ABS VENTURI JET AERATOR

For the mixing and aeration of wastewater

Application Areas
The ABS venturi jet aerator is used for a variety of applications in treatment plants, balancing tanks and in storm water retention tanks. While mixing or aeration units may be more efficient as stand alone units for a specific process, the combined effect of mixing and aeration gives certain process advantages.The venturi principle and theory of aeration is explained later in the leaflet.

The relatively low capital cost and easy installation plus the use of standard sewage pumps explains the popularity of these units.

Ejector Principle
An ABS submersible pump generates the primary flow (water). The reduced cross section area in the nozzle accelerates the flow as it enters into the suction zone. The increased flow velocity lowers the pressure in this zone enough to suck in air (secondary flow). When passing the mixing zone the primary and secondary flows mix completely due to turbulence, and leave the diffuser as a water jet with fine air bubbles.
The inclusion of air bubbles in the stream is of major assistance to the mixing process.The bubbles attach themselves to particles in suspension with the result that the rate of settlement is reduced and a better mixing achieved.
In order for the biological processes to take place i.e. for the breakdown of the bacteria mass from the waste materials present, the bacteria need energy. This is obtained from the metabolic processes. These metabolic processes only take place if adequate dissolved oxygen is present in the liquid.
The bacteria use up the available oxygen relatively quickly.
In order to prevent the bacteria dying it is necessary to introduce oxygen into the liquid via the aeration system.
The ABS venturi is an ideal unit for oxygen enrichment.

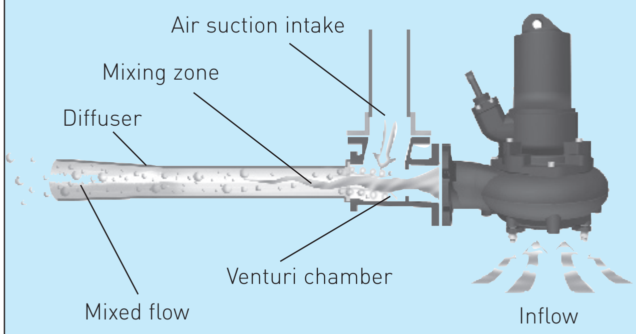
Oxygen content /oxygen uptake
Oxygen content: The proportion of soluble oxygen in water cannot normally exceed the saturation value.
This is mainly dependent on the temperature and to a lesser degree on the barometric pressure. The maximum oxygen content of fresh (non- sea water) is as follows:

An average value for water is only 10mg /1 = 0,001 % oxygen.
The higher the oxygen deficiency the higher is the oxygen input.

Temperature °C	0	5	10	15	20	25	30
Oxygen Content mg / 1	14.6	12.8	11.3	10.1	9.1	8.3	7.6

Definition: Oxygen deficiency
The oxygen deficiency is the oxygen quantity in mg /1, by which the actual oxygen content is less than the saturation value at the particular liquid temperature.

Venturi jet principle



- ☐ Extremely simple installation, even in a flooded tank
- ☐ Ideal for mixing, combined with aeration of waste waters containing sewage, offal, organic industrial effluent, slurry etc
- ☐ No need for compressed air supply as it is self aspirating
- ☐ Used in balance tanks to mix effluent while the addition of oxygen helps prevent septicity
- ☐ Ideal for cleaning of storm tanks
- ☐ Can supply oxygen for aeration in breakdown or overload circumstances
- ☐ Low noise level compared to surface systems
- ☐ No aerosol effect
- ☐ Can be used where water levels vary
- ☐ Standard ABS pump from the AFP range
- ☐ Special structures such as bridges, not needed

Air/Oxygen

The composition of air in the atmosphere is more or less constant. In air we have:

- ☐ 20.9% volume oxygen
- ☐ 78.0% volume nitrogen
- ☐ some carbon dioxide
- ☐ some hydrogen
- ☐ inert gases

The solubility or oxygen saturation concentration of oxygen in water is a property of this liquid which is of major importance for all aeration processes. The solubility of oxygen in water is limited. The temperature of the water is also a major factor. Water at 0°C can absorb approximately double the 02 of water at 30°C.

The oxygen transfer from air into water is based on the physical process of diffusion (mutual combination of 2 or more gases liquids or solutions). The diffusion takes place at the border area between air and water. The diffusion velocity (water / air - air / water) is dependent on the oxygen content of the water. The lower the oxygen content of the water the higher the diffusion velocity of air.

Oxygen Uptake

The oxygen uptake is dependent on the water temperature.
The oxygen uptake rises with the sewage temperature.
The oxygen saturation value falls as the temperature rises.

Sewage temperature	Oxygen usage	Maximum oxygen saturation level for sewage
10°C	4.5 mg 0_2 /1 per hour	Approx. 11.3 mg 0_2 /1 sewage
20°C	9mg 0_2 /1 per hour	Approx. 9.1 mg 0_2 /1 sewage
30°C	18 mg 0_2 /1 per hour	Approx 7.6 mg 0_2 /1 sewage

Influence of the jet depth on the input of oxygen

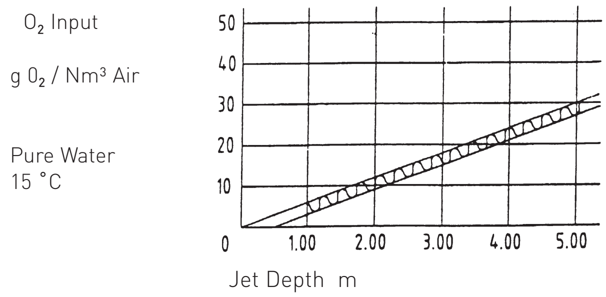


Table of air flow and liquid flow

Pump Type*	kW	Nozzle ømm	quantity	Air : Nm³/h water depth 1.5	3	4	5	6	Water m³/h	Tank Shape dimensions: m		
AFP 1041.4 M15/4	1,5	55	1	56	39	35	-	-	50	6.0 x 4.0	4.9	5.5
AFP 1041.3 M22/4	2,2	55	1	70	47	40	-	-	70	7.2 x 4.8	5.9	6.6
AFP 1041.1 M30/4	3,0	55	1	75	56	48	-	-	100	8.0 x 5.3	6.5	7.4
AFP 1042.3 M40/4	4,0	55	1	95	62	50	-	-	140	9.5 x 6.3	7.8	8.8
AFP 1541.1 M60/4	6,0	80	1	170	115	97	90	80	190	12.0 x 8.0	9.8	11.1
AFP 1541.A M90/4	9,0	80	1	230	170	160	140	120	240	15.0 x 10.0	12.2	3.8
AFP 1543.2 ME160/4	16,0	80	1	390	284	273	263	231	315	17.5 x 11.5	14.2	16.0
AFP 2045.1 ME185/4	18,5	80	2	560	440	405	360	330	500	21.0 x13.0	16.4	18.0

*Note: Other pump types may also be used

Performance data for venturi jet showing oxygen transfer at different water depth immersion

Pump Type*	Jet DN x N	Water Circulation m³/H	Oxygen Transfer Kg/H 1.5m depth	Oxygen Transfer Kg/H 3.0m depth	Oxygen Transfer Kg/H 4.0m depth	Oxygen Transfer Kg/H 5.0m depth
AFP 1041.4 M15/4	100 x 1	50	1.00	1.40	1.68	-
AFP 1041.3 M22/4	100 x 1	70	1.26	1.70	1.92	-
AFP 1041.1 M30/4	100 x 1	100	1.35	2.00	2.30	-
AFP 1042.3 M40/4	100 x 1	140	1.71	2.23	2.40	-
AFP 1541.1 M60/4	150 x 1	190	3.00	4.14	4.65	5.40
AFP 1541.A M90/4	150 x 1	240	4.14	6.12	7.68	8.40
AFP 1543.2 ME160/4	150 x 1	315	7.02	10.22	13.10	15.78
AFP 2045.1 ME185/4	150 x 2	500	10.08	15.84	19.44	21.60

*Note: Other pump types may also be used

The oxygen transfer has been measured as per ASCE Standard procedures "Measurement of Oxygen Transfer in Clean Water" ed. 1992

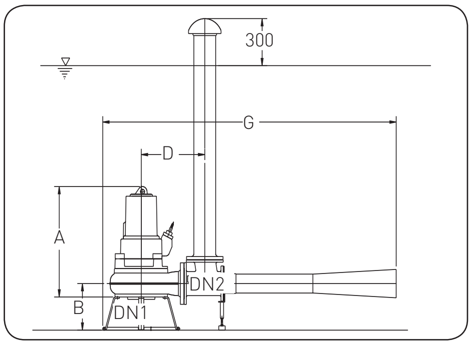
Technical Data

Pump Type AFP	Motor Type M	Jet DX x N	Internal diameter mm x DN	Air inlet DN	Motor Power* P_1 kW	P_2 kW	speed RPM	voltage V	amps A	type of cable** Direct	YΔ	Water m^3 /H	Weight kg
AFP 1041.4	M15/4	100 x 1	55 x 1	100	2.69	1.95	1450	400	5.4	(1)	-	50	88
AFP 1041.3	M22/4	100 x 1	55 x 1	100	3.06	2.20	1450	400	5.7	(1)	-	70	88
AFP 1041.1	M30/4	100 x 1	55 x 1	100	4.21	3.00	1450	400	7.5	(1)	-	100	95
AFP 1042.3	M40/4	100 x 1	55 x 1	100	5.25	4.00	1450	400	8.7	!2)	(2)	140	130
AFP 1541.1	M60/4	150 x 1	80 x 1	150	7.35	6.00	1450	400	12.9	(2)	(2)	190	155
AFP 1541.A	M90/4	150 x 1	80 x 1	150	11.30	9.00	1450	400	20.0	(1)	(1)	240	122
AFP 1543.2	ME160/4	150 x 1	80 x 1	150	18.76	16.00	1450	400	30.0	(3)	(3)	300	227
AFP 2045.1	ME185/4	150 x 2	80 x 2	150	22.1	18.5	1450	400	35.1	(3)	(3)	500	266

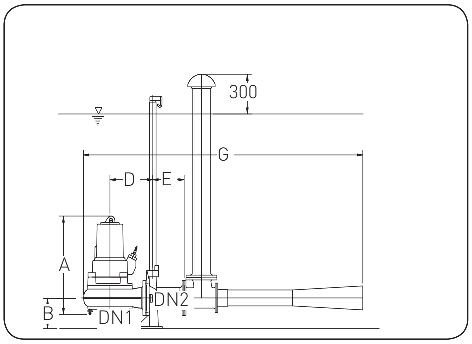
* P_1 = Power taken from mains; P_2 = Power at motor shaft;
Stator insulation class F (155°C);
Protection Type IP 68 Thermal sensors in stator to protect motor from overheating;
Moisture probes in the oil chamber; Maximum temperature 40° for continuous operation;
80° for intermittent operation.

**Pumps are supplied as standard with 10m cable and free ends

Dimensions in mm

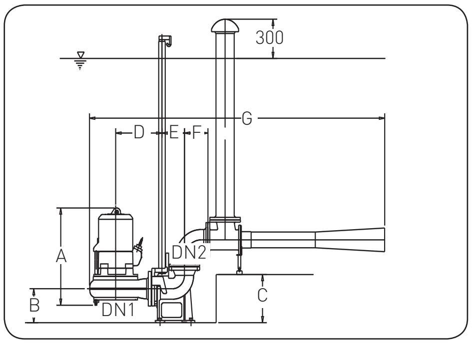


	AFP 1041 M22/4	AFP 1042 M40/4	AFP 1042 M90/4	AFP 1541 M40/4	AFP 1541 M90/4	AFP 1543 ME160/4	AFP 2045 ME185/4
A	534	618	622	618	662	802	25
B	269	286	286	286	286	320	386
D	390	390	390	470	470	495.5	560.5
G	1601	1601	1601	2204	2204	2289	2362
DN1	100	100	100	150	150	150	200
DN2	100	100	100	150	150	150	200**

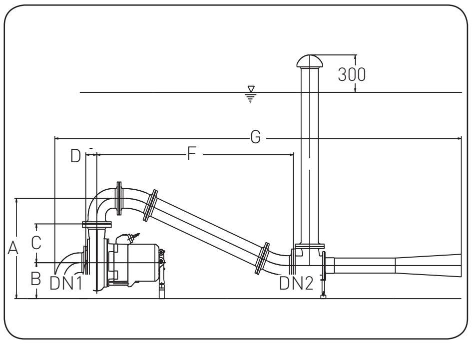


	AFP 1041 M22/4	AFP 1042 M40/4	AFP 1042 M90/4	AFP 1541 M40/4	AFP 1541 M90/4	AFP 1543 ME160/4	AFP 2045 ME185/4
A	534	618	662	618	662	802	825
B	200	200	200	250	250	250	290
D	357	357	357	408	408	433	535
E	Variable*	Variable*		Variable*		Variable*	Variable*
G	1590 +E	1603+E	1603+E	2530+E	2530+E	2586+E 2H	768+E
DN1	100	100	100	150	150	150	200
DN2	100	100	100	150	150	150	200**

*Variable (The length dimension depends on the customers own pipe length selection)



	AFP 1041 M22/4	AFP 1042 M40/4	AFP 1042 M90/4	AFP 1541 M40/4	AFP 1541 M90/4	AFP 1543 ME160/4	AFP 2045 ME185/4
A	534	618	662	618	662	802	825
B	225	225	225	280	280	280	320
C	371	371	371	463	463	463	550
D	357	357	357	408	408	433	535
E	180	180	180	210	210	210	245
F	180	180	180	220	220	220	260
G	1989	2002	2002	2707	2707	2763	2943
DN1	100	100	100	150	150	150	200
DN2	100	100	100	150	150	150	200**



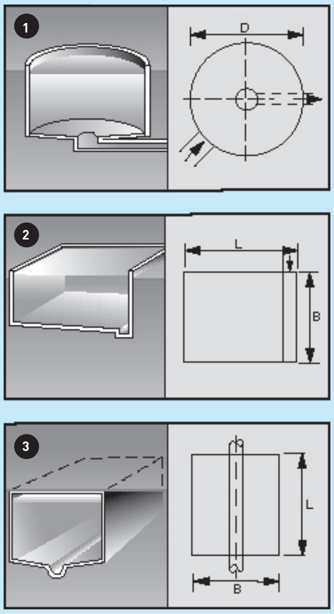
	AFP 1041	AFP 1042	AFP 1541	AFP 1543	AFP 2045
A	680	680	765	865	920
B	235	235	235	310	310
C	265	265	310	335	400
D	193	246	246	108	140
F	Variable*	Variable*	Variable*	Variable*	Variable*
G	Variable*	Variable*	Variable*	Variable*	Variable*
DN1	100	100	150	150	200
DN2	100	100	150	150	200**

*Variable (The length dimension depends on the customers own pipe length selection)
**Adaptor needed DN 200 to twin DN 150

ABS VENTURI JET AERATOR

ABS venturi jet for Storm Tank cleaning

Tank



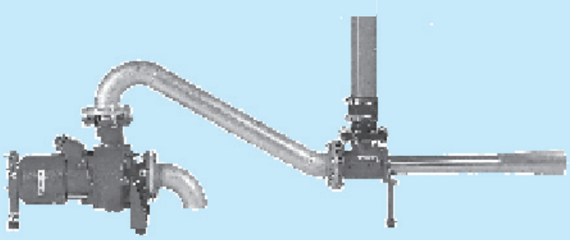
Tank dimensions area to be cleaned		Tank shape	ABS venturi jet	Jet (mm)
5.5 mø	(24m²)	I	AFP 1041.1 M30/4	100
6.5 mø	(33m²)	I	AFP 1042.3 M40/4	100
8.0 mø	(50m²)	I	AFP 1541.1 M60/4	150
13.0 mø	(133m²)	I	AFP 1541.1 M90/4	150
14.0 mø	(154m²)	I	AFP 1543.2 ME160/4	150
15.5 mø	(188m²)	I	AFP 2045.2 ME160/4	150
8.0 x 6.0m	(48m²)	2	AFP 1041.1 M30/4	100
10.0 x 8.0m	(80m²)	2	AFP 1042.3 M40/4	100
18.0 x 10.0m	(180m²)	2	AFP 1541.1 M60/4	150
22.0 x 12.0m	(264m²)	2	AFP 1541.1 M90/4	150
24.0 x 13.0m	(312m²)	2	AFP 1543.2 ME160/4	150
27.0 x 14.0m	(378m²)	2	AFP 2045.2 ME160/4	150
8.0 x 5.0m	(40m²)	3	AFP 1041.1 M30/4	10
10.0 x 6.5m	(65m²)	3	AFP 1042.3 M40/4	100
15.0 x 8.0m	(120m²)	3	AFP 1541.1 M60/4	150
20.0 x 10.0m	(200m²)	3	AFP 1541.1 M90/4	150
22.0 x 10.0m	(220m²)	3	AFP 1543.2 ME160/4	150
24.0 x 11.0m	(264m²)	3	AFP 2045.2 ME160/4	150

What happens:
A rain over-flow tank or storm water tank fills up after a large amount of rain has fallen.
Other particles such as dirt, sludge, solids, leaves and sand etc. get washed in together with the rain. These materials begin to putrify after a very short period. This gives rise to foul odours. It is necessary to clean the tank.

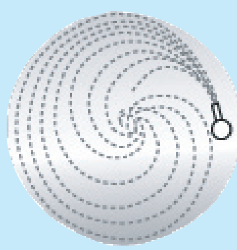
The cleaning process:
The venturi jet is based on the injection principle and is dimensioned so that a highly effective air-water mix is produced which results in optimum cleaning performance.
The air-water mix has a spread which is highly effective both in the production of horizontal and vertical flows, and results in thorough tank cleaning.
For optimum effectiveness of tank cleaning, it is essential that the ABS venturi jet is correctly positioned.

The ABS venturi jet is best set up at the deepest part of the tank. ABS submersible pumps of the AFP series are combined either in a horizontal or vertical manner with the venturi jet.
When using this system not only is the tank cleaned, but there is also an input of oxygen. Putrification of the organic matter is thereby delayed or prevented.
In addition this pre-aeration reduces the load on the treatment plant.
The maximum cleaning effect of the venturi jet is achieved when the tank is almost empty.
As a general rule, cleaning of the floor of the tank takes place when the water level has sunk to approximately 0.9m.
In the majority of cases it is necessary to have continuous operation until the tank has been emptied.

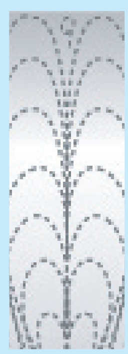
Venturi tank cleaning



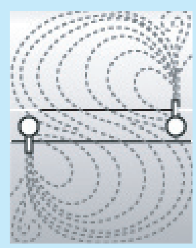
Tank shapes



1 Circular tank with central outflow



2 Rectangular tank with outflow at one end



3 Rectangular tank with central channel

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