

## MESH and MICRON SIZES

**What is a micron?** Micron is the measure of length most frequently used to describe tiny particle sizes. The term micron is actually a commonly used shorthand for micrometer (American spelling) or micrometre (international spelling). The official symbol for the micron or micrometer is  $\mu\text{m}$ , sometimes simplified as  $\text{um}$ . A micron is defined as one-millionth of a meter, a little more than one twenty-five thousandth of an inch.

**Note: ISM offers fluid, gas and air flow management components some of which contain filter mesh as a component part. ISM does offer mesh itself and is unable to source or provide it.**

**What does mesh size mean?** Mesh size usually is referring to the mesh number (a US measurement standard) and its relationship to the size of the openings in the mesh and thus the size of particles that can pass through these openings. Figuring out the mesh number is simple. All you do is count the number of openings in one linear inch of screen. This count is the mesh number. A 4-mesh screen means there are four little square openings across one inch of screen. A 100-mesh screen has 100 openings per inch, and so on.

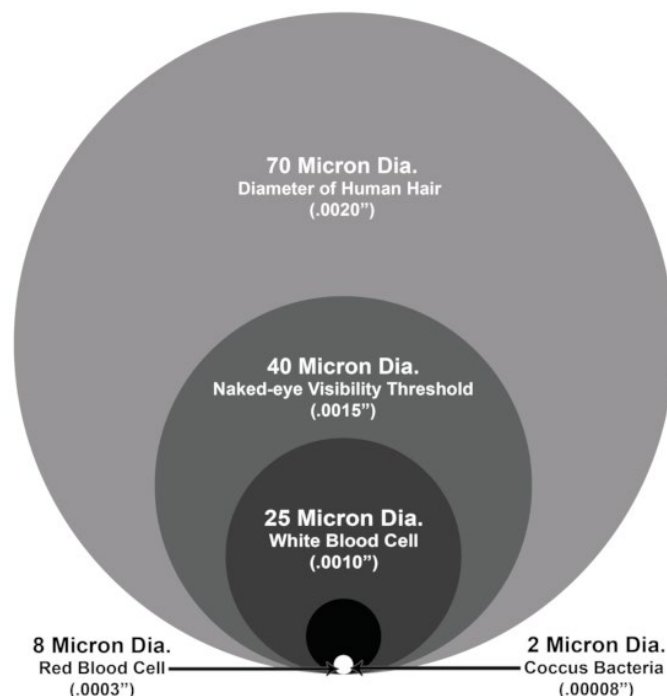
As the number indicating the mesh size increases, the size of the openings and thus the size of particles captured by the screen decreases. Higher mesh numbers = smaller particle sizes. It is very important to remember that mesh size is not a precise measurement of the mesh opening size. This is because screens can be made with different materials with different thicknesses of strands or wire. The thicker the strands, the smaller the openings that a particle can pass through, and vice versa.

Also keep in mind that mesh is a two-dimensional sheet and the actual 3D shapes of particles vary dramatically. A good example of this is the diameter of a hair versus its length. Particles can also be elastic amalgams or clumps of mixed materials that can deform and squeeze through mesh openings.

**How fine do screens get?** This depends on the thickness of the wire or strand used to make the mesh. Most ISM flow control components do not contain filter screens any finer than 500 mesh. The primary reason for this is that as the mesh number rises, the space between the wires or strands becomes smaller. At some point the mesh number becomes so high that the percentage of open area is too low to be useful. This point is usually somewhere between 450 and 700 mesh depending on the diameter of the wire or filament used. *Note: Beyond 325 to 400 mesh, particle size is normally described only in microns.*

US Mesh*	Microns	Inches	Millimeters
35	500	0.0197	0.5000
40	400	0.0165	0.4000
45	354	0.0138	0.3540
50	297	0.0117	0.2970
60	250	0.0098	0.2500
70	210	0.0083	0.2100
80	177	0.0070	0.1770
100	149	0.0059	0.1490
120	125	0.0049	0.1250
140	105	0.0041	0.1050
170	88	0.0035	0.0880
200	74	0.0029	0.0740
230	63	0.0025	0.0630
270	53	0.0021	0.0530
325	44	0.0017	0.0440
400	37	0.0015	0.0370
450	32	0.0013	0.0320
500	25	0.0010	0.0250
635	20	0.0008	0.0200

\*Values are based on the American National Standard for Industrial Wire Cloth (American Standard ASTM - E 11).



**Some micron size comparisons**



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# PARTICLE SIZES in MIRONs of COMMON MATERIALS

bacteria	0.3 to 60
beach sand	100 to 2000
cayenne pepper (ground)	15 to 1000
cement dust	3 to 100
cinnamon (ground)	70 to 200
clay	0.1 to 2
coal dust	1 to 100
coffee (ground)	5 to 400
concrete dust	3 to 100
copier toner	0.5 to 15
corn starch	0.1 to 0.8
dust (atmospheric)	0.001 to 40
dust (household)	0.05 to 100
dust mites	100 to 300
eye of a needle	1230
flour (wheat - milled)	25 to 212
gelatin powder	5 to 90
giardia cysts	8 to 14
ginger (ground)	25 to 40
human hair	70 (40 to 120)
human vision (lower limit)	40
mustard (ground)	6 to 10
oil smoke	0.03 to 1
pet dander	0.5 to 100
pollens	2 to 200
red blood cells	6 to 8
salt (table salt)	100 to 300
sand (beach)	62.5 to 2,000
sand (fine)	125 to 250
silt	2 to 50
skin flakes	0.5 to 10
smoke (oil)	0.03 to 1
smoke (wood)	0.2 to 3
spider web	2 to 3
spores (mold)	3 to 12
spores (plant)	3 to 100
spray dried milk powder	30 to 80
sugar (granulated)	250 to 500
sugar (icing)	20 to 24
sugar (powdered)	60
talcum powder (ground talc)	0.5 to 50
tea dust	8 to 300
tobacco smoke	0.01 to 4
viruses	0.005 to 0.3
white blood cells	6 to 20
yeast cells	1 to 50



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# US STANDARD and TYLER MESH

Approximate Equivalent Mesh Count	US Sieve Mesh Number <sup>1</sup>	Tyler Equivalent Mesh <sup>2</sup>	Typical Nominal Wire Diameter <sup>4</sup>		Typical Nominal Sieve Size Opening <sup>4</sup>	
			mm	inch	mm	inch
2	-	2½ Mesh	5.600	0.2205	8.0000	0.3150
3	-	3 Mesh	1.870	0.0736	6.7000	0.2638
3	No. 3½	3½ Mesh	1.6000	0.0630	5.6000	0.2205
4	No. 4	4 Mesh	1.6000	0.0630	4.7500	0.1870
5	No. 5	5 Mesh	1.4000	0.0551	4.0000	0.1575
6	No. 6	6 Mesh	1.2500	0.0492	3.3500	0.1319
7	No. 7	7 Mesh	1.1200	0.0441	2.8000	0.1102
8	No. 8	8 Mesh	1.0000	0.0394	2.3600	0.0929
10	No. 10	9 Mesh	0.9000	0.0354	2.0000	0.0787
12	No. 12	10 Mesh	0.8000	0.0315	1.7000	0.0669
14	No. 14	12 Mesh	0.7100	0.0280	1.4000	0.0551
16	No. 16	14 Mesh	0.6300	0.0248	1.1800	0.0465
18	No. 18	16 Mesh	0.5600	0.0220	1.0400	0.0409
20	No. 20	20 Mesh	0.5000	0.0197	0.8500	0.0335
24	No. 25	24 Mesh	0.4500	0.0177	0.7100	0.0280
28	No. 30	28 Mesh	0.4000	0.0157	0.6000	0.0236
32	No. 35	32 Mesh	0.3150	0.0124	0.5000	0.0197
35	No. 40	35 Mesh	0.2800	0.0110	0.4250	0.0167
42	No. 45	42 Mesh	0.2240	0.0088	0.3550	0.0140
48	No. 50	48 Mesh	0.2000	0.0079	0.3000	0.0118
60	No. 60	60 Mesh	0.1600	0.0063	0.2500	0.0098
65	No. 70	65 Mesh	0.1400	0.0055	0.2120	0.0083
80	No. 80	80 Mesh	0.1250	0.0049	0.1800	0.0071
100	No. 100	100 Mesh	0.1000	0.0039	0.1500	0.0059
115	No. 120	115 Mesh	0.0900	0.0035	0.1250	0.0049
150	No. 140	150 Mesh	0.0710	0.0028	0.1060	0.0042
170	No. 170	170 Mesh	0.0630	0.0025	0.0900	0.0035
200	No. 200	200 Mesh	0.0500	0.0020	0.0750	0.0030
250	No. 230	250 Mesh	0.0450	0.0018	0.0630	0.0025
270	No. 270	270 Mesh	0.0360	0.0014	0.0530	0.0021
325	No. 325	325 Mesh	0.0320	0.0013	0.0450	0.0018
400	No. 400	400 Mesh	0.0300	0.0012	0.0380	0.0015
435 <sup>3</sup>	No. 450	-	0.0280	0.0011	0.0305	0.0012
500 <sup>3</sup>	No. 500 <sup>5</sup>	-	0.0250	0.0010	0.0254	0.0010
632 <sup>3</sup>	No. 635 <sup>5</sup>	-	0.0200	0.0008	0.0203	0.0008

1. US sieve numbers differ from Tyler Mesh in that they are arbitrary numbers.
2. Tyler Equivalent Mesh or Tyler Mesh Size is the number of openings per linear inch of mesh.
3. These mesh numbers are calculated approximations.
4. Values are based on ASTM E11-17, ISO 565-1990 and ISO 3310-1:2016 sieve specifications.

[ASTM E11-17](#)

[ISO 565-1990](#)

[ISO 3310-1:2016](#)

5. These sieves are not standard series sieves but are in common use.



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## MESH and MICRONS FAQs

### ***How do you convert mesh opening size to microns?***

It is possible to calculate an approximate mesh opening size for plane weave mesh with square openings. Both the wire or strand diameter and the distance between the centers of two adjoining strands must be known to do this. Filter mesh manufacturers provide the mesh opening size or the mesh's percent of open area or both. If a mesh opening size is provided in inches, it can be easily converted to microns. One micron is one-millionth of a meter and 1 inch = 25.4 millimeters.

### ***What is mesh number?***

Mesh number indicates the number of filaments or wires per linear inch of fabric or wire filter cloth. As mesh number increases, the size of the mesh openings decreases. Mesh number is not a precise measurement of particle size because of variations in the size of the wire or strands used in the screen. The mesh scales used to classify particle sizes in the US are: US Sieve Series and Tyler Mesh Size.

### ***What is US Standard Mesh?***

US Standard Mesh, also called US Standard Sieve is a series of screen sieves generally used to classify granular material by particle size. US Standard Mesh numbers are also more broadly used to describe the size of screen, strainer and filter mesh woven from monofilament or metal wires. US Standard Sieve uses arbitrarily assigned numbering and is based on ASTM E11-17.

### ***What is Tyler Mesh?***

Tyler Equivalent, also called Tyler Mesh or Tyler Standard Sieve Series is the other commonly used series of screen sieves generally used to classify granular material by particle size in the US. Tyler Mesh numbers represent the actual number of openings per linear inch of mesh. Tyler mesh was created by the W. S. Tyler screening company in 1910. This series of standard screen sizes was adopted as a national standard by the United States and many other countries.

### ***What is mesh sieve?***

Sieves and screens are usually used in material handling for characterizing larger particle sized materials, usually greater than 44-micron (325 Mesh). Two scales are used to classify particle sizes: US Sieve Series and Tyler Mesh Size.

### ***How do you measure mesh size?***

Woven filter mesh and screen technical specifications are usually given as mesh counts, mesh numbers, mesh openings and/or center-to-center distances. Mesh count and mesh number are the number of openings per inch measured starting at the center of one wire. Mesh opening is a measure of the space between the wires. Mesh center-to-center measurements are from the center of one wire to the center of the next adjacent parallel wire.

### ***How large is a micron?***

A micron is a metric unit of measure. A micron is one-thousandth of a millimeter.

### ***How large is a human hair in microns?***

Europeans consider hair with a diameter of 0.04 to 0.06 mm as thin, hair with a diameter between 0.06 and 0.08 mm as normal, and hair with a diameter between 0.08 and 0.1 mm as thick. By comparison with European hair, Asian hair is significantly thicker at 0.08 to 0.12 mm.



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## MESH and MICRONS FAQs

### ***What is the lower size limit of human vision?***

A normal eye with good but average vision can see objects as small as about a tenth of a millimeter.

### ***What is dust made up of?***

Household dust contains small amounts of plant pollen, human and animal hairs, textile fibers, paper fibers, minerals from outdoor soil, human skin cells, plus other materials which are found in the local environment. Atmospheric dust is even more diverse.

### ***How small are smoke particles?***

Smoke is a collection of airborne solid and liquid particulates and gases. The composition of smoke and the sizes of particles vary widely. In general smoke particle size is dependent on what is being burned and the combustion conditions.

### ***What is micron rating of a filter?***

Generally, the micron rating of a filter micron is intended to indicate the ability of a filter to remove particles of that micron size or larger.

### ***What is sieve size?***

Sieve sizes are usually regulated by standards. Sieve standards in common use are ISO 565:1990 and ISO 3310-1:2000 (international), EN 933-1 (European) and ASTM E11:17 (US). EN standards are available with national badging such as BS EN (Britain), FR EN (France), DIN EN (Germany), etc.

### ***What is sieve analysis?***

A sieve analysis (or gradation test) is a practice or procedure used (commonly used in civil engineering) to assess the particle size distribution (also called gradation) of a granular material. The size distribution is often of critical importance to the way the material performs in use.

### ***What is a mesh screen?***

A metal mesh may be woven, knitted, welded, expanded, photo-chemically etched or electroformed (screen filter) from steel or other metals. In clothing, mesh is loosely woven or knitted fabric that has a large number of closely spaced holes.

### ***How is wire mesh measured?***

Woven filter mesh and screen measurements are provided as mesh counts, mesh opening sizes and/or a center-to-center distances. Mesh count is the number of openings per inch measured starting at the center of one wire. Mesh opening size is the space between wires or strands. Mesh center-to-center measurements are from the center of one wire or strand to the center of the next adjacent parallel wire.

### ***What is porosity?***

Porosity refers to the ratio of open space in a filter material to the amount of volume taken up by the filter media itself. Typically, a filter with high porosity will have a more open structure, and therefore, higher flow with lower pressure drops.



# MESH and MICRONS GLOSSARY

## ***What is particle size distribution?***

The particle-size distribution of a powder, granular material or particles dispersed in fluid describes the relative number of particles present according to their size.

## ***Absolute filtration rating***

The absolute rating or cut-off point of a filter material refers to the diameter of the largest spherical glass particle, usually given in micrometers that will pass through the filter under laboratory conditions. It is provided as an indication of the largest opening in the filter material.

## ***Closed weave cloth***

When closed weave filter cloth is viewed at a right angle to its surface, the spaces between the filaments are not visible. Closed weave cloths tend to be thicker and stiffer than open weave cloths.

## ***Feed side***

The side of a filter or filtration processing system is where the material to be filtered enters.

## ***Mesh count***

The mesh count is the number of filaments or wires per linear inch of fabric or wire filter cloth.

## ***Mesh number***

Mesh number indicates the number of filaments or wires per linear inch of fabric or wire filter cloth. Because mesh number frequently refers to mesh standards also, it also may indicate the filament or wire diameter too.

## ***Mesh opening (aperture size)***

The mesh opening is a description of the open area between the wires or filaments in the warp and weft directions of a mesh screen.

## ***Mesh thickness***

Mesh thickness is the thickness of unstretched mesh.

## ***Monofilament***

Monofilament is a single extruded synthetic filament. Monofilament fibers can be manufactured in precise sizes.

## ***Open area***

Open area is the proportion of total screen area that is open space. It is given as a percentage.

## ***Open weave***

Open weave cloths, when viewed at right angles to their surfaces, have visible spaces between the filaments.

## ***Particle size distribution***

The particle-size distribution of a powder, granular material or particles dispersed in fluid describes the relative number of particles present according to their size.





# MESH and MICRONS GLOSSARY

## **Plain weave**

This is the most basic weave. It uses a simple over and under pattern. See also “square weave”.

## **Retentate**

Retentate is the material captured on the upstream side of a filter.

## **Screen (filter screen)**

Screen or filter screen is sheets made of perforated metal, woven monofilament or woven wire strands.

## **Screen filtration**

Screen filtration is the mechanical filtration of particles, using filter screen or mesh, from liquid or gas flows.

## **Separation**

Separation is a filtration process that divides mixtures of particles and liquids or gases into filtered liquid or gas and captured particles.

## **Sieve**

In general, a sieve is a device for separating wanted material from unwanted material using screen. Sieves are widely used in material handling for characterizing the particle size distribution of a sample using standardized uniform screens.

## **Square weave**

This is the most basic weave. It uses a simple over and under pattern. See also “plain weave”.

## **Surface filter media**

Surface filter media captures particles on its upstream surface. Its ratings is usually based on the smallest particle it can repeatedly capture.

## **Upstream side or surface**

This is the feed side of a filter.

## **Warp**

Warp is used to identify the filaments or wires running the length of a cloth or screen as it is woven.

## **Weft**

Weft is used to identify the filaments or wires running across the width of a cloth or screen as it is woven.

## **Wire cloth**

Wire cloth is a woven product. The most common metals used for wire cloth strands include aluminum and aluminum alloys, copper and copper alloys such as brass and bronze, steel and stainless steel. Wire cloth is used for sifting, straining and screening.

