Sieving

Innovative Technology Sets Standards Worldwide

RETSCH analytical vibratory sieve shakers are used in research & development, quality control of raw materials, semi finished and finished products as well as in production monitoring. The AS 200 series provides a suitable instrument for every requirement and budget. While the AS 300 control is designed for large feed quantities up to 6 kg, the AS 450 control is the ideal sieve shaker for big loads up to 25 kg.

All shakers are suitable for dry and wet sieving. Their patented electromagnetic drive produces a 3-D throwing motion which ensures optimum use of the open sieve area and lets the sample move equally over the whole sieving surface. All electromagnetic sieve shakers feature individual amplitude setting which allows adaptation to the sample characteristics and therefore sharp fractionizing even after very short sieving times. The "control" models can be used as measuring instruments according to DIN EN ISO 9000 ff.

AS 200 basic – The Budget-Priced Basic Model

The economical alternative of the series with familiar RETSCH quality and reliability. With digital adjustment of power and sieving time.

Vibratory Sieve Shaker AS 200 basic with clamping device "economy" and sieve stack

AS 200 digit cA – The All-Purpose Standard Model

The AS 200 digit cA is recommended whenever digital time display, interval operation and adjustment along the vibration height are required.

Vibratory Sieve Shaker AS 200 digit cA with clamping device "standard" and sieve stack

AS 200 control – Meeting the Highest Standards for Quality Control

The microprocessor-controlled measuring and control unit of this model ensures a constant vibration height, allowing for 100% reproducibility of results even among different AS 200 control shakers. One particular characteristic makes this RETSCH product stand out from others: Instead of the vibration height, it is possible to set the sieve acceleration which is independent of the power frequency. Together with the possibility of calibration, this ensures comparable and reproducible sieving results worldwide. Thus, all requirements for the test materials monitoring according to DIN EN ISO 9000 ff are met.

All sieving parameters – vibration height, time, and interval – are set, displayed and monitored digitally which makes operation of the AS 200 control very convenient and quick. Up to 99 standard operating procedures (SOPs) may be stored for routine analyses.

Benefits

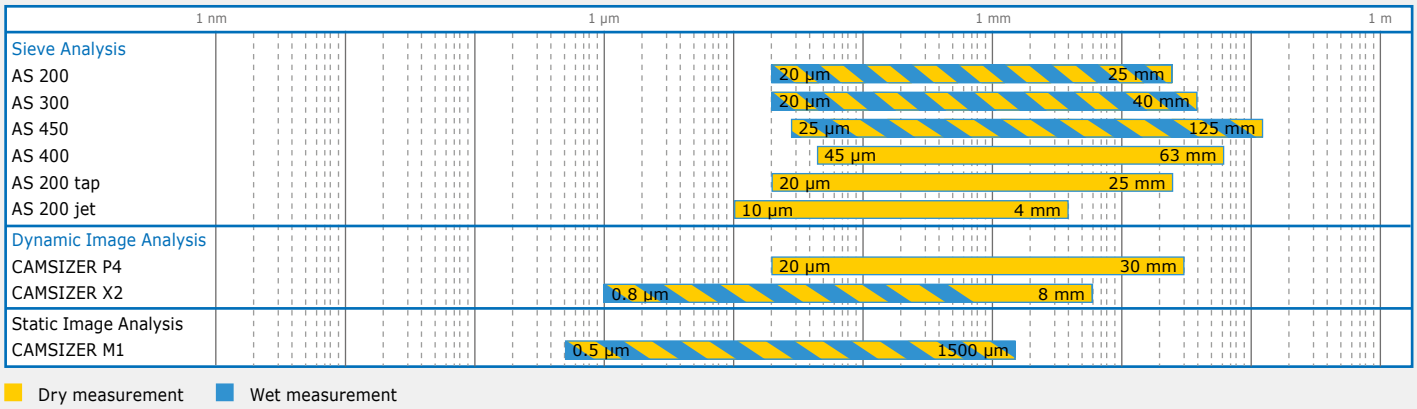
- Sieving with 3-D effect
- For sieves up to 203 mm (8") Ø
- Suitable for dry and wet sieving
- Measuring range 20 µm to 25 mm
- Memory for 99 Standard Operating Procedures (SOPs)
- Digital setting and control of sieving parameters
- Sieve acceleration independent of power frequency
- Patented electromagnetic drive (EP 0642844)
- Test materials monitoring according to DIN EN ISO 9000 ff

Video on www.retsch.com/as200

Vibratory Sieve Shaker AS 200 control with clamping device "comfort" and sieve stack

Through the integrated interface the instrument can be connected to a PC and controlled with the evaluation software EasySieve®. This program enables the user to carry out the whole sieving process and its subsequent documentation with convenience, accuracy and conforming to standards.

The perfect solution for each measuring range



AS 300 control – Designed for Test Sieves up to 315 mm Ø

The AS 300 model has all the benefits of the AS 200 control but is designed for test sieves with a diameter up to 315 mm, providing a sieve surface which is approximately 2.5 times larger. Therefore, the AS 300 is able to separate up to 6 kg of material in one working run. Repetitive operations are greatly simplified with the possibility to store up to 99 standard operating procedures (SOP). For perfectly reproducible sieving results, the AS 300 control can be programmed with sieve acceleration independent of the power frequency instead of vibration height.

The microprocessor-controlled measuring device monitors and automatically readjusts the vibration height. All sieving parameters are set, displayed and monitored digitally. The AS 300 control can be calibrated, and is thus suitable for test materials monitoring. Like all instruments of the "control" series, the AS 300 has an integrated interface for using the evaluation software EasySieve® to control, set and visualize all parameters, including complete documentation of the sieving process.

Benefits

- Sieving with 3-D effect
- For sieves up to 315 mm Ø
- Suitable for dry and wet sieving
- Measuring range 20 µm to 40 mm
- Memory for 99 Standard Operating Procedures (SOPs)
- Digital setting and control of sieving parameters
- Sieve acceleration independent of power frequency
- Reproducible and globally comparable sieving results
- Short sieving times due to large sieve surface and effective movement
- Test materials monitoring according to DIN EN ISO 9000 ff

Video on www.retsch.com/as300

Vibratory Sieve Shaker AS 300 control with clamping device "comfort" and sieve stack

The sieve shakers of the AS 450 series are robust floor models with a remote operation panel designed for use with 400/450 mm test sieves. They are suitable for sieving products such as minerals, construction materials, coal or soil.

AS 450 basic – The Budget-Priced Alternative

This sieve shaker covers a size range from 25 µm to 125 mm and accepts loads of up to 15 kg. Time and amplitude are digitally set which ensures reproducibility of the sieving process.

The AS 450 basic is suitable for dry and wet sieving. It is the economic solution for users who need to sieve larger quantities of dry material with reliable results.

Vibratory Sieve Shaker AS 450 basic, sieve stack 450 mm Ø, remote operation panel

AS 450 control – The High-Performance Model with CET Technology

With the Vibratory Sieve Shaker AS 450 control RETSCH have designed their first 3-D shaker for 400 mm and 450 mm sieves. It can be used for dry and wet sieving of sample amounts of up to 25 kg. The AS 450 control combines the benefits of electro-magnetic sieving – controlled amplitude with highest reproducibility – with the powerful drive based on CET technology (Continuous Energy Transfer).

Even with high loads a constant vibration height of 2.2 mm and, as a result, high separation efficiency are achieved thanks to the continuous controlled energy input. Manual re-sieving is no longer required.

When it comes to operating comfort, the AS 450 control meets all the requirements of a modern laboratory. All parameters such as amplitude, time and interval are digitally set, displayed and controlled via a remote operation panel. It is possible to store up to 9 standard operating procedures for routine tasks. Like all instruments of the "control" series, the AS 450 comes with a calibration certificate and can be controlled with the evaluation software EasySieve®.

Remote operation panel (e.g. wall-mounted)

Vibratory Sieve Shaker AS 450 control with clamping device "standard" and sieve stack

Benefits

- Sieving with 3-D effect
- High sieve loads (up to 25 kg)
- Suitable for dry and wet sieving
- Measuring range 25 µm to 125 mm
- Sieve stack up to 963 mm, for sieves up to 450 mm Ø
- Memory for 9 Standard Operating Procedures (SOPs)
- With remote operation panel
- Sieve acceleration independent of power frequency
- Test materials monitoring according to DIN EN ISO 9000 ff

Video on www.retsch.com/as450

Accessories and Options

A wide selection of accessories and options for sieve shakers completes RETSCH's portfolio for optimum sieve analysis results.

- **Clamping devices**
  With the RETSCH clamping devices the sieves are clamped safely, quickly and conveniently on the sieve shaker. The clamping devices "comfort" are particularly user-friendly and time-efficient. Special versions are available for sieving wet materials. The picture below shows clamping devices of the AS 200 which can also be used with models AS 300 and AS 400.


clamping device „comfort"


clamping device „standard"


clamping device „economy"


universal wet sieve clamping device "comfort"


universal sieve clamping device "standard"


Easily clamped

Clamping device „comfort"
A sieve analysis starts as early as loading the sieve shaker and clamping the lid on the sieve stack. Especially when many samples need to be sieved each day, easy and quick handling of the clamping device is a great benefit. RETSCH's clamping device "comfort" was developed with this in mind. Loading the sieves or changing the height of the sieve stack is done easily without the need to loosen screws or take off the clamp. The "comfort" clamping devices are available for all vibratory and horizontal sieve shakers.

- **Test sieves**
  Standard-compliant and manufactured on the basis of the latest production technology. Standard sieve stacks available.
- **Accessories for test sieves**
  Collecting pans, intermediate pans, intermediate rings and sieve lids.
- **Accessories for wet sieving**
  Clamping lid with nozzles, collecting pans with outlet, venting rings.
- **Software EasySieve® and EasySieve® CFR**
  For control, evaluation and documentation of sieve analyses according to relevant standards.
- **Sieving aids**
  Chain rings, brushes, cubes, balls (e.g. for reducing agglomerations when sieving particles < 100 µm and keeping the mesh free).
- **IQ/OQ Documents**
  We provide IQ/OQ documentation for the „control" sieve shakers to support IQ/OQ certification by our customers.
- **Sample dividers**
  Meaningful results can only be obtained if the sample represents the original material. Sample dividers produce representative part samples, thus ensuring reproducibility of the analysis.
- **Ultrasonic baths and dryers**
  Suitable for thorough cleaning of test sieves and for quick, gentle drying of samples and sieves.

Vibratory Sieve Shakers at a Glance

	Vibratory Sieve Shakers					
						
Model	AS 200 basic	AS 200 digit cA	AS 200 control	AS 300 control	AS 450 basic	AS 450 control
Applications	separation, fractioning, particle size determination					
Feed material	powders, bulk materials, suspensions					

Performance data

Measuring range*	20 µm – 25 mm	20 µm – 25 mm	20 µm – 25 mm	20 µm – 40 mm	25 µm – 125 mm	25 µm – 125 mm
Max. batch / feed capacity*	3 kg	3 kg	3 kg	6 kg	15 kg	25 kg
Max. number of fractions**	9/17	9/17	11/23	9/17	12/8	13/9 (min. 3)
Max. mass of sieve stack	4 kg	4 kg	6 kg	10 kg	50 kg	50 kg
Adjustment of sieving parameters						
Amplitude	digital 1–100 % (~3 mm)	digital 0.2 – 3 mm	digital 0.2 – 3 mm	digital 0.2 – > 2.2 mm	digital 0 – > 2 mm	digital 0.2 – > 2.2 mm
Sieve acceleration***	–	–	1.0 – > 15.1 g	1.0 – > 10.0 g	–	1.0 – > 11.0 g
Time	digital 1 – 99 min	digital 1 – 99 min	digital 1 – 99 min	digital 1 – 99 min	digital 1 – 99.9 min	digital 1 – 99 min
Interval operation	–	10 s (fixed)	1 – 99 s	1 – 99 s	10 s (fixed)	10 – 99 s
Storable Standard Operating Procedures (SOPs)	–	–	99	99	1	9
Sieving motion	throwing motion with angular momentum					
Suitable for wet sieving	✓	✓	✓	✓	✓	✓
Serial interface	–	–	✓	✓	–	✓
Including test certificate / calibration possible	–	–	✓	✓	–	✓

Technical data

Suitable sieve diameters	100 mm – 203 mm			100 mm – 315 mm	400 mm – 450 mm	
Height of sieve stack	up to 510 mm		up to 620 mm	up to 510 mm	up to 830 mm	up to 963 mm
W x H x D	417 x 212 x 384 mm			417 x 222 x 384 mm	680 x 280 x 680 mm	714 x 435 x 658 mm
Net weight	approx. 35 kg			approx. 42 kg	approx. 140 kg	approx. 200 kg
More information on	**www.retsch.com/as200**	**www.retsch.com/as200**	**www.retsch.com/as200**	**www.retsch.com/as300**	**www.retsch.com/as450**	**www.retsch.com/as450**

*depending on feed material and used sieve set **depending on sieve height and clamping unit ***(1 g = 9.81 m/s²)

Typical Sample Materials

Vibratory sieve shakers are used for particle size analysis of products such as construction and filling materials, soil, chemicals, sand, coffee, coal, fertilizers, flour, metal powders, minerals, seeds, washing powder, cement clinker and many more.

Soil

Coffee

AS 400 control – Sieving on One Level

The RETSCH AS 400 control is used for sieving dry goods with test sieves up to 400 mm in diameter. The uniform, horizontal circular sieving motion produces a sharp separation of the sample fractions. Fine and coarse-grained goods from areas such as milling, brewing, chemical industry, quarries, soil testing, woodworking and plastics industry, can be exactly separated with the AS 400 control. This particular sieving motion is preferably used for long or fibrous, needle-shaped or flat materials due to their horizontal orientation. For the testing of plastics (grainy molding materials), the standard DIN 53 477 stipulates exactly this circular sieving motion.

The AS 400 control can be used as test instrument for the quality control according to DIN EN ISO 9000 ff. Due to the controlled drive which is independent of the power frequency the AS 400 control yields reproducible results worldwide. The speed and sieving time are set, displayed and monitored digitally. The instrument is supplied with a test certificate and can be recalibrated.

If desired, the rotation direction can be set to alternate in the interval. A memory for 9 sieving programs facilitates routine analyses. The AS 400 control has an integrated interface for controlling all sieving parameters via the EasySieve® software.

The AS 400 control is a robust device, which meets highest requirements due to its superior technology. The base plate can take very high loads due to 4 eccentric guides. With the option to install clamping devices for sieves with diameters from 100 mm to 400 mm (4" to 16") the AS 400 is suitable for a wide range of applications. With the proven clamping device "comfort" the sieve stack can be fastened conveniently with two simple steps. For occasional sieving processes we recommend the inexpensive clamp "standard".

The clamping devices of AS 200 and AS 300 can be used with the AS 400 for clamping sieve stacks with diameters of 100 mm, 150 mm, 200/203 mm and 305/315 mm.

Horizontal Sieve Shaker AS 400 control with clamping device "comfort" and sieve stack

Benefits

- Circular sieving motion according to DIN 53477
- For sieves up to 400 mm Ø
- Measuring range 45 µm to 63 mm
- Easy operation, ergonomic design
- Free digital selection of process parameters (time, speed, interval)
- Memory for 9 Standard Operating Procedures (SOPs)
- Test materials monitoring according to DIN EN ISO 9000 ff

Video on www.retsch.com/as400

Accessories and Options

- **Clamping devices**
- **Test sieves**
- **Sieving aids**
- **IQ/OQ documentation**
- **Software EasySieve®**
- **Sample dividers**
- **Ultrasonic baths and dryers**

IQ/OQ documentation and sieving aids for AS 400

AS 400 at a Glance

Model	Horizontal Sieve Shaker
	
	AS 400 control

Applications	fractioning, particle size determination
Feed material	powders, bulk materials

Performance data

Measuring range*	45 µm – 63 mm
Max. batch / feed capacity	5 kg
Max. number of fractions**	7/9/17
Max. mass of sieve stack	15 kg
Adjustment of sieving parameters	
Speed	digital, 50 – 300 min^{-1}
Time	digital, 1 – 99 min
Interval operation	1 – 10 min
Storable Standard Operating Procedures (SOPs)	9
Sieving motion	horizontal circular motion
Suitable for wet sieving	–
Serial interface	✓
Including test certificate / can be calibrated	✓

Technical data

Suitable sieve diameters	100 mm – 400 mm
Height of sieve stack	up to 450 mm
W x H x D	540 x 260 x 507 mm
Net weight	approx. 70 kg
More information on	**www.retsch.com/as400**

* depending on feed material and used sieve set
** depending on the used sieve heights

Typical Sample Materials

The horizontal circular sieving motion of the AS 400 control is perfectly suitable for the separation of materials such as construction materials, wood chips, compost, flour, milled grain, grainy molding materials, seeds and many more.

Wood chips

Flour

AS 200 tap – Mechanizing Hand Sieving

The RETSCH AS 200 tap is suitable for dry sieving with test sieves of 200 mm or 8" diameter. The combination of horizontal, circular sieving motions with vertical taps reproduces the principle of hand sieving. The uniform mechanical action ensures reliable and reproducible measurement results.

This special type of sieving motion used by the AS 200 tap is specified in various standards for particle size analysis of materials such as activated carbon, diamonds, spices, metal powders, abrasives or cement.

Operating the AS 200 tap is exceptionally easy and safe. The integrated clamping device allows for sieve stacks with up to 7 or 13 fractions, depending on the height of the sieve frame. The sieving time is set from 1 to 99 minutes via a digital display.

The number of rotations and taps is fixed; the tapping motion can be deactivated, if required. A safety switch and an anti-trap protection provide maximum safety. Thanks to an integrated interface, the AS 200 tap can be controlled with the evaluation software EasySieve®.

Benefits

- Sieving with circular motion and vertical taps according to standards
- Measuring range 20 µm to 25 mm
- For 200 mm / 8" sieves
- Sieve stack up to 350 mm
- Digital time setting
- Integrated interface
- Suitable for dry sieving

Video on www.retsch.com/as200tap

Tap Sieve Shaker AS 200 tap with sieve stack

25 mm
20 µm

Horizontal Circular Sieving Motion with Taps

Accessories and Options

The AS 200 tap is a robust and maintenance-free sieve shaker. The compact sound-enclosure cabinet helps to substantially reduce noise emission and ensures CE conformity.

Accessories

- **Test sieves**
- **Ball-pan hardness test kit**
- **Sieving aids**
- **IQ/OQ documentation**
- **Software EasySieve®**
- **Sample dividers**
- **Ultrasonic baths and dryers**

Tap Sieve Shaker AS 200 tap with sound-enclosure cabinet and sieve stack

AS 200 tap at a Glance

Model	Tap Sieve Shaker
	
	AS 200 tap

Applications	fractioning, particle size determination
Feed material	powders, bulk materials

Performance data

Measuring range*	20 µm – 25 mm
Max. batch / feed capacity	3 kg
Max. number of fractions**	7/13
Max. mass of sieve stack	6 kg
Adjustment of sieving parameters	
Speed	fixed, 280 min^{-1}, taps: 150 min^{-1}
Time	digital, 1 – 99 min
Interval operation	–
Storable Standard Operating Procedures (SOPs)	–
Sieving motion	horizontal circular motion with taps
Suitable for wet sieving	–
Serial interface	✓
Including test certificate / can be calibrated	–

Technical data	without sound-enclosure cabinet	with sound-enclosure cabinet
Suitable sieve diameters	200 mm / 203 mm (8")	
Height of sieve stack	up to 350 mm	
W x H x D	700 x 650 x 450 mm	735 x 675 x 530 mm
Net weight	approx. 68 kg	approx. 92 kg
More information on	**www.retsch.com/as200tap**	

* depending on feed material and used sieve set
** depending on the used sieve heights

Typical Sample Materials

Tap sieve shakers are used for sieving a variety of materials including activated carbon, diamonds, spices, metal powders, abrasives cement etc.

Diamonds

Cement

AS 200 jet – Quick and Gentle Quality Control of Fine Powders

The Air Jet Sieving Machine AS 200 jet is particularly suitable for low density and low particle size materials which tend to agglomerate. It is used with sieves of 10 microns mesh size and up. The procedure is very gentle on the material as no mechanical sieving aids are required. The average sieving time is only 2-3 minutes.

The AS 200 jet is specifically designed for test sieves with a diameter of 203 mm/8" (or 200 mm with adapter). The air jet generated by an industrial vacuum cleaner can be adjusted by using the manual vacuum regulation. Optionally, an automatic vacuum regulation is available.

The Open Mesh Function, a procedure which greatly reduces the number of near-mesh particles, provides optimum separation efficiency, excellent reproducibility and a longer service life of the sieves.

Sieving time and nozzle speed are conveniently selected with a single button; the settings are shown in the graphic display. The Quick Start Mode is used to start the sieving process under standard conditions without entering parameters.

Air Jet Sieving Machine AS 200 jet with test sieve

Air Jet Sieving Machine AS 200 jet with cyclone and sample bottle

Benefits AS 200 jet

- Air jet technology for dispersion and deagglomeration
- Measuring range 10 µm to 4 mm
- Quick, efficient procedure
- Open Mesh Function reduces near-mesh particles
- Digital parameter setting (time, vacuum, speed)
- Quick Start option
- Variable nozzle speed
- Automatic vacuum regulation and cyclone (options)
- Memory for 9 Standard Operating Procedures (SOPs)
- Suitable for RETSCH standard sieves
- Maintenance-free

Video on www.retsch.com/as200jet

Accessories and Options

- **Cyclone with holder and collecting receptacle**
  To extend the service life of the filters in the vacuum cleaner and for recovery of the sample fraction passing the sieve, we recommend the use of the optional cyclone. The separation degree and limiting particle size respectively depend on the sample characteristics.
- **Automatic vacuum regulation**
  The automatic vacuum regulation permanently monitors the air jet and keeps it at a constant rate. This increases the reproducibility of the sieve analysis.
- **Industrial vacuum cleaner**
- **Test sieves 20 µm and up with stainless steel sieve mesh**
- **Test sieves 10 µm and 15 µm with electroformed sheet (ISO 3310-3)**
- **Adapter and lid for test sieves**
  200 mm Ø x 50 mm and 200 mm Ø x 25 mm
- **Sieving aids**
- **IQ/OQ documents**
- **Software EasySieve®**
- **Sample dividers**
- **Ultrasonic baths and dryers**

The delivery scope of the AS 200 jet includes a manual vacuum regulation (1), two sieve lids (2), a sound absorber (3) and a rubber mallet.

AS 200 jet at a Glance

Model	Air Jet Sieving Machine
	
	AS 200 jet

Applications	fractioning, particle size determination
Feed material	powders, bulk materials

Performance data

Measuring range*	10 µm – 4 mm
Max. batch / feed capacity*	approx. 100 g
Max. number of fractions	1 (2 with cyclone)
Adjustment of sieving parameters	
Nozzle speed	digital, 5 – 55 min^{-1}
Time	digital, 00:10 – 99:59 min
Open Mesh Function	10 min^{-1} (fixed), +20°, -10°
Vacuum**	2000 – 9999 Pa / 20 – 99 mbar / 0.3 – 1.45 psi
Storable Standard Operating Procedures (SOPs)	9 plus Quick Start
Sieving motion	dispersion by air jet
Serial interface	✓
Including test certificate / can be calibrated	✓

Technical data

Suitable sieve diameters	RETSCH standard test sieves Ø 200 mm/203 mm (8")
Height of sieve stack	1 sieve 25/50 mm (1"/2")
W x H x D	460 x 288 x 305 mm
Net weight	approx. 14 kg
More information on	**www.retsch.com/as200jet**

*depending on feed material and used sieve
** using the automatic vacuum regulation

Typical Sample Materials

The Air Jet Sieving Machine AS 200 jet is perfectly suitable for particle size analysis of construction materials, spices, catalysts, plastics, flour, pharmaceutical products and many more.


Spices


Plastics

Test Sieves 200, 203 mm (8") in Diameter – Highest Precision for Accurate Analysis Results

The well-proven RETSCH sieves consist of a solid stainless steel sieve frame of high stability for reliable sieving results. Paying close attention to mesh-specific requirements, the sieve fabric is precisely joined into the frame and tautened. The individual laser engraving of each RETSCH test sieve provides a clear and accurate labeling with full traceability.

The sieves can be easily combined with all other sieve brands. Each sieve that leaves our company comes with a test report or, at your request, with a special inspection certificate in conformity with national and international standards. RETSCH calibration certificates confirm a great number of precision measurements, thus ensuring an even higher statistical reliability for your quality control.

RETSCH test sieves are available in many sizes and varieties, primarily in the four frame sizes most widely used in laboratory analytics:

- 200 x 50 mm, 200 x 25 mm
- 8"x 2" (203 x 50 mm), 8"x 1" (203 x 25 mm).

Test sieves 200 x 50 mm and 200 x 25 mm

Benefits

- Stainless steel sieve frame with high form stability
- High degree of corrosion resistance and easy cleaning thanks to high-alloy stainless steel
- Sieve mesh sizes from 20 µm to 125 mm
- Permanently tight sieve fabric
- Excellent product quality due to extensive optical inspection
- Maximum stability and optimum sealing when used in sieve stacks thanks to the o-ring which is placed in the recess designed for this purpose
- Clear and precise labeling of the sieves with full traceability based on individualized laser engraving

www.retsch.com/sieves

Test Sieves with Diameters of 100, 150, 305, 315, 400 and 450 mm

- Sieve meshes, frames and labeling comply with standards
- Tested 5 times, with quality certificate
- According to DIN ISO, ASTM, BS
- Individual inspection certificate for test materials monitoring according to ISO 9000 ff available on request
- Stainless steel sieves, 20 µm to 125 mm
- Also available with perforated plate, round or square

Accessories and Options

A wide selection of accessories allows for perfect sieve analyses.

- **Accessories for test sieves**
  Collecting pans, collecting pans with outlet, intermediate pans, intermediate rings, venting rings and sieve lids.
- **Sieving aids**
  Chain rings, agate, rubber or steatite balls, brushes, polyurethane cubes.
- **Test sieve rack**
  Accommodates up to 10 test sieves of 200/203 mm Ø.
- **Ultrasonic baths and dryers**
  For thorough cleaning of test sieves and for quick and gentle drying of samples and sieves.
- **Sample dividers**
  For the extraction of representative part samples.

...more details on www.retsch.com

Control, Evaluation, Documentation with EasySieve® and EasySieve® CFR

EasySieve®, the RETSCH software for particle size analyses, automatically performs and documents all measurement and weighing processes – from the registration of the weight of the sieve to the evaluation of the data.

The intuitive design of the software reflects the process of particle size analysis step by step. The abundance of evaluation possibilities offers maximum flexibility with regard to user-specific adjustments.

The new EasySieve CFR version offers compliance with FDA 21 CFR Part 11.

Particle Size and Particle Shape Analysis with Image Analysis

MICROTRAC MRB
PARTICLE CHARACTERIZATION

Dynamic Image Analysis is one of the most accurate methods when it comes to measuring the particle size and particle shape. It is an established alternative to sieve analysis and laser diffraction and is greatly superior to these with regard to precision, reproducibility and information content in a size range from 0.8 µm to 30 mm. The particle analyzer CAMSIZER P4 measures pourable bulk goods and granulates with a maximum particle size of 30 mm. The CAMSIZER X2 is ideally suited for analyzing fine powders and suspensions from 0.8 µm up to several mm. The CAMSIZER M1 uses static image analysis to measure particles in a range from 0.5 µm to 1,500 µm and provides accurate size and shape information down to the low micron range.

CAMSIZER® P4 – Particle Characterization of Pourable Bulk Goods

Microtrac MRB's CAMSIZER P4 is a high-performance particle analyzer which uses Dynamic Image Analysis for the simultaneous measurement of particle size and particle shape of powders and granulates.

The patented Dual Camera Technology provides the required resolution to characterize pourable solids in a wide size range from 20 µm to 30 mm. The CAMSIZER P4 offers a wealth of information on particle characteristics with a typical measurement time of only a few minutes. Moreover, the size analysis results are 100% compatible to those obtained by sieve analysis.

These features make the CAMSIZER P4 the perfect alternative to traditional sieving.

Dynamic Particle Analyzer CAMSIZER P4

Benefits

- Dynamic Image Analysis with patented Dual Camera Technology (complies with ISO 13322-2)
- Wide measuring range from 20 µm to 30 mm
- Measurement results 100 % compatible to sieve analysis and laser diffraction results.
- Results in real time (analysis of 60 images/s)
- Particle shape analysis possible (e.g. to detect agglomerations, broken particles or contaminations)
- Reliable detection of „oversized" particles
- Results in real time (analysis of 60 images/s)

www.microtrac.com/camsizerp4

CAMSIZER® X2 – For Quality Control of Fine Powders and Suspensions

The CAMSIZER X2 is ideally suitable for quality control of fine powders, granulates and suspensions in a size range from 0.8 µm to 8 mm. It features the Dual Camera Technology just like the CAMSIZER P4 but is optimized for analysis of fine particles.

The CAMSIZER X2 provides three alternative dispersion options via the modular X-Change system: Pourable, not agglomerating powders are measured in free fall (X-Fall module); the dry dispersion unit (X-Jet module) disperses agglomerated particles through a nozzle with adjustable overpressure; finally, it is also possible to disperse the particles in liquid (X-Flow module). Thus the CAMSIZER X2 offers the optimum dispersion option for every sample material.

Dynamic Particle Analyzer CAMSIZER X2 with X-Jet module for dispersion by air pressure

Benefits

- Dynamic Image Analysis with patented Dual Camera Technology (complies with ISO 13322-2)
- Wide measuring range from 0.8 µm to 8 mm
- New optical system with ultra-strong LEDs for highest resolution and excellent depth of sharpness
- Frame rate of more than 300 images/s with 4.2 MPixel cameras
- Reliable detection of smallest amounts of „undersized" or „oversized" particles
- Results in real time
- Modular system „X-Change" for dry and wet dispersion

www.microtrac.com/camsizerx2

CAMSIZER X2 with X-Dry module

Benefits of the Dual Camera Technology

The dual camera technology invented by Microtrac MRB is a landmark in the development of image analysis technology. Extremely wide dynamic measuring ranges can be analyzed by simultaneously employing two cameras with different magnifications. This is accomplished without hardware adjustments or modifications and without compromising accuracy. Each camera is specialized for one measuring range. The ZOOM camera analyzes fine particles with highest precision whereas the BASIC camera detects the larger particles with excellent statistics. A special algorithm combines the information provided by both cameras and delivers the exact size distribution in a possible range of more than three decades!

This arrangement resolves a significant drawback of many image analysis systems that employ only one camera, e. g. microscopes. Such instruments either cannot correctly report the fine particles in wide size distributions, or the large particles are not captured due to the small field of view.

dual camera technology

CAMSIZER® M1 – Fully Automated Static Image Analysis

With the CAMSIZER M1 MICROTRac MRB extends their range of powerful particle characterization instruments.

The measurement method of Static Image Analysis (ISO 13322-1) is perfectly suited for high-resolution analysis of narrow particle size distributions in the lower micron range while simultaneously determining the particle shape of fine powders and suspensions. The sample stage of the CAMSIZER M1 may be equipped with various inserts allowing for evaluation of an area corresponding to up to eight standard object slides.

The CAMSIZER M1 convinces with superior technology. The system features five objectives with magnifications from 2.5 x to 50 x and three illumination modes: incident light, transmitted light and a combination of both. The analyzer may be equipped with an additional 1.25 x or 100 x objective.

The sample stage covers a wide traversing range and possesses a high positional accuracy. Hence, the CAMSIZER M1 provides pin-sharp images and guarantees optimum measurement conditions over the complete size range.

With the innovative stitching function, large and elongated particles extending over more than one image can be pieced together and evaluated, even if they exceed the nominal upper limit of the measurement range.

Static Particle Analyzer CAMSIZER M1 with M-Jet

Benefits

- Measuring range 0.5 to 1,500 µm
- 18.1 Megapixel color camera - 5 magnifications
- Exact analysis of small particles
- Evaluation of individual particles with Particle X-Plorer software module
- Shape analysis with highest precision
- Dry and wet measurement possible
- Highly efficient dispersion unit M-Jet for preparation of powder samples

www.microtrac.com/camsizerm1

Efficient powder dispersion with M-Jet

Set parameters: The M-Jet is operated conveniently via a touch display

Load sample: A powder sample is placed into the dispersion chamber of the M-Jet.

Dispersion: The sample is distributed homogeneously onto an object slide and is ready for analysis.

CAMSIZER® at a Glance

	Particle Analyzers		
			
Model	CAMSIZER® P4	CAMSIZER® X2	CAMSIZER® M1
Applications	Particle size and shape measurement with Dynamic Image Analysis and Static Image Analysis		
Type of analysis	dry analysis	dry and wet analysis	dry and wet analysis
Feed material	dry, pourable bulk goods	fine powders, granulates, suspensions	fine powders and suspensions
Performance data			
Measurement range	20 µm – 30 mm	0.8 µm – 8 mm	0.5 µm – 1,500 µm
Measurement principle	Dynamic Image Analysis with Dual Camera Technology (complies with ISO 13322-2)	Dynamic Image Analysis with Dual Camera Technology (complies with ISO 13322-2)	Static Image Analysis (ISO 13322-1)
Measurement time	approx. 2 – 3 min*	approx. 1 – 3 min*	approx. 5 – 60 min*
Measurement	60 images/s, approx. 1.3 MPixel	> 300 images/s, approx. 4.2 MPixel	> 2 images/s, 18.1 MPixel
Technical data			
W x H x D	approx. 650 x 850 x 350 mm	approx. 580 x 850 x 570 mm	approx. 450 x 540 x 550 mm
Net weight	approx. 40 kg	approx. 50 kg	approx. 45 kg
More information on	**www.microtrac.com/camsizerp4**	**www.microtrac.com/camsizerx2**	**www.microtrac.com/camsizerm1**

*depends on desired statistics

Typical Sample Materials

CAMSIZER P4: Sugar, fertilizers, food, pharmaceutical pellets, catalysts, abrasives, plastic granulates and extrudates, sand, metal powders, sediments, and many more.

CAMSIZER X2: Fine powders and granulates such as food, coffee, pharmaceutical products, metals, abrasives, chemical raw materials, construction materials, ceramics, fibres, suspensions, and many more.

CAMSIZER M1: Pharmaceutical active ingredients and excipients, metal powder, abrasives, chemical raw materials, ceramics, fibers, suspensions, food etc.


Pharmaceuticals


Metal Powder

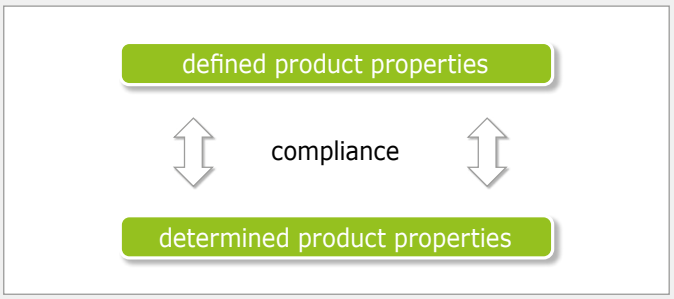
When Size Matters

For the characterization of bulk goods the knowledge of their particle size distributions is essential as it influences important physical and chemical properties such as solubility, flowability or surface reaction. In many industries traditional sieve analysis is the standard for production and quality control of powders and granules. Advantages of sieve analysis include easy handling, low investment costs, precise and reproducible results obtained in a relatively short time and the possibility to separate the particle size fractions. Therefore, sieving is equal with analysis methods based on laser diffraction or image processing which, due to the different measuring techniques, provide different results.

To guarantee a high degree of reproducibility and reliability, sieve shakers and accessories have to fulfill the requirements of national and international standards.

Sieve Analysis in Quality Control

The term "quality" describes the compliance of defined properties with the detected properties of a product as determined by tests. A product can be described as high-quality when a test ascertains that the desired properties lie within a given tolerance.



The particle sizes and their distribution within a material quantity – i.e. the fractions of particles of different sizes – have a crucial influence on physical and chemical properties and thus on the product quality. A few examples of properties which may be influenced by the particle size distribution:

- Strength of concrete
- Taste of chocolate
- Dissolution properties of pills
- Flowability and solubility of washing powder

These examples clearly show how important it is to know the particle size distribution, particularly within the context of quality assurance of bulk goods for production processes. If the particle size distribution changes during the production process the product properties, and thereby the quality, will change as well.

Some examples taken from everyday life show how closely particle size distribution is linked to product properties:

- If the particles of **ground filter coffee** are too coarse, the contained flavors cannot dissolve completely in hot water. This is due to the fact that only the flavors contained in the particle surface are washed out, and the taste of the coffee cannot fully develop. If the coffee is ground too fine, too many flavors, acids and bitter aromas are dissolved and deteriorate the taste.

- **Abrasive papers and grinding pastes** need abrasive agents with a very narrow particle size distribution. If the particles are too coarse, the paper/paste can leave deep grooves in the treated surface; if the particles are too fine, the grinding effect is reduced.

- **Activated carbon filters**, for example in respiratory masks, need a large reaction surface to efficiently absorb hazardous organic solvents from the air. If the particles in the filter are too coarse, efficient neutralization of the harmful vapors is not possible. If the particles are too fine, air permeability is reduced.

Sieving Methods

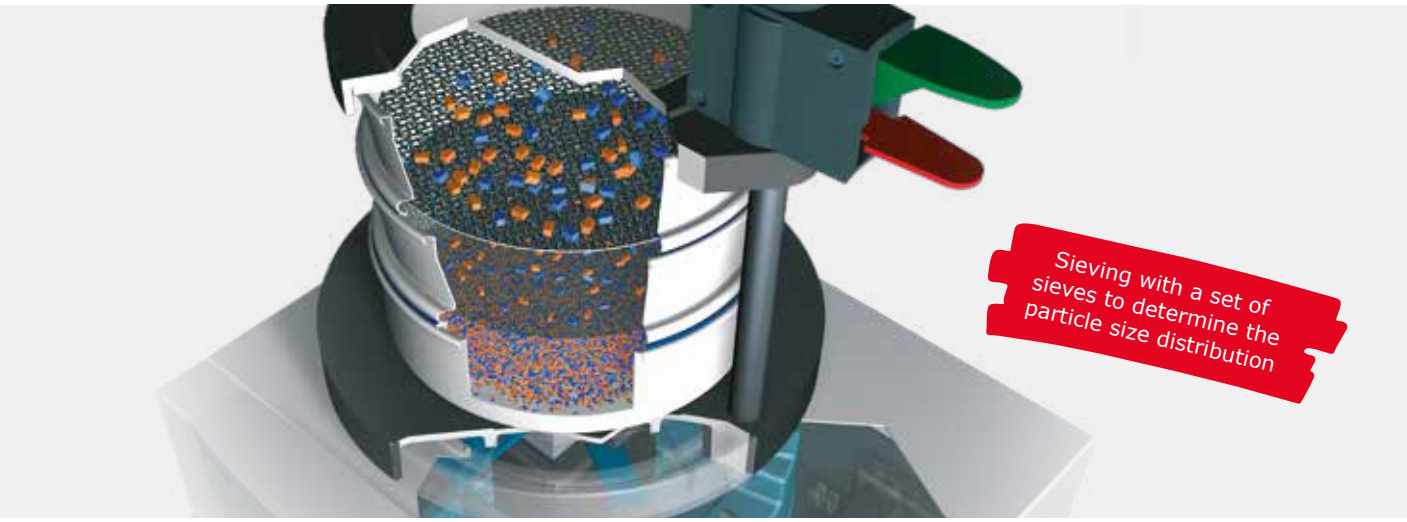
The sieving movement sets the sample in motion, making the particles hit the sieve mesh where they are "compared" with the apertures of every sieve. The probability of a particle passing through the sieve mesh is determined by the ratio of the particle size to the sieve aperture, its orientation and the number of encounters between the particle and the mesh openings.

Sieve cut

Single sieving is carried out with one test sieve of a defined mesh size and is used to determine the percentage of undersize and oversize to get a general idea of the sample characteristics. A particle size distribution in the actual sense is not obtained with this method.

Particle size analysis using a set of sieves

If more fractions are required, a set of sieves is used. The sieves are arranged in a stack with the mesh size increasing from bottom to top. The sample is then placed on the top sieve and is separated by the sieving process into different fractions.



Selecting the sieving method

The appropriate sieving method depends largely on the degree of fineness of the sample material (fig. 1). Dry sieving is the preferred method for the size range between 40 µm and 125 mm. However, the measurement range is limited by properties of the sample such as a tendency to agglomerate, density or electrostatic charge.

Wet sieving extends the measurement range to 20 µm. If wet sieving is not permitted, air jet sieving is an alternative which provides acceptable results down to 10 µm.

Measurement ranges of different sieving methods

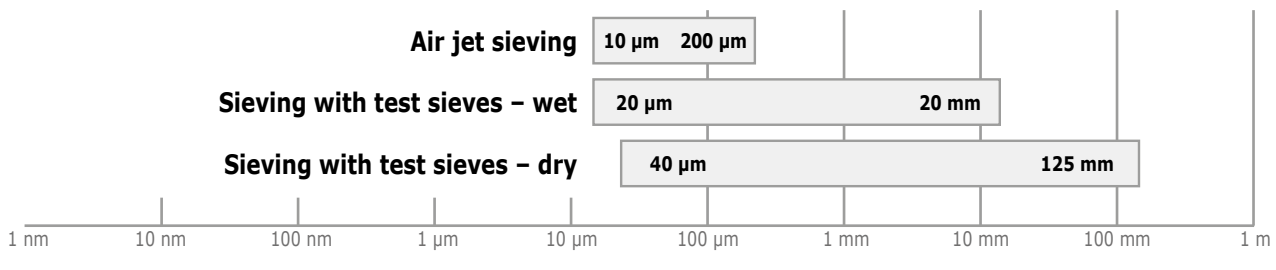


Fig. 1

Vibratory sieving

The sample is thrown upwards by the vibrations of the sieve and falls back down on the mesh. The amplitude indicates the vertical vibration height of the sieve. With vibratory sieving, the sample is subjected to a 3-dimensional movement, i.e. a circular motion superimposes the vertical throwing motion. As a result the sample is spread uniformly across the whole sieve area and the particles get a new orientation, passing the sieve apertures when falling back on the mesh. RETSCH "control" sieve shakers feature digital setting of amplitude and sieving time. During the sieving process, an integrated control unit performs a continuous comparison between the set and actual amplitude values thus ensuring reproducible sieving processes according to standards like DIN EN ISO 9000ff (see page 119 for wet sieving).

Principle of vibratory sieving

Horizontal sieving

In a horizontal sieve shaker the sieves move in horizontal circles in a plane. Horizontal sieve shakers are preferably used for needle-shaped, flat, long or fibrous samples. Due to the planar sieving motion, most particles maintain their orientation on the sieve.

Principle of horizontal sieving

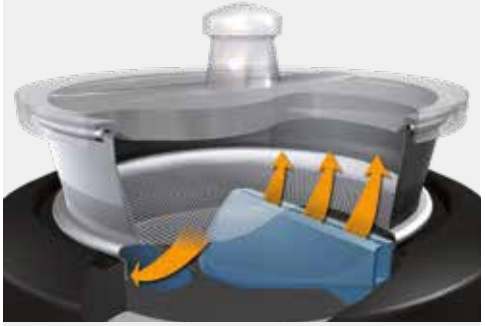
Tap sieving

In a tap sieve shaker a horizontal, circular movement is superimposed by a vertical tapping motion. Tap sieve shakers are specified in various standards for particle size analysis. The number of comparisons between particles and sieve apertures is substantially lower with tap sieving than with vibratory sieving (2.5 s^{-1} as compared to ~50 s^{-1}) which results in longer sieving times. On the other hand, the tapping motion gives the particles a greater impulse which leads to a better separation efficiency for some materials. With low density materials, however, the fraction of fines obtained with tap sieving is lower.

Principle of tap sieving

Air jet sieving

The air jet sieve is used for single sieving, i.e. only one sieve is required for each sieving process (sieve cut). The sieve itself is not moved during the process. The material on the sieve is dispersed by a rotating jet of air: A vacuum cleaner connected to the sieving machine generates a vacuum inside the sieving chamber and sucks in fresh air through a rotating slit nozzle. When passing the narrow slit of the nozzle the air stream is accelerated and blown against the sieve mesh, dispersing the particles. Above the mesh, the air jet is distributed over the complete sieve. When the particles hit the sieve lid the air jet is redirected and agglomerates are dissolved. Thus the finer particles are transported through the mesh openings into the vacuum cleaner or, optionally, into a cyclone. When carrying out a sieve cut with air jet sieving the obtained undersize is determined by weighing the sample before and after sieving. If a size distribution curve is required, this procedure is continued with increasing mesh sizes. The oversize on the finer sieve is put on the sieve next in size and is sieved again.



Principle of air jet sieving

Sieve Analysis Procedures

To obtain reproducible sieving results, it is essential that all steps of the sieving process are carried out with precise and reliable instruments (sieve shaker, balances). The evaluation software EasySieve® greatly reduces the time needed for recording and evaluating the data and also helps to minimize data transfer errors.

Sieve analysis comprises the following steps:

- Sampling
- Sample division (if required)
- Selection of suitable test sieves
- The actual sieving process
- Recovery of sample material
- Data evaluation
- Cleaning and drying of test sieves

Sampling / Sample Division

The importance of sampling is demonstrated in figure 2: Even if the analysis is carried out correctly, random sampling (e.g. with a scoop) leads to varying results which are not reproducible although the samples come from the same initial material. In the selected example the difference between the fractions of 1 mm and 2 mm is almost 20%.

Therefore, it is essential that sampling is carried out with utmost care. A basic requirement for reproducible sieve analysis is the extraction of a representative part sample from the bulk. Representative means that the properties of the part sample, in this case the particle size distribution, have to be identical with those of the bulk.

Sampling of large volumes of bulk materials, such as ship or train loads, may be difficult. To obtain a representative part sample, it is necessary to take samples from various locations and mix them together. Professional sample dividers with a marginal standard deviation should be used for this process (fig. 3).

A laboratory sample is often bigger than the amount of material a sieve shaker can process. The maximum batch size depends on various factors such as number and aperture size of the sieves, maximum particle size and width of distribution of the sample. The standard DIN 66165 provides more details, e.g. the maximum amount of oversize material which should remain on a square decimeter of the sieve bottom.

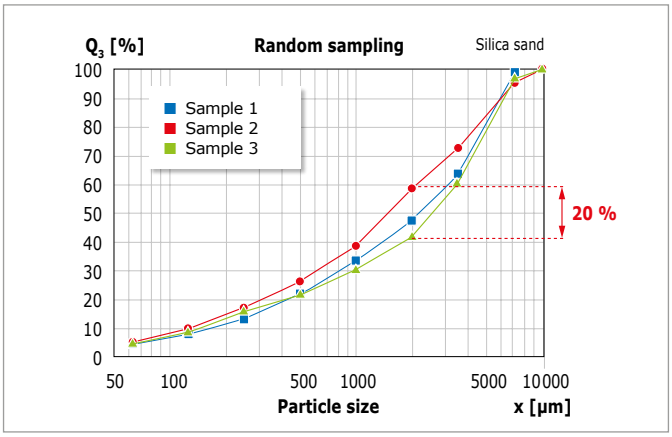


Fig. 2: Random sampling with a scoop: Three correct sieve analyses provide three different results

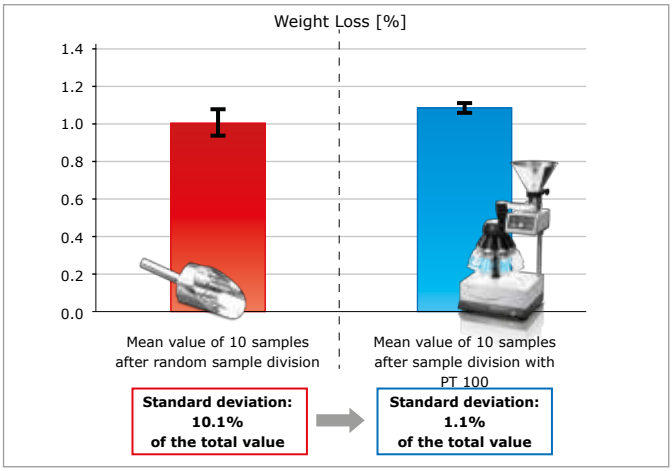


Fig. 3: The standard deviation, for example in a plastic sample analyzed for its moisture content, can be drastically reduced by using a sample divider.

Selection of the Sieves

The selection of the sieves depends on the sample quantity but also on the particle size distribution. The mesh sizes of the sieve stack should cover the complete size range of the sample in regular intervals. The wider the size range of the sample, the more sieves should be used. Relevant standards can help to determine the suitable mesh sizes.

Correct loading of the sieves ensures reproducible results!

Calculation of sieve load

The oversize on a sieve with a mesh size of 1 mm, for example, should not be more than 20 cm^3 per square decimeter. For a 200 mm sieve that equals 63 cm^3 oversize, for a 400 mm sieve it is 252 cm^3. The maximum batch should not exceed twice the amount of the oversize value, i.e. a 200 mm sieve with mesh size 1 mm should not be filled with more than 126 cm^3 sample material. By multiplying these values with the bulk density, the corresponding masses can be obtained.

mesh size	max. batch	max. permitted sieve oversize
25 µm	14 cm^3	7 cm^3
45 µm	20 cm^3	10 cm^3
63 µm	26 cm^3	13 cm^3
125 µm	38 cm^3	19 cm^3
250 µm	58 cm^3	29 cm^3
500 µm	88 cm^3	44 cm^3
1 mm	126 cm^3	63 cm^3
2 mm	220 cm^3	110 cm^3
4 mm	346 cm^3	173 cm^3
8 mm	566 cm^3	283 cm^3

Examples for the maximum batch and permitted sieve oversize for 200 mm sieves (according to DIN 66165)

IMPORTANT: For a sieve analysis at least one complete part sample, obtained by sample division, is needed.

Sieve Analysis Step by Step

- Select sieves and sieve pan
- Ascertain the empty weights of sieves and sieve pan*
- Stack sieves with increasing mesh size on the sieve pan
- Weigh the sample and place it on upper sieve (largest mesh size), observing the maximum load*
- Place sieve stack with sample on sieve shaker and clamp it
- Set amplitude and sieving time*
- Start the sieve analysis*
- When the sieving time is over weigh each sieve and pan with the corresponding sample fraction*
- Determine the mass and percentage of each fraction*
- Evaluation*

*The evaluation software EasySieve® automatically records the weights and allows for a quick and simple evaluation of the sieve analysis. All RETSCH sieve shakers of the "control" series can be controlled with EasySieve®.

Stacking of sieves (example)
The mesh sizes decrease from top to bottom.

Sample Recovery

When the sieve analysis is finished the sample is collected from the sieves. The fact that sieving provides single size fractions is a strong advantage over optical measurement systems. The fractions are not only analysis values but physically exist.

Data Evaluation

After mass and percentages of the single size fractions have been ascertained by weighing, the data is evaluated. This can be done manually or with the help of quick and reliable software such as RETSCH's EasySieve®.

Exemplary sieve analysis results

sieve [µm]	net weight [g]	weight after sieving [g]	difference [g]	percentage p_3 [%]	cumulative distribution Q_3 [%]
Pan	501	505.5	4.5	3	3
45	253	259	6	4	7
63	268	283	15	10	17
125	298	328	30	20	37
250	325	373	48	32	69
500	362	384.5	22.5	15	84
1,000	386	401	15	10	94
2,000	406	412	6	4	98
4,000	425	428	3	2	100
			= 150 g	= 100 %	

Sieve cut

In some cases it may be sufficient to determine the percentage of oversize and undersize of a sample. This single sieving usually only serves as an orientation, e.g. to evaluate the results of a size reduction process. To obtain a sieve cut, a sieve with a defined mesh size and a collecting pan are subjected to the sieving motion; apart from that the whole process is comparable to sieving with a set of sieves. The sieve cut is also used for air jet sieving.

The difference between original sample weight and the cumulated single fractions is called sieving loss. According to DIN 66165 the sieving process must be repeated if the loss is greater than 1 %.

The percentage mass fractions are graphically displayed as histograms (fig. 4). The example shows the greatest fraction (p_3) with 32 % in the size range between 250 and 500 microns. By adding up the individual fractions and interpolation between the points of measurement the cumulative distribution curve Q_3 is obtained (fig. 5).

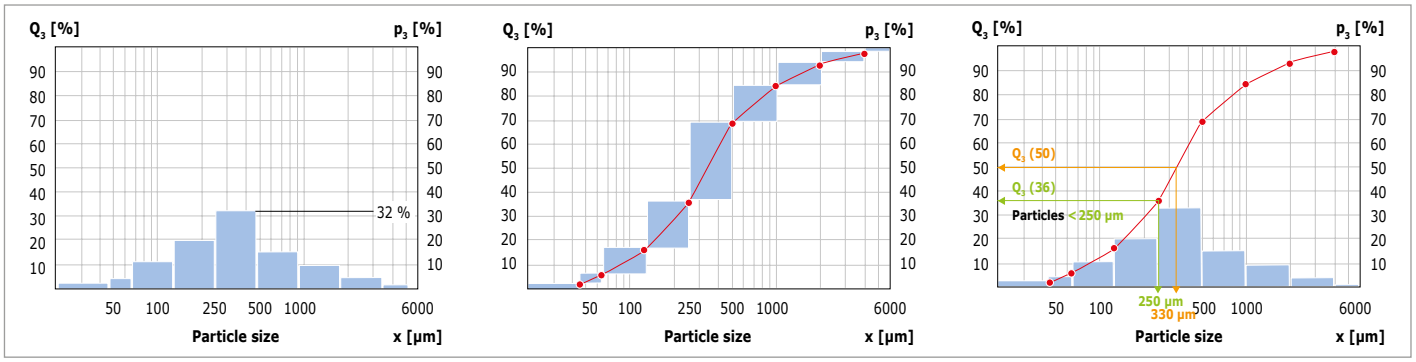


Fig. 4: Histogram of the single fractions

Fig. 5: Histogram with cumulative distribution curve

Fig. 6: Cumulative distribution curve with exemplary percentages

The cumulative curve in figure 6 can be interpreted as follows: The corresponding value of the particle size 250 µm on the y-axis is 36 %. This means that 36 % of the sample is smaller than 250 µm. To determine the median $Q_3(50)$ of the distribution, the corresponding particle size (330 µm) can be read off the x-axis, which means 50 % of the sample are smaller than or equal 330 µm. The same method is applied to determine the results for different $x(Q_3)$ and $Q_3(x)$ values of the sample.

IMPORTANT: Sieving focuses on the equivalent diameter of a particle. If the particles are not spherical but, for example, longish they can pass vertically through the sieve apertures if they hit the mesh with the appropriate orientation. Thus it is possible that a fraction of particle sizes between 250 µm and 500 µm also contains particles which are longer than 500 µm. For such cases horizontal sieving is the preferred method.

Cleaning of Test Sieves

Test sieves are measuring instruments which should be treated with care before, during and after sieving.

- By no means should the sample be forced through the sieve mesh during the sieving process. Even a light brushing of the material – particularly through very fine fabric – may lead to changes of the mesh and damage the sieve wire gauze.
- When the sieving is done, near-mesh particles trapped in the sieve mesh are easily removed by turning the sieve up-side down and tapping it lightly on a table.
- Coarser fabrics with mesh sizes > 500 microns can be effectively cleaned dry or wet with a hand brush with plastic bristles. Possible damage of the wire gauze by these tools is highly unlikely.
- Sieves with a mesh size below 500 microns should generally be cleaned in an ultrasonic bath. The high intensity of ultrasound helps to remove near-mesh particles from the fine fabrics.
- Water together with a standard surfactant is recommended as cleaning agent. Cleaning in an ultrasonic bath usually takes about 2 – 3 minutes. After that the sieves have to be thoroughly rinsed with water and dried.
- It is generally not recommended to use strong lye or acid. Only in exceptional cases is it acceptable to use 5% acetic acid or sodium carbonate solution to remove finest particles from the sieve mesh. After such cleaning the sieves should be rinsed extra carefully with water to remove all possible residues which could cause corrosion.

Drying of Test Sieves

Drying cabinets of various sizes can be used for drying test sieves. It is recommended not to exceed a temperature of 80 °C. With higher temperatures especially the fine metal wire mesh could become warped; as a result, the tension of the fabric inside the sieve frame is reduced which makes the sieve less efficient.

RETSCH's Fluid Bed Dryer TG 200 is particularly effective in drying test sieves with a diameter of 200/203 mm. The wet sieves are stacked together. A preheated variable air flow blows through the stack and accelerates the drying process. After only 3 – 5 minutes the sieves are dry and can be used again. Before cleaning or drying the sieves, the rubber or plastic seal rings have to be removed.

The correct handling, cleaning, drying and storing of the test sieves ensures their long service life and accuracy.

Ultrasonic Bath UR 3

Rapid Dryer TG 200

Optimizing Sieving Time and Amplitude/Speed

The ideal parameters for sieving time and amplitude/speed depend on the material to be sieved. They have a crucial influence on the sieving result.

Usually, national and international standards as well as internal regulations provide plenty of product-specific information about sieve analyses and the corresponding parameters. If such basic information cannot be obtained, the optimum sieving time and amplitude have to be determined experimentally.

Figure 7 shows the influence of the amplitude on the sieving result. Three trials were carried out: silica sand was sieved for 5 minutes with amplitudes of 0.5 mm, 1.2 mm and 2 mm. The highest sieve undersize is achieved with a 1.2 mm amplitude (more than 30 % of the total sample is contained in the finest fraction <35 µm). There is a simple explanation for this result: if the amplitude is too low, the particles don't lift off high enough from the sieve which means they cannot orientate freely or move freely over the sieve area. If the amplitude is too high, the particles are thrown too high upwards and thus have less opportunity to compare themselves with the apertures of the sieve.

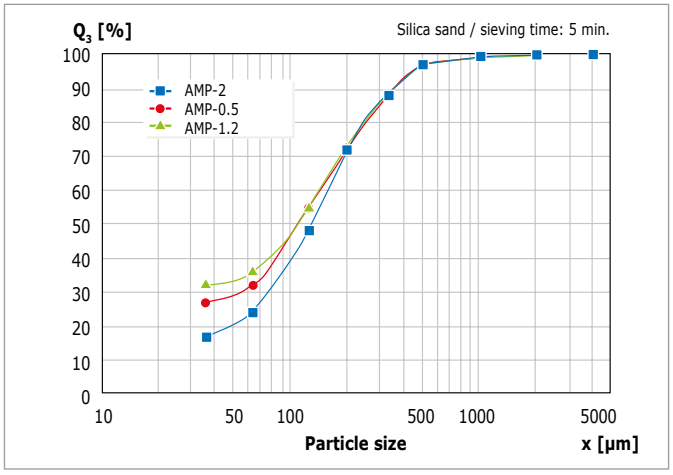


Fig. 7: The influence of different amplitudes on the sieving result

The effect of optimum amplitude is a state called statistical resonance (see fig. 8). The probability of a particle passing the mesh is at its maximum when the throw time corresponds to a period in the sieve vibration. In such a case the sieving material will be moved with a different orientation to a different sieve aperture with every single vibration, resulting in high separation efficiency and short sieving times.

The best results for sieves with a diameter of 200 mm/203 mm are usually achieved with amplitudes between 1.2 and 1.3 mm.

The optimal sieving time according to DIN 66165 is achieved if, after one minute of sieving, less than 0.1 % of the feed quantity passes the sieve. If the undersize is larger, the sieving time should be prolonged.

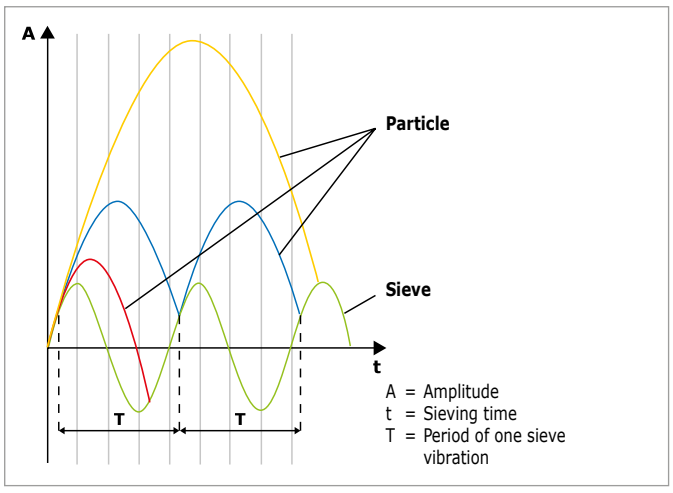


Fig. 8: Movement of particles in relation to sieve bottom;
blue graph: particle is in statistical resonance with sieve bottom;
red graph: particle falls down too quickly;
yellow graph: particle was thrown up too high.

Sieving Aids to Support the Sieving Process

RETSCH offers chain rings, agate, steatite and rubber balls, brushes, polyurethane cubes.

Reciprocal effects between particles have a decisive influence on the „sieveability" of the fines. Examples for these are intermolecular Van der Waals forces (dipole-dipole interaction), fluid bridges in samples with residual moisture or frictional effects caused by electrostatic charge (fig. 9). Adhesive forces cause agglomeration of the particles.

Agglomerates falsify the particle size distribution because instead of individual particles, collectives of particle are measured with the result that the percentage of coarse particles is too high. Sieving aids help to prevent the formation of agglomerates or to break them.

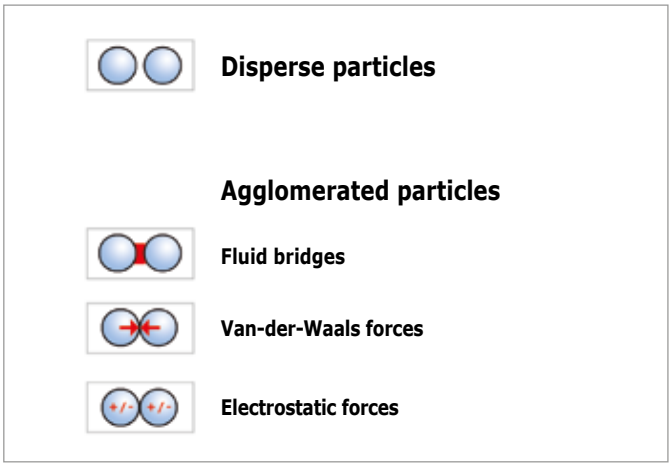


Fig. 9: Adhesive forces among particles which may affect the sieving result

There are three groups of sieving aids:

(a) Mechanical sieving aids (e.g. rubber cubes, brushes, agate, rubber or steatite balls, chain rings): They destroy agglomerates and dislodge wedged particles from the sieve mesh.

(b) Solid additives (e.g. talcum, Aerosil®) are mainly used for fatty, moist, sticky and oily products: They are mixed with the sample, attach themselves to the particle surface and bind the unwanted components. Their particle size is so small that their influence on the actual particle size analysis is marginal. It should be taken into account that the addition of solid matter to the sample will change its mass.

(c) Liquid additives (e.g. anti-static spray, benzine, alcohol, surfactant): They either reduce electrostatic charges, wash out fatty or oily components or reduce the surface tension in wet sieving processes.

Wet Sieving

Usually, sieving processes are carried out with dry material. However, in some cases wet sieving is the only option, for example if the sample is a suspension and must not be dried or if very fine, possibly agglomerated powders below 45 µm needs to be characterized. Dry sieving is not recommendable in these cases as the sieve apertures may be clogged by the sample material.

The sieve stack is placed on the sieve shaker and the suspension is poured on the upper sieve. In addition to the vibrational movement the sieving process is supported by water from the spray nozzle located above the top sieve. Rinsing is carried out until the liquid leaving the pan outlet is no longer clouded with solid particles. The fines fraction can be retrieved by filtration. During wet sieving air cushions may form between the sieves, particularly with mesh sizes below 100 microns. This effect can be avoided by using RETSCH's venting rings which are placed between the sieves of the stack. These rings let the air cushions expand without loss of liquid or sample.

IMPORTANT: The water must not change the sample material, i.e. the particles should not swell, dissolve or react with the liquid.

Wet sieving is basically carried out like dry sieving; however, a few points need to be observed:

- The material to be sieved is mixed with water until it becomes a suspension. To reduce the surface tension and facilitate passage of the material, a few drops of surfactant may be added.
- Moisten each sieve with water and place on top of the collecting pan with outlet (with increasing mesh size).
- Place venting rings between the sieves to permit the expansion of air cushions (for sieves < 100 µm).
- If the smallest fraction that leaves the sieve stack shall be weighed, too, it has to be collected, e.g. by filtration.
- Recommended parameters:
  - amplitude of 1 – 1.2 mm in interval mode
  - time setting: 5 min (in most cases 2-3 min is sufficient for a sieving process).
- Flow rate: approx. 500 – 800 ml/min (for sieves with 200 mm/203 mm Ø)

1 Prepare the suspension
2 Pour sample on top sieve
3 Clamp the sieve lid with spray nozzle
4 Wet sieving process (rinsing + vibration)
5 Outlet and collection of liquid
6 Rinse the sieves

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