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Design of a Wind Pipe Installation Using a Solenoid Valve at the Piksi Ganesha Indonesia Polytechnic Laboratory

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Abstract

This study aims to design a wind pipe installation using a solenoid valve in Piksi Ganesha Indonesia Polytechnic laboratory. The research used the R & D (Research and Development) method. The research results are: 1) the testing of the use of a wind pipe installation using a solenoid valve produced an average wind pressure of 88.57 psi.; (2) the product usability test was 70% which belongs to the "very useful" category for use in the laboratory of the Indonesian Polytechnic Piksi Ganesha; (3) at a pressure of 20 psi when the solenoid valve was open, the air pressure released by the air duster gun increased gradually according to the compressor capacity, while at a pressure of 20 psi when the solenoid valve was closed, the air duster gun could not release the air because the solenoid valve was closed, so the wind could not move towards the air duster gun.

Keywords: Design, Wind pipe installation, Solenoid valve

Abstrak

Penelitian ini bertujuan untuk merancang instalasi pipa angin menggunakan solenoid valve di laboratorium Politeknik Piksi Ganesha Indonesia. Metode penelitian yang digunakan adalah Metode R & D (Research and Development). Hasil penelitian : 1) Pengujian penggunaan instalasi pipa angin menggunakan solenoid valve memerlukan tekanan angin rata - rata 88,57 psi. (2) Uji kemanfaatan produk adalah 70% dalam kategori sangat bermanfaat digunakan di laboratorium Politeknik Piksi Ganesha Indonesia. (3) Pada tekanan 20 psi pada saat katup solenoid terbuka maka tekanan angin yang dikeluarkan air duster gun akan meningkat secara bertahap sesuai dengan kapasitas kompresor, sedangkan pada tekanan 20 psi pada saat katup solenoid tertutup air duster gun tidak dapat mengeluarkan angin karena katup solenoid tertutup sehingga angin tidak dapat bergerak menuju air duster gun.

***Kata-kata kunci**: Perancangan, Instalasi Pipa Angin, Solenoid Valve*

1. Introduction

In the automotive world, the piping system is always used and utilized in work and learning in the workshop [1]. Moreover, it must be designed as effectively and efficiently as possible to maintain the safety of the pipe installation itself when it is used [2]. The design of the wind pipe installation is needed other than as a tool to help someone's work, especially in the automotive world, also as a medium of learning in schools [3]. When you want to design a wind pipe installation, the most crucial thing is in the design of the piping system because in designing a good piping system and according to procedures, it is very necessary to ensure security and safety in the process of working and learning [4].

Advances in technology, especially automotive engines, are developing rapidly. The rapid development of technology is caused by a trend that is always developing in society [5]. Advances in the industrial world also affects the increasingly rapid progress in the automotive world, especially workshop equipment [6]. Equipment that initially used conventional power switched to using mechanical power. The use of mechanical power also has a positive impact on workshop owners and consumers because it can shorten processing time.

When designing a good wind pipe installation, what needs to be considered in order to ensure the safety and security of its users are pipe diameter, component specifications, pipe connections, and installation design [7]. The design of a good pipe installation system is expected to produce practical pipe installations, which in the manufacturing process in terms of laying and safety must be considered in accordance with applicable work operational standards [8]. In designing a wind pipe installation using a solenoid valve, one of the most frequently used energies is electric power. Electric power is a vital public need as well as a decisive source of cheap energy required in various activities [9]. The compressor is a tool that uses electrical energy in the Piksi Ganesha Indonesia Polytechnic laboratory, where this compressor is the main component of this research. Compressors are also used to obtain compressed air, and compressed air is used to tighten and free bolts, inflate tires, and to operate impact wrench, air blow gun, tire inflator, and others.

2. Method

a. Materials

Equipment and materials needed to make a wind pipe installation using a solenoid valve include [10] : medium B galvanized pipe, air duster gun, air hose reel, pipe end lathe, iron tee,

iron knee, quick coupler, compressor hose, insulation, solenoid valve, power cable, mcb switch, grinder, marker, welding mask, electric welding, tape measure, grinding glasses, work clothes, work shoes, wire brush and pliers locking grip pliers.

b. Method

This study is a research and development (Research and Development). The research was carried out at the Piksi Ganesha Indonesia Polytechnic Laboratory. The research method diagram is presented in **Figure 1.**

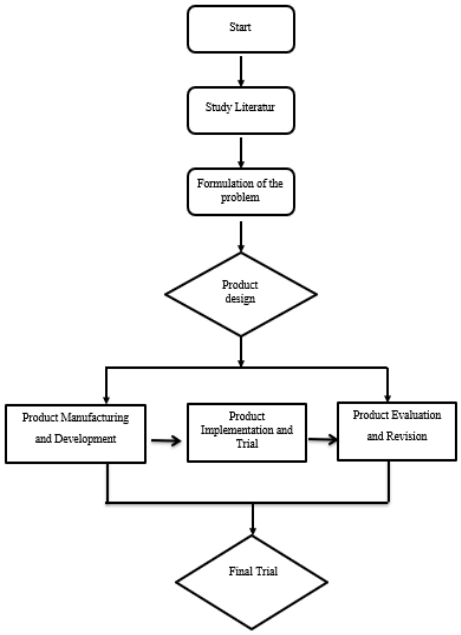

Figure 1. Diagram of Research and Development Research Methods

Then, the design of the wind pipe installation using a solenoid valve is presented in **Figure 2.**

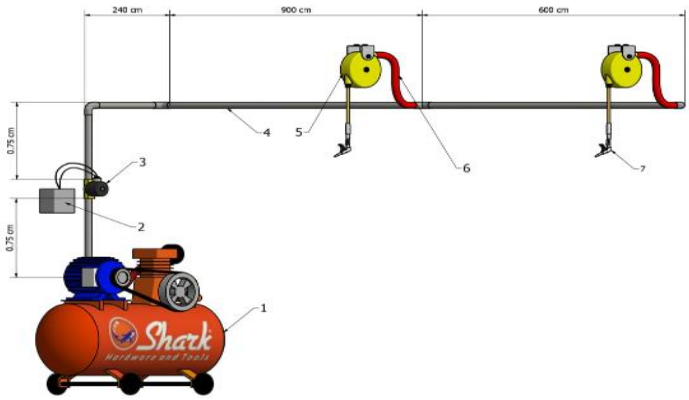

Figure 2. The Design of a Wind Pipe Installation Using a Solenoid Valve

Description : Compressor (1), MCB Switch (2), Solenoid Valve (3), Galvanized Pipe (4), Air hose reel (5), Compressor hose (6), Air duster gun (7).

The working mechanism of the Wind Pipe Installation using a Solenoid Valve is elaborated as follows. When plugging in the plug, the electricity to the compressor will automatically conduct electricity so that the compressor turns on and makes the dynamo rotate, and the van belt will move the piston. Both pistons will suck and push the wind. The wind then exits through the hose to the galvanized pipe and stops at the solenoid valve because the solenoid valve is still closed. The solenoid valve is closed because it has not been electrified (Normally Closed) **[11].** When the solenoid valve is electrified, that is, when the MCB switch is in the ON position, the solenoid valve will open, and pressurized wind will flow towards the air house reel. On the air hose reel, an air duster gun is installed. After that, the air duster gun can be used according to its function.

3. Results and Discussion

a. The results of the design of the wind pipe installation using a solenoid valve

The result of the design of a wind pipe installation using a solenoid valve at the Piksi Ganesha Indonesia Polytechnic Laboratory is presented in **Figure 3.**

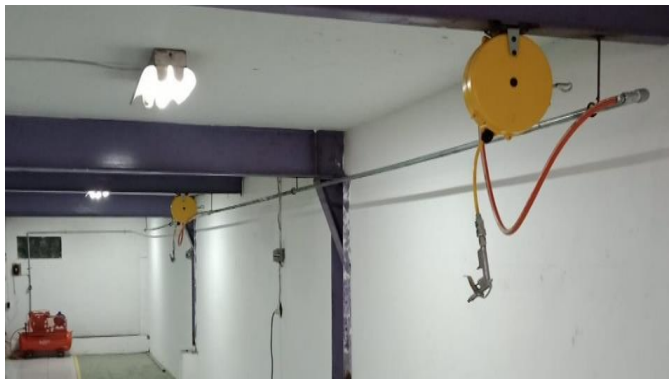

Figure 3. The Result of the Design 0f The Wind Pipe Installation Using A Solenoid Valve

Figure 3 is illustration the result of this research, namely making a wind pipe installation using a solenoid valve. Initially, a wind pipe installation had existed at the Piksi Ganesha Indonesia Polytechnic Laboratory. However, the solenoid valve, MCB switch, and air hose reel had not been installed. Then, in this study, the design of the wind pipe installation using a solenoid valve, air hose reel, and MCB switch was made.

b. Testing of air pipe installation products using a solenoid valve

The results of testing the installation of a wind pipe using a solenoid valve are presented in **Table 1.**

Table 1. Result of Testing Installation of Wind Pipe

No	Incoming pressure	Solenoid Valve	Resulting pressure
1.	10 psi	Open	0 psi
2.	35 psi	Open	10 psi
3.	50 psi	Open	40 psi
4.	65 psi	Open	50 psi
5.	85 psi	Open	70 psi
6.	95 psi	Open	80 psi
7.	110 psi	Open	110 psi
8.	110 psi	Closed	100 psi
9.	90 psi	Closed	60 psi
10.	70 psi	Closed	50 psi
11.	60 psi	Closed	30 psi
12.	40 psi	Closed	25 psi
13.	20 psi	Closed	0 psi
14.	10 psi	Closed	0 psi
15.	0 psi	Closed	0 psi

Based on **Table 1.**, if the air pressure coming out of the compressor and then entering the galvanized pipe is 35 psi when the solenoid valve is open, then the pressure generated on the air duster gun is 10 psi, and so on until the compressor is filled, and the air pressure generated by the air duster gun will continue to rise as long as the solenoid valve remains open. On the other hand, if the compressor releases air pressure of 40 psi when the solenoid valve is closed, then slowly, the air pressure released by the air duster gun will decrease until the air duster gun cannot release air anymore because the solenoid valve is closed, and the wind blowing cannot flow to the air duster gun from the compressor through the galvanized pipe.

The comparative result of the incoming wind pressure and the generated wind pressure when the solenoid valve is open and closed is presented in **Figure 4**.

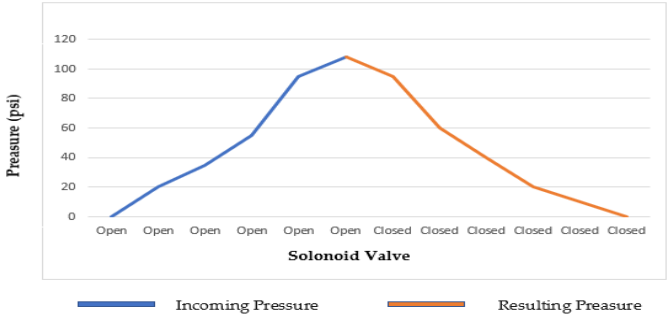

Figure 4. Comparative Result of The Incoming Wind Pressure and The Generated Wind Pressure When The Solenoid Valve is Open and Closed

Based on **Figure 4**, it can be concluded that the incoming wind pressure when the solenoid valve is open will increase according to the wind capacity that can be generated by the compressor so that the air pressure released by the air duster gun when it is about to be used will also increase. On the other hand, if the solenoid valve is closed, the air pressure produced by the air duster gun will also decrease because the solenoid valve is closed so that wind cannot flow down the galvanized pipe to the air duster gun.

Then, the results of testing the wind pipe installation product using a solenoid valve using existing tools at the Piksi Ganesha Indonesia Polytechnic Laboratory are presented in **Table 2.**

Table 2. Testing Results for Air Pipe Installation Products Using a Solenoid Valve

No	Tool Function	Wind Pressure
1.	Inflating motorcycle tires with a tyre inflator	90 psi
2.	Removing and installing car wheel bolts with impact wrench	100 psi
3.	Removing and installing nuts with air screw driver	85 psi
4.	Cleaning dust using an air duster gun	80 psi
5.	Making a hole in the surface of the object with an air drill	90 psi
6.	Painting the vehicle body with a spray gun	85 psi
7.	Leveling the surface of a flat object with an air sander	80 psi
	Mean	88,57 psi

Based on **Table 2**, when used to operate tools such as an air duster gun, impact wrench, and others, it required an average wind pressure of 88.57 psi.

c. Test the Use of Tools through Respondents

Product usability test through respondents by the students of the automotive engine study program Piksi Ganesha Indonesia Polytechnic is presented in **Table 3.**

Table 3. Questionnaire Response

No	Question	Mean
1	Student Voting is very useful in terms of the highest achievement	70 %
2	Students choose quite useful in terms of the highest achievement	20 %
3	Students choose less useful in terms of the highest achievement	10 %

Based on **Table 3**, the average use of wind pipe installations using solenoid valves at the Piksi Ganesha Indonesia Polytechnic Laboratory is 70% in the "very useful" category, 20% in the "moderately useful" category, 10% in the "less useful" category.

4. Conclusion

Based on the results of making and testing a wind pipe installation using a solenoid valve at the Piksi Ganesha Indonesia Polytechnic Laboratory, it can be concluded that the wind pipe installation using a solenoid valve can function properly. The resulting wind pressure was also in accordance with the desired pressure, so it could operate the air duster gun and others. Then, the installation of a wind pipe using a solenoid valve can be used as learning media when the students of the automotive engine study program at the Piksi Ganesha Indonesia Polytechnic do the practicum.

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