

**BRAKE SYSTEM TORQUE BALANCE TEST CODE COMMERCIAL VEHICLE**

**Foreword**—This reaffirmed document has been changed only to reflect the new SAE Technical Standards Board format.

- 1. Scope**—This SAE Recommended Practice provides a field test procedure and instructions for:
- Instrumentation and Equipment
  - Vehicle Preparation
  - Test of air-braked single and combination vehicles
  - Calculation of brake force distribution
  - This test procedure is intended to be used as a field procedure. If a more refined method, utilizing laboratory equipment, is required, refer to SAE J1505.

**1.1 Purpose**—This code provides a method to determine the brake force distribution (brake system effectiveness) for commercial vehicles.

**2. References**

**2.1 Applicable Publication**—The following publication forms a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

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

SAE J1505—Brake Force Distribution Test Code—Commercial Vehicles

**3. Instrumentation**

**3.1** Each vehicle must be equipped with:

3.1.1 A decelerometer

3.1.2 Speedometer

3.1.3 Pressure gage accurate within 1.8 kPa ( $\pm 1/2$  lbf/in<sup>2</sup>) in the 69 to 345 kPa (10 to 50 lbf/in<sup>2</sup>) range. Install the gage as follows:

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## SAE J225 Reaffirmed JUN93

- 3.1.3.1 For single-unit vehicles, pressure gage in the foot valve circuit with the highest pressure, upstream of any other valve. This will be the reference gage for the procedure in 5.4.
- 3.1.3.2 For combination vehicles, pressure gage in control line coupling between tractor and first trailer. This will be the reference gage for the procedure in 5.4.
- 3.1.4 A stopwatch
- 3.1.5 Shutoff valves to be installed as follows:
  - 3.1.5.1 For single-unit vehicles, the valve to be installed to permit cut-off of front or rear brakes.
  - 3.1.5.2 Valve to be installed to permit each unit in the combination to be braked separately.
- 3.1.6 Adjustable pedal stop can be used (where conditions permit) to ensure constant application pressures.

3.2 Test should be run on a dry, substantially level roadway (not to exceed  $\pm 1\%$  grade).

### 4. **Vehicle Information and Data**

- 4.1 Vehicle Information Sheet (Figure 1) to be filled in prior to starting test.
- 4.2 Brake Force Distribution Test Data Sheets #1 and #2 (Figures 2 and 3) to be filled out and used during the test and for calculating brake distribution.

### 5. **Vehicle Preparation**

- 5.1 Brakes to be adjusted to manufacturer's specifications.
- 5.2 Load vehicle to its normal operating capacity, but sufficient load at each axle to prevent brake lock-up below 345 kPa (50 lbf/in<sup>2</sup>). Do not exceed the GVWR. Record axle weights on Vehicle Information Sheet (Figure 1).
- 5.3 Brakes should be fully seated and free from oil or other contaminants.
- 5.4 Determine the reference pressure level at which braking starts to occur at each brake by raising the vehicle and rotating the wheel by hand while gradually increasing the input to the brake system. Record the reference pressure level at which brake torque is first evident on the Brake Force Distribution Test Data Sheet (Figure 3). Continue to increase pressure to approximately 275 kPa (40 lbf/in<sup>2</sup>) and then slowly release it until the point at which no brake drag is detected. Record the reference pressure level at the no-drag point on the Brake Force Distribution Test Data Sheet (Figure 3). The average of these two recorded values is defined as the Brake Threshold Pressure. Calculate the threshold pressure for each brake and average these values for each axle or tandem set. Threshold pressure should be as close to the same value as possible at each axle.

NOTE—If each axle of the tandem set is supplied from different circuits of the foot valve, an average threshold pressure should not be used. This could mask a problem on one axle.

SAE J225 Reaffirmed JUN93

**VEHICLE INFORMATION SHEET**  
(FOR SAE J225 TEST CODE)

Test No. \_\_\_\_\_ Test Date \_\_\_\_\_  
 Test Facility and Location \_\_\_\_\_  
 Truck/Tractor Year, Make, and Model \_\_\_\_\_  
 Trailer Year, Make, and Model \_\_\_\_\_  
 Trtr. V.I.N. or Unit No. \_\_\_\_\_ Trtr. V.I.N. or Unit No. \_\_\_\_\_  
 G.A.W.R. Truck/Trtr.: Front \_\_\_\_\_ Rear \_\_\_\_\_ Total \_\_\_\_\_  
 Weight Distribution  
 Truck/Trtr.: Front \_\_\_\_\_ Rear \_\_\_\_\_ Total \_\_\_\_\_  
 Trtr. Axle(s) \_\_\_\_\_  
 Gross Total \_\_\_\_\_

**BRAKES:**

	Type(1)	Size	Make	Lining (Edge Code)
Truck/Tractor: Front	_____	_____	_____	_____
Truck/Tractor: Rear	_____	_____	_____	_____
Trailer:	_____	_____	_____	_____

**Brake Drum/Rotor:**

	Type(2)
Truck/Tractor: Front	_____
Truck/Tractor: Rear	_____
Trailer:	_____

**ACTUATION DETAILS:**

Air Chamber Size	Slk. Adj. Lgth. or Wedge Angle	Type(3)	Adjustment		Cam(4) Rotation
			551 kPa (80 psi) Left	Stroke @ (80 psi) Right	
Truck/Tractor: Front	_____	_____	_____	_____	_____
Rear-fwd.	_____	_____	_____	_____	_____
Rear-rear	_____	_____	_____	_____	_____
Trailer: Front	_____	_____	_____	_____	_____
Rear	_____	_____	_____	_____	_____

**TIRES:**

	Size
Tractor: Front	_____
Tractor: Rear-fwd.	_____
Tractor: Rear-rear	_____
Trailer: Front	_____
Trailer: Rear	_____

**SPECIAL CONDITIONS:**

Special conditions or equipment which might affect brake performance: \_\_\_\_\_

- (1) Cam, disc, widge, etc.
- (2) Cast or composite drum, vented or nonvented rotor, etc.
- (3) Automatic, manual, etc.
- (4) With or opposite drum, etc.

FIGURE 1—VEHICLE INFORMATION SHEET (FOR SAE J225 TEST CODE)

**SAE J225 Reaffirmed JUN93**

Date \_\_\_\_\_

Test Number \_\_\_\_\_

Tractor Unit Number \_\_\_\_\_

Trailer Unit Number \_\_\_\_\_

Glad Hand Pressure kPa (psi)	1. All Brakes m/s <sup>2</sup> (ft/s <sup>2</sup> )	2. Tractor Brakes (Truck Front Axle) m/s <sup>2</sup> (ft/s <sup>2</sup> )	3. Trailer Brakes (Truck Rear Axle) m/s <sup>2</sup> (ft/s <sup>2</sup> )
69 (10)	_____	_____	_____
69 (10)	_____	_____	_____
69 (10)	_____	_____	_____
Avg.	_____	_____	_____
Coastdown	_____	_____	_____
Decel	_____	_____	_____
137.9 (20)	_____	_____	_____
137.9 (20)	_____	_____	_____
137.9 (20)	_____	_____	_____
Avg.	_____	_____	_____
2 - Coastdown	_____	_____	_____
Decel	_____	_____	_____
206.8 (30)	_____	_____	_____
206.8 (30)	_____	_____	_____
206.8 (30)	_____	_____	_____
Avg.	_____	_____	_____
3 - Coastdown	_____	_____	_____
Decel	_____	_____	_____
275.8 (40)	_____	_____	_____
275.8 (40)	_____	_____	_____
275.8 (40)	_____	_____	_____
Avg.	_____	_____	_____
Coastdown	_____	_____	_____
Decel	_____	_____	_____

FIGURE 2—SAE J225 BRAKE FORCE DISTRIBUTION TEST DATA SHEET #1

**SAE J225 Reaffirmed JUN93**

Date \_\_\_\_\_ Test Number \_\_\_\_\_

Tractor Unit Number \_\_\_\_\_ Trailer Unit Number \_\_\_\_\_

COASTDOWN DECELERATION TIMES (t)

COASTDOWN EQUATION

1 - \_\_\_\_\_ 3 - \_\_\_\_\_

$$d = \frac{2.234}{t} \text{ Metric}$$

2 - \_\_\_\_\_ 4 - \_\_\_\_\_

$$d = \frac{7.33}{t} \text{ English}$$

RUN #    Decel

RUN #    Decel

1    \_\_\_\_\_

3    \_\_\_\_\_

2    \_\_\_\_\_

4    \_\_\_\_\_

Formula for braking percentages at 69, 137.9, 206.8, or 275.8 kPa (10, 20, 30, or 40 psi). Use average minus coastdown or just decel from Brake Force Distribution Test Data Sheet #1

Truck Front or Tractor  
 (#2 - Coastdown) + (#3 - Coastdown) x 100 = %

Truck Rear or Trailer  
 (#2 - Coastdown) + (#3 - Coastdown) x 100 = %

Braking Percentage

<u>Truck Front or Tractor</u>	<u>kPa</u> <u>(psi)</u>	<u>Truck Rear or Trailer</u>
_____	69    (10)	_____
_____	137.9    (20)	_____
_____	206.8    (30)	_____
_____	275.8    (40)	_____

THRESHOLD PRESSURES

Reference Pressure at Front Brake

Increasing Pressure: LF \_\_\_\_\_ RF \_\_\_\_\_ Average Threshold Pressure \_\_\_\_\_  
 Decreasing Pressure: LF \_\_\_\_\_ RF \_\_\_\_\_  
 Threshold Pressure (Avg): LF \_\_\_\_\_ RF \_\_\_\_\_

Reference Pressure at Truck Rear or Tractor

Increasing Pressure: LF \_\_\_\_\_ RF \_\_\_\_\_ LR \_\_\_\_\_ RR \_\_\_\_\_ Average Threshold Pressure \_\_\_\_\_  
 Decreasing Pressure: LF \_\_\_\_\_ RF \_\_\_\_\_ LR \_\_\_\_\_ RR \_\_\_\_\_  
 Threshold Pressure (Avg): LF \_\_\_\_\_ RF \_\_\_\_\_ LR \_\_\_\_\_ RR \_\_\_\_\_

Reference Pressure at Trailer

Increasing Pressure: LF \_\_\_\_\_ RF \_\_\_\_\_ LR \_\_\_\_\_ RR \_\_\_\_\_ Average Threshold Pressure \_\_\_\_\_  
 Decreasing Pressure: LF \_\_\_\_\_ RF \_\_\_\_\_ LR \_\_\_\_\_ RR \_\_\_\_\_  
 Threshold Pressure (Avg): LF \_\_\_\_\_ RF \_\_\_\_\_ LR \_\_\_\_\_ RR \_\_\_\_\_

FIGURE 3—SAE J225 BRAKE FORCE DISTRIBUTION TEST DATA SHEET #2

**5.5 Temperature Conditioning**—The first test of any day should be preceded by a series of five snubs from 64.37 to 32.18 km/h (40 to 20 mph) at 1.8 to 2.4 m/s<sup>2</sup> (6 to 8 ft/s<sup>2</sup>) at not less than 1.60 km (1 mile) intervals. In the event the test is interrupted such that the brakes are allowed to cool to ambient temperature, the conditioning process should be repeated prior to resuming test.

## **6. Brake Distribution Test**

### **6.1 Single-Unit Vehicles**

#### 6.1.1 TEST PROCEDURES

6.1.1.1 Fill out Vehicle Information Sheet (Figure 1).

6.1.1.2 Temperature condition brakes per 5.5.

6.1.1.3 With all brakes operating make three snubs from 48.28 to 32.18 km/h (30 to 20 mph) at not less than 0.80 km (1/2 mile) intervals (transmission in neutral or clutch disengaged) at 69 kPa (10 lbf/in<sup>2</sup>) control line pressure. Record resultant stabilized decelerations on the Brake Force Distribution Test Data Sheet #1 (Figure 2). If there is difficulty in reading decelerations or large variances in decelerations occur, rerun the test at 103.4 kPa (15 lbf/in<sup>2</sup>). Repeat the three-snob procedure at 137.9, 206.8, and 275.8 kPa (20, 30, and 40 lbf/in<sup>2</sup>). Record resultant decelerations.

6.1.1.4 By means of the valve installed per 3.1.5.1, shut off the rear brakes and repeat 6.1.1.3.

6.1.1.5 Restore the rear brakes to operation and shut off the front brakes. Repeat 6.1.1.3.

6.1.1.6 Determine the coastdown time from 48.28 to 40.23 km/h (30 to 25 mph) by accelerating the vehicle to 56.32 km/h (35 mph), shift to neutral or declutch with no braking. Measure the time between 48.28 to 40.23 km/h (30 and 25 mph) and record on the Brake Force Distribution Test Data Sheet #2 (Figure 3). Calculate the deceleration for each of the coastdown runs using either the Metric or English formula on the Brake Force Distribution Test Data Sheet #2 (Figure 3).

NOTE—This must be done in the same direction or directions as the snubs previously were made with respect to wind and road-grade. Average the four coastdown decelerations. If conditions do not permit coastdown time test, use 0.01 m/s<sup>2</sup> (0.3 ft/s<sup>2</sup>) as average coastdown deceleration on the Brake Force Distribution Test Data Sheet #1 (Figure 2).

6.1.1.7 Check data by comparing the sum of decelerations on each axle (corrected for coastdown) with the decelerations achieved with all axles (corrected for coastdown). Values should be comparable. Rerun portions of test as necessary if discrepancies are large.

6.1.1.8 Complete the Brake Force Distribution calculation on the Brake Force Distribution Test Data Sheet #2 (Figure 3).

### **6.2 Tractor and Semitrailer or Truck and Trailer**

#### 6.2.1 TEST PROCEDURE

6.2.1.1 Proceed through steps 6.1.1.1 and 6.1.1.2.