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Hydraulic Evaluation of the LEANCON Wave Energy Converter

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by

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Preface

This report is a product of the co-operation agreement between Aalborg University and LEANCON (by Kurt Due Rasmussen) on the evaluation and development of the LEANCON wave energy converter (WEC). The work has focused on evaluation of the power production of the device, based on laboratory testing of a model of the WEC provided by LEANCON.

LEANCON, represented by Kurt Due Rasmussen, has been extensively involved in the testing of the device, including the instrumentation, model setup and execution of the tests in the laboratory, all under the supervision of the personnel of the Wave Energy Research Group at Department of Civil Engineering, Aalborg University.

The report has been prepared by assistant professor Jens Peter Kofoed (e-mail: jpk@civil.aau.dk) in co-operation with associate professor Peter Frigaard, both from the Wave Energy Research Group at Department of Civil Engineering, Aalborg University.

Aalborg, Oct. 2008

Table of Contents

1 Introduction

1.1 The concept

The LEANCON WEC is a wave energy converter based on the concept of oscillating water columns. In working principle it differs from other OWCs in the way that it uses positive as well as negative pressure at the same time. This entails that the resulting vertical force on the WEC is minimized when the WEC stretches over more than one wave length, as illustrated in Figure 1.

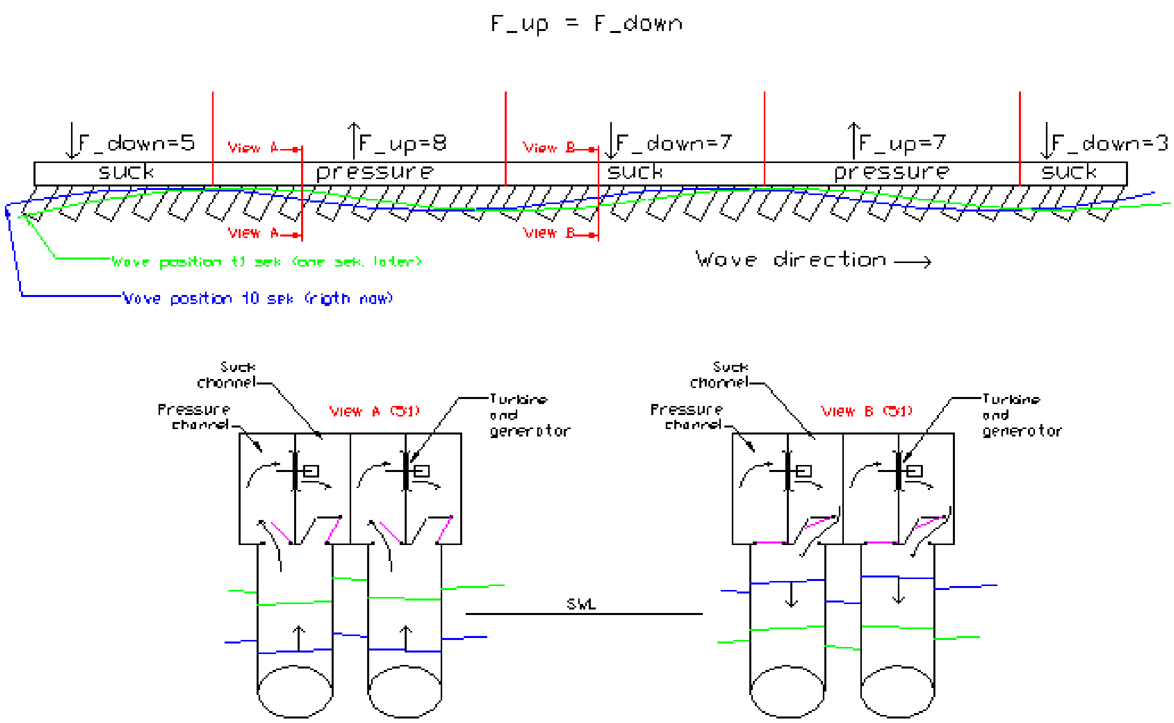

Figure 1 Illustration of LEANCON WEC working principle (http://www.leancon.dk/).

The “suction” forces (F_down) from the negative pressure on parts of the WEC prevent it from floating up on the top of the waves. In this way the device can have a low weight (constructed from high strength fiber material), which is expected to reduce production costs.

Before the air flow reaches the power take off system (PTO) the air flow has been rectified by the non-return valves also indicated in Figure 1. This means that the LEANCON WEC can use an ordinary air turbine, while most other OWC uses a Wells turbine. The expectation is that the efficiency of an ordinary single direction flow air turbine is considerably higher than it is the case for a bi-directional Wells turbine, even if considering the losses in the non-return valves. The intension is to have large holes over each tube (OWC chamber) covered with a light weight flap valve that directs the air in the wanted direction when it is open. Hereby pressure loss and turbulences are expected to be kept low.

1.2 Objectives

The objective of the work reported here, has been to estimate the power production potential for the LEANCON WEC for a realistic combination of wave states. Prior to the power production tests in irregular wave states, the device has been undergoing a large number of tests in regular wave states corresponding to equivalent irregular ones, to perform an optimization of the load (resistance to the air flow, corresponding to an air turbine as PTO in full scale device) for various drafts of the device.

The majority of the tests have been performed using a bottom fixed structure, but a number of tests have also been performed using two different floating configurations.

Finally, model tests were performed with the structure floating to estimate mooring forces in extreme conditions, for two different mooring configurations.

2 Laboratory test setup

The model tests have been performed using a 1:40 length scale model, provided by LEANCON. It consist of a total of 120 OWC chambers or pipes, arranged in two rows under two beams connected to each other in a V-shaped fashion, see Figure 2. The tests have been carried out in the deep 3-D wave tank at Department of Civil Engineering, Aalborg University.

Figure 2 The LEANCON WEC 1:40 scale model in the deep 3-D wave basin at Department of Civil Engineering, Aalborg University.

The model has been constructed so the channels for air intake and exhaust, respectively, are funneled into each a single tube, via flexible hoses, as shown in Figure 2.

The total width of model is 6.0 m, corresponding to 240 m in full scale. The water depth was 0,73 m, corresponding to 29.2 m in full scale..

The power absorbed by the device has been indirectly measured through continues times series of:

- Pressure in intake pipe p_i
- Pressure in exhaust pipe p_e
- Flow velocity (in exhaust pipe) v

Thus, the power P is calculated as the time average of:

$$P(t) = \left(p_e(t) - p_i(t)\right)v(t) \qquad =>$$

$$P = \overline{P} = \frac{1}{T_t}\int_0^{T_t} P(t)dt$$

Figure 3 Upper: Valve and scale for valve for regulation of flow (corresponding to load on PTO) in intake. Similar setup used for exhaust. Lower, left: Thermo based flow speed measuring device placed in exhaust pipe. Lower, right; Wave gauges placed in front of right half of model, used for reflection analysis of waves.

The flow in the exhaust pipes was measured using a thermal flowmeter (0-10 m/s), which had been carefully calibrated in the tube section used. A flow rectifier was used in the tube as well. For pressure measurements, highly sensitive gauges were used (0 – 500 Pa). Due to uncertainties on the flow measurements at very small flow speeds, some inaccuracies will be present in the measured power at the lowest wave conditions.

The scaling applied has been done according to the Froud Law, i.e. assuming inertia forces to be dominant. Resulting scaling ratios for relevant length scales are given in Table 1.

Table 1 Scaling ratios.

Parameter	Model	Full Scale	1:40	1:10	1:4
Length	1.0	S	40	10	4
Area	1.0	S^2	1600	100	16
Volume	1.0	S^3	64000	1000	64
Time	1.0	$S^{0.5}$	6	3.2	2
Velocity	1.0	$S^{0.5}$	6	3.2	2
Force	1.0	S^3	64000	1000	64
Power	1.0	$S^{3.5}$	404772	3162	128

2.1 Wave conditions

During the model testing of the LEANCON WEC a number of standard wave states were used, as recommended by Bølgekraftudvalget (2000). For tests related to power production estimation, the wave states listed in Table 2 were used as target. The corresponding wave state parameters for irregular, as well as regular, in model scale are also given in Table 5. The corresponding wave states for a scale 1:10 is also given, as this is expected to be representative for the situation at a proposed test location in Nissum Bredning, Denmark.

Table 2 Power production wave states, prototype scale (1:1).

Wave State	Hs [m]	Tz [s]	Tp [s]	Energy flux [kW/m]	Prob. occur. [%]
1	1.0	4.0	5.6	2.1	46.8
2	2.0	5.0	7.0	11.6	22.6
3	3.0	6.0	8.4	32.0	10.8
4	4.0	7.0	9.8	65.6	5.1
5	5.0	8.0	11.2	114.0	2.4

Table 3 Power production wave states, approximated Nissum Bredning scale (1:10).

Wave State	Hs [m]	Tz [s]	Tp [s]	Energy flux [W/m]	Prob. occur. [%]
1	0.1	1.3	1.8	7	46.8
2	0.2	1.6	2.2	37	22.6
3	0.3	1.9	2.7	101	10.8
4	0.4	2.2	3.1	207	5.1
5	0.5	2.5	3.5	360	2.4

Table 4 Power production wave states, model scale (1:40).

Wave State	Hs [m]	Tz [s]	Tp [s]	Energy flux [W/m]	Prob. occur. [%]
1	0.025	0.63	0.89	0.21	46.8
2	0.050	0.79	1.11	1.15	22.6
3	0.075	0.95	1.33	3.16	10.8
4	0.100	1.11	1.55	6.48	5.1
5	0.125	1.26	1.77	11.27	2.4

Table 5 Power production irregular wave states and corresponding regular wave states, model scale.

Wave State	Hs [m]	Tp [s]	H [m]	T [s]	Prob. occur. [%]
1	0.025	0.89	0.018	0.89	46.8
2	0.050	1.11	0.035	1.11	22.6
3	0.075	1.33	0.053	1.33	10.8
4	0.100	1.55	0.071	1.55	5.1
5	0.125	1.77	0.088	1.77	2.4

For tests related to extreme conditions, the wave states listed in Table 6 to Table 8 will be used as target.

Table 6 Extreme wave states, prototype scale (1:1).

Wave State	Hs [m]	Tz [s]	Tp [s]	Return period [years]
D10	8	9.4	13.1	10
D50	9	9.9	13.8	50
D100	10	10.4	14.5	100

Table 7 Extreme wave states, approximated Nissum Bredning scale (1:10).

Wave State	Hs [m]	Tz [s]	Tp [s]	Return period [years]
D10	0.800	2.97	4.14	-
D50	0.900	3.13	4.36	-
D100	1.000	3.29	4.59	-

Table 8 Extreme wave states, model scale (1:40).

Wave State	Hs [m]	Tz [s]	Tp [s]	Return period [years]
D10	0.200	1.49	2.07	10
D50	0.225	1.57	2.18	50
D100	0.250	1.64	2.29	100

3 Laboratory test results

The model tests have been performed in four groups:

- Tests for load optimization. Regular waves. Bottom fixed structure. Varying load and draft.
- Power production tests. Irregular waves. Bottom fixed structure. Draft varied, load according to optimal from previous tests.
- Power production tests. Irregular waves. Floating structures, with and without reference plate. Draft varied slightly, load according to optimal from previous tests.
- Mooring system. Characterization and tests in irregular waves corresponding to extreme wave conditions.

The results hereof are reported in the following.

3.1 Load optimization

Results of tests performed for load optimization with regular waves with bottom fixed structure, subjected to varying load and draft, is given in graphs below.

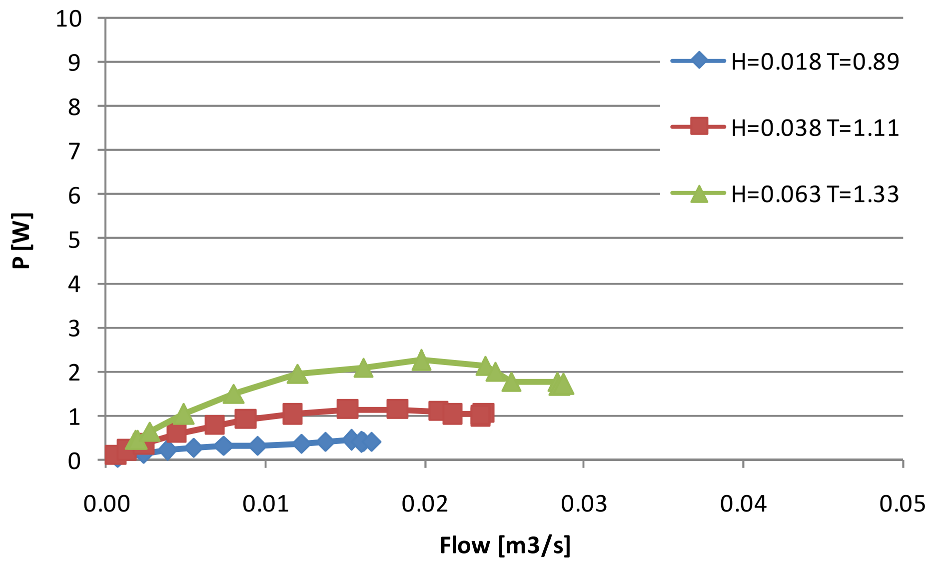

Figure 4 Load optimization tests, regular waves. Draft = 0.03 m.

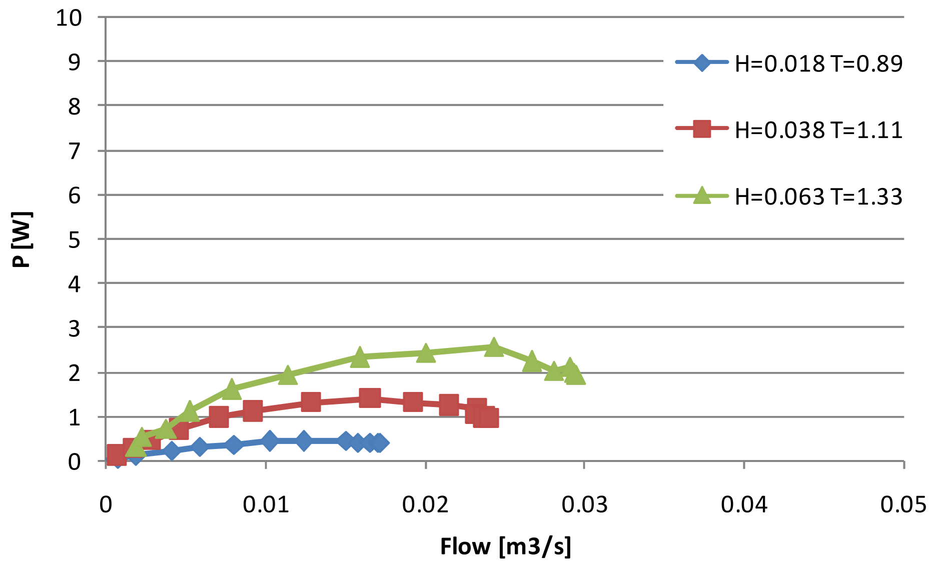

Figure 5 Load optimization tests, regular waves. Draft = 0.04 m.

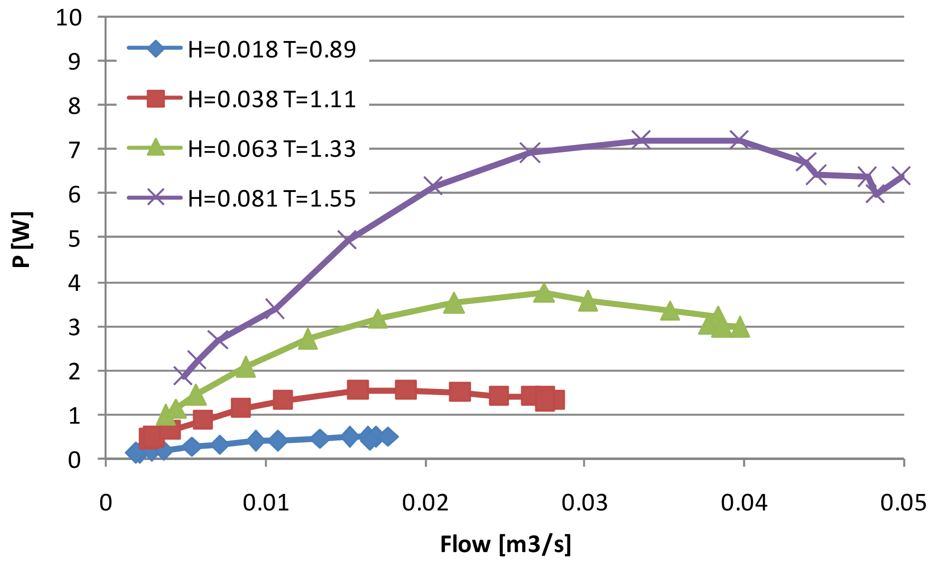

Figure 6 Load optimization tests, regular waves. Draft = 0.05 m

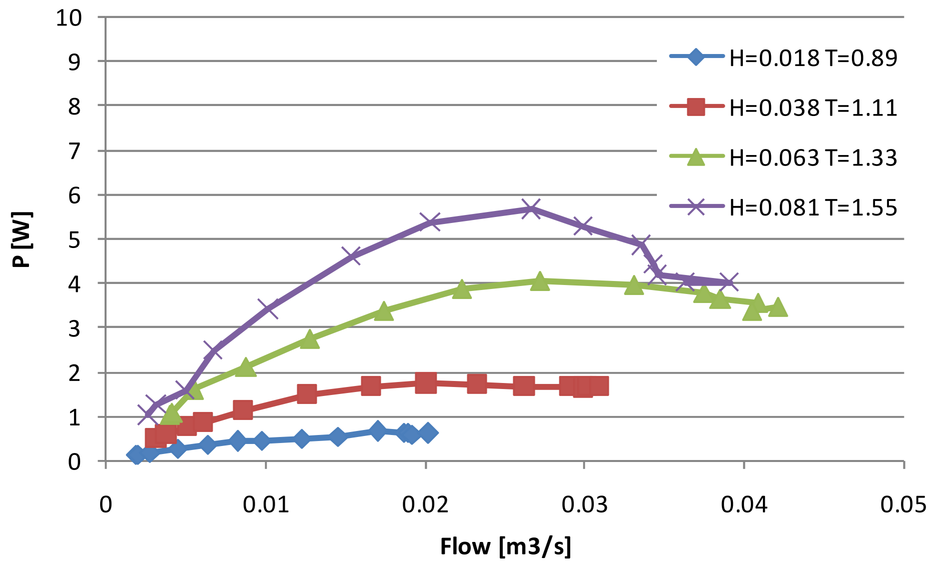

Figure 7 Load optimization tests, regular waves. Draft = 0.06 m.

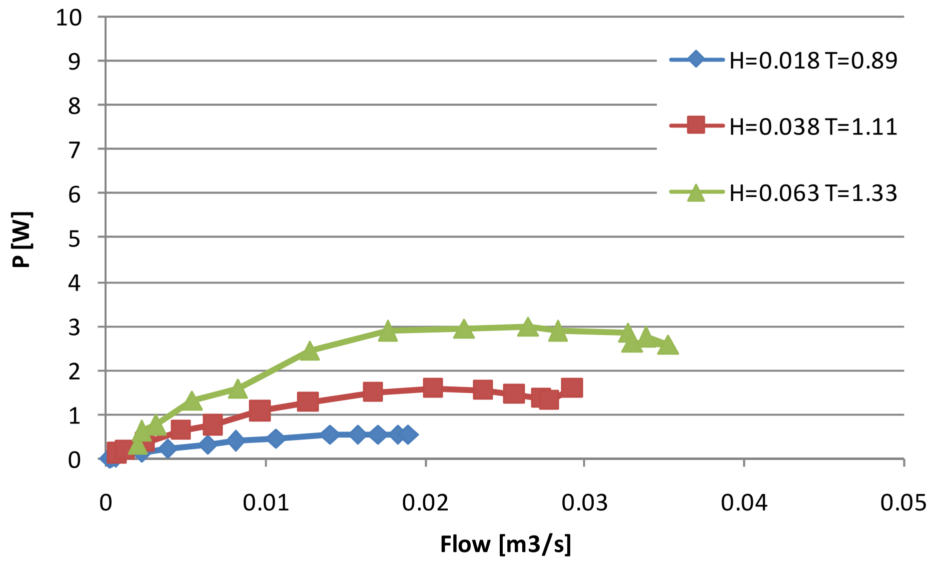

Figure 8 Load optimization tests, regular waves. Draft 0.07 m.

From these tests the load configurations corresponding to max. efficiencies have been picked out, and given in the graph and table below.

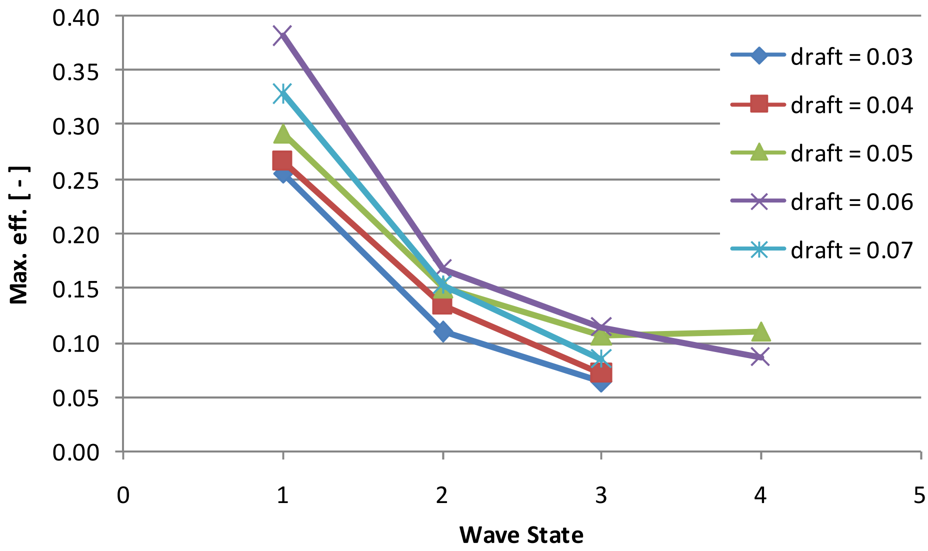

Figure 9 Max. efficiencies found in tests using regular waves (from previous section) for the various wave states and drafts.

Table 9 Max. efficiencies for power production wave states for varying drafts in regular waves. Corresponding to Figure 9.

Wave State	Draft 0.03 m	Draft 0.04 m	Draft 0.05 m	Draft 0.06 m	Draft 0.07 m
1	0.256	0.266	0.293	0.382	0.328
2	0.109	0.134	0.150	0.168	0.153
3	0.064	0.072	0.107	0.115	0.085
4			0.110	0.087	
5					

3.2 Power production, bottom standing

Tests using irregular waves, with loadings corresponding to the ones found optimal from the previous tests with regular waves, have been performed. The draft found to be optimal from the previous tests (draft = 0.06 m) has been used. Furthermore, tests with draft = 0.07 m was carried out as well for later reference.

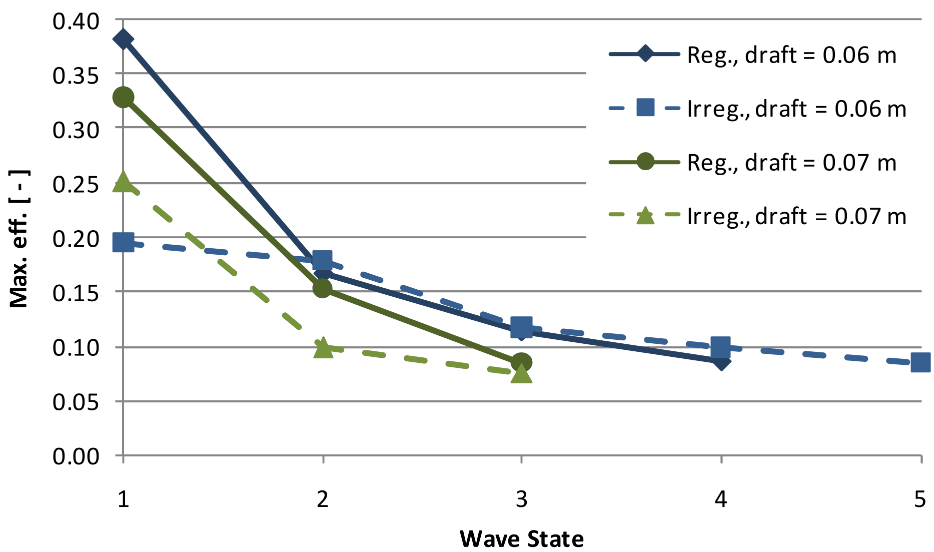

Figure 10 Max. efficiencies for tests using irregular and regular waves.

Table 10 Max. efficiencies for bottum standing structure in irregular wave states. These values are corresponding to Figure 10.

Wave State	Draft 0.06 m	Draft 0.07 m
1	0.195	0.252
2	0.179	0.098
3	0.117	0.075
4	0.098	
5	0.084	

Some tests in the higher wave states had to be abandoned, as they resulted in water flowing through the non-return valves and into the main beam of the model, resulting in malfunction of the non-return valves in these situations.

3.3 Power Production, floating

As the real LEANCON WEC will not be bottom standing, but floating, tests have been carried out simulating this situation as well. This is done well knowing that the motions will not be perfectly modeled as the weight and weight distribution of the model is not in scale (the model is heavier compared to a correctly scaled version). Furthermore, the exact layout of the substructure is not yet established. Therefore, two different configurations have been tested in a floating situation. One (denominated 'with plate') where most of the necessary buoyancy (to establish the wanted draft) is located in 'reference plates' near the sea bottom at the three supporting legs (one at front, and two in the rear). As the plates are places near the sea bottom, they will have a highly stabilizing effect on the heave, pitch and roll of the structure. In the other configuration (denominated 'no plate'), the buoyancy was primarily established by introducing sheets of foam inside the tubes, effectively thickening walls of the cylindrical air chambers. Thus, the structure is more or less continuously supported. Simultaneously, the geometry of the air chambers are changed hereby - the effective diameter of the air chamber is reduced significantly – which is likely to have and effect on the power absorption.

The results of the tests with these configurations are given below.

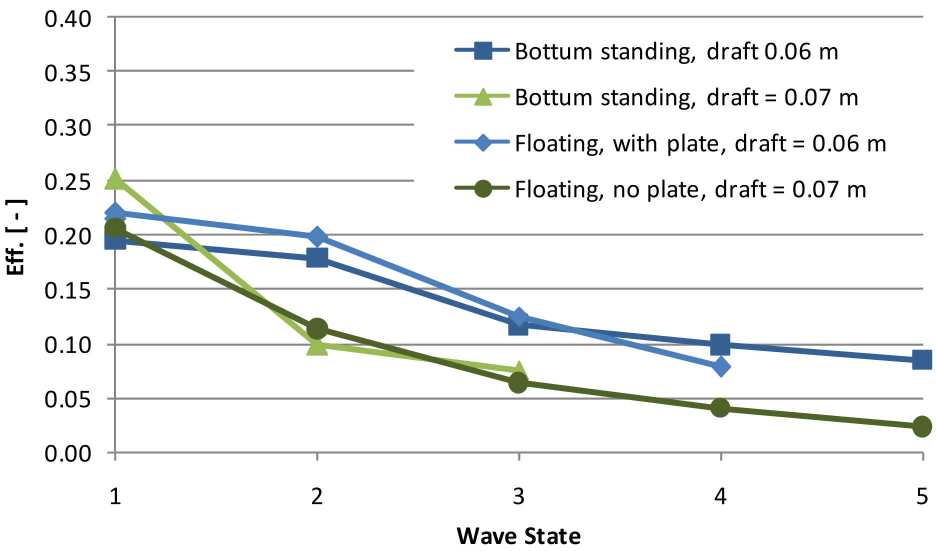

Figure 11 Irregular waves, bottom standing vs. floating.

Table 11 Max. efficiencies for floating structure in irregular wave states. Note that for draft = 0.06 m horizontal damper plates were mounted at the bottom of the structure ("with plates" configuration).

Wave State	Draft 0.06 m	Draft 0.07 m
1	0.220	0.207
2	0.198	0.113
3	0.125	0.064
4	0.078	0.041
5		0.023

3.4 Mooring forces

To keep the floating versions of the model in place in wave tank, some mooring lines had to be deployed. As no mooring system has yet been designed for the LEANCON WEC two different mooring arrangements (covering a probable range of characteristics) where tested. The first including a "small", not stiff, spring, resulting in characteristic overall mooring system stiffness of ~15 N/m. The second including a "larger", stiffer, spring, resulting in characteristic overall mooring system stiffness of roughly 4 times the previous one, i.e. ~60 N/m. Working curves of the two systems are shown in Figure 12.

Pre-stressing of mooring line, device in neutral position was approx. 6 N.

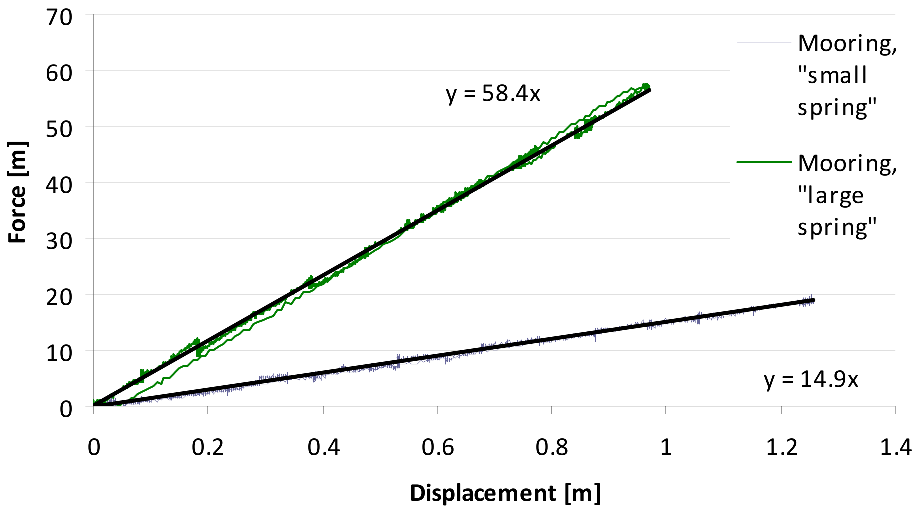

Figure 12 Mooring line characteristics. Model scale.

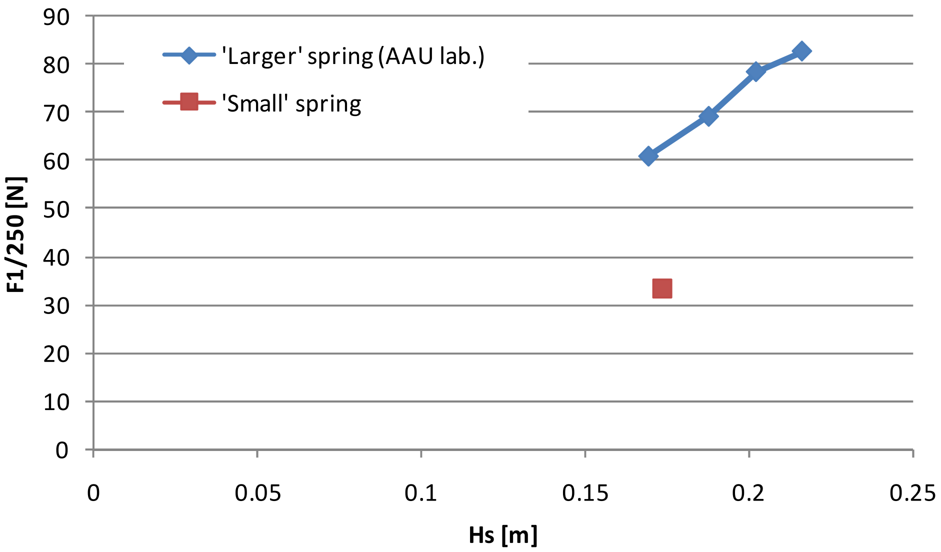

Figure 13 Mooring forces, 1/250 quantile. Model scale.

An example of the distribution of force peaks for a selected test is given in Figure 14.

The measured moorings forces have been scaled up to Nissum Bredning scale and North Sea scale, see below.

Table 12 Mooring forces in extreme wave states, model scale. First line correspond to “small spring” in mooring system, rest to “larger spring”. The data corresponds to Figure 13.

Filename	Draft [m]	Hs [m]	Tp [s]	F1/250 [N]
IF_18_19_xx_07_01.dat	0.07	0.174	1.99	33.21
IF_18_19_xx_07_02.dat	0.07	0.169	1.99	60.97
IF_20_20_xx_07_02.dat	0.07	0.188	2.07	69.13
IF_22_21_xx_07_02.dat	0.07	0.202	2.18	78.31
IF_25_22_xx_07_02.dat	0.07	0.217	2.29	82.54

Table 13 Mooring forces in extreme wave states, scale 4:1 (Nissum Bredning). First line correspond to “small spring” in mooring system, rest to “larger spring”

Filename	Draft [m]	Hs [m]	Tp [s]	F1/250 [kN]
IF_18_19_xx_07_01.dat	0.28	0.69	4.0	2.13
IF_18_19_xx_07_02.dat	0.28	0.68	4.0	3.90
IF_20_20_xx_07_02.dat	0.28	0.75	4.1	4.42
IF_22_21_xx_07_02.dat	0.28	0.81	4.4	5.01
IF_25_22_xx_07_02.dat	0.28	0.87	4.6	5.28

Table 14 Mooring forces in extreme wave states, Prototype 40:1 scale (Danish Sector of the North Sea). First line correspond to “small spring” in mooring system, rest to “larger spring”

Filename	Draft [m]	Hs [m]	Tp [s]	F1/250 [MN]
IF_18_19_xx_07_01.dat	2.8	6.9	12.6	2.13
IF_18_19_xx_07_02.dat	2.8	6.8	12.6	3.90
IF_20_20_xx_07_02.dat	2.8	7.5	13.1	4.42
IF_22_21_xx_07_02.dat	2.8	8.1	13.8	5.01
IF_25_22_xx_07_02.dat	2.8	8.7	14.5	5.28

A 50 years extreme wave state with Hs = 9.0 m would thus result in a max. (average of 1/250 largest force peaks) mooring force of ~5.5 MN, for the case where a mooring system stiffness of 96 kN/m is applied.

It should be noted that the extreme forces measured here are corresponding to force and displament levels which exceeds the lines shown in the mooring characteristics in Figure 12. Therefore, these numbers should be treated with caution as it is like the behavior of the mooring system at these loadings is non-linear.

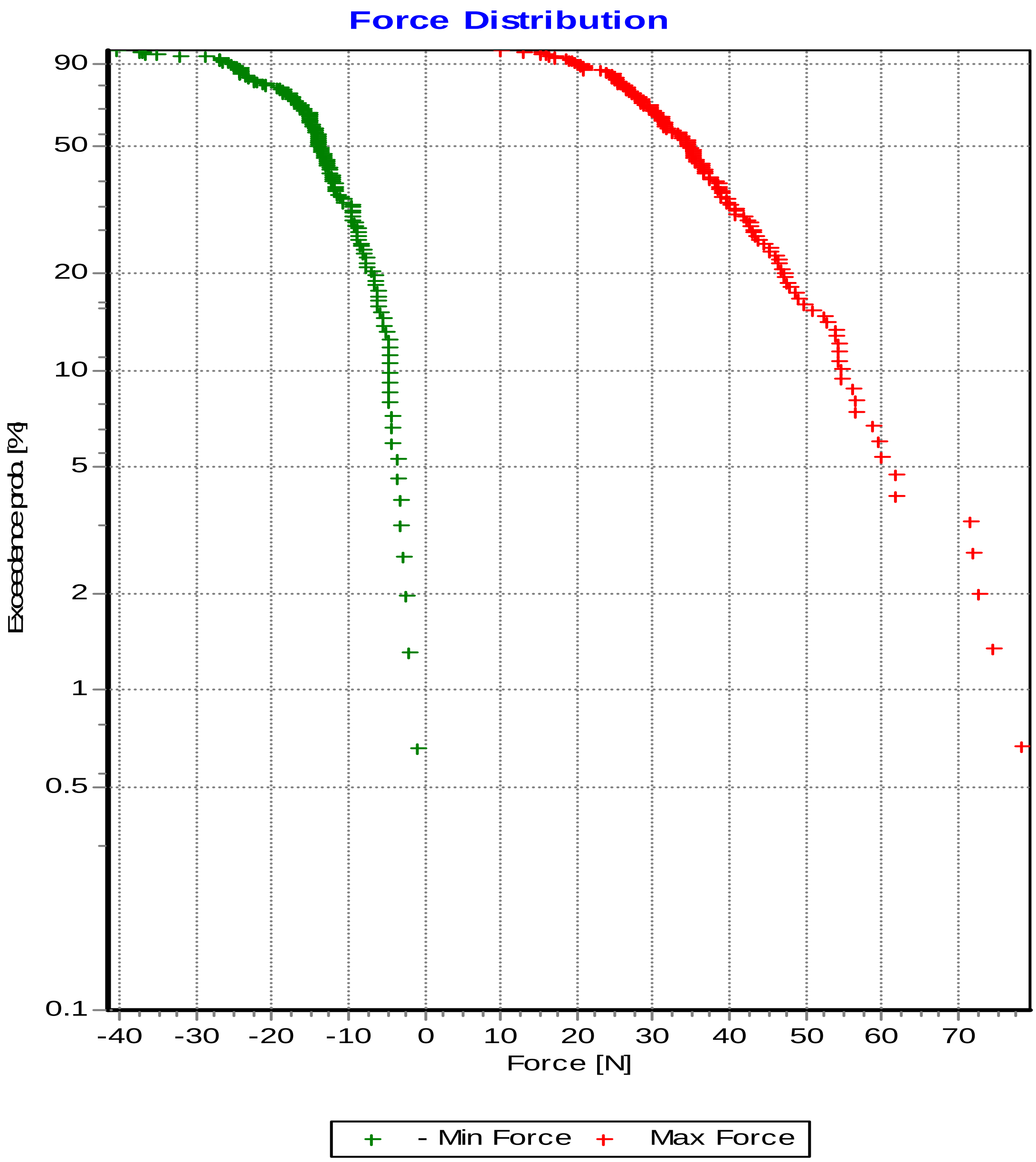

Figure 14 Force peak distribution for tests with 'large spring' in a wave state with Hs = 0.202 m and Tp =2.18 s Model scale. (IF_22_21_xx_07_02.dat)

4 Estimation of yearly power production

Based on the results of the tests with the three different configurations (bottom standing, with plate, no plate) the corresponding early power production of the device, have been estimated. The efficiencies used for this are shown in Figure 15.

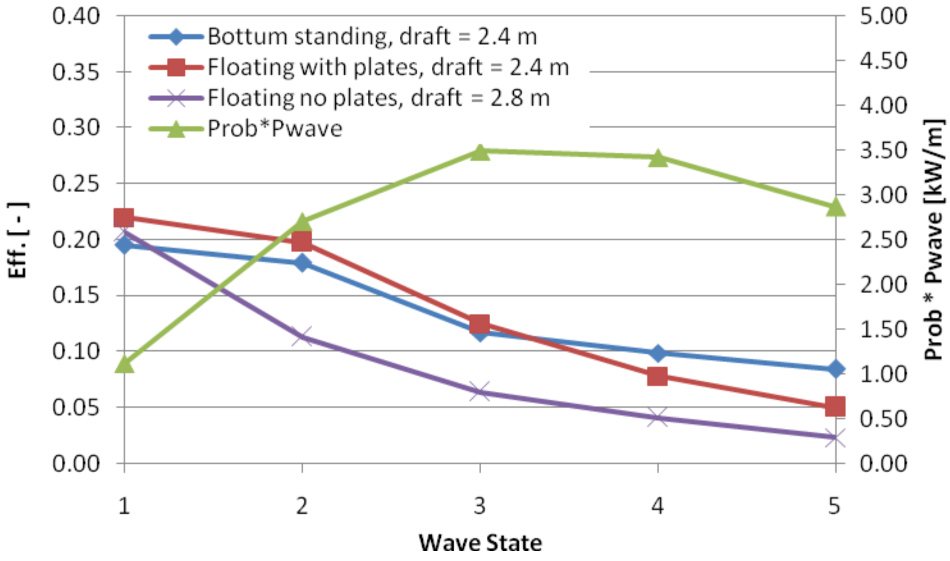

Figure 15 Efficiencies of the LEANCON WEC in irregular wave states, for the tested 3 configurations, plotted together with the available wave power multiplied with probability.

The efficiencies from these tests have been turned into yearly power productions for the three configurations, see Table 15. The efficiencies in the individual wave states are defined as the ratio between the amount of measured power (in the airflow in the device) and the amount of power in the irregular waves over the width of the device (calculated from the measured wave spectras).

The overall efficiencies are defined as the ratio between the amount of generated power (in the airflow in the device), weighted with probability for the individual wave states, and the amount of power in the irregular waves over the width of the device (calculated from the measured wave spectras), also weighted with probability for the individual wave states.

Table 15 Power production estimates for the LEANCON WEC in irregular wave states, for the tested 3 configurations, scaled to North Sea location. Grey figure is conservatively estimated by visual observations and extrapolation. Given maximum generator power values are average values for the individual wave states, and do not include the short time fluctuations within each wave state.

Wave State	Pwave	Prob	Prob*Pwave	Bottum standing, draft = 2.4 m			Floating with plates, draft = 2.4 m			Floating no plates, draft = 2.8 m		
				Eff.	Energy prod.	Pgen	Eff.	Energy prod.	Pgen	Eff.	Energy prod.	Pgen
	[kW/m]	[%]	[kW/m]	[-]	[kW/m]	[kW/m]	[-]	[kW/m]	[kW/m]	[-]	[kW/m]	[kW/m]
1	2.4	46.8	1.12	0.195	0.22	0.47	0.2198	0.25	0.53	0.2066	0.23	0.49
2	12.0	22.6	2.71	0.179	0.48	2.14	0.1976	0.53	2.37	0.1130	0.31	1.35
3	32.3	10.8	3.49	0.117	0.41	3.79	0.1249	0.44	4.04	0.0638	0.22	2.06
4	67.0	5.1	3.42	0.098	0.34	6.60	0.0783	0.27	5.25	0.0409	0.14	2.74
5	119.7	2.4	2.87	0.084	0.24	10.10	0.0500	0.14	5.98	0.0231	0.07	2.77
Yearly average [kW/m]			13.61		1.69			1.63			0.97	
Overall eff. [-]					0.124			0.120			0.071	
Yearly prod. pr. LEANCON WEC [GWh/y]					3.56			3.43			2.03	
Max. Pgen [MW]						2.42			1.44			0.66
Load factor [-]						0.17			0.27			0.35

Table 16 Power production estimates for the LEANCON WEC in irregular wave states, for the tested 3 configurations, scaled to Nissum Bredning location. Grey figure is conservatively estimated by visual observations and extrapolation. Given maximum generator power values are average values for the individual wave states, and do not include the short time fluctuations within each wave state.

Wave State	Pwave	Prob	Prob*Pwave	Bottum standing, draft = 0.24 m			Floating with plates, draft = 0.24 m			Floating no plates, draft = 0.28 m		
				Eff.	Energy prod.	Pgen	Eff.	Energy prod.	Pgen	Eff.	Energy prod.	Pgen
	[W/m]	[%]	[W/m]	[-]	[W/m]	[W/m]	[-]	[W/m]	[W/m]	[-]	[W/m]	[W/m]
1	6.6	46.8	3.11	0.195	0.61	1.30	0.2198	0.68	1.46	0.2066	0.64	1.37
2	36.7	22.6	8.29	0.179	1.48	6.57	0.1976	1.64	7.25	0.1130	0.94	4.15
3	101.2	10.8	10.93	0.117	1.28	11.85	0.1249	1.37	12.64	0.0638	0.70	6.46
4	207.4	5.1	10.58	0.098	1.04	20.43	0.0783	0.83	16.24	0.0409	0.43	8.48
5	360.5	2.4	8.65	0.084	0.73	30.43	0.0500	0.43	18.02	0.0231	0.20	8.34
Yearly average [W/m]			41.56		5.14			4.95			2.91	
Overall eff. [-]					0.378			0.364			0.214	
Yearly prod. pr. LEANCON WEC [kWh/y]					1082.14			1040.96			612.12	
Max. Pgen [kW]						0.73			0.43			0.20
Load factor [-]						0.17			0.27			0.35

It should be noted that the power reported here generally is the **available power in the flow**, not taking into account losses further down the power train, i.e. in airturbines, generators, frequency inverters etc.

5 Results and conclusions

From the results of the tests the following conclusions have been drawn:

- The peak efficiencies were found to be 5 - 38 %, depending on the wave state, in the tests with regular waves. The corresponding peak efficiencies in the tests with irregular waves for a bottom standing structure were found to be 7 – 25 %. For the floating, with plates, configuration the values were slightly reduced, and for the floating, no plates, configuration they were reduced further (4 – 21 %).

- From the tests it was generally found that the max. efficiencies were identified for the lowest wave states. This is considered to be linked to the diameter of the OWC chambers which are small when compared to the wave lengths (more so in the larger wave states than the in the smaller), which again means that resonance is not achieved, at least not in the larger wave states. This is also confirmed from visual observations of the phase shift between the water column inside the air chamber and outside (generally small phase shifts indicating little resonance). This gives reason to believe that there is 'room for improvement', as it probably is possible by design, to move the point of optimal performance to higher wave states, and thereby increase the yearly production.

- All results reported in terms of power productions, are given as the power available in the measured airflow. This means, on the one hand side, that losses further down the power train are not included in the power production figures and efficiencies, and the delivered amounts of power in terms of electricity is therefore expected to be lower. On the other hand, losses in non-return valves and flow channels, from the OWC chambers and to the measuring points, are not modeled correctly (not possible to fulfill Reynolds and Frouds scaling laws simultaneously), and is therefore is most likely proportionally higher than it will be the case at larger scales. This means that the measured amount of power in the air flow is likely to be slightly underestimated.

- In terms of overall efficiencies (yearly power productions, prototype wave states) the bottom standing configuration reached 12.4 % (3.56 GWh/y), floating, with plates 12.0 % (3.43 GWh/y) and floating, no plates, 7.1 % (2.03 GWh/y). Assuming the needed installed capacity of the power take-off system is equal the mean power production in the largest wave state (Hs = 5 m, prototype scale), this leads to load factors (ratio between average production over time and installed capacity) of 0.17, 0.27 and 0.35, respectively for the three configurations. Thus, even though the floating, no plates, configuration shows the lowest overall efficiency, it also shows the highest load factor. This is due to the fact that the device in this configuration has very low efficiencies in the highest wave states (most likely due to wave induced motions), which is limiting the max. power level. Please note that the chosen installed capacity equal to the mean power production in the largest wave state probably will not be sufficient to achieve the reported power production levels, as there will be variation of the produced power, also in the largest wave state.

- Tests to estimate mooring forces on the structure were also performed with two different mooring characteristics. The mooring setup which is considered most suitable leads to max. mooring forces (50 years event) in the order of magnitude of 6 MN for the prototype location (corresponding to 6 kN at the Nissum Bredning location). However, these numbers have to used with caution, as the peak loads appear for an non-tested part of the work curve of the mooring system, and furthermore only valid for the applied characteristics.

In summary the model tests have shown that the concept is working and that the device is able to capture the wave energy and convert it into a unidirectional airflow (which is a key specialty of this device), and that this is done with a reasonable efficiency. There are furthermore good reasons to believe that the performance can be improved through further optimization. The device shows good behavior in extreme wave conditions and mooring forces are considered to be of manageable magnitudes.

6 References

Bølgekraftudvalgets Sekretariat (Kim Nielsen): *Bølgekraftprogram – Forslag til systematik i forbindelse med sammenligning af bølgekraftanlæg og status år 2000*. (30 pages in Danish). Published by Bølgekraftudvalgets Sekretariat / Danish Energy Agency, Jan. 2000.

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Appendices

7 Appendix 1: Table of model test results

Codes for file names:

Filename format: ab_cc_dd_ee_ff_nn

a: R: regular waves, I: Irregular waves
b: B: Bottum mounted, F: Floating
cc: Wave Height (target), cm
dd: Wave Period (target), 1/10 sec.
ee: Valve setting, 0 - 25
ff: Draft, cm
nn: Serial no.

Filename	WS	Draft [m]	Valve setting [-]	H or Hm0 [m]	T or Tp [s]	P_wave [W]	Flow [m3/s]	p_tot [Pa]	P [W]	Eff. [-]
080515										
RB_02_09_00_05_01.dat	1	0.05	0	0.018	0.89	0.29	0.0020	69.3	0.13	0.0742
RB_02_09_02_05_01.dat	1	0.05	2	0.018	0.89	0.29	0.0019	66.6	0.12	0.0706
RB_02_09_04_05_01.dat	1	0.05	4	0.018	0.89	0.29	0.0028	68.2	0.17	0.1000
RB_02_09_06_05_01.dat	1	0.05	6	0.018	0.89	0.29	0.0035	58.9	0.20	0.1153
RB_02_09_08_05_01.dat	1	0.05	8	0.018	0.89	0.29	0.0054	54.7	0.28	0.1630
RB_02_09_10_05_01.dat	1	0.05	10	0.018	0.89	0.29	0.0071	49.6	0.33	0.1915
RB_02_09_12_05_01.dat	1	0.05	12	0.018	0.89	0.29	0.0094	45.1	0.39	0.2300
RB_02_09_14_05_01.dat	1	0.05	14	0.018	0.89	0.29	0.0108	40.1	0.39	0.2287
RB_02_09_16_05_01.dat	1	0.05	16	0.018	0.89	0.29	0.0134	37.2	0.46	0.2654
RB_02_09_18_05_01.dat	1	0.05	18	0.018	0.89	0.29	0.0153	34.1	0.48	0.2786
RB_02_09_20_05_01.dat	1	0.05	20	0.018	0.89	0.29	0.0164	32.1	0.48	0.2799
RB_02_09_22_05_01.dat	1	0.05	22	0.018	0.89	0.29	0.0170	30.6	0.48	0.2778
RB_02_09_24_05_01.dat	1	0.05	24	0.018	0.89	0.29	0.0177	30.4	0.50	0.2926
RB_02_09_25_05_01.dat	1	0.05	25	0.018	0.89	0.29	0.0165	26.3	0.41	0.2391
RB_04_11_00_05_01.dat	2	0.05	0	0.038	1.11	1.72	0.0027	170.2	0.44	0.0421
RB_04_11_02_05_01.dat	2	0.05	2	0.038	1.11	1.72	0.0030	170.8	0.48	0.0469
RB_04_11_04_05_01.dat	2	0.05	4	0.038	1.11	1.72	0.0040	164.6	0.64	0.0615
RB_04_11_06_05_01.dat	2	0.05	6	0.038	1.11	1.72	0.0061	153.1	0.88	0.0850
RB_04_11_08_05_01.dat	2	0.05	8	0.038	1.11	1.72	0.0085	138.8	1.13	0.1095
RB_04_11_10_05_01.dat	2	0.05	10	0.038	1.11	1.72	0.0112	122.6	1.32	0.1276
RB_04_11_12_05_01.dat	2	0.05	12	0.038	1.11	1.72	0.0158	105.0	1.55	0.1502
RB_04_11_14_05_01.dat	2	0.05	14	0.038	1.11	1.72	0.0189	86.9	1.53	0.1480
RB_04_11_16_05_01.dat	2	0.05	16	0.038	1.11	1.72	0.0222	72.1	1.51	0.1463
RB_04_11_18_05_01.dat	2	0.05	18	0.038	1.11	1.72	0.0247	61.5	1.42	0.1377
RB_04_11_20_05_01.dat	2	0.05	20	0.038	1.11	1.72	0.0267	56.5	1.42	0.1372
RB_04_11_22_05_01.dat	2	0.05	22	0.038	1.11	1.72	0.0276	53.9	1.39	0.1340
RB_04_11_24_05_01.dat	2	0.05	24	0.038	1.11	1.72	0.0281	50.8	1.32	0.1272
RB_04_11_25_05_01.dat	2	0.05	25	0.038	1.11	1.72	0.0276	51.0	1.30	0.1260
RB_06_13_00_05_01.dat	3	0.05	0	0.063	1.33	5.89	0.0037	280.4	0.99	0.0279
RB_06_13_02_05_01.dat	3	0.05	2	0.063	1.33	5.89	0.0044	278.4	1.14	0.0322
RB_06_13_04_05_01.dat	3	0.05	4	0.063	1.33	5.89	0.0057	271.4	1.44	0.0407
RB_06_13_06_05_01.dat	3	0.05	6	0.063	1.33	5.89	0.0087	253.9	2.06	0.0584
RB_06_13_08_05_01.dat	3	0.05	8	0.063	1.33	5.89	0.0126	227.9	2.70	0.0764
RB_06_13_10_05_01.dat	3	0.05	10	0.063	1.33	5.89	0.0170	199.8	3.18	0.0901
RB_06_13_12_05_01.dat	3	0.05	12	0.063	1.33	5.89	0.0218	168.4	3.51	0.0993
RB_06_13_14_05_01.dat	3	0.05	14	0.063	1.33	5.89	0.0275	149.4	3.77	0.1066
RB_06_13_16_05_01.dat	3	0.05	16	0.063	1.33	5.89	0.0302	126.6	3.55	0.1005
RB_06_13_18_05_01.dat	3	0.05	18	0.063	1.33	5.89	0.0354	111.6	3.37	0.0953
RB_06_13_20_05_01.dat	3	0.05	20	0.063	1.33	5.89	0.0384	96.6	3.20	0.0905
RB_06_13_22_05_01.dat	3	0.05	22	0.063	1.33	5.89	0.0378	89.0	3.05	0.0863
RB_06_13_24_05_01.dat	3	0.05	24	0.063	1.33	5.89	0.0397	86.3	2.97	0.0840
RB_06_13_25_05_01.dat	3	0.05	25	0.063	1.33	5.89	0.0387	82.2	2.97	0.0840
RB_09_15_00_05_01.dat	4	0.05	0	0.081	1.55	10.90	0.0048	426.8	1.87	0.0286
RB_09_15_02_05_01.dat	4	0.05	2	0.081	1.55	10.90	0.0057	439.2	2.22	0.0339
RB_09_15_04_05_01.dat	4	0.05	4	0.081	1.55	10.90	0.0071	416.6	2.66	0.0407
RB_09_15_06_05_01.dat	4	0.05	6	0.081	1.55	10.90	0.0106	376.9	3.38	0.0517
RB_09_15_08_05_01.dat	4	0.05	8	0.081	1.55	10.90	0.0152	348.2	4.94	0.0755
RB_09_15_10_05_01.dat	4	0.05	10	0.081	1.55	10.90	0.0206	309.7	6.14	0.0940
RB_09_15_12_05_01.dat	4	0.05	12	0.081	1.55	10.90	0.0266	262.5	6.90	0.1055
RB_09_15_14_05_01.dat	4	0.05	14	0.081	1.55	10.90	0.0336	216.8	7.20	0.1100
RB_09_15_16_05_01.dat	4	0.05	16	0.081	1.55	10.90	0.0397	185.2	7.19	0.1099
RB_09_15_18_05_01.dat	4	0.05	18	0.081	1.55	10.90	0.0440	156.5	6.69	0.1023
RB_09_15_20_05_01.dat	4	0.05	20	0.081	1.55	10.90	0.0446	135.7	6.40	0.0979
RB_09_15_22_05_01.dat	4	0.05	22	0.081	1.55	10.90	0.0478	124.5	6.36	0.0973
RB_09_15_24_05_01.dat	4	0.05	24	0.081	1.55	10.90	0.0483	121.2	5.98	0.0914
RB_09_15_25_05_01.dat	4	0.05	25	0.081	1.55	10.90	0.0499	121.5	6.39	0.0977
RB_02_09_00_06_01.dat	1	0.06	0	0.018	0.89	0.29	0.0019	70.9	0.12	0.0706
RB_02_09_02_06_01.dat	1	0.06	2	0.018	0.89	0.29	0.0020	69.5	0.13	0.0758
RB_02_09_04_06_01.dat	1	0.06	4	0.018	0.89	0.29	0.0028	66.2	0.18	0.1025
RB_02_09_06_06_01.dat	1	0.06	6	0.018	0.89	0.29	0.0045	63.5	0.26	0.1543
RB_02_09_08_06_01.dat	1	0.06	8	0.018	0.89	0.29	0.0063	59.7	0.35	0.2055
RB_02_09_10_06_01.dat	1	0.06	10	0.018	0.89	0.29	0.0083	53.9	0.42	0.2459
RB_02_09_12_06_01.dat	1	0.06	12	0.018	0.89	0.29	0.0098	48.4	0.45	0.2613
RB_02_09_14_06_01.dat	1	0.06	14	0.018	0.89	0.29	0.0122	43.3	0.49	0.2859
RB_02_09_16_06_01.dat	1	0.06	16	0.018	0.89	0.29	0.0146	40.1	0.54	0.3161
RB_02_09_18_06_01.dat	1	0.06	18	0.018	0.89	0.29	0.0171	36.3	0.66	0.3820
RB_02_09_20_06_01.dat	1	0.06	20	0.018	0.89	0.29	0.0186	34.4	0.62	0.3592
RB_02_09_22_06_01.dat	1	0.06	22	0.018	0.89	0.29	0.0189	32.2	0.62	0.3617
RB_02_09_24_06_01.dat	1	0.06	24	0.018	0.89	0.29	0.0192	31.9	0.58	0.3391
RB_02_09_25_06_01.dat	1	0.06	25	0.018	0.89	0.29	0.0202	31.2	0.60	0.3501

Filename	WS	Draft [m]	Valve setting [-]	H or Hm0 [m]	T or Tp [s]	P_wave [W]	Flow [m3/s]	p_tot [Pa]	P [W]	Eff. [-]
RB_04_11_00_06_01.dat	2	0.06	0	0.038	1.11	1.72	0.0031	174.3	0.51	0.0490
RB_04_11_02_06_01.dat	2	0.06	2	0.038	1.11	1.72	0.0038	169.0	0.60	0.0577
RB_04_11_04_06_01.dat	2	0.06	4	0.038	1.11	1.72	0.0051	160.6	0.77	0.0743
RB_04_11_06_06_01.dat	2	0.06	6	0.038	1.11	1.72	0.0061	149.4	0.85	0.0823
RB_04_11_08_06_01.dat	2	0.06	8	0.038	1.11	1.72	0.0086	138.4	1.11	0.1075
RB_04_11_10_06_01.dat	2	0.06	10	0.038	1.11	1.72	0.0127	125.7	1.49	0.1442
RB_04_11_12_06_01.dat	2	0.06	12	0.038	1.11	1.72	0.0166	107.9	1.68	0.1625
RB_04_11_14_06_01.dat	2	0.06	14	0.038	1.11	1.72	0.0201	90.5	1.74	0.1677
RB_04_11_16_06_01.dat	2	0.06	16	0.038	1.11	1.72	0.0233	78.1	1.72	0.1659
RB_04_11_18_06_01.dat	2	0.06	18	0.038	1.11	1.72	0.0263	68.9	1.66	0.1606
RB_04_11_20_06_01.dat	2	0.06	20	0.038	1.11	1.72	0.0290	65.0	1.68	0.1619
RB_04_11_22_06_01.dat	2	0.06	22	0.038	1.11	1.72	0.0300	61.2	1.64	0.1588
RB_04_11_24_06_01.dat	2	0.06	24	0.038	1.11	1.72	0.0302	60.4	1.65	0.1598
RB_04_11_25_06_01.dat	2	0.06	25	0.038	1.11	1.72	0.0310	60.9	1.67	0.1614
RB_06_13_00_06_01.dat	3	0.06	0	0.063	1.33	5.89	0.0039	284.5	1.04	0.0294
RB_06_13_02_06_01.dat	3	0.06	2	0.063	1.33	5.89	0.0042	277.2	1.08	0.0304
RB_06_13_04_06_01.dat	3	0.06	4	0.063	1.33	5.89	0.0055	269.6	1.59	0.0451
RB_06_13_06_06_01.dat	3	0.06	6	0.063	1.33	5.89	0.0088	255.7	2.13	0.0602
RB_06_13_08_06_01.dat	3	0.06	8	0.063	1.33	5.89	0.0127	234.9	2.74	0.0775
RB_06_13_10_06_01.dat	3	0.06	10	0.063	1.33	5.89	0.0174	210.8	3.37	0.0954
RB_06_13_12_06_01.dat	3	0.06	12	0.063	1.33	5.89	0.0223	181.5	3.87	0.1096
RB_06_13_14_06_01.dat	3	0.06	14	0.063	1.33	5.89	0.0272	152.5	4.05	0.1146
RB_06_13_16_06_01.dat	3	0.06	16	0.063	1.33	5.89	0.0331	129.4	3.95	0.1119
RB_06_13_18_06_01.dat	3	0.06	18	0.063	1.33	5.89	0.0375	113.1	3.77	0.1068
RB_06_13_20_06_01.dat	3	0.06	20	0.063	1.33	5.89	0.0385	102.4	3.66	0.1035
RB_06_13_22_06_01.dat	3	0.06	22	0.063	1.33	5.89	0.0408	96.0	3.57	0.1012
RB_06_13_24_06_01.dat	3	0.06	24	0.063	1.33	5.89	0.0405	93.1	3.39	0.0959
RB_06_13_25_06_01.dat	3	0.06	25	0.063	1.33	5.89	0.0421	93.2	3.48	0.0985
080521										
RB_09_15_00_06_01.dat	4	0.06	0	0.081	1.55	10.90	0.0026	339.7	1.02	0.0155
RB_09_15_02_06_01.dat	4	0.06	2	0.081	1.55	10.90	0.0031	348.6	1.25	0.0191
RB_09_15_04_06_01.dat	4	0.06	4	0.081	1.55	10.90	0.0049	338.8	1.57	0.0240
RB_09_15_06_06_01.dat	4	0.06	6	0.081	1.55	10.90	0.0067	322.8	2.49	0.0381
RB_09_15_08_06_01.dat	4	0.06	8	0.081	1.55	10.90	0.0102	298.0	3.40	0.0520
RB_09_15_10_06_01.dat	4	0.06	10	0.081	1.55	10.90	0.0154	261.9	4.61	0.0704
RB_09_15_12_06_01.dat	4	0.06	12	0.081	1.55	10.90	0.0203	229.5	5.36	0.0820
RB_09_15_14_06_01.dat	4	0.06	14	0.081	1.55	10.90	0.0267	190.6	5.66	0.0866
RB_09_15_16_06_01.dat	4	0.06	16	0.081	1.55	10.90	0.0300	148.4	5.28	0.0808
RB_09_15_18_06_01.dat	4	0.06	18	0.081	1.55	10.90	0.0336	132.6	4.84	0.0740
RB_09_15_20_06_01.dat	4	0.06	20	0.081	1.55	10.90	0.0343	119.1	4.41	0.0674
RB_09_15_22_06_01.dat	4	0.06	22	0.081	1.55	10.90	0.0346	106.6	4.16	0.0637
RB_09_15_24_06_01.dat	4	0.06	24	0.081	1.55	10.90	0.0391	102.5	4.00	0.0612
RB_09_15_25_06_01.dat	4	0.06	25	0.081	1.55	10.90	0.0364	99.0	4.01	0.0613
RB_02_09_00_04_01.dat	1	0.04	0	0.018	0.89	0.29	-0.0003	62.6	-0.02	-0.0118
RB_02_09_02_04_01.dat	1	0.04	2	0.018	0.89	0.29	-0.0002	62.2	-0.01	-0.0070
RB_02_09_04_04_01.dat	1	0.04	4	0.018	0.89	0.29	0.0007	61.3	0.05	0.0288
RB_02_09_06_04_01.dat	1	0.04	6	0.018	0.89	0.29	0.0019	57.0	0.11	0.0667
RB_02_09_08_04_01.dat	1	0.04	8	0.018	0.89	0.29	0.0041	54.2	0.23	0.1364
RB_02_09_10_04_01.dat	1	0.04	10	0.018	0.89	0.29	0.0058	44.7	0.30	0.1753
RB_02_09_12_04_01.dat	1	0.04	12	0.018	0.89	0.29	0.0081	43.1	0.37	0.2160
RB_02_09_14_04_01.dat	1	0.04	14	0.018	0.89	0.29	0.0103	37.6	0.42	0.2452
RB_02_09_16_04_01.dat	1	0.04	16	0.018	0.89	0.29	0.0124	31.4	0.43	0.2517
RB_02_09_18_04_01.dat	1	0.04	18	0.018	0.89	0.29	0.0151	27.8	0.46	0.2663
RB_02_09_20_04_01.dat	1	0.04	20	0.018	0.89	0.29	0.0158	24.3	0.42	0.2434
RB_02_09_22_04_01.dat	1	0.04	22	0.018	0.89	0.29	0.0166	23.0	0.41	0.2365
RB_02_09_24_04_01.dat	1	0.04	24	0.018	0.89	0.29	0.0170	22.2	0.40	0.2352
RB_02_09_25_04_01.dat	1	0.04	25	0.018	0.89	0.29	0.0172	22.5	0.41	0.2387
RB_04_11_00_04_01.dat	2	0.04	0	0.038	1.11	1.72	0.0007	152.3	0.11	0.0106
RB_04_11_02_04_01.dat	2	0.04	2	0.038	1.11	1.72	0.0017	153.7	0.28	0.0271
RB_04_11_04_04_01.dat	2	0.04	4	0.038	1.11	1.72	0.0028	148.8	0.46	0.0441
RB_04_11_06_04_01.dat	2	0.04	6	0.038	1.11	1.72	0.0046	140.2	0.70	0.0679
RB_04_11_08_04_01.dat	2	0.04	8	0.038	1.11	1.72	0.0071	131.1	0.97	0.0940
RB_04_11_10_04_01.dat	2	0.04	10	0.038	1.11	1.72	0.0092	113.4	1.10	0.1061
RB_04_11_12_04_01.dat	2	0.04	12	0.038	1.11	1.72	0.0129	99.5	1.31	0.1263
RB_04_11_14_04_01.dat	2	0.04	14	0.038	1.11	1.72	0.0166	82.3	1.39	0.1340
RB_04_11_16_04_01.dat	2	0.04	16	0.038	1.11	1.72	0.0193	65.9	1.31	0.1269
RB_04_11_18_04_01.dat	2	0.04	18	0.038	1.11	1.72	0.0216	54.0	1.23	0.1192
RB_04_11_20_04_01.dat	2	0.04	20	0.038	1.11	1.72	0.0233	47.1	1.19	0.1146
RB_04_11_22_04_01.dat	2	0.04	22	0.038	1.11	1.72	0.0232	40.4	1.05	0.1013
RB_04_11_24_04_01.dat	2	0.04	24	0.038	1.11	1.72	0.0237	38.4	0.97	0.0942
RB_04_11_25_04_01.dat	2	0.04	25	0.038	1.11	1.72	0.0241	37.5	0.95	0.0919

Filename	WS	Draft [m]	Valve setting [-]	H or Hm0 [m]	T or Tp [s]	P_wave [W]	Flow [m3/s]	p_tot [Pa]	P [W]	Eff. [-]
RB_06_13_00_04_01.dat	3	0.04	0	0.063	1.33	5.89	0.0019	222.5	0.31	0.0089
RB_06_13_02_04_01.dat	3	0.04	2	0.063	1.33	5.89	0.0022	226.7	0.54	0.0152
RB_06_13_04_04_01.dat	3	0.04	4	0.063	1.33	5.89	0.0038	220.4	0.73	0.0207
RB_06_13_06_04_01.dat	3	0.04	6	0.063	1.33	5.89	0.0052	205.5	1.10	0.0312
RB_06_13_08_04_01.dat	3	0.04	8	0.063	1.33	5.89	0.0079	181.1	1.60	0.0453
RB_06_13_10_04_01.dat	3	0.04	10	0.063	1.33	5.89	0.0114	163.5	1.93	0.0546
RB_06_13_12_04_01.dat	3	0.04	12	0.063	1.33	5.89	0.0159	144.8	2.31	0.0655
RB_06_13_14_04_01.dat	3	0.04	14	0.063	1.33	5.89	0.0200	124.6	2.43	0.0687
RB_06_13_16_04_01.dat	3	0.04	16	0.063	1.33	5.89	0.0243	97.0	2.56	0.0724
RB_06_13_18_04_01.dat	3	0.04	18	0.063	1.33	5.89	0.0267	81.7	2.24	0.0633
RB_06_13_20_04_01.dat	3	0.04	20	0.063	1.33	5.89	0.0281	70.5	2.03	0.0576
RB_06_13_22_04_01.dat	3	0.04	22	0.063	1.33	5.89	0.0291	68.4	2.11	0.0599
RB_06_13_24_04_01.dat	3	0.04	24	0.063	1.33	5.89	0.0294	62.1	1.94	0.0549
RB_06_13_25_04_01.dat	3	0.04	25	0.063	1.33	5.89	0.0293	64.6	1.97	0.0558
RB_02_09_00_03_01.dat	1	0.03	0	0.018	0.89	0.29	0.0000	62.9	0.00	-0.0010
RB_02_09_02_03_01.dat	1	0.03	2	0.018	0.89	0.29	-0.0003	61.0	-0.02	-0.0105
RB_02_09_04_03_01.dat	1	0.03	4	0.018	0.89	0.29	0.0008	58.3	0.05	0.0273
RB_02_09_06_03_01.dat	1	0.03	6	0.018	0.89	0.29	0.0023	54.4	0.14	0.0795
RB_02_09_08_03_01.dat	1	0.03	8	0.018	0.89	0.29	0.0038	49.4	0.21	0.1238
RB_02_09_10_03_01.dat	1	0.03	10	0.018	0.89	0.29	0.0055	48.0	0.27	0.1601
RB_02_09_12_03_01.dat	1	0.03	12	0.018	0.89	0.29	0.0074	41.5	0.33	0.1898
RB_02_09_14_03_01.dat	1	0.03	14	0.018	0.89	0.29	0.0095	36.2	0.32	0.1882
RB_02_09_16_03_01.dat	1	0.03	16	0.018	0.89	0.29	0.0122	32.1	0.36	0.2126
RB_02_09_18_03_01.dat	1	0.03	18	0.018	0.89	0.29	0.0137	27.9	0.41	0.2388
RB_02_09_20_03_01.dat	1	0.03	20	0.018	0.89	0.29	0.0154	26.1	0.44	0.2560
RB_02_09_22_03_01.dat	1	0.03	22	0.018	0.89	0.29	0.0162	23.5	0.42	0.2447
RB_02_09_24_03_01.dat	1	0.03	24	0.018	0.89	0.29	0.0161	22.4	0.39	0.2293
RB_02_09_25_03_01.dat	1	0.03	25	0.018	0.89	0.29	0.0167	22.9	0.40	0.2352
RB_04_11_00_03_01.dat	2	0.03	0	0.038	1.11	1.72	0.0007	141.8	0.10	0.0093
RB_04_11_02_03_01.dat	2	0.03	2	0.038	1.11	1.72	0.0013	139.9	0.21	0.0204
RB_04_11_04_03_01.dat	2	0.03	4	0.038	1.11	1.72	0.0024	134.6	0.35	0.0341
RB_04_11_06_03_01.dat	2	0.03	6	0.038	1.11	1.72	0.0045	126.6	0.59	0.0574
RB_04_11_08_03_01.dat	2	0.03	8	0.038	1.11	1.72	0.0069	114.0	0.77	0.0741
RB_04_11_10_03_01.dat	2	0.03	10	0.038	1.11	1.72	0.0088	99.3	0.92	0.0891
RB_04_11_12_03_01.dat	2	0.03	12	0.038	1.11	1.72	0.0118	84.4	1.03	0.0991
RB_04_11_14_03_01.dat	2	0.03	14	0.038	1.11	1.72	0.0152	68.6	1.13	0.1090
RB_04_11_16_03_01.dat	2	0.03	16	0.038	1.11	1.72	0.0183	56.1	1.13	0.1094
RB_04_11_18_03_01.dat	2	0.03	18	0.038	1.11	1.72	0.0209	47.2	1.09	0.1051
RB_04_11_20_03_01.dat	2	0.03	20	0.038	1.11	1.72	0.0218	41.8	1.02	0.0989
RB_04_11_22_03_01.dat	2	0.03	22	0.038	1.11	1.72	0.0237	39.8	1.04	0.1003
RB_04_11_24_03_01.dat	2	0.03	24	0.038	1.11	1.72	0.0235	36.9	0.97	0.0933
RB_04_11_25_03_01.dat	2	0.03	25	0.038	1.11	1.72	0.0236	38.6	1.00	0.0970
RB_06_13_00_03_01.dat	3	0.03	0	0.063	1.33	5.89	0.0019	215.0	0.46	0.0130
RB_06_13_02_03_01.dat	3	0.03	2	0.063	1.33	5.89	0.0019	222.1	0.47	0.0134
RB_06_13_04_03_01.dat	3	0.03	4	0.063	1.33	5.89	0.0028	214.4	0.66	0.0186
RB_06_13_06_03_01.dat	3	0.03	6	0.063	1.33	5.89	0.0049	202.0	1.02	0.0289
RB_06_13_08_03_01.dat	3	0.03	8	0.063	1.33	5.89	0.0080	180.4	1.51	0.0427
RB_06_13_10_03_01.dat	3	0.03	10	0.063	1.33	5.89	0.0120	160.1	1.95	0.0552
RB_06_13_12_03_01.dat	3	0.03	12	0.063	1.33	5.89	0.0162	136.2	2.08	0.0588
RB_06_13_14_03_01.dat	3	0.03	14	0.063	1.33	5.89	0.0198	111.7	2.25	0.0638
RB_06_13_16_03_01.dat	3	0.03	16	0.063	1.33	5.89	0.0238	92.3	2.15	0.0607
RB_06_13_18_03_01.dat	3	0.03	18	0.063	1.33	5.89	0.0244	76.5	2.00	0.0565
RB_06_13_20_03_01.dat	3	0.03	20	0.063	1.33	5.89	0.0254	65.6	1.76	0.0500
RB_06_13_22_03_01.dat	3	0.03	22	0.063	1.33	5.89	0.0283	62.6	1.77	0.0500
RB_06_13_24_03_01.dat	3	0.03	24	0.063	1.33	5.89	0.0285	58.8	1.69	0.0479
RB_06_13_25_03_01.dat	3	0.03	25	0.063	1.33	5.89	0.0288	58.9	1.71	0.0484
RB_02_09_00_07_01.dat	1	0.07	0	0.018	0.89	0.29	0.0003	64.1	0.02	0.0103
RB_02_09_02_07_01.dat	1	0.07	2	0.018	0.89	0.29	0.0004	64.5	0.03	0.0153
RB_02_09_04_07_01.dat	1	0.07	4	0.018	0.89	0.29	0.0006	61.1	0.04	0.0221
RB_02_09_06_07_01.dat	1	0.07	6	0.018	0.89	0.29	0.0022	59.3	0.14	0.0813
RB_02_09_08_07_01.dat	1	0.07	8	0.018	0.89	0.29	0.0039	55.4	0.23	0.1316
RB_02_09_10_07_01.dat	1	0.07	10	0.018	0.89	0.29	0.0063	51.4	0.34	0.1970
RB_02_09_12_07_01.dat	1	0.07	12	0.018	0.89	0.29	0.0081	46.5	0.40	0.2321
RB_02_09_14_07_01.dat	1	0.07	14	0.018	0.89	0.29	0.0107	40.0	0.46	0.2680
RB_02_09_16_07_01.dat	1	0.07	16	0.018	0.89	0.29	0.0141	36.5	0.55	0.3211
RB_02_09_18_07_01.dat	1	0.07	18	0.018	0.89	0.29	0.0157	32.1	0.56	0.3283
RB_02_09_20_07_01.dat	1	0.07	20	0.018	0.89	0.29	0.0171	28.9	0.55	0.3210
RB_02_09_22_07_01.dat	1	0.07	22	0.018	0.89	0.29	0.0183	27.5	0.56	0.3271
RB_02_09_24_07_01.dat	1	0.07	24	0.018	0.89	0.29	0.0190	27.4	0.55	0.3220
RB_02_09_25_07_01.dat	1	0.07	25	0.018	0.89	0.29	0.0189	27.3	0.56	0.3244

Filename	WS	Draft [m]	Valve setting [-]	H or Hm0 [m]	T or Tp [s]	P_wave [W]	Flow [m3/s]	p_tot [Pa]	P [W]	Eff. [-]
RB_04_11_00_07_01.dat	2	0.07	0	0.038	1.11	1.72	0.0007	147.8	0.12	0.0113
RB_04_11_02_07_01.dat	2	0.07	2	0.038	1.11	1.72	0.0012	143.0	0.19	0.0186
RB_04_11_04_07_01.dat	2	0.07	4	0.038	1.11	1.72	0.0024	137.4	0.36	0.0351
RB_04_11_06_07_01.dat	2	0.07	6	0.038	1.11	1.72	0.0047	127.2	0.64	0.0621
RB_04_11_08_07_01.dat	2	0.07	8	0.038	1.11	1.72	0.0067	112.9	0.76	0.0735
RB_04_11_10_07_01.dat	2	0.07	10	0.038	1.11	1.72	0.0097	102.8	1.08	0.1040
RB_04_11_12_07_01.dat	2	0.07	12	0.038	1.11	1.72	0.0127	90.4	1.26	0.1222
RB_04_11_14_07_01.dat	2	0.07	14	0.038	1.11	1.72	0.0168	78.3	1.51	0.1462
RB_04_11_16_07_01.dat	2	0.07	16	0.038	1.11	1.72	0.0205	67.5	1.58	0.1527
RB_04_11_18_07_01.dat	2	0.07	18	0.038	1.11	1.72	0.0237	56.2	1.53	0.1483
RB_04_11_20_07_01.dat	2	0.07	20	0.038	1.11	1.72	0.0256	48.8	1.46	0.1412
RB_04_11_22_07_01.dat	2	0.07	22	0.038	1.11	1.72	0.0273	43.4	1.36	0.1311
RB_04_11_24_07_01.dat	2	0.07	24	0.038	1.11	1.72	0.0278	43.2	1.33	0.1287
RB_04_11_25_07_01.dat	2	0.07	25	0.038	1.11	1.72	0.0292	47.3	1.58	0.1529
RB_06_13_00_07_01.dat	3	0.07	0	0.063	1.33	5.89	0.0019	228.9	0.34	0.0096
RB_06_13_02_07_01.dat	3	0.07	2	0.063	1.33	5.89	0.0022	238.5	0.61	0.0174
RB_06_13_04_07_01.dat	3	0.07	4	0.063	1.33	5.89	0.0031	226.2	0.76	0.0214
RB_06_13_06_07_01.dat	3	0.07	6	0.063	1.33	5.89	0.0054	220.4	1.30	0.0369
RB_06_13_08_07_01.dat	3	0.07	8	0.063	1.33	5.89	0.0082	204.2	1.60	0.0453
RB_06_13_10_07_01.dat	3	0.07	10	0.063	1.33	5.89	0.0128	184.0	2.44	0.0690
RB_06_13_12_07_01.dat	3	0.07	12	0.063	1.33	5.89	0.0176	162.1	2.88	0.0815
RB_06_13_14_07_01.dat	3	0.07	14	0.063	1.33	5.89	0.0225	139.6	2.96	0.0837
RB_06_13_16_07_01.dat	3	0.07	16	0.063	1.33	5.89	0.0265	111.2	2.99	0.0847
RB_06_13_18_07_01.dat	3	0.07	18	0.063	1.33	5.89	0.0283	99.3	2.88	0.0815
RB_06_13_20_07_01.dat	3	0.07	20	0.063	1.33	5.89	0.0327	89.4	2.84	0.0805
RB_06_13_22_07_01.dat	3	0.07	22	0.063	1.33	5.89	0.0330	83.2	2.64	0.0746
RB_06_13_24_07_01.dat	3	0.07	24	0.063	1.33	5.89	0.0353	77.0	2.59	0.0734
RB_06_13_25_07_01.dat	3	0.07	25	0.063	1.33	5.89	0.0339	79.1	2.74	0.0776
				X						
IB_03_09_12_06_01.dat	1	0.06	12	0.023	0.89	0.20	0.0021	13.3	0.04	0.0324
IB_03_09_15_06_01.dat	1	0.06	15	0.023	0.89	0.20	0.0038	12.2	0.06	0.0522
IB_03_09_18_06_01.dat	1	0.06	18	0.023	0.89	0.20	0.0058	11.6	0.09	0.0723
IB_03_09_21_06_01.dat	1	0.06	21	0.023	0.89	0.20	0.0065	10.7	0.10	0.0844
IB_03_09_24_06_01.dat	1	0.06	24	0.023	0.89	0.20	0.0053	9.9	0.07	0.0554
IB_06_11_12_06_01.dat	2	0.06	12	0.053	1.11	1.38	0.0050	31.4	0.24	0.0285
IB_06_11_15_06_01.dat	2	0.06	15	0.053	1.11	1.38	0.0071	20.8	0.18	0.0215
IB_06_11_18_06_01.dat	2	0.06	18	0.053	1.11	1.38	0.0123	22.4	0.37	0.0443
IB_06_11_21_06_01.dat	2	0.06	21	0.053	1.11	1.38	0.0142	16.8	0.30	0.0360
IB_06_11_24_06_01.dat	2	0.06	24	0.053	1.11	1.38	0.0187	24.3	0.42	0.0502
IB_03_09_12_07_01.dat	1	0.07	12	0.023	0.89	0.20	0.0021	-1146.0	-8.04	-6.8342
IB_03_09_15_07_01.dat	1	0.07	15	0.023	0.89	0.20	0.0036	11.9	0.07	0.0556
IB_03_09_18_07_01.dat	1	0.07	18	0.023	0.89	0.20	0.0051	10.8	0.08	0.0644
IB_03_09_21_07_01.dat	1	0.07	21	0.023	0.89	0.20	0.0057	9.7	0.09	0.0796
IB_03_09_24_07_01.dat	1	0.07	24	0.023	0.89	0.20	0.0063	8.5	0.11	0.0919
IB_06_11_12_07_01.dat	2	0.07	12	0.053	1.11	1.38	0.0060	31.2	0.24	0.0287
IB_06_11_15_07_01.dat	2	0.07	15	0.053	1.11	1.38	0.0119	40.8	0.69	0.0836
IB_06_11_18_07_01.dat	2	0.07	18	0.053	1.11	1.38	0.0124	26.1	0.49	0.0595
IB_06_11_21_07_01.dat	2	0.07	21	0.053	1.11	1.38	0.0140	17.1	0.21	0.0256
IB_06_11_24_07_01.dat	2	0.07	24	0.053	1.11	1.38	0.0141	17.0	0.35	0.0423
IB_09_13_12_06_01.dat	3	0.06	12	0.090	1.33	4.96	0.0074	45.9	0.77	0.0257
IB_09_13_15_06_01.dat	3	0.06	15	0.090	1.33	4.96	0.0103	29.5	0.47	0.0158
IB_09_13_18_06_01.dat	3	0.06	18	0.090	1.33	4.96	0.0152	16.3	0.26	0.0087
IB_09_13_21_06_01.dat	3	0.06	21	0.090	1.33	4.96	0.0168	20.2	0.61	0.0204
IB_09_13_24_06_01.dat	3	0.06	24	0.090	1.33	4.96	0.0176	21.7	0.51	0.0172
IB_12_15_12_06_01.dat	4	0.06	12	0.122	1.55	27.05	0.0061	55.6	0.59	0.0036
IB_12_15_15_06_01.dat	4	0.06	15	0.122	1.55	27.05	0.0201	171.7	3.80	0.0234
IB_12_15_18_06_01.dat	4	0.06	18	0.122	1.55	27.05	0.0131	32.6	0.92	0.0057
IB_12_15_21_06_01.dat	4	0.06	21	0.122	1.55	27.05	0.0156	15.8	0.41	0.0025
IB_12_15_24_06_01.dat	4	0.06	24	0.122	1.55	27.05	0.0214	26.6	0.94	0.0058

Filename	WS	Draft [m]	Valve setting [-]	H or Hm0 [m]	T or Tp [s]	P_wave [W]	Flow [m3/s]	p_tot [Pa]	P [W]	Eff. [-]
080528										
RB_06_13_14_06_02.dat	3	0.06	14	0.067	1.33	6.04	0.0207	132.2	2.75	0.0759
RB_06_13_18_06_02.dat	3	0.06	18	0.061	1.33	5.81	0.0280	97.0	2.72	0.0781
RB_06_13_22_06_02.dat	3	0.06	22	0.061	1.33	5.80	0.0310	79.9	2.49	0.0714
RB_04_11_14_06_02.dat	2	0.06	14	0.038	1.11	1.64	0.0169	86.0	1.46	0.1486
RB_04_11_18_06_02.dat	2	0.06	18	0.040	1.11	1.87	0.0227	63.3	1.44	0.1283
RB_04_11_22_06_02.dat	2	0.06	22	0.038	1.11	1.67	0.0251	52.4	1.31	0.1312
RB_02_09_14_06_02.dat	1	0.06	14	0.017	0.89	0.28	0.0106	41.0	0.44	0.2625
RB_02_09_18_06_02.dat	1	0.06	18	0.018	0.89	0.30	0.0155	33.9	0.52	0.2875
RB_02_09_22_06_02.dat	1	0.06	22	0.018	0.89	0.28	0.0172	30.3	0.52	0.3141
RB_09_15_14_06_02.dat	4	0.06	14	0.080	1.55	10.23	0.0266	202.5	5.39	0.0878
RB_09_15_18_06_02.dat	4	0.06	18	0.081	1.55	11.19	0.0360	148.5	5.36	0.0798
RB_09_15_22_06_02.dat	4	0.06	22	0.081	1.55	11.27	0.0400	118.3	4.74	0.0702
IB_03_09_15_06_02.dat	1	0.06	15		0.89					
IB_03_09_18_06_02.dat	1	0.06	18	0.023	0.89	0.20	0.0107	23.2	0.27	0.2200
IB_03_09_21_06_02.dat	1	0.06	21	0.022	0.89	0.19	0.0112	20.4	0.25	0.2195
IB_06_11_15_06_02.dat	2	0.06	15	0.054	1.11	1.44	0.0166	70.0	1.28	0.1487
IB_06_11_18_06_02.dat	2	0.06	18	0.052	1.11	1.30	0.0210	58.2	1.35	0.1726
IB_06_11_21_06_02.dat	2	0.06	21	0.053	1.11	1.41	0.0232	51.5	1.31	0.1555
IB_09_13_15_06_02.dat	3	0.06	15	0.092	1.33	5.14	0.0223	125.2	3.15	0.1021
IB_09_13_18_06_02.dat	3	0.06	18	0.088	1.33	4.86	0.0273	94.8	2.93	0.1006
IB_09_13_21_06_02.dat	3	0.06	21	0.089	1.33	4.88	0.0298	80.9	2.74	0.0934
IB_03_09_15_06_03.dat	1	0.06	15	0.052	0.89	1.35	0.0099	62.3	1.58	0.1950
IB_06_11_18_06_03.dat	2	0.06	18	0.054	1.11	1.43	0.0231	55.1	1.54	0.1791
IB_06_11_21_06_03.dat	2	0.06	21	0.074	1.11	3.36	0.0255	125.0	2.21	0.1096
IB_07_13_12_06_03.dat	3	0.06	12	0.075	1.33	3.47	0.0158	100.0	2.44	0.1172
IB_07_13_15_06_03.dat	3	0.06	15	0.109	1.33	8.38	0.0215	202.0	4.62	0.0918
IB_11_15_12_06_03.dat	4	0.06	12	0.106	1.55	8.02	0.0200	154.0	4.74	0.0985
IB_11_15_15_06_03.dat	4	0.06	15	0.137	1.55	15.41	0.0265	311.1	5.43	0.0587
IB_14_17_09_06_03.dat	5	0.06	9	0.135	1.77	14.99	0.0150	276.0	7.59	0.0844
080606										
IB_03_09_15_07_01.dat	1	0.07	15	0.022	0.89	0.19	0.0095	27.5	0.28	0.2515
IB_06_11_18_07_01.dat	2	0.07	18	0.055	1.11	1.51	0.0178	43.3	0.89	0.0984
IB_07_13_12_07_02.dat	3	0.07	12	0.078	1.33	3.71	0.0144	103.6	1.68	0.0753
IF_03_09_15_07_01.dat	1	0.07	15	0.024	0.89	0.21	0.0092	26.4	0.26	0.2066
IF_06_11_15_07_01.dat	2	0.07	18	0.054	1.11	1.43	0.0189	45.5	0.97	0.1130
IF_03_09_15_07_02.dat	3	0.07	12	0.078	1.33	3.76	0.0137	91.0	1.44	0.0638
IF_11_15_12_07_01.dat	4	0.07	12	0.106	1.55	8.45	0.0158	115.0	2.07	0.0409
IF_14_17_12_07_01.dat	5	0.07	12	0.146	1.77	18.53	0.0170	132.0	2.57	0.0231
080611										
IB_06_11_18_06_01.dat	2	0.06	18	0.052	1.11	1.33	0.0229	63.9	1.62	0.2025
IP_03_09_15_06_01.dat	1	0.06	15	0.023	0.89	0.20	0.0090	26.7	0.25	0.2152
IP_03_09_15_06_02.dat	1	0.06	15	0.023	0.89	0.20	0.0088	26.9	0.26	0.2198
IP_06_11_18_06_02.dat	2	0.06	18	0.053	1.11	1.37	0.0231	64.0	1.63	0.1976
IP_07_13_12_06_02.dat	3	0.06	12	0.071	1.33	3.15	0.0158	134.7	2.36	0.1249
IP_11_15_12_06_02.dat	4	0.06	12	0.099	1.55	7.41	0.0175	172.6	3.48	0.0783