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The Filtration Upgrade for Gas Turbines

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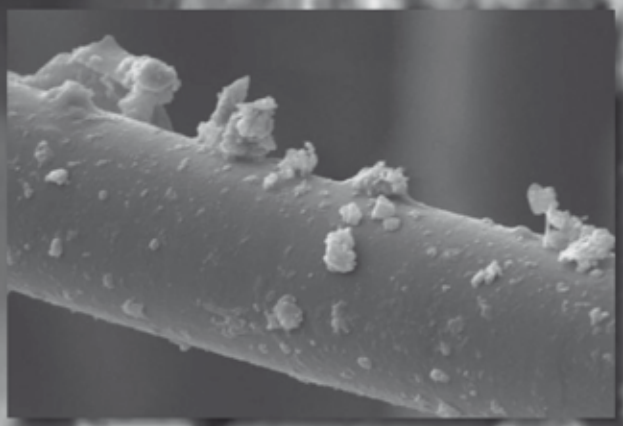
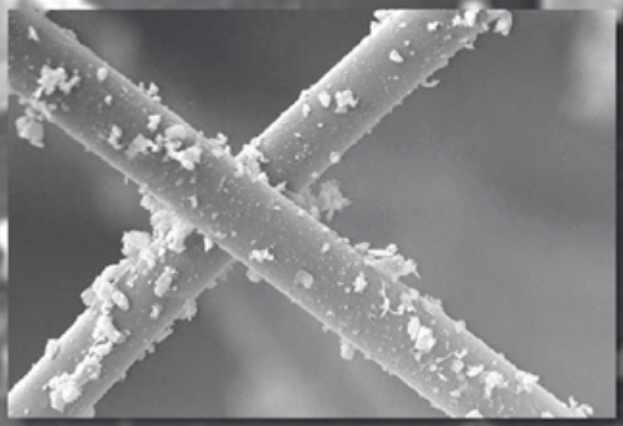
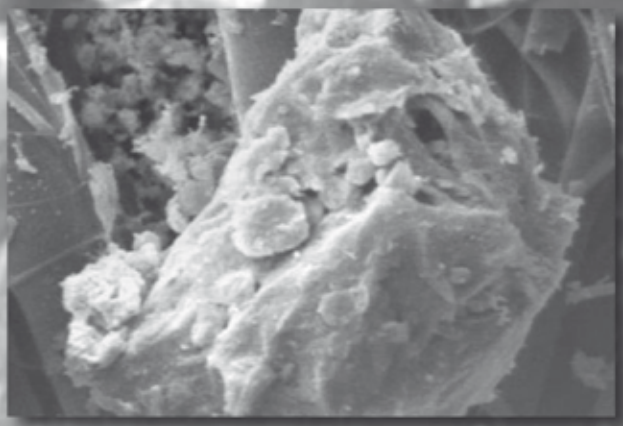
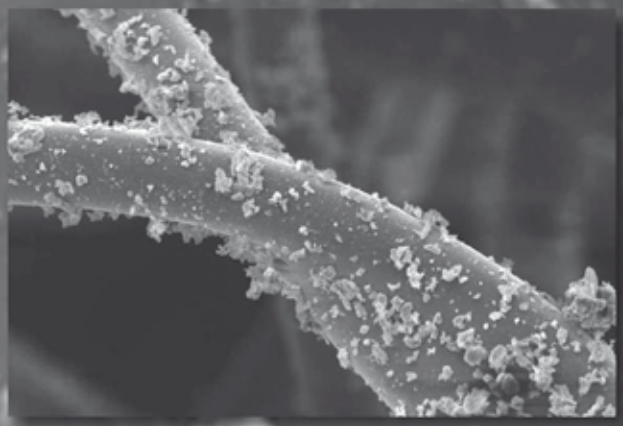
Filter systems – what makes the best stand out from the rest

An optimum balance of properties and features.









Up to 90 % of power output decline of gas turbines is attributable to inadequate filtration of inlet air.

Pressure Drop

Every kilopascal of inlet air pressure drop into a gas turbine causes a **loss in power of roughly 1–1.5 %**. When evaluating inlet air filters for gas turbines, users must look for more than just low pressure drop. High filtration efficiency is even more important for upholding power output capacity over long-term service.

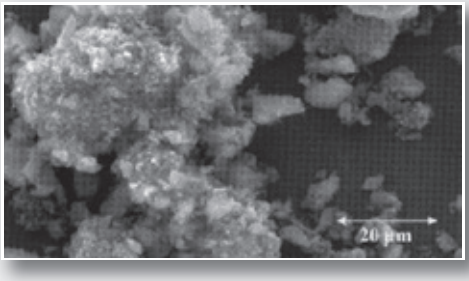
Efficient Filtration

Outdoor ambient air contains a wide spectrum of suspended particles, most of which are invisible to the naked eye. These fine components make up the predominant part of the particles entering the compressor and turbine during operation of gas turbine power stations. They enter as a consequence of inefficient inlet air filtration. The result is fouling. **As 70–85% of the power output loss** of gas turbine engines occurs due to compressor fouling, filtering out these extremely fine particles is of the utmost importance.

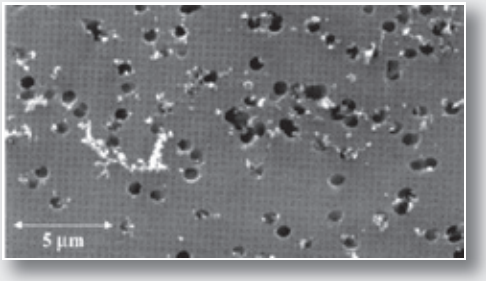
EMW® Filter Systems

EMW® offers personalized solutions for highly efficient inlet air filtration in gas turbine engines worldwide.Whether intended for use in normal locations or near coastlines or sandy deserts, EMW® filter systems are designed for the specific conditions at the user's site. Each system supplied is optimized for the airborne dust particles at the intended site, ensuring efficient filtration which prevents problems before they arise. EMW® air filters offer users an optimum balance of constantly high filtration performance and minimum increase in pressure drop over their entire service life. Their low initial pressure drop is another benefit provided to enthusiastic users worldwide.

Test Dust vs. Actual Outdoor Dust



ASHRAE test dust particles



Typical particles in actual ambient air

Comparison of Particle Sizes

The particles found in ambient air have little in common with the test dust grades specified in commonly used test procedures. Substantial differences in size between the two are easily seen. Most of the particles in the ambient air we breathe are smaller in diameter than 1 micrometer (µm).

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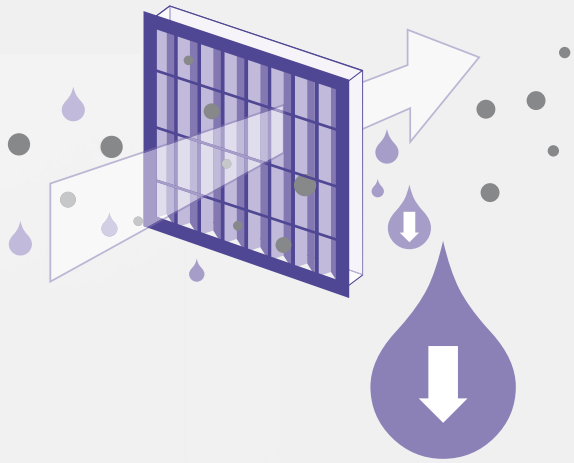
Layout of an Efficient Filter System

Our Specialists for Perfect Air Filtration.

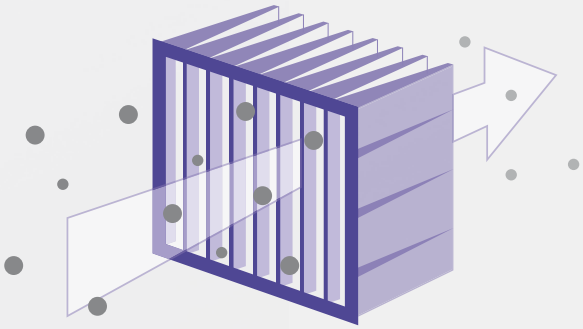
1 The Coalescer Unit



Liquid droplets in inlet air can contaminate pre-filters and final filters, causing increased overall pressure drop. The increase is primarily due to wetting and resultant swelling of particles already captured by the filter elements. This shortens the service lifespan of the affected air filters. The solution: EMW® coalescers which efficiently remove water drops from the inlet air stream.

- Prevents droplet contamination in downstream filtration stages
- Extends service lives of pre-filters and final filters

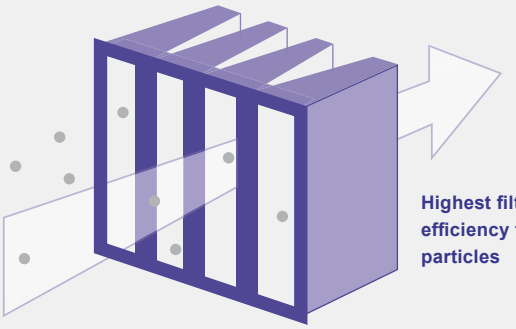
2+X The Pre-Filter Unit



Here is where removal of airborne solid particles begins. The pre-filter unit separates off coarse dust particles, protecting the downstream filters from excessive solids build-up.

- High-performance filters designed specifically for coarse particles
- Progressively structured medium with high initial arrestance
- Effective protection for final filter unit

3 The Final Filter Unit

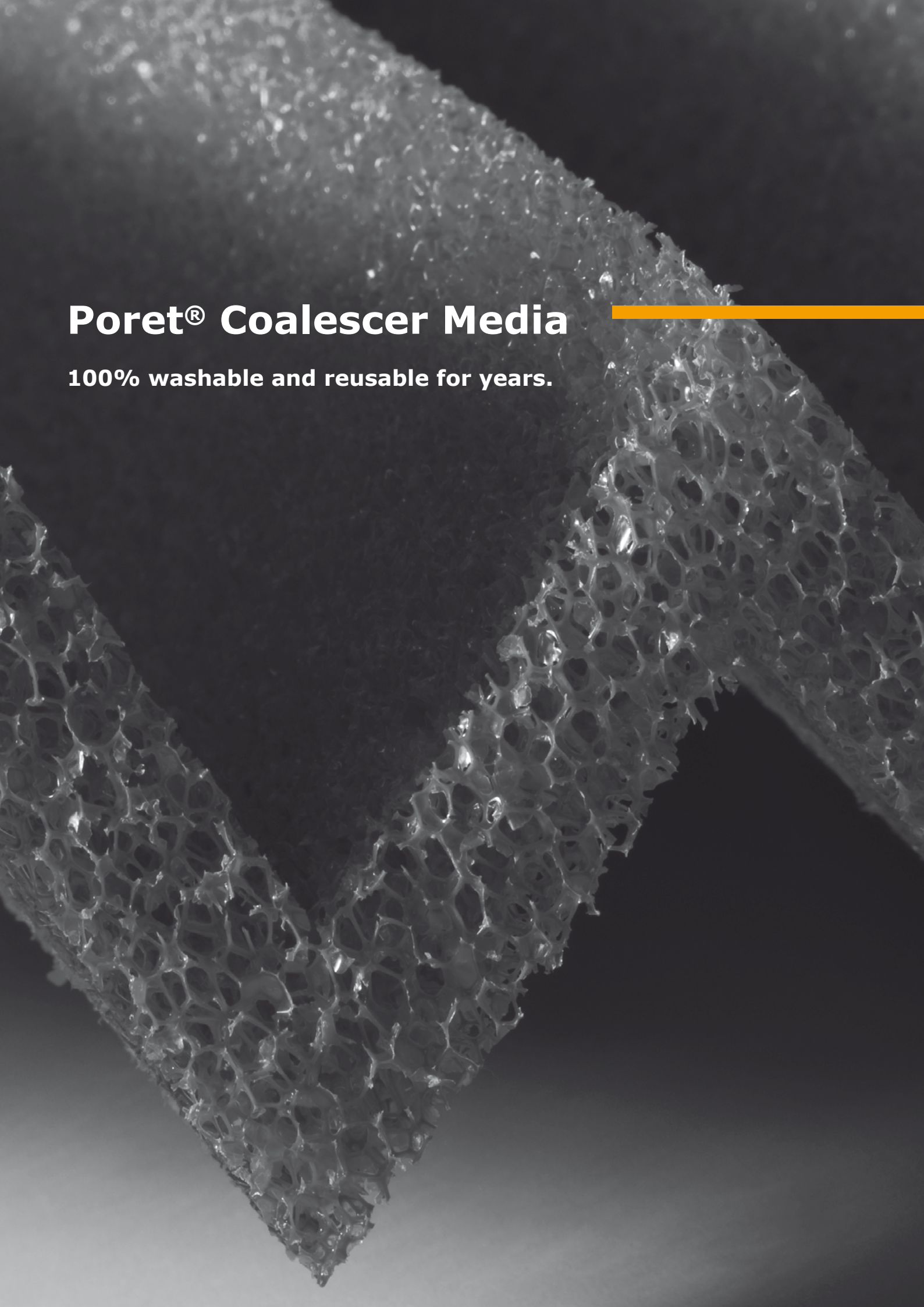


Highest filtration efficiency for ultra-fine particles

Get a step ahead with EMW®: Longer service life due to optimum configuration and extremely large filter surface!

EMW® offers a wide selection of high quality and extremely efficient air filters which radically reduce compressor fouling and other harmful processes. EMW® filters provide longest service life and virtually time-independent pressure drop due to their optimum design configuration and extremely large filter surfaces. Their high separation efficiency is maintained over their full service life.

- Available in **Fine-**, **ISO-** and **(H)EPA** filter classes
- Highly efficient filtration performance with minimum increase in pressure drop
- Reduced drop in power output of gas turbine
- Lower fuel consumption and CO_2 generation



Poret® Coalescer Media

100% washable and reusable for years.

Our Filter Systems

Coalescer Unit

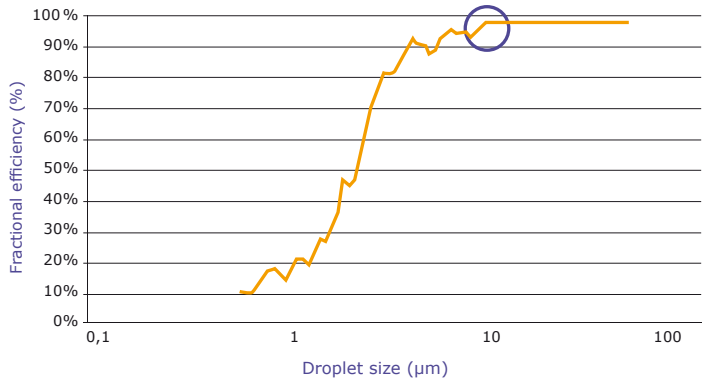
Coalescer elements remove entrained droplets from inlet air, preventing them from contaminating downstream filters. The physical mechanisms involved can be illustrated using the simple example of fog in ambient air. Fog is composed of tiny microscopic water droplets approximately 10–40 micrometers (µm) in diameter. As these droplets are collected in the coalescer, they agglomerate and their average size and weight increase. No longer buoyant in air, these larger droplets are separated off downwards by gravity.

EMW® offers two different coalescer media providing efficient moisture removal from gas turbine inlet air streams: Verfiltan®, a melamine-coated glass fibre mat and PORET®, an open-cell filter foam. PORET® in particular provides impressively long service life. Our CDS coalescer elements enclose PORET® in a frame with cast airtight joint, providing maximum reliability in demanding applications with highest air throughput.

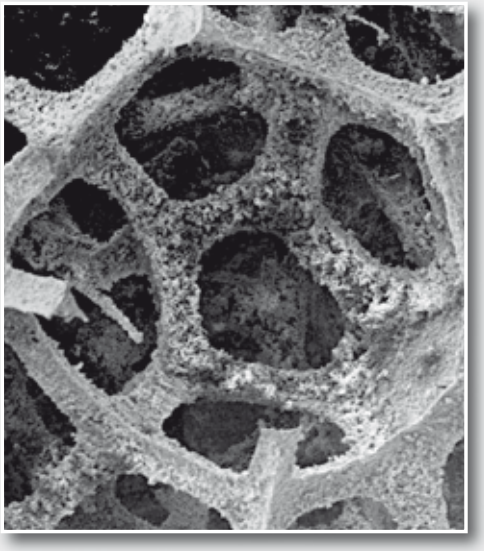
Type		CDS-P
Filter media		filter foam
Dimensions	mm inch	592 x 592 x 48 23.31 x 23.31 x 1.89
Air flow rate		3400 m^3/h (2000 cfm)
Test aerosol		water droplets
Initial pressure drop		65 Pa (0.26" wg)

Also available on request in cut-to-size sections or in replaceable plastic frames.

Droplet Removal Testing of EMW CDS-P Coalescers



In the commonly encountered droplet size range of >10 µm, CDS-P coalescers achieve a separation efficiency of 90% – 100%.



No pore clogging, even at high dust contents – with PORET® foam media.

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Pre-Filter Unit

EMW® Z-Line^{GT}
Available in Filter Classes G4 - M5 and the ISO 16890 filter groups.

The EMW® Z-Line GT pre-filter cell boasts high stability and durability, and effectively prevents constant filter changing. Accordingly reduction of maintenance work includes the stage of pre-filters as well as the following, more efficient operating filter stages.

A robust plastic housing is used instead of a vulnerable cardboard frame. The progressive filter medium is firmly attached thanks to permanent gluing on all four sides. In addition to a better adhesion, the spacers fitted in the core, influencing a permanently low pressure difference. Filter medium collapsing or framework parts falling apart are no longer an issue.

Type		Z-Line ^{GT}	Z-Line ^{GT}	Z-Line ^{GT}
Filter class	(EN 779) (ISO 16890)	G4 ISO Coarse 80%	G4 ISO Coarse 80%	G4 ISO Coarse 80%
Dimensions	mm inch	592 x 592 x 48 23.31 x 23.31 x 1.89	592 x 592 x 96 23.31 x 23.31 x 3.78	592 x 592 x 150 23.31 x 23.31 x 5.90
Air flow rate		3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)
Initial pressure drop		65 Pa (0.26" wg)	55 Pa (0.22" wg)	80 Pa (0.32" wg)

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EMW® Pocket Filters
Available in Filter Classes G3 – F7 and the
ISO 16890 filter groups.

EMW® pre-filters feature a progressively structured medium designed to efficiently catch large particles in the inlet air stream. A continuous foamed-in-place seal prevents lateral flow around the filter even at high air flow rates. The results: Low initial pressure drop and increased service life of the filtration system.

Type		S45 KR-7 N	S45 KR-10 NG	S45 KR-6 SG
Filter class	(EN 779) (ISO 16890)	G4 ISO Coarse 50%	G4 ISO Coarse 55%	G4 ISO Coarse 70%
Dimensions	mm inch	500 x 500 x 180 19.68 x 19.68 x 7.09	592 x 592 x 190 23.31 x 23.31 x 7.48	592 x 592 x 360 23.31 x 23.31 x 14.17
Air flow rate		3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)
Initial pressure drop		75 Pa (0.30" wg)	50 Pa (0.20" wg)	30 Pa (0.12" wg)

Type		GT 50 KR-8 SG	GT 60 KR-8 SG
Filter class	(EN 779) (ISO 16890)	M5 ISO ePM_{10} 70%	M6 ISO ePM_{10} 75%
Dimensions	mm inch	592 x 592 x 600 23.31 x 23.31 x 23.62	592 x 592 x 600 23.31 x 23.31 x 23.62
Air flow rate		3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)
Initial pressure drop		55 Pa (0.22" wg)	60 Pa (0.24" wg)

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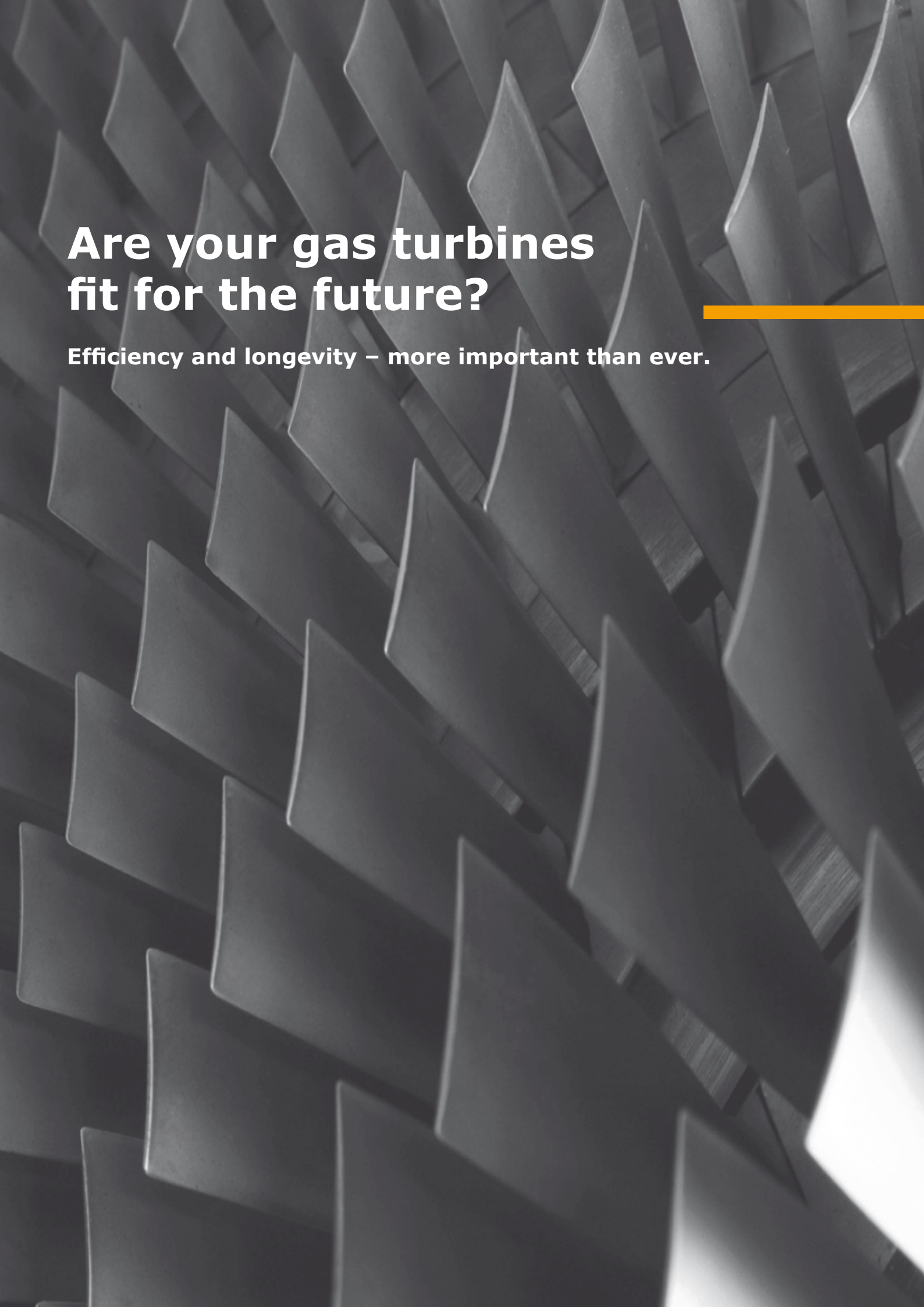


Are your gas turbines fit for the future?

Efficiency and longevity – more important than ever.

GT Compact Filters

Ambitious. Flexible. Highly Reliable.
EMW® GT Minipleat compact filters incorporate an impressive range of features which add up to high filtration efficiency and low pressure drop.

1. Highly efficient filter media: The filter media are selected as required to ensure efficient removal of the encountered particulates even at high volume throughputs.

2. Enormous filter area: Minipleat technology provides maximum filter surface area in a compact, space-saving configuration while still permitting smooth aerodynamic flow.

3. Heavy-duty frame: The frame's material of construction and design are decisive for realizing ease of installation as well as streamlined flow for minimum pressure drop. The plastic frames of EMW® GT Minipleat compact filters are aero-dynamically optimized for flow conditions in gas turbine inlet air filtration. Simple to install, the compact filters are also fully incinerable, permitting convenient disposal after use.

4. Leak-proof: If the filter media are not reliably bonded to the frame, leakage can result, particularly at high air flow rates. These leaks permit free passage of air particles around the filter. To prevent problems of this nature, EMW® Minipleat filter media are bonded to the frame by a cast airtight joint. The reliable full-perimeter bond prevents leakage even at highest flow rates. In addition, all EMW® filters are available with a continuous foamed-in-place seal located on the air inlet or outlet side as desired.

5. Superb strength: EMW® GT Minipleat compact filters incorporate a fully synthetic nonwoven reinforcing mat on the air outlet side. This heavy-duty configuration withstands pressure drops of over 5000 Pa for many filter designs.

Our Filter Systems

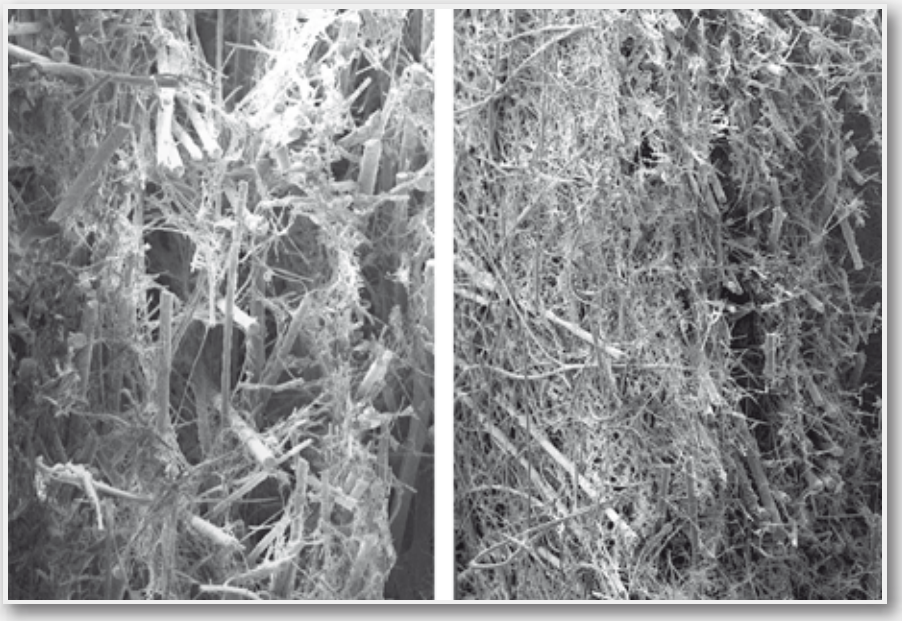
Final Filter Unit

EMW® GT Minipleat Compact Filters in Filter Classes F7 – F9 and the ISO 16890 filter groups are equipped with a fully synthetic nonwoven mat on the outlet side for highest reliability even under heavy-duty conditions, withstanding even highest pressure drops e.g. > 5000 Pa.

In addition, EMW® GT Minipleat compact filters feature enormous surface areas ranging up to 34 m². Filter box versions are available with surface areas of up to 40 m². These high-quality filter media fulfil requirements for highest filtration efficiency of inlet air with virtually constant pressure drop.

High-Quality Glass-Fibre Media in Action

The outstanding particulate retention of EMW® air filters can be seen in the SEM photographs shown below. EMW® filter media fulfil highest requirements for physical strength and filtration efficiency.



Filter Media Comparison
Picture on the left shows a medium in F9, whereas the picture on the right shows a medium in H13 with a much denser fibre structure.

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Filter F7 and ISO ePM_1

Type		MPK 47 - 20 GT	MPK 37 - 23 GT	MPK 47 - 31 GT
Filter class	(EN 779) (ISO 16890)	F7 ISO ePM_1 55%	F7 ISO ePM_1 50%	F7 ISO ePM_1 50%
Dimensions	mm inch	592 x 592 x 296 23.31 x 23.31 x 11.65	592 x 592 x 400 23.31 x 23.31 x 15.75	592 x 592 x 400 23.31 x 23.31 x 15.75
Air flow rate		3400 m^3/h (2000 cfm) 4250 m^3/h (2500 cfm)	3400 m^3/h (2000 cfm) 4250 m^3/h (2500 cfm)	3400 m^3/h (2000 cfm) 4250 m^3/h (2500 cfm)
Initial pressure drop		90 Pa (0.36" wg) 115 Pa (0.46" wg)	55 Pa (0.22" wg) 75 Pa (0.30" wg)	60 Pa (0.24" wg) 90 Pa (0.36" wg)

Filter F8 and ISO ePM_1

Type		MPK 48 - 20 GT	MPK 38 - 23 GT	MPK 48 - 31 GT
Filter class	(EN 779) (ISO 16890)	F8 ISO ePM_1 65%	F8 ISO ePM_1 65%	F8 ISO ePM_1 70%
Dimensions	mm inch	592 x 592 x 296 23.31 x 23.31 x 11.65	592 x 592 x 400 23.31 x 23.31 x 15.75	592 x 592 x 400 23.31 x 23.31 x 15.75
Air flow rate		3400 m^3/h (2000 cfm) 4250 m^3/h (2500 cfm)	3400 m^3/h (2000 cfm) 4250 m^3/h (2500 cfm)	3400 m^3/h (2000 cfm) 4250 m^3/h (2500 cfm)
Initial pressure drop		100 Pa (0.40" wg) 135 Pa (0.54" wg)	90 Pa (0.36" wg) 125 Pa (0.50" wg)	65 Pa (0.26" wg) 90 Pa (0.36" wg)

Filter F9 and ISO ePM_1

Type		MPK 49 - 20 GT	MPK 39 - 23 GT	MPK 49 - 31 GT
Filter class	(EN 779) (ISO 16890)	F9 ISO ePM_1 80%	F9 ISO ePM_1 85%	F9 ISO ePM_1 80%
Dimensions	mm inch	592 x 592 x 296 23.31 x 23.31 x 11.65	592 x 592 x 400 23.31 x 23.31 x 15.75	592 x 592 x 400 23.31 x 23.31 x 15.75
Air flow rate		3400 m^3/h (2000 cfm) 4250 m^3/h (2500 cfm)	3400 m^3/h (2000 cfm) 4250 m^3/h (2500 cfm)	3400 m^3/h (2000 cfm) 4250 m^3/h (2500 cfm)
Initial pressure drop		105 Pa (0.42" wg) 155 Pa (0.62" wg)	80 Pa (0.32" wg) 115 Pa (0.46" wg)	65 Pa (0.26" wg) 100 Pa (0.40" wg)

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(H)EPA – The Next Level

ABRASION, FOULING AND CORROSION ARE PREVENTABLE.

A new trend is emerging in the sector of gas turbine inlet air filtration. Ever more frequently, highest-efficiency (H)EPA filters are selected as the solution of choice for optimum protection of gas turbines.

A leader in (H)EPA technologies for many years, EMW® offers comprehensive product solutions to keep your gas turbine plant at the cutting edge.

EMW® (H)EPA Filter E12

Retrofitting with filter class EPA-12 (old designation HEPA 12) EMW® air filters dramatically reduced fouling.

Compressor Fouling reduces energy efficiency of gas turbine engines, increases fuel consumption and CO_2 emissions.

EMW® - MPK GT in E12
(H)EPA class air filters effectively prevent compressor fouling. The unit shown above, protected by E12 class EMW® (H)EPA filters, was operated over 48,000 hours without need for online or offline compressor washing.

For Case Studies please visit us at www.emw.de

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Recommended by leading gas turbine manufacturers: (H)EPA air filters

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EPA E10

Type		MPK 410 28 GT	MPK 410 31 GT	MPK 410 32 GT	MPK 410 38 GT
Filter class (EN 1822)		E10	E10	E10	E10
Dimensions	mm	592 x 592 x 298	592 x 592 x 400	595 x 595 x 400	592 x 592 x 400
	inch	23.31 x 23.31 x 11.73	23.31 x 23.31 x 15.75	23.43 x 23.43 x 15.75	23.31 x 23.31 x 15.75
Air flow rate		3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)
Initial pressure drop		150 Pa (0.60" wg)	120 Pa (0.48" wg)	120 Pa (0.48" wg)	125 Pa (0.50" wg)
Fractional efficiency at MPPS*		≥ 85 %	≥ 85 %	≥ 85 %	≥ 85 %

EPA E11

Type		MPK 411 28 GT	MPK 411 31 GT	MPK 411 32 GT	MPK 411 38 GT
Filter class (EN 1822)		E11	E11	E11	E11
Dimensions	mm	592 x 592 x 298	592 x 592 x 400	595 x 595 x 400	592 x 592 x 400
	inch	23.31 x 23.31 x 11.73	23.31 x 23.31 x 15.75	23.43 x 23.43 x 15.75	23.31 x 23.31 x 15.75
Air flow rate		3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)
Initial pressure drop		185 Pa (0.74" wg)	155 Pa (0.62" wg)	125 Pa (0.50" wg)	150 Pa (0.60" wg)
Fractional efficiency at MPPS*		≥ 95 %	≥ 95 %	≥ 95 %	≥ 95 %

EPA E12

Type		MPK 412 28 GT	MPK 412 31 GT	MPK 412 32 GT	MPK 412 38 GT
Filter class (EN 1822)		E12	E12	E12	E12
Dimensions	mm	592 x 592 x 298	592 x 592 x 400	595 x 595 x 400	592 x 592 x 400
	inch	23.31 x 23.31 x 11.73	23.31 x 23.31 x 15.75	23.43 x 23.43 x 15.75	23.31 x 23.31 x 15.75
Air flow rate		3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)	3400 m^3/h (2000 cfm)
Initial pressure drop		280 Pa (1.12" wg)	230 Pa (0.92" wg)	190 Pa (0.76" wg)	220 Pa (0.88" wg)
Fractional efficiency at MPPS*		≥ 99.5 %	≥ 99.5 %	≥ 99.5 %	≥ 99.5 %

* Most Penetrating Particle Size

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Are you interested in upgrading the power output of your gas turbine engines?

If so, we should talk. Our team of experts are at your disposal to provide knowledgeable advice and assistance.

Excellence in filtration

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