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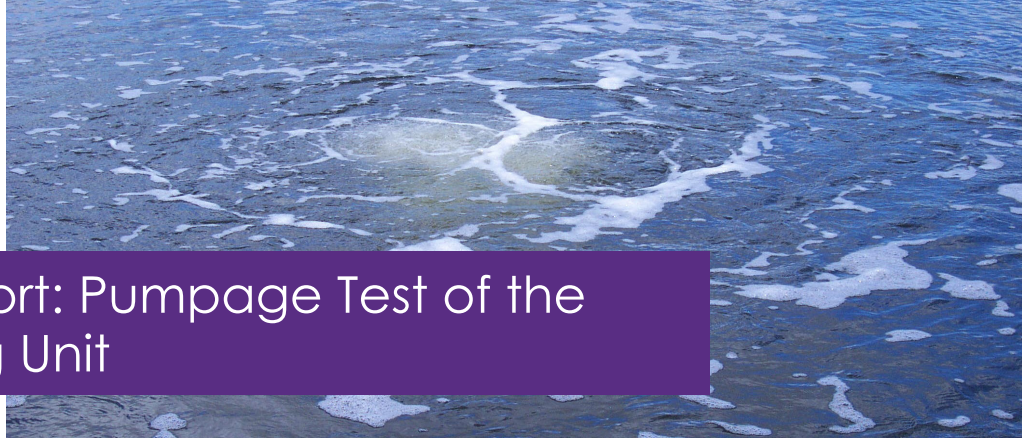


Independent Test Report: Pumpage Test of the Vertex Aeration/Mixing Unit

Testing Procedures

Testing was conducted June 28, 2001. Tests were conducted in a stainless steel test tank 25'x8'x16'.

The Vertex™ CoActive AirStation™ was operated at different depths to confirm performance levels.

Velocity and flow measurement and calculations came from data utilizing the equipment below.

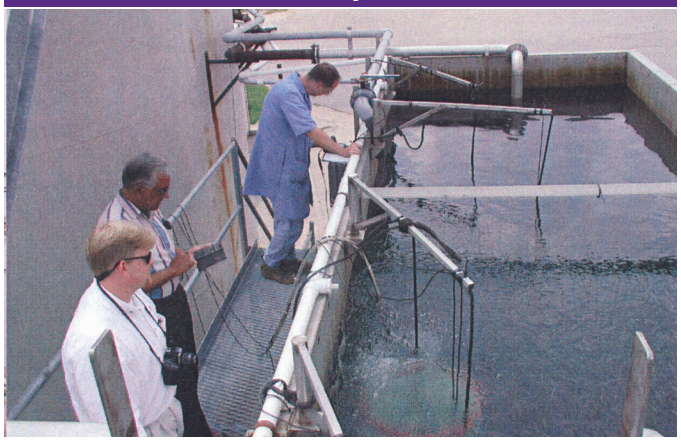
Equipment

- Positive displacement compressor provided the air supply.
- 0 to 90-scfh roto-meter was used to measure and adjustment the airflow.
- Swoffer™ Velocity Meter, Model 2100 was used to measure the water velocity.
- 2.7 square foot draft tube 3.0 feet high was used to channel the flow vertical for velocity measurement.
- Two underwater video cameras were used to confirm flow orientation of the velocity meter.

Methodology

- The velocity data was collected every 30 seconds then summed and averaged from three location radial from the center of the draft tube.
- This was done at each submergence depth.
- The direct pumped vs. submergence depth was then plotted on the attached chart.
- Direct pumpage was then plotted on the attached chart.
- Direct pumpage was calculated by; Q=VA, flow equals velocity times area.

Flow Velocity Test Tank



Flow Velocity Test Module

Testing Lab

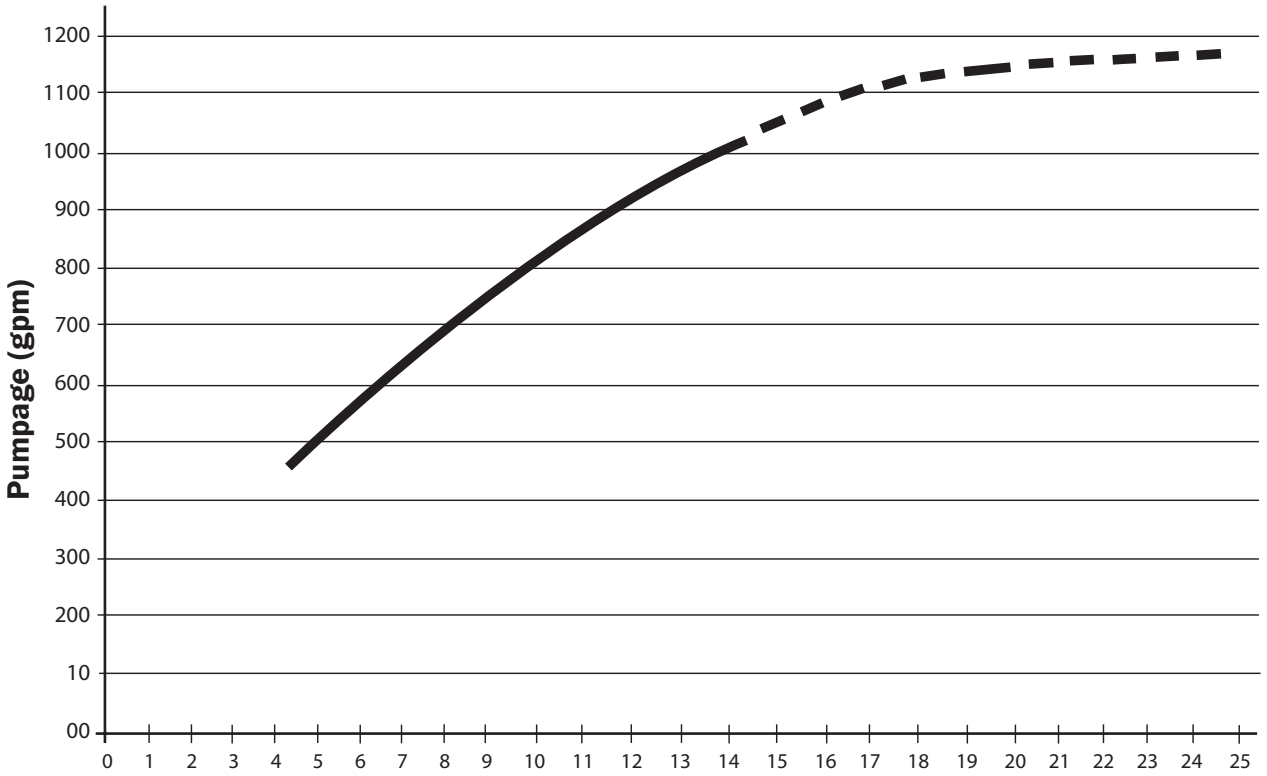
2100 NW 33rd St • Pompano Beach, FL 33069 • 844.432.4303 • vertexaquaticsolutions.com

Individual Test Data

VELOCITY (ft/sec)															
4 ft deep			6 ft deep			8 ft deep			10 ft deep			12 ft deep		
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
0.28	0.78	0.24	0.27	0.91	0.34	0.57	0.89	0.58	0.68	0.97	0.74	0.29	1.00	1.31
0.20	0.48	0.20	0.25	0.57	0.53	0.31	0.82	0.44	0.70	0.94	0.70	0.25	0.72	1.07
0.19	0.64	0.31	0.23	0.70	0.41	0.60	0.73	0.48	0.76	0.88	0.69	0.24	0.88	0.51
0.15	0.50	0.23	0.20	1.00	0.44	0.47	1.03	0.56	0.67	1.04	0.65	0.23	0.72	0.70
0.20	0.43	0.19	0.22	0.84	0.35	0.56	0.73	0.47	0.83	1.24	0.67	0.59	1.05	0.78
0.17	0.40	0.17	0.52	0.86	0.42	0.52	0.86	0.76	0.79	1.29	0.68	0.36	1.03	0.63
0.20	0.50	0.12	0.45	0.94	0.49	0.24	0.88	0.77	0.62	1.14	0.74	0.57	1.24	0.49
0.22	0.73	0.22	0.20	0.98	0.63	0.55	0.66	0.74	0.55	0.76	0.68	0.69	1.15	1.10
0.26	0.87	0.80	0.36	1.01	0.48	0.46	0.86	0.56	0.48	0.88	0.36	0.70	0.96	0.97
0.19	0.88	0.62	0.45	0.91	0.30	0.38	0.86	0.72	0.37	0.88	0.47	0.45	1.06	1.22
0.16	0.72	0.35	0.37	0.54	0.20	0.53	1.13	0.28	0.29	0.75	0.51	0.36	0.62	1.08
0.26	0.89	0.49	0.29	0.53	0.51	0.49	0.56	0.44	0.24	0.83	0.64	0.73	0.62	0.80
0.16	0.51	0.55	0.28	0.41	0.48	0.48	0.77	0.75	0.23	0.96	0.70	0.68	0.73	0.93
0.16	0.70	0.40	0.29	0.42	0.51	0.42	0.72	0.49	0.37	1.06	0.63	0.57	0.91	0.59
0.18	0.67	0.33	0.36	0.35	0.70	0.63	0.76	0.22	0.34	1.14	0.56	0.71	0.91	0.74
0.26	0.64	0.02	0.28	0.49	0.42	0.46	0.79	0.58	0.42	1.02	0.59	0.78	1.09	0.59
0.21	0.46	0.53	0.22	0.87	0.23	0.31	0.64	0.72	0.55	0.84	0.54	0.49	1.08	0.89
0.18	0.52	0.60	0.20	0.63	0.43	0.18	0.72	0.59	0.68	1.26	0.50	0.71	0.69	0.83
0.15	0.53	0.54	0.26	1.02	0.23	0.37	0.61	0.57	0.47	0.99	0.66	0.69	0.69	0.76
0.25	0.65	0.42	0.21	0.98	0.43	0.22	1.02	0.48	0.30	1.07	0.52	0.39	0.87	0.68
0.15	0.70	0.10	0.23	0.95	0.84	0.38	0.50	0.64	0.24	0.97	0.48	0.60	1.17	0.80
0.18	0.75	0.38	0.25	0.76	0.61	0.57	0.87	0.30	0.30	1.13	0.70	0.73	1.27	0.77
0.15	0.72	0.24	0.23	0.75	0.40	0.38	0.70	0.40	0.36	1.02	0.68	0.83	1.06	0.84
0.22	0.64	0.43	0.21	0.55	0.70	0.27	0.97	0.42	0.37	0.64	0.69	0.82	1.16	0.67
0.19	0.50	0.22	0.33	0.68	0.50	0.20	1.22	0.66	0.40	0.83	0.92	0.71	1.08	1.05
0.17	0.50	0.13	0.20	0.68	0.46	0.56	0.94	0.58	0.45	1.05	0.49	0.84	1.27	0.89
0.14	0.64	0.10	0.21	0.67	0.42	0.26	1.03	0.65	0.48	0.91	0.77	0.91	0.73	0.95
AVERAGE														
0.19	0.63	0.33	0.28	0.74	0.46	0.42	0.82	0.55	0.48	0.98	0.63	0.59	0.95	0.84

Individual Test Data

Pumpage vs Submergence Depth Unit Operated at 1.0 cfm

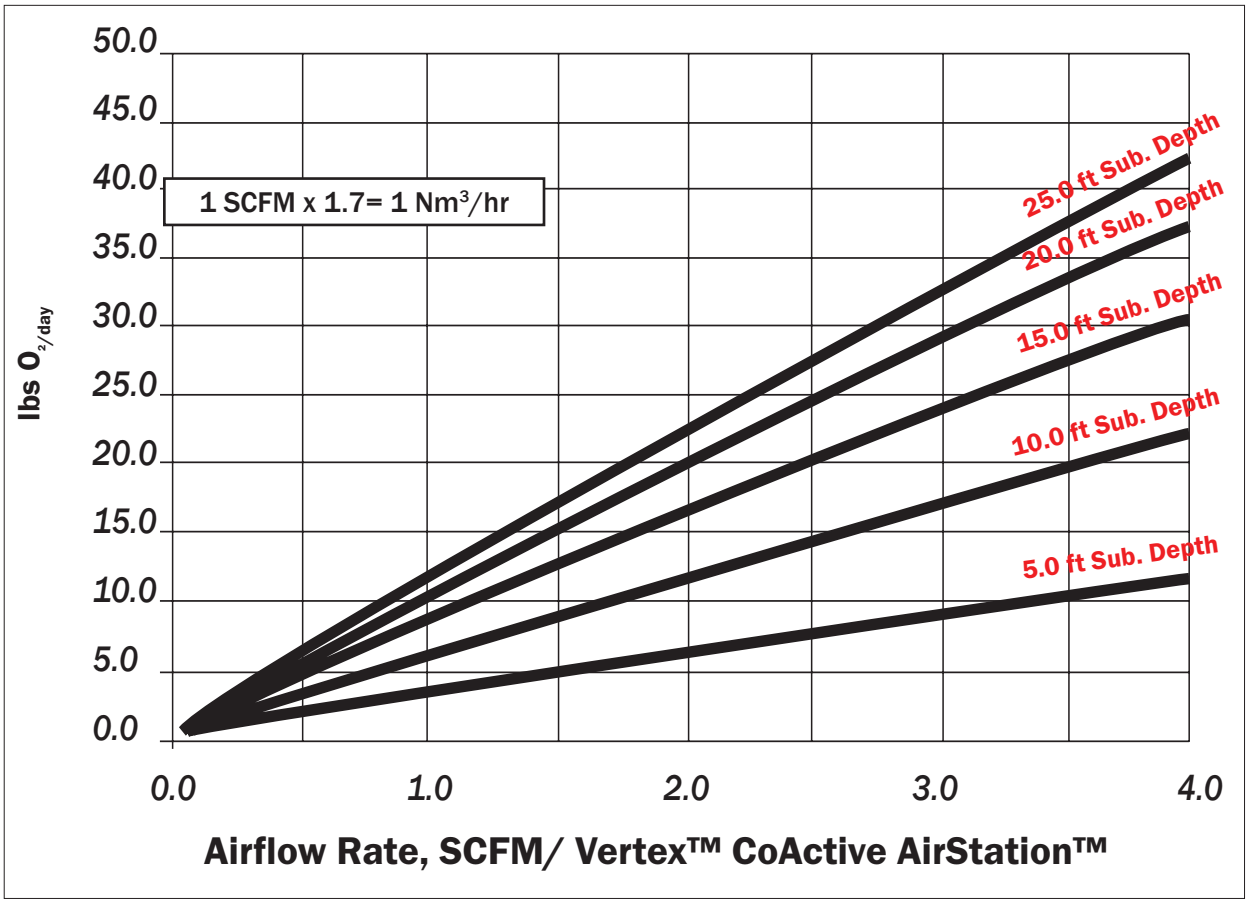


Note: Induced flow greatly increase total circulation values for the VertexTMunit. Induced flow also increase in respect to depth and creates circulation values of 2-5 times direct pumpage.

SUBMERGENCE DEPTH (ft)									
Location Velocity	Submergence depth(ft)	Point A	Point B	Point C	Average Velocity (ft/s)	Area (ft2)	Flow (ft3/s)	Flow (ft3/min)	Flow (gpm)
Average	4	0.19	0.63	0.33	0.38	2.7	1.04	62.22	465
Average	6	0.28	0.74	0.46	0.49	2.7	1.33	80.06	599
Average	8	0.42	0.82	0.55	0.60	2.7	1.62	96.98	726
Average	10	0.48	0.98	0.63	0.70	2.7	1.88	112.70	844
Average	12	0.59	0.95	0.84	0.79	2.7	2.14	128.64	962
Projected	14								1014
Projected	16								1100
Projected	18								1125
Projected	20								1150
Projected	22								1160
Projected	24								1170
Projected	26								1175

Flows from 14 to 26 foot submergence depth are projected from test data from 4 to 12 foot submergence.

Oxygen Transfer Curves Unit Operated at 1.0 scfm



Flow Velocity Test Apparatus for Vertex™ CoActive AirStation™

Letter of Certification

To Whom It May Concern:

This is to advise that the Vertex™ CoActive AirStation™ was tested at a Clean Water Testing Facility on June 28, 2001. This testing procedure was designed to demonstrate the ability of the Vertex™ unit to pump and circulate water in lake, reservoir, or other basins.

This is to certify that the test procedure and the test apparatus were operated in accordance with testing plan and procedures attached herewith. The testing was conducted inside a stainless steel tank 8 feet x 25 feet x 16 feet sidewall depth and utilized one Vertex™ CoActive AirStation™ diffuser mounted in a cylindrical draft tube. This device was used to create vertical flow streams generated by the diffuser, whose velocities could be measured.

The test procedure was designed to measure the direct pumpage of the Vertex diffuser unit. The aeration unit could be moved to submergence different depths so that the pumpage rate of the unit could be measured at these depths. Thus, a pumpage curve could be created for the unit at different submergence depths. It should be recognized that the direct pumpage was the only measurement conducted. Total circulation capability of the device includes the direct pumpage plus secondary pumpage created by induced flow entrained during the rise of the air bubbles from the diffusers.

The testing procedure employed two 9 inch disc diffuser units. The units were installed in a draft tube. Velocities of the liquid pumped through the draft tube were measured after the flow had stabilized and then at 30 second intervals at multiple locations over the surface of the draft tube. The velocities were averaged to generate a typical average velocity through the draft tube. This allowed calculation of the approximate pumpage of the diffuser units using the relationship: Flow, Q = Area (A) x velocity (V). The velocities and the resulting pumpage rate data of the unit at various depths are attached herewith.

The testing was witnessed by Mr. Cary Martin, Sales Manager, Vertex Water Features, Dr. Henry Liu, Professor Emeritus, Civil & Environmental Engineering Department, University of Missouri and myself.

I certify the testing procedures outlined above and the test apparatus are as described in this document and the test results.

Sincerely,

Shankha K. Banerji., Ph. D., P.E.
Missouri Professional Engineer
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