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The Effect Of Engine Running Towards Toyota Innova Type G 2.4 A/T 2017 CAR Alternator Charging System

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A B S T R A C T

The engine rotation of the Toyota Innova Type G 2.4 A/T 2017, which is the object of this research, has an electrical system to perform well. The battery as the only power source used in the electrical system is equipped with an alternator as a dynamo to recharge the battery. The problem in this study is how the effect of varying engine speed on the alternator output current and battery voltage on the Toyota Innova Type G 2.4 A/T 2017. The method that will be used in this study is an experimental method by testing varying engine speed to find out how major influence on the alternator charging system. The results of this study indicate that the higher the rotation, the current generated by the alternator to the battery will increase, while the output voltage of the alternator with a voltage regulator can adjust to the condition of the voltage from the battery, which is stable and constant.

INTRODUCTION

Electricity has an important role to play in powering production and powering systems used for agricultural, health care, educational and commercial needs. Demands or needs for electric power in vehicle transportation have increased rapidly over the years and are expected to continue to increase. The use of engine-driven load replacement devices with electrically powered versions, the introduction and establishment of various new functions on vehicles [1]. The increasing demand for electrical power is driving the development of automotive power generation and control technologies, and motivating the development of high-power, high-voltage electrical systems and components [2].

One of the machines that has undergone many refinement processes in the automotive industry is the alternator. It is almost impossible or almost impossible for a machine to not have an alternator, for example cars, trucks, buses, recreational vehicles, boats, airplanes, agricultural machinery, earthmoving equipment and all types of stationary engines. The alternator does its job very well but there is still a lack of information about it. Some of us may not know what an alternator is. In the event of a fault/failure, most alternator models are available from dealers, alternator stores, often even department stores [3].

The charging system for most cars is done while the engine is running, generally generating a voltage between 13.5 and 14.4 volts.. System charging requires a more voltage than the battery's rated voltage to overcome the battery's internal resistance [4]. This is because the electric current needed to recharge the battery will not flow if the voltage

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coming out of the charging system is equal to the battery voltage. The charging rate will be faster if there is a greater potential difference (voltage) between the battery voltage and the alternator output voltage. Charging occurs when the alternator voltage exceeds the battery voltage. It is possible that the Alternator does not produce enough charging voltage until the alternator speed is greater than about 2000 RPM [5]. Typically, alternators have an output of 6000 RPM to 12000 RPM or more without an additional output boost. Alternator speed is different for different types of cars. The speed of the alternator depends on the speed of the engine. For racing cars, the speed ratio between the engine and the alternator is usually 1:1. For a drag car, the comparison is usually 1:2. And for use on the street, the ratio is usually 1:3.

The voltage causes the current to flow, this energy is then converted. This is described as a power. The unit of power is watts [6]. Calculate the power using Ohm's law.

Power = Voltage X Current (1)

P = VI or I = P/V or V = P/I

When the engine cannot be started, the alternator voltage is less than the battery voltage so that the current flows from the battery to the vehicle load and the alternator diode prevents current from flowing to the alternator. When the engine is started, the alternator's output is greater than the battery voltage, so that current flows from the alternator to the vehicle's load and the battery. This implies that the alternator output voltage must always be above battery voltage during engine operation. However, the actual voltage used is critical and dependent on a number of factors [7].

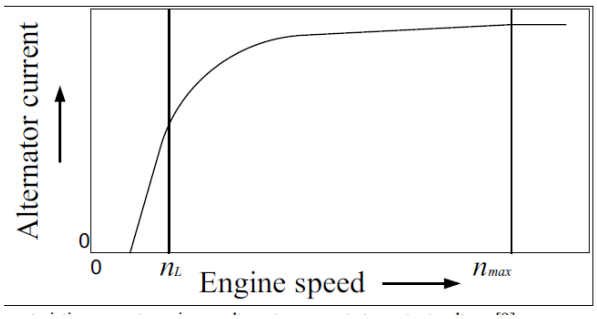

Figure 1. Characteristic curve at maximum alternator current at constant voltage (Bosch, 2011).

The relationship between alternator speed and alternator current is shown in Figure 1. The alternator output current depends on speed. The speed of the alternator depends on the turn ratio from 1:2 to 1:3 (crankshaft to alternator). The bigger the speed, the bigger the output. The first current is issued at 6000 RPM alternator [8].

Measurements of the alternator before and after the modification show results that are directly proportional to the output. Measurement of the alternator at 1100 RPM generates a voltage of 4.57 Volts before further modifications are carried out after modifications produce 14.56 Volts. The analysis of the results obtained yields an average difference of 2.8% so that it can be concluded that the modification has not achieved maximum [9].

Amiruddin & Rohmantoro, 2020, said that the measurement of charging current and voltage after the AHO modification but the charging system is still halfwave is 0.35 Amperes and 12.4 Volts. The results of current and voltage measurements after AHO modification and full wave charging system are 0.42 Amperes and 13.5 Volts. This value is obtained when the engine speed is idle 1600 rpm and burdened with head light. It was concluded that the highest charging current and voltage were found in the full wave charging system.

Modification of the ketinting engine with the addition of an alternator resulted in a change in the dimensions of the machine from the previous (p x l x h) 353 x 374 x 346 to 346 x 514 x 413.23 mm. The research results show that the time needed to charge the battery is influenced by the engine speed. The greater the engine speed, the faster the charging or the less time it takes to fully fill the battery. At 1500 rpm rotation time is 16 hours 12 minutes, 2000 rpm rotation is 11 hours 2 minutes, and 2500 rpm rotation is 7 hours 15 minutes. The results of the fuel consumption test experienced an increase of 80-90 percent in liters/hour from before being modified to after being modified. Technically this modification of the ketinting engine can help fishermen operate at night, but its economic feasibility requires further research [11].

Burhanudin et al., 2012, said that there is a significant difference between the voltage stability between the no-load point contact type alternator and the regulator IC type alternator because the sig value is 0.000, then Ha is approved and Ho is denied. Likewise, there is a significant difference between the voltage stability between point contact type alternators and regulator IC type alternators, because the sig value is 0.009. Because the significance value is > alpha (0.05), Ha is approved and Ho is denied.

The relationship between the motor pulley and the alternator tends to be linear, this is in comparison to the greater the rotation of the motor pulley, the smaller the torque produced, the best current is the smallest current coming out of the alternator which is 16A, namely in testing the alternator pulley 7cm and the motor pulley 7cm, using In this variation, the time obtained for charging is 2.625 hours (2 hours 37 minutes 30 seconds). The largest current is 159A, namely the 7cm pulley motor variation and the pulley diameter of 10cm and 12cm, at a current of 159A it is expected not to be used because it will speed up memory defects in the battery [13]

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A pulley diameter of 78 mm at low speed outputs a voltage of 13.3 V and 12 A, medium speed the alternator output reads 14.1 V and at high speed 14.5 V at a stable current of 10A. The diameter of the pulley is 68 mm, from low rotation the voltage on the voltmeter is 13.4 V, 10 A, the medium rotation is read 14.2 V and the high rotation is 14.7 V. The amperage output remains stable 10 A. The pulley diameter is 63 mm. The low rotation voltmeter reads 13 .8 V, medium speed 14.3 V and high speed 15.1 V, with ammeter reading 10 A. [14].

The Toyota Innova Type G 2.4 A/T 2017 car is a means of transportation that is widely used by various groups of people and companies because it has great power and is fuel efficient. This vehicle uses fossil-based fuels, namely Diesel, Dexlite and Pertamina Dex, so it is classified as a diesel engine vehicle.

The battery in the Toyota Innova Type G 2.4 A/T 2017 serves as a source of ignition and electricity or power supply in large quantities to parts that require a power supply. Of course the capacity of the battery installed in this car has limited capabilities, which if taken and used over and over will wear out, eventually being unable to continuously provide all the power required by the car. The battery must always be fully charged so that it is able to supply electrical power when needed by the electrical parts, including to supply ignition to the combustion chamber. Because it is important to maintain the battery so that it remains fully charged continuously without a decrease in power and a decrease in current strength, which in turn affects the ability to supply the battery's own power to the parts that require electrical power.

Whether or not charging the Toyota Innova Type G 2.4 A/T 2017 car battery is efficient requires a good closed cycle, where the discharge capacity of the battery is balanced with its charging capacity. This cycle must be maintained continuously so that it does not cause problems, whether it is a problem of undersupply or overcharging or what is known as oversupply. To carry out the task of balancing this power, an engine component known as the alternator is needed. Apart from charging the battery, the charging system also provides the current needed by the electrical parts that need it while the engine is running.

The purpose of this research is to find out how major influence in the alternator charging system

METHOD

The cars used as experimental research objects were the Toyota Innova Type G 2.4 A/T 2017 and the GS Astra LN3 MF 65Ah 12 V Accu / Battery. No modifications were made to the car, especially the alternator. And no additional electrical devices are added. Only stock items are used. Avometer is used to measure electric voltage and ammeter, to measure electric current strength. The results of the tests carried out are then analyzed using the measurement results to determine the relationship between the rotational speed and the current strength and the resulting voltage.

Alternator speed and engine speed are measured and compared to get the speed ratio. This method is much easier than measuring the alternator shaft diameter and engine shaft diameter to get the speed ratio. The alternator is driven by the engine.

RESULTS AND DISCUSSION

Based on the results of current measurements in testing the effect of engine speed on the alternator charging system in the Toyota Innova Type G 2.4 A/T 2017 car, the following graph is made;

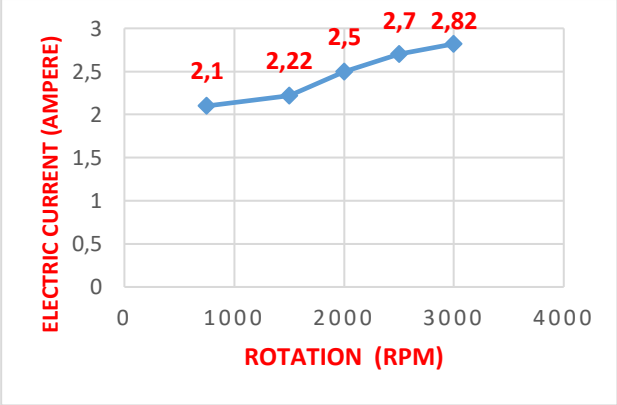

Figure 2. The Relationship Between Rotation Against Current Strength

In Figure 2 it can be seen that at 750 rpm the current generated by the alternator to the battery is 2.1 A, increases at 1500 rpm by 2.22 A, then at 2000 rpm at 2.5 A, at 2500 rpm it increases by 2.7 A, and at 3000 rpm it increases to 2.82 A. So it can be concluded that the higher the rotation, the greater the current generated by the alternator to the battery will increase. this is because the battery is not fully charged so the charging current to the battery is increasing. This is in line with research conducted by [3] which says the faster the alternator, the greater the power generated and when the power is greater, charging the battery is faster because the power that will be supplied to other electricity consumers is more than enough. Current is inversely proportional to voltage. When the alternator current is high at low speed, the battery voltage will drop, and it will take more time to fully charge. But when the output current of the alternator is low at low speed, the battery voltage is high because the battery gets enough power to recharge it., The alternator produces output energy even at low speed and its efficiency is achieved at higher values [15].

The results of the voltage measurement in testing the effect of engine rotation on the alternator charging system in the Toyota Innova Type G 2.4 A/T 2017 car are then graphed as follows;

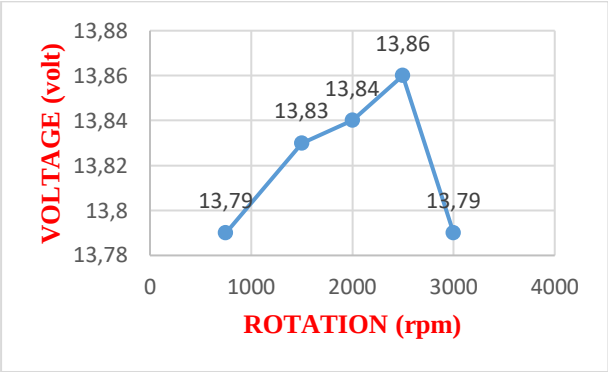

Figure 3. The relationship between rotation and voltage

In Figure 3, it can be seen that at idle speed (750 rpm) the battery voltage is 13.79 V, at 1500 rpm rotation is 13.83 V, increases at 2000 rpm rotation is 13.84 V, then at 2500 rpm rotation is 13, 86 V and drops at 3000 rpm at 13.79 V. So it can be concluded that the higher the rotation, the alternator output voltage will tend to last according to the increasingly full battery voltage, this is due to the condition of the battery used when testing the battery in good condition.

Increasing the rotation of the alternator will accelerate the rotating magnetic field around the stator coil and produce a faster change in magnetic flux across the stator coil, which in turn produces a greater electric voltage. Therefore, the higher the alternator turns, the greater the voltage generated by the alternator. However, Figure 3.2 shows that at a maximum rotation of 3000 rpm the voltage drops, this is because the alternator output voltage does not only depend on the rotation, but is also influenced by other factors such as the load and the condition of the voltage regulator. The higher the engine speed, the stronger the current and voltage will increase and the battery will be fuller, with a regulator that functions to ensure that the output voltage from the alternator remains stable and is in accordance with the needs of the battery and car's electrical system.

The reliability of vehicle electrical equipment is determined by the performance of the alternator, as the main source of electricity. The defect in the car alternator causes a decrease in the energy produced, which is characterized by changes in the output voltage and current strength [16]. Diagnosing the technical condition of the car alternator by assessing changes in its parameters during the load cycle is very necessary. The alternator's load cycle has been developed to be tested on the vehicle. The load cycle specifically includes the modes of movement of the vehicle, which are characterized by changes in the speed of movement and power, which makes it possible to assess the performance of the car's alternator. The numerical values of the load cycle parameters were obtained when testing a serviceable alternator on a passenger vehicle. Further studies are aimed at determining the numerical value of the cycle corresponding to the alternator with the most specific fault

CONCLUSIONS

Depend on the research results, the following conclusions can be drawn;

The higher the rotation, the current generated by the alternator to the battery will increase, while the output voltage of the alternator will tend to stay in line with the increasingly full battery voltage (the output voltage of the alternator always adjusts to the condition of the voltage from the battery.

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NOMENCLATURE

Meaning of symbols used in the equations and other symbols presented in your article must be presented in this section.

ρ	meaning of ρ
E	meaning of E
J_c	meaning of J_c

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Author's biography must be short and concise (100 words maximum).

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