

# AFM<sup>®</sup>

The unique bio-resistant  
Activated Filter Media



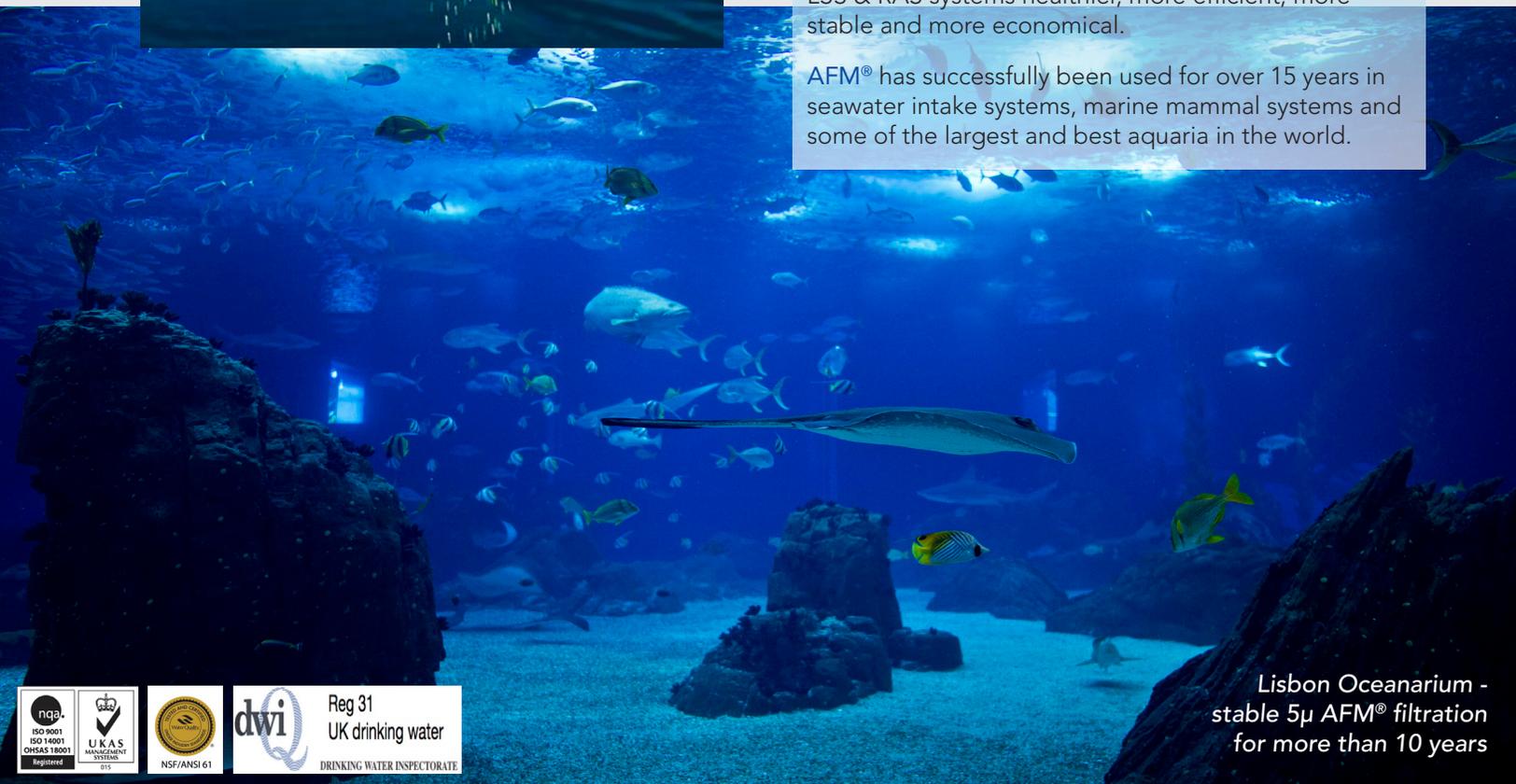
AFM<sup>®</sup> filtered Sealion pools in  
Mundomar, Benidorm

## What is AFM<sup>®</sup>?

AFM<sup>®</sup> stands for **A**ctivated **F**ilter **M**aterial, a revolutionary filter media made from glass whose performance exceeds that of quartz and glass sand by filtering at least 30% more organics.

AFM<sup>®</sup> is bio-resistant and self-sterilising. This makes LSS & RAS systems healthier, more efficient, more stable and more economical.

AFM<sup>®</sup> has successfully been used for over 15 years in seawater intake systems, marine mammal systems and some of the largest and best aquaria in the world.



Lisbon Oceanarium -  
stable 5µ AFM<sup>®</sup> filtration  
for more than 10 years

# For best filter performance you need the best filtration media, AFM®

## Filtration performance:

AFM® filters without flocculation down to 5µ at a velocity of 8 gpm/ft². It retains at least 30 % more organic substances than fresh sand or glass media. In chlorinated systems with optimised coagulation and flocculation with APF and ZPM, a nominal filtration of 0.1 microns will be achieved.

AFM® is bioresistant, it offers no home for bacteria, viruses and other pathogens:

## Fish Systems:- Stable sub 5µ filtration:

Sand is a good mechanical filter but also provides a perfect support for bacterial growth as every grain of sand is colonised by bacteria within a few days. Mechanical filtration is compromised by bacterial nitrification that consumes oxygen from the water, depresses the pH and causes anaerobic coagulation of the sand. Clogging causes channeling of the bed and sporadic release of filtered material and undesirable pathology into the process water.



## Chlorinated Mammal Systems: - Less trichloramines

Bacteria settling on sand media immediately excrete a mucus biofilm to protect themselves against the disinfectant. Entire communities of bacteria live in the biofilm including legionella, vibrio and other undesirable pathogens.

Bacteria in the biofilm convert urea to ammonia which then reacts with chlorine to form inorganic chloramine (mono, di- and trichloramine) and trihalomethanes. Trichloramines are responsible for the unpleasant chlorine smell and also present a severe animal health hazard.

AFM® does not support bacteria and there will therefore be no biofilm and hence no pathogens housed within it. If there are no bacteria urea will remain in the water and reacts with chlorine to form harmless, odourless chlorurea.

No bacteria → no biofilm → less trichloramines → no chlorine smell → no pinniped eye irritation → no cetacean pulmonary irritation → no walrus skin irritation.

No bacteria → lower chlorine demand → less chlorine consumption → less Disinfection By-Products (DBP's):

Chlorine reacts with organic and inorganic substances and produces undesirable, harmful reaction by-products such as trichloramine and Trihalomethanes (THM's).

With AFM® and effective coagulation and flocculation we remove far more substances than with sand or glass media. The better the filtration the lower the chlorine consumption and less disinfection by-products are produced.

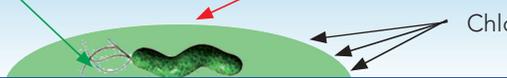
## How bacteria survive even in chlorinated systems

Bacteria stick and grow on most surfaces

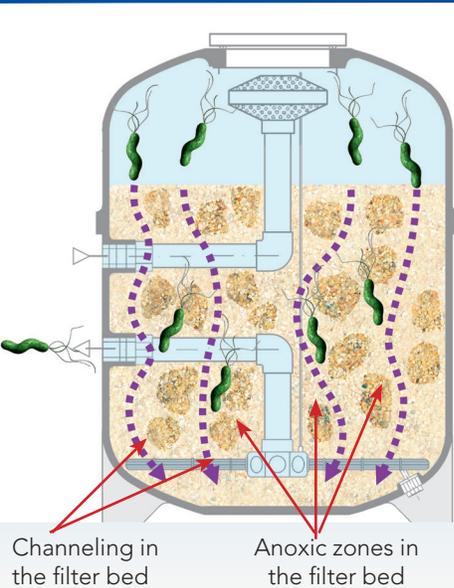
Bacteria cling to surfaces - walls, floor, pipes & especially on the sand media

Bacteria secrete a mucus to protect themselves against chlorine oxidation.

Chlorine cannot penetrate the biofilm that protects the bacteria.



## Filtration with sand



Bacteria colonise the sand which becomes a biofilter

→ Nitrification consumes O<sub>2</sub> and depresses the pH

→ Anaerobia leads to undesirable pathology in the filters and both clogging and channeling of the media

→ Filtration quality becomes unstable

→ Undesirable bacterial cell biomass is constantly discharged from the filter.

Channeling in the filter bed  
Anoxic zones in the filter bed

AFM® is not compromised by bacterial growth and provides stable sub 5µ filtration for reliable mechanical filtration and evacuation, even of Cryptocaryon oocysts, in backwash.

No bacteria means no biofilm in the AFM® filter and no channel formation to disrupt the filter function. The performance of AFM® remains consistently high for 10 - 15 years.

# What makes AFM® so effective?

## 1. Clean, carefully selected glass:

AFM® is only made from pure green or brown glass which have the necessary metal oxides to make AFM® self-sterilising.

## 2. Ideal hydraulic properties:

The raw material is ground into the optimal grain size and shape that is crucial for the outstanding hydraulic characteristics of AFM®. No dangerous glass splinters are allowed to be present in the filter material. Our ISO certified manufacturing process ensures that this is not the case.

## 3. Activation process:

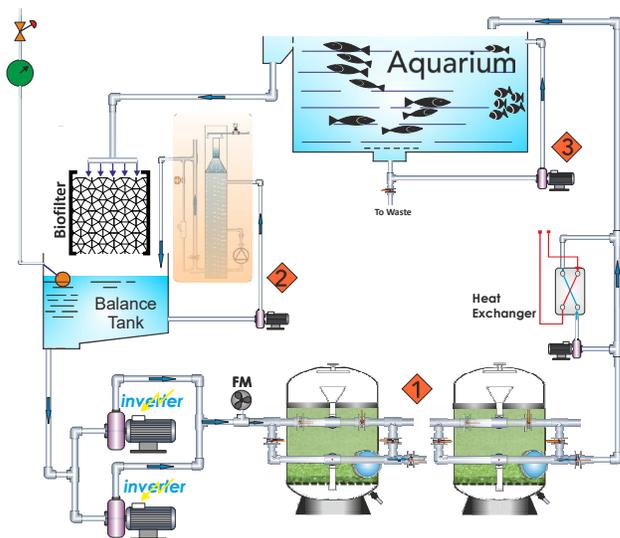
The AFM® activation process creates a mesoporous structure with a huge catalytic surface area. Sand has a surface area of over 1000 ft<sup>2</sup> per ft<sup>3</sup> but activated AFM® has a surface area of over 300,000 ft<sup>2</sup> per ft<sup>3</sup> which allows a much greater surface area for adsorption and catalytic reactions. Hydroxyl groups on the surface give AFM® a strong negative charge known as the zeta potential that attracts heavy metals and organic molecules. In the presence of oxygen or oxidising agents the catalytic surface generates free radicals that make AFM® self-sterilising.

## Your advantages at a glance

- ✓ **Crystal clear water** – AFM® filtration is much finer and much more stable than quartz sand or normal glass media
- ✓ **No Bacteria** – Legionella, vibrio, cryptocaryon and many other pathogens grow in the protection of the biofilm. No biofilm means no place for pathogens to hide in the filter.
- ✓ **pH stability** - No bacterial nitrification in the filter that would otherwise depress the pH. Biofiltration can be deported to a more appropriate, well aerated vessel.
- ✓ **Reduced bioload** - No bacteria means less total load on the system and lower chlorine consumption in chlorinated systems
- ✓ **No smell of chlorine** – No heterotrophic bacteria means no trichloramine and thus no disturbing smell and harmful disinfection by-products.
- ✓ **Ecological and economical** – No Biofilm means AFM® saves energy and chemical consumption by filtering more efficiently and saves 50% of backwash water compared to sand.

### Dryden Aqua AFM® Aquarium LSS

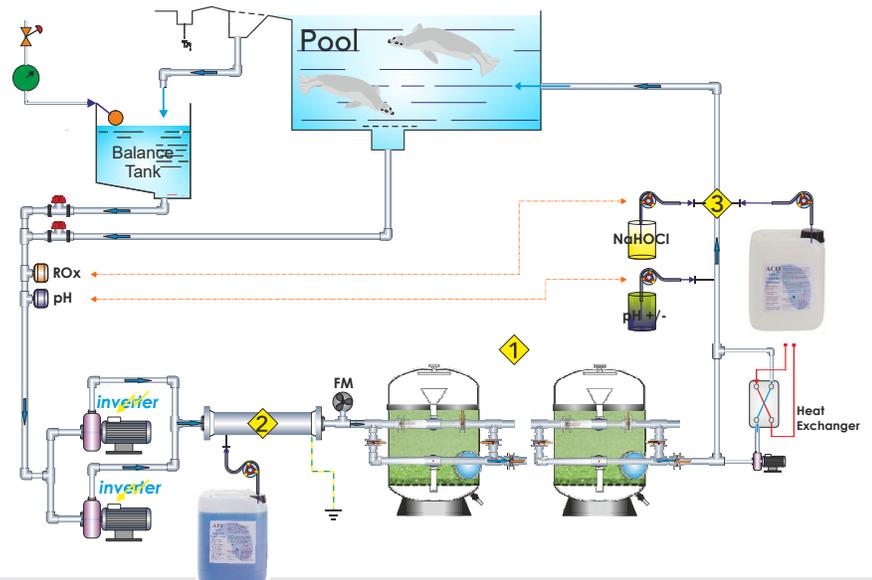
There are many possible aquarium LSS schematic configurations. The following is just one example.



- 1 **1<sup>st</sup> Circuit** Biofiltration + Filtration with AFM®
- 2 **2<sup>nd</sup> Circuits** By-pass circuits e.g. protein skimmer
- 3 **3<sup>rd</sup> Circuits** For mixing/water movement.

### Dryden Aqua Integrated System (DAISY) for Mammals

DAISY was developed with the aim to eliminate production of harmful disinfection by-products.



- 1 **Filtration with AFM®**
- 2 **Coagulation and flocculation with APF and ZPM**
- 3 **Catalytic oxidation with ACO**

## AFM® Technical data

### What is the recommended layering of AFM®?

If you are currently using sand or glass sand simply replace this in your filter with AFM®.

While sand has a specific weight of 90 lb/ft<sup>3</sup>, the specific weight of AFM® is 78 lb/ft<sup>3</sup>, and therefore it needs about 15 % less AFM® according to weight.

For example: if your filter contains 350 lb of sand, only 300 lbs of AFM® are needed.

AFM® is supplied in four different grain sizes and should be used as follows:

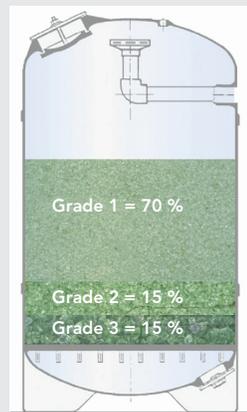
**AFM® grade 0** = grains of 0.01 to 0.02 in,  
for fine 1µ filtration only

**AFM® grade 1** = grains of 0.016 to 0.04 in,  
in the upper layers of the filter = 70 %

**AFM® grade 2** = grains of 0.04 to 0.08 in,  
for support of grade 1 = 15 %

**AFM® grade 3** = grains of 0.08 to 0.16 mm,  
for support of grade 2 = 15 %

For all DIN filters with nozzle plates, grade 3 can be substituted with grade 2.



### Operating criteria:

Recommended filtration velocity:  
6 - 10 gpm/ft<sup>2</sup>

Backwash: AFM® grade 1 minimum 18 gpm/ft<sup>2</sup>  
AFM® grade 0 minimum 10 gpm/ft<sup>2</sup>

Required backwash bed expansion: min 15 %

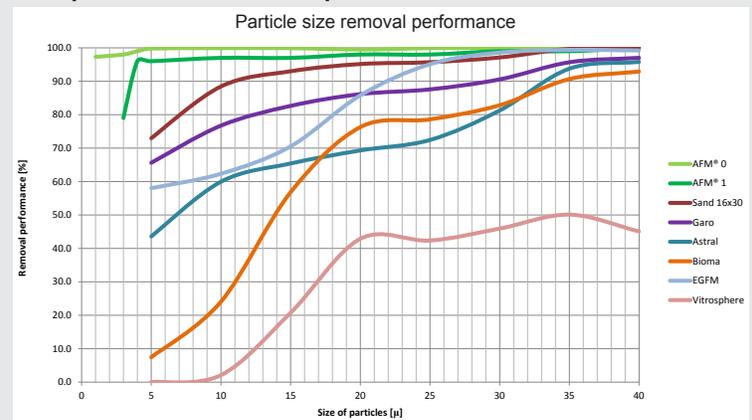
### AFM® grade 1 specification:

Specific weight:	78 lb/ft <sup>3</sup>
Effective size:	0.018 in
Hardness	> 7 mohs
Sphericity:	> 0.7
Roundness:	> 0.6
Uniformity coefficient:	< 1.5 to 1.7
Cross-sectional ratio:	2 to 2.4
Specific gravity:	150 lb/ft <sup>3</sup>
Purity:	99,95 %
Embodied energy:	<65 kwh/t
Bulk bed density:	10.4 lb/gal
Organic material:	< 50 ppm

### Chemical composition in %:

Silica	72	Calcium	11
Magnesium	2	Lanthanum	1
Sodium	13	Cobalt	0.016
Aluminium	1.5	Lead	<0.005
Antimony	<0.001	Mercury	<0.0005
Arsenic	<0.0001	Titanium	<0.1
Barium	0.02	Rubidium	<0.05
Cadmium	<0.0001	Iridium	<0.05
Chromium	0.15	Platinum	<0.0001

### Comparison of Filtration performance:



## Who is Dryden Aqua?

We are a Scottish marine biological company founded in 1980 primarily to serve the aquaculture industry and AFM was developed specifically for aquaculture and aquarium use. Our unique knowledge combination and detailed understanding of biological as well as physico-chemical reactions has since enabled us to develop into other markets where sustainable water treatment processes can make a difference.

Our passion however remains in the aquaculture and aquarium industries which provided the foundation for our commitment to conservation and sustainable technology. Our mission is to help make the world a better place by providing solutions that save lives in developing countries, improve overall public health around the world and have a positive environmental impact on our ecosystem.