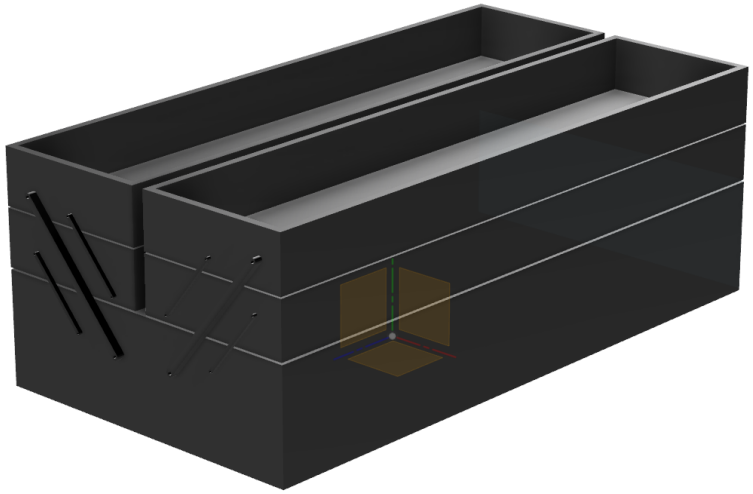
TA201P: Introduction to Manufacturing Processes I

2020-2021, Summer Semester

Project Report:- S6- Group No. 3

CANTILEVER TOOLBOX



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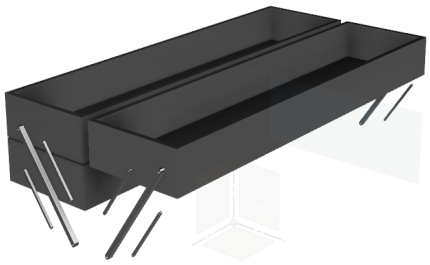

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Introduction

Cantilever Box

The heavy-duty model in the market is the cantilever box. For keeping heavy tools inside, the space allocated is more, but still, the spaces can be adjusted, removing the nuts and bolts inside the box.

This cool box can be carried anywhere in your workplace to get your work done quickly. Since the model is made heavy, longevity is more when compared to the other models.

Types

A toolbox could refer to several types of storage to hold tools. It could mean a small portable box that can carry a few tools to a project location or a large storage system set on casters. Modern toolboxes are predominantly metal or plastic. Wood was the material of choice for tool boxes built beginning in the early 19th century.

Tool boxes can be mainly divided as 5 types.They are:

- Plastic
- Steel
- Aluminium
- Waterproof
- Cantilever

About Item

- **Sturdy Material**:- Made with **cold-reduced** carbon steel sheets and strips (**SPCC**), the tool box is of great hardness and durability with high load-bearing capacity.
- **5-Tray Design**:- 4 metal connectors on both sides connect the 5 foldable trays, making it convenient for use with the retractable design. Get easy access to the tools placed in different trays.
- **Zinc Phosphate**:- The surface of the steel tool box is covered by a fine and dense zinc phosphating, providing great rust and corrosion resistance for long-lasting use.
- **Convenient Long Handles**:- A pair of metal handles shares the same length with the toolbox. It's more comfortable to grip and convenient for you to carry around.
- **Large Capacity**:- With a dimension of 500mm×200mm×230mm, the 21in metal toolbox is of large capacity. (Note: It's ready to serve out of the box with no installation needed.)

Motivation

In deciding what the Group Project would be based on, different group members came up with multiple ideas. We discussed the merit of each of these in our group meets. We mainly talked about the future use of the project, manufacturing processes involved and the feasibility of making the project. We wanted to choose something which is of value for the user and at the same time challenges us from a manufacturing point of view. Finally, we decided to go ahead with three of the projects, namely The Cantilever toolbox, foldable bridge and two point slider. We then discussed them with our Lab incharge and tutor and finally decided to choose The Cantilever toolbox for our project. Cantilever toolbox can hold multiple tools and is portable, thus it is of great value to the user. Additionally, it's material selection, structure and mechanism are challenging to design and provide us with the opportunity to use our creativity.

Acknowledgement

We would like to express our sincere gratitude to our Tutor, Prof. Dr. Amarendra K Singh and our lab-in-charge Dr.Anil Kumar Verma for their support, constant supervision and encouragement throughout this project. Their support and direction was instrumental throughout the execution of the project. We thank Prof. Dr.Anish Upadhaya, Course Instructor, for providing us with this opportunity to explore our creativity and also helped to manufacture a product virtually which included various lab manufacturing processes. We also thank our Tas, Yugesh Kumar and Gulnaz Parween for their valuable time.They not only helped us throughout the project, but also trained us in the various skills necessary to complete the project.

Work Distribution

Member	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
SHIVANI GUNTAKA						
SHUBHAM JANGID						
SIDDHARTHA PRATAP SINGH						
SUMEET GUPTA						
TEKI SAI NIKHIL						
VATSALYA SINGH						
VIKASH MEGHWAL						
AAKASH CHOUDHARY						
AAKASH RATHI						

Material Selection

We have had three potential candidates for toolbox material, which are carbon fibre, carbon steel and aluminium alloy. We compared them based on corrosion resistance, cost, hardness and strength and picked the best one among them.

Corrosion Resistance

In our research, carbon steel was found to destroy less than 10 mm per year. Carbon fiber was found to be resistant to corrosion and aluminum alloy exhibited insignificant corrosion.
Based on the above data, it is apparent that aluminum alloy and carbon fiber would be ideal as far as corrosion resistance is concerned.

Cost

We found that Aluminum alloy is the cheapest among all the materials and hence preferred over others.

Hardness and Strength

We compared the tensile strength of all the materials and found Carbon fibre the strongest of all. Aluminium and carbon steel are not as strong as carbon fibre but they are strong enough to prevent any damage from tools. Therefore, all the three materials can be used for toolbox making.

Best one

All the three materials have their own advantages and disadvantages like aluminium alloy offers a higher resistance to corrosion as compared to carbon steel but the former is less stronger than carbon fibre. Also, aluminium alloy is way cheaper than the other two materials. So, after mutually discussing and keeping all the facts in our mind, we selected aluminium alloy for making toolbox material.

Material List and Cost

Part No.	Part	Material Required	Dimension (mm)	Quantity	Process Used	Approx. Cost (INR)
1	Base Box	Aluminium Alloy	300mm x 157.5 x 52.5mm	1	Cutting,cold rolling	136.29₹
2	Cabinets	Aluminium Sheets	300 x 75.8 x 26.3	4	Welding & cold rolling, Drilling, cutting	267.41₹
3	Handle	Aluminium	Length = 303mm Radius = 3mm	1	Casting & welding	72.15₹
4	Edge Strips	Aluminium	40.4mm x 1.2 mm	8	Casting, Drilling, Welding	16.27₹
5	Center Strips	Aluminium	80.0mm x 1.2mm	4	Casting, Drilling, Welding	15.38₹
6	Extra Metal Sheet used	Aluminium	40 mm x 1500mm	1	Cutting	123.12₹
	Total Cost					**630.62₹**

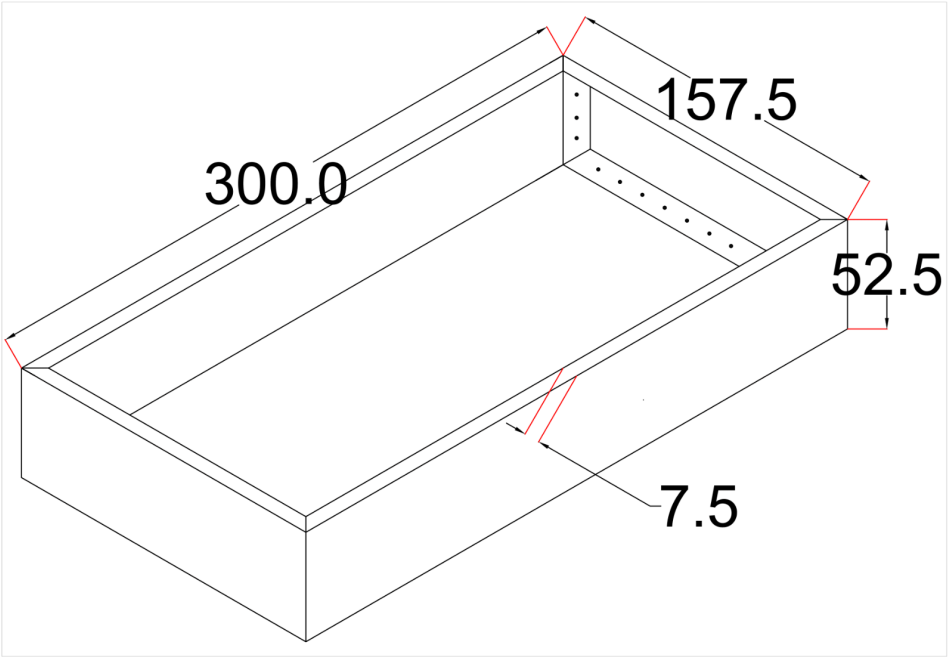
Step by step Manufacturing Process

1. We mark out the sizes of overall metal pieces on the sheet of Aluminium alloy from which the base and cabinets are to be made, using a metre rule with given dimensions.
2. Then, we cut out the sheets of marked sizes using sheet cutting.
3. Base and Cabinets are made by welding sheets together ensuring all angles meet properly.
4. Mark out the positions of the holes for strap pivots so as to acquire the required tray mechanism, centre punch the positions and then drill all holes.
5. Then, we assemble the trays in position above the base, as per our drawing, and measure the holes' centres for each strap and by adding the width of the strap to each centre length we get the lengths of respective straps.
6. We mark out and cut those straps as well.
7. We use grinding to make the ends of the straps semi-circular without shortening the straps at all.
8. We mark and drill out the holes on both ends of the straps.
9. Then, we mark and cut out two lids with the given dimensions and attach them with aur upper cabinets using hinges.
10. We cast out the aluminium handle and weld it to our toolbox using straps

ISOMETRIC DRAWINGS

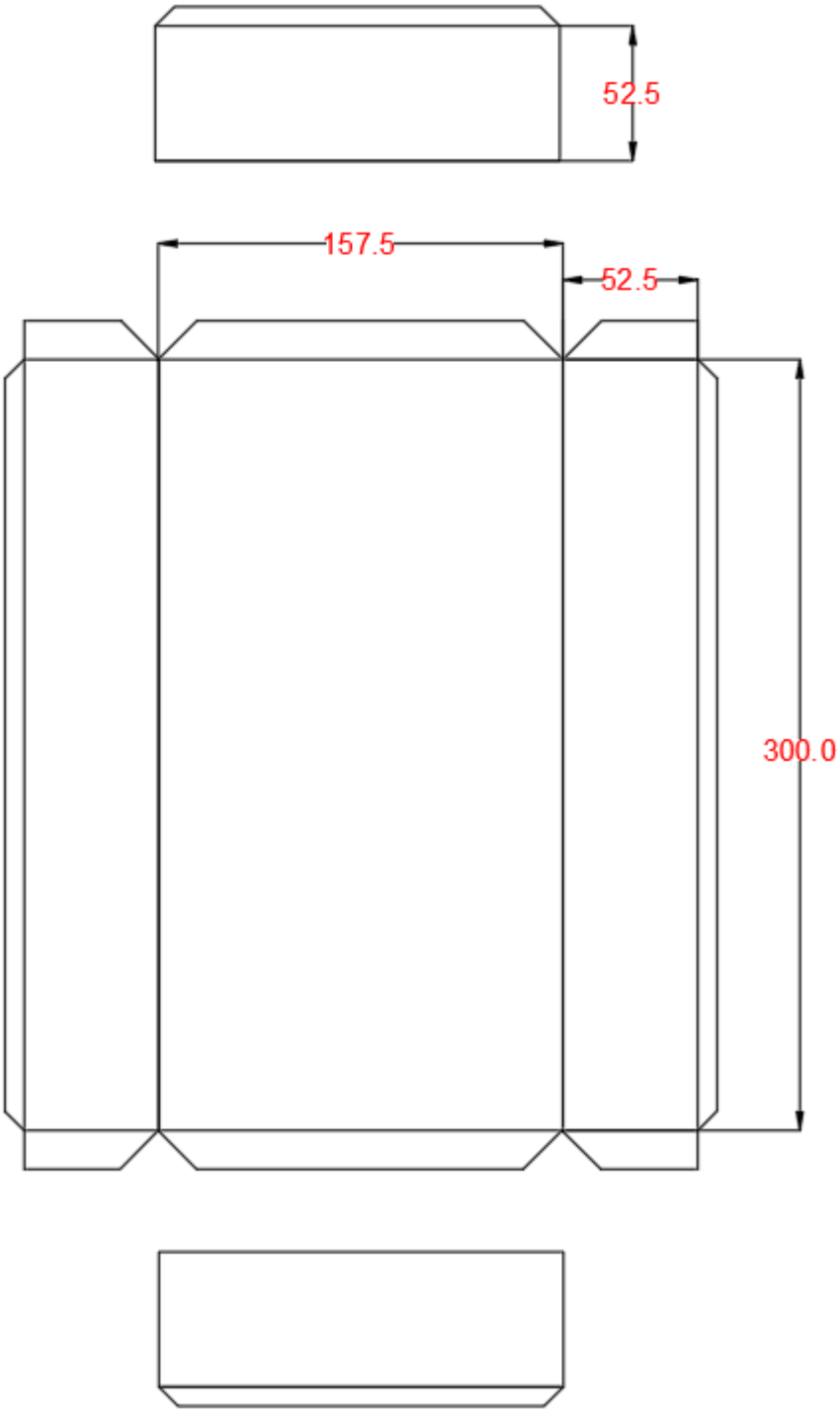
BASE BOX

ISOMETRIC



Name	View	Dimension (mm) (L x B x H)	Thickness (mm)	Count	Manufacturing Process Used
Base Box	Isometric	300 x 157.5 x 52.5	7.5	1	Cutting, Cold rolling

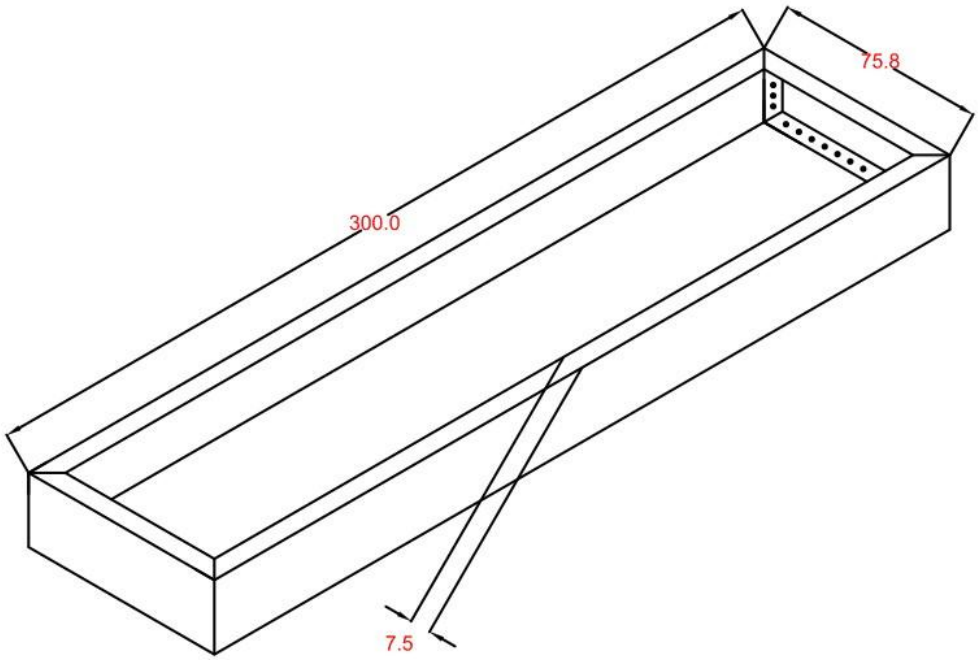
ORTHOGRAPHIC



Name	View	Dimension (mm) (L x B x H)	Thickness (mm)	Count	Manufacturing Process Used
Base Box	Orthographic	300 x 157.5 x 52.5	7.5	1	Cutting, Cold rolling

CABINET

ISOMETRIC



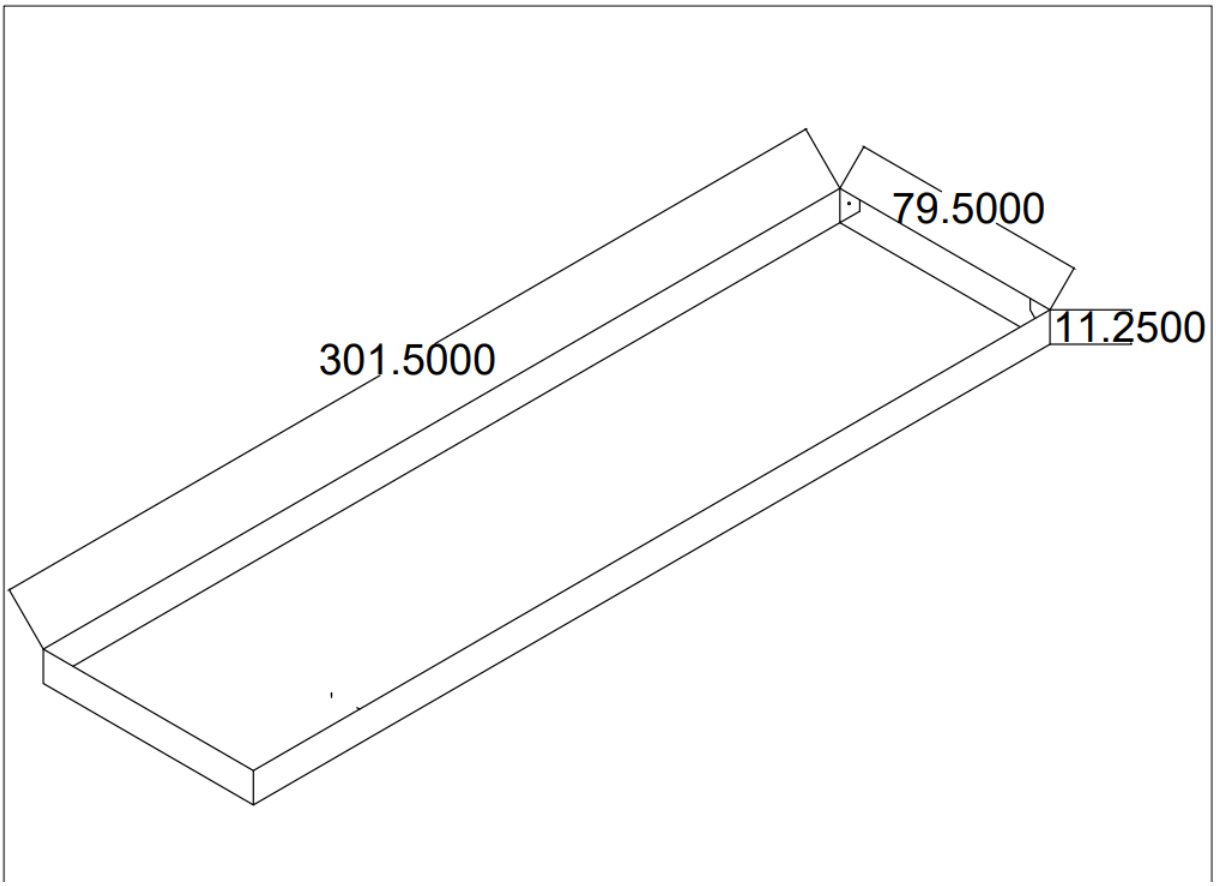
Name	View	Dimension (mm) (L x B x H)	Thickness (mm)	Count	Manufacturing Process Used
Cabinet	Isometric	300 x 75.8 x 52.5	7.5	4	Welding, Cold Rolling, Drilling, Cutting

ORTHOGRAPHIC

Name	View	Dimension (mm) (L x B x H)	Thickness (mm)	Count	Manufacturing Process Used
Cabinet	Orthographic	300 x 75.8 x 52.5	7.5	4	Welding, Cold Rolling, Drilling, Cutting

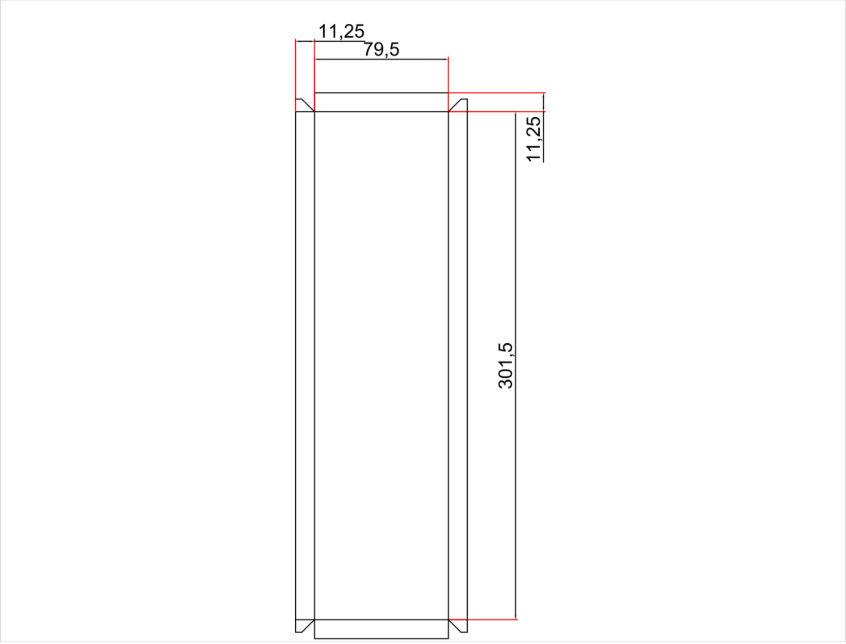
LID

ISOMETRIC



Name	View	Dimension (mm) (L x B x H)	Thickness (mm)	Count	Manufacturing Process Used
Lid	Isometric	301.5 x 79.5 x 11.25	1.5	2	Cutting, Cold Rolling

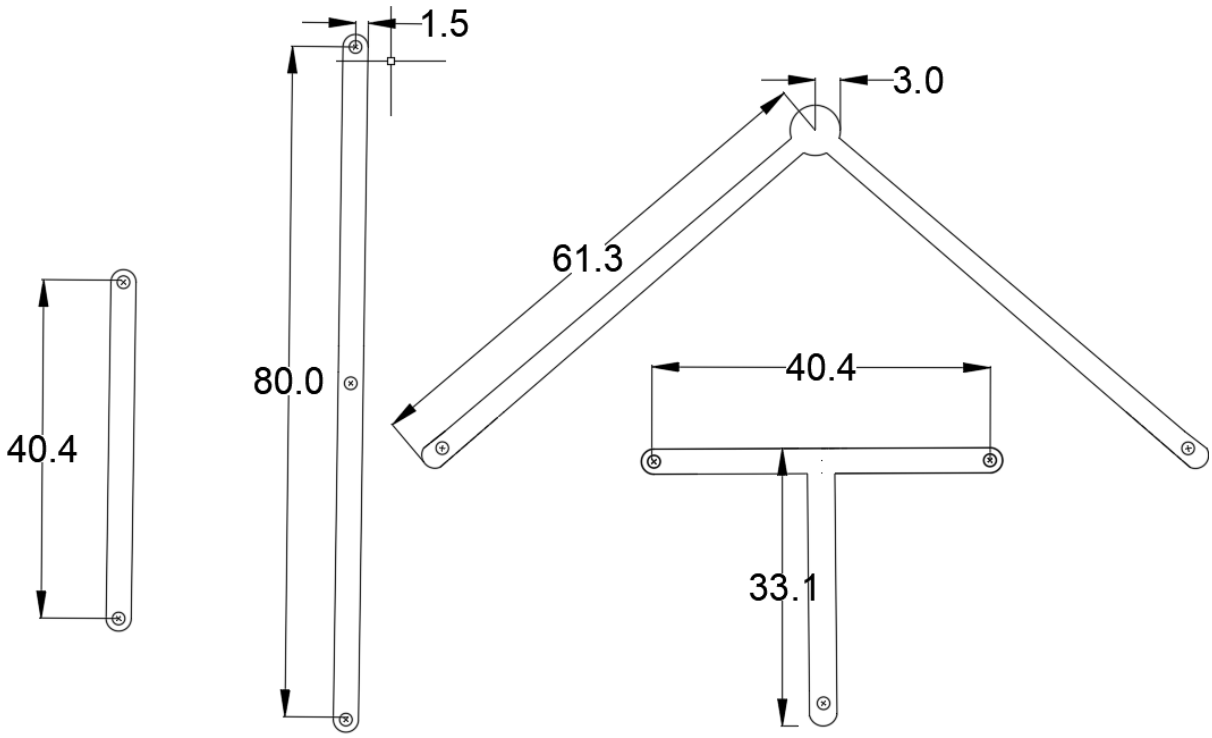
ORTHOGRAPHIC



Name	View	Dimension (mm) (L x B x H)	Thickness (mm)	Count	Manufacturing Process Used
Lid	Orthographic	301.5 x 79.5 x 11.25	11.25	2	Cutting, Cold Rolling

METAL STRIPS

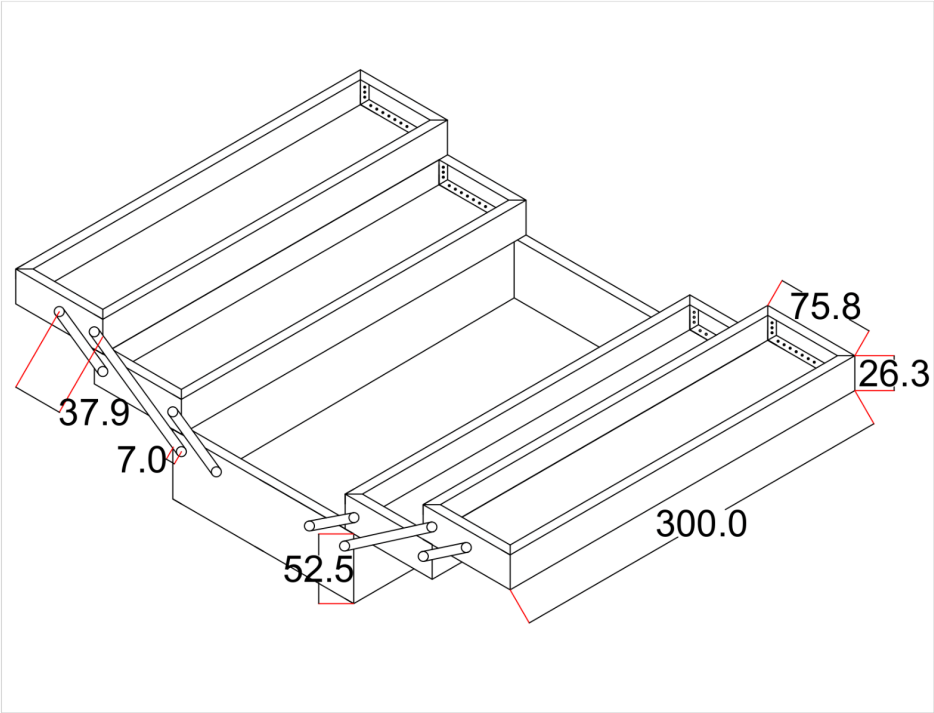
ORTHOGRAPHIC



Name	View	Dimension (mm) (L x B x H)	Thickness (mm)	Count	Manufacturing Process Used
Metal Strips	Orthographic		1.2		

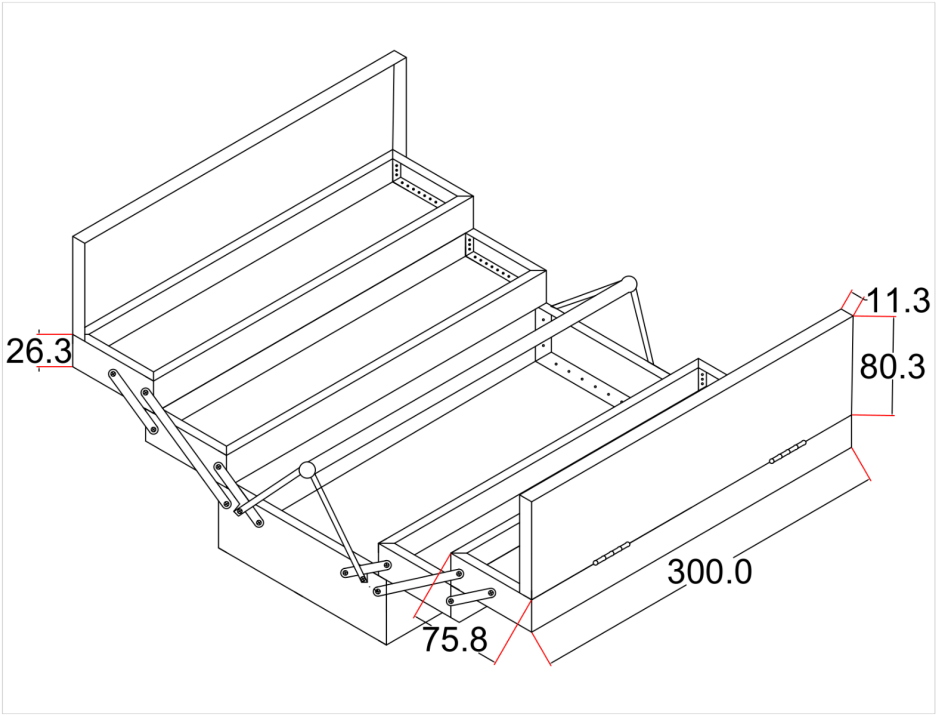
ASSEMBLED TOOLBOX

ISOMETRIC



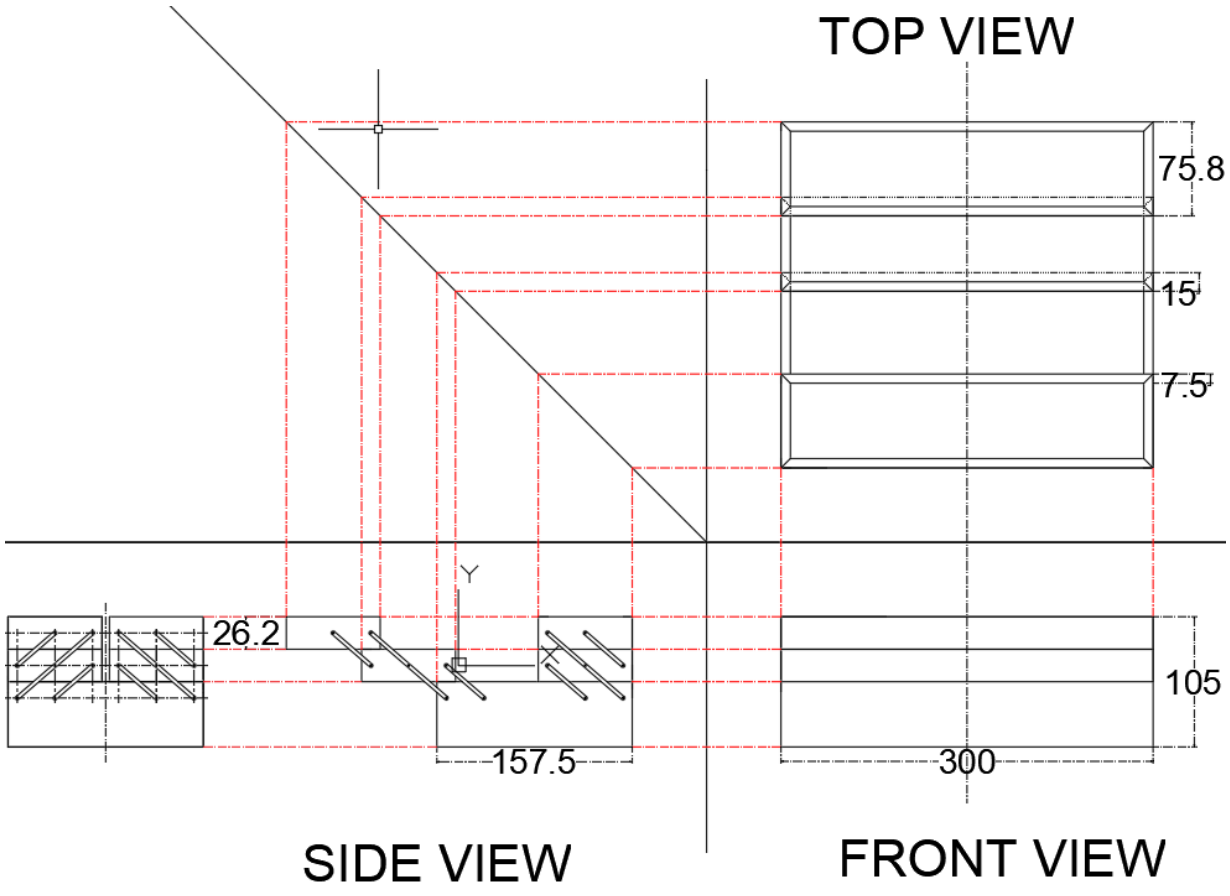
Name	View	Dimension (mm) (L x B x H)	Thickness (mm)	Manufacturing Process Used
Assembled Tool Box	Isometric	300 x 157.5 x 105	7.5	Cutting, Cold Rolling Drilling Cutting

ISOMETRIC



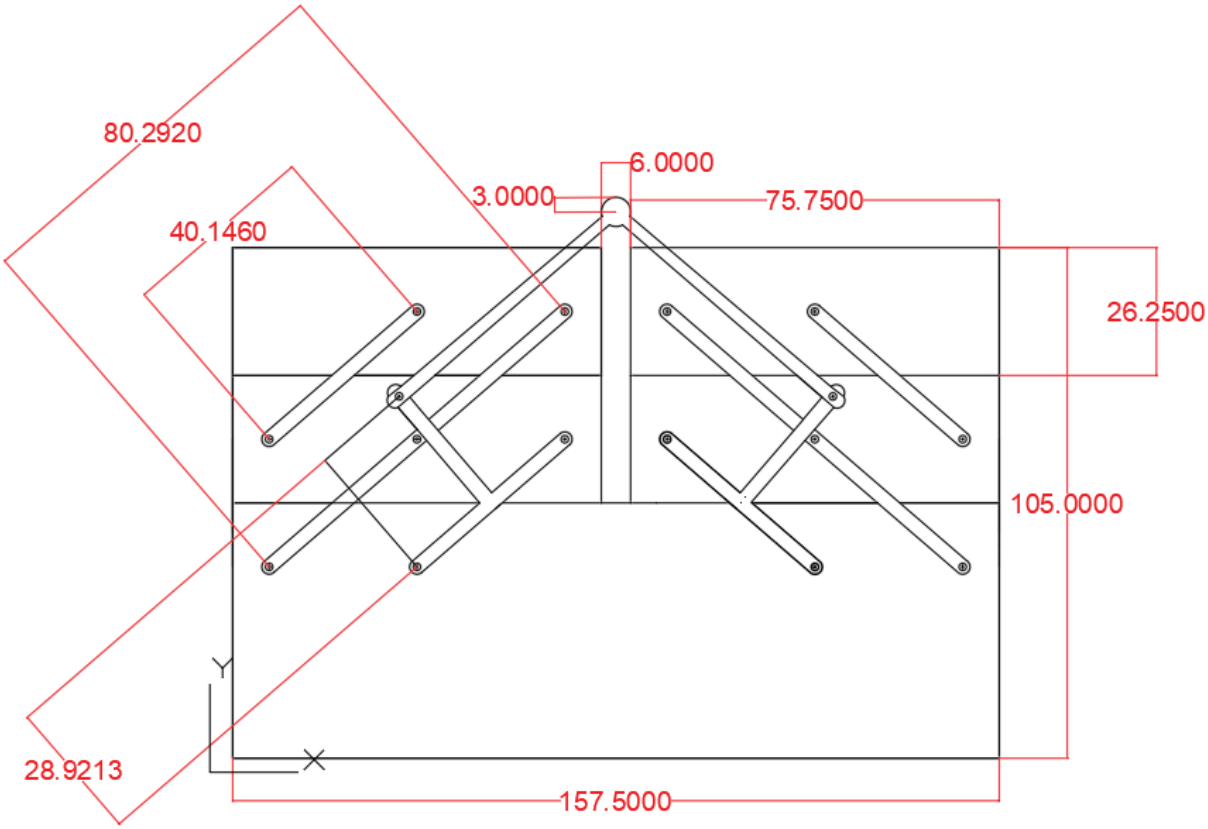
Name	View	Dimension (mm) (L x B x H)	Thickness (mm)	Manufacturing Process Used
Assembled Tool Box	Isometric	300 x 157.5 x 105	7.5	Cutting, Cold Rolling Drilling Cutting

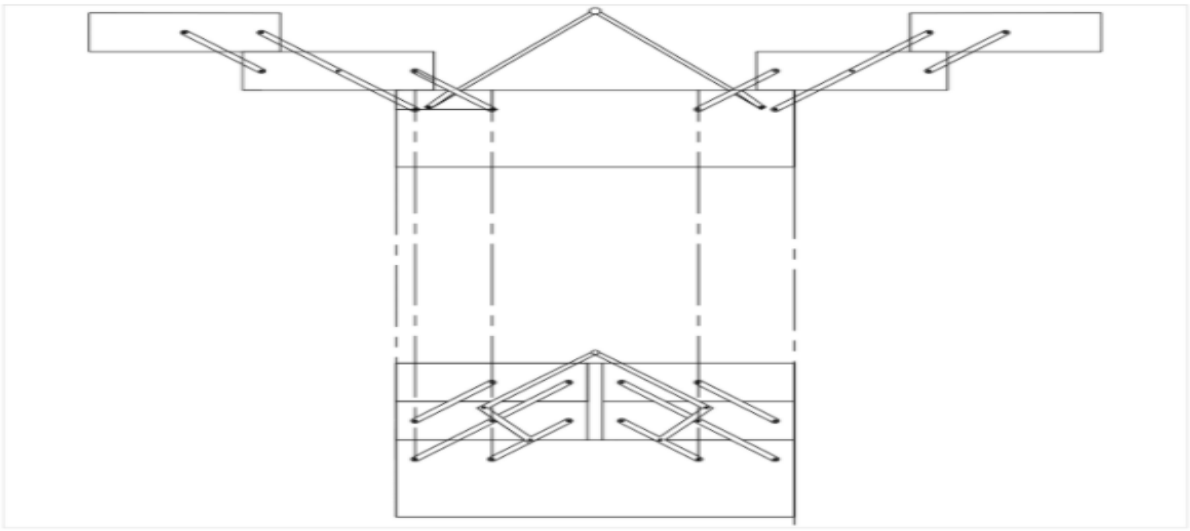
ORTHOGRAPHIC



Name	View	Dimension (mm) (L x B x H)	Thickness (mm)
Assembled Tool Box	Orthographic	300 x 157.5 x 105	7

Front View Of the Cantilever Tool Box (Open and Close View)





Name	View	Dimension (mm) (L x B x H)	Thickness (mm)
Assembled Tool Box	Orthographic	300 x 157.5 x 105	7

Sustainability

The material used for the box is aluminium and aluminium alloys. Aluminium has few advantages over other material , some of them are discussed below :

- **Aluminium Recycling** – Aluminium recycling benefits present and future generations by conserving energy and other natural resources. It requires up to 95% less energy to recycle aluminium than to produce primary metal and thereby avoids corresponding emissions, including greenhouse gases.
- **Corrosion Resistant and Long Lasting Strength** – Aluminium is corrosion resistant compared to iron. Aluminium alloys are used to provide good strength and durability.
- **Lightweight** – Lightweight and durable aluminium best suits the basic purpose of a toolbox.

References

1. https://cornerfieldshop.com/2020/01/11/cantilever-toolbox/
2. AutoCad, Fusion360 and other Engineering Drawing Tools for this Project
3. https://pdfcoffee.com/cantilever-toolbox-design-pdf-free.html
4. Lectures Slides of course TA201
5. Material Cost List : **List of cost of materials**

Group Project B Slide link

https://docs.google.com/presentation/d/1WYdCKurS0EFwZGeYdPN1A8VvKyL-ICNvxrZp407gTK4/edit#slide=id.ge42f1898f3_3_1