POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

ALTERNATOR TEST BENCH

AKMAL SYAZANI BIN RUZAIMY	**08DKM20F2019**
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JABATAN KEJUTERAAN MEKANIKAL

SESI 2 : 2022/2023

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Laporan ini dikemukan kepada Jabatan Kejuteraan Mekanikal sebagai memenuhi sebahagian syarat penganugerahan Diploma Kejuteraan Mekanikal.

JABATAN KEJURUTERAAN MEKANIKAL

SESI 2: 2022/2023

AKUAN KEASLIAN DAN HAK MILIK

ALTERNATOR TEST BENCH

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2. Saya mengakui bahawa Alternator Test Bench dan harta intelek yang ada di dalamnya adalah hasil karya/ reka cipta asli saya tanpa mengambil atau meniru mana-mana harta intelek daripada pihak-pihak lain.

3. Saya bersetuju melepaskan pemilikan harta intelek Alternator Test Bench kepada Politeknik Sultan Salahuddin Abdul Aziz Shah bagi memenuhi keperluan untuk penganugerahan **Diploma Kejuruteraan Mekanikal** kepada saya.

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sebagai Penyelia Projek pada tarikh:) AHMAD FAKARUDDIN

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ABSTRACT

An alternator is an electrical generator that converts mechanical energy to electrical energy in the form of alternating current. In car engine, an alternator as an integral part of every combustion engine vehicle, its main responsibility is to convert mechanical energy to electrical energy so that can charge and maintain the battery performance so the battery can supply the electric current to all components in the car. The problem faced by every mechanic when maintaining the alternator is when they want to test the alternator after completing the maintenance. The duration of the maintenance process will be long when the alternator is not working properly because the mechanic has to remove the alternator from the car engine again. In addition, the alternator test bench machine that is on the market now is too expensive. Our objective in developing this project is to design and produce a test bench to test alternators. In addition, it can facilitate maintenance work and alternator installation by mechanics. This it can save the cost of buying a test bench alternator that costs thousands of ringgit. Our alternator is used to test the amperage and voltage on the tested alternator. It is suitable fortesting alternators used by cars. Hopefully, this alternator test bench is successfully produced and can help mechanics who need this tool in testing and maintaining alternators.

ABSTRAK

Alternator ialah penjana elektrik yang menukarkan tenaga mekanikal kepada tenagaelektrikdalam bentuk arus ulang alik. Dalam enjin kereta, alternator sebagai bahagian penting dalam setiap kenderaan enjin pembakaran, tanggungjawab utamanya adalah untuk menukar tenaga mekanikal kepada tenaga elektrik supaya boleh mengecas dan mengisi semula bateri dalam enjin dan komponen elektrik lain didalam kereta. Masalah yang dihadapi oleh setiap mekanik semasa menyelenggara alternator ialah apabila mereka ingin menguji alternator setelah selesaimelakukan penyelenggaraan. Tempoh proses penyelenggaraan akan menjadi lama apabila alternator tidak berfungsi dengan baik kerana mekanik perlu mengeluarkan alternator dari enjin kereta semula. Tambahan pula, mesin bangku ujian alternator yang berada di pasaran sekarang terlalu mahal. Objektif yang ditetapkan dalam membangunkan projek ini adalah untuk mereka bentuk dan menghasilkan bangku ujian untuk menguji alternator. Selain itu, ia dapat memudahkan kerja penyelenggaraan dan pemasangan alternator oleh mekanik. Oleh itu, ia dapat menjimatkan kos pembelian alternator bangku ujian yang berharga ribuan ringgit. Alternator ini digunakan untuk menguji amperage dan voltan pada alternator yang diuji. Ia sesuai untuk menguji alternator yang digunakan oleh kereta. Semoga bangku ujian alternator ini berjaya dihasilkan dan dapat membantu mekanik yang memerlukan alat ini dalam menguji danmenyelenggara alternator.

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CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

Alternator test bench is a tool or machine used to test the voltage and ampere readings on the alternator. In the automotive industry, the alternator test bench is very helpful in the process of maintaining the alternator. But not all car workshops have such machines and they have to maintain the alternator manually. The technology that encompasses and integrates all the traditional engineering domains of electrical, mechanical, and software," as specified by the definition of automation, current computer technology used in electronics to run and manage the production process. In order to produce goods both quantitatively and qualitatively, manufacturing companies are under extremely high demand in today's competitive climate. As the primary component of any automotive, alternators are checked and certified using systems like the alternator test bench after each procedure during production. Modern computer-controlled charging systems adapt the charging rate tochanging driving circumstances as well as the electrical demands on the battery and alternator. When something goes wrong, diagnosis becomes significantly more challenging asa result. Due to misdiagnosis, alternators have one of the highest return rates of any repair part. An alternator should be bench tested on a test stand to see if its output is within specifications.

1.2 PROBLEM STATEMENT

The process of maintaining the alternator is where we remove the alternator on the car and maintain it like cleaning the parts on the alternator. The problem faced by every mechanics when maintaining the alternator is when they want to test the alternator after completing the maintenance. This is because the mechanic needs to reinstall the alternator on the car to test the condition of the alternator. Duration of the maintenance process will be long when the alternator is not working properly because the mechanic must remove the alternator from the car engine again.

The alternator test bench machine that is on the market now is too expensive. It reached the price of tens of thousands of ringgits. Small workshops cannot afford to buy such machines.

1.3 OBJECTIVE

For this final year project, we are going to make an new alternator test bench with some changes that might solve problems from the existing test bench . Our main objectives are:

1. To design and produce a test bench to test alternators.
2. To facilitate maintenance work and alternator installation by mechanics.
3. To save cost.

1.4 SCOPE

For our product, we have a set of limitations on the operation to ensure that our testbench can fully achieve its objectives. The scopes are:

1. The ability to test the voltage and current on the alternator.
    - Have a voltmeter ammeter
    - The ideal voltage for an alternator is 14 volts
    - The ratings of an alternator range from roughly 60 or 70 amps to 150amps or higher.

2. The suitable size for an alternator test bench
    - The size of our product is small and compact, it is suitable for small workshops to test alternators.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION
(MUHAMMAD SHAHIRUEL MAULA SYED TAJUDIN)

This chapter will explain the research done by individuals behind this project. This study was selected based on scientific operations related to alternator test bench to be designed. In addition, this chapter also describes the components that will be used in this project. This study is also conducted to ensure that the project is in good working order.In relevance to our project about alternator test bench, this literature review will consider determined theoretical interpretations. As this literature review aims to bring forth a clear understanding of the functions of alternator in this industry.

An alternator is a type of electrical generator that transforms mechanical energy into alternating current. Most alternators use a revolving magnetic field with a stationary armature for cost and simplicity reasons.

In 1960, the Chrysler Corporation's Valiant became the first manufacturing car with an alternator as standard equipment, years before. In order to power radio equipment on specialized vehicles during World War II, the contemporary style of vehicle alternatorwas initially employed in military applications. Following the war, additional automobileswith significant electrical demands. For example, ambulances and radio taxis could also be fitted with optimal alternators.

2.2 PREVIOUS RESEARCH

(ADAM HARITH BIN FURHAN)

There are many types of alternator test bench in market with different designs and prices. Alternator test bench started to evolve to ease and simplify users. Figure 2.1 below shows different types of alternator in the market.

2.2.1 Type A

Figure 2.1: Alternator test bench type A

Multifunctional test bench designed for the quick and the accurate diagnostics of the automotive alternators and starters of the passenger cars and the light commercial vehicles. The evaluation of the technical condition of 12/24V automotive alternators at the loads 100A and 50A respectively.

This test bench can be used in workshops for the repair of starters and alternators to determine the technical condition of the unit before and after maintenance. It also can be used in organizations that trade spare parts of cars for pre-sale inspection of units to reduce reclamation

Drive power, kW	Drive speed, rpm
2.2	0-3000

2.2.2 Type B

Figure 2.2 : Alternator test bench type B

Multifunctional test bench designed for the quick and the accurate diagnostics of the automotive alternators and starters of the passenger cars and the light commercial vehicles. The evaluation of the technical condition of 12/24V automotive alternators at the loads 200A and 100A respectively.

This test bench operates under 380V power supply and two batteries needed to test alternators and starters of 24V. Besides testing alternators and starters, it can also do voltage regulator testing. The design is compact and suitable for small service

Drive power , kW	**Drive speed, rpm**
5,5	0-3000

2.2.3 Type C

Figure 2.3 : Alternator test bench type C

Multifunctional test bench designed for the quick and the accurate diagnostics of the automotive alternators and starters of the passenger cars and the trucks. The test bench software is regularly updated for the expanding of the range of diagnosed units. Automotive 12 and 24V alternators with the different connection pins for the loads up to 300A (12V) and 150A (24V).

The bench can check 48V alternators and two batteries needed to test alternators. It can easily house the batteries of up to 110Ah. The bench also has a battery charger with the charging rate of up to 20A and can check 48V alternators. It also has an oil tank for testing vacuum pump alternators. The bench has a thermal camera that monitors the entire alternator and reads the maximum temperature at a particular spot.

Drive power , kW	**Drive speed, rpm**
7.5	0-3000

Table 2.1: Criteria Comparison

Picture	Criteria	Design
 TYPE A	➢ Tests starters, alternators, all types of voltage-regulator at 100A & 50A ➢ Displaying of output voltage and alternator current as the oscillogram ➢ 7" touch-screen	➢ Small, compact ➢ 570×505×450
 TYPE B	➢ Tests starters, alternators, all types of voltage-regulator at 200A & 100A ➢ Diagnostics of alternator that don't have the voltage regulator ➢ Electronic self-protection prevents the bench electronic components from damages if the unit's connected wrong.	➢ Medium-sized rectangular ➢ 550×450×1050
 TYPE C	➢ Tests starters, alternators, all types of voltage-regulator at 300A & 150A ➢ Displaying of output voltage and alternator current as the oscillogram ➢ Has a thermal camera that monitors the entire alternator	➢ Slightly bigger rectangular, ➢ 655×900×1430

2.3 COMPONENTS

(AKMAL SYAZANI BIN RUZAIMY)

In this literature review, we have also do done some research on important components that we wanted to include in our project. This can guide us on how to apply in the product for it to work completely and efficiently. Without this components the product will have difficulty to work properly.

2.3.1 Electric Motor

In this product we are going to use electric motor for the project to work. A motor is a device that uses electricity to create mechanical energy. Operating through the interaction of magnetic field and current carrying conductors to generate force is mostly how electric motor work. The two major types of electric motors are:

- AC motors, which are powered by alternating current
- DC motors, which are powered by direct current

The stator and rotor are the two most crucial components of an AC motor. The rotor is the rotating part of the motor meanwhile stator is the stationary part of the motor. Smaller power conversion is frequently done with single phase AC motors. It isalso mostly applied in electrical product such as refrigerator, hair dryer, washing machine, etc.

The DC motor is the most often used actuator for providing continuous movement, and its rotational speed is easily controllable. A DC motor is also the same as AC motor which consist two parts, a stator which is the stationary part and the rotoris the rotating part. There are three types of DC motor;

i. Brushed motor.
ii. Brush less motor.
iii. Servo motor.

Table 2.2: AC and DC Motor Comparison

AC Motor	DC Motor
➢ Powered from AC current. ➢ Can be single phase or three phase. ➢ Does not use brush. ➢ Have a longer life span.	➢ Powered form DC current. ➢ All DC motor are single phase. ➢ Use brushes. ➢ Does not have a longer life span.

Electric motors are classified based on factors such as power source type, construction, application, and motion output type. They can be brushed or brush less, single- phase, two-phase,or three-phase, axial or radial flux, and air-cooled or liquid-cooled.

Figure 2.4 : Electric Motor

Torque (linear or rotary force) generated by an electric motor is utilize to push an external mechanism such as a fan or a hoist. For its size, an electric motor is often intended for continuous rotation or linear movement over a long distance. Magnetic solenoids are also transducers that convert electrical power to mechanical motion, but they have a limited range of motion.

2.3.2 Alternator

When the engine is running, an alternator is a sort of electric generator that charges the battery and powers the electrical system. Until the 1960s, automobiles employed DC dynamo generators with commutators.The alternator gradually replaced the dynamo as silicon-diode rectifiers became more widely available and affordable. This was encouraged by the increasing electrical power required for cars during this time period, with increasing loads from larger headlamps, electric wipers, heated rear windows, and other accessories.

What is the function of a car alternator?

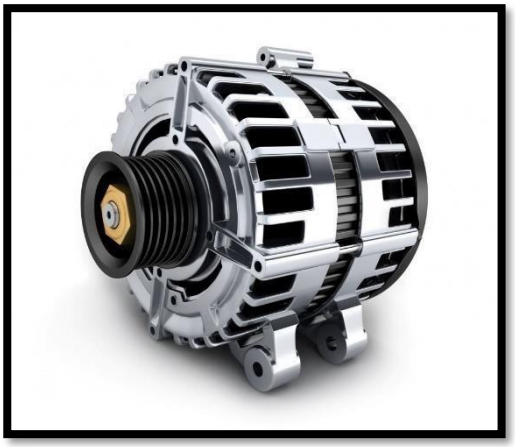


Figure 2.5: Car Alternator

The alternator and battery work together to keep your car running. While the battery provides the initial power to start your car after it has been turned off, the alternator keeps most of the electrical components powered while the engine is running. While your car is idling and moving, it powers components such as the radio, headlights, and power windows.

When the engine is turned on, it powers a drive belt, which turns a pulley connected to the alternator's rotor shaft. This shaft then spins a set of magnets, producing alternating current (AC). The alternator's rectifier converts this alternating current (AC) power into direct current (DC) power, which powers the electrical components and charges the car battery while driving.

2.3.3 Voltmeter & Ammeter

Figure 2.6: Voltmeter & Ammeter

A voltmeter is a device that measures the difference in electric potential (voltage) between two locations in an electric circuit. It is a two-terminal device, with one terminal connected to the point of higher potential and the other terminal connected to the point of lower potential. The voltage is measured in volts (V).

Voltmeters are typically classified as analog or digital. Analog voltmeters have a needle that moves across a scale to indicate the voltage. Digital voltmeters display the voltage as a number on a screen.

An ammeter is a device that measures the current in a circuit. The term comes fromthe fact that electric currents are measured in amperes (A). The ammeter is connected in serieswith the circuit in which the current is to be measured for direct measurement. An ammeter's resistance is typically low enough that it does not create a substantial voltage drop in the circuit being monitored.

2.4 SUMMARY

This chapter teaches us that conducting a literature review is critical. All of our research has aided us in the process of identifying previous product criteria and combining them with our concept. This research also helps us generate new ideas and improve the design and features of our products. Overall, based on the literature review, we discovered that our process for generating ideas was very systematic, which aided the project planning process.

CHAPTER 3
METHODOLOGY

3.1 INTRODUCTION

(AKMAL SYAZANI BIN RUZAIMY)

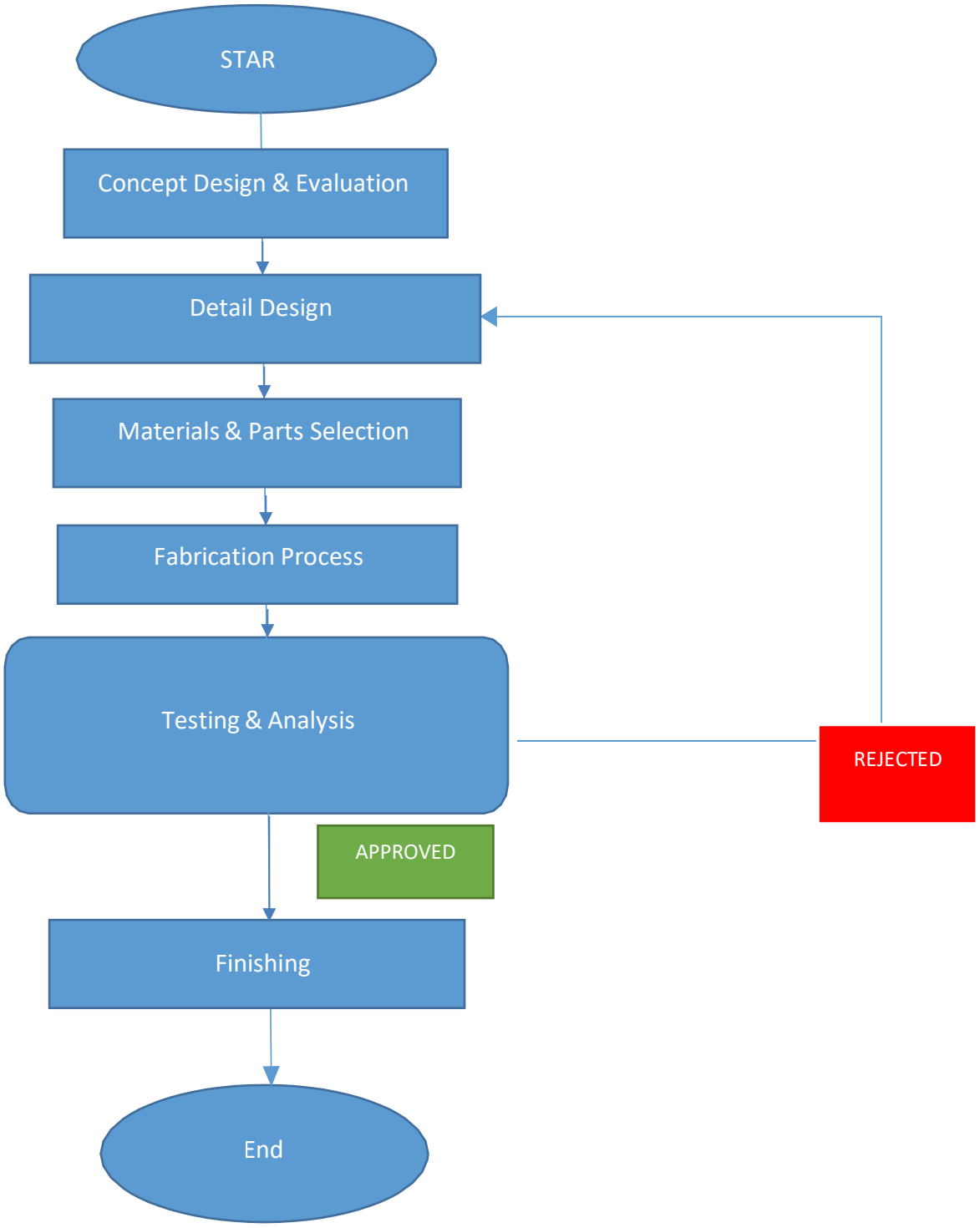
Methodology refers to the methods, discussions and assumptions that involved in the process of building something. Each step of project is a process to complete the project. Every step must be followed one by one and must be done carefully. Before the project finish, various process needs to be done according to procedures to ensure that the project don't have any problems.

This approach is a broad research plan that outlines the steps involved in doing research and, among other things, explains the methodologies that will be employed. These techniques, as noted in this strategy, determine how data is gathered or, in certain cases situations, how to estimate a particular result. Method does not explain specific ways, even if the nature and types of processes to be used in a particular process or to achieve a certain objective are given more weight.

This chapter includes the dissertation's research methodology, as the title indicates. This part will be broken down into four areas for greater clarity: project design, design evaluation, material selection, and data analysis tools that will be applied to this research.

3.2 FLOWCHART

Flowchart is important operation to finish the work. It use to represent of the process.All the step in this flowchart is to represent a short description for the process step.



3.3 CONCEPT DESIGN & EVALUATION
(AKMAL SYAZANI BIN RUZAIMY)

During this process, each group member creates their own alternator test bench using Inventor software. After the design was completed, we evaluated each design and selected the best design and work concept.

Concept "A"

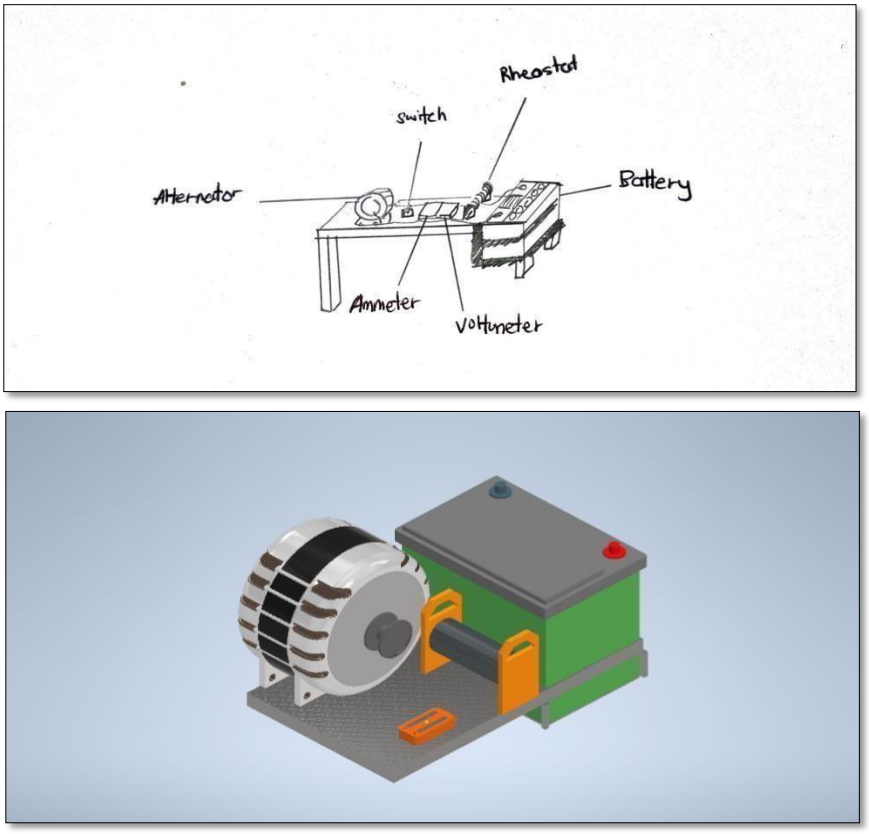


Figure 3.1: Design concept A

It is necessary to connect the alternator on the handmade bench, the voltage is adjusted by a rheostat to 14V, and the rotor speed of the drill can spin up to 1000 rpm. After the alternator operating at the same rate (14V), it is necessary to measure the recoil force of the current. When the recoil force is not less than 44 A, the alternator operation is good. If the figure is lower, it indicates possible problems with the winding, probably the rectifier are damaged, brushes wear is possible. The alternator performance testing can be done by an oscilloscope. Rotate the alternator rotor with a frequencyabout 2000 RPM using a drill.

Concept "B"

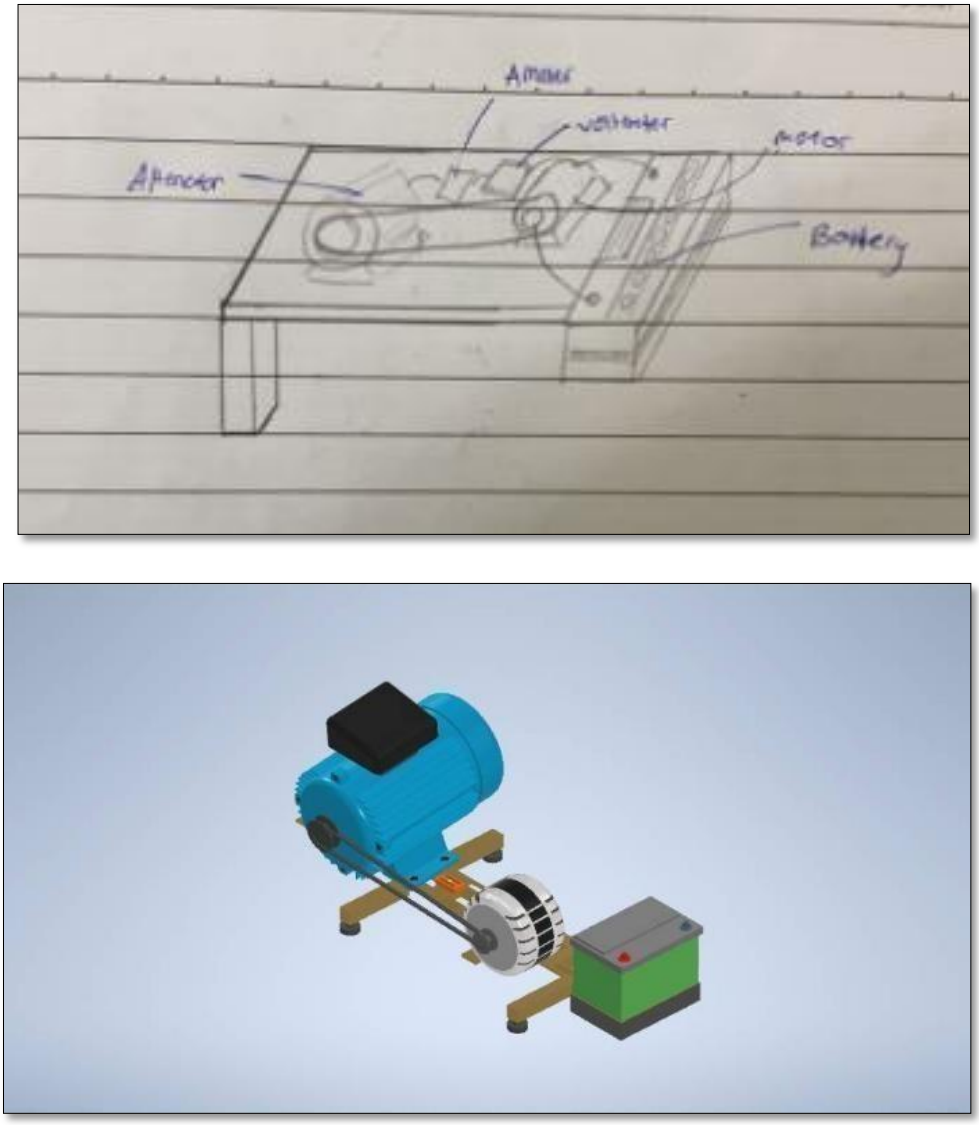


Figure 3.2: Design concept B

This alternator test bench is using motor 1 HP motor that rotate until 1490 rpm and can power up to 220V .Alternators have one of the highest return rates of any repair part often because of misdiagnosis. But with this design and alternative this design can run a stable horsepower to test an alternator. This test bench include battery for the alternator to be able to start. The alternator can be started if the battery voltage is above 12.2 volts, at which point the alternator can be checked with a voltmeter. The ideal voltage for an alternator is 13.5v to 14v.Electrical problems include faulty rectifiers or regulators, worn brushes and slip rings, and damaged winding. Potential alternator failure is frequently suggested by irregular lighting of the instrument cluster's charge bulb, sporadic dead batteries,or strange sounds and scents.

Concept "C"

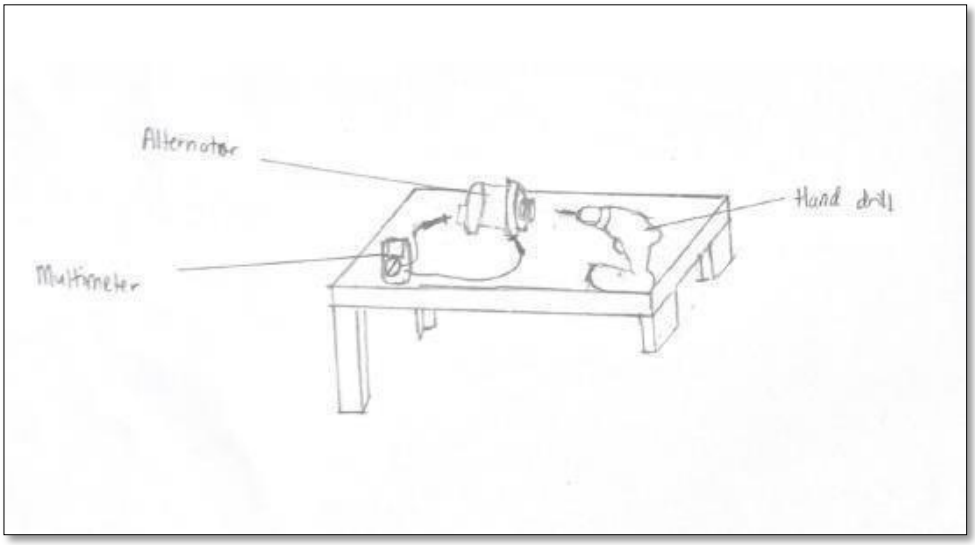


Figure 3.3: Design concept

Clamp the alternator to the bench securely. Connect the impact driver and the alternator using a 15/16 socket to spin the alternator. Measure the output,voltage using a multi meter and connect the positive lead of the multi meter to the positive side of the terminal and negative lead of the multi meter to the earth side on the alternator. Set the impact driver to max velocity and connect it to the alternator. Spin the pulley slowly until there is a reading of voltage on the multi meter. The impact driver have 12 volts power output and can spin until 1000 rpm to help the alternator to charge electricity. There's a power surge when you press the trigger of any power tool, in this case giving an output of 20V, within moments its settles down to its normal output, 18V.

Table 3.1: Comparison table

IDEA / CATOGAGORIES	Concept "A"	Concept "B"	Concept "C"
DURABILITY		✓	
USER FRIENDLY		✓	
COST (LOW TO HIGH)			✓
MAINTAINENCE	✓		
SIZING			✓
POWER		✓	
TOTAL	**1/6**	**3/6**	**2/6**

As the table shows, the most suitable concept is concept B, because it will bring more benefits than the other two concepts. Concept B has the highest level of durability compared to Concept A and Concept C. It also has the best power output compared to Concept A and Concept C which use batteries and hand drills.

3.4 PRODUCT SPECIFICATION

Following the selection of the second concept design as our final product design,we drew the product plan in greater depth and with more precise measurements, such as height, size, area, and diameter, to speed up the production process for project 2. These specifications, which are requested and not overly difficult, were also decided bythe survey we conducted.

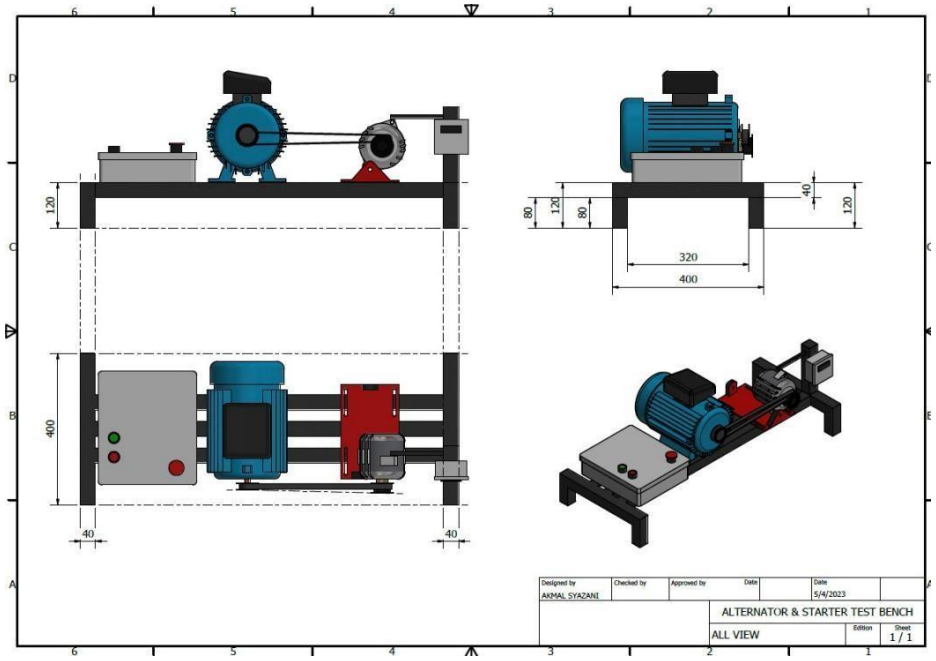


Figure 3.4: Alternator Test Bench Drawing Specification

The selection of materials is very important to ensure the durability of the product to be produced as well as the safety of the user to prevent accidents from occurring when the product is used. The selection of the appropriate metal for the product frame, base, handle screws, etc. is a priority in the selection of materials.

3.5 MATERIAL & PART SELECTION

(AKMAL SYAZANI BIN RUZAIMY)

Before beginning the fabrication process, we must decide what material will be used for each component. Material selection is critical because it influences the product's resilience after fabrication. The product's strength and durability are considered to prevent it from failing during project 2 testing and data collection. These are the parts and the materials used to make them:

Hollow Steel

Figure 3.5: Hollow steel

Hollow structural sections (HSS) are a form of metal profile. They are typically made of cold-rolled steel and shaped into a hollow, tubular piece. Hollow structural steel has a wide range of applications because to its excellent strength-to-weight ratio, economy, and simplicity when compared to other steel materials.

Steel Plate

Figure 3.6: Steel plate

A 2-inch steel plate is used as a holder base for the alternator in our project. The selection of the appropriate plate is very important to ensure the durability and strength of the base is guaranteed to prevent the base plate from breaking or bending.

Rubber Base

Figure 3.7: Rubber base pads

The use of base rubber pads can reduce vibrations and shocks on the project frame. To ensure the stability of the frame, this rubber base pads can also ensure the stability of the base so that it does not wobble.

Alternator

An alternator is an electrical machine that generates an alternating current. It is an important component in a car that recharges the battery and provides energy for the vehicle's electrical system, when the car engine is turned on. when the engine is on, all parts of the car can work such as interior and exterior lights. AC power may be produced by using a motor generator set where you use the DC power to run a DC motor which then runs an AC alternator producing true sinusoid wave forms.

As a result, the alternator uses a rectifier to convert alternating current to direct current. The alternator's output voltage varies with vehicle speed, so a regulator is used to limit this and maintain a near constant output.

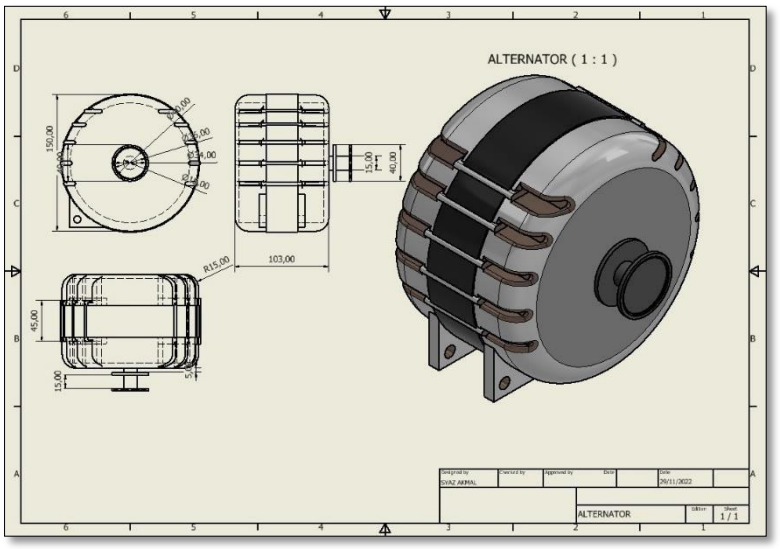


Figure 3.8: Alternator Drawing

ALTERNATOR PARTS:

- REGULATOR
- RECTIFIER
- ROTOR
- SLIPS RING
- SLIP RING AND BEARING
- STATOR
- DRIVE END BEARING
- PULLEY

1. Regulator

Figure 3.9 : Regulator

The voltage regulator is a component that manages the alternator's output to the battery in terms of quantity. Due to the numerous functions it is created with and how they operate according to their uses, it regulates the charging process.

2. Rectifier

Figure 3.10 : Rectifier

During the charging process, the rectifier is utilized to convert direct current (DC) from alternating current (AC) output.

3. Rotor

Figure 3.11 : Rotor

The alternator's rotor, which rotates the pulley and powers the belt system, is a moving component inside the alternator. It functions as an electromagnet that spins.

4. Slips ring

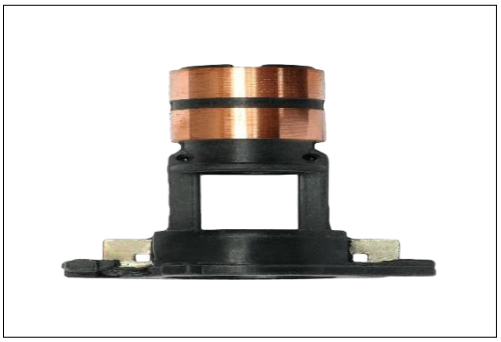


Figure 3.12 : Slips ring

Direct current can be obtained and used to power the rotor through the slip rings**.**

5. Slips ring and bearing

Figure 3.13 : Slips ring & bearing

The rotor shaft's rotation is supported by alternator bearings.

6. Stator

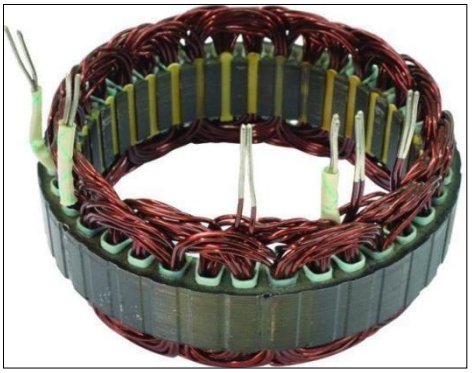


Figure 3.14 : Stator

An iron ring called a stator has multiple wire coils twisted around it. When a magnetic field is created, the portion of the stator that serves as the alternator's body produces an electrical current.

7. Drive and bearing

Figure 3.15 : Drive & bearing

The rotor shaft's rotation is supported by the driving end bearings as well.

8. Pulley

Figure 3.16 : Pulley

The drive belt system and the rotor shaft are both connected by the pulley. Despite the fact that the drive belt transfers the engine's rotation to the pulley. The charging process is triggered by rotation.

AMMETER & VOLTMETER

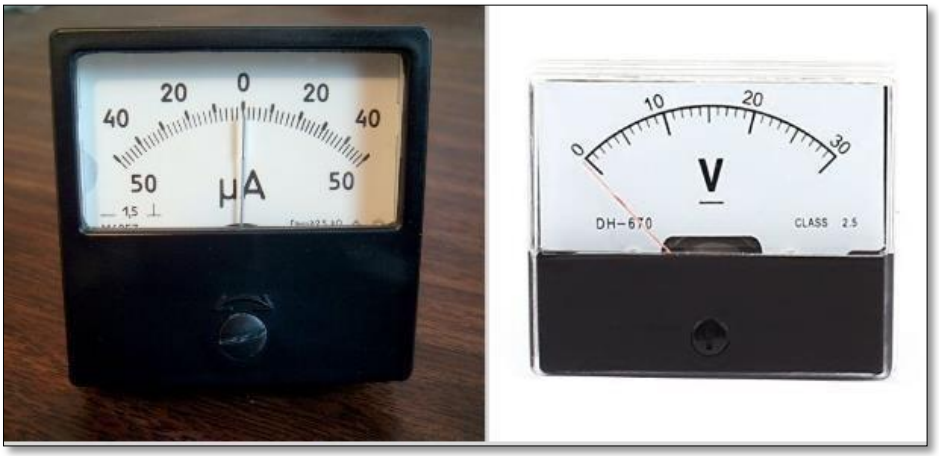


Figure 3.17 : Ammeter & Voltmeter

Ammeter is an instrument for measuring either direct (DC) or alternating (AC) electric current, in amperes. An ammeter can measure a wide range of current values because at high values only a small portion of the current is directed through the meter mechanism.

Voltmeter is an instrument used for measuring the potential difference, or voltage, between two points in an electrical or electronic circuit. Some voltmeters are intended for use in direct current (DC) circuits; others are designed for alternating current (AC) circuits.

- The voltage for normal alternators are 12.5 V to 13-14.5 V
- The voltage for bad alternators are 12.5 V or less

ELECTRIC MOTOR (AC)

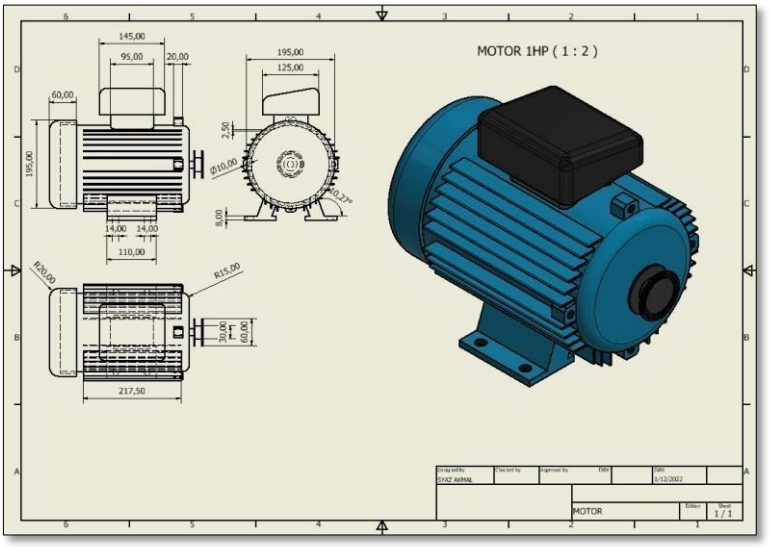


Figure 3.18 : Electric Motor

A direct current (DC) motor is a type of rotary electric motor that converts direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by induced magnetic fields caused by current flowing through a coil. Almost all types of DC motors have an internal mechanism, either electromagnetically or electronic, that changes the direction of current in a portion of the motor on a regular basis.

BELT

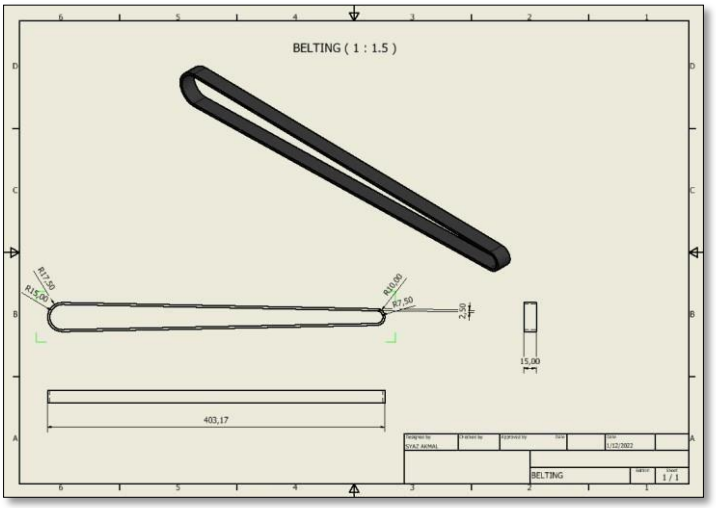


Figure 3.19 : Belting

The alternator belt keeps the car battery charged while the engine is running, and is directly connected to the health of your battery. It connects the alternator, power steering oil pump, and crosses the crank pulley, which provides momentum. Newer cars use serpentine belts because they are easy to replace. Most belts need to be changed at least every 50,000 miles. Most belts should be replaced every 50,000 miles. When a belt fails, you may hear a squeaking or chirping sound.

3.6 FABRICATION

3.6.1 Frame work

(ADAM HARITH BIN FURHAN)

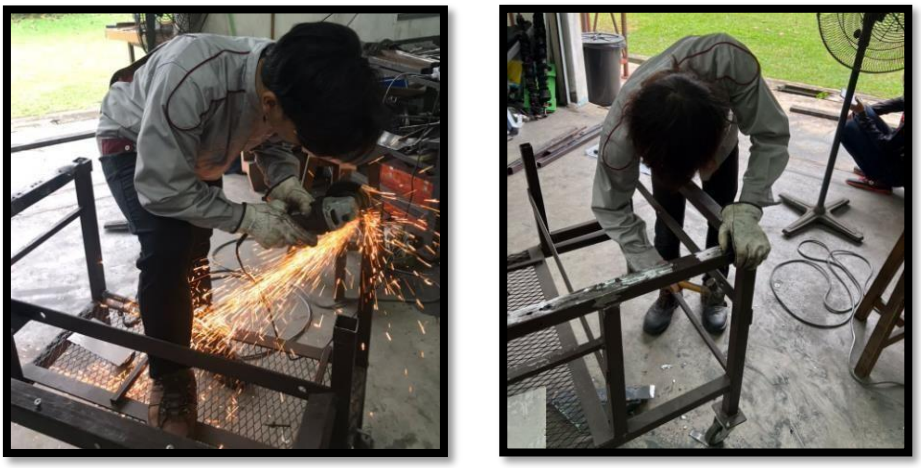


Figure 3.20 : Cutting steel process

The frame work was done by all three of us, using hollow steel to make the frame of the test bench. Figure 3.20 shows that Adam Harith and Akmal Syazani is cutting hollow steel from final year project.

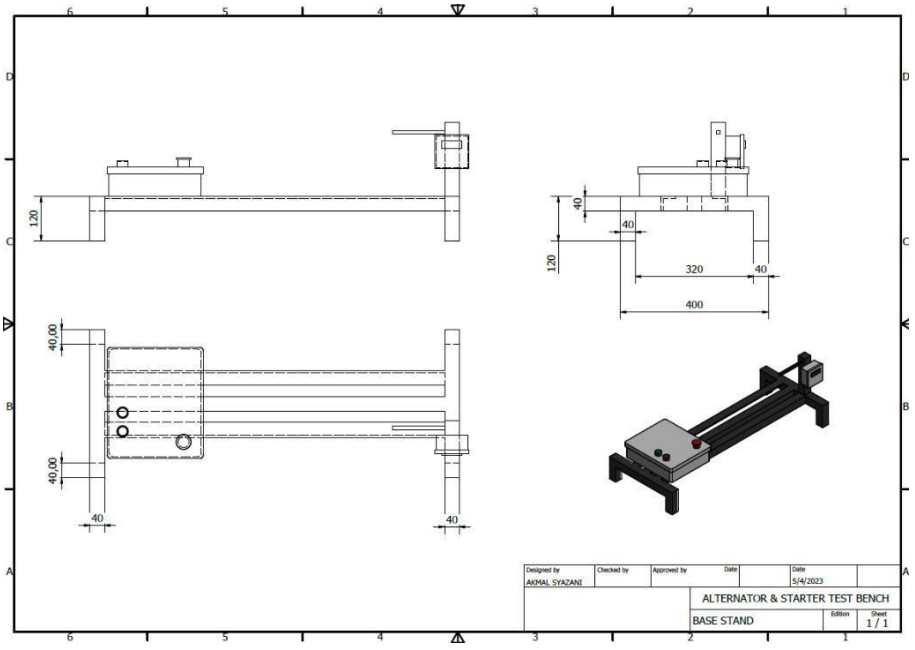


Figure 3.21 : Framework

Figure 3.22 : Welding process

Figure 3.23 : Welding process

The next step is to weld the steel that was cutted, to form a frame that can support many components such as, electric motor, panel board and alternator. Figure 3.21 and figure 3.22 shows that all threeof us are using MIG welding to assemble the frame.

3.6.2 Custom Alternator Holder Base Plate

(AKMAL SYAZANI BIN RUZAIMY)

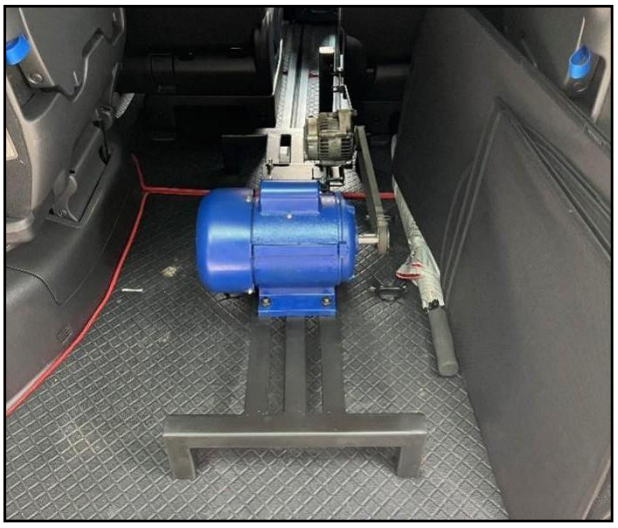


Figure 3.24 : Test bench after custom plate

After the basic frame is finished welding, the project frame is sent to the welding specialist workshop to do the custom process of the alternator holder base. For the base, we use a 2-inch steel plate as a base and a 3.5-inch metal plate for the alternator holder.

3.6.3 The project was sent to the engineering workshop in Klang for the modification process on motor pulley

(AKMAL SYAZANI BIN RUZAIMY)

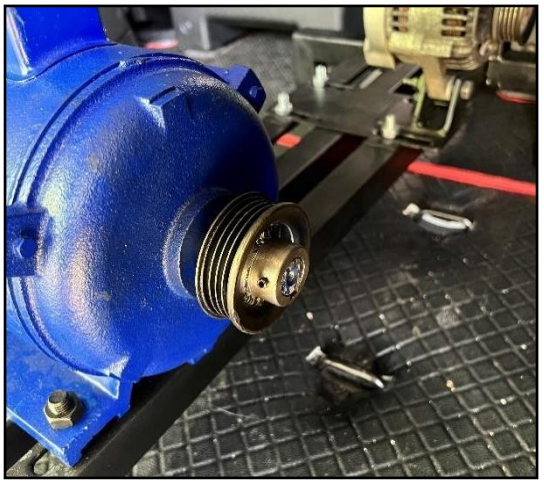


Figure 3.25 : Pulley Motor

A shaft with an inner diameter of 28mm is used as a pulley connecting shaft. With a length of 50mm and an outer diameter of 38mm, we use "stainless steel" type iron and the design is the type that can be opened and installed with a "Key" design on the magnet slot of the motor shaft.

3.6.4 Electrical and Mechanical Parts
(AKMAL SYAZANI BIN RUZAIMY)

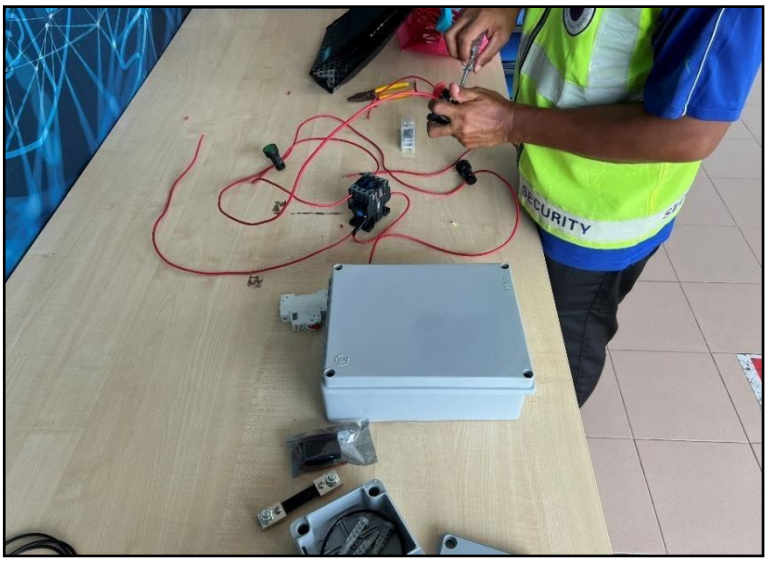


Figure 3.26 : Wiring planning process

The picture above shows Akmal Syazani with Mr. Mahadir, a person who has knowledge and experience in home wiring. The wiring of the motor must be carefully examined in order to prevent unwanted incidents such as short circuits, "motherboard" burning or unstable currents.

Figure 3.27 : Electrical parts assembly

Figure 3.27 above shows how Akmal Syazani installed in the electrical components. He assembled the components such as MCB, wire, panel board, emergency push button, start button and multi meter to complete the mechanism.

3.7 MATERIALS AND TOOLS

Table 3.2 : Material & Tools Cost

DESCRIPTION	QTY	UNIT PRICE	TOTAL
Motor-12V (1hp)	1	350	350.00
Voltmeter/Ammeter	1	29.00	29.00
Besi	1	150.00	150.00
Panel board	1	40.00	40.00
Pulley Motor	1	100.00	100.00
Cable 2:5 *10-15m*	1	15.00	15.00
Button normally open/close	2	5.00	10.00
Emergency stop button	1	12.00	12.00
MCB	1	4.00	4.00
Contractor	1	30.00	30.00
Screw & bracket	1	5.00	5.00
Rubber Base	4	1.50	6.00
		SUBTOTAL	751.00
		Quote Total(RM)	**751.00**

3.8 TESTING AND ANALYSIS

(MUHAMMAD SHAHIRUEL MAULA SYED TAJUDIN)

During this process, data is collected and analysed to determine whether our product met the target, solved the problem, and detected any flaws. The data that will be collected during this process is:

Survey Research

Survey research is the collection of information from a sample of people based on their replies to questions. The survey will include questions about demographics, alternator testbench usage, innovation, and ideas. It will be given to 20 respondents who work in the automobile business. We will learn about current market demand using this way.

3.9 SUMMARY

In a nutshell, this chapter contains detailed information on the explanations and justifications for the product's design, as well as the total cost of the product. All of the materials are carefully selected to guarantee that they can cater to the main function of the product while also having a stylish design

CHAPTER 4
FINDING AND DISCUSSION

4.1 INTRODUCTION
(MUHAMMAD SHAHIRUEL MAULA SYED TAJUDIN)

This chapter covers all of the "Alternator Test Bench' important data and analysis. The data is very important to ensure that the project's objective and scope are achieved. If the data analysis meets the objective, it indicates that our project was success. So, in order for this initiative to go properly, we've decided to gather all relevant data to investigate each case in order for this project to go off without a hitch.

4.2 FINDINGS DATA

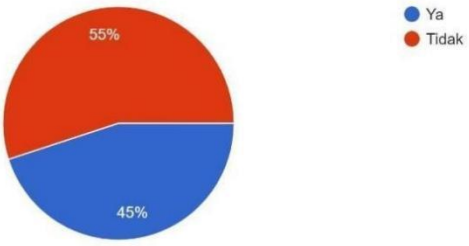
Creating a survey form is an important method to find the consent of the public to produce a project in order to identify alternatives or ideas found in the project. In addition, this survey form will be conducted or filled in by car users and mechanics, and any information obtained will only be used for research surveys only.

Next, this survey form there is more than one question to be asked, and this survey was conducted online by using Google form. By doing this survey, it can identify opinions and honest answers from respondents as well get consent to continue the project idea.

From the survey conducted there are 20 people have answered this survey question. Of the total respondents, most of them agreed with the idea of the project because it can benefit them in the future. Below is the data from the survey form.

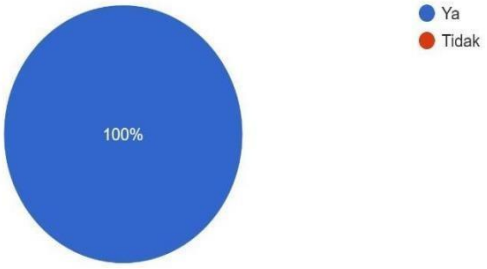
Jika anda mempunyai sebuah kereta, adakah kereta anda pernah mengalami kerosakan pada alternator ?

20 responses



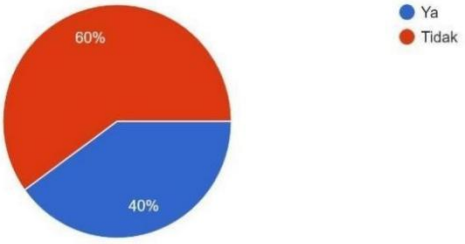
Adakah Alternator Test Bench dapat membantu mekanik di bengkel ?

20 responses



Alternator test bench yang ada di pasaran sekarang ini dalam lingkungan harga RM20K hingga RM60K Berdasarkan harga alternator test bench...dakah bengkel-bengkel kecil mampu membelinya ?

20 responses



4.3 INSTRUCTION MANUAL
(ADAM HARITH BIN FURHAN)

1. Disassemble alternator from the car to check the condition of the alternator.

Figure 4.1 : Disassemble process for alternator

2. Install the alternator into the alternator test bench.

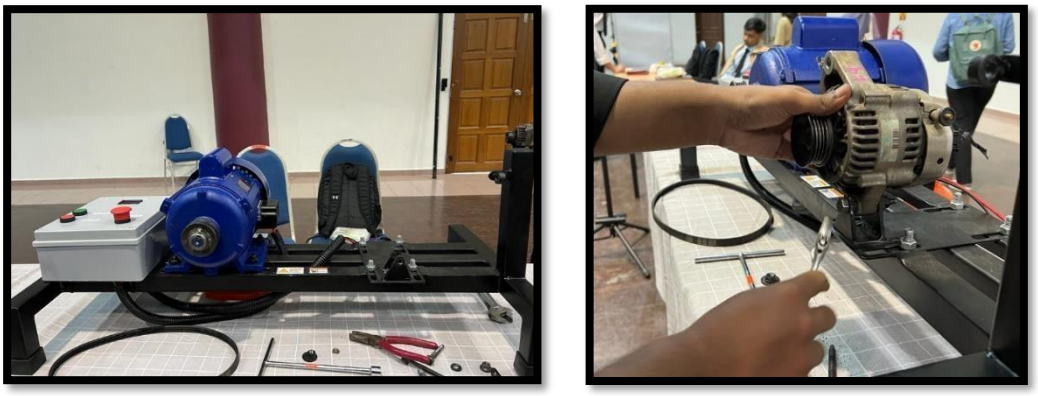


Figure 4.2 : Installation of alternator to test bench

3. Make sure the belt has a suitable tension into it.

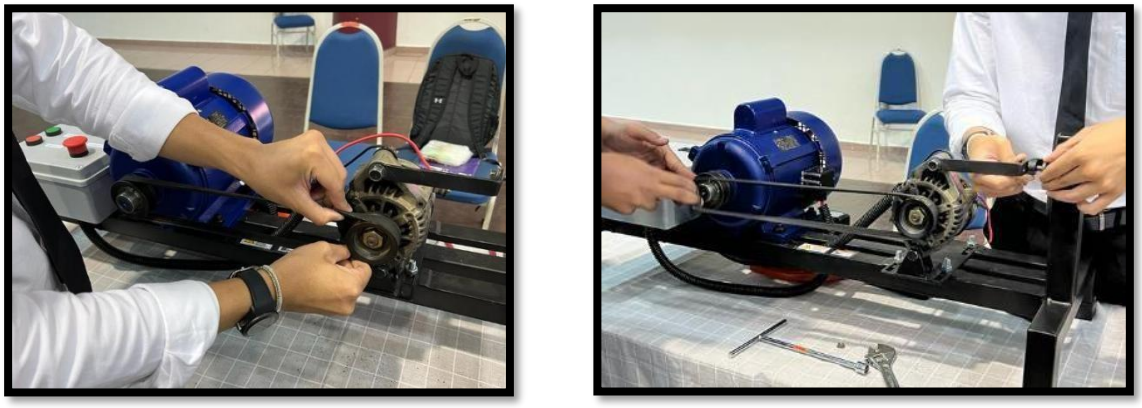


Figure 4.3 : Belt installation

4. Press the start button on the alternator test bench to start the test.

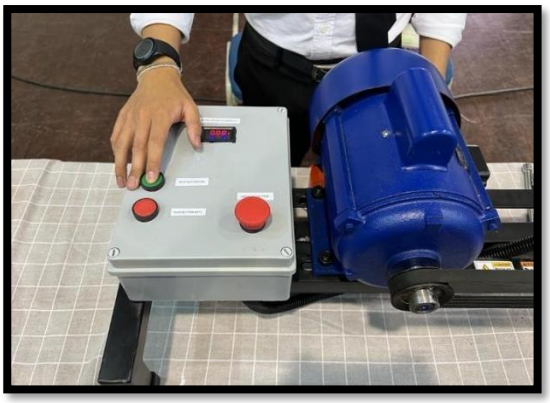


Figure 4.4 : The electric motor is turned on

5. Beware of the rotation of the belt.

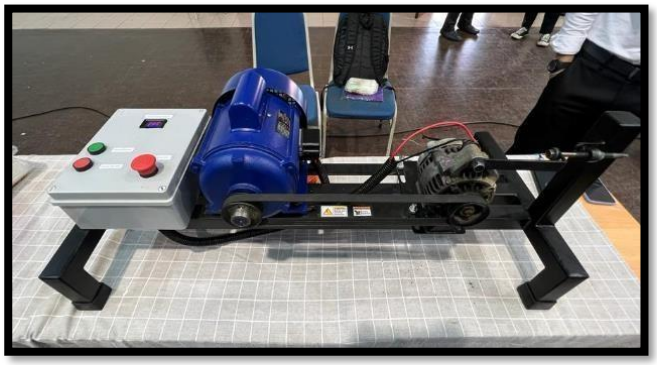


Figure 4.5 : The electric motor is running

6. Check the voltage and ampere reading on the Voltmeter & Ammeter (a good alternator should produce 13.5-14.5 volts, meanwhile a bad alternator produce 12.5 volts or low)

Figure 4.6 : Meter display

7. Press the stop button to stop the electric motor from running.

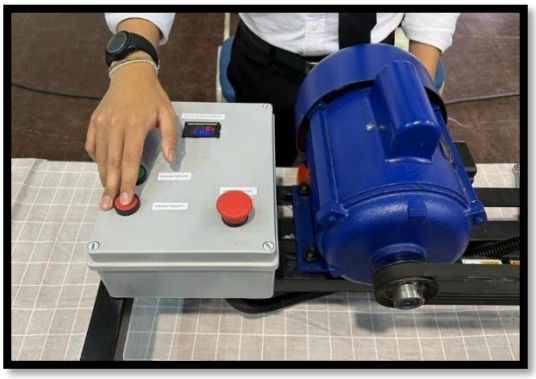


Figure 4.7 : The close button is pressed

8. Press the emergency button to stop the test bench from running. (Press if necessary)

Figure 4.8 : Kill switch is pressed

9. Repair or replace the alternator if the voltage reading is not adequate.
10. Disassemble the alternator from the test bench.

Figure 4.9 : Alternator removed

11. Install alternator in the car.

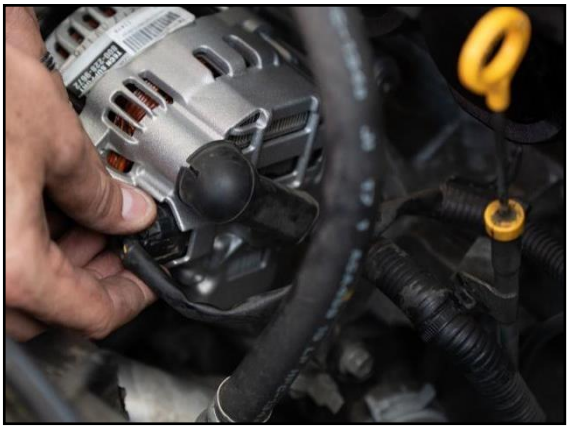


Figure 4.10 : Alternator is installed on the car

4.4 TEST RESULTS

(MUHAMMAD SHAHIRUEL MAULA SYED TAJUDIN)

Once the project was completed, several testing was done to make sure that some of the data was taken into account. The time it takes for the alternator to reach power rotation,the suitable rpm to read alternator ,the suitable pulley size ,the suitable belt type. We may draw inferences about our alternator test bench based on the information we have and compare them to other alternator test bench on the market.

1. Time it takes for the alternator to reach power.

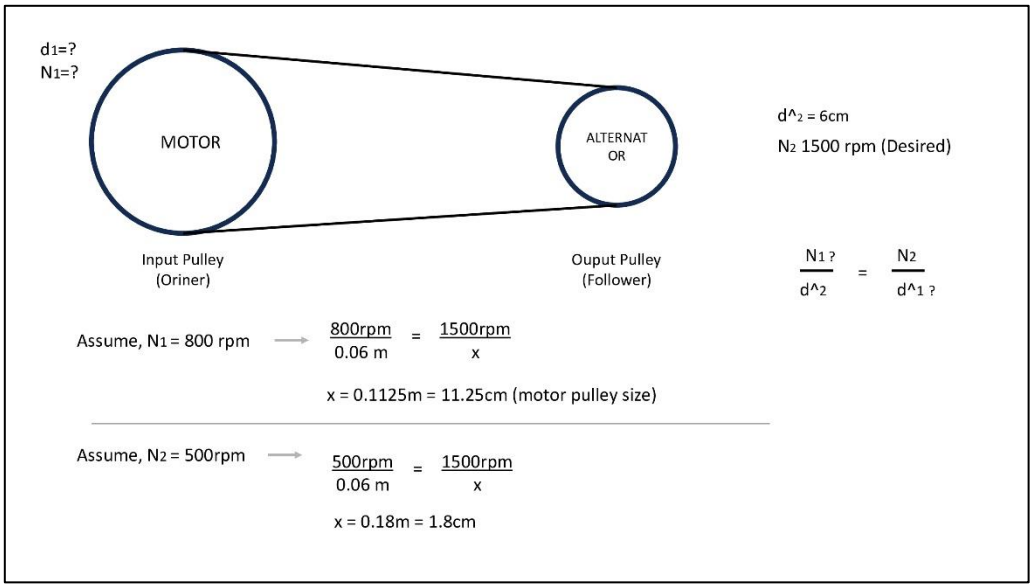
The time that our survey had done is between 30 second to 60 second before the alternator can reach the power that need to make the rotation.After that alternator reach a suitable rotation than we can read that our alternator could be used or not by read it by using an ammeter and voltmeter.

2. The suitable rpm to read alternator.

We bought the electric motor that can reach until 1500 rpm because the suitable rpm is 1500 rpm for 1.8L engine car.

3. The suitable pulley size

Pulley size is so important to make the rotation reach the suitable power because if the two pulley is in same size the motor cannot reach the optimal power.We had try many size of pulley to the motor to reach the optimal power.The chosen pulley size that we are using is 18 cm for the motor pulley and 6 cm for the alternator pulley.



Simple calculation pulley size

4. Suitable belt type

- V belt type

The most popular and longest-used variety is the traditional V-belt. In many different industries, including agriculture, ventilation, and industrial machinery, the original traditional V design replaced leather belts. Traditional V-belts have a load range of 1/500 horsepower to 500 horsepower. They typically result in larger bearing loads and are less effective than narrow V-belts. Classic V-belts, however, offer a high tolerance for challenging operating circumstances.The interior length in inches and the cross-section size make up the standard component number format.

Figure 4.11 : V-belt

- Timing belt

For engines with bigger bores and strokes, timing belts, also known as cam belts, are timing chains. They are essential to the operation of internal combustion engines. The valves and pistons will function properly if the camshaft and crankshaft are in synchrony with one another.

Figure 4.12 : Timing belt

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION
(ADAM HARITH BIN FURHAN)

The entire project's discussion, conclusion, and upgrade plan are covered in this chapter. The research was carried out using data from the project's test run. As a result, the description of all test run findings and interpretation will be explained in this chapter. Finally, depending on the outcome of the discussion and the improvement plan that has been developed.

5.2 CONCLUSION

The study investigated the possibility of making an Alternator Test Bench that are cheap than the other test bench in market. This project could be a biggest turnover in market cause it cost less than other product and can help small workshop to buy it.

All the data has been collected by using questionnaire via Google Form that has been distributed publicly to mechanics. There are 20 respondents that contributed to the survey.

According to the results of a survey of mechanics, according to the survey all vote that this test bench can help in the workshop. Aside from that, all the project's objectives have been met with great success. Following the completion of the questionnaire, it was discovered that 20(100%) respondents believe that an Alternator Test Bench will make their lives easier.

5.3 RECOMMENDATIONS

Based on the findings and conclusion of the study, here a several recommendations that can be considered in the future.

- Put a cover for the belt to ensure more safety.
- Build an Alternator Test bench that can do more test than just a output for voltage and current for alternator.

5.4 LIMITATIONS

Initially the product cannot test the car that are more than 1.8L cause the alternator are different types and different power torque for test. Maybe we could use a more power motorto run a test to a bigger types of engine car.

5.5 SUMMARY

To summarize, the project was a success. The project is capable of achieving all of the suggested objectives. The product is clearly needed by mechanics based on the results of the questionnaire. Alternator Test Bench may become one of the most in- demand products in the near future, as there are currently unavailable in Malaysia.

REFERENCES

- (Systems, n.d.) Available: https://idea4t.com/test-systems/components/alternator-test-system/
- (Servicems, n.d.) Available: https://servicems.eu/en/news/post/426-Handmade-bench-for-testing.html
- (Counterman, n.d.) Available: https://www.counterman.com/bench-testing-can-reveal-if-the-alternator-is-the-problem/
- (diagnostics of alternators and starters, n.d.)
- (Check an alternator, n.d.)
- (dvelectronics, n.d.) Available: https://www.dvelectronics.com/products/alternator-and-starter-testing-systems/jbt-1/
- (Servicems, Different methods of alternator diagnostics, n.d.) Available: https://servicems.eu/en/news/post/659-Different-methods-of-alternator-diagnostics.html
- (Wikipedia, n.d.) Available: https://en.wikipedia.org/wiki/Automotive_battery#:~:text=An%20automobile%20battery%20is%20an,solution%2C%20which%20is%20the%20electrolyte.
- (ac dc motors, n.d.)
- (Tribune, 2023) Available: https://www.chicagotribune.com/consumer-reviews/sns- bestreviews-tools-the-best-impact-driver-20190905-story.html

ATTACHMENT

ATTACHMENT A

Gant Chart Project 1

GANTT CHART PROJECT 1 (2022)

Week / Activities	Status	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15
Student	P															
Registeration	C															
Presentaion of	P															
Ideas	C															
Preparing	P															
Proposal	C															
Survey	P															
	C															
Literature	P															
Review	C															
Methodology	P															
	C															
Writing	P															
Proposal	C															
Presentation	P															
Proposal	C															
Submission	P															
Proposal	C															

P	PLANNING
C	COMPLETE

Gant Chart Project 2

Week / Activities	Status	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
ASSEMBLING	P														
	C														
TESTING	P														
	C														
DATA & ANALYSIS	P														
	C														
VIDEO & SLIDE PRESENTATION	P														
	C														
TECHNICAL REPORT	P														
	C														
POSTER	P														
	C														
PRESENTATION	P														
	C														
SUBMISSION REPORT	P														
	C														

P	PLANNING
C	COMPLETE

ATTACHMENT B

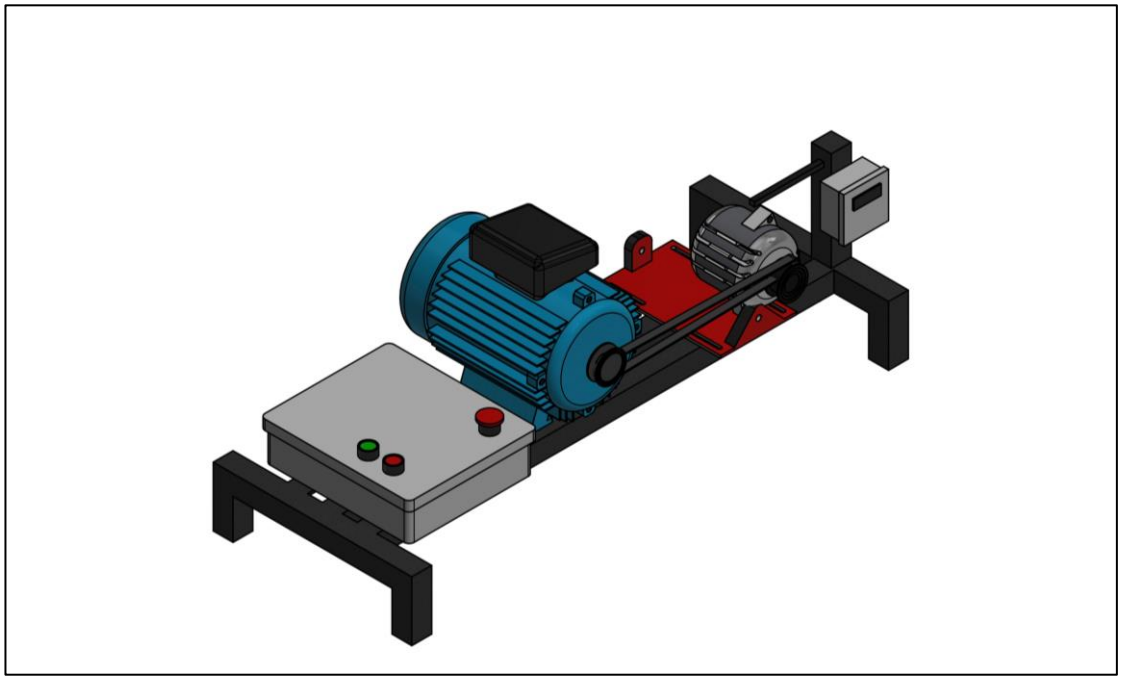


Figure 6.1 : Main 3D Drawing

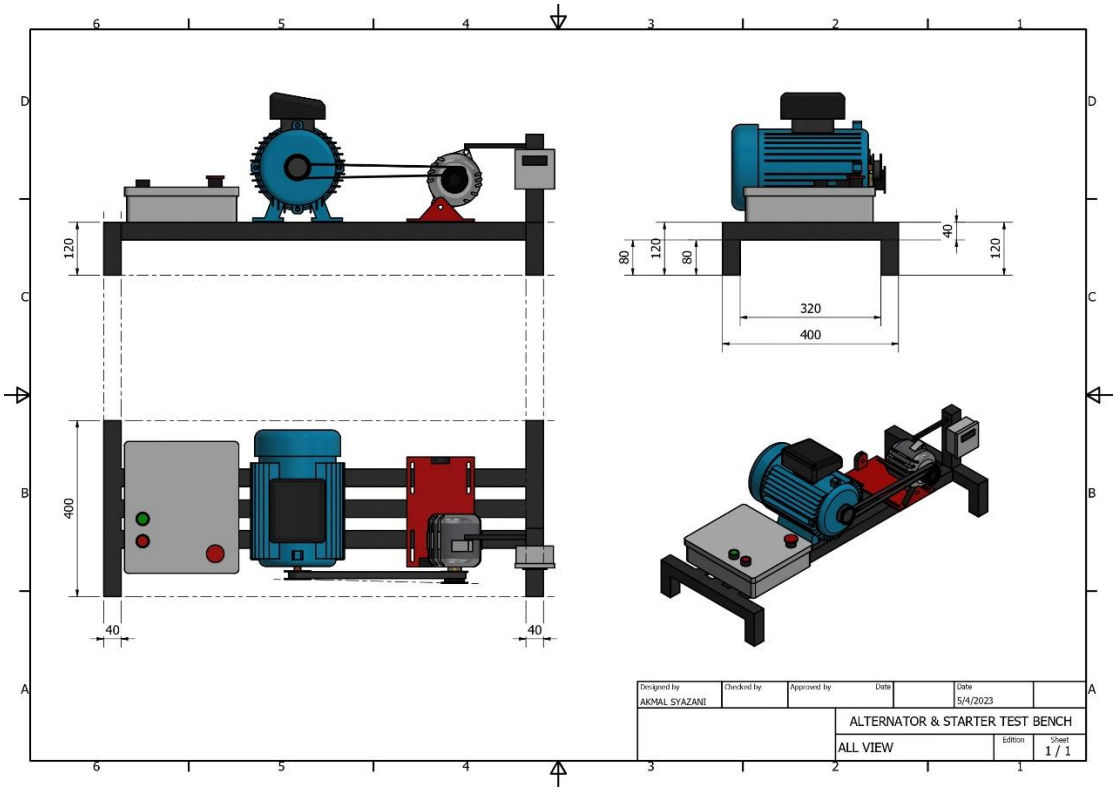


Figure 6.2 : All view 3D drawing

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ALTERNATOR TEST BENCH

AKMAL SYAZANI BIN RUZAIMY08DKM20F2019

ADAM HARITH BIN FURHAN08DKM20F2029 MUHAMMAD SHAHIRUEL MAULA SYED TAJUDIN08DKM20F2030

JABATAN KEJUTERAAN MEKANIKAL

SESI 2 : 2022/2023

ADAM HARITH BIN FURHAN08DKM20F2029 MUHAMMAD SHAHIRUEL MAULA SYED TAJUDIN08DKM20F2030

Laporan ini dikemukan kepada Jabatan Kejuteraan Mekanikal sebagai memenuhi sebahagian syarat penganugerahan Diploma Kejuteraan Mekanikal.

JABATAN KEJURUTERAAN MEKANIKAL

SESI 2: 2022/2023

AKUAN KEASLIAN DAN HAK MILIK

ALTERNATOR TEST BENCH

Kami, AKMAL SYAZANI BIN RUZAIMY (NO KP: 02 020119-10-0075), ADAM HARITH BIN FURHAN (NO KP: 020604-10-0431), MUHAMMAD SHAHIRUEL MAULA SYED TAJUDIN (NO KP: 020705-10-2495) adalah pelajar Diploma KejuruteraanMekanikal, Politeknik Sultan Salahuddin Abdul Aziz Shah, yang beralamat di Persiaran Usahawan, Seksyen U1, 40150 Shah Alam, Selangor.

Saya mengakui bahawa Alternator Test Bench dan harta intelek yang ada di dalamnya adalah hasil