EUREKA FORBES
Your friend for life

Get Membrane like Performance without Membrane !!!!!

Get Membrane like Performance .....at 30% life cycle cost !!

"AUTOMATED VARIABLE FILTRATION" AVF TECHNOLOGY

EUREKA FORBES LIMITED

Head Office:
B1/B2, 701 Marathon Innova, Off
Ganpatrao Kadam Marg, Lower Parel,
Mumbai – 400 013
Tel: 022-30449782

Sales Office
Eureka Forbes Limited
No:88, 4th Floor, Anmol Palani Building
GN Chetty Road, T. Nagar,
Chennai– 6000017

Contact
Water Projects Division
H. Venkatraman
Manager Business Development
Mobile 9381750003
Tel: 044-30289285
✉ : venkat.r@eurekaforbes.com

FORBES PRO
WATER PROJECTS

What is Automated Variable Filtration ?

Are you saving money by reusing your effluent water through tertiary treatment ?

If NOT, then get AVF now !

If YES, then

Are you using expensive membranes to make your effluent water process/ potable quality ?

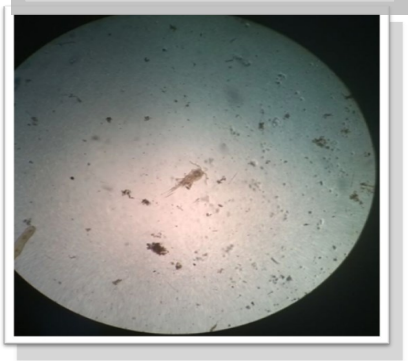
Are you incurring high operation and maintenance cost running the pressure filters or membranes ?

If YES, then get AVF now !

AVF is the state of art tertiary waste water treatment technology which is useful for removing suspended matter, BOD, reactive substances & phosphorous, making water suitable for reuse. It can effectively remove bacterial contamination and micro-organisms like *Giardia*, *Cryptosporidium* and Cyclops that so far, required expensive membranes for removal.

The technology is simple enough and yet more effective compared to other conventional treatment systems. It utilizes proprietary engineered media, which does not require rejuvenation. This technology achieves performance equivalent to expensive micro-filtration membranes which need frequent replacements. Lower capital cost and operating cost as low as one-third of membrane technologies makes AVF a compelling value proposition.

Simplicity of operation is an added advantage over membrane technologies that require complex controls and instrumentation. The upward flow of influent is cleaned by downward floe of filter media. Thus, no requirement of additional filter media cleaning process.



Why AVF- Automated Variable Filtration ?

FEATURES	BENEFITS
·**Continuously cleaned media bed**	No shutdown for backwash cycles Elimination of ancillary backwash equipment No flow control valves, splitter boxes or backwash controls
·**No underdrains or screens**	No short-circuiting
·**Media washed with filtrate**	Optimum media-washing efficiency Superior filtrate quality
·**No level control**	Reduced operator attention Minimizes overall pressure-drop
·**Internal, vertical airlift**	Reduces potential for pluggage Significantly reduces wear/ maintenance Can be easily maintained without filter shutdown
·**Low power requirements**	Up to 70% less compressed air vs. other self-cleaning filters

WORKING PRINCIPLE– AVF

⇒ Feed water shall be pumped to proposed AVF units. After influent feed is introduced at the top, it flows downward.

⇒ The feed is introduced into the bottom of the media bed through a series of feed radials. As the influent flows upward through the downward moving media bed, organic and inorganic impurities are captured by the media.

⇒ The clean, polished filtrate continues to move upward and exits at the top of the filter over through the effluent pipe. A small volume of compressed air is introduced at the bottom of the airlift, drawing the media into the airlift pipe.

⇒ The media is scoured within the airlift pipe. The effectiveness of this scouring process is vastly greater than what can be expected in conventional sand filtration backwash.

⇒ The scouring dislodges any solid particle attached to the media grains. The dirty slurry is pushed to the top of the airlift and into the reject compartment.

⇒ As the media cascades down through the concentric stages of the washer, it encounters a small amount of polished filtrate moving upward.

⇒ The clean recycled media is deposited on the top of the media bed where it once again begins the influent cleaning process and its eventual migration to the bottom of the filter.

What it delivers for Tertiary Sewage Treatment Applications ?

Parameter	Unit	After AVF treatment
BOD	mg/lit	<10 *
COD	mg/lit	<60 *
Total Suspended Solids	mg/lit	<10
Oil & Grease	mg/lit	Nil
Phosphorous	mg/lit	<2
Nitrogen	mg/lit	< 10 **
Turbidity	NTU	<5

* Removal of particulate BOD / COD ** With biological de-nitrification

Civil Units in making

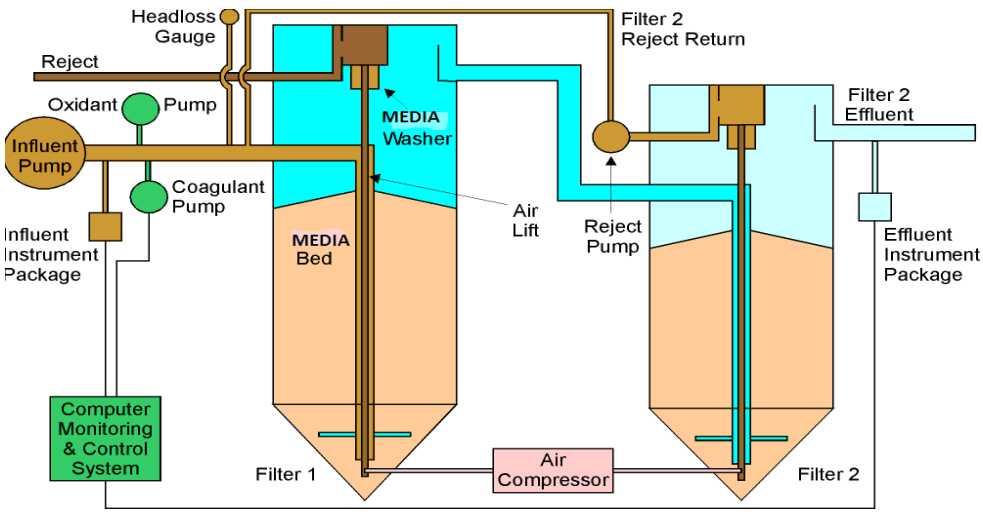
Pre-fabricated Unit

Applicable for all size

Ideally suited for large flow rates

Convenient system

Typical Two Stage AVF



FORBES PRO WATER PROJECTS

PILOT STUDY– PASHAN LAKE WATER TREATMENT

This Lake is an artificial lake near the suburb of Pashan. The lake was built in the 1990s to accommodate the water requirement of the neighborhood. The main inlet of the lake is a small river (*Ram Nadi*), which is even controlled by the barrage located to the north of the lake. Pashan lake has a total catchment area of 40 square kilo-meters, and serves as a source of water to the old Pashan village. Recent urbanization around the lake has led to the fall in the quality of the water which was potable earlier. The lake and its surrounding area attract migratory birds. It is a popular spot for bird watchers. The uncontrolled growth of weed, including hyacinth, is an indicator of rising pollution. The water has now Cyclops, diatoms, worms & so on with presence of BOD / COD / Phosphorous / TKN as per the analytical water reports.

Eureka Forbes & PRO Canada team met the PMC officials and presented them the unique technology AVF – Automated Variable Filtration which removes the suspended / particulate matter with great efficiency and simplicity. The officials were impressed with the technology presentation and asked us, if we could demonstrate the purification of Pashan Lake water and thereby removing the contaminants like BOD / COD / E-coli / TKN / Phosphorous etc. We agreed immediately & they built a system on this unique AVF technology. The AVF system is installed & commissioned near Pashan Lake campus and it is presently treating @ 35,000 Lt. water per hour.

Presently, the water from the under drain system of the lake is taken into a Jackwell. The submersible pumps installed in this well lifts the water in feed it to the Raw water tank 1. The water from this tank overflows into Raw water tank 2. Both these tanks are of HDPE, 7.5 m3 capacity. They are provided with the aeration by the help of twin lobe blower & the air grid placed at the tank bottom. The Dissolved Oxygen (DO) in the water is increased by aeration and the aerated water goes again by gravity into the Raw Water Tank 3.

From here, the water is pumped to the AVF system. Two pumps are installed for the purpose. The Coagulation & Sodium Hypo chloride is dosed online before static mixer and water goes to the inlet chamber of AVF 1. The Flocculent is dosed in this chamber and the water goes into the AVF 1.

The outlet of AVF1 is taken to the 2nd stage AVF 2 for further filtration. The AVF 1 & AVF 2 reject lines are connected together & taken to the drain through valves/ rotameters. A very small portion of air is induced at bottom of both AVF filters to keep the media in fluidized condition and thereby making the water sparkling clean.

Raw water **AVF Treated- 1st Stage** **AVF Treated- 2nd Stage**

The treated water can be used for Varity of applications as it is free from germs, cycst, cyclops, suspended matter and has very low levels of BOD / COD / TKN etc. We measure the turbidity of water online using HACH meters and have got excellent results. The inlet turbidity of water was @ 22 NTU & we got 0.22 NTU at the outlet of AVF which is unheard in media filtration process. The water is sparkling clear and ready to be reused.

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PILOT STUDY– PASHAN LAKE WATER TREATMENT

UNIK Lab
Environmental & Chemical Analysts

912 Sadashiv Peth, Deepvijay Apartment, Near Kalanjali Silk & Sarees, Pune 411030. Phone : **020 24490360/61.**
E-mail : uniklab@gmail.com, info@uniklab.in

TEST REPORT

Report No.: 1606/54,55,56,57 **Date:** 27/Jun/2016

Name of the Company: Forbes Enviro Solutions Ltd. Shivne
Site- Pashan lake

Type of sample: Pashan Lake water

Your Ref. No.: Personal discussions with Mr. Jaikrishnan

No. of Samples: Four

Date of receipt of sample: 21/06/2015

Sample collected by : Party

Sr. No.	Parameters	Values			
		A	B	C	D
1	Turbidity as NTU	19.2	16.5	1.6	0.4
2	COD	51.2	35.2	19.2	12.8
3	3 days BOD @27°C	13.5	9.5	2.5	1.6
4	Total Kjeldahl Nitrogen as N	19.04	12.6	8.96	3.64
5	Phosphate as P	1.044	0.84	0.69	0.64
6	Coliform Bacteria MPN/100ml	> 1600	> 1600	> 1600	7.8
7	E Coli Per 100 ml	Present	Present	Present	Absent
8	Colour, Hazen units	1.0	1.0	0.0	0.0
9	Total Suspended solids	36.0	22.0	7.0	3.0

(All values except pH are in mg/l)

Analyst *Lab in-charge*

1. The analysis is carried by using standard methods.2. Results pertain only to the sample tested.3. Report in full or part shall not be reproduced without written permission of Unik Lab.4.Sample will be preserved for 7 days after analysis and date.

< 0.5 NTU TURBIDITY

Raw water AVF Treated Water Reject water

LAB REPORT FROM UNIK LAB– 27TH JUNE

Sr. No.	Paramater	Raw Water - Pashan Lake (A)	Aerated Water - AVF 1 Feed (B)	Treated Water - AVF 1 Outlet (C)	Treated Water - AVF 2 Outlet (D)
1	Turbidity	19.2	16.5	1.6	0.4
2	COD	51.2	35.2	19.2	12.8
3	3 days BOD	13.5	9.5	2.5	1.6
4	Total Kjeldahl Nitrogen as N	19.04	12.6	8.96	3.64
5	Phosphate as P	1.044	0.84	0.69	0.64
6	Coliform Bacteria MPN / 100 ml	> 1600	> 1600	> 1600	7.8
7	E Coli / 100 ml	Present	Present	Present	Absent
8	Colour Hazen units	1	1	0	0
9	Total Suspended solids	36	22	7	3

APPLICATIONS OF AVF TECHNOLOGY

- Municipal / Township level drinking water treatment
- Sewage water recycle & reuse
- Industrial Waste water recycle & reuse



- Cooling water side stream filtration
- Desalination projects water filtration
- Algae water filtration



- Fly ash pond water filtration
- Replacement of slow sand filters
- Industrial Side Stream Filtration.



- Where phosphorous & bacterial removal after filtration will be an advantage

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USEPA—APPROVAL

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 100007-1866

Dual media ™ is EPA Approved as Equivalent to Membrane Microfiltration

Dual media ™ provides removal of pollutants to levels previously achievable only by Microfiltration

Dear Interested Party:

The United States Environmental Protection Agency, Region 2 (EPA) and the New York State Department of Heath (NYSDOH) are soliciting your input as to weather Continuous Backwash Upflow Dualmedia Filtration (CBUDSF) should be approved as equivalent to microfiltration for removing *Giardia* cysts and *Cryptosporidium* oocysts from treated wastewater discharged in New York City's drinking watersheds.

Test Results of New Study (cont'd)

...12 runs...large loadings.
…outstanding performance...7- log removal.
...detected no (oo)cysts.
…rigorous statistical analysis...95% accuracy.
...exceeded SWTR/proposed regulations for *Giardia* and *Cryptosporidium* for drinking water filtration.

COMPARISON BETWEEN AVF & GRAVITY SAND FILTERS

PARAMETERS	AUTOMATED VARIABLE FILTRATION– AVF	GRAVITY FILTERS
Treated water quality	AVF has demonstrated 7 log removal of micro-organisms like Giardia and Cryptosporidium and gives water quality equivalent to membrane micro filtration. Higher bed depth of media results into higher dirt loading capacity.	It removes only suspended matters and gives the treated water quality equivalent to conventional sand filters i.e. < 5 NTU turbidity at very low inlet levels.
Backwash equipments	As backwash is continuous and it is a continuously cleaned media filter, no provision is needed for backwash water tank & backwash pump / piping etc.	For backwashing, separate backwash pumps, valves and piping shall be required
Standby Unit	As backwash is continuous & service is also continuous, standby filter is not required for backwash	During backwashing, standby filter or shutdown is required
Power	As there is no requirement of high flow rate backwash pumps, power consumption shall be very less.	As separate backwash pumps required for backwashing, comparatively, power consumption is very much on higher side
Manpower	As backwash is continuous and it is a continuously cleaned media filter, almost no intervention of operating persons needed. You save on dedicated operator cost.	Backwash frequency is daily hence the dedicated manpower is required & more intervention of operating persons needed.
Backwash	Since backwash waste volume is in small proportion, backwash waste recycle sump shall be very small. Ideally it can be recycled back to the clarifier inlet directly.	Since backwash waste volume is very large, backwash waste recycle sump shall be of huge capacity. This is additional cost since water is scarce & needs to be saved.
Footprint	AVF design requires lesser space than that of gravity filters. Approximate 50 m2 area is required for 6.5 MLD WTP	Gravity filters operate on lower velocities and hence require more space. Approximate 80 m2 area is required for 6.5 MLD WTP
Civil works	Civil works involved in AVF is comparatively less as there is no need to construct OH tank for back wash or backwash recirculation sump etc.	Civil works involved in gravity filter is more than that in AVF
Media	Engineered filter media is required. The life if this media is very high. Only 2 to 3% make up would be required per year.	Conventional sand media is required. After every 2-3 years media needs to be replaced making it costly & time consuming.
Peak Load	AVF can take momentary peak loads effectively thereby maintaining constant water quality.	Conventional gravity filters cannot handle variations in inlet parameters effectively.

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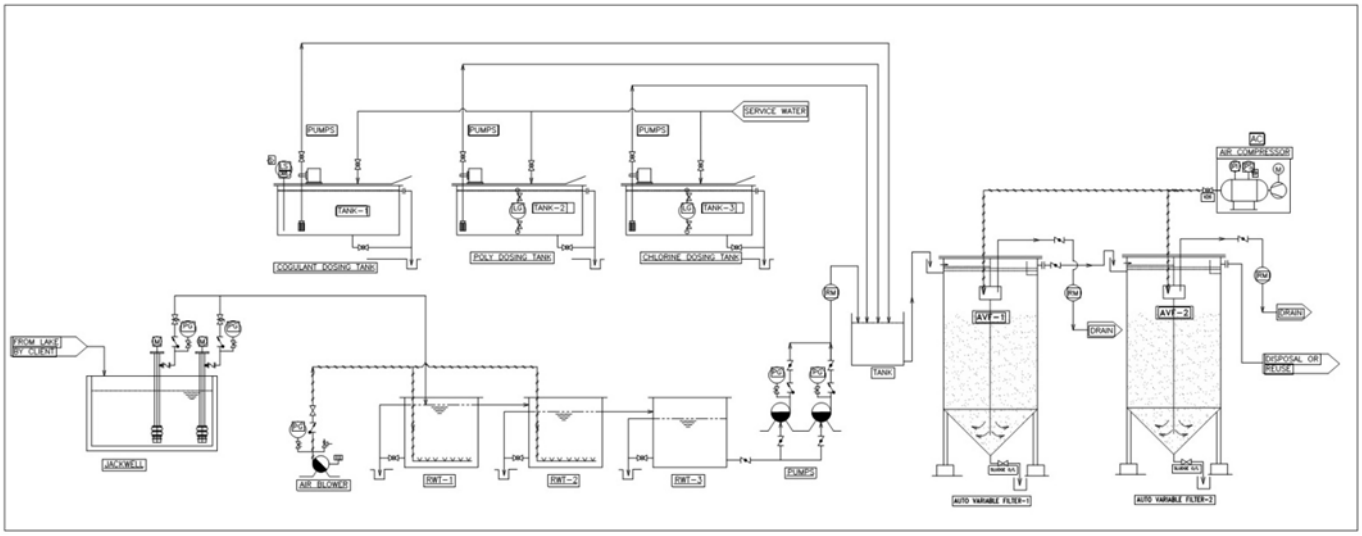
PROCESS DIAGRAM



PUNE MUNICIPAL CORP- REPORT

PUNE MUNICIPAL CORPORATION

पुणे महानगरपालिका
मुख्य जलकेंद्र पुणे ३०.
जोयक क्र.-Lab No-E87
दिनांक- 20/08/2016

Parvati Water Works Laboratory

Date: - 20/08/2016
Report Code E-87

Bacteriological and Chemical Report Of Water Samples Collected as on 16/08/2016
Challan No.0095686 Challan Date16/08/2016 Amount (RS): 3620/-
Sr. No. Water Sample Collection Address

1) Eureka Forbes Ltd.Shivane Pune-411023 Pashan lake Water and Filter Water samples.

Sr. No.	Parameter	As per I.S. Standard No. 10500:2012				
		Pashan Lake water **Sample No.1**	Pashan Lake Treated Water through Eureka Forbes AVF Technology **Sample No. 2**	Desirable Limit	Permissible Limit	Unit
1	Colour	20	3	5	15	Hazan
2	PH	7.74	8.13	Between 6.5 To 8.5	No Relaxation	–
3	Turbidity	8.70	0.6	Max 1	Max 5	N.T.U.
4	Hardness	345	338	Max 200	Max 600	PPM
5	Alkalinity	336	334	Max 200	Max 600	PPM
6	Chlorides	120	110	Max 250	Max 1000	PPM
7	Nitrate	2.4	1.3	Max 45	No.relaxation	PPM
8	Nitrite	0.15	0.04	-	-	PPM
9	Coliform	35000	0	0	0	100ml
10	E-Coli	17000	0	0	0	100ml
11	Residual Chlorine Test	NIL	0.1	0.2	-	PPM
12	TDS	463	469	Max 500	Max 2000	PPM

Remark:- सदरचा नमुना/नमुने मालकानी स्वत: आणून दिला. उपरोक्त नमुना/ नमुने हा प्रतिनिधिक असल्याचे गृहीत धरले आहे. सदरचा अहवाल हा वैयक्तिक माहीतीसाठी असून, याचा वापर कुठल्याही प्रकारच्या परवान्यासाठी केल्याने उद्भवणाऱ्या कायदेशीर बाबींस हे कार्यालय जबाबदार असणार नाही. तसेच नमुनांच्या उद्गमाविषयीचा पडताळा हया कार्यालयामार्फत केलेला नाही.

Note :- 1) Sample No. 1 Pashan Lake Raw Water is not potable as per IS 10500:2012
2) Sample No.2 " AVF " treated Pashan lake Water confirms to IS 10500:2012 For Bacteriological Parameters Only

केमिस्ट 22/8/16

IIT VARANASI- REPORT

भारतीय प्रौद्योगिकी संस्थान
INDIAN INSTITUTE OF TECHNOLOGY
(काशी हिन्दू विश्वविद्यालय)
(BANARAS HINDU UNIVERSITY)
रासायनिक अभियांत्रिकी एवं प्रौद्योगिकी विभाग
DEPARTMENT OF CHEMICAL ENGINEERING & TECHNOLOGY
(उन्नतशील केन्द्र एवं डी एस टी प्रायोजित "पिराट" विभाग)
(CENTRE OF ADVANCED STUDY & DST DEPARTMENT UNDER FIST)
(वाराणसी - २२१००५) Varanasi - 221005

Date: 7.10.2016

To whom it mat concern

I have studies and verified the technology "AVF- Automated Variable Filtration" being promoted by Eureka Forbes Limited.

The technology uses continuous backwash up-flow filter mechanism. The technology is unique and simple in operation and maintenance. The turbidity removal efficiency is excellent and the treated water turbidity is below 0.5 NTU. The conventional method of gravity filtration can not remove bacterial species effectively. However, AVF can effectively take care of these problems at very low cost and at small space requirement. It can be very effective for removal of TSS of industrial effluents and hence BOD/COD if TSS has organic content.

I visited the Pilot plant at Pashan Lake in Pune and found that AVF is also highly efficient in removal of Cyclops and other bacterial contamination along with SS and turbidity. It may be noted that the BOD/COD related to particulate matter only be removed in this operation and there will not be reduction in dissolved solid.

(B.N. Rai)
Dr. B.N. RAI
Professor
Deptt. of Chem. Engg. & Tech.
IIT (B.H.U.), Varanasi

Fax: 091-0542-2368092; Email: bnrai.che@itbhu.ac.in

CONSULTANT- REPORT

Communication Address -
Flat no. 6, Vishnu-Laxmi Soc.,
S.No. 8-9, Erandawana,
Behind Karve Road Telephone Exchange,
Off. Karve Road, Pune 411004.
Maharashtra. INDIA
Tel - 25441705 25444124
ketan@aquaconsultants.in

Aquamate Consultants Pvt. Ltd.
(Water Supply, Drainage, Storm Water Designing)
www.aquaconsultants.in

Ref : ACPL/Ref/1060 Date : 04.10.16

To whomsoever it may concern

The "AVF – Automated Variable Filtration" was installed for trials at Nanded City Township Campus, Pune by Eureka Forbes Limited.
The technology uses continuous backwash up-flow filter mechanism. The technology is unique and simple in operation & maintenance.
The Dam water was fed to the AVF plant after pre-treatment & the turbidity was reduced from 20-25 NTU at inlet to lower than 0.5 NTU at outlet consistently for a period of 6 months. The water was potable for human consumption after AVF system.
The revised drinking water standards can be met effectively & consistently with "AVF" technology in cost effective manner.
The AVF, two stage plant was also tested at Nanded City for tertiary sewage filtration where it demonstrated excellent reduction in TSS / BOD / COD / TKN as supplemented by lab reports. The secondary treated sewage water after AVF filtration was clear transparent in appearance and was exceeding all disposal / reuse water standards for sewage.

With Kind regards

Mr. Ketan Dantale
Director
AQUAMATE CONSULTANTS PVT. LTD.

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