DESIGN AND FABRICATE GAS STOVE STAND AND EXTRACTOR HOOD STAND

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DESIGN AND FABRICATE GAS STOVE STAND AND EXTRACTOR HOOD STAND

MUHAMAD FADHLI BIN OTHMAN

Report submitted in partial fulfilment of the requirements
for the award of the degree of
Diploma in Mechanical Engineering

Faculty of Mechanical Engineering
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DECEMBER 2012

SUPERVISOR'S DECLARATION

We hereby declare that we have checked this project and in our opinion this project is satisfactory in terms of scope and quality for the award of the degree of Diploma of Mechanical Engineering

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I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurently submitted for award of other degree.

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ABSTRACT

This final year project is about to design and fabricate the gas stove stand with extractor hood rack that suit to be used in kitchen. The objective of the project is to design and fabricate gas stove stand with extractor hood rack. This project also describes the review of products which are available in the market following to the title of the project. Design generation is showed and solid three dimensional structure modelling of the gas stove stand and extractor hood stand design was developed with solid work software. This report also explain the fabrication process that carrying in this project. Descriptions of material also show on this report in order to design this projek. As the conclusion, this project has achieved its goal through the succesful product making.

ABSTRAK

Projek tahun akhir ini membentangkan mengenai merekabentuk dan fabrikasi pendirian gas dapur dengan rak pemerah hud yang sesuai digunakan di dapur. Objektif projek ini adalah merekabentuk dan fabrikasi pendirian gas dapur dengan rak pemerah hud. Projek ini juga menerangkan kajian produk yang terdapat di pasaran berikutan tajuk projek. Rekabentuk generasi menunjukkan dan pepejal tiga model struktur pendirian gas dapur dan rak pendirian pemerah hud telah dihasilkan dengan perisian kerja pepejal. Laporan ini juga menerangkan proses fabrikasi yang dijalankan dalam projek ini. Laporan ini juga menunjukkan bahan-bahan yang digunakan dalam merekabentuk projek ini. Sebagai kesimpulan, projek ini telah mencapai matlamatnya melalui pembuatan produk yang berjaya.

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LIST OF ABBREVIATIONS

AL	Aluminium
ZA	Zinc aluminium
SMAW	Shield metal arc welding
MMA	Manual metal arc welding
TIG	Tungsten inert gas
GTAW	Gas tungsten arc welding
UMP	Universiti Malaysia Pahang

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This chapter explained about the project objectives, project backgaround, project scope, and problem statement that been conducted.

1.2 PROJECT SYNOPSIS

Final year project is one subjects of this semester. This subject carries four hour credits. In this subject, a project needs to fulfill by the student. The current project is to design and fabricate kitchen gas stove with cooker hoods. Final year project. The student must have hardworking and high discipline attitude. This project involves a few process in other to fabricate it. This project were testing with a real gas stove and cooker hoods dimensions.

1.3 PROBLEM STATEMENT

1) To avoid the stove from slip when use
2) To prevent smoke from regrouping in the kitchen
3) To avoid floor from oil that produce when cooking

1.4 OBJECTIVE

To design and fabricate gas stove stand with extractor hood stand

1.5 PROJECT SCOPE

1) Focused for two burner gas stove
2) Focused on table top
3) Focused on extractor hood that has weight less than 12 kg

1.6 REPORT OVERVIEW

1.6.1 Chapter 1

In this chapter discussed about the problem statement, project objective and project scope. This chapter explain the main thing to why to design design this product.

1.6.2 Chapter 2

The purpose of this chapter is to provide a review of past research efforts related to gas stove stand and extractor hodd. A review of other relevant research studies is also provided. Substantial literature has been studied on history, types of lamp and material needed.

1.6.3 Chapter 3

This chapter discusses about all the information and data that required and fabrication process for this project. Firstly, to designing the gas stove stand and extractor hood skill in drawing and.This kind of data is required to design the concept of tree lamp.

1.6.4 Chapter 4

In this chapter explain and review abaout the final result of the product. This chapter also explain about the result of product testing, the advantages of product and a discuss abaout the product.

1.6.5 Chapter 5

This chapter briefly explain the conclude of overall of this project. The experience we gather and all the skills that we learn during fabricate this product. It also review about the little recommendation in order to make this product function more efficiently.

CHAPTER 2

LITERATURE RIVIEW

2.1 INTRODUCTION

In a small kitchen needed the furnishings that could accomodate but do not to make kitchen became visible narrow especially for cooking. For example, gas stove stand and extractor hood rack. I have design a gas stove stand together with place to put the extarctor hood. This invention ia a two-in one use. Here's the example gas stove stand. It's a gas stove stand which design together with extractor hood. As we know, gas stoves are often moving ang slipping when used on the table. It also often leaves stains such as oil and other substances. In order to solve the problems, the stand that I design is considering all the current weakness.

2.2 EXTRACTOR HOOD RIVIEW

An extractor hood consists of three main components that is a skirt or capture panel to contain the raising gases, one or more grease filters, and a fan tangential blower for force ventilation. There are two major configurations of extractor hoods, ducted (or vented) application, and ductless (or recirculating) application. In a ducted application, the output collar of the extractor hood's blower motor is attached to a duct system, which terminates outside the building. In a ductless application, a filter, often containing activated charcoal, removes odor and smoke particles from the air before releasing the cleaned air back into the kitchen. A ducted system allows for removal of all forms of airborne contamination, while a ductless one recirculates heat and moisture into the kitchen. In addition, a ducted application eliminates the

need for regular replacement of the filters, and avoids the airflow restriction (and resultant loss of power) caused by them.

However, ducted application can be impractical, due to lack of space or ability to install a duct system, make-up air requirements, or the additional cost of heating/cooling the make-up air. Some range hood designs allow for both types of applications. Exhaust hoods almost always include built-in lighting (incandescent, fluorescent, or halogen) to illuminate the cooking surface. In addition, some manufacturers offer matching accessories, such as backsplash panels, pot racks, shelf units, or dish racks.Extractor hoods controls are typically electronic, though some low-end models use electromechincal controls. Extractor hoods with electronic controls can offer remote control, motorized height adjustment, thermal sensor, overheat protection, boost mode, delayed shut-off, filter cleaning reminder, active noise cancellation, temperature display, user presets (memory), and so on.

2.3 GAS STOVE

2.3.1 Portable stove

A portable stove is a cooking stove specially designed to be portable and lightweight, as in camping, picnicking, backpacking, or other use in remote locations where an easily transportable means of cooking or heating is needed. Portable stove can be used in diverse situations, such as for outdoor food service or catering and also in field hospitals. Since the invention of the portable stove in the 19th century, a wide variety of designs and models have seen use in a number of different applications. Portable stoves can be broken down into several broad categories based on the type of fuel used and stove design: unpressurized stoves that use solid or liquid fuel placed in the burner before ignition, stoves that use a volatile liquid fuel in a pressurized burner, bottled gas stoves, and gravity-fed “spirit” stoves.

2.4 TYPE OF STOVE

A kitchen stove, usually called a stove , range, or cooker, or oven is a kitchen appliaince designed for the purpose of cooking food. Kitchen stoves rely on the

application of direct heat for the cooking process and may also contain an oven, used for baking.Modern kitchen stoves have burner on the top. A cooktop can refer to the top of a stove or burners built into a countertop.many cooktops are made from glass-ceramic. A drop-in range has both burners on the top and an oven and hangs from a cutout in the countertop(that is , it cannot be installed free-standing on its own). Most modern stoves come in together with built-in extractor hoods.

2.4.1 charcoal stoves

Stove continued to evolve and charcoal began to replace wood as the burning material in stoves. These stoves had flat tops and the heat was concentrated on one side of the stoves top so that cooks could cook things at different temperatures based on where the pot or pan was located.

Figure 2.1: Charcoal stoves stand

2.4.2 electric stoves

Once electric power was widely and economically available, electric stoves became a popular alternative to fuel-burning appliances. The first electric stoves use heating elements made of high-resistance metal to produce heat. The cooktop (range) surface had one or more circular heating elements, insulated with compressed magnesia and sheathed in a spiral metal tube. Heating elements for the oven are of similar construction but an elongated loop to distribute heat. Elements were made as plug-in consumer-replaceable parts and could also be easily removed for cleaning. Temperature of cooking elements was regulated by adjusting a bimetal thermostat control switch, which switched power on and off to control the average heating effect of the elements.

Figure 2.2: Electric stoves stand

2.5 RIVIEW OF GAS STOVE STAND

The stand of gas stove are design based on the dimensional size of the stove. Portable stove stand make the user become more easier to handle when want to replace it in room kitchen. Safety factor are analyse during the testing with the stove. To make it more safe to be put on the table top, rubber liner are put on each stand to avoid it easily to slip on table top. It also come in together with built-in extractor

hoods rack. Stainless steel is suitable material made a stand. With a high stand from stainless, it can make the stand more long-lasting.

Figure 2.3: 2 burner gas stoves stand

2.6 RIVIEWS ON SELECTED MATERIAL

2.6.1 Mild Steel

Mild steel, also called plain-carbon steel, is the most common form of steel because its price is relatively low while it provides material properties that are acceptable for many applications. Low carbon steel contains approximately 0.05–0.15% carbon and mild steel contains 0.16–0.29% carbon; making it malleable and ductile, but it cannot be hardened by heat treatment. Mild steel has a relatively low

tensile strength, but it is cheap and malleable; surface hardness can be increased through carburizing.

It is often used when large quantities of steel are needed, for example as structural steel. The density of mild steel is approximately 7.85 g/cm3 (7850 kg/m3 or 0.284 lb/in3) and the Young's modulus is 210 GPa (30,000,000 psi).

Low carbon steels suffer from yield-point runout where the material has two yield points. The first yield point (or upper yield point) is higher than the second and the yield drops dramatically after the upper yield point. If a low carbon steel is only stressed to some point between the upper and lower yield point then the surface may develop Luder bands. Low carbon steels contain less carbon than other steels and are easier to cold-form, making them easier to handle.

2.6.2 Aluminium

Aluminium (or aluminum) is a chemical element in the boron group with symbol Al and atomic number 13. It is silvery white, and it is not soluble in water under normal circumstances.

Aluminium is the third most abundant element (after oxygen and silicon), and the most abundant metal, in the Earth's crust. It makes up about 8% by weight of the Earth's solid surface. Aluminium metal is so chemically reactive that native specimens are rare and limited to extreme reducing environments. Instead, it is found combined in over 270 different minerals. The chief ore of aluminium is bauxite.

Aluminium is remarkable for the metal's low density and for its ability to resist corrosion due to the phenomenon of passivation. The most useful compounds of aluminium, at least on a weight basis, are the oxides and sulfates.

Despite its prevalence in the environment, aluminium salts are not known to be used by any form of life. In keeping with its pervasiveness, aluminium is well

tolerated by plants and animals. Owing to their prevalence, potential beneficial (or otherwise) biological roles of aluminium compounds are of continuing interest.

2.6.3 Zinc Aluminium

Zinc-aluminium (ZA) alloys are alloys whose main constituents are zinc and aluminium. Other alloying elements include magnesium and copper. This type of alloy was originally developed for gravity casting. They were designed to compete with bronze, cast iron and aluminium using sand and permanent mold casting methods. Distinguishing features of ZA alloys include high as-cast strength, excellent bearing properties, as well as low energy requirements (for melting).

ZA alloys make good bearings because their final composition includes hard eutectic zinc-aluminium-copper particles embedded in a softer zinc-aluminium matrix. The hard particles provide a low-friction bearing surface, while the softer material wears back to provide space for lubricant to flow, similar to Babbitt metal.[citation needed]

The numbers associated with the name represent the amount of aluminium in the alloy (i.e. ZA8 has 8% aluminium).

2.6.4 Rubber

Natural rubber, also called India rubber or caoutchouc, as initially produced, consists of suitable polymers of the organic compound isoprene with minor impurities of other organic compounds plus water. Forms of polyisoprene that are useful as natural rubbers are classified as elastomers. Currently the rubber is harvested mainly in the form of the latex from certain trees. The latex is a sticky, milky colloid drawn off by making incisions into the bark and collecting the fluid in vessels. This process is called "tapping". The latex then is refined into rubber ready for commercial processing. Natural rubber is used extensively in many applications and products, either alone or in combination with other materials. In most of its useful forms it has a large stretch ratio, high resilience, and is extremely waterproof.

2.7 WELDING

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work pieces and adding a filler material to form a pool of molten material (the *weld pool*) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. This is in contrast with soldering and brazing, which involve melting a lower-melting-point material between the work pieces to form a bond between them, without melting the work pieces.

Many different energy sources can be used for welding, including a gas flame, an electric arc, a laser, an electron beam, friction, and ultrasound. While often an industrial process, welding can be done in many different environments, including open air, under water and in outer space. Regardless of location, however, welding remains dangerous, and precautions must be taken to avoid burns, electric shock, eye damage, poisonous fumes, and overexposure to ultraviolet light.

Figure 2.4: Welding process

2.7.1 Arc Welding

One of the most common types of arc welding is shielded metal arc welding (SMAW), which is also known as manual metal arc welding (MMA) or stick welding. Electric current is used to strike an arc between the base material and consumable electrode rod, which is made of steel and is covered with a flux that protects the weld area from oxidation and contamination by producing CO_2 gas during the welding process. The electrode core itself acts as filler material, making separate filler unnecessary.

The process is versatile and can be performed with relatively inexpensive equipment, making it well suited to shop jobs and field work. An operator can become reasonably proficient with a modest amount of training and can achieve mastery with experience. Weld times are rather slow, since the consumable electrodes must be frequently replaced and because slag, the residue from the flux, must be chipped away after welding. Furthermore, the process is generally limited to welding ferrous materials, though special electrodes have made possible the welding of cast iron, nickel, aluminum, copper, and other metals. Inexperienced operators may find it difficult to make good out-of-position welds with this process.

2.7.2 TIG Welding

TIG (Tungsten Inert Gas) or even as it called GTAW (Gas Tungsten Arc Welding) uses non-consumable tungsten electrode and inert gas for shielding. It also can be implemented with or without filler metal. Tungsten is used due to its high melting point (3410°C). GTAW is most used for aluminium stainless steel.

Advantages of GTAW is can produce high quality welds, no weld spatter, little or no cleaning required after welding since no flux is used. The level of heat input also affects weld quality. Low heat input, caused by low welding current or high welding speed, can limit penetration and cause the weld bead to lift away from the surface being welded. If there is too much heat input, however, the weld bead grows in width while the likelihood of excessive penetration and spatter increase.

Additionally, if the welding torch is too far from the workpiece the shielding gas becomes ineffective causing porosity within the weld. This results in a weld with pinholes, which is weaker than a typical weld.

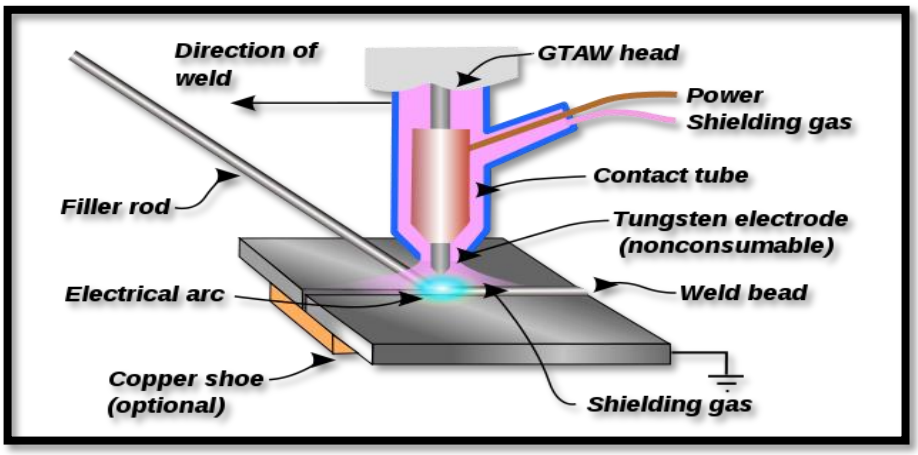


Figure 2.5: Schematic of Tungsten Inert Gas (TIG) Welding

2.8 DRILLING

Drilling is easily the most common machining process. One estimate is that 75% of all metal-cutting material removed comes from drilling operations. Drilling involves the creation of holes that are right circular cylinders. This is accomplished most typically by using a twist drill, something most readers will have seen before. The chips must exit through the flutes to the outside of the tool. As can be seen in the figure, the cutting front is embedded within the work piece, making cooling difficult. The cutting area can be flooded, coolant spray mist can be applied, or coolant can be delivered through the drill bit shaft.

2.8.1 Drill Press

A typical manual drill press is shown in the figure below. Compared to other powered metal cutting tools, a drill press is fairly simple, but it has evolved into a versatile necessity for every machine shop.

Figure 2.6: Drill press machine

2.9 GRINDING PROCESS

Grinding is a finishing process used to improve surface finish, abrade hard materials, and tighten the tolerance on flat and cylindrical surfaces by removing a small amount of material. Information in this section is organized according to the subcategory links in the menu bar to the left.

In grinding, an abrasive material rubs against the metal part and removes tiny pieces of material. The abrasive material is typically on the surface of a wheel or belt and abrades material in a way similar to sanding. On a microscopic scale, the chip formation in grinding is the same as that found in other machining processes. The abrasive action of grinding generates excessive heat so that flooding of the cutting area with fluid is necessary.

Figure 2.7: Hand grinder

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter inludes about all the process to fabricate gas stove stand and extractor hood stand from beginning to the end of the project. There are three dimensional drawing using solid work and fabrication process.

3.2 OVERALL RESEARCH METHODOLOGY

Overall this project is following the flow chart from take the title from the supervisor, then the second task from taking the title is finding the related literature riview from the project given. Then, sketch some design of the project to be choose the best design using concept screening method. Aftre that, draw the final design selected using solid work. After the fabrication is finish, report documentation is writing to describe all the process since the beginning to the end of the project.

3.3 DESIGN

3.3.1 Concept Generation

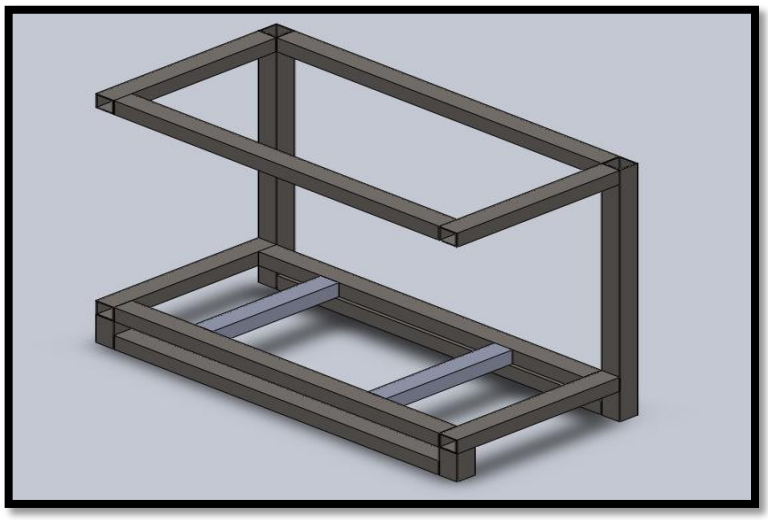


FIGURE 3.1: Concept A

ADVANTAGES

1) Easy to fabricate
2) Lightweight

DISADVANTAGES

1) Cant’t stand high mass

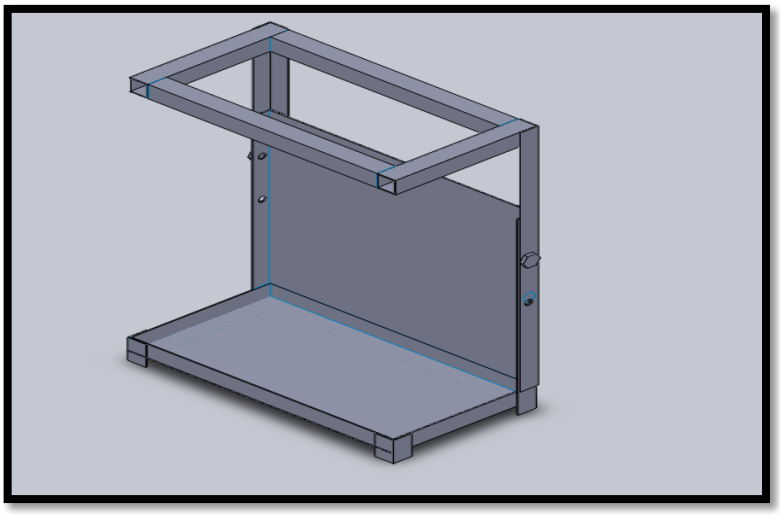


Figure 3.2: Concept B

ADVANTAGES

1) Can stand high mass
2) Has oil liner
3) Adjustable

DISADVANTAGES

1) Surface smooth leg
2) Heavy

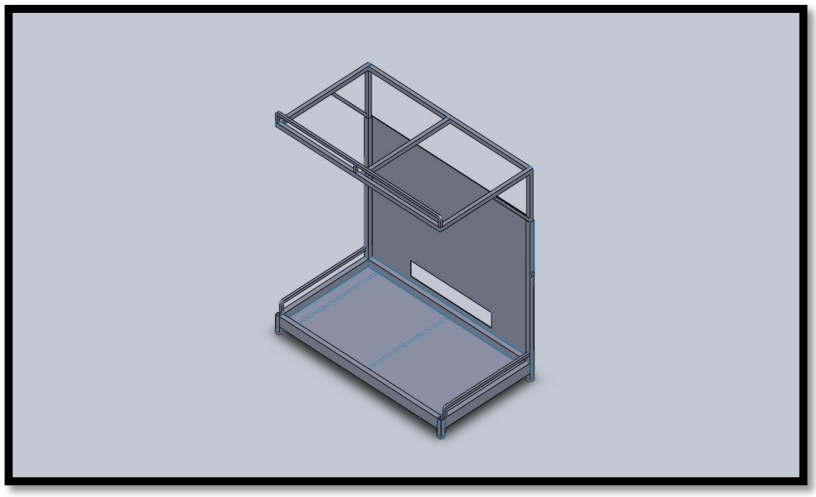


Figure 3.3: Concept C

ADVANTAGES

1) lightweight
2) has oil liner
3) Adjustable
4) High stability
5) Has a rubber liner

DISADVANTAGES

1) Need more material

3.3.2 CONCEPT GENERATION AND EVALUATION

Three design for gas stove stand and extractor hood stand are develop then evaluated against the datum of the device using Pugh concept. Concept comparable is shown in **table 3.1**

Table 3.1 : Pugh's Selection Method

Criteria	**concept**		
	A	**B**	**C**
Lightweight	+	-	+
Portability	+	+	+
Safety	-	+	+
Can stand high mass	-	+	+
Stability	0	0	0
Easy to manufacture	+	-	-
∑+	3	3	4
∑0	1	1	1
∑ -	2	1	1
Net score	1	2	3
Ranking	3	2	1

"0" : same as "-" : worse than "+" : better than

Concept C was chosen because it meet the criteria. It is because the design is lightweight, portability, more safety and can stand high mass.

3.3.3 FINALIZE DESIGN

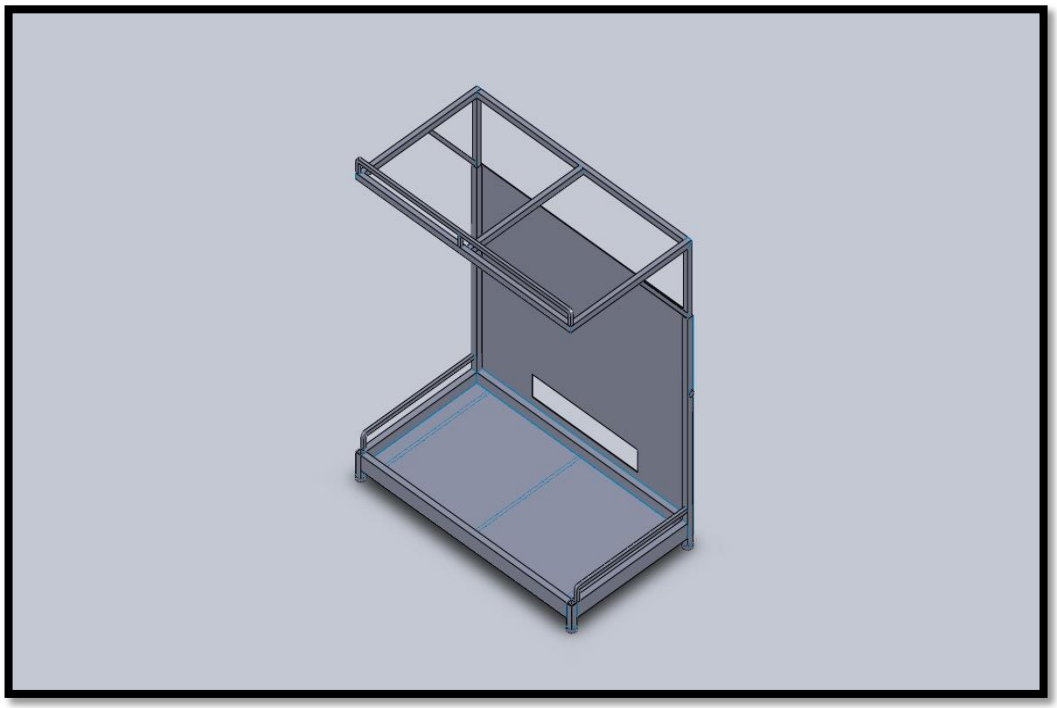


Figure 3.4: Final design

3.4 FABRICATION PROCESS

This process is about to fabricate the product using the material selected and make it based on the design by following the dimension stated. There are several method and process that involves in making this product. Many tools and machines are used. Fabrication involves in making product only while manufacturing involves producing the product in a large batch.

3.5 PROCESS INVOLVES

In order to make the design, fabrication process need to be done first. The fabricated process starts from dimensioning the material until it finish as desired product the process that involved in this project are:

3.5.1 Measuring: material measure to desired a dimension.

Figure 3.5: Measuring process

3.5.2 Marking: all measured materials needed to be marked in order to give an accurate dimension.

Figure 3.6: Marking process

3.5.3 Cutting: the marked material needed to be cut by using metal cutting grinder

Figure 3.7: Cutting process

3.5.4 Drilling: the marked holes were drilled for bolts and nuts placing to make it adjustable stand

Figure 3.8: Drilling process

3.5.5 Joining: the material joined by using welding method

Figure 3.9: joining process

3.5.6 Grinding: any rough surface cause by welding spark were grind to give smooth and safe surface using grinding machine and filing by filers and sand paper to give a smooth edge and followed by painting process.

Figure 3.10: grinding process

CHAPTER 4

RESULT AND DISCUSSION

4.1 INTRODUCTION

The purpose of this chapter is to discuss the result after fabrication and experiment of the product. This chapter will also discuss about some the problem of the product and how to improve it.

4.2 FINAL PRODUCT

The final product is divide into two parts that is gas stove stands and extractor hoods rack. The fabrication process divide into two. First fabricate the gas stove stand and second fabricate extractor hood stand. The dimensional of the design is based on the real dimensional size of the gas stove and extractor hood. This is because, the design is design to be adjustable. The extractor hood rack can be adjust it height by using the screw on the stand.

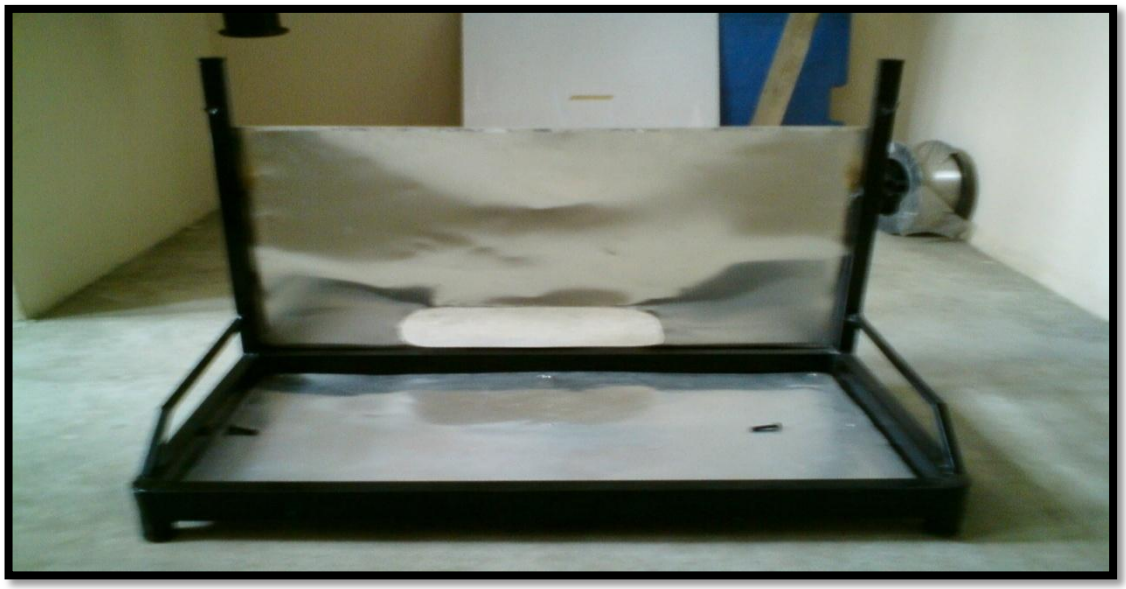


Figure 4.1: Gas stove stands

Figure 4.2: Extractor hood stand

4.3 COMPLETE PRODUCT

Figure 4.3: Front view

Figure 4.4: Side view

Figure 4.5: Rear view

4.4 PRODUCT ADVANTAGES

4.4.1 Adjustable height

The holes at the extractor hoods stand is for adjustable purpose. The stand assemble together to make the product can be adjust it height. The stand has two different level of height. The stand are adjust by using the screw that are mounted on stand.

Figure 4.6: Before adjust stands

Figure 4.7: After adjust stands

4.4.2 Rubber Liner on Stand

The gas stove stands are provide with the rubber liner. This is made in purpose to prevent the stands from easily slip when put o table top. It also make it more safety to use.

Figure 4.8: stands with rubber liner

4.4.3 Oil Trap

The oil trap is design to prevent the dirty substance from falling onto table or wall staining. This oil trap used aluminium as the material. So it rust resistance thus prevent it from rusting.

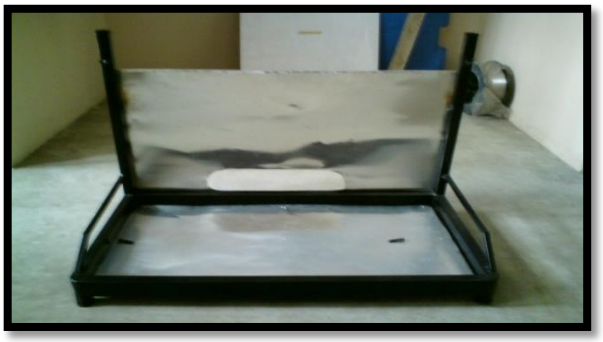
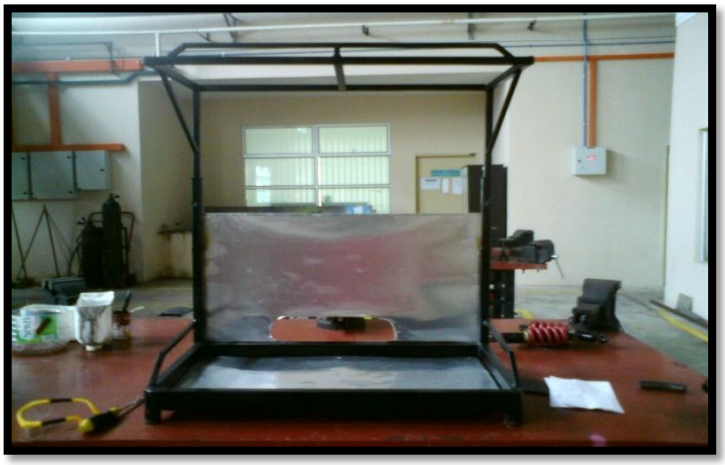


Figure 4.9: Oil Trap

4.4 PRODUCT TESTING

The final product is test on the table top to see how it stability. It also want to see the stand can function well to prevent it from slip when put on table top. The produst is stable when put on table. The stand also make it become more rough with the surface. So, it can't easily slip from the table.



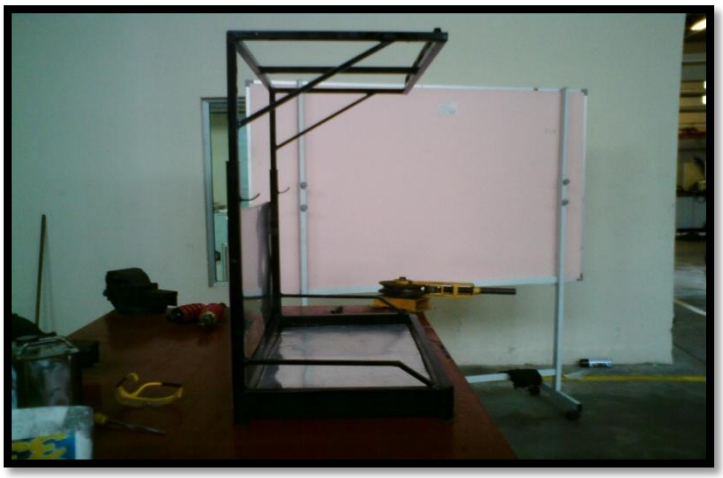


Figure 4.10: Product testing

4.5 DISCUSSION

In this project, several observations have been done with respect to the fabrication of the gas stove stand and extractor hood stand. The outcome of gas stove stand and extractor hoos stand was achieve the objective of this project. All the component or part of stand can function in good condition for example the stand can stabilize when put on table top. The stand also can be used without slip because the stand is posted with rubber liner to make it more stable.

However, this gas stove stand and extractor hood stand can't stand with higher mass according to the unsuitable material used in the fabrication process. It only can stand 12 kg below of extractor hood. Mild steel was perfect in order to reduce weight, but the weight of extractor hood makes it not suitable to stand the weight more than 12 kg of extractor hood. Besides that, this material can be corrossion if it surface exposed with oxygen and water. The painting method can be used to prevent this problem.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

As a conclusion, this project has practice and gives more knowledge about many mechanical properties such as machining and many others material during the fabrication process. Besides that, we also can gain knowledge about the material type, structure and others else. This product also has produces to make an improvement compare to other gas stove stands that had been exist in market. It because it has two function in one product. It also suitable to be used in small place because of the small size. The final year project is very important because it can make our self more dicipline and punctual. Finally, the objective of this project that to develop and fabricates portable stands has been achieve.

5.2 RECOMMENDATION

The recommendations can improve this product in the future:

1) The material used should be more stregthen to stand with high mass
2) The screw should be change with another lock to make the stand can be Change it high more efficiently.

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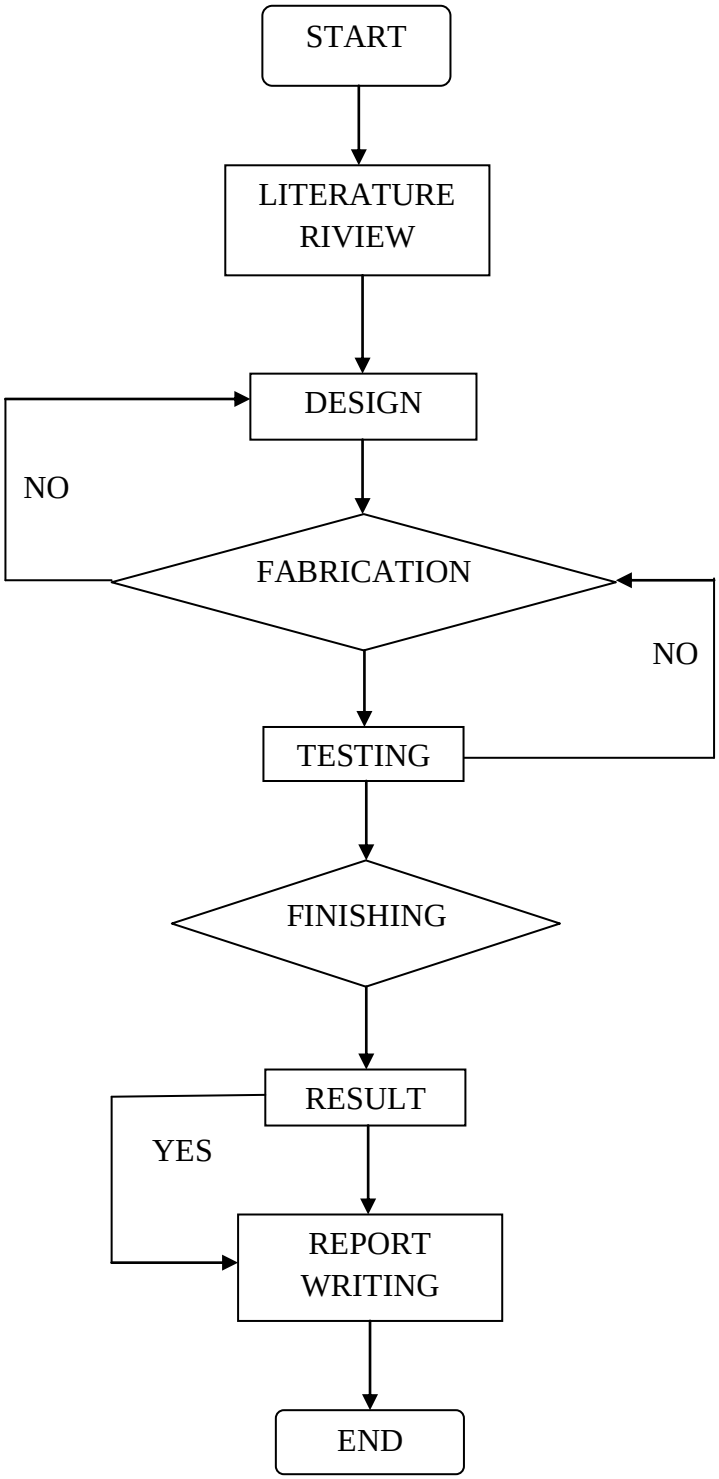
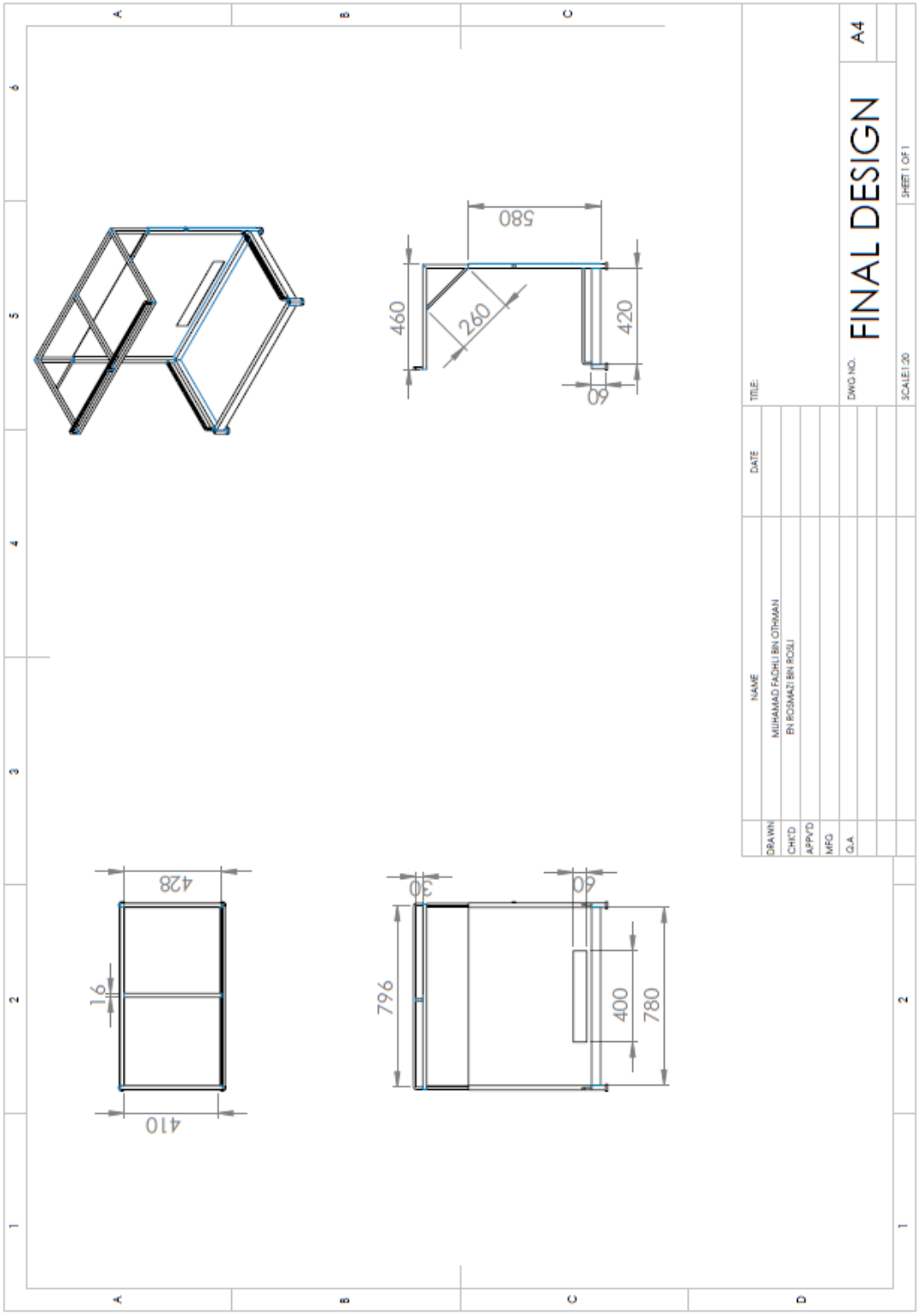
APPENDICES

PROJECT FLOW



PROJECT SCHEDULE

WEEK / ACTIVITIES		1	2	3	4	5	6	7	8	9	10	11	12	13	14
DISCUSSION REGARDING THE PROJECT	PLAN														
	ACTUAL														
MEETING WITH SUPERVISOR	PLAN														
	ACTUAL														
SKETCH AND DESIGN	PLAN														
	ACTUAL														
FINALIZE DESIGN	PLAN														
	ACTUAL														
SLIDE FOR FIRST PRESENTATION	PLAN														
	ACTUAL														
FIRST PRESENTATION	PLAN														
	ACTUAL														
FABRICATION	PLAN														
	ACTUAL														
MAKING FINAL SLIDE	PLAN														
	ACTUAL														
FINAL PRESENTATION	PLAN														
	ACTUAL														
FINAL REPORT	PLAN														
	ACTUAL														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APPV'D
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