GVWR of the vehicle.

S.6.4 *Transmission selector control.* For S7.3, S7.5, S7.8, S7.15, S7.17, S7.11.1.2, S7.11.2.2, S7.11.3.2, and as required for S7.13, the transmission selector control is in neutral for all decelerations. For all other tests during all decelerations, the transmission selector is in the control position, other than overdrive, recommended by the manufacturer for driving on a level surface at the applicable test speed. To avoid engine stall during tests required to be run in gear a manual transmission may be shifted to neutral (or the clutch disengaged) when the vehicle speed decreases to 20 mph.

S6.5 *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.

S6.6 *Vehicle openings.* All vehicle openings (doors, windows, hood, trunk, convertible top, cargo doors, etc.) are closed except as required for instrumentation purposes.

S6.7 *Ambient temperature.* The ambient temperature is any temperature between 32° F. and 100° F.

S6.8 *Wind velocity.* The wind velocity is zero.

S6.9 *Road surface.* Road tests are conducted on a 12-foot-wide, level roadway having a skid number of 81. Burnish stops are conducted on any surface. The parking brake test surface is clean, dry, smooth Portland cement concrete.

S6.10 *Vehicle position.* The vehicle is alined in the center of the roadway at the start of each brake application. Stops, other than spike stops, are made without any part of the vehicle leaving the roadway. Except as noted below,

stops are made without lockup of any wheel at speeds greater than 10 mph. There may be controlled lockup on an antilock-equipped axle, and lockup of not more than one wheel per vehicle, uncontrolled by an antilock system. Locked wheels at speeds greater than 10 mph are allowed during spike stops (but not spike check stops), partial failure stops and inoperative brakepower or power assist unit stops.

S6.11 *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. A second thermocouple may be installed at the beginning of the test sequence if the lining wear is expected to reach a point causing the first thermocouple to contact the metal rubbing surface of a drum or rotor. For center-grooved shoes or pads, thermocouples are installed within one-eighth of an inch to one-quarter inch of the groove and as close to the center as possible.

S6.12 *Initial brake temperature.* Unless otherwise specified the brake temperature is 150° F. to 200° F.

S6.13 *Control forces.* Unless otherwise specified, the force applied to a brake control is not less than 15 lb and not more than 150 lb.

S7. *Test procedures and sequence.* Each vehicle shall be capable of meeting all the requirements of S5 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 burnish and reburnish procedures and in S7.9 and S7.10. Automatic adjusters may be locked out, according to the manufacturer's recommendation, when the vehicle is prepared for testing. If this option is selected, adjusters must remain locked out for entire sequence of tests. A vehicle shall be deemed to comply with the stopping distance requirements of S5.1 if at least one of the stops at each speed and load specified in each of S7.3, S7.5, S7.8, S7.9, S7.10, S7.15, or S7.17 (check stops) is made within a stopping distance that does not exceed the corresponding distance specified in table II. When the transmission selector control is required to be in neutral for a deceleration, a stop or snub shall be obtained by the following procedures: (1) Exceed the test speed by 4 to 8 mph; (2) close the throttle and coast in gear to approximately 2 mph above the test speed; (3) shift to neutral; and (4) when the test speed is reached, apply the service brakes.

S7.1 *Brake warming.* If the initial brake temperature for the first stop in a test procedure (other than S7.7 and S7.16) has not been reached, heat the brakes to the initial brake temperature by making not more than 10 snubs from not more than 40 to 10 mph, at a deceleration not greater than 10 fpsps.

S7.2 *Pretest instrumentation check.* Conduct a general check of instrumentation by making not more than 10 stops from a speed of not more than 30 mph, or 10 snubs from a speed of not more than 40 to 10 mph, at a deceleraton of not more than 10 fpsps. If instrument repair, replacement, or adjustment is necessary, make not more than 10 additional stops or snubs after such repair, replacement, or adjustment.

S7.3 *Service brake system—first (preburnish) effectiveness test.* Make six stops from 30 mph. Then make six stops from 60 mph.

S7.4 *Service brake system—burnish procedure.*

S7.4.1 *Vehicles with GVWR of 10,000 lb or less.*

S7.4.1.1 *Burnish.* Burish the brakes by making 200 stops from 40 mph at 12 fpsps (the 150 lb control force limit does not apply here). The interval from the start of one service brake application to the start of the next shall be either the time necessary to reduce the initial brake temperature to beween 230° F. and 270° F., or the distance of 1 mile, whichever occurs first. Accelerate to 40 mph after each stop and maintain that speed until making the next stop.

S7.4.1.2 *Brake adjustment — post burnish.* After burnishing, adjust the brakes manually in accordance with the manufacturer's recommendation if the brake systems are manual or if the automatic adjusters are locked out, or by making stops as recommended by the manufacturer if the automatic adjusters are operative.

S7.4.2 *Vehicles with GVWR greater than 10,000 lb.*

S7.4.2.1 *Burnish.* Burnish the brakes by making 500 snubs at 10 fpsps in the sequence specified in Table IV and within the speed ranges indicated. After each brake application accelerate to the next speed specified and maintain that speed until making the next brake application at a point 1 mi from the initial point of the previous brake application. If a vehicle cannot attain any speed specified in 1 mi, continue to accelerate until the speed specified is reached or until a point 1.5 mi from the initial point of the previous brake application is reached, whichever occurs first. If during any of the brake applications specified in Table IV the hottest brake reaches 500°F. make the remainder of the 500 applications from that snub condition, except that a higher or lower snub condition shall be followed (up to the 60 mph initial speed) as necessary to maintain a temperature of 500° F. ±50°F.

TABLE IV

Series	Snubs	Snub conditions (highest speed indicated, miles per hour)
1	175	40-20
2	25	45-20
3	25	50-20
4	25	55-20
5	250	60-20

S7.4.2.2 *Brake adjustment — post burnish.* After burnishing, adjust the brakes manually in accordance with the manufacturer's recommendation if the brake systems are manual or if the automatic adjusters are locked out, or by making stops as recommended by the manufacturer if the automatic adjusters are operative.

S7.5 *Service brake system—second effectiveness test.* Repeat S7.3. Then (for passenger cars) make four stops from 80 mph if the speed attainable in 2 miles is not less than 84 mph.

S7.6 *First reburnish.* Repeat S7.4, except make 35 burnish stops or snubs. Reburnish a vehicle whose brakes are burnished according to S7.4.2.1 by making 35 snubs from 60 mph to 20 mph, but if the hottest brake reaches 500°±50° F. make the remainder of the 35 applications from such initial speed divisible by five but less than 60 mph as necessary to maintain a temperature of 500° F±50° F.

S7.7 *Parking brake test.* The parking brake tests for any vehicle on different grades, in different directions, and for different loads may be conducted in any order. The force required for actuation of a hand-operated brake system shall be measured at the center of the hand grip area or at a distance of 1½ inches from the end of the actuation lever, as illustrated in Figure II.

S7.7.1 *Test procedure for requirements of S5.2.1.*

S7.7.1.1 Condition the parking brake friction elements so that the temperature at the beginning of the test is at any level not more than 150° F. (when the temperature of components on both ends of an axle are averaged).

S7.7.1.2 Drive the vehicle, loaded to GVWR, onto the specified grade with the longitudinal axis of the vehicle in the direction of the slope of the grade, stop the vehicle and hold it stationary by application of the service brake control, and place the transmission in neutral.

S7.7.1.3 With the vehicle held stationary by means of the service brake control, apply the parking brake by a single application of the force specified in (a) or (b), except that a series of applications to achieve the specified force may be made in the case of a parking brake system design that does not allow the application of the specified force in a single application:

(a) In the case of a passenger car, not more than 125 pounds for a foot-operated system, and not more than 90 pounds for a hand-operated system; and

(b) In the case of a school bus, not more than 150 pounds for a foot-operated system, and not more than 125 pounds for a hand-operated system.

S7.7.1.4 Following the application of the parking brake in accordance with S7.7.1.3, release all force on the service brake control and commence the measurement of time if the vehicle remains stationary. If the vehicle does not remain stationary, reapplication of the service brake to hold the vehicle stationary, with reapplication of a force to the parking brake control at the level specified in S7.7.1.3 (a) or (b) as appropriate for the vehicle being tested (without re-

lease of the ratcheting or other holding mechanism of the parking brake) may be used twice to attain a stationary position.

S7.7.1.5 Following observation of the vehicle in a stationary condition for the specified time in one direction, repeat the same test procedure with the vehicle orientation in the opposite direction on the specified grade.

S7.7.1.6 Check the operation of the parking brake application indicator required by S5.3.1(d).

S7.7.2 *Test procedure for requirements of S5.2.2.* (a) Check that transmission must be placed in park position to release key;

(b) Test as in S7.7.1, except in addition place the transmission control to engage the parking mechanism; and

(c) Test as in S7.7.1 except on a 20 percent grade, with the parking mechanism not engaged.

S7.7.3 *Lightly loaded vehicle.* Repeat S7.7.1 or S.7.7.2 as applicable except with the vehicle at lightly loaded vehicle weight.

S7.7.4 *Non-service brake type parking brake systems.* For vehicles with parking brake systems not utilizing the service brake friction elements, burnish the friction elements of such systems prior to parking brake tests according to the manufacturer's published recommendations as furnished to the purchaser. If no recommendations are furnished, run the vehicle in an unburnished condition.

S7.8 *Service brake system—lightly loaded vehicle (third effectiveness) test.* Make six stops from 60 mph with vehicle at lightly loaded vehicle weight.

S7.9 *Service brake system test-partial failure.*

S7.9.1 With the vehicle at lightly loaded vehicle weight, alter the service brake system to produce any one rupture or leakage type of failure, other than a structural failure of a housing that is common to two or more subsystems. Determine the control force, pressure level, or fluid level (as appropriate for the indicator being tested) necessary to activate the brake system indicator lamp. Make four stops if the vehicle is equipped with a split service brake system, or 10 stops if the vehicle is not so equipped, each from 60 mph, by a continuous application of the service brake control. Restore the service brake system to normal at completion of this test.

S7.9.2 Repeat S7.9.1 for each of the other subsystems.

S7.9.3 Repeat S7.9.1 and S7.9.2 with vehicle at GVWR. Restore the service brake system to normal at completion of this test.

S7.9.4 (For vehicles with antilock and/or variable proportioning brake systems). With vehicle at GVWR, disconnect functional power source, or otherwise render antilock system inoperative. Disconnect variable proportioning brake system. Make four stops, each from 60 mph. If more than one antilock or variable proportioning brake subsystem is provided, disconnect or render one subsystem inoperative and run as above. Restore system to normal at completion of this test. Repeat for each subsystem provided.

Determine whether the brake system indicator lamp is activated when the electrical power source to the antilock or variable proportioning unit is disconnected.

S7.10 *Service brake system—inoperative brake power unit or brake power assist unit test.* (For vehicles equipped with brake power unit or brake power assist unit.)

S7.10.1 *Regular procedure.* (This test need not be run if the option in S7.10.2 is selected.) On vehicles with brake power assist units, render the brake power assist unit inoperative, or one of the brake power assist unit subsystems if two or more subsystems are provided, by disconnecting the relevant power supply. Exhaust any residual brake power reserve capability of the disconnected system. On vehicles with brake power units, disconnect the primary source of power. Make four stops, each from 60 mph by a continuous application of the service brake control. Restore the system to normal at completion of this test. For vehicles equipped with more than one brake power unit or brake power assist unit, conduct tests of each in turn.

S7.10.2 *Optional Procedures—passenger cars only.* On vehicles with brake power assist units, the unit is charged to maximum prior to start of test. (Engine may be run up in speed, then throttle closed quickly to attain maximum charge on vacuum assist units.) Brake power units shall also be charged to maximum accumulator pressure prior to start of test. No recharging is allowed after start of test.

(a) (For vehicles with brake power assist units.)

Disconnect the primary source of power. Make six stops each from 60 mph, to achieve the average deceleration for each stop as specified in table III. Apply the brake control as quickly as possible. Maintain control force until vehicle has stopped.

At the completion of the stops specified above, deplete the system of any residual brake power reserve capability. Make one stop from 60 mph at an average deceleration of not lower than 7 fpsps for passenger cars (equivalent stopping distance 554 feet), or 6 fpsps for vehicles other than passenger cars (equivalent stopping distance 646 feet) and determine whether the control force exceeds 150 pounds.

(b) (For vehicles with brake power units with accumulator type systems) Test as in S7.10.2(a), except make 10 stops instead of 6 and, at the completion of the 10 stops, deplete the failed element of the brake power unit of any residual brake power reserve capability before making the final stop.

(c) (For vehicles with brake power assist or brake power units with backup systems.) If the brake power or brake power assist unit operates in conjunction with a backup system and the backup system is activated automatically in the event of a primary power failure, the backup system is operative during this test. Disconnect the primary source of power of one subsystem. Make 15 stops, each from 60 mph, with the backup system activated for the failed subsystem, to achieve an average deceleration of 12 fpsps for each stop.

(d) Restore systems to normal at completion of these tests. For vehicles equipped with more than one brakepower assist or brakepower unit, conduct tests of each in turn.

S7.11 *Service brake system—first fade and recovery test.*

S.7.11.1 *Baseline check stops or snubs.*

S.7.11.1.1 *Vehicles with GVWR of 10,000 lb or less.* Make three stops from 30 mph at 10 fpsps for each stop. Control force readings may be terminated when vehicle speed falls to 5 mph. Average the maximum brake control force required for the three stops.

S7.11.1.2 *Vehicles with GVWR greater than 10,000 pounds.* With transmission in neutral (or declutched), make three snubs from 40 to 20 mph at 10 fpsps for each snub. Average the maximum brake control force required for the three snubs.

S7.11.2 *Fade stops or snubs.*

S7.11.2.1 *Vehicles with GVWR of 10,000 pounds or less.* Make 5 stops from 60 mph at 15 fpsps followed by 5 stops at the maximum attainable deceleration between 5 and 15 fpsps for each stop. Establish an initial brake temperature before the first brake application of 130° to 150°F. Initial brake temperatures before brake applications for subsequent stops are those occurring at the distance intervals. Attain the required deceleration within 1 second and, as a minimum, maintain it for the remainder of the stopping time. Control force readings may be terminated when vehicle speed falls to 5 mph. Leave an interval of 0.4 mi between the start of brake applications. Accelerate immediately to the initial test speed after each stop. Drive 1 mi at 30 mph after the last fade stop, and immediately follow the recovery procedure specified in S7.11.3.1.

S7.11.2.2 *Vehicles with GVWR greater than 10,000 lb.* With transmission in neutral (or declutched) make 10 snubs from 40 to 20 mph at 10 fpsps for each snub. Establish an initial brake temperature before the first brake application of 130° F. to 150° F. Initial brake temperatures before brake application for subsequent snubs are those occurring in the time intervals specified below. Attain the required deceleration within 1 s and maintain it for the remainder of the snubbing time. Leave an interval of 30 s between snubs (start of brake application to start of brake application). Accelerate immediately to the initial test speed after each snub. Drive for 1.5 mi at 40 mph after the last snub and immediately follow the recovery procedure specified in S7.11.3.2.

S7.11.3 *Recovery stops or snubs.*

S7.11.3.1 *Vehicles with GVWR of 10,000 lb or less.* Make five stops from 30 mph at 10 fpsps for each stop. Control force readings may be terminated

when vehicle speed falls to 5 mph. Allow a braking distance interval of 1 mi. Immediately after each stop accelerate at maximum rate to 30 mph and maintain that speed until making the next stop. Record the maximum control force for each stop.

S7.11.3.2 *Vehicles with GVWR greater than 10,000 lb.* With transmission in neutral (or declutched) make five snubs from 40 to 20 mph at 10 fpsps for each snub. After each snub, accelerate at maximum rate to 40 mph and maintain that speed until making the next brake application at a point 1.5 mi from the point of the previous brake application. Record the maximum control force for each snub.

S7.12 *Service brake system—second reburnish.* Repeat S7.6.

S7.13 *Service brake system—second fade and recovery test.* Repeat S7.11 except in S7.11.2 run 15 fade stops or 20 snubs instead of 10.

S7.14 *Third reburnish.* Repeat S7.6.

S7.15 *Service brake system—fourth effectiveness test.* Repeat S7.5. Then (for passenger cars) make four stops from either 95 mph if the speed attainable in 2 mi is 99 to (but not including) 104 mph, or 100 mph if the speed attainable in 2 mi is 104 mph or greater.

S7.16 *Service brake system—water recovery test.*

S7.16.1 *Baseline check stop.* Make three stops from 30 mph at 10 fpsps for each stop. Control force readings may be terminated when vehicle speed falls to 5 mph. Average the maximum brake control force required for the three stops.

S7.16.2 *Wet brake recovery stops.* With the brakes fully released at all times, drive the vehicle for 2 min at a speed of 5 mph in any combination of forward and reverse directions, through a trough having a water depth of 6 in. After leaving the trough, immediately accelerate at a maximum rate to 30 mph without a brake application. Immediately upon reaching that speed make five stops, each from 30 mph at 10 fpsps for each stop. After each stop (except the last), accelerate the vehicle immediately at a maximum rate to a speed of 30 mph and begin the next stop.

S7.17 *Spike stops.* Make 10 successive spike stops from 30 mi/h with the transmission in neutral, with no reverse stops. Make spike stops by applying a control force of 200 lb while recording control force versus time. Maintain control force until vehicle has stopped. At completion of 10 spike stops, make six effectiveness stops from 60 mi/h.

S7.18 *Final inspection.* Inspect—

(a) The service brake system for detachment or fracture of any components, such as brake springs and brake shoes or disc pad facing.

(b) The friction surface of the brake, the master cylinder or brake power unit reservoir cover and seal and filler openings, for leakage of brake fluid or lubricant.

(c) The master cylinder or brake power unit reservoir for compliance with the volume and labeling requirements of S5.4.2 and S5.4.3. In determining the fully applied worn condition assume that the lining is worn to: (1) Rivet or bolt heads on riveted or bolted linings, or (2) within one thirty-seconds of an inch of shoe or pad mounting surface on bonded linings, or (3) the limit recommended by the manufacturer, whichever is larger relative to the total possible shoe or pad movement. Drums or rotors are assumed to be at nominal design drum diameter or rotor thickness. Linings are assumed adjusted for normal operating clearance in the released position.

(d) The brake system indicator light(s), for compliance with operation in various key positions, lens color, labeling, and location, in accordance with S5.3.

S7.19 *Moving barrier test.* (Only for vehicles that have been tested according to S7.7.2.) Load the vehicle to GVWR, release parking brake, and place the transmission selector control to engage the parking mechanism. With a moving barrier as described in paragraph 3.3 of SAE recommended practice J972 "Moving Barrier Collision Tests," November 1966, impact the vehicle from the front at 2½ mi/h. Keep the longitudinal axis of the barrier parallel with the longitudinal axis of the vehicle. Repeat the test, impacting the vehicle from the rear.

NOTE.—The vehicle used for this test need not be the same vehicle that has been used for the braking tests.

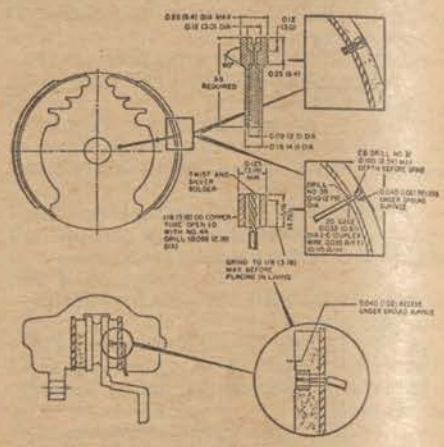
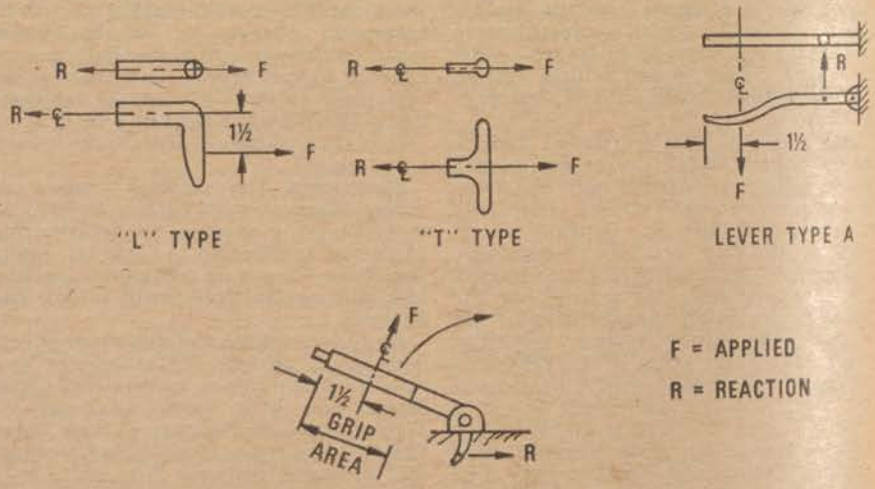


FIGURE 1 - TYPICAL PLUG THERMOCOUPLE INSTALLATIONS

Note: The second thermocouple shall be installed at .080 inch depth within 1 inch circumferentially of the thermocouple installed at .040 inch depth.



LOCATION FOR MEASURING BRAKE APPLICATION FORCE (HAND BRAKE)

FIGURE II

TABLE I—BRAKE TEST PROCEDURE

SEQUENCE AND REQUIREMENTS

No.	Sequence	Test load		Test procedure	Requirements
		Light	GVWR		
1	Instrumentation check			S7.2	
2	First (preburnish) effectiveness test		X	S7.3	S5.1.1.1
3	Burnish procedure		X	S7.4	
4	Second effectiveness		X	S7.5	S5.1.1.2
5	First reburnish		X	S7.6	
6	Parking brake	X	X	S7.7	S5.2
7	Third effectiveness (lightly loaded vehicle)	X		S7.8	S5.1.1.3
8	Partial failure	X	X	S7.9	S5.1.2
9	Inoperative brake power and power assist units		X	S7.10	S5.1.3
10	First fade and recovery		X	S7.11	S5.1.4
11	Second reburnish		X	S7.12	
12	Second fade and recovery		X	S7.13	S5.1.4
13	Third reburnish		X	S7.14	
14	Fourth effectiveness		X	S7.15	S5.1.1.4
15	Water recovery		X	S7.16	S5.1.5
16	Spike stops		X	S7.17	S5.1.6
17	Final inspection			S7.18	S5.6
18	Moving barrier test		X	S7.19	S5.2.2.3

TABLE II.—*Stopping distances*

Vehicle test speed (miles per hour)	Stopping distance in feet for tests indicated											
	I			II			III			IV		
	1st (preburnish) and 4th effectiveness; spike effectiveness check			2d effectiveness			3d (lightly loaded vehicle) effectiveness			Inoperative brake power and power assist unit; partial failure		
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
30	[1] 57	[1] 69(1st) [1] 65(4th)	[1] 88	[1] 54	[1] 65	[1] 81	51	65	81	114	194	218
35	74	110	132	70	110	132	67	110	132	155	264	312
40	96	144	173	91	144	173	87	144	173	202	345	388
45	121	182	218	115	182	218	110	182	218	257	436	490
50	150	225	264	142	225	264	135	225	264	317	538	605
55	181	272	326	172	272	326	163	272	326	383	651	732
60	[1] 216	[1] 323	[1] 388	[1] 204	[1] 323	[1] 388	[1] 194	[1] 323	[1] 388	[1] 456	[1] 775	[1] 872
80	[1] 405	[2]	[2]	[1] 383	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]
95	607	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]
100	673											

[1] Distances for specified tests.
[2] Not applicable.

NOTE.—(a) Passenger cars; (b) vehicles other than passenger cars with GVWR of 10,000 lb or less; (c) vehicles other than passenger cars with GVWR greater than 10,000 lb.
(39 F.R. 25945—July 15, 1975)

TABLE III.—*Inoperative brake power assist and brake power units*

[Passenger cars]

Stop No.	Average deceleration, FPSPS		Equivalent stopping distance, feet	
	Col. 1 Brake power assist	Col. 2 Brake power unit	Col. 3 Brake power assist	Col. 4 Brake power unit
1	16	16	242	242
2	12	13	323	298
3	10	12	388	323
4	9	11	431	352
5	8	10	484	388
6	7.5	9.5	517	409
7	(Depleted) 7.0	9.0	554	431
8	N.A.	8.5	N.A.	456
9	N.A.	8.0	N.A.	484
10	N.A.	7.5	N.A.	517
11	N.A.	(Depleted) 7.0	N.A.	554

§ 571.121 Standard No. 121; Air Brake Systems.

S1 *Scope.* This standard establishes performance and equipment requirements for braking systems on vehicles equipped with air brake systems.

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

S3 *Application.* This standard applies to trucks, buses, and trailers equipped with air brake systems. However, it does not apply to a fire fighting vehicle manufactured before June 1, 1976, or a heavy hauler trailer manufactured before September 1, 1977, or to any vehicle manufactured before September 1, 1977, that has a gross axle weight rating (GAWR) for any axle of 24,000 pounds or more, two or more front steerable axles with a GAWR of 16,000 pounds or more for each axle, or that, in combination with another vehicle, constitutes a part of an "auto transporter" as defined in S4. In addition, the standard does not apply to any trailer whose unloaded vehicle weight is not less than 95 percent of its GVWR, or any vehicle that meets any one of criteria (a) through (d), as follows:

(a) An overall vehicle width of 108 inches or more;

(b) An axle that has a GAWR of 29,000 pounds or more;

(c) A speed attainable in 2 miles of not more than 33 mph; or

(d) (1) A speed attainable in 2 miles of not more than 45 mph; and

(2) An unloaded vehicle weight that is not less than 95 percent of the vehicle GVWR; and

(3) No passenger-carrying capacity.

S4 *Definitions.*

"Air brake system" means a system that uses air as a medium for transmitting pressure or force from the driver control to the service brake, but does not include a system that uses compressed air or vacuum only to assist the driver in applying muscular force to hydraulic or mechanical components.

"Antilock system" means a portion of a service brake system that automatically controls the degree of rotational wheel slip at one or more road wheels of the vehicle during braking.

"Heavy hauler trailer" means a trailer with one or more of the following characteristics:

(1) Its brake lines are designed to adapt to separation or extension of the vehicle frame; or

(2) Its body consists only of a platform whose primary cargo-carrying surface is not more than 40 inches above the ground in an unloaded condition, except that it may include sides that are designed to be easily removable and a permanent "front-end structure" as that term is used in § 393.106 of this title.

"Auto transporter" means a truck and a trailer designed for use in combination to transport motor vehicles, in that the towing vehicle is designed to carry cargo at a location other than the fifth wheel and to load this cargo only by means of the towed vehicle.

"Speed attainable in 2 miles" means the speed attainable by accelerating at maximum rate from a standing start for 2 miles on a level surface.

"Skid number" means the frictional resistance of a pavement measured in accordance with American Society for Testing and Materials Method E–274–65T at 40 m.p.h., omitting water delivery as specified in paragraph 7.1 of that method.

S5 *Requirements.* Each vehicle shall meet the following requirements under the conditions specified in S6.

S5.1 *Required equipment—trucks and buses.* Each truck and bus shall have the following equipment:

S5.1.1 *Air compressor.* An air compressor of sufficient capacity to increase air pressure in the supply and service reservoirs from 85 pounds per square inch (p.s.i.) to 100 p.s.i. when the engine is operating at the vehicle manufacturer's maximum recommended r.p.m. within a time, in seconds, determined by the quotient

$$\frac{\text{Actual reservoir capacity} \times 25}{\text{Required reservoir capacity}}$$

S5.1.2 *Reservoirs.* One or more service reservoir systems, from which air is delivered to the brake chambers, and either an automatic condensate drain valve for each service reservoir or a supply reservoir between the service reservoir system and the source of air pressure.

S5.1.2.1 The combined volume of all service reservoirs and supply reservoirs shall be at least 12 times the combined volume of all service brake chambers at maximum travel of the pistons or diaphragms.

S5.1.2.2 Each reservoir shall be capable of withstanding an internal hydrostatic pressure of five times the compressor cutout pressure or 500 p.s.i., whichever is greater, for 10 minutes.

S5.1.2.3 Each service reservoir system shall be protected against loss of air pressure due to failure or leakage in the system between the service reservoir and the source of air pressure, by check valves or equivalent devices whose proper functioning can be checked without disconnecting any air line or fitting.

S5.1.2.4 Each reservoir shall have a condensate drain valve that can be manually operated.

S5.1.3 *Towing vehicle protection system.* If the vehicle is intended to tow another vehicle equipped with air brakes, a system to protect the air pressure in the towing vehicle from the effects of a loss of air pressure in the towed vehicle.

S5.1.4 *Pressure gauge.* A pressure gauge in each service brake system, readily visible to a person seated in the normal driving position, that indicates the service reservoir system air pressure. The accuracy of the gauge shall be within plus or minus 7 percent of the compressor cut-out pressure.

S5.1.5 *Warning signal.* A signal, other than a pressure gage, that gives a continuous warning to a person in the normal driving position when the ignition is in the "on" or "run" position and the air pressure in the service reservoir system is below 60 p.s.i. The signal shall be either visible within the driver's forward field of view, or both audible and visible.

S5.1.6 *Antilock warning signal.* A signal on each vehicle equipped with an antilock system that gives a continuous warning to a person in the normal driving position when the ignition is in the "on" or "run" position in the event of a total electrical failure of the antilock system. The signal shall be either visible within the driver's forward field of view or both audible, for a duration of at least 10 seconds, and continuously visible. The signal shall operate in the specified manner each time the ignition is returned to the "on" or "run" position.

S5.1.7 *Service brake stop lamp switch.* A switch that lights the stop lamps when the service brake control is statistically depressed to a point that produces a pressure of 6 p.s.i. or less in the service brake chambers.

S5.2 *Required equipment—trailers.* Each trailer shall have the following equipment:

S5.2.1 *Reservoirs.* One or more reservoirs to which the air is delivered from the towing vehicle.

S5.2.1.1 A reservoir shall be provided that is capable, when pressurized to 90 p.s.i., of releasing the vehicle's parking brakes at least once and that is unaffected by a loss of air pressure in the service brake system.

S5.2.1.2 Total service reservoir volume shall be at least eight times the combined volume of all service brake chambers at maximum travel of the pistons or diaphragms.

S5.2.1.3 Each reservoir shall be capable of withstanding an internal hydrostatic pressure of 500 p.s.i. for 10 minutes.

S5.2.1.4 Each reservoir shall have a condensate drain valve that can be manually operated.

S5.2.1.5 Each service reservoir shall be protected against loss of air pressure due to failure or leakage in the system between the service reservoir and its source of air pressure by check valves or equivalent devices.

S5.3 *Service brakes—road tests.* The service brake system on each truck and bus shall, under the conditions of S6.1, meet the requirements of S5.3.1, S5.3.3, and S5.3.4 when tested without adjustments other than those specified in this standard. The service brake system on each trailer shall, under the conditions of S6.1, meet the requirements of S5.3.2, S5.3.3, and S5.3.4 when tested without adjustments other than those specified in this standard. However, the truck and trailer portions of an auto transporter (if both are manufactured after September 1, 1976), shall, in combination, meet the requirements of S5.3.1 as they apply to a single unit truck or bus, in place of the requirements of S5.3.2 as they apply to the trailer portion, and in place of the requirements of S5.3.1 as they apply to the truck portion in the loaded condition.

S5.3.1 *Stopping distance—trucks and buses.* Except for a bus manufactured before January 1, 1977, and except as provided in S5.3.1.2 and S5.3.1.3, when stopped six times for each combination of weight, speed, and road condition specified in S5.3.1.1, in the sequence specified in Table I, the vehicle shall stop at least once in not more than the distance specified in Table II, measured from the point at which movement of the service brake control begins, without any part of the vehicle leaving the roadway and without lockup of any wheel at speeds above 10 mph except for:

(a) Controlled lockup of wheels allowed by an antilock system, or

(b) Lockup of wheels on nonsteerable axles other than the two rearmost nonliftable, nonsteerable axles on a vehicle with more than two nonsteerable axles.

TABLE I—STOPPING SEQUENCE

1. Burnish.
2. Control trailer service brake stops at 60 mi/h (for truck-tractors tested with a control trailer in accordance with S6.1.10.6).
3. Control trailer emergency brake stops at 60 mi/h (for truck-tractors tested with a control trailer in accordance with S6.1.10.7).
4. Stops with vehicle at gross vehicle weight rating:
   (a) 20 mi/h service brake stops on skid number of 75.
   (b) 60 mi/h service brake stops on skid number of 75.
   (c) 20 mi/h service brake stops on skid number of 30.
   (d) 20 mi/h emergency brake stops on skid number of 75.
   (e) 60 mi/h emergency brake stops on skid number of 75.
5. Parking brake test with vehicle loaded to gross vehicle weight rating.
6. Stops with vehicle at unloaded weight plus 500 lb:
   (a) 20 mi/h service brake stops on skid number of 75.
   (b) 60 mi/h service brake stops on skid number of 75.
   (c) 20 mi/h service brake stops on skid number of 30.
   (d) 20 mi/h emergency brake stops on skid number of 75.
   (e) 60 mi/h emergency brake stops on skid number of 75.
7. Parking brake test with vehicle at unloaded weight plus 500 lb.

S5.3.1.1 Stop the vehicle from 60 m.p.h. and 20 m.p.h. on a surface with a skid number of 75, and from 20 m.p.h. on a wet surface with a skid number of 30, with the vehicle (a) loaded to its gross vehicle weight rating, and (b) at its unloaded vehicle weight plus 500 pounds (including driver and instrumentation). If the speed attainable in 2 miles is less than 60 m.p.h., the vehicle shall stop from a speed in Table II that is 4 to 8 m.p.h. less than the speed attainable in 2 miles.

S5.3.1.2 When stopped in accordance with S5.3.1, with its brakes fully applied, a truck manufactured before September 1, 1977, that has a front steerable non-driving axle with a GAWR of 16,000 pounds or more, or a front steerable drive axle with a GAWR of less than 18,000 pounds, and a truck manufactured before September 1, 1975, that has a front steerable drive axle of any GAWR, need not meet the requirement that it stop in the distance specified in Table II for stops on a surface with a skid number of 75 if the brakes on its front axle conform to the retardation formula and Column 1 values of S5.4.1. These vehicles must nevertheless meet the requirements of staying within the 12-foot lane and those relating to wheel lock-up.

TABLE II.—*Stopping distance in feet*

Vehicle speed in miles per hour	Service brake		Emergency brake, skid No. 75	
	Skid No. 75	Skid No. 30		
	(1)	(2)	(3)	(1)
20	35	60	83	85
25	53	----------	123	131
30	75	----------	170	186
35	101	----------	225	250
40	131	----------	288	325
45	165	----------	358	409
50	203	----------	435	504
55	246	----------	520	608
60	293	----------	613	720

S5.3.2 *Stopping capability — trailers.* When tested at each combination of weight, speed, and road condition specified in S5.3.2.1, in the sequence specified in Table I, with air pressure of 90 p.s.i. in the control line and service reservoir system and with no application of the towing vehicle's brakes, a trailer shall stop without any part of the trailer leaving the roadway and without lockup of any wheel at speeds above 10 mph, except for

(a) Controlled lockup of wheels allowed by an antilock system, or

(b) Lockup of wheels on nonsteerable axles other than the two rearmost nonliftable, nonsteerable axles on a trailer with more than two nonsteerable axles.

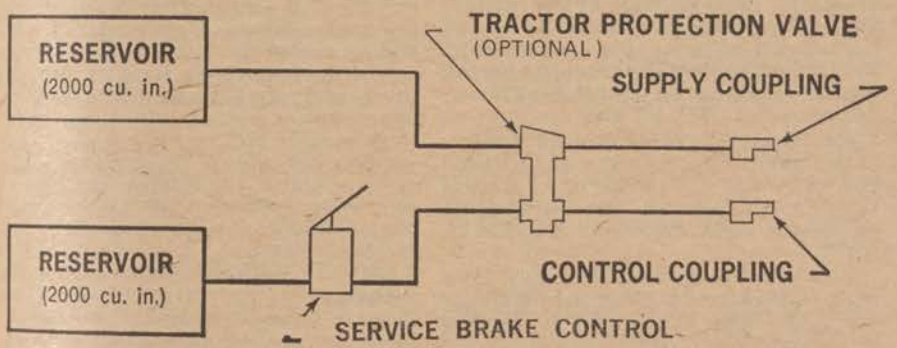
S5.3.2.1 Stop the vehicle from 60 m.p.h. and 20 m.p.h. on a surface with skid number of 75, and from 20 m.p.h. on a wet surface with a skid number of 30, with the vehicle (a) loaded to its gross vehicle weight rating, and (b) at its unloaded vehicle weight plus 500 pounds (including instrumentation).

S5.3.3 *Brake actuation time.* With an initial service reservoir system air pressure of 100 psi, the air pressure in each brake chamber shall, when measured from the first movement of the service brake control, reach 60 psi in not more than 0.45 seconds in the case of trucks and buses, 0.35 seconds in the case of trailer converter dollies, and 0.30 seconds in the case of trailers other than trailer converter dollies. A vehicle designed to tow a vehicle equipped with air brakes shall be capable of meeting the above actuation time requirement with a 50-cubic-inch test reservoir connected to the control line coupling. A trailer, including a trailer converter dolly, shall meet the above actuation time requirement with its brake system connected to the test rig shown in Figure 1.

S5.3.4 *Brake release time.* With an initial service brake chamber air pressure of 95 psi, the air pressure in each brake chamber shall, when measured from the first movement of the service brake control, fall to 5 psi in not more than 0.55 seconds in the case of trucks and buses, and fall to 5 psi in not more than 0.65 seconds in the case of trailers, including trailer converter dollies. A vehicle designed to tow another vehicle equipped with air brakes shall be capable of meeting the above release time requirement with a 50-cubic-inch test reservoir connected to the control line coupling. A trailer, including a trailer converter dolly, shall meet the above release time requirements with its brake system connected to the test rig shown in Figure 1.

FIGURE 1

TRAILER TEST RIG



S5.4 *Service brake system—dynamometer tests.* When tested without prior road testing, under the conditions of S6.2, each brake assembly shall meet the requirements of S5.4.1, S5.4.2, and S5.4.3 when tested in sequence and without adjustments other than those specified in the standard. For purposes of the requirements of S5.4.2 and S5.4.3, an average deceleration rate is the change in velocity divided by the deceleration time measured from the onset of deceleration.

S5.4.1 *Brake retardation force.* The sum of the retardation forces exerted by the brakes on each vehicle designed to be towed by another vehicle equipped with air brakes shall be such that the quotient

$$\frac{\text{sum of the brake retardation forces}}{\text{sum of GAWR's}}$$

relative to brake chamber air pressure, shall have values not less than those shown in Column 1 of Table III. Retardation force shall be determined as follows:

TABLE III

BRAKE RETARDATION FORCE

Brake retardation force, GAWR Col. 1	Brake chamber pressure, psi, Col. 2
0.05	20
0.12	30
0.18	40
0.25	50
0.31	60
0.37	70
0.41	80

S5.4.1.1 After burnishing the brake pursuant to S6.2.6, retain the brake assembly on the inertia dynamometer. With an initial brake temperature between 125° F. and 200° F., conduct a stop from 50 m.p.h., maintaining brake chamber air pressure at a constant 20 p.s.i. Measure the average torque exerted by the brake from the time the specified air pressure is reached until the brake stops and divide by the static loaded tire radius specified by the tire manufacturer to determine the retardation force. Repeat the procedure six times, increasing the brake chamber air pressure by 10 p.s.i. each time. After each stop, rotate the brake drum or disc until the temperature of the brake falls to between 125° F. and 200° F.

S5.4.2 *Brake power.* When mounted on an inertia dynamometer, each brake shall be capable of making 10 consecutive decelerations at an average rate of 9 f.p.s.p.s. from 50 m.p.h. to 15 m.p.h., at equal intervals of 72 seconds, and shall be capable of decelerating to a stop from 20 m.p.h. at an average deceleration rate of 14 f.p.s.p.s. 1 minute after the 10th deceleration. The series of decelerations shall be conducted as follows:

S5.4.2.1 With an initial brake temperature between 150° F. and 200° F. for the first brake application, and the drum or disc rotating at a speed equivalent to 50 m.p.h., apply the brake and decelerate at an average deceleration rate of 9 f.p.s.p.s. to 15 m.p.h. Upon reaching 15 m.p.h., accelerate to 50 m.p.h. and apply the brake for a second time 72 seconds after the start of the first application. Repeat the cycle until 10 decelerations have been made. The service line air pressure shall not exceed 100 p.s.i. during any deceleration.

S5.4.2.2 One minute after the end of the last deceleration required by S5.4.2.1 and with the drum or disc rotating at a speed of 20 m.p.h., decelerate to a stop at an average deceleration rate of 14 f.p.s.p.s.

S5.4.3 *Brake recovery.* Starting 2 minutes after completing the tests required by S5.4.2, the brake of a vehicle other than either front axle brake of a truck-tractor shall be capable of making 20 consecutive stops from 30 mph at an average deceleration rate of 12 ft/s/s, at equal intervals of 1 minute measured from the start of each brake application. The service line air pressure needed to attain a rate of 12 ft/s/s shall be not more than 85 lb/in², and not less than 20 lb/in² for a brake not subject to the control of an antilock system, or 12 lb/in² for brake subject to the control of an antilock system.

S5.5 *Antilock system.*

S5.5.1 *Antilock system failure.* On a vehicle equipped with an antilock system, electrical failure of any part of the antilock system shall not increase the actuation and release times of the service brakes.

S5.5.2 *Antilock system power—trailers.* On a trailer equipped with an antilock system that requires electrical power for operation, the power shall be obtained from the stop lamp circuit. Additional circuits may also be used to obtain redundant sources of electrical power.

S5.6 *Parking brake system.* Each vehicle other than a trailer converter dolly shall have a parking brake system that under the conditions of S6.1 meets the requirements of S5.6.1 or S5.6.2, at the manufacturer's option, and the require-

ments of S5.6.3 and S5.6.4. However, a trailer manufactured before June 30, 1976, that is designed to transport bulk agricultural commodities in off-road harvesting sites and to a processing plant or storage location, as evidenced by skeletal construction that accommodates harvest containers, a maximum length of 28 feet, and an arrangement of air control lines and reservoirs that minimizes damage in field operations, shall meet the requirements of this section or, at the option of the manufacturer, the requirements of § 393.43 of this title.

S5.6.1 *Static retardation force.* With all other brakes rendered inoperative, during a static drawbar pull in a forward or rearward direction, the static retardation force produced by the application of the parking brakes shall be:

(a) In the case of a vehicle other than a truck-tractor that is equipped with more than two axles, such that the quotient

$$\frac{\text{static retardation force}}{\text{GAWR}}$$

is not less than 0.28 for any axle other than a steerable front axle; and

(b) In the case of a truck-tractor that is equipped with more than two axles, such that the quotient

$$\frac{\text{static retardation force}}{\text{GVWR}}$$

is not less than 0.14.

S5.6.2 *Grade holding.* With all parking brakes applied, the vehicle shall remain stationary facing uphill and facing downhill on a smooth, dry portland cement concrete roadway with a 20-percent grade, both (a) when loaded to its gross vehicle weight rating, and (b) at its unloaded vehicle weight plus 500 pounds (including driver and instrumentation).

S5.6.3 *Application and holding.* The parking brakes shall be applied by an energy source that is not affected by loss of air pressure or brake fluid pressure in the service brake system. Once applied, the parking brakes shall be held in the applied position solely by mechanical means.

S5.6.4 *Parking brake control—trucks and buses.* The parking brake control shall be separate from the service brake control. It shall be operable by a person seated in the normal driving position. The control shall be identified in a manner that specifies the method of control operation. The parking brake control shall control the parking brakes of the vehicle and of any air braked vehicle that it is designed to tow.

S5.7 *Emergency brake system-trucks and buses.* Each vehicle shall be equipped with an emergency brake system which, under the conditions of S6.1, conforms to the requirements of S5.7.1 through S5.7.3. The emergency brake system may be a part of the service brake system or incorporate portions of the service brake and parking brake systems.

S5.7.1 *Emergency brake system performance.* When stopped six times for each combination of weight and speed specified in S5.3.1.1 on a road surface with a skid number of 75 with a single failure in the service brake system of a part designed to contain compressed air or brake fluid (except failure of a common valve, manifold, brake fluid housing, or brake chamber housing), the vehicle shall stop at least once in not more than the distance specified in Column 3 of Table II, measured from the point at which movement of the service brake control begins, without any part of the vehicle leaving the roadway, except that a truck-tractor tested at its unloaded vehicle weight plus 500 pounds shall stop at least once in not more than the distance specified in Column 4 of Table II.

S5.7.2 *Emergency brake system operation.* The emergency brake system shall be applied and released, and be capable of modulation, by means of the service brake control.

S5.7.3 *Towing vehicle emergency brake requirements.* In addition to meeting the other requirements of S5.7, a vehicle designed to tow another vehicle equipped with air brakes shall—

(a) In the case of a truck-tractor in the unloaded condition and a single unit truck which is capable of towing an air-brake equipped vehicle and is loaded to gross vehicle weight rating, be capable of meeting the requirements of S5.7.1 by operation of the service brake control only, with the trailer air supply line and air control line from the towing vehicle vented to the atmosphere in accordance with S6.1.14;

(b) In the case of a truck-tractor loaded to gross vehicle weight rating, be capable of meeting S5.7.1 by operation of the service brake control only, with the air control line from the towing vehicle vented to the atmosphere in accordance with S6.1.14; and

(c) Be capable of modulating the air in the supply or control line to the trailer by means of the service brake control with a single failure in the towing vehicle service brake system as specified in S5.7.1.

S5.8 *Emergency braking capability—trailers.* Each trailer other than a trailer converter dolly shall have a parking brake system that conforms to S5.6 and that applies with the force specified in S5.6.1 or S5.6.2 when the air pressure in the supply line is at atmospheric pressure. A trailer converter dolly shall have, at the manufacturer's option, (a) a parking brake system that conforms to S5.6 and that applies with the force specified in S5.6.1 or S5.6.2 when the air pressure in the supply line is at atmospheric pressure, or (b) an emergency system that automatically controls the service brakes when the service reservoir is at any pressure above 20 lb/in^2 and the supply line is at atmospheric pressure. However, a trailer manufactured before June 30, 1976, that is designed to transport bulk agricultural commodities in off-road harvesting sites and to a processing plant or storage location, as evidenced by skeletal construction that accommodates harvest containers, a maximum length of 28 feet, and an arrangement of air control lines and reservoirs that minimizes damage in field operations, shall meet the requirements of this section or, at the option of the manufacturer, the requirements of § 393.43 of this title.

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

S6.1 *Road test conditions.*

S6.1.1 Except as otherwise specified the vehicle is loaded to its gross vehicle weight rating, distributed proportionately to its gross axle weight ratings.

S6.1.2 The inflation pressure is as specified by the vehicle manufacturer for the gross vehicle weight rating.

S6.1.3 Unless otherwise specified, the transmission selector control is in neutral or the clutch is disengaged during all decelerations and during static parking brake tests.

S6.1.4 All vehicle openings (doors, windows, hood, trunk, cargo doors, etc.) are in a closed position except as required for instrumentation purposes.

S6.1.5 The ambient temperature is between 32° F. and 100° F.

S6.1.6 The wind velocity is zero.

S6.1.7 Stopping tests are conducted on a 12-foot wide level roadway having a skid number of 75, unless otherwise specified. The vehicle is alined in the center of the roadway at the beginning of a stop.

S6.1.8 The brakes on a vehicle manufactured before September 1, 1976, are burnished before testing, at the manufacturer's option, in accordance with S6.1.8.1 or S6.1.8.2. The brakes on a vehicle manufactured on or after September 1, 1976, are burnished before testing in accordance with S6.1.8.1. However, for vehicles with parking brake systems not utilizing the service brake friction elements, burnish the friction elements of such systems prior to the parking brake test according to the manufacturer's recommendations.

S6.1.8.1 With the transmission in the highest gear appropriate for the series given in Table IV make 500 brake applications at a deceleration rate of 10 ft/s/s, or at the vehicle's maximum deceleration rate, if less than 10 ft/s/s, in the sequence specified in Table IV. After each brake application, accelerate to the speed specified and maintain that speed until making the next brake application at a point 1 mile from the initial point of the previous brake application. If a vehicle cannot attain the specified speed in 1 mile, continue to accelerate until the specified speed is reached or until the vehicle has traveled 1.5 miles from the initial point of the previous brake application. If during any of the brake applications specified in Table IV, the hottest brake reaches 500°F, make the remainder of the 500 applications from that snub condition except that a higher or lower snub condition shall be used as necessary to maintain an after-stop temperature of 500°F.±50°F. Any automatic pressure limiting valve is in use to limit pressure as designed, except that any automatic front axle pressure limit-

ing valve is bypassed if the temperature of the hottest brake on a rear axle exceeds the temperature of the hottest brake on a front axle by more than 125° F. A bypassed valve is reconnected if the temperature of the hottest brake on a front axle exceeds the temperature of the hottest brake on a rear axle by 100°F. After burnishing; adjust the brakes as recommended by the vehicle manufacturer.

TABLE IV

Series	Snubs	Snub conditions (highest speed specified in miles per hour)
1	175	40–20
2	25	45–20
3	25	50–20
4	25	55–20
5	250	60–20

S6.1.8.2 With the transmission in the highest gear range appropriate for 40 mph, make 400 brake applications from 40 mph to 20 mph at 10 ft/s/s. After each brake application accelerate to 40 mph and maintain that speed until making the next application at a point 1.5 miles from the point of the previous brake application. After burnishing, adjust the brakes as recommended by the vehicle manufacturer.

S6.1.9 Static parking brake tests for a semitrailer are conducted with the front-end supported by an unbraked dolly. The weight of the dolly is included as part of the trailer load.

S6.1.10 In a test other than a static parking brake test, a truck-tractor manufactured before September 1, 1976, is tested at its gross vehicle weight rating by loading it without a trailer or, at the manufacturer's option, by coupling it to a flatbed semitrailer (hereafter, control trailer) as specified in S6.1.10.1 to S6.1.10.7. In a test other than a static parking brake test, a truck-tractor manufactured on or after September 1, 1976, is tested at its gross vehicle weight rating by coupling it to a control trailer as specified in S6.1.10.1 to S6.1.10.7.

S6.1.10.2 The center of gravity of the to this standard.

S6.1.10.2 The center of gravity of the loaded control trailer is on the trailer's longitudinal centerline at a height of 66 ± 3 in. above the ground.

S6.1.10.3 For a truck-tractor with a rear axle gross axle weight rating of 26,000 lb or less, the control trailer has a single axle with a gross axle weight rating of 18,000 lb and a length, measured from the transverse centerline of the axle to the centerline of the kingpin, of 258±6 in.

S6.1.10.4 For a truck-tractor with a total rear axle gross axle weight rating of more than 26,000 lb the control trailer has a tandem axle with a combined gross axle weight rating of 32,000 lb and a length, measured from the transverse centerline between the axles to the centerline of the kingpin, of 390±6 in.

S6.1.10.5 The control trailer is loaded so that its axle is loaded to its gross axle weight rating and the tractor is loaded to its gross vehicle weight rating, with the tractor's fifth wheel adjusted so that the load on each axle measured at the tire-ground interface is most nearly proportional to the axles' respective gross axle weight ratings.

S6.1.10.6 *Test equipment specification.* The control trailer's service brakes are capable of stopping the combination from the maximum speed at which the tractor is tested, under the conditions of S6.1, without assistance from the tractor brakes, in the distance found by multiplying the value 68, 90, 115, 143, 174, 208, or 245 (corresponding to a speed of 30, 35, 40, 45, 50, 55, or 60 mph as appropriate for the truck-tractor tested) by the ratio:

$$\frac{\text{weight on all axles of combination}}{\text{weight on trailer axles}}$$

with the tractor's fifth wheel adjusted as specified in S6.1.10.5, the trailer service reservoirs pressurized to 100 lb/in², and the trailer loaded so that its axle is at gross axle weight rating and its kingpin is at empty vehicle weight. The stopping distance is measured from the point at which movement of the valve controlling the trailer brakes begins. The service brake chambers on the trailer reach 60 lb/in² in not less than 0.20 second and not more than 0.30 second, measured from the instant at which movement of the valve controlling the trailer brakes begins.

S6.1.10.7 *Test equipment specification.* The control trailer's emergency brakes are capable of stopping the combination under the conditions of S6.1 from the maximum speed at which the tractor is tested, without assistance from the tractor's brakes, in the distance found by multiplying the emergency brake stopping distance in column 3 of table II by the ratio:

$$\frac{\text{weight on all axles of combination}}{\text{weight on trailer axles}}$$

with the combination loaded in accordance with S6.1.10.5. Stopping distance is measured from the point at which movement of the valve controlling the trailer brakes begins. The pressure in trailer brakes begins. In the case of control trailers that utilize parking brakes for emergency stopping capability, the pressure in the trailer's spring parking brake chambers falls from 95 lb/in² to 5 lb/in² in not less than 0.50 second and not more than 0.60 second, measured from the instant at which movement of the valve controlling the trailer's spring parking brakes begins.

S6.1.11 *Special drive conditions.* A vehicle equipped with an interlocking axle system or a front wheel drive system that is engaged and disengaged by the driver is tested with the system disengaged.

S6.1.12 *Liftable axles.* A vehicle with a liftable axle is tested at gross vehicle weight rating with the liftable axle down and at unloaded vehicle weight with the liftable axle up.

S6.1.13 After September 1, 1975, the trailer test rig shown in Figure 1 is capable of increasing the pressure in a 50 cubic inch reservoir from atmospheric to 60 lb/in² in 0.06 second, measured from the first movement of the service brake control to apply service brake pressure and of releasing pressure in such a reservoir from 95 to 5 lb/in² in 0.22 second measured from the first movement of the service brake control to release service brake pressure.

S6.1.14 In testing the emergency braking system of towing vehicles under S5.7.3(a) and S5.7.3(b), the hose(s) is vented to the atmosphere at any time not less than 1 second and not more than 1 minute before the emergency stop begins, while the vehicle is moving at the speed from which the stop is to be made and any manual control for the towing vehicle protection system is in the position to supply air and brake control signals to the vehicle being towed. No brake application is made from the time the line(s) is vented until the emergency stop begins and no manual operation of the parking brake system or towing vehicle protection system occurs from the time the line(s) is vented until the stop is completed.

S6.2 *Dynamometer test conditions.*

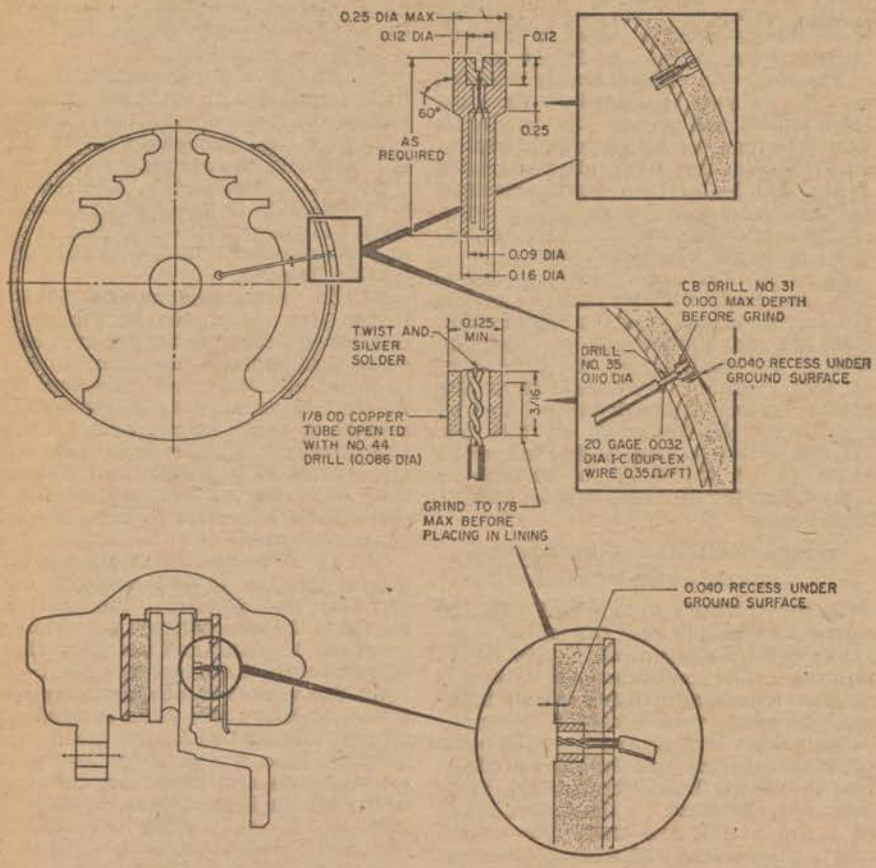
S6.2.1 The dynamometer inertia for each wheel is equivalent to the load on the wheel with the axle loaded to its gross axle weight rating.

S6.2.2 The ambient temperature is between 75° F. and 100° F.

S6.2.3 Air at ambient temperature is directed uniformly and continuously over the brake drum or disc at a velocity of 2,200 feet per minute.

S6.2.4 The temperature of each brake is measured by a single plug-type thermocouple installed in the center of the lining surface of the most heavily loaded shoe or pad as shown in Figure 2. The thermocouple is outside any center groove.

FIGURE 2
THERMOCOUPLE INSTALLATION



S6.2.5 The rate of brake drum or disc rotation on a dynamometer corresponding to the rate of rotation on a vehicle at a given speed is calculated by assuming a tire radius equal to the static loaded radius specified by the tire manufacturer.

S6.2.6 Brakes are burnished before testing as follows: Place the brake assembly on an inertia dynamometer and adjust the brake as recommended by the brake manufacturer. Make 200 stops from 40 m.p.h. at a deceleration of 10 f.p.s.p.s., with an initial brake temperature on each stop of not less than 315° F. and not more than 385° F. Make 200 additional stops from 40 m.p.h. at a deceleration of 10 f.p.s.p.s. with an initial brake temperature on each stop of not less than 450° F. and not more than 550° F. After burnishing, the brakes are adjusted as recommended by the brake manufacturer.

S6.2.7 The brake temperature is increased to a specified level by conducting one or more stops from 40 m.p.h. at a deceleration of 10 f.p.s.p.s. The brake temperature is decreased to a specified level by rotating the drum or disc at a constant 30 m.p.h.

EFFECTIVE DATE NOTE:

1. The provisions of S5.7 above become effective September 1, 1976. For the convenience of the user, the superseded text is set forth below:

S5.7 *Emergency braking capability—trucks and buses.* Each truck and bus shall have a braking system with emergency braking capability that meets the requirements of S5.7.1, or, at the manufacturer's option, the requirements of S5.7.2.

S5.7.1 *Parking brake system with automatic application.* Each vehicle shall have a parking brake system acting on each axle, except steerable front axles, that conforms to S5.6 and that meets the following requirements:

S5.7.1.1 *Automatic application.* The parking brakes shall be automatically applied and the supply line to any towed vehicle vented to atmospheric pressure when the air pressure in all service revervoirs is less than the automatic application pressure level. The automatic application pressure level shall be between 20 and 45 p.s.i.

S5.7.1.2 *Automatic braking performance.* With the parking brake automatically applied, a vehicle shall either be capable of meeting the requirements of S5.7.2.3, with distances measured from the point of automatic application, or shall have a static retardation force quotient not greater than 0.40 for any axle, determined in accordance with S5.6.1.

S5.7.1.3 *Release after automatic application.* After automatic application, the parking brakes shall be releasable at least once by means of a parking brake control. The parking brakes shall be releasable only if they can be automatically reapplied and exert the force required by S5.6 immediately after release.

S5.7.1.4 *Manual operation.* The parking brakes shall be manually operable and releasable when the air pressure in the service reservoir system is sufficient to keep the parking brakes from automatically applying.

S5.7.2 *Modulated emergency braking system.* Each vehicle that does not have a parking brake system that is automatically applied in the event of air pressure loss shall have a parking brake system conforming to S5.6 that is capable of manual application at any reservoir system pressure level, and shall have an emergency braking system that meets the following requirements.

S5.7.2.1 *Emergency braking control.* The emergency braking system shall be controlled by the service brake control or the parking brake control. The control for the emergency braking system shall control the brakes on any towed vehicle equipped with air brakes.

S5.7.2.2 *Emergency braking system failure.* In the event of a failure of a valve, manifold, brake fluid housing, or brake chamber housing that is common to the service brake and emergency braking systems, loss of air shall not cause the parking brake to be inoperable.

S5.7.2.3 *Emergency braking stopping distance.* Except as specified in S5.7.2.3.1 and S5.7.2.3.2, when stopped six times for each combination of weight and speed specified in S5.3.1.1 on a road surface with a skid number of 75, with a single failure in the service brake system of a part designed to contain compressed air or brake fluid (except failure of a common valve, manifold, brake fluid housing, or brake chamber housing), the vehicle shall stop at least once in not more than the distance specified in column 3 of Table II, measured from the point at which movement of the brake control begins, without any part of the vehicle leaving the roadway, except that a truck-tractor tested at its unloaded vehicle weight plus 500 pounds shall stop at least once in not more than the distance specified in Column 4 of Table II.

S5.7.2.3.1 A truck manufactured before September 1, 1976, that has a front steerable non-driving axle with a GAWR of 16,000 pounds or more, or a front steerable drive axle with a GAWR of less than 18,000 pounds, and a truck manufactured before September 1, 1975, that has a front steerable drive axle of any GAWR, must stop in accordance with S5.7.2.3 without any part of the vehicle leaving the roadway, but need not stop in the distances specified.

S5.7.2.3.2 When stopped in accordance with S5.7.2.3, a truck or bus manufactured before September 1, 1975, other than a truck described in S5.7.2.3.1, shall stop at least once for each speed and weight condition on a surface with a skid number of 75 in not more than the distance specified in Table IIa instead of meeting the stopping distances specified in Table II for stops on a surface with a skid number of 75.

EFFECTIVE DATE NOTE 2: New paragraph S6.1.14 above becomes effective September 1, 1976.

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