Truck and bus - Service brake structural integrity dynamometer test procedure

1. Scope

This standard specifies the test procedures for evaluating the structural integrity of normally operated service brakes of trucks and buses by using the inertia dynamometer.

2. Normative reference

The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard.
If the indication of the year of coming into effect is given to these referred standards, only the edition of indicated year constitutes the provision of this Standard but the revision and amendment made thereafter are not applied.

JIS D 0210:1995 General rules of brake test method of automobiles and motor cycles

3. Definitions

Definitions of main terms used in this standard shall conform to those defined in **2** (Definitions) of **JIS D 0210**.

4. Classification of tests

Tests shall be classified as follows.

a) Structural integrity test

Test to investigate the yield state or breakdown of the brake in the course of the permanent deformation process. The term breakdown as used herein is the condition in which deformation, cracks, or other abnormal conditions have developed to impair the brake function.

b) Structural durability test

Test to investigate the durability of the brake under conditions severer than normal.

Remark: In tests **a)** and **b)** above, tests shall be conducted in both forward and reverse directions.

5. Test conditions

5.1 Vehicle classification

Test vehicles shall be classified into the following categories according to the riding capacity and gross vehicle mass.
Each of these categories is designated as follows. Given in parentheses for reference are the names used in the technical regulations for braking equipment of trucks and buses.

Category M2 (Class 1 buses): Buses with a riding capacity of 10 persons or more and a gross vehicle mass of 5t or less
Category M3 (Class 2 buses): Buses with a riding capacity of 10 persons or more and a gross vehicle mass of more than 5t
Category N1 (Class 1 trucks): Trucks with a gross vehicle mass of 3.5t or less
Category N2 (Class 2 trucks): Trucks with a gross vehicle mass of more than 3.5t and less than 12t
Category N3 (Class 3 trucks): Trucks with a gross vehicle mass of more than 12t

5.2 Conditions of brake parts

The conditions of each of different brake parts at the time of testing shall comply with **4.3** (Conditions of brake parts) of **JIS D 0210**.

5.3 Inertia

AVA Documents
Document Sharing Hub

Full document details: JASO C421 2005

The calculating formula and setting of the inertia shall comply with **7** (Calculating formula) of **JIS D 0210**. Enter the calculating formula used in the recording sheet (data sheet of structural integrity test results (see **Attached Table 2**).

5.4 Braking torque

The calculating formula for the braking torque shall comply with **7** (Calculating formula) of **JIS D 0210**. Enter the calculating formula used in the recording sheet (summary sheet of structural integrity test results (see Attached Table 2).

5.5 Temperature measurement method

Measurement of brake temperature shall be basically taken on the fixed side and comply with **6** (Temperature measurement method) of **JIS D 0210**.

Remark: Record if the above general rule is not followed.

5.6 Cooling wind

Wind velocity shall be, as a rule, 11 m/s and an adjustment should be made to ensure that the wind hits the projection surface of the brake uniformly and continuously.

The wind shall have room temperature.

Remark: Record if the above general rule is not followed.

5.7 Heating conditions

The burnishing conditions shall apply if it is necessary to raise the brake temperature to a predetermined value.

6. Test procedures

6.1 Structural integrity test

6.1.1 Test preparations

Before mounting the brake on the testing machine, check that the brake remains intact with no grease, paint, or other foreign objects on the surface of the friction material. Clean the friction surface of the drum or disc. Mount thermocouples at the prescribed places of the lining or pad. Mount the brake on the testing machine, center it correctly, and record runout in the drum or disc.

Remark: Record if the general rule is not followed.

6.1.2 Test items and test order

Test items and test order shall be as follows. Different brakes should be used in the forward and reverse tests (see **Attached Table 1**).

a) Initial measurement

Measure dimensions of brake components and record the measured values as necessary.

b) Burnishing

Direction of rotation:	Forward in the forward test and reverse in the reverse test, and backward in the reverse test.
Initial speed:	60 km/h
Braking deceleration:	3.0 m/s^2
Brake temperature:	120 °C for N1 vehicle; 150 °C for M2, M3, N2, and N3 vehicles
Number of braking operations:	200 times for N1 vehicle; 300 times for M2, M3, N2, and N3 vehicles

c) Brake adjustment

The clearance between the brake lining (or pad) and the drum (or disc) is adjusted as specified by the manufacturer as necessary.

d) Structural integrity test

1) Forward test

Initial speed:	50 km/h for N1 vehicle; 30 km/h for M2, M3, N2, and N3 vehicles
Braking deceleration:	Increased from 4.0 m/s^2 stepwise in increments of 2.0 m/s^2 up to breakdown of the brake if it is feasible.
Brake temperature:	65 °C and over to 95 °C incl.
Number of braking operations:	5 times for each braking deceleration

AVA Documents
Document Sharing Hub
Full document details: JASO C421 2005

2) Reverse test

To be conducted only if the test is judged as necessary to be conducted according to the specific brake mechanism involved and the load condition of the brake mounted in the actual vehicle.

Initial speed:	20 km/h
Braking deceleration:	Increased from 4.0 m/s^2 stepwise in increments of 2.0 m/s^2 up to breakdown of the brake if it is feasible.
Brake temperature:	65 °C and over to 95 °C incl.
Number of braking operations:	5 times for each braking deceleration

e) Inspection

1) Main check items for the drum brake

Deformed anchor
Deformed or collapsed shoe web
Deformed back plate
Deformed or loose mounting portion
Separated shoe or lining, or one that has come off position

2) Main check items for the disc brake

Widened pad insertion portion
Widened caliper
Deformed or collapsed pad
Deformed or loose mounting portion

6.1.3 Record

Data shall be recorded as follows:
Unusual noise, unusual brake drag or contact, brake fluid leak, air leak, or any other abnormal symptom at each setting of braking deceleration.
Line pressure required for achieving each setting of braking deceleration.
Actual number of braking operations and torque up to breakdown.

For each of **1)** or **2)** of **6.1.2 e)**, make a check after 5 braking operations at each braking deceleration setting as necessary and record the results. The record format shall comply with **Attached Tables 2** and **3.**

6.2 Structural durability test

6.2.1 Test preparations

In accordance with **6.1.1**

6.2.2 Test items and test order

Test items and test order shall be as follows. Different brakes should be used in the forward and reverse tests (see **Attached Table 1**).

a) Initial measurement

Measure dimensions of brake components and record the measured values as necessary.

b) Burnishing

In accordance with **6.1.2 b)**

c) Brake adjustment

In accordance with **6.1.2 c)**

d) Structural durability test

1) Forward test

Initial speed:	50 km/h for N1 vehicle; 30 km/h for M2, M3, N2, and N3 vehicles
Braking deceleration:	12.0 m/s^2 for N1 vehicle; 8.0 m/s2 for M2, M3, N2, and N3 vehicles
Brake temperature:	65 °C and over to 120 °C incl.
Number of braking operations:	1000 times

2) Reverse test

To be conducted only if the test is judged as necessary to be conducted according to the specific brake mechanism involved and the load condition of the brake mounted in the actual vehicle.

AVA Documents
Document Sharing Hub

Full document details: JASO C421 2005

Initial speed: 20 km/h
Braking deceleration: 8.0 m/s^2 for N1 vehicle; 6.0 m/s^2 for M2, M3, N2, and N3 vehicles
Brake temperature: 65 °C and over to 120 °C incl.
Number of braking operations: 1000 times

e) Inspection

In accordance with **6.1.2 e)**

6.2.3 Record

Data shall be recorded as follows:

Throughout the entire test procedure, record any unusual noise, unusual brake drag or contact, brake fluid leak, air leak, or other abnormal symptom. Record the pressure and actually measured torque as necessary.

For each of **1)** or **2)** of **6.1.2 e)**, make a check after the 10th, 50th, 100th, and if necessary, make a check at every 100th up to the 1000th braking operations, and record any unusual symptom.

The measuring instruments used should be calibrated.

The record format shall comply with **Attached Tables 2** and **4**.

6.3 Change of brake temperature

In vehicles, in which the brake temperature is particularly difficult to raise, the brake temperatures of 65 °C, 95 °C, 120 °C, and 150 °C may be changed to 35 °C, 65 °C, 80 °C, and 100 °C, respectively.

7. Structural integrity test by means of seesaw testing machine (optional item)

a) Test conditions

The brake system shall be mounted in the vehicle in such a condition that approximates most that in the actual vehicle. Measurement of temperatures is optional.

b) Test items and test order

Table 1 shows the test items, order, and conditions.

Table 1 Test items, order, and conditions

Item and order		Test conditions			Remark
		Braking time s	Braking deceleration m/s^2	No. of braking operations times	
1	Initial measurement	—	—	—	
2	Burnishing	1 to 2	3.5	5000	
3	Structural integrity test	1 to 2	From 4.0 to, if possible, breakdown in increments of 2.0	5 times for each deceleration setting	Adjust clearance before test.
4	Final measurement and inspection				

c) Seesaw testing machine

This testing machine, as illustrated in **Figure 1**, performs the following operations of <1>, <2>, and <3> repeatedly. Specifically, <1> Moves the arm attached to the brake drum up and down using the air cylinder to rotate the brake drum through about 15°; <2> Actuates the pressure unit immediately after the rotation of the brake drum; and <3> Releases the air cylinder and the pressure unit at the uppermost rotated position or the lowermost rotated position.

Documents
Document Sharing Hub
Full document details: JASO C421 2005