
INTERNATIONAL STANDARD



335

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Hard coal — Determination of caking power — Roga test

Houille — Détermination du pouvoir agglutinant — Essai Roga

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 27 has reviewed ISO Recommendation R 335 and found it technically suitable for transformation. International Standard ISO 335 therefore replaces ISO Recommendation R 335-1963 to which it is technically identical.

ISO Recommendation R 335 was approved by the Member Bodies of the following countries :

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

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The Member Body of the following country expressed disapproval of the Recommendation on technical grounds :

France

The Member Bodies of the following countries disapproved the transformation of ISO/R 535 into an International Standard :

Czechoslovakia
Romania
United Kingdom

Hard coal – Determination of caking power – Roga test

0 INTRODUCTION

The purpose of the Roga test, which provides one of the parameters adopted for the "International Classification of Hard Coal by Type" of the United Nations Economic Commission for Europe, is to assess the caking power of a coal under standard conditions.

Although the Roga test and the Gray-King test both assess the caking properties of a coal, they do not measure precisely the same parameters and shall not therefore be regarded as alternative methods.

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method of determining the caking power of hard coal by the Roga test.

2 PRINCIPLE

The caking power of a coal is defined by the mechanical strength of the crucible coke obtained by carbonization under standard conditions of an intimate mixture of 1 g of coal and 5 g of standard anthracite. The crucible coke obtained is then submitted to a drum test in a strictly prescribed manner and the Roga Index is calculated from the results.

3 REAGENT

3.1 Standard anthracite

An anthracite of E.C.E. Code No. 100 A, having an ash content of less than 4 % on the dry basis and a volatile matter number of 5 to 6,5 % on the dry, ash-free basis (see note). Carefully sieve the anthracite before use on sieves of 0,3 mm and 0,4 mm apertures (square); retain the fraction passing the 0,4 mm sieve and remaining on the 0,3 mm sieve for the test.

NOTE – An anthracite of E.C.E. Code No. 100 A but having a different ash and volatile matter content may be used, provided it has been found by experiment to give the same results, within the tolerances of the method (see clause 8), as those obtained using the standard anthracite.

4 APPARATUS

The balance shall be sensitive to 0,01 g.

4.1 Crucible, porcelain, having the following dimensions :

external diameter at the top	40 ± 1,5 mm
external diameter at the base	20 ± 1,5 mm
external height	40 ± 1,5 mm
wall thickness	less than 2 mm

4.2 Lid : heat-resistant steel plate, 55 mm square, 1,5 to 2 mm thick, with a hole 2 mm in diameter in the centre.

4.3 Stirrer, made of wire, having an 8 mm loop at one end.

4.4 Heat-resistant steel weight, of 110 to 115 g, of the following dimensions : 31 mm in diameter and 21 mm in height, with a threaded hole in the centre 7 mm in diameter and 10 to 12 mm deep into which can be screwed a suitable rod for lifting the weight from the crucible.

4.5 Press for compressing the mixture of coal and standard anthracite under a weight of mass 6 kg (see figure 1).

4.6 Electric furnace, with a zone of uniform temperature and a temperature control device capable of maintaining that zone at 850 ± 10 °C.

4.7 Drum with a cover, driving shaft, transmission gear and electric motor for carrying out the abrasion test on coke. The drum (see figure 2) has a 200 mm internal diameter, is 70 mm deep and is made of 2 mm thick sheet iron. To the inside walls, which shall be perfectly finished, are welded two symmetrical sheet iron strips 70 mm long, 30 mm wide and 2 mm thick. To close the drum, the cover is seated on a felt or rubber gasket and is secured by four wing-nuts. The drum is fitted with a threaded stub axle which serves to couple it to the driving shaft. It is convenient to mount two drums on a single shaft to enable two tests on two different samples to be carried out simultaneously. The drum is rotated with the stub axle horizontal at 50 ± 2 rev/min.

4.8 Laboratory sieve, made of thin brass sheet, with 1 mm round holes.

4.9 Stopwatch.

4.10 Asbestos sheet.

4.11 Brush.

5 PREPARATION OF SAMPLE

Crush the sample of air-dried coal to pass a 0,2 mm test sieve. Take care to avoid an excessive production of particles smaller than 0,1 mm. It is essential that not less than 40 % of the total sample consists of particles between 0,1 and 0,2 mm. Mix the crushed sample thoroughly for at least 1 min, preferably by mechanical means.

6 PROCEDURE

It is emphasized that duplicate determinations are to be carried out on each sample of coal, but that these shall not be done simultaneously.

Weigh a clean, dry crucible, place in it 1 g of the coal and 5 g of the standard anthracite (3.1), both weighed to an accuracy of 0,01 g. Mix carefully for 2 min with the stirrer (4.3), level off the surface and place the steel weight on it. Press the whole for at least 30 s under a weight with a mass of 6 kg. Remove the crucible from the press and cover it with the lid, leaving the steel weight in the crucible.

Raise the temperature of the furnace to 850 ± 10 °C and insert the crucible (see note below). Check the temperature on the floor of the furnace at the side of the crucible and ensure that the temperature of 850 ± 10 °C is regained within 5 min from the insertion of the crucible. After a total heating time of 15 min, remove the crucible from the furnace and allow it to cool on an asbestos plate for 45 min.

After cooling, remove the weight from the crucible by means of the rod. Brush back into the crucible any particles of coke adhering to the weight and weigh the crucible plus contents to an accuracy of 0,01 g. Transfer the contents of the crucible very carefully to the sieve. Carefully transfer back to the crucible the larger pieces of coke, using a pair of tweezers. Sieve the remaining coke very carefully and transfer the oversize back to the crucible. Reweigh the crucible plus contents. Transfer the contents of the crucible to the drum and fit the cover. Connect the drum to the axle, start the stopwatch and rotate the drum for 5 min at a speed of 50 ± 2 rev/min. Remove the coke from the drum and sieve it again. Transfer the coke remaining on the sieve back to the crucible and reweigh. Return the coke from the crucible to the drum and repeat the abrasion procedure, sieving and reweighing of the oversize exactly as described above. Carry out a third abrasion test under the same conditions, sieve and weigh the final oversize. All weighings shall be made to an accuracy of 0,01 g.

NOTE – For convenience, a second crucible may be heated in the furnace at the same time; it is emphasized, however, that duplicate determinations on a single sample of coal shall not be carried out simultaneously.

7 EXPRESSION OF RESULTS

The Roga Index (R.I.) is given by the formula

$$\frac{100}{3 m_1} \left(\frac{m_2 + m_5}{2} + m_3 + m_4 \right)$$

where

m_1 is the total mass, in grams, of crucible coke after carbonization;

m_2 is the mass, in grams, of coke remaining on the sieve before the first abrasion test;

m_3 is the mass, in grams, of coke remaining on the sieve after the first abrasion test;

m_4 is the mass, in grams, of coke remaining on the sieve after the second abrasion test;

m_5 is the mass, in grams, of coke remaining on the sieve after the third abrasion test.

The Index shall be reported to the nearest integer, as the mean of the results of two separate determinations which do not differ by more than 3 units (see clause 8). Where the difference is greater, the test shall be repeated.

8 PRECISION OF DETERMINATION

Caking power	Maximum acceptable differences between results	
	Same laboratory (Repeatability)	Different laboratories (Reproducibility)
ISO 335-1974	3 units	5 units

8.1 Repeatability

The results of duplicate determinations, carried out at different times, in the same laboratory by the same operator with the same apparatus on the same analysis sample, shall not differ by more than the above value.

8.2 Reproducibility

The means of the results of duplicate determinations, carried out in each of two laboratories on representative portions taken from the same sample after the last stage of sample preparation, shall not differ by more than the above value.

9 TEST REPORT

The test report shall include the following particulars :

- a) the reference of the method used;
- b) the results and the method of expression used;
- c) any unusual features noted during the determination;
- d) any operation not included in this International Standard, or regarded as optional.

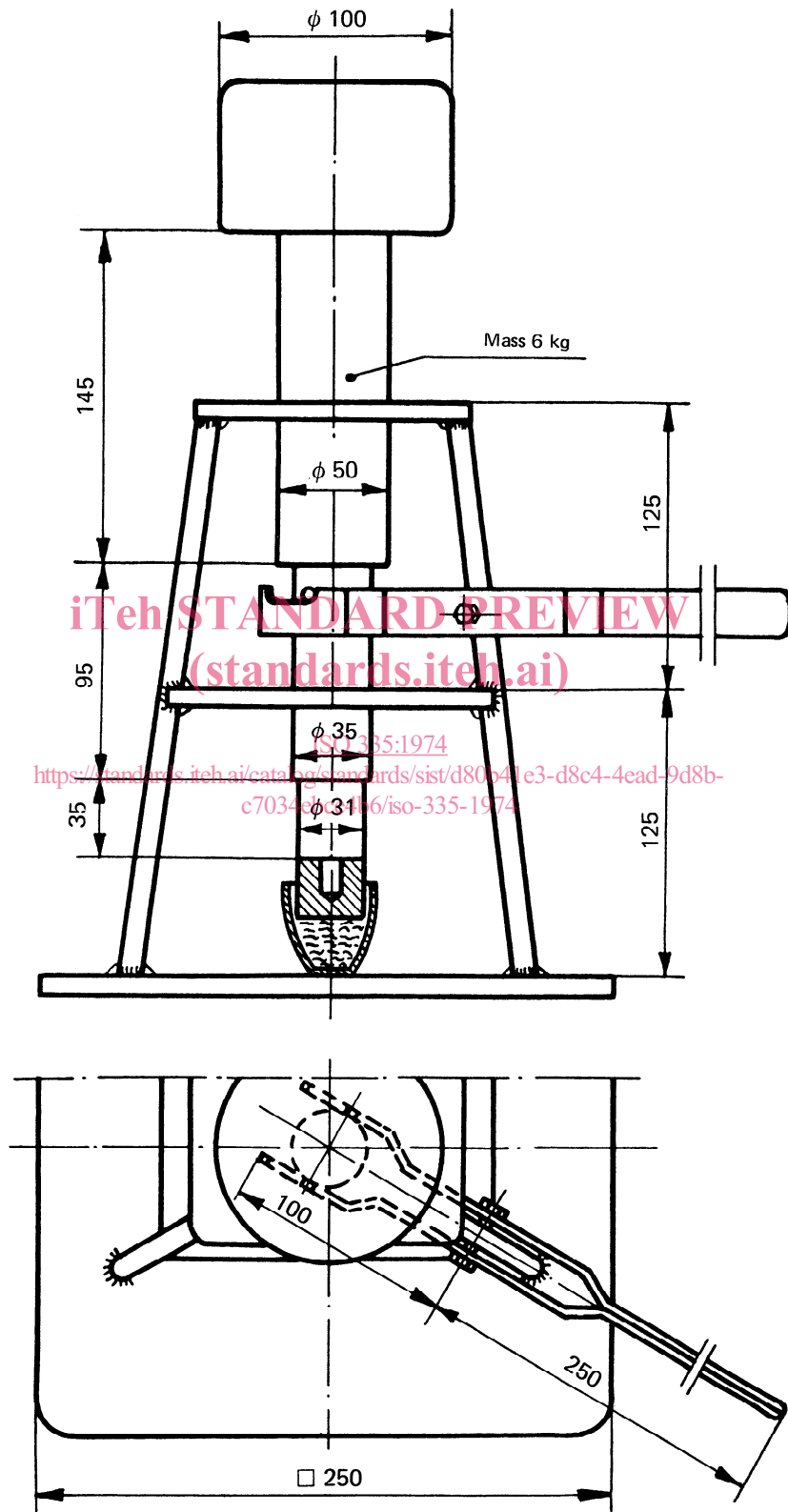


FIGURE 1 – Press used for compressing the mixture of anthracite and test coal

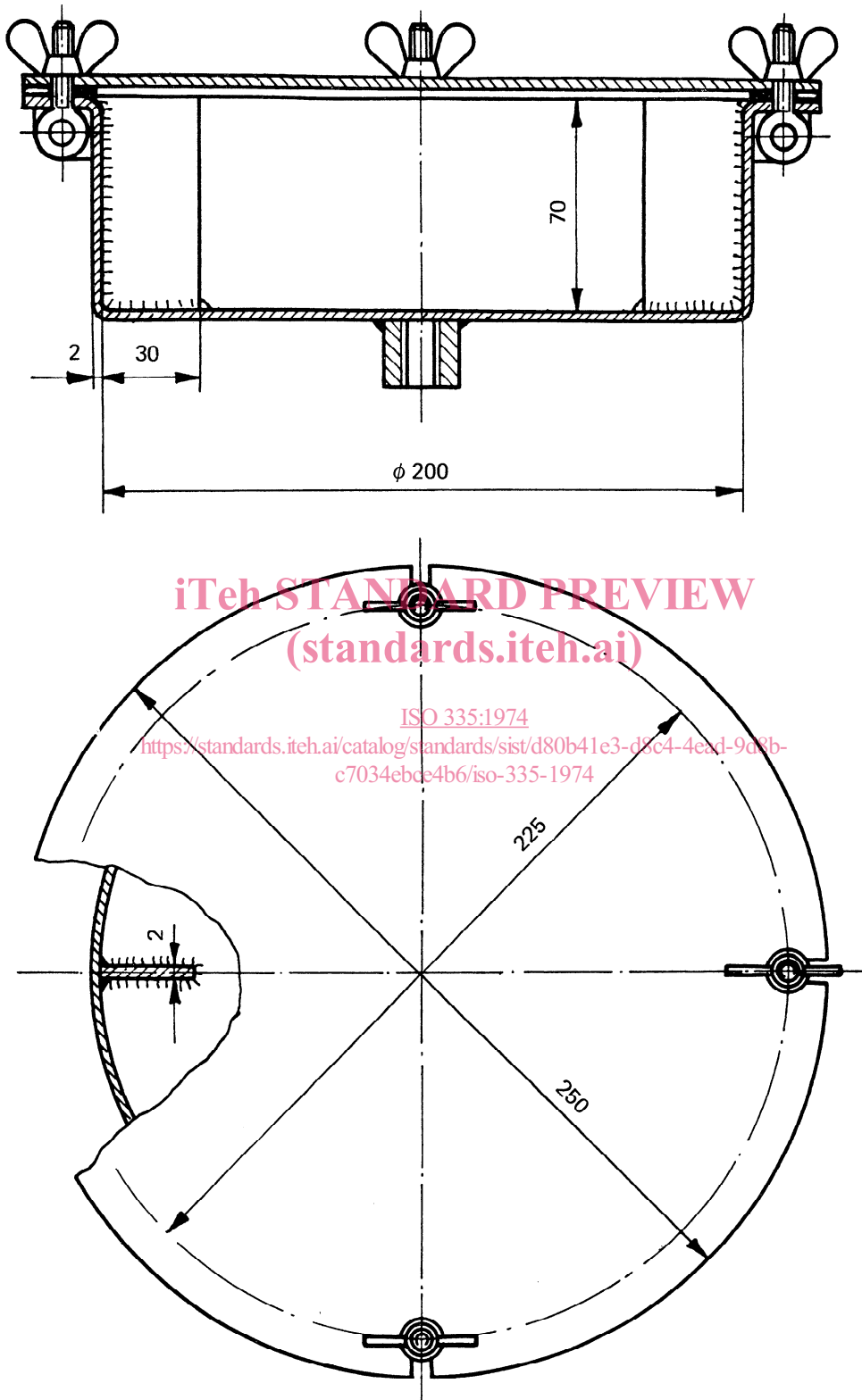


FIGURE 2 – Drum used for abrasion test

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