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# Management Temperature on Cooling Time in Control Room KM Gunung Dempo

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*ABSTRACT*

To get optimal comfort conditions in tropical climates such as Indonesia, a system is needed that regulates the air situation based on humidity, heating, and cooling of the air in the room. This condition aims to provide comfort and stabilize the temperature in the condition of the body of every human being. Air conAn airing system, known as Air Conditioning (AC) is on,e a tool to condition the room to remain at a stable temperature.

Temperature regulation is closely related to controlled systems with temperature changes. The control sets or controls one or several specific quantities (variables, parameters). The temperature regulation system consists of inputs or set points that state the current state of the area or reaction to the system, outputs that state the output or action of the system, and plants that are controlled or controlled objects. This study used quantitative research methods with a percentage descriptive approach by comparing the Effect of temperature regulation on the indoor cooling time of around 48m2. The Air Conditioning used in this study is Daikin half PK by ignoring the age of the product. The analysis requirements test used using classical assumption tests include normality tests, linearity tests, autocorrelation, multicollinearity, and heteroscedasticity to measure the magnitude of the influence of temperature regulation on cooling time.

The results showed that temperature regulation affects the cooling time. Based on the H1 hypothesis, a simultaneous significance score (F test) was obtained with a value of 126.109 and a significance score of 0.000 with a significance score criterion < 0.05; then H0 was rejected, so it can be concluded that temperature regulation affects cooling time. The magnitude of the influence of temperature regulation on cooling time is 93.8%. In comparison, 6.2% is influenced by other things that are not studied, for example, outdoor temperature, room tightness, and the number of people and equipment in the room. Based on this study, temperature regulation substantially contributes to cooling time, so it is necessary to regulate the temperature in the efficiency of using electrical energy. The author suggests the importance of regulating room cooling with ideal temperatures in room cooling systems and the use of inverter technology in continuous use as an effort to reduce global heating.



## 1. Introduction.

An air conditioning system, known as Air Conditioning (AC), is one of the equipment that helps regulate air conditions around (Singh & Simina, 2004). Air temperature conditions in Indonesia with a tropical climate use air conditioning is needed to condition the room to remain at a stable temperature to get optimal comfort conditions. Adjustment of room air conditions must be maintained for a long operational time to condition the temperature set so that it is always in a relaxed state (Khandelwal et al., 2017).

The way Air Conditioning (AC) works is to condition the

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air situation in a room that is arranged based on humidity, heating, and cooling of the air in the room (Zhou et al., 2021). This condition aims to provide comfort so as to stabilize the temperature in the condition of the body of every human (Koelblen et al., 2018; Ma et al., 2021).

One of the supporting components of Air Conditioning (AC) is a compressor, oil separator, condenser, dryer, evaporator, expansion valve, refrigerant, and other electrical systems (Goldstein et al., 2005). All components must always be maintained by the manual instruction book so that the performance of the Air Conditioning (AC) machine always works optimally by predetermined standards.

If the system is in average condition when operating and the specified temperature has been reached in the room, the system will stop automatically by disconnecting the electric current by the thermostat on the compressor engine, and the system will operate again when the room temperature rises (James et al., 2017). This is very influential in minimizing damage to the Air Conditioning (AC) machine so that it makes the engine more durable and will increase engine efficiency better because the compressor does not work continuously for a long time. However, the problem that often occurs is that the cooling water pressure is less than optimal, resulting in the compressor turning off due to a hot condenser and less than optimal refrigerant performance; it significantly affects the service life of Air Conditioning (AC).

In general, problems that often occur related to Air Conditioning (AC) performance are the lack of maximum cooling engine efficiency; there needs to be an evaluation based on data in the field to make reference materials as supporting data to determine the level of efficiency of Air Conditioning (AC) machine performance obtained from statistical data calculations through testing the Effect of temperature regulation on cooling time, It is expected that the calculation of the data obtained can make evaluation materials for carrying out maintenance and obtaining temperature efficiency and electrical energy (Saidur, 2010).

The author will conduct an analysis to determine the magnitude of the value that affects temperature regulation on cooling time so that it needs to be tested simply by calculating the time needed to reach the average temperature, which is between 20 ° C - 30 ° C. To reach this temperature, we can calculate how much time it takes to reach the ideal temperature so that it can be a testing material for Air Conditioning (AC).

This study took the library from influence, such as settings, cooling time, SPSS, and Air Conditioning (AC). Influence is the power that arises from something (person, thing) that shapes a person's disposition, beliefs, or actions (Blundell et al., 2015). Influence is the trigger to get something desired (Guerin, 2003). Temperature regulation is closely related to the control system with changes to a specific temperature (S. X. Li et al., 2009). The control system is the process of regulating or controlling one or several quantities (variables, parameters) so that it is at a specific price (range) or maintained stability (Riahi Sfar et al., 2018). The temperature regulation system consists of inputs or set points that state the current state of the area or reaction to the system, outputs that state the output or reaction of the actual system, and plants are objects that are controlled or controlled (Aguiar et al., 2005). In an open state, control does not depend on output, so the system cannot correct in case of interference (Steubing et al., 2016; Thornton, 2009); not only that, to get good results is very dependent on a calibration that is established bond between input and output, and there is no internal or external interference. In a closed control system, the output or reaction of the system can affect the control action (Guo & De Persis, 2021). Control depends on the output so that the system can provide corrections in case of interference. To create proper control, control methods are needed to avoid the formation of over-correction that can cause abnormal systems (Nogami et al., 2021).

The speed of cooling time is the influence of heat transfer and thermal conductivity on the cooling media, including temperature, humidity, and ambient air quality, so that the cooling time has the proper cooling capacity and is controlled in operation (Miao et al., 2021). SPSS is a software used to perform computer-based statistical calculations (Larrosa et al., 2015). The advantage of this program is that one of them is that we can do calculations quickly from all statistical calculations from straightforward to complicated or complex. However, if done manually, it will take longer. The user's task only needs to design the variables to be analyzed, enter data, and perform calculations using the stages contained in the available menu.

After the calculation, the user's task is to interpret the numbers obtained by SPSS. This process of interpretation is what is important to do rather than just entering numerical values and calculating them. In carrying out the interpretation, we must be equipped with the interpretation of the tests carried out and about statistics and research methodology, SPSS, which is known as the most popular statistical data processing software and is widely used in various certain aspects. SPSS has complete capabilities in processing and analyzing statistical data, which helps manage based on statistical information data and reporting methods within a more excellent range of analysis (Verhoef, 2002).

Air Conditioner (AC) is equipment that works by changing heat from a low-temperature heat reservoir to a high-temperature heat reservoir with a substance in the form of a fluid so that it reaches the desired temperature and humidity (Olkis et al., 2021). Air Conditioner (AC) works by transferring heat from indoors to outdoors (Stockman et al., 2021). The compressor that functions to drain refrigerant into a copper pipe in the form of an air coil flows from an air fan or blower so that the heat in the air is absorbed by the refrigerant pipe and makes the dew point that is flowed into the room to make the air around the room cool (Jwo et al., 2006).

## 2. Methodology.

The author uses quantitative methods because the data is concrete. The data to be processed is data with a ratio of (Polhuis et al., 2022) so that the data that is the focus of this study is to determine the influence of temperature variables and time variables so that the magnitude of the influence of each Variable to be used can be known.

The descriptive method used in this study was carried out to determine the value of each Variable (Gijon-Nogueron et al., 2016; Nurdayati et al., 2021). The descriptive method uses case studies to provide a detailed picture of the background and scope with an emphasis on the factors of a particular case or covering the overall factors and phenomena of the case as a whole (Hagen et al., 2019).

This study was conducted by the author for one month and two days using AC half PK which was also the population and sample in this study. The population is a generalized area consisting of objects or subjects that have specific quantities and characteristics that are determined by researchers to be studied and then draw conclusions (Bratus et al., 2017). The population is the sum total of objects or subjects that are in an area and meet certain conditions(K. Li, 2022; Valerii Zhuk, 2020). After the data is collected and tabulated, then a requirements test is carried out and processed using simple regression. Through this approach, significant results will be obtained on the relationship between the variables studied.

## 3. Results.

### *3.1. Results of Percentage Descriptive Analysis.*

The author describes temperature regulation against time using tables and bar charts about temperature regulation against time, based on the results of the study can be seen in Table 1 below:

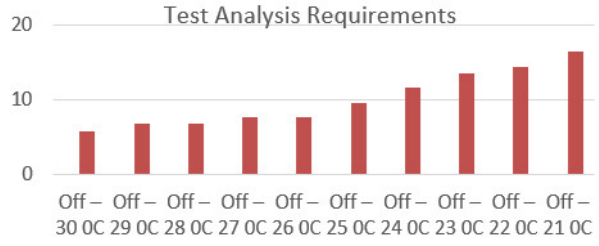
Table 1: Description of Temperature Control Against Time.

| No. | Temperature Intervals | Criteria | Time (Minutes) | Percentage |
|---|---|---|---|---|
| 1 | Off – 30 $^0$C | Impermeable | 6 | 5,77% |
| 2 | Off – 29 $^0$C | Impermeable | 7 | 6,73% |
| 3 | Off – 28 $^0$C | Impermeable | 7 | 6,73% |
| 4 | Off – 27 $^0$C | Impermeable | 8 | 7,69% |
| 5 | Off – 26 $^0$C | Impermeable | 8 | 7,69% |
| 6 | Off – 25 $^0$C | Impermeable | 10 | 9,62% |
| 7 | Off – 24 $^0$C | Impermeable | 12 | 11,54% |
| 8 | Off – 23 $^0$C | Impermeable | 14 | 13,46% |
| 9 | Off – 22 $^0$C | Impermeable | 15 | 14,42% |
| 10 | Off – 21 $^0$C | Impermeable | 17 | 16,35% |
| Total | | | 104 | 100% |

Source: Authors.

Based on Table 1 above, it can be seen that the temperature variable experiences an interval that is relatively directly proportional to the cooling time variable. The calculation results show that the average time for the cooling process required by the engine is 10 minutes, which is at intervals of 250C. More details can be illustrated through the bar chart (Figure 1).

Figure 1: Temperature Against Time Setting Diagram.

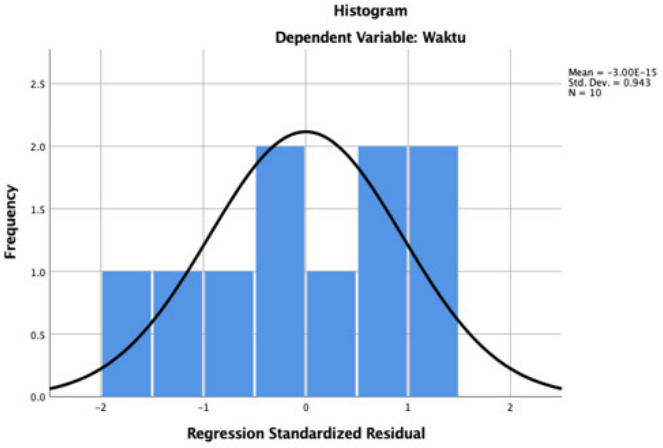



Source: Authors.

## 4. Test Analysis Requirements.

a. Normality Test

Figure 2: Normality Test.




Source: Research data processed, 2022.

Based on Figure 2. From the results of the normality test above, it can be seen that most of the data is shown by small circles that tend to approach the linear line. So it can be concluded that the data is distributed normally.

Table 2: Normality Test Results.

**One-Sample Kolmogorov-Smirnov Test**

| | | Unstandardized Residual |
|---|---|---|
| N | | 10 |
| Normal Parameters[b] | Mean | .0000000 |
| | Std. Deviation | .95979796 |
| Most Extreme Differences | Absolute | .133 |
| | Positive | .113 |
| | Negative | -.133 |
| Test Statistic | | .133 |
| Asymp. Sig. (2-tailed) | | .200[c,d] |

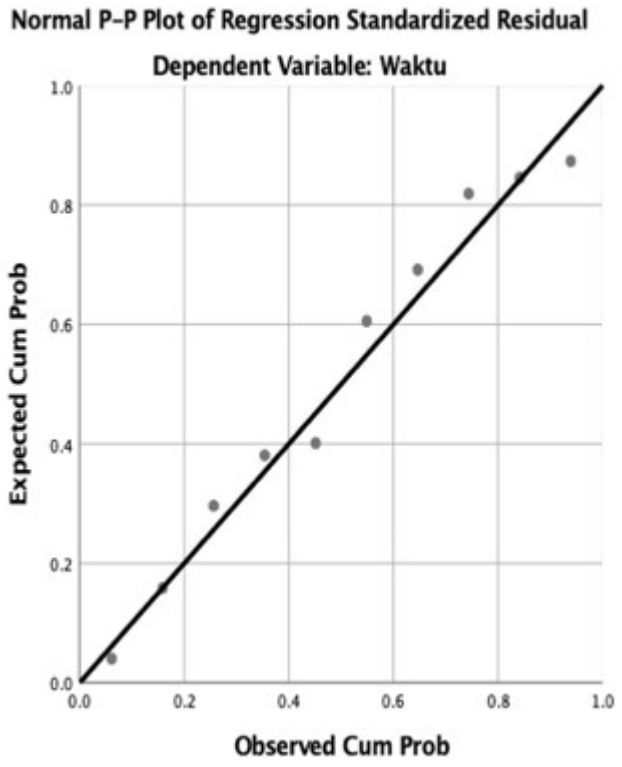
a. Test distribution is Normal.
b. Calculated from data.

Source: Authors.

The normality test performed with the Kolmogorov - Smirnov sample shows that the test results in Table. 2 indicate a standard deviation with a value of 0.95. This is the result of testing conducted using SPSS software. So it can be concluded that after testing, the normality test is known to have significant values of 0.95 > 0.05. This shows that the normality test residue is usually distributed with a probability of > 0.05.

b. Linearity Test

Figure 3: Linearity Test Graph.




Source: Processed Research Data, 2022.

c. Autocorrelation Test

Table 3: Autocorrelation Test Results.

| Model | R | R Square | Adjusted R Square | Std. The error in the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | 0.946[a] | 0.895 | 0.881 | 0.65845 | 2.088 |

Predictors (Constant), Lag_Temperature

Dependent Variable: lag Time

Source: Authors.

Based on Table 3 above, the result of the calculation of the Durbin Watson value is 2.088; the value will then be compared with the significance table value of 5%. The number of samples is 10 (n), and the number of variables is 2 (k = 2); then, from the Durbin Watson table will be obtained a dD value of 1,320. Since the DW value of 2.088 is greater than the dU limit of 1.320 and less than 4-1.320 = 2.68, it can be concluded, according to the comparison of Durbin Watson's Table, that there is no autocorrelation.

d. Multikolinearity Test

Table 4: Multicollinearity Test Results.

| Model | Correlations | Collinearity Statistics | |
|---|---|---|---|
| | Partial | Tolerance | VIF |
| (Constant) | | | |
| temperature | .099 | .779 | 1.013 |

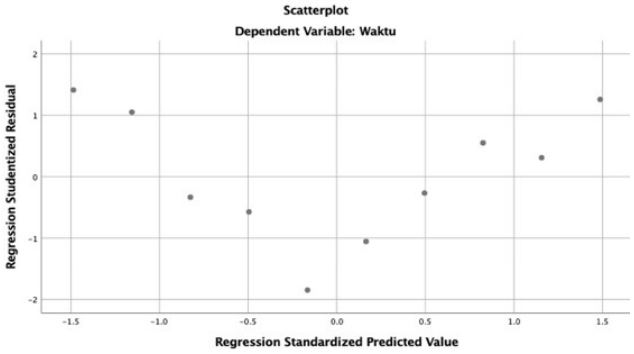
a Dependent Variable: Time

Source: Authors.

Based on Table 4 above, the VIF column on the temperature variable shows a value of 1.013, while the tolerance column shows a value of .779. Based on the tolerance and VIF values of each independent Variable, show a tolerance value of > 0.10 and a VIF value of <10, so from the calculation of data using SPSS software, it can be concluded that the data model in the calculation does not occur multicollinearity with significant values that meet the requirements.

e. Heterokedasticity Test

Figure 4: Scatterplot Chart.




Source: Authors.

Through the scatterplot graph, it can be seen whether a regression model has homoscedasticity or not. Based on the results of Figure 4, it can be seen that the points spread randomly both above and below the number 0 on the Y-axis; it can be concluded that there is no heteroscedasticity in the regression model in this study.

Table 5: Heteroscedasticity Test Results.

| Model | Unstandardized coefficients | | Standardized coefficients | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| 1 (Constant) | -.202 | 1.432 | | -.141 | 0.892 |
| Temperature | 0.039 | 0.056 | 0.237 | 0.691 | 0.509 |

a. Dependent Variable: RES 2

Source: Authors.

Based on Table 5 above, it can be seen that the Sig. Value of 0.509 where > 0.05, then the regression model is free from the symptoms of heteroscedasticity or also called homoscedasticity. It is said that there are no symptoms f

heteroscedasticity if the value of Sig. indicated by "Prob > chi2" is > 0.05.

f. Hypothesis Testing Results

Table 6: T-Test Test Results.

| model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. EError | Beta | | |
| 1(Constant) | 41.927 | 2.876 | | 14.578 | .000 |
| Temperature | -1.236 | .112 | -.989 | -11.031 | .000 |

a. Time-dependent Variable

Source: Authors.

Based on Table 6 above, the results of the temperature variability have a calculated t value of -11.031 which means it has a more excellent value than the table t value with a value of -2.306 and a Sig. A value of 0.000 has a smaller value than the table significance level of 0.05. So if analogous in the formula 0.000 < 0.05 and -11.031 > - 2.306. then from the results of these calculations, it can be concluded that H0 is rejected, which shows that temperature variables affect time.

g. Simultaneous Significance Test (Test F)
In this study, the F test is needed to determine the effects of independent and dependent variables together or which affect the Variable (Y), namely cooling time, and which is influenced by the variable (X), namely temperature regulation. The test here is done by comparing the f value in the calculation of the above Table and compared with the F value of the Table and the size of the sig value. The Table above is used to determine the significant value in the F value of the Table, the value of Sig. Compared to the significance value, which is 0.05.

Table 7: Simultaneous Test Results (Test F).

ANOVA[a]

| Model | Some of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| 1. Regression | 126.109 | 1 | 126.109 | 121.684 | .000[b] |
| Residual | 8.291 | 8 | 1.036 | | |
| Total | 134.400 | 9 | | | |

a. Dependent Variable: Time
b. Predictors(Constant ), Temperature

Source: Authors.

Based on Table 7 above, the calculation results of temperature variations have a calculated f value of 126,109 and Sig. of 0.000 in the ANOVA table. From the f value obtained, it will be compared with the f table that has been calculated previously, and the results obtained are 5.12. From this value, the calculated f value has a more excellent value than the table f value with a value of 126.109 and a Sig. A value of 0.000 has a smaller value than the table significance level of 0.05. So if analogous in the formula 0.000 < 0.05 and 126.109 > 5.12. then from the results of these calculations, it can be concluded that H0 is rejected, which shows that there is an influence of independent variables together to the dependent Variable, so H1 is accepted; that is, there is an influence of temperature regulation on cooling time.

h. Coefficient of Determination (R2)
The coefficient of determination is a test to measure the percentage of influence of the independent Variable with the dependent Variable in the percentage value in a regression model. The value that can be used for the coefficient of determination is the value in R Square in the regression model calculation, the value in R2 is the value between zero, and the value of one, and values that are close to one are independent variables can produce almost all the information needed for the prediction of variation in the dependent Variable.

Table 8: Coefficient of Determination Test Results.

Model Summary

| Model | R | R Square | Adjust R Square | Std. Error The error Estimate |
|---|---|---|---|---|
| 1 | .969[a] | .938 | .931 | 1.018 |

a. Predictors: (Constant), Temperature

Source: Authors.

Table 8. above shows an R Square value of 0.931, meaning that there is an influence of 93.8%; it shows that the independent Variable provides almost all the information needed to predict the dependent Variable. This percentage, of course, shows that the dependent variable can be explained by an independent variation of 93.8% and while the remaining 6.2% is another independent variable that is not explained in this study.

## 5. Discussion.

Based on the results of statistical calculations of the Effect of temperature regulation on cooling time, it is obtained that temperature regulation has a significant influence on cooling time. This can be shown by the results of statistical calculations processing data which show that the results of simultaneous significance testing (F test) have a good value of 126,109 with a significance value of 0.000. Based on the results of the decision-making criteria, it shows that the H0 hypothesis is rejected, which means that the results of simultaneous significance test calculations show that there is an influence of independent variables together on the dependent Variable so that H1 is accepted, that is, there is an influence of temperature regulation on cooling time.

Based on the test results shows that the temperature regulation variable influences the grinding time, with a good value seen from the tested coefficient of determination, which is 93.8%. In comparison, the remaining 6.2% is influenced by other factors that are not included in this study, such as room tightness, the outdoor temperature then, the number of people in the room, weather, and the location of the cruise area and others that can be used as factors external in this study. The results of this study are in line with research conducted by (Gaetani et al., 2018) that temperature regulation influences grinding time.

## Conclusions.

Based on the results of the study, it can be concluded that temperature regulation affects cooling time based on the H1 hypothesis; it is shown by a simultaneous significance score (F test) with a value of 126.109 and a significance score of 0.000 with a significance score criterion < 0.05 then H0 is rejected, so it can be concluded that temperature regulation affects cooling time. The magnitude of the influence of temperature regulation on cooling time is 93.8%, while 6.2% is influenced by other things that are not studied. Suggestions that can be conveyed based on the results of this study are, Temperature regulation makes a substantial contribution to cooling time, so it is necessary to regulate the temperature in the efficiency of using electrical energy in the long term. The need to regulate room cooling with the ideal temperature in the room cooling system and the use of inverter technology in continuous use to reduce global heating.

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