

Australian Standard[®]

**Coal and coke — Analysis and
testing**

**Part 20: Higher rank coal —
Hardgrove grindability index**

This Australian Standard was prepared by Committee MN/1, Coal and Coke. It was approved on behalf of the Council of Standards Australia on 3 February 1992 and published on 15 June 1992.

The following interests are represented on Committee MN/1:

Australasian Institute of Mining and Metallurgy
Australian Coal Association
Australian Coal Industry Research Laboratories
Australian Coal Preparation Society
Australian Institute of Energy
Bureau of Steel Manufacturers of Australia
Confederation of Australian Industry
CSIRO, Division of Coal and Energy Technology
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PREFACE

This Standard was prepared by the Standards Australia Subcommittee on Coal Evaluation, under the supervision of the Committee on Coal and Coke, as a revision of AS 1038.20–1981, *Methods for the analysis and testing of coal and coke, Part 20: Determination of Hardgrove grindability index of hard coal*. It is based on ISO 5074:1980, *Hard Coal – Determination of Hardgrove grindability index*.

Major differences from the previous edition are as follows:

- (a) Update of nomenclature and format in line with current practice.
- (b) Revision of precision data based on the results of an extensive interlaboratory test program.
- (c) Inclusion of acceptance criteria for Hardgrove grindability machine calibration data.

This Standard is not technically equivalent to ISO 5074.

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FOREWORD

Grindability of coal is a composite property embracing a number of specific properties such as hardness, strength, tenacity and fracture.

Hardgrove grindability, based on the method developed by Hardgrove¹, is determined by grinding a coal sample in a laboratory batch grinder, and comparing the yield of pulverized coal with that given by a calibration curve derived from a series of certified reference coals. Some of the important variables that can influence the result of this determination are the method of sample preparation and the moisture content of the coal.^{2,3}

Hardgrove grindability index provides an empirical ranking of the relative grindability or ease of pulverization of a coal under standardized conditions, and may serve as a means of estimating the capacity and power consumption of commercial pulverizers to grind different coals.^{1,4}

¹ HARDGROVE, R.M. Grindability of coal, *Trans. ASME, F.S. Power Division*, 1932, 54, 37.

² CALLCOTT, T.G. Coal grindability—A standardized procedure for the determination of coal grindability and a survey of the grindabilities of British coals. *J. Inst. Fuel*, 1956, 29, 207.

³ CALLCOTT, T.G. Coal grindability II—Effect of sample preparation in the Hardgrove test. *J. Inst. Fuel*, 1957, 30, 466.

⁴ FITTON, A. and JACKSON, R. Some experiences of coal grinding plant tests on a ring-ball mill and a tube mill. *J. Inst. Fuel*, 1959, 32, 520.

STANDARDS AUSTRALIA

Australian Standard
Coal and coke—Analysis and testing

Part 20: Higher rank coal—Hardgrove grindability index

1 SCOPE This Standard sets out the method for determining the grindability index of higher rank coal, using the Hardgrove machine. It also prescribes the procedure for calibration of the test machines, using Australian standard certified reference materials (ASCRMs).

2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS

1038 Methods for the analysis and testing of coal and coke

1038.16 Part 16: Acceptance and reporting of results

1152 Test sieves

2096 Classification and coding systems for Australian coals

2646 Sampling of solid mineral fuels

2646.6 Part 6: Hard coal - Preparation of samples

2706 Numerical values - Rounding and interpretation of limiting values

3 DEFINITIONS For the purpose of this Standard, the definition below applies.

3.1 Higher rank coal (as defined in AS 2096) - coal having a gross specific energy of 21 MJ/kg or greater on an ash-free, moist basis *and* a gross specific energy of 27 MJ/kg or greater on a dry, ash-free basis.

4 PRINCIPLE A prepared sample of coal of limited particle size range is ground under defined conditions in a laboratory mill of standardized design. The grindability index is derived from a sieve analysis of the ground product, and by reference to a calibration prepared from Australian certified reference materials.

5 APPARATUS

5.1 Weighing device—a balance capable of weighing 100 g to the nearest 0.01 g.

5.2 Weighing device—a balance capable of weighing 1500 g, to the nearest 1 g.

5.3 Sample divider—as specified in AS 2646.6.

5.4 Crusher—a laboratory plate mill capable of reducing 4.0 mm nominal top size coal particles to 1.18 mm with the production of a minimum of material finer than 600 µm. The plates shall be about 100 mm in diameter and serrated. The distance between the plates shall be adjustable and the relative frequency of rotation of the plates shall not exceed 200 r/min. Roll or impact crushers shall not be used, because the former produces platelike particles and the latter produces excessive fines.

5.5 Sieves

5.5.1 Wire-cloth test sieves—complying with AS 1152, of approximately 200 mm diameter, with aperture sizes 1.18 mm, 600 µm and 75 µm respectively, and having a cover and receiver.

5.5.2 Protective sieve—capable of nesting on the test sieves, with round or square hole apertures in the range 16 mm to 19 mm.

A plate sieve having round holes is recommended; if a standard wire-cloth sieve is used, it shall be marked as unsuitable for test sieving (see Note to Clause 7(c)).

5.6 Mechanical sieving machine*—capable of accepting an assembly of vertically nested sieves and a cover and receiver of diameter about 200 mm. A satisfactory sieving action is a horizontal oscillatory motion of amplitude 25 mm to 30 mm, at a frequency of approximately 5 Hz, while striking the top of the oscillating assembly with a mass of approximately 2 kg, moving through a vertical distance of about 25 mm under the influence of gravity, at a frequency of approximately 150 blows/min.

Alternatively, the nest of sieves, cover and receiver may be vibrated by an electromagnetic device, provided that the sieving performance is equivalent to the mechanically vibrated machine described.

* A Ro-Tap machine has been found to be suitable.