

ICS 73.010
CCS D 04



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 23561.12-2024

Replacing GB/T 23561.12-2010

**Methods for determining the physical and mechanical
properties of coal and rock - Part 12: Method for the
determination of coal hardness coefficients**

煤和岩石物理力学性质测定方法 第12部分:煤的坚固性系数测定方法

Issued on: August 23, 2024

Implemented on: March 1, 2025

**Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC**

Table of Contents

1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Apparatus	1
5 Specification of the specimens	3
6 Test procedure	4
7 Calculation of results	4
Annex A (normative) Record sheet for the determination of the hardness coefficient of coal	5
References	6

Note on the printed English title

The English title printed on the cover of GB/T 23561.12-2024 reads "Methods for determining the physical and mechanical properties of coal and rock-Part 12: Method for the determination coal hardness coefficients". The spelling has been corrected here; the Chinese title and the technical terminology are unchanged.

1 Scope and terms

1 The part covers the apparatus, the specification of the specimens, the test procedure and the calculation of results for determining the hardness coefficient of coal by the crushing method. It applies to the determination and calculation of the hardness coefficient where the lump size of the coal sample is 20 mm to 30 mm; where the lump size of 20 mm to 30 mm cannot be reached, a coal sample of 1 mm to 3 mm lump size may be used for the determination and the calculation.

2 The part has no normative references.

3.1 hardness coefficient of coal: an index, taken as a whole, of the ability of a coal block to resist failure. The entry is quoted from GB/T 16414-2008, 2.21.

4 Apparatus

4 The apparatus is mainly the following. A crushing cylinder, shown in Figure 1 with its dimensions in millimetres, made up of a drop weight, the cylinder body and the cylinder bottom. A measuring cylinder, shown in Figure 2 with its dimensions in millimetres, made up of a graduated plunger rule and the measuring tube. Sieves of 0.5 mm, 20 mm and 30 mm

aperture, one of each. A balance of 1 000 g maximum capacity and 0.01 g scale interval. Other tools, namely a small hammer, a funnel and containers.

5 Specification of the specimens

5.1 Two blocks of coal about 100 mm across are taken at each of the upper, middle and lower parts of the thickness of a freshly exposed seam. Where the sample is taken by drilling from the surface, two pieces about 100 mm long are likewise taken at the upper, middle and lower parts of the seam thickness. Once taken, the coal samples shall be wrapped and sealed at once with cling film, a plastic bag or plastic sheet and adhesive tape, so that they keep their natural moisture.

5.2 The coal samples shall carry a label giving the place, the horizon and the time of sampling and similar particulars.

5.3 The coal samples shall not be dropped or knocked while they are carried and transported, and no artificial cracks shall be produced in them.

5.4 The coal samples are broken with the small hammer into pieces of 20 mm to 30 mm, and the pieces between 20 mm and 30 mm are sifted out with the sieves of 20 mm and of 30 mm aperture.

5.5 Of the material so prepared, 50 g is weighed out as one portion, five portions make one group, and three groups in all are weighed out.

6 Test procedure

6.1 Before the test, the inside wall of the crushing cylinder is checked for smoothness and the free fall of the drop weight inside the cylinder is checked for freedom.

6.2 The crushing cylinder is set on a concrete floor or on a steel plate 20 mm thick and one portion of the specimen is put in. The drop weight, of 2.4 kg, is raised to a height of 600 mm, measured from the bottom face of the weight to the top face of the cylinder bottom, and let fall freely onto the specimen. Each portion is struck three times, and the five crushed portions are put together into one container.

6.3 The crushed material of each group of five portions is poured together onto the 0.5 mm sieve and sifted; the sieve is held level and shaken gently through about 200 mm, until no more coal dust falls through.

6.4 The powder that has passed the sieve is put into the measuring cylinder with the funnel and tapped gently so that it packs down. The graduated plunger rule is then inserted gently until it touches the powder in the tube. The reading L at the point A level with the mouth of the measuring cylinder, see Figure 2, is the height actually measured for the powder in the cylinder, read to the millimetre.

6.5 Where L is 30 mm or more, the number of blows n is fixed at three and the other groups are determined in the same way, following 6.1 to 6.4. The results are recorded as in Annex A.

6.6 Where L is less than 30 mm, that group of specimens is void, the number of blows n on each portion is changed to five, and the crushing, sifting and measurement of 6.1 to 6.4 are repeated, still with five portions to a group, to obtain the coal powder height L . The results are recorded as in Annex A.

7 Calculation of results

7.1 Where the lump size of the coal sample reaches 20 mm to 30 mm, the hardness coefficient f of the coal is calculated by formula (1) from the number of blows n on each portion and the measured height L , in millimetres, of the coal powder that has passed the sieve for each group. The equation did not survive extraction cleanly and is not reproduced here. Three groups of five portions each are determined in parallel and the arithmetic mean is taken, the result being given to two significant figures. The test report lists the result of each group and the arithmetic mean of the three groups. The results are recorded as in Annex A.

7.2 Where the lump size of the coal sample does not reach 20 mm to 30 mm, a coal sample of 1 mm to 3 mm lump size shall be used and the hardness coefficient of that 1 mm to 3 mm sample, written with the subscript 1 to 3, is determined as in 7.1. Where that coefficient is 0.25 or less, the hardness coefficient f of the coal is equal to it. Where it is greater than 0.25, the hardness coefficient f is calculated by formula (2) as 1.57 times the coefficient of the 1 mm to 3 mm sample, minus 0.14. In the list of symbols under formula (2) the original defines f as the hardness coefficient of rock, although the clause and the rest of the part deal with coal.

A.1 Annex A gives the record sheet for the determination, Table A.1, whose head carries the organisation sending the sample, the place of sampling, the time of sampling and the date of determination, and whose columns are the number of the coal or rock sample, the class of coal or rock, the number of the specimen, the number of blows n , the reading L of the measuring cylinder in millimetres, the hardness coefficient f , the mean value of f and a remarks column, with lines at the foot for the person who carried out the determination, the person who calculated and the person who checked.

B Relationship to the previous edition

The part replaces GB/T 23561.12-2010. Besides changes of structure and editorial changes, the main technical changes listed in the foreword are the addition of a statement of the field of application in clause 1, a change to the order in which the sieve apertures are given in the apparatus clause, the addition of cling film to the wrapping and sealing

materials in 5.1, the addition of a check of the crushing cylinder before the test in 6.1, and the addition in 7.2 of the calculation to be used where the lump size of the coal sample taken does not reach 20 mm to 30 mm.

The part belongs to GB/T 23561, which is planned in sixteen parts covering sampling, true density, bulk density, porosity, water absorption, moisture content, uniaxial compressive strength and softening coefficient, deformation parameters, triaxial strength and deformation parameters, tensile strength, shear strength, the hardness coefficient of coal, the point load strength index, the swelling ratio of rock, the swelling stress of rock and the slake durability index of rock.