

SURFACE VEHICLE RECOMMENDED PRACTICE

J1626™-2

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Superseding J1626-2 JAN2017

Recommended Practice for Braking, Stability, and Control Performance
Test Procedure for Air-Brake-Equipped Trucks and Buses

RATIONALE

This SAE Recommended Practice is intended as a guide toward industry practice and subject to change so as to keep pace with experience and technical advances. The usage of this recommended practice is limited to trucks and buses equipped with air brake systems with a GVWR greater than 10000 pounds.

This document has been modified from SAE J1626-1 truck tractor to incorporate air brake equipped trucks and buses test procedure. The following sections were modified; changed all truck tractor wording to trucks and buses throughout the document, 3.1 definitions add trucks and buses, 3.5 was removed based on combination weight not applicable, 3.7.1 was removed based on tractor trailer combination not applicable and modified for trucks and buses, 3.13 remove unbraked control trailer not applicable, 6.8 removed control trailer reservoir not applicable, 6.13 and 8.2.2 removed the additional brake adjustment at the completion of the 500 snub burnish not applicable with trucks and buses, Section 7 test sequence was modified to follow FMVSS 121 truck and bus sequence, 8.1.3 truck and bus loading changes, 9.1.3, 10.1.2 and 11.1.2 removed brake adjustments not applicable, 9.1.1 corrected 20 foot cone spacing, 9.2.1 changed 35 to 30 mph and changed 44 to 40 mph, 9.2.2 corrected reference 3.9 to 3.8, 11.2.1a removed the word "only," Figure 5D removed LLVW, and corrected all header spacing between two-digit section number and header. Figures (data sheets) removed trailer ballast C.G. height measurement, bobtail proportional and fifth wheel height not applicable.

SAE J1626-2 has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

This Recommended Practice provides a road test procedure for trucks and buses, to evaluate their compliance with Federal Motor Vehicle Safety Standard (FMVSS) 121; Air Brake Systems. Units of measure are English in lieu of metric to be consistent with FMVSS 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 issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J293 Truck and Bus Grade Parking Performance Requirements

SAE J299 Stopping Distance Test Procedure

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SAE WEB ADDRESS:

Full document details: SAE J1626_2_202304

For more information on this standard, visit
https://www.sae.org/standards/content/J1626/2_202304/

Documents

Document Sharing Hub

SAE J360	Truck and Bus Grade Parking Performance Test Procedure
SAE J693	Truck Overall Widths Across Dual Tires
SAE J971	Brake Power Rating Test Code - Commercial Vehicle Inertia Dynamometer
SAE J1626	Braking, Stability, and Control Performance Test Procedures for Air and Hydraulic Brake Equipped Trucks, Truck Tractors and Buses
SAE J1626-1	Recommended Practice for Braking, Stability, and Control Performance Test Procedure for Air-Brake-Equipped Truck-Tractors
SAE J1729	Parking Brake Drawbar Pull Test Procedure - Truck and Bus
SAE J2503	Drawbar Pull Performance Criteria

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E1136	Specification for a Radial Standard Reference Test Tire
ASTM E1337	Standard Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using a Standard Reference Test Tire

2.1.3 FMVSS Publication

Available from U.S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328.

FMVSS 121	Air Brake Systems
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3. DEFINITIONS

3.1 TRUCKS AND BUSES

3.1.1 For the purpose of this standard, a truck is a motor vehicle designed to transport cargo.

3.1.2 For the purpose of this standard, a bus is a motor vehicle designed to transport people.

3.2 SNUB

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

3.3 STOPPING DISTANCE

Means the distance traveled by a vehicle from the point of application of force to the brake control to the point at which the vehicle reaches a complete stop (0 mph).

3.4 UNLOADED VEHICLE WEIGHT (UVW)

Is the weight of a motor vehicle with standard equipment, maximum capacity of engine fuel, oil, and coolant.

3.5 GROSS AXLE WEIGHT RATING (GAWR)

Is 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.

3.6 GROSS VEHICLE WEIGHT RATING (GVWR)

- 3.6.1 Is 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. The ballast center of gravity height should be at the vehicle manufacturer's recommendations. Actual vehicle test weight is to be within +2/-0% of the specified weight. Axle weights are to be within $\pm 2\%$ of their proportional share of the test weight.

3.7 LIGHTLY LOADED VEHICLE WEIGHT (LLVW)

- 3.7.1 Truck LLVW is the unloaded vehicle weight (UVW) plus up to 500 pound including driver, observer, and instrumentation. An additional 1000 pound can be allotted for vehicles that require a roll bar for testing purposes. Liftable axles shall be lifted for LLVW vehicle tests.
- 3.7.2 Bus LLVW is the unloaded vehicle weight (UVW) plus up to 500 pound including driver, observer, and instrumentation. An additional 1000 pound can be allotted for vehicles that require a roll bar for testing purposes. Liftable axles shall be lifted for LLVW vehicle tests.

3.8 FULL BRAKE APPLICATION

- 3.8.1 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 seconds after application is initiated.

3.9 INITIAL BRAKE TEMPERATURE (IBT)

Means the average temperature of the service brakes on the hottest axle of the vehicle 0.2 mile before any brake application.

3.10 MAXIMUM DRIVE - THROUGH SPEED

Means the highest possible constant speed at which the vehicle can be driven through 200-foot arc of a PFC no greater than 0.5 in a 500-foot radius curve without leaving the 12-foot lane width.

3.11 PEAK FRICTION COEFFICIENT (PFC)

Means 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 E1337.

3.12 WHEEL LOCKUP

Means 100% wheel slip.

3.13 ANTILOCK BRAKE SYSTEM (ABS)

Means 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 Anemometer or equivalent device 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.
- 4.2 Ambient temperature device to record ambient test temperatures, 32 to 100 °F range with ± 0.5 °F accuracy at 70 °F, maximum non-linearity ± 1.0 °F over the range, and visual output resolution of 1 °F.
- 4.3 Tire pressure gauge, $\pm 1.0\%$ of indicated value.
- 4.4 Brake lining thermocouples, ± 10.0 °F at 300 °F, maximum non-linearity of ± 20 °F over the range and visual output resolution of 5 °F, installed per SAE J971, and display for brake lining temperature.
- 4.5 Fifth wheel, optical or other equivalent device to measure and display (or record) vehicle speed, ± 0.5 mph, and stopping distance accuracy of 1% of indicated value, and visual output resolution of 0.1 feet.
- 4.6 A device to indicate first brake control (treadle or brake pedal) movement, $\pm 1.0\%$ of indicated value, and full brake control displacement, or brake control pressure, $\pm 1\%$ of indicated value, versus time, capable of 0.1 second resolution.
- 4.7 Wheel lockup detector or equivalent measuring device providing an electrical indication of wheel rotation (or wheel lockup) to a continuous recorder or digital data recorder. The lockup detector or measuring system must provide an indication for wheels that lockup above 10 mph, +1 mph, -0 mph. Measure wheel velocity or identify wheel lockup of 1 second duration or more.
- 4.8 Decelerometer or equivalent device to measure vehicle deceleration rate, 1G range with ± 0.5 ft/s² (feet per second per second) accuracy at 32.2 ft/s², maximum non-linearity of ± 0.5 ft/s² over the range, and visual output resolution of 0.5 ft/s².
- 4.9 Solenoid valve(s) with a 0.5 (+0.1/-0.0) in diameter ports and/or with equivalent exhaust capacity to deplete the reservoir with the air compressor charging at engine RPM to attain vehicle test speed.
- 4.10 Pressure, $\pm 1.0\%$ of the indicated value, for measuring brake control pressure and system pressure.
- 4.11 Static Retardation Force (Drawbar Pull) Parking Brake Test
Refer to SAE J1729 for required instrumentation and equipment.
- 4.12 Grade Holding Parking Brake Test
Refer to SAE J360 for required instrumentation and equipment.
- 4.13 Weighing scales, $\pm 1.0\%$ of indicated weight.
- 4.14 A continuous recorder, i.e., an oscillograph or computer utilizing a digital data acquisition system and/or equivalent system, to make a permanent, supplemental record of service brake pedal application, parking brake force, deceleration, individual wheel lockup, brake lining temperatures, distance and speed versus time, with the same accuracies as the above direct reading instrumentation or as otherwise indicated.

5. VEHICLE INFORMATION

The vehicle information will be contained on Data Sheet 1.

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. Stops must not be performed with a tail wind component in excess of 5 mph.
- 6.3 Unless otherwise specified, the transmission shall be in the highest gear appropriate for a speed of 40 mph during burnish snubs and test stops conditioning.
- 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-foot (+0/-2 inch) wide roadway with a PFC no greater 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-foot (+0/-2 inch) wide lane curved on a 500-foot radius (to lane centerline) on a surface with a PFC no greater than 0.5. The arc length must be at least 300 foot. A 100-foot approach to the arc is recommended to properly align the vehicle to the lane. Lane boundaries are defined by 12 to 18-inch-high vertical markers (such as cones) on a 20-foot spacing with the inside edge of the markers placed on the 12-foot wide lane boundaries.
- 6.8 Roadway shall be flat with no more than a 1% grade in all directions, including crown.
- 6.9 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).
- 6.10 Initial Brake Temperature (IBT)

Reference 3.9 for definition. The IBT must be between 150 and 200 °F for each stability and control, service, emergency stops and parking brake tests. Warm brakes to the required temperature by making 40 to 20 mph snubs at 10 ft/s².

- 6.11 Automatic adjusters must remain activated for the duration of the test.
- 6.12 Unless otherwise specified, the brakes may be adjusted up to three times during the burnish procedure, at intervals specified by the vehicle manufacturer, in accordance with the vehicle manufacturer's recommendation.
- 6.13 Individual brake lining temperatures should be less than 200 °F when being adjusted or checked.
- 6.14 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.
- 6.15 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.
- 6.16 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.
- 6.17 The driver may steer as necessary to stay within the lane.
- 6.18 Vehicle speed shall be within +0, -2 mph and stopping distance corrected per SAE J299.



6.19 The static retardation (drawbar pull) tests shall be conducted per SAE J1729 and SAE J2503.

6.20 The grade holding tests shall be conducted per SAE J360 and SAE J293.

7. TEST SEQUENCE – AIR BRAKE TRUCKS AND BUSES

7.1 Burnish (Section 8 and Data Sheet 2).

7.2 Stability and control test at GVWR (Section 9 and Data Sheet 3). This test is optional and not required.

7.3 Service brake GVWR stopping distance test at 60 mph (Section 10 and Data Sheet 4).

7.4 Emergency brake GVWR stopping distance test at 60 mph (Section 11 and Data Sheet 5).

7.4.1 Emergency brake GVWR primary system only stopping distance test at 60 mph.

7.4.2 Emergency brake GVWR secondary system only stopping distance test at 60 mph.

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

7.4.4 Emergency brake GVWR trailer supply line failure and the trailer control line vented to atmosphere for trucks designed for towing vehicles stopping distance test at 60 mph.

7.4.5 Emergency brake GVWR middle reservoir failure for articulated buses with three axles stopping distance test at 60 mph.

7.5 “Grade holding” parking brake test at GVWR¹ (Section 12 and SAE J360, optional).

7.6 “Static retardation force” (drawbar pull) parking brake test at GVWR¹ (Section 12 and SAE J1729).

7.7 Stability and control test at LLVW (Section 9 and Data Sheet 3).

7.8 Manual adjustment of the brakes per the manufacturer’s recommendations (Data Sheet 4).

7.9 Service brake LLVW stopping distance test at 60 mph (Section 10 and Data Sheet 4).

7.10 Emergency brake LLVW stopping distance test at 60 mph (Section 11 and Data Sheet 5);

7.10.1 Emergency brake LLVW primary system only stopping distance test at 60 mph.

7.10.2 Emergency brake LLVW secondary system only stopping distance test at 60 mph.

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

7.10.4 Emergency brake LLVW middle reservoir failure for articulated buses with three axles stopping distance test at 60 mph.

7.11 “Grade holding” parking brake test at LLVW¹ (Section 12 and SAE J360, optional).

7.12 Final inspection (Section 13 and Data Sheet 6).

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. BURNISH (DATA SHEET 2)

8.1 Test Preparation

8.1.1 Install brake lining thermocouples per SAE J971.

8.1.2 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)

8.1.3 Trucks or Buses shall be loaded to GVWR per Section 3.

8.1.4 The vehicle brakes should be adjusted prior to burnish per the vehicle manufacturer's recommendation.

8.2 Test Procedure

8.2.1 Burnish the brakes by making 500 snubs between 40 and 20 mph at a deceleration rate of 10 ft/s², or at the vehicle's maximum deceleration rate if less than 10 ft/s², with the transmission in the highest gear appropriate for a speed of 40 mph (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.

8.2.2 The vehicles brakes may be adjusted as specified by the vehicle manufacturer up to three times during the burnish procedure, in accordance with the vehicle manufacturer's recommendation. Record adjustment data on data sheets.

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

8.2.4 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.

8.3 Test Data Recording

Brake lining temperatures and brake application pressure to maintain a 10 ft/s² decel should be recorded at each 25th brake snub (pressure optional).

9. STABILITY AND CONTROL TEST PROCEDURE (DATA SHEET 3)

9.1 Test Preparation

9.1.1 Stability and control tests are performed on a 12-foot (+0/-2 inch) wide lane curved on a 500-foot radius (to lane centerline) on a surface with a PFC no greater than 0.5. The arc length must be at least 300 foot. A 100-foot approach to the arc is recommended to properly align the vehicle to the lane. Lane boundaries are defined by 12 to 18-inch-high vertical markers (such as cones) on a 20 foot spacing with the inside base edge of the markers placed on the 12 foot wide lane boundaries.

9.1.2 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.
- d. Recording device to record start of braking and primary control line pressure (or full brake control displacement) as a function of time.

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

9.2 Test Procedure

9.2.1 Maximum Drive-Through Speed and Braking Speed Determination

With the vehicle centered within the lane, starting at 30 mph, attempt to drive through the curved 500-foot radius wet surface with a PFC not greater than 0.5 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 test facility course maximum recommended speed (i.e., suggested maximum 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 compliance braking runs. Record on data sheet. Conduct additional brake test runs to determine the maximum achieved braking speed while remaining within the 12 foot lane width. Record on data sheet.

9.2.2 Braking Runs

With the vehicle centered within the lane and configured in the highway operational mode, make four full brake application stops as described in 3.8 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 foot 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.

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

9.2.4 Repeat braking runs as described in 9.2.2 and 9.2.3 to determine the maximum achieved braking speed.

9.3 Test Data Recording

9.3.1 Maximum drive-through speed.

9.3.2 Initial braking speeds (see Data Sheet 3).