The Engineering Society For Advancing Mobility Land Sea Air and Space®

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SAE J225 AUG88

Brake System Torque Balance Test Code Commercial Vehicle

SAE Recommended Practice
Revised August 1988

Submitted for Recognition as an American National Standard

The Engineering Society For Advancing Mobility Land Sea Air and Space ®
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TRUCK AND BUS PRACTICE

SAE J225

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ø BRAKE SYSTEM TORQUE BALANCE TEST CODE COMMERCIAL VEHICLE

1. PURPOSE:

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

2. SCOPE:

The code provides a field test procedure and instructions for:

2.1 Instrumentation and Equipment

2.2 Vehicle Preparation

2.3 Test of air-braked single and combination vehicles

2.4 Calculation of brake force distribution

2.5 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.

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 ±1/2 lbf/in^2 (1.8 kPa) in the 10 to 50 lbf/in^2 (69 to 345 kPa) range. Install the gage as follows:

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 ±1% grade).

4. VEHICLE INFORMATION AND DATA:

4.1 Vehicle Information Sheet (Fig. 1) to be filled in prior to starting test.

4.2 Brake Distribution Test Data Sheet #1 and #2 (Figs. 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 50 lbf/in^2 (345 kPa). Do not exceed the GVWR. Record axle weights on Vehicle Information Sheet (Fig. 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 Test Data Sheet (Fig. 3). Continue to increase pressure to approximately 40 lbf/in^2 (275 kPa) 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

5.4 (Continued)

the Test Data Sheet (Fig. 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.

5.5 Temperature Conditioning: The first test of any day should be preceded by a series of five snubs from 40 to 20 mph (64.37 to 32.18 km/h) at 6 to 8 ft/s/s (1.8 to 2.4 m/s/s) at not less than 1 mile (1.60 km) 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 (Fig. 1).

6.1.1.2 Temperature condition brakes per 5.5.

6.1.1.3 With all brakes operating make three snubs from 30 to 20 mph (48.28 to 32.18 km/h) at not less than 1/2 mile (0.80 km) intervals (transmission in neutral or clutch disengaged) at 10 lbf/in^2 (69 kPa) control line pressure. Record resultant stabilized decelerations on the Test Data Sheet #1 (Fig. 2). If there is difficulty in reading decelerations or large variances in decelerations occur, rerun the test at 15 lbf/in^2 (103.4 kPa). Repeat the three-snub procedure at 20, 30 and 40 lbf/in^2 (137.9, 206.8 and 275.8 kPa). 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 30 to 25 mph (48.28 to 40.23 kmk/h) by accelerating the vehicle to 35 mph (56.32 km/h), shift to neutral or declutch with no braking. Measure the time between 30 and 25 mph (48.28 to 40.23 km/h) and record on the Test Data Sheet #2 (Fig. 3). Calculate the deceleration for each of the coastdown runs using either the English or Metric formula on the Test Data Sheet #2 (Fig. 3).

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

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

6.2.1.3 By means of the valve installed per 3.1.5.2, shut off the trailer brakes and repeat 6.2.1.2.

6.2.1.4 Restore the trailer brakes to operation. Shut off the towing vehicle brakes (or use the trailer brake hand valve if so equipped). Repeat 6.2.1.2.

6.2.1.5 Determine coastdown time and make calculations per 6.1.1.6 and 6.1.1.8.

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

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

6.3 Longer Combinations:

6.3.1 Provide jumper hoses or shut off valves, or both, so that each individual unit in the train can be braked by itself from the towing vehicle.

6.3.2 Test Procedure:

6.3.2.1 Proceed as in 6.2.1 through 6.2.1.7.

6.3.2.2 Calculate the brake distribution force for the various units in the train using the same mathematical approach shown for single unit and two unit combinations.

NOTE: The Data Sheet does not provide for all the data and calculations required for brake distribution on longer combinations. Use separate sheets as required.

The phi (Ø) symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

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 Nc. _____ Trlr V.I.N. or Unit No. _____
G.A.W.R. Truck/Trtr.: Front _____ Rear _____ Total _____
Weight Distribution
Truck/Trtr: Front _____ Rear _____ Total _____
Trlr. Axle(s) _____
Gross Total _____

BRAKES:

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

Brake Drum/Rotor: _____ Type(2) _____

Truck/Tractor: Front _____
Rear _____
Trailer: _____

ACTUATION DETAILS:

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

TIRES:

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

SPECIAL CONDITIONS:
Special conditions or equipment which might affect brake performance:

_____
_____
_____

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

FIGURE 1

SAE J225 BRAKE FORCE DISTRIBUTION TEST DATA SHEET #1

Date _____ Test Number _____

Tractor Unit Number _____ Trailer Unit Number _____

Glad Hand Pressure (Psi)	1. All Brakes FPSPS	2. Tractor Brakes (Truck Front Axle) FPSPS	3. Trailer Brakes (Truck Rear Axle) FPSPS
10			
10			
10			
Avg.			
- Coastdown			
Decel			
20			
20			
20			
Avg.			
2 - Coastdown			
Decel			
30			
30			
30			
Avg.			
3 - Coastdown			
Decel			
40			
40			
40			
Avg.			
- Coastdown			
Decel			

FIGURE 2

SAE J225 BRAKE FORCE DISTRIBUTION TEST DATA SHEET #2

Date _____ Test Number _____

Tractor Unit Number _____ Trailer Unit Number _____

COASTDOWN DECELERATION TIMES (t)

1 - _____ 3 - _____

2 - _____ 4 - _____

COASTDOWN EQUATION

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

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

RUN #	Decel	RUN #	Decel
1	_____	3	_____
2	_____	4	_____

Formula for braking percentages at 10, 20, 30, or 40 psi. Use average minus coastdown or just decel from 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

Truck Front or Tractor	PSI	Truck Rear or Trailer
_____	10	_____
_____	20	_____
_____	30	_____
_____	40	_____

THRESHOLD PRESSURES

Reference pressure at Front Brake

Increasing Pressure: LF _____ RF _____

Decreasing Pressure: LF _____ RF _____ Average Threshold Pressure _____

Threshold Pressure (Avg): LF _____ RF _____

Reference Pressure at Truck Rear or Tractor

Increasing Pressure: LF _____ RF _____ LR _____ RR _____ Average Threshold

Decreasing Pressure: LF _____ RF _____ LR _____ RR _____ Pressure

Threshold Pressure (Avg): LF _____ RF _____ LR _____ RR _____ _____

Reference Pressure at Trailer

Increasing Pressure: LF _____ RF _____ LR _____ RR _____ Average Threshold

Decreasing Pressure: LF _____ RF _____ LR _____ RR _____ Pressure

Threshold Pressure (Avg): LF _____ RF _____ LR _____ RR _____ _____

FIGURE 3