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JASO

Japanese Automobile Standard

Wear Test Procedure on Inertia Dynamometer-Brake Friction Materials

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In the event of any doubt, the original
standards in Japanese should be referred.

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Wear Test Procedure on Inertia Dynamometer–Brake Friction Materials

1. Scope

This standard specifies a dynamometer test procedure for the measurement of wears of brake linings and pads to be used in service brakes of automobiles(1).

Note 1: Special motor vehicles and motorcycles are excluded from the application. Trailers with nominal gross coupled weights (GCW) exceeding 40 tons are also excluded from the application.

Remark: In this standard, units and numerical values given in { } are based on the International System of Units (SI), and are given for reference.

2. Purpose

This standard aims to determine wear characteristics of automobile brake linings and pads, and to establish a standardized dynamometer test procedure that may be related to actual conditions of vehicles on market.

3. Definitions

Definitions of major terms used in this standard shall be as follows.

(1) **Initial speed**
Speed at the time brake application is initiated and read on a calibrated speed indicator.

(2) **Braking deceleration**
Braking deceleration kept almost constant during the brake application by brake lever control force or pedal effort, except under transient condition. In a practical test, the value shall be converted into the brake torque calculated by the equation given in 4.3.

(3) **Initial brake temperature**
Temperature read according to the prescription at the time brake application is initiated. Where more than one brake are used and tested at the same time, the initial brake temperature shall be the highest of all brakes.

4. Test Conditions

4.1 Conditions of Each Element of Braking Devices

Conditions of each element of braking devices shall generally be maintained as specified below all through the testing period.

(1) The brake linings or pads, the drum(s) or disc(s), and the brake fluid to be used in the test shall be formal new products at the beginning of the test.

(2) The brake mechanism and the braking devices shall be assembled with formal parts of normal specifications and functions, and if necessary, shall suitably be adjusted.

4.2 Inertia

Inertia shall be calculated according to the following equation, and the most approximate value shall be selected for the setting.

$$I = \frac{W \cdot r^2}{G} \{I = m \cdot r^2\} \quad \cdots\cdots\cdots\cdots (1)$$

where, I : inertia ($kgf \cdot m \cdot s^2$) {$kg \cdot m^2$}
W: test load (kgf) {N}
r : dynamic tire effective radius (m)
G: gravitational acceleration (9.8 m/s^2)

The test load W according to the type of test equipment such as dual dynamometer, single dynamometer, etc. and the test method shall be the value obtained by dividing the gross vehicle weight by the ratio of braking force of each wheel at the time of braking deceleration 0.3 G.

4.3 Braking torque

Either one of following equations shall be used for the calculation of the braking torque.

$$T = \frac{W \cdot r}{G} \alpha \cdots\cdots (2), \text{ or } T' = \frac{I'}{r} \alpha \cdots\cdots (3)$$

where, T: braking torque obtained from the gross vehicel weight (kgf·m) {N·m}
T': braking torque obtained from the inertia during the test (kgf·m) {N·m}
I': inertia during the test ($kgf \cdot m \cdot s^2$) {$kg \cdot m^2$}
α : braking deceleration (m/s^2)
r : dynamic tire effective radius (m)
G: gravitational acceleration (9.8m/s^2)
W: test load (kgf) {N}

The test load W is the value obtained by dividing the gross vehicle weight by the ratio of braking force of each wheel at the time of braking deceleration 0.3 G. The calculation equation used shall be entered on the recording sheet (Brake Specifications and Summary Table of Test Results).

4.4 Measurement of Temperature

The temperature measuring point shall be generally at the rotating side (of drum(s) or disc(s)), and thermo-

couple(s) shall be installed at following locations. (See **Reference Fig. 1**)

(1) **For drum brake**
Approximate center of the lining width direction, 2 to 3 mm from the drum inside surface.

(2) **For disc brake**
Approximate center of the disc thickness, and around the effective radius for the radial direction.

Remark: If the above general provision is not used in the test, it shall be mentioned on the recording sheet to that effect.

4.5 Cooling Wind

The wind velocity shall be, as a rule, 11 m/s, which shall be so adjusted that the wind blows uniformly and continuously against the braking devices. The temperature of the wind shall be the room temperature. If the initial brake temperature does not reach to the specified value, the wind velocity may be adjusted arbitrary, but it shall be mentioned on the recording sheet.

5. Test Procedure

5.1 Preparation for Test

(1) Make sure that no abnormalities are found on the brake before installing it on the test equipment. Make also sure that grease or any other foreign matter is not adhered onto the linings or pads.

(2) A thermocouples shall be attached to the specified location on the drum(s) or disc(s), and the friction surface shall be cleaned using acetate, etc.

(3) The brake shall be attached onto the test equipment and centered. Drum or disc deflection shall be recorded.

5.2 Test Items and Test Sequence

5.2.1 General Wear Tests

Wear tests specified in (1), (2) and (3) shall be carried out in series in use of same sample.

(1) **Burnish**
Initial speed: 50 km/h
Braking deceleration: 0.3 G constant
Initial brake temperature: 100°C
Number of applications: 200 times

Remark: If the contact of the friction surface is not adequate with the specified number of applications, the braking shall be repeated until a sufficient contact is attained.

(2) **Wear Test**
Initial speed: 50 km/h
Braking deceleration: 0.3 G constant
Initial brake temperature:
Drum brake 100°C, 200°C, 250°C and 300°C (350°C)
Disc brake 100°C, 200°C, 250°C, 300°C, 350°C, 400°C (450°C) (500°C)
Number of applications:
For initial brake temperatures of 100°C and 250°C: 1000 times
For initial brake temperatures of 300°C and 350°C: 500 times
For initial brake temperatures exceeding 400°C: 200 times
Measurement: Measurement and recording specified in **6.** and **7.** shall be done, and results shall be recorded for each specified temperature.

Remarks 1: Initial brake temperatures in parentheses are optional.
2: Temperature rise when changing test conditions shall be generally done without any wind, and the number of brake applications required to raise the temperature shall be handled as the number of brake applications after the temperature rise.
3: If the initial brake temperature does not reach the specified value, the test shall be terminated and excluded from test data.
4: The output shall be generally kept constant when braking. If the input is kept constant, the pressure shall also be kept constant at a level allowing the braking deceleration equivalent to 0.3 G.
5: If no adequate wear is obtained for the measurement by the number of brake applications specified thereof, braking shall be repeated until adequate amount of wear is obtained.

(3) **Second Wear Test**
Initial speed: 50 km/h
Braking deceleration: 0.3 G constant
Initial brake temperature:
Drum brake 100°C, 200°C (250°C) (300°C)
Disc brake 100°C, 200°C (250°C) (300°C) (400°C)
Number of applications:
For initial brake temperatures of 100°C and 200°C (250°C): 500 times
For initial brake temperature of (300°C): 250 times
For the initial brake temperature of (400°C): 100 times
Measurement: The measurement and recording specified in **6.** and **7.** shall be done, and results shall be recorded for each initial brake temeprature.

Remark: The same as those given in the **Remarks 1** through **5** of **5.2.1 (2)** above.

5.2.2 High Speed Wear Test (Optional Test Items)

(1) Burnish

Initial speed: 50 km/h
Braking deceleration: 0.3 G constant
Initial brake temperature: 100°C
Number of applications: 200 times

Remark: If the contact of the friction surface is inadequate with the specified number of applications, the braking shall be repeated until a sufficient contact is ensured.

(2) High Speed Wear Test

Initial speed: 100 km/h

Remark: For the vehicle with the nominal maximum speed below 100 km/h, the test shall be done with the maximum speed.

Braking deceleration: 0.3 G constant
Initial brake temperature: 100°C
Number of applications: 100 times
Measurement: Carry out the measurement and recording specified in **6.** and **7.**

Remark: According to **Remarks 1** through **5** given in **5.2.1 (2).**

6. Measuring Procedure

6.1 Measurement of Wear Thickness

The measurement of the thickness of brake lining or pad wears shall be done as follows.

(1) Measuring Instruments

Micrometer or equivalent instruments shall be used in measurement, and the accuracy shall be up to 0.01 mm.

(2) Measuring Locations

In order to ensure accurate measurement of brake lining or pad wears, 4 to 6 points on each side, total 8 to 12 points on both sides, shall be measured for linings. For pads, on the other hand, 4 to 8 points shall be selected for the measurement. (See Reference Fig. 2)

(3) Measurement

The thickness of brake linings or pads shall be measured for each specified test temperature with the accuracy of 0.01 mm under the room temperature condition.

6.2 Wear Mass Measurement (Optional Item)

The measurement of the mass of brake lining or pad wear shall be done as follows.

(1) An appropriate measuring instrument such as balance or other equivalent instruments with the accuracy of 0.01 g shall be used.

(2) The mass of the brake linings or pads shall be measured for each test temperature with the accuracy of 0.01 g under the room temperature condition.

Remarks 1: The surface conditions or dimensions of the drum(s) or disc(s) may be measured and recorded if necessary.

2: If the mass of the brake linings or pads exceeds 1 kg, the measuring accuracy may be 0.1 g.

7. Recording

The recording procedure shall be as follows.

(1) The thickness wear rate shall be expressed in the mean value by averaging all values of 1000 times of brake applications. It is also desirable to record the maximum and minimum values for reference.

(2) It is desirable to express the wear mass by the mean value by averaging all values of 1000 times of brake applications.

(3) It is also desirable to express the wear rate as calculated by following equations.

$$V = \frac{t \cdot A}{E_k} \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad (4)$$

$$E_k = \frac{I \cdot \omega^2 \cdot N}{2} \quad \cdots\cdots\cdots\cdots\cdots \quad (5)$$

where, V : wear rate (10^{-7} cm^3/kgf·m) {10^{-7} cm^3/N·m}
E_k: total work (kgf·m) {N·m}
I : inertia (kgf·m·s^2) (kg·m^2}
t : thickness of wear (cm)
A : area of linings or pads (cm^2)
ω : angular velocity (rad/s)
N : number of brake applications

(4) The temperature, initial speed, number of applications, and the number of times when the specified temperature attained during the test shall be recorded.

(5) It is desirable to measure the pressure and braking torque (torque wave form) with intervals of 100 times of brake applications.

(6) The room temperature at the time of test shall be recorded.

(7) If any abnormalities such as noise, vibration, etc. are found during the test, such abnormalities shall be recorded.

(8) The recording sheet shall be according to **Appended Tables 2** through **4.**

Remark: It is desirable to indicate the amount of wear of each brake lining individually for some types of brakes.

Appended Table 1 List of Test Items

Test item \ Test conditions		Initial speed km/h	Initial brake temperature °C		Braking deceleration G	Number of applications N	Remark
			Drum	Disc			
1. General wear tests	Burnish(2)	50	100		0.3	200	Measure the thickness of linings or pads for each specified temperature. Initial temperatures in parentheses are optional.
	Wear test	50	100 200 250 300 (350)	100 200 250 300 350 400 (450) (500)	0.3	100 ~ 250°C 1000 times 300 ~ 350°C 500 times 400°C or higher 200 times	
	Second wear test	50	100 200 (250) (300)	100 200 (250) (300) (400)	0.3	100 ~ (250°C) 500 times (300°C) 250 times (400°C) 100 times	
2. High speed wear test	Burnish(2)	50	100		0.3	200 times	
	High speed(3) wear test	100	100		0.3	100 times	

Notes 2: The burnish shall be continued until an adequate contact between the brake and linings or pads can be attained, if the first burnish does not provide an adequate contact.

3: If the nominal maximum speed of the test vehicle is below 100 km/h, the test shall be done at the nominal maximum speed of the vehicle.

Remark: If an adequate amount of wear cannot be obtained with the specified number of braking applications, the braking shall be repeated until an adequate amount of wear is obtained.

Appended Table 2 Summary Sheet of Brake Specifications and Performance

Test No. _____
Date _____
Room temperature _____
Tested by _____

Vehicle Specifications

Name of vehicle _____ Model _____ Year _____
Vehicle loading (unladen) _____ ( ) kgf {N} Braking force ratio at 0.3G Front ____ % Rear ____ % Others _____
Tire size Front _____ Rear _____ Dynamic tire effective radius Front _____ mm Rear _____ mm

Brake Specifications

Name of brake _____
Brake size Inside diameter (effective radius) _____ mm x Outside dia. _____ mm x Thickness _____ mm
Lining (pad) length (sliding direction) _____ mm x Width _____ mm x Thickness _____ mm Total area (one wheel) _____ cm^2
Friction material Brand _____ Manufacturer _____ Lot No. _____

Brake Dynamometer Test Conditions

Test equipment Single, dual (front, 2 wheels; rear, 2 wheels, 1 wheel each) 4 wheels Pressure control device With Without
Inertia value used (calculated value) Front _____ $kgf \cdot m \cdot s^2$ $\{kg \cdot m^2\}$ Rear _____ $kgf \cdot m \cdot s^2$ $\{kg \cdot m^2\}$
Flywheel rpm/vehicle speed _____ rpm $\{min^{-1}\}$/50km/h Braking torque _____ kgf·m {N·m}/0.3G
Temperature measurement Fixed side _____ Rotating side _____ Calculation equations (2) and (3)

Test Results Output constant, Input constant

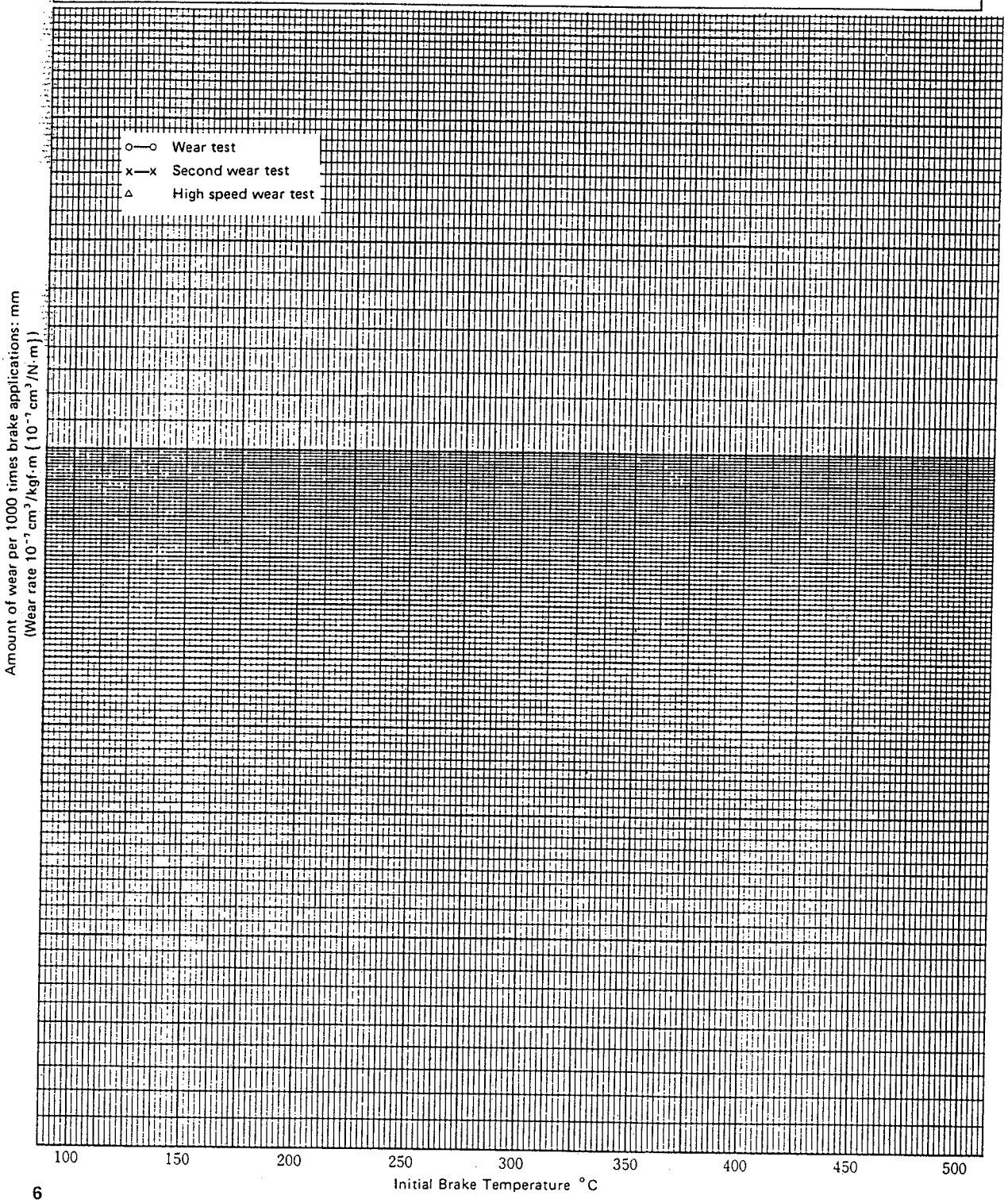
Measuring item / Test item	Initial speed km/h	Temperature °C	Number of applications the specified temp. attained within the the braking frquency (times)	Amount of wear (mm) per 1000 times of brake applications			Wear rate $10^{-7}cm^3/kgf \cdot m$ $\{10^{-7}cm^3/N \cdot m\}$	Mass of wear per 1000 times g
				Minimum value	Maximum value	Mean value		
General wear tests	Wear test	50						
	Second wear test	50						
High speed wear test								

Final inspection: Conditions of friction materials _____ Drum or disc conditions _____
Conditions of mechanical elements _____ Conditions of fluid pressure circuit _____

Observations: _____

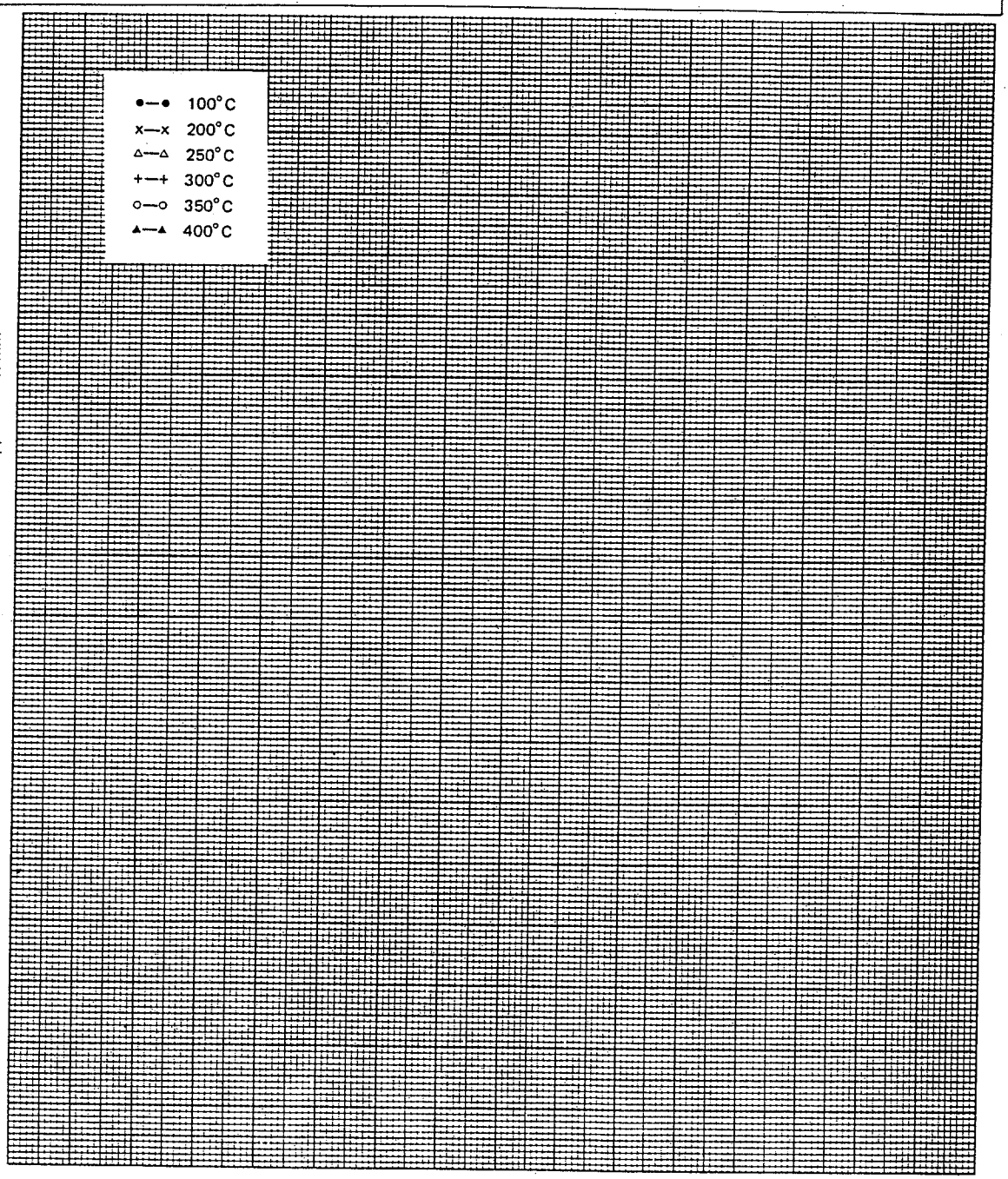
Appended Table 3 Wear Test (for Each Temperature)

Name of vehicle _____ Model _____ Cylinder bore _____ Test No. _____
Name of brake _____ Friction material _____ Date _____
Inertia _____ kgf·m·s² {kg·m²} Pressure control With/without Tested by _____
Single, dual (Fx2 · Rx2 · F+R) 4 wheels Room temperature _____ °C
Output constant, Input constant



Appended Table 4 Wear Test (Wear Pattern)

Name of vehicle	Model	Cylinder bore	Test No.
Name of brake		Friction material	Date
Inertia kgf·m·s² {kg·m²}		Pressure control With/without	Tested by
Single, dual (Fx2 · Rx2 · F+R) 4 wheels		Room temperature °C	
Output constant, Input constant			



Schematic of measuring locations

Reference Fig. 1 Thermocouple Installation Methods

(1) At the rotating side

For drum brakes:

2 to 3 mm from the drum inside surface and approximate center of the lining width direction.

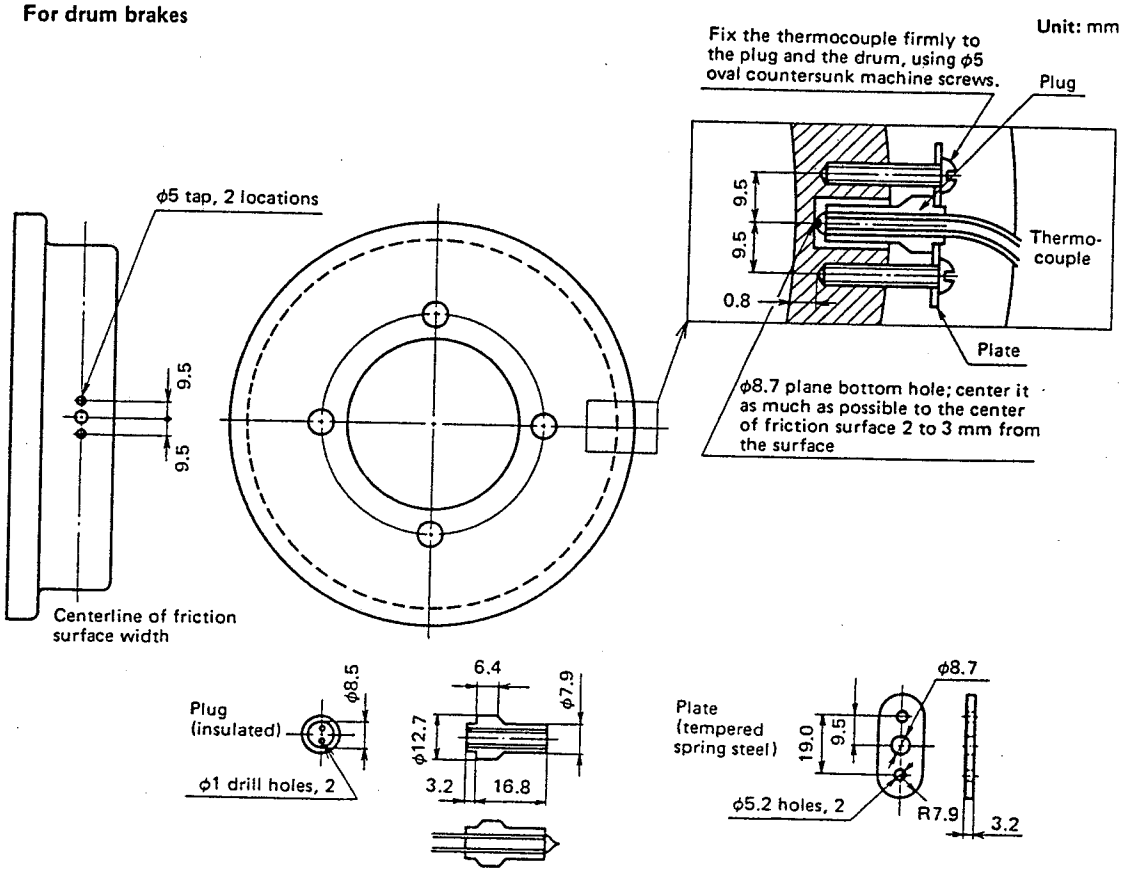
For disc brakes:

Approximate center of the disc thickness, around the effective radius; if the disc is very thick, 5 mm from the surface.

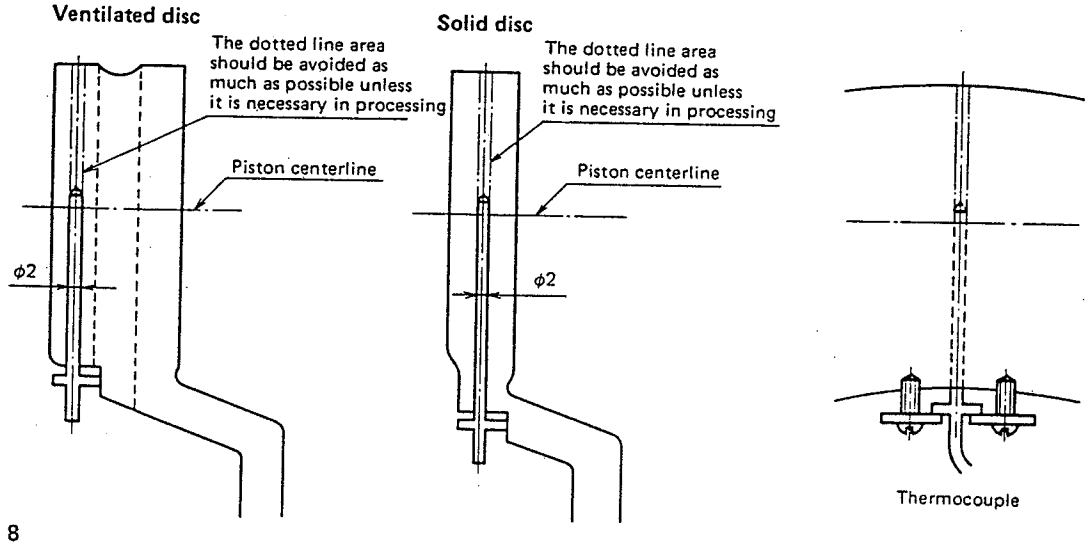
Remark: If the test is done differently from the general provision, it shall be mentioned on the recording sheet.

For drum brakes

Unit: mm



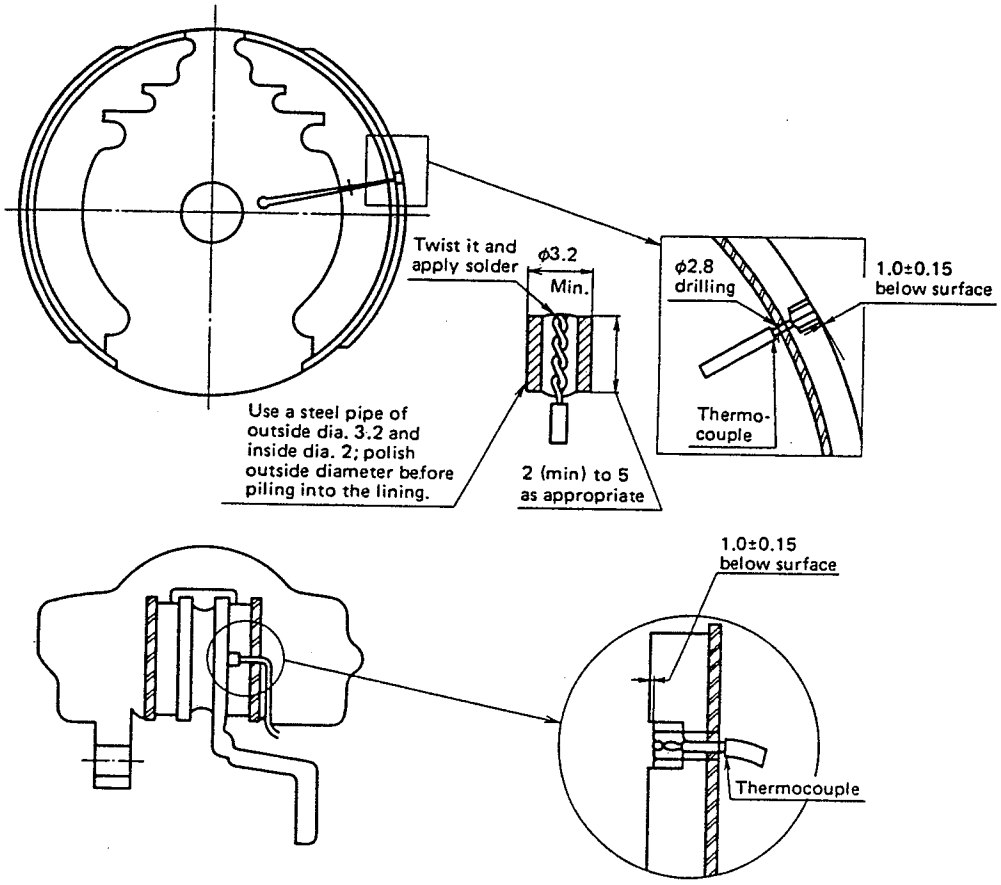
For disc brakes



(2) At the fixed side

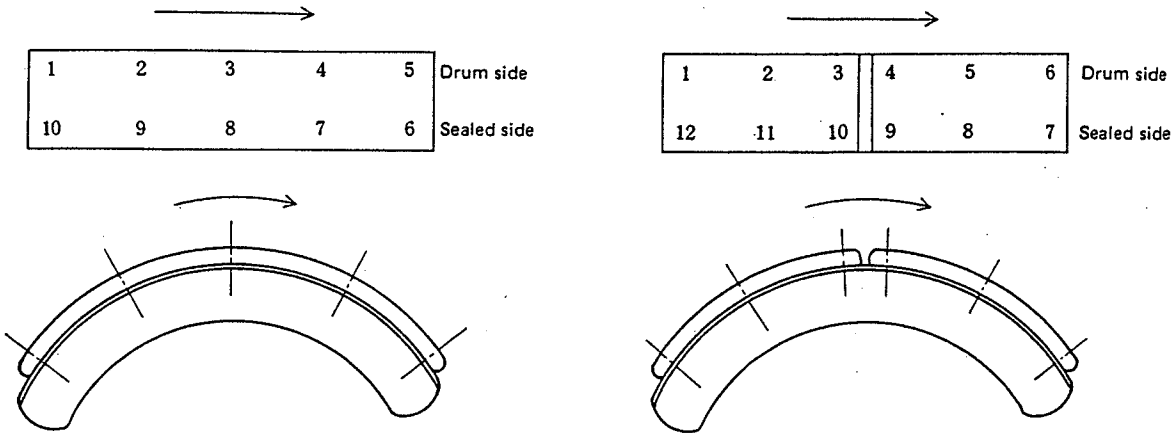
Install the thermocouple around the center of the friction surface of the brake shoe or pad with the highest load.

Unit: mm

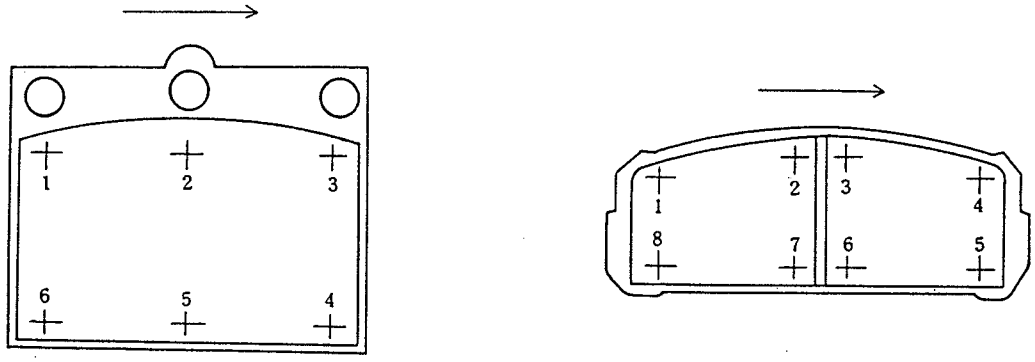


Reference Fig. 2 Wear Thickness Measuring Points

(1) Examples of Brake Linings



(2) Examples of Pads



Remark: Arrow marks show respective directions of the drum or disc rotation.

Explanatory Note
on
JASO C 427-83 Wear Test Procedure on Inertia Dynamometer-Brake Friction Materials

Direction of Revision and Contents of Major Revisions

1. Direction of Revision

JASO standards are generally subject to periodical revision once in every 3 years, and the revision work was initiated in May, 1982, for JASO C 427-75 (Wear Test Procedure on Inertia Dynamometer-Brake Friction Materials) by the Lining Wear Test Subcommittee, according to the decision taken by the Braking Technical Committee.
The Subcommittee discussed the possibility of simulating wears of brake linings and pads by using dynamometers. It is, in fact, still difficult to standardize the simulation of wears that would occur on various kinds of vehicles. Nevertheless, the majority of the Subcommittee members agreed that the prediction of market life of such a friction material would be possible by determining temperature characteristics of the amount of wear for friction materials. No substantial revisions are thus added to the entire contents of the standard, and only the test conditions are revised to a certain extent, since it was decided that more data should be accumulated for further revisions in future.

2. Contents of Major Revisions and Reasons for Such Revisions

(1) It was decided that provisions that are common to those given in JASO C 446-79 (General Rules of Brake of Automobiles and Motorcycles) such as definitions, test conditions, etc. should be quoted from the said standard.

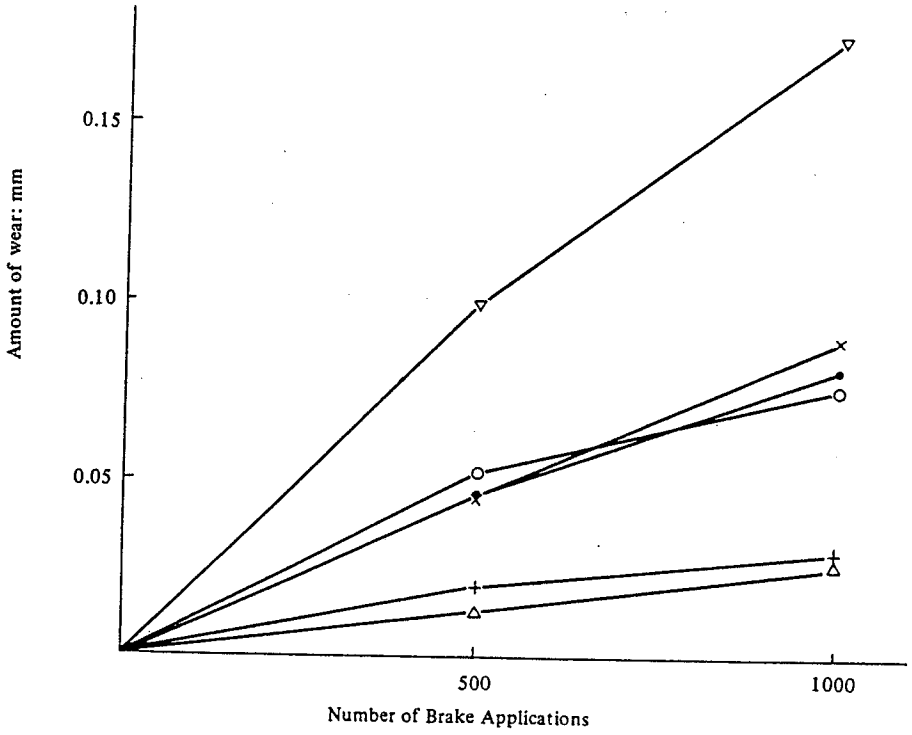
(2) In line with the decision to introduce the SI units, such units are added, as the first step to the introduction of SI units.

(3) The number of burnish braking applications (frequency of braking) is specified here. For large trucks and buses, however, is specified that the braking be repeated until an adequate contact is attained between the brake and linings or pads, as it is often difficult for large trucks and buses to ensure an adequate contact.

(4) The initial speed (for general wear tests) is specified as 50 km/h for all types of vehicles.
Since the determination of wear characteristics against temperature is vital in wear tests, the initial speed must be such that the temperature variation can be minimized during braking yet to ensure sufficient measurement of amounts of wears. Some expressed an opinion that the original standard should be kept as it was (PA – PC 60 km/h others 50 km/h), while some other argued that the initial speed should be unified to 50 km/h alone. The Subcommittee thus carried out related tests and surveied and concluded that the initial speed should be unified to 50 km/h.

(5) The number of brake applications (braking frequency) is doubled from the original standard. This is due to the fact that the original frequency is sometimes inadequate to find wear characteristics, as initial wears often accounted for the majority with the original braking frequency. Furthermore, the amount of wear was sometimes inadequate for friction materials with better wear resistance if the braking is done by the specified number of brake applications which in turn would result in inaccurate measurement. The braking frequency is thus doubled from the original frequency.

Reference Fig.



(6) An additional initial brake temperature 500°C is given as an optional test temperature for disc brake tests. This is because the initial brake temperatures of some disc brake vehicles rise as high as 500°C when descending a hill, etc.

(7) "Wear Test After Thermal Hysteresis" is renamed as "Second Wear Test" in order to indicate clearly that the same wear test be repeated for the same sample. The original standard did not specify clearly how the thermal hysteresis be given to each sample. Due to the fact that manufacturers that employ wear test after thermal hysteresis use the same sample after the first wear test using new products, the revised standard gives the same provision accordingly.

(8) "High Speed Wear Test" is given as an optional test item. As a result of experiments to determine the difference in amount of wear according to respective initial speeds, it was found that the amount of wear at high speeds could be assumed from the amounts of wears in general wear tests and the temperature rise in braking from a high speed. The high speed wear test is thus given as an optional test item.

(9) Weight measurement and wear rate indication are also added as optional items.

Explanatory Remarks on Revised Contents

Revised contents of the standard that appear to need additional explanations will be described in item by item in the following. (Numbers of items are the same with those given in the Text.)

1. Scope

Service brakes of passenger cars, trucks, buses and trailers are subject to the application of this standard. Those for motorcycles and special motor vehicles are excluded again from the application, since even dynamometer tests for general performance have not been done so far.

3. Definitions

They are as defined in JASO C 446-79.

4. Test Conditions

4.1 Conditions of Each Element of Braking Devices

Since the friction surface of a brake is vulnerable and subject to damage during the test, it is specified that new products are to be generally used.

4.2 Inertia

The provision is in line with JASO C 446-79.

4.4 Measurement of Temperature

Due to the nature of wear tests, thermocouples may be broken or damaged at the friction material side. Therefore, the measurement of temperature is to be done generally at the rotating side. Reference figures are given as specific examples for the location of thermocouple installation. Ventilated discs are also added for reference.

4.5 Cooling Wind

It is allowed to select an appropriate wind velocity if it is difficult to attain the specified initial brake temperature. When the test condition is changed, the test should be generally done without any wind, as wind may affect greatly to the number of brake applications (See Remarks given in 5.2.1.)

5. Test Procedure

5.2 Test Items and Test Sequence

5.2.1 General Wear Tests

This is the most general and common test item, absolutely necessary as basic wear data.

(1) Burnish

The expression of "until an adequate contact is obtained" given in the original standard for the number of brake applications (braking frequency) is vague without a clear indication to the braking frequency, which creates some ambiguity in practical test. Therefore, 200 times of brake applications currently employed by the majority of manufacturers is adopted here. The number of brake applications may be increased for large trucks and buses since it is sometimes difficult to obtain the necessary contact with the specified braking frequency.

(2) Wear Test

Some subcommittee members said that the initial speed should be maintained as specified in the original standard (60 km/h for PA – PC; 50 km/h for other vehicles), while some others said that it should be unified to 50 km/h for all vehicles. Experiments were carried out to check on this question, and following findings were obtained. Namely, the brake temperature should be kept as constant as possible for the test to determine temperature characteristics of friction materials, without much fluctuation in temperature. In this regard, the unification to 50 km/h was found to be preferable if the amount of wear of friction material is interpreted as the characteristics against temperature, since the brake temperature would rise by 15°C higher at the speci-

fied measuring location if the initial speed is 60 km/h, as compared with the temperature where the initial speed is 50 km/h. Furthermore, there is another merit for the initial speed of 50 km/h, as the braking intervals are shorter than that of 60 km/h, which will result in shorter test period. The amount of wear with the initial speed of 50 km/h is adequate for the measurement. Because of the foregoing, as well as the fact that it is meaningless to set different initial speeds for different categories of vehicles, it was decided to adopt the unified value of 50 km/h for all vehicles. As for the initial brake temperature, many expressed a wish to add the initial brake temperature of 500°C, since some disc brake vehicles would encounter high brake temperatures as 500°C when climbing up or down hills. It was thus decided to add 500°C as an optional initial brake temperature.

For the braking frequency, an opinion was expressed during the revisional process of JASO C 406-74 that the frequency specified in the standard was inadequate. Tests were carried out to confirm this question and found that some friction materials had shown much initial wears, and overall wear characteristics could not be clearly determined with the braking frequency. For friction materials with higher wear resistance (semi-metallic materials, etc.), on the other hand, the amount of wear obtained by the frequency was too small to determine wear characteristics, which would result in low measuring accuracy. Some expressed an opinion that the frequency should not be changed simply because of the presence of semi-metallic materials, etc. since such materials were not widely used yet. In the end, it was decided that the frequency should be increased by twofold for general cases, while it is also allowed to increase the frequency if an adequate amount of wear is not obtained with the revised frequency.

For friction materials with much initial wears, only wear data having liniarity to the braking frequency should be treated as valid data.

Remark: It is specified in the remark that test conditions during the brake temperature rise be kept without any wind. This is because the priority is placed on attaining the desired conditions as soon as possible, whereas a considerable number of brake applications is required at high temperatures. As for the braking method, the most desirable method, i.e. the constant output is set as a rule, but the input may be made constant if it is convenient for the test equipment. A provisional clause is added, however, that the pressure setting should be such to attain 0.3G or equivalent deceleration in order to minimize variables in test conditions.

(3) Second Wear Test

Some data indicated that friction materials subjected to thermal hysteresis would show greater amounts of wears under lower temperature conditions. The majority of wear data showed that the effect of thermal hysteresis was not so significant under high temperature conditions, while few other data showed increased wears on certain materials. Although no provision for the method of applying thermal hysteresis to samples is given in the original standard, many manufacturers are carrying out another wear test at 100°C or 200°C after thermal hysteresis. Therefor, it is specified in this standard that the second wear test be carried out using the same sample after the general wear tests.

The temperature pitch for the initial brake temperature is specified as 100°C, as a rule, since this pitch is adequate to determine the hysteresis. 300°C and 400°C are given as optional test temperatures. 250°C is also added, taking account of an opinion that a displacement point exists around 250°C in relation to the effect of thermal hysteresis. The braking frequency for this test is left as specified in the original standard, since the amount of wear will increase than that by the original standard, and the effect of initial wear will be absent by this new provision.

5.2.2 High Speed Wear Test

The difference in amount of wear according to the initial speed was checked, and following findings were obtained. In some cases, it was possible to assume the amount of wear at high speeds from the amount of wear with the initial brake temperature and the temperature rise during high speed braking, which gave a basis of an opinion that high speed wear test could be excluded. Nevertheless, some other cases showed that the difference in amount of wear could not be attributed to temperature alone. The high speed wear test is, therefore, left in this standard as an optional test.

Although controversional opinions were expressed on the initial speed, it is unified to 100 km/h for all vehicles, except for vehicles with nominal maximum speeds below 100 km/h. For the latter vehicles, it is specified that the nominal maximum speed be employed in the test.

For the initial brake temperature, 100°C alone is specified since it is unlikely that the initial brake temperature becomes higher than 100°C due to the unlikelyness of high speed and continuous brake applications when running on ordinary roads. Moreover, if the initial brake temperature is set higher than 100°C, cracks or other abnormalities may result in friction surfaces such as drum, rotor, etc.

The braking frequency is set as 100 times as specified in the original standard, taking account of the amount of wear

under high speed braking conditions.
Burnish conditions are made common to those of the general wear tests, since heat spots may result if the test is done too rapidly and radically, as well as the fact that the high speed wear test is done in the same condition as general wear tests in practice.

6. Measuring Procedure

The measuring accuracy of 0.01 mm is required for the measurement of linings or pads thickness. Manufacturers concerned are also using micrometers (accuracy 0.001 mm) or dial gauges (accuracy 0.01 mm) for that purpose, and hence no objections were raised to the specification in this standard. The room temperature is specified for the measurement, taking account of the effect of swelling of friction materials.
The measurement of the mass of linings or pads are made an optional test item, in order to compensate for the error caused by temperature and the error caused by the lifting of adhere surfaces.

7. Recording

The introduction of marking of wear rate was suggested by several companies, and it was decided that the marking is to be done as an optional item.