International Standard 6106

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Abrasive products — Grain sizes of diamond or cubic boron nitride

Produits abrasifs — Dimensions des grains de diamant ou de niture de bore

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Foreword

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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.

International Standard ISO 6106 was developed by Technical Committee ISO/TC 29, *Small tools*, and was circulated to the member bodies in February 1978.

It has been approved by the member bodies of the following countries :

Australia	India	South Africa, Rep. of
Belgium	Italy	Spain
Bulgaria	Japan	Sweden
Chile	Korea, Dem. P. Rep. of	Switzerland
Czechoslovakia	Mexico	Turkey
France	Netherlands	United Kingdom
Germany, F. R.	Poland	
Hungary	Romania	

The member body of the following country expressed disapproval of the document on technical grounds :

USSR

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Abrasive products — Grain sizes of diamond or cubic boron nitride

1 Scope and field of application

This International Standard establishes a method for checking the grain size of diamond or cubic boron nitride as used for the manufacture of industrial products such as grinding wheels, saws, etc.

It applies to grains of particle sizes between 41 and 1 180 µm.

It gives the grit size designation, the size limits, the sieves to be used in determining them and the procedure to be adopted for checking the size of the grain exclusive of any metal coating.

NOTE — For simplification, reference is made throughout this International Standard to "diamond" grains, but all indications also apply to cubic boron nitride.

2 References

ISO 565, *Test sieves — Woven metal wire cloth and perforated plate — Nominal sizes of apertures.*

ISO 2591, *Test sieving.*

ISO 3310/1, *Test sieves — Technical requirements and testing — Part 1 : Metal wire cloth.*

3 Equipment

3.1 Sieving machine

The machine to be used shall have a rotational frequency of approximately 290 min^{-1} and shall give 156 vertical taps per minute. The nest of sieves shall be free to rotate under these combined forces. The sieving machine shall be equipped with a plate on which the sieves rest. The lid shall be equipped with a cork plug. The drop distance between the cork plug and the tapper shall be 38 ± 6 mm (1.5 ± 0.25 in).

3.2 Test sieves

3.2.1 Coarse group (1 180 to 425 µm)

The test sieves to be used shall be sieves with woven metal wire cloths as sieving media and a round frame of 200 mm (8 in) diameter and 25 mm (1 in) depth.

These sieves shall conform to the requirements of ISO 2591 and ISO 3310/1.

A receiver (pan) and a lid (cover) are necessary.

NOTE — The sieves used for measurement of sizing shall be calibrated in relation to one another.

3.2.2 Fine group (455 to 41 µm)

Electroformed sieves with 200 mm (8 in) or 75 mm (3 in) diameter and 25 mm (1 in) depth frames of brass or stainless steel shall be used. A receiver and a lid are necessary.

These electroformed sieves shall have a supporting grid of 2,2 lines per centimetre (5.6 wires per inch) bonded to the top surface of the sieve to prevent diamond grain sliding over the smooth top surface, which would considerably reduce sieving efficiency.

The sieves shall have apertures of the sizes indicated in table 1 (annex B gives the reasons for choosing these apertures).

Table 1 — Aperture sizes of electroformed sieves

Aperture size[1] µm	Ruling lines		Aperture size[1] µm	Ruling lines	
	cm^{-1}	in^{-1}		cm^{-1}	in^{-1}
455	16,4	41.7	139	46,3	117.6
384	18,7	47.6	127	49,2	125.0
360	20,3	51.6	116	49,2	125.0
322	21,9	55.6	107	59,1	150.0
302	24,6	62.5	97	65,6	166.6
271	26,2	66.6	90	65,6	166.6
255	26,2	66.6	85	71,6	181.8
227	30,3	76.9	75	78,7	200.0
213	30,3	76.9	65	78,7	200.0
197	35,8	90.9	57	87,5	222.2
181	35,8	90.9	49	98,4	250.0
165	39,4	100.0	41	98,4	250.0
151	43,7	111.1			

1) Tolerance on the aperture sizes :

± 3 µm for the aperture sizes ⩾ 139
± 2 µm for the aperture sizes ⩽ 127

3.3 Sample splitter

A sample splitter which will produce a sample representative of the material shall be used.

3.4 Balance

A laboratory balance shall be used which has a precision of a least 0,01 g if using 200 mm sieves or at least 0,001 g if using 75 mm sieves.

3.5 Timer

A timer with an accuracy of ± 15 s in 15 min shall be used.

4 Procedure

4.1 Atmospheric conditions

The test shall be performed under the following conditions :

— relative humidity : 45 to 55 %;

— temperature : 20 to 25 °C (68 to 77 °F).

4.2 Sampling

The material to be tested shall be blended and divided utilizing a sample splitter so as to obtain a representative sample.

The resulting sample shall then be spread out on a stainless steel pan and allowed to acclimatize for 30 min at a relative humidity and temperature as specified in 4.1.

The mass of sample, measured with the precision specified in 3.4, shall fall within the required range indicated in tables 2 and 3.

4.3 Preparation for sieving

Assemble the desired nest of sieves in order of aperture size with the coarsest sieve on top and with a receiver on the bottom. Pour the test sample onto the top sieve and place a lid over the latter. Place the entire unit in the machine. The sieve nest must be free to rotate during the sieving cycle, otherwise incomplete sieving and erratic results may occur. To facilitate rotation, maintain a clearance of 3 mm (0.125 in) between the sieve nest lid and head yoke of the machine, and ensure that the receiver spring clip does not bind on the bottom receiver.

With 75 mm (3 in) sieves, use a special adaptor (see annex A).

4.4 Sieving procedure

Set the timer controlling the sieving machine for 15 min and set the machine in operation. At the completion of the cycle remove the sieve nest from the machine. Beginning with the top sieve (coarsest), empty the oversize onto a clean piece of glossy paper by gently striking the frame. Fine group sieves shall not be brushed; the underside of coarse group sieves shall be brushed with a soft brass wire brush to remove particles embedded in the sieve.

Repeat this procedure with each subsequent sieve, taking care not to damage the sieves.

Clean fine group sieves periodically by ultrasonic methods.

5 Evaluation of the results

5.1 Weighing the sieve fractions

Oversize and undersize shall be weighed to the precision specified in 3.4.

If the sum of the masses of all the fractions, i.e. oversize plus undersize, is less than 99 % of the original mass, the above procedure shall be repeated on a new sample.

5.2 Calculation of results

The oversize and undersize masses shall be expressed as percentages of the sum total of all the fraction masses.

6 Designation and grading limits

Tables 2 and 3 give the grain designations and the limits for the particle size distribution of each grit.

Two systems of designation are envisaged.

6.1 One, which is more particularly used in Europe, is based on sieve nominal aperture sizes according to ISO 565. The code number is made up of the sum of the aperture size, in micrometers, of the largest sieve used, and the number of intervals between the largest and smallest sieves used.

6.2 The other, which is more particularly used in the United States of America, is based on the US designation of sieves (it is the approximate number of openings per linear inch). The code number is made up of the numbers of the two sieves used, separated by a stroke, with the largest aperture sieve first.

NOTE - Countries adopting this International Standard may add a letter (D, B or any other letter) before the code number, in their national standards.

Examples showing the use of tables 2 and 3

Consider a grain designated 151 (or 100/120)

At least 99,9 % of the diamond shall pass through the oversize-limiting sieve, in this case 227 µm. All the diamond may pass through the upper test sieve, in this case, the 165 µm sieve. Not more than 10 % shall be retained on it.

It is permissible to have 100 % undersize through the upper test sieve and 100 % oversize on the lower test sieve (127 µm), the requirement being that at least 87 % of the grains shall pass through the upper test sieve and shall remain on the lower test sieve.

Not more than 10 % shall pass through the lower test sieve and not more than 2 % through the undersize-limiting sieve (90 µm).

As a further clarification :

If 100 % of the diamond claimed to be 151 passes through both the oversize-limiting and upper test sieves, and 88 % is retained on the lower test sieve, the diamond shall not be accepted because 12 % passing through the lower test sieve exceeds the 10 % allowed for this grit size.

Table 2 — Particle size distribution from wire sieves

Grit designation		Sieve aperture size (according to ISO 565)	Test sample for 200 mm sieve	99,9 % through sieve (oversize-limiting sieve)	Upper test sieve		Lower test sieve			2 % through sieve (undersize-limiting sieve)
1st system (see 6.1)	2nd system [1] (see 6.2)				aperture size	max. oversize	aperture size	min. oversize	max. undersize	
		µm	g	µm	µm	%	µm	%	%	µm
Narrow range grades										
1 181	16/18	1 180/1 000	80 to 120	1 700	1 180	8	1 000	90	8	710
1 001	18/20	1 000/850	80 to 120	1 400	1 000	8	850	90	8	600
851	–	850/710	80 to 120	1 180	850	8	710	90	8	500
711	–	710/600	80 to 120	1 000	710	8	600	90	8	425
601	–	600/500	80 to 120	850	600	8	500	90	8	355
501	–	500/425	80 to 120	710	500	8	425	90	8	300
Wide range grades										
1 182	–	1 180/850	80 to 120	1 700	1 180	8	850	90	8	600
852	20/30	850/600	80 to 120	1 180	850	8	600	90	8	425
602	30/40	600/425	80 to 120	850	600	8	425	90	8	300

1) Some grain sizes are used in the first designation system and not in the second, hence the missing designations.

Table 3 — Particle size distribution from electroformed sieves

Grit designation		Sieve aperture size (according to ISO 565)	Test sample for sieves		99,9 % through sieve (oversize-limiting sieve)	Upper test sieve		Lower test sieve			2 % through sieve (undersize-limiting sieve)
1st system (see 6.1)	2nd system[1] (see 6.2)		200 mm	75 mm		aperture size	max. oversize	aperture size	min. oversize	max. undersize	
		μm	g	g	μm	μm	%	μm	%	%	μm
Narrow range grades											
426	—	425/355	80 to 120	9,6 to 14,5	600[2]	455	8	360	90	8	255
356	—	355/300	80 to 120	9,6 to 14,5	500[2]	384	8	302	90	8	213
301	50/60	300/250	80 to 120	9,6 to 14,5	455	322	8	255	90	8	181
251	—	250/212	80 to 120	9,6 to 14,5	384	271	8	213	90	8	151
213	—	212/180	80 to 120	9,6 to 14,5	322	227	8	181	90	8	127
181	80/100	180/150	40 to 60	4,8 to 7,2	271	197	10	151	87	10	107
151	100/120	150/125	40 to 60	4,8 to 7,2	227	165	10	127	87	10	90
126	120/140	125/106	40 to 60	4,8 to 7,2	197	139	10	107	87	10	75
107	140/170	106/90	40 to 60	4,8 to 7,2	165	116	11	90	85	11	65
91	170/200	90/75	40 to 60	4,8 to 7,2	139	97	11	75	85	11	57
76	200/230	75/63	20 to 30	2,4 to 3,6	116	85	11	65	85	11	49
64	230/270	63/53	20 to 30	2,4 to 3,6	97	75	11	57	85	11	41
54	270/325	53/45	20 to 30	2,4 to 3,6	85	65	15	49	80	15	—
46	325/400	45/38	20 to 30	2,4 to 3,6	75	57	15	41	80	15	—
Wide range grades											
427	40/50	425/300	80 to 120	9,6 to 14,5	600[2]	455	8	302	90	8	213
252	60/80	250/180	80 to 120	9,6 to 14,5	384	271	8	181	90	8	127

1) Some grain sizes are used in the first designation system and not in the second, hence the missing designations.

2) Do not use electroformed sieves but woven wire sieves of 200 mm (8 in) diameter or 75 mm (3 in) diameter and 25 mm (1 in) depth.

Annex A

Special adaptors for 75 mm (3 in) sieves

A.1 Lid plate adaptor

This consists of a spacer ring made of 6 mm (0.25 in) thick wood, plastic or reinforced plastic material fitted beneath the lid of the machine such that the ring centre will accommodate the 75 mm (3 in) lid while still allowing the nest of sieves some freedom to move as indicated in 4.3 (see figure 1).

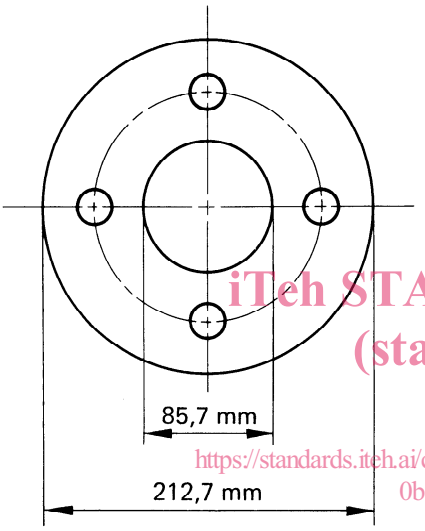

Figure 1

A.2 Bottom plate adaptor

This consists of a light U-shaped spacing piece of 6 mm (0.25 in) thick wood, plastic or reinforced plastic material. It is designed to hold the nest of 75 mm (3 in) sieves in an axial position on the machine while at the same time permitting the nest of sieves to slide into position (see figure 2).

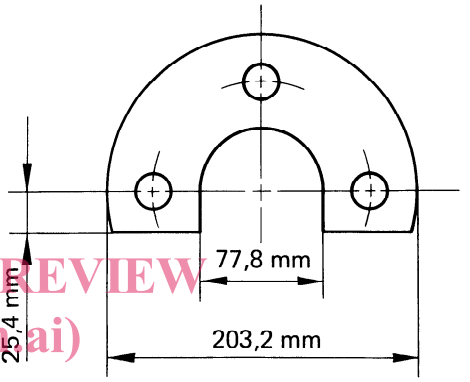

Figure 2

Annex B

Choice of aperture sizes for electroformed test sieves

From comparison of the results of sieving diamond grit with woven wire and electroformed sieves, it has been found that the aperture of the matching electroformed sieve has to be larger than the nominal size of the woven wire sieve probably because of the different geometry of the sieve. This difference was established by a calibration procedure.

It has also been found that the results of sieving a given grit with different sets of certified standard wire sieves are variable, due to the unavoidable but permitted variation in the actual apertures of standard woven wire sieves.

In addition to differences between sieves, every real wire sieve behaves as if it has two effective aperture sizes. Under specified sieving conditions, the larger of these determines the lower limit of oversize which can never pass, the smaller determines the upper limit of undersize which will always pass. Particles of intermediate size may or may not pass, depending on how and where they move on the sieve surface. Thus the sieve behaves differently — as though it has different apertures — according to whether it is being used to hold back oversize or screen undersize.

Corresponding to each wire sieve size, therefore, there are two electroformed sieves as specified :

— one, the upper control sieve, is slightly larger than the calibrated median size of equivalent woven wire sieves;

— the other, the lower control sieve, is slightly smaller than the calibrated median size of equivalent woven wire sieves.

However, because of the geometric effect mentioned above, the minimum size electroformed sieve is usually larger than the nominal wire sieve aperture size.

The apertures in table 1 take all these factors into account, which necessarily results in the use of sizes which do not conform to the recommended sieve apertures in ISO 565.

In testing diamond for percentage-on-size, two electroformed sieves are used. For example, when testing 107 for percentage-on-size, the 116 µm sieve used is the larger of the pair of sieves calibrated to correspond to the 106 mesh wire sieve, and the 90 µm sieve used corresponds to the smaller of the sieve pair calibrated to correspond to the 90 mesh wire sieve.