

Transformed

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION
R 349

AUDIBERT-ARNU DILATOMETER TEST FOR COAL

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BRIEF HISTORY

The ISO Recommendation R 349, *Audibert-Arnu Dilatometer Test for Coal*, was drawn up by Technical Committee ISO/TC 27, *Solid Mineral Fuels*, the Secretariat of which is held by the British Standards Institution (B.S.I.).

Work on this question by the Technical Committee began in 1951 and led, in 1957, to the adoption of a Draft ISO Recommendation.

In May 1958, this Draft ISO Recommendation (No. 238) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies:

Austria	Greece	Portugal
Belgium	India	Romania
Burma	Italy	Turkey
Canada	Japan	United Kingdom
Czechoslovakia	Mexico	U.S.S.R.
Denmark	New Zealand	Yugoslavia
Germany	Poland	

One Member Body opposed the approval of the Draft: Spain.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in December 1963, to accept it as an ISO RECOMMENDATION.

Amendment 1 – November 1971 – to ISO Recommendation R 349-1963

Amendment 1
to ISO Recommendation R 349-1963

AUDIBERT-ARNU DILATOMETER TEST FOR COAL

Section 4, PROCEDURE, clause 4.3

Replace the 1st paragraph by “The coal is heated at a rate of 3 °C per minute”.

In the 6th paragraph, 2nd line, replace “chosen” by “stated”.

BRIEF HISTORY

Amendment 1 to ISO Recommendation R 349-1963, *Audibert-Arnu dilatometer test for coal*, was drawn up by Technical Committee ISO/TC 27, *Solid mineral fuels*, the Secretariat of which is held by the British Standards Institution (BSI).

Draft ISO Recommendation No. 1932 was drawn up on this subject, and was circulated to all the ISO Member Bodies for enquiry in April 1970. It was approved by the following Member Bodies :

Australia	India	Sweden
Belgium	Iran	Switzerland
Canada	Italy	Thailand
Chile	Korea, Rep. of	Turkey
Czechoslovakia	Netherlands	U.A.R.
Denmark	New Zealand	United Kingdom
France	Poland	U.S.A.
Germany	Portugal	U.S.S.R.
Greece	South Africa, Rep. of	Yugoslavia

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as AMENDMENT 1 to ISO Recommendation R 349-1963.

AUDIBERT-ARNU DILATOMETER TEST FOR COAL

1. OBJECT AND SCOPE

The Audibert-Arnu test is one of the parameters adopted for the International Classification of Hard Coals by Type of the United Nations Economic Commission for Europe. The object of the test is to determine the coking properties of hard coal or hard coal blends on the laboratory scale.

In principle, the test is not designed, nor can it be used, to indicate the pressures exerted by hard coals on the walls of industrial carbonization ovens.

2. PRINCIPLE AND TERMINOLOGY

A pencil made of powdered coal formed under pressure is inserted into a precisely calibrated narrow tube and topped by a calibrated steel rod (piston) which slides in the bore of the tube.

The whole is heated at a constant and definite rate.

By making regular readings of the displacement of the piston as a function of the temperature and expressing the displacements observed as percentages of the original length of the pencil, a curve of the type shown in Figure 1 below can be plotted.

The following items are characteristic (see note below):

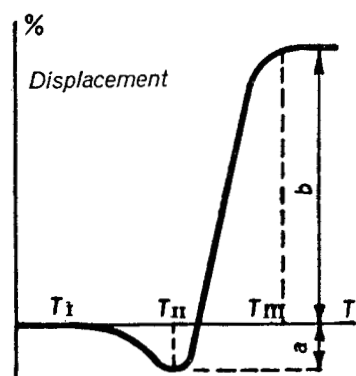


FIG. 1

T_I temperature at which the piston has moved down 0.5 mm *: *softening temperature*.

T_{II} temperature at which the piston reaches its lowest point: *temperature of maximum contraction*.

T_{III} temperature at which the piston reaches its highest point: *temperature of maximum dilatation*.

a maximum contraction, of the length of the pencil per cent.

b maximum dilatation, of the length of the pencil per cent.

If, after contraction has taken place, the piston does not return to its original level, the dilatation, equal, in absolute value, to the difference between the final level of the piston and the original zero level, is reported as negative.

NOTE. — The principal factors capable of distorting the results of this empirical test are the following:

(a) Deterioration of the coal, consequent on bad storage or faulty drying;

* Or 1 division, if the scale is calibrated in percentage of the standard length of pencil.

(b) Deviation from the tolerances of

- (1) the internal dimensions of the dilatometer tube,
- (2) the clearance between tube and piston,
- (3) the mass of the piston,
- (4) the dimensions of the mould;

(c) Deviation from the specified mean rate and regularity of heating;

(d) Deviation from the specification for the preparation of the sample in respect of maximum particle size, or for the pencil in respect of its length after tamping.

3. APPARATUS

3.1 Apparatus for preparing the coal pencil

- 3.1.1 *Mould*, polished internally, with accessories, as shown in Figures 2 and 2 A, pages 10 and 11.
- 3.1.2 *Gauge*, as shown in Figure 2, page 10.
- 3.1.3 *Ram*, of which Figure 3, page 12, shows an example.
- 3.1.4 *Press*, of which Figure 4, page 13, shows an example.

3.2 Dilatometer and accessories

- 3.2.1 *Dilatometer tubes and pistons*, as shown in Figure 5, page 14.

3.3 Other apparatus

- 3.3.1 *Electric furnace*, of which Figure 6, page 15, shows an example, consisting of a block of metal resistant to oxidation and of sufficiently high melting point. A suggested material is aluminium bronze. The metal block is pierced by at least two holes of 15 mm diameter by 350 mm deep to take the dilatometer tubes and one hole 320 mm deep to take a temperature-measuring device. The block is heated by a metallic winding, suitably insulated. Control gear permits the use of any selected rate of heating up to 5 deg per minute over a temperature range of 300 to 550 °C.

The furnace should be constructed so that the temperature conditions are uniform in the dilatometer tubes placed in their normal position in each hole.

To verify this, the furnace is heated at a rate of 5 deg per minute. When the temperature reaches about 450 °C, an exploration is made of the lower 180 mm of a dilatometer tube placed in the furnace, by comparing the readings on the normal temperature measuring device and a thermometric probe placed in the tube. The difference between the probe temperatures and the mean temperature shown by the normal temperature measuring device should be less than

$$\begin{aligned} &\pm 2 \text{ deg in the lower 120 mm,} \\ &\pm 5 \text{ deg from 120 to 180 mm.} \end{aligned}$$

This verification is not to be confused with the later calibration of the temperature measuring device; it is intended to measure only the temperature variation along the tube.

The furnace is equipped with an adjustable scale for each hole. The scale is preferably engraved on a mirror in front of which the indicator pointer of the piston moves. It is at least 180 mm in length and calibrated in millimetres or in percentages of the standard length of the pencil (60 ± 0.25 mm, see clause 4.2).