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To cite this article: A. Indriani *et al* 2019 *IOP Conf. Ser.: Mater. Sci. Eng.* **505** 012120

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# Performance of Generator Pneumatic for Power Plant of Ocean Wave

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**Abstract.** Pneumatic mechanism has been used in the electrical fields, industrial fields, automotive fields, mechanical fields and so on. The principle of pneumatic work is up and down the piston due to the pressure happen in this system. This mechanism can be applied for ocean wave power generation by use wave water. In the previous study, pneumatic mechanism has been used for mini generator of wave power plant [1]. Component of generator for power plant of ocean wave consist on shaft, tube, magnet neodymium, buoys, lamp LED and wire. In this paper we will focus on the varying of dimensions and position of valve and number of buoys. The results show that position valve of tube piston with double exhaust valve can be work well to give output (Voltage) compare the single exhaust valve. The output of position of tube piston with double exhaust valve is 3.2 Volt with 5 buoys and 2 parallel tube piston.

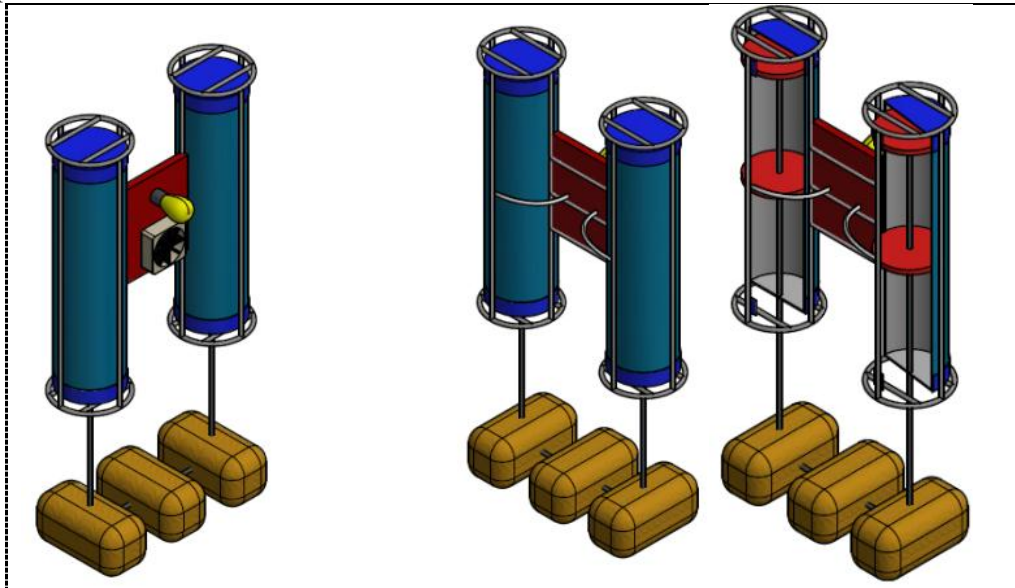
## 1. Introduction

Ocean wave is a biggest resources that always exist in the world. Started from beginning of century until the end of century. Resources of ocean wave can be used for long time without less and also can be replace another resources such as fossil fuel, coal, gas and etc. Similarly with resources of solar, wind and water, ocean wave have some advantages like sea area widely, continuous wavelength, cheaper, flexible, simple equipment requirement, friendly for environment and animal. The problem is the how to design machine or method to get the maximum performance of wave length. Application of wave length power plant can be seen in ocean wave machine [1-8] such as Pelamis [2, 3], Oscillating of Water Column [5, 6], Wave of Surge, Salter of Duck [2, 3], Cockerel Raft [2-6] and Piston [1].

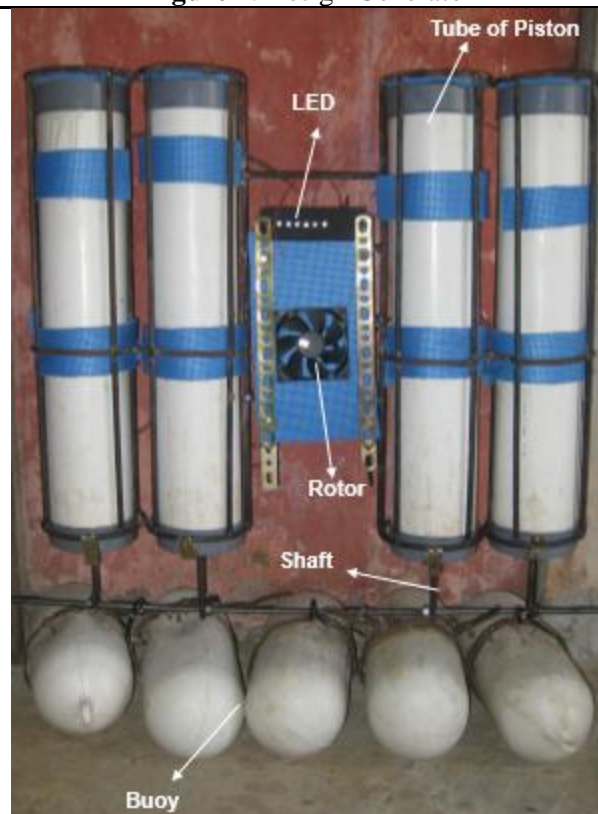
In case of generator by using piston mechanism, the problem happen at uncontinuous move up and down of sea wave length, the pressure is not constant to driven generator therefore the performance of generator for ocean wave length power plant is not stable and optimum. This phenomenon needs some innovation for design to improving the performance of generator for wave length power plant. Like using variant valve to make the pressure become constant, design generator by variant magnet, application many buoys and selection material for tube of piston. In previous research we used one exhaust valve in the top of tube piston and the results show that pneumatic mechanism can give small output (Voltage) and make the light is on [1]. This mechanism still have problem such as unstable pressure due to the piston move down from upper to inside the tube is low and make lamp become lighter small. To solve this problem in this paper generator by use double exhaust valve is applied in the upper and lower position of tube piston. For other variant one exhaust valve at the centre tube piston



also is applied and using many buoys to improve performance of generator for ocean wavelength for power plant.



**Figure 1.** Design Generator



**Figure 2.** Component of the ocean wave power plant

## 2. Method

Generator for ocean wavelength power plant using pneumatic mechanism is considered in this research. Generator for ocean wave length power plant have some component such as piston, tube piston, shaft, pipe for air circulation, buoys, rotor and stator (generator) and light LED. Pneumatic mechanism is

applied for moving and driven the generator. This mechanism is use to get the new resources for power plant at ship as power of light emergency. Generator for ocean wavelength power plant using pneumatic mechanism is put in the ship by clamp. Figure 1 show the component generator of ocean wavelength using pneumatic mechanism consist piston, tube piston, shaft, buoys and etc. Piston, tube piston, shaft, pipe for air circulation is called the mechanic component and generator is called electrical component. The principal working generator of ocean wavelength using pneumatic mechanism is the buoys push the shaft piston to move up and down depend on length of ocean wavelength. When length of ocean wavelength is high, buoys could push the shaft piston to up and other side become down if the length of ocean wavelength is low. High and low the length of ocean wave length making pressure air inside of pipe tube. Then the air will be push the generator to work and having output.

Figs. 1 and 2 show the main component of the power plant of ocean wave. Diameter and height of components piston tube is 101.6 mm and 400 mm. Diameter shaft is 12 mm and length is 1.5 times height of tube piston. Diameter of buoys is 112 mm and length 210 mm. The number of buoys is 3-5 as shown in Fig. 1.

### 3. Result and Discussions

Results of performance generator of power plant of ocean wave by use pneumatic mechanism depend on the performance each component. Performance of mechanic component will be get by measure the pressure air inside tube and voltage from generator for electrical component. Pressure air inside of tube depend on dimension of tube, position of exhaust valve, number of buoys and height ocean wavelength. Figure 3 show the results mechanical and electrical components process. Where show that generator of ocean wave machine for power plant by pneumatic mechanism working well and light LED is on. Also from this figure show that the electrical and mechanical component is function well.

Table 1 show the results value of generator performance power plant of ocean wave. The reach average time for single (center) and double (upper and lower) exhaust valve of tube piston. The reach average time to center exhaust valve of tube piston is 0 and reach average time for upper and lower exhaust valve of tube piston is 1.8s by using 3 number of buoys and become decrease with more number of buoys. For single center exhaust valve of tube piston need more pressure to reach time with good push air inside of the tube piston.

**Table 1 Testing Time for Upper and Lower Position of Piston**

No	Position	Number of Buoys	Average Time (s)
1	Single at centre tube		0
	Upper and lower tube	3	1.8
2	Single at centre tube		0
	Upper and lower tube	4	1.65
3	Single at centre tube		0
	Upper and lower tube	5	1.5

Table 2 show that result of testing data performance generator using pneumatic mechanism for single and double exhaust valve of tube piston. The value of output/voltage and rotation depend on the number of buoys as shown in Table 2. The value of output/voltage and rotation is 0 for single exhaust valve at the center of tube piston with many number of buoys. This result shows that the design generator with many number of buoys not enough effected to give the output/voltage and rotation (rpm). In other hand, for double exhaust valve give the maximum output is 3.2 V and rotation 450 rpm with 5 number of

buoys. The value of output/voltage and rotation become decrease until 1.7 V when using 3 number of buoys. This results show that the position of exhaust valve and number of buoys have effect for output/voltage and rotation on the ocean wavelength machine. This phenomenon happen on the generator for ocean wave length machine because if the number of buoys increase then the pressure air inside of tube piston become higher. If the number of buoys is smaller than the pressure air inside of tube is low.

By using 4 tube of piston and 1-6 LED is get the results as shown in Table 3. From the table 3 show that the generator performance of power plant of ocean wave increasing followed rotation, current and voltage. When the position of tube is up then the value of rotation is lower than the low position of piston. This due to compression inside of piston is big when the position of piston lower. The value of rotation for upper position is 1826 rpm and lower position is 2156 rpm. Current and voltage value is 11.26 mA and 2.5 Volt.

**Table 2 Testing Data Performance of Pneumatic Mechanism**

No	Position	Number of Buoys	Rotation (rpm)	Voltage (V)
1	Single at centre tube		0	0
	Upper and lower tube	3	280	1.7
2	Single at centre tube		0	0
	Upper and lower tube	4	320	2.1
3	Single at centre tube		0	0
	Upper and lower tube	5	450	3.2



**Figure 3. Testing with Light LED**

**Table 3. Piston Position and Performance Generator of Ocean Wave Power Plant**

Number LED	Piston Position	Testing 1			Testing 2		
		rpm	mA	V	rpm	mA	V
1	Up	1826	11.25	2.5	1472	11.16	2.5
	Down	2156	1.29	2.3	1739	0.87	2
6	Up	1863	5.51	3	1165	3.03	2.3
	Down	2672	10.77	2.3	2734	4.31	2.5

#### 4. Conclusions

Conclusions from experimental show that the results of performance generator pneumatic for power plant of ocean wave:

- [1] Performance generator for power plant of ocean wave component depend on number of buoys and position of exhaust valve on the tube piston. When the number of buoys increased, the value of output (Voltage) and rotation (rpm) become high. When the position or piston is up the rotation is smaller than the down position of piston.
- [2] For current and output/voltage, when the position of piston is up the value of current become higher than down position of piston. In other hand the output/voltage is smaller for up position of piston compare down position of piston.
- [3] Maximum value of output/voltage and rotation is 3.2 V and 450 rpm by use 5 number of buoys and double exhaust valve position.

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#### Acknowledgement

This research was financially supported by the Ministry of Research Technology and Higher Education Republic of Indonesia through Hibah Penelitian Unggulan Perguruan Tinggi and Institution of Research and Community Service University of Bengkulu.