

AFM[®]

US Edition

Activated Filter Media for Industrial & Municipal Water Filtration Applications



What is AFM[®]?

AFM[®], Activated Filter Media is a highly engineered activated filter media made from specific up-cycled colored glass types.

AFM[®] is a direct replacement for sand in any sand filter.

AFM[®] grade 1 is certified to remove more than 90% of 4 micron particles, more than double the fine particle retention of sand.

AFM[®] surface activation prevents biofouling, improves biosecurity and stops channelling.

AFM[®] has a minimum service life in excess of 10 years and provides a short pay-back.



AFM[®] : Simple, efficient and sustainable water treatment

About Dryden Aqua

Dryden Aqua is one of the largest manufacturer of glass filtration media in the world. Our **Activated Filter Media AFM®** is verified to double the performance of sand filters without the need for additional investment in infrastructure.

Founder of Dryden Aqua, Dr Howard Dryden is a marine biologist with a unique knowledge combination of biology, chemistry and technology. He is the inventor and developer of the activated, bio-resistant filter media AFM®.

Dryden Aqua provides innovative solutions for drinking water, food and beverage processing, industrial process water as well as municipal and industrial waste water worldwide.



Our Mission

Our mission is to provide solutions that have a positive environmental impact on our ecosystem. We help to make this world a better place - a non-toxic environment for everyone.

Our production in Edinburgh, Scotland:



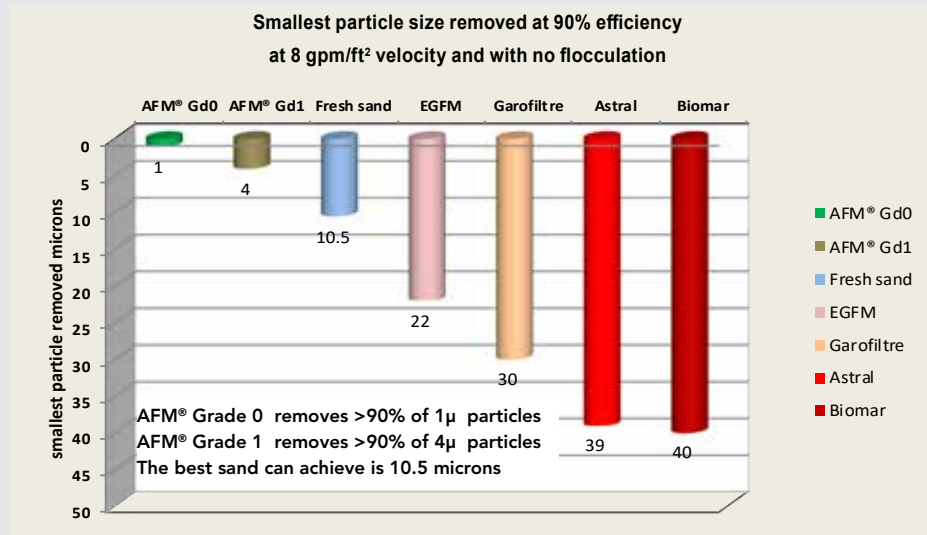
AFM[®] Performance & Benefits

Filtration performance and grade of filter media

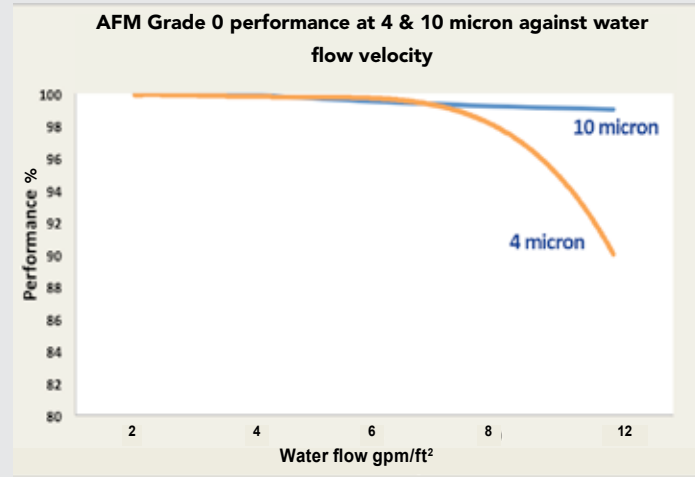
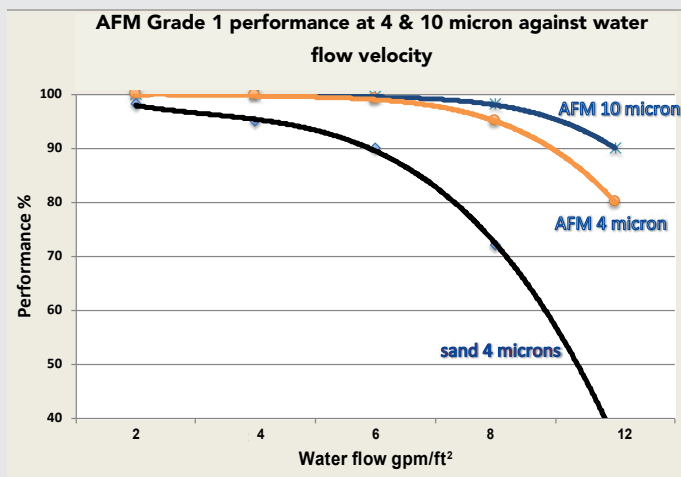
The graph (right) results from tests carried out by accredited lab, IFTS under a European Program that encourages comparative tests of competitive products.

The tests compared performance of sand and crushed glass media. AFM[®] Grades 0 & 1 retained more than 90% of 1 μ and 4 μ particles respectively. New sand was the best of the rest with >90% of 10.5 μ particles retained.

AFM[®] Grade 1 therefore filters more than twice as well as new sand and more than 5 times as well as any other media tested.



Source: IFTS test data, France, 2014
Sand was 16/30 Leighton Buzzard sand.



AFM[®] Key Points:

- AFM[®] is a direct replacement for sand in any type of sand filter without the need for further investments
- Has more than double the fine particle retention performance of sand
- Has an engineered, activated surface to adsorb fine particles including some priority substances, heavy metals and metalloids such as arsenic, ferric and manganese.
- Resists biological fouling and prevents channelling
- Substantially reduces product water oxidation demand
- Reduces backwash water demand by an average of 50%
- Provides quick ROI, usually less than 2 years on water consumption alone
- Has a life cycle more than 4 times longer than sand and in excess of 10 years
- Is certified to ISO 9001: 2015, ISO 14001, 18001 & 45001 standards & is certified to HACCP NSF50 & for drinking water use under European DWI Reg 31 as well as NSF61.

Dryden Aqua Water Treatment

Dryden Aqua Technology is applicable in all areas where biology plays a role or might influence the quality of water treatment. Some key examples are as follows:

Pre-treatment prior to membranes

Maintenance of cartridge filters and fouling of membranes for RO and UF is a major cost. AFM® has much better fine particle retention than sand. It also reduces fouling because it does not contain free silica that cause silicate blockage. Sand filters are biofilters and constantly discharge bacteria into the product water to foul the membranes. AFM® resists biofouling and does not become a biofilter.

Removal of arsenic, ferric and manganese

AFM® will remove many metal contaminants from the water, and is particularly effective for arsenic and ferric. Contaminated water is usually ground water which must be strongly aerated for a period of at least 30 minutes prior to filtration. If arsenic needs to be removed, additional ferric may be added to achieve a ratio of 10:1 (ferric:arsenic) to facilitate oxidation and co-precipitation.

Cooling tower side-stream filtration

Water treatment is essential for cooling tower recycled water. AFM® removes nutrients to control pathogenic bacteria such as Legionella thereby reducing requirement for corrosion inhibitors, biocides and anti-scalants by up to 50%.

Tertiary treatment of effluent

AFM® replaces sand in tertiary treatment filters without the need for any modifications. AFM® will not biofoul and will more than double the performance of the treatment system, offering a sustainable, low cost and high performance alternative to sand.

These are only a few extracts from a spectrum of applications for AFM® and Dryden Aqua Technology.

Dryden Aqua's AFM® is the highest performance, most tested and most certificated filtration media on the market.

Dryden Aqua thrives on the challenge of new applications and welcomes any inquiry where our technology might make a difference.



AFM[®] Applications

Recommended applications for Dryden Aqua AFM[®]

Application Type	Associated Processes		PSF Typical flow		%age reduction
			gpm/ft ²		
Municipal & Industrial Drinking Water			min	max	
Arsenic removal	Oxidation 30 mins by aeration	FeCl coagulation prior to AFM [®] filtration	>2	<8	90% reduction
Iron removal	Oxidation 30 mins by aeration prior to AFM [®] filtration		>4	<8	95% reduction
Manganese removal	Oxidation 500mV with H ₂ O ₂ or NaHOCl + 30 mins aeration	FeCl coagulation prior to AFM [®] filtration	>4	<8	98% reduction
Membrane pre-filtration	AFM [®] filtration to 5µ (AFM [®] Gd1) or 1µ (AFM [®] Gd0)	1 micron cartridge filter	>4 >2	<6 <4	SDI <3
Seawater Intake Filtration	Pre-screening of macro-algae by mesh or wedgewire screens	AFM [®] filtration	>4	<8	
Industrial Process Water					
Organic pollutants & oils, TSS, VSS & particles >1 micron	Oxidation 30 min by aeration	Alginate Flocculant + 2 - 4 gpm/ft ² filtration for concentrations 100 - 2000 mg/l	>4	<6	95% reduction
TSS, VSS & Particles > 1 µ	Oxidation 30 min by aeration	>2 < 4 gpm/ft ² if loads of 1 - 5 µ particles	>4	<6	
Cooling tower sidestream filtration	Filtration 6 - 8 gpm/ft ² with AFM [®]		>6	<8	
Municipal Wastewater					
Phosphorous & Bacteria, BOD, COD & TOC	DAF's or MBBR filtration or Aggressive aeration + Flocculation via ZPM	Coagulation with LaCl (noPhos) + ZPM for PO ₄ ²⁻ removal			
Tertiary Treatment	Pre-filtration to <100 µ + FeCl coagulation then AFM [®]	Oxidation 30 mins with NaHOCl after AFM [®] filters	>2	<6	-95% COD
Industrial Wastewater					
Low conc' mineral oil (<50mg/l) removal	Oxidation 30 mins by aeration	Coagulation & PAC flocculation prior to AFM [®]			98% reduction
Medium conc' mineral oil (<500mg/l) removal	Oxidation 30 mins by aeration + Coagulation & PAC flocculation	Dissolved Air Flotation prior to AFM [®] filtration at 5 - 6 gpm/ft ² max.	>2	<6	98% reduction
Chromium or Copper removal	pH correction 7.0-7.5 by MgO ₂ or 8.5 (caustic). Reduction by dosage of Calcium polysulphide via ZPM + injection of DA GF50 (sub 50 micron glass powder).	Sedimentation 30 mins prior to AFM [®] filtration at 5 - 10 gpm/ft ² max	>2	<4	95% reduction

AFM[®] can be substituted for sand in any pressure or rapid gravity sand filter. It is suitable for many applications beyond those identified above and can be substituted for e.g. membrane filtration in many applications. It will significantly outperform sand in terms of particle retention, stability, backwash water consumption and service life.

Use of AFM®

How to use AFM®

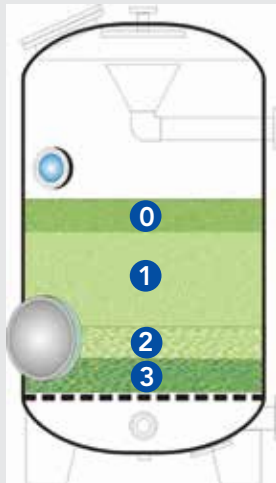
- AFM® is a direct replacement for sand in any type of sand filter
- AFM® has a 15 % lower density than sand: e.g. if your filter takes 220 lb of sand it will only require: $220 \times 0.85 = 187$ lb of AFM®.

AFM® Grades

- AFM® is produced in 4 Grades
- Grades 0 and 1 provide fine filtration
- Grades 2 and 3 provide support and ensure good flow distribution through the filter

Recommended operational parameters

Parameter	Value
Filtration velocity	1 - 15 gpm/ft ²
Back Wash Velocity	> 18 gpm/ft ²
Max. operating differential pressure	< 8 psi
Back Wash Duration	for 3 - 10 mins
Water pH limits	4 - 10
Water temperature limits	32 - 212°F



Recommended AFM® Grades and arrangement from top to bottom, in Pressure Filters

Grade, Size (mm)		Commercial Purification	High Purification	Ultra Purification
Grade 0	0.25 - 0.5 mm	n/a	20 %	60 %
Grade 1	0.4 - 0.8 mm	70 %	50 %	20 %
Grade 2	0.7 - 2 mm	15 %	15 %	10 %
Grade 3	2 - 4 mm	15 %	15 %	10 %

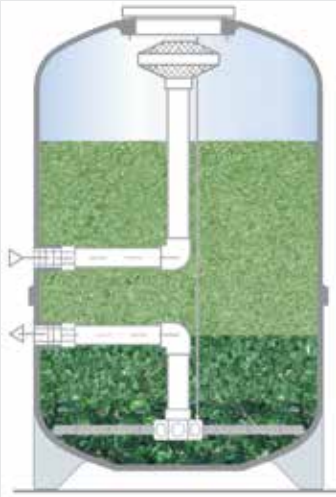
Before first use of AFM®:

Backwash AFM® for 5 minutes, 3 consecutive times, with potable water and then rinse for 5 minutes.



Summary of AFM® Properties and Certifications

Product ID



Name:	Dryden Aqua AFM® - Activated Filter Media
Usage:	Replaces sand in all media filtration applications
Material:	Green & amber up-cycled glass. Optimized mechanical filtration performance with activated mesoporous surface
Unique Features:	Bio-resistant, self-sterilizing, predictable performance, filtration down to 1 micron (Grade 0), 4 microns (Grade 1)

About AFM®

AFM® is one of the most efficient granular filtration medium available on the market. It is highly engineered to give optimum mechanical filtration performance in a range of industrial and municipal water filtration applications.

AFM® replaces sand in all filtration applications and can be used in a conventional sand filter without modification.



AFM® Production

AFM® is:

- manufactured from very specific green and brown glass types
- engineered to obtain optimum and consistent particle size and shape
- activated to increase the surface area up to 300 times of that of crushed glass or sand.
- chemically and thermally treated to ensure permanent negatively charged surface properties that make AFM® self-sterilizing

AFM® Performance

AFM® :

- will not support bacterial growth
- at up to 8.2 gpm/ft²/hr will consistently filter, without flocculation:
 - >95% of 4µ particles (Grade 1)
 - >95% of 1µ particles (Grade 0)
- will selectively filter positively charged ionic particles such as heavy metals
- will not suffer from channelling or preferential pathways
- will consistently evacuate more than 95% of retained particles using 50% or less water than required for sand. (backwash duration 5 mins max at 18.44 gpm/ft²/hr).
- has a minimum service lifespan of 10 years or more.



AFM® Certification

Certified:

- ISO 9001: 2015, ISO 14001 & 45001.
- NSF 50 & 61 for potable water use.
- DWI EC Regulation 31 certification for potable water use.
- European Water Directive (98/83/EC) & 80/778/EEC compliant.
- HACCP Certified for agriculture, food and drinks markets.
- BSEN12902 and BSEN12904 compliant.
- Independently tested by accredited laboratory, IFTS (Institute of Filtration and Techniques of Separation) according to EC ETV (Environmental Testing Verification) program. Found to give vastly superior performance in filtration and backwash than any other product tested.



NSF/ANSI 50 & 61

AFM[®] Specification

AFM[®] product specifications

Specification	Grade 0	Grade 1	Grade 2	Grade 3
Particle size	0.25 - 0.5 mm	0.4 - 0.8 mm	0.7 - 2.0 mm	2.0 - 4.0 mm
Undersized	< 5 %	< 5 %	< 10 %	< 10 %
Oversized	< 5 %	< 5 %	< 10 %	< 10 %
Effective size (expressed as d10)	0.27 mm	0.44 mm	0.82 mm	2.3 mm
Hardness	> 7 mohs	> 7 mohs	> 7 mohs	> 7 mohs
Sphericity (average range)	0.77	0.78	0.81	0.82
Uniformity coefficient (d60/d10)	<1.5	<1,5	<1,5	<1,5
Aspect ratio	2 : 2.4	2 : 2.4	2 : 2.4	2 : 2.4
Organic contamination	< 1,764 oz/ton	< 1,764 oz/ton	< 1,764 oz/ton	< 1,764 oz/ton
Colored glass (green/amber)	> 98 %	> 98 %	> 98 %	> 98 %
Specific gravity (grain)	20 lb/gal	20 lb/gal	20 lb/gal	20 lb/gal
Embodied energy	< 72 kW/ton	< 65 kW /ton	< 50 kW/ton	< 50 kW/ton
Porosity (%) (calculated, uncompacted)	50	44	42	40
Porosity (%) (calculated, compacted)	40	38	37	37
Bulk bed density	10,7 lb/gal	10,7 lb/gal	10,7 lb/gal	10,7 lb/gal
Attrition, (50 % bed expansion, 100 hour's backwash).	< 1 %	< 1 %	< 1 %	< 1 %



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