MECH 2230-02

Advanced Engineering and Design

Final Design Project

# Wiper Mechanism

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# ABSTRACT

The purpose of this project is to conduct a technical drawing of a wiper mechanism on CATIA V5 software. This software is a computer aided-designing program that provides the user an open space tool to create engineering designs of a different kind such as 3D models, Orthographic views of products, exploded view of each part, and many more. Various laboratories and tutorials were conducted before this project was given to us. Each tutorial and lab provided the necessary understanding of dimensioning, creating, and analyzing the details provided to us to successfully create the wiper. Similarly, each part of the wiper was designed through the instructions, guidelines, and dimensions provided in the help file, and those CATPart and CATDrawings filetype were uploaded to the blackboard. This report comprises the explanation of each part, description of the design problem, picture of the assembly design, 3D model, orthographic view, and overall function associated with the structure. This report summarizes the overall project providing the viewer each detail and reasoning on how and why this project was conducted.


# 1. INTRODUCTION

**Design Statement:**

This project includes creating a wiper mechanism with the help of sketches, bill of materials and sample of the assembly design to build 3D solid models (CATPart) of each respective component, an assembly model of the final design, and an orthographic view (CATDrawings) of each built along with the exploded view of the 3D model. The main objective is to utilize the experience gained throughout the course and practice them to create innovate methods of sketching designs and solid works.

**Background Research:**

A wiper is an important component of any automobiles that is used for wiping the glass surface for clear vision aiding in times of rain, fog, or any visionary difficulties. It provides safety to the driver as well as assists to keep the glass clean throughout the use. A wiper consists of many parts that helps it to perform effectively. A wiper usually consists of wiper arm that moves left to right, motor arm which moves the wiper arm and various links to provide support to among themselves.

The windshield wiper mechanism is based on a six-bar linkage which basically means that it is constructed from six links among the parts having seven joints in total. This provides one-degree of freedom to the mechanism. This provides a two-couple curve that projects in an angular shaped of a parallelogram.

The electric motor plays an important role which converts the circular rotation of the dynamo into an intermittent rotation through the wiper arm. With 4 different arms with variable length, a certain pattern of rotation is created which helps in cleaning the glass.

Cars like Mercedes Benz and Subaru XT uses a complex eccentric-arc system to wipe the front glass. This wiper covers almost all the parts of the front screen.

A simple wiper usually has 4 to 5 components but, the list of wiper parts that were used in this project with its functions are enlisted below.

1. Wiper Frame: A metallic-back stripped frame that moves on definite direction (left to right) in each interval to wipe off the glass surface during the times of rain, fogs, or any visionary difficulties. It keeps the glass of the car clean with the help of the wiper part. The wiper is usually in U-shape.

2. Motor Housing: The technical component of the wiper, which aids on moving the wiper's arm to perform its wiping duty.

3. Motor Arm: Motor arm is the connection link between drive link, motor housing and wiper frame that provides rigidity.

4. Drive Link: Next to the motor arm is the drive link that connects rocket arm to the main component. The springs are added to connect each pivot shaft to the drive link.

5. Rocket Arm: Two rocket arms are required to create equilibrium between all the components. This part helps to maintain stable flow created with certain angle.

6. Connector Link: Two rocket arms are connected to each other through the connector link. Connector link provides stability and is the part of the six-bar linkage.

7. Pins: Pins provide inter-lockage in between all the arms and connectors.

8. British Square Key: This 3-sized key is placed in the motor housing along the motor shaft to run the tool. It was first created in Britain.

# 2. Component Design

## 2.1 Comments regarding CAD concepts, and CATIA tools and techniques

Various CAD designing concepts were used to create the components of the wiper. Through the help of profile, lines were created which was then dimensioned as per the instruction given. The completed profile or any shape were either padded or pocketed to provide thickness to the object. Various holes, chamfers and edge fillet were constructed and dimensioned as per the guideline. Some parts were given with specific material that was used to make it with. So, these parts were applied similar material, for instance, Pin A, B, C and D were designated as Steel. Parts with angular shape were created using Arc toolbar. To create holes with certain angular pattern, Circular Pattern Toolbar was used. Some calculations were used to find the dimension of the certain object. For example, the circular pattern in Wiper Frame was created with an angle of 30 degree.

## 2. 2 Component Design:

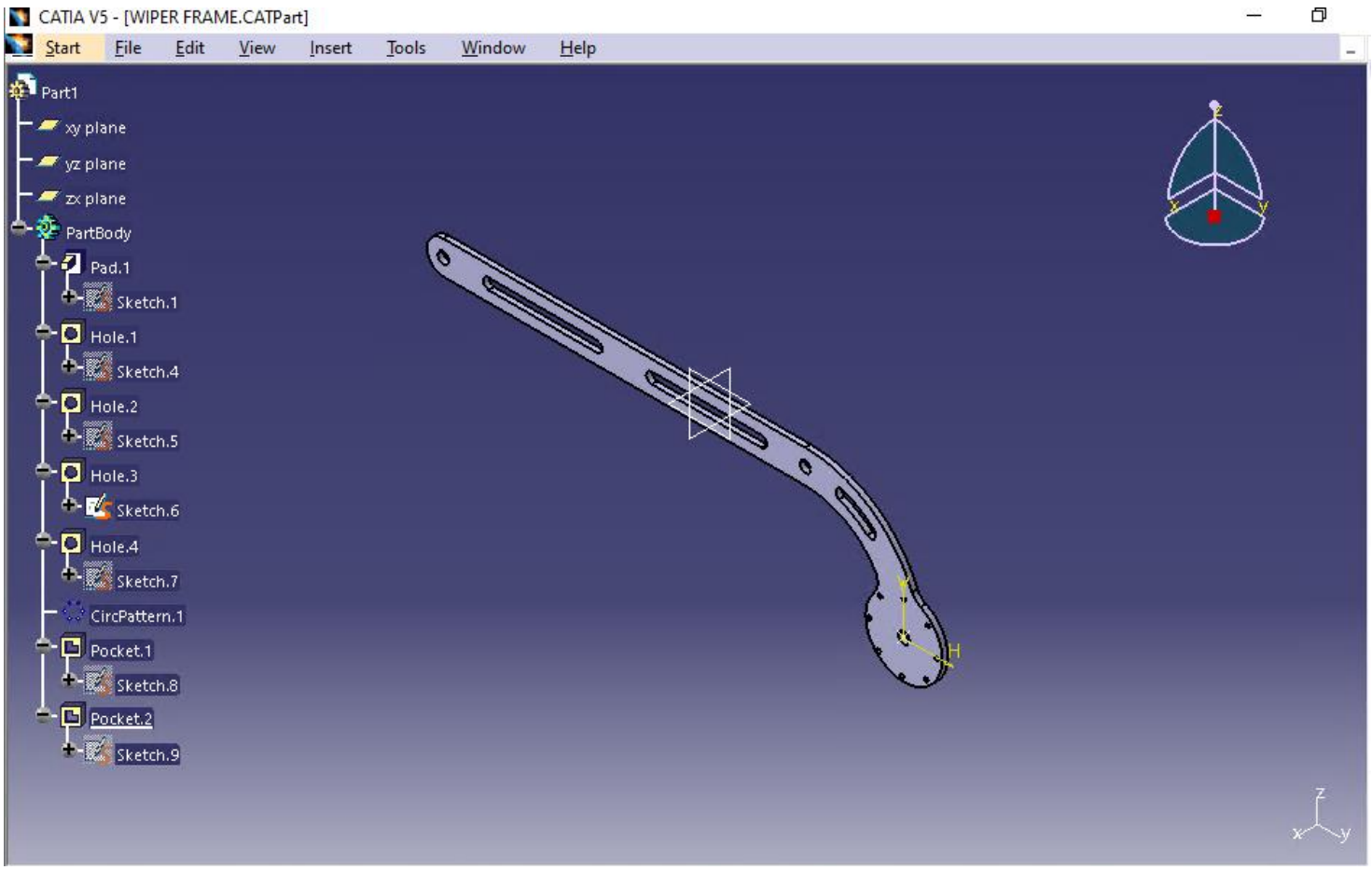


Figure 1. Wiper Frame (CATPart)

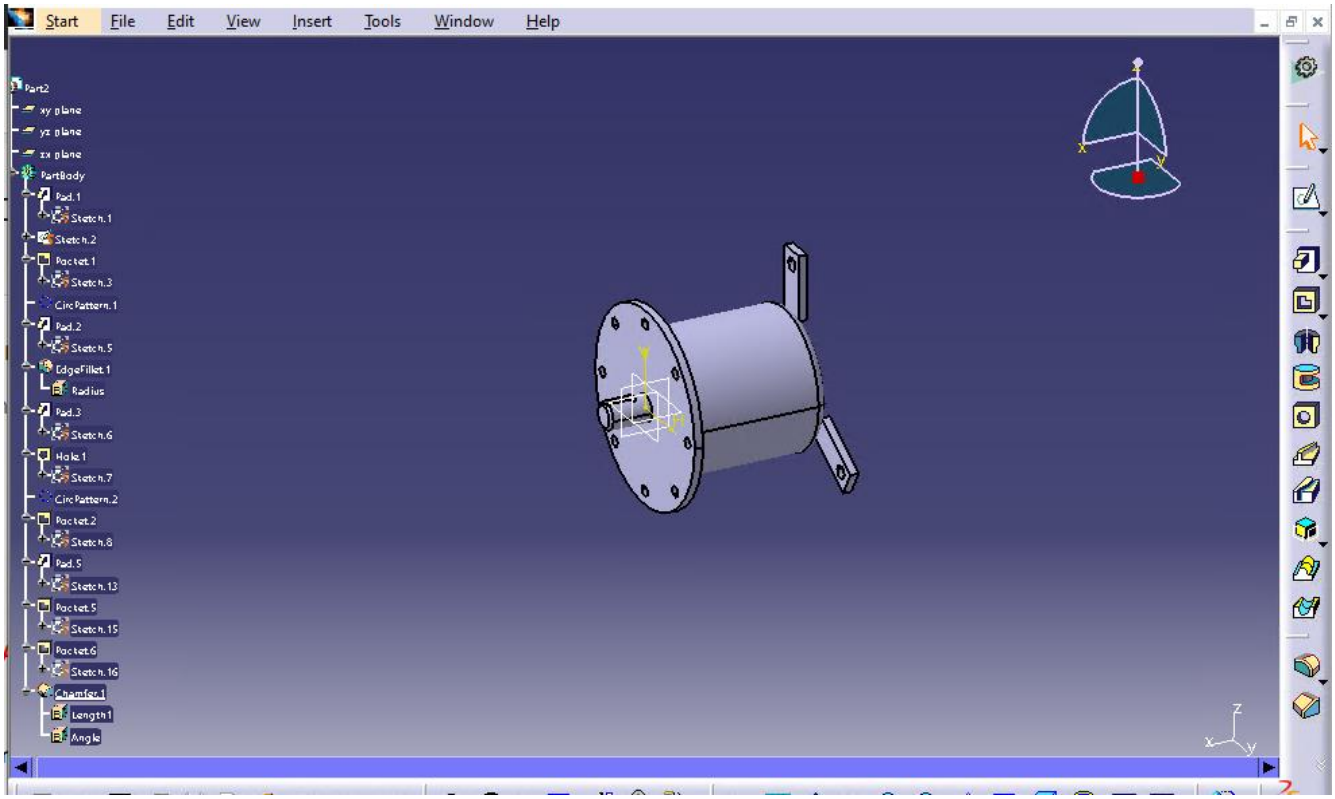


Figure 2. Motor Housing (CATPart)

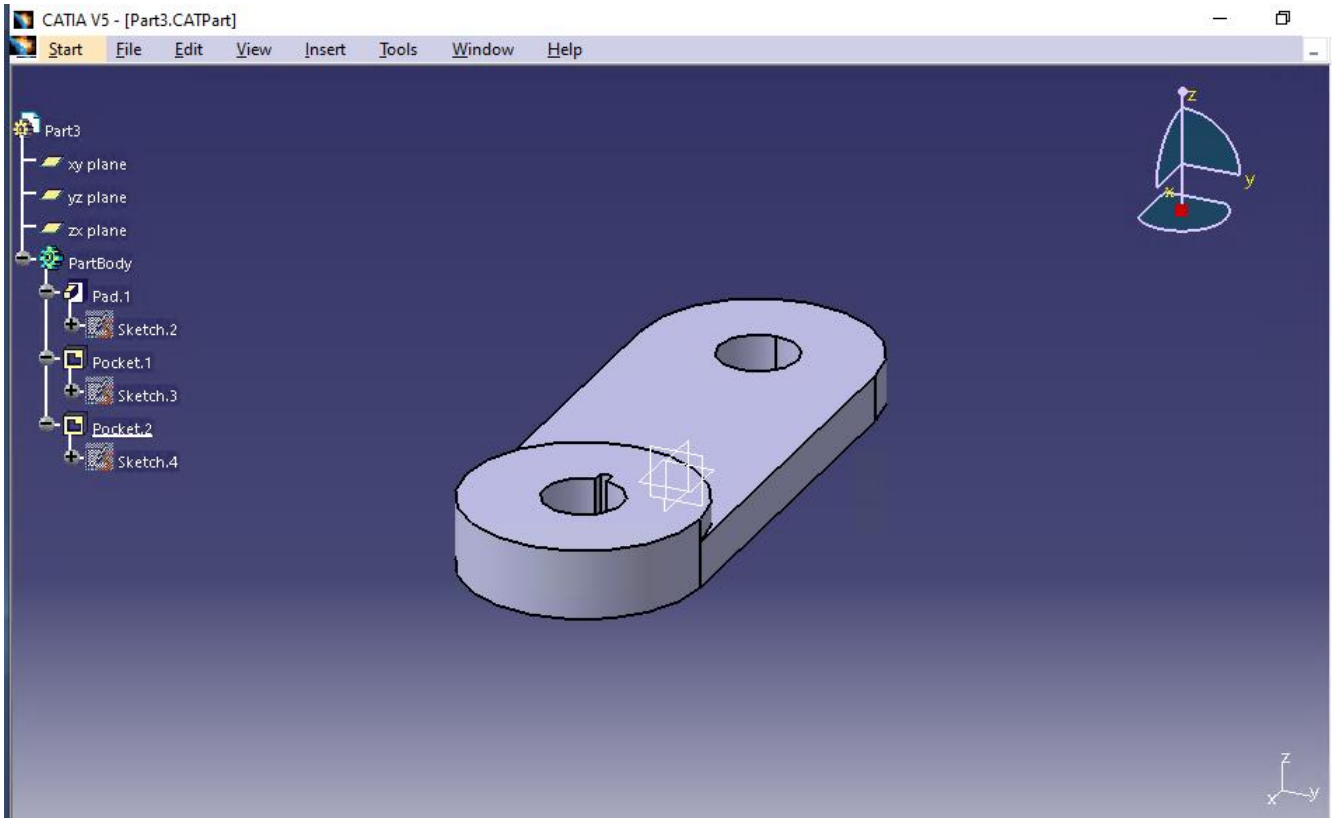


Figure 3. Motor Arm (CATPart)

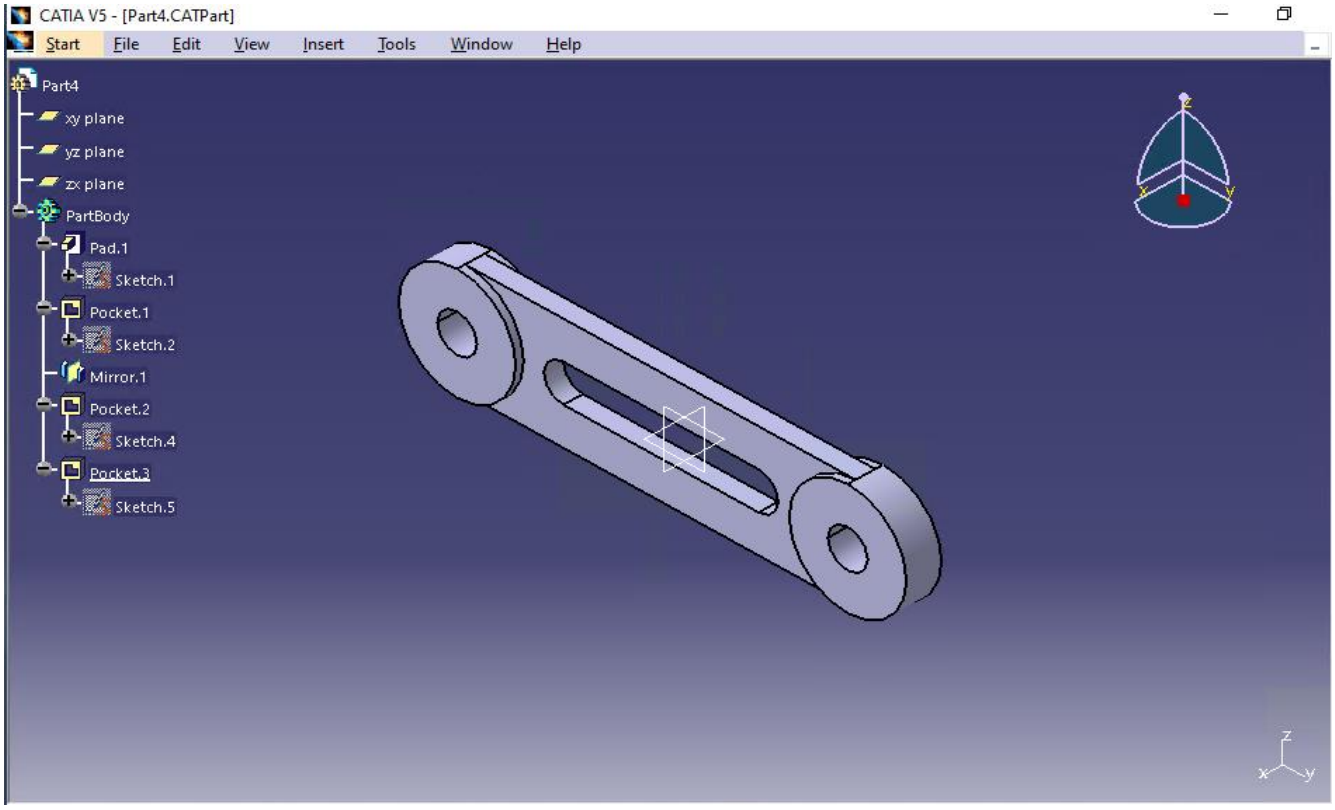


Figure 4. Drive Link (CATPart)

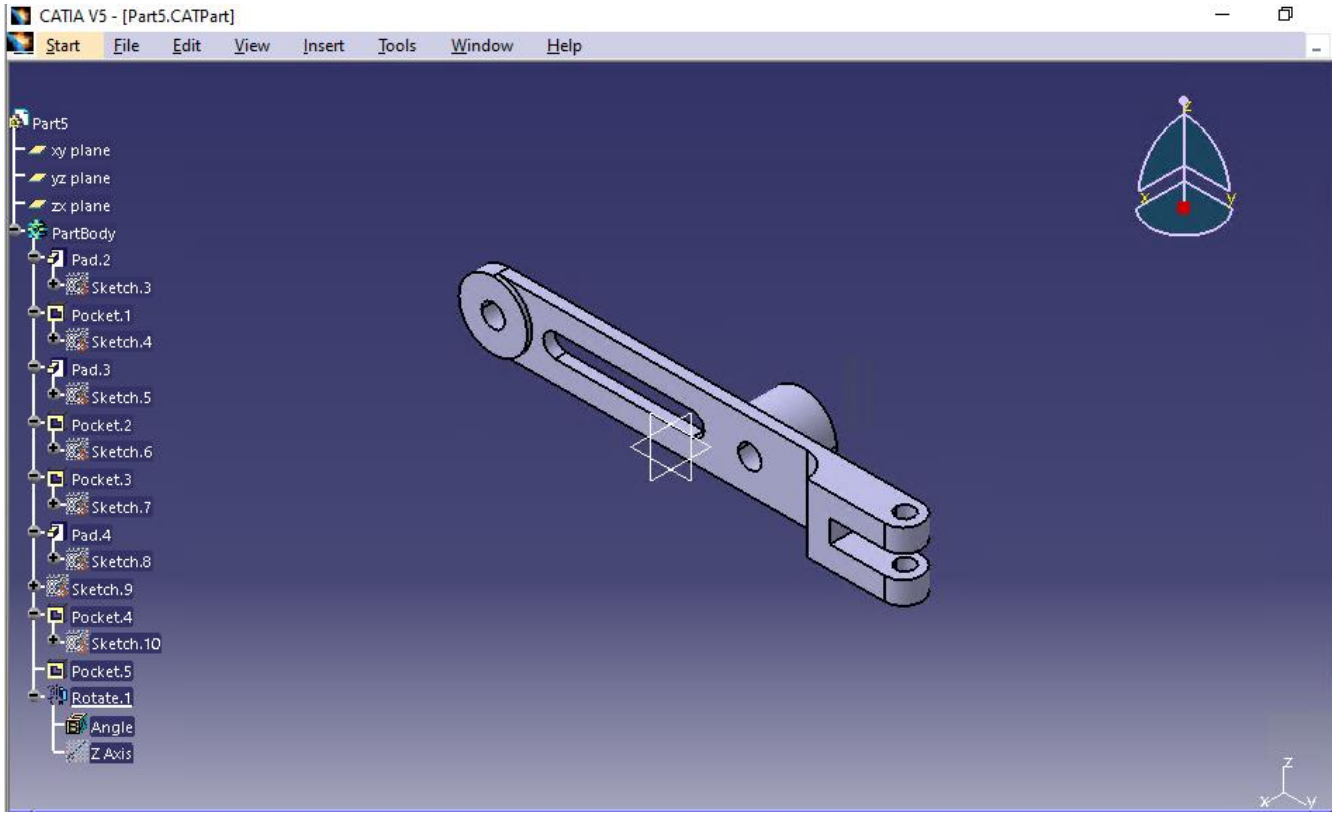


Figure 5. Rocket Arm (CATPart)

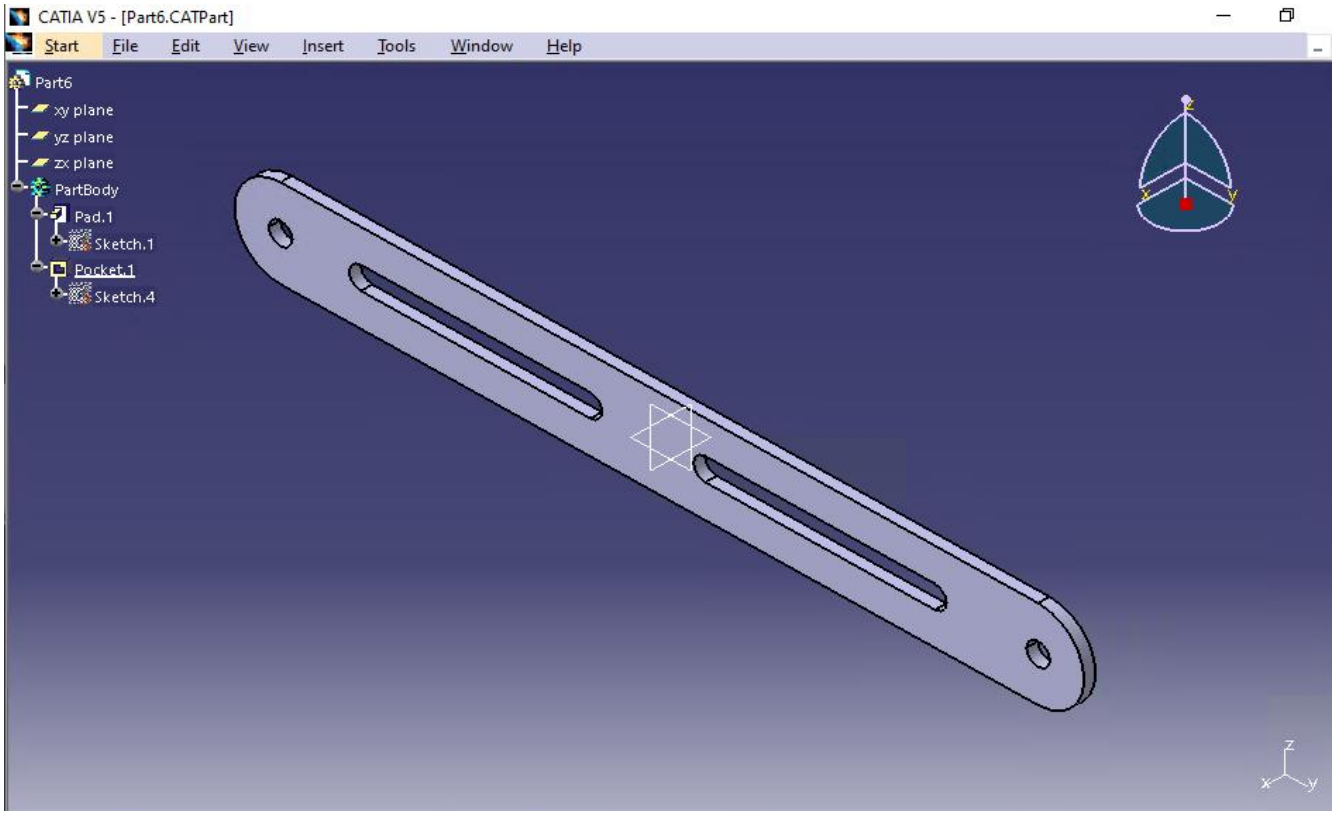


Figure 6. Connector Link (CATPart)

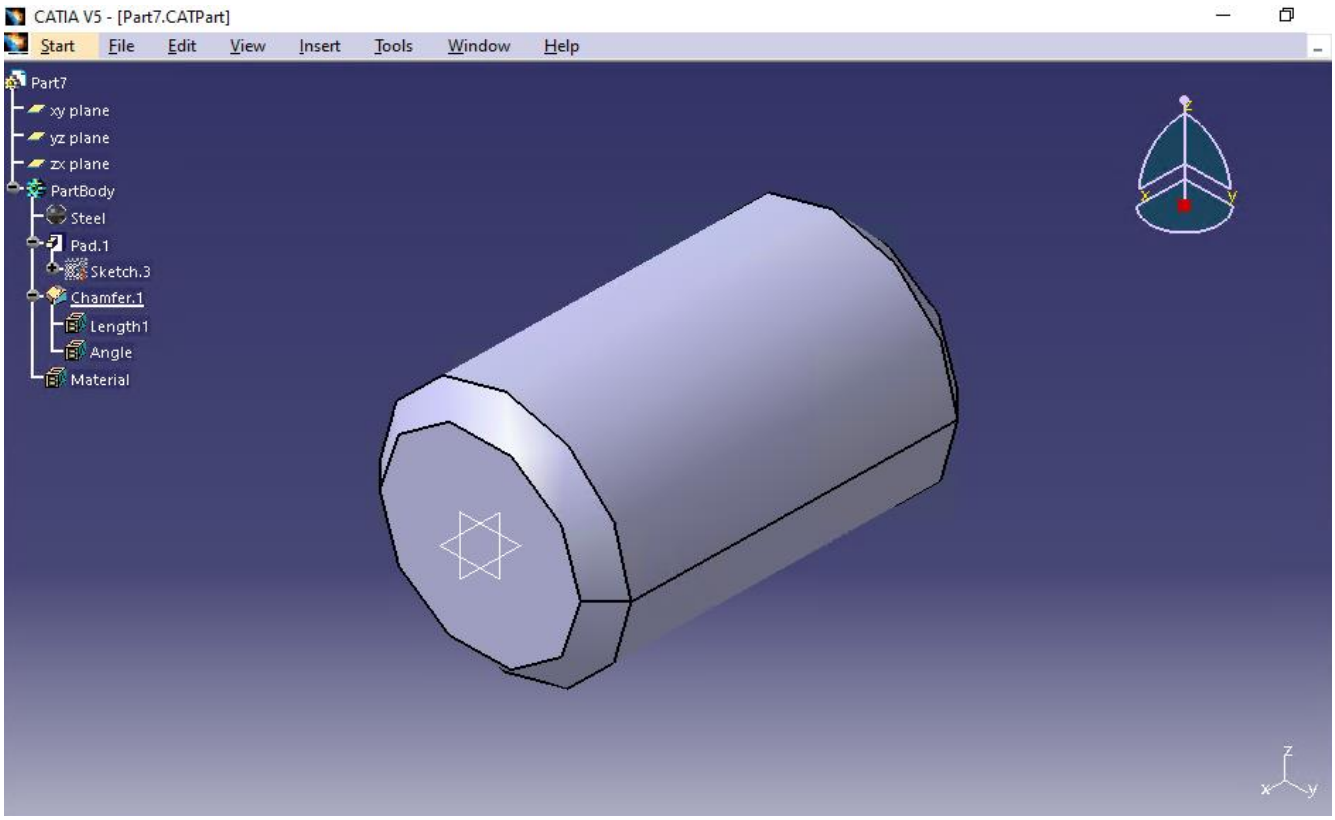


Figure 7. Pin A (CATPart)

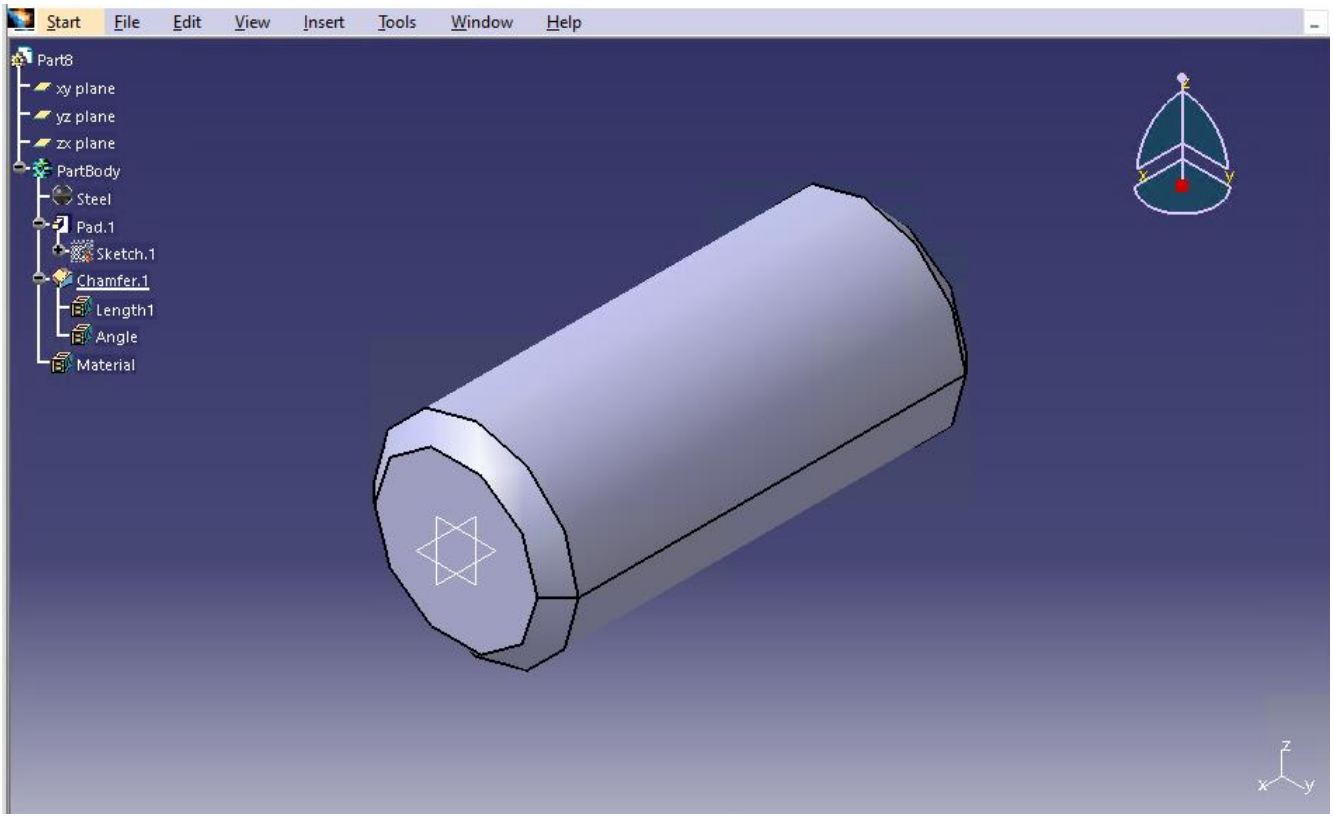


Figure 8. Pin B (CATPart)

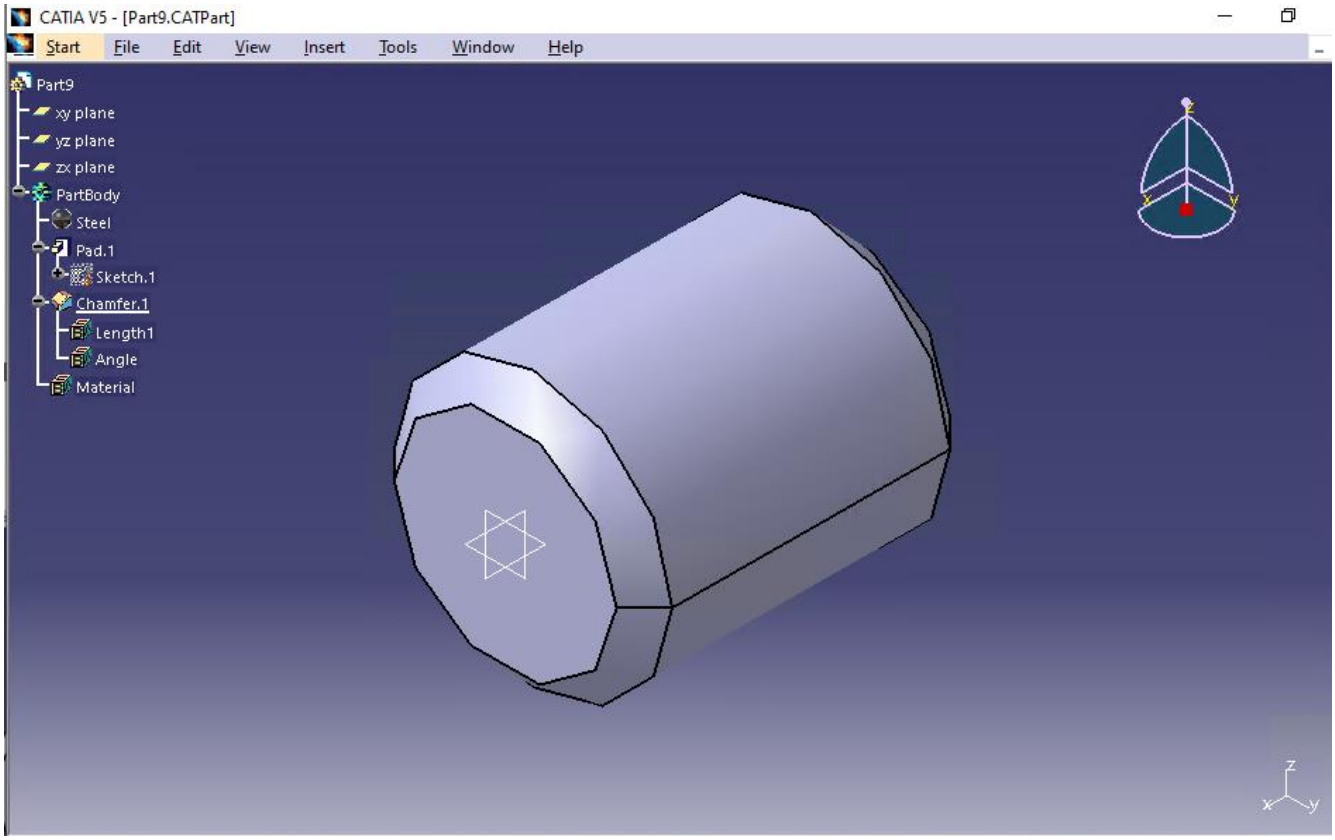


Figure 9. Pin D (CATPart)

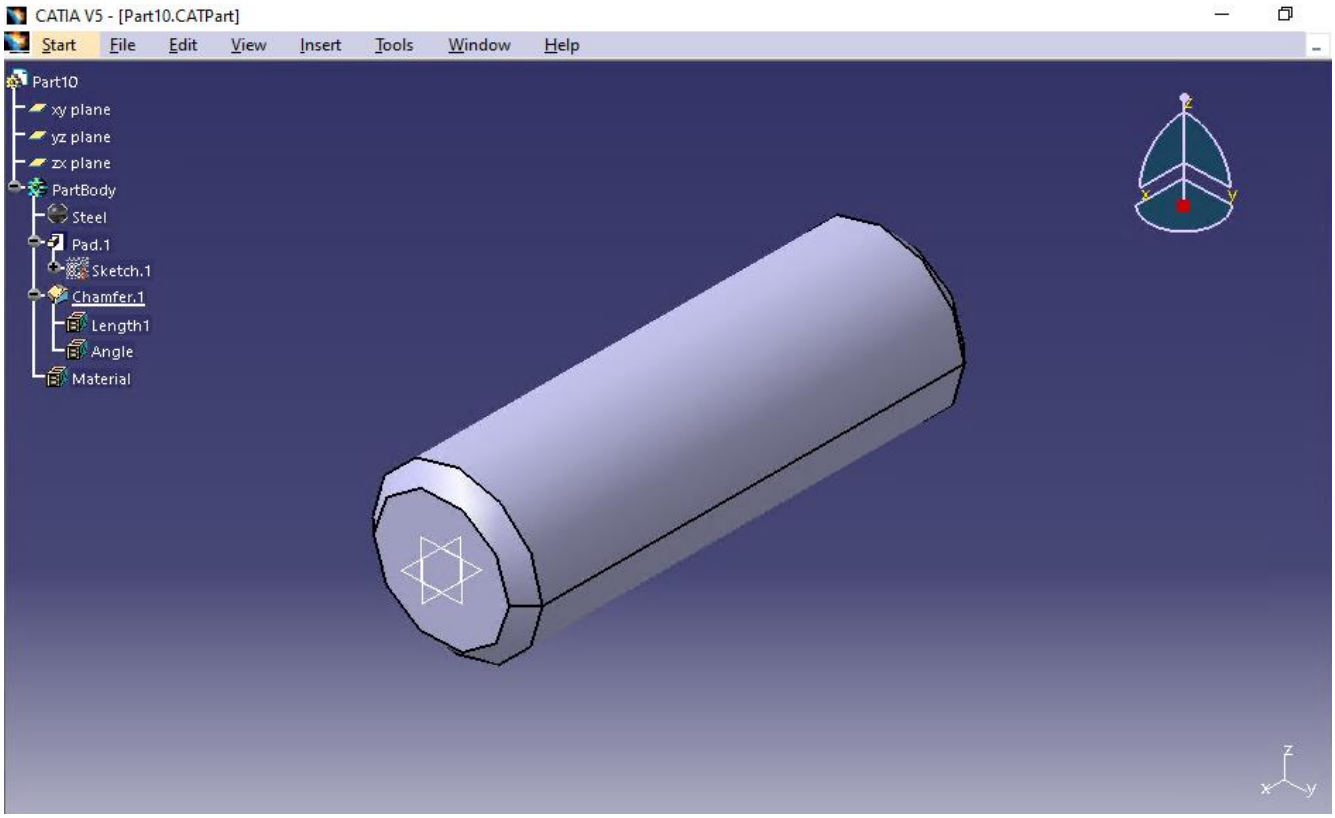


Figure 10. Pin C (CATPart)

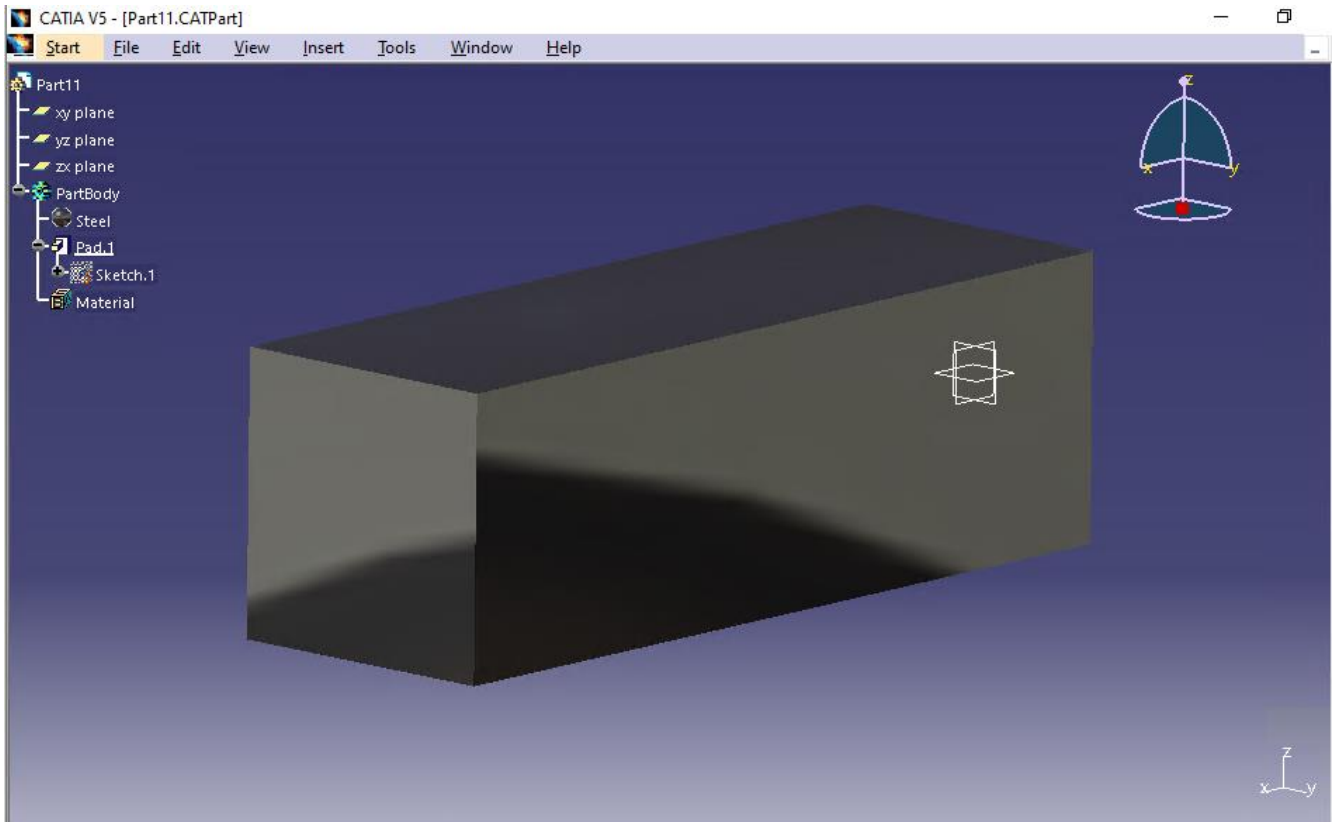


Figure 11. British Square Key (CATPart)

2.3 Detail drawings (CAT Drawing) for each non-standard part in the assembly:

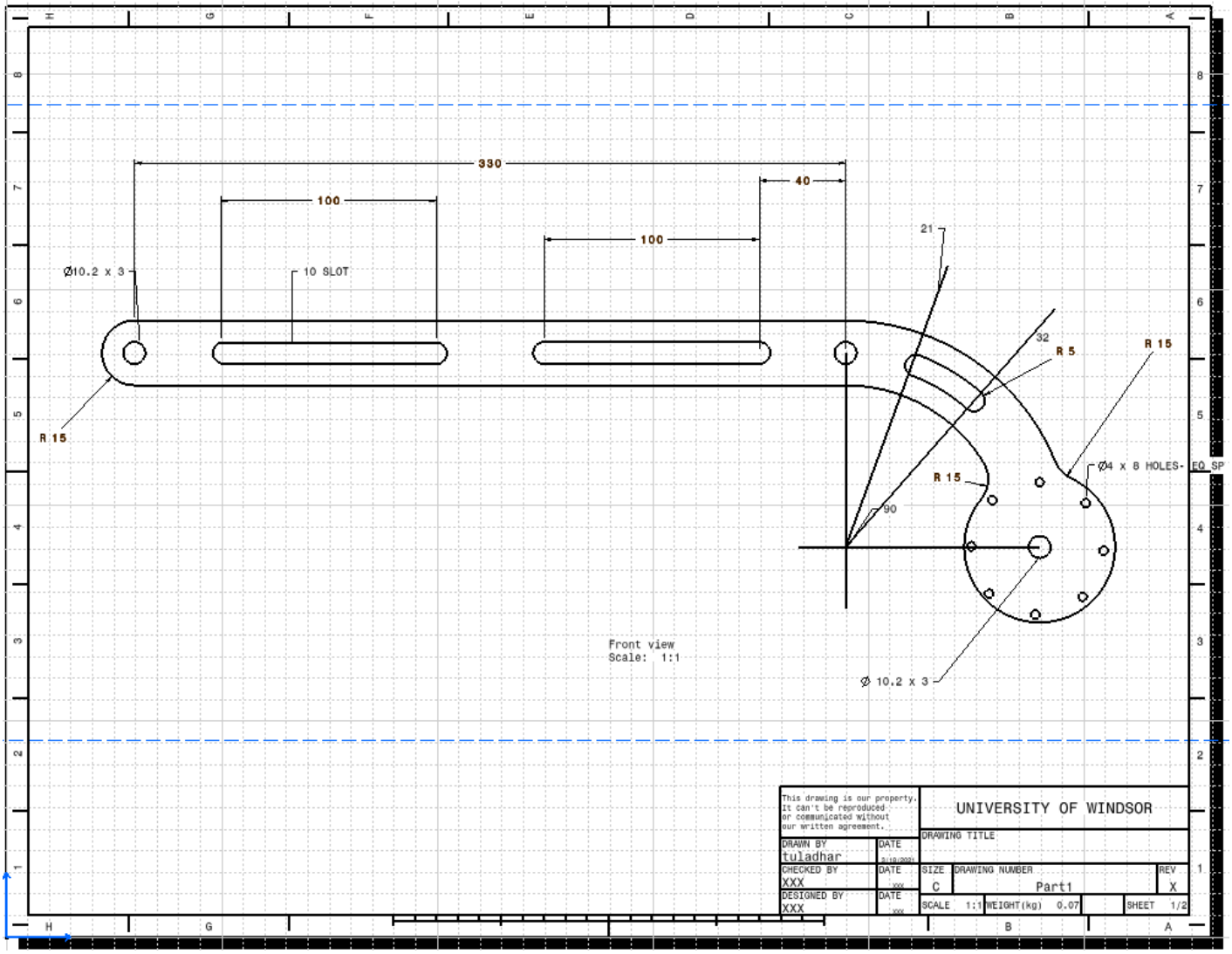


Figure 12. Wiper Frame (CATDrawings)

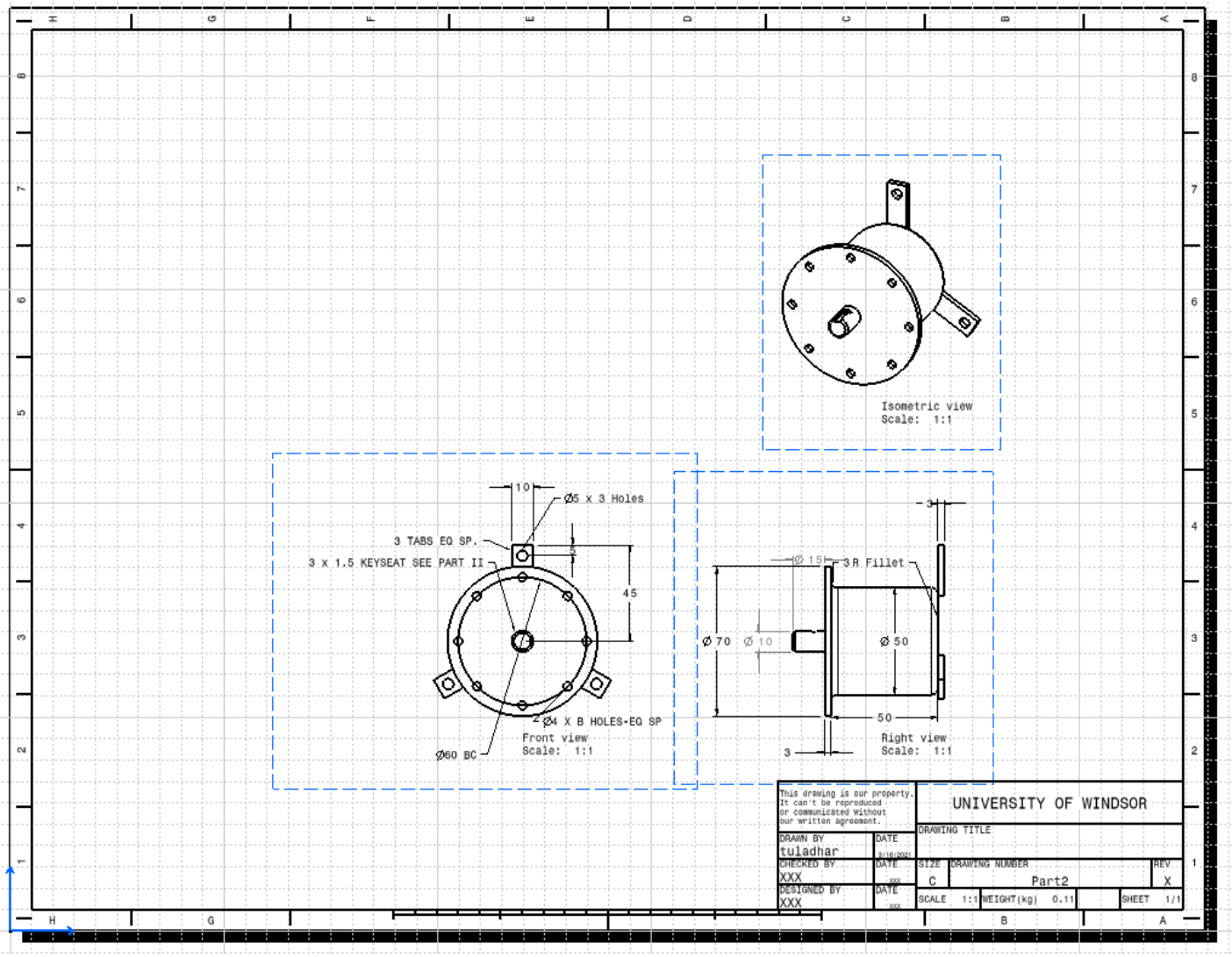


Figure 13. Motor Housing (CATDrawings)

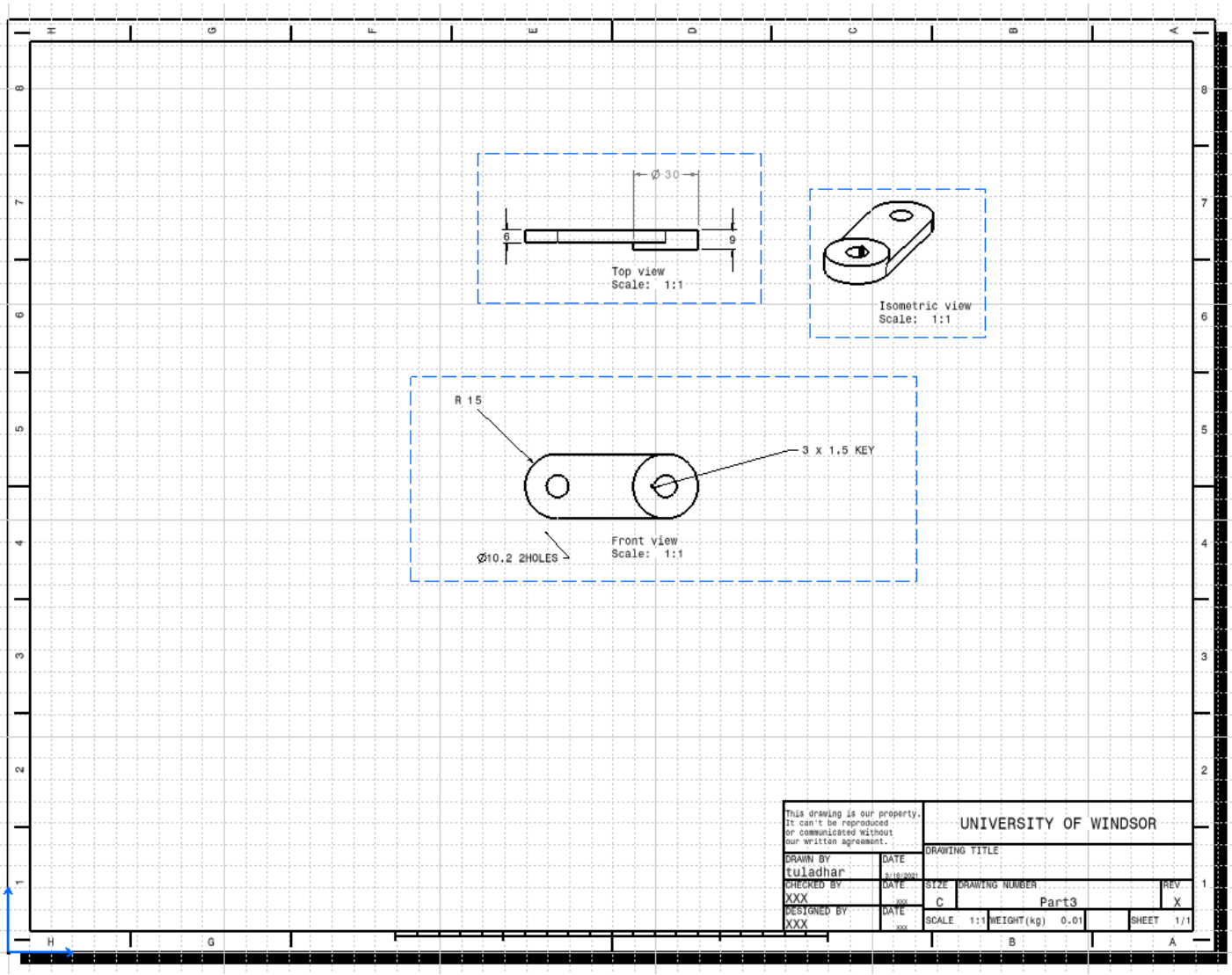


Figure 14. Motor Arm (CATDrawings)

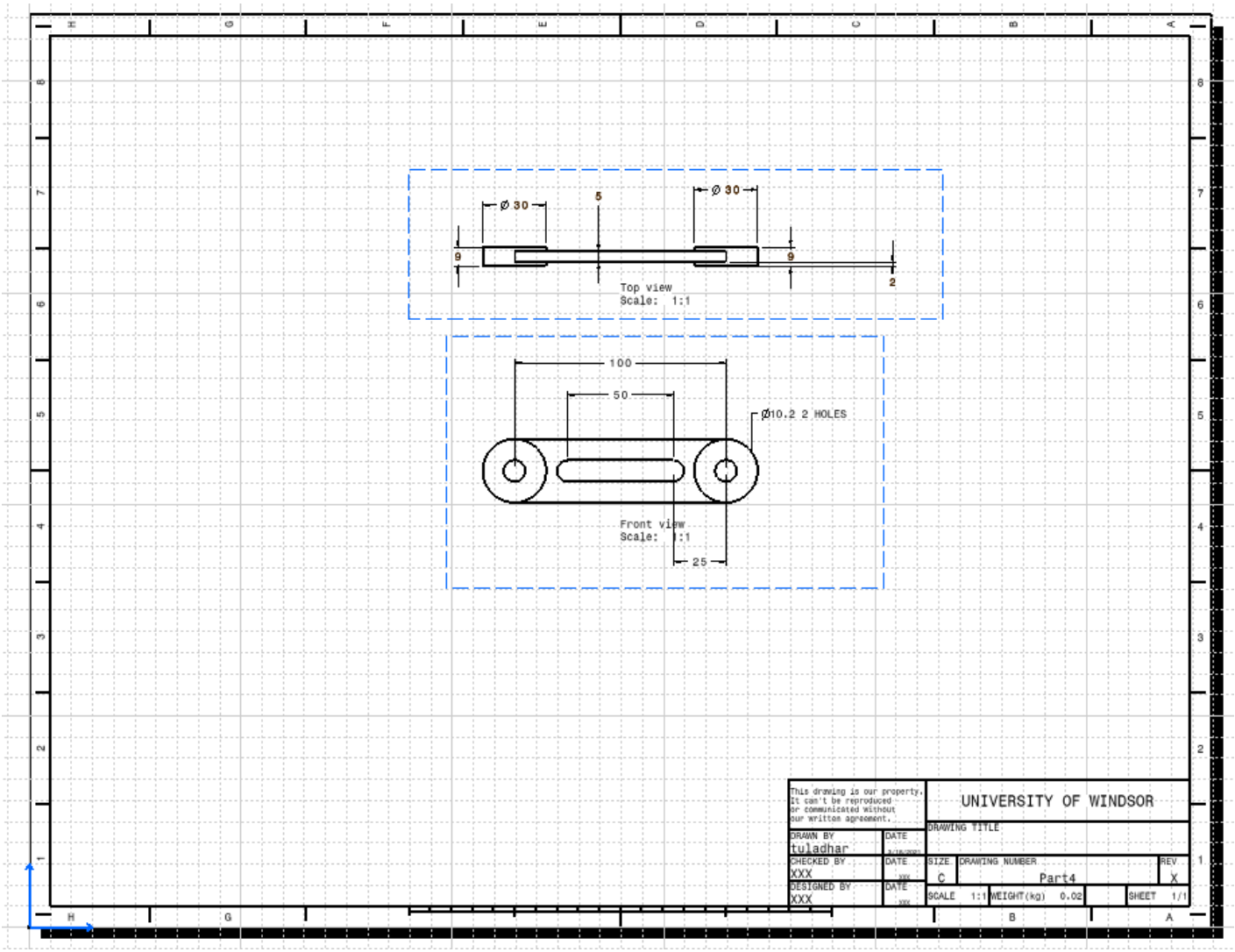


Figure 15. Drive Link (CATDrawings)

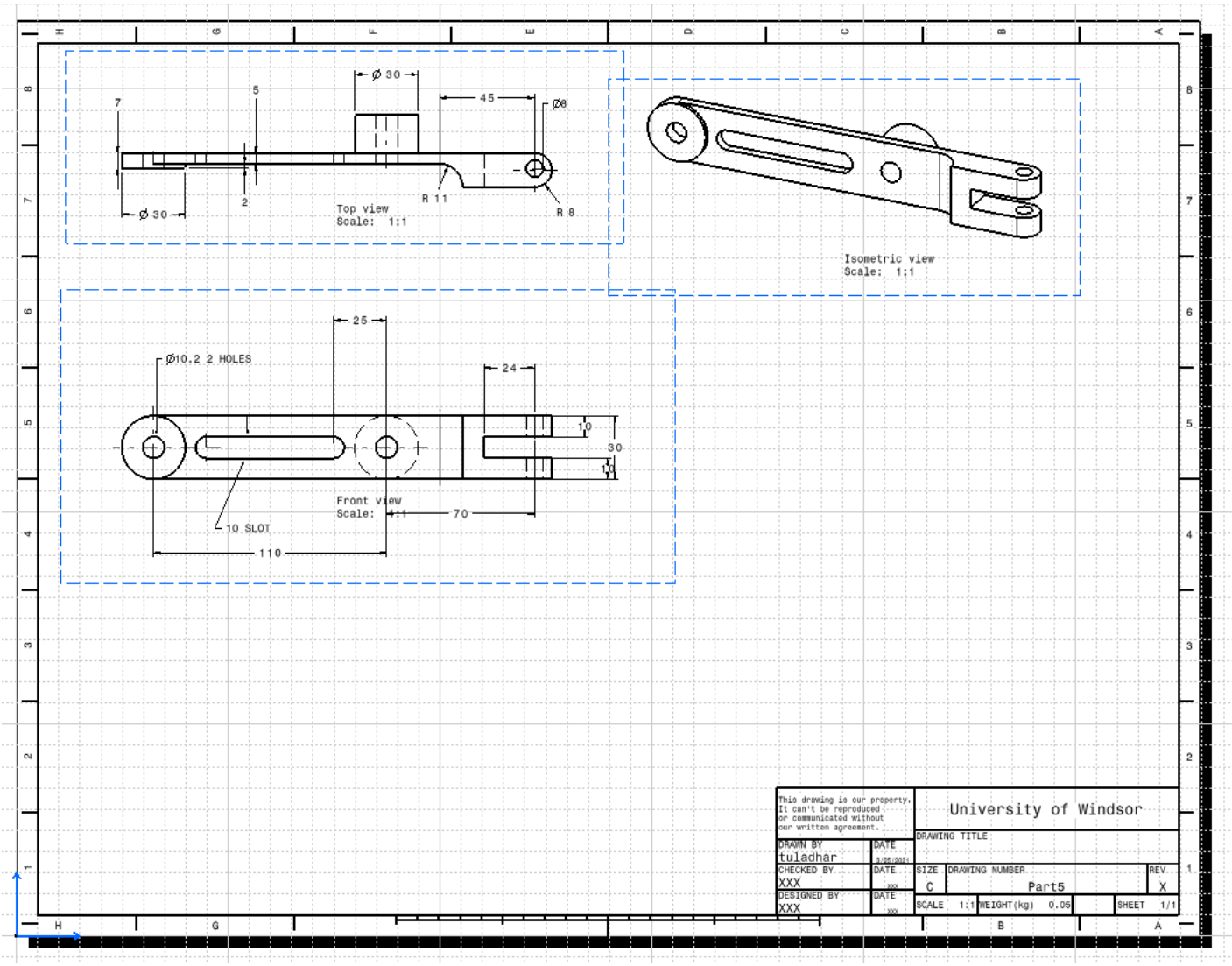


Figure 16. Rocket Arm (CATDrawings)

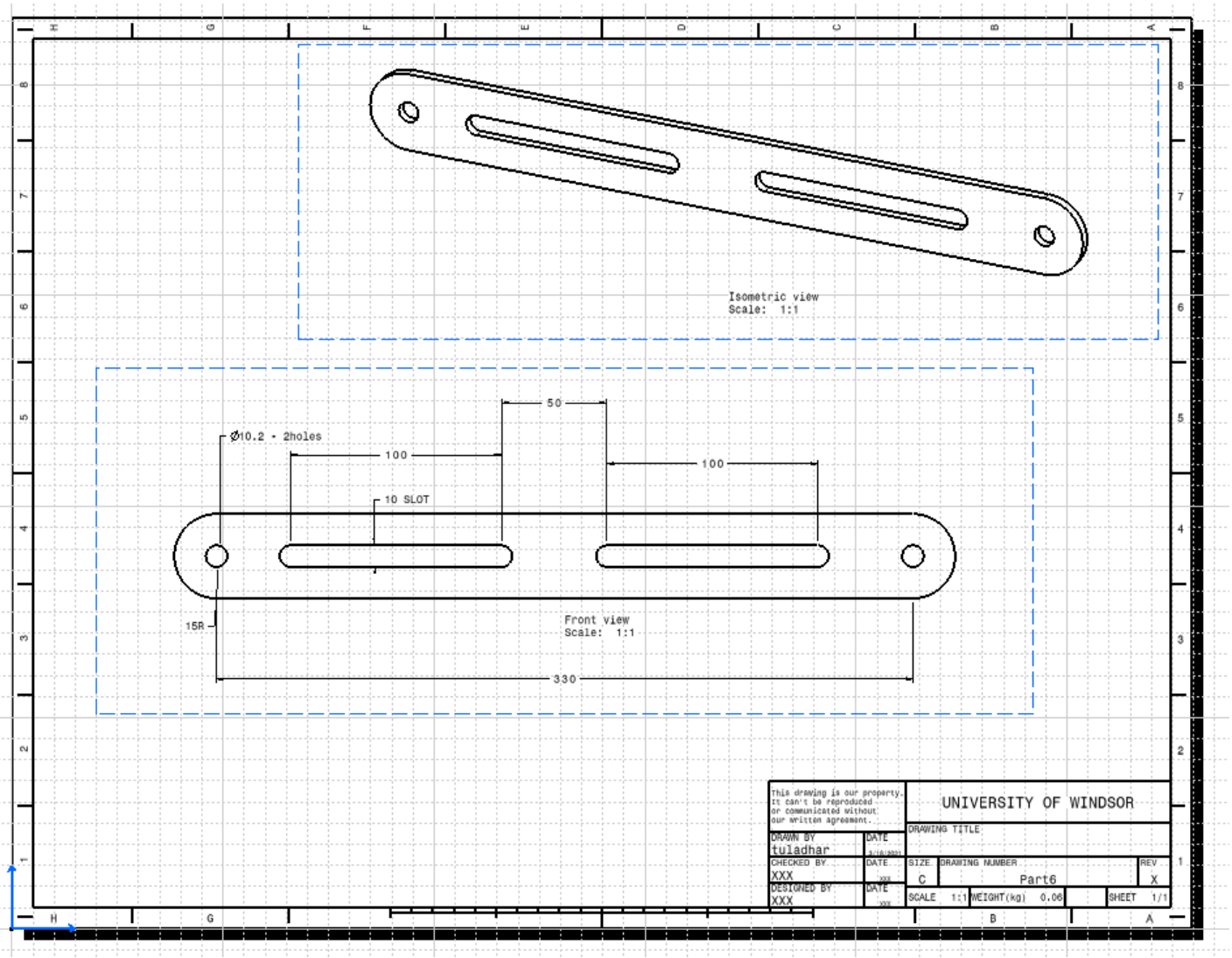


Figure 17. Connector Link (CATDrawings)

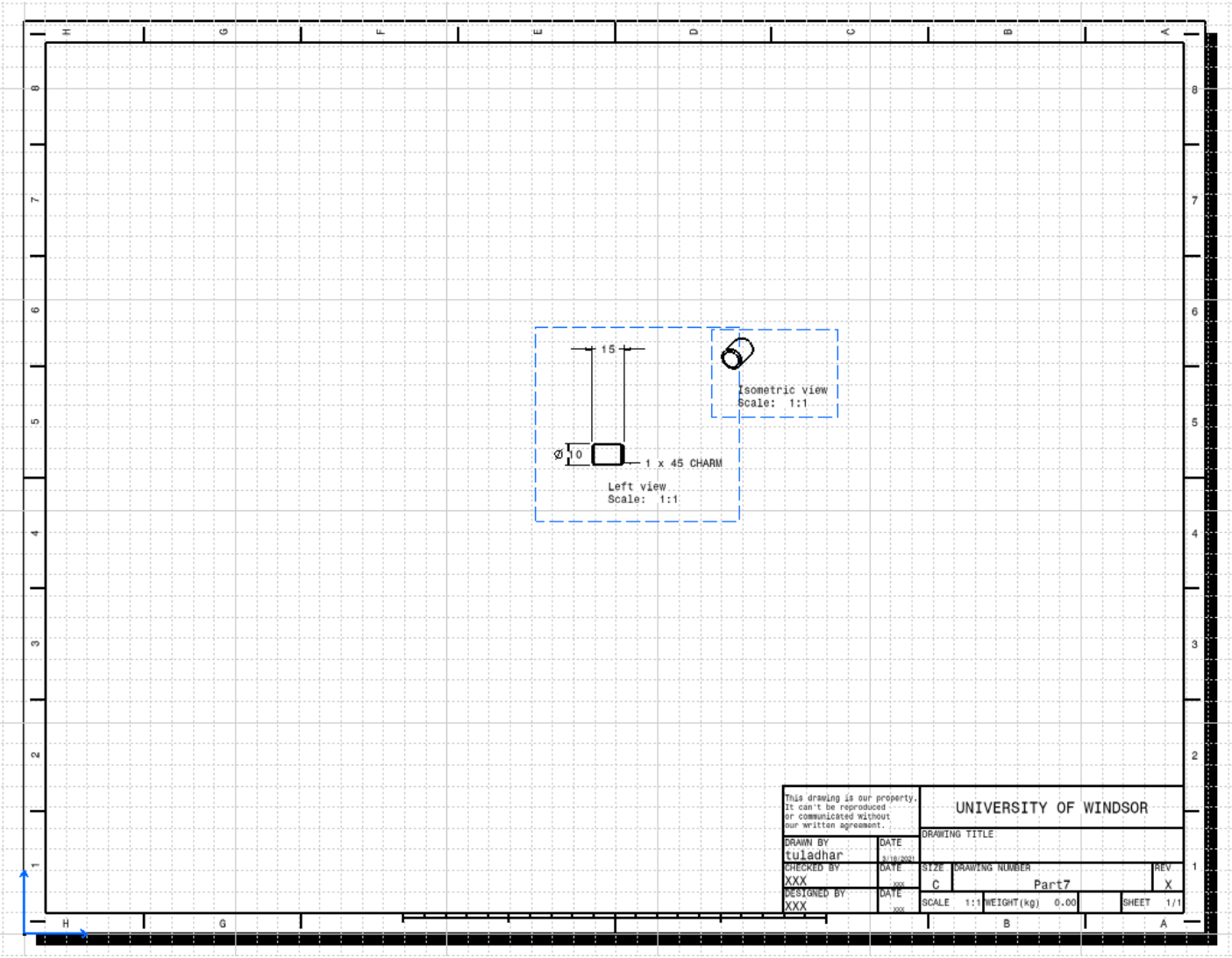


Figure 18. Pin A (CATDrawings)

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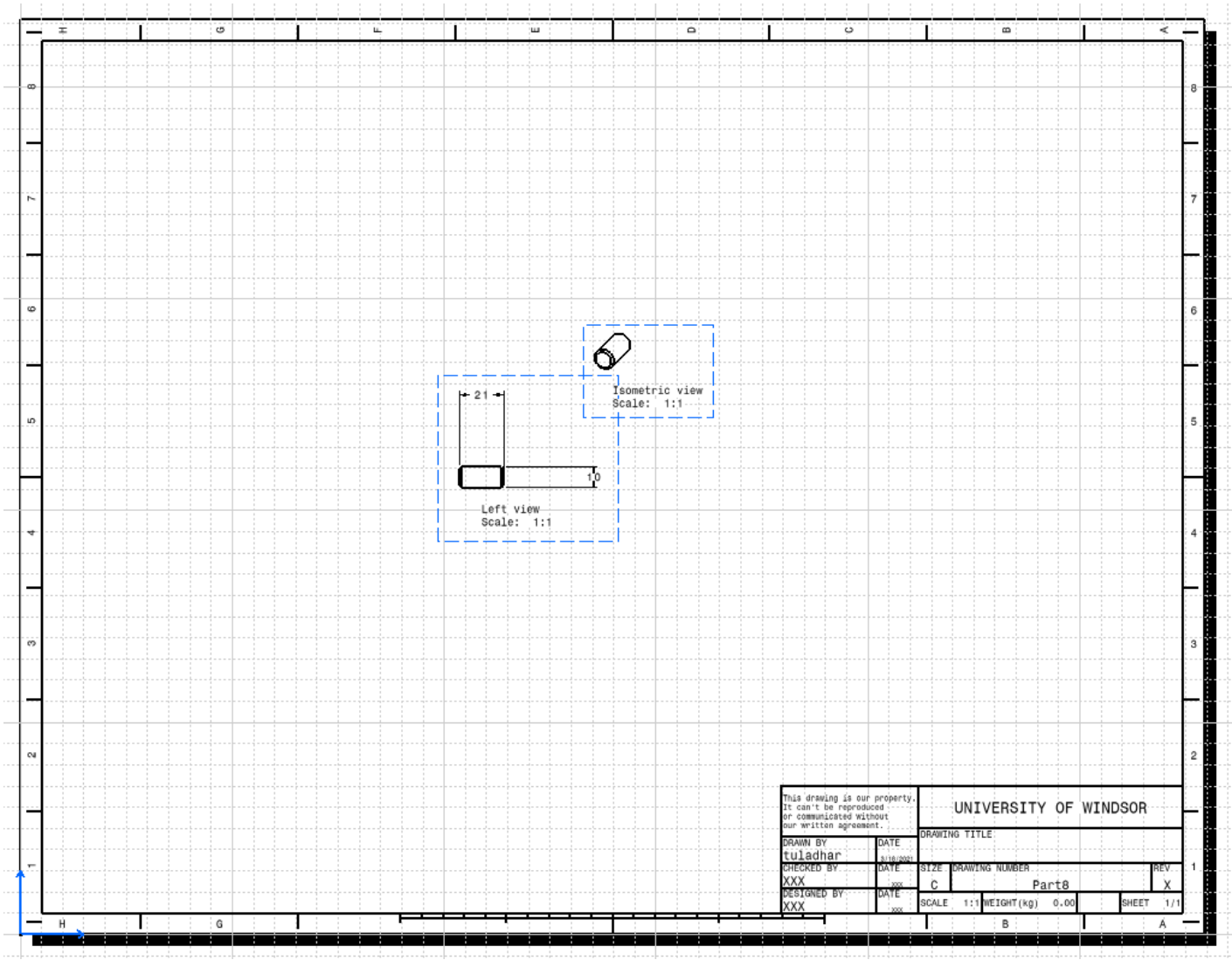


Figure 19. Pin B (CATDrawings)

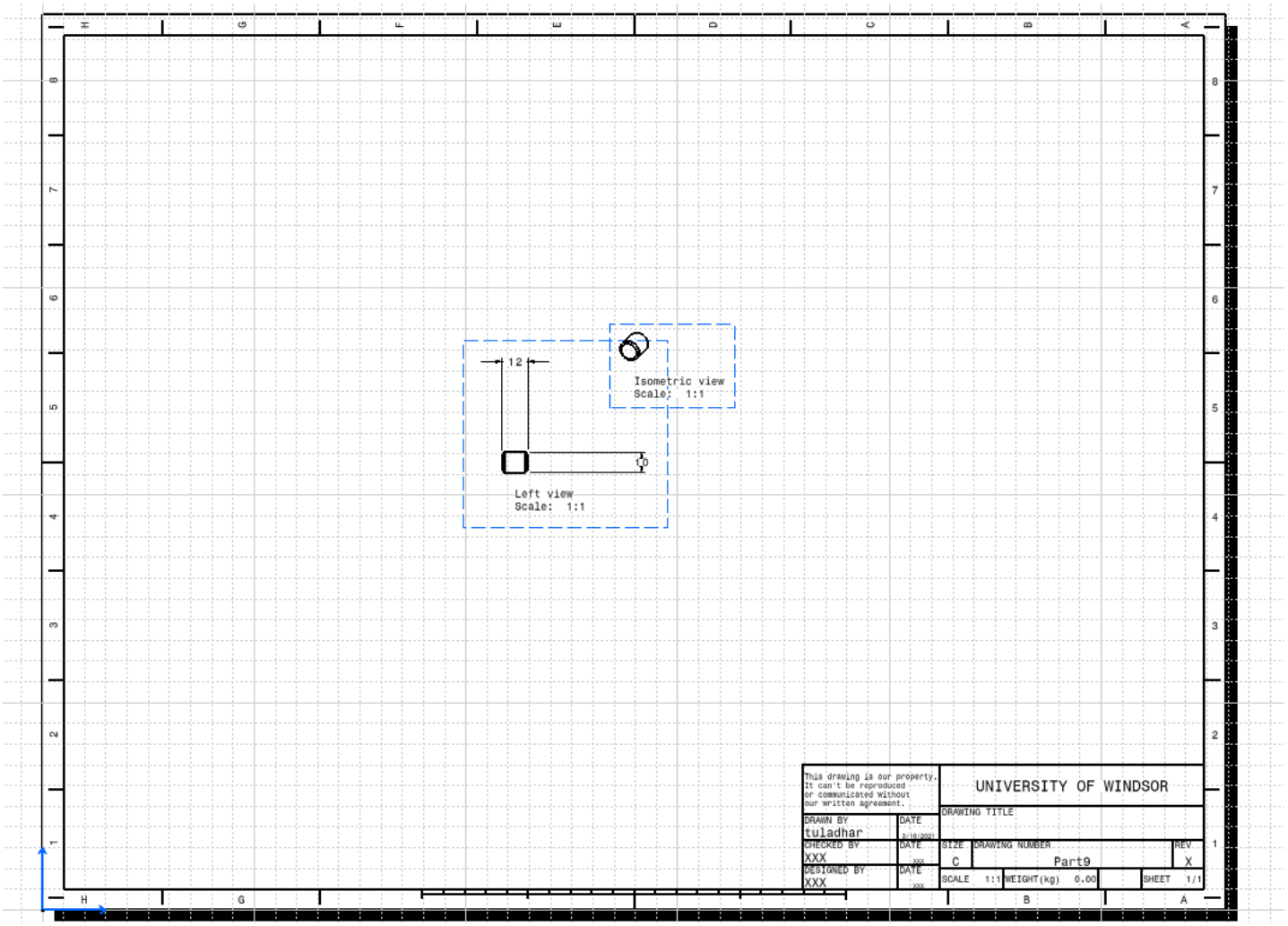


Figure 20. Pin C (CATDrawings)

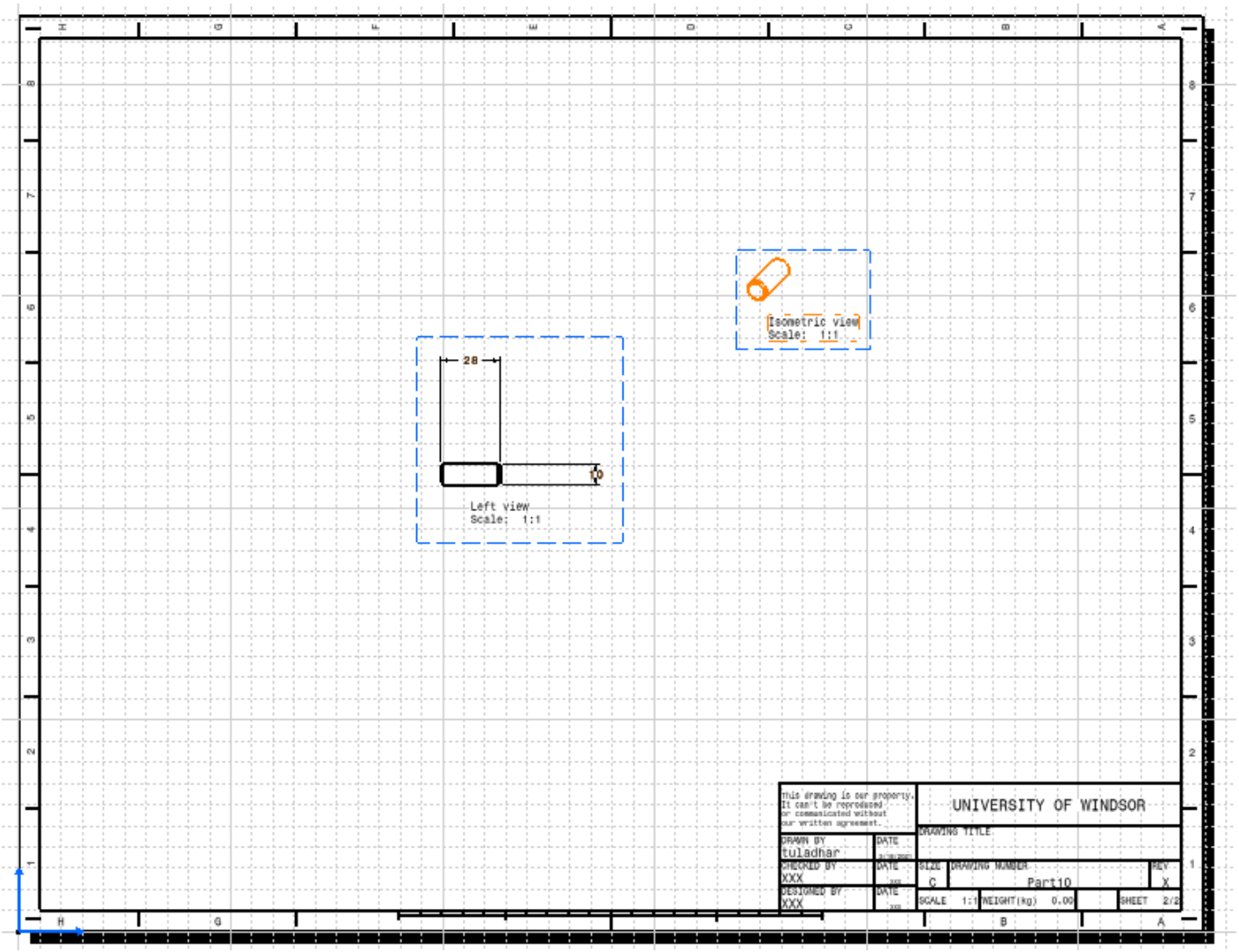


Figure 21. Pin D (CATDrawings)

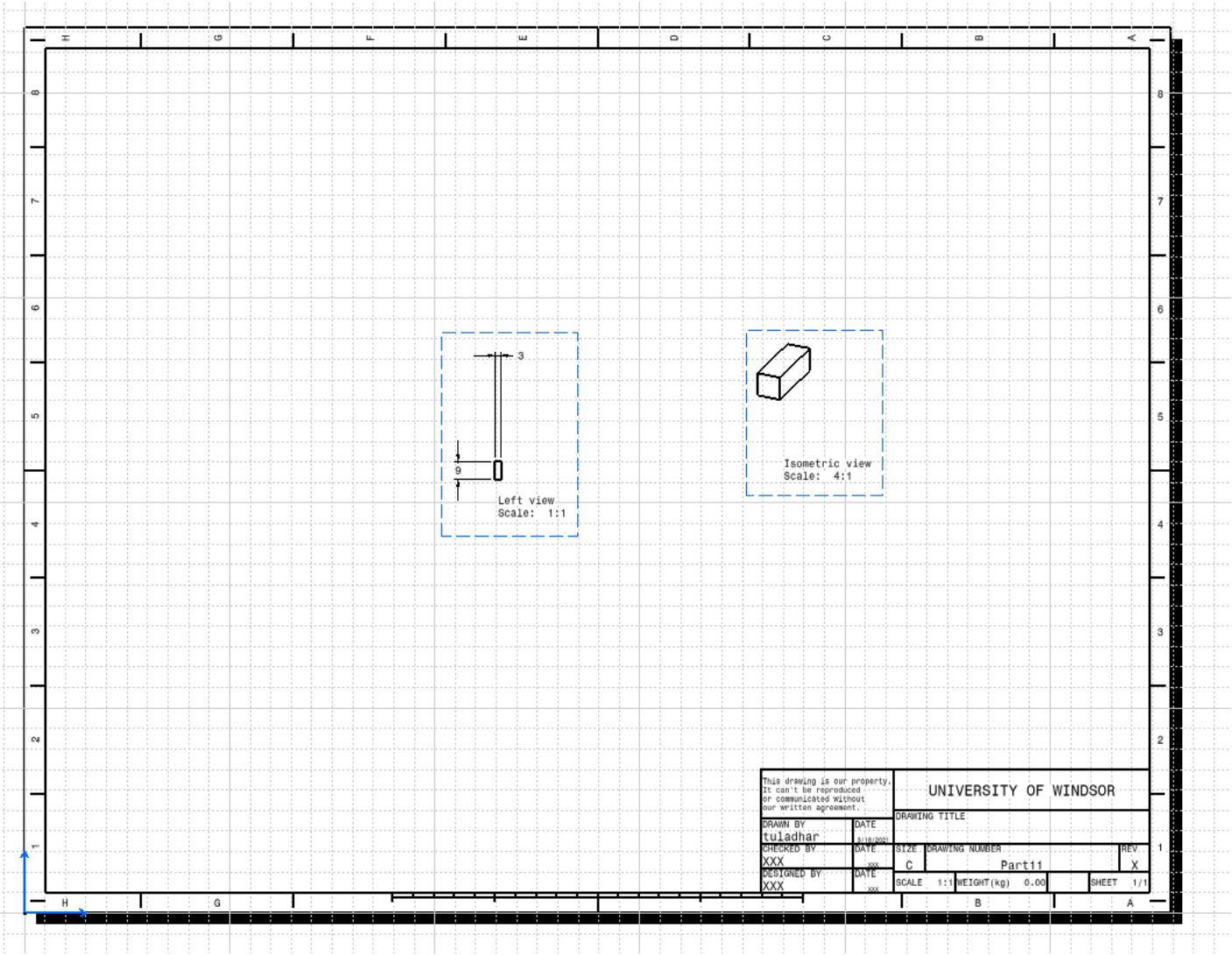


Figure 22. British Square Key (CATDrawings)

# 3. Assembly Design

## 3.1 Comments regarding CAD concepts, and CATIA tools and techniques

Wiper was created through the help of product toolbar on the assembly design part. Each part was then created one by one from the part toolbar. Various techniques like padding, pocketing and arc lengthening were performed to create each piece. Pieces which had specifications of what material was it made from were designated their kind. Edge fillets, Circular Pattern, Chamfers were some of the concepts used to create arcs and bends in each corner of the components. Similarly, After the pieces were made, by using Constraints such as Surface Constraint, parts were attached together. With the help of compass, the pieces were moved around as per the model picture provided to us. Offset Constraint was used on the axis of each hole of the arms to insert pins between them. Similarly, title block and bill of materials was created on the CATDrawings of the assembled part. Each part was given their respective names through the text toolbar on the CATDrawings. Similarly, exploded view was generated from the help of compass which separate the component from the joining constraints assigned to it.

## 3.2 3-D model for the assembly

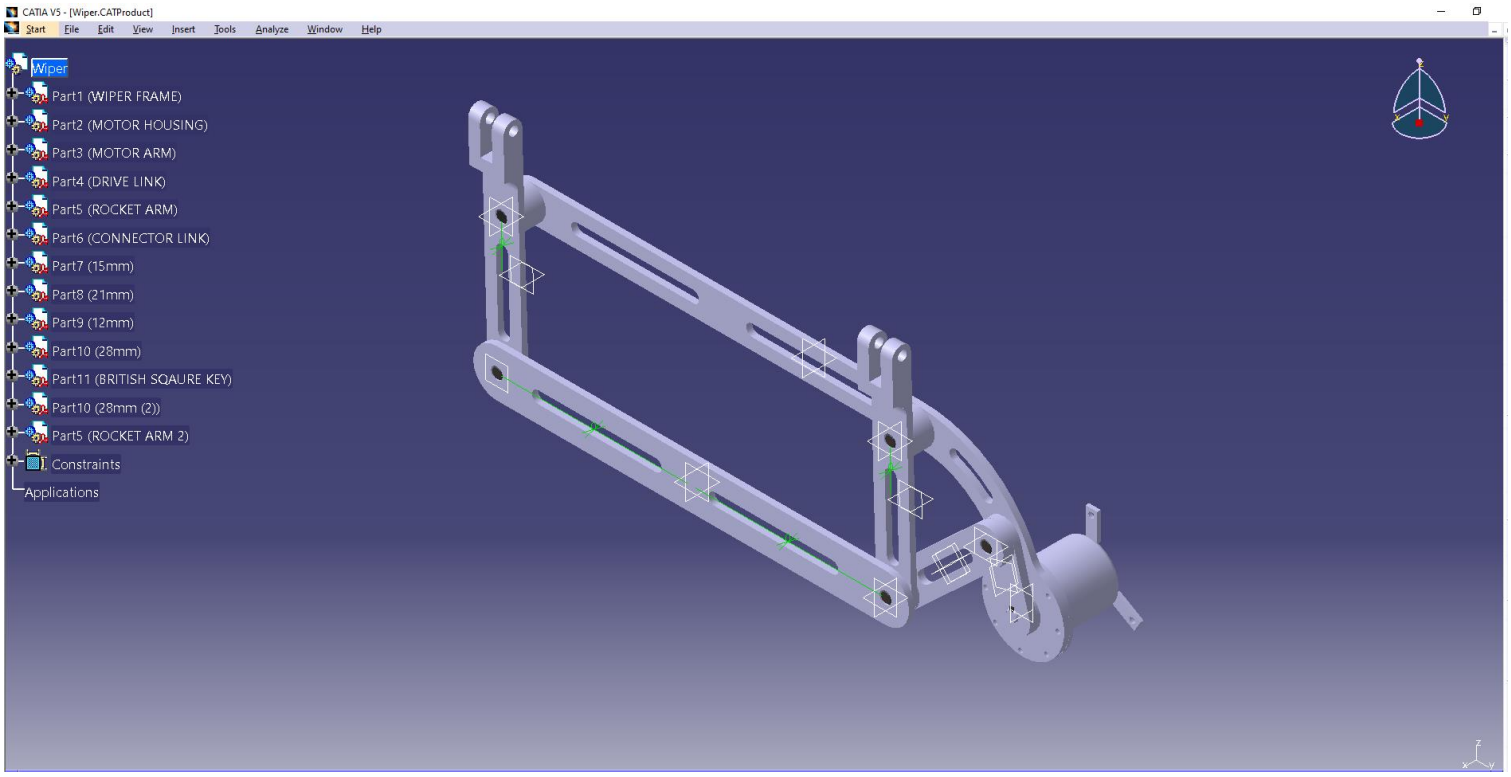


Figure 23. Operational Assembly Design of Wiper

3.3. An orthographic assembly drawing (CATDrawings), using drafting workbench

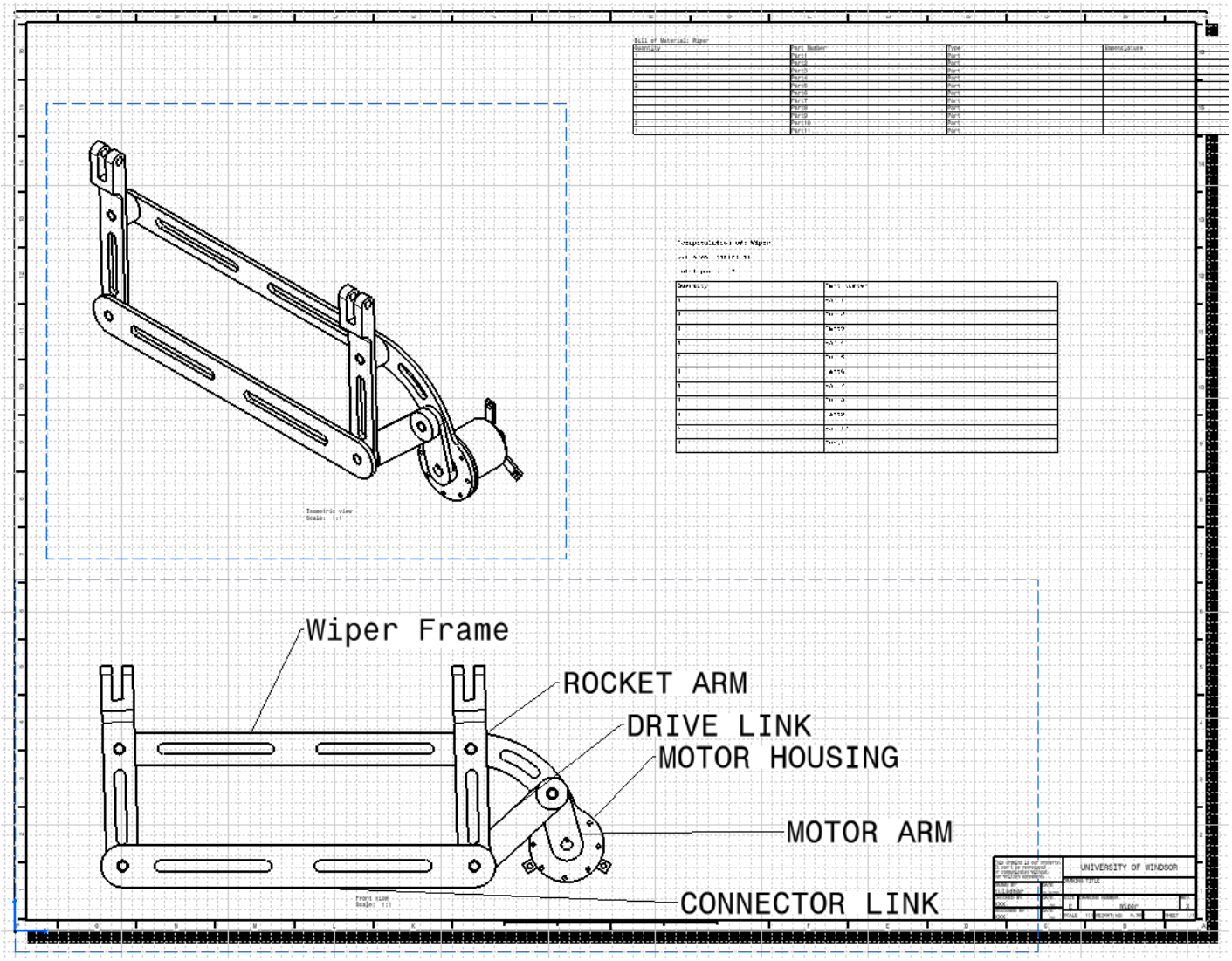


Figure 24. Assembly Design

Bill of Material: Wiper

| Quantity | Part Number | Type |
|---|---|---|
| 1 | Part1 | Part |
| 1 | Part2 | Part |
| 1 | Part3 | Part |
| 1 | Part4 | Part |
| 2 | Part5 | Part |
| 1 | Part6 | Part |
| 1 | Part7 | Part |
| 1 | Part8 | Part |
| 1 | Part9 | Part |
| 2 | Part10 | Part |
| 1 | Part11 | Part |

Figure 25. Bill of Materials

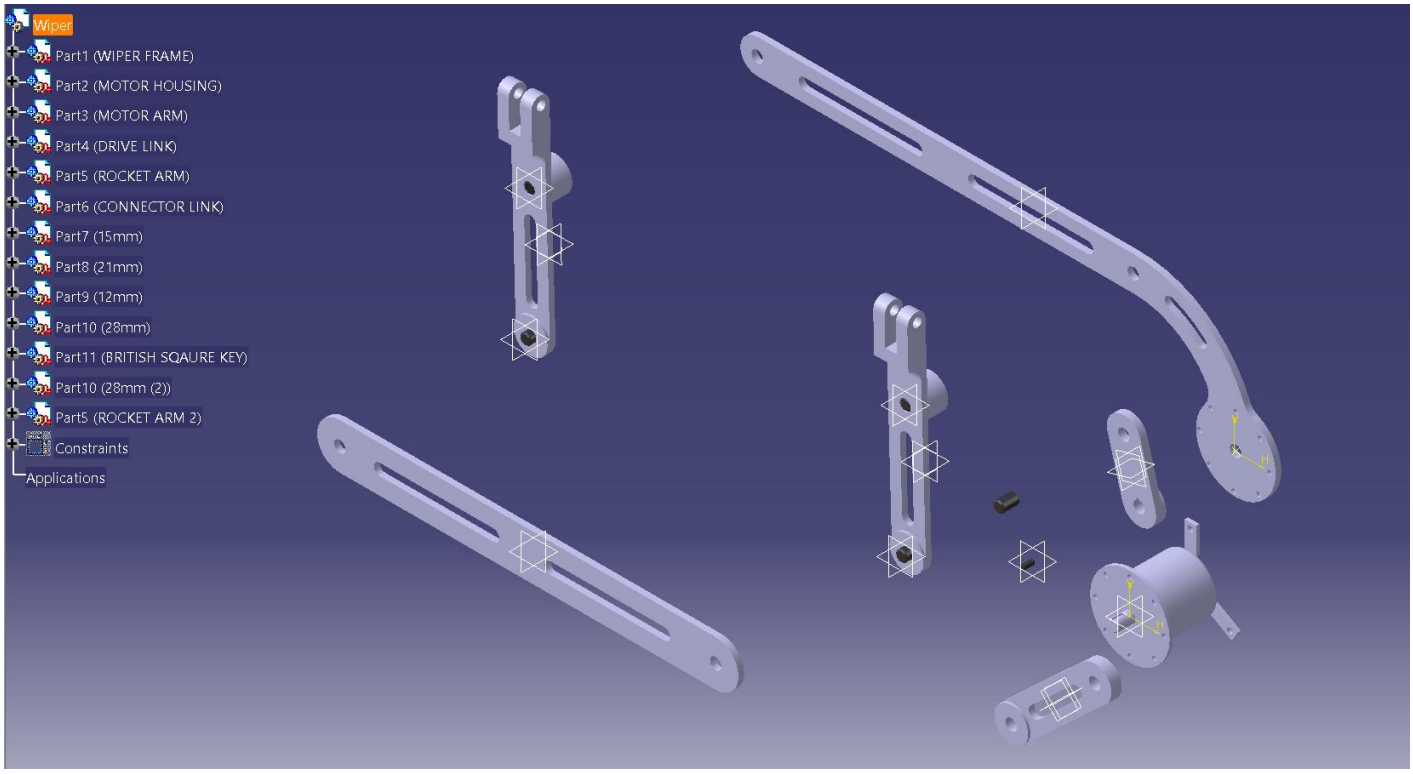


Figure 26. Exploded View of the Wiper

## 4. Conclusions/reflections:

Thus, by using the engineering concepts such as constraining/dimensioning, isometric views and auxiliary views concept, bill of materials, and the offsetting, the final assembled and orthographic view of the wiper mechanism was created. The experience and skills gained from the Labs and Tutorials were used in this project to create the precise design of the project. As mentioned earlier, each component was first created on the assembly design and was given thickness using the pad toolbar, then these components were all connected using the constraint toolbar and exploded with the use of the compass. Similarly, constrain toolbar provided necessary assembling feature to produce a design from each component to an operational assembly wiper. After the assembly design was created, the assembled design of the final product as well as each component were then drafted to create its orthographic view. The orthographic view was constraint using the transformation toolbar. Each component of the wiper was given its respective names, such as wiper Frame, motor housing, drive link and so on.

Exploded view, title block and the bill of material was added to the orthographic view of the operational assembled body. Thus, from this project, we have learnt how is an engineering design or tool is created on computers and how are they explained and structured so that the viewers get the most convenient way of looking at it. Through the help of constraints, we have come to know if the design if it can exist in the real-life scenario. Through this project, I reflected upon all the practices that I did during my laboratory and exercise and utilized them all to create such important engineering design in a car system.

# 5. REFERENCES

1. Kirstie Plantenberg, An Introduction to CATIA V5 release 19 (A Hands-On Tutorial Approach), Schroff Development Corp. (SDC) Publications

2. Windshield wiper. (n.d.). Retrieved March 25, 2021, from http://www.madehow.com/Volume-7/Windshield-Wiper.html