TEST REPORT N. RA_2019_00004811

Filtration efficiency and retention capacity test
according to NF P 90-319 § 4 with derogation
Domestic swimming pools — Filtration groups and systems —
Test method for evaluating the filtration efficiency, the retention capacity and the mechanical resistance

§ 4 Measure of filtration efficiency and retention capacity

Sample ref. AFM 21 ng (0,4 - 0,8mm) Sample 2

CUSTOMER IDENTIFICATION	
Company	**DRYDEN AQUA**
Address	BUTERFIELD INDUSTRIAL ESTATE, EH19 3JQ EDINBURGH UNITED KINGDOM
Contact	**Mr Mike CAUSER**
Purchase order nb	P05085

IFTS REFERENCES	
Purchase order nb	ARC_00005012
IFTS Order n.	AFF_00004159
Quotation n.	DEV_00005083.00

Written by
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Validated and signed by
Test Manager

Pierre-Colin GERVAIS

REVISION TABLE			
Date	*Version*	*Reason for revision*	*Revision Description*
10/08/2019	RA_2019_00004811	Initial release	

1 - SCOPE

DRYDEN AQUA has requested IFTS (Institut de la Filtration et des Techniques Séparatives) as per purchase order number P05085 to evaluate the performance of a specified number of samples according to NF P 90-319 §4 with derogation - Domestic swimming pools - Filtration groups and systems - Test method for evaluating the filtration efficiency, the retention capacity and the mechanical resistance §4 : Filtration efficiency and retention capacity.

The data contained in the following paragraphs establishes the report of the test performed on the sample identified in paragraph 2 of this document. A separate test report is issued for any other test requested as per the purchase order.
This test has been performed with qualified personnel using thoroughly selected equipements in order to comply with test conditions summarized in paragraph 3 of this document. IFTS is accredited by the COFRAC to carry out tests and perform modular activities dealt with by the ISO/IEC 17025.

2 - TEST SAMPLE

Sample ref.	*IFTS ref.*
AFM 21 ng (0,4 - 0,8mm) Sample 2	ECH_00031256
Grade 3 (2 - 4mm)	ECH_00031263

Sample ref. : AFM 21 ng (0,4 - 0,8mm) Sample 2 and Grade 3 (2 - 4mm)
supplied by DRYDEN AQUA

3- TEST CONDITIONS

3.1 Determination of the filtration efficiency and the retention capacity

The following test conditions have been applied :

- Standard : NF P 90-319 §4 with derogation*
- Multipass circulation of contaminant
- Test liquid : Filtered water
- Temperature : 23°C
- Contaminant : ISO CTD
- Initial contaminant concentration : 5 mg/L
- Test flow rate : 0,37 m3/h
- Test volume : 41,9 L
- Counting sizes : 1, 2, 4, 6, 8, 10, 20, 25 µm
- Flow speed : 20 m3/h.m²

*In terms of concentration, couting sizes and test volume

3.2 Picture and size of the installation

The main pump of the test circuit is installed upstream tested filter
- Column size H=205 cm ; d=15,4 cm ; Ω=0,0186 m²
- Filtration's beds sizes :
  Height / Diameter(AFM 21 ng (0,4 - 0,8mm) Sample 2) : H=85 cm / d=15,4 cm
  Height / Diameter(Grade 3 (2 - 4mm) Sample 9) : H=15 cm / d=15,4 cm

Fig 1. : Picture of test rig

4- TEST RESULTS

4.1 Test end criteria

	Test end criteria	Actual value	End criteria
Final ΔP - Initial ΔP (kPa)	70 kPa	3	No
Test duration (min)	≥ 360	362	Yes

4.2 Filtration performances

Retention capacity (g)	Filtration ratio 80% (µm)	Filtration efficiency 45µm (%)	Comments
11,39	< 1	> 98,9	/

The global filtration rating and the global filtration efficiency are calculated based on total counting data relative to all the test duration at 5 mg/L.

4.3 Detailed test results

Test identification

Test date : 03/10/2019	Operator : ML	IFTS n. : ECH_00031256

Customer reference

Filter ref. : AFM 21 ng (0,4 - 0,8mm) Sample 2

Test parameters

Test fluid : Filtered water	Test dust : ISO CTD	Batch n. : 13388C

Test results

Parameters		Contaminant injection				Particle counting			
Test flow rate (m3/h)	0,37	Flow rate (L/h)	Concentration (mg/L)			Counter	Sensor	Flow rate (mL/min)	Volume (mL)
Temperature (°C)	23,4		Initial	Final	Average				
Concentration (mg/L)	5,2	10,02	202	181	191,5	PAMAS 2132	WaterViewer	25	25
Test duration (min)	362								

Initial cleanliness (#/mL)

Particle number/mL	Sizes (µm)	> 1	> 2	> 4	> 6	> 8	> 10	> 20	> 25
	Upstream	**110,52**	**75,64**	**33,6**	**12,96**	**7,48**	**5,68**	**2,4**	**1,76**
	Downstream	**42**	**23,84**	**10,16**	**5,12**	**4,08**	**3,88**	**3,32**	**2,92**

Filtration efficiency and Particle number (#/mL)

Sizes (µm)		> 1		> 2		> 4		> 6		> 8		> 10		> 20		> 25	
Upstream	E (%)	12702	94,6	8737	96,9	3359	99,3	1338	99,9	559	99,9	274	99,9	20	99	8	98,9
Downstream		684		270		25		2		0		0		0		0	

Retention capacity

Final concentration (mg/L) :	4,38	Volume (L) :	41,9		
Injected mass (g) :	11,6	Non-retained mass (g) :	0,18	Retention capacity (g) :	11,39

Retention capacity :	CR=	11,4	g
Filtration efficiency (45µm) :	E45=	> 98,9	%
Filtration ratio (80%) :	S80=	< 1	µm

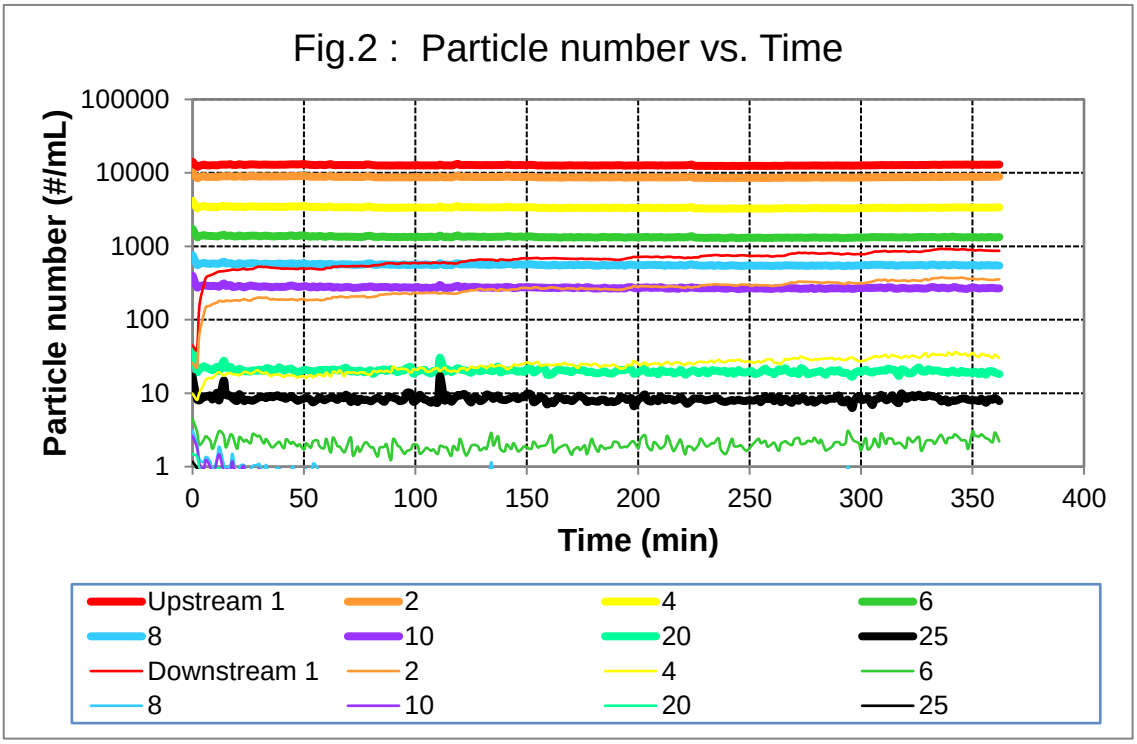
Fig.2 : Particle number vs. Time
Particle number (#/mL)
100000
10000
1000
100
10
1
0
50
100
150
200
250
300
350
400
Time (min)
Upstream 1
2
4
6
8
10
20
25
Downstream 1
2
4
6
8
10
20
25

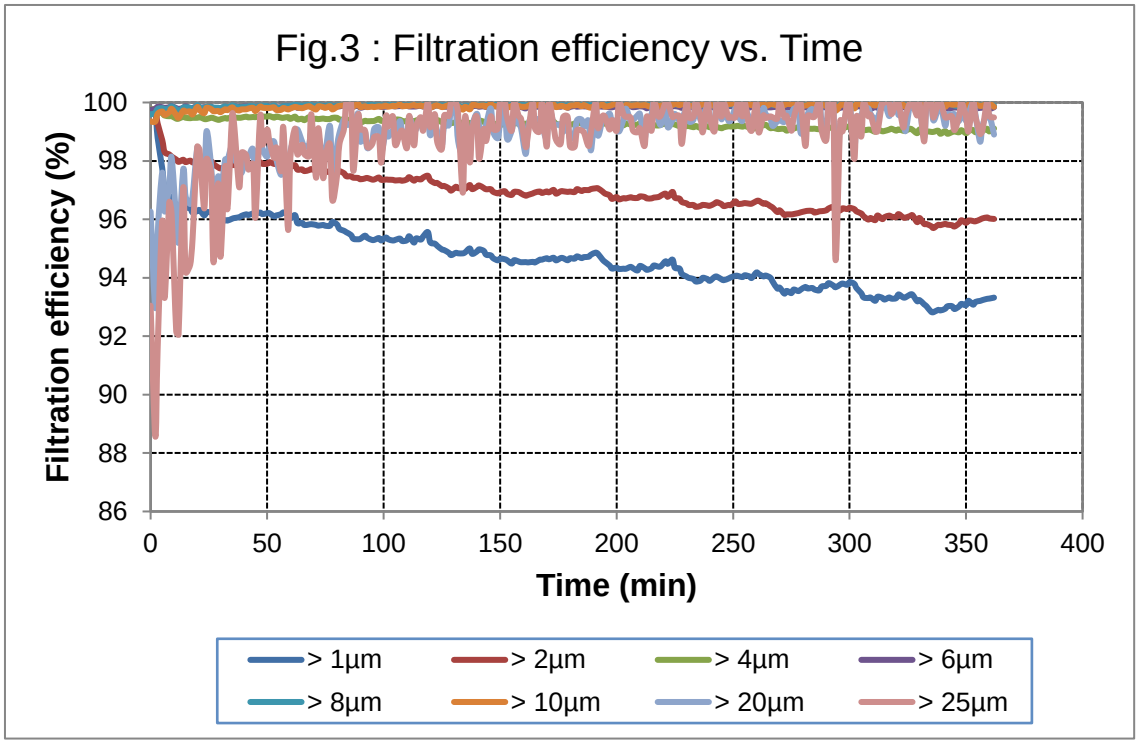
Fig.3 : Filtration efficiency vs. Time
Filtration efficiency (%)
100
98
96
94
92
90
88
86
0
50
100
150
200
250
300
350
400
Time (min)
> 1µm
> 2µm
> 4µm
> 6µm
> 8µm
> 10µm
> 20µm
> 25µm

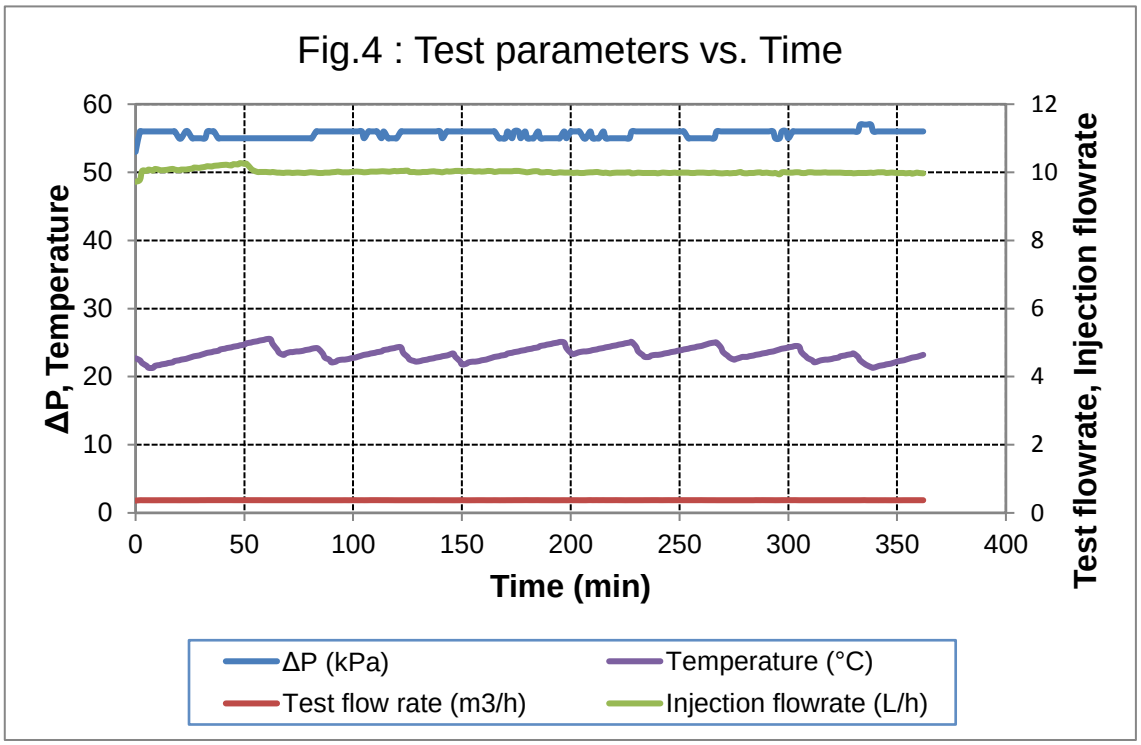
Fig.4 : Test parameters vs. Time
ΔP, Temperature
Test flowrate, Injection flowrate
Time (min)
ΔP (kPa)
Temperature (°C)
Test flow rate (m3/h)
Injection flowrate (L/h)

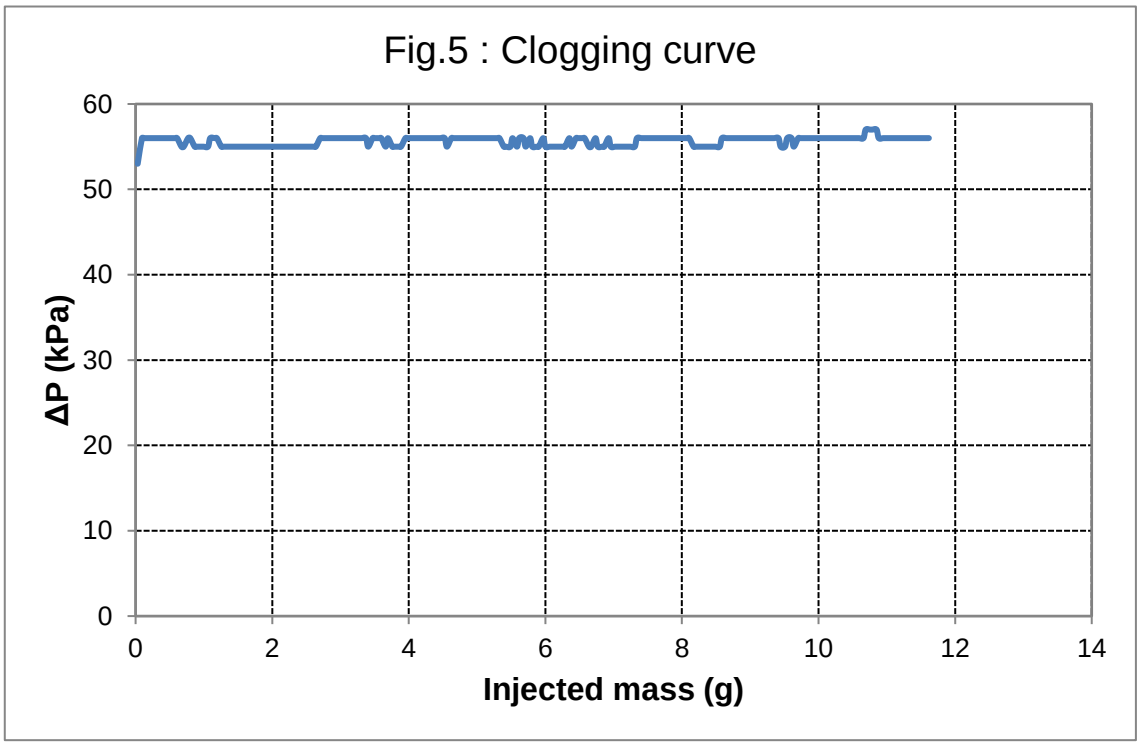
Fig.5 : Clogging curve
ΔP (kPa)
Injected mass (g)

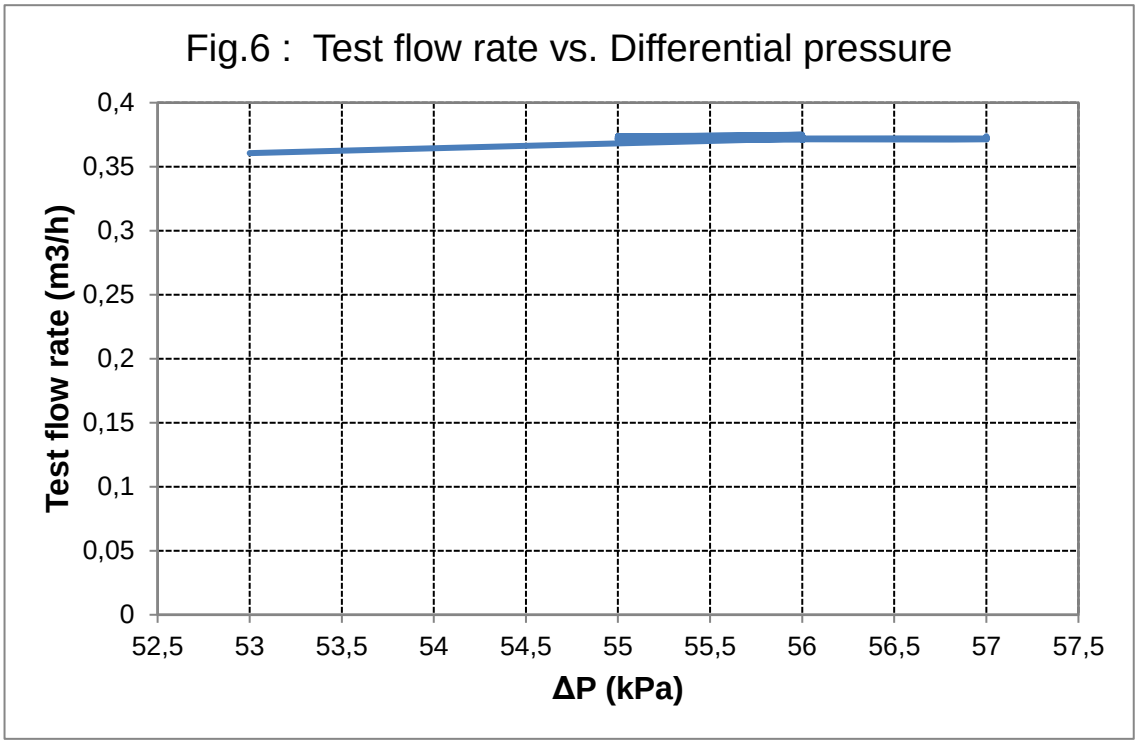
Fig.6 : Test flow rate vs. Differential pressure
Test flow rate (m3/h)
0,4
0,35
0,3
0,25
0,2
0,15
0,1
0,05
0
52,5
53
53,5
54
54,5
55
55,5
56
56,5
57
57,5
ΔP (kPa)

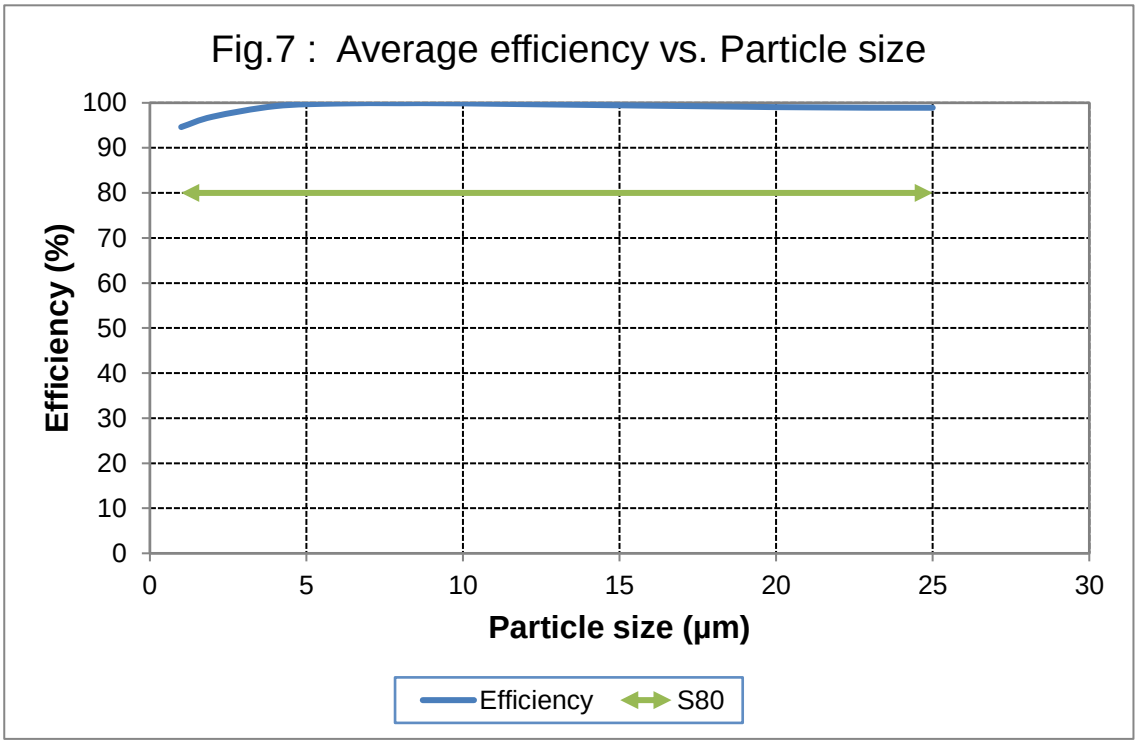
Fig.7 : Average efficiency vs. Particle size
Efficiency (%)
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
Particle size (µm)
Efficiency
S80