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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Road vehicles — Brake linings — Evaluation of friction material characteristics — Small sample bench test procedure

Véhicules routiers — Garnitures de freins — Évaluation des caractéristiques de matériaux de frottement — Méthode d'essai sur machine à petits échantillons

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7881 was prepared by Technical Committee ISO/TC 22, *Road vehicles.*

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Road vehicles — Brake linings — Evaluation of friction material characteristics — Small sample bench test procedure

0 Introduction

Certain friction material characteristics can be evaluated on laboratory test machines, using small samples. As is generally the case with material tests, such a method cannot alone ensure the suitability of the material tested for any particular industrial application. It only gives quantified information on the characteristics as tested.

1 Scope and field of application

This International Standard specifies the equipment and procedure for testing small samples of specified sizes of brake lining material on a bench test machine, and a method for evaluation of the test results.

This International Standard applies to brake lining materials for drum brakes and disc brakes.

2 Definitions

For the purposes of this International Standard, the following definitions apply.

2.1 thermal class A: Conditions corresponding to a fade test carried out at a pressure of 1 050 kPa and at a temperature limited to 350 °C. (See table 2 and clauses A.1 and B.1 in annexes A and B respectively.)

2.2 thermal class B: Conditions corresponding to a fade test carried out at a pressure of 3 000 kPa and at temperatures up to 400 °C. (See table 2 and clauses A.2 and B.2 in annexes A and B respectively.)

2.3 cold friction: Average of the friction coefficient values measured at temperatures of 100, 150 and 200 °C during the fade test. (See annexes A and B.)

2.4 hot friction: Average of the friction coefficient values measured:

a) either at temperatures of 300 and 350 °C during the fade test, and 300 °C during the recovery test, in the case of thermal class A conditions (see clauses A.1 and B.1);

b) or at temperatures of 350 and 400 °C during the fade test, and 350 °C during the recovery test, in the case of thermal class B conditions (see clauses A.2 and B.2).

3 Symbols and units

Table 1 indicates the symbols used in this International Standard, with their respective SI units.

For further characterizing of the symbols, the following indices apply:

i: beginning

e: end

a: cold friction

b: hot friction

Table 1 — Symbols and units

Designation	Symbol	Unit
Drum diameter	D	mm
Drum rotational speed	n	$\min^{-1}$ (r/min)
Pressure	p	kPa
Drum temperature	T	°C
Drum heating or cooling time	t	min
Instantaneous coefficient of friction	μ	—
Average coefficient of friction	$\bar{\mu}$	—
Standard deviation [1]	s	—
Normal thermal loading	N	—
High thermal loading	H	—

1) For five specimens: $\sqrt{\dfrac{\sum_1^5 (\bar{\mu} - \bar{\mu}_a \text{ or } \bar{\mu}_b)^2}{5 - 1}}$

4 Test equipment

The test machine, which is capable of subjecting test samples to the levels of pressure, speed and temperature laid down, is shown schematically in figure 1.

The friction drum surface dimensions are given in figure 2; it shall be perlitic cast iron to the following specification:

C: 3,3 to 3,5 %

Mn: 0,55 to 0,75 %

Si: 1,8 to 2,1 %

S: 0,2 % max.

P: 0,2 % max.

Ni: 0,6 to 0,7 %

Cr: 0,15 to 0,25 %

Mo: 0,2 to 0,3 %

Brinell hardness HB: 180 to 230

NOTE — Trace elements such as titanium and vanadium can influence friction and wear properties; their presence should therefore be known and checked in all drum tests.

The effective graph of the heating and cooling process shall not deviate by more than ±15 °C from the curves shown in figures 3 and 4.

Equipment for measuring and recording drum temperature, drum rotational speed, friction force and time shall be accurate to ±2 %.

NOTE — A recommended method of drum conditioning and surface preparation is given in annex C.

5 Sampling and conditioning

A representative sample shall consist of five specimens taken at random from different production batches of a friction material.

The dimensions of specimens shall be 25,4 mm × 25,4 mm with a thickness between 3 and 6 mm.

Consistency of sample thickness may be critical when comparing test results of like materials.

Any identification marks shall be on the non-friction surface.

6 Test method

Each specimen of a representative sample shall be tested.

According to the objective of the test and/or the nature of the lining, the test shall be carried out, under either A conditions (thermal class A), or B conditions (thermal class B) as defined in clause 2 and table 2.

Place the specimen in the test machine (see clause 4 and figure 1) and run the tests as given in table 2 at the appropriate values; plot the results in a graph as shown in annex A (either clause A.1 or A.2).

7 Test results

7.1 Test results for each specimen shall be recorded on a graph as shown in annex A (either clause A.1 or A.2).

7.2 From the graph, extract and record the data as shown in annex B (either clause B.1 or B.2).

7.3 For each specimen, calculate the average values of the coefficient of friction for temperature ranges "a" (cold friction) and "b" (hot friction).

7.4 From the averages in 7.3, calculate the averages $\bar{\mu}_a$ and $\bar{\mu}_b$ and standard deviations of "a" and "b".

Table 2 — Test schedule

Test No.	Purpose	Brake applications Type	Brake applications Number	Revolutions min^{-1} (r/min)	Pressure kPa	Temperature °C T_i	Temperature °C T_e	Time	Further conditions
1	Bedding	continuous	—	310	700	200		—	Surface contact 95 % min. Cool when necessary
2	Base line	intermittent	20	420	1 050	100 ±10	—	10 s on 20 s off	—
3	Conditioning	continuous[1]	—	420	1 050	100	300	max. 10 min	Heat according to figure 3
4	Recovery	intermittent	3	420	1 050	250	100	Cool down in 50 °C steps, each step to be followed by 10 s brake application	Cool according to figure 4
5	Fade	continuous[1]	—	420	A = 1 050 B = 3 000	100	A = 350 B = 400	—	Heat according to figure 3
6	Recovery	intermittent	A = 3 B = 4	420	A = 1 050 B = 3 000	A = 350 B = 400	200	Cool down in 50 °C steps, each step to be followed by 10 s brake application	Cool according to figure 4

1) Take simultaneous readings of friction force and drum temperature at 30 s intervals.

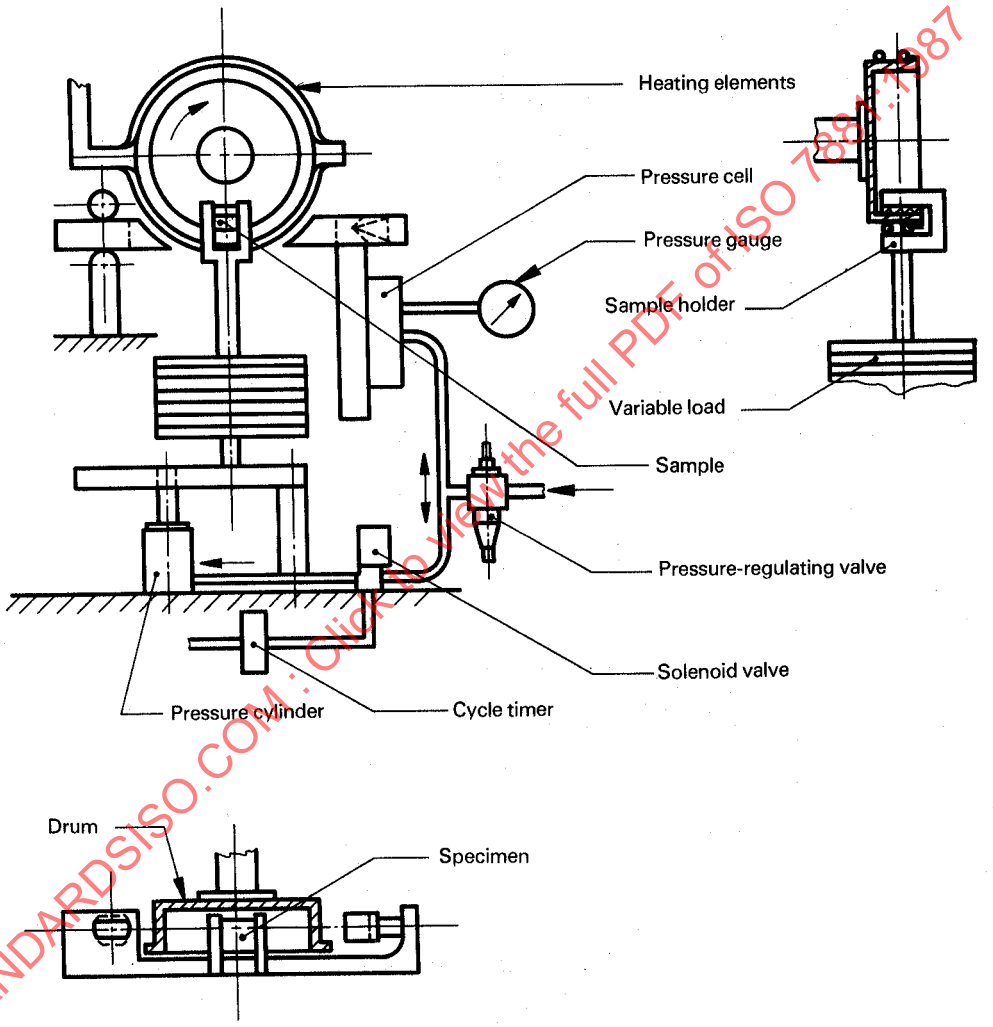


Figure 1 — Schematic diagram of test machine

Dimensions in millimetres

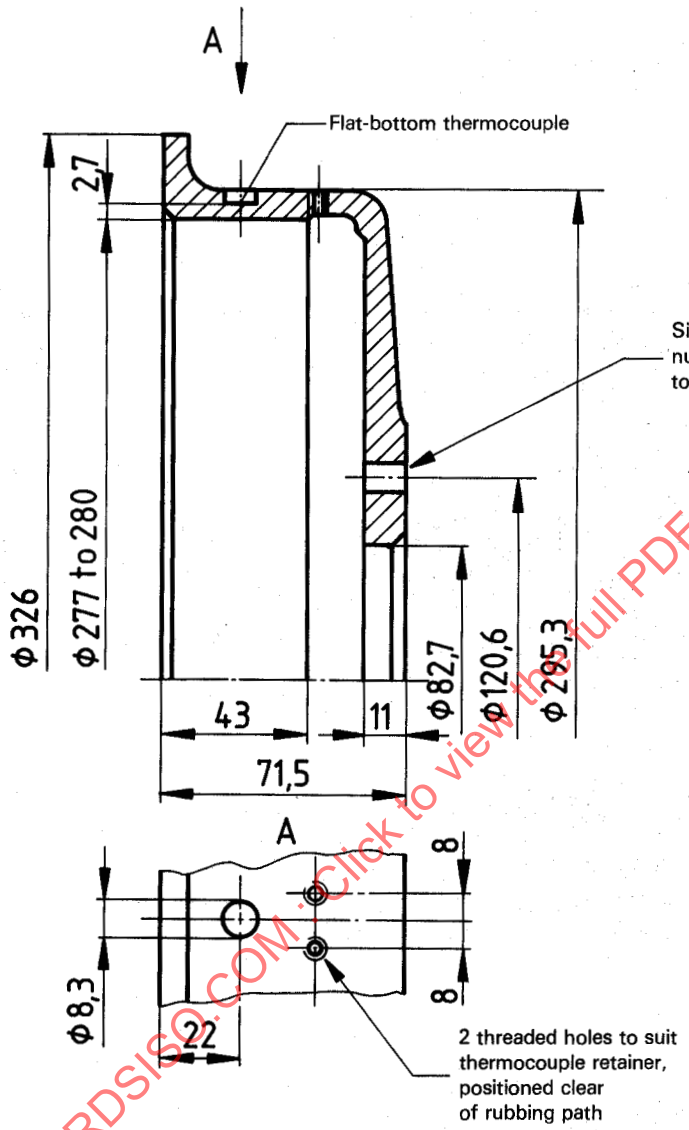


Figure 2 — Drum dimensions

8 Evaluation of results

8.1 A representative sample of the friction material type shall be subjected to check bench testing.

From the test results, friction values are calculated for cold friction "a" and hot friction "b".

8.2 The tests differentiate between two levels:

— thermal class A duty material;

— thermal class B duty material.

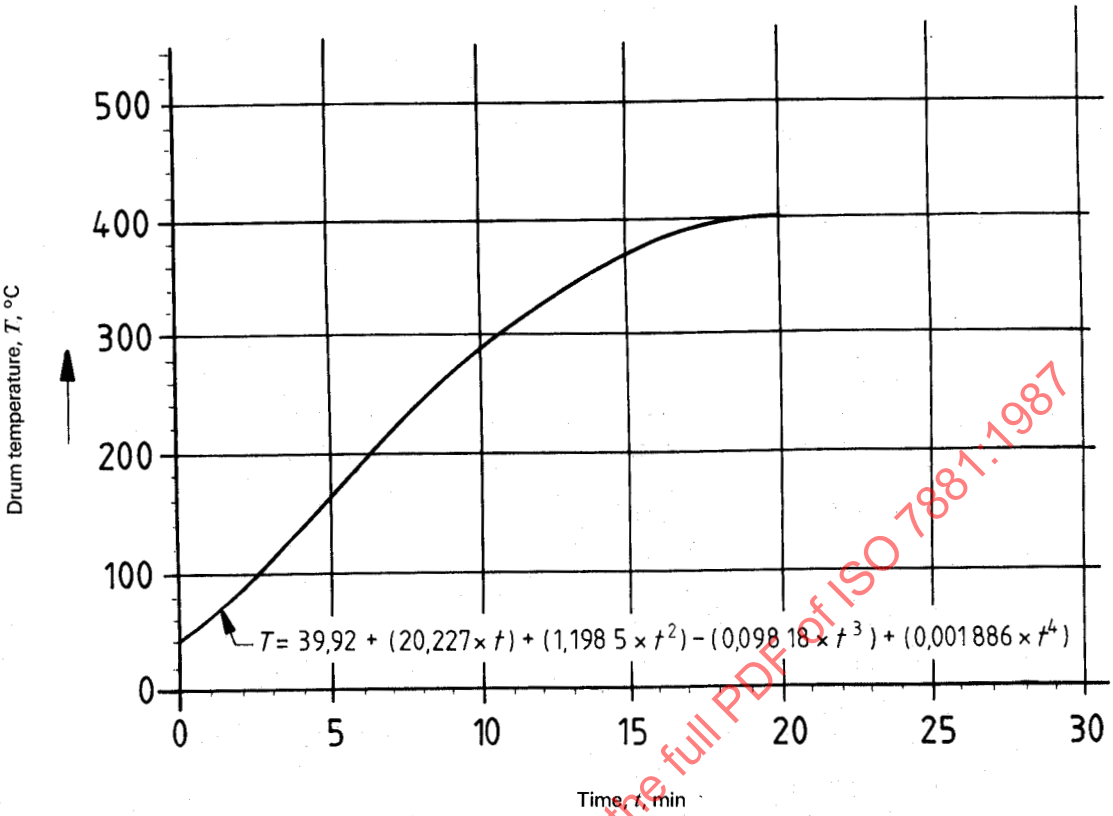


Figure 3 — Temperature/time graph for drum heating

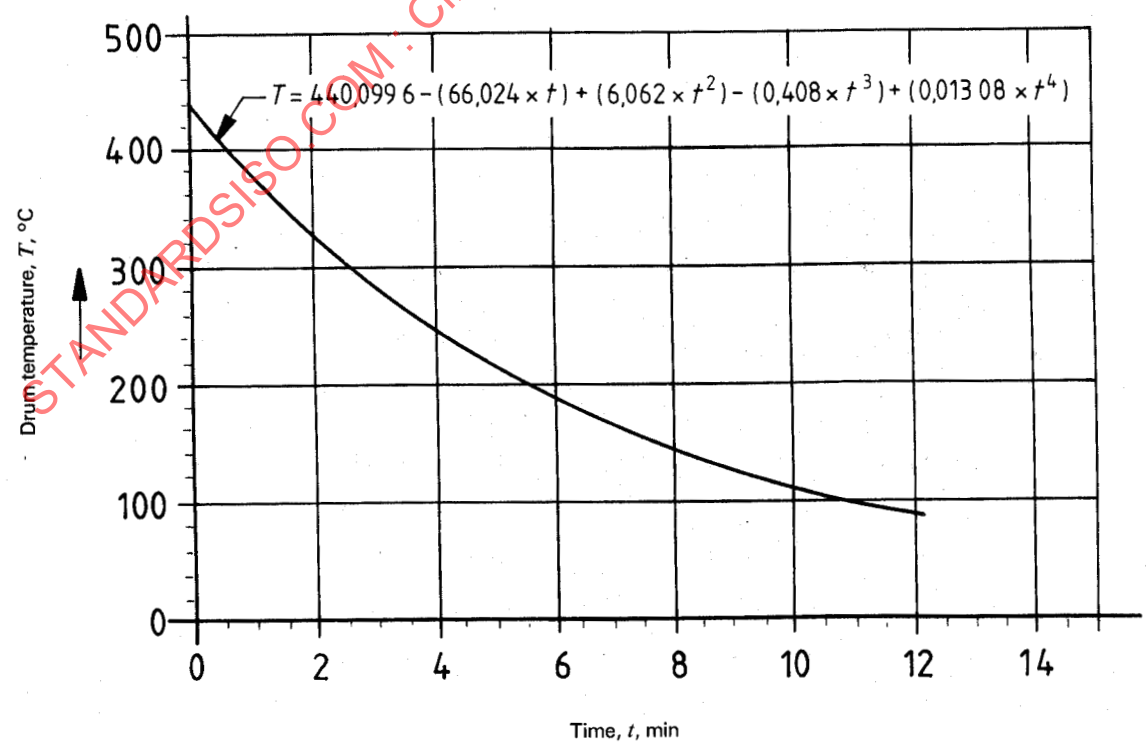
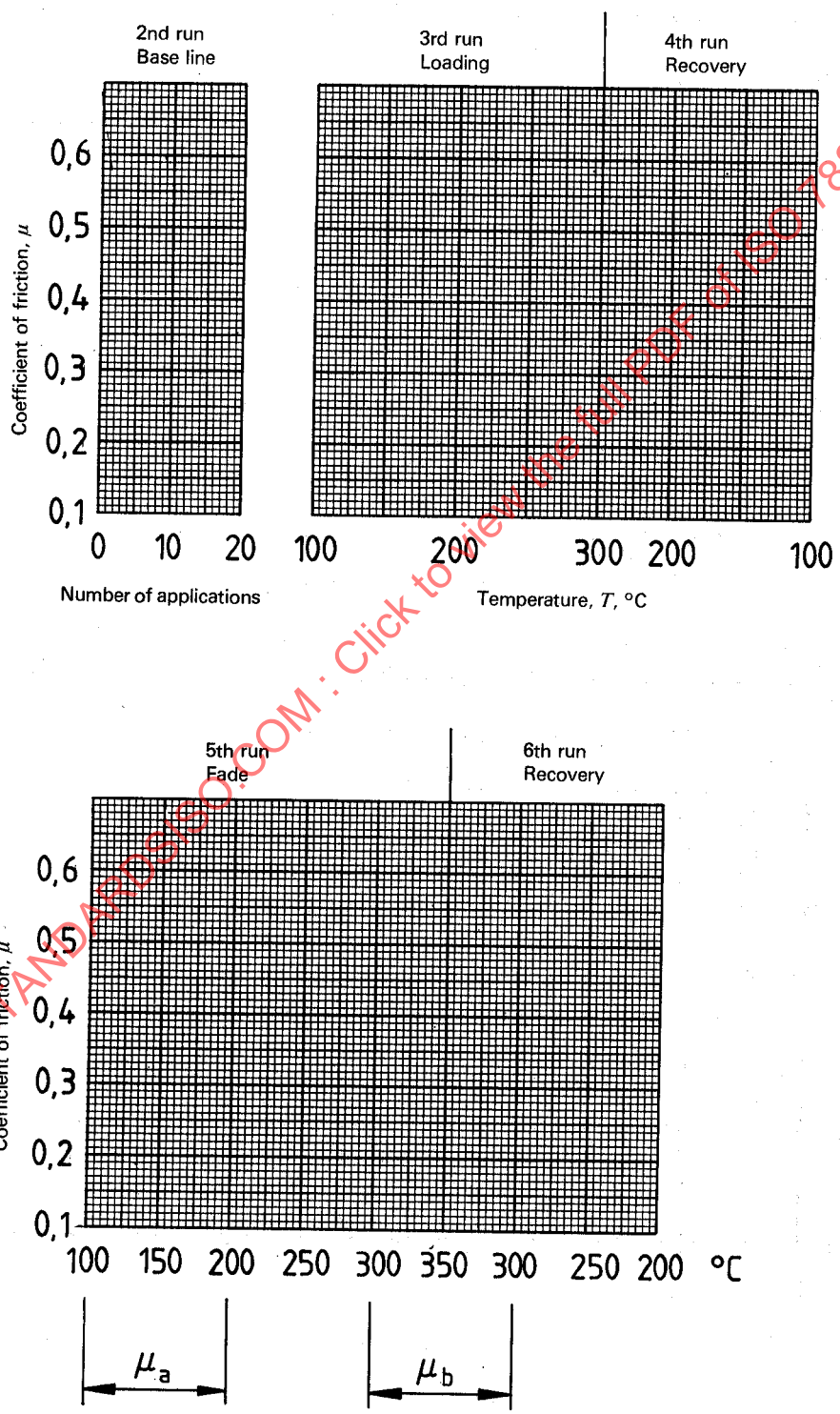


Figure 4 — Temperature/time graph for drum cooling

Annex A

Material graphs

A.1 Graph for class A duty material



A.2 Graph for class B duty material