

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY TEST PROCEDURE

FOR

FMVSS 105

Hydraulic And Electric Brake Systems



ENFORCEMENT
Office of Vehicle Safety Compliance
Room 6115, NVS-220
400 Seventh Street, SW
Washington, DC 20590

OVSC LABORATORY TEST PROCEDURE NO. 105
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REVISION CONTROL LOG
FOR OVSC LABORATORY TEST PROCEDURES

TP-105-03 - HYDRAULIC AND ELECTRIC BRAKE SYSTEMS

Test Procedure		FMVSS 105 Amendment	Effective Date	Description
Rev. No.	Date			
00	-	-	1/1/1968	Original release
01	-	-	-	-
02	11/23/1992	52FR19874, 5/28/87 53FR8200, 3/14/88 54FR22905, 5/30/89 54FR40082, 9/29/89	6/29/1987 9/12/1988 6/29/1989 9/1/1991	Label options for ABS warning lamp New burnish procedure GVWR>10K Brake warning lamps, label & check function Automatic brake adjusters, if equipped, operational
03	7/1/2005	57FR47800, 10/20/92 58FR45461, 8/30/93 60FR6434, 2/2/95 60FR13216, 3/10/95 60FR13297, 3/10/95 61FR19562, 5/2/96 62FR46907, 9/5/97 62FR51064, 9/30/97 64FR9446, 2/26/99 64FR48562, 9/7/99 65FR6327, 2/9/00 68FR47485, 8/11/03 69FR75486, 12/17/04 70FR37706, 6/30/05	10/20/1994 8/30/1994 9/1/2000 3/1/1999 3/1/1999 6/3/1996 9/1/1998 9/1/2002 9/1/1999 10/7/1999 3/27/2000 10/10/2003 1/18/2005 6/30/2006	Automatic brake adjusters required Opt burnish extended GVWR>10K S105 & S135, manufacturers' option for PC ABS required GVWR>10K Stopping distances GVWR>10K Delete obsolete burnish procedure GVWR>10K Electric PC & LTV, electric brakes S105 & S135, manufacturers' option for LTV Delay ABS malfunction indicator lamp Corrections to stopping distance table Brake warning lamp label RBS Braking-in-a-curve test GVWR>10K Roll bar permitted, LLVW & stability tests Parking Brake Required GVWR>10K

1. PURPOSE AND APPLICATION

The Office of Vehicle Safety Compliance (OVSC) provides contractor laboratories with Laboratory Test Procedures as guidelines for obtaining compliance test data. The data are used to determine if a specific vehicle or item of motor vehicle equipment meets the minimum performance requirements of the subject Federal Motor Vehicle Safety Standard (FMVSS). The purpose of the OVSC Laboratory Test Procedures is to present a uniform testing and data recording format, and provide suggestions for the use of specific equipment and procedures. These Laboratory Test Procedures do not constitute an endorsement or recommendation for use of any product or method. If any contractor views any part of an OVSC Laboratory Test Procedure to be in conflict with a FMVSS or observes deficiencies in a Laboratory Test Procedure, the contractor is required to advise the Contracting Officer's Technical Representative (COTR) and resolve the discrepancy prior to the start of compliance testing.

The OVSC Laboratory Test Procedures are not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment which will assist in procuring the required compliance test data. However, the application of any such testing technique or equipment is subject to prior approval of the COTR.

NOTE: The OVSC Laboratory Test Procedures, prepared for the limited purpose of use by independent laboratories under contract to conduct compliance tests for the OVSC, are not rules, regulations or NHTSA interpretations regarding the meaning of a FMVSS. The Laboratory Test Procedures are not intended to limit the requirements of the applicable FMVSS(s). In some cases, the OVSC Laboratory Test Procedures do not include all of the various FMVSS minimum performance requirements. Recognizing applicable test tolerances, the Laboratory Test Procedures may specify test conditions that are less severe than the minimum requirements of the standard. In addition, the Laboratory Test Procedures may be modified by the OVSC at any time without notice, and the COTR may direct or authorize contractors to deviate from these procedures, as long as the tests are performed in a manner consistent with the standard itself and within the scope of the contract. Laboratory Test Procedures may not be relied upon to create any right or benefit in any person. Therefore, compliance of a vehicle or item of motor vehicle equipment is not necessarily guaranteed if the manufacturer limits its certification tests to those described in the OVSC Laboratory Test Procedures.

2. GENERAL REQUIREMENTS

This standard specifies requirements for hydraulic and electric service brake systems, and associated parking brake systems. The purpose of this standard is to insure safe braking performance under normal and emergency conditions.

The service brakes shall be capable of stopping each vehicle in effectiveness tests within specific distances and speeds. There are additional requirements for stability while braking in a curve. Also, the vehicle shall be capable of stopping under partial failure of the service brake system and an inoperative brake power assist unit or brake power unit, if applicable.

Each vehicle, when applicable, shall be manufactured with a parking brake system which, when engaged, shall be capable of holding the vehicle stationary on a graded surface for a specified time. As an option, for vehicles that are equipped with a transmission which incorporates a parking mechanism, be capable of remaining stationary when impacted by a barrier moving at two and a half mph.

Each vehicle shall have one or more brake system indicator lamps, mounted in front of and in clear view of the driver. Indicator lamps shall be activated both when certain vehicle conditions occur and when the ignition switch is turned to a certain position as a check of lamp function.

Each vehicle shall have a specific brake fluid warning statement located on or near the brake fluid reservoir filler plug or cap.

Each vehicle shall be capable of completing all performance requirements without detachment or fracture of any component of the braking system and 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.

3. SECURITY

The contractor shall provide appropriate security measures to protect the OVSC test vehicles and parts during the entire compliance testing program. The contractor is also financially responsible for any acts of theft and/or vandalism which occur during the storage of test vehicles. Security problems which arise shall be reported by telephone to the COTR and the Industrial Property Manager (IPM), Office of Contracts and Procurement (OCP), within 2 working days after the incident. A letter containing specific details of the security problem shall be sent to the IPM (with copy to the COTR) within 4 working days. The contractor shall protect and segregate all photographs and data that evolve from compliance testing. No information concerning the vehicle safety compliance testing program shall be released to anyone except the COTR, unless specifically authorized by the COTR or the COTR's Branch or Division Chief.

NO INDIVIDUALS, OTHER THAN CONTRACTOR PERSONNEL DIRECTLY INVOLVED IN THE COMPLIANCE TESTING PROGRAM, SHALL BE ALLOWED TO WITNESS ANY VEHICLE COMPLIANCE TEST UNLESS SPECIFICALLY AUTHORIZED BY THE COTR.

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire vehicle compliance testing area, test fixtures and instrumentation in a neat, clean and painted condition with test instruments arranged in an orderly manner consistent with good test laboratory housekeeping practices.

5. TEST SCHEDULING AND MONITORING

The contractor shall submit a test schedule to the COTR prior to testing. Tests shall be completed as required in the contract. Scheduling shall be adjusted to permit sample motor vehicles to be tested to other FMVSS as may be required by the OVSC. All testing shall be coordinated to allow monitoring by the FMVSS No. 105 COTR, engineer, or any person authorized by the COTR.

6. TEST DATA DISPOSITION

The contractor shall make all vehicle preliminary compliance test data available to the COTR on location within 4 hours after the test. Final test data shall be furnished to the COTR within 5 working days. Additionally, the contractor shall analyze the preliminary test results as directed by the COTR. All backup data sheets, technical notes, etc., shall be either sent to the COTR or destroyed at the conclusion of each delivery order, purchase order, etc.

7. GOVERNMENT FURNISHED PROPERTY (GFP)

ACCEPTANCE OF TEST VEHICLES

The Contractor has the responsibility of accepting each test vehicle whether delivered by a new vehicle dealership or another vehicle transporter. In both instances, the contractor acts in the OVSC's behalf when signing an acceptance of the test vehicle delivery. When a vehicle is delivered, the contractor must check to verify the following:

- A. All options listed on the "window sticker" are present,
- B. Tires and wheels are new and the same as listed,
- C. There are no dents or other interior or exterior flaws,
- D. The vehicle has been properly prepared and is in running condition, and
- E. Owner's manual, warranty document, consumer information, and extra set of keys are present.

A Vehicle Condition form will be supplied to the contractor when the test vehicle is transferred from a new vehicle dealership or between test contracts. The contractor must complete a Vehicle Condition form for each vehicle and deliver it to the COTR with the Final Test Report or the report will not be accepted for payment.

NOTIFICATION OF COTR

The COTR must be notified within 24 hours after a vehicle has been delivered. In addition, if any discrepancy or damage is found at the time of delivery, a copy of the Vehicle Condition form shall be sent to the COTR immediately.

8. CALIBRATION OF TEST INSTRUMENTS

Before the contractor initiates the safety compliance test program, a test instrumentation calibration system shall be implemented and maintained in accordance with established calibration practices. The calibration system shall be set up and maintained as follows:

- A. Standards for calibrating the measuring and test equipment will be stored and used under appropriate environmental conditions to assure their accuracy and stability.
- B. All measuring instruments and standards shall be calibrated by the contractor, or a commercial facility, against a higher order standard at periodic intervals NOT TO EXCEED TWELVE (12) MONTHS! Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.
- C. All measuring and test equipment and measuring standards will be labeled with the following information:
 - (1) Date of calibration
 - (2) Date of next scheduled calibration
 - (3) Name of the technician who calibrated the equipment
- D. A written calibration procedure shall be provided by the contractor which includes as a minimum the following information for all measurement and test equipment:
 - (1) Type of equipment, manufacturer, model number, etc.
 - (2) Measurement range
 - (3) Accuracy
 - (4) Calibration interval
 - (5) Type of standard used to calibrate the equipment (calibration traceability of the standard must be evident)
- E. Records of calibration for all test instrumentation shall be kept by the contractor in a manner which assures the maintenance of established calibration schedules. All such records shall be readily available for inspection when requested by the COTR. The calibration system will need the acceptance of the COTR before the test program commences. Further guidance is provided in the International Standard ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment" and American National Standard ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment - General Requirements".
- F. Daily pre and post test Instrumentation calibration sheets or equivalent, as

shown in section 19, are to be included in the final test report.

9. PHOTOGRAPHIC DOCUMENTATION

Photographs shall be 8 x10 inches (black and white or color), and properly focused for clear images. A label or placard identifying the test vehicle model, NHTSA number and date (or item of equipment part number and date) shall appear in each photograph and must be legible. Each photograph shall be labeled as to the subject matter.

As a minimum the following photographs shall be included in each final test report, where applicable:

- A. 3/4 frontal view from left side of vehicle (at GVWR).
- B. 3/4 rear view from right side of vehicle (at GVWR).
- C. Close up view of vehicle's certification label.
- D. Close up view of vehicle's tire information label (if not part of certification label).
- E. Close up view of thermocouple installation of left front and right rear (with wheels and or drums removed).
- F. Test instrumentation in vehicle.
- G. Test track dimensioned layout (may be a scaled drawing).
- H. Photos of all test instrumentation used in conducting this test with full description; may be a composite photo taken with instrumentation removed from vehicle.
- I. Spike stop applier as installed in the vehicle.
- J. Vehicle being weighed and location(s) of ballast in vehicle.
- K. Close up view of brake system indicator lamps, when activated under the condition(s) specified in test procedure section 14.
- L. Close up view of brake fluid reservoir label as defined in test procedure section 14.
- M. Close up of any failures.

10. DEFINITIONS (S4)

NOTE: Parenthetical references, shown as above (S4), relate to sections in FMVSS 105.

NOTE: Text in Italics indicates pertains to electric vehicles, electrically-actuated service brakes, electrically transmitted brake signal, and/or RBS.

ANTILOCK SYSTEM

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.

ANTILOCK BRAKE SYSTEM (ABS)

A portion of a service brake system that automatically controls the degree of rotational wheel slip during braking by:

1. Sensing the rate of angular rotation of the wheels
2. Transmitting signals regarding the rate of wheel angular rotation to one or more controlling devices which interpret those signals and generate responsive controlling output signals
3. Transmitting those controlling signals to one or more modulators which adjust brake actuating forces in response to those signals

AVERAGE PEDAL FORCE (not defined in standard)

Average value taken from the initiation of the pedal force until completion of the stop. (60 FR 6434, Feb. 2, 1995, page 6431)

Initiation of the pedal force is the point at which brake application can be detected and data acquisition begun without false triggering, e.g. 5 - 10 Newtons (1 - 2 Lbs.)

AVERAGE DECELERATION (not defined in standard -see above)

Average value taken from the initiation of the pedal force until completion of the stop.

NOTE: The recorded deceleration is acquired from the moment the service brake pedal is moved until the vehicle reaches zero speed. Therefore, the time needed to achieve the target deceleration (rise time) and the time the vehicle goes from the target deceleration to zero (fall time) will be included in the average deceleration calculation. Hence the recorded average deceleration values will be slightly less than the required/target values even if the driver maintains the correct deceleration for the majority of the stop

BACKUP SYSTEM

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

BRAKE POWER ASSIST UNIT

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

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.

DIRECTLY CONTROLLED WHEEL

A wheel for which the degree of rotational wheel slip is sensed, either at that wheel or on the axle shaft for that wheel and corresponding signals are transmitted to one or more modulators that adjust the brake actuating forces at that wheel. Each modulator may also adjust the brake actuating forces at other wheels that are on the same axle or in the same axle set in response to the same signal or signals.

ELECTRIC VEHICLE (EV)

A motor vehicle that is powered by an electric motor drawing current from rechargeable storage batteries, fuel cells, or other portable sources of electrical current, and which may include a non-electrical source of power designed to charge batteries and components thereof.

ELECTRICALLY-ACTUATED SERVICE BRAKES

Service brakes that utilize electrical energy to actuate the foundation brakes.

FULL BRAKE APPLICATION

A brake application in which the force on the brake pedal reaches 150 pounds within 0.3 seconds from the point of application of force to the brake control.

HYDRAULIC BRAKE SYSTEM

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.

INDIRECTLY CONTROLLED WHEEL

A wheel at which the degree of rotational wheel slip is not sensed, but at which the modulator of an antilock braking system adjusts its brake actuating forces in response to signals from one or more sensed wheels.

INITIAL BRAKE TEMPERATURE

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

- A. For vehicles with a GVWR of 10,000 lbs. or less, unloaded vehicle weight (UVW) plus 400 lbs. (including driver and instrumentation)
- B. For vehicles with a GVWR greater than 10,000 lbs., unloaded vehicle weight (UVW) plus 500 lbs. (including driver and instrumentation)

MAXIMUM DRIVE-THROUGH SPEED

The highest possible constant speed at which the vehicle can be driven through 200 feet of a 500-foot radius curve arc without leaving the 12-foot lane.

MINIMUM PEDAL FORCE (not defined in standard)

When a minimum pedal force is specified, after the ramp up of the pedal force past the minimum specified value, the stop must be completed without the pedal force going lower than this minimum value except when the vehicle velocity approaches zero at the termination of the stop.

MOTOR HOME

A motor vehicle with motive power that is designed to provide temporary residential accommodations, as evidenced by the presence of at least four of the following facilities: cooking; refrigeration or ice box; self-contained toilet; heating and/or air conditioning; a potable water supply system including a faucet and a sink; and a separate 110-125 volt electric power supply and/or an LP gas supply.

PARKING MECHANISM

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.

PEAK FRICTION COEFFICIENT (PFC)

The ratio of the maximum value of braking test wheel longitudinal force to the simultaneous vertical force occurring prior to wheel lockup, as the braking torque is progressively increased.

PRESSURE COMPONENT

A brake system component that contains the brake system fluid and controls or senses the fluid pressure.

REGENERATIVE BRAKING SYSTEM (RBS)

An electrical energy system that is installed in an EV for recovering or dissipating kinetic energy, and which uses the propulsion motor(s) as a retarder for partial braking of the EV while returning electrical energy to the propulsion batteries or dissipating electrical energy.

SKID NUMBER

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

SNUB

The braking deceleration of a vehicle from a higher reference speed to a lower reference speed that is greater than zero.

SPIKE STOP

A stop resulting from the application of 200 lbs of force on the service brake control in 0.08 s.

SPLIT SERVICE BRAKE SYSTEM

A brake system consisting of two or more subsystems actuated by a single control, designed so that a single failure in any subsystem (such as a leakage-type failure of a pressure component of a hydraulic subsystem except structural failure of a housing that is common to two or more subsystems, or an electrical failure in an electric subsystem) does not impair the operation of any other subsystem.

STOPPING DISTANCE

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.

TANDEM AXLE

A group of two or more axles placed in close arrangement one behind the other with the center lines of adjacent axles not more than 72 inches apart.

VARIABLE PROPORTIONING BRAKE SYSTEM

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.

WHEEL LOCKUP

100 percent wheel slip.

11. TEST EQUIPMENT AND REFERENCES

The following test equipment or equivalent is recommended:

- A. Optical or mechanical fifth wheel to measure vehicle velocity, 150 fps range with accuracy of ± 0.7 fps at 88 fps, maximum non-linearity of ± 1.5 fps over the range and visual output resolution of 0.15 fps.
- B. 140-tooth gear magnetic pickup or equivalent to measure stopping distance, 10⁵ feet range with accuracy of + 10 feet in 1,000 feet, maximum non-linearity of ± 20 feet, per 2,000 feet increment, and visual output resolution of 0.1 foot.
- C. Two load cells to measure normal pedal force on service brake and parking brake, (perpendicular to pedal face), 300 pound range with accuracy of ± 1.5 pounds at 150 pounds, maximum non-linearity of +3 pounds over the range, and visual output resolution of 1.5 pounds.
- D. Iron-constantan thermocouple, plug type. Maximum wire resistance variation $\pm 10\%$ pyrometer calibrated value for non-compensated pyrometers.
- E. Friction material temperature instrumentation (pyrometer) to measure brake lining temperatures, 1,200°F range with $\pm 10^\circ\text{F}$ accuracy at 300°F, maximum non-linearity of $\pm 20^\circ\text{F}$ over the range and visual output resolution of 5°F.
- F. Decelerometer to measure vehicle deceleration rate, 1G range with ± 0.5 fpsps accuracy at 32.2 fpsps, maximum non-linearity of ± 0.5 fpsps over the range, and visual output resolution of 0.5 fpsps.
- G. Ambient temperature gauge to record ambient test temperatures, 32°F to 100°F range with $\pm 0.5^\circ\text{F}$ accuracy at 70°F, maximum non-linearity $\pm 1.0^\circ\text{F}$ over the range, and visual output resolution of 1°F.
- H. Stopwatch to measure elapsed time during certain tests, 15 minute range with accuracy ± 0.5 second in 60 seconds, maximum non-linearity of 1.5 seconds over the range, and visual output resolution of 0.1 second.
- I. Anemometer to measure wind velocity. Twenty-five (25) mph range with ± 1 mph accuracy at 15 mph, maximum non-linearity of ± 2 mph over the range and visual output resolution of 1 mph.
- J. Ballast to simulate passenger, cargo, etc. Ballast with a density of 50 to 450 lb/ft³ is used in the seating area of all vehicles, as well as the cargo areas of vehicles with a GVWR of 10,000 pounds or less. Ballast with a

density of 400 to 725 lb/ft³ shall be used in the cargo area of vehicles with a GVWR which exceeds 10,000 pounds.

- K. Wheel lockup detector providing an electrical indication of wheel rotation (or wheel lockup) to a continuous recorder or digital data recorder with data acquisition software. The lockup detector system must provide a visual indication for wheels that lockup above 10 mph, + 1 mph, - 0 mph and remain on until the system is reset.

The reset circuitry must have the capability of resetting the visual indicators while the vehicle speed is above 10 mph. The system must also have the capability of recording, either on a strip chart or digital acquisition graph, any combination of wheel lockup, and show which wheel or wheels locked up at speeds above 10 mph.

- L. A continuous recorder, ie, an oscillograph or computer utilizing a digital data acquisition system, to make a permanent, supplemental record of service brake pedal force, parking brake force, deceleration, lockup, distance and speed versus time, with the same accuracies as the above direct reading instrumentation or as otherwise indicated.

- M. Manufacturer's shop manual.

- N. An application device shall be used for the spike stops which meets the application rate requirement of that test.

- O. A moving barrier, as described in Paragraph 3.3 of SAE Recommended Practice J972, "Moving Barrier Collision Tests," November 1966, is required for the Optional Parking Brake Test Procedure on vehicles with a transmission which incorporates a parking brake mechanism. Paragraph 3.3 of SAE J972 lists the following barrier characteristics:

- (1) The barrier shall be of very rigid construction.
- (2) Its total weight shall be 4,000 pounds (however, allowable tolerance for this test shall be + 0 pounds, - 50 pounds).
- (3) The flat face of the barrier shall be 2 feet 6 inches high, 8 feet wide, and have a 7 inch, \pm 1 inch, ground clearance. The face of the barrier shall be covered with 0.750 inch thick plywood.
- (4) The chassis upon which the moving barrier is mounted shall have a remote or inertia controlled braking device capable of stopping it.

The barrier design must be approved by the NHTSA COTR prior to being used.

- P. *Voltage meter to measure battery capacity for electric vehicles or brakes utilizing battery power for brake actuation.*

12. PRETEST REQUIREMENTS

Prior to conducting any compliance tests, contractors are required to submit a detailed in-house compliance test procedure to the COTR which includes a step-by-step description of the methodology to be used and a detailed check-off list.

The contractor's test procedure shall contain a complete listing of test equipment actually used. The list of test equipment shall include instrument accuracy and calibration due dates. The contractor shall conspicuously identify revisions to its in-house procedures and ensure that obsolete documents are not used.

There shall be no contradiction between the OVSC Laboratory Test Procedure and the contractor's in-house test procedure. Written approval must be obtained from the COTR before initiating the compliance test program so that all parties are in agreement.

TEST DATA LOSS

A compliance test is not to be conducted unless all of the various test conditions specified in the applicable OVSC Laboratory Test Procedure have been met. Failure of a contractor to obtain the required test data and to maintain acceptable limits on test parameters in the manner outlined in the applicable OVSC Laboratory Test Procedure may require a retest at the expense of the contractor. The retest costs will include the cost of the replacement vehicle (with the same equipment as the original vehicle) or item of motor vehicle equipment and all costs associated with conducting the retest. The original test specimen (vehicle or equipment item) used for the invalid test shall remain the property of OVSC, and the retest specimen shall remain the property of the contractor. If there is a test failure, the contractor shall retain the retest specimen for a period not exceeding 180 days. If there is no test failure, the Contractor may dispose of the test specimen upon notification from the COTR that the final test report has been accepted.

The Contracting Officer of NHTSA is the only official authorized to notify the contractor that a retest is required. The retest shall be completed within two (2) weeks after receipt of notification by the Contracting Officer that a retest is required. If a retest is conducted, no test report is required for the original test.

13. GENERAL TEST CONDITIONS

Where a range of conditions is specified, the vehicle shall be capable of meeting the requirements at all points within the range.

A. Tire inflation pressure (S6.3)

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

B. Transmission selector control (S6.4)

For Effectiveness tests (S7.3, S7.5(b), S7.8, S7.15), Stability and Control (S7.5(a)), Spike stops (S7.17), baseline fade and recovery snubs for vehicles greater than 10,000 pounds GVWR (S7.11.1.2), Fade snubs for vehicles greater than 10,000 pounds GVWR (S7.11.2.2), Recovery snubs for vehicles greater than 10,000 pounds GVWR (S7.11.3.2), and as required for Second fade and recovery test (S7.13), the transmission selector control is in NEUTRAL for all decelerations. Also see section O (3).

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.

C. Engine (S6.5)

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.

D. Vehicle Openings (S6.6)

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

E. Ambient Temperature (S6.7)

All phases for which there are performance requirements shall be run with ambient air temperature between 32°F and 100°F.

F. Wind Velocity - Zero (S6.8)

Test Tolerance: Under no circumstances shall tests be conducted with the wind velocity exceeding 11.2 mph (FMVSS 135). Tests shall not be conducted either into or with winds exceeding 10 mph whose directions are within 45 degrees (left or right - front and rear) of the vehicle's longitudinal centerline. [This test tolerance not specified in standard]

G. Road Surface (S6.9)

For vehicles with a GVWR OF 10,000 POUNDS OR LESS, 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. (S6.9.1)

For vehicles with a GVWR GREATER THAN 10,000 POUNDS, road tests excluding stability and control during braking tests, are conducted on a 12-foot-wide, level roadway, having a peak friction coefficient of **0.9** when measured using an American Society for Testing and Materials (ASTM) E 1136 standard reference test tire, in accordance with ASTM Method E 1337-90, at a speed of 40 mph, without water delivery. Burnish stops are conducted on any surface. The parking brake test surface is clean, dry, smooth, Portland cement concrete. (S6.9.2(a))

For vehicles with a GVWR greater than 10,000 pounds, stability and control during braking tests are conducted on a 500-foot-radius curved roadway with a wet level surface having a peak friction coefficient of 0.5 when measured on a straight or curved section of the curved roadway using an American Society for Testing and Materials (ASTM) E1136 standard reference tire, in accordance with ASTM Method E1337-90, at a speed of 40 mph, with water delivery. (S6.9.2(b))

NOTES: [not specified in standard]

- (1) Except for the parking brake test surface, each roadway shall be flat within ± 1 percent grade in all directions (including crown).
- (2) The road shall be under exclusive control of contractor at time of test.
- (3) Travel to and from the test roads shall be minimal and entail only moderate braking. Dusty or muddy road surfaces shall be avoided.

H. Vehicle Position and Wheel Lockup Restrictions (S6.10)

- (1) The vehicle is aligned in the center of the roadway at the start of each brake application.

- (A) Stops, other than spike stops, are made without any part of the vehicle leaving the roadway.
 - (B) Twelve-foot (12') lanes shall be clearly marked.
- (2) For vehicles with a GVWR OF 10,000 POUNDS OR LESS, stops are made with wheel lockup permitted only as follows (S6.10.1):
- (A) At vehicle speeds above 10 mph, there may be controlled wheel lockup on an antilock-equipped axle, and lockup of not more than one wheel per vehicle, uncontrolled by an antilock system. (Dual wheels on one side of an axle are considered a single wheel)
 - (B) At vehicle speeds of 10 mph or less, any wheel may lock up for any duration.
 - (C) Unlimited wheel lockup is allowed during spike stops (but not spike check stops), partial failure stops, and inoperative brake power or power assist unit stops.
- (3) For vehicles with a GVWR GREATER THAN 10,000 POUNDS, stops are made with wheel lockup permitted only as follows (S6.10.2):
- (A) At vehicle speeds above 20 mph, any wheel on a non-steerable axle other than the two rearmost non-liftable, nonsteerable axles may lock up for any duration. The wheels on the two rearmost non-liftable, non-steerable axles may lock up according to (B).
 - (B) At vehicle speeds above 20 mph, one wheel on any axle or two wheels on any tandem may lock up for any duration.
 - (C) At vehicle speeds above 20 mph, any wheel not permitted to lock in (A) or (B) may lock up repeatedly, with each lockup occurring for a duration of one second or less.
 - (D) At vehicle speeds of 20 mph or less, any wheel may lock up for any duration.
 - (E) Unlimited wheel lockup is allowed during partial failure stops, and inoperative brake power or power assist stops.

I. Thermocouples (S6.11)

Measure brake temperatures by installing plug-type thermocouples 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. Install a second thermocouple to a .080 inch depth within one inch circumferentially of the first thermocouple installed at .040 inch depth to be used if the lining wear reaches a point causing the first thermocouple to contact the metal rubbing surface of a drum or rotor. Exception: if the vehicle's hydraulic split is such that the most heavily loaded shoe or disc pad will not be applied during partial failure testing, install the second thermocouple in the other shoe or pad at 0.080 inch depth and connect it during the appropriate partial failure test.

For center-grooved shoes or pads, thermocouples are installed within 0.125 inch to 0.25 inch of the groove and as close to the center as possible.

In all cases, install thermocouples with minimum disassembly or adjustment of the brakes. If original adjustment is disturbed, it should be reset to the manufacturer's specification. Inspect friction material and drum or disc for any abnormalities or wear, and photograph if present.

Non-service brake frictional surfaces shall have thermocouples installed in addition to service brakes.

J. Initial Brake Temperature (S6.12)

The initial brake temperature shall be **150°F to 200°F** unless otherwise specified. (For each stop)

K. Control Forces (S6.13)

Unless otherwise specified, the force applied to a brake control is not to be less than 15 POUNDS AND NOT MORE THAN 150 POUNDS

L. Verify the calibration of all instrumentation at the start and end of each test day using a written procedure approved for the instrumentation. If failure is indicated on any test, immediately recheck the calibration of all instrumentation after the COTR has been notified. Document results for inclusion in final report as shown in Data Sheet 24.

M. The test driver will exercise best effort to make the test stops within the prescribed parameters. The vehicle speed shall be within + 0 mph and - 1 mph of the required speed for test stops. In the effectiveness (stopping

distance) tests, achieve a deceleration as quickly as possible that will bring one or more of the vehicle's wheels to an incipient skid condition without locking up more than one wheel. Attempt to avoid repeated lock-up of the same wheel or sustaining a locked wheel throughout a high speed stop. Stops with wheel lock-up not allowed count as attempts for a particular test sequence.

If, on the first two stops of a test sequence, the driver is unable to achieve a passing stop (i.e., first stop resulted in lock-up of two wheels over 10 mph and second stop resulted in exceeding the required stopping distance), consult the NHTSA COTR for guidance on the remaining stops. For stops where the criterion is deceleration (i.e., fade and recovery), the average deceleration of the vehicle shall be within + 0 fpsps and - 1 fpsps. [not specified in standard]

N. For all spike stops the pedal force is to be applied in accordance with the requirements of **Figure 2**. [Standard specifies 200 lb. pedal force applied in 0.08 seconds.]

O. *Electric Vehicles and Electric Brakes*

(1) *State of Charge (S6.2):*

(A) *The state of charge of the propulsion batteries is determined in accordance with SAE Recommended Practice J227a, Electric Vehicle Test Procedure, February 1976. The applicable sections of J227a are 3.2.1 through 3.2.4, 3.3.1 through 3.3.2.2, 3.4.1 and 3.4.2, 4.2.1, 5.2, 5.2.1, and 5.3. (S6.2.1)*

TYPICAL PLUG TYPE THERMOCOUPLE INSTALLATION

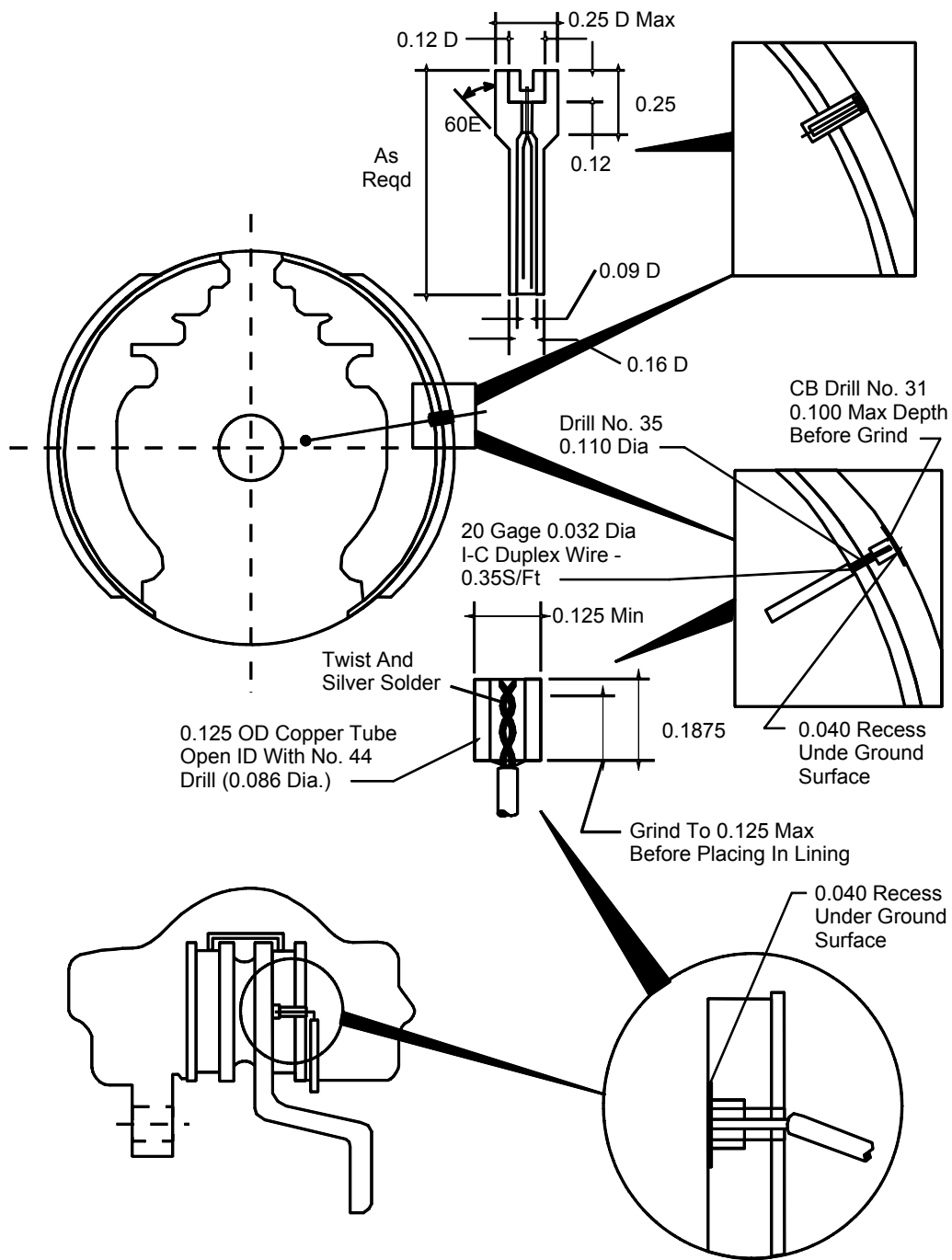


FIGURE 1

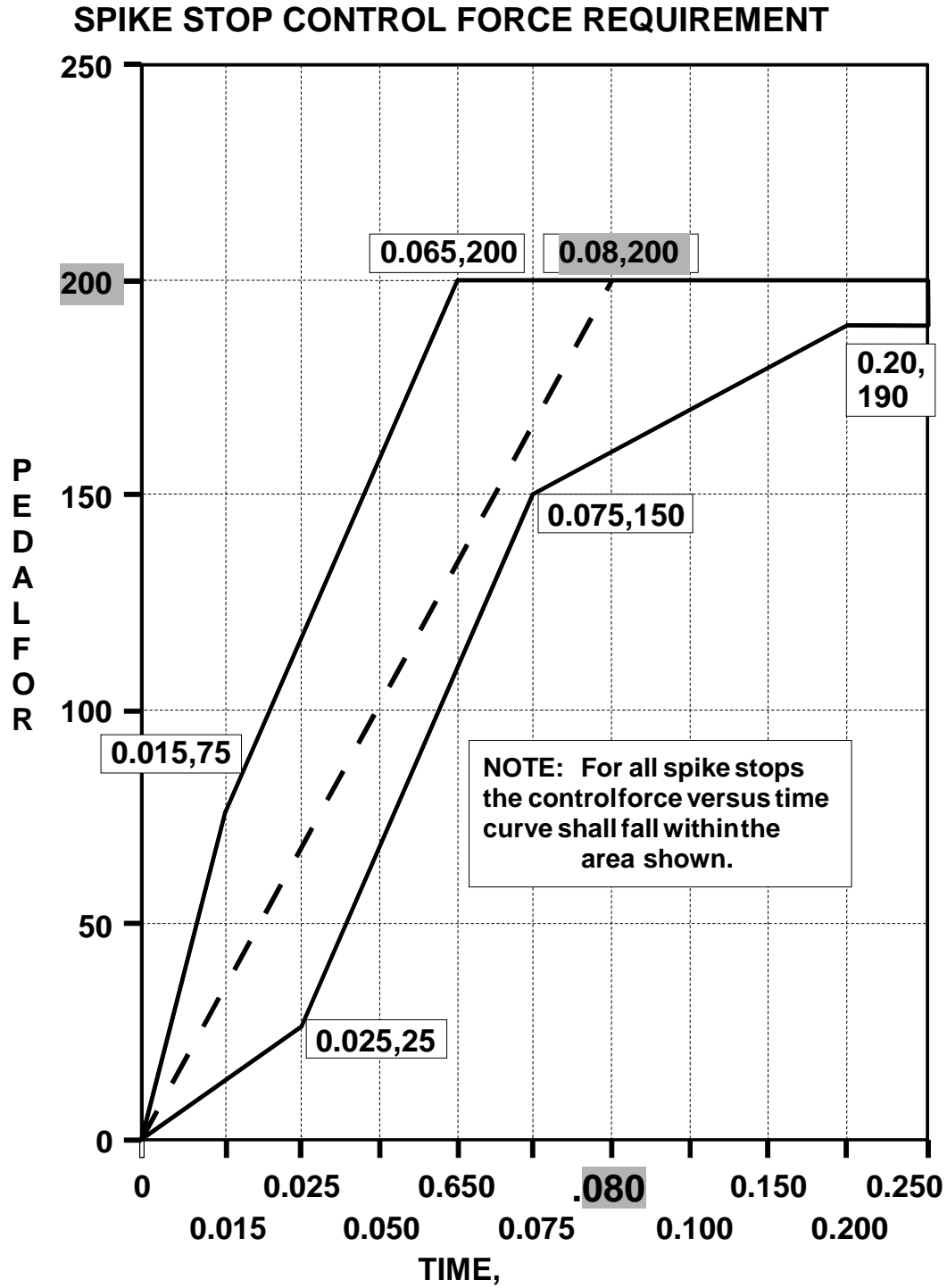


Figure 2

- (B) *At the beginning of the first effectiveness test specified in S7.3, and at the beginning of each burnishing procedure, each EV's propulsion battery is at the MAXIMUM STATE OF CHARGE recommended by the manufacturer, as stated in the vehicle operator's manual or on a label that is permanently attached to the vehicle, or, if the manufacturer has made no recommendation, at a state of charge of not less than 95 percent. If a battery is replaced rather than recharged, the replacement battery is to be charged and measured for state of charge in accordance with these procedures. During each burnish procedure, each propulsion battery is restored to the recommended state of charge or a state of charge of not less than 95 percent after each increment of 40 burnish stops until each burnish procedure is complete. The batteries may be charged at a more frequent interval if, during a particular 40-stop increment, the EV is incapable of achieving the initial burnish test speed. During each burnish procedure, the propulsion batteries may be charged by an external means or replaced by batteries that are charged to the state of charge recommended by the manufacturer or a state of charge of not less than 95 percent*
- (C) *At the beginning of each performance test in the test sequence (S7.3, S7.5, S7.7 through S7.11, and S7.13 through S7.19), unless otherwise specified, each propulsion battery of an EV is at the maximum state of charge recommended by the manufacturer, as stated in the vehicle operator's manual or on a label that is permanently attached to the vehicle, or, if the manufacturer has made no recommendation, at a state of charge of not less than 95 percent. If batteries are replaced rather than recharged, each replacement battery shall be charged and measured for state of charge in accordance with these procedures. No further charging of any propulsion battery occurs during any of the performance tests in the test sequence of this standard. If the propulsion batteries are depleted during a test sequence such that the vehicle reaches automatic shut-down, will not accelerate, or the low state of charge warning lamp is illuminated, the vehicle is to be accelerated to brake test speed by auxiliary means. (S6.2.3)*
- (2) *Regenerative Braking System (RBS):*
- (A) *For an EV equipped with RBS, the RBS is considered to be part of the service brake system if it is automatically*

controlled by an application of the service brake control, if there is no means provided for the driver to disconnect or otherwise deactivate it, and if it is activated in all transmission positions, including neutral. The RBS is operational during all burnishes and all tests, except for the test of a failed RBS. (S6.2.4). For EVs having a MANUAL control for setting the level of regenerative braking, the manual control, at the beginning of each burnish procedure, is set to provide MAXIMUM regenerative braking throughout the burnish. (S6.2.2)

- (B) *For an EV equipped with an RBS that IS NOT part of the service brake system, the RBS is operational and if adjustable, is set to produce the MAXIMUM regenerative braking effect during the burnishes and the fade stops or snubs, and IS DISABLED during the test procedures. If the vehicle is equipped with a neutral gear that automatically disables the RBS, the test procedures which are designated to be conducted in gear may be conducted in neutral. (S6.2.4)*

- (3) *EV Neutral Testing:*

For tests conducted IN NEUTRAL, the operator of an EV with no NEUTRAL position (or other means such as a clutch for disconnecting the drive train from the propulsion motor(s)) does not apply any electromotive force to the propulsion motor(s). Any electromotive force that is applied to the propulsion motor(s) automatically remains in effect unless otherwise specified by the test procedure. (S6.2.5)

P. Vehicle Speed (S5.1)

If a vehicle is incapable of attaining a speed specified in effectiveness tests, partial failure, inoperative brake power assist unit of brake power units, or spike stops, (S5.1.1, S5.1.2, S5.1.3, 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 fade and recovery testing (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.

Q. Vehicle Weight (S6.1)

- (1) For tests at GVWR, load the vehicle such that the weight on each axle as measured at the tire-ground interface is in proportion to its GAWR, except that each fuel tank is filled to any level from 100 percent of capacity (corresponding to full GVWR) to 75 percent. 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. (S6.1.1)
- (2) For applicable tests at LLVW (Stability and Control, Parking Brake, third effectiveness test and partial failure), load the vehicle to LLVW such that the added weight, except for the roll bar structure allowed for trucks and busses with a GVWR greater than 10,000 pounds, is distributed in the front passenger seat area in multipurpose passenger vehicles, and trucks, and in the area adjacent to the driver's seat in buses. (S6.1.2)

R. Automatic adjusters must remain activated at all times. (S7)

S. 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 (S7):

- (1) Exceed the test speed by 4 mph to 8 mph
- (2) Close the throttle and coast in gear to approximately 2 mph above the test speed
- (3) Shift to neutral
- (4) When the test speed is reached, apply the service brakes

T. Special Drive Conditions. (S6.14)

A vehicle with a GVWR greater than 10,000 pounds 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.

U. Selection of Compliance Options. (S6.15)

Where manufacturers options are specified, the manufacturer shall select the option by the time it certifies the vehicle and may not thereafter select a different option for the vehicle. Each manufacturer shall, upon request from the National

Highway Traffic Safety Administration, provide information regarding which of the compliance options it has selected for a particular vehicle or make/model.

PERMANENT RECORDING OF DATA

Where permanent trace recording is not required, data shall be recorded on standard report forms. Changes or corrections shall be made by drawing a line through the original entry, which must remain legible, adding the change above or alongside, and initialed.

Prior to conducting any compliance tests, contractors are required to submit a detailed in-house compliance test procedure and equipment list to the COTR which includes a step-by-step description of the methodology to be used and a detailed check-off list. Written approval must be obtained from the COTR before commencing testing so that all parties are in agreement.

The contractor's test procedure shall contain a complete listing of test equipment and a detailed check-off list. There shall be no contradiction between the OVSC Laboratory Test Procedure and the contractor's in-house test procedure. The list of test equipment shall include instrument accuracy and calibration dates.

14. COMPLIANCE TEST EXECUTION

- A. Testing shall be conducted for the following vehicle categories according to the sequence set forth in the Table below:
- (1) Multipurpose passenger vehicles (MPV), trucks, and buses (other than school buses) (GVWR less than 8,000 pounds – greater than 7716 lbs.)
 - (2) MPVs, trucks, and buses (other than school buses) (gross weight between 8,000 and 10,000 pounds)
 - (3) School buses (GVWR 10,000 pounds or less)
 - (4) School buses (GVWR more than 10,000 pounds)
 - (5) MPVs, trucks, and buses (other than school buses) (GVWR more than 10,000 pounds)
- B. Test without replacing any brake system part, or making any adjustments to the brake system other than as permitted in the burnish and reburnish procedures, and S7.9 (partial failure tests) and S 7.10 (inoperative brake power unit or brake power assist unit test) (S7).
- C. 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 applicable test (S7.3, S7.5, S7.8, S7.9, S7.10, S7.15 and S7.17) is made within a stopping distance that does not exceed the corresponding distance specified in Table II. (S7)
- D. Brake Warming (S7.1)
- If the initial brake temperature for the first stop in a test procedure (other than S7.7- parking brake test and S7.16 - Water recovery test) 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.
- E. Check brake fluid reservoirs for proper amount of fluid. Note any deficiency in amount or condition in fluid.
- F. Secure all equipment and ballast.

Brake Test Sequence and Vehicle Category Applicability

SEQUENCE	TEST LOAD	TP Sect.	FMVSS Req.	FMVSS Proc.	MPV,BUS TRUCK (7716 to < 8K)	MPV,BUS TRUCK (8K-10K)	SCHOOL BUSES (<10K)	SCHOOL BUSES (>10K)	MPV,BUS TRUCK (>10K)
Instrumentation Check	—	14.1	—	S7.2	X	X	X	X	X
Speed Determination	LLVW	14.2	S5.1	—	X	X	X	X	X
1st Effectiveness	GVWR	14.3	S5.1.1.1	S7.3	X	X	X	X	
Burnish	GVWR	14.4	-	S7.4	X	X	X	X	X
2nd Effectiveness	GVWR	14.5	S5.1.1.2	S7.5(b)	X	X	X	X	X
1st Reburnish	GVWR	14.6	-	S7.6	X	X	X	X	X
Parking Brake	LLVW GVWR	14.7	S5.2	S7.7	X	X	X	X	X
Stability and Control	LLVW	14.7A	S5.1.7	S7.5(a)				X	X
3 rd Effectiveness	LLVW	14.8	S5.1.1.3	S7.8	X		X	X	X
Partial Failure: a. Hydraulic Split b. Signal Transmitted Electrically Inop. c. RBS Inop.	LLVW	14.9	S5.1.2	S7.9 S7.10.3	X	X	X	X	X
Partial Failure: a. Hydraulic Split b. Signal Transmitted Electrically Inop. c. RBS Inop. d. ABS Inop. e. Variable Prop. f. Electrically Actuated Brakes g. Depleted Batteries for Electrically Actuated Brakes	GVWR	14.9	S5.1.2 S5.1.3.5 S6.2.6	S7.9 S7.10.3	X	X	X	X	X
Inoperative Brake Power unit or Power Assist	GVWR	14.10	S5.1.3	S7.10	X	X	X	X	X
1st Fade and Recovery	GVWR	14.11	S5.1.4	S7.11	X	X	X	X	
2nd Reburnish	GVWR	14.12	-	S7.12	X	X	X	X	
2nd Fade and Recovery	GVWR	14.13	S5.1.4	S7.13	X	X	X	X	
3 rd Reburnish	GVWR	14.14	-	S7.14	X	X	X	X	
4 th Effectiveness	GVWR	14.15	S5.1.1.4	S7.15	X	X	X		
Water Recovery	GVWR	14.16	S5.1.5	S7.16	X	X	X	X	
Spike Stops	GVWR	14.17	S5.1.6	S7.17	X	X	X		
Final Inspection	—	14.18	S5.3 S5.4 S5.5 S5.6	S7.18	X	X	X	X	X

14.1 INSTRUMENTATION CHECK (S7.2) (Data Sheet 4)

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 deceleration 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.

14.2 SPEED DETERMINATION (S5.1) (Data Sheet 5)

Record the speed which the vehicle at **GVWR** will attain in a distance of two miles from a standing start.

For an EV, the speed attainable in 2 miles is determined with the propulsion batteries at a state of charge of not less than 95 percent at the beginning of the run. (S5.1.1.4)

14.3 FIRST EFFECTIVENESS TEST (PREBURNISH) (S7.3/ S5.1.1.1) (Data Sheet 6)

Make 6 stops from 30 mph and 6 stops from 60 mph. Record the stopping distances.

14.4 BURNISH PROCEDURE (S7.4) (Data Sheet 7)

A. Burnish - Vehicles with GVWR OF 10,000 POUNDS OR LESS (S7.4.1)

Burnish 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 between 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.

Brake Adjustment – Post Burnish: After burnishing, adjust the brakes in accordance with the manufacturer's published recommendations. (S7.4.1.2)

B. Burnish – Vehicles with a GVWR GREATER THAN 10,000 POUNDS (S7.4.2)

Make 500 snubs between 40 mph and 20 mph at a deceleration rate of 10 fpsps. Except where an adjustment is specified, after each brake application accelerate to 40 mph 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 the vehicle cannot attain a speed of 40 mph in 1 mph, continue to accelerate until the vehicle reaches 40 mph or until the vehicle has traveled 1.5 miles from the initial point of the previous brake application, whichever occurs first. The brakes shall be adjusted three times during the burnish procedure, in accordance with the manufacturer's recommendations, after 125, 250, and 375 snubs.

Brake Adjustment – Post Burnish: After burnishing, adjust the brakes in accordance with the manufacturer's published recommendations. (S7.4.2.2)

14.5 SECOND EFFECTIVENESS TEST (S7.5/S5.1.1.2) (Data sheet 8)

VEHICLES WITH A GVWR OF 10,000 POUNDS OR LESS and ALL School Busses, make 6 stops from 30 mph. Record the stopping distances.

ALL VEHICLES make 6 stops from 60 mph.

VEHICLES WITH A GVWR OF 10,000 POUNDS OR LESS must also make 4 stops from 80 mph (only if the vehicle speed attainable in 2 miles is 84 mph or greater)

14.6 FIRST RE-BURNISH (S7.6) (Data Sheet 9)

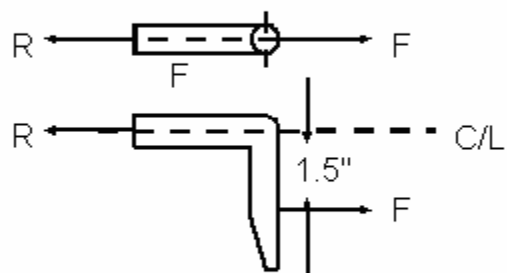
Repeat burnish procedure set forth in 14.4 (S7.4), except make 35 burnish stops or snubs.

14.7 PARKING BRAKE TESTS (S7.7/S5.2) (Data Sheet 10)

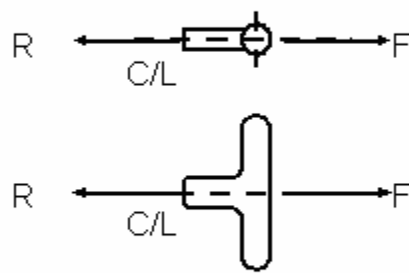
- A. The parking brake tests within 14.7.1 or 14.7.2 and 14.7.3 (different grades, directions, and loads) can be conducted in any order, but if the parking brake does not use the service brake system elements (non-service brake type parking brake system), any burnishing of the friction elements recommended by the manufacturer to the owner should be executed before testing. If no recommendations are furnished, run the vehicle in an unburnished condition (S7.7.4).
- B. Verify that each vehicle has a parking brake system of a friction type with a solely mechanical means to retain engagement.
- C. Force Application:
 - (1) For vehicles with a GVWR OF 10,000 LBS. OR LESS, the force applied to the parking brake control must not exceed 125 pounds for a foot-operated system and 90 pounds for a hand-operated system (S5.2 (a)). (S7.7.1.3(a))

- (2) For a vehicle with GVWR GREATER THAN 10,000 LBS., the force applied to the parking brake control must not exceed 150 pounds for a foot-operated system and 125 pounds for a hand-operated system (S5.2 (b)). (S7.7.1.3(b))
 - (3) For a vehicle using electrically-activated parking brake, apply the parking brake by activating the parking brake control. (S7.7.1.3(c))
- D. 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 1.5 inches from the end of the actuation lever as illustrated in Figure 3 (S7.7).
- E. All parking brake tests require an initial parking brake friction element temperature of less than 150°F, averaging the temperatures of the brakes to be used (S7.7.1.1)
- F. All tests are made both facing up and facing down the grade, at LLVW and GVWR.

LOCATION FOR MEASURING HAND BRAKE APPLICATION FORCE

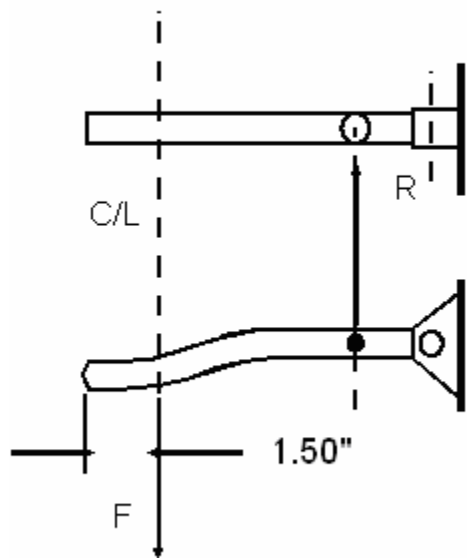


"L" TYPE

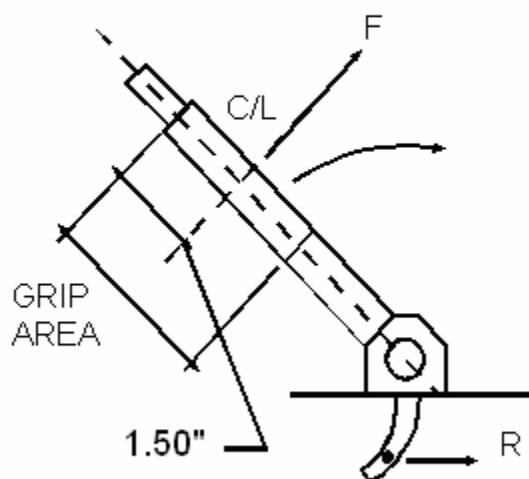


"T" TYPE

F = APPLIED
R = REACTION



LEVER TYPE A



LEVER TYPE B

FIGURE 3

G. General Parking Brake Procedure:

- (1) Drive the vehicle, loaded to the specified amount, 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 (S7.7.1.2).
- (2) With the vehicle held stationary by means of the service brake control, apply the parking brake by a single application of the force specified for foot or hand operated parking brake system, 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 (S7.7.1.3).
- (3) Following the application of the parking brake, release all force on the service brake control and commence the measurement of time if the vehicle remains stationary (S7.7.1.4).
- (4) If the vehicle does not remain stationary, re-application of the service brake to hold the vehicle stationary, with re-application of a force to the parking brake control at the level specified above as appropriate for the vehicle being tested (without release of the ratcheting or other holding mechanism of the parking brake) may be used twice to attain a stationary position (S7.7.1.4).
- (5) Following observation of the vehicle in a stationary condition for the specified 5 minute time in one direction, repeat the same test procedure with the vehicle orientation in the opposite direction on the specified grade (S7.7.1.5).
- (6) Verify activation of the parking brake application indicator light (S7.7.1.6).

14.7.1 SCHOOL BUS WITH A GVWR OF 10,000 LBS. OR LESS (S7.7.1/S5.2.1), EXCEPT OPTION AS PROVIDED IN 14.7.2.

Load the vehicle to **GVWR**.

Utilizing procedure (G) above, the parking brake system must be capable of holding the vehicle stationary on a **30** percent (16.7 degrees) grade (to the limit of traction on the braked wheels) for 5 minutes.

Repeat for reverse direction.

14.7.2 SCHOOL BUS WITH A GVWR OF 10,000 LBS. OR LESS
(S7.7.2/S7.19/S5.2.2) MANUFACTURER OPTION:

For use of this option, the vehicle must have:

- A transmission or transmission control which incorporates a parking mechanism, and
- A parking mechanism that must be engaged before the ignition key can be removed.

At **GVWR**, utilize procedure (G) above, except in addition to the parking brake, place the transmission control to engage the parking mechanism. The parking brake system and parking mechanism when both are engaged must be capable of holding the vehicle stationary (to the limit of traction on the braked wheels) for five minutes, on a **30** percent grade (S5.2.2.1).

At **GVWR**, utilize procedure (G) above, with only the parking brake engaged (parking mechanism not engaged) except on a **20** percent grade. The parking brake system when engaged must be capable of holding the vehicle stationary (to the limit of traction on the braked wheels) for five minutes on a **20** percent (11.3 degrees) grade (S5.2.2.2).

At **GVWR**, with the parking mechanism engaged and the parking brake not engaged, impact the vehicle at each end, on a level surface at 2.5 mph with a moving barrier as described in paragraph 3.3 of SAE recommended practice J972 "Moving Barrier Collision Tests,". Keep the longitudinal axis of the barrier parallel with the longitudinal axis of the vehicle. The parking mechanism shall not disengage or fracture in a manner permitting vehicle movement (S5.2.2.3). Note: The vehicle used for this test need not be the same vehicle that has been used for the braking tests.

REPEAT 14.7.1 OR 14.7.2 AS APPLICABLE EXCEPT AT LIGHTLY LOADED VEHICLE WEIGHT (LLVW) (S7.7.3) with the added weight, except for the roll bar structure allowed for trucks and busses with a GVWR greater than 10,000 pounds, distributed in the front passenger seat area in, multipurpose passenger vehicles, and trucks, and in the area adjacent to the driver's seat in busses.

14.7.3 Multipurpose passenger vehicles, truck, and bus with a GVWR OF 10,000 LBS. OR LESS (other than school buses) shall be capable of holding the vehicle stationary for 5 minutes in both forward and reverse directions, on a 20 percent grade. (S5.2.3(a))

Multipurpose passenger vehicles, trucks, and buses with a GVWR greater than 10,000 lbs. must hold the vehicle stationary for 5 minutes, in both forward and

reverse directions, on a 20 percent grade. (S5.2.3(b))

For both **GVWR** and **LLVW** conditions, repeat 14.7 (G) procedure above. The parking brake system shall be capable of holding the vehicle stationary for 5 minutes on a **20** percent (11.3 degrees) grade.

14.7A STABILITY AND CONTROL DURING BRAKING (S7.5(a)/S5.1.7)

(Braking-in-a-curve test) (Data Sheet 10A)

For vehicles with a GVWR greater than 10,000 pounds.

With the vehicle at LLVW, or at the manufacturers option, at the LLVW plus not more than an additional 1000 pounds for a roll bar structure on the vehicle, stop **four** consecutive times from 30 mph or 75 percent of the maximum drive-through speed, whichever is less. At least **three** times, the vehicle must remain within the 12-foot lane, without any part of the vehicle leaving the roadway.

Use a full brake application for the duration of the stop, with the clutch pedal depressed or the transmission selector control in the neutral position, for the duration of each stop.

Establish the 500-foot radius roadway and using traffic cones or similar, delineate the 12 foot wide roadway. Ensure a wet surface prior to testing. Starting with the vehicle in the center of the lane, attempt to drive through the curved 500 ft radius test lane at a constant speed. Increase or decrease speed in subsequent runs as necessary until the maximum drive-through speed is determined. Verify maximum drive-through speed at least once by repeating runs at 1 mph above the previously determined value. Take 75% of this speed and compare to 30 mph. The test is to be conducted at the lesser of these two speeds.

Proceed with 4 required stops starting with the vehicle in the center of the lane at the speed determined above. Make the brake application only in the curved lane and at a speed as close as possible to the designated speed.

The vehicle must remain within the 12-foot roadway without any part of the vehicle leaving the roadway in at least three of the four stops.

14.8 **THIRD EFFECTIVENESS TEST** (S7.8/S5.1.1.3) (Data Sheet 11)

With the vehicle at **LLVW**, or at the manufacturers option for a vehicle with a GVWR greater than 10,000 pounds, at lightly loaded vehicle weight plus not more than an additional 1,000 pounds for a roll bar structure on the vehicle. make 6 stops from 60 mph.

NOTE: For vehicles with a **GVWR** between 8,000 and 10,000 lbs., this test only applies to school buses.

14.9 PARTIAL SERVICE BRAKE FAILURE (S7.9/S5.1.2) (Data Sheet 12)

14.9.1 **HYDRAULIC**-PARTIAL FAILURE TEST, LIGHTLY LOADED: FIRST SUBSYSTEM (S7.9.1)

With the vehicle at **LLVW** or at the manufacturer's option for a vehicle with a GVWR greater than 10,000 pounds, at lightly loaded vehicle weight plus not more than an additional 1,000 pounds for a roll bar structure on the vehicle, alter the service brake system to produce any one rupture or leakage type failure in a single subsystem, other than a structural failure of a housing that is common to two or more subsystems (S5.1.2.1).

Record the alteration made, control force, pressure level, or fluid level (as appropriate for the indicator being tested) necessary to activate the brake system indicator lamp.

If the vehicle is equipped with a split service brake system, make 4 stops from 60 mph using the remaining portion of the service brake system. Record the stopping distance.

If the vehicle is NOT EQUIPPED with a split service brake system, make 10 stops, each from 60 mph, by a continuous application of the service brake control (S5.1.2.2).

Restore the service brake system to normal functioning at completion of test.

14.9.2 **HYDRAULIC**- PARTIAL FAILURE TEST, LIGHTLY LOADED; ADDITIONAL SUBSYSTEM (S7.9.2)

Repeat 14.9.1 for each of the other hydraulic subsystems.

14.9.3 **BRAKE SIGNAL TRANSMITTED ELECTRICALLY**-PARTIAL FAILURE TEST; (S5.1.2.3/S7.9.5)

*For a vehicle manufactured with a service brake system in which the brake signal is transmitted electrically between the brake pedal and some or all of the foundation brakes, regardless of the means of actuation of the foundation brakes, induce any single failure in any circuit that electrically transmits the brake signal, and with all other systems intact, at **LLVW**, make 4 stops from 60 mph. Record the stopping distance.*

Determine whether the brake system indicator lamp is activated when the failure is induced.

14.9.4 ELECTRIC VEHICLE WITH REGENERATIVE BRAKE SYSTEM (RBS)-PARTIAL FAILURE TEST; (S5.1.2.4/S7.9.6)

*For an EV with RBS that is part of the service brake system, with the RBS disconnected and all other systems intact, at **LLVW**, make 4 stops from 60 mph. Record the stopping distance.*

Determine whether the brake system indicator lamp is activated when the RBS is disconnected.

14.9.5 HYDRAULIC-PARTIAL FAILURE TEST; FULLY LOADED (S7.9.3)

Reload vehicle to the **GVWR**. Repeat 14.9.1.

Restore the service brake system to normal functioning at completion of test.

14.9.6 HYDRAULIC-PARTIAL FAILURE TEST; FULLY LOADED (S7.9.3)

With vehicle loaded to the **GVWR**. Repeat 14.9.2 until all subsystems have been altered.

Restore the service brake system to normal functioning at completion of test.

14.9.7 ANTI-LOCK AND VARIABLE PROPORTIONING-PARTIAL FAILURE BRAKE SYSTEM TEST (S7.9.4/S5.5.2).

With the vehicle at **GVWR**, disconnect functional power source, or otherwise render antilock system inoperative if so equipped.

Make 4 stops each from 60 mph. Record the stopping distance.

Determine whether the brake system indicator lamp activates when the electrical power source to the antilock system is disabled.

For an EV that is equipped with both ABS and RBS that is part of the service brake system, VERIFY that the ABS controls the RBS. (S5.5.2) If separate indicator lamps labeled ABS and RBS are provided, both must be illuminated. If not, describe method used to verify that the ABS controls the RBS on data sheets

Restore system to normal at completion of test.

With the vehicle only at **GVWR**, disconnect variable proportioning brake system if so equipped.

Make 4 stops from 60 mph. Record the stopping distance.

Determine whether the brake system indicator lamp activates when the electrical power source to the variable proportioning unit is disabled.

Restore system to normal at completion of test.

If more than one antilock or variable proportioning brake subsystem is provided, disconnect or render one subsystem inoperative and run as above. Repeat for each subsystem provided.

Restore system to normal at completion of test.

14.9.8 BRAKE SIGNAL TRANSMITTED ELECTRICALLY-PARTIAL FAILURE TEST;
(S5.1.2.3/S7.9.5)

Repeat 14.9.3 at **GVWR**.

Restore system to normal at completion of test.

14.9.9 ELECTRIC VEHICLE WITH REGENERATIVE BRAKE SYSTEM (RBS)-
PARTIAL FAILURE TEST; (S5.1.2.4/S7.9.6)

Repeat 14.9.4 at **GVWR**.

Restore system to normal at completion of test.

14.9.10 ELECTRICALLY-ACTUATED SERVICE BRAKES-PARTIAL FAILURE;
(S5.1.3.5/S7.10.3(a))

*For vehicles with electrically-actuated service brakes (brake power unit), with any single electrical failure in the electrically-actuated service brakes and all other systems intact, at **GVWR**, make 4 stops each from 60 mph. Record the stopping distance.*

14.9.11 ADDITIONAL TEST FOR ELECTRICALLY-ACTUATED SERVICE BRAKES;
AUXILIARY BATTERIES PROVIDING POWER TO ACTUATE BRAKES
DEPLETED (S6.2.6)

*A vehicle equipped with ELECTRICALLY-ACTUATED SERVICE BRAKES also performs the following test series. Conduct 10 stopping tests from a speed of 100 km/h or the maximum vehicle speed, whichever is less. At least two of the 10 stopping distances must be less than or equal to 70 meters. The vehicle is loaded to **GVWR** for these tests and the transmission is in the neutral position when the service brake control is actuated and throughout the remainder of the test. The battery or batteries providing power to those electrically-actuated*

brakes, at the beginning of each test, shall be in a depleted state of charge for conditions A, B, or C of this paragraph as appropriate. An auxiliary means may be used to accelerate an EV to test speed.

- A. *For an EV equipped with ELECTRICALLY-ACTUATED SERVICE BRAKES deriving power from the propulsion batteries, and with automatic shut-down capability of the propulsion motor(s), the propulsion batteries are at not more than five percent above the EV actual automatic shut-down critical value. The critical value is determined by measuring the state-of-charge of each propulsion battery at the instant that automatic Shut-down occurs and averaging the states-of-charge recorded.*
- B. *For an EV equipped with ELECTRICALLY-ACTUATED SERVICE BRAKES deriving power from the propulsion batteries, and with no automatic shut-down capability of the propulsion motor(s), the propulsion batteries are at an average of not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.3.1(e) of this standard, is illuminated.*
- C. *For a vehicle which has an auxiliary battery (or batteries) that provides electrical energy to operate the ELECTRICALLY-ACTUATED SERVICE BRAKES, the auxiliary battery(batteries) is (are) at (at an average of) not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.3.1(e) of this standard, is illuminated.*

14.10 INOPERATIVE BRAKE POWER UNIT OR BRAKE POWER ASSIST UNIT TEST (S7.10/S5.1.3)

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 distances specified in Appendix 2 Table.

A vehicle equipped with one or more brake power assist units, must be tested to 14.10.1 below, or optional procedures 14.10.2 A or C, chosen at the option of the manufacturer.

A vehicle equipped with one or more brake power units, must be tested to 14.10.1 below, or optional procedures 14.10.2 B or C, chosen at the option of the manufacturer.

14.10.1 REGULAR PROCEDURE (S7.10.1) (S5.1.3.1)

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 4 stops each from 60 mph by a continuous application of the service brake control. Record the stopping distance.

Restore the system to normal at completion of this test.

For vehicles equipped with more than one brake power assist unit or brake power unit, conduct tests on each in turn.

14.10.2 OPTIONAL PROCEDURE (S7.10.2)

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 (S5.1.3.2(a)) (S7.10.2(a)).

Disconnect the primary source of power, making power assist unit inoperative. Make 6 consecutive stops each from 60 mph (with inoperative unit NOT initially depleted of reserve capability), to achieve the average deceleration (not lower than) for each stop as specified in following table. Apply the brake control as quickly as possible. Maintain control force until vehicle has stopped.

Inoperative Brake Power Assist and Brake Power Units

Stop No.	Average Deceleration, fpsps		Equivalent Stopping Distance, ft.	
	Column 1	Column 2	Column 3	Column 4
	Brake Power Assist	Brake Power Unit	Brake Power Assist	Brake Power Unit
	(b) and (c)	(b) and (c)	(b) and (c)	(b) and (c)
1	14.0	13.0	277	298
2	12.0	11.0	323	352
3	10.0	10.0	388	388
4	8.5	9.5	456	409
5	7.5	9.0	517	431
6	6.7	8.5	580	456
7	6.0 ¹	8.0	646	484
8	Na	7.5	Na	517
9	Na	7.0	Na	554
10	Na	6.5	Na	596
11	Na	6.0 ¹	na	646

¹ Depleted.

(b) vehicles other than passenger cars with GVWR of 10,000 lbs or less

(c) vehicles with GVWR greater than 10,000 lbs

NA=Not applicable.

At the completion of the stops specified above, DEplete the system of any residual brake power reserve capability. Make 1 STOP from 60 mph at an average deceleration of not lower than 6 fpsps for vehicles other than passenger cars (equivalent stopping distance 646 feet) and determine whether the control force exceeds 150 pounds. (S5.1.3.2(b))

- (B) For vehicles with one or more brake power units with accumulator type reserve systems (S5.1.3.3)

Test as in 14.10.2 A above, except make 10 consecutive 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. (S7.10.2 (b))

- (C) For vehicles with brake power assist or brake power units with backup systems. (S5.1.3.4)

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 only the backup system activated

for the failed subsystem, to achieve an average deceleration of 12 fpsps (equivalent stopping distance of 323 feet) for each stop.

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

14.11 FIRST FADE/RECOVERY TEST (S7.11/S5.1.4) (Data Sheet 14)

14.11.1 Baseline Check Stops or Snubs

- A. Vehicles with GVWR OF 10,000 LBS OR LESS (S7.11.1.1)

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. The control force shall be not less than 10 lbs, nor more than 60 lbs. (S5.1.4.1)

- B. Vehicles with GVWR GREATER THAN 10,000 LBS (S7.11.1.2)

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. The control force may be between 10 pounds and 90 pounds. (S5.1.4.1)

14.11.2 Fade Stops or Snubs (S7.11.2)

- A. Vehicles with GVWR OF 10,000 LBS OR LESS (S7.11.2.1 and S5.1.4.2(a))

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 below.

- B. Vehicles with GVWR GREATER THAN 10,000 LBS (S7.11.2.2 and S5.1.4.2(b))

With transmission in neutral (or declutched) make 10 snubs from 40 mph 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 second and maintain it for the remainder of the snubbing time. Leave an interval of 30 seconds 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 below.

14.11.3 Recovery Stops or Snubs (S7.11.3 and S5.1.4.3).

A. Vehicles with GVWR OF 10,000 LBS OR LESS (S7.11.3.1 and S5.1.4.3(a))

Make 5 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 minute. 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.

Control force application must fall 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
- (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. Vehicles with GVWR GREATER THAN 10,000 LBS (S7.11.3.2 and S5.1.4.3(b))

With transmission in neutral (or declutched) make 5 snubs from 40 mph 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.

Control force application must fall 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)
- (2) A minimum of –
 - (A) The average control force for the baseline check minus 10 pounds
 - (B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds).

14.12 Second Re-burnish (S7.12) (Data Sheet 15)

Repeat procedure 14.6 – 1st Re-burnish

14.13 Service Brake System – Second Fade and Recovery Test (S7.13) (Data Sheet 16)

Repeat procedure 14.11 – First Fade and Recovery, except run 15 fade stops or 20 snubs instead of 10.

14.14 Third Re-burnish (S7.14) (Data Sheet 17)

Repeat procedure 14.6 – 1st Re-burnish

14.15 Service Brake System – Fourth Effectiveness Test (S7.15/S5.1.1.4) (Data Sheet 18)

Vehicles with a GVWR OF 10,000 LBS OR LESS, make stops from 30 mph and 60 mph. If the speed attainable in 2 miles is not less than 84 mph, conduct 80 mph stopping tests.

14.16 Service Brake System – Water Recovery Test (S7.16/S5.1.5) (Data Sheet 19)

14.16.1 Baseline Check Stop (S7.16.1 and S5.1.5.1)

Make 3 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. The control force used for the baseline check stops or snubs must not be less than 10 pounds, nor more than 60 pounds, for vehicles less than 10,000 pounds GVWR. For vehicles with a GVWR of 10,000 pounds or more, the control force may be between 10 and 90 pounds.

14.16.2 Wet Brake Recovery Stops (S7.16.2)

With the brakes fully released at all times, drive the vehicle 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. After leaving the trough, immediately accelerate at a maximum rate to 30 mph without a brake application. Immediately upon reaching that speed make 5 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.

Control force application must fall within the following maximum and minimum limits:

For vehicles with a GVWR OF 10,000 LBS OR LESS (S5.1.5.2(a)):

- A. A maximum for the first 4 recovery stops of 150 pounds, and for the 5th stop, of 45 pounds more than the average control force for the baseline check but in no case more than 90 pounds.
- B. A minimum of –
 - (1) The average control force for the baseline check minus 10 pounds, or
 - (2) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds).

For vehicles with a GVWR GREATER THAN 10,000 LBS (S5.1.5.2(b)):

- A. A maximum for the first 4 recovery stops of 150 pounds, and for the 5th stop, of 60 pounds more than the average control force for the baseline check (but in no case more than 110 pounds); and
- B. A minimum of –
 - (1) The average control force for the baseline check minus 0 pounds, or
 - (2) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds).

14.17 Spike Stops (S7.17/S5.1.6) (Data Sheet 20)

For vehicles with a GVWR OF 10000 LBS OR LESS, make 10 successive spike stops from 30 mph with the transmission in neutral, with no reverse stops. Make spike stops by applying a control force of 200 pounds within 0.08 seconds while recording control force versus time. Maintain control force until vehicle has stopped. At completion of 10 spike stops, make 6 effectiveness stops from 60 mph, one of which meets stopping distance requirements.

14.18 Final Inspection (S7.18) (Data Sheet 21)

14.18.1 Brake System Integrity (S5.6/S7.18)

At the completion of the road performance test, remove wheels from vehicle and verify that vehicle meets the complete performance requirements of this procedure without –

- A. Detachment or fracture of any component of the braking system, such as brake springs and brake shoes or disc pad facing other than minor cracks that do not impair attachment of the friction facings. All mechanical components of the braking system shall be intact and functional.

Friction facing tear-out (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.

14.18.2 Master Cylinder Reservoirs (S5.4.1)

Verify that the master cylinder has a reservoir compartment for each service brake subsystem serviced by the master cylinder.

Verify that loss of fluid from one compartment shall not result in a complete loss of brake fluid from another compartment.

14.18.3 Reservoir Capacity (S5.4.2)

Verify that the reservoirs, whether for master cylinders or other type systems, have a **TOTAL MINIMUM** capacity (full reservoir 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.

In determining the fully applied worn condition (S7.18(c)), assume that the lining is worn to –

- A. Rivet or bolt heads on riveted or bolted linings, or
- B. Within 0.8 mm (0.03125 inch) of shoe or pad mounting surface on bonded linings, or
- C. 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. Refer to Data Sheet 23 and to Appendix 1 for procedure to calculate master cylinder volume requirements.

Verify that reservoirs have completely separate compartments for each service brake 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. (To determine volume displaced by a full stroke of each piston may require disconnecting hydraulic lines from each piston chamber, applying brakes and catching the displaced fluid in a calibrated receptacle.)

If applicable, verify that 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.

14.18.4 Reservoir Labeling (S5.4.3)

Verify that vehicle has a brake fluid warning statement that reads as follows, in letters at least 0.125 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.")

Verify that the lettering is –

- 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
- C. Of a color that contrasts with its background, if it is not engraved or embossed

14.18.5 Brake System Warning Indicator (S5.3)

Verify that vehicle has one or more visual brake system warning indicators, mounted in front of and in clear view of the driver, which meet the requirements of S5.3.1 through S5.3.5 below.

Determine if a vehicle with a GVWR OF 10,000 LBS OR LESS has a single common indicator lamp, which is allowed. For vehicles with GVWR GREATER THAN 10,000 LBS , a common indicator can be utilized for gross loss of pressure, drop in the level of the brake fluid, or application of the parking brake.

Verify that for a vehicle with a GVWR OF GREATER THAN 10,000 LBS, there is a SEPARATE indicator lamp for antilock brake system malfunction.

14.18.6 Activation (S5.3.1)

Verify that an indicator lamp is activated when the ignition (start) switch is in the "on" ("run") position and whenever any of conditions A or B, C, D, E, F, and G 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) as indicated by 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 psi between the active and failed brake system measured at a master cylinder outlet of a slave cylinder outlet. Installation of pressure transducers may be required.
 - (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 1/2 of the normal system pressure.

Verify that the options provided in S5.3.1(a) do not apply to a vehicle manufactured WITHOUT A SPLIT SERVICE BRAKE SYSTEM; such a vehicle shall, to meet the requirements of S5.3.1(a), be equipped with a malfunction 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 0.25 inch in height.

- 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 1/4th (25%) of the fluid capacity of that reservoir compartment, whichever is greater.

- C. A malfunction that affects the generation or transmission of response or control signals in an antilock brake system, or a total functional electrical failure in a variable proportioning brake system.
- D. Application of the parking brake.
- E. *For a vehicle with ELECTRICALLY-ACTUATED SERVICE BRAKES, failure of the source of electric power to the brakes, or diminution of state of charge of the batteries to less than a level specified by the manufacturer for the purpose of warning a driver of degraded brake performance.*
- F. *For a vehicle with electric transmission of the service brake control signal, failure of a brake control circuit.*
- G. *For an EV with RBS that is part of the service brake system, failure of the RBS.*

14.18.7 Indicator Light Function Check (S5.3.2)

Verify that all indicator lamps are 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.

The indicator lamps need not be activated when a starter interlock is in operation.

14.18.8 Indicator Light Duration (S5.3.3)

Verify that each indicator lamp activated due to a condition specified in S5.3.1 (12.18.6) shall remain activated as long as the malfunction exists, whenever the ignition (start) switch is in the "on" (run) position, whether or not the engine is running.

For vehicles with a GVWR GREATER THAN 10,000 LBS, verify that each message about the existence of a malfunction, as described in S5.3.1(c) (antilock or variable proportioning malfunction), shall be **stored** in the antilock brake system after the ignition switch is turned to the "off" position and the indicator lamp shall be automatically reactivated when the ignition switch is again turned to the "on" position. The indicator lamp shall also be activated as a check of lamp function whenever the ignition is turned to the "on" (run) position. The indicator lamp shall be deactivated at the end of the check of lamp function unless there is a malfunction or a message about a malfunction that existed

when the key switch was last turned to the "off" position .

14.18.9 Function (S5.3.4)

Verify that when a visual warning indicator is activated, it is steady burning or flashing.

14.18.10 Labeling (S5.3.5)

- A. Verify that each indicator lamp has letters not less than 0.125 inch high.

Verify that the labeling for each indicator light is legible to the driver in daylight when lighted.

Verify that words in addition to those required by this standard and/or FMVSS 101 are for the purpose of clarity.

- B. Verify that if a single common indicator is used, the lamp displays the word "Brake".

Verify that the letters and background of a single common indicator are of contrasting colors, one of which is red.

- C. If separate indicators are used for one or more of the conditions described in S5.3.1(a) through S5.3.1(g) (14.18.6) of this standard (gross loss of pressure, drop in brake fluid level, ABS or variable proportioning failure, parking brake application, *electrically actuated service brakes, electric transmission of service brake control, and RBS*), the indicator display shall include the word "Brake" and appropriate additional labeling, except as provided in (1) through (5) below:

- (1) Verify that if a separate indicator lamp is provided for gross loss of pressure, the words "Brake Pressure" are used for S5.3.1(a). (Gross loss of pressure)
- (2) Verify that if a separate indicator lamp is provided for low brake fluid, the words "Brake Fluid" are used for S5.3.1(b), (Fluid level drop) except for vehicles using hydraulic system mineral oil.
- (3) If a separate indicator lamp is provided for an anti-lock system, verify that the single word "Antilock" or "Anti-lock", or the abbreviation "ABS", is used for S5.3.1(c). (ABS or Variable proportioning)
- (4) If a separate indicator lamp is provided for application of the parking brake, verify that the single word "Park" is used for

S5.3.1(d). (Parking Brake)

- (5) *If a separate indicator is used for the regenerative brake system, verify that the symbol "RBS" is used. RBS failure may also be indicated by a lamp displaying the symbol "ABS/RBS."*

Except for a separate indicator lamp for an anti-lock system, a regenerative system, or an indicator for both anti-lock and regenerative system, verify that the letters and background of each separate indicator lamp is of contrasting colors, one of which is RED. The letters and background of a separate indicator lamp for an anti-lock system, a regenerative system, or a lamp displaying both an anti-lock and a regenerative system shall be of contrasting colors, one of which is YELLOW.

14.18.11 Antilock and Variable Proportioning Brake Systems (S5.5)

Verify that each vehicle with a GVWR GREATER THAN 10,000 LBS, except for any vehicle with a speed attainable in 2 miles of not more than 33 mph, shall be equipped with an antilock brake system that directly controls the wheels of at least one front axle and the wheels of at least one rear axle of the vehicle.

On each vehicle with a GVWR GREATER THAN 10,000 POUNDS but not greater than 19,500 pounds and motor homes with a GVWR greater than 10,000 pounds but not greater than 22,500 pounds manufactured before March 1, 2001, the antilock brake system may also directly control the wheels of the rear drive axle by means of a single sensor in the driveline. Wheels on other axles of the vehicle may be indirectly controlled by the antilock brake system.

Verify that for an EV that is equipped with both ABS and RBS that is part of the service brake system, the ABS controls the RBS (S5.5.2)

14.18.12 Service Brake System (S5.1)

Verify that vehicle is equipped with a service brake system acting on all wheels.

Verify that wear of service brakes shall be compensated by means of a system of automatic adjustment.

15. INSTRUCTIONS FOR COMPLETING DATA SHEETS

Data is to be furnished in every data blank provided on the report forms, or if not applicable, insert "NA". Corrections are to be made by drawing a line through the data, leaving it legible and adding the correct entry,

initials, and date.

Record any unusual brake performance, such as pull, noise, smoke, wrap-up, or skid, that occurs during the testing.

Every sheet of any document relating to a test, including automatic continuous recorder data, will contain the NHTSA number of the vehicle, date, vehicle, and test identification.

NOTE: Average Pedal Force and Average Deceleration are calculated from the initiation of the pedal force until completion of the stop. (60 FR 6434, Feb. 2, 1995, page 6431)

NOTE: The exact target speeds specified for each test will, in most cases, not be achievable. As a result, all actual stopping distances are to be adjusted to represent the distances that would have been obtained had the exact test speed been achieved. These corrected distances are calculated using the Society of Automotive Engineers, Inc., "Stopping Distance Test Procedure – SAE J299", where the following expression is derived:

Corrected stopping distance =

$$\frac{[(\text{Target initial speed})^2 / (\text{Actual initial test speed})^2]}{\text{Actual stopping distance}} \times \text{Actual stopping distance}$$

16. POST TEST REQUIREMENTS

After the required tests are completed, the contractor shall:

Verify all instrumentation, test data records and photographs;

Restore the vehicle to its original configuration, if necessary;

Complete the Vehicle Condition Report form including word description of the vehicle's post test condition;

Move the test vehicle to a secure area; and

Place all original records in a secure and organized file awaiting test data disposition.

17. Reports

17.1 Monthly Status Reports

The contractor shall submit a monthly Test Status Report and a Vehicle Status Report to the FMVSS 105 COTR. The Vehicle Status report shall be submitted until all FMVSS 105 vehicles are transferred to another FMVSS or otherwise disposed of. Samples of the required reports are found in the report forms section.

17.2 Apparent Test Failure

Any indication of an test failure shall be communicated by telephone or to the COTR within 24 hours with written notification mailed within 48 hours (Saturday and Sunday hours excluded). A Notice of Test Failure (see report forms section) with a copy of the particular compliance test data sheet(s) and preliminary data plot(s) shall be included.

If possible, repeat that portion of the test where the failure was noted to ensure that there is a test failure.

In the event of a test failure, a post test calibration check of some critically sensitive test equipment and instrumentation (if applicable) may be required for verification of accuracy. The necessity for the calibration shall be at the COTR's discretion and shall be performed without additional costs to the OVSC.

17.3 Final Test Reports

17.3.1 Copies

In the case of an apparent test failure, 7 copies of the Final Test Report shall be submitted to the COTR for acceptance within 3 weeks of test completion.

Where there has been no indication of an apparent noncompliance, 3 copies of each Final Test Report shall be submitted to the COTR for acceptance within 3 weeks of test completion. No payment of contractor's invoices for conducting compliance tests will be made prior to the Final Test Report acceptance by the COTR. Contractors are requested to NOT submit invoices before the COTR is provided with copies of the Final Test Report.

Contractors are required to submit the first Final Test Report in draft form within 1 week after the compliance test is conducted. The contractor and the COTR will then be able to discuss the details of both test conduct and report content early in the compliance test program.

Contractors are required to PROOF READ all Final Test Reports before submittal to the COTR. The OVSC will not act as a report quality control office for

contractors. Reports containing a significant number of errors will be returned to the contractor for correction, and a "hold" will be placed on invoice payment for the particular test.

17.3.2 Requirements

The Final Test Report, associated documentation (including photographs), are relied upon as the chronicle of the compliance test. The Final Test Report will be released to the public domain after review and acceptance by the COTR. For these reasons, each final report must be a complete document capable of standing by itself.

The contractor should use **detailed** descriptions of all compliance test events. Any events that are not directly associated with the standard but are of technical interest should also be included. The contractor should include as much **detail** as possible in the report.

Instructions for the preparation of the first three pages of the final test report are provided for standardization.

17.3.3 First Three Pages

A. FRONT COVER

A heavy paperback cover (or transparency) shall be provided for the protection of the final report. The information required on the cover is as follows:

- (1) Final Report Number such as 105-ABC-0X-001 where
 - 105 is the FMVSS tested
 - ABC are the initials for the laboratory
 - 0X is the Fiscal Year of the test program
 - 001 is the Group Number (001 for the 1st test, 002 for the 2nd test, etc.)

- (2) Final Report Title And Subtitle such as

COMPLIANCE TESTING FOR FMVSS 105
Hydraulic and Electric Brake Systems

XYZ Motor Co.
200X Deluxe 4-door sedan
NHTSA No. CX0101

- (3) Contractor's Name and Address such as
 - COMPLIANCE TESTING LABORATORIES, INC.
 - 4335 West Dearborn Street
 - Detroit, Michigan 48090

NOTE: DOT SYMBOL WILL BE PLACED BETWEEN ITEMS (3) AND (4)

- (4) Date of Final Report completion
- (5) The words "**FINAL REPORT**"
- (6) The sponsoring agency's name and address as follows:

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
400 Seventh Street, SW
Room 6111 (NVS-220)
Washington, DC 20590

B. FIRST PAGE AFTER FRONT COVER

A disclaimer statement and an acceptance signature block for the COTR shall be provided as follows:

This publication is distributed by the U. S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared By: _____

Approved By: _____

Approval Date: _____

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: _____

Acceptance Date: _____

- C. **SECOND PAGE AFTER FRONT COVER**
A completed Technical Report Documentation Page (Form DOT F1700.7) shall be completed for those items that are applicable with the other spaces left blank. Sample data for the applicable block numbers of the title page follows.

Block 1 — REPORT NUMBER

105-ABC-0X-001

Block 2 — GOVERNMENT ACCESSION NUMBER

Leave blank

Block 3 — RECIPIENT'S CATALOG NUMBER

Leave blank

Block 4 — TITLE AND SUBTITLE

Final Report of FMVSS 105 Compliance Testing of 200X XYZ
Deluxe 4-door sedan, NHTSA No. CX0101

Block 5 — REPORT DATE

March 1, 200X

Block 6 — PERFORMING ORGANIZATION CODE

ABC

Block 7 — AUTHOR(S)

John Smith, Project Manager / Bill Doe, Project Engineer

Block 8 — PERFORMING ORGANIZATION REPORT NUMBER

ABC-DOT-XXX-001

Block 9 — PERFORMING ORGANIZATION NAME AND ADDRESS

ABC Laboratories
405 Main Street
Detroit, MI 48070

Block 10 — WORK UNIT NUMBER

Leave blank

Block 11 — CONTRACT OR GRANT NUMBER

DTNH22-9X-D-12345

Block 12 — SPONSORING AGENCY NAME AND ADDRESS

US Department of Transportation
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
400 Seventh Street, SW, Room 6111 (NVS-220)
Washington, DC 20590

Block 13 — TYPE OF REPORT AND PERIOD COVERED

Final Test Report
Feb. 15 to Mar. 15, 200X

Block 14 — SPONSORING AGENCY CODE

NVS-220

Block 15 — SUPPLEMENTARY NOTES

Leave blank

Block 16 — ABSTRACT

Compliance tests were conducted on the subject 200X XYZ Deluxe 4-door sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-105-0X for the determination of FMVSS 105 compliance.

Test failures identified were as follows:

None

NOTE: Above wording must be shown with appropriate changes made for a particular compliance test. Any questions should be resolved with the COTR.

Block 17 — KEY WORDS

Compliance Testing
Safety Engineering
FMVSS 105

Block 18 — DISTRIBUTION STATEMENT

This report is available via NHTSA's web site. Search www.nhtsa.dot.gov/cars/problems/comply/ for the HS# and then input this number into (<http://www-odi.NHTSA.dot.gov/tis/index.cfm>) for the report.

Copies of this report are available from —

NHTSA Technical Information Services
Room 2336, (NPO-405)
400 Seventh St., SW
Washington, DC 20590
Email: tis@nhtsa.dot.gov
FAX: 202-493-2833

Block 19 — SECURITY CLASSIFICATION OF REPORT

Unclassified

Block 20 — SECURITY CLASSIFICATION OF PAGE

Unclassified

Block 21 — NUMBER OF PAGES

Add appropriate number

Block 22 — PRICE

Leave blank

17.3.4 Table of Contents

Final test report Table of Contents shall, at a minimum, include the following:

Section 1 — Purpose of Compliance Test

Section 2 — Test Procedure and Summary of Results

Section 3 — Compliance Test Data Sheets

Section 4 — Noncompliance Data (if applicable)

Section 5 — Photographs

Section 6 — Test Equipment List and Calibration Information

18. DATA SHEETS

DATA SHEET 1
VEHICLE INFORMATION

MAKE/MODEL/BODY STYLE: _____
 MODEL YEAR: _____ ; MANUFACTURE DATE: _____
 NHTSA NO.: _____ ; VIN: _____
 GVWR: _____ ; WHEELBASE: _____
 GAWR FRONT: _____ ; GAWR REAR: _____

FOR BUSES ONLY –
 CHASSIS MFR.: _____
 SERIAL NO.: _____ ; NO. OF SEATS: _____
 MANUFACTURE DATE: _____

ENGINE TYPE: _____ ; DISPLACEMENT: _____
 ENGINE HORSEPOWER: _____ ; IDLE SPEED: _____
 TRANSMISSION TYPE: _____ ; NO. OF AXLES: _____

ELECTRIC VEHICLE: _____ ; *HYBRID VEHICLE:* _____

TIRE SIZE: _____ ; TYPE: _____
 TIRE MANUFACTURER: _____
 RECOMMENDED PRESS. AT GVWR: FRONT - _____ psi; REAR - _____ psi

BRAKES - FRONT: DRUM _____ DISC _____
 BRAKES - REAR: DRUM _____ DISC _____

BRAKE ACTUATION - Describe Hydraulic Circuit Split: _____

FOUNDATION BRAKES :
 HYDRAULIC _____ ; *ELECTRIC* _____ ; SPLIT _____

ELECTRICALLY-ACTUATED SERVICE BRAKES: YES__ NO__

ELECTRIC TRANSMISSION OF SERVICE BRAKE CONTROL SIGNAL: YES__ NO__

REGENERATIVE BRAKING SYSTEM (RBS): YES__ NO__

RBS PART OF SERVICE BRAKE SYSTEM: YES__ NO__

BRAKE POWER UNIT: __ Hydraulic ; __ Vacuum ; __ Other__

	YES	NO
BRAKE POWER ASSIST UNIT:	__	__
BRAKE POWER UNIT WITH ACCUMULATOR:	__	__
BRAKE POWER ASSIST OR POWER UNIT WITH BACKUP:	__	__
VARIABLE PROPORTIONING SYSTEM:	__	__

ANTISKID DEVICE: MFR- _____

DIRECTLY CONTROLLED WHEELS:

PARKING MECHANISM: _____

DESCRIBE - _____

BRAKE MASTER CYLINDER DIAMETER: _____

BRAKE PEDAL RATIO: _____

FRONT BRAKE COMPONENT MATERIALS AND CONSTRUCTION:

FOR DRUM BRAKES				FOR DISC BRAKES			
	MATERIAL		CONSTRUCTION		MATERIAL		CONSTRUCTION
	Cast Iron		Cast		Cast Iron		Integral Cast
	Steel		Composite		Steel		2-Piece
	Bi-Metallic		Centrifused		Bi-Metallic		Vented
			Pressed				Unvented

FRONT BRAKE DIAMETER: Inside - _____ ; Outside - _____

FRONT DISC BRAKE THICKNESS (include vent): _____

FRONT DRUM BRAKE SHOE CAGE DIA.: Left - _____ ; Right - _____
 DIAMETER RESET TO: Left - _____ ; Right - _____

FRONT BRAKE COMPONENT DIMENSIONS AND LINING CODE/COLOR:

	FOR DRUM BRAKES		FOR DISC BRAKES	
WIDTH	Primary		Inboard	
	Secondary		Outboard	
LENGTH	Primary		Inboard	
	Secondary		Outboard	
THICKNESS	Primary		Inboard	
	Secondary		Outboard	
CODE/COLOR	Primary *		Inboard	
	Secondary *		Outboard	

* Primary/Secondary may be leading/trailing or other

HYDRAULIC PISTON DIAMETER: _____

DRUM BRAKE WHEEL CYLINDER - _____
 DISC BRAKE CALIPER - _____

REAR BRAKE COMPONENT MATERIALS AND CONSTRUCTION:

FOR DRUM BRAKES				FOR DISC BRAKES			
	MATERIAL		CONSTRUCTION		MATERIAL		CONSTRUCTION
	Cast Iron		Cast		Cast Iron		Integral Cast
	Steel		Composite		Steel		2-Piece
	Bi-Metallic		Centrifused		Bi-Metallic		Vented
			Pressed				Unvented

REAR BRAKE DIAMETER: Inside - _____ ; Outside - _____

REAR DISC BRAKE THICKNESS (include vent): _____

REAR DRUM BRAKE SHOE CAGE DIA.: Left - _____ ; Right - _____
 DIAMETER RESET TO: Left - _____ ; Right - _____

REAR BRAKE COMPONENT DIMENSIONS AND LINING CODE/COLOR:

	FOR DRUM BRAKES		FOR DISC BRAKES	
WIDTH	Primary		Inboard	
	Secondary		Outboard	
LENGTH	Primary		Inboard	
	Secondary		Outboard	
THICKNESS	Primary		Inboard	
	Secondary		Outboard	
CODE/COLOR	Primary *		Inboard	
	Secondary *		Outboard	

* Primary/Secondary may be leading/trailing or other

HYDRAULIC PISTON DIAMETER: _____

DRUM BRAKE WHEEL CYLINDER - _____
DISC BRAKE CALIPER - _____

OTHER COMPONENT INFORMATION:

Friction-type Parking Brake - _____ Hand Operated

_____ Foot Operated

Nonservice Brake Type Parking Brake - _____ Hand Operated

_____ Foot Operated

ELECTRIC BRAKES INFORMATION: _____

NOTE (do not include this note in final report): If at any time after the test series has begun, any brake system part requires replacement or the brake system requires adjustments other than permitted in burnish and reburnish procedures, discontinue testing and notify the COTR immediately.

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

NOTE: The following data sheets indicate requirements for vehicles with GVWR less than 8,000 pounds. For other vehicle categories, refer to Appendix 2 for required Stopping Distances and the Test Procedure for all other requirements.

**DATA SHEET 2 (1 of 9)
SUMMARY OF TESTS**

VEHICLE: _____ NHTSA NO.: _____

GVWR: _____

TEST	REQD PERFORMANCE	ACTUAL PERFORMANCE	PASS	FAIL
Max. Speed in 2 miles	None	_____ mph	N/A	N/A
FIRST EFFECTIVENESS	30 mph:	_____ Of 6 stops pass		
	Pedal force, 15-150 lb Stopping distance, 65 ft for 1 stop	Best stop: _____ Ft, _____ lb PF(max)		
	60 mph:	_____ Of 6 stops pass		
	Pedal force, 15-150 lb Stopping distance, 242 ft for 1 stop	Best stop: _____ Ft, _____ lb PF(max)		
SECOND EFFECTIVENESS	30 mph:	_____ Of 6 stops pass		
	Pedal force, 15-150 lb Stopping distance, 57 ft for 1 stop	Best stop: _____ Ft, _____ lb PF(max)		
	60 mph:	_____ Of 6 stops pass		
	Pedal force, 15-150 lb Stopping distance, 216 ft for 1 stop	Best stop: _____ Ft, _____ lb PF(max)		
	80 mph:	_____ Of 4 stops pass		
	Pedal force, 15-150 lb Stopping distance, NA ft for 1 stop	Best stop: _____ Ft, _____ lb PF(max)		

REMARKS

DATA SHEET 2 (2 of 9)
SUMMARY OF TESTS

VEHICLE: _____ NHTSA NO.: _____

TEST	REQUIRED PERF.	ACTUAL PERF.	PASS	FAIL
Parking Brake REGULAR	Shall hold vehicle stationary for 5 minutes in both uphill and downhill direction on a 20% grade, both at LLVW and GVWR, with no more than 90 lb hand lever or 125 lb foot pedal force	Held stationary for 5 minutes? ----- Yes/No NOTE: Uphill = Uphill and Dhill = Downhill Force (lbs) GVWR - Uphill GVWR - Dhill LLVW - Uphill LLVW - Dhill ___ Foot Pedal ___ Hand Lever		
Parking Brake OPTIONAL	(1) Shall meet REGULAR PROCEDURE requirements with transmission in "PARK" (2) Shall meet REGULAR PROCEDURE requirements on 20% slope with transmission in "NEUTRAL" (3) Parking mechanism shall not disengage or suffer damage in front and rear 2.5 mph moving barrier impacts	Force (lbs) GVWR/30%-Uhill GVWR/30%-Dhill GVWR/20%-Uhill GVWR/20%-Dhill LLVW/20%-Uhill LLVW/20%-Dhill LLVW/30%-Uhill LLVW/30%-Dhill Meets Moving Barrier Specification -----		
<u>Stability and Control</u>	At least 3 stops within lane	Number of stops in lane		

DATA SHEET 2 (3 of 9)
SUMMARY OF TESTS

VEHICLE: _____ NHTSA NO.: _____

TEST	REQD PERFORMANCE	ACTUAL PERFORMANCE	PASS	FAIL
THIRD EFFECTIVENESS (Light Load)	60 mph: Pedal Force: 15-150 lbs Stopping distance, 216 ft for 1 of 6 stops with any subsystem	_____ of 6 stops pass		
		Best stop: _____ ft, _____ lb PF(max)		
PARTIAL FAILURE LLVW – HYDRAULIC SPLIT	60 mph: Pedal Force: 15-150 lbs Stopping distance, 517 ft for 1 of 4 stops with any subsystem failed	System #1 _____ failed: _____ of 4 stops pass Best stop: _____ ft, _____ lb PF(max)		
		System #2 _____ failed: _____ of 4 stops pass _____ ft, _____ lb PF: (max)		
PARTIAL FAILURE GVWR – HYDRAULIC SPLIT	60 mph: Pedal Force: 15-150 lbs Stopping distance, 517 ft for 1 of 4 stops with any subsystem failed	System #1 _____ failed: _____ of 4 stops pass Best stop: _____ ft, _____ lb PF (max)		
		System #2 _____ failed: _____ of 4 stops pass Best stop: _____ ft, _____ lb PF(max)		
PARTIAL FAILURE: (LLVW and/or GVWR) ANTILOCK AND/OR VARIABLE PROP. <i>BRAKE SIGNAL TRANSMITTED ELECTRICALLY</i> <i>RBS FAILURE</i> <i>ELECTRICALLY ACTUATED SERVICE BRAKES FAILURE</i>	60 mph: Pedal Force: 15-150 lb Stopping distance, 517 ft for 1 of 4 stops with any subsystem failed	_____ ABS _____ failed: _____ of 4 stops pass Best stop: _____ (max) _____ ft, _____ lb PF		
		_____ RBS _____ failed: _____ of 4 stops pass Best stop: _____ ft, _____ lb PF(max)		
		_____ Electric Signal _____ failed: _____ of 4 stops pass Best stop: _____ ft, _____ lb PF(max)		
INOPERATIVE SYSTEM: <i>ELECTRICALLY ACTUATED SERVICE BRAKES POWERED BY AUXILIARY BATTERIES – DEPLETED</i>	10 stops from 100 kph or Max. speed. 2 stops less than 70 meters.	_____ of 10 stops pass		
		Best stop: _____ m, _____ lb PF(max) :		

REMARKS:

DATA SHEET 2 (4 of 9)
SUMMARY OF TESTS

VEHICLE: _____ NHTSA NO.: _____

TEST	REQD PERFORMANCE	ACTUAL PERFORMANCE	PASS	FAIL
INOPERATIVE POWER UNIT	60 mph: Pedal Force: 15-150 lbs Stopping distance, 517 ft for 1 of 4 stops with power dis- connected and reserve depleted	_____ of 4 stops pass		
		Best stop: _____ Ft, _____ lb PF(max)		
INOPERATIVE POWER UNIT - OPTIONAL PROCEDURE (Brake Power Assist Units)	6 stops from 60 mph, at specified decelerations 7th stop at not less than 7 fpsps (554 ft)			
		7th stop: _____ fpsps decel _____ lb PF(max)		
INOPERATIVE POWER UNIT - OPTIONAL PROCEDURE (Accumulator Systems)	10 stops from 60 mph, at specified decelerations 11th stop at not less than 7 fpsps (554 ft)			
		11th stop: _____ fpsps decel _____ lb PFMax		
INOPERATIVE POWER UNIT - OPTIONAL PROCEDURE (Backup Systems)	15 stops from 60 mph, at average deceleration of 12 fpsps (stopping distance, 323 ft)	_____ of 15 stops within 323 ft		
		Worst stop: _____ fpsps decel _____ lb PF(max)		
		Best stop: _____ M, _____ lb PF(max)		

REMARKS:

DATA SHEET 2 (5 of 9)
SUMMARY OF TESTS

VEHICLE: _____ NHTSA NO.: _____

TEST	REQD PERFORMANCE	ACTUAL PERFORMANCE	PASS	FAIL
FIRST FADE AND RECOVERY (Baseline)	30 mph: 3 stops at 10 fpsps Pedal force: 10-60 lb	Average Control Force _____ lb PF		
FIRST FADE AND RECOVERY (Fade)	60 mph: Pedal force: 15-150 lb (min) Stops 1-5: 15 fpsps decel (min) Stops 6-10: 5-15 fpsps decel	Stops 1-5: _____ fpsps decel (min) _____ lb PF (max)		
		Stops 6-10: _____ fpsps decel (min) _____ lb PF (max)		
FIRST FADE AND RECOVERY (Recovery)	30 mph: Make 5 stops at not less than 10 fpsps. (1) a max for 1st 4 recovery stops of 150 lb, and for the 5th stop, of 20 lb more than the avg control force for the baseline check; and (2) a min of (a) the avg control force for the baseline check minus 10 lb, or (b) the baseline check times 0.6, which-ever is lower (but in no case less than 5 lb) Allowable range: _____ to _____ pounds	Stops 1-4: _____ fpsps decel (min) _____ lb PF (max)		
		Stop 5: _____ fpsps decel (min) _____ lb PF (max)		

REMARKS:

DATA SHEET 2 (6 of 9)
SUMMARY OF TESTS

VEHICLE: _____ NHTSA NO.: _____

TEST	REQD PERFORMANCE	ACTUAL PERFORMANCE	PASS	FAIL
SECOND FADE AND RECOVERY (Baseline)	30 mph: 3 stops at 10 fpsps Pedal force: 10-60 lb	Average Control Force _____ lb PF		
SECOND FADE AND RECOVERY (Fade)	60 mph: Pedal force: 15-150 lb (min) Stops 1-5: 15 fpsps decel (min) Stops 6-10: 5-15 fpsps decel	Stops 1-5: _____ fpsps decel (min) _____ lb PF (max)		
		Stops 6-10: _____ fpsps decel (min) _____ lb PF (max)		
SECOND FADE AND RECOVERY (Recovery)	30 mph: Make 5 stops at not less than 10 fpsps. (1) a max for 1st 4 recovery stops of 150 lb, and for the 5th stop, of 20 lb more than the avg control force for the baseline check; and (2) a min of (a) the avg control force for the baseline check minus 10 lb, or (b) the baseline check times 0.6, which-ever is lower (but in no case less than 5 lb) Allowable range: _____ to _____ pounds	Stops 1-4: _____ fpsps decel (min) _____ lb PF (max)		
		Stop 5: _____ fpsps decel (min) _____ lb PF (max)		

REMARKS:

DATA SHEET 2 (7 of 9)
SUMMARY OF TESTS

VEHICLE: _____ NHTSA NO.: _____

TEST	REQD PERFORMANCE	ACTUAL PERFORMANCE	PASS	FAIL
FOURTH EFFECTIVENESS	30 mph: Pedal force: 15-150 lb Stopping distance: 65 ft for 1 of 6 stops	___ of 6 stops pass Best stop: _____ Ft, _____ lb PF(max)		
	60 mph: Pedal force: 15-150 lb Stopping distance: 242 ft for 1 of 6 stops	___ of 6 stops pass Best stop: _____ Ft, _____ lb PF(max)		
	80 mph: Pedal force: 15-150 lb Stopping distance: 459 ft for 1 of 4 stops	___ of 4 stops pass Best stop: _____ Ft, _____ lb PF(max)		
WATER RECOVERY (Baseline)	30 mph: 3 stops at 10 fpsps Pedal force: 10-60 lb	Average Control Force _____ lb PF		
WATER RECOVERY (Recovery)	30 mph: Make 5 stops at not less than 10 fpsps. (1) a max for 1st 4 recovery stops of 150 lb, and for the 5th stop, of 45 lb more than the avg control force for the baseline check; and (2) a min of (a) the avg control force for the baseline check minus 10 lb, or (b) the baseline check times 0.6, which-ever is lower (but in no case less than 5 lb) Allowable range: _____ to _____ pounds	Stops 1-4: _____ fpsps decel (min) _____ lb PF (max) Stop 5: _____ fpsps decel (min) _____ lb PF (max)		

REMARKS:

DATA SHEET 2 (8 of 9)
SUMMARY OF TESTS

VEHICLE: _____ NHTSA NO.: _____

TEST	REQD PERFORMANCE	ACTUAL PERFORMANCE	PASS	FAIL
SPIKE STOPS	30 mph: Vehicle shall be capable of making 10 spike stops	_____ stops completed Max. pedal force _____ lb		
POST SPIKE EFFECTIVENESS	60 mph: Pedal force: 15-150 lb Stopping distance: 242 ft for 1 of 6 stops	_____ of 6 stops pass Best stop: _____ ft, _____ lb PF (max)		
MOVING BARRIER (For vehicles tested by the Optional Parking Brake Procedure)	Parking mechanism shall not disengage or fracture when vehicle is subjected to front and rear 2.5 mph moving barrier impacts	Front Impact: Vehicle Movement? Yes__ ; No		
		Rear Impact: Vehicle Movement? Yes__ ; No		

REMARKS:

DATA SHEET 2 (9 of 9)
SUMMARY OF TESTS

VEHICLE: _____ NHTSA NO.: _____

TEST	REQD PERFORMANCE	ACTUAL PERFORMANCE	PASS	FAIL
BRAKE SYSTEM INTEGRITY	No component fracture or brake fluid leak	Yes _____ ; No		
MASTER CYLINDER RESERVOIR	Compartment for each subsystem. Loss of fluid independent.	Yes _____ ; No		
RESERVOIR CAPACITY	Total minimum and subsystem capacity.	Yes _____ ; No		
RESERVOIR LABELING	Warning Statement	Yes _____ ; No		
WARNING INDICATOR	Correct number.	Yes _____ ; No		
INDICATOR ACTIVATION	During System Failures.	Yes _____ ; No		
INDICATOR FUNCTION CHECK	Lamp Function Check.	Yes _____ ; No		
INDICATOR LIGHT DURATION	Remains activated.	Yes _____ ; No		
INDICATOR FUNCTION	Steady or Flashing.	Yes _____ ; No		
INDICATOR LIGHT LABELING	Letter Height and Wording.	Yes _____ ; No		
ANTILOCK BRAKE SYSTEM	If Required, and Wheel Sensors.	Yes _____ ; No		

REMARKS:

RECORDED BY: _____

DATE: _____

APPROVED BY: _____

DATA SHEET 3
VEHICLE WEIGHT

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

SCALE(S) USED: _____

NOTE: GVWR, LLVW and axle weights to measured within + 0% and -1%.

GVWR INFORMATION (taken from vehicle Certification Label):

GVWR - _____ lb GVWR Front - _____ lb

GVWR Rear - _____ lb

TARGET AXLE WEIGHT: Front - _____ lb

Rear - _____ lb

UNLOADED VEHICLE WEIGHT (UVW):

Left Front - _____ lb Left Rear - _____ lb

Right Front - _____ lb Right Rear - _____ lb

Total Front - _____ lb Total Rear - _____ lb

Total UVW - _____ lb

Front Axle Load % = Total Front / TOTAL **UVW** = _____ %

Rear Axle Load % = Total Rear / TOTAL **UVW** = _____ %

LIGHT LOADED VEHICLE WEIGHT (LLVW):

Note 1: LLVW = UVW + 400 lb

Note 2: Weight distributed in front passenger seat area

Note 3: Neither axle load at LLVW less than at UVW; ballast as required

Left Front - _____ lb Left Rear - _____ lb

Right Front - _____ lb Right Rear - _____ lb

Total Front - _____ lb Total Rear - _____ lb

Total LLVW - _____ lb

Front Axle Load % = Total Front / TOTAL **LLVW** = _____ %

Rear Axle Load % = Total Rear / TOTAL **LLVW** = _____ %

(Continued on next page)

ACTUAL TEST LLVW:

Left Front - _____ lb Left Rear - _____ lb
 Right Front - _____ lb Right Rear - _____ lb

 Total Front - _____ lb Total Rear - _____ lb

 Total Actual Test LLVW - _____ lb

Front Axle Load % = Total Front / TOTAL **LLVW** = _____ %
 Rear Axle Load % = Total Rear / TOTAL **LLVW** = _____ %

Load: Driver/Observer-____# + Instrumentation.-____# + Ballast-____# = 400 lbs

FULLY LOADED VEHICLE WEIGHT (GVWR):

Note 1: Vehicle loaded so axle loads proportional to GAWR shown previously

Note 2: But no axle weight to be less than at LLVW

Load: Driver/Observer-____# + Instrumentation.-____# + Ballast-____# = 400 lbs

Left Front - _____ lb Left Rear - _____ lb
 Right Front - _____ lb Right Rear - _____ lb

 Total Front - _____ lb Total Rear - _____ lb

 Total GVWR - _____ lb

Front Axle Load % = Total Front / TOTAL **GVWR** = _____ %
 Rear Axle Load % = Total Rear / TOTAL **GVWR** = _____ %

REMARKS:

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 4 INSTRUMENTATION CHECK

GVWR, 10 stops, 30 to 0 mph, 10 fpsps, 150 - 200°F IBT

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Actual (Act.)	Corrected (Corr.)							
	L/R	L/R										
30 MPH RECORDED DATA												
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

Instruments functional Yes - _____ No - _____
 If no, additional 10 stops permitted.
 Record on additional data sheet.

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Requirements - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 5
MAXIMUM SPEED

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

SPEED VS. DISTANCE DETERMINATION:

GVWR, accelerate from 0 mph to maximum speed attainable in 2 miles or to 104 mph. Record distances to speeds.

MAXIMUM ACCELERATION (Visual):

0 to 40 mph - _____ time in seconds

0 to 60 mph - _____ time in seconds

0 to 80 mph - _____ time in seconds

MAXIMUM SPEED:

Visual - _____ mph

Recorded - _____ mph

For EV - propulsion batteries state of charge _____ (95% Min.)

REMARKS:

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 6
FIRST EFFECTIVENESS (S7.3)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____
 TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ kg
 TIRE PRESSURE (Cold): Front - _____ Rear - _____
 ODOMETER READING: Start - _____ Finish - _____

FIRST EFFECTIVENESS SCHEDULE:
 GVWR 150-200°F IBT, 6 stops in neutral, 30 & 60-0 mph
 (NOTE: SAMPLE IS FOR VEHICLE LESS THAN 8,000 GVWR)

FIRST EFFECTIVENESS REQUIREMENTS:
 1 Stop, 30 mph 65 ft, 60 mph 242 ft, pedal force ≤150, lockup ≤1 wheel, stay in 12 ft lane
 (NOTE: SAMPLE IS FOR VEHICLE LESS THAN 8,000 GVWR)

Stop No.	Initial Brake Temperature, EF		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
30 MPH RECORDED DATA												
1												
2												
3												
4												
5												
6												
60 MPH RECORDED DATA												
1												
2												
3												
4												
5												
6												

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 7
BURNISH AND ADJUSTMENT (S7.4)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____
 TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs
 TIRE PRESSURE (Cold): Front - _____ Rear - _____
 ODOMETER READING: Start - _____ Finish - _____

BURNISH SCHEDULE:

GVWR, 200 stops in gear, 40-0 mph, 12 fpsps decel, 230-270°F IBT or 1 mile interval whichever is shorter.

BURNISH REQUIREMENTS:

Lockup \leq 1 wheel, stay in 12 ft lane. NOTE: Pedal force may exceed 150 lb.

Stop No.	Initial Brake Temperature, °F		Speed (mph)	MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.								
	L/R	L/R								
RECORDED DATA										
1										
25										
50										
75										
100										
125										
150										
175										
200										

BRAKE ADJUSTMENT (Post Burnish) SCHEDULE:

Adjust service brake per manufacturer's specification.

Record manufacturer's procedure and amount adjusted.

Front/Rear- _____

Manufacturer's Procedure - _____

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 8

SECOND EFFECTIVENESS (S7.5(b))

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____
 TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs
 TIRE PRESSURE (Cold): Front - _____ Rear - _____
 ODOMETER READING: Start - _____ Finish - _____

SECOND EFFECTIVENESS SCHEDULE:

GVWR, 6 stops in neutral, 30, 60 and 80-0 mph, 150-200°F IBT.

SECOND EFFECTIVENESS REQUIREMENTS:

1 stop, 30 mph 57 ft, 60 mph 216 ft, 80 mph 3__ ft, pedal force ≤150, lockup ≤1 wheel, stay in 12 ft lane

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		Maximum Pedal Force (Lbs.)	Max. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	Avg. Pedal Force (Lbs.)	Avg. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
30 MPH RECORDED DATA												
1												
2												
3												
4												
5												
6												
60 MPH RECORDED DATA												
1												
2												
3												
4												
5												
6												
80 MPH RECORDED DATA												
1												
2												
3												
4												

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____
 RECORDED DATA PROCESSED BY: _____ DATE: _____
 APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 9
RE-BURNISH AND ADJUSTMENT (S7.6)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; TEST WT: _____ lbs; GVWR: _____ LLVW

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

FIRST RE-BURNISH SCHEDULE:

GVWR, 35 stops in gear, 40-0 mph, 12 fpsps decel, 230-270°F IBT or 1 mile interval whichever is shorter.

FIRST RE-BURNISH REQUIREMENTS:

Lockup ≤1 wheel, stay in 12 ft lane. NOTE: Pedal force may exceed 150 lb.

Stop No.	Initial Brake Temperature, EF		Speed (mph)	MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.								
	L/R	L/R								
RECORDED DATA										
1										
10										
20										
30										
35										

BRAKE ADJUSTMENT (Post Burnish) SCHEDULE:

Adjust service brake per manufacturer's specification.

Record manufacturer's procedure and amount adjusted.

Front/Rear- _____

Manufacturer's Procedure - _____

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 10 (1 of 2)
PARKING BRAKE (S7.7.1)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____
 TEMP.: _____ °F; TEST WT: _____ lbs; GVWR: _____ LLVW
 TIRE PRESSURE (Cold): Front - _____ Rear - _____
 ODOMETER READING: Start - _____ Finish - _____

PARKING BRAKE SCHEDULE:

GVWR & LLVW, IBT ≤ 150°F, neutral, 30% grade, vehicle held on grade with service brake pedal force ≤150 lb, then parking brake applied and service brake released. 2 reapplications of force to service brake and parking brake allowed.

PARKING BRAKE REQUIREMENTS:

Hold vehicle stationary for 5 minutes, GVWR & LLVW, uphill and downhill, park brake pedal force ≤125 lb foot lever, ≤90 lb hand lever.

PARKING BRAKE: Hand Lever - ___ Foot Lever - ___ ELECTRICALLY-ACTUATED ___

RECORDED DATA								
Weight (GVWR/ LLVW)	Brake Temperature, °F		Non- Service Elements (*)	Direction (Uphill/ Downhill)	Percent Grade (%)	Min. Force to Hold (lb)	Number Reapply Of Force	Service Brake Pedal Force (lb)
	LR	RR						

(*) MFRS BURNISH PROCEDURE FOR NON-SERVICE ELEMENTS & DATA:

Is equipped with a parking brake of friction type with a solely mechanical means for engagement: YES ___ NO ___

PARKING BRAKE INDICATOR LAMP OPERATION: On - ___ Off ___

DATA INDICATES COMPLIANCE: Yes - ___ ; No - ___ ; No Reqmts ___

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 10 (2 of 2)
OPTIONAL PARKING BRAKE (S7.7.2)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____
 TEMP.: _____ °F; TEST WT: _____ lbs; GVWR: _____ LLVW
 TIRE PRESSURE (Cold): Front - _____ Rear - _____
 ODOMETER READING: Start - _____ Finish - _____

OPTIONAL PARKING BRAKE SCHEDULE*:

Must satisfy ignition key requirement below to use.
 GVWR & LLVW, IBT ≤150°F, parking mechanism engaged, 30% grade, vehicle held on grade with parking mechanism and service brake pedal force ≤150 lb, then parking brake applied and service brake released, 2 reapplications of force to service and parking brake allowed.
 GVWR & LLVW, IBT ≤150°F, neutral (parking mechanism not engaged), 20% grade, held on grade as above without parking mechanism.

OPTIONAL PARKING BRAKE REQUIREMENTS:

Hold vehicle stationary for 5 minutes 30 & 20% grades, GVWR & LLVW, uphill and downhill, parking brake force ≤125 lb foot pedal & ≤90 lb hand lever.
 Also must complete moving barrier test following final inspection.

IS IT NECESSARY TO ENGAGE THE TRANSMISSION PARKING MECHANISM TO REMOVE THE IGNITION KEY?

Yes - _____ No - _____

Describe Mechanism: _____

PARKING BRAKE: Hand Lever - _____ Foot Lever - _____

RECORDED DATA								
Weight (GVWR/LLVW)	Brake Temperature, °F		Non-Service Elements (*)	Direction (Uhill/Dhill)	Percent Grade (%)	Min. Force to Hold (lb)	Number Reapply Of Force	Service Brake Pedal Force (lb)
	LR	RR						

(*) MFRS BURNISH PROCEDURE FOR NON-SERVICE ELEMENTS & DATA:

PARKING BRAKE INDICATOR LAMP OPERATION: On - _____ Off-

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts -

DRIVER: _____ ; OBSERVER:

RECORDED DATA PROCESSED BY: _____ DATE:

APPROVING LAB. OFFICIAL: _____ DATE:

DATA SHEET 10A
STABILITY AND CONTROL / BRAKING-IN-A-CURVE (S7.5(a))

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

STABILITY AND CONTROL SCHEDULE:

LLVW, 4 stops, clutch depressed or neutral, full brake application, 30 mph or 75 percent of maximum drive-through speed (whichever is less). 150 - 200°F IBT.

STABILITY AND CONTROL SCHEDULE REQUIREMENTS:

3 stops with full brake application without any part of the vehicle leaving the 12-foot wide roadway.

Maximum Drive-Through Speed

Attempt	Maximum Drive-Through Speed (mph)	MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
1					
2					
3					
4					

Maximum Drive-Through Speed: _____

75% of Max. Drive-Through Speed: _____

Stability and Control Stops

Stop	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction Of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
RECORDED DATA												
1												
2												
3												
4												

REMARKS:

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 11
THIRD EFFECTIVENESS (S7.8)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

THIRD EFFECTIVENESS SCHEDULE:

LLVW, 6 stops, in neutral, 60-0 mph, 150-200°F IBT.

THIRD EFFECTIVENESS REQUIREMENTS:

1 stop, 60 mph 216 ft, pedal force ≤ 150 , lockup ≤ 1 wheel, stay in 12 ft lane

Stop	Initial Brake Temperature, °EF		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
60 MPH RECORDED DATA												
1												
2												
3												
4												
5												
6												

REMARKS:

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 12
PARTIAL FAILURE (S7.9) (1 of 7)
HYDRAULIC SPLIT SYSTEM
Subsystem #1 and #2

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

PARTIAL FAILURE SCHEDULE (Lightly Loaded Vehicle **LLVW):**

LLVW, 4 stops, in gear, with each subsystem (split service system, brake signal transmitted, RBS failure) inoperative, 60-0 mph, 150-200°F IBT; non-split system vehicle: 10 stops.

PARTIAL FAILURE REQUIREMENTS:

1 stop, 60 mph 517 ft, pedal force ≤ 150 lb, lockup allowed, stay in 12 ft lane.
 Warning light ON at 50 lb pedal force manual, 25 lb power, or 225 psi.

ENTER PARTIAL FAILURE DATA IN TABLE ON NEXT PAGE.

(Continued on next page)

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
60 MPH RECORDED DATA SYSTEM NO. 1 INOPERATIVE												
1												
2												
3												
4												
Warning light on at: ____ lb Pedal Force (Visual meter), ____ psi line pressure ____ Fluid level Sensor Once the light for low brake pressure or brake fluid level is ON, does it remain ON until the induced problem is corrected? Yes - ___ No - ____												

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
60 MPH RECORDED DATA SYSTEM NO. 2 INOPERATIVE												
1												
2												
3												
4												
Warning light on at: ____ lb Pedal Force (Visual meter), ____ psi line pressure ____ Fluid level Sensor Once the light for low brake pressure or brake fluid level is ON, does it remain ON until the induced problem is corrected? Yes - ___ No - ____												

DATA INDICATES COMPLIANCE: Yes - ____ ; No - ____ ; No Reqmts - ____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB OFFICIAL: _____ DATE: _____

DATA SHEET 12 (2 of 7)
PARTIAL FAILURE (S7.9.3)
HYDRAULIC SPLIT SYSTEM
Subsystem #1 and #2

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____°F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

PARTIAL FAILURE SCHEDULE (Fully Loaded Vehicle **GVWR**):

GVWR, 4 stops, in gear, with each subsystem inoperative, 60-0 mph, 150-200°F
IBT; non-split system vehicle: 10 stops.

PARTIAL FAILURE REQUIREMENTS:

1 stop, 60 mph 517 ft, pedal force ≤ 150 lb, lockup allowed, stay in 12 ft lane.

ENTER PARTIAL FAILURE DATA IN TABLE ON NEXT PAGE.

(Continued on next page)

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
60 MPH RECORDED DATA SYSTEM NO. 1 INOPERATIVE												
1												
2												
3												
4												
Warning light on at: ____ lb Pedal Force (Visual meter), ____ psi line pressure ____ Fluid level Sensor Once the light for low brake pressure or brake fluid level is ON, does it remain ON until the induced problem is corrected? Yes - ___ No -												

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
60 MPH RECORDED DATA SYSTEM NO. 2 INOPERATIVE												
1												
2												
3												
4												
Warning light on at: ____ lb Pedal Force (Visual meter), ____ psi line pressure ____ Fluid level Sensor Once the light for low brake pressure or brake fluid level is ON, does it remain ON until the induced problem is corrected? Yes - ___ No -												

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 12 (3 of 7)
PARTIAL FAILURE
ANTILOCK OR VARIABLE PROPORTIONING
BRAKE SYSTEM – Partial Failure (S7.9.4)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

ANTILOCK OR VARIABLE PROPORTIONING BRAKE SYSTEM SCHEDULE:

GVWR only, 4 stops, in gear, 60-0 mph, power reserves depleted, 150-200°F IBT

PARTIAL FAILURE REQUIREMENTS:

1 stop, 60 mph 517 ft, pedal force ≤150 lb, lockup allowed, stay in 12 ft lane.

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
60 MPH RECORDED DATA												
1												
2												
3												
4												

Brake Warning Light Operation: On - _____ Off - _____
 (for electrical failure of antilock or variable proportioning system)

For an EV with ABS and RBS as part of the service brake system, does the ABS control the RBS? YES _____ NO _____

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE _____

DATA SHEET 12 (4 of 7)
PARTIAL FAILURE
BRAKE SIGNAL TRANSMITTED ELECTRICALLY (S7.9.5)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

BRAKE SIGNAL TRANSMITTED ELECTRICALLY SCHEDULE:

GVWR and LLVW, 4 stops, in gear, 60-0 mph, each subsystem inoperative, 150-200°F IBT

REQUIREMENTS:

1 stop, 60 mph 517 ft, pedal force ≤150 lb, lockup allowed, stay in 12 ft lane.

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
60 MPH RECORDED DATA												
1												
2												
3												
4												

Brake Warning Light Operation: On - _____ Off - _____
 (for electrical signal failure)

REMARKS:

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 12 (5 of 7)
PARTIAL FAILURE
ELECTRIC VEHICLE WITH REGENERATIVE BRAKE SYSTEM (RBS) (S7.9.6)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

RBS SCHEDULE:

GVWR and LLVW, 4 stops, in gear, 60-0 mph, each subsystem inoperative, 150-200°F IBT

REQUIREMENTS:

1 stop, 60 mph 517 ft, pedal force ≤150 lb, lockup allowed, stay in 12 ft lane.

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
60 MPH RECORDED DATA												
1												
2												
3												
4												

Brake Warning Light Operation: On - _____ Off - _____
 (for RBS failure)

REMARKS:

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 12 (6 of 7)
PARTIAL FAILURE
ELECTRICALLY ACTUATED SERVICE BRAKES (S7.9.7)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

ELECTRICALLY ACTUATED SERVICE BRAKES SCHEDULE:

GVWR only, 4 stops, in gear, 60-0 mph, each subsystem inoperative, 150-200°F
 IBT

REQUIREMENTS:

1 stop, 60 mph 517 ft, pedal force ≤150 lb, lockup allowed, stay in 12 ft lane.

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
60 MPH RECORDED DATA												
1												
2												
3												
4												

REMARKS:

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

**DATA SHEET 12 (7 of 7)
ELECTRICALLY - ACTUATED BRAKES
POWERED BY AUXILIARY BATTERIES- Additional Test (S6.2.6)**

VEHICLE:		NHTSA NUMBER:		DATE:	
TEMP.:		WIND VELOCITY:		ROAD PFC:	
ODOMETER START:		ODOMETER FINISH:			

ELECTRICALLY – ACTUATED BRAKES POWERED BY AUXILIARY BATTERIES

GVWR, 10 stops, Neutral, 100 kph or Max. speed – whichever is less
Auxiliary batteries depleted (5% charge above light illumination),

Condition (a), (b), or (c) per S6.3.12 _____

IBT: $\geq 65^{\circ}\text{C}$, $\leq 100^{\circ}\text{C}$

TEST SPEED: 100 km/h or Max. Speed (whichever is less)

PEDAL FORCE: 65 N minimum to 500 N maximum

WHEEL LOCKUP:

No lockup of any wheel for longer than 0.1 seconds at speeds > 15 km/h

Performance Requirement: 2 stops max. 70 meters

Stop No.	Initial Brake Temperature, C		Speed (kph)	Stopping Distance (meters)	MAX. Pedal Force (n)	MAX. Decel. (mpsps)	Wheel Lockup Above 16 kph	Dir. Of Stop	Stay in Lane	Battery State Of Charge %	AVG. Pedal Force (n)	AVG. Decel. (mpsps)
	Front Avg. L/R	Rear Avg. L/R										
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

Brake warning Light Operation: On - _____ Off - _____ (for aux. batt. discharge)

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 13 (1 of 3)**BRAKE POWER AND POWER ASSIST UNITS - REGULAR PROCEDURE (S7.10.1)**

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

REG. PROCED. - INOP. BRAKE POWER & POWER ASSIST UNITS SCHEDULE:

GVWR, 4 stops, in gear, 60-0 mph, power reserves depleted, 150-200F IBT.

PARTIAL FAILURE REQUIREMENTS:

1 stop, 60 mph 517 ft, pedal force ≤ 150 lb, lockup allowed, stay in 12 ft lane.

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
60 MPH RECORDED DATA												
1												
2												
3												
4												

REMARKS:

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 13 (2 of 3)**BRAKE POWER AND POWER ASSIST UNITS - OPTIONAL PROCEDURE (S7.10.2)**

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____
 TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs
 TIRE PRESSURE (Cold): Front - _____ Rear - _____
 ODOMETER READING: Start - _____ Finish - _____

**OPTIONAL PROCEDURE FOR INOP. BRAKE POWER & POWER ASSIST UNITS
 TEST CONTROL REQUIREMENTS:**

Fully charge each unit and disconnect primary source of power, 60-0 mph, in gear, 150-200°F IBT, average deceleration specified in each stop. Number of stops depend on equipment used.

REQUIRED AVERAGE DECELERATION RATES:

Stop No.	Brake Power Assist (7 Stops)		Brake Power With Accumulator (11 Stops)		Brake Power Assist Or Brake Power With Backup (15 Stops)
	Deceleration (fpsps)	Equivalent Distance (ft)	Deceleration (fpsps)	Equivalent Distance (ft)	Deceleration/Distance (fpsps/ft)
1	16.0	242	16.0	242	NOTE: Vehicles with this equipment shall make 15 stops at 12 fpsps, stopping distance 323 ft
2	12.0	323	13.0	298	
3	10.0	388	12.0	323	
4	9.0	431	11.0	352	
5	8.0	484	10.0	388	
6	7.5	517	9.5	409	
7	* 7.0	554	9.0	431	
8			8.5	456	
9			8.0	484	
10			7.5	517	
11			* 7.0	554	

* Depleted

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 13 (3 of 3)

BRAKE POWER AND POWER ASSIST UNITS - OPTIONAL PROCEDURE (S7.10.2)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____
 TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs
 TIRE PRESSURE (Cold): Front - _____ Rear - _____
 ODOMETER READING: Start - _____ Finish - _____

OPTIONAL PROCEDURE FOR INOP. BRAKE POWER & POWER ASSIST UNITS:

Fully charge each unit and disconnect primary source of power, 60-0 mph, in gear, 150-200°F IBT, average deceleration specified in each stop. Number of stops depend on equipment used. Lockup allowed + 10 mph.

Stop No.	Target Decel. (fpsps)	Speed (Act) (mph)	Decel. (Max) (fpsps)	Avg. Sust. Decel.	SD (Recvd)	RF (Max)	Wheel Lockup >10 mph	DIR	Stay In Lane
SYSTEM FAILED:									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 14 (Part 1 of 2)
FIRST FADE AND RECOVERY (S7.11)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

FIRST FADE AND RECOVERY (BASELINE) SCHEDULE:

GVWR, 3 stops, in gear, 30-0 mph, 150-200°F IBT, 10 fpsps decel.

FIRST FADE AND RECOVERY (BASELINE) REQUIREMENTS:

Pedal force 10-60 lb, lockup ≤1 wheel, stay in 12 ft lane.

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
RECORDED DATA												
1												
2												
3												
AVERAGE MAX. PEDAL FORCE = _____												

REMARKS:

FIRST FADE AND RECOVERY (FADE) SCHEDULE:

GVWR, 10 stops, in gear, 60-0 mph, 130-150°F IBT, 15 fpsps decel., 0.4 mile interval.

FIRST FADE AND RECOVERY (FADE) REQUIREMENTS:

5 stops at 15 fpsps, 5 stops at 5-15 fpsps, pedal force ≤150; terminate PF reading at 5 mph.

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Application Time (sec.)	MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)	Comments Smoke, Odor, Brake Pull
	Front Avg.	Rear Avg.										
	L/R	L/R										
RECORDED DATA												
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
TIME: END OF FIRST STOP TO END OF LAST STOP: MINUTES - _____, SECONDS - _____												

Visual pedal force (max) within range above? Yes - _____, No _____
(if NO, contact COTR)

REMARKS:

DATA INDICATES COMPLIANCE: Yes - _____; No - _____; No Reqmts - _____

DRIVER: _____; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 14 (Part 2 of 2)
FIRST FADE AND RECOVERY (S7.11)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

FIRST FADE AND RECOVERY (RECOVERY) SCHEDULE:

GVWR, 5 stops, in gear, 30-0 mph, 10 fpsps decel., 1.0 mile interval.

FIRST FADE AND RECOVERY (RECOVERY) REQUIREMENTS:

5 stops at 10 fpsps, stops 1-4 pedal force ≤150, stop 5 pedal force + 20 lb to lesser of - 10 or 0.6 times the average baseline pedal force.

Pedal force range (must be computed before next test):

Max - _____ lb Min - _____ lb

Stop No.	Initial Brake Temperature, °F		Speed (mph)	MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)	Comments Smoke, Odor, Brake Pull
	Front Avg.	Rear Avg.									
	L/R	L/R									
RECORDED DATA											
1											
2											
3											
4											
5											

Visual pedal force (max) within range above? Yes - _____ , No - _____
 (if NO, contact COTR)

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 15
SECOND REBURNISH (S7.12)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

SECOND RE-BURNISH SCHEDULE:

GVWR, 35 stops in gear, 40 - 0 mph, 12 fpsps decel, 230 - 270°F IBT or 1 mile interval whichever is shorter.

SECOND RE-BURNISH REQUIREMENTS:

Lockup ≤1 wheel, stay in 12 ft lane. NOTE: Pedal force may exceed 150 lb.

Stop No.	Initial Brake Temperature, °F		Speed (mph)	MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)	Comments Smoke, Odor, Brake Pull
	Front Avg.	Rear Avg.									
	L/R	L/R									
RECORDED DATA											
1											
10											
20											
30											
35											

BRAKE ADJUSTMENT (Post Burnish) SCHEDULE:

Adjust service brake per manufacturer's specification.
 Record manufacturer's procedure and amount adjusted.

Front/Rear - _____
 Manufacturer's Procedure - _____

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 16 (Part 1 of 2)
SECOND FADE AND RECOVERY (S7.13)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

SECOND FADE AND RECOVERY (BASELINE) SCHEDULE:

GVWR, 3 stops, in gear, 30-0 mph, 150-200°F IBT, 10 fpsps decel.

SECOND FADE AND RECOVERY (BASELINE) REQUIREMENTS:

Pedal force 10-60 lb, lockup ≤1 wheel, stay in 12 ft lane.

Stop No.	Initial Brake Temperature, EF		Speed (mph)	MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.								
	L/R	L/R								
RECORDED DATA										
1										
2										
3										
AVERAGE MAX. PEDAL FORCE = _____										

REMARKS:

SECOND FADE AND RECOVERY (FADE) SCHEDULE:

GVWR, 15 stops, in gear, 60-0 mph, 140-150°F IBT, 15 fpsps decel., 0.4 mile interval.

SECOND FADE AND RECOVERY (FADE) REQUIREMENTS:

10 stops at 15 fpsps, next 5 stops at 5-15 fpsps, pedal force ≤150; terminate PF reading at 5 mph.

(Continued on next page)

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Application Time (sec.)	MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)	Comments Smoke, Odor, Brake Pull
	Front Avg.	Rear Avg.										
	L/R	L/R										
RECORDED DATA												
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
TIME: END OF FIRST STOP TO END OF LAST STOP: MINUTES - _____, SECONDS - _____												

Visual pedal force (max) within range above? Yes - _____, No - _____
 (if NO, contact COTR)

REMARKS:

DATA INDICATES COMPLIANCE: Yes - _____; No - _____; No Reqmts - _____

DRIVER: _____; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 16 (Part 2 of 2)
SECOND FADE AND RECOVERY (S7.13)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

SECOND FADE AND RECOVERY (RECOVERY) SCHEDULE:
 GVWR, 5 stops, in gear, 30-0 mph, 10 fpsps decel., 1.0 mile interval.

SECOND FADE AND RECOVERY (RECOVERY) REQUIREMENTS:
 5 stops at 10 fpsps, stops 1-4 pedal force ≤150, stop 5 pedal force + 20 lb to lesser of -
 10 or 0.6 times the average baseline pedal force.
 Pedal force range (must be computed before next test):
 Max - _____ lb Min - _____ lb

Stop No.	Initial Brake Temperature, °F		Speed (mph)	MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)	Comments Smoke, Odor, Brake Pull
	Front Avg.	Rear Avg.									
	L/R	L/R									
RECORDED DATA											
1											
2											
3											
4											
5											

Visual pedal force (max) within range above? Yes - _____ , No - _____
 (if NO, contact COTR)

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 17
THIRD RE-BURNISH (S7.14)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

THIRD RE-BURNISH SCHEDULE:

GVWR, 35 stops in gear, 40-0 mph, 12 fpsps decel, 230-270°F IBT or 1 mile interval whichever is shorter.

THIRD RE-BURNISH REQUIREMENTS:

Lockup ≤1 wheel, stay in 12 ft lane. NOTE: Pedal force may exceed 150 lb.

Stop No.	Initial Brake Temperature, °F		Speed (mph)	MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)	Comments Smoke, Odor, Brake Pull
	Front Avg.	Rear Avg.									
	L/R	L/R									
RECORDED DATA											
1											
10											
20											
30											
35											

BRAKE ADJUSTMENT (Post Burnish) SCHEDULE:

Adjust service brake per manufacturer's specification.

Record manufacturer's procedure and amount adjusted.

Front/Rear- _____

Manufacturer's Procedure - _____

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 18
FOURTH EFFECTIVENESS (S7.15)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____
 TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs
 TIRE PRESSURE (Cold): Front - _____ Rear - _____
 ODOMETER READING: Start - _____ Finish - _____

FOURTH EFFECTIVENESS SCHEDULE:

GVWR, 6 stops, in neutral, 30,60, & 80-0 mph, 150-200°F IBT.

FOURTH EFFECTIVENESS REQUIREMENTS:

1 stop, 30 mph 65 ft, 60 mph 242 ft, 80 mph 459 ft, pedal force ≤150, lockup ≤1 wheel, stay in 12 ft lane

Stop No.	Initial Brake Temperature, °F		Speed (mph)	Stopping Distance (ft.)		Maximum Pedal Force (Lbs.)	Max. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	Avg. Pedal Force (Lbs.)	Avg. Decel. (fpsps)
	Front Avg.	Rear Avg.		Act.	Corr.							
	L/R	L/R										
30 MPH RECORDED DATA												
1												
2												
3												
4												
5												
6												
60 MPH RECORDED DATA												
1												
2												
3												
4												
5												
6												
80 MPH RECORDED DATA												
1												
2												
3												
4												

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____
 DRIVER: _____ ; OBSERVER: _____
 RECORDED DATA PROCESSED BY: _____ DATE: _____
 APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 19
WATER RECOVERY (S7.16)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

WATER RECOVERY (BASELINE) SCHEDULE:

GVWR, 3 stops, in gear, 30-0 mph, 150-200°F IBT, 10 fpsps decel.

WATER RECOVERY (BASELINE) REQUIREMENTS:

Pedal force 10-60 lb, lockup ≤1 wheel, stay in 12 ft lane.

Stop No.	Initial Brake Temperature, °F		Speed (mph)	MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg.	Rear Avg.								
	L/R	L/R								
RECORDED DATA										
1										
2										
3										
AVERAGE MAX. PEDAL FORCE = _____										

REMARKS:

WATER RECOVERY (RECOVERY) SCHEDULE:

Drive back and forth at 5 mph for 2 minutes in 6 inch deep water.

GVWR, 5 stops, in gear, 30-0 mph, 10 fpsps, stops initiated as soon as 30 mph is reached.

WATER RECOVERY (RECOVERY) REQUIREMENTS:

4 stops at 10 fpsps, pedal force ≤150 lb, 5th stop, max. baseline plus 45 lb. All stops, min. force baseline minus 10 lb or times 0.6.

Pedal force range (must be computed before next test):

Max - _____ lb Min - _____ lb

Stop No.	Initial Brake Temperature, °F		Speed (mph)	MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)	Comments Smoke, Odor, Brake Pull
	Front Avg.	Rear Avg.									
	L/R	L/R									
RECORDED DATA											
1											
2											
3											
4											
5											

Visual pedal force (max) within range above? Yes - _____, No - _____
(if NO, contact COTR)

REMARKS:

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 20
SPIKE STOPS (S7.17)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

SPIKE STOPS SCHEDULE:

GVWR, 10 stops in neutral, 30-0 mph, 200 lb pedal force in 0.08 sec, 150-200°F IBT, no reverse stops or brake adjustment.

SPIKE STOPS REQUIREMENTS:

Complete stops without failure, lockup allowed.

Stop No.	Initial Brake Temperature, °F		Speed (MPH)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)
	Front Avg. L/R	Rear Avg L/R									
60 MPH RECORDED DATA											
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

(Continued on next page)

STOP NO.	FIRST PEAK PEDAL FORCE (LB)	TIME TO FIRST PEAK (SEC)	PROJ. TIME TO 200 LB (SEC)	ACTUAL TIME TO MAX PF (SEC)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

POST SPIKE EFFECTIVENESS SCHEDULE:

GVWR, 6 stops, in neutral, 60-0 mph, 150-200°F IBT.

POST SPIKE EFFECTIVENESS REQUIREMENTS:

1 stop, 60 mph 242 ft, pedal force ≤150 lb, lockup ≤1 wheel, stay in 12 ft lane.

Max - _____ lb Min - _____ lb

Stop No.	Initial Brake Temp., EF		Speed (mph)	Stopping Distance (ft.)		MAX. Pedal Force (Lbs.)	MAX. Decel (fpsps)	Wheel Lockup above 10 mph	Direction of Stop	Stay in Lane	AVG. Pedal Force (Lbs.)	AVG. Decel. (fpsps)	Comments Smoke, Odor, Brake Pull
	Front Avg.	Rear Avg.		Act.	Corr								
	L/R	L/R											
RECORDED DATA													
1													
2													
3													
4													
5													
6													

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 21 (Part 1 of 6)
TEST COMPLETION INSPECTION (S7.18)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMPERATURE: _____ °F; WIND VELOCITY & DIRECTION: _____

TEST COMPLETION INSPECTION REQUIREMENTS:

No detachment or fracture of any components such as brake springs, brake shoe, or disc pads facing. All mechanical components shall be intact and functional. Friction facing tearout shall not exceed 10% of the lining on any single frictional element. No visible brake fluid or lubricant on the friction surface of the brake. No leakage at any system reservoir cover, seal, or filler opening.

BRAKE SYSTEM INTEGRITY (S5.6):

Friction Material condition: Primary/Inner		Friction Material Condition: Secondary/Outer	
LF		LF	
RF		RF	
LR		LR	
RR		RR	
DRUM (OR ROTOR) CONDITION:		BRAKE FLUID/LUBRICANT INSIDE BRAKES:	
LF		LF	
RF		RF	
LR		LR	
RR		RR	
HYDRAULIC COMPONENT CONDITION:		MECHANICAL COMPONENT CONDITION:	
LF		Brk/Ped	
RF		Pow/Brk	
LR		Stop/Lamp	
RR		Linkage	
M/CYL		Other	

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 21 (Part 2 of 6)
TEST COMPLETION INSPECTION (S7.18)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

DATE			REQUIREMENTS	PASS	FAIL
RESERVOIR COMPARTMENTS (S5.4.1)					
(1) Does master cylinder have a reservoir compartment for each brake subsystem?		Yes _ No _	Master cylinder shall have a reservoir compartment for each subsystem.		
(2) Does loss of fluid in one compartment result in complete loss from another compartment?		Yes _ No _	Loss of fluid from one compartment shall not cause complete loss from another compartment.		
Reservoir Capacity (S5.4.2)					
NOTE: Reservoir total minimum capacity is defined as Total Capacity of Reservoir.					
Shall conform to requirements (1) or (2), state units: (1) For reservoirs having completely separate compartments for each subsystem:					
Subsystem 1 Subsystem reservoir capacity			Shall have a total minimum capacity equivalent to the fluid displacement resulting when all wheel cylinders or caliper pistons serviced by that portion of the reservoir move from a new lining, fully retracted position to a fully worn, properly adjusted, fully applied position.		
Subsystem 1 Fluid displaced from new to worn linings					
Subsystem 2 Subsystem reservoir capacity			Same as above		
Subsystem 2 Fluid displaced from new to worn linings					
(2) For reservoirs utilizing a portion of the reservoir for a common supply to two or more subsystems:					
Total minimum capacity for the entire master cylinder reservoir.			Shall have total minimum capacity for entire reservoir for displacement resulting from all subsystem wheel cylinders or caliper positions moving from new lining to full worn condition		
Fluid displaced from new to worn linings					
Subsystem 1 Min volume in partial compartment			Shall have minimum reservoir volume in partial compartment equal to at least the volume displaced by the master cylinder piston servicing the subsystem.		
Subsystem 1 Fluid displaced by master cylinder piston servicing subsystem					
Subsystem 2 Min volume in partial compartment			Same as above		
Subsystem 2 Fluid displaced by master cylinder piston servicing subsystem					

REMARKS:

DATA SHEET 21 (Part 3 of 6)
TEST COMPLETION INSPECTION (S7.18)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

DATE		REQUIREMENTS	PASS	FAIL
BRAKE POWER UNIT RESERVOIR (S5.4.2)				
	Volume displaced in charging system piston or accumulator to normal operating pressure plus wheel cylinder or caliper piston displacement.	Shall have a capacity at least equal to fluid displacement required to charge the system pistons on accumulators to normal operating pressure plus displacement when wheel cylinders or caliper pistons move from new lining to full worn condition as above.		
Master Cylinder Reservoir Labeling (S5.4.3)				
	Exact copy of reservoir label:	Label shall read: "Warning, clean filler cap before removing; use only fluid* from a sealed container". * Fluid type specified in 48 CFR 571.116		
	Measure letter height	Letters shall be at least 0.125" high		
	Describe label attachment method and location.	Label shall be permanently affixed, engraved or embossed and located so as to be visible by direct view either on or within 4 inches of the brake fluid reservoir filler plug or cap.		
	Does the lettering contrast with the background?	Yes _ No _ If label is not engraved or embossed, letters shall be of a color that contrasts with the background		

REMARKS:

Brake System (S5.1) (S5.2) (S6.2.4(a))

Service brake system acting on ALL wheels?	Yes _ No _	Must meet requirement		
Wear of the service brake is compensated for by means of a system of automatic adjustment?	Yes _ No _	Must meet requirement		
Each vehicle shall have a parking brake system of a friction type with a solely mechanical means to retain engagement.	Yes _ No _			
For an EV with RBS, RBS is part of the of the service brake system if it is automatically controlled by an application of the service brake control, if there is no means provided for the driver to disconnect and it is activated in all transmission positions, including neutral.	Yes _ No _	NO Requirement		

REMARKS:

DATA SHEET 21 (Part 4 of 6)
TEST COMPLETION INSPECTION (S7.18)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

CONDITION	ANSWER	REQUIREMENTS	PASS	FAIL
Brake Systems Indicator Lamp (S5.3)				
Describe location of brake indicator lamp:		Shall be in front & in clear view of driver.		
<i>Vehicles with GVWR greater than 10,000 lbs. ABS indicator light.</i>		<i>Must be separate indicator light for ABS.</i>		
Brake System Indicator Light Function Check (S5.3.2)				
Does lamp light with ignition (start) switch at ON/RUN?	Yes_ No_	Lamps activate when ignition switch is turned to "on" position when the engine is not running, or when the switch is in a position between "on" and "start" .		
Does lamp light with ignition between ON and Start?	Yes_ No_			
BRAKE SYSTEM INDICATOR LIGHT ACTIVATION (S5.3.1)				
CONDITION	LIGHT ON?	REQUIREMENT	PASS	FAIL
(a) In event of hydraulic leak (1) On or before appearance of pressure differential of 225 psi		SPLIT SERVICE BRAKE SYSTEMS: When ignition (Start) switch is ON, lamp must light for (a) or (b), (c), (d), (e), (f), and (g). SERVICE BRAKE SYSTEM NOT SPLIT: When Ignition is ON, lamp must light and alarm sound when supply pressure falls to 50% normal Normal pressure - Alarm pressure - Lamp(s) flash -		
(2) On or before brake application force reaches 50 lb (manual system)				
(3) On or before brake application force reaches 25 lb (power assisted system)				
(4) On or before supply pressure to brake power unit falls to 50%				
(b) If any reservoir falls below either "safe" level or 25% of capacity				
(c) If a malfunction that effects the generation or transmission of response or control signals in ABS or a total electrical failure in a variable proportioning brake system.				
(d) If Parking Brake applied				
(e) For a vehicle with <u>electrically-actuated service brakes</u> , failure of the source of electric power to the brakes, or diminution of state of charge of the batteries to less than a level specified by the manufacturer for the purpose of warning a driver of degraded brake performance.				
(f) For a vehicle with <u>electric transmission of the service brake control signal</u> , failure of a brake control circuit.				
(g) For an EV with RBS that is part of the service brake system, failure of RBS.				

REMARKS:

DATA SHEET 21 (Part 5 of 6)
TEST COMPLETION INSPECTION (S7.18)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

CONDITION	ANSWER	REQUIREMENTS	PASS	FAIL
Brake Systems Indicator Lamp Duration (S5.3.3)				
Indicator light activated due to S5.3.1 conditions?	Yes ___ No ___	Must remain activated as long as condition exists whenever ignition "on" position whether or not the engine is running.		
For vehicles with GVWR greater than 10,000 lbs. GVWR, ABS or variable proportioning malfunction stored after ignition turned "off"?	Yes ___ No ___	Malfunction must be stored.		
Brake system Indicator Light Function (S5.3.4)				
Warning indicator activated - steady burning or flashing?	Yes ___ No ___	Must be steady burning or flashing		
Antilock and Variable Proportioning Brake Systems (S5.5)				
Vehicles with GVWR greater than 10,000 lbs. must be equipped with ABS.	Yes ___ No ___	Must be ABS equipped		
Vehicles with GVWR greater than 10,000 lbs., the ABS directly controls the wheels of at least one front axle and the wheels of at least one rear axle.	Yes ___ No ___	Must meet condition		
For an EV that is equipped with both ABS and RBS, the ABS must control the RBS.	Yes ___ No ___	ABS must control RBS		

REMARKS:

DATA SHEET 21 (Part 6 of 6)
TEST COMPLETION INSPECTION (S7.18)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

CONDITION	ANSWER	REQUIREMENTS	PASS	FAIL
BRAKE INDICATOR LAMP LABELING (S5.3.5)				
FOR SINGLE COMMON INDICATOR				
Indicator lamp letter height		Not less than .125 inches high		
Indicator light legible		Labeling for each indicator light is legible to the driver in daylight.		
Additional indicator light wording		For purposes of clarity only		
If only one lamp is used, is it labeled "BRAKE"?	Yes_ No_	Single common indicator, lamp displays "Brake"		
If single common indicator, colors.		Letters and background of single common indicator are of contrasting colors, one of which is red.		
FOR SEPARATE OR SEPARATE AND COMMON INDICATORS				
Indicator lamp letter height		Not less than .125 inches high		
Indicator light legible		Labeling for each indicator light is legible to the driver in daylight.		
If Common and separate indicators are used, list labels: If vehicle GVWR greater than 10,000 lbs.		Common indicator must be labeled "Brake". If Separate indicator for gross loss of pressure labeled "Brake Pressure" If Separate indicator for low brake fluid, labeled "Brake Fluid" If Separate indicator for Anti-lock, labeled "Antilock", or "Anti-lock" or "ABS" If Separate indicator for parking brake, labeled "Park" <i>If separate indicator for regenerative brake system, labeled "RBS", or "ABS/RBS"</i> Must have <u>separate</u> ABS indicator light		
For separate indicators(EXCLUDING ABS and RBS), color of letters and background. List:		Separate indicator letters and background are of contrasting colors, one of which is RED .		
For separate ABS and RBS indicators, letter and background color. List:		Separate indicator letters and background are of contrasting colors, one of which is YELLOW		
VEHICLES WITHOUT A SPLIT SERVICE BRAKE SYSTEM				
List label: Describe audible tone: Record letter height:		To meet requirement of gross loss of pressure, label must be "STOP-BRAKE FAILURE" Must have continuous or intermittent audible signal Warning light must be flashing Block capital letters not less than one-quarter of an inch in height.		

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 22
MOVING BARRIER TEST (S7.19)

VEHICLE: _____ ; NHTSA NO.: _____ ; DATE: _____

TEMP.: _____ °F; WIND VEL./DIRECT.: _____ ; TEST WT: _____ lbs

TIRE PRESSURE (Cold): Front - _____ Rear - _____

ODOMETER READING: Start - _____ Finish - _____

VEHICLE WEIGHT: _____ lb; MOVING BARRIER WEIGHT: _____ lb

MOVING BARRIER TEST (Only for Vehicles Tested Per the Optional Parking Brake Test Procedure):

With parking brake released and parking mechanism engaged, impact the vehicle from the front at 2.5 mph with the moving barrier. Repeat from rear.

REQUIREMENTS: Parking mechanism shall not disengage or fracture in any manner permitting vehicle movement.

FRONT END IMPACT:

Impact Speed - _____ mph (Visual) Impact Speed - _____ mph (Recorded)

Did parking mechanism disengage? Yes - _____ No - _____

Was parking mechanism damaged? Yes - _____ No - _____

If yes, describe:

Vehicle moved _____ inches during impact test.

REAR END IMPACT:

Impact Speed - _____ mph (Visual) Impact Speed - _____ mph (Recorded)

Did parking mechanism disengage? Yes - _____ No - _____

Was parking mechanism damaged? Yes - _____ No - _____

If yes, describe:

Vehicle moved _____ inches during impact test.

DATA INDICATES COMPLIANCE: Yes - _____ ; No - _____ ; No Reqmts - _____

DRIVER: _____ ; OBSERVER: _____

RECORDED DATA PROCESSED BY: _____ DATE: _____

APPROVING LAB. OFFICIAL: _____ DATE: _____

DATA SHEET 23
CALCULATION OF MINIMUM RESERVOIR VOLUME REQUIREMENTS

BRAKE		LINING		
LOCATION	TYPE	DESCRIPTION	MINIMUM THICKNESS	THICKNESS TO FULLY WORN (1) in.
Left Front	Drum Disc	Leading Primary Inboard	Pre-test - Post-Test - Δ -	
		Trailing Secondary Outboard	Pre-test - Post-Test - Δ -	
LINING CLEARANCE: Diametral (2) _____ ; Inboard _____ ; Outboard _____				
WHEEL CYLINDER DIAMETER (3) _____ ; CALIPER PISTON DIAMETER (3) _____				
SHOE CAGE DIAMETER (4) _____ ; CENTER POINT OF BRAKE ASSY TO CENTER POINT OF W.C. _____				
Right Rear	Drum Disc	Leading Primary Inboard	Pretest - Post Test - Δ -	
		Trailing Secondary Outboard	Pretest - Post Test - Δ -	
LINING CLEARANCE: Diametral (2) _____ ; Inboard _____ ; Outboard _____				
WHEEL CYLINDER DIAMETER (3) _____ ; CALIPER PISTON DIAMETER (3) _____				
SHOE CAGE DIAMETER (4) _____ ; CENTER POINT OF BRAKE ASSY TO CENTER POINT OF W.C. _____				
SUBSYSTEM 1 CONSISTS OF:	LF	LR	RF	RR
SUBSYSTEM 2 CONSISTS OF:	LF	LR	RF	RR
(1) MFRS RECOMMENDATIONS ____ ; REAR - TOP OF RIVET HEADS ____ ; FRONT - 1/32 INCH				
(2) DRUM BRAKES, MEASURED AT HORIZONTAL CENTERLINE				
(3) MFRS DATA				
(4) RESET POSITION				

DATA SHEET 23

DATA FOR CALCULATION OF MINIMUM RESERVOIR VOLUME REQUIREMENTS

BRAKE		LINING		
LOCATION	TYPE	DESCRIPTION	MINIMUM THICKNESS	THICKNESS TO FULLY WORN (1) in.
Left Front	Drum	Leading Primary Inboard <u> X </u>	Pre-test - <u> 0.425 </u> Post-Test - <u> 0.403 </u> Δ - <u> 0.022 </u>	0.324
	Disc <u> X </u>	Trailing Secondary Outboard <u> X </u>	Pre-test - <u> 0.393 </u> Post-Test - <u> 0.380 </u> Δ - <u> 0.013 </u>	0.300
LINING CLEARANCE: Diametral (2) <u> N/A </u> ; Inboard <u> 0 </u> ; Outboard <u> 0 </u>				
WHEEL CYLINDER DIAMETER (3) <u> N/A </u> ; CALIPER PISTON DIAMETER (3) <u> 2.38" </u>				
SHOE CAGE DIAMETER (4) <u> N/A </u> ; CENTER POINT OF BRAKE ASSY TO CENTER POINT OF W.C. <u> N/A </u>				
Right Rear	Drum <u> X </u>	Leading <u> X </u> Primary Inboard	Pre-test - <u> 0.206 </u> Post-Test - <u> 0.200 </u> Δ - <u> 0.006 </u>	0.122
	Disc	Trailing <u> X </u> Secondary Outboard	Pre-test - <u> 0.238 </u> Post-Test - <u> 0.231 </u> Δ - <u> 0.007 </u>	0.179
LINING CLEARANCE: Diametral (2) <u> 0.0250" </u> ; Inboard <u> N/A </u> ; Outboard <u> N/A </u>				
WHEEL CYLINDER DIAMETER (3) <u> 0.750" </u> ; CALIPER PISTON DIAMETER (3) <u> N/A </u>				
SHOE CAGE DIAMETER (4) <u> 9.45" </u> ; CENTER POINT OF BRAKE ASSY TO CENTER POINT OF W.C. <u> 3" </u>				
SUBSYSTEM 1 CONSISTS OF:	LF <u> X </u>	LR	RF <u> X </u>	RR
SUBSYSTEM 2 CONSISTS OF:	LF	LR <u> X </u>	RF	RR <u> X </u>
(1) MFRS RECOMMENDATIONS <u> </u> ; REAR - TOP OF RIVET HEADS <u> </u> ; FRONT - 1/32 INCH				
(2) DRUM BRAKES, MEASURED AT HORIZONTAL CENTERLINE				
(3) MFRS DATA				
(4) RESET POSITION				

DATA SHEET 24 (1 OF 2)
INSTRUMENT CALIBRATION (12 MONTH MAXIMUM INTERVAL)
(SAMPLE)

INSTRUMENT	SERIAL NUMBER	CALIBRATION DATE	NEXT CALIBRATION
Data Acquisition System			
Computer			
Software			
Pedal Force Transducer			
Park Brake Force Transducer			
LF Hydraulic Pressure Transducer			
RF Hydraulic Pressure Transducer			
LR Hydraulic Pressure Transducer			
RR Hydraulic Pressure Transducer			
Accelerometer			
Fifth Wheel			
Wind Velocity			
Ambient Temperature Gauge			
LF Brake Thermocouple			
RF Brake Thermocouple			
LR Brake Thermocouple			
RR Brake Thermocouple			
Fifth Wheel Velocity			
Lock-up Detection System			

Calibration should include linearity checks.

TECHNICIAN: _____ ; QUALITY ASSURANCE: _____

DATE: _____

DATA SHEET 24 (2 OF 2)
DAILY INSTRUMENT CALIBRATION
(SAMPLE)

NOTE: A daily pretest and post test abbreviated instrumentation calibration is required per Section 8.

INSTRUMENT	(EXAMPLES) CALIBRATION PROCEDURE	DESIRED VALUE	INDICATED VALUE MORNING	INDICATED VALUE EVENING	ALLOWED DEVIATION
Velocity Meter	2.568 kHz Input				
5th Wheel Distance Meter	Drive Measured Distance				
5th Wheel Velocity Meter	Drive Measured Distance vs. Time				
Pedal Force Transducer	Dead Weight/Shunt				
Accelerometer	Known Accel. Or to Known Angles				
Brake Thermocouple					
Slip Ring					
Lock-up Detector	Hand Spin Wheel Over 9.3 mph - Vehicle Stopped				

Comments:

TECHNICIAN: _____ ; QUALITY ASSURANCE: _____

DATE: _____

19. FORMS

LABORATORY NOTICE OF TEST FAILURE TO OVSC

FMVSS NO.: 105

TEST DATE: _____

LABORATORY: _____

CONTRACT NO.: DTNH22-_____ ; DELV. ORDER NO.: _____

LABORATORY PROJECT ENGINEER'S NAME: _____

TEST VEH. MAKE/MODEL/BODY STYLE: _____

VEHICLE NHTSA NO.: _____; VIN: _____

VEHICLE MODEL YEAR: _____; BUILD DATE: _____

TEST FAILURE DESCRIPTION:

S105 REQUIREMENT, PARAGRAPH ____ :

NOTIFICATION TO NHTSA (COTR):

DATE: _____ BY: _____

REMARKS:

MONTHLY TEST STATUS REPORT
FMVSS 105
DATE OF REPORT:

NO.	VEHICLE NHTSA NO., MAKE & MODEL	SCHEDULED TEST START DATE	COMPLIANCE TEST DATE	PASS/ FAIL	DATE REPORT SUBMITTED	DATE INVOICE SUBMITTED	INVOICE PAYMENT DATE
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

MONTHLY VEHICLE STATUS REPORT
FMVSS 105
DATE OF REPORT:

NO.	VEHICLE NHTSA NO., MAKE & MODEL	DATE OF DELIVERY	ODOMETER READING	TEST COMPLETE DATE	VEHICLE SHIPMENT DATE	ODOMETER READING
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

20. APPENDIX

APPENDIX 1

Procedure and Example for Determining Master Cylinder Volume Requirement

The procedure followed for determining the minimum volume requirements is outlined in the example shown below. The required data are taken from Data Sheet 23.

DETERMINATION OF MASTER CYLINDER MINIMUM
VOLUME REQUIREMENTS

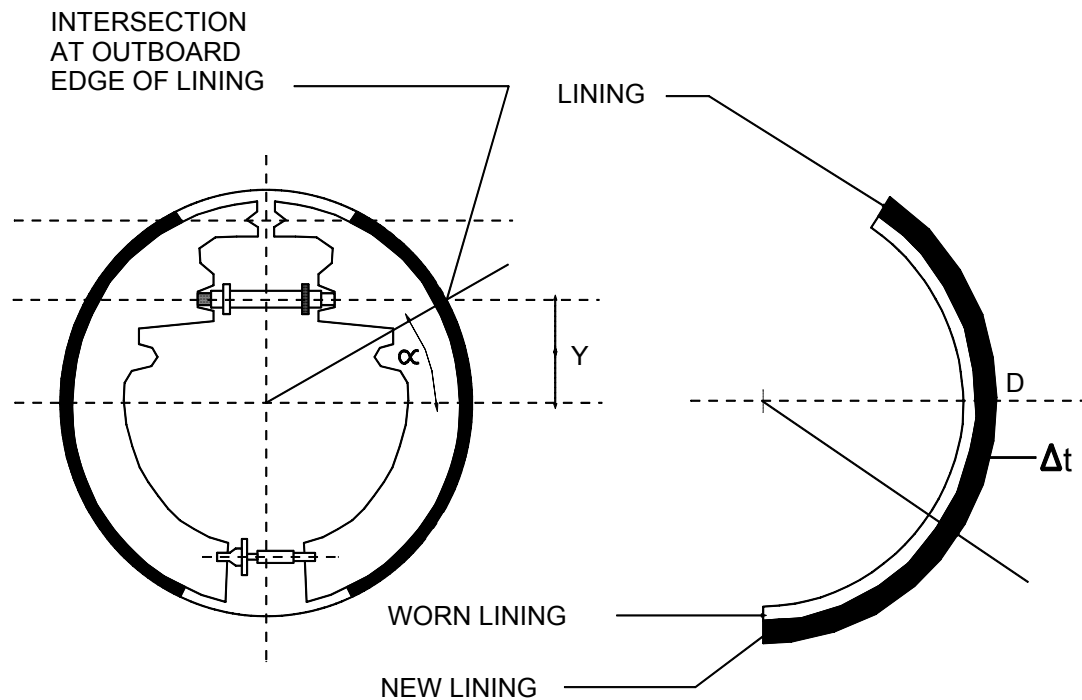


FIGURE 1A

DRUM BRAKES

Volume Required, $V_r = [(2C + \Delta t_s + \Delta t_p)/\cos\alpha] \times A \times \text{NWC}$, where –

:	$V_r =$	Volume required per wheel
	$C =$	Manufacturer's recommended drum-to-lining clearance
	$\Delta t_p =$	Change in thickness of primary lining
	$\Delta t_s =$	Change in thickness of secondary lining
	$Y =$	Center point of wheel cylinder to center point of brake assembly
	$A =$	Cross sectional area of the wheel cylinder bore

NWC = Number of wheel cylinders serviced by the reservoir in question
 $\infty = \text{Sin}^{-1}(2Y/D)$
 D = Shoe Cage Diameter

DISC BRAKES

Volume Required, $V_r = (\Delta t_i + \Delta t_{ic} + \Delta t_o + t_{oc}) \times [\Pi (D^2)]/4$, where –

V_r = Volume required per wheel

Δt = Change in thickness (average)

i = inboard

o = Outboard

D = Caliper cylinder diameter

c = Average clearance

Using the above equations, the volume requirements for each wheel are calculated as shown below:

Drum Brake (rear):

$$V_r = (2C + \Delta t_p + \Delta t_s \times 1)/\cos \infty$$

$$C = 0.025 \text{ in.}$$

$$\Delta t_p = 0.122 \text{ in.}$$

$$\Delta t_s = 0.179 \text{ in.}$$

$$D = 9.45 \text{ in.}$$

$$\infty = \text{Sin}^{-1} (2 \times 3)/9.45 = 39.4^\circ; \cos \infty = 0.772$$

$$A = \Pi \times (0.75)^2 = 0.44 \text{ in.}^2$$

$$V_r = [(2 \times 0.025 \times 0.179 + 0.122)/0.772] \times 0.44$$

$$V_r = 0.13 \text{ in.}^3 (2.1 \text{ ml})$$

Disc Brake (front):

$$V_r = (\Delta t_i + \Delta t_o + t_{ic} + t_{oc}) \times (\Pi D^2)/4$$

$$\Delta t_i = 0.324 \text{ in.}$$

$$\Delta t_o = 0.300 \text{ in.}$$

$$t_{ic} = t_{oc} = 0$$

$$D = 2.38 \text{ in.}$$

$$V_r = (0 + 0.324 + 0.300)[(\Pi \times 2.38^2)/4]$$

$$V_r = 2.77 \text{ in.}^3 (45.0 \text{ ml})$$

TOTAL VOLUME REQUIRED = $V_t = 2(0.13 \text{ in.}^3 (2.1 \text{ ml})) + 2(2.77 \text{ in.}^3 (45.0 \text{ ml})) = 5.8 \text{ in.}^3 (94.2 \text{ ml})$

APPENDIX 2

Vehicle Test Speed (mph)	STOPPING DISTANCES IN FEET FOR TESTS INDICATED											
	I 1 st Effectiveness (preburnished); 4 th Effectiveness; Spike effectiveness check			II 2 nd Effectiveness			III 3 rd Effectiveness (lightly loaded vehicles)				IV Inoperative brake power and power assist unit; Partial Failure	
	(b)	(c)	(d)	(b) and (c)	(d)	(e)	(b)	(c)	(d)	(e)	(b) and (c)	(d) and (e)
30	65 ^{1,2}	69(1st) ^{1,2} 65(4th and spike) ^{1,2} 72 ¹	88	57 ¹	78	70 ^{1,2}	57	65	84	70	130	170
35	83	91	132	74	106	96	74	83	114	96	176	225
40	108	119	173	96	138	124	96	108	149	124	229	288
45	137	150	218	121	175	158	121	137	189	158	291	358
50	169	185	264	150	216	195	150	169	233	195	359	435
55	204	224	326	181	261	236	181	204	281	236	433	530
60	242 ¹	267 ¹	388	216 ¹	310 ¹	280 ¹	216 ¹	242 ^{1,2}	335 ¹	280 ¹	517 ¹	613 ¹
80	459 ¹	510 ¹										
95												
100												

¹ Distances for specified tests.

² Applicable to school buses only.

NA = Not Applicable

NOTE:

(b) Vehicles with GVWR of less than 8,000 lbs

(c) Vehicles with GVWR of not less than 8,000 lbs and not more than 10,000 lbs

(d) Vehicles, other than buses, with GVWR greater than 10,000 lbs

(e) Buses, including school buses, with GVWR greater than 10,000 lbs.