

AS/NZS 4518.2:1997
ISO 8486-2:1996

Australian/New Zealand Standard[®]

**Bonded abrasives—Determination
and designation of grain size
distribution**

Part 2: Microgrits F230 to F1200



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AS/NZS 4518.2:1997

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee ME/33, Abrasives. It was approved on behalf of the Council of Standards Australia on 30 September 1997 and on behalf of the Council of Standards New Zealand on 29 September 1997. It was published on 5 December 1997.

The following interests are represented on Committee ME/33:

Abrasives Institute of Australia
Australian Association of Certification Bodies
Australian Business
Australian Chamber of Commerce and Industry
Bureau of Steel Manufacturers of Australia
Industrial Diamond Association
New Zealand Institute of Engineering Sciences
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This Standard was issued in draft form for comment as DR 97162.

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Part 2: Microgrits F230 to F1200

Originated in Australia as part of AS B279—1968.
Previous Australian edition part of AS 1487—1975.
Jointly revised and redesignated in part as AS/NZS 4518.2:1997.

PUBLISHED JOINTLY BY:

STANDARDS AUSTRALIA
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Homebush NSW 2140 Australia

STANDARDS NEW ZEALAND
Level 10, Radio New Zealand House,
155 The Terrace,
Wellington 6001 New Zealand

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME/33, Abrasives, to supersede, in part, AS 1487—1975, *Abrasive grain size*.

This Standard is identical with and has been reproduced from ISO 8486-2:1996, *Bonded abrasives—Determination and designation of grain size distribution*, Part 2: *Microgrits F230 to F1200*.

The objective of this Standard is to provide manufacturers and users of bonded abrasive products with a method for assessing the size distribution of microgrits in the range F230 to F1200 which are intended to be used in the manufacture of products such as grinding wheels, saws and the like.

This Standard is one of a series of Standards applicable to bonded and coated abrasive products.

Statements expressed in mandatory terms in notes to tables, figures or clauses are deemed to be requirements of this Standard.

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8486 Bonded abrasives—Determination and designation of grain size distribution

4518 Bonded abrasives—Determination and designation of grain size distribution

8486-1 Part 1: Macrogrits F4 to F220

4518.1 Part 1: Macrogrits F4 to F220

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AUSTRALIAN/NEW ZEALAND STANDARD

Bonded abrasives — Determination and designation of grain size distribution —**Part 2:****Microgrits F230 to F1200****1 Scope**

This part of ISO 8486 sets forth a method for determining or checking the size distribution of microgrits from F230 to F1200 in fused aluminium oxide and silicon carbide.

It specifies the grit designation for the testing of those grits used in the manufacture of bonded abrasive products and general industrial applications and those removed from bonded products as well as loose grits used in polishing.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 8486. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8486 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 8486-1:1996, *Bonded abrasives — Determination and designation of grain size distribution — Part 1: Macrogrits F4 to F220*.

3 Definitions

For the purposes of this part of ISO 8486 the definitions given in ISO 8486-1 as well as the following apply.

3.1 microgrits: Grits with grain size distributions which are determined by sedimentation.

4 Method of checking grain size distribution**4.1 Grain size distribution**

The grain size distribution of microgrits F230 to F1200 is determined according to the following criteria:

- the grain size (theoretical grain diameter) must not exceed the maximum permissible d_{s3} value at the 3 % point of the grain size distribution curve;
- the median grain size (theoretical grain diameter) must be within the specified tolerances of the d_{s50} value at the 50 % point of the grain size distribution curve;
- the grain size (theoretical grain diameter) must attain at least the $d_{s94/95}$ value at the 94/95 % point of the grain size distribution curve.

These three criteria must be met. The values are specified in table 1 for the photosedimentometer (94 %) and in table 2 for the US sedimentometer (95 %).

Testing of microgrits F230 to F1200 is carried out by sedimentation according to clause 5 of this standard.

4.2 Grading

The "F" microgrit-series is a graduated series of eleven microgrits starting at a median particle size of 53 μm and ending at 3 μm determined by photosedimentometer. This series follows on from the finest grain in the "F" series macrogrits F220 (63 μm) and uses the same ratio as that series, i.e. $\sqrt[4]{2}$.

The calculation of the individual grain size values (see table 3) has been made as follows:

- the ratio of the median grain sizes F230 and F240 is $\sqrt[4]{2} \cdot f^0$ i.e. it corresponds approximately to the progressive ratio of the test sieves for macrogrits;
- the ratio of the median grain sizes of the following grits F240 and F280 is $\sqrt[4]{2} \cdot f^1$;
- the ratio of the succeeding grain sizes is $\sqrt[4]{2} \cdot f^n$

where $n = 1, 2, 3, 4, 5, 6, 7, 8, 9$ and where the following equation applies to the factor " f "

$$53 = 3 \left(\sqrt[4]{2} \right)^{10} \cdot f^{(0+1+2+3+\dots+9)}$$

$$f = \sqrt[45]{\frac{53}{3 \left(\sqrt[4]{2} \right)^{10}}} = 1,0257$$

This produces a series of ratios starting at 1,189 and ending at 1,495.

Table 1 — Grain size distribution of microgrits F230 to F1200 (photosedimentometer)

Grit designation	d_{s3} value max. μm	Median grain size d_{s50} value μm	d_{s94} value min. μm
F230	82	53 ± 3	34
F240	70	$44,5 \pm 2$	28
F280	59	$36,5 \pm 1,5$	22
F320	49	$29,2 \pm 1,5$	16,5
F360	40	$22,8 \pm 1,5$	12
F400	32	$17,3 \pm 1$	8
F500	25	$12,8 \pm 1$	5
F600	19	$9,3 \pm 1$	3
F800	14	$6,5 \pm 1$	2
F1000	10	$4,5 \pm 0,8$	1
F1200	7	$3 \pm 0,5$	1 (at 80 %)

Table 2 — Grain size distribution of microgrits F230 to F1200 (US sedimentometer)

Grit designation	d_{s3} value max. μm	Median grain size d_{s50} value μm	d_{s95} value min. μm
F230	77	$55,7 \pm 3$	38
F240	68	$47,5 \pm 2$	32
F280	60	$39,9 \pm 1,5$	25
F320	52	$32,8 \pm 1,5$	19
F360	46	$26,7 \pm 1,5$	14
F400	39	$21,4 \pm 1$	10
F500	34	$17,1 \pm 1$	7
F600	30	$13,7 \pm 1$	4,6
F800	26	11 ± 1	3,5
F1000	23	$9,1 \pm 0,8$	2,4
F1200	20	$7,6 \pm 0,5$	2,4 (at 80 %)

NOTE — These values were calculated by the following algorithms, based on ISO round-robin tests. Factors for conversion from Eppendorf photosedimentometer (x) to US sedimentometer (y) are:

d_{s3} value	$y = 0,760x + 15,1$	$k^{(1)} = 0,9997$
d_{s50} value	$y = 0,961x + 4,8$	$k = 0,9992$
$d_{s94/95}$ value	$y = 1,090x + 1,3$	$k = 0,9997$

1) k is the correlation factor via which the confidence interval limits for linear relationships were verified.

Table 3 — Calculation of the f^n factors (photosedimentation)

Grit designation	Median grain size μm	Formula
F230	53	Starting point
F240	45	$f^0 = 1 = \frac{53}{44,5} \cdot \frac{1}{\sqrt[4]{2}}$
F280	37	$f^1 = \frac{44,5}{36,5} \cdot \frac{1}{\sqrt[4]{2}}$
F320	29	$f^2 = \frac{36,5}{29,2} \cdot \frac{1}{\sqrt[4]{2}}$
F360	23	$f^3 = \frac{29,2}{22,8} \cdot \frac{1}{\sqrt[4]{2}}$
F400	17	$f^4 = \frac{22,8}{17,3} \cdot \frac{1}{\sqrt[4]{2}}$
F500	13	$f^5 = \frac{17,3}{12,8} \cdot \frac{1}{\sqrt[4]{2}}$
F600	9	$f^6 = \frac{12,8}{9,3} \cdot \frac{1}{\sqrt[4]{2}}$
F800	7	$f^7 = \frac{9,3}{6,5} \cdot \frac{1}{\sqrt[4]{2}}$
F1000	5	$f^8 = \frac{6,5}{4,5} \cdot \frac{1}{\sqrt[4]{2}}$
F1200	3	$f^9 = \frac{4,5}{3} \cdot \frac{1}{\sqrt[4]{2}}$

5 Testing of microgrits F230 to F1200

5.1 General

The testing of microgrits F230 to F1200 is carried out by sedimentation.

Criteria for the determination of the grain size distribution are

- the theoretical grain size at the 3 % point of the grain size distribution curve (d_{s3} value),
- the theoretical grain size at the 50 % point of the grain size distribution curve (d_{s50} value) and
- the theoretical grain size at the 94/95 % point of the grain size distribution curve ($d_{s94/95}$ value).

The permissible values are given in tables 4 and 5.

2) Micro-F-mastergrits of fused aluminium oxide and silicon carbide can be obtained from Staatliche Materialprüfungsanstalt Darmstadt, Grafenstraße 2, D-64283 Darmstadt.

This information is given for the convenience of users of this part of ISO 8486 and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

Table 4 — Permissible deviations resulting from the variations due to the measuring technique (photosedimentometer)

Grit designation	Permissible deviations for the values		
	d_{s3} μm	d_{s50} μm	d_{s94} μm
F230	+ 3,5	$\pm 2,5$	- 1,5
F240			
F280	+ 2,5	$\pm 1,5$	- 0,8
F320			
F360			
F400			
F500	+ 2	± 1	- 0,5
F600			
F800			
F1000	+ 1,5	$\pm 0,5$	- 0,4
F1200			

Table 5 — Permissible deviations resulting from the variations due to the measuring technique (US sedimentometer)

Grit designation	Permissible deviations for the values		
	d_{s3} μm	d_{s50} μm	d_{s95} μm
F230	+ 1,5	$\pm 1,5$	- 1,5
F240			
F280	+ 1,5	± 1	- 1,5
F320			
F360			
F400			
F500	+ 1,5	$\pm 0,8$	- 1,5
F600			
F800			
F1000	+ 1,5	$\pm 0,5$	- 1,5
F1200			

5.2 Designation of the test method

The designation of the test method for microgrits F230 to F1200 shall include an indication of the measuring instrument used thus:

- test-MICRO F – Eppendorf photosedimentometer;
- test-MICRO F – Sedigraph series;
- test-MICRO F – US sedimentometer;
- test-MICRO F – "Others".

5.3 Test method

The test method is based on Micro-F-mastergrits²⁾.

4

Each Micro-F-mastergrit is accompanied by a certificate of the Staatliche Materialprüfungsanstalt Darmstadt (MPA) stating the value at the 50 % point determined by means of their Eppendorf photosedimentometer. The values measured shall be corrected on the basis of the mastergrit values.

The determination of grain sizes by use of different measuring instruments, e.g. with the Eppendorf photosedimentometer, with the different types of sedigraphs or with instruments using other principles of measurement may give deviating results.

5.4 Preparation of the sample

Prior to the test the sample shall be heated at a temperature of $600\text{ }^{\circ}\text{C} \pm 20\text{ }^{\circ}\text{C}$ for at least 10 min. It is recommended that the sample be dispersed by means of ultrasonics for example.

5.5 Test procedure

The test shall be carried out in accordance with the instructions for the measuring instrument used.

5.6 Evaluation

5.6.1 Determination of grain size distribution

The principle upon which this method is based is the comparison of the median (50 %) size determined in a cooperative test on the Micro-F-mastergrits of MPA Darmstadt with that determined by the testing laboratory on its own instruments.

The difference between these two values will also be added algebraically to the 3 %, 50 % and 94/95 % values of the sample.

The following method applies:

- determine the d_{50} value of the Micro-F-mastergrit and calculate the difference between this value and the corresponding value shown on the MPA Darmstadt certificate;
- measure the d_{53} , d_{50} and $d_{94/95}$ values of the sample and add, algebraically, the mastergrit difference as determined above;
- compare the corrected measured results with the values in table 1.

3) Obtainable from Eppendorf Gerätebau Netheler & Hinz GmbH, Barkhausenweg 1, D-22339 Hamburg 63.

This information is given for the convenience of users of this part of ISO 8486 and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

EXAMPLE

SiC F240, for the d_{50} value:

— Mastergrit (MG):

MG- d_{50} value according to MPA certificate	44,9 μm
MG- d_{50} value measured	42,3 μm
Difference	+ 2,6 μm

— Sample:

Value measured	42,8 μm
To be added	+ 2,6 μm
Corrected value of the sample	45,4 μm

From table 1 this value is within the tolerances of the d_{50} value for grit F240.

5.6.2 Evaluation of the corrected test results

A sample complies with this part of ISO 8486 if the corrected values for d_{53} , d_{50} and $d_{94/95}$ are within the permissible limits given in tables 1 or 2.

When checking the measured results allowance must be made for the variations due to the measuring technique. These permissible deviations, given in tables 4 or 5, have been determined on the basis of the standard deviations resulting from an ISO round-robin test.

The tolerances for production microgrits, given in tables 1 and 2, are to be increased by these values.

6 Measuring instruments: Technical description and measuring methods

6.1 General

This clause describes the application of the Eppendorf photosedimentometer and the US sedimentometer for testing microgrits F230 to F1200 of fused aluminium oxide and silicon carbide to be used for bonded abrasive products and for polishing in the form of loose abrasive grains.

6.2 Eppendorf photosedimentometer

The Eppendorf photometer 1101 M is used, in combination with the sedimentation accessory equipment 1551, for testing microgrits³⁾.

The Eppendorf photosedimentometer consists mainly of:

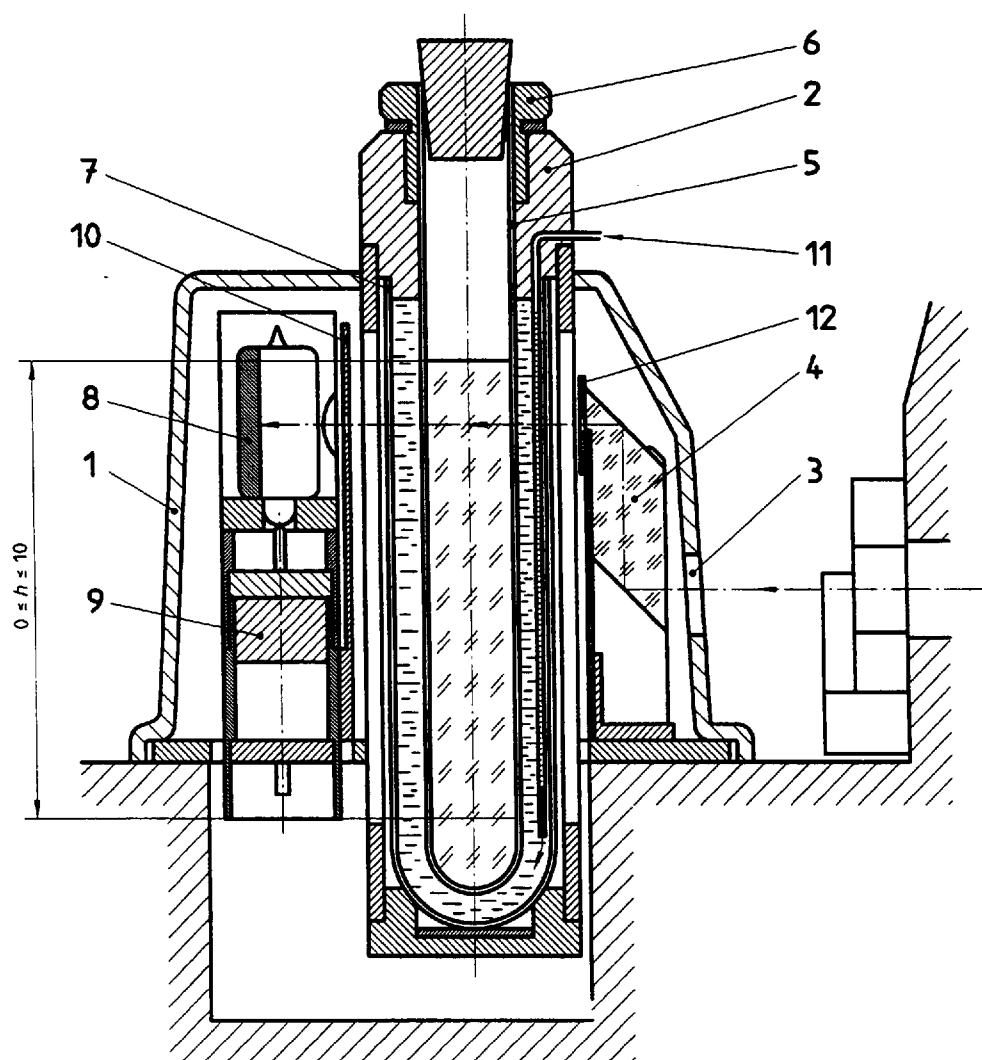
- a sedimentation tube of high light-transmitting capacity (cylindrical measuring cell) with a water jacket, the temperature of which is maintained constant at $20\text{ }^{\circ}\text{C} \pm 0,5\text{ }^{\circ}\text{C}$ by means of a thermostat;
- a light source from which a light beam falls onto a photoelectric cell passing through the sedimentation tube;
- a galvanometer recording, at any given moment of the measurement procedure, the intensity of

the light falling onto the photocell and consequently the light absorption in the sedimentation tube;

- a device for the height adjustment of the sedimentation tube as against the light beam providing a maximum height of sedimentation, h , of 10 cm.

The fundamental assembly of the sedimentation equipment 1551 to be used in combination with the Eppendorf photometer is shown in figure 1.

Dimensions in centimetres



Key

- | | |
|---|----------------------------------|
| 1 Case (light-proof) | 7 Glass inset for heating jacket |
| 2 Heating jacket | 8 Photoelectric cell |
| 3 Opening for light beam | 9 Photocell adapter |
| 4 Deviating prism | 10 Screen |
| 5 Sedimentation tube (cylindrical measuring cell) | 11 Inlet for heating jacket |
| 6 Cell adjusting screw | 12 Screen with slit |

Figure 1 — Sedimentometer accessory equipment 1551 to be used in combination with the Eppendorf photometer

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