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American National Standard

Specifications for the Size of Abrasive Grain — Grinding Wheels, Polishing and General Uses

UNIFIED ABRASIVES MANUFACTURERS' ASSOCIATION

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Unified Abrasives Manufacturers' Association

DEVELOPER

Grain Committee

Approved April 17, 2012

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American National Standards Institute, Inc.

American National Standard

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Contents

Foreword (This Foreword is not part of American National Standard B74.12-2012)

This document was originally developed by a committee of the Abrasive Grain Association (AGA) to provide a nationally recognized standard for checking the size of abrasive grain for grinding wheels, polishing and general industrial uses. It is intended to serve as a common basis of understanding for abrasive grain producers and for the manufacturers, distributors, and users of these products.

Work on this standard was initiated after it became evident that there was sufficient interest to justify the establishment of an ANSI standard for this material. The original draft, which was based on Commercial Standard CS271-65, was prepared in the Spring of 1967 and approved in 1968. It was revised in 1974 and 1976, reaffirmed in 1982, and revised again in 1992, 2000, 2009 and the most recent revision in 2012.

Future additions and revisions that may be necessary will be considered by the Accredited Standards Committee B74, which represents a cross-section of those interested in abrasives. Suggestions for improvement gained in the use of this standard should be sent to the Unified Abrasives Manufacturers' Association, 30200 Detroit Road, Cleveland, OH 44145-1967.

The ANSI Accredited Standards Committee B74 on Abrasives, which reviewed and approved this standard had the following personnel at the time of approval:

Roger Cloutier, Chairman
J. Jeffery Wherry, Secretary

Organization Represented	*Name of Representative*
Cemented Carbide Producers Association	TBD
	J. Jeffery Wherry (Alt.)
Compressed Air & Gas Institute, Pneumatic Tool Section	John H. Addington
General Services Administration	Steve Hooper
Industrial Diamond Association of America, Inc.	Ion Benea
	Terry Kane (Alt.)
Society of Carbide and Tool Engineers	Joseph B. Freiland
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Unified Abrasives Manufacturers' Association	
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Coated Committee	Thomas Service
	Darrell DeGeus (Alt.)
Grain Committee	Tom Martinez
	Jerry Bandholz (Alt.)
Suberabrasives Committee	Ed Galen
	Thomas Service (Alt.)
	Kevin Thomas (Alt.)

The personnel of Technical Committee No. 2 on Loose Abrasives was as follows:

Tom Martinez, Chairman
J. Jeffery Wherry, Secretary

Len Angelone
Jerry Bandholz
Chris Ciccarelli
Steve Hooper
Charles G. Hubbard
Robert Mesanovic
Dave Rock
Frank Woodard

American National Standard

Specifications for the Size of Abrasive Grain — Grinding Wheels, Polishing and General Industrial Uses

1 Scope and purpose

The purpose of this standard is to establish a nationally recognized basis for checking the size of abrasive grain for use in the manufacture of grinding wheels, general polishing and other general industrial uses such as pressure blasting, lithoplate graining, etc.[1)] It is intended to serve as a common basis of understanding for abrasive grain producers, and for the manufacturers, distributors, and users of these abrasive products. This standard sets forth the grit size designations, the size limits and the sieves used in determining them, as well as the test procedure which is used by the industry for checking the size of abrasive grain. Abrasive grain is a natural or manufactured substance that is reduced by crushing to specific grit sizes, and is then made into products which are used for removing extraneous material by grinding, polishing, lapping, etc. Examples of some of the natural materials are corundum, emery, and garnet; manufactured materials are fused aluminum oxide and silicon carbide.

2 Equipment

2.1 Sieve shaker

It is preferred that a standard Rotap[2)] test-sieving machine be used in this test because the limits set forth in tables 2 and 3 were based on the use of this machine. However, particle size distribution can also be determined by vibration type sieving machines, by microscopy, by image recognition, or by static light scattering provided the machine provides reproducible and comparable results. Before testing the sieves, it is recommended that the Rotap be checked and calibrated as explained in section 2.2, Rotap Calibration.

2.2 Rotap calibration

Before testing sieves, it is recommended that the Rotap be checked and calibrated. The number of revolutions per minute, taps per minute, height of the tapper and accuracy of the timer should be determined. These values should be as follows:

revolutions/minute	280 ± 10
taps/minute	150 ± 5
height of tapper	1-5⁄16″ ± 1⁄16
5 minute timer	± 5 seconds

Further, it is suggested the Rotap performance be calibrated and monitored periodically using standard sands and sieves used exclusively for Rotap calibration. Select sieves in the coarse, medium and fine range. Number 25, 45, 80 and 170 sieves are examples. Percent cumulative in the third position in a 5 sieve setup is measured using the following sieves:

No. 25	No. 45	No. 80	No. 170
16	30	50	100
20	40	70	140
25	45	80	170
30	50	100	200
35	60	120	230
pan	pan	pan	pan

1) The grading of abrasive grain for coated abrasives is covered in ANSI B74.18-1996 and the grading of diamond powder is covered in ANSI B74.20-1997. Grading of diamond abrasive grain is covered in ANSI B74.16-1995.

2) Source of Rotap testing sieve shaking machines and availability of UAMA Standard Sands can be obtained by writing to the Unified Abrasives Manufacturers Association, 30200 Detroit Road, Cleveland, Ohio 44145-1967, www.uama.org.

Each sieve is tested in triplicate. Values are recorded on a control chart. Calibrations are performed periodically and monitored to insure consistent Rotap performance.

The importance of calibration of the Rotap and related equipment is to be emphasized. A considerable portion of the variation encountered in this test procedure is due to this equipment.

2.3 Sieves

Standard eight inch diameter metal frame nested sieves, either half or full height, should be used. A cover and a pan are required. These sieves shall conform to the latest edition of ASTM Standard E-11, Specifications for Sieves for Testing Purposes (Wire Cloth Sieves, Round - Hole and Square - Hole Plate Screens or Sieves)[3] which are described in table 1. These sieves are to be calibrated with UAMA Standard Sands.

2.4 Sieve calibration

The sieve to be tested must be physically sound. The wire mesh must be taut and free of broken or stretched wires. Solder joints must be solid. Sieve frames must be cylindrical and nest easily with other sieves to allow proper movement while testing.

The use of UAMA standard sands is recommended for calibration of testing sieves. UAMA Standard Sands[4] are provided for sieves No. 4 through No. 325. Each sieve is to be tested in the third position in a 5 sieve setup. All standard sand sizes are fabricated with 0% retained on the top sieve, approximately 50% cumulative on the sieve to be tested and less than 1% in the pan.

Sieves are to be tested using 100 grams ± 5 of the appropriate standard sand[5]. Care is to be exercised in securing a representative sample from the original container. A suggested method for securing that sample is as follows:

a) Empty the contents of the original container through a small riffle sampler.

b) Blend thoroughly by dumping the two splits through the riffle sampler several times.

c) After blending, split the sample by halving, quartering, etc., until the required 100 grams ± 5 remains.

This representative sample is to be rotapped on the appropriate nest of sieves for 5 minutes. Sieves are to be selected for the nest as follows:

		Example
S1	2 sieves coarser	25
	▲	
S2	next coarser sieve	35
	▲	
S3	sieve to be tested	40
	▼	
S4	next finer sieve	45
	▼	
S5	next finer sieve	50
pan	pan	pan

The sieves coarser than the sieve being tested should be tested sieves if possible (except No. 4, 5 and 6 sieves). The reason for the 5 sieve setup is to simulate the actual mass when using the sieves for testing grading.

[3] Copies of standards of the American Society for Testing and Materials are available from their offices at 1916 Race St., Philadelphia, PA 19103.

[4] Because of the variety and variability of rotap sieves used in the industry (brass and stainless wire cloth, round and square hole plate screens, height differences, wire diameter and opening differences, etc.), a set of U.S. Std. half-height sieves meeting ASTM E11 was selected as the basis (master sieves) for the UAMA Standard Sand program. These sieves may or may not be an average of sieves in general usage. The UAMA Standard Sands are a common vehicle to measure differences between users' sieves and an attempt to standardize sieve qualification via a performance test versus an optical test. Optical measurement (per ASTM E-11) is too broad and does not readily correlate with performance testing of a sieve. With increased emphasis on statistical testing capability in the abrasives industry, it has become necessary to define a more precise method for sieve calibration. This method utilizes the most commonly tested material in the Industry (medium density Brown Aluminum Oxide) as the Standard Sand media, thus minimizing variables due to shape and density.

[5] As an alternative to using UAMA Standard Sands, users of this ANSI standard may choose to calibrate testing sieves using internally derived standard minerals. In this case, the other testing procedures described in Section 2.4 are to be followed.

Testing is to be done in triplicate. The average of the cumulative percentage retained on the tested sieve is to be compared to the value of the standard sand. Factoring may be used to correct variation up to ±10% from the standard sand. A suitable sieve should be within ± 5 percentage points of the value of the standard sand.

2.5 Sample splitter

A sample splitter, which will produce a representative sample should be used. Any commercially available device is acceptable.

2.6 Balance

A standard laboratory balance should be employed which has a sensitivity of at least 0.1 gram.

Table 1 - Test sieve specifications[1)]

Sieve designation		Nominal sieve opening		Nominal wire diameter	
Standard[2)]	Alternate No.	mm	in (approx. equivalents)	mm	in (approx. equivalents)
8.0 mm	5⁄16	8.0	0.312	2.00	0.079
6.7 mm	0.265	6.7	0.265	1.80	0.071
5.6 mm	3 ½	5.6	0.223	1.60	0.063
4.75 mm	4	4.75	0.187	1.60	0.063
4.00 mm	5	4.00	0.157	1.40	0.055
3.35 mm	6	3.36	0.132	1.25	0.049
2.80 mm	7	2.83	0.110	1.12	0.044
2.36 mm	8	2.38	0.094	1.00	0.039
2.00 mm	10	2.00	0.079	0.900	0.036
1.70 mm	12	1.68	0.066	0.800	0.032
1.40 mm	14	1.41	0.056	0.710	0.028
1.18 mm	16	1.19	0.047	0.630	0.025
1.00 mm	18	1.00	0.039	0.560	0.022
850 micron	20	0.841	0.033	0.500	0.020
710 micron	25	0.707	0.028	0.450	0.018
600 micron	30	0.595	0.023	0.400	0.016
500 micron	35	0.500	0.020	0.315	0.012
425 micron	40	0.420	0.017	0.280	0.011
355 micron	45	0.354	0.014	0.224	0.009
300 micron	50	0.297	0.012	0.200	0.008
250 micron	60	0.250	0.010	0.150	0.006
212 micron	70	0.210	0.008	0.140	0.006
180 micron	80	0.177	0.007	0.125	0.005
150 micron	100	0.149	0.006	0.100	0.004
125 micron	120	0.125	0.005	0.090	0.004
106 micron	140	0.105	0.004	0.071	0.003
90 micron	170	0.088	0.004	0.063	0.003
75 micron	200	0.074	0.003	0.050	0.002
63 micron	230	0.063	0.003	0.045	0.002
53 micron	270	0.053	0.002	0.036	0.001
45 micron	325	0.044	0.002	0.032	0.001

[1)] The Sieves referred to above are those of the United States Standard Sieve Series (ASTM E-11)

[2)] These Standard Designations correspond to the values for test sieve apertures recommended by the International Standards Organization (ISO).

2.7 Timer

A suitable laboratory timer with an accuracy of ±5.0 seconds is satisfactory for this test.

2.8 Reproducibility

Assuming that the Rotap and all associated accessories (timers, balances, etc.) are properly calibrated, it has been found that at a 95% confidence level, a sieve tested on a variety of Rotaps (using an AGA Standard Sand) can be expected to agree within ±3 percentage points of the standard sand value.

3 Procedures

3.1 General

The following procedure should be employed in obtaining a sieve size analysis as specified in tables 2 and 3 for the applicable type and grit size of abrasive grain.

Table 2 – Allowable limits for the sizing of abrasive grain for grinding wheel manufacture and general polishing purposes[1)]

Grit No.	Sieve[1)] through which 100% must pass	Control Sieve[1)]		Maximum of over-size on control sieve[1)]	Minimum through control sieve and retained		Cumulative minimun through control sieve and retained		Maximum of 3% through sieve No. [1)]
		No.	opening inches	%	%	on sieve No. [1)]	%	on sieve No. [1)]	
4	5/16	3 1/2	0.223	20	40	4	70	4 and 5	6
5	0.265	4	0.187	20	40	5	70	5 and 6	7
6	3 1/2	5	0.157	20	40	6	70	6 and 7	8
7	4	6	0.132	20	40	7	70	7 and 8	10
8	5	7	0.110	20	45	8	70	8 and 10	12
10	6	8	0.094	20	45	10	70	10 and 12	14
12	7	10	0.079	20	45	12	70	12 and 14	16
14	8	12	0.066	20	45	14	70	14 and 16	18
16	10	14	0.056	20	45	16	70	16 and 18	20
20	12	16	0.047	20	45	18	70	18 and 20	25
22	14	18	0.039	20	45	20	70	20 and 25	30
24	16	20	0.033	25	45	25	65	25 and 30	35
30	18	25	0.028	25	45	30	65	30 and 35	40
36	20	30	0.023	25	45	35	65	35 and 40	45
40	25	35	0.020	30	40	40	65	40 and 45	50
46	30	40	0.017	30	40	45	65	45 and 50	60
54	35	45	0.014	30	40	50	65	50 and 60	70
60	40	50	0.012	30	40	60	65	60 and 70	80
70	45	60	0.010	25	40	70	65	70 and 80	100
80	50	70	0.008	25	40	80	65	80 and 100	120
90	60	80	0.007	20	40	100	65	100 and 120	140
100	70	100	0.006	20	40	120	65	120 and 140	200
120	80	120	0.005	20	40	140	65	140 and 170	230
150	100	140	0.004	15	40	200	65	200 and 230	325
180	120	170	0.004	15	40	200 and 230	65	200, 230 and 270	—
220	140	200	0.003	15	40	230 and 270	60	230, 270 and 325	—
240	170	200	0.003	5	8	230 and 270	38	230, 270 and 325	—

[1)] The sieves referred to are those of the United States Sieve Series, described in table 1, which have been in conformance with the AGA Standard Sands. (Information on the AGA Standard Sands can be obtained from the UAMA, 30200 Detroit Road, Cleveland, Ohio 44145-1967.)

3.2 Sample

The sample to be tested should be blended and quartered utilizing a mechanical sample splitter so as to obtain a representative sample weighing 100 grams. Weigh the sample to the nearest 0.1 gram.

3.3 Sieves

The desired nest of sieves is assembled in order of mesh size with the coarsest sieve on the top, progressing to the finest with a pan on the bottom. The test sample is poured, a cover is placed on the top sieve, and the entire unit placed in the sieve shaker. The sieve supporting plate should be adjusted so as to hold the sieves firmly but still allowing circular movement of the sieve stack.

3.4 Sieving

The timer controlling the sieve shaker is set for five minutes and turned on. At the completion of the cycle, the nest of sieves is removed from the shaker. Beginning with the top (coarsest) sieve, empty the portion of the grain retained onto a clean piece of paper. Invert the sieve on the paper. Brush the underside of the sieve with a soft brass wire brush on sieves coarser than 100 mesh and with a hair brush on sieves finer than 100 mesh using gentle strokes to remove all of the particles imbedded in the sieve. Care should be taken not to damage the sieve cloth. The frame of the sieve may be tapped lightly with the handle of the brush to aid in particle removal. Repeat procedure for each sieve utilized in the test.

Table 3 – Allowable limits for the sizing of abrasive grains for use in other general industrial uses such as pressure blasting and lithoplate graining[1)]

Grit No.	Sieve[1)] through which 100% must pass	Control Sieve[1)]		Maximum of oversize on control sieve[1)]	Minimum through control sieve and retained		Cumulative minimum through control sieve and retained		Maximum of 5% through sieve No. [1)]
		No.	opening inches	%	%	on sieve No. [1)]	%	on sieve No. [1)]	
16	8	14	0.056	25	35	16	70	16 and 18	25
20	10	16	0.047	25	35	18	70	18 and 20	30
24	14	18	0.039	25	35	20	60	20 and 25	40
30	16	20	0.033	30	45	30	60	30 and 35	45
36	18	25	0.028	15	50	35	80	35 and 40	50
46	25	40	0.017	30	30	45	55	45 and 50	70
54	30	45	0.014	35	25	50	60	50 and 60	80
60	35	50	0.012	35	35	60	60	60 and 70	100
70	40	60	0.010	25	35	70	65	70 and 80	120
80	45	70	0.008	35	30	80	60	80 and 100	140
90	50	80	0.007	25	35	100	60	100 and 120	170
100	60	100	0.006	25	30	120	55	120 and 140	230
120	70	120	0.005	25	20	140	50	140 and 170	270
150	80	140	0.004	25	30	200	60	200 and 230	325
180	80	170	0.004	20	30	200 and 230	60	200, 230 and 270	—
220	100	200	0.003	15	30	230 and 270	50	230, 270 and 325	—
240	120	200	0.003	10	5	230 and 270	30	230, 270 and 325	—

[1)] The sieves referred to are those of the United States Sieve Series, described in table 1, which have been in conformance with the AGA Standard Sands. (Information on the AGA Standard Sands can be obtained from the UAMA, 30200 Detroit Road, Cleveland, Ohio 44145-1967.)

3.5 Weighing the sieve fractions

The grain obtained from each sieve should be transferred to the balance pan and weighed to the nearest 0.1 gram. If the sum of the weights of all of the fractions, i.e., the material retained on each sieve and the pan, is less than 99 grams, the above procedure should be repeated on a new sample.

3.6 Calculation of results

Calculate the percentage retained on each sieve, including the pan, relative to the initial weight of the sample.

4 Reproducibility

This procedure has been tested on coarse, medium and fine grit sizes. At a 95% confidence level, using a sample split into three representative portions, reproducibility is ±6% of the weight percent retained on any one screen.

5 Standard grading limits

5.1 General

The standard grit sizes and allowable limits for each size of abrasive grain labeled, designated or otherwise represented as complying with this American National Standard are given in tables

Table 4 – Permissible deviation as a result of variations in the measuring technique

Grit designation	Test sieve 1	Test sieve 2	Test sieve 3	Test sieves 3 and 4	Test sieves 3, 4 and 5	Remainder in the bottom pan
	%	%	%	%	%	%
4 5 6 7	0	+ 4	– 4	– 4	—	—
8 10 12 14	0	+ 4	– 4	– 4	—	—
16 20 22 24	0	+ 4	– 4	– 4	—	—
30 36 40 46	0	+ 4	– 4	– 4	—	—
54 60	0	+ 4	– 4	– 4	—	—
70 80	0	+ 3	– 3	– 3	—	—
90 100 120 150	0	+ 3	– 3	– 3	—	—
180 220	0	+ 3	– 3	– 3	– 3	—

Example of the use of tables 2 and 4 in the post delivery testing of 10 grit material:

The maximum 20% value for material retained on the No. 8 sieve is increased to 24%. The minimum 45% value for material retained on the No. 10 sieve is reduced to 41% and the cumulative minimum of 70% retained on the No. 10 and No. 12 sieves is reduced to 66%.

2 and 3 as determined in accordance with the test methods specified in section 3 herein.

5.2 Standard grit sizes of aluminum oxide and silicon carbide abrasives

Table 2 lists the allowable grading limits for the sizing of aluminum oxide and silicon carbide abrasive grain for use in the manufacturing of grinding wheels and for general polishing purposes.

5.3 Example of use of table 2

The following is an example of the use of this standard: Taking grit No. 10, all material must pass through the coarsest sieve — in this case the No. 6. Through the next coarsest sieve, termed the “control sieve” — in this case the No. 8 — all material may pass, but not more than 20% may be retained on it. At least 45% must be retained on the No. 10 sieve, but it is permissible to have 100% pass through No. 8, the control sieve, and remain on No. 10 sieve, the requirement being that the grain passing through No. 8, the control sieve, and retained on No. 10 and No. 12, must add to at least 70%. Consequently, if 45% was retained on No. 10 sieve, then at least 25% must be retained on the No. 12 sieve. There is no requirement for material retained on the finest sieve — in this case the No. 14 sieve — but not more than 3% is permitted to pass through the No. 14 sieve.

5.4 Standard grit sizes for all abrasive grains for use in other general industrial uses such as pressure blasting and lithoplate graining, etc.

Table 3 lists the allowable grading limits for the sizing of all abrasive grains for use in other general industrial uses such as pressure blasting and lithoplate graining.

5.5 Permissible deviation as a result of variations in the measuring technique

Table 4 lists allowable deviations to tables 2 and 3 due to variations in sieves, Rotaps and individual testing differences.

6 Alternative Methods

The Technical Committee No. 2 on Loose Abrasives acknowledges the emergence of alternative test methods to determine the particle size of abrasive grains for grinding wheels, polishing and general industrial uses as defined in ANSI B74.12. These methods are based on electronic, optical, laser or other related principles. Preliminary studies on these methods have been conducted on an ad-hoc basis by some member companies. The studies indicate that such methods may prove to be beneficial to users of this ANSI standard. For further information, contact the Unified Abrasives Manufacturers’ Association.

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