SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
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SURFACE VEHICLE STANDARD

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(R) Braking, Stability, and Control Performance Test Procedures for Air- and Hydraulic-Brake-Equipped Trucks, Truck-Tractors and Buses

1. Scope—This SAE Recommended Practice provides a road test procedure for trucks, truck-tractors, and buses to evaluate their compliance with Federal Motor Vehicle Safety Standards (FMVSS) 105 and 121; Hydraulic and Air Brake Systems. Units of measure are English in lieu of metric to be commensurate with FMVSS 105 and 121.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest version of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from the SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J299—Stopping Distance Test Procedure
SAE J971—Brake Power Rating Test Code—Commercial Vehicle Inertia Dynamometer

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 1136—Specification for a Radial Standard Reference Test Tire
ASTM E 1337—Standard Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using a Standard Reference Test Tire

2.1.3 FMVSS PUBLICATIONS—Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

FMVSS 105—Hydraulic Brake Systems
FMVSS 121—Air Brake Systems

3. Definitions

3.1 Truck—A vehicle with motive power designed primarily for the transportation of property or special purpose equipment. For the purpose of this document, 'trucks' refers to trucks with GVWRs over 10 000 lb other than truck-tractors.

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3.2 Truck Tractor—For the purpose of this document, is a truck designed to tow a semi-trailer through a fifth wheel located over the rear axle(s). This document uses this kind of 'towed vehicle' for the truck-tractor's tests at GVWR.

3.3 Bus (School Buses, Motorhomes, and Other People Transportation Buses)—A vehicle with motive power designed primarily for the transportation of people. School buses in this document will require specific procedures that are so identified. Motorhomes and other people transportation buses are treated like a truck/non-school bus.

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

3.5 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 complete stop.

3.6 Unloaded Vehicle Weight (UVW)—The weight of a motor vehicle with standard equipment, maximum capacity of engine fuel, oil, and coolant.

3.7 Vehicle Combination Weight—For the purpose of this document, is the combined weight of a truck-tractor and the semi-trailer it is towing.

3.8 Gross Axle Weight Rating (GAWR)—The maximum rated capacity of a single axle system (axle with tires, wheels, and suspension) as measured at the tire-road interface as stated on the vehicle certification label.

3.9 Gross Vehicle Weight Rating (GVWR)—The maximum rated capacity of a single vehicle as stated on the vehicle certification label. Liftable axles shall be down for GVWR tests. Unless otherwise specified, vehicles are loaded to GVWR as follows:

3.9.1 Trucks are loaded to their GVWR using axle loads proportional to the respective gross axle weight ratings GAWR. In the case where ballast cannot be positioned without exceeding a GAWR, reduce the amount of ballast so that the axle load does not exceed the guidelines of 3.9.4, maintaining the load proportioning as closely as possible to the specified proportioning. The ballast center of gravity height is no more than 32 in above the top of the truck frame rail.

3.9.2 Truck-tractors are to be loaded to GVWR using a single axle unbraked control trailer. The control trailer has a single axle with a gross axle weight rating of 18 0OO lb and a length, measured from the transverse centerline of the axle to the centerline of the kingpin, of 258 in ± 6 in. All ballast on the control trailer is placed directly above the kingpin. Load distribution is to be in proportion to the tractor's GAWRs, with the trailer axle as close as possible to 4500 lb. Adjust the load distribution by altering the fifth wheel position, if applicable. The center of gravity height of the ballast must be less than 24 in above the top of the tractor fifth wheel. In the case where the tractor fifth wheel cannot be adjusted as specified without exceeding a GAWR, reduce the amount of ballast so that the axle load does not exceed the guidelines of 3.9.4, maintaining the load proportioning as close as possible to the specified proportioning.

3.9.3 Buses with a body are loaded to their GVWR using axle loads proportional to the respective gross axle weight ratings (GAWR). In the case where ballast cannot be positioned without exceeding a GAWR, reduce the amount of ballast so that the axle load does not exceed the guidelines of 3.9.4, maintaining the load proportioning as closely as possible to the specified proportioning. The ballast will be positioned in compartments, tanks, and on the floor in the seating areas.

3.9.4 Actual vehicle test weight is to be within +2/–0% of the weight specified in 3.9.1, 3.9.2, and 3.9.3. Axle weights are to be within ±2% of their proportional share of the test weight.

3.10 Lightly Loaded Vehicle Weight (LLVW)

3.10.1 Truck LLVW is the unloaded vehicle weight (UVW) plus 3000 lb load frame and up to 500 lb including driver, observer, and instrumentation. An additional 1000 lb can be allotted for vehicles that require a rollbar for testing purposes. Liftable axles shall be lifted for LLVW vehicle tests. The load frame fore-aft center of gravity location is the same as for the GVWR location.

3.10.2 Truck Tractor LLVW is the unloaded vehicle weight (UVW) plus up to 500 lb including driver, observer, and instrumentation. An additional 1000 lb can be allotted for vehicles that require a rollbar for testing purposes. Liftable axles shall be lifted for LLVW vehicle tests.

3.10.3 Bus LLVW is the unloaded vehicle weight (UVW) plus the body if tested as a bus and up to 500 lb including driver, observer, and instrumentation. An additional 1000 lb can be allotted for vehicles that require a rollbar for testing purposes. Liftable axles shall be lifted for LLVW vehicle tests.

3.11 Full Brake Application

3.11.1 Air Full Brake Application means an application of the brake control (treadle or brake pedal) in which pressure in any of the valve's output circuits reaches 85 psi, or the brake control has reached maximum displacement, within 0.2 s after application is initiated.

3.11.2 Hydraulic Full Brake Application for the Stability and Control tests means an application of the brake control (brake pedal) in which the apply force reaches 150 lb at the pedal, or the brake control has reached maximum displacement, within 0.2 s after application is initiated.

NOTE—That this procedure allows the pedal force to exceed 150 lb.

3.11.3 Hydraulic Full Brake Application for all other tests means an application of the brake control (brake pedal) in which the apply force does not exceed 150 lb maximum at the pedal per FMVSS 105.

3.12 Initial Brake Temperature (IBT)—The average temperature of the service brakes on the hottest axle of the vehicle 0.2 mile before any brake application.

3.13 Maximum Drive—Through Speed—The highest possible constant speed at which the vehicle can be driven through 200-ft arc of a PFC less than 0.5 in a 500 ft radius curve without leaving the 12-ft lane.

3.14 Peak Friction Coefficient (PFC)—The ratio of the maximum value of longitudinal force to the simultaneous vertical force occurring prior to wheel lockup, as the braking torque is progressively increased, as measured using the procedure in ASTM E 1337.

3.15 Unbraked Control Trailer—A single axle semi-trailer with a GAWR of 18 000 lb and a length, measured from the transverse centerline of the axle to the centerline of the kingpin, of 258 in ± 6 in and ballast CG height less than 24 in above the top of the tractor's fifth wheel and trailer axle weight of 4500 lb (defined in FMVSS 121).

3.16 Wheel Lockup—100% wheel slip.

3.17 Antilock Brake System (ABS)—A portion of a service brake system that automatically controls the degree of rotational wheel slip during braking by: (a) sensing the rate of angular rotation of the wheels; (b) 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; and (c) transmitting those controlling signals to one or more modulators which adjust brake actuating forces in response to those signals.

4. Instrumentation and Equipment

4.1 A device to measure wind speed, ±2.0 mph, and direction.

4.2 A device to measure ambient temperature, ±0.5 °F.

4.3 Tire pressure gauge, ±1.0% of indicated value.

4.4 Brake lining thermocouples, ±10.0 °F, installed per SAE J971 JUN91, and display for brake lining temperature.

4.5 Fifth wheel or other device to measure and display (or record) vehicle speed, ±0.5 mph, and stopping distance, ±5.0%.

4.6 A device to indicate first brake control (treadle or brake pedal) movement, ±1.0% of indicated value, and full brake control displacement, or brake control pressure, ±1% of indicated value versus time, capable of 0.1 s resolution, or brake pedal force, ±1% of indicated value versus time, capable of 0.1 s resolution.

4.7 A device or method to measure wheel lockup, ±5.0 rpm.

4.8 Decelerometer, ±0.5 fpsps, to measure vehicle deceleration.

4.9 Solenoid valve(s) with a 0.5 (+0.1/–0.0) in diameter ports.

4.10 Pressure, ±1.0% of the indicated value, for measuring brake control pressure and system pressure.

4.11 Static Retardation Force (Drawbar Pull) Parking Brake Test

4.11.1 A device to pull the vehicle with park brake applied, at the required rate of 4 ft/min or less.

4.11.2 Load cell, ±300 lb, to measure pull force.

4.11.3 Device or method of measuring wheel rotation, ±5.0% of indicated value.

4.12 Grade Holding Parking Brake Test

4.12.1 A device, ±2.0 in, or method to measure vehicle movement once the parking brake has been applied.

4.12.2 Stopwatch, ±5 s.

4.12.3 Inclinometer, ±1%, or other method to measure surface grade/slope.

4.13 Hydraulic pedal force, ±1% of indicated value, measuring equipment.

4.14 Hydraulic tees, shut-off valves and plumbing to render (i.e., divert fluid back to the reservoir) the primary and secondary brakes inoperative during partial failure stops.

4.15 Weighing scales, ±1.0% of indicated weight.

5. Vehicle Information—The vehicle information will be contained on Data Sheet 1 (see Figures 1A through 1C).

6. Test Conditions and Facilities

6.1 Ambient air temperature must be between 32 and 100 °F.

6.2 Wind velocity should not exceed 15 mph.

6.3 Unless otherwise specified, the transmission shall be in neutral or the clutch depressed during burnish snubs and test stops.

6.4 All vehicle openings (doors, windows, hood, etc.) must be closed except as required for instrumentation purposes.

6.5 Unless otherwise specified, the brake control can be applied and modulated at any desired rate.

6.6 Service and emergency stopping distance tests are conducted on a straight 12-ft (+0/–2 in) wide roadway with a PFC less than 0.9 (dry Portland cement concrete or equivalent surface). The vehicle shall be aligned with the center of the roadway at the beginning of each stop. The roadway shall be marked on both sides.

6.7 Stability and control tests are performed on a 12-ft (+0/–2 in) wide lane curved on a 500-ft radius (to lane centerline) on a surface with a PFC less than 0.5. The arc length must be at least 300 ft. A 100-ft. approach to the arc is recommended to properly align the vehicle to the lane. Lane boundaries are defined by 12 to 18 in high vertical markers (such as cones) on a 20-ft spacing with the inside edge of the markers placed on the 12-ft wide lane boundaries.

6.8 For truck tractor tests that utilize the control trailer, a 50 in^3 reservoir shall be attached to the tractors control glad-hand. Tractor protection valve to be in the bobtail position for bobtail tests and the towing position for towing the control trailer.

6.9 Roadway shall be flat with no more than a 1% grade in all directions, including crown.

6.10 Tires must be inflated to the pressure specified by the vehicle manufacturer for the gross vehicle weight rating, measured cold (at the beginning of each test day).

6.11 Initial Brake Temperature (IBT) means the average temperature of the service brakes on the hottest axle of the vehicle 0.2 miles before any brake application. The IBT must be between 150 and 200 °F for each stability and control, service, and emergency stop. Air brake vehicle temperature just prior to any parking brake test must be between 150 and 200 °F. Hydraulic brake school bus lining material temperature just prior to any parking brake test shall not be more than 150 °F (when the temperature of components on both ends of an axle are averaged or the temperature of the driveline type parking brake material). Warm brakes to the required temperature by making 40 to 20 mph snubs at 10 fpsps.

6.12 Automatic adjusters must remain activated for the duration of the test.

6.13 Unless otherwise specified, brakes can be adjusted per the vehicle manufacturer's procedure at anytime.

6.14 Individual brake lining temperatures should be less than 200 °F when being adjusted or checked.

6.15 The air system reservoir pressure must be at compressor governor cut out pressure (+0/–10 psi) within 0.2 mile before the beginning of any stability and control and service or emergency brake stop or just prior to any parking brake test.

6.16 Vehicles equipped with an interlocking axle system or front-wheel-drive system capable of being manually engaged by the driver shall be tested with the system disengaged.

6.17 Any auxiliary braking device (driveline retarders) capable of being manually engaged by the driver shall be tested with the auxiliary device(s) both engaged and disengaged for the stability and control, service, and emergency tests.

6.18 The driver may steer as necessary to stay within the lane.

6.19 Vehicle speed is to be within the tolerance specified and stopping distance corrected per SAE J299.

6.20 The static retardation tests are conducted on level dry Portland cement concrete or equivalent surface.

6.21 The grade holding tests are conducted on a 20% (+1%/–0%) grade of dry smooth Portland cement concrete or equivalent.

7. Test Sequence—Air Brake Truck-Tractors

7.1 Burnish (Data Sheet 2) (see Figures 2A and 2B.)

7.2 Stability and control test at GVWR - optional (Data Sheet 3) (see Figure 3.)

7.3 Stability and control test at LLVW (Data Sheet 3) (see Figure 3.)

7.4 Service brake LLVW stopping distance test at 60 mph (Data Sheet 4) (see Figure 4.)

7.5 Emergency brake LLVW stopping distance test at 60 mph (Data Sheet 5) (see Figures 5A through 5D.)

7.5.1 Emergency brake LLVW primary system failure stopping distance test at 60 mph.

7.5.2 Emergency brake LLVW secondary system failure stopping distance test at 60 mph.

7.6 "Grade holding" parking brake test at LLVW[1] (Data Sheet 6) (see Figure 6.)

7.7 Service brake GVWR stopping distance test at 60 mph (Data Sheet 4) (see Figure 4.)

7.8 "Grade holding" parking brake test at GVWR[1] (Data Sheet 6) (see Figure 6.)

7.9 "Static retardation force" (drawbar pull) parking brake test at GVWR[1] (Data Sheet 7) (see Figure 7.)

7.10 Final inspection (Data Sheet 8) (see Figure 8.)

8. Test Sequence—Air Brake Trucks and Buses

8.1 Burnish (Data Sheet 2) (see Figures 2A and 2B.)

8.2 Stability and control test at GVWR - optional (Data Sheet 3) (see Figure 3.)

8.3 Stability and control test at LLVW (Data Sheet 3) (see Figure 3.)

8.4 Service brake LLVW stopping distance test at 60 mph (Data Sheet 4) (see Figure 4.)

8.5 Emergency brake LLVW stopping distance at 60 mph (Data Sheet 5) (see Figures 5A through 5D).

8.5.1 Emergency brake LLVW primary system failure stopping distance test at 60 mph.

8.5.2 Emergency brake LLVW secondary system failure stopping distance test at 60 mph.

8.5.3 Emergency brake primary control line failure LLVW stopping distance test at 60 mph.

1. FMVSS 121 allows the option of performing the grade holding test at LLVW and GVWR or the static retardation force parking brake test at GVWR.

8.6 "Grade holding" parking brake test at LLVW (Data Sheet 6) (see Figure 6.)

8.7 Service brake GVWR stopping distance test at 60 mph (Data Sheet 4) (see Figure 4.)

8.8 Emergency brake GVWR stopping distance test at 60 mph (Data Sheet 5) (see Figures 5A through 5D.)

8.8.1 Emergency brake GVWR primary system failure stopping distance test at 60 mph.

8.8.2 Emergency brake GVWR secondary system failure stopping distance test at 60 mph.

8.8.3 Emergency brake GVWR primary control line failure stopping distance test at 60 mph.

8.8.4 Trailer air supply and control line failure GVWR stopping distance test at 60 mph (Truck only).

8.9 "Grade holding" parking brake test at GVWR[2] (Data Sheet 6) (see Figure 6.)

8.10 "Static retardation force" (drawbar pull) parking brake test at GVWR[2] (Data Sheet 7) (see Figure 7.)

8.11 Final inspection (Data Sheet 8) (see Figure 8.)

9. Test Sequence—Hydraulic Brake Trucks and Buses (Non-School Buses)

9.1 Instrument check – optional, up to 10 snubs at 40 to 10 mph at 10 fpsps.

9.2 Burnish (Data Sheet 2) (see Figures 2A and 2B.)

9.3 2nd Effectiveness GVWR service brake stopping distance test at 60 mph (Data Sheet 4) (see Figure 4.)

9.4 1st Re-burnish at GVWR (Data Sheet 9) (see Figure 9.)

9.5 "Grade Holding" parking brake test at GVWR (Data Sheet 6) (see Figure 6.)

9.6 "Static retardation force[3]" - optional (drawbar pull) parking brake test at GVWR (Data Sheet 7) (see Figure 7.)

9.7 3rd Effectiveness LLVW service brake stopping distance test at 60 mph (Data Sheet 4) (see Figure 4.)

9.8 Partial failure LLVW stopping distance test at 60 mph (Data Sheet 5) (see Figures 5A through 5D.)

9.8.1 Primary system failure LLVW stopping distance test at 60 mph.

9.8.2 Secondary system failure LLVW stopping distance test at 60 mph.

9.9 "Grade holding" parking brake test at LLVW (Data Sheet 6) (see Figure 6.)

9.10 Stability and control test at LLVW (Data Sheet 3) (see Figure 3.)

9.11 Stability and control test at GVWR - optional (Data Sheet 3) (see Figure 3.)

2. FMVSS 121 allows the option of performing the grade holding test at LLVW and GVWR or the static retardation force parking brake test at GVWR.
3. FMVSS 105 does not allow provision for static retardation force. This is an optional method/procedure within this document for objective data.

9.12 Partial failure GVWR stopping distance test at 60 mph (Data Sheet 5) (see Figures 5A through 5D.)

9.12.1 Primary system failure GVWR stopping distance test at 60 mph.

9.12.2 Secondary system failure GVWR stopping distance test at 60 mph.

9.13 ABS inoperative service brake GVWR stopping distance test at 60 mph (Data Sheet 5) (see Figures 5A through 5D.)

9.14 Inoperative brake power assist service brake GVWR stopping distance test at 60 mph (Data Sheet 5) (see Figures 5A through 5D.)

9.15 Final inspection (Data Sheet 10) (see Figure 10.)

10. Test Sequence —Hydraulic Brake School Buses

10.1 Instrument check - optional, up to 10 snubs at 40 to 10 mph at 10 fpsps.

10.2 Burnish (Data Sheet 2) (see Figures 2A and 2B.)

10.3 2nd Effectiveness GVWR service brake stopping distance tests at 30 and 60 mph (Data Sheet 4) (see Figure 4.)

10.4 1st Re-burnish at GVWR (Data Sheet 9) (see Figure 9.)

10.5 "Grade Holding" parking brake test at GVWR (Data Sheet 6) (see Figure 6.)

10.6 "Static retardation force[4]" - optional (drawbar pull) parking brake test at GVWR (Data Sheet 7) (see Figure 7.)

10.7 3rd Effectiveness service brake LLVW stopping distance test at 60 mph (Data Sheet 4) (see Figure 4.)

10.8 Partial failure LLVW stopping distance test at 60 mph (Data Sheet 5) (see Figures 5A through 5D.)

10.8.1 Primary system failure LLVW stopping distance test at 60 mph.

10.8.2 Secondary system failure LLVW stopping distance test at 60 mph.

10.9 "Grade holding" parking brake test at LLVW (Data Sheet 6) (see Figure 6.)

10.10 Stability and control test at LLVW (Data Sheet 3) (see Figure 3.)

10.11 Stability and control test at GVWR - optional (Data Sheet 3) (see Figure 3.)

10.12 Partial failure GVWR stopping distance test at 60 mph (Data Sheet 5) (see Figures 5A through 5D.)

10.12.1 Primary system failure GVWR stopping distance test at 60 mph.

10.12.2 Secondary system failure GVWR stopping distance test at 60 mph.

10.13 ABS inoperative service brake GVWR stopping distance test at 60 mph (Data Sheet 5) (see Figures 5A through 5D.)

4. FMVSS 105 does not allow provision for static retardation force. This is an optional method/procedure within this document for objective data.

10.14 Inoperative brake power assist service brake GVWR stopping distance test at 60 mph (Data Sheet 5) (see Figures 5A through 5D.)

10.15 1st Fade and recovery at GVWR (Data Sheets 11 and 12) (see Figures 11 and 12.)

10.16 2nd Re-burnish at GVWR (Data Sheet 9) (see Figure 9.)

10.17 2nd Fade and recovery at GVWR (Data Sheets 11 and 12) (see Figures 11 and 12.)

10.18 3rd Re-burnish at GVWR (Data Sheet 9) (see Figure 9.)

10.19 Water recovery at GVWR (Data Sheet 13) (see Figure 13.)

10.20 Final inspection (Data Sheet 10) (see Figure 10.)

11. Burnish—(Data Sheet 2) (See Figures 2A and 2B.)

11.1 Test Preparation

11.1.1 Install brake lining thermocouples per SAE J971 JUN91.

11.1.2 Install the following instrumentation:

a. Thermocouple readout
b. Decelerometer
c. Speed-measuring device or calibrate vehicle speedometer
d. Device to measure brake control line pressure (optional)
e. Device to measure brake application pedal force (optional)

11.1.3 Trucks and buses are to be loaded to GVWR so that wheels do not lock during burnish snubs.

11.1.4 Truck tractors shall be loaded by coupling to an unbraked control trailer. The vehicle combination weight shall equal the GVWR of the truck tractor. The ballast on the unbraked control trailer shall be located so that the truck tractor's wheels do not lock during burnish snubs.

11.1.5 The vehicle brakes should be adjusted prior to burnish per the vehicle manufacturer’s recommendation.

11.2 Test Procedure

11.2.1 Burnish the brakes by making 500 snubs between 40 mph and 20 mph at a deceleration rate of 10 fpsps, or at the vehicle's maximum deceleration rate if less than 10 fpsps, with clutch depressed, or automatic transmission in neutral where appropriate (if provided, switchable retarders should be in off position). Except, where an adjustment is indicated, 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 mile, 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.

11.2.2 The vehicles equipped with air brakes may be adjusted as specified by the vehicle manufacturer up to three times during the burnish procedure. The vehicles equipped with hydraulic brakes may be adjusted as specified by the vehicle manufacturer at the specified intervals (i.e., 125, 250, and 375) per FMVSS 105. Also, brakes should be adjusted at the conclusion of the burnishing, in accordance with the vehicle manufacturer's recommendation. Record adjustment data on data sheets.

11.2.3 Road conditions should be dry. Slightly wet is permissible but discontinue burnish when noticeable splash and spray occurs.

11.2.4 DRIVER BREAKS

a. Driver breaks during the procedure should be minimized and recorded on the data sheets.
b. Driver breaks should not occur within any 25 snub sequence.
c. Each 25th snub can be a complete stop in order to record data.

11.3 Test Data Recording—Brake lining temperatures and brake application pressure to maintain a 10 fpsps decel should be recorded at each 25th brake snub (Pressure optional).

12. Stability and Control Test Procedure—(Data Sheet 3) (see Figure 3.)

12.1 Test Preparation

12.1.1 Stability and control tests are performed on a 12-ft (+0/–2 in) wide lane curved on a 500-ft radius (to lane centerline) on a surface with a PFC less than 0.5. The arc length must be at least 300 ft. A 100-ft approach to the arc is recommended to properly align the vehicle to the lane. Lane boundaries are defined by 12 to 18 in high vertical markers (such as cones) on a 20-ft spacing with the inside base edge of the markers placed on the 12-ft wide lane boundaries.

12.1.2 Install the following instrumentation and equipment:

a. Fifth wheel or other speed measuring device.
b. Trigger switch to measure (detect) start of braking (first brake control movement).
c. Pressure transducer to measure brake primary control line pressure or device to measure full displacement of brake control or pedal force transducer.
d. Recording device to record start of braking and primary control line pressure (or full brake control displacement or pedal force) as a function of time.

12.1.3 Adjust brakes (optional).

12.1.4 Adjust vehicle weight to appropriate load condition as per test sequence.

12.2 Test Procedure

12.2.1 MAXIMUM DRIVE-THROUGH SPEED AND BRAKING SPEED DETERMINATION—With the vehicle centered within the lane, starting at 35 mph, attempt to drive through the curved 500-ft radius low Mu test lane at a constant speed. Increase or decrease speed in subsequent runs as necessary until the maximum drive-through speed is determined to the nearest whole mph increment. Do not exceed 40 mph. Verify maximum drive-through speed at least once by repeating runs at 1 mph above the previously determined value. Record maximum drive-through speed on data sheet. Take 75% of the maximum drive-through speed and round this value to the nearest whole mph increment to determine test speed for braking runs. Record on data sheet 3 (Figure 3).

12.2.2 BRAKING RUNS—With the vehicle centered within the lane and configured in the highway operational mode, make six full brake application stops as described in 3.11 from the test speed determined in the previous stop. Make the brake applications after the front end of the vehicle has traveled at least 60 ft in the curved lane on the test surface. Vehicle speed at which the brakes are applied should be within –0.5 to +1.0 mph of the target test speed.

12.2.3 Repeat braking runs with manual controlled driveline retarder (a) in other position (on/off).

12.3 Test Data Recording

12.3.1 Maximum drive-through speed

12.3.2 Initial braking speed

12.3.3 Initial brake temperature

12.3.4 Stopping distance

12.3.5 Brake application pressure or maximum pedal force or displacement

12.3.6 Treadle or Pedal application time

12.3.7 Deviation from lane boundaries

12.3.8 Lane boundary markers hit

12.3.9 Ambient temperature

12.3.10 Wind speed and direction

***13. Service Brake Stopping Distance Test*—**(Data Sheet 4) (See Figure 4.)

13.1 Test Preparation

13.1.1 Install the following additional instrumentation and equipment:

a. Method or device to measure or monitor individual wheel lock-up.
b. Pressure gauge/transducer to measure brake control line pressure (optional).
c. For hydraulic brake vehicles, force transducer to measure brake application force (optional).

13.1.2 Adjust brakes (optional).

13.1.3 Adjust vehicle weight to appropriate load condition as per test sequence.

13.2 Test Procedure

13.2.1 Conduct six stops from the initial speed listed in the test sequence on the straight lane high Mu test surface (dry Portland cement concrete or equivalent) while trying to achieve the shortest stopping distance while staying within the lane and with wheel lock-up (100% wheel slip) permitted only as follows:

a. At vehicle speeds above 20 mph, any wheel on a nonsteerable axle other than the two rearmost nonliftable, nonsteerable axles may lock up for any duration. The wheels on the two rearmost nonliftable, nonsteerable 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 lock-up occurring for a duration of 1 s or less.
d. At vehicle speeds of 20 mph or less, any wheels may lock up for any duration.

13.2.2 If the vehicle speed attainable in 2 miles is less than the required initial speed in the test sequence, the vehicle shall stop from a speed which is a multiple of 5 mph between 20 and 60 mph, that is 4 to 8 mph less than the speed attainable in 2 miles.

13.2.3 Repeat the test with manual controlled driveline retarders in other position (on/off).

13.3 Test Data Recording

13.3.1 Initial braking speed

13.3.2 Initial brake temperature

13.3.3 Stopping distance

13.3.4 Brake application pressure or maximum pedal force

13.3.5 Deviation from lane boundary

13.3.6 Individual wheel lock-up

13.3.7 Ambient temperature

13.3.8 Wind speed and direction

14. Air Brake Vehicles Emergency Brake Stopping Distance Test—(Data Sheet 5) (see Figures 5A through 5D.)

14.1 Test Preparation

14.1.1 Install the following additional instrumentation and equipment:

a. Solenoid valve in largest port in the appropriate air reservoir.
b. Pressure gauge/transducer to measure brake control line pressure (optional).

14.1.2 Adjust brakes (optional).

14.1.3 Adjust vehicle weight to appropriate load condition as per test sequence.

14.2 Test Procedure

14.2.1 Conduct six stops from the initial speed listed in the test sequence on the straight lane high Mu test surface (dry Portland cement concrete or equivalent) while trying to achieve the shortest stopping distance while staying in the lane under the following conditions;

a. Activate the solenoid valve to vent pressure to atmosphere.
b. Initiate the stop within 5 s after the low-pressure warning is activated.

NOTE—Wheel lock-up is permitted.

14.2.2 If the vehicle speed attainable in 2 miles is less than the required initial speed in the test sequence, the vehicle shall stop from a speed which is a multiple 5 mph between 20 and 60 mph, that is 4 to 8 mph less than the speed attainable in 2 miles.

14.2.3 Repeat the test with manual controlled driveline retarders in other position (on/off).

14.2.4 Repeat 14.2.1 through 14.2.3 for the primary and secondary system failures.

14.2.5 Repeat 14.2.1 through 14.2.3 for the primary control line failure (trucks and buses only).

14.2.6 Repeat the test with the solenoid in the trailer supply line and the trailer control line vented to atmosphere for trucks other than truck tractors that are also towing vehicles (GVWR only).

14.3 Test Data Recording

14.3.1 Initial braking speed

14.3.2 Initial brake temperature

14.3.3 Stopping distance

14.3.4 Brake application pressure or maximum pedal effort

14.3.5 Average deceleration rate

14.3.6 Deviation from lane boundary

14.3.7 Individual wheel lock-up

14.3.8 Ambient temperature

14.3.9 Wind speed and direction

15. Hydraulic Brake Vehicles Emergency Brake Stopping Distance Test—(Data Sheet 5) (see Figures 5A through 5D.)

15.1 Test Preparation

15.1.1 Install the following additional instrumentation and equipment:

a. Hydraulic valves to render (divert the fluid back to the reservoir) the primary and secondary system inoperative.
b. Pressure gauge/transducer to measure brake control line pressure (optional).
c. Force transducer to measure brake application force (optional).

15.1.2 Adjust brakes (optional).

15.1.3 Adjust vehicle weight to appropriate load condition as per test sequence.

15.2 Test Procedure

15.2.1 Conduct six stops from the initial speed listed in the test sequence on the straight lane high Mu test surface (dry Portland cement concrete or equivalent) while trying to achieve the shortest stopping distance while staying in the lane under the following conditions;

a. Transmission selector is in the control position, other than overdrive, recommended by the manufacture for driving on a level surface at the applicable test speed. To avoid engine stall during tests required to run in gear, a manual transmission may be shifted to neutral (or disengaged) when the vehicle speed decreases to 20 mph.
b. Activate the hydraulic valves to render (i.e., divert the fluid back to the reservoir) the appropriate system inoperative.
c. Initiate the stop after the appropriate system has been rendered inoperative.

NOTE—Wheel lock-up is permitted.

15.2.2 If the vehicle speed attainable in 2 miles is less than the required initial speed in the test sequence, the vehicle shall stop from a speed which is a multiple 5 mph between 20 and 60 mph, that is 4 to 8 mph less than the speed attainable in 2 miles.

15.2.3 Repeat the test with manual controlled driveline retarders in other position (on/off).

15.2.4 Repeat 15.2.1 through 15.2.3 for the other failed systems (i.e., primary, secondary, ABS, and power assist).

15.2.5 Restore the brake system to normal operation.

15.3 Test Data Recording

15.3.1 Initial braking speed

15.3.2 Initial brake temperature

15.3.3 Stopping distance

15.3.4 Brake application pressure or maximum pedal force

15.3.5 Average deceleration rate

15.3.6 Deviation from lane boundary

15.3.7 Individual wheel lock-up

15.3.8 Ambient temperature

15.3.9 Wind speed and direction

NOTE—For hydraulic-brake-equipped trucks and buses (non-school buses), utilize the reburnish procedure in 17.1 when required.

16. Parking Brake

NOTE—For air brake vehicles, the following procedures apply only to vehicles equipped with conventional spring-applied, air-release parking brake systems from which air is exhausted after actuation of the parking brake control.

16.1 Static Retardation Force Test (Drawbar Pull Test)—(Data Sheet 7) (see Figure 7.)

16.1.1 TEST PREPARATION

a. Adjust brakes per manufacturer's recommendations (optional).
b. Adjust vehicle weight to appropriate load condition as per test sequence.
c. For hydraulic brake vehicles, burnish the parking brake friction material per the manufacturer recommendations if not used during the service applications.
d. Install/prepare drawbar pull device, load cell, and wheel or driveline parking brake rotation measuring device or method.
e. For hydraulic brake school buses, force transducer for foot and/or hand control efforts.
f. Position vehicle on level dry Portland cement concrete or equivalent surface in line with pull cable. Connect pull cable and force measuring device so that cable is level within ±5 degrees.
g. Mark circumference of tire(s) on braked wheel(s) at point of tire/ground contact or driveline parking brake at one point on the drum or disc contact and at 90, 180, and 270 degrees from that point.

h. For air brake vehicles, disable spring brake chambers on axle(s) other than the axle being tested.
i. Place vehicle transmission in neutral.
j. For air brake vehicles, charge brake system reservoirs to compressor governor cut-out pressure.
k. Turn engine off.

16.1.2 TEST PROCEDURE

a. Warm the brakes per the specified IBT identified in 6.11 by making 40 to 20 mph snubs at 10 fpsps. Apply and hold service brakes at full pedal/treadle travel.
b. Apply parking brakes.
c. Hydraulic brake school buses with a GVWR > 10 000 lb apply the maximum allowable 150 lb to the foot control or 125 lb to the hand control parking brake.
d. Release service brakes.
e. Pull vehicle forward at a maximum rate of 4 ft/min until the wheel or driveline parking brake rotates 90 degrees. Release parking brakes.
f. Repeat 16.1.2.a through e, starting from 90, 180, and 270 degrees of wheel or driveline parking brake rotation.
g. Repeat 16.1.2.a through f, except pull the vehicle in the rearward direction. Warm brakes, if necessary, to achieve specified IBT.

16.1.3 TEST DATA RECORDING

a. Pull direction.
b. Parking brake temperature.
c. For hydraulic brake school buses, record foot and/or hand control force.
d. Record peak drawbar pull force for each 90 degrees of wheel or driveline parking brake rotation.
e. Record GVWR.

16.2 Grade Holding Test—(Data Sheet 6) (see Figure 6.)

16.2.1 TEST PREPARATION

a. Adjust brakes per manufacturer's recommendations (optional).
b. Adjust vehicle weight to appropriate load condition as per test sequence.
c. For hydraulic brake vehicles, burnish the parking brake friction material per the manufacturer recommendations if not used during the service applications.
d. Install/prepare device to measure vehicle movement on the grade.
e. Test Facility - A 20% (+1%/–0%) grade of dry smooth Portland cement concrete or equivalent.
f. For hydraulic brake school buses, force transducer for foot and/or hand control efforts.

NOTE— It is recognized that the weight of the truck-tractor/test trailer combination (GCW) is greater than the tractor GVWR. If the combination will not park on the test grade at the GCW, reduce the weight to equal truck-tractor GVWR and retest.

16.2.2 TEST PROCEDURE

a. Warm the brakes per the specified IBT identified in 6.11 by making 40 to 20 mph snubs at 10 fpsps.
b. Charge air brake system reservoirs to compressor governor cut-out pressure.
c. Ascend grade (dry Portland cement concrete or equivalent surface). Apply and hold service brakes at full pedal/treadle travel.
d. Place vehicle transmission in neutral.
e. Turn engine off.
f. Apply parking brakes.

g. Hydraulic brake school buses with a GVWR > 10 000 lb, apply a maximum of 150 lb to the foot control or 125 lb to the hand control parking brake. If the vehicle does not remain stationary, reapplication of the service brakes to hold the vehicle stationary, with reapplication of the force to the parking brake control at the level specified as appropriate for the vehicle being tested may be used twice to attain a stationary position.
h. Release service brakes.
i. Observe and record vehicle performance.
j. Repeat 16.2.2.a through i, except reposition the vehicle in the descending direction. Warm brakes, if necessary, to achieve specified IBT.

16.2.3 TEST DATA RECORDING

a. Parking direction.
b. Parking brake temperature.
c. For hydraulic brake school buses, record foot and/or hand control force.
d. Record movement of vehicle that takes place after release of service brakes until vehicle becomes stationary.
e. Record ability to hold vehicle stationary for 5 min.
f. Record GVWR.

17. Other Hydraulic Brake School Bus Tests

17.1 Hydraulic Re-Burnish - 1st, 2nd, and 3rd—(Data Sheet 9) (see Figure 9.)

17.1.1 TEST PREPARATION—Install the following instrumentation:

a. Thermocouple readout
b. Decelerometer
c. Speed measuring device or calibrate vehicle speedometer
d. Device to measure brake control line pressure (optional)
e. Device to measure brake application pedal force (optional)

17.1.2 TEST PROCEDURE—Conduct 35 snubs from 40 to 20 mph at 10 fpsps at 1 mile intervals. The test is conducted at GVWR.

17.1.3 TEST DATA RECORDING

a. Record 1st, 2nd, or 3rd reburnish test.
b. Record average brake application pedal force.
c. Record average deceleration rate.
d. Record initial brake temperature.

17.2 Hydraulic Fade and Recovery - 1st and 2nd—(Data Sheets 11 and 12) (see Figures 11 and 12.)

17.2.1 TEST PREPARATION

a. The 1st fade test follows the failed system stopping test, therefore, no additional test preparation is required. The test is conducted at GVWR.

17.2.2 BASELINE CHECK SNUBS TEST PROCEDURE

17.2.2.1 Conduct 3 snubs from 40 to 20 mph at 10 fpsps on the straight lane high Mu test surface (dry Portland concrete or equivalent) under the following conditions;

a. With the transmission in neutral or clutch depressed.
b. Measure the maximum brake control force. The IBT for each snub should be between 150 and 200 °F.
c. Average the maximum brake control force required for the 3 snubs (Average should be between 10 and 60 lb.)

17.2.3 FADE SNUBS TEST PROCEDURE

17.2.3.1 Conduct 10 snubs for 1st fade and 20 snubs for 2nd fade, from 40 to 20 mph at 10 fpsps on the straight lane high Mu test surface (dry Portland concrete or equivalent) under the following conditions;

a. With the transmission in neutral or clutch depressed.
b. Measure the maximum brake control force.
c. Before the first snub application, the IBT should be between 130 to 150 °F.
d. The required 10 fpsps deceleration should be obtained within 1 s and held at that rate for the entire snub.
e. Interval between snubs are to be 30 s (i.e., start of brake application to start of next brake application).
f. Record each snub's maximum brake control force and accelerate to 40 mph for the next snub.
g. After completing last snub, accelerate to 40 mph, and maintain for 1.5 miles, and move immediately to the recovery snubs (i.e., 17.2.4).

17.2.4 RECOVERY SNUBS TEST PROCEDURE

17.2.4.1 Conduct 5 snubs for 1st and 2nd recovery snubs, from 40 to 20 mph at 10 fpsps on the straight lane high Mu test surface (dry Portland concrete or equivalent) under the following conditions;

a. After the 1.5 miles in 17.2.3.1.g, make 5 snubs from 40 to 20 mph at 10 fpsps at 1.5 mile intervals.
b. Record the maximum brake control force.
c. Brake control force requirements.
d. Maximum

   1. First 4 snubs – 150 lb.
   2. Last snub – 20 lb over baseline average, no greater than 100 lb.

e. Minimum

   1. 10 lb less than baseline average or
   2. Baseline average times 0.60
   3. Use the lowest value or the two above. The minimum not to be below 5 lb.

17.2.5 TEST DATA RECORDING

17.2.5.1 Baseline

a. Record 1st or 2nd baseline.
b. Record maximum brake application pedal force.
c. Record deceleration rate.
d. Record initial brake temperature.

17.2.5.2 Fade

a. Record 1st or 2nd fade test.
b. Record initial speed.
c. Record maximum brake application pedal force.
d. Record deceleration rate.
e. Record snub time interval.
f. Record initial brake temperature.

17.2.5.3 Recovery

a. Record 1st or 2nd recovery test.
b. Record maximum brake application pedal force.
c. Record deceleration rate.
d. Record initial brake temperature.

17.3 Hydraulic Water Recovery—(Data Sheet 13) (see Figure 13.)

17.3.1 TEST PREPARATION

a. The water recovery follows the fade and recovery tests, therefore, no additional test preparation is required. The test is conducted at GVWR.

17.3.2 BASELINE CHECK STOPS TEST PROCEDURE

17.3.2.1 Conduct 3 stops from 30 mph at 10 fpsps on the straight lane high Mu test surface (dry Portland concrete or equivalent) under the following conditions;

a. With the transmission in neutral or clutch depressed.
b. Measure the maximum control force. Control force readings may be terminated when vehicle speed falls to 5 mph.
c. The IBT for each stop should be between 150 and 200 °F.
d. Average the maximum brake control force required for the 3 stops.

17.3.3 WET BRAKE RECOVERY STOPS TEST PROCEDURE

17.3.3.1 Conduct 5 stops from 30 mph at 10 fpsps on the straight lane high Mu test surface (dry Portland concrete or equivalent) under the following conditions;

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

17.3.4 TEST DATA RECORDING

17.3.4.1 Baseline

a. Record initial brake temperature.
b. Record initial speed.
c. Record stopping distance.
d. Record maximum brake application pedal force.
e. Record average deceleration rate.
f. Record deviation from the lane.
g. Record wheel lock-up.

17.3.4.2 Water Recovery Stops

a. Record initial brake temperature.
b. Record initial speed.
c. Record stopping distance.
d. Record maximum brake application pedal force.
e. Record average deceleration rate.
f. Record deviation from the lane.
g. Record wheel lock-up.

18. Final Inspection

18.1 Air Brake Vehicles—Inspect the following and record results in Data Sheet 8 (see Figure 8.)

a. Brake system for structural integrity.
b. Verify that all brake lines are connected and brakes operate.
c. Verify brake adjustment is within manufacturer limits.

18.2 Hydraulic Brake Vehicles—Inspect the following and record results in Data Sheet 10 (see Figure 10.)

a. Service brake system for detachment or fracture of any components, such as brake springs and brake shoes or disc pad facing.
b. Friction surface of the brake, the master cylinder or brake power unit reservoir cover and seal and filler openings, for leakage of brake fluid or lubricant.
c. Drums or rotors are assumed to be at nominal design drum diameter or rotor thickness.
d. Linings are assumed adjusted for normal operating clearance in the release.

Test No.: _____ Test Date(s) - From: _____ To: _____
Test Organization: _____ Test Location: _____
Make: _____ Type: _____ Model: _____
VIN: _____ D.O.M.: _____ Wheelbase, in.: _____ GVWR, lbs.: _____
CG Ht. (in. above ground) – Unloaded Chassis: _____ @ LLVW: _____ @ GVWR: _____
CG Ht. (in. above 5th Wheel) Trailer Ballast: _____ CG Ht. (in. above top of frame)Truck Ballast: _____
Axle Configuration[1]: _____ Retarder(s) Type(s): _____

Foundation Brakes:

Axle	Type[2]	Make	Size (in)	Lining Make	Lining Edge Code
1					
2					
3					
4					
5					
6					
7					

Brake Drum /Rotor

Axle	Type[3]	Make	Weight (lbs.)	Dust Shields (Y/N)
1				
2				
3				
4				
5				
6				
7				

Air Actuation Details:

Axle	Air Chambers Make	Air Chambers Type[4]	Slack Adjusters Length or Wedge Angle	Slack Adjusters Make	Slack Adjusters Cam Rotation[5]
1					
2					
3					
4					
5					
6					
7					

ABS

Make: _____ Model: _____ Config: _____ Axles Sensed[6]: ____ , ____ , ____

FIGURE 1A—DATA SHEET 1—VEHICLE INFORMATION

Hydraulic Actuation Details:

Axle	Disc Calipers Make	Size	Wheel Cylinder Make	Size	
1					
2					

Power Unit: Hydraulic, Vacuum, etc.: _____

Brake Power Assist Unit: Yes _____ No _____

Brake Power Unit w/Accumulator: Yes _____ No _____

Power Assist or Power Unit w/Backup: Yes _____ No _____

Variable Proportioning System: Yes _____ No _____

Parking Mechanism: Yes _____ No _____

Description: Friction-Type Parking Brake: _____

Non-Service Brake Type Parking Brake: _____

Master Cylinder Diameter: _____

Pedal Ratio: _____

Describe Hydraulic Circuit Split: _____

Air System:

Compressor Capacity (cfm): _____ Cut-out (psi): _____ Cut-in (psi): _____

Air Dryer – Make: _____ Model: _____ Type: _____

Regen. Valve Pressure Drop, psi: _____ Valve Location (circuit) : _____

Valve Crack Pressures & Treadle Differential (psi)[7] Axle 1: _____ Axle 2: _____ Axle 3: _____

Axle 4: _____ Axle 5: _____ Axle 6: _____ Axle 7: _____ Treadle: _____

Bobtail Proportioning (Y/N): _____ Front Axle Limiting (Y/N): _____

Spring Brake Inversion Valve Make: _____ Model: _____ Axles Controlled: _____

Specifics Regarding Air Brake System Components: _____

Air Tank Volumes, (cu. in.):

Supply: _____ Primary: _____ Secondary: _____

Auxiliary: _____ Isolated From Service? _____

Hydraulic System:

Reservoir Volume _____

Steering Pump Output (psi) at Idle Engine Speed: _____

Flow (gpm) at Idle Engine Speed: _____

Pedal Valve: _____

Specifics Regarding Hydraulic Brake System Components: _____

FIGURE 1B—DATA SHEET 1—VEHICLE INFORMATION (CONTINUED)

Axles/Suspensions

Axle	Type[8]	O.A. Width[9]	Dist. To Steer Axle	Liftable (Y/N)	Suspension Description Type	Suspension Description Make	Suspension Description Model
1							
2							
3							
4							
5							
6							
7							

Tires:

Axle	No. per Axle	PSI	Size	Make	Model	Data Book SLR (in)
1						
2						
3						
4						
5						
6						
7						

Fifth Wheel:

Fifth Wheel Height Relative to Ground Unladen (in): _____ Fifth Wheel Position(in)[10]: _____

Special Conditions:

Special conditions or equipment which might affect brake performance: _____

Weights (lbs.):

Axle No(s).	LLVW	Burnish	Fully Loaded	GAWR
Subtotal	N/A			
Trailer	N/A			
Total				

Footnotes for Vehicle Information Sheets (pages 22-24):

[1] 4x2, 6x4, 10x4,etc.
[2] Cam, disc, wedge, etc.
[3] Cast or composite drum, vented or non-vented rotor, etc.
[4] Size; If piston type follow size with "P"; If long stroke diaphragm type follow with "L"
[5] Same or opposite to forward wheel rotation
[6] Number of the axle where sensors are located
[7] Total crack pressures between treadle valve and brake chambers
[8] Steer, drive, pusher, tag
[9] Measured as per SAE J693
[10] Relative to rear drive axle(s) centerline ("+ "= ahead, "-" = behind)

FIGURE 1C—DATA SHEET 1—VEHICLE INFORMATION (CONTINUED)

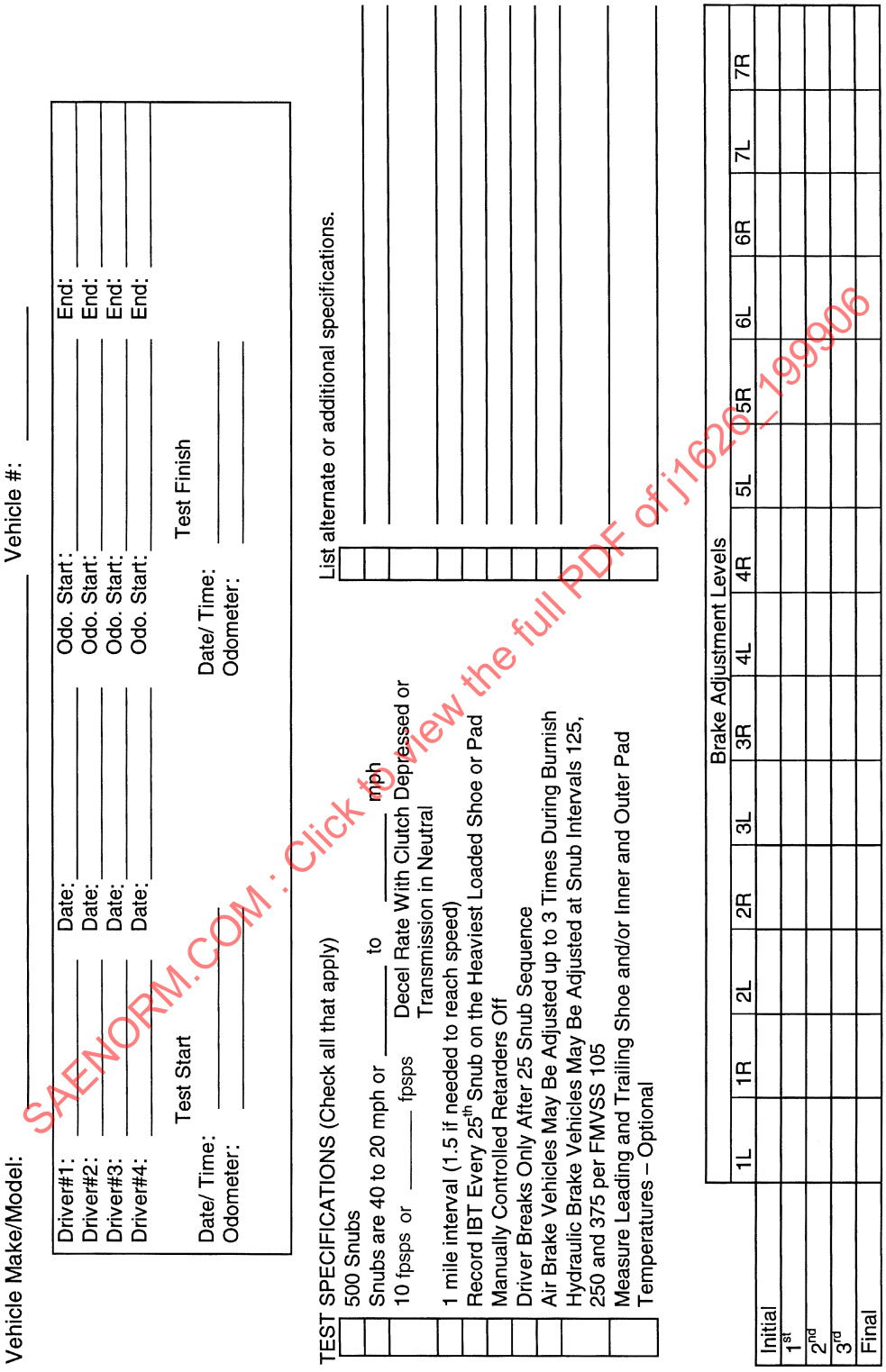

FIGURE 2A—DATA SHEET 2—BURNISH

FIGURE 2B—DATA SHEET 2—BURNISH (CONTINUED)

Vehicle Make/Model: _____ Vehicle #: _____

Snub #	Initial Speed Mph	Average Cntr. Pres. (psi) And/Or Max Pedal Force (lb.)	Decel fpsps	Initial Brake Temperatures °F												Amb. Temp °F	Driver Initials	Time	Comments
				1LL or 1LI	1LT or 1LO	1RL or 1RI	1RT or 1RO	2LL or 2LI	2LT or 2LO	2RL or 2RI	2RT or 2RO	3LL or 3LI	3LT or 3LO	3RL or 3RI	3RT or 3RO				
1	40																		
25	40																		
50	40																		
75	40																		
100	40																		
125	40																		
150	40																		
175	40																		
200	40																		
225	40																		
250	40																		
275	40																		
300	40																		
325	40																		
350	40																		
375	40																		
400	40																		
425	40																		
450	40																		
475	40																		
500	40																		

COMMENTS: _____

Note: 1LL – Axle 1 Left Leading Shoe
1LT – Axle 1 Left Trailing Shoe
1LI – Axle 1 Left Inner Pad
1LO – Axle 1 Left Outer Pad

Vehicle: _____ GVWR: _____ LLVW: _____
Date: _____ Driver: _____ Observer: _____

TEST SPECIFICATIONS:

- Check Brake Adjustment (optional)
- Check Tire Pressure
- Vehicle Configuration in Highway Operational Mode
- Max. Drive-Through Speed (nearest whole mph):
- 75% of Max. Drive-Through Speed (nearest whole mph):
- Braking Runs at 30 mph or 75% Max. Drive-Through Speed:
- IBT 150 to 200°F
- Clutch Depress or Transmission in Neutral
- Full Brake Application
- Vehicle in Center of Lane at Start
- Manually Controlled Retarder: ON _____ OFF _____
  N/A _____

Stop	IBT (°F)	Initial Speed (mph)	Stopping Distance Actual (ft)	Stopping Distance Corr. Per SAE J299	Application Press. (psi) or Pedal Force (lb.)	Apply Time (sec)	Approx. Dist. Out of Lane (ft)	No. Markers Hit	Comments
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

Note: First four stops are at 75% maximum drive through speed.

Time	Date	AMB °F	Wind Speed, mph	Wind Direction	Odometer
Start:					
Finish:					

Comments: _____

FIGURE 3—DATA SHEET 3—STABILITY AND CONTROL TEST

Vehicle: _____ GVWR: _____ LLVW: _____
Date: _____ Driver: _____ Observer: _____

TEST SPECIFICATIONS:

- Check Brake Adjustment (optional)
- Check Tire Pressure
- 60 mph Air and Hydraulic Service Brake Stops or 30 and 60 mph Hydraulic Service Brake School Bus Stops
- IBT 150 to 200°F
- Clutch Depressed or Transmission in Neutral
- Brakes Can Be Modulated
- Vehicle in Center of Lane at Start
- Manually Controlled Retarder: ON _____ OFF _____
  N/A _____

60 mph Air and Hydraulic Service Brake Stops or 30 and 60 mph Hydraulic Service Brake School Bus Stops

Stop	IBT (°F)	Initial Speed (mph)	Stopping Distance Actual (ft)	Corrected Stopping Distance Per SAEJ299	Application Pressure (psi) or Max. Pedal Force (lb.)	Avg. Decel (fpsps)	In 12 ft Lane Yes or No	Approx. Distance Out-of-Lane (ft.)	Wheel Lock-Up Indication
1									
2									
3									
4									
5									
6									

	Date	AMB °F	Wind Speed	Wind Direction	Odometer
Start:					
Finish:					

Comments: _____

FIGURE 4—DATA SHEET 4—AIR AND HYDRAULIC SERVICE BRAKE STOPPING

Vehicle: _____ GVWR: _____ LLVW: _____
Date: _____ Driver: _____ Observer: _____

TEST SPECIFICATIONS:

- Check Brake Adjustment (optional)
- Check Tire Pressure
- 60 mph Air or Hydraulic Emergency Brake Stops
- IBT 150 to 200°F
- For Air Brake Vehicles, Clutch Depressed or Transmission in Neutral
- For Hydraulic Brake Vehicles, Transmission Selector is in the Control Position (i.e., in gear) Until Speed Decreases to 20 MPH.
- Brakes Can Be Modulated
- Vehicle in Center of Lane at Start
- Manually Controlled Retarder: ON _____ OFF _____
  N/A _____

60 mph Air or Hydraulic Emergency Brake Stops
Primary Air and Hydraulic System Failure

Stop	IBT (°F)	Initial Speed (mph)	Stopping Distance Actual (ft)	Corrected Stopping Distance Per SAEJ299	Application Pressure (psi) or Max. Pedal Force (lb.)	Avg. Decel (fpsps)	In 12 ft Lane Yes or No	Approx. Distance Out-of-Lane (ft.)	Wheel Lock-Up Indication
1									
2									
3									
4									
5									
6									

	Date	AMB °F	Wind Speed	Wind Direction	Odometer
Start:					
Finish:					

Comments: _____

FIGURE 5A—DATA SHEET 5—AIR AND HYDRAULIC EMERGENCY BRAKE STOPPING

Vehicle: _____ GVWR: _____ LLVW: _____
Date: _____ Driver: _____ Observer: _____

60 mph Air or Hydraulic Emergency Brake Stops
Secondary Air and Hydraulic System Failure

Stop	IBT (°F)	Initial Speed (mph)	Stopping Distance Actual (ft)	Corrected Stopping Distance Per SAEJ299	Application Pressure (psi) or Max. Pedal Force (lb.)	Avg. Decel (fpsps)	In 12 ft Lane Yes or No	Approx. Distance Out-of-Lane (ft.)	Wheel Lock-Up Indication
1									
2									
3									
4									
5									
6									

	Date	AMB °F	Wind Speed	Wind Direction	Odometer
Start:					
Finish:					

Comments: _____

Vehicle: _____ GVWR: _____ LLVW: _____
Date: _____ Driver: _____ Observer: _____

60 mph Air Emergency Brake Stops – Primary Control Line Failure (Truck and Bus Only)

Stop	IBT (°F)	Initial Speed (mph)	Stopping Distance Actual (ft)	Corrected Stopping Distance Per SAEJ299	Application Pressure (psi)	Avg. Decel (fpsps)	In 12 ft Lane Yes or No	Approx. Distance Out-of-Lane (ft.)	Wheel Lock-Up Indication
1									
2									
3									
4									
5									
6									

	Date	AMB °F	Wind Speed	Wind Direction	Odometer
Start:					
Finish:					

Comments: _____

FIGURE 5B—DATA SHEET 5—AIR AND HYDRAULIC EMERGENCY BRAKE STOPPING (CONTINUED)

Vehicle: _____ GVWR: _____ LLVW: _____
Date: _____ Driver: _____ Observer: _____

60 mph Air Emergency Brake Stops - Trailer Supply Line

Stop	IBT (°F)	Initial Speed (mph)	Stopping Distance Actual (ft)	Corrected Stopping Distance Per SAEJ299	Application Pressure (psi)	Avg. Decel (fpsps)	In 12 ft Lane Yes or No	Approx. Distance Out-of-Lane (ft.)	Wheel Lock-Up Indication
1									
2									
3									
4									
5									
6									

	Date	AMB °F	Wind Speed	Wind Direction	Odometer
Start:					
Finish:					

Comments: _____

Vehicle: _____ GVWR: _____ LLVW: _____
Date: _____ Driver: _____ Observer: _____

60 mph Inoperative Power Assist Hydraulic Service Brake Stops

Stop	IBT (°F)	Initial Speed (mph)	Stopping Distance Actual (ft)	Corrected Stopping Distance Per SAEJ299	Application Pressure (psi) or Max. Pedal Force (lb.)	Avg. Decel (fpsps)	In 12 ft Lane Yes or No	Approx. Distance Out-of-Lane (ft.)	Wheel Lock-Up Indication
1									
2									
3									
4									

	Date	AMB °F	Wind Speed	Wind Direction	Odometer
Start:					
Finish:					

Comments: _____

FIGURE 5C—DATA SHEET 5—AIR AND HYDRAULIC EMERGENCY BRAKE STOPPING (CONTINUED)

Vehicle: _____ GVWR: _____ LLVW: _____
Date: _____ Driver: _____ Observer: _____

ABS Inoperative Hydraulic Service Brake Stops

Stop	IBT (°F)	Initial Speed (mph)	Stopping Distance Actual (ft)	Corrected Stopping Distance Per SAEJ299	Application Pressure (psi) or Max. Pedal Force (lb.)	Avg. Decel (fpsps)	In 12 ft Lane Yes or No	Approx. Distance Out-of-Lane (ft.)	Wheel Lock-Up Indication
1									
2									
3									
4									

	Date	AMB °F	Wind Speed	Wind Direction	Odometer
Start:					
Finish:					

Comments: _____

FIGURE 5D—DATA SHEET 5—AIR AND HYDRAULIC EMERGENCY BRAKE STOPPING (CONTINUED)

Vehicle: _____ GVWR: _____ LLVW: _____
Date: _____ Driver: _____ Observer: _____

TEST SPECIFICATIONS:

- Check Parking Brake Adjustment (optional)
- Parking Brake Temperature Between 150 to 200°F
- Hold on Grade With Full Application of Service Brake
- Place Transmission in Neutral
- Turn Engine Off and Apply Parking Brake
- Release Service Brakes
- Hydraulic brake type buses with a GVWR > 10 000 lb. apply a maximum allowable 150 lb. to the foot control or 125 lb. to the hand control parking brake.

		Parking Brake Temperature	Movement to Become Stationary on Grade (inches)	Stationary on Grade for 5 min. Yes or No	Foot or Hand Ctrl Force (lb.)
Test 1	Up Grade				
	Down Grade				
Test 2	Up Grade				
	Down Grade				

Date	AMB °F	Wind Speed, MPH	Wind Direction	Odometer, miles

Comments: _____

FIGURE 6—DATA SHEET 6—GRADE HOLDING PARKING BRAKE

Vehicle: _____ GVWR: _____
Date: _____ Driver: _____ Observer: _____

TEST SPECIFICATIONS:

- Check Parking Brake Adjustment (optional)
- Disable Spring Brake Chambers on Axles Not Being Tested
- Transmission in Neutral
- Full Apply of Service Brake Before Applying Parking Brake (release service brake before drawbar pull)
- For Air Brake Vehicles, Parking Brake Temperature Between 150 to 200°F
- For Hydraulic Brake School Buses, Parking Brake Temperature Shall Not Be More Than 150°F.
- Hydraulic Brake School Buses With a GVWR > 10 000 lb. Apply a Maximum Allowable 150 lb. to the Foot Control or 125 lb. to the Hand Control Parking Brake.

AXLE#:_____ DRAWBAR PULL – PEAK FORCE DURING WHEEL OR DRIVELINE PARKING BRAKE ROTATION:

Parking Brake Temperature Before Forward Pull:_____ Before Reverse Pull:_____

Pull Direction	0-90° Rotation Pull Force (lb.)	Foot or Hand Ctrl Force (lb.)	90-180° Rotation Pull Force (lb.)	Foot or Hand Ctrl Force (lb.)	180-270° Rotation Pull Force (lb.)	Foot or Hand Ctrl Force (lb.)	270-360° Rotation Pull Force (lb.)	Foot or Hand Control Force (lb.)
Forward								
Reverse								

Parking Brake Temperature After Forward Pull:_____ After Reverse Pull:_____

AXLE#:_____ DRAWBAR PULL – PEAK FORCE DURING WHEEL OR DRIVELINE PARKING BRAKE ROTATION:

Parking Brake Temperature Before Forward Pull:_____ Before Reverse Pull:_____

Pull Direction	0-90° Rotation Pull Force (lb.)	Foot or Hand Ctrl Force (lb.)	90-180° Rotation Pull Force (lb.)	Foot or Hand Ctrl Force (lb.)	180-270° Rotation Pull Force (lb.)	Foot or Hand Ctrl Force (lb.)	270-360° Rotation Pull Force (lb.)	Foot or Hand Control Force (lb.)
Forward								
Reverse								

Parking Brake Temperature After Forward Pull:_____ After Reverse Pull:_____

GVWR:_____

Comments:_____
_____
_____

FIGURE 7—DATA SHEET 7—STATIC RETARDATION FORCE PARKING BRAKE