

Sieve analysis is an inexpensive, direct method for measuring the size of powders and granular materials. It's also usually the first method employed, when a company is trying to get a handle on how particle size analysis affects their finished product.

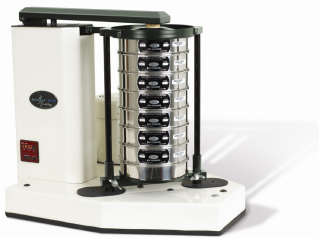
A stack of wire mesh test sieves, is arranged with the largest apertures on the top, and the smallest apertures on the bottom.



A mechanical shaker is used to agitate the nest of sieves, so that the particles drop through to the aperture size they are retained on, because they are too big to pass.



There are a number of different types of sieve agitators. Most of the original research relative to coffee grind analysis in the 1950's, was carried out, using ROTAP (Short for rotating tapping) Sieve Shakers, which were designed to provide results similar to hand agitation, the original direct method for conducting a sieve test. ROTAP Sieve Shakers, because of their design, are somewhat noisy, and require an isolation cabinet, or separate room, for hearing safety. Now there are a number of alternative methods available for effective sieve agitation.



DURATAP SHAKER

Provides aggressive rotating / tapping motion, that simulates hand sieving. Requires some maintenance, and noise isolation. Separation to 20 microns



ENDECOTT'S M200

Simple analogue vibratory sieve shaker, with 3D Motion. Separations to 20 microns.



FILTRA FTS 0200

Digital Vibratory Sieve Shaker, gives additional flexibility with adjustable amplitude, and intermittent pause function. Separations to 20 microns.



ATM L3P Sonic Sifter

uses low volume sound frequency to agitate particles, in a transparent sieve stack. Results in about 2 minutes. Separations to 3 microns.



ENDECOTT'S AIR SIZER

uses rotating jet nozzle, and vacuum pressure, to provide particle separations of cohesive or electrostatic particles, like Espresso. Separations to 20 microns

Laboratory tests sieves generally have rims between 3 inch & 12 diameter, and are fitted with stainless steel wire mesh.

The apertures in the wire mesh are precisely sized to conform to US & International specifications, most notably ASTM & ISO



Most of the work in the coffee industry, references the following sieve sizes

ASTM E-11 / ISO 3310
 #12 (1.7 mm), #16 (1.18 mm), #20 (.850 mm), #30 (.600 mm), #40 (.425 mm), #50 (.300 mm)

The sieves are arranged with the larger apertures on the top, and a receiving pan on the bottom. The material retained on the sieves, is subtracted from the sieve empty weight, and expressed as a percentage of the whole.



The percentages retained on each sieve, should match the target percentages on the below chart, for each different type of brewing method.

The sieve diameter, and amount of sample used, have more to do with proper sampling techniques, than any published specification.

TARGET SIEVING AMOUNTS FOR GROUND COFFEE



ORIGINAL CBC SPECIFICATIONS

GRIND		E.P.	REGULAR	ADC	DRIP	FINE	VENDING	EUROPEAN		
								COARSE	MEDIUM	FINE
OTHER NAMES		Regular	Um	Autodrip Silex	All-Purpose Universal	Silex Food Service	Single Cup Vend	NS	NS	Espresso
CONVERSION CHART		ASTM #12 =TYLER #10 =1.70mm	ASTM #16 =TYLER #14 =1.18mm	ASTM #20 =TYLER #20 =.850mm	ASTM #30 =TYLER #28 =.600mm	ASTM #40 =TYLER #35 =.425mm	ASTM #50 =TYLER #48 =.300mm			
MESH SIZES										
TYLER	ASTM									
No (s) 10/14 Sieves	ASTM No(s) 12/16 Sieves	NS	33%	NS	7%	0%	NS	NS	NS	NS
No (s) 20/28 Sieves	ASTM No(s) 20/30 Sieves	NS	55%	NS	73%	70%	NS	NS	NS	NS
Pan	Pan	NS	12%	NS	20%	30%	NS	NS	NS	NS
Particle size (u)*	Particle size (u)*	NS	1020	NS	840	720	NS	NS	NS	NS
Avg. Sieve Mesh (Opening)	Avg. Sieve Mesh (Opening)	NS	16 (0.0390")	NS	20 (0.300")	24 (0.278")	NS	NS	NS	NS
Avg. Particle Dia. (cells) +	Avg. Particle Dia. (cells) +	NS	26	NS	21	18	NS	NS	NS	NS
Avg. Particle per gram	Avg. Particle per gram	NS	1200	NS	2200	3500	NS	NS	NS	NS
Exposed Granule Area (CM2)	Exposed Granule Area (CM2)	NS	46	NS	57	67	NS	NS	NS	NS

NORTH AMERICAN INDUSTRY NORMS

GRIND		E.P.	REGULAR	ADC	DRIP	FINE	VENDING	EUROPEAN		
								COARSE	MEDIUM	FINE
OTHER NAMES		Regular	Um	Autodrip Silex	All-Purpose Universal	Silex Food Service	Single Cup Vend	NS	NS	Espresso
CONVERSION CHART		ASTM #12 =TYLER #10 =1.70mm	ASTM #16 =TYLER #14 =1.18mm	ASTM #20 =TYLER #20 =.850mm	ASTM #30 =TYLER #28 =.600mm	ASTM #40 =TYLER #35 =.425mm	ASTM #50 =TYLER #48 =.300mm			
MESH SIZES										
TYLER	ASTM									
No (s) 10/14 Sieves	ASTM No(s) 12/16 Sieves	35%	27%	17%	8%	2%	NS	NS	NS	NS
No (s) 20/28 Sieves	ASTM No(s) 20/30 Sieves	42%	60%	65%	65%	62%	10%	NS	NS	NS
No. 35 Sieves	ASTM No(s) 40 Sieve	N/A	N/A	N/A	N/A	N/A	35%	N/A	50%	65%
No. 48 Sieves	ASTM No(s) 50 Sieve	N/A	N/A	N/A	N/A	N/A	35%	N/A		
Pan	Pan	13%	13%	18%	27%	36%	20%	52%	20%	32%
Particle size (u)*	Particle size (u)*	1050	925	825	775	645	400	600	480	360
Avg. Sieve Mesh (Opening)	Avg. Sieve Mesh (Opening)	16 (0.0390")	18 (0.278")	20 (0.0328")	22 (0.0300")	26 (0.0242")	40 (0.0165")	28 (0.0232")	32 (0.0195")	42 (0.0138")
Avg. Particle Dia. (cells) +	Avg. Particle Dia. (cells) +	26	23	21	19	16	10	15	12	9
Avg. Particle per gram	Avg. Particle per gram	1,100	1,600	2,300	2,800	4,800	20,000	NS	12,000	28,000
Exposed Granule Area (CM2)	Exposed Granule Area (CM2)	45	50	58	62	74	118	80	102	134

MEASURING COFFEE GRINDS WITH SIEVE ANALYSIS

Sieves are manufactured with precise tolerances in the wire mesh, to ensure the retained particles are representative of the sieve aperture size.

There are different degrees of specification compliance.

- COMPLIANCE LEVEL
- INSPECTION LEVEL
- CALIBRATION LEVEL

The higher the level of compliance, the more apertures are inspected.

In order to ensure the sieves are still in compliance, they need to be inspected / calibrated, on a regular basis.

RECOMMENDED SIEVE RECERTIFICATION SCHEDULE

Aperture Schedule

- 5 inches to .25 inches 80 uses or 36 months
- US No. 1/2 to US No. 12 70 uses or 30 months
- US No. 14 to US No. 40 60 uses or 24 months
- US No. 45 to US No. 140 50 uses or 18 months
- US No. 170 to US No. 325 35 uses or 12 months
- US No. 400 to US No. 635 20 uses or 6 months

Besides cleaning sieves regularly, with either a small brush, or preferably, with the help of a sonic sifter, they must be inspected on occasion, to verify the sieves are still in compliance.



ULTRASONIC CLEANERS CLEAN SIEVES EFFECTIVELY WITHOUT DAMAGING THEM

Sieves are calibrated, either by third party verification, which can get very expensive, or in house by a variety of methods.



Sieve calibration beads usually come with 5 single shot bottles of soda lime glass microspheres, that are designed to be retained by specific apertures, in order to verify the sieve is still in spec.



Another method often used for calibrating test sieves, is to maintain a stack of calibration sieves, where through performance testing, the results are compared to the working sieves (Sieves used for testing).

A caliper may also be employed to manually measure sieve apertures, and compare to the standards employed. (cont)

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TABLE 1 Nominal Dimensions and Permissible Variations for Sieve Cloth and Compliance, Inspection and Calibration Test Sieves

Sieve Designation	Nominal Sieve Opening	Nominal Mesh	Nominal Aperture	Nominal Aperture	Nominal Aperture	Nominal Aperture	Nominal Aperture	Nominal Aperture	Nominal Aperture	Nominal Aperture	Nominal Aperture	Nominal Aperture	Permissible Variations	
													Min.	Max.
100	1.49	100	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49
150	0.98	150	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
200	0.75	200	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
250	0.60	250	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
300	0.50	300	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
350	0.425	350	0.425	0.425	0.425	0.425	0.425	0.425	0.425	0.425	0.425	0.425	0.425	0.425
400	0.375	400	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375
450	0.335	450	0.335	0.335	0.335	0.335	0.335	0.335	0.335	0.335	0.335	0.335	0.335	0.335
500	0.300	500	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
550	0.270	550	0.270	0.270	0.270	0.270	0.270	0.270	0.270	0.270	0.270	0.270	0.270	0.270
600	0.250	600	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
650	0.225	650	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225
700	0.210	700	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210
750	0.190	750	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190
800	0.175	800	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175
850	0.160	850	0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.160
900	0.150	900	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
950	0.140	950	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140
1000	0.130	1000	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130
1050	0.125	1050	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
1100	0.120	1100	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120
1150	0.115	1150	0.115	0.115	0.115	0.115	0.115	0.115	0.115	0.115	0.115	0.115	0.115	0.115
1200	0.110	1200	0.110	0.110	0.110	0.110	0.110	0.110	0.110	0.110	0.110	0.110	0.110	0.110
1250	0.105	1250	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105
1300	0.100	1300	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
1350	0.095	1350	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095
1400	0.090	1400	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090
1450	0.085	1450	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085
1500	0.080	1500	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080
1550	0.075	1550	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075
1600	0.070	1600	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070
1650	0.065	1650	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
1700	0.060	1700	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060
1750	0.055	1750	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055
1800	0.050	1800	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
1850	0.045	1850	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045
1900	0.040	1900	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
1950	0.035	1950	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
2000	0.030	2000	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
2050	0.025	2050	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
2100	0.020	2100	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
2150	0.015	2150	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
2200	0.010	2200	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
2250	0.005	2250	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005