**Universidade de Coimbra**

*Departamento de Engenharia Mêcanica*

*Bachelor's Degree in Mechanical Engineering*

# Final Report

# Exercise Bike

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# Summary

# Introduction

This present work was developed with the intention of recreating an exercise bike using the CAD (Computer Aided Design) software SOLIDWORKS® 2020, using as a basis a real model of an exercise bike, namely the HC 3015 model from the Kikos® brand.


*Figure 1: Kikos® HC 3015 Exercise Bike*

In this regard, in the assembly, all electronic elements were removed, and some simplifications were made to certain mechanical components of the bike, such as the absence of axles and bearings inside the pedals. Therefore, the assembly in its final form consists of a total of 27 non-standardized parts distributed among the group members according to the complexity of each part.

Finally, the work also includes various calculations performed by the group necessary for the correct modeling of the exercise bike, such as tolerancing of some measurements to ensure precise component adjustments. Thus, the final version of the exercise bike, although it does not include all the features required for its real-world operation, ensures the stability of the assembly structure.

# 1. Project Development

The group responsible for carrying out this project consists of 4 members, namely Felipe Tassari Aveiro (2020218786), Afonso da Silva Pereira (2020222413), Mariana Pinheiro de Andrade (2020229859), and Vasco Tafiiv Soares (2020215734). From this perspective, the group discussed various possibilities for how the exercise bike would be made, due to the difficulty faced mainly because of the lack of a technical drawing containing measurements and other specifications of the assembly. This fact highlighted the importance of having a precise and complete technical drawing of the assembly for the correct manufacture of this equipment; however, after much research, the team found a model of a bike that served as the basis for the project.

## 1.1. Recreation of the real model

The assembly created by the group was based on the model of the Kikos® HC 3015 exercise bike, since the "User Manual" of the product is available online at https://docplayer.com.br/21284871-Manual-do-usuario-bicicleta-ergometrica-hc-3015.html. In this regard, this manual provided more detailed information about the parts involved in the assembly of the bike, as can be seen in Figure 2:

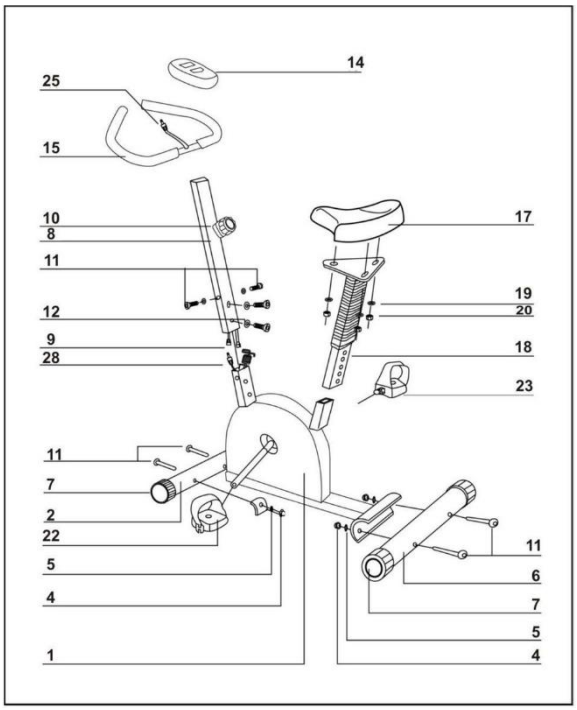



*Figure 2: Listing of parts for the Kikos® HC 3015 model*

After a joint analysis of the manual, it was concluded that several changes would be necessary to ensure the complete assembly of the bike. As a result, some alterations were made, including: dividing the main structure into 3 components to ensure coherence in its assembly and partitioning the structure so that these components were composed of different materials (SOLIDWORKS® 2020 software allows the use of only one type of material for each part); removal of electronic components from the assembly; creation of an element responsible for holding the 3 components of the main structure together (referred to as a joint); absence of axle and bearing in the pedals; etc.

### 1.2. Enumeration of parts

The final version of the bike consists of a total of 27 non-standardized parts, with the tasks delegated among the members to divide them by complexity, while ensuring a minimum of 4 parts for each member. From this perspective, an Excel® spreadsheet was created to organize the responsibility for making each member's parts. Additionally, the spreadsheet also served as a means of communication for the group by indicating the progress of each part's construction, and therefore, it was updated as the project progressed. The final version of the spreadsheet can be seen in Figures 3, 4, and 5:

| Felipe | | Vasco | |
|---|---|---|---|
| Main structure 1 | √ | Front support 1 | √ |
| Main structure 1' | √ | Front support 2 | √ |
| Main structure 2 | √ | Saddle support 1 | √ |
| Handlebar | √ | Saddle support 2 | √ |
| Handlebar foam | √ | Saddle | √ |
| Handlebar locking pin | √ | | |
| Handlebar cap | √ | | |
| Joint | √ | | |

*Figure 3: Felipe and Vasco assigned Parts*

| Afonso | | Mariana | |
|---|---|---|---|
| Front stabilizer | √ | Crank | √ |
| Rear stabilizer | √ | Chainring | √ |
| Front cap | √ | Right pedal | √ |
| Rear cap | √ | Left pedal | √ |
| | | Adjustment pin | √ |
| | | Spring | √ |
| | | Strap | √ |
| | | Chain (part 1) | √ |
| | | Chain (part 2) | √ |
| | | Freewheel | √ |

*Figure 4: Afonso and Mariana assigned Parts*

| | | | |
|---|---|---|---|
| **Total of parts (Felipe):** | 8 | **Legend:** | |
| **Total of parts (Vasco):** | 5 | X | Nothing done |
| **Total of parts (Afonso):** | 4 | √** | 2D and part matching missing |
| **Total of parts (Mariana):** | 10 | √* | 2D missing |
| **Total of parts:** | 27 | √ | All done |

*Figure 5: Spreadsheet legend*

## 2. Project execution

After the proper allocation of parts to each team member, the stage of manufacturing the components commenced. In this regard, to have a better understanding of the bike's dimensions and the proportion of other parts, the first components to be modeled were the 3 parts comprising the main structure of the assembly. Therefore, the technical drawings of each part and the calculations necessary for the selection of standardized elements are presented below:

## 2.1. Technical drawings

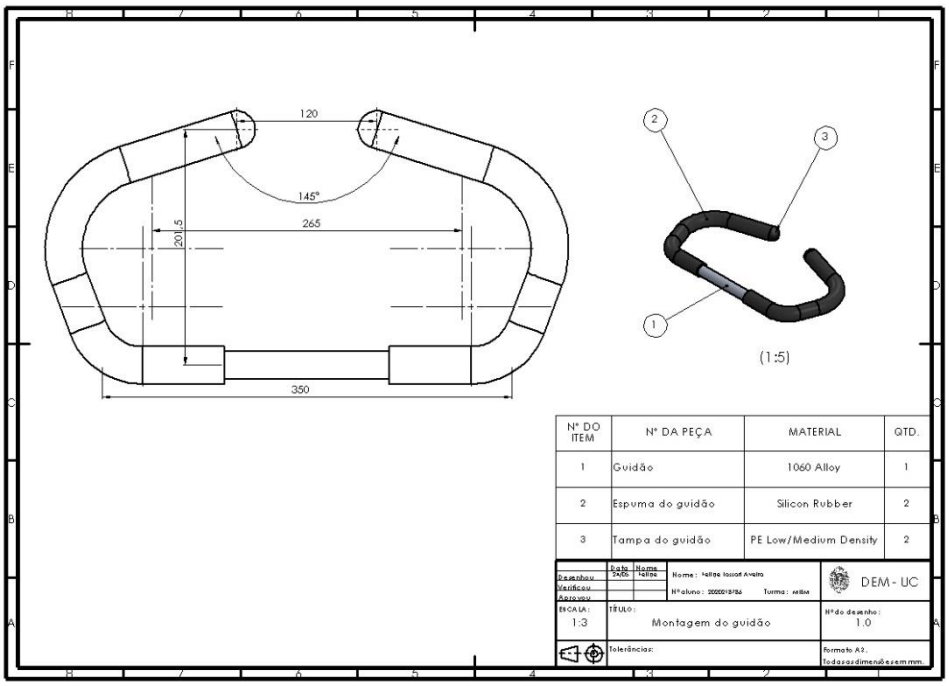



*Figure 6: Handlebar assembly*

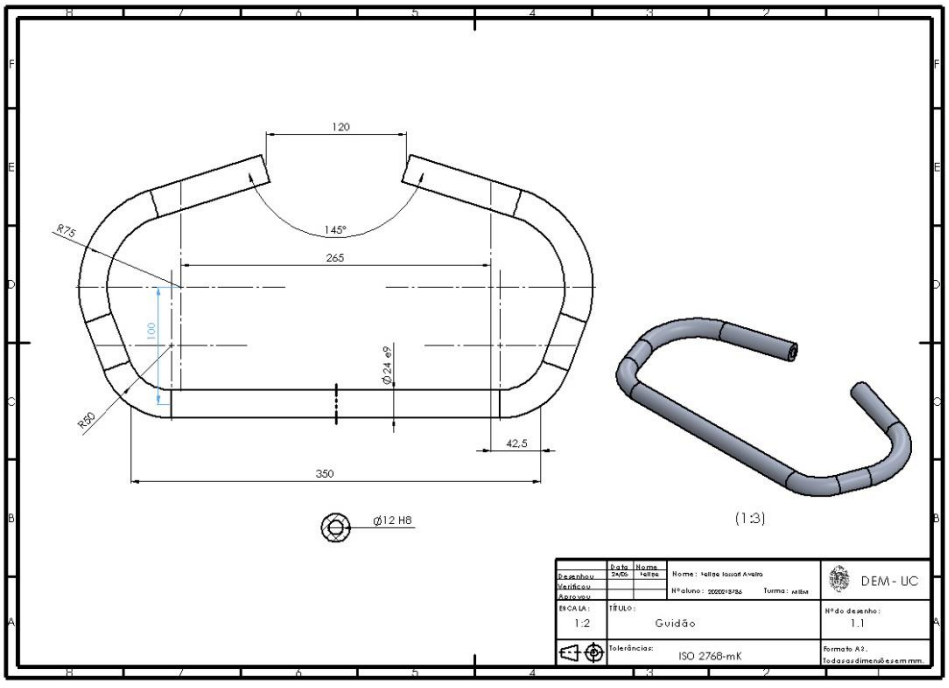



*Figure 7: Handlebar*

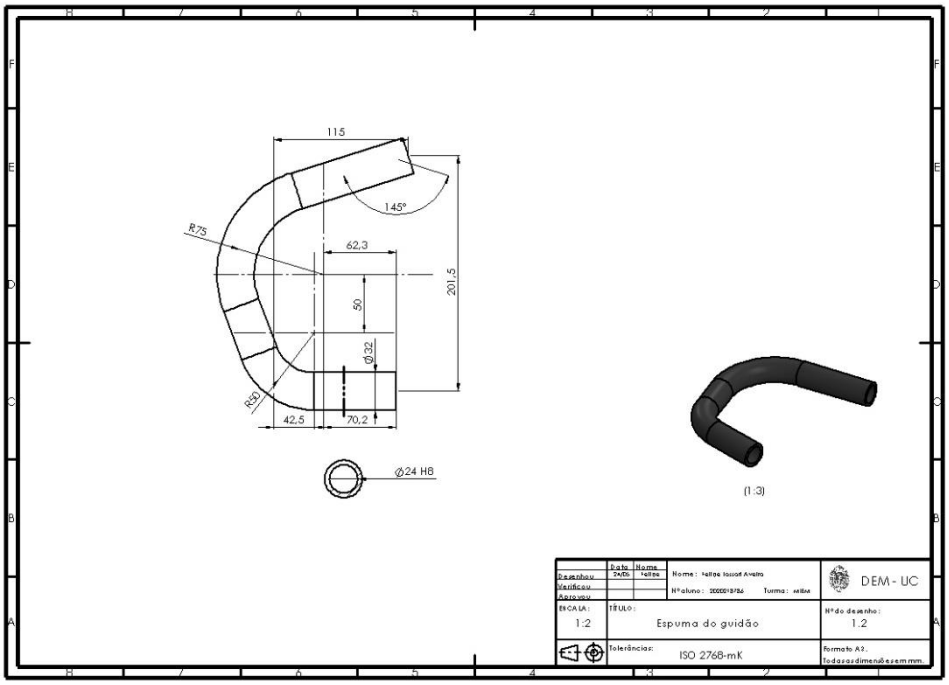



*Figure 8: Handlebar foam*

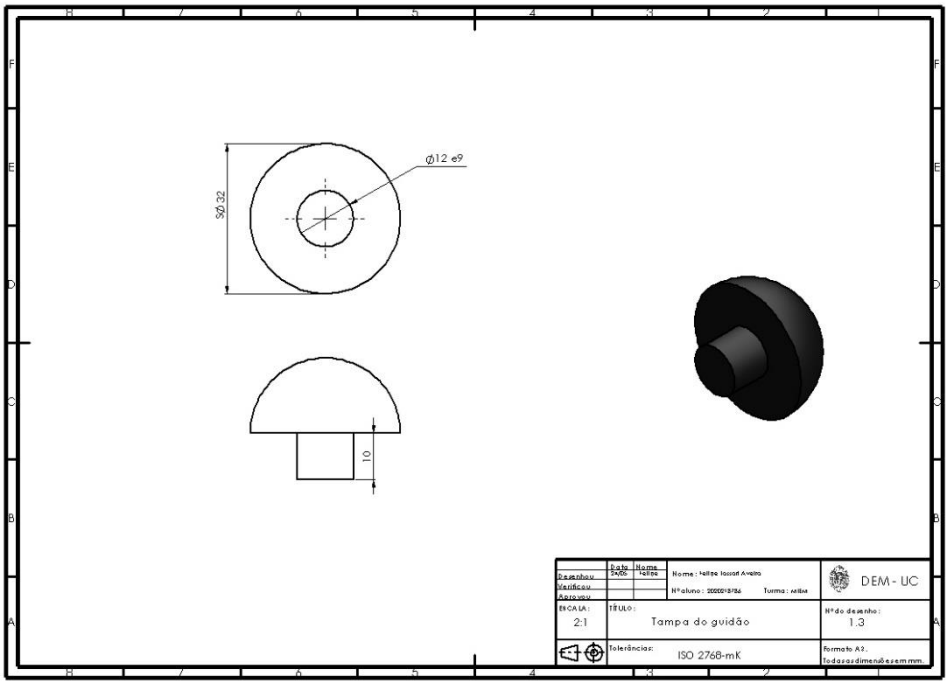



*Figure 9: Handlebar cap*

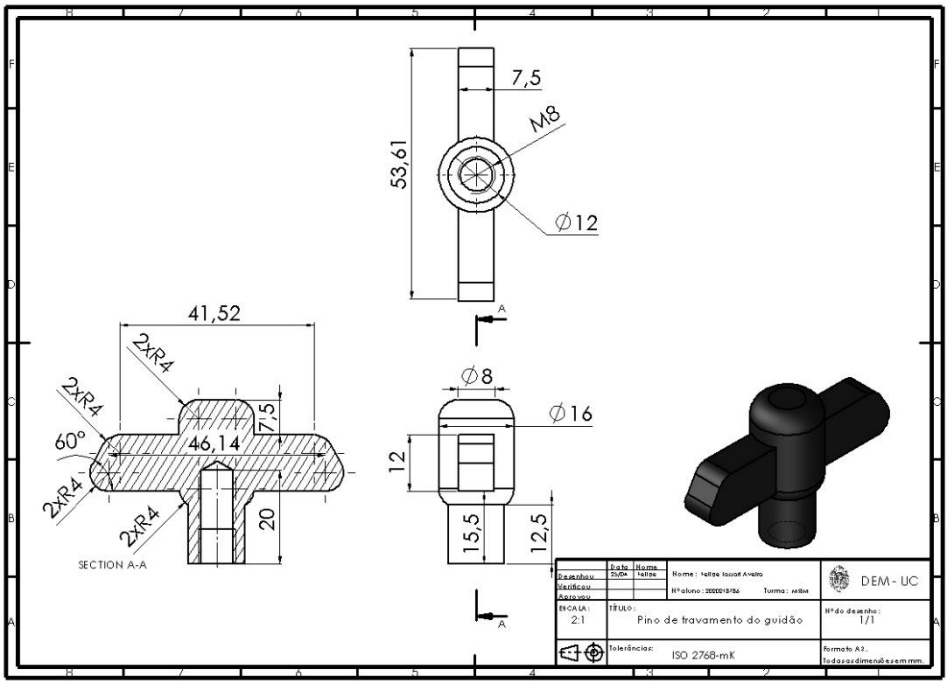



*Figure 10: Handlebar locking pin*

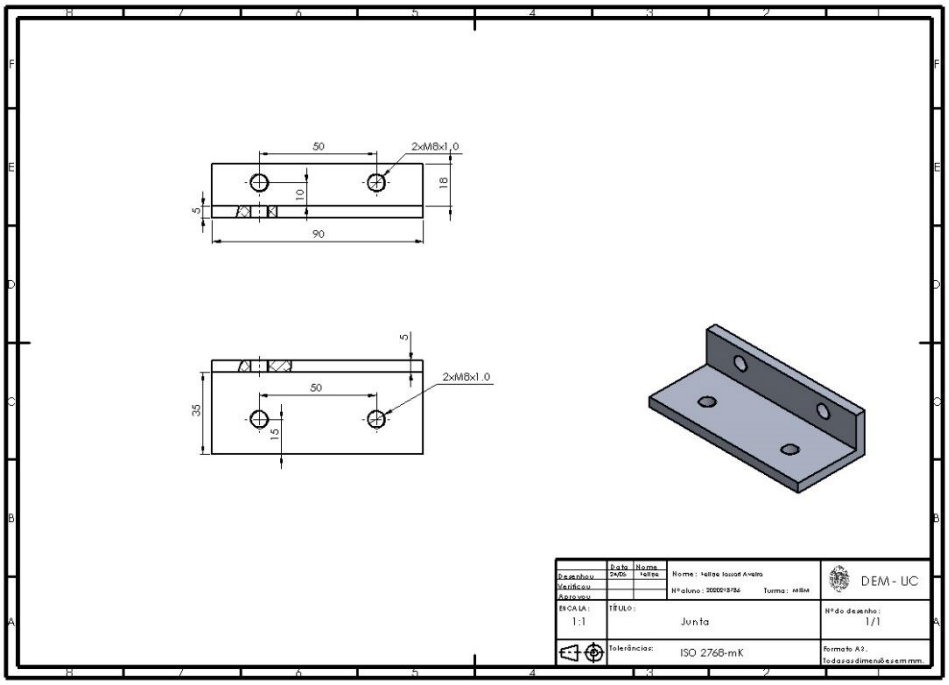



*Figure 11: Joint*

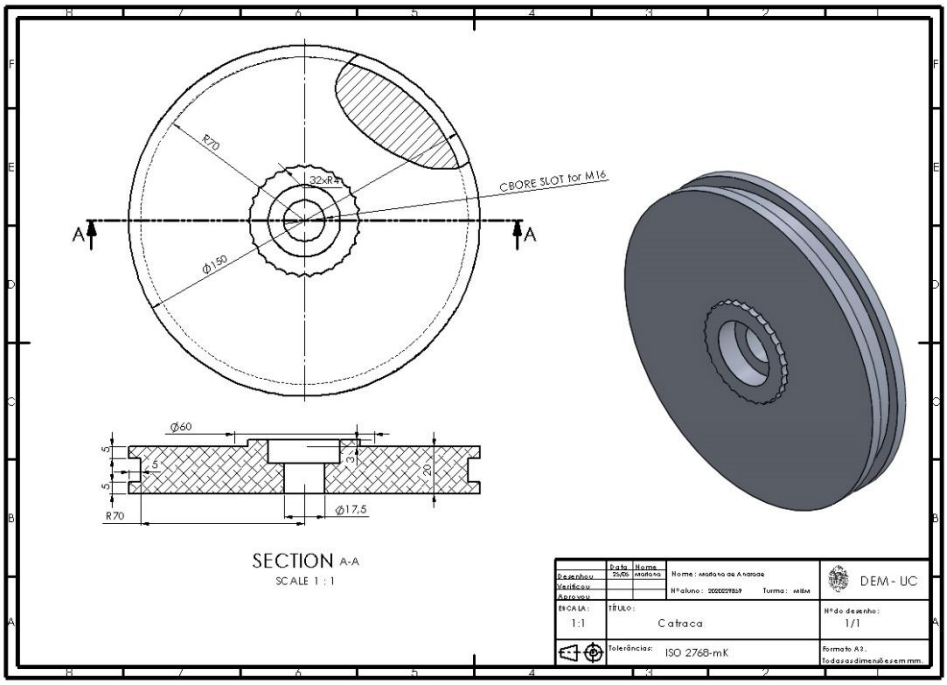



*Figure 12: Freewheel*

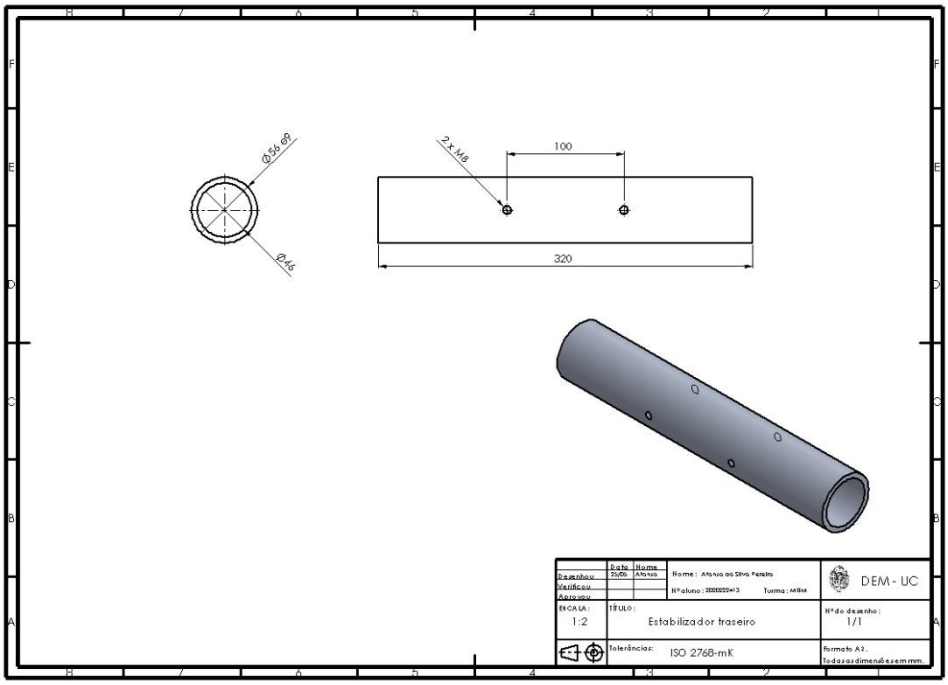



*Figure 13: Rear stabilizer*

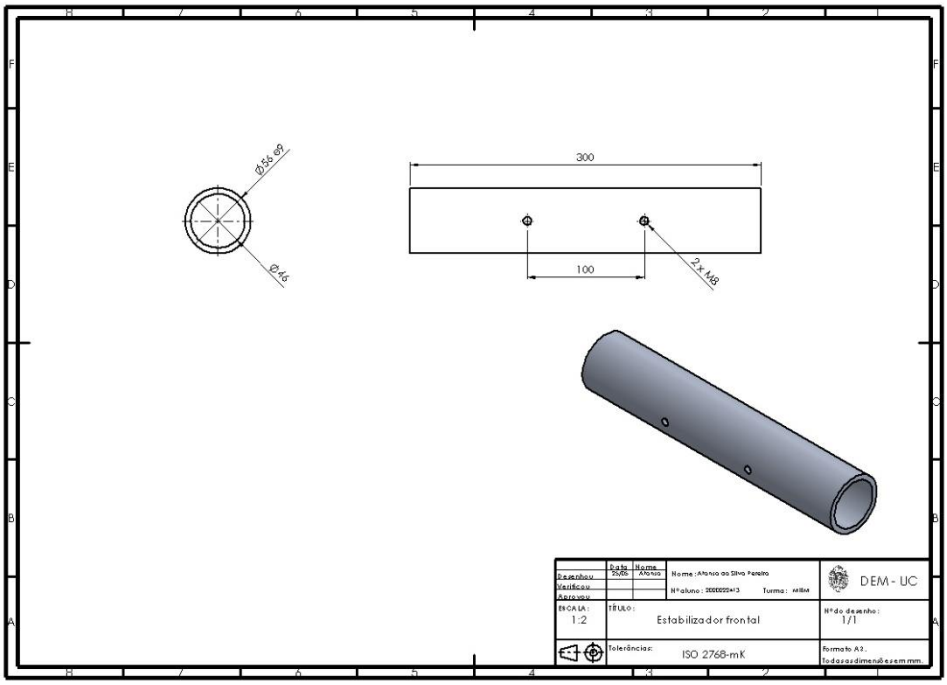



*Figure 14: Front stabilizer*

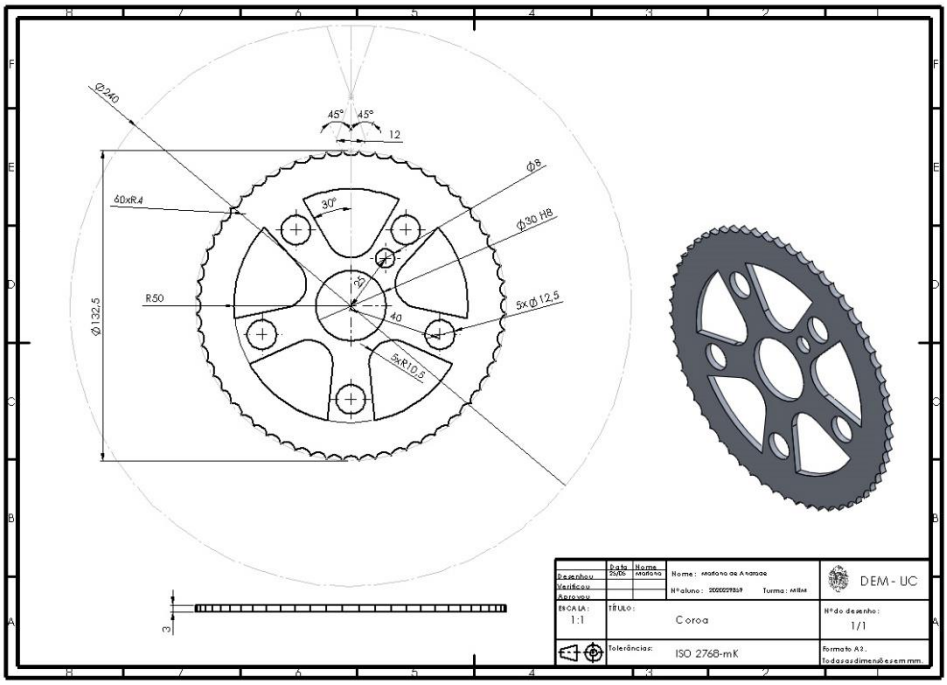



*Figure 15: Chainring*

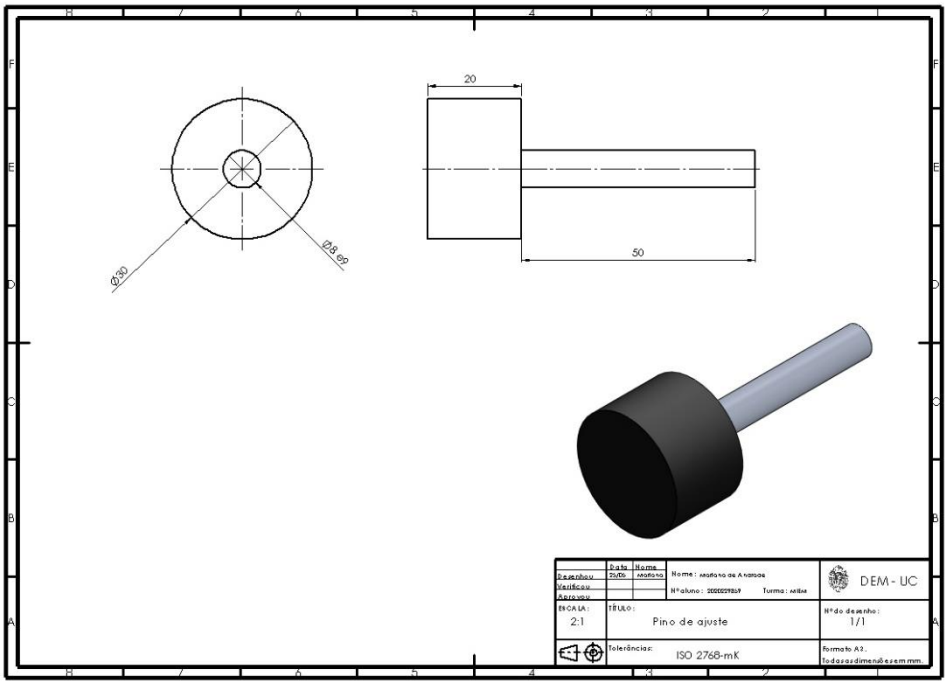



*Figure 16: Adjustment pin*

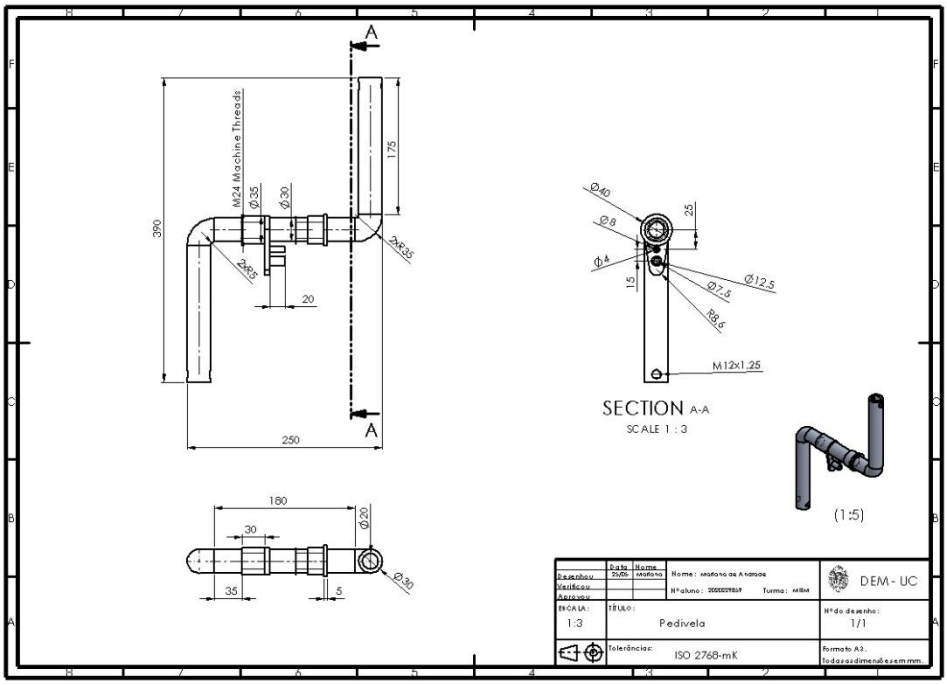



*Figure 17: Crank*

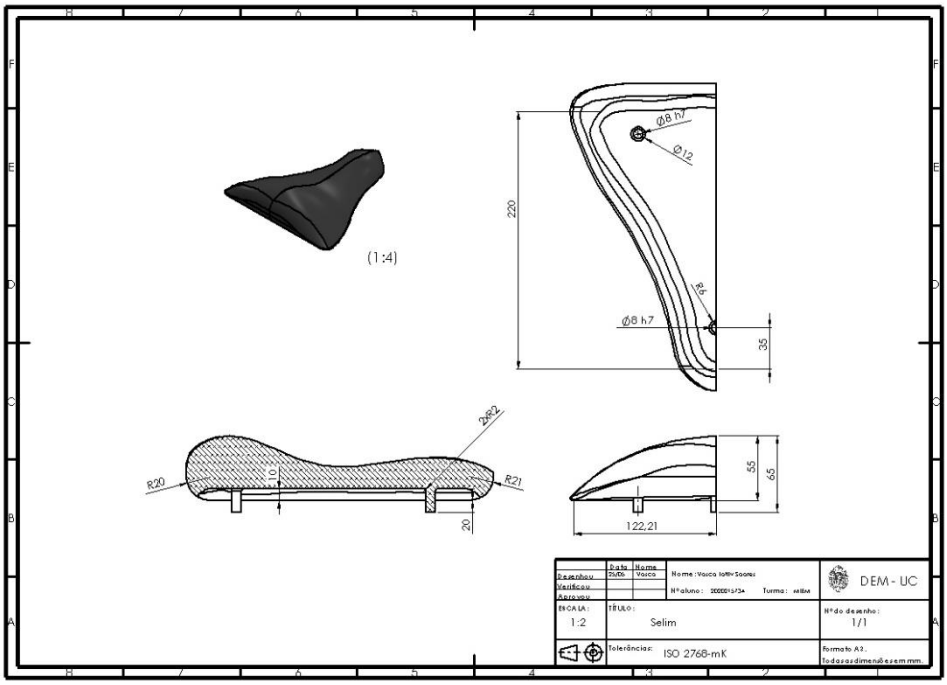



*Figure 18: Saddle*

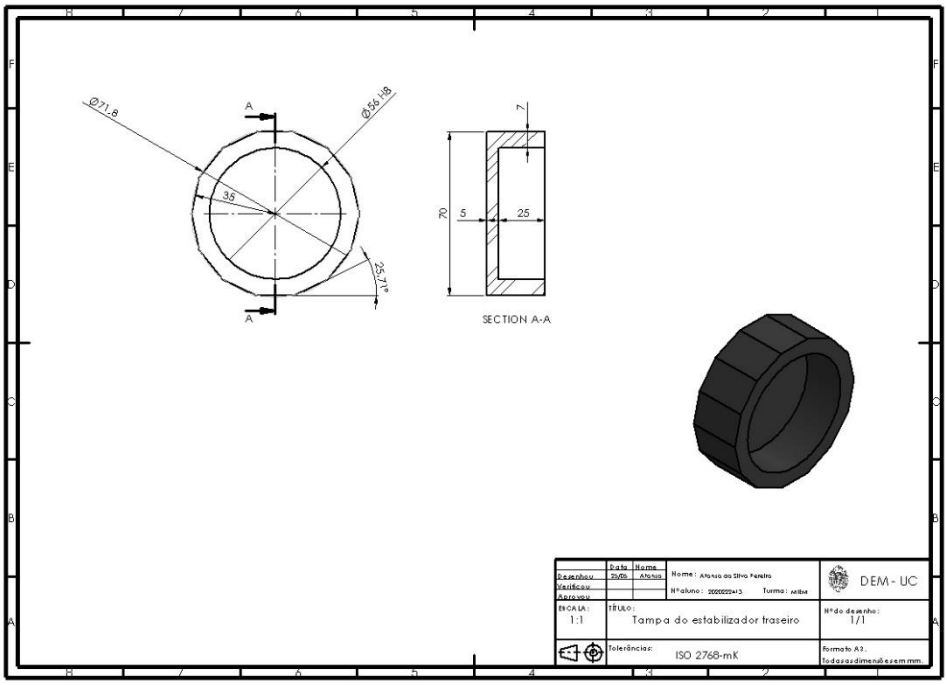



*Figure 19: Rear stabilizer cap*

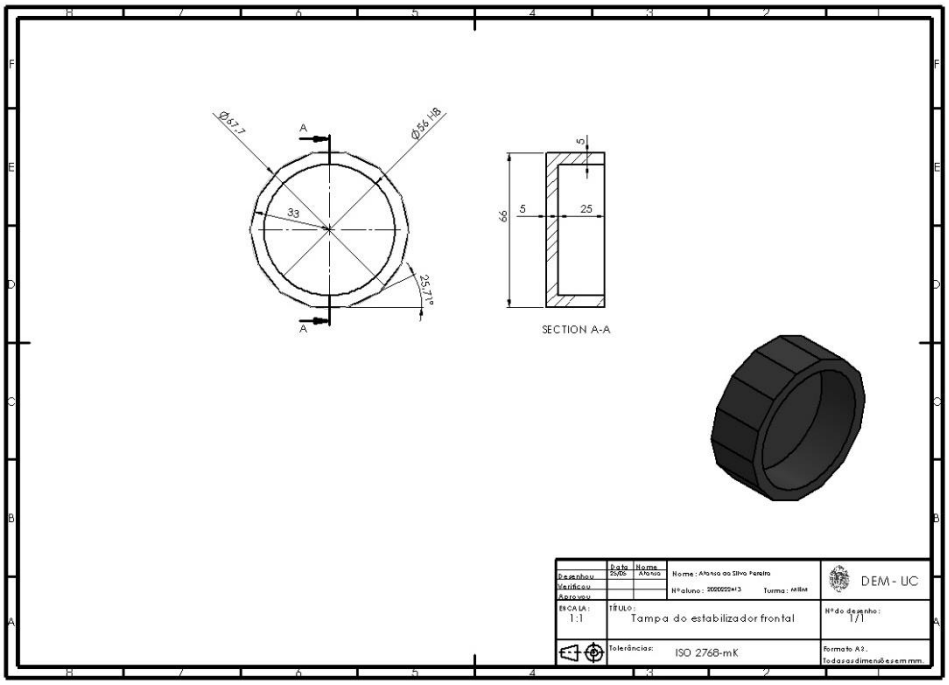



*Figure 20: Front stabilizer cap*

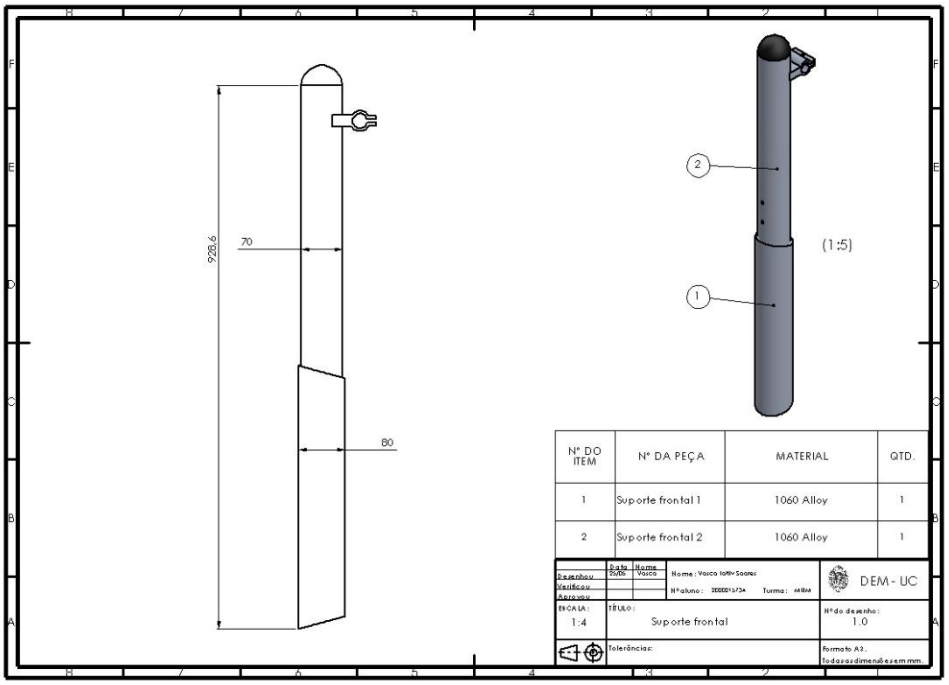



*Figure 21: Front support*

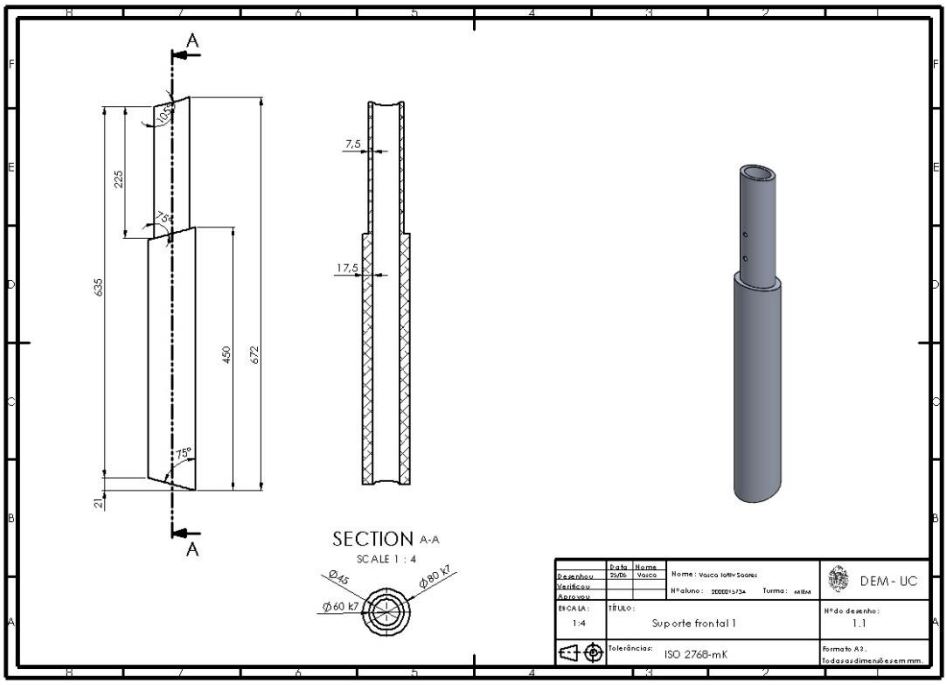



*Figure 22: Front support 1*

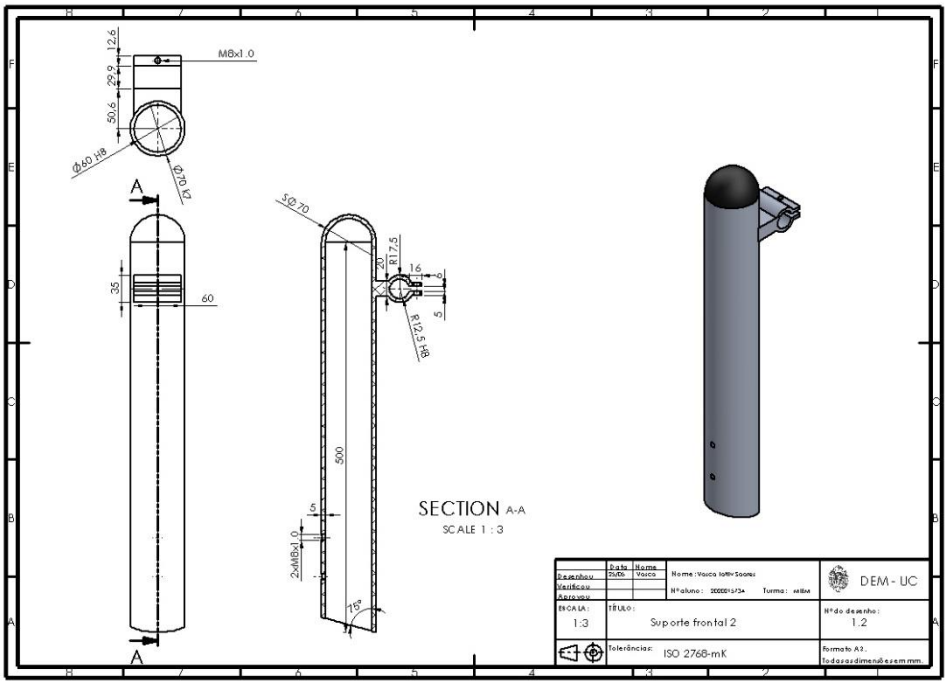



*Figure 23: Front support 2*

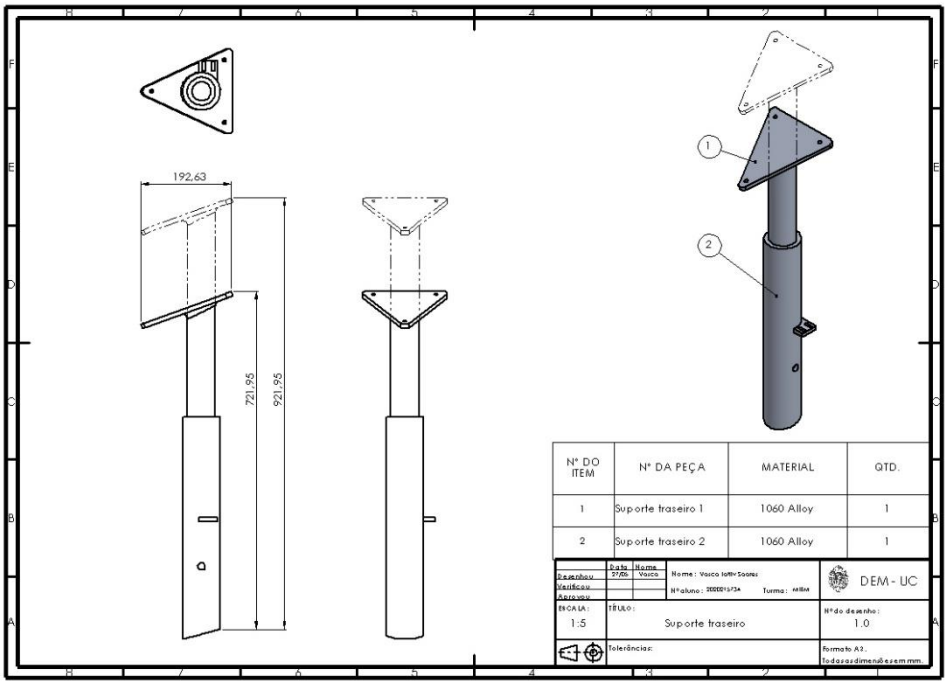



*Figure 24: Rear support*

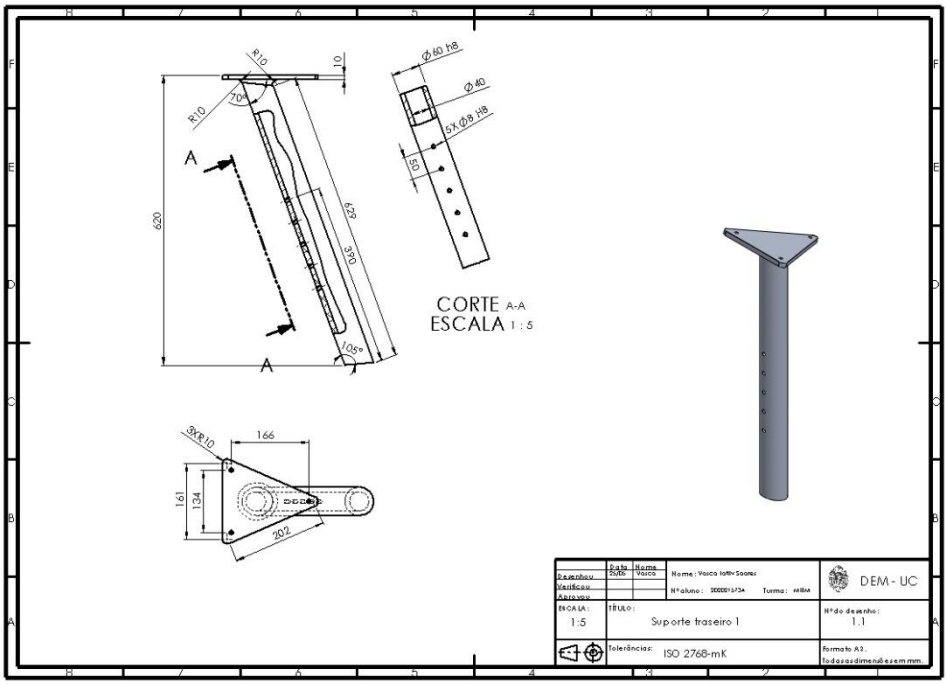



*Figure 25: Rear support 1*

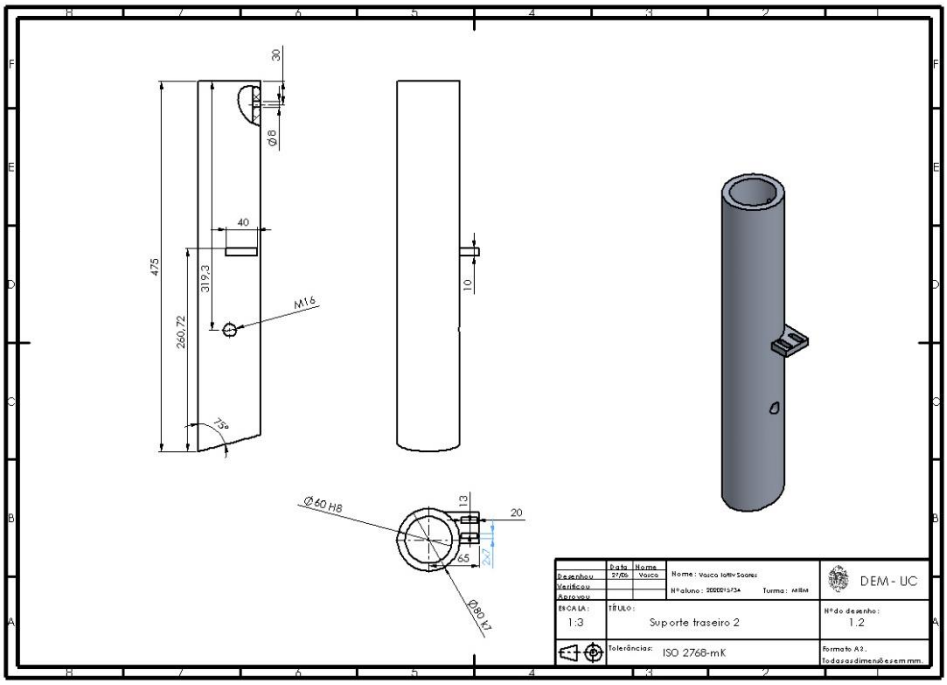



*Figure 26: Rear support 2*

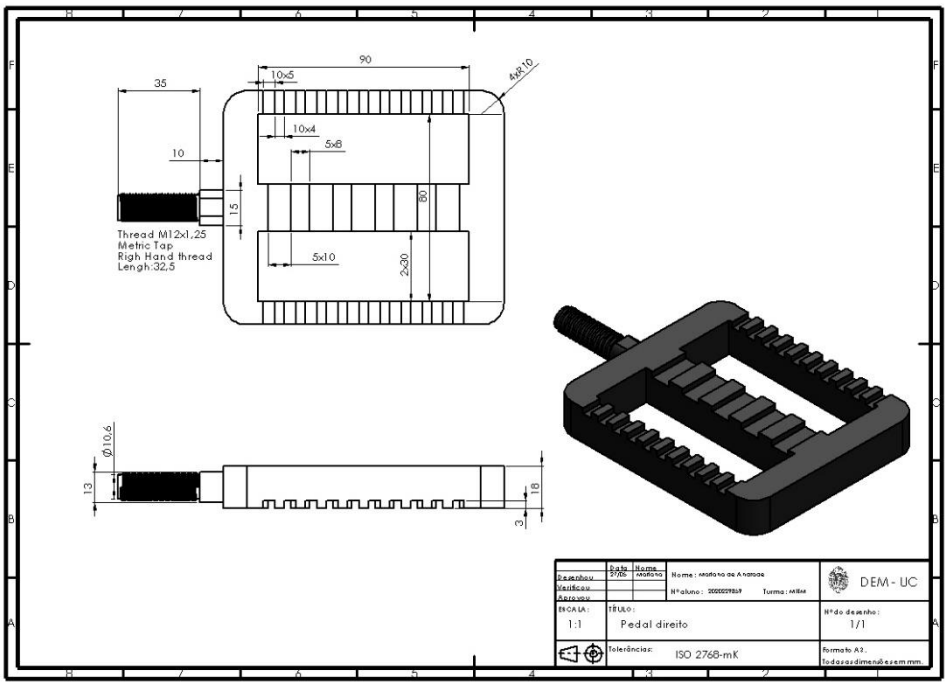



*Figure 27: Right pedal*

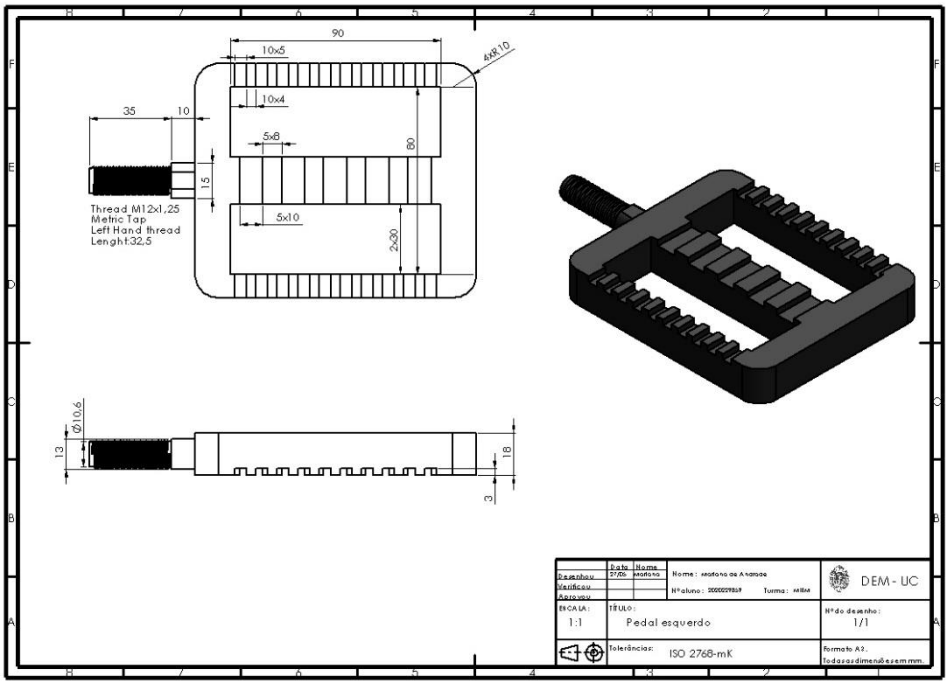



*Figure 28: Left pedal*

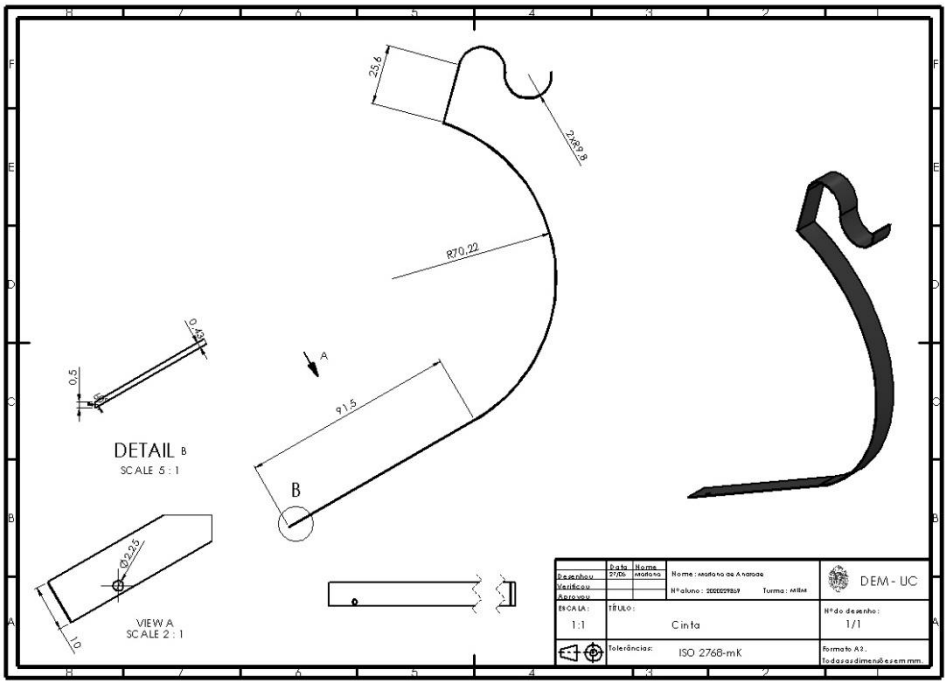



*Figure 29: Strap*

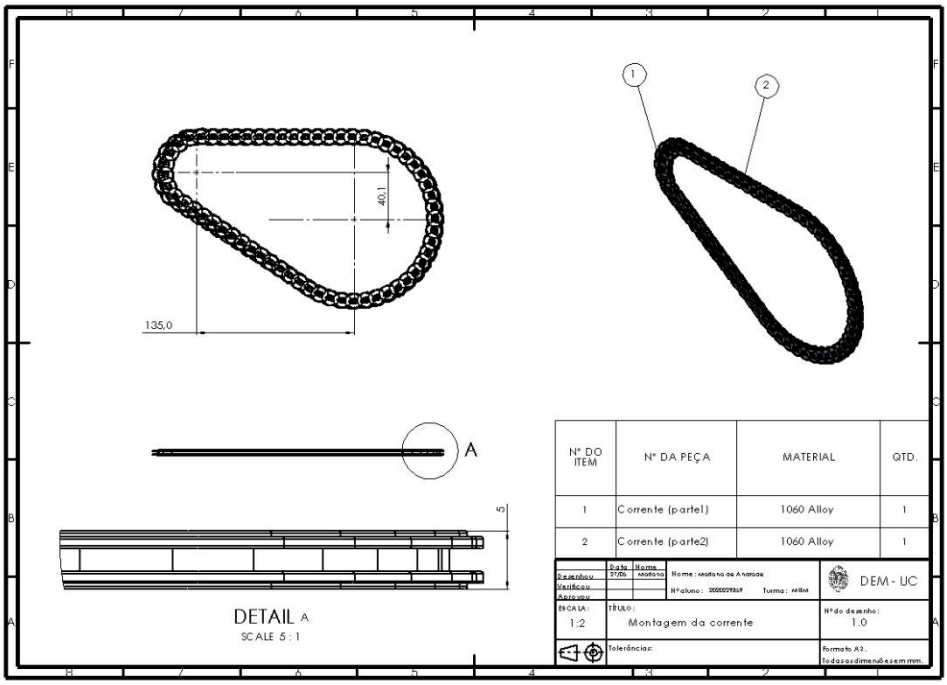



*Figure 30: Chain assembly*

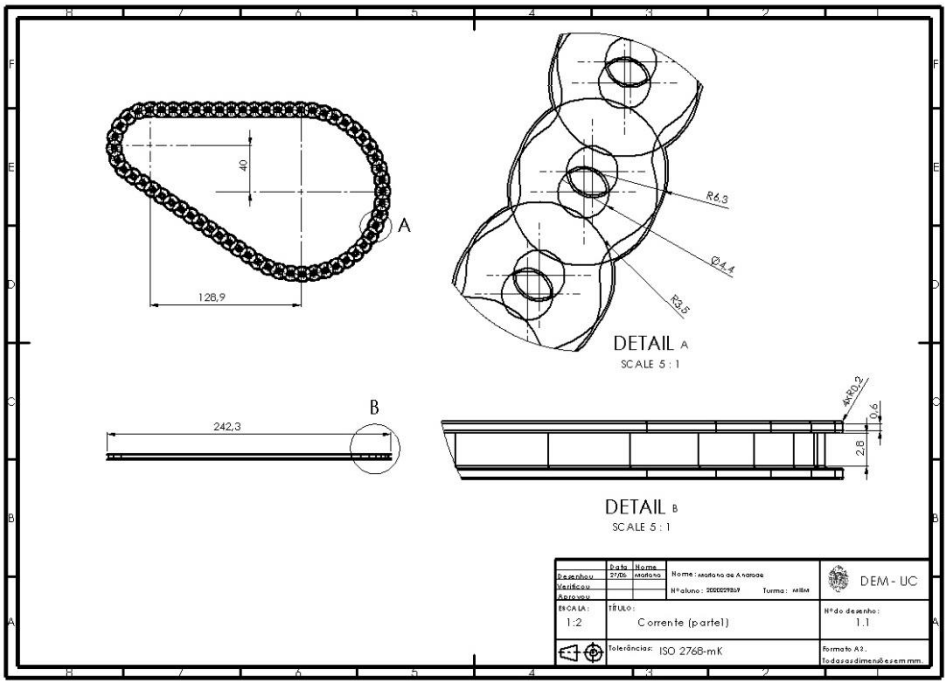



*Figure 31: Chain (part 1)*

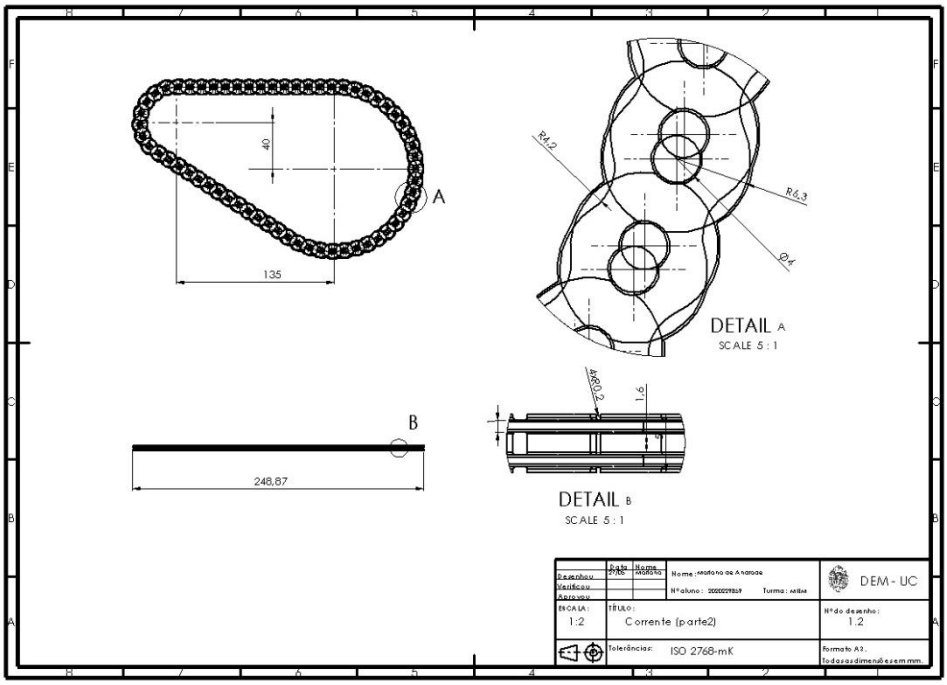



*Figure 32: Chain (part 2)*

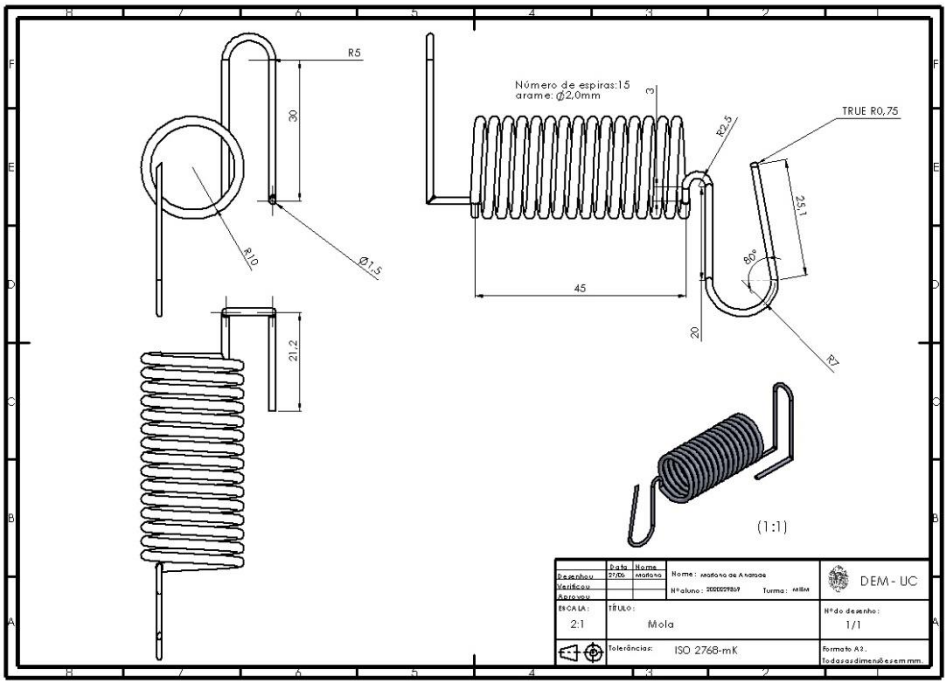



*Figure 33: Spring*

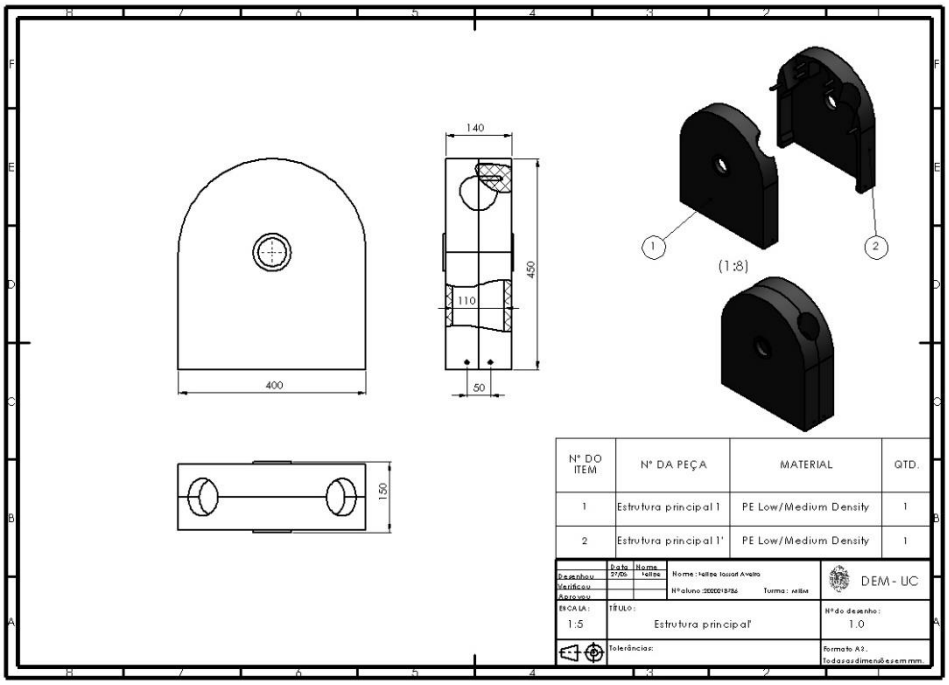



*Figure 34: Main structure'*

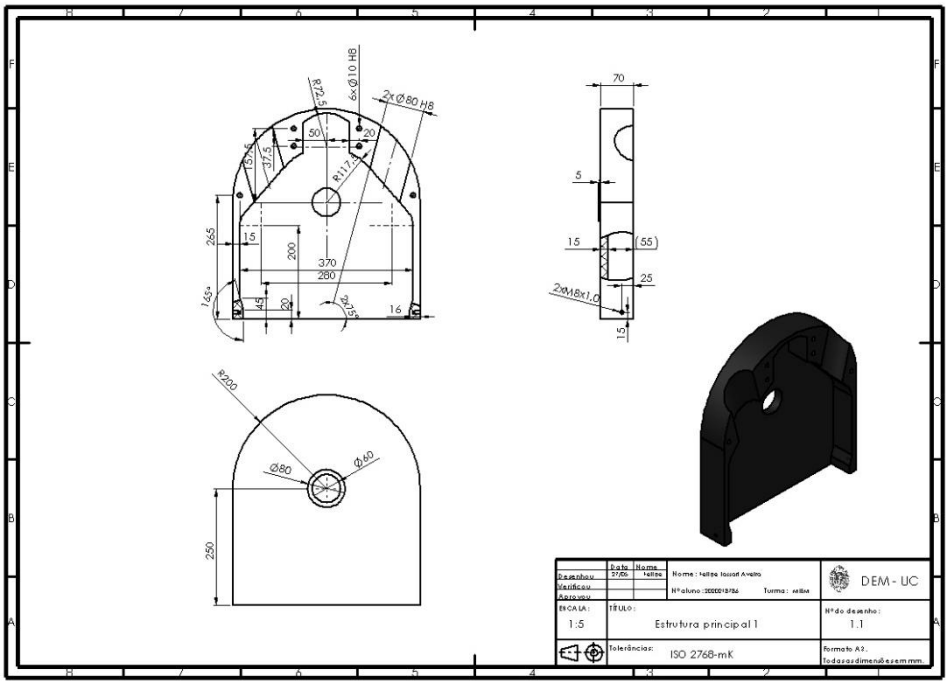



*Figure 35: Main structure 1*

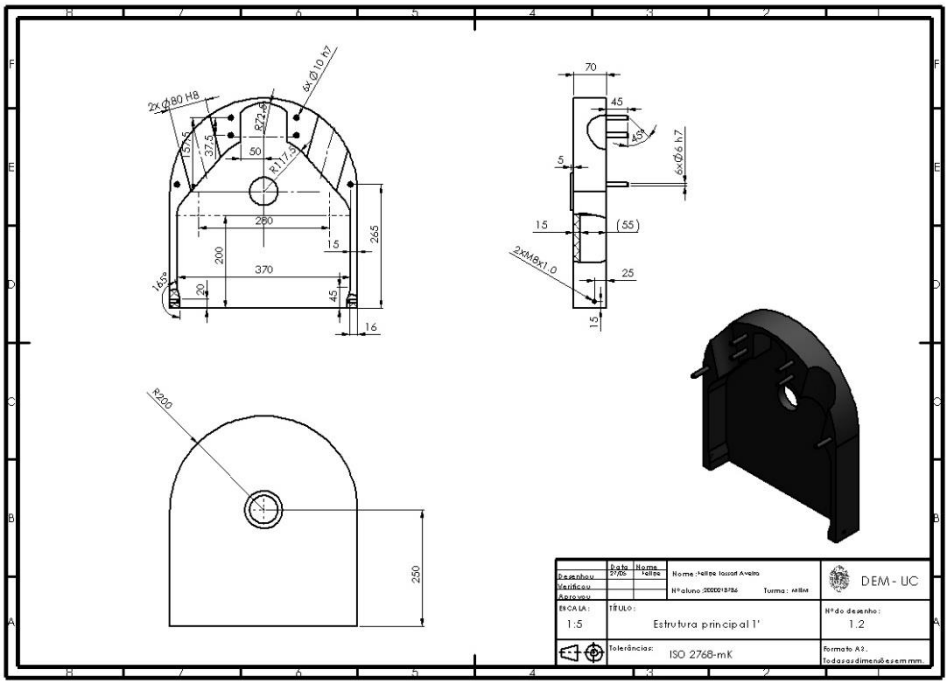



*Figure 36: Main structure 1'*

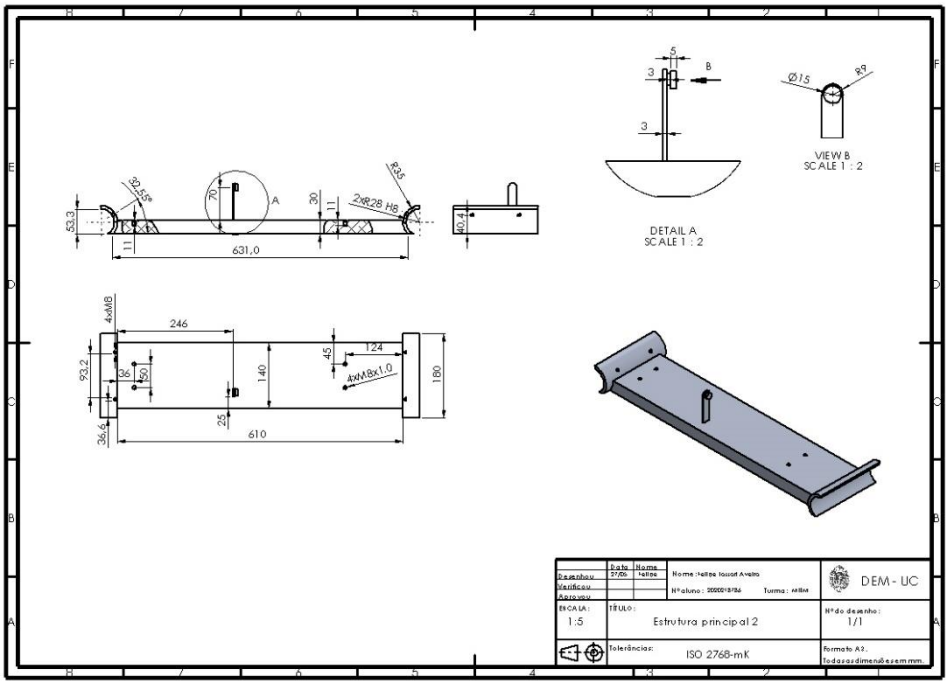
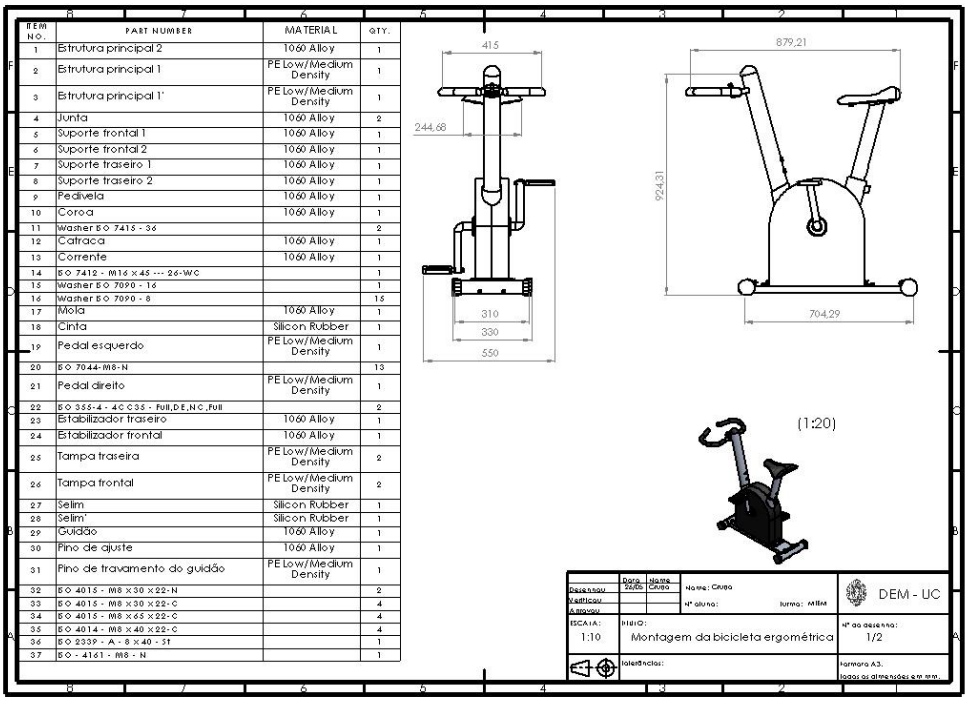



*Figure 37: Main structure 2*



| ITEM NO. | PART NUMBER | MATERIAL | QTY. |
|---|---|---|---|
| 1 | Estrutura principal 2 | 1060 Alloy | 1 |
| 2 | Estrutura principal 1 | PE Low/Medium Density | 1 |
| 3 | Estrutura principal 1' | PE Low/Medium Density | 1 |
| 4 | Junta | 1060 Alloy | 2 |
| 5 | Suporte frontal 1 | 1060 Alloy | 1 |
| 6 | Suporte frontal 2 | 1060 Alloy | 1 |
| 7 | Suporte traseiro 1 | 1060 Alloy | 1 |
| 8 | Suporte traseiro 2 | 1060 Alloy | 1 |
| 9 | Pedivela | 1060 Alloy | 1 |
| 10 | Coroa | 1060 Alloy | 1 |
| 11 | Washer ISO 7415 - 36 | | 2 |
| 12 | Catraca | 1060 Alloy | 1 |
| 13 | Corrente | 1060 Alloy | 1 |
| 14 | ISO 7412 - M16 x 45 --- 26-WC | | 1 |
| 15 | Washer ISO 7090 - 16 | | 1 |
| 16 | Washer ISO 7090 - 8 | | 16 |
| 17 | Mola | 1060 Alloy | 1 |
| 18 | Cinta | Silicon Rubber | 1 |
| 19 | Pedal esquerdo | PE Low/Medium Density | 1 |
| 20 | ISO 7044-M8-N | | 13 |
| 21 | Pedal direito | PE Low/Medium Density | 1 |
| 22 | ISO 355-4 - 4C C35 - Full,DE,NC,Full | | 2 |
| 23 | Estabilizador traseiro | 1060 Alloy | 1 |
| 24 | Estabilizador frontal | 1060 Alloy | 1 |
| 25 | Tampa traseira | PE Low/Medium Density | 2 |
| 26 | Tampa frontal | PE Low/Medium Density | 2 |
| 27 | Selim | Silicon Rubber | 1 |
| 28 | Selim' | Silicon Rubber | 1 |
| 29 | Guidão | 1060 Alloy | 1 |
| 30 | Pino de ajuste | 1060 Alloy | 1 |
| 31 | Pino de travamento do guidão | PE Low/Medium Density | 1 |
| 32 | ISO 4015 - M8 x 30 x 22-N | | 2 |
| 33 | ISO 4015 - M8 x 30 x 22-C | | 4 |
| 34 | ISO 4015 - M8 x 65 x 22-C | | 4 |
| 35 | ISO 4014 - M8 x 40 x 22-C | | 4 |
| 36 | ISO 2339 - A - 8 x 40 - St | | 1 |
| 37 | ISO - 4161 - M8 - N | | 1 |



*Figure 38: Exercise Bike assembly*

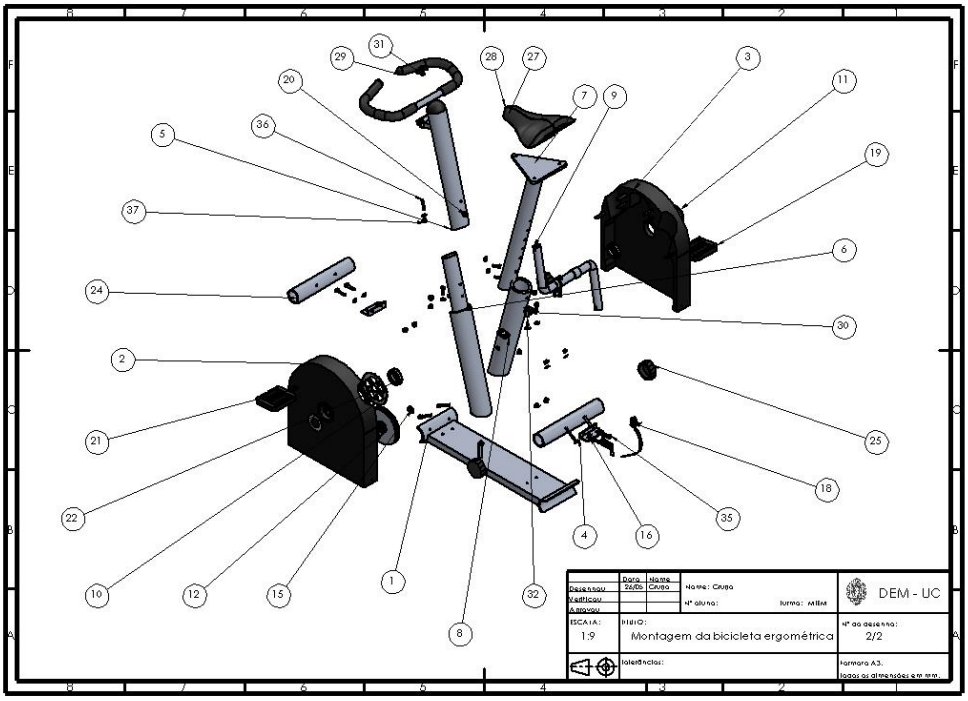




*Figure 39: Exploded view of the Exercise Bike*

## 2.2. Calculations of standardized elements

Calculations necessary for the selection of standardized elements were performed, and they are as follows:

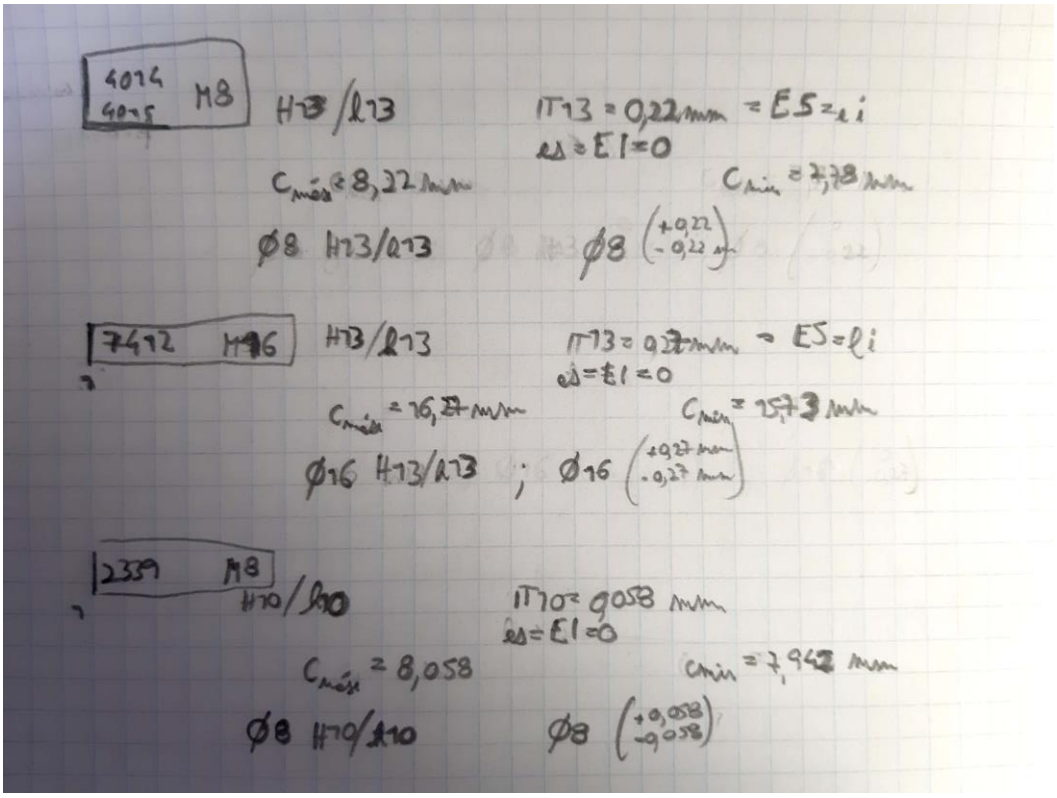



*Figure 40: Calculations*

# 3. Conclusion

In summary, through meticulous planning and execution of this exercise bike project, and with significant effort and dedication from the group, the desired outcome was achieved, based on a real model of an exercise bike. Initially, the team faced challenges in the project execution, primarily due to the lack of technical drawings of the parts in the assembly. However, the exercise bike that served as inspiration for this work, specifically the Kikos® HC 3015, proved essential in overcoming these obstacles, providing a sense of the assembly's size and its components. Therefore, considering what was studied in the Technical Drawing II course and the present work, the importance of detailed analysis of a machine project to ensure its functionality is evident, particularly the relevance of precise technical drawings as a form of language within the industrial context.