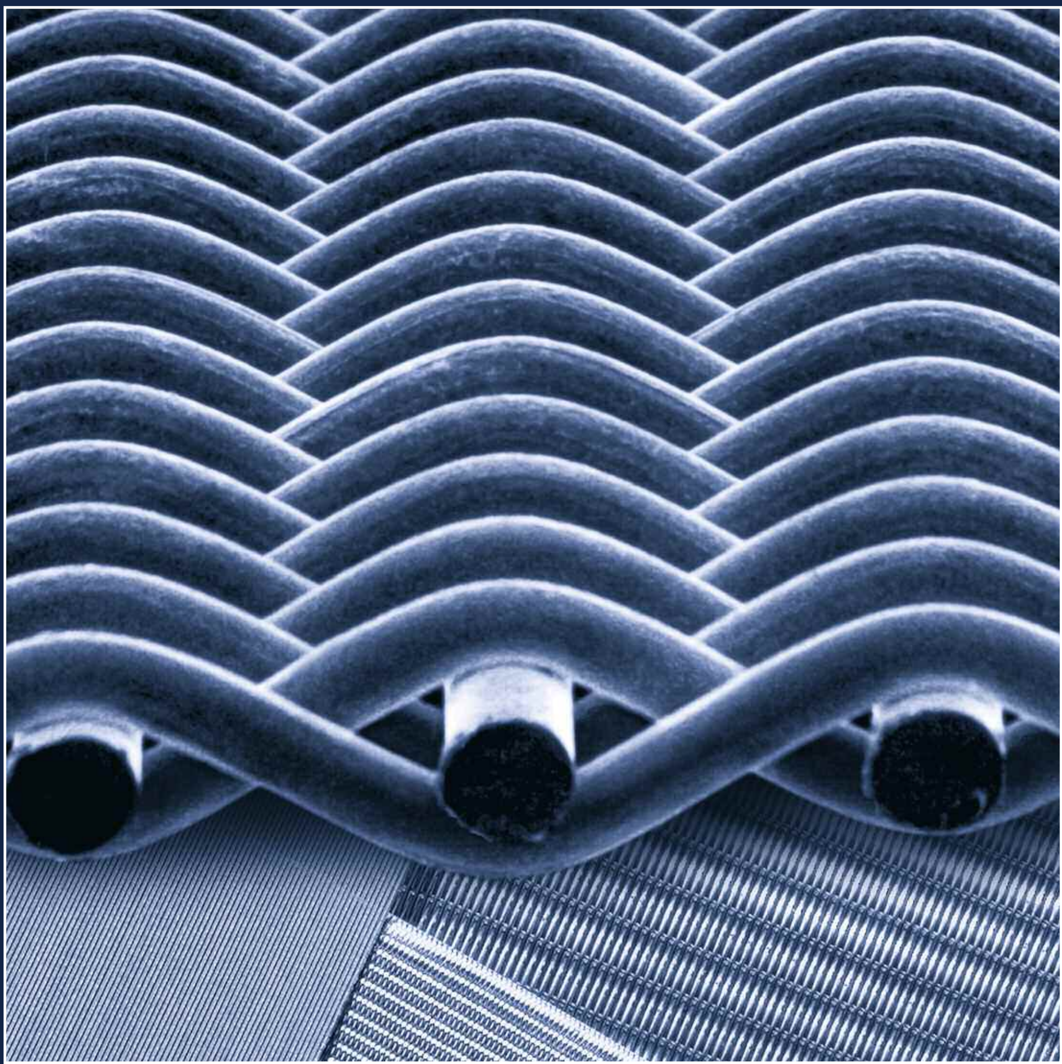
HAVER & BOECKER

DIE DRAHTWEBER



MINIMESH® METAL FILTER WOVEN WIRE CLOTH.
WOVEN WIRE CLOTH - TO THE HIGHEST STANDARDS.

MINIMESH® METAL FILTER WOVEN WIRE CLOTH.

Haver & Boecker has a long tradition in the manufacture of the finest quality stainless steel wire mesh. We have been pioneering mesh development & production techniques for over 125 years, as is proven by our many patents & certifications. Our highly qualified employees continuously develop innovative solutions for the complex demands of our customers all over the world. With our in-house expertise we are always available for comprehensive technical advice at the highest level.

Our quality management system, certified to DIN EN ISO 9001:2008 provides assurance through all stages of production, from the initial wire selection to manufacturing the finished product.

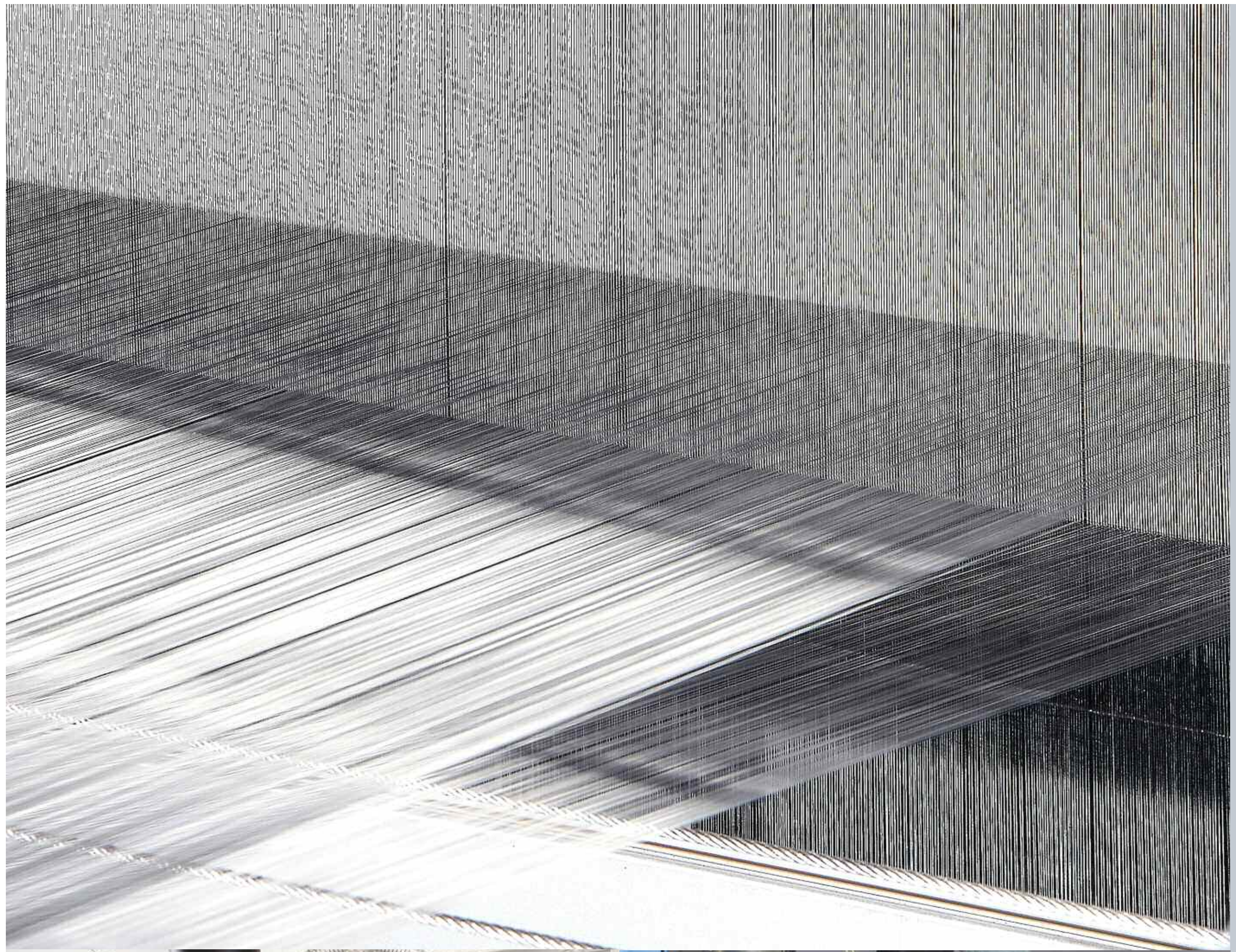
MINIMESH® metal filter cloth.
MINIMESH® metal filter cloth has been used as a filtration media for over 100 years. It is characterised by its trouble-free production, easy maintenance and long lifespan. The geometric filter structure is completely uniform throughout the entire area when compared to fibre-based filter materials made of paper, plastic or metal. Due to the metallic material used, wire mesh filters have high mechanical strength, good temperature resistance, wettability and are extremely resistant to chemical and physical influences. MINIMESH® filter cloth is used for filtration, fluidising, drying, screening and for various thermal, electronic and acoustic applications. It is also suitable for use in all conventional fabrication processes.

The best materials for the best woven mesh.
In addition to so-called "open" weaves with square or rectangular openings as fine as 20 µm aperture, there are also a variety of filter weaves offering a micron retention in the fine micron range. MINIMESH® is predominantly made of stainless steel, for example 1.4301, 1.4306, 1.4401 and 1.4404. Other materials can be used as per customer request, providing they conform to the pre-requisite metallurgical properties for extremely fine wire. You can find more information about special alloys and non-ferrous NE metals in our POROSTAR Filter Elements brochure (P 55) and Materials for Woven Wire Cloth (P 43).

Haver & Boecker began producing wire cloth in Hohenlimburg, Germany, in 1887. Today we are one of the world's leading wire weaving companies with a global network of offices and manufacturing facilities.

Our work is based upon experience, continuous research and development of our products and manufacturing processes, along with the knowledge and ability of our staff. This combination of tradition and innovation allows us to meet and exceed the high expectations of our customers.

WOVEN WITH PERFECTION AND PRECISION.



TERMINOLOGY AND FILTRATION CHARACTERISTIC VALUES:

Filtration

Filtration is the mechanical separation of suspended solid particles of a certain size from a viscous phase. The viscous phase flows through a porous material that is permeable.

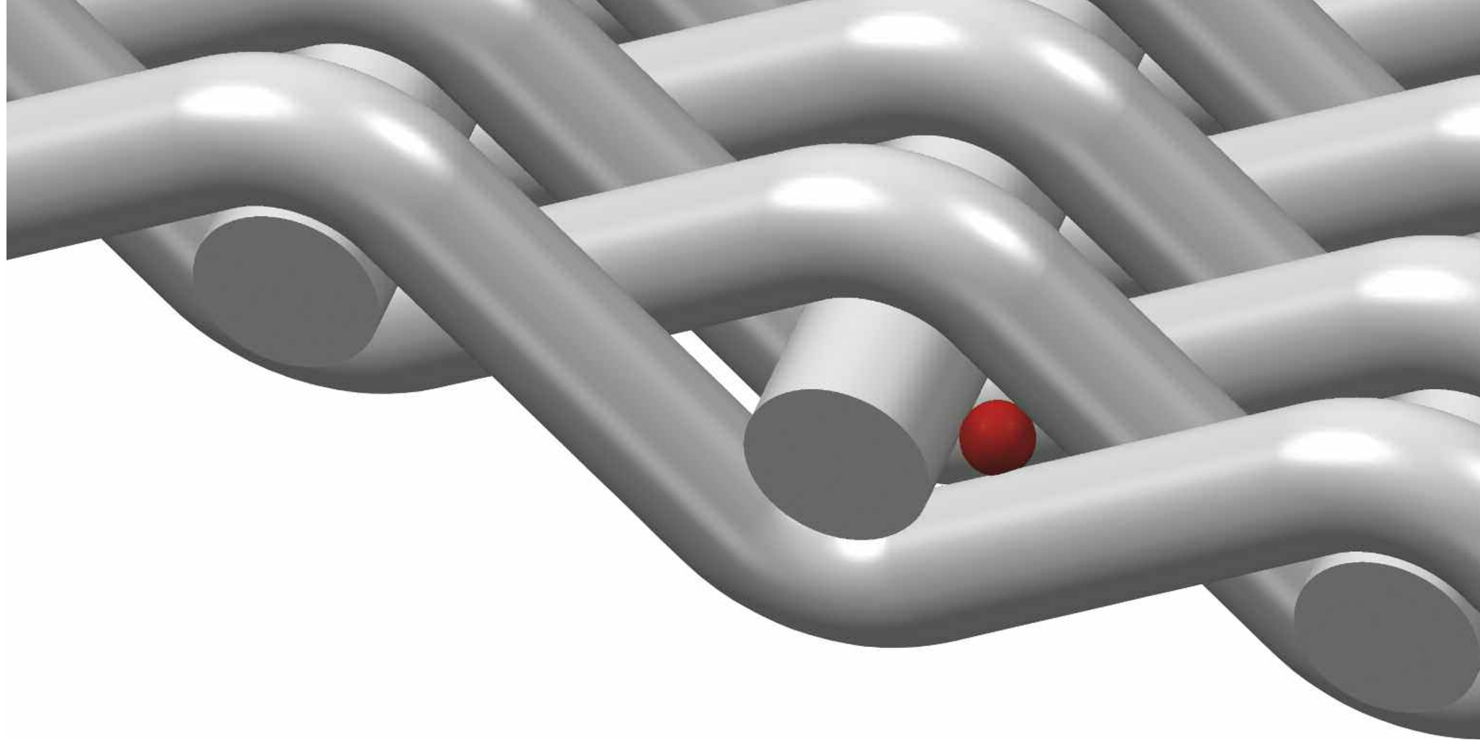
- In surface filtration, primarily particles that are larger than the pore canals are retained on the upper surface of the filter medium. The subsequent particles that deposit on the filter surface form a so-called filter cake.
- For depth filtration, additional separation mechanisms apply in addition to the pore geometry. These effects include blocking effect, sedimentation, inertia and diffusion.
- In cross-flow filtration, the filter medium is placed perpendicular to the flow direction. The particles lodge in the filter surface.

Micron retention

Micron retention defines the diameter of the largest round particle which can pass through the filter medium. The quality of the separation effect is influenced by various factors, for example the particle size and particle shape distribution of the input material, the proportion of solid in the viscous phase, the flow speed, the phase properties, the operating parameters of the filter system and the geometric structure of the filter medium. A clear and comparable specification of a characteristic value is only possible with exact information of the filtration method used.

Pore diameter

Pore diameter describes the equivalent diameter of the pore canal within the filtration medium. The resulting distribution function provides information about the separation effect. A proven process is the capillary pressure method (see also page 6).



Geometric pore size

Compared to other filter media, the specific properties of a woven wire mesh may be precisely described and defined by the weave type, wire diameter and mesh count. This distinct advantage can be used to calculate the geometric pore size without having to use exhaustive measuring methods. The resultant value describes the diameter of a round sphere that is just able to pass through the wire mesh. The mathematical equations based on this process were developed by the University of Stuttgart within the scope of AVIF Projects A224 and A251 and experimentally validated via a glass bead test (see also page 6 “Glass Bead Test“).

Pressure drop

When flow takes place across a filter medium, there is a pressure differential between the input and discharge sides, dependent on the filter geometry, ambient operating conditions and phase properties. With solid flow data, the pressure loss coefficient

(zeta) $$\zeta = \frac{\Delta p}{\frac{\rho}{2} \cdot v^2}$$

with $v = 1 \frac{m}{s}$

$\rho = 1{,}2041 \frac{kg}{m^3}$ *(medium air)*

Δp = *pressure difference Pa*

is given as a characteristic value for assessing permeability (see also page 7: Flowrate measurement).

Porosity

The porosity of a filter medium is the ratio of empty space volume to the total component volume, expressed as a percentage. In contrast with other filter media, for woven wire cloth the entire empty space volume is traversed by the flow.

MEASUREMENT METHODS FOR CHARACTERISING FILTER MEDIA.

Capillary pressure method (Bubble Point Test)

This method is used for determining the maximum pore diameter. Preparation involves mounting the sample in a test rig and subjecting it to a wetting liquid with a defined interfacial tension until all the pores of the filter medium are filled. A pressure is then applied on the non-wet side until the first air bubbles force through the mesh against the test liquid. The maximum capillary pressure, the so-called bubble point, is a measure of the filter medium's equivalent pore diameter.

$$d_{equivalent\ pore} = \frac{4 \cdot \sigma}{\Delta p}$$

with σ *testliquid surface tension*
Δp *capillary pressure difference*

Determining the equivalent pore diameter is done assuming a circular opening oriented in a horizontal plane. By evaluating the weave type, number of apertures per unit length and wire diameter, the maximum pore diameter can be calculated and thus characterises the largest sphere passing through the filter medium.

Flowrate porometry

Flowrate porometry is an extension of the capillary pressure method and is used for determining the distribution of pores. A sample that is completely filled with a test liquid is subjected to an increasing air volume flow, from the first bubble point and beyond, until all pores flow. To determine this characteristic value, Haver & Boecker use a measurement system with an ultra-fine resolution sensor for the test pressure and air throughput.

Pore size distribution: The permeability weighted pore size distribution is calculated from wet-flow (pressure-volumetric flowrate-dependency of the wet sample) and dry-flow (corresponds to a dry sample).

Mean Flow Pore Size: the pressure value where the wet-flow is half of the dry-flow. From this the mean pore size can be calculated.
Norm: ASTM F 316-03, ASTM E 1294, and others.

Glass bead test

The glass bead test is based on the classic screening process. Glass beads with a sphericity of almost 1 and known size distribution are placed on the filter medium and screened. Particle passage is evaluated by the largest particle diameter.

Flow-through measurement

The flow-through test is used for determining the technical flow parameters of filter media. Here Haver & Boecker employ an automatic pressure drop test unit that determines the pressure drop behaviour of filter meshes within laminar air throughput. The test results vary and depend on the permeability of the filter medium and can be used for additional calculations (filter performance when used with other Newtonian media, filter layouts and so on).

Residual contamination analysis

This technical cleanliness test is for measuring particle contamination on the surface of filters and filter components. The particles are removed from the test object using a liquid-based extraction process. The extraction fluid is then filtered by a filter membrane that separates the particles, which are then microscopically counted and classified according to size. Haver & Boecker use an automatic residual contamination analysis system that also differentiates between metallic, non-metallic and fibrous material.
Norm: VDA Volume 19 and ISO 16232.

Tensile tests

Tensile testing determines the mechanical properties of metallic test specimens eg. elastic limit, yield point, ultimate strength and others, by using an axial loading until rupture (breaking point) is reached. Haver & Boecker conduct tests using the most up-to-date computer-controlled universal testing machines.

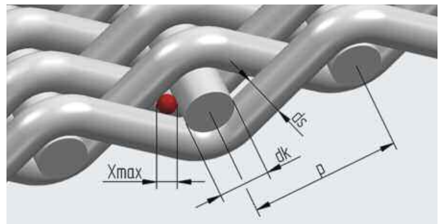
- Weaving wire: for example incoming good inspection, production testing
- Woven wire cloth: for example production testing, end-of-line tests

Norm: DIN EN ISO 6892-1 and others.

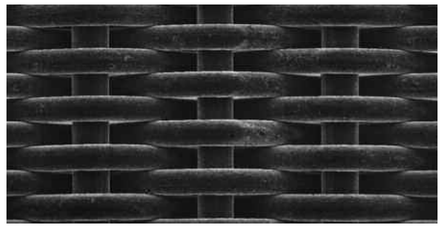
MINIMESH® SPW – SINGLE PLAIN DUTCH WEAVE.

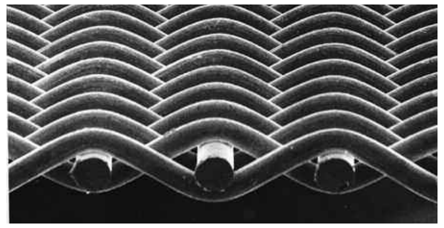
SPW – Single Plain Dutch Weave.

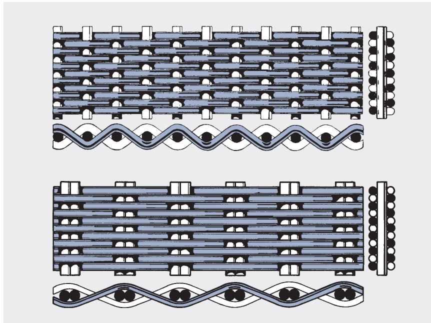
The weft wires are woven in a plain weave without a space between the weft wires (aperture width is 0). There are approximately 5 times more weft wires with respect to the number of warp wires. Hence the strength is higher in the weft direction. The SPW filter weave is used for surface filtration and is characterised by its ease of cleaning and back flushing. The pore size of the most common MINIMESH® SPW filter mesh cloth is within the range of 40 µm and 300 µm. To reduce pore size, single and double warp wires are used.



Because of its robustness and good flow properties, it is suitable for almost every application – whether as a filter for separating solids from a viscous phaze, for minimising sound or other applications that require ease of use.







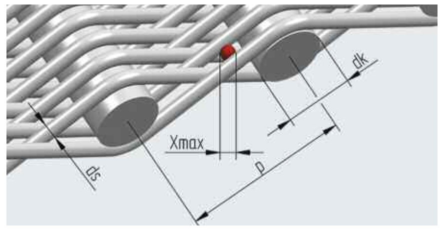
Notes on the SPW table:
- Definition: see pages 4-5, Terminology and Filtration Characteristic Values
- Column 3: largest geometrically determined pore size, tolerance ± 5% (according to AVIF-Project A224, A251)

1	2	3	4	5		6	7	8
Type of weave	MESH	Geometric pore size µm	Pressure drop-coefficiant ζ	Tensile strength warp N/cm	weft N/cm	Porosity theor. %	Weight kg/m²	Cloth thickness mm
SPW 30 S	120 x 620	30	190	145	245	60	0.43	0.14
SPW 40 S	90 x 460	41	145	170	310	61	0.54	0.18
SPW 50 S	72 x 380	50	125	210	375	61	0.67	0.22
SPW 60 S	60 x 300	61	105	265	455	61	0.83	0.27
SPW 70 S	52 x 280	70	95	305	480	61	0.93	0.30
SPW 80 S	45 x 230	81	85	355	600	61	1.11	0.35
SPW 90 S	40 x 200	91	80	405	675	61	1.26	0.40
SPW 100 S	35 x 190	103	70	415	805	62	1.39	0.46
SPW 125 S	29 x 150	126	62	565	905	61	1.74	0.56
SPW 150 S	24 x 120	152	57	690	1120	61	2.13	0.66
SPW 175 S	21 x 110	174	52	770	1265	61	2.44	0.77
SPW 200 S	18 x 90	203	50	945	1495	60	2.89	0.90
SPW 250 S	14 x 70	260	42	1120	1870	61	3.67	1.14
SPW 300 S	12 x 64	302	40	1060	1995	61	4.00	1.30

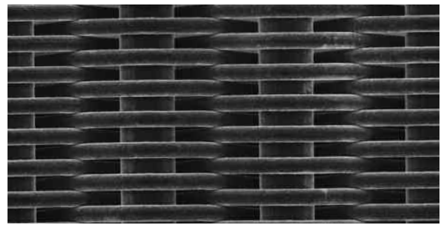
MINIMESH® HIFLO – HIGH PERFORMANCE FILTER WEAVE.

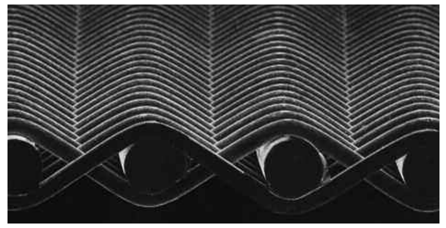
HIFLO – High Flow Filter Weave.

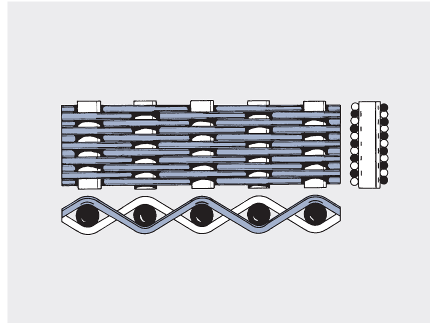
MINIMESH® HIFLO filter weave corresponds to the pore size range of the SPW MINIMESH®. By utilising very fine wires woven in plain weave, a high number of pores per unit area is achieved. This allows a very high throughput rate with small pore sizes. The MINIMESH® HIFLO filter weave is a surface filter, which means the smallest pore is determined by the distance between the weft wires and not by the pores within the three dimensional filter weave. Cleaning, back-flushing and strength are similar to the MINIMESH® SPW filter weave.



As a rule, MINIMESH® HIFLO is used for filtration jobs that require high throughput rates with low filter medium contamination levels.







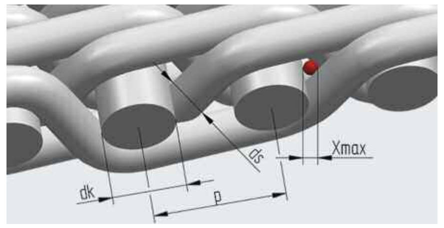
Notes on the HIFLO table:
- Definition: see pages 4-5, Terminology and Filtration Characteristic Values
- Column 3: largest geometrically determined pore size, tolerance ± 5% (according to AVIF-Project A224, A251)

1	2	3	4	5		6	7	8
Type of weave	MESH	Geometric pore size µm	Pressure drop-coefficiant ζ	Tensile strength warp N/cm	weft N/cm	Porosity theor. %	Weight kg/m²	Cloth thickness mm
HIFLO 15 S	230 x 1720	15	320	80	105	63	0.18	0.06
HIFLO 20 S	175 x 1250	20	240	105	155	63	0.24	0.08
HIFLO 25 S	142 x 1020	25	200	125	180	63	0.30	0.10
HIFLO 30 S	117 x 840	30	170	145	210	63	0.36	0.12
HIFLO 35 S	80 x 700	36	120	285	250	63	0.53	0.18
HIFLO 40 S	88 x 640	40	125	185	270	63	0.48	0.16

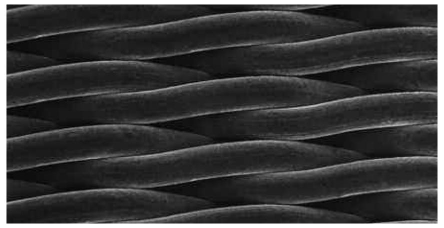
MINIMESH® DTW – DUTCH TWILLED WEAVE.

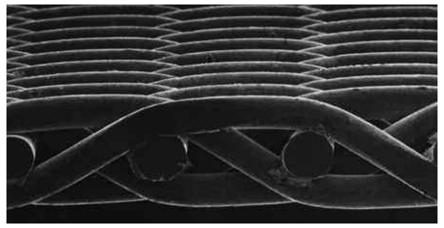
DTW – Dutch Twilled Weave.
Twilled weave

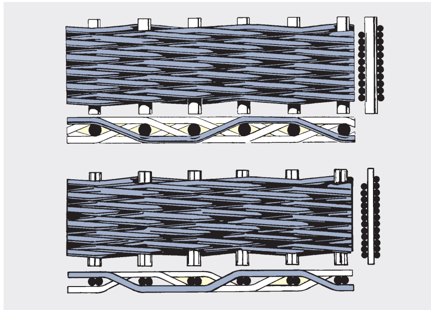
Our MINIMESH® DTW Dutch twilled filter weave has weft wires woven as closely as possible in the classic 2/2 twilled weave. The very thin weft wires allow good flow-through properties with very small pore sizes. The MINIMESH® DTW filter weave is thicker and more stable than the MINIMESH® HIFLO filter weave and is characterised by good workability and very compact pore distribution. MINIMESH® DTW is a surface filter where the filtered material in most cases accumulates as a filter cake on the mesh surface.



MINIMESH® DTW filter weaves reach a precise separation efficiency and are suitable as a distribution medium due to the high wettability.







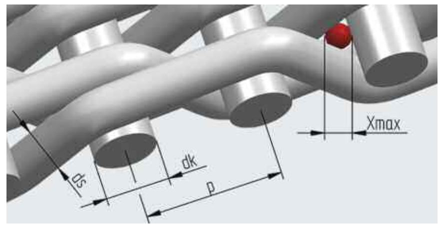
Notes on the DTW table:
- Definition: see pages 4-5, Terminology and Filtration Characteristic Values
- Column 3: largest geometrically determined pore size, tolerance ± 5% (according to AVIF-Project A224, A251)

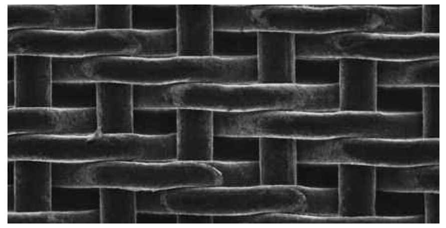
1	2	3	4	5		6	7	8
Type of weave	MESH	Geometric pore size µm	Pressure drop-coefficiant ζ	Tensile strength warp N/cm	weft N/cm	Porosity theor. %	Weight kg/m²	Cloth thickness mm
DTW 7 S	425 x 2800	7	2970	100	245	34	0.33	0.06
DTW 8 S	375 x 2300	8	3800	150	220	33	0.45	0.09
DTW 9 S	240 x 1600	9	4830	300	290	31	0.76	0.14
DTW 10 S	325 x 2300	10	2370	160	225	34	0.45	0.09
DTW 14 S	200 x 1400	14	1500	225	450	34	0.75	0.14
DTW 20 S	165 x 1400	20	800	185	465	40	0.69	0.15
DTW 21 S	165 x 1100	21	1220	190	565	36	0.84	0.17
DTW 45 S	80 x 700	46	330	190	790	46	1.15	0.27
DTW 90 S	40 x 560	88	300	235	1080	48	1.51	0.37
DTW 95 S	35 x 500	94	400	170	1325	47	1.70	0.41
DTW 120 S	30 x 360	121	260	440	1850	45	2.55	0.59

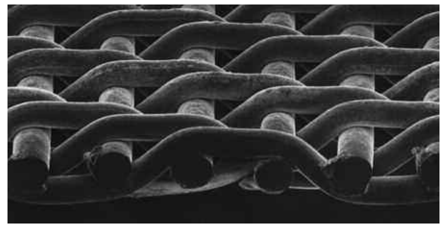
MINIMESH® BMT/BMT-ZZ – BROAD MESH TWILLED DUTCH WEAVE.

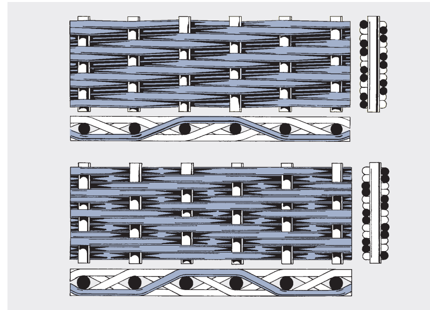
BMT/BMT-ZZ – Broad Mesh Twilled Dutch Weave.

MINIMESH® BMT filter weave is a special type of 2/2 twilled Dutch weave where the weft wires are not close to each other, as is the case with the MINIMESH® DTW, but instead are woven at a defined distance from each other. This allows specific customer requirements for a surface filter to be accurately met. Haver & Boecker recommends the MINIMESH® BMT filter weave in zigzag design, which provides the greatest possible mesh stability. MINIMESH® BMT is characterised by its high throughput and economy.









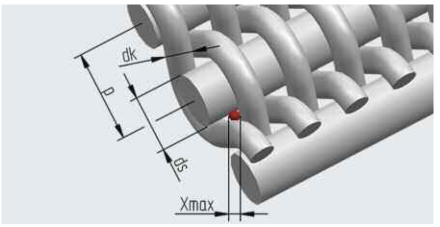
Notes on BMT and BMT ZZ table:
- Definition: see pages 4-5, Terminology and Filtration Characteristic Values
- Column 3: largest geometrically determined pore size, tolerance ± 5% (according to AVIF-Project A224, A251)

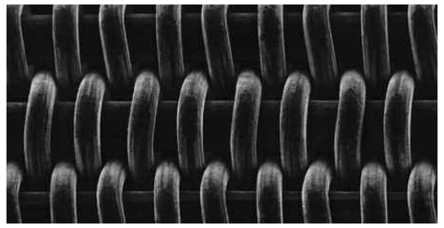
1	2	3	4	5		6	7	8
Type of weave	MESH	Geometric pore size µm	Pressure drop-coefficiant ζ	Tensile strength warp N/cm	weft N/cm	Porosity theor. %	Weight kg/m²	Cloth thickness mm
BMT ZZ 13 S	325 x 1900	13	1210	155	195	41	0.41	0.09
BMT ZZ 14 S	325 x 1600	14	1030	165	280	40	0.43	0.09
BMT ZZ 16 S	260 x 1250	16	1050	170	360	40	0.58	0.12
BMT ZZ 27 S	200 x 900	27	430	200	395	47	0.63	0.15
BMT ZZ 39 S	165 x 800	39	300	190	360	49	0.69	0.17
BMT ZZ 41 S	200 x 600	41	160	185	210	62	0.46	0.15
BMT 45 S	120 x 600	45	170	350	395	51	0.89	0.23
BMT 55 S	120 x 400	55	90	270	320	60	0.72	0.23

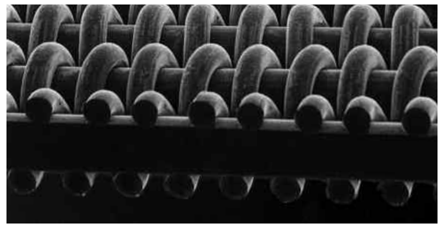
MINIMESH® RPD – REVERSE PLAIN DUTCH WEAVE.

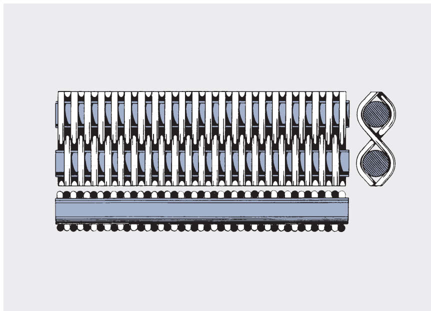
RPD – Reverse Plain Dutch Weave.

Like the MINIMESH® SPW, the MINIMESH® RPD Reverse Plain Dutch Weave is a plain weave filter mesh, but has a reversed wire diameter arrangement. Thin warp wires are positioned close to each other and the thicker weft wire is woven in at a defined distance. The resulting higher strength in the warp direction makes MINIMESH® RPD popular for use as a filter belt. Moreover this versatile reverse plain Dutch weave is used in applications requiring specific acoustic properties, mechanical robustness and high throughput for filtration.









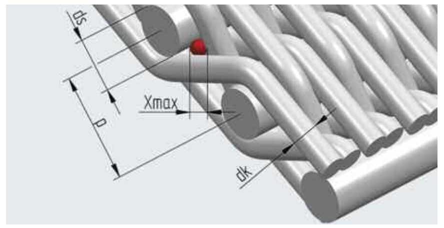
Notes on the RPD table:
- Definition: see pages 4-5, Terminology and Filtration Characteristic Values
- Column 3: largest geometrically determined pore size, tolerance ± 5% (according to AVIF-Project A224, A251)

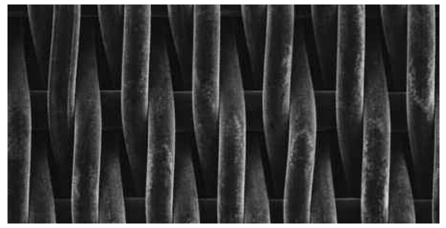
1	2	3	4	5		6	7	8
Type of weave	MESH	Geometric pore size µm	Pressure drop-coefficiant ζ	Tensile strength warp N/cm	weft N/cm	Porosity theor. %	Weight kg/m²	Cloth thickness mm
RPD 25 S	720 x 150	26	420	220	325	51	0.65	0.17
RPD 27 S	630 x 130	27	500	200	455	49	0.80	0.20
RPD 55 S	600 x 100	53	150	210	410	56	0.74	0.21
RPD 60 S	290 x 75	59	210	390	650	52	1.36	0.36
RPD 120 S	170 x 40	121	70	615	815	58	1.81	0.55
RPD 125 S	175 x 50	124	120	430	885	54	2.03	0.56
RPD 135 S	130 x 30	137	95	815	1270	53	3.01	0.82
RPD 150 S	130 x 35	151	65	850	1050	58	2.50	0.75
RPD 315 S	94 x 16	314	25	3185	580	67	2.42	0.94

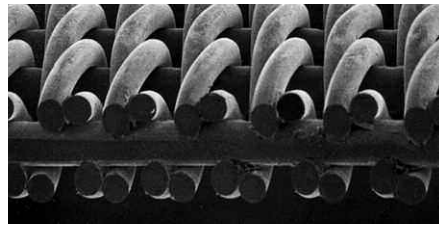
MINIMESH® TRD – TWILLED REVERSE DUTCH WEAVE.

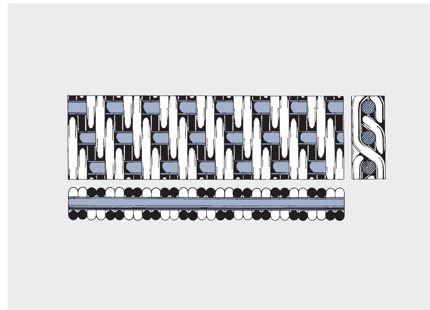
TRD – Twilled Reverse Plain Dutch Weave.

MINIMESH® TRD twilled reverse plain Dutch weave is comparable to the reverse plain Dutch weave, however the warp wire is woven in a 2/2 twilled weave. This gives the advantage of not distorting the warp wire as much as in the plain weave. The resulting high strength in the warp direction favours applications such as a filtration belt.









Notes on the TRD table:
- Definition: see pages 4-5, Terminology and Filtration Characteristic Values
- Column 3: largest geometrically determined pore size, tolerance ± 5% (according to AVIF-Project A224, A251)

1	2	3	4	5		6	7	8
Type of weave	MESH	Geometric pore size µm	Pressure drop-coefficiant ζ	Tensile strength warp N/cm	weft N/cm	Porosity theor. %	Weight kg/m²	Cloth thickness mm
TRD 75 S	400 x 125	75	80	330	275	61	0.78	0.26
TRD 115 S	320 x 38	115	110	1445	640	52	2.66	0.70
TRD 260 S	132 x 18	263	60	5815	530	57	4.45	1.31
TRD 320 S	132 x 17	319	35	2575	765	58	4.08	1.24
TRD 540 S	72 x 15	536	25	6450	880	62	5.45	1.81

SELECTING THE APPROPRIATE FILTER MEDIUM.

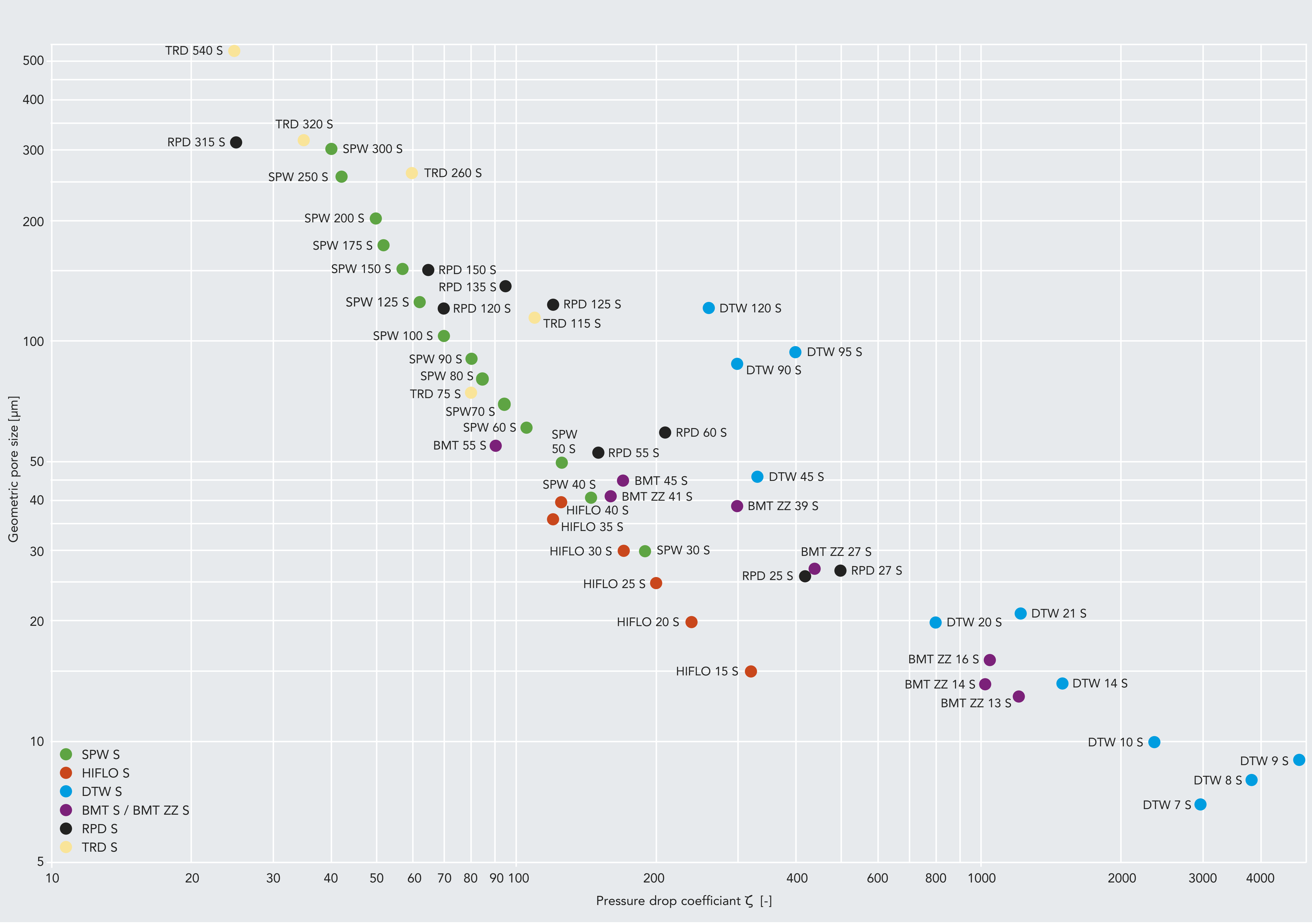
If the wire cloth is used as a surface filter, then the following design data is necessary for selecting the optimum type of woven wire cloth:

Fluid properties:
- Process temperature
- Density ρ
- Kinematic viscosity ν

Flow properties:
- Volumetric flowrate $\dot{V}$
- Flow area A
- Maximum pressure drop Δp

Particle properties:
- Particle size/particle size distribution
- Particle cut size

This data allows the permeability and geometric pore diameter to be determined. The characteristic values allow the selection of the appropriate woven wire cloth – in accordance with the required application & the material requirements.



Belgium

HAVER BELGIUM S.A.
Rue des Gaillettes 9
B-4651 BATTICE
Téléphone: +32-87-69 29 60
Fax: +32-87-69 29 61
E-Mail: hbsa@cybernet.be
Internet: www.haverbelgium.com

France

HAVER & BOECKER
Toiles Métalliques
7, Rue Sainte Catherine
F-24100 BERGERAC
Téléphone: +33-5-53 24 93 13
Fax: +33-5-53 24 95 99
E-Mail: haver.toiles@wanadoo.fr
Internet:
www.les-tissus-metalliques.com

Spain

HAVER & BOECKER
Telas Metalicas
Avda. Les Bobiles, 7
Casa 2
E-08850 GAVA (Barcelona)
Teléfono: +34-93-6 62 63 55
Fax: +34-93-6 62 90 59
E-Mail: haverboecker@telefonica.net
Internet: www.telas-metalicas.com

Great Britain

H&B Wire Fabrications Ltd.
30-32 Tatton Court
Kingsland Grange, Woolston
GB-WARRINGTON
Cheshire WA1 4RR
Phone: +44-1925-81 95 15
Fax: +44-1925-83 17 73
E-Mail: sales@hbwf.co.uk
Internet: www.hbwf.co.uk

Belarus

OOO HAVER BY
Ul. Zhukova, D.3
231300 LIDA, GRODNO
Тел/факс: +375-154-53-82-52
E-Mail: info@haver.by
Internet: www.haver.by

India:

HAVER STANDARD INDIA Pvt. Ltd.
Standard House, 83,
Maharshi Karve Marg,
P.O.Box 2082, MUMBAI - 400 002
Phone: 22-22060016 + 22060031
Fax: 22-22086915
E-Mail: wiremesh@haverstandard.com
Internet: www.haverstandard.com

U.S.A.

W.S. TYLER
8570 Tyler Boulevard
USA-MENTOR, Ohio 44060
Phone: +1-440-974-1047
+1-800-321-6188
Fax: +1-440-974-0921
E-Mail: wstyler@wstyler.com
Internet: www.wstyler.com

Canada

W.S. TYLER CANADA LTD.
225 Ontario Street
CAN-ST. CATHARINES
Ontario L2R 7B6
Phone: +1-905-688-2644
+1-800-325-5993
Fax: +1-905-688-4733
E-Mail: wstsales@wstyler.on.ca
Internet: www.wstyler.on.ca

HAVER & BOECKER · Ennigerloher Straße 64 · 59302 OELDE · Germany
Phone: +49 (0) 2522-300 · Fax: +49 (0) 2522 30-404
E-Mail: dw@haverboecker.com
Internet: www.weavingideas.com

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