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Inverator Starting Energy Saver Design For Electric Power Efficiency in Water Pumps

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Abstract –*The use of a water pump at the initial start is the use of electricity with a large capacity which sometimes faces various kinds of efficiency problems. These problems include an increase in current that occurs in the channel by improving the quality of electric power, especially in the electrical system in the area of the use of the water pump, which is expected to be able to improve the quality of electric power. The purpose of the research was to design an inverator starting energy saver as an effort to improve power quality for electricity savings, electric power efficiency in water pumps. This improvement is also expected to be able to reduce the cost of using electricity bills, especially in the use of water pumps. To be able to carry out the improvement of the quality of the electric power, it is necessary to calculate the active power and apparent power when the water pump is used. After performing these calculations, the installation of the inverator starting circuit saver electricity will be used. By carrying out these steps by installing a series of invertor that can improve the quality of electrical power. And by using the inverator circuit starting Energy saver, it is clear that it produces an active power efficiency value of 82% of the active power before using the 272-watt inverator circuit and active power after using the 223.9-watt inverator circuit, and also produces an apparent power efficiency value of 83% before using the circuit inverator 275.18 VA and apparent power after using the inverator circuit 227.94 VA.*

Keywords: *Starting Energy Saver, Inverator, Water Pump, Efficiency*

I. Introduction

In modern life today the use of electrical energy is very large, the amount of energy used is determined by reactance (R), inductance (L) and capacitance (C). Every household equipment (load) certainly has a difference in the amount of electrical energy consumption needed. This is because the equipment (load) is both inductive and capacitive, which generates reactive power [1] [2]. This reactive power is useless power so that it cannot be converted into power but is needed for the process of transmitting electrical energy to the load [3] .

.This improvement is also expected to be able to reduce the cost of electricity bills at home and at locations that use water pumps [4] [5]. Recent technological developments have progressed quite rapidly, marked by the presence of electronic equipment or commonly referred to as electrical loads. The use of electrical loads today is indeed far more complex than the use of electrical loads in the past. The use of these electrical loads is widely used both in households, office buildings, and in industry so that it affects and causes a decrease in the supply system and power quality [6] [7].

The need for good quality electrical power and in terms of various electrical equipment used both in laboratories, lecture rooms, and other rooms that use electrical equipment [8], it is very necessary to have good quality electrical power in supporting all forms of lecture activities within the scope of faculty, Generally, the distribution of electrical power is used to serve loads such as: electric motors, computers [7] and other electrical equipment in which these loads contain coils of inductor wire. Inductors are components that absorb electric power for the purposes of magnetization

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and electric power. is called reactive power [9] [10].

Based on previous research on energy saving, the researchers designed an inverator starting energy saver on a water pump where this research was conducted aiming to design an Inverator Starting Energy Saver circuit that is useful for saving electricity on a water pump, to analyze the difference before and after using the Inverator Starting Energy Saver circuit on the water pump, to calculate the efficiency value contained in the water pump.

II. Methodology

The research was conducted at the Electrical Engineering Laboratory, Faculty of Engineering, Universitas Muhammadiyah Sumatera Utara and at Street Gelatik 12 No. 399 Perumnas Mandala.

Inverator is a tool for boosting electrical power surges, this tool does not violate the provisions of PLN because it does not interfere or change anything on the PLN meter. The electrical power capacity installed on the home network will limit the use of electrical power that can be distributed to the load [7]. The inverator is designed to reduce the electric current caused by electrical loads, while the core components of simple inverator equipment are 0.3 mm diameter nickelin wire in the form of a winding, 820 Ohm resistor, LED and gypsun compound fluid, as shown in Figure 1 below:

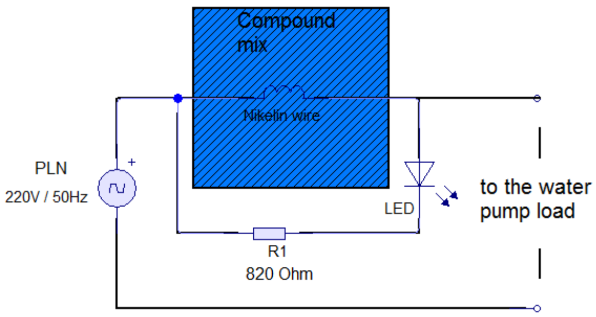


Fig 1. Simple Inverator Design

It can be seen in Figure 1, the blue color is a compound mixture in which there is a nickeline wire. The resistor is connected in series with the cathode of the LED, the ends of each resistor and the anode of the LED are connected in parallel with the ends of the nickeline wire. The end of the nickel wire and the LED anode is one of the positive output terminals of the load, and for the negative terminal output directly from the negative source of the inverator circuit. The function of this inverator is a tool to reduce current through the parallel winding of nickeline and resistors, and the function of this compound mix is to function as an insulator and coolant on nickeline wire.

There are 4 ingredients as the main components in the completion of this research, namely:

1) Inverator Starting Energy Saver, used as a 10% - 40% electrical energy saving device which is suitable for use for electric motor loads such as Water Pumps.
2) Power Meter, Power meter is a measuring instrument that can read voltage, current, frequency, power factor, active power and KVARH electricity consumption [11],
3) Shimizu brand water pump PS 160 BIT model as the measured load
4) Stop Contact, as a liaison between the Water Pump and the Inverator Circuit Starting Energy Saver.

Inverator Starting Energy Saver Inverators are several Varistors and Capacitors and other circuits that will reduce inrush currents and Energy Savers on electric motor loads [10] [12], especially the use of Water Pumps. In general, electrical loads that have inrush current characteristics are electric motors [13], but this also happens to other electrical equipment that has capacitors/elco and diodes or rectifier circuits, such as power supplies on PCs. An electric power booster is an electronic device that is used as a medium for distributing electrical energy and increasing the use of electrical energy [14]. In accordance with the working principle of an electric generator, this unit is capable of producing a strong current and alternating voltage (AC) which works through the principle of activation of AC electric voltage.

The process of testing and data collection will be carried out every 30 minutes when the Water Pump is used. Data recording and observation is carried out starting from data on voltage, current, frequency, Pf, active power and apparent power generated before and after using the Inverator Starting Energy Saver circuit.

III. Result and Analysis

The design and installation of the test equipment is shown in Figure 2. Knowing the current, voltage and frequency of the water pump used is very important, especially if we want to install an inverator starting Energy Saver for efficient use of electrical power. From the data, the value on the nameplate on the water pump used is not absolute because the electric voltage from the PLN source is not constant at 220 Volts [10].

Fig. 2. Tool Design

Fig. 3. Nameplate water pump

Judging from Figure 3 above, the important data from the water pump needed for measurements and calculations are 220 Volt voltage, 1.3 Ampere current and 50 Hz frequency.

The researchers conducted measurements and direct observations in the field to prove the value of voltage, current, frequency and power factor (cos phi) [15] [16] , as well as the power generated when the water pump was operating. So the authors would like to inform the results of research conducted from observations carried out that studies of data collection in the field can be concluded that the differences that will occur before and after using the inverator starting Energy Saver, where data collection for 30 minutes is then changed to 60 minutes due to usage time pump water in one day 60 minutes or 1 hour of use, to meet 500 liter water barrels plus 2 300 liter water tanks for a total of 800 liters per 30 minutes of running water pump, then multiplied in one month of use.

III.1 Measurements Result

1) Live Load Data Not using Inverator starting Energy Saver

Measurements and direct observations were carried out for 30 minutes to meet the 800 liter water needs. The results of these measurements and direct observations without using the Inverator starting Energy Saver, where the measuring instrument used is the power meter.

From the measurement results, the data on the results of voltage, current, power factor and power can be tabled in table 1 below:

TABLE I
LOAD MEASUREMENT BEFORE USING THE INVERATOR STARTING ENERGY SAVER

Load	T	Voltage	Current	Power factor	Load Power
Water Pump Shimizu PS 160 BIT	30 minute	216 V	1,274 A	0,98	272 W

2) Live Load Data Already Using Inverator Start Energy Saver

Based on the purpose of this study to produce efficiency in the use of electrical energy, direct measurements and observations were carried out for 30 minutes to meet 800 liters of water needs. The results of measurements and direct observations are using the Inverator starting Energy Saver, where the measuring instrument used is the power meter.

From the measurement results, the data on the results of voltage, current, power factor and power can be tabled in table II below:

TABLE II
MEASUREMENT OF LOAD AFTER USING INVERATOR STARTING ENERGY SAVER

Load	T	Voltage	Current	Power factor	Load Power
Water Pump Shimizu PS 160 BIT	30 minute	207,6V	1,098 A	0,98	223,9 W

From the measurement results when using the Inverator Starting Energy Saver, there is a decrease in voltage and current as well as the power generated at the water pump. This is due to the large enough resistance in the inverator circuit, so that the inverator output voltage drops. This voltage drop also affects the current decrease due to resistance through obstacles in the inverator circuit. From the results of the voltage using the Inverator Starting

Energy Saver, it is still allowed because it is not up to 10%, which is 9.4%.

III.2 Calculation

1)Calculations Before and After Using the Inverator Starting Energy Saver

Active Power (Before) [17]
Given: V = 216. Volt
I = 1.274 Ampere
Power factor (Cos phi) = 0.98
Asked : P ....?
P = V x I xCos phi [17]
= 216 x 1.274 x 0.98
= 269.68 Watt→on the Power Meter measuring instrument reads 272 Watt

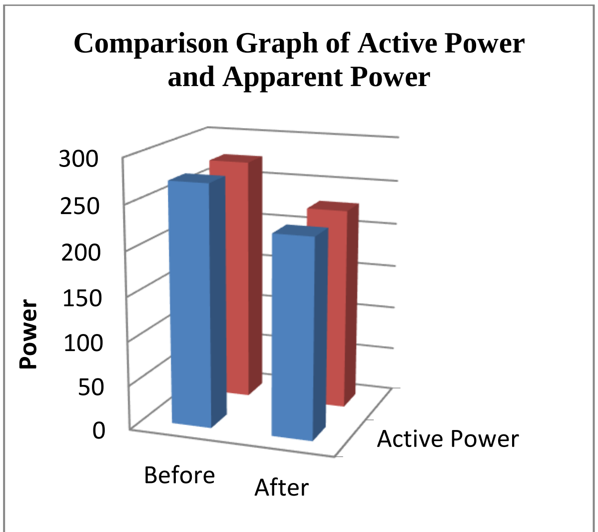
Active Power (After)
Given: V = 207.6 Volt
I = 1.098 Ampere
Power factor (Cos phi) = 0.98
Asked : P ....?
P = V x I x Cos phi
= 207.6 x 1.098 x 0.98
= 223.39 Watt→on the Power Meter measuring instrument it reads 223.9 Watt

2) Apparent Power Calculation Before and After
Apparent Power (Before) [18]

Given: V = 216. Volt
I = 1.274 Ampere
Asked: S........?
S = V . I
= 216 x 1.274
= 275.18 VA

Apparent Power (After)
Given: V = 207.6 Volt
I = 1.098 Ampere
Asked: S........?
S = V . I
= 207.6 x 1.098
= 227.94 VA

From the measurement results and the calculation results for active power and apparent power before and after using the inverator starting energy saver circuit, the results can be seen in the following graph of Figure 4:



	Before	After
Active Power	272	223.9
Apparent Power	275.18	227.94

Fig 4.Comparison Graph of Active Power Usage and Apparent Power Before and after Using the Inverator Starting Energy Saver

3)Active Power Consumption Efficiency, ApparentPower

Active Power Efficiency [19]
Given : P after : 223.9 Watt
P before : 272 Watt
Asked :Efficiency…………?
η % =(P after)/(P before)x 100%
=223.9/272 x 100%
=0.82 x 100%
= 82%

Apparent Power Efficiency
Given= S after : 227.94 VA
S before : 275.18 VA
Asked : Efficiency…………?
η% =(S after)/(S before)x 100%
= 227.94/275.18 x 100%
= 0.83 x 100%
= 83%

IV. Conclusion

Based on the purpose of this research, where the expected results and also able to reduce the use of electric power, especially in the use of water pumps. To be able to carry out the improvement of the quality of the electric power, it has been carried out and has concluded the calculation of the active power and apparent power when the water pump is used. After doing these calculations, through the use of the inverator starting circuit, the electricity saver is used. By performing these steps by installing and using the inverator circuit starting Energy saver, it is clear that it produces an active power efficiency value of 82% of the active power before using the 272 Watt inverator circuit and active power after using the 223.9 Watt inverator circuit, and also produces an efficiency value. the apparent power is 83% before using the inverator circuit 275.18 VA and the apparent power after using the inverator circuit is 227.94 VA.

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