The Analysis of Comparison Electrical Power Measurement on LED Lamps

Prisma Megantoro1, Geston Bakti Munthoa2, Kunal Kunal3, Phong Thanh Nguyen4, Elsayed T. Helmy5

1,2 Department of Electrical Engineering and Informatics, Universitas Gadjah Mada, Yogyakarta, Indonesia
3 School of Information, Communication & Technology, Indraprastha University, Delhi, India
4 Director, Department of Project Management, Ho Chi Minh City Open University, Vietnam
5 National Institute of oceanography and fisheries, Alexandria

gestionbakti@mail.ugm.ac.id, Kunal.karn007@gmail.com, phong.nt@ou.edu.vn, stalaat41@gmail.com

Abstract—This study uses 2 variations of the value of the DC 12V LED lamp power that is 12W and 15W with 3 different brands of lamp variations. Measurement of input voltage and current is carried out using a Krisbow KW06-490 DC clampmeter that has been calibrated as a standard measuring instrument and a Krisbow KW06-491 DC clampmeter that has not been calibrated as a test gauge 1 and a Multimeter Viper DT830B that has not been calibrated as a test gauge 2. Data the current and input voltage between each lamp and different lamp brands are used to calculate the value of the test lamp power and then compare it. The big conclusion from this study was found that the error value between the value of the test power or the power needed for these devices to operate [8] – [11]. These parameters need an audit so that there is no loss to consumers who use the product as a device in a home lighting system.

Keywords—voltage, current, power measurement, error

I. INTRODUCTION

Electrical energy is one form of energy that is needed by humans [1] – [4]. Electrical energy is used by humans as an energy source for equipment to help with any work [5] – [7]. One form of utilization of electrical energy is for lighting equipment sources such as lights as lighting sources at night. Devices that require electrical energy sources also have a certain electrical energy consumption in accordance with the power needed for these devices to operate [8] – [11]. These parameters need an audit so that the correctness of the device’s power is in accordance with the specifications so that users can adjust electrical energy consumption. This can be done with the measurement process. Metrology is a science related to measurement. Everyday life of every human being is never separated from the wholeness and knowledge of metrology in the field of measurement, evaluation, and weighing [12] – [17]. Similarly, the industrial sector requires tools that can measure accurately to determine the quality standards of a product through a calibration process [18] – [25]. This also occurs in one form or type of industrial products in the electric magnitude sector, namely LED lights (Light Emitting Diode) [24] – [28] DC 12V, where the power specifications written on the product must be in accordance with the actual value so that there is no loss to consumers who use the product as a device in a home lighting system.

The selection of this type of lamp because this type of lamp is one of the emergency lights used as lighting when the AC source from PLN does not exist with a substitute source that is easy to find or commonly used by the public that is the type of accumulator or 12V DC battery whose use is often found as a source of electricity on the bicycle motorcycle that is easy to find.

Based on these problems, the authors do this research, which can later find out the truth of the power value of a DC 12V LED lighting product in a variety of different lamp brands with the same power specifications.

II. METHOD

This chapter discusses the components needed for testing, the measurement tools used, and the data collection methods and methods for testing them.

The time and place of research will be conducted in the second week of February 2018 at the designated place, namely the Metrology Instrumentation Laboratory, Vocational School, Gadjah Mada University, Yogyakarta.

Multimeter [29] – [31] or multimeter (analog) is a device that is generally used to measure the quantities of voltage (AC, DC), strong currents [32] – [36] (usually DC only), and resistance. In accordance with its function the multimeter is also called the AVO-meter, which is an Ammeter, Voltmeter and Ohmmeter. Basically, a multimeter uses a D’Arsonval type current meter. The basic specification in choosing a multimeter is its sensitivity or sensitivity [37] – [40]. Sensitivity is related to the loading effect on the measured circuit.

![Fig. 1. Electric current measurement scheme](image-url)

V1 is a calibrated standard measurement device, V2 and V3 are tested measurement device.
The study uses variations of R, S, and T lamp brands, each with a power value of 15 and 12 Watt.

Voltage and current measurement on LEDs 12 VDC

Voltage measurement using 3 measuring devices with different voltage measurement functions, namely Krisbow KW06-490 which has been calibrated as a standard measuring instrument and as a comparison of the results of voltage measurements on other measuring devices used, Krisbow KW06-491, and Viper DT830B which is installed or used to measure at the same time as a comparison test measuring instrument standard measurement results by pairing it in parallel at the lamp input voltage. Current measurement using 3 measuring devices with different DC current measurement functions, namely Krisbow KW06-490 which has been calibrated as a standard measurement tool and as a comparison of the results of measuring the current in other measuring devices used by means of pinning positive or red wire on the lamp to measure the value currents, Krisbow KW06-491 installed or used to measure at the same time as a measuring instrument comparative test standard measurement results are also the same, namely by clamping or clamping the positive cable or red color on the lamp to measure the current value, and Viper DT830B installed or used to measure at once as a comparison test measuring instrument standard measurement results with a current measuring function but installed or measured using the multimeter probe whose configuration is in series on the positive wire or red color on the lamp to measure the current value. From the data obtained, the value of the input voltage read on each lamp sample has a value of around ± 11.6 V from the voltage setting on the DC power supply of 12 V.

The difference in input voltage readings are caused by one of them being the type of DC power supply that is used to have an output voltage regulation manually by turning the output voltage knob until the output reading value on the indicator display on the LCD is valued at 12 V, so the DC power supply output voltage value is not necessarily right at 12 V. On the average input voltage reading of DC 12V brand LED lights with 12 Watt power on 3 different multimeters namely (11.60 ± 1.04) Volts, (11.61 ± 1.24) Volts, (11.61 ± 1.32) Volt, the average input voltage reading of LED brand 12V DC lights with 12 Watt power on 3 different multimeters is equal to (11.70 ± 1.05) Volts, (11.71 ± 1.55) Volt, (11.69 ± 1.64) Volt, the average input voltage reading of a 12V DC LED T brand with 12 Watt power on 3 different multimeters is (11.60 ± 1.07) Volts, (11.69 ± 1.26) Volts, (11.66 ± 1.51) Volts. The average input voltage of a 12V DC R brand LED lamp with 15 Watt power on 3 different multimeters is equal to (11.60 ± 1.09) Volts, (11.66 ± 1.62) Volts, (11.65 ± 1.82) Volt, the average input voltage reading of a S 12V DC LED lamp with 15 Watt power at 3 different multimeters is (11.6 ± 1.09) Volts, (11.69 ± 1.31) Volts, (11, 67 ± 1.49) Volt, the average input voltage reading of a T 12V DC LED lamp with 15 Watt power at 3 different multimeters is (11.60 ± 1.08)
Volts, \((11.65 \pm 1.27)\) Volts, \((11.66 \pm 1.58)\) Volts. Voltage readings are presented in Figure 3 and Figure 4.

Fig. 3. Average measured voltage on LED 12V histogram

![Image](image1)

Fig. 4. Average measured voltage on LED 15V histogram

![Image](image2)

From the data obtained, the current value read in each lamp sample has a different value. The difference in current readings is caused by one of them being the circuit scheme or configuration of the LEDs on the lamps as well as the number of LEDs and the characteristics of the LEDs used by each brand of lights, so the current rating reads for each lamp becomes different.

On the average current reading of DC 12V LED lights R brand with 12 Watt power on 3 different multimeters namely \((0.50 \pm 0.60)\) Ampere, \((0.57 \pm 1.40)\) Ampere, \((0.57 \pm 1 \, 64)\) Ampere, the average current reading of a S 12V DC brand with 12 Watts of power at 3 different multimeters is \((0.30 \pm 0.35)\) Ampere, \((0.34 \pm 1.32)\) Ampere, \((0.39 \pm 1.56)\) Amperes, the average current reading of LEDs 12V brand T with 12 Watt power on 3 different multimeters that is equal to \((0.40 \pm 0.78)\) Ampere, \((0.43 \pm 1.58)\) Ampere, \((0.45 \pm 1.54)\) Ampere.

On the average current reading of DC 12V LED lights R brand with 15 Watt power on 3 different multimeters namely \((1.20 \pm 0.59)\) Ampere, \((1.28 \pm 1.76)\) Ampere, \((1.32 \pm 1, 79)\) Amperes, while the average current reading of DC S 12V brand LEDs with 15 Watt power at 3 different multimeters is \((1.30 \pm 0.38)\) Ampere, \((1.33 \pm 1.49)\) Ampere, \((1.39 \pm 1.71)\) ampere, the average current reading of a 12V DC LED T brand with 15 Watt power on 3 different multimeters is \((1.40 \pm 0.74)\) Ampere, \((1.43 \pm 1, 53)\) Ampere, \((1.44 \pm 1.74)\) Ampere. Flow readings are presented in Figure 5 and Figure 6.

![Image](image3)

Fig. 5. Average measured current on LED 12V histogram

![Image](image4)

Fig. 6. Average measured current on LED 15V histogram

**Error analysis**

Errors regarding specifications are obtained only through the results of comparisons between the power values read by the Krisbow KW06-490 standard DC clampmeter that has been calibrated with the written power values on the DC 12V LED lamp specifications printed on the lamp package. Comparison of errors presented in Table 1.

| TABLE I. POWER ERROR MEASUREMENT TEST OF THE STANDART AND TESTED |
|---------------------------------------------------------------|
| **Brand** | **Power (W)** | **Error (%)** |
| R        | 12           | 51.67         |
|          | 15           | 7.2           |
| S        | 12           | 70.75         |
|          | 15           | 0.53          |
| T        | 12           | 61.33         |
|          | 15           | 8.27          |

**IV. CONCLUSIONS**

From the research that has been done, the following conclusions are obtained. The value of the error reading
power on the test gauge with LED 12V DC brand lights, while for 12V DC LED lamps with 12W power are R, S, and T brand lights. In 15W lamps with a 12W power of ± 7.59% and ± 10.76%, in the S brand with 15W power of ± 2.89% and ± 7.39%, while in the T brand with 15W power of ± 2.98%, and ± 3.19%. The error value between the test power value or the use of DC 12V LED lights with a written power of 12W on R, S, and T brand lights is ± 51.67%, ± 70.75%, ± 61.33%. In 15W lamps the brands R, S, and T were ± 7.20%, ± 0.53%, ± 8.27%. Lamp samples that have the closest power value to the written value for DC 12V LED lamps with 12W power are R brand lamps, while for 12V DC LED lamps with 15W power are S brand lights.

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Prisma Megantor1, The Analysis of Comparison Electrical Power Measurement on LED Lamps

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