



TECHNICAL REPORT 7882

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Road vehicles — Brake linings — Determination of thermal conductivity by guarded hot-plate apparatus

Véhicules routiers — Garnitures de freins — Détermination de la conductivité thermique par la méthode de la plaque chaude gardée

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ISO/TR 7882 was prepared by Technical Committee ISO/TC 22, *Road vehicles*.

The reasons which led to the decision to publish this document in the form of a technical report type 2 are explained in the Introduction.

0 Introduction

This Technical Report is based on existing data on the method of determination of the thermal conductivity of materials for building and construction.

No experience has yet been acquired by industry on the application of the method to those materials constituting brake linings especially taking into account the extremely high service temperatures. For this reason the document is published as a technical report, type 2.

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1 Scope

This Technical Report describes a method of determining the thermal conductivity of homogeneous materials or the thermal resistance of coated materials by means of the guarded hot-plate apparatus by applying it to brake linings for road vehicles.

The hot-plate apparatus is suitable for materials in the form of flat sheets. The measuring method used is suitable not only for homogeneous materials but also for more or less homogeneous porous, fibrous, granulated or coated materials.

2 Field of application

The method given in this Technical Report applies to materials with a thermal conductivity below 2 kcal/(m·h·°C) [2,3 W/(m·K)].

3 Definitions

For the purposes of this Technical Report, the following definitions apply.

3.1 thermal conductivity, λ : Property of a material which determines the magnitude of the heat flux which, in a given temperature field, flows through the test area under the action of the temperature gradient assumed to be effective in a direction perpendicular to the area concerned.

3.2 thermal resistance, R : Thermal resistance of a material coat of thickness d , equal to d/λ .

4 Units

Thermal conductivity, λ , is expressed in kilocalories per metre hour degree Celsius [kcal/(m·h·°C)] or in watts per metre kelvin [W/(m·K)].

Thermal resistance, R , is expressed in square metres hours degree Celsius per kilocalorie (m²·h·°C/kcal) or in square metres kelvins per watt (m²·K/W).

Tables 1 and 2 provide conversions into other units in each case.

Table 1 — Conversion of units for thermal conductivity

Unit Conversion	kcal/(m·h·°C)	cal/(cm·s·°C)	W/(cm·K)	W/(m·K)
1 kcal/(m·h·°C)	1	0,002 778	0,011 63	1,163
1 cal/(cm·s·°C)	360	1	4,186 8	418,68
1 W/(cm·K)	85,98	0,238 8	1	100
1 W/(m·K)	0,859 8	0,002 388	0,01	1

Table 2 — Conversion of units for thermal resistance

Unit Conversion	m ² ·h·°C/kcal	m ² ·K/W
1 m ² ·h·°C/kcal	1	0,859 8
1 m ² ·K/W	1,163	1

5 Method of determination

5.1 Principle

Determination of the thermal conductivity of specimens of sheet form from the heat flux and measuring the temperature difference in the steady-state condition, and the specimen dimensions.

5.2 Determination

5.2.1 Two-plate method

In the method using the two-plate apparatus (see figure 1), the mean thermal conductivity is found from two specimens of sheet form which are arranged symmetrically on either side of a hot-plate. From the opposite outer surfaces of the specimens, the heat is conducted away by cooling plates. To prevent heat losses to the side, the hot-plate is surrounded by a hot ring the inside surface temperature of which shall be the same as the temperature of the hot-plate.