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BORANG PENGESAHAN STATUS TESIS

JUDUL: DESIGN AND FABRICATE A NEW CONCEPT RECYCLE BIN FOR GENERAL PURPOSE

SESI PENGAJIAN: 2008/2009

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DESIGN AND FABRICATE A NEW CONCEPT RECYCLE BIN FOR GENERAL PURPOSE

WAN MUHAMMAD AZWAN FAZLEY BIN WAN ISMAIL

A report submitted in partial fulfilment of the requirements
For the award of the
Diploma of Mechanical Engineering

Faculty of Mechanical Engineering
UNIVERSITI MALAYSIA PAHANG

NOVEMBER 2008

SUPERVISOR DECLARATION

I hereby declare that I have checked this project report and in my opinion this project is satisfactory in terms of scope and quality for the award of Diploma in Mechanical Engineering.

Signature : ……

Supervisor : HAZAMI BIN CHE HUSSAIN

Date : NOVEMBER 2008

DECLARATION

I declare that this report entitled “Design Fabricate a New Concept Recycle Bin for General Purpose” is the results of my own work and research. The report has not been accepted for any degree and is not concurently submitted for award of other degree.

SIGNATURE: ……..

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ABSTRACT

This project is about designing and fabricating the recycle bin that can store rubbish such as can, glass and paper. To design and fabricated this recycle bin, it must be compare with other product that available in the market. First, get an idea from internet, magazine, newspaper or other from available data. Form there the information and idea to design and fabricated can be created.

Whole project involves various methods such as collecting data, concept design and fabrication process. The whole project involved various method and process that usually use in engineering such as concept design, analysis process and lastly fabrication process. Overall from this project, time management and discipline is important to make sure this project goes smooth as plan and done at correct time.

ABSTRAK

Projek ini adalah mengenai merekacipta dan membuat bakul sampah kitar semula yang boleh menyimpan sampah seperti tin, kaca dan kertas. Untuk merekabentuk dan membuat bakul sampah kitar semula, ia hendaklah dibandingkan dengan produk lain yang mungkin berada dalam pasaran. Langkah pertama, dapatkan maklumat daripada internet, majalah, suratkhabar atau daripada sumber yang lain. Daripada sumber tersebut, proses merekacipta dan membina bakul sampah akan dapat dihasilkan.

Keseluruhan projek melibatkan pelbagai cara atau kaedah seperti mengumpulan data, rekabentuk konsep dan proses membina. Kaedah yang selalu yang digunakan dalam kejuruteraan seperti proses analisis juga digunakan. Secara keseluruhan daripada projek ini, pengurusan masa dan disiplin adalah penting dalam memastikan projek berjalan lancar dan siap tepat pada waktunya.

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CHAPTER 1

INTRODUCTION

1.1 Project Synopsis

The purpose of the project is to design and fabricate a new concept recycle bin for general purpose to fulfill the requirement for home and office. This recycle bin would be different from another recycle bin that have in market. In this study, the new concept of recycle bin will be designed and fabricate and ensure these recycle comply with customer needs. As the Diploma final year project allocates the duration of 1 semester, this project is need skills to handle several machines such as punch machine, bending machine, MIG, drilling and grinder.

Title of this project is “Design and fabricate a new concept Recycle Bin for general purpose”. This project involves the fabrication of recycle bin with a specification regarding strength, material and cost. With the newly designed and fabricated this recycle bin, tests are required to be conducted and to verify the design. Overall, this project will acquire the skill of design and fabrication.

1.2 Problem Statement

The problems are common as below and faces by housewife and officer. The figure is showed in **Figure 1.1**:

Figure 1.1: Current recycle bin

- No specific and systematic to store rubbish.
- Fly come closely to the rubbish because the rubbish is not covered
- The rubbish not covered and look so disgust

1.3 Project Scope of Work

- To develop of concept selection of recycle bin.
- This recycle bin has two drawer and two barrel that have a 55,440m^3 volume space for rubbish.
- To made recycle bin uses a material such as rectangle hollow steel bar and zinc sheet metal
- The process will use like bending, punching, and joining like welding (MIG) and rivet and cutting.

1.4 Project Objective

The objectives of this project are to design and fabricate a new concept recycle bin for general purpose which it can give more better or systematic storage to store rubbish than other recycle bin in market and the concept is applicable to use in kitchen or office. The objective also to make an environment friendly recycle bin and design the product based on customer need

1.5 Planning Project

According to the Gantt chart in **Table 1.1**, project started by briefing by lecturer about PTA and include chooses the title of the project. After got the title at week 2, project briefing started followed by collecting literature review. These include gathering raw data via internet, book and other source. The planning process for literature review is from week 2 until week 3.

After that, this project was continued with make a research and sketch from week 3 until week 5. This is started with sketching 3 types of recycle bin and then identifies the best product from analysis. The finalized concept is includes detail drawing. So the design of recycle bin that was chosen using solidwork software with actual dimension.

After identifies finalized concept, finding a raw material to fabricate was started. Materials to be used must be suitable and easy to get. The specification when choosing a material is includes strength, durability and light. This is important for fabrication process.

The fabrication was started after finish finding a raw material and cutting the material. According the Gantt chart, the fabrication process is from week 6 until week 12. After finish the fabrication, we get the result and also do the discussion or conclusion.

Next task is the final presentation preparation and report writing. The report writing occurs during the finalized concept and fabrication. (from week 5 until week 13). Then, for week 14 i must present my project and submit report writing.

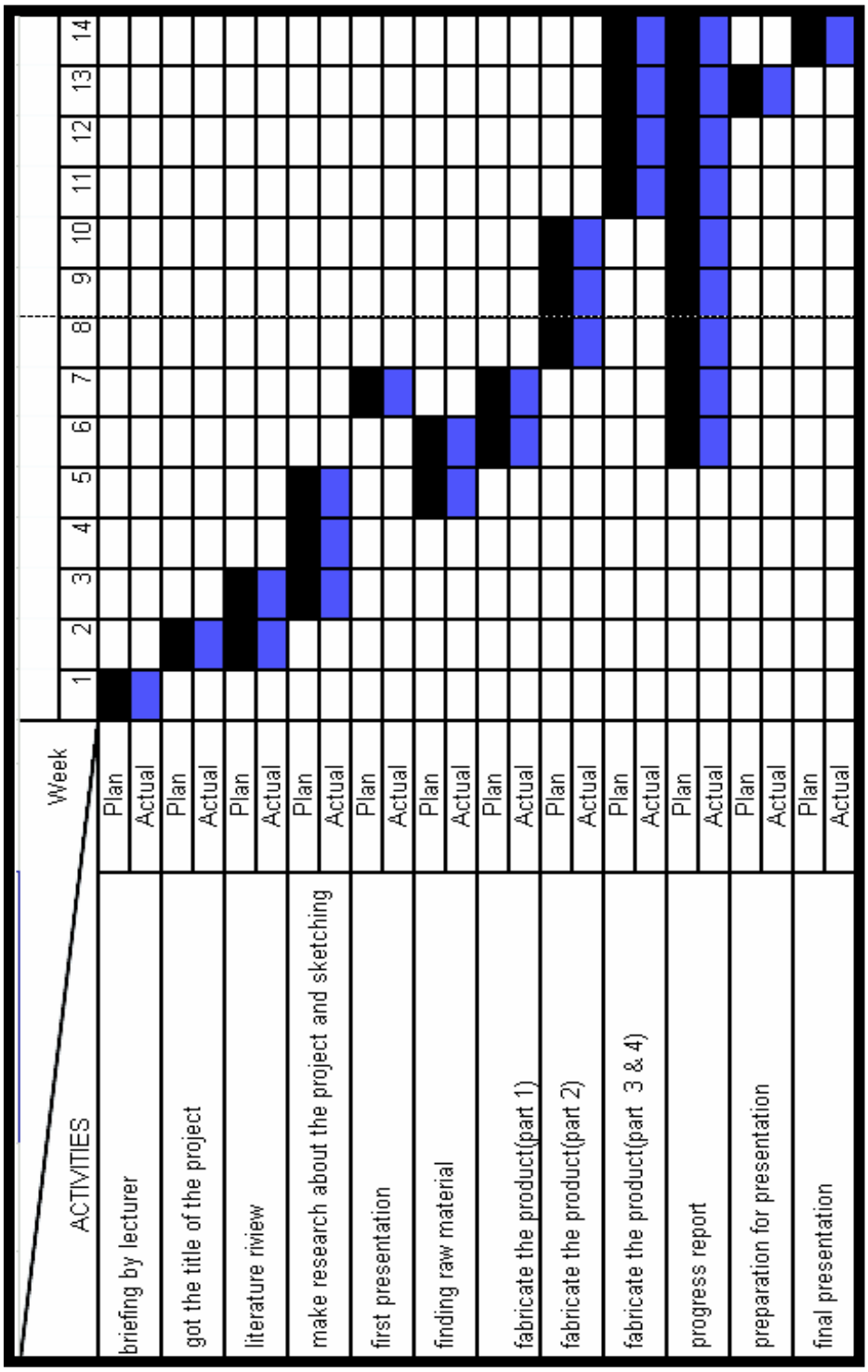


Table 1.1: Gantt chart

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will show the recycle bin in market as the comparison and about fabrication process such as punching, bending, welding, drilling that use in making recycle bin.

Recycling has been a common practice for most of human history, with recorded advocates as far back as Plato in 400 BC. Recycle bins exist in various sizes for use in homes, offices, and large public facilities. Separate containers are often provided for paper, tin or aluminum cans, and glass or plastic bottles.

2.2 Comparison of Current Design

In this project, 3 current designs from market are selected to make a comparison. This comparison is specific to recycle bin function of way to storage the rubbish, material use, and design shape.

2.2.1 Suncast Recycle Bin Kit BH183PK

Figure 2.1: Suncast Recycle Bin Kit BH183PK

i. Advantage
- ❖ Easy to move /Lightweight
- ❖ Can be size of height
- ❖ Have 3 barrel to storage more rubbish

ii. Disadvantage
- ❖ Simple design
- ❖ Not stabile
- ❖ Open and close up cover by manually

iii. Material use
- ❖ Plastic

2.2.2 SamePaperPlayAgain Paper Recycle Bin

Figure 2.2: SamePaperPlayAgain Paper Recycle Bin

i. Advantage
   - ❖ Small design and do not need big space to locate the recycle bin in home or office
   - ❖ Easy to move /Lightweight

ii. Disadvantage
   - ❖ Have a small space to storage paper
   - ❖ Simple design
   - ❖ Not stabile
   - ❖ Storage for paper only

iii. Material use
   - ❖ Plastic

2.2.3 3 in 1 Recycle Bin

Figure 2.3: 3 in 1 Recycle Bin

i. Advantage
   - ❖ Can move easily
   - ❖ Can open and close the top cover easily by push the pedal
   - ❖ Have 3 barrel to storage different in kind of rubbish

ii. Disadvantage
   - ❖ Have a small barrel (Cannot storage much rubbish)
   - ❖ Difficult to fabricate

iii. Material use
   - ❖ Stainless steel
   - ❖ Plastic

2.2.4 Basket Recycle Bin

Figure 2.4: Basket recycle bin

i. Advantage
   - ❖ Light weight
   - ❖ Small (reduce of using space)
     - ❖ Simple design

ii. Disadvantage
   - ❖ Not covered the rubbish
   - ❖ Easily to inverted

iii. Material use
   - ❖ Plastic

2.3 Machining process

2.3.1 Turret Punch Machine

Figure 2.5: Turret Punch Machine

Boasting state of the art equipment such as Turret Punch Press, designed for fast operator set-up and cycle times. With 58 tool stations 4 of which are indexible(with an accuracy of 0.01 degrees). A series of tool configurations can be set-up on the turret and only removed for maintenance, thus set-up time is drastically reduced. The machined equipped with a Fanuc 18PC Multi-Axis CNC Control, which is used to motion the carriage and table in the X, Y direction as well as T (tool selection) and C (tool rotation). With feed-rate, ram rpm position controls this machine can process jobs at a faster rate than others would take to set-up tooling alone.

2.3.2 Bending Machine

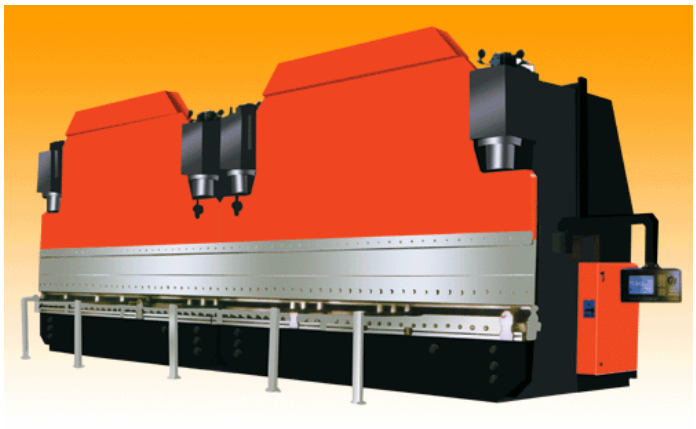


Figure 2.6: Bending Machine

Press brakes and bending machine are used to bend and fold metal by pressing it into a die. There are several types of press brakes and bending machines. Example include a hydraulic press brake, folding equipment, bending machine, press brake tooling, CNC brake press and a sheet metal press brake. A hydraulic press brake is designed for both specialized sheet metal work and continuous production application. A hydraulic press brake is designed to handle tough industrial production jobs from single-cycle operations to automated cell components. Folding equipment can be used to stiffen new metal panels that would otherwise flap around, and to put lips on pieces of sheet that would normally need screws passed through the front face. A bending machines forms angels in sheet metal. Press brake tooling is used in cold-forming metal sheets or strips into desired sections. A CNC brake press is a computer numerically controlled, fully automated brake press with extensive bending capacity and networking Function. A sheet metal press brake is used to bend.

2.3.3 Gas metal arc welding (GMAW)

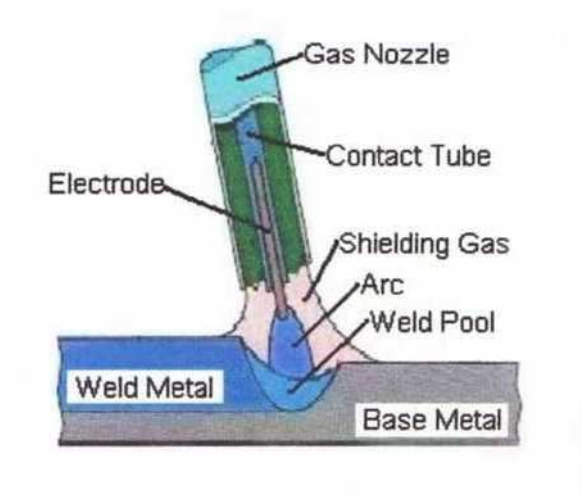


Figure 2.7: Gas metal arc welding

Gas metal arc welding (GMAW), sometimes referred to by its subtypes metal inert gas (MIG) welding or metal active gas (MAG) welding, is a semi-automatic or automatic arc welding process in which a continuous and consumable wire electrode and a shielding gas are fed through a welding gun. A constant voltage, direct current power source is most commonly used with GMAW, but constant current systems, as well as alternating current, can be used. There are four primary methods of metal transfer in GMAW, called globular, short-circuiting, spray, and pulsed-spray, each of which has distinct properties and corresponding advantages and limitations.

Originally developed for welding aluminum and other non-ferrous materials in the 1940s, GMAW was soon applied to steels because it allowed for lower welding time compared to other welding processes. The cost of inert gas limited its use in steels until several years later, when the use of semi-inert gases such as carbon dioxide became common. Further developments during the 1950s and 1960s gave the process more versatility and as a result, it became a highly used industrial process. Today, GMAW is the most common industrial welding process, preferred for its versatility, speed and the relative ease of adapting the process to robotic automation. The automobile industry in particular uses GMAW welding almost exclusively. Unlike welding processes that do

not employ a shielding gas, such as shielded metal arc welding, it is rarely used outdoors or in other areas of air volatility. A related process, flux cored arc welding, often does not utilize a shielding gas, instead employing a hollow electrode wire that is filled with flux on the inside

2.3.4 Drilling

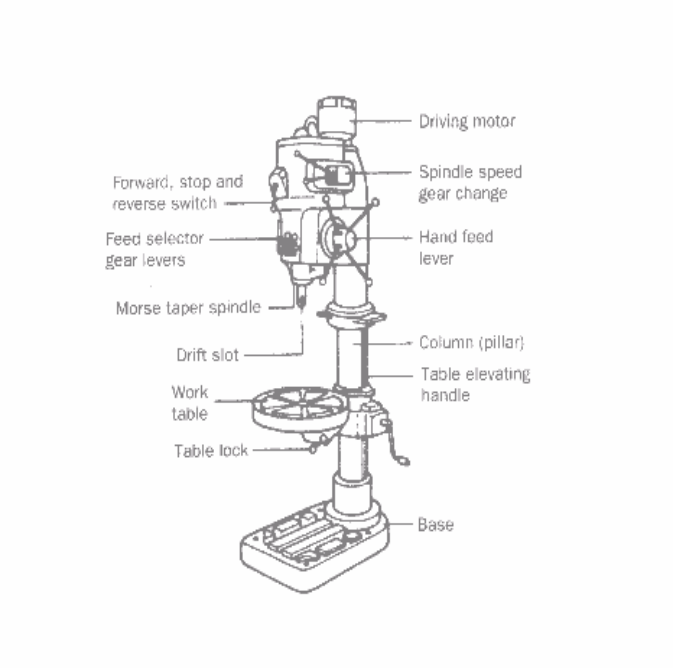


Figure 2.8: Drill press

A drill press (also known as pedestal drill, pillar drill, or bench drill) is a fixed style of drill that may be mounted on a stand or bolted to the floor or workbench. A drill press consists of a base, column (or pillar), table, spindle (or quill), and drill head, usually driven by an induction motor. The head has a set of handles (usually 3) radiating from a central hub that, when turned, move the spindle and chuck vertically, parallel to the axis of the column. The table can be adjusted vertically and is generally moved by a rack and pinion; however, some older models rely on the operator to lift and reclamp the table in position. The table may also be offset from the spindle's axis and in some cases rotated

to a position perpendicular to the column. The size of a drill press is typically measured in terms of *swing*. Swing is defined as twice the *throat distance*, which is the distance from the center of the spindle to the closest edge of the pillar. For example, a 16-inch drill press will have an 8-inch throat distance. Speed change is achieved by manually moving a belt across a stepped pulley arrangement. Some drill presses add a third stepped pulley to increase the speed range. Modern drill presses can, however, use a variable-speed motor in conjunction with the stepped-pulley system; a few older drill presses, on the other hand, have a sort of traction-based continuously variable transmission for wide ranges of chuck speeds instead, which can be changed while the machine is running.

2.3.5 Shearing

Figure 2.9: Shearing

Shearing is a metalworking process which cuts stock without the formation of chips or the use of burning or melting. Strictly speaking, if the cutting blades are straight the process is called shearing; if the cutting blades are curved then they are shearing-

type operations. The most commonly sheared materials are in the form of sheet metal or plates, however rods can also be sheared. Shearing-type operations include: blanking, piercing, roll slitting, and trimming. A punch (or moving blade) is used to push the workpiece against the die (or fixed blade), which is fixed. Usually the clearance between the two is 5 to 10% of the thickness of the material, but dependent on the material. Clearance is defined as the separation between the blades, measured at the point where the cutting action takes place and perpendicular to the direction of blade movement. It affects the finish of the cut (burr) and the machine's power consumption. This causes the material to experience highly localized shear stresses between the punch and die. The material will then fail when the punch as moved 15 to 60% the thickness of the material, because the shear stresses are greater than the shear strength of the material and the remainder of the material is torn. Two distinct sections can be seen on a sheared workpiece, the first part being plastic deformation and the second being fractured. Because of normal inhomogeneities in materials and inconsistencies in clearance between the punch and die, the shearing action does not occur in a uniform manner. The fracture will begin at the weakest point and progress to the next weakest point until the entire workpiece has been sheared; this is what causes the rough edge. The rough edge can be reduced if the workpiece is clamped from the top with a die cushion. Above a certain pressure the fracture zone can be completely eliminated.http://en.wikipedia.org/wiki/Shearing_%28metalworking%29 - cite_note-degarmo425-1

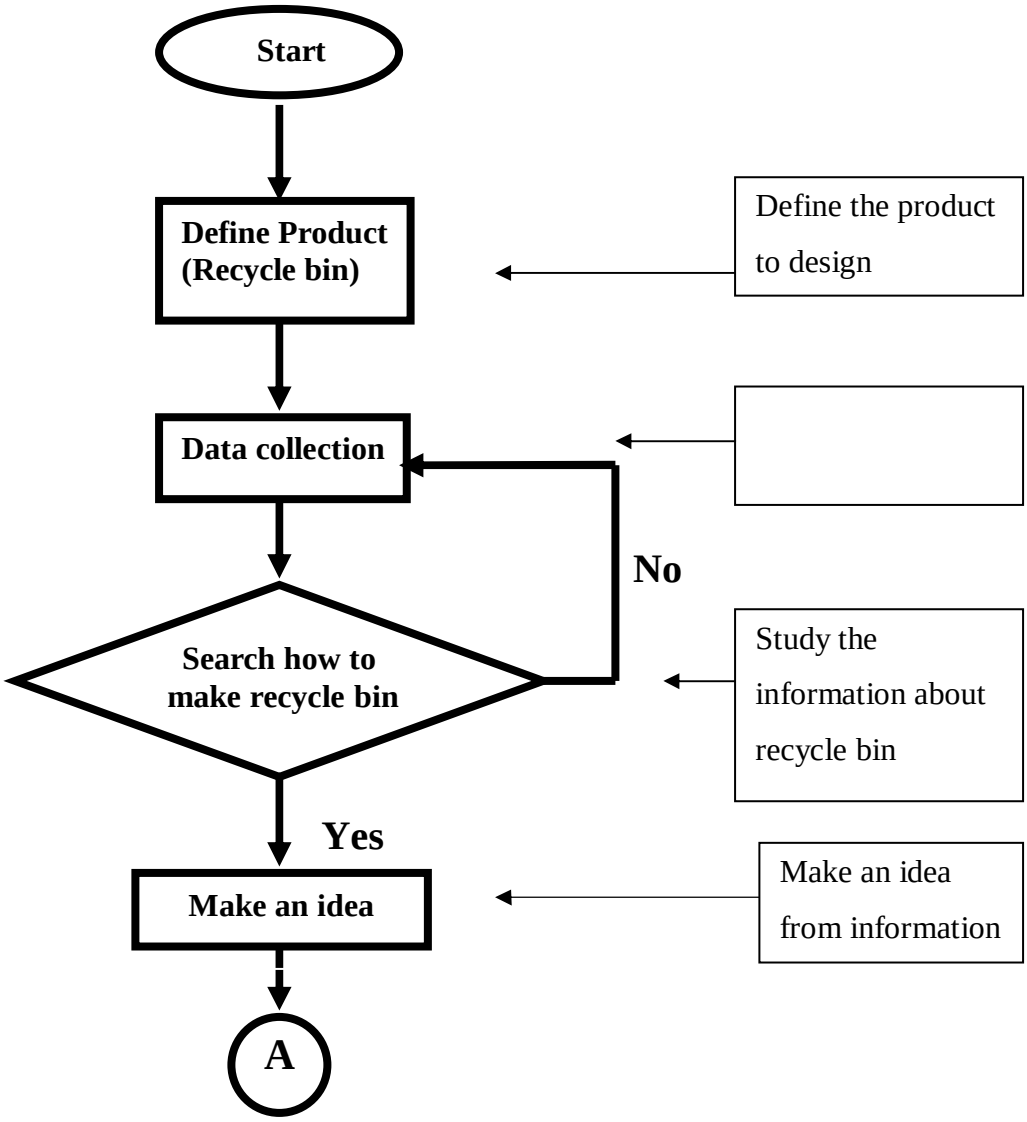
CHAPTER 3

METHODOLOGY AND PROCEDURE

3.1 Introduction

Project methodology is a body of practices, procedures and rules used by those who work in a set of working methods. This chapter will discuss about methods and machining process that will be use to make the recycle bin. All the methods that will be explain in this chapter are very important procedure to ensure it follow the entire project schedule so that it will move smoothly. Effective methods will give clear view on how to do this project. These methods will guidance in so that the project will be finish at the right time as planning.

3.2 Project Flow Diagram



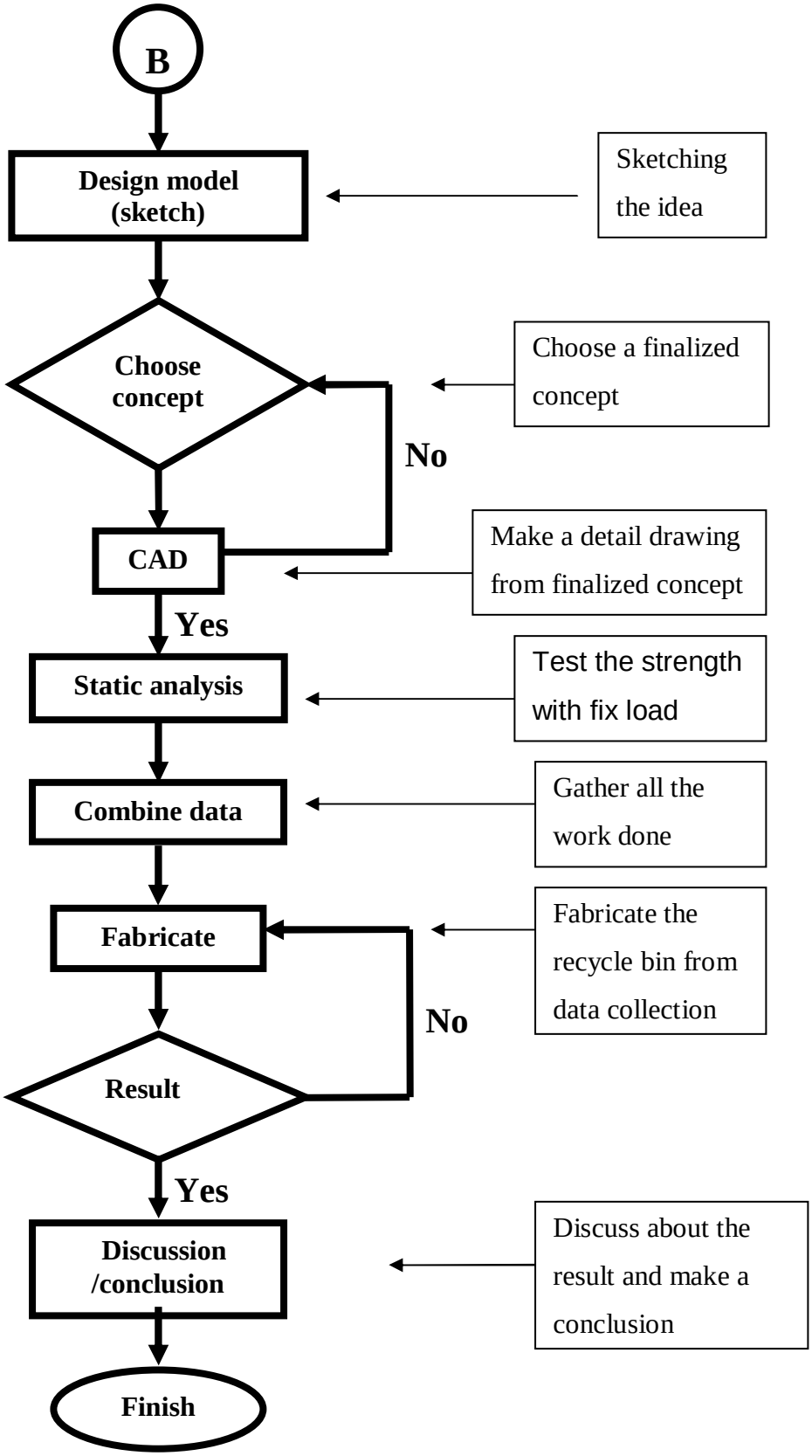


Figure 3.1: Project flow chart

From the flow chart above, this project was start with define the product title that the product is recycle bin. Then, collect the raw data from via internet, book and other source. After get the data, make a study and make a lot of research about recycle bin. This includes a study about concept of storage the rubbish, process to fabricate, and material to use.

Then the information gathered and the project is continued with the design process. It is important to make a best design for the project. After several design sketched, the best concept have been chosen for finalized recycle bin concept design. The selected design is then transferred to detail drawing by using Solidwork software.

After all the engineering drawing finished, analysis stage has been implemented. The evaluation is by considering the strength, durability, safety and others.

After that, all the data has been gathered and fabrication process will started. The manufacturing processes include in this process are welding, cutting, drilling, bending and others.

Then after all processes that mentioned above is done, all data for report writing are gathered. Preparation for final presentation also being made by finished the slide show. The project ended after the presentation and submission of the report.

3.3 Design

The design and fabrication of recycle bin of storage must be compliance to several aspects. The design consideration must be done carefully so the design can be fabricated and the parts are all functioning. The aspects that must be considered in designing the recycle bin are such as barrel carried strength. The barrel carried needs to have certain strength to ensure that it can load barrel and the rubbish like can and bottle glass. The second thing is material. Usually use the available material is one of aspects that have been considered. The materials used depend on their purpose and their function. Then another factor must be consider is cost. The cost of whole system must be not exceeding from budget and reasonable. It should reduce the cost to the minimum. Besides that the ergonomic factors also need to be considered. The recycle bin must be user friendly and give a pride to people to have it

3.4 Drawing

The drawings are divided into two categories, which are:

i. Sketching – all the ideas for the recycle bin fabrication are sketched on the paper first to ensure that idea selection is good or not.
ii. CAD software – the selected design or concept sketched is transfer to solid modeling and engineering drawing using Solidworks software.

3.5 Sketching Drawing Selection

From the existing ideas, several sketching had been done to be considered to find the best design as the final ideas, which are:

3.5.1 Concept A

The **Figure 3.2** below was showed about the design for concept A. Concept A design is simple design. This concept has a big barrel to store more rubbish. The design of product also makes it easy to store the rubbish. But it when the barrel is full, it very difficult to remove the rubbish inside it. The raw material need to use in this design is stainless steel. This design also has a small dimension that means it does not need a big space to keep it in home or office.

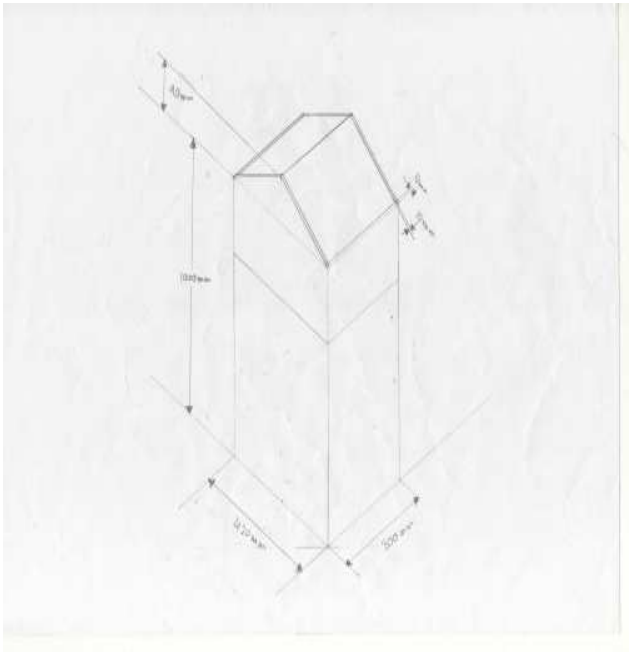


Figure 3.2: Concept A

3.5.2 Concept B

The **Figure 3.3** below is showed about the design for concept B. Concept B design is round shape. The raw material need to use in this design is stainless steel. The design concept for this design is simple and has a good looking. The up cover for this design can open and close with push the button at the bottom product. At up cover also have a hole that the function is to make people put the rubbish like paper and can easily without open the top cover. But the disadvantages for this design is, it only have a one barrel that mean the rubbish store in it is mix together. This design also has a small dimension that means it does not need a big space to keep it in home or office.

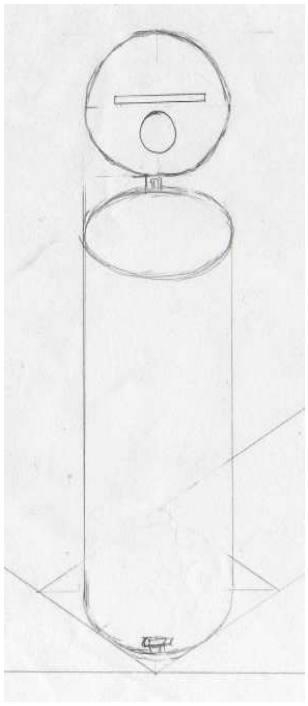


Figure 3.3: Concept B

3.5.3 Concept C

The **Figure 3.4** below is showed about the design for concept C. The raw material need to use in this design is stainless steel. This design concept has a two barrel that mean it has more space to store the rubbish. The concept to store the rubbish in the barrel is needed to pull the barrel carried to make the door opened. This concept also makes it easy to move the rubbish when the barrel is full. Besides that, it also has a drawer that the function is to store the plastic bag for the barrel or can store another thing like hardware tool. But the disadvantage of this concept is it difficult to move it because it doesn't have the wheels. This design also needs a big space to keep it in home or office because it has a big dimension.

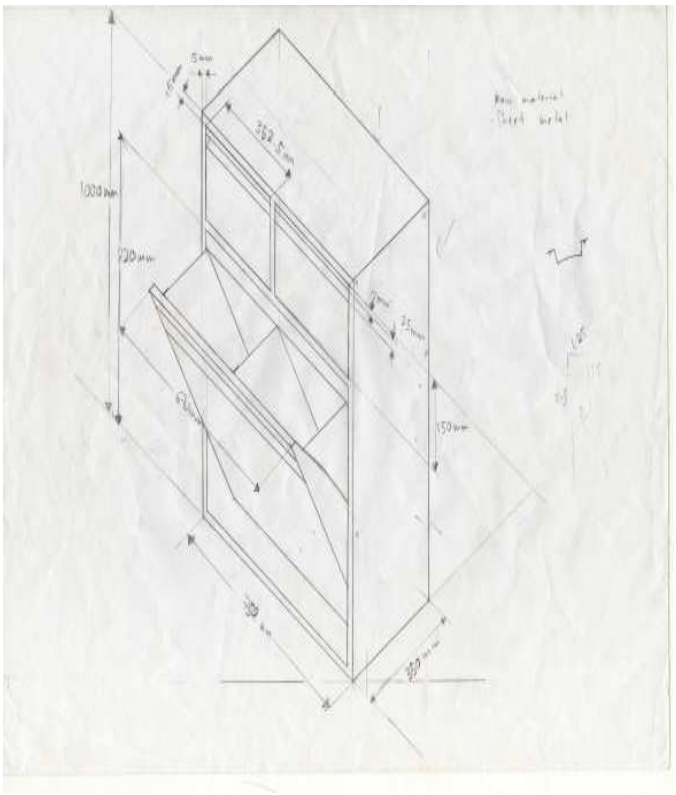


Figure 3.4: Concept C

3.6 Concept Evaluation

Three concepts for the recycle bin was develop. To choose the finalized concept, Pugh Concept Selection was use to get the final sketch to produce. The comparison between each concept was showed in **Table 3.1**.

Selection of criteria	**Concepts**		
	A (datum concept)	**B**	**C**
Durability	0	-	+
Concept storage	0	+	+
Barrel space	0	0	+
Easy of manufacturing	0	-	0
Easily to remove the rubbish from recycle bin	0	-	+
Keep the rubbish safely	0	+	+
{ +	0	2	4
{ 0	6	1	1
{ -	0	3	0
Net score	0	-1	4
Ranking	2	3	1

Table 3.1: Concept Generation and evaluation

Notes:

+ = better than

- = Worse than

- = same as

From the concept evaluation using Pugh concept, one of the best designs will be selected. Criteria or characteristics for the product to be fabricated are most important thing to be considered before fabrication process.

The first selection criteria are the strength. The strength of the product can be known through the analysis. The next selection criterion is whether the product is easy to use.

Beside that, easy to manufacture also be an important criteria to select the design. It is include the process to fabricate the concept, the material that will use the capability of the machine at FKM lab to fabricate the design and others.

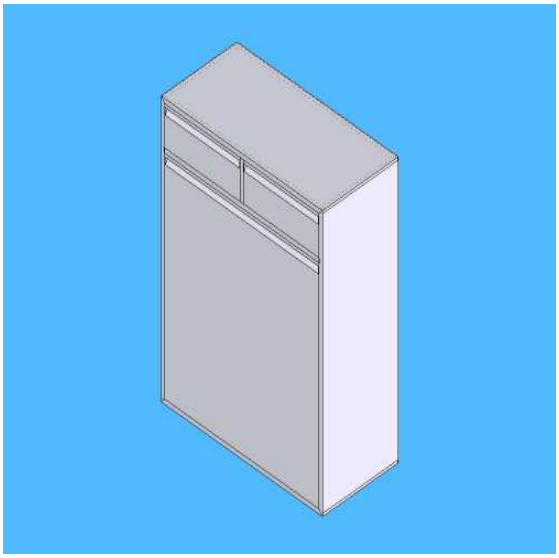
After that, cost of manufacture also has been considered as selection material. Lastly criteria are customer needs. It is important to know what customers want about this product

According to the criteria above, the concept C has been selected as the best design. It is because the concept C can fulfill the criteria and have some advantages compared to design A and design B.

3.7 Product Design Specification

After got the finalized concept from the concept selection, the product design specification is like below:

i. Finalized Concept



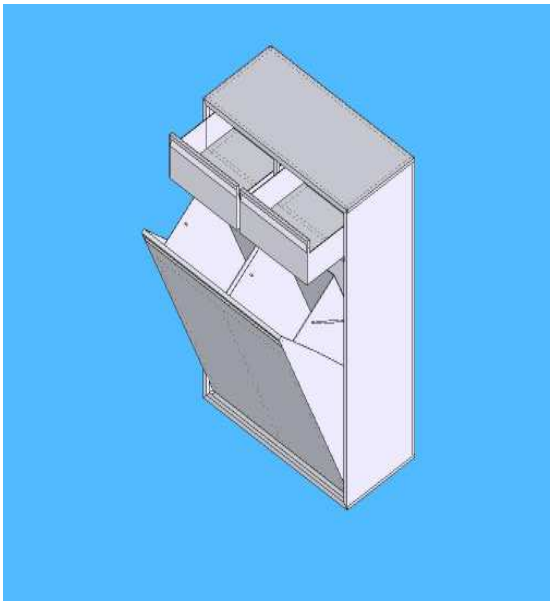


Figure 3.5: Finalized concept

ii. Chassis

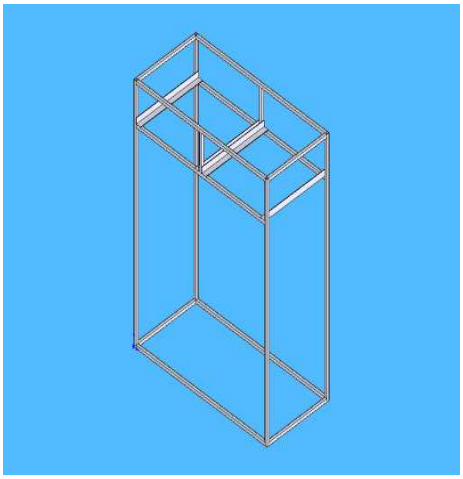


Figure 3.6: Chassis

- Raw material: 1. 1/2 x 1/2 inches hollow bar
  2. Zinc sheet metal

- Process: 1. Welding(MIG)
  2. Bending
  3. Punching

- Function: 1. as a chassis to hold the cover and barrel carried and also to hold the drawer.
  2. Make the recycle bin more strength

iii. Barrel Carried

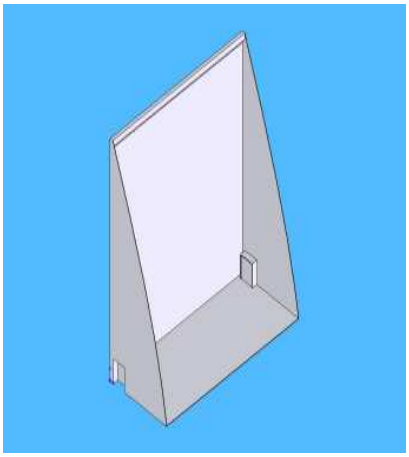


Figure 3.7: Barrel carried

- Raw material: 1. zinc sheet meta 2mm thickness
- Process: 1. welding(MIG)
  2. Bending
  3. Punching
- Function: 1. to hold the barrel in recycle bin.

iv. Drawer

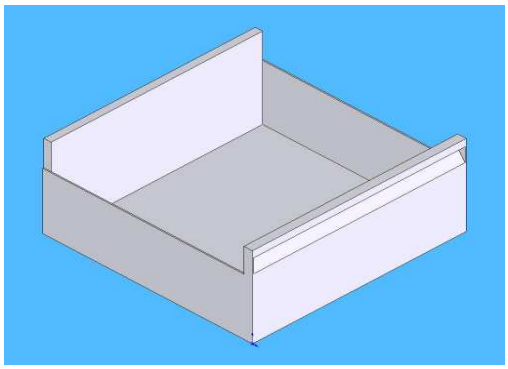


Figure 3.8: Drawer

- Raw material: 1. Zinc sheet metal 2mm thickness

- Process: 1. Welding(MIG)
  2. Bending
  3. Punching

- Function : 1. To storage plastic bag
  2. To storage hardware tool.

v. Top and Bottom Cover

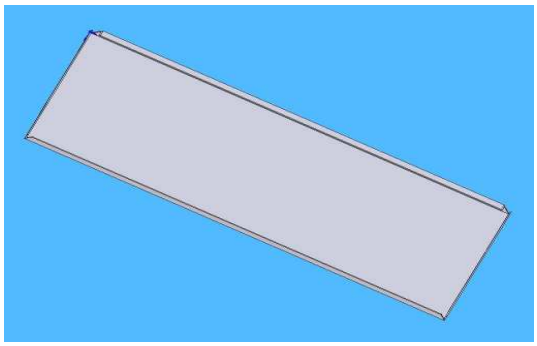


Figure 3.9: Top and bottom cover

- Raw material: 1. Zinc sheet metal 2mm thickness
- Process: 1. Bending
  2. Punching
- Function: 1. as the cover at the top and bottom side of recycle bin

vi. Left and Right Cover

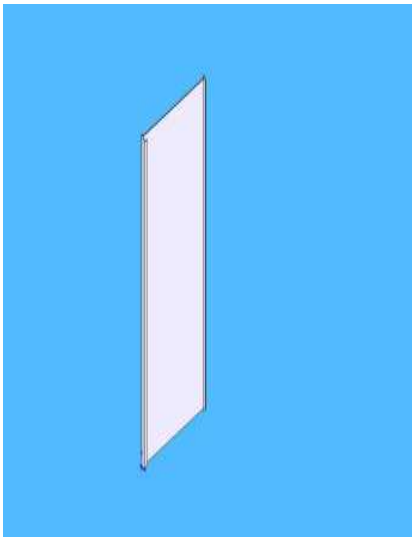


Figure 3.10: Left and right cover

- Raw material: 1. Zinc sheet metal 2mm thickness
- Process: 1. Bending
  2. Punching
- Function: 1. as the cover at the left and right side of recycle bin

vii. Joining Part

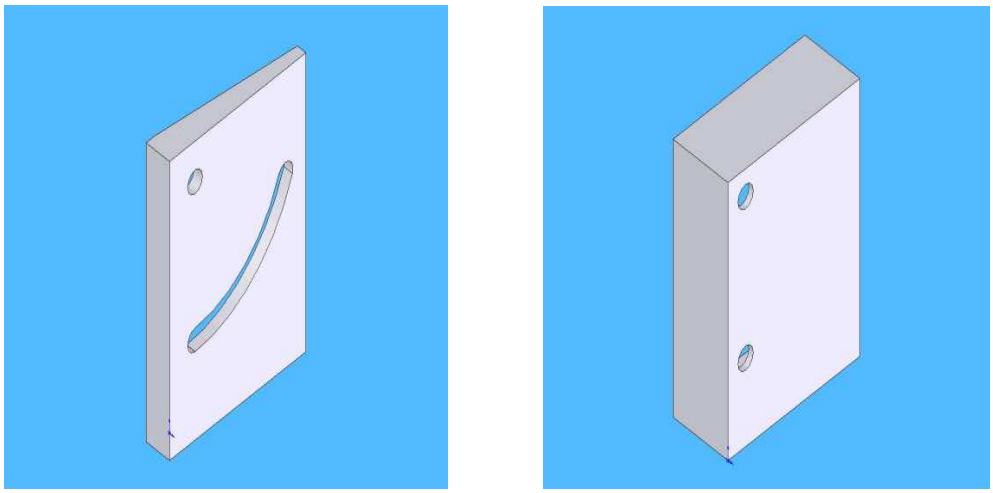


Figure 3.11: Joining part

- Raw material: 1. steel sheet metal 4mm thickness
- Process: 1. Bending
  2. Drilling
- Function: 1. as the part for system mechanism at barrel carried.

viii. Rear Cover

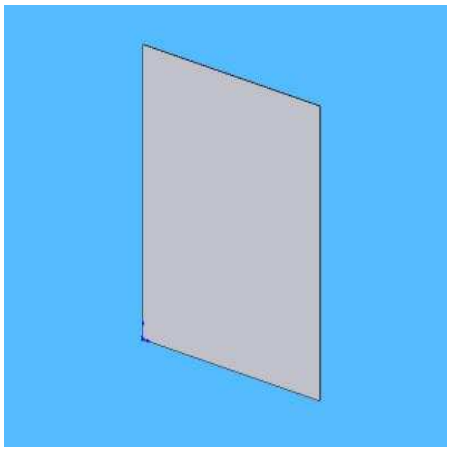


Figure 3.12: rear cover

- Raw material: 1. Zinc sheet metal 2mm thickness
- Process: 1. shearing
- Function: 1. as the cover at the rear side of recycle bin

ix. Barrel

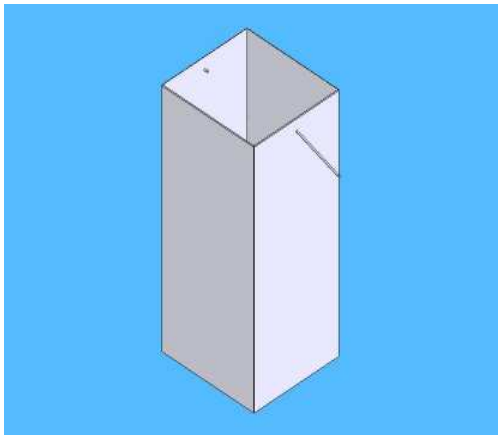


Figure 3.13: barrel

- Raw material: 1. Zinc sheet metal 2mm thickness
- Process: 1. Bending
  2. Punching
  3. Drilling
- Function: 1. to storage a rubbish

3.8 Fabrication Process

This process is about using the material chosen and makes the product base on the design and by followed the design dimension. Many methods can be used to fabricate product for instant punching, shearing and welding. In the project fabrication process needed to make the recycle bin is suitable for the application. The process need to do step by step.

3.8.1 Material Selection

The material that will be use in this fabrication is hollow steel bar (½ x ½) and zinc sheet metal. In **Table 3.2** below will show the dimension for each material that needs to be cutting.

Material	Part	Length (mm^3)	Quantity
Zinc sheet metal (1mm)	cover	380 x 943 x 1	2
		380 x 750 x 1	2
		926 x 731 x 1	1
		45 x 750 x 1	1
		45 x 150 x 1	1
	Drawer	190 x 351 x 1	2
		554 x 345 x1	2
		372 x 164 x1	2
	Barrel carried	751 x 290 x 1	2
		1070 x 720 x1	1
	Barrel	350 x 615 x1	4
		280 x 615 x 1	4
		278 x 328 x 1	2
	Total all (mm^2)	5579890mm^2	
Rectangular hollow steel bar (1.25mm x 1.25mm)	Chassis	943 x 1.25 x 1.25	4
		725 x 1.25 x 1.25	7
		325 x 1.25 x 1.25	4
		150 x 1.25 x 1.25	2
	Total length (mm)	10447mm	

Table 3.2: material specification

3.8.2 Measuring and Marking

Measuring is very important to get the accurate dimension of the part we need. This is important because when the dimension is wrong, we cannot match the part with another part. The part that must be consider to measuring with exactly value is drawer, barrel carried, chassis, and joining part. Measuring process can be referred in **Figure 3.14**.

Figure 3.14: Measuring and marking

3.8.3 Cutting Process

This process comes after the measuring process. The machine that needs to use is floor disc cutter. All the material like hollow steel bar (½ x ½ inches) need use this machine to cut it. The process is showed in **Figure 3.15**.

Figure 3.15: Cutting process

3.8.4 Welding Process

This process comes after we get all the material that is complete with exactly dimension. This process is use to join all the material we get. The process is showed in **Figure 3.16**

Figure 3.16: Welding process

3.8.5 Shearing Process

Shearing is a process that uses to cut a sheet metal. By using this machine we can get the material with exactly dimension. The process is showed in **Figure 3.17**.

Figure 3.17: Shearing process

3.8.6 Bending Process

Bending process is using TrumaBend V85S. This process is use for bend the sheet metal into require shape. The process is showed in **Figure 3.18**.

Figure 3.18: Bending process

3.8.7 Drilling

Drilling process is using press drilling. This is to makes a hole for inserting screw. Besides that, another hole also makes to insert a barrel hander. The process is showed in **Figure 3.19**.

Figure 3.19: Drilling process

3.8.8 Grinding Process

The bead and chip from welding and cutting must be removing by using a hand grinding. This process must do to get a finishing surface before spray the product. The bead and chip also can cause injured to the customer if we not remove it. The process is showed in **Figure 3.20**.

Figure 3.20: Grinding process

3.8.9 Finishing Process (painting)

This process is lastly process and it is done after all the process before this complete. First, all the rough surface at recycle bin must be remove by sand paper. Then the product must be paint to avoid the rust. The process is showed in **Figure 3.21**.

Figure 3.21: Spraying process

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

After finish fabrication process, all information about this product is collected and gathered. It is important to classify the product before it can use. Besides that, the analysis of the project also will be discussed in this chapter. It includes the types of defeat, product specification and cause of problem of the project. The analysis also helped to give improvement of the recycle bin. The complete recycle bin is like below.

4.2 Result

4.2.1 Isometric View

The **Figure 4.1** below is showed a result from the isometric viewer.

Figure 4.1: Isometric view

4.2.2 Front View

The **Figure 4.2** below is showed a result from the front viewer.

Figure 4.2: Front view

4.2.3 Side View

The **Figure 4.3** below is showed a result from the side viewer.

Figure 4.3: Side view

4.2.4 Rear View

The **Figure 4.4** below is showed a result from the rear viewer.

Figure 4.4: Rear view

4.2.5 Barrel

The **Figure 4.5** below is showed a result from the isometric viewer for barrel.

Figure 4.5: Barrel

4.3 Product Specification

This is another example of analysis process. The product is classify to several category such as weight, colour, wide, height and other else. The product specification is like below.

Category	Result
Weight	60 kg
Colour	grey
L x W x H	750mm x 350mm x 943 mm
Maximum load for barrel carried	1000 N
Maximum load for drawer	250 N

Table 4.1: Table of product specification

4.4 Discussion

Discussion is needed to discuss about the result we get. It include about the problem we have face and the type of defect in the product. It happens from fabrication process and the weakness using several machine and tool. Types of defects are like below.

4.4.1 Bead

The voltage when welding process is not suitable for this material. The movement of hand is not constant during weld process also cause of the defected. **Figure 4.6** is an example for a defect in cover.

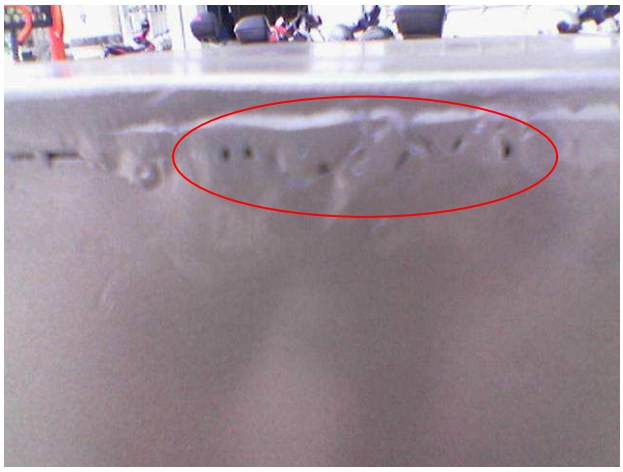


Figure 4.6: Bead at the cover

4.4.2 Cover surface not flat

This is happened after all of cover are join together with the chassis using a MIG. This is because the zinc sheet metal is too soft. The defect is showed in **Figure 4.7**.

Figure 4.7: Defect at top cover

4.4.3 Gap

There are gap between the cover with the barrel carried. This defect happened in a fabrication process while doing grinding process. This is occurring because of a careless while grind the edge of a barrel carried. The defect is showed in **Figure 4.16**.

Figure 4.8: Gap between two parts.

4.4.4 Do not have clearance

The drawer and barrel carried is difficult to pull it out because there is have a big friction between the drawer surfaces with the cover surface. This is because between this surface do not have a clearance. It happened because the dimension for the drawer is little big than the actual size. The defect is showed in **Figure 4.9**.

Figure 4.9: Friction between two parts

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter is mainly discussed about the conclusion of the project, concluding all the process that involved. This chapter also discuss about some recommendation and improvement that can be add for this product.

5.2 Conclusion

The conclusion for this project is based on the result of the product that have done. The result that has done is very satisfied and has been done based on project planning. The result of product also has finish according to the drawing dimension that has been making before. From this project also teaches how to understand so many things especially learned how to design a product that is beneficial and learned this subject practically. Besides that the most important is to make a detail drawing so that the fabrication can run smoothly. From this project also can learn how to use several machines that never have a chance to learn before.

5.3 Recommendation

Precise planning of the work progress will make sure that the project can be done in a short time. Having a good time management can guaranty that any of student tasks to complete in a good ways and also give more time to focus on this project and other subjects. To improve this project in the future work, it can be done in different way. Firstly it is better to use the very lighter and high strength material so that the recycle bin can be reducing their mass. The recommend material to use in the future is aluminum. The purpose is we can move the recycle bin easily from other site to another site. Second is making a modification to the design or adding a new part like adding a wheel. Then replace the barrel material from zinc sheet metal to plastic to reducing their mass. It to make sure that the customer can adopt the barrel easily when the rubbish is full in the barrel. The drawers also can be improving with adding a roller slider to reduce a friction when we opened it. Lastly adding a pad to the drawer and barrel carried hander that is made from rubber to make sure the customer do not get injured when touch the edge shape hander.

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2. *http://en.wikipedia.org/wiki/product.asp?123004*

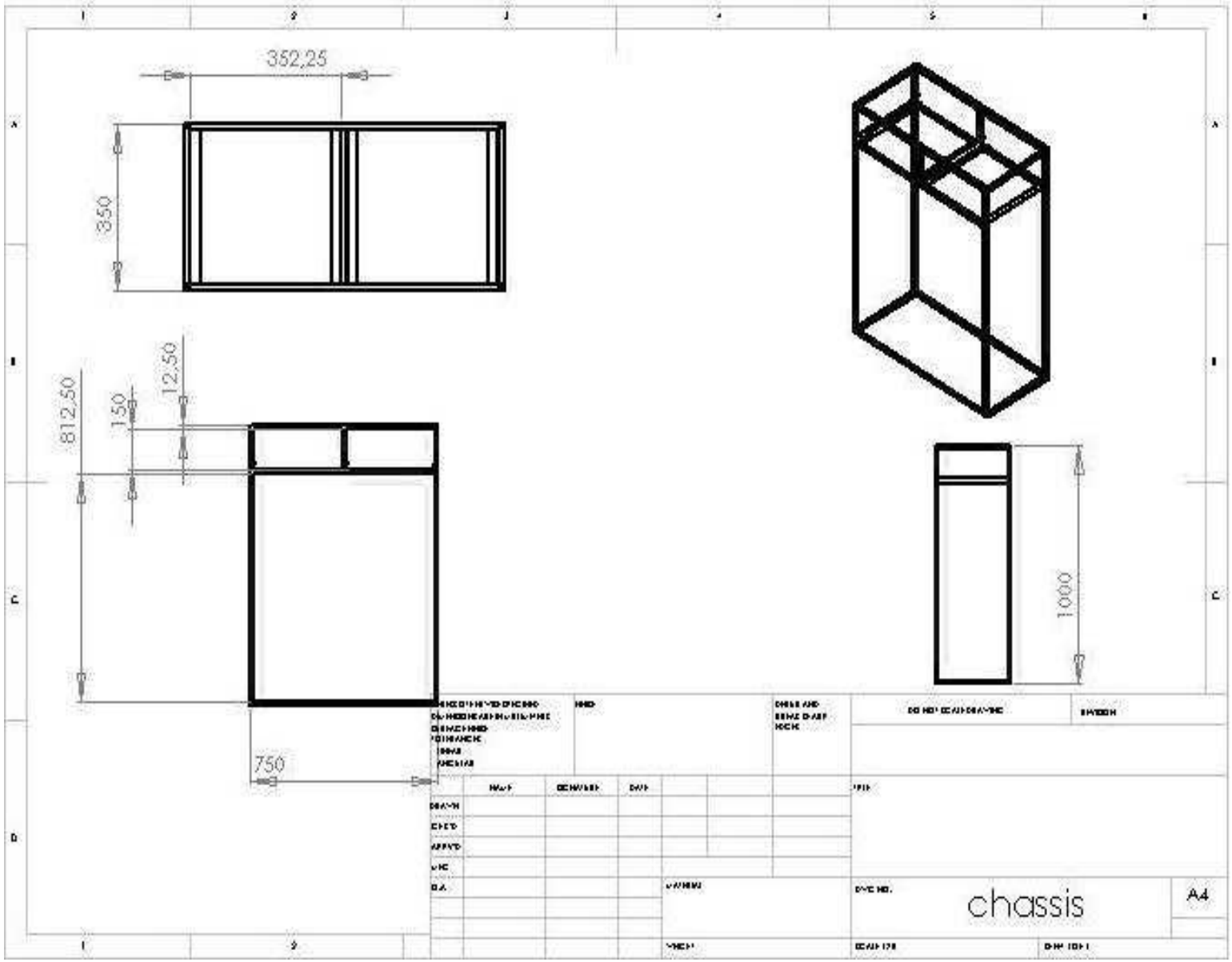
3. *http://en.wikipedia.org/wiki/bending.htm*

4. *http://en.wikipedia.org/wiki/punching.htm*

5. *Kalpakjian Schmid, Manufacturing Engineering And Technology, Fifth Edition In SI Units.*

APPENDIX A

DETAIL DRAWING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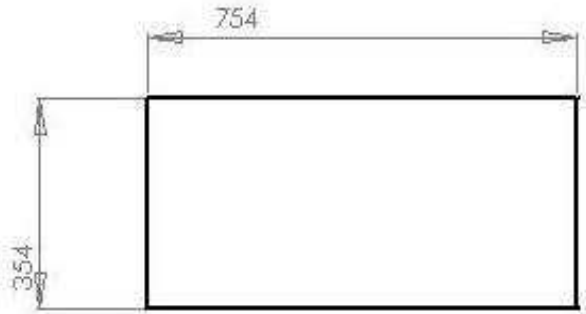

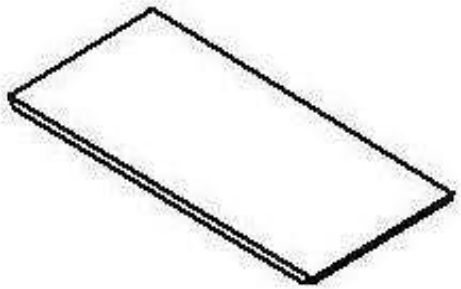

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CHK'D								
APPV'D								
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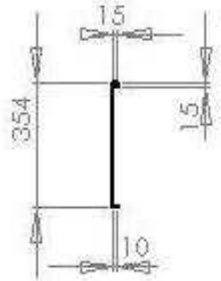

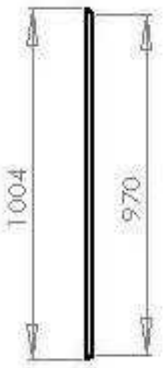

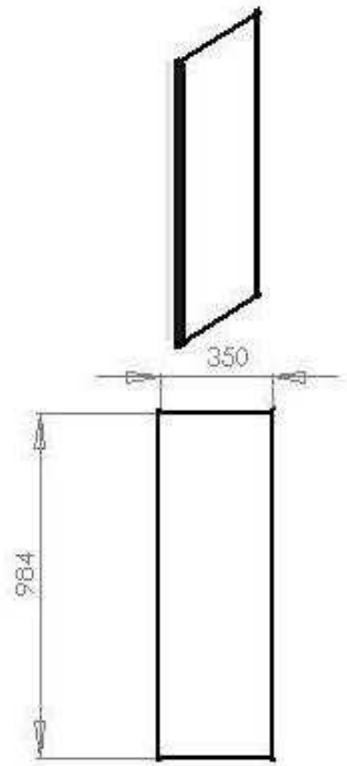

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CHK'D			
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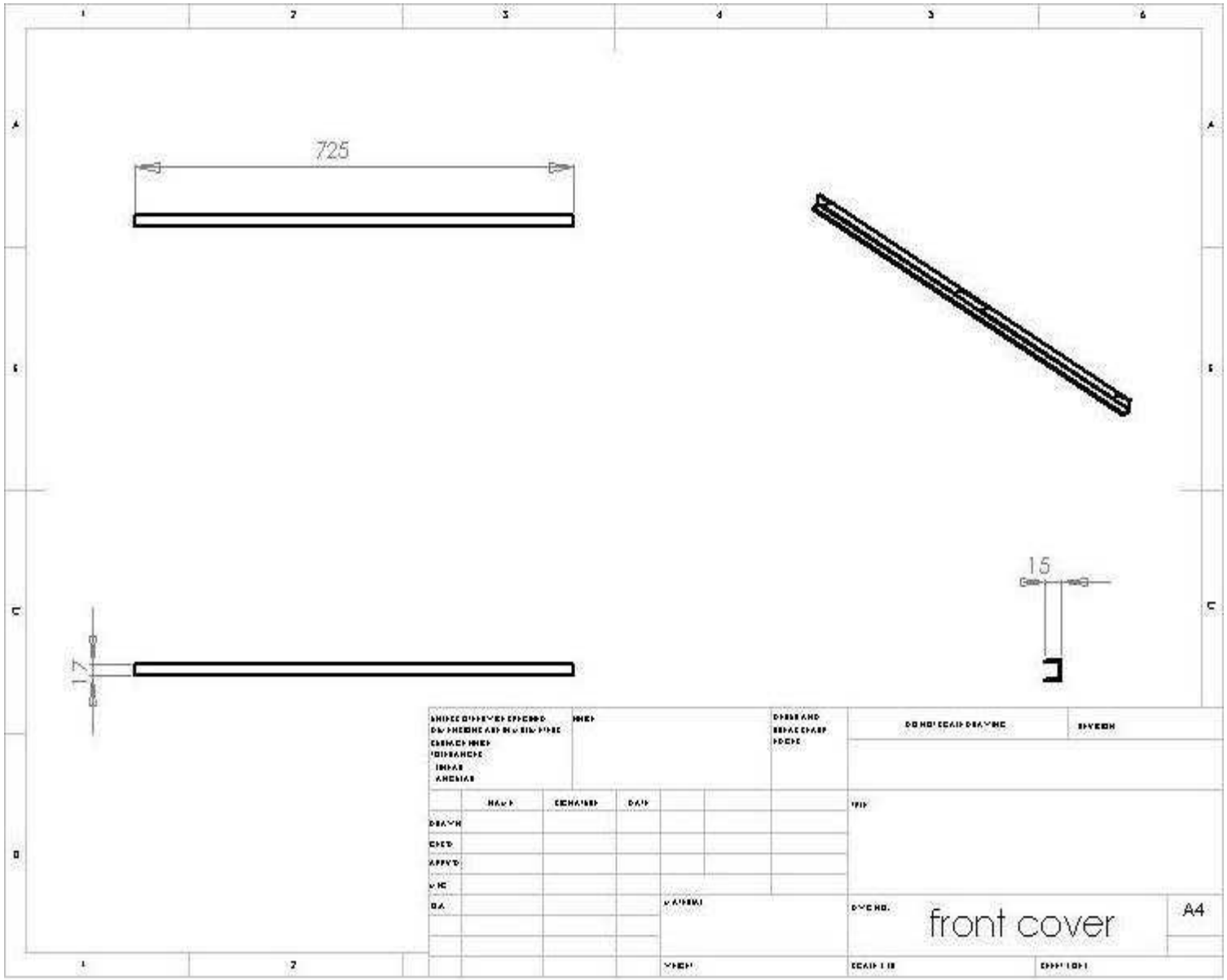
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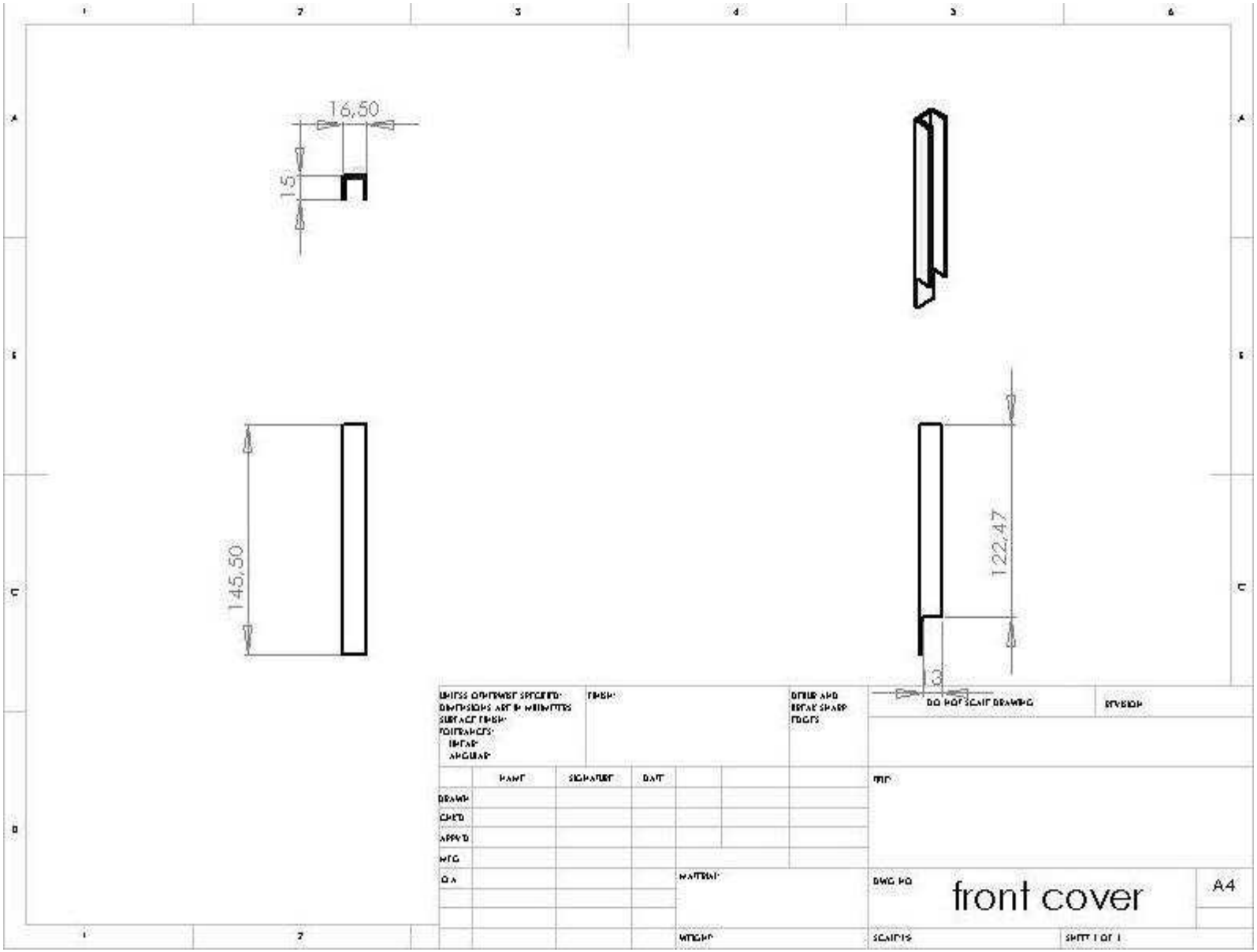
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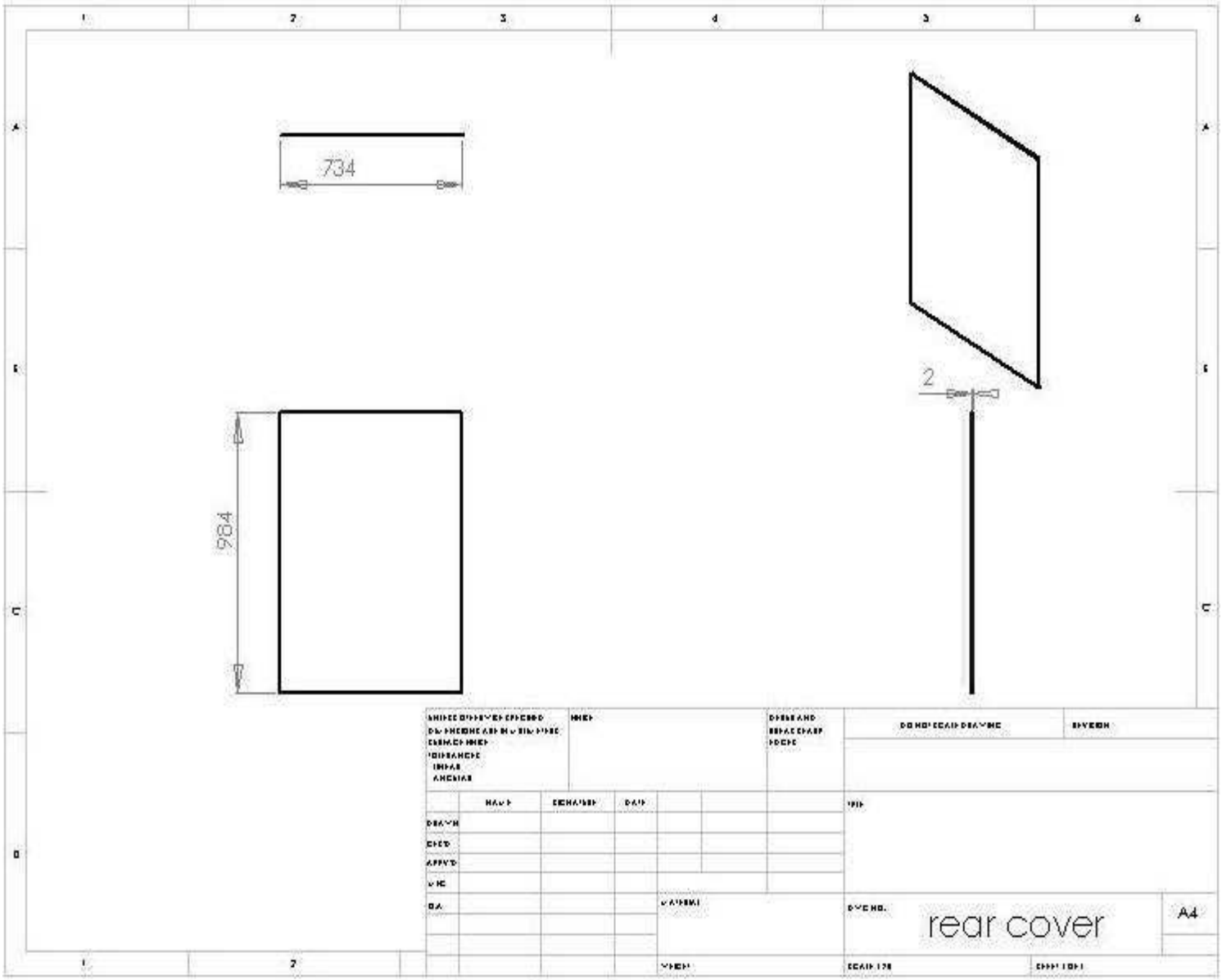
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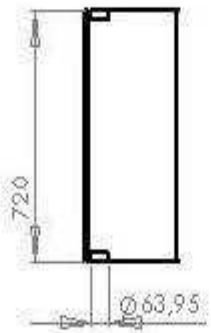

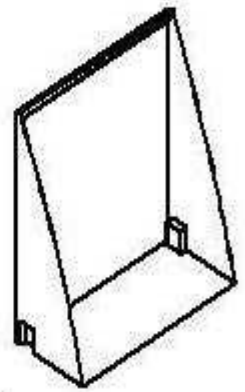

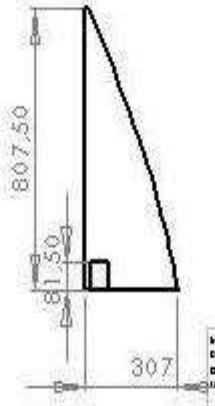

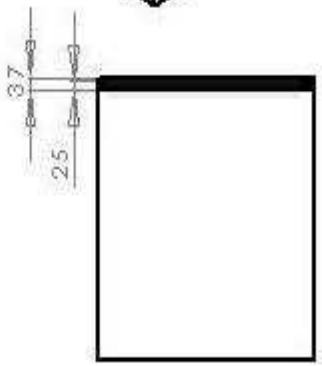

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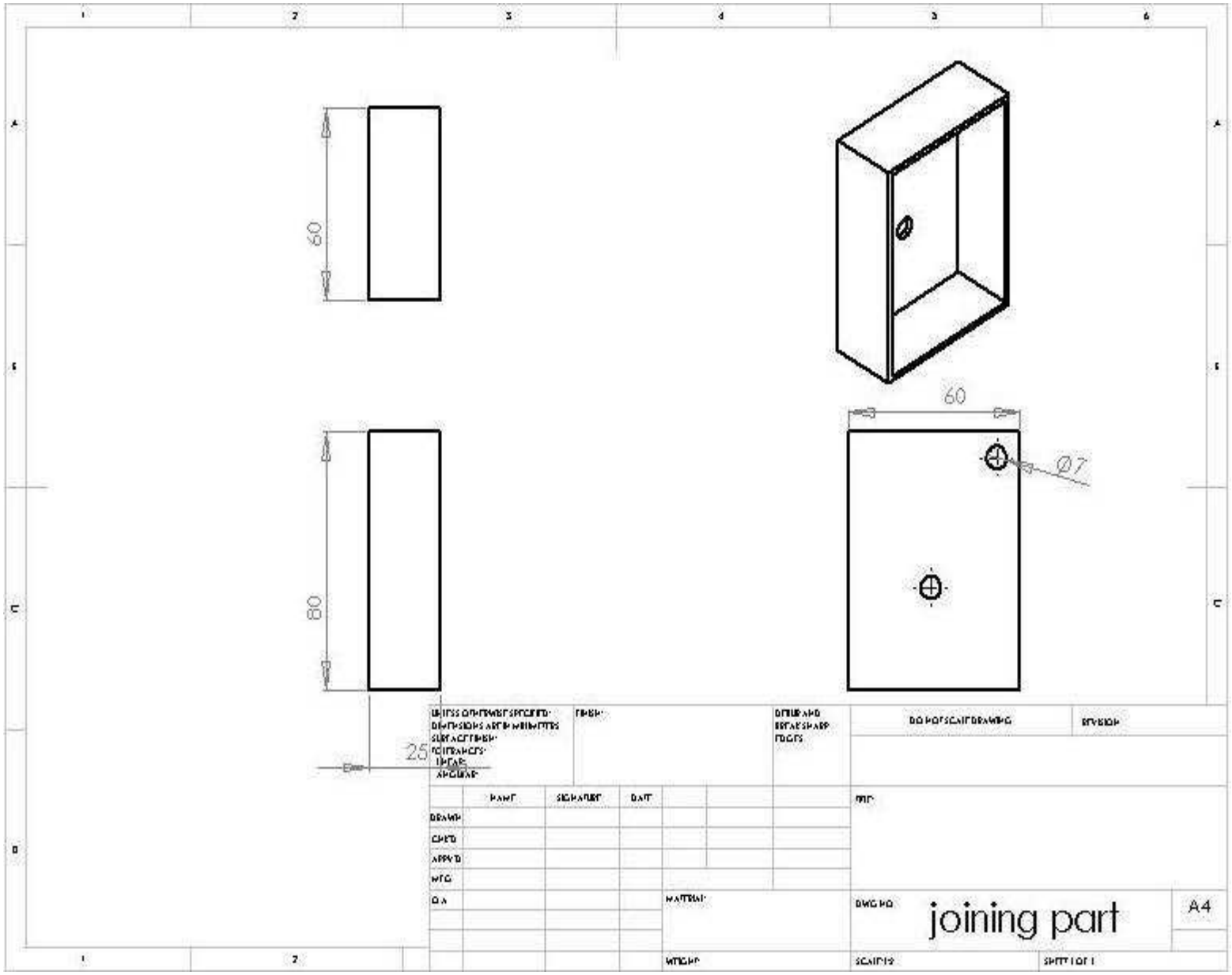
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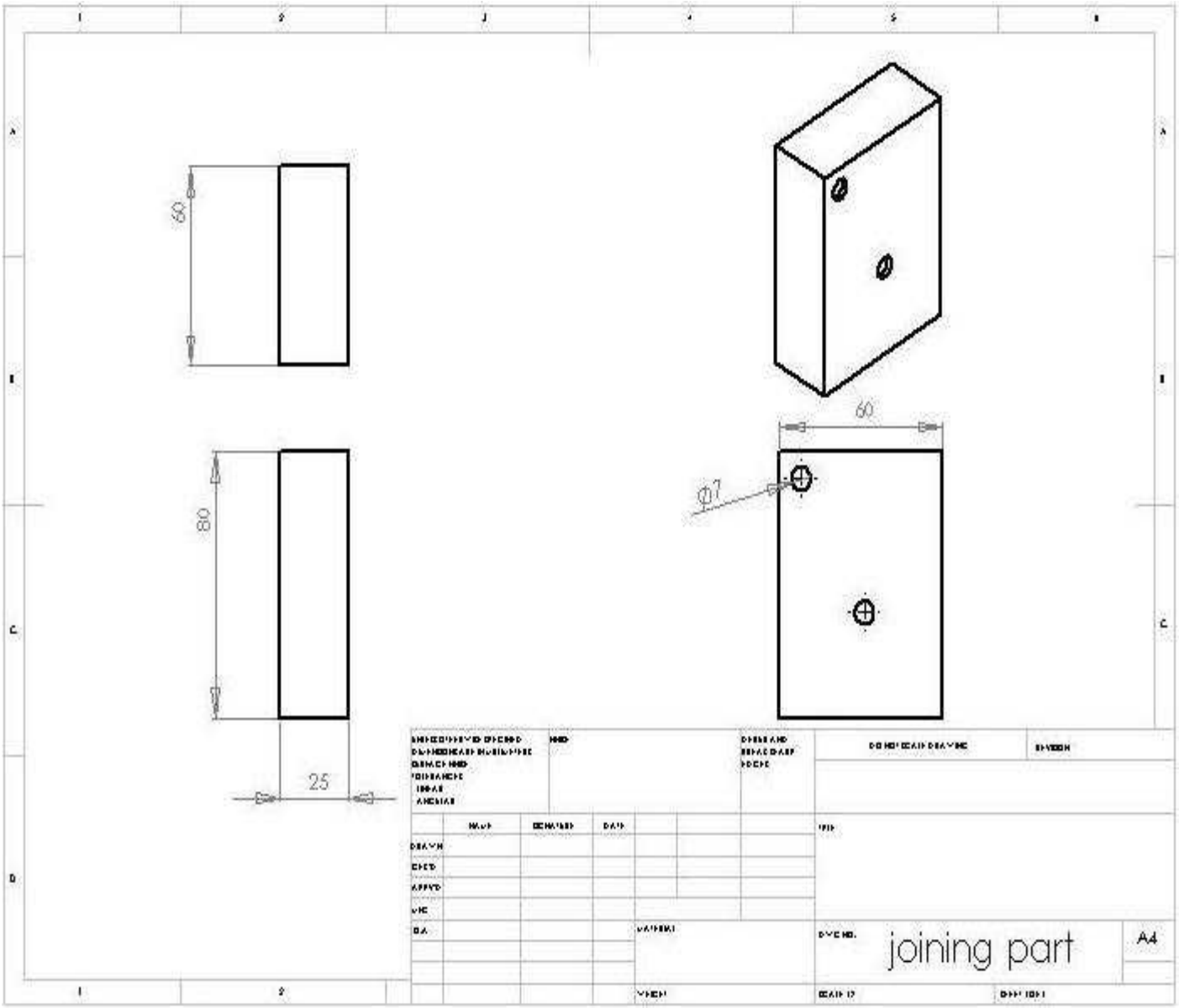
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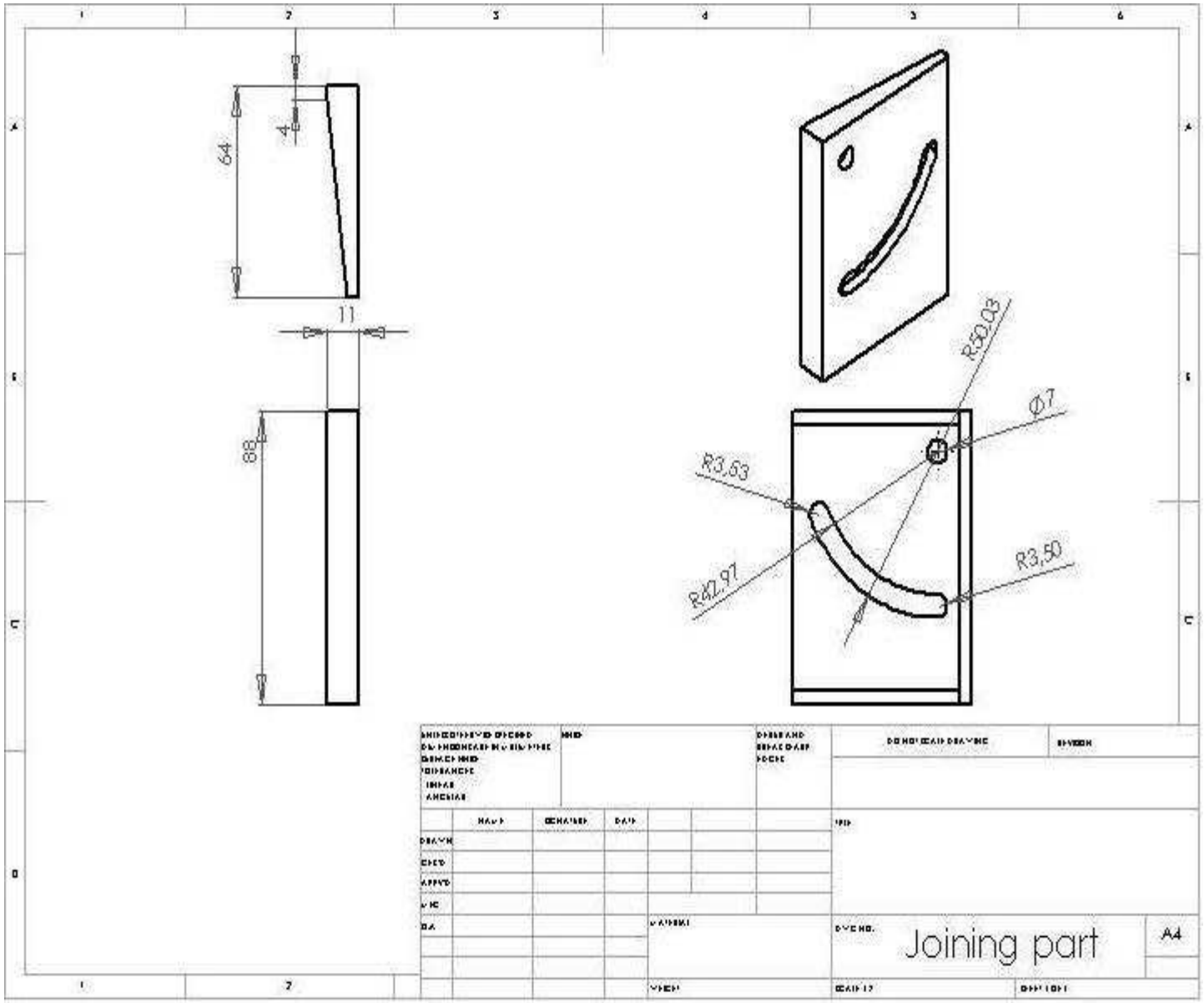
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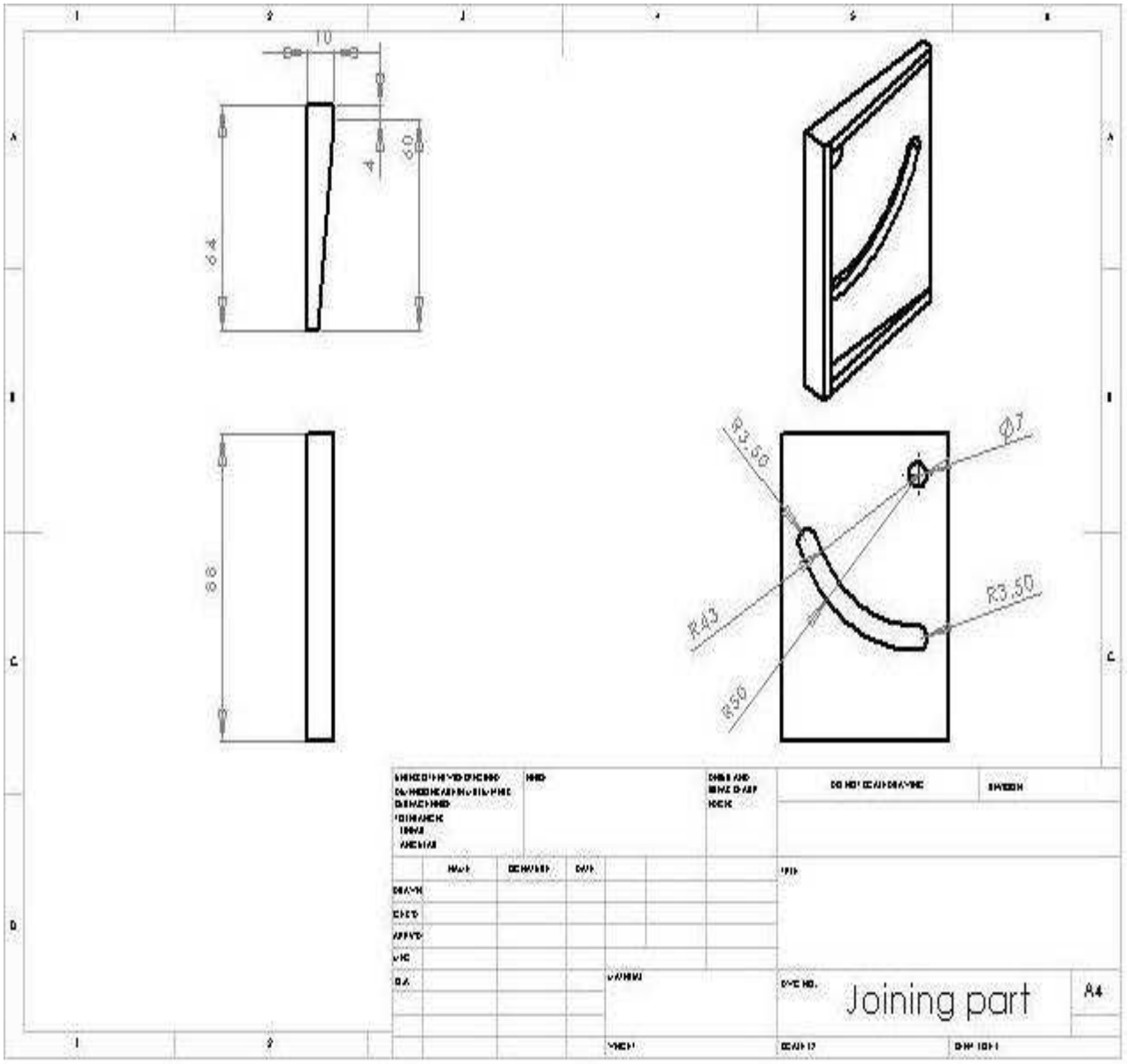
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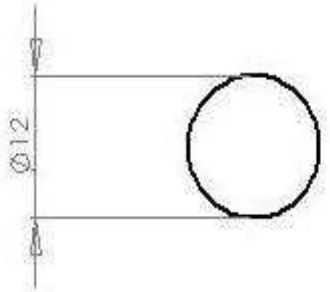

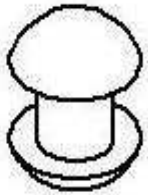

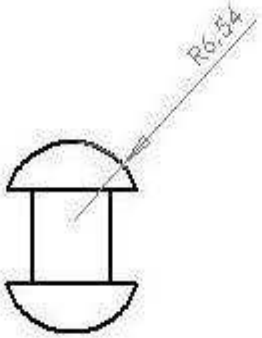

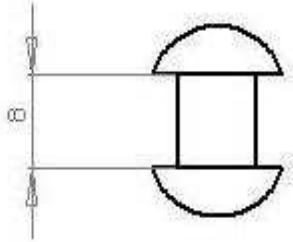

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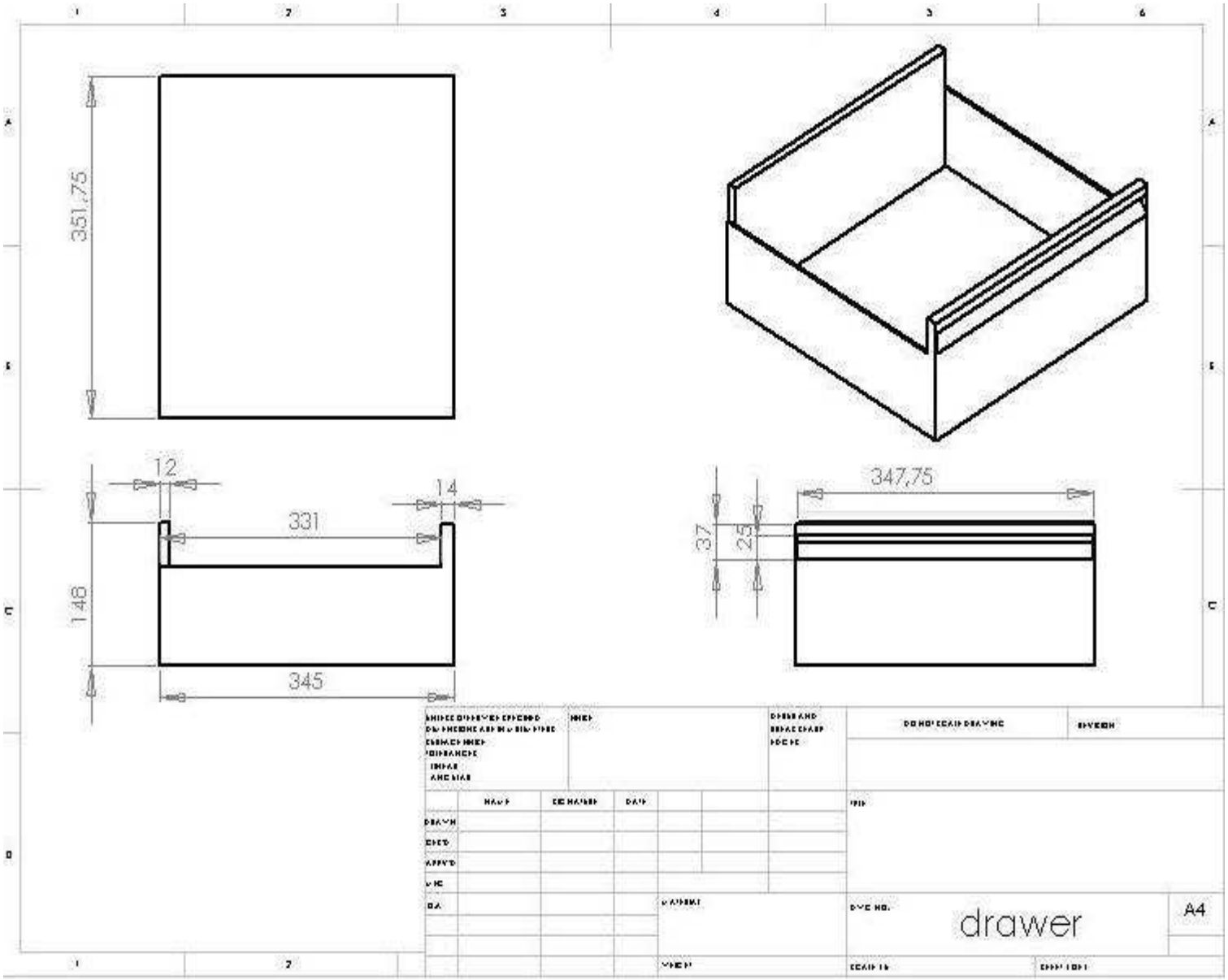
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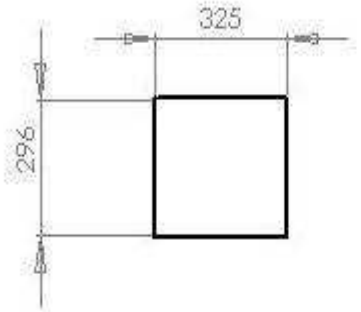

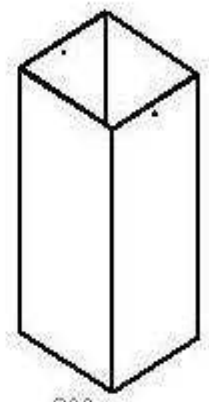

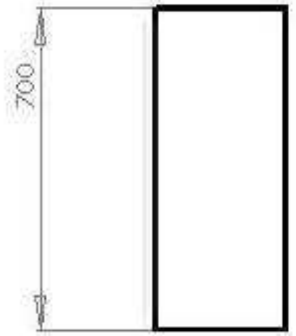

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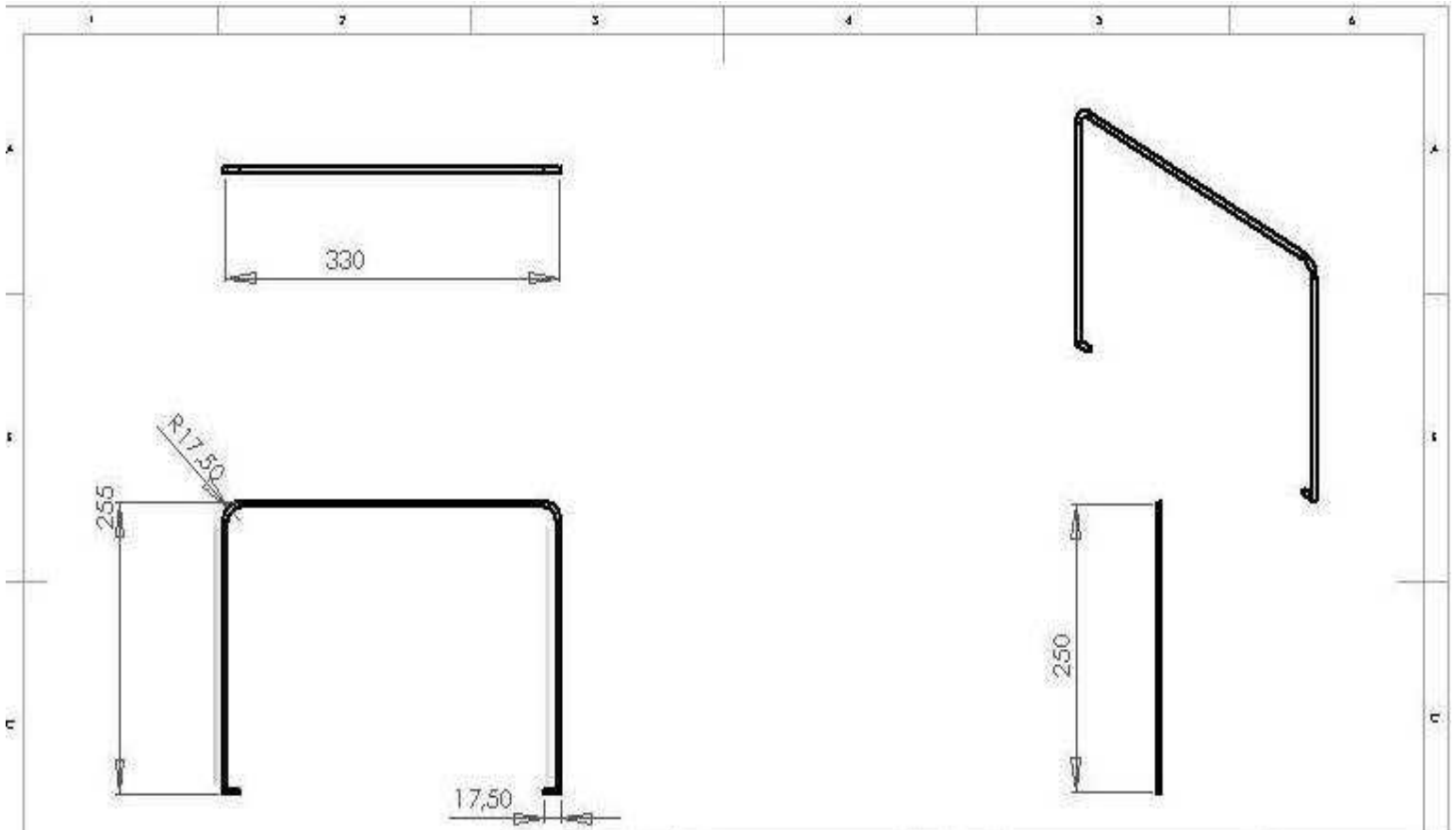

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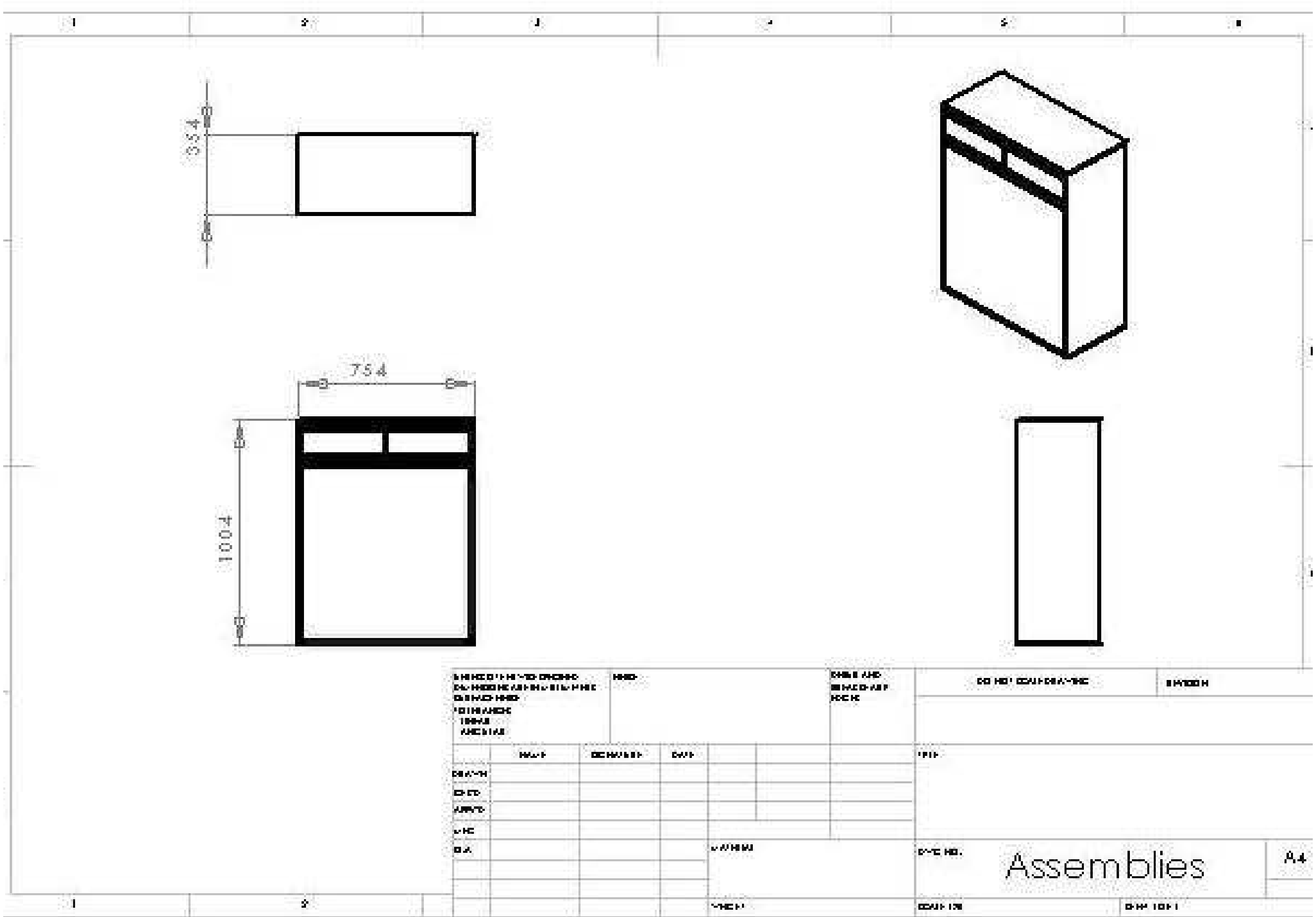
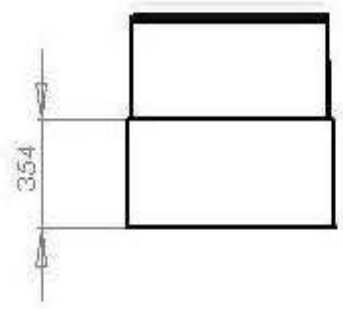
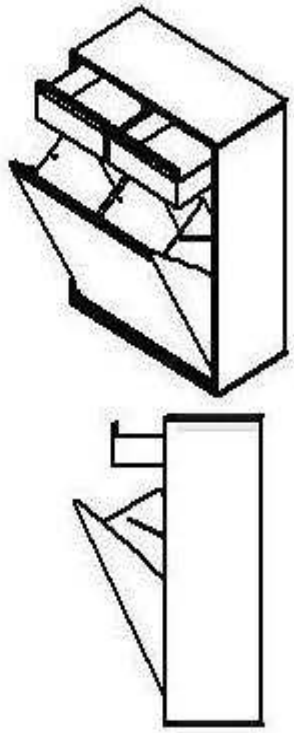
Q.A				MATERIAL			DWG NO. barrel holder	A4
				WEIGHT			SCALE:1:5	SHEET 1 OF 1


354
754
1004
Assemblies
A4





UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETRES
SURFACE FINISH:
TOLERANCES:
LINEAR
ANGULAR

FINISH:

DEBUR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING

REVISION

	NAME	SIGNATURE	DATE
DRAWN			
CHK'D			
APPV'D			
MFG			
Q.A			

TITLE:

MATERIAL:

DWG NO.

assembly part

A4

WEIGHT:

SCALE:1:50

SHEET 1 OF 1

APPENDIX B

MACHINE TOOL AND EQUIPMENT

MIG Welding Machine

Abrasive Cutter

Measuring Tape

Hand Grinding

Personal Protection Equipment (PPE):

Visor, Goggle, Glove & Apron

Hand Drill

Rivet Pop