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IMPLEMENTATION OF PUMP INSTALLATION SIMULATION WITH SMART RELAY BASED WATER LEVEL FOR PRACTICAL TOOLS IN LEARNING PROCESS

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Abstract. Polytechnic is a skil-based education with a lot of training and practice, it is necessary to be prepared a practicum facilities in terms of instrumentation and control devices, especially pump installation system. An important role in the operation of a system is the electrical system in the form of control is useful to facilitate pump installation operation system and this piping is called the Water Level Control. The complicated difficulty of assembling electrical installations manually. This problem can be solved with water livel contol pump installation system based on smart rerlay. The purpose of this research is to know the discharge of pump water. The data show the average of the water debit calculation theoretically 1.03 liters / minute, mean water debit test at 1.44 liter / minute tool. In conclusion there is a difference about 0.41 liters / minute, the determination of frictional foctor price, coefficient of endurance, pipe diameter, bend type in the specification material not in accordance with the actual material size. It is suggested to the policy makers in the field of vocational education that the tools and practical facilities must be well designed to more effective consider the condition of student learning.

Keywords : Pump installation, smart relay, water level control.

1. INTRODUCTION

Today the international climate leads to industrialization and requires much alumus of the Mechanical Engineering Department who has good qualifications. Polytechnic is education based on skills with debriefing which is quite a lot in the field of practice. The Mechanical Engineering Department will also strive to improve the competence of graduates by providing knowledge that enables graduates to compete in the industrial world.

Increasing the competency of graduates is very necessary to prepare practical facilities in terms of instrumentation and control equipment, especially those related to the pump installation system, this system is widely used in hotels, offices, households and industries. This fluid channel installation system plays an important role in the process of fluid distribution and the efficiency of a fluid channel will be maximal [1].

The things that need to be known in understanding the fluid channel installation system are the plans made appropriately include; determination of pump capacity, pump head, pump power, fluid flow discharge, pipe diameter, pipe position, fittings and bends [2], in addition to those often found in tanks or reservoirs that support system performance especially the system clean water. Reflecting the pump installation system that is no less important and has an important role in the operation of a system is a useful electrical control system to simplify the process of operating a pump installation system and piping is called Water Level Control [3].

The electrical system can be adjusted according to user needs. The electrical system is in the form of controls, there are some difficulties including, complicated in assembling manual electrical installations. This fluid channel installation system includes pumping systems, piping systems, and electrical systems that are still lacking

in understanding the basics of the system.

This problem can be overcome by using a smart rerlay-based water level control system for the learning process. The smart relay system can work automatically, the cost is cheap, maintenance is low, and is quite good when applied in the workplace [4]. It is hoped that this system can improve the competence of the practitioner and graduates can compete in the world of work.

Starting from the description above that focuses on research on pump installation simulation tools with smart relay based water level control, the problem formulation can be described as follows: (a) how to design a pump installation simulation tool with smart relat-based water level control? (b) can the installation of pumps with water level control based on smart relays be used to test the water discharge (Q) of the pump?.

The purpose of simulating pump installations with smart relay based water level control in this study is as follows: (a) know the basics of designing pump installation simulations with water level control based on smart relays, (b) Knowing the pump installation simulation with water level control based smart relay as a practical tool for pipe, pump and electricity installation with water level control and smart relay, and water discharge (Q) from the pump, (c) the output target of this research is the basic understanding that occurs in the system. This simulation will be a method that makes it easy to design piping and control installation systems and engineering applications. The results of this study are published in the PNB logic journal.

The benefits of simulating pump installations with smart relay based water level control in this study are as follows: (a) useful as a practical tool about pumping systems, piping and electricity on water pipe installation, (b) useful as a tool to increase competence in the learning and progress process Bali State Polytechnic Mechanical Engineering Department, (c) useful as a tool to complete the learning facilities in the practicum of the Engineering Department Bali State Polytechnic Machine, so that students master the pumping system, piping and electricity especially with water level control based on smart relay.

2. METHODS

2.1 Design Concepts

The design concept carried out in this study was to design a clean water installation which is usually used as a pump installation simulation device with smart relay based water level control, which was used as a practice simulation for students in the Bali State Polytechnic Mechanical Engineering Department. Design drawing Pump installation simulation tool with smart relay based water level control [4], installation design can be seen in Figure 1.

Figure 1 Simulation of the Pump System

2.2 Scope of Research

The scope of research in making pump simulation devices with smart relay based water lever control is as follows:

a. Drawing and location of components on pump simulation devices with water level control based on smart relays, for installation of clean water.
b. Installing the components in the piping installation on the work desk.
c. Looking for data, namely pump water discharge in a simulation tool.

2.3 Location of Application Simulation Tools

The application of a pump installation simulation tool with a water level control based on smart relay is applied as a practical simulation tool in the Laboratory of Mechanical Engineering of the Bali State Polytechnic.

2.4 Instruments and Materials

The instruments and materials used in this study are as follows:

a. Measuring instruments used
1) Stop watch is used to record the time to calculate debit (l / sec).
2) Metal meters are used to measure the height, length, width of the work table.
3) Digital cameras made by Japang are used to document every activity inside this research.

b. Material used
The materials used in this study were one work desk unit, four pump units with a capacity of 10 l / minute, a 3 liter water tank, a PVC pipe (poly vinilchloride) of ½ "size, 3 water level control, smart relay.

2.5 Data Collection

The data collected from the pump installation simulation tool with smart water level control based on the other is the pump water discharge. Data obtained from the pump installation simulation tool with smart relay based water level control is used to determine the water discharge (Q), and be labeled.

2.6 Research Procedures

To avoid errors in data collection, a research procedure is made as follows:

a. Preparation stage
1) Library study
2) Take care of the letters needed to support the course of the research.
3) Establish a place of research
4) Ask permission from the head of the Mechanical Technology Workshop to conduct research.
5) Prepare data collection officers and tools for research purposes.

b. Implementation Phase
1) Determining the dimensions of the material used
2) Measurements refer to the simulation system in the pump simulation system.
3) Record data obtained and labeled.
4) Comparing the average water debit calculation theoretically with the average water discharge data from testing

2.7 Data Analysis

Data obtained from the results of measurements or calculations from two treatments are analyzed, with the aim to find out how much difference occurs or there is no difference between the ait debit data in theoretical calculations with the water discharge data from the test on the pump simulation tool.

3. RESULTS AND DISCUSSION

3.1 The way the Pump System Works

The workings of the pump system simulation tool with water level control based on smart relay are divided into two parts, namely:

a. How to work part one of the pump system
How it works pump part one is pump 1 functions to suck water from the tube 1 then pump water into the tube 2. Pump 1 works according to the command of water level control 1 which will signal pump 1 to live or die according to the amount of water in the tube 2. Next pump 2 functions to suck water from tube 2 then pump water to tube 4. Pump 2 works according to the command of water level control 2 which will signal pump 2 to live or die according to the amount of water in tube 4, shown in figure 2.

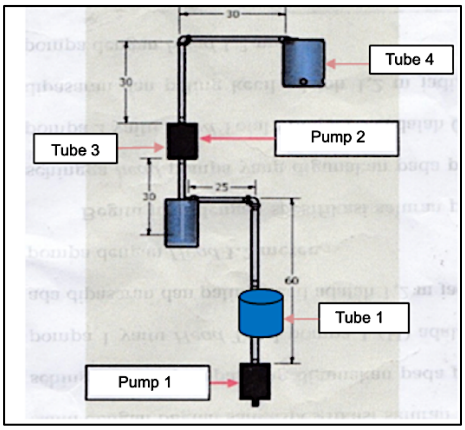


Figure 2 How the pump system works

b. How to work part two of the pump system

The way it works is pump 4 functions to suck water from tube 1 then pump water towards tube 3. Pump 4 works according to the order of water level control 3 which will signal 4 pump live or die according to the amount of water in the tube 3. Then pump 3 functions to suck water from tube 3 then pump water to the tube 4. Pump 3 works according to the order of water level control 4 which will give the signal to pump 3 live or die according to the amount of water in tube 4, shown in figure 3.

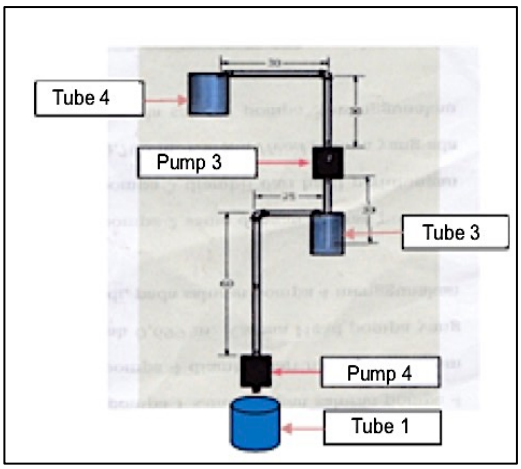


Figure 3. How the Pump System Works Two

In practice, only pump 2, between pump 1 and pump 2 (including part one pump system), while pump 4 and pump 3 (including part two pumping system), if part one of the pumping system works then part two of the pumping system does not work otherwise alternately. But when the POWER + button is pressed then part one and part two of the pump system works, this is done at any time if the water needs are not sufficient, then all pump systems need to work to meet the water needs of the water installation system.

3.2 Calculating theoretical water discharge (Q)

By knowing the results of calculations and data that exist in the installation of pumps with water level control based on smart relays as follows:

Pipe diamete (D) = 0,0166 m

The acceleration of the flow in the pipe = 0,471 m/s

calculate the pipe area and Q [5,6] as follows:

Pipe area = $1/4 .\pi .D^2$ ..... (1)

$= 1/4 . 3,14 \times 0,000276 m^2$

$= 0,000217 m^2$

$Q = A.v$ ..... (2)

$= 0,000217 m^2 . 0,471 m/s$

$= 0,000011 m^3/s$

= 1,03 liter/minute

So the water discharge (Q) on one tap is 1.03 liters / minute

3.3 Data on Test Results in the Pump Installation System

Data of water discharge from the results of theoretical calculations and test data from the pump installation system with smart relay based water livel control, are shown in Table 1.

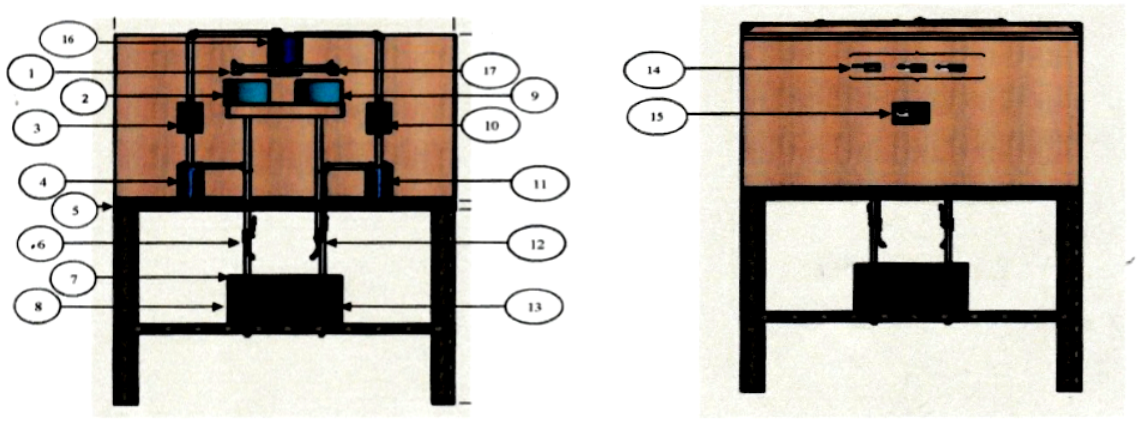
Table 1. Water Discharge from Two Passages

Data Number	Theoretical Calculation Results (liter/minute)	Tool Testing Results (liter/minute)	Different (liter/minute)
1	1,03	1,75	0,72
2	1,03	1,65	0,62
3	1,03	1,55	0,52
4	1,03	1,45	0,42
5	1,03	1,35	0,32
6	1,03	1,25	0,22
7	1,03	1,15	0,02
8	1,03	1,10	0,07
9	1,03	1,09	0,06
10	1,03	1,05	0,02
11	1,03	1,05	0,02
Average	1,03	1,44	0,41

In table 3.1 shows the average water discharge calculated is 1.03 liters / minute while the average water discharge test results on the tool is 1.44 liters / minute, this means there is a difference of 0.41 liters / minute, this because in determining the price of friction factor and resistance coefficient, pipe diameter and type of bend in the material specifications do not match the size of the material actually [2,7].

3.4 Pump Installation Simulation with Water Level Based Smart Relay for Practicum in the Learning Process

Pump Installation Simulation with Water Level Based Smart Relay for Practicum in the Learning Process as Figur 4 follows:



Front view Back view

Information:

1. Tap 1
2. Tube 3
3. Pump 2
4. Tube 2
5. Workbench
6. *Stop* the tap
7. Tube 1
8. Pump 1
9. Tube 3
10. Pump 3
11. Tube 3
12. *Stop* the tap 2
13. Pump 4
14. *Water Level Control* (1,2, dan 3)
15. *Smart Relay*
16. Tube 4
17. Tap 2

Figur 4. Pump Installation Simulation

4. CONCLUSION

4.1 Conclusions

From data collection on a pump simulation tool with water level control based on smart ralay, conclusions can be drawn as follows:

a. Pump simulation tool with smart water level control based on being able to as a practical tool to test water discharge, and able to improve in the learning process
b. Showing the average water debit from the theoretical calculation is 1.03 liters/minute, while the average water discharge from the test results is 1.44 liters/minute, this means that there is a difference of 0.41 liters/minute, this is because in determining the price of the friction factor and the coefficient of resistance, the pipe diameter and type of bend in the material speci fi cation do not match the actual material size.

4.2 Suggestions

a. To policy makers in the field of vocational education in order to provide practical and practical facilities to more effectively pay attention to the conditions of student learning.
b. Further researchers can do more accurate data retrieval by measuring the material directly actually do not depend on the specifications in the material, thus it will be obtained more accurate results.

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