# Desk build report

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PRJ2-RPT1-v1.0 – August 31, 2025

**Abstract**

This document is a report for our design and making of a Do-It-Yourself (DIY) desk.

## Revision History

| Revision | Date | Author(s) | Description |
|---|---|---|---|
| 1.0 | 31AUG2025 | TH | Creation |

## Document distribution



## Contents

## Acronyms

**CAD** Computer assisted design
**DIY** Do-It-Yourself
**PETG** polyethylene terephthalate glycol

# 1 Introduction

We cover the Computer assisted design (CAD) and making of a basic personal desk for a home. The final, assembled, result can be seen on Fig. 1. The design uses only metal tubes, a panel of wood, L brackets, various nuts and bolts and 3D-printed parts. CAD files are available and are parametric to some extent (for instance to change the width, depth and height of the desk). Drawings are also

Figure 1: Final assembled desk.

made available to make sharing the design easier. We showcase the realisation of one of these desks.

Be mindful that the desk, as designed here, has a non-standard very low height.

## 2 Design drivers

We present a very high-level specification of what drove the design.

**Desk for computer usage** The desk is meant to be used as a computer station. This means only one person uses it at a time, and the user always sits on the same side of the desk. This also means that a backplate is useful for cable management.

**Assembly and disassembly** The desk design must be compatible with easy assembly and disassembly. In particular, we avoid soldering, which is very common in steel furniture, but makes the end product bulky and hard to move around.

**Accessible materials** The design is optimized to require only the minimum number of different base components. We only want one type of metal tube, and minimize the diversity of nuts, bolts and washers.

**Accessible machining tools** We minimize the required tools for making the desk. The most advanced tools required are a saw to cut the metal tubes and a pillar drill to make the various holes in them. No soldering equipment is required.

**Customization** The design allows for customization of the desk width and depth through a parametrization of the CAD files. The height of the desk may also be customized in advance as well as after manufacturing thanks to 3D-printed feet which may be redesigned to the desired height offset.

**Sturdy** The final desk must feel absolutely rigid in all axes and bear a relatively heavy load. Be mindful that this is a *look and feel* type of requirement, and that we did not formally validate (or even estimate) the load which this design can bear.

# 3 Design

We give a description of our design solution, followed by a list of the parts.

## 3.1 Description

We describe the CAD design, starting with an overall view, and then detailing particular points. Note the colors of the parts in CAD views are chosen for clarity, and are not representative of reality.

### 3.1.1 Overview

The design is composed of a steel frame, holding a wooden tabletop. Another wood panel is present on the back of the frame to serve as a help for cable management. Substantial side bracing is added on the left, rear and right side of the frame, leaving room for the user's legs in the front. CAD views of the full assembly are given in Fig. 2, and of the frame alone in Figs. 4 and 5. The steel tubes have 2mm wall thickness to ensure rigidity.

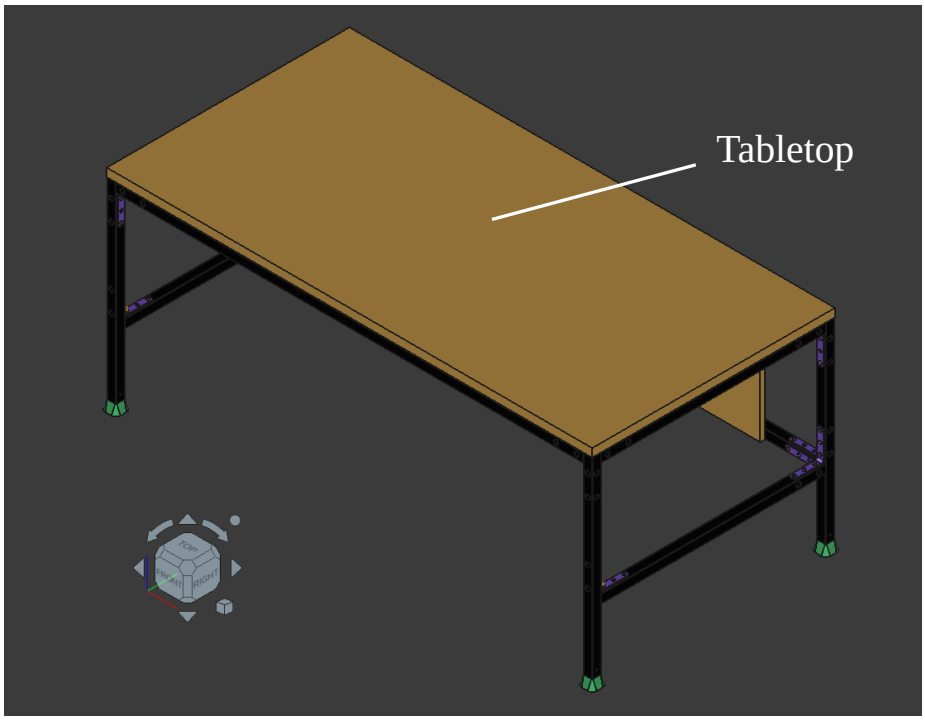



Figure 2: Assembly CAD: three-quarter top view.

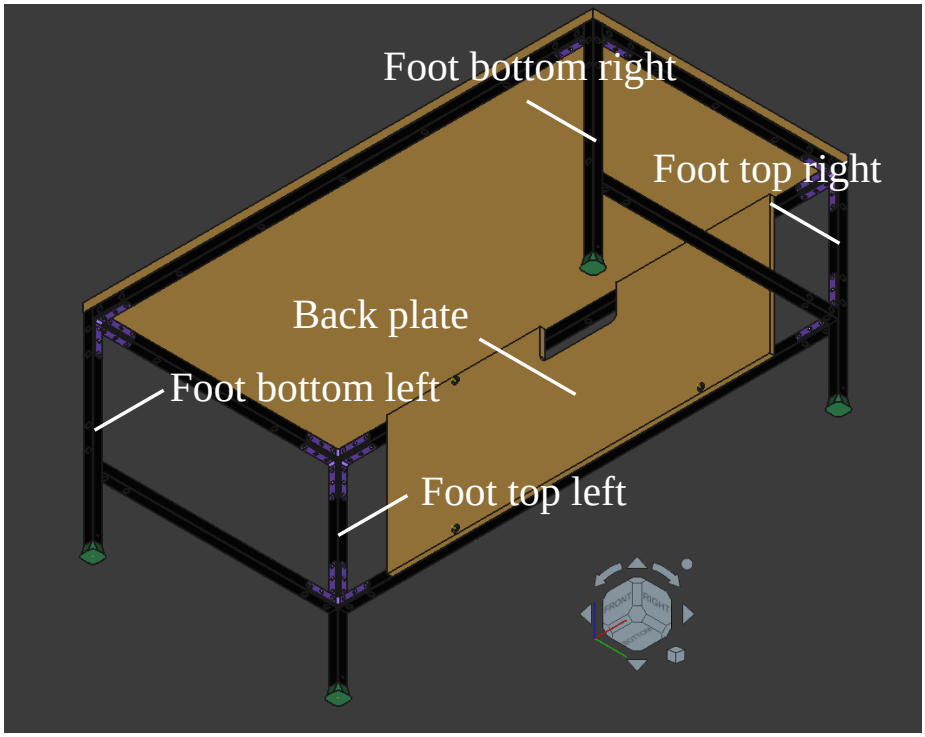



Figure 3: Assembly CAD: three-quarter bottom view.

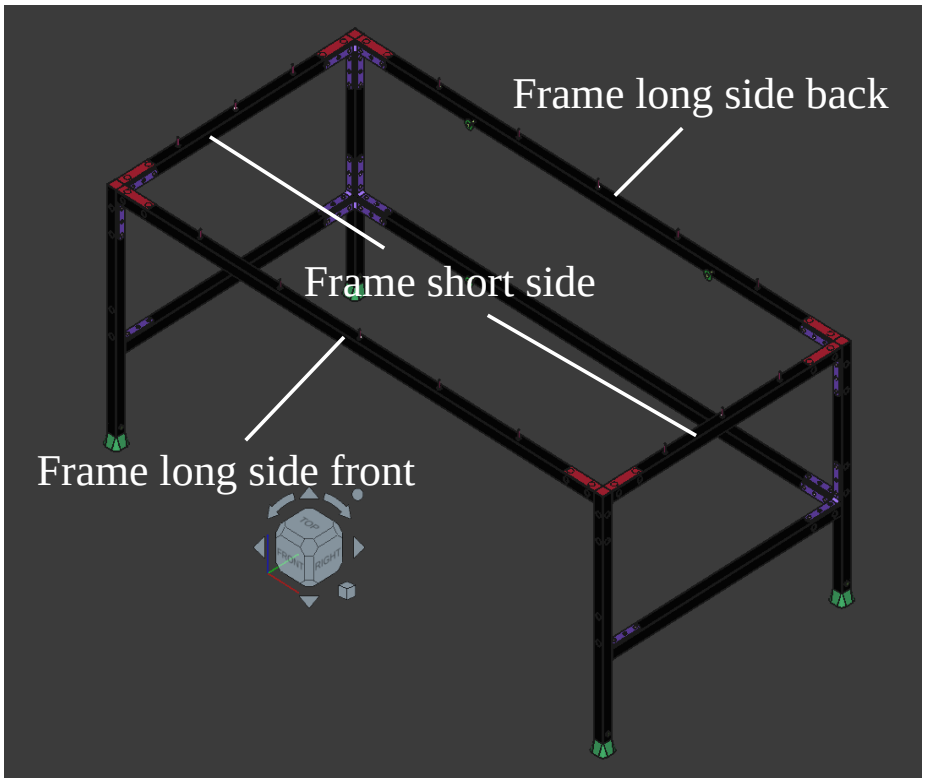



Figure 4: CAD view of the steel frame alone, three-quarter top view.

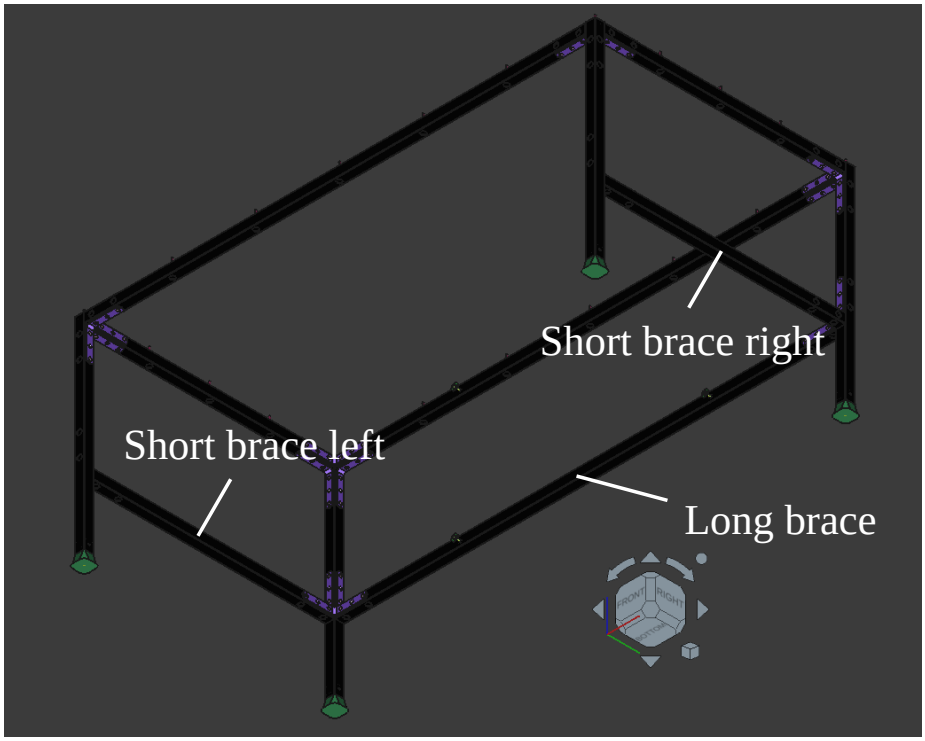



Figure 5: CAD view of the steel frame alone, three-quarter bottom view.

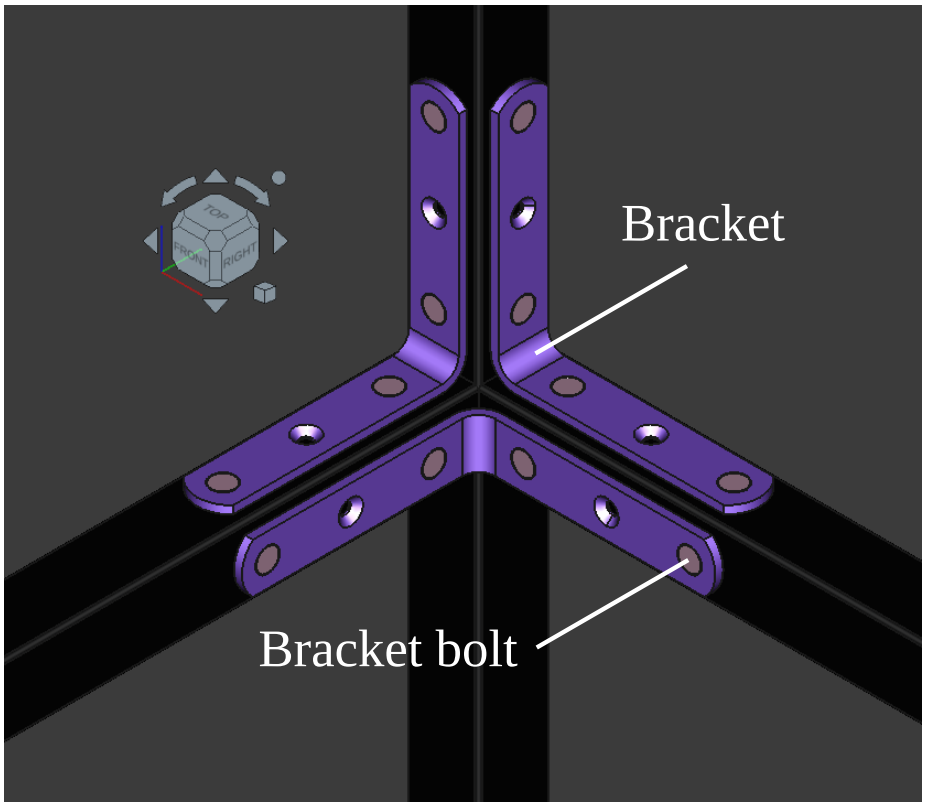



Figure 6: CAD view of brackets in one corner of the frame.

### 3.1.2 Tubes bracketing

The tubes are bracketing using metal, L-shaped, brackets (Fig. 6). There are as many brackets in place as assembly constraints would allow. The brackets are fairly long. Four screws per bracket are used to hold the assembly in place. The bracket holes are countersunk. The bracket screws are held in place with nuts on the inside of the tubes. Access holes are drilled opposite to every bracket hole in the tubes, to allow access for assembly and disassembly (Fig. 7).

### 3.1.3 Feet

The frame is equipped with four plastic (3D-printed) feet (Fig. 8). The feet are inserted into the steel tubes, and held together by two screws inserted into captive square nuts inside the feet (Fig. 9).

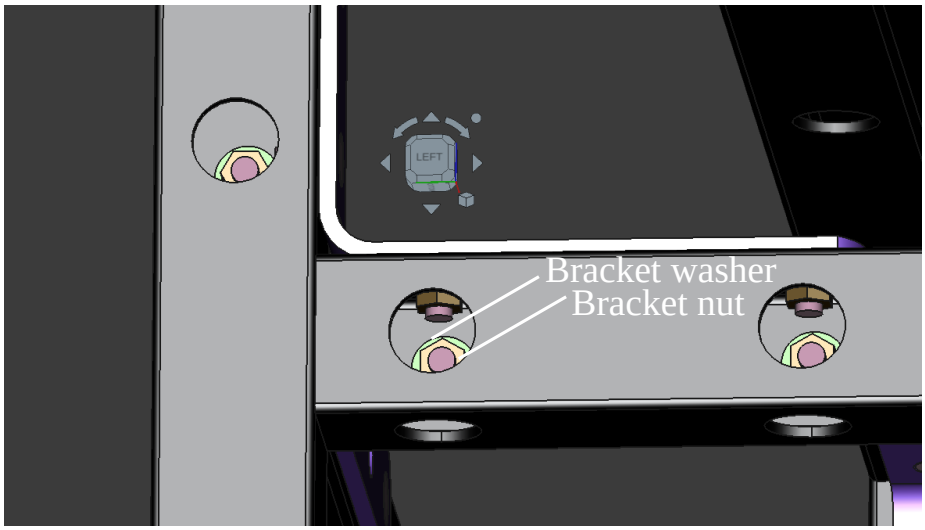



Figure 7: CAD view of the access holes.

#### 3.1.4 Frame interface with the tabletop

The tabletop is held flush against the top of the frame using plastic (3D-printed) interface corners and screws (Fig. 10). The plastic corners are inserted into the top of the four corner tubes and not held by any fasteners. The tabletop is then screwed to the side tubes of the frame. The interface corners and washers share the same thickness, such that the tabletop rests on an even plane.

#### 3.1.5 Back plate

The back plate is held in place by four bolts inserted in through-holes and held with nuts from the inside of the rear tubes (Fig. 11). A large washer is used to distribute the force on the wood.

### 3.2 Parts

Tab. 1 lists the parts in the design, along with a reference to the corresponding drawing, the quantity of parts included in the assembly of one desk, and a weight estimation per part. The weight of the steel tubes is 1.68 kg per meter, we ignore the mass of holes. The total mass of parts is 56.2 kg.

Tab. 2 lists the fasteners, along with standard, dimensions, type, quantity and weight. The total mass of fasteners is 434 g.

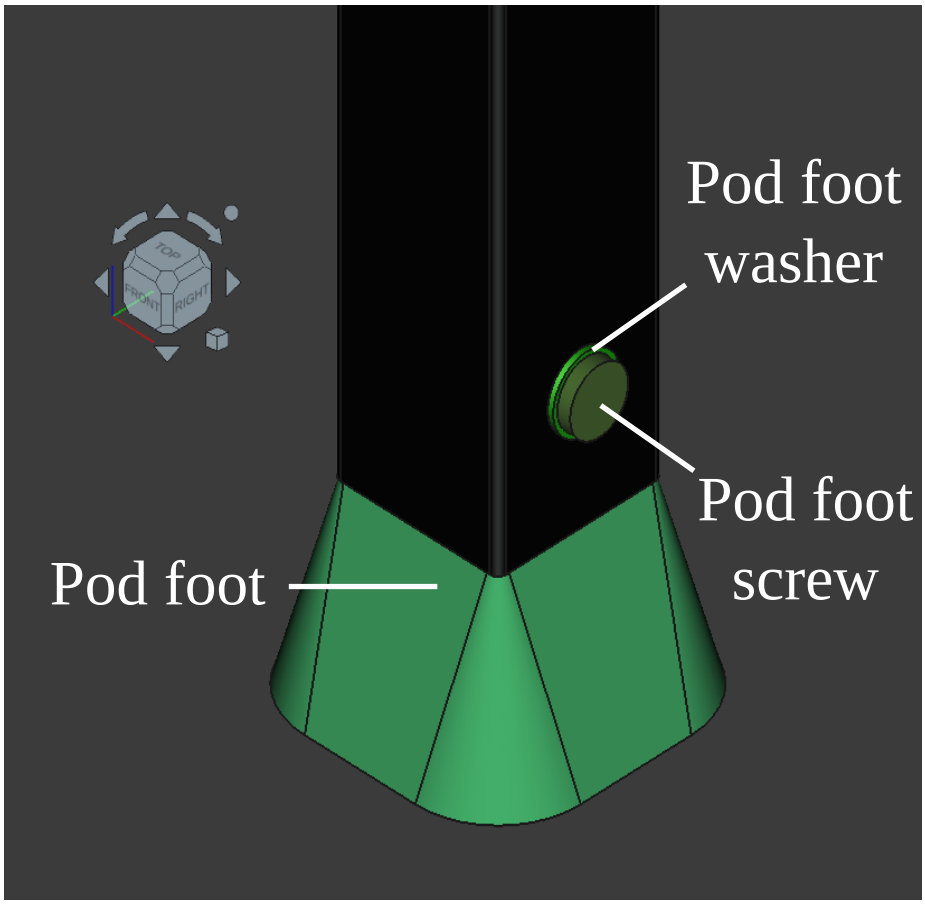



Figure 8: CAD view of the feet.

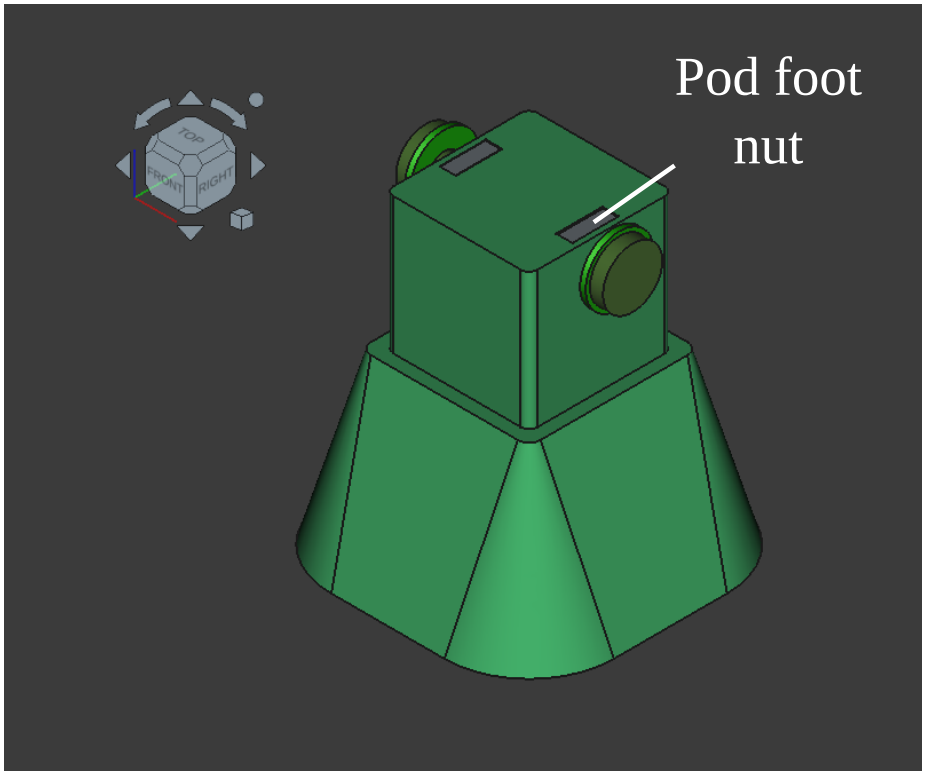



Figure 9: CAD view of the feet fasteners.

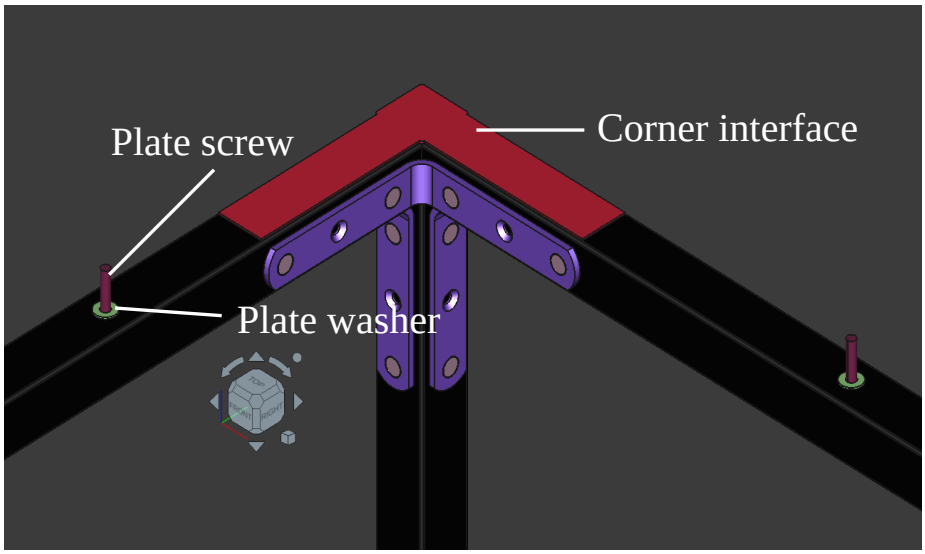



Figure 10: CAD view of the tabletop interface corner.

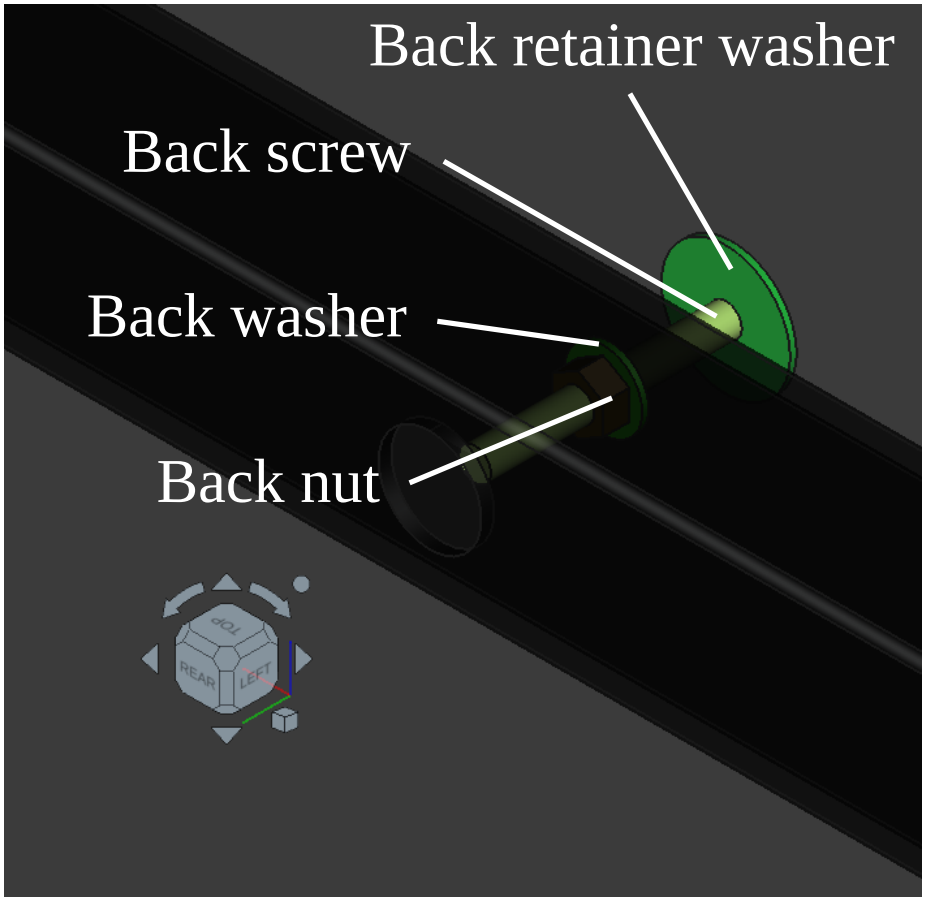



Figure 11: CAD view of the back plate fixation.

| Part name | Drawing reference | Quantity | Unit weight |
|---|---|---|---|
| Tabletop | PRJ2-DRW11 | 1 | 27.6 kg |
| Back plate | PRJ2-DRW12 | 1 | 10 kg |
| Foot bottom left | PRJ2-DRW1 | 1 | 1.06 kg |
| Foot bottom right | PRJ2-DRW2 | 1 | 1.06 kg |
| Foot top left | PRJ2-DRW3 | 1 | 1.06 kg |
| Foot top right | PRJ2-DRW4 | 1 | 1.06 kg |
| Frame long side back | PRJ2-DRW5 | 1 | 2.59 kg |
| Frame long side front | PRJ2-DRW6 | 1 | 2.59 kg |
| Frame short side | PRJ2-DRW7 | 2 | 1.24 kg |
| Long brace | PRJ2-DRW8 | 1 | 2.59 kg |
| Short brace left | PRJ2-DRW9 | 1 | 1.24 kg |
| Short brace right | PRJ2-DRW10 | 1 | 1.24 kg |
| Bracket | PRJ2-DRW13 | 20 | 0.077 kg |
| Pod foot | PRJ2-DRW14 | 4 | 0.020 kg |
| Corner interface | PRJ2-DRW15 | 4 | 0.011 kg |

Table 1: Parts list.

| Name | Standard | Material | Dimension | Type | Quantity | Unit weight |
|---|---|---|---|---|---|---|
| Bracket bolt | ISO-14581 | INOX A2 | 5x12 | Countersunk, T25 head | 80 | 1.91 g |
| Plate screw | DIN571 | INOX A2 | 5x25 | Hexagon head, coach screw | 16 | 3.77 g |
| Bracket nut | DIN934 | INOX A2 | 5 | NA | 80 | 1.03 g |
| Back nut | idem | idem | idem | idem | 4 | idem |
| Bracket washer | NFE 25514 | INOX A2 | 5x12 | Flat | 80 | 0.62 g |
| Plate washer | idem | idem | idem | idem | 20 | idem |
| Back washer | idem | idem | idem | idem | 4 | idem |
| Pod foot washer | idem | idem | idem | idem | 8 | idem |
| Back screw | Undetermined | INOX A2 | 5x30 | Flat head, T25 | 4 | 4.7 g |
| Back retainer washer | Undetermined | INOX A2 | 5x25 | Flat | 4 | 5.3 g |
| Pod foot screw | Undetermined | INOX A2 | 5x10 | Flat T25 head | 8 | 2.2 g |
| Pod foot nut | DIN562 | INOX A2 | 5 | NA | 8 | 0.88 g |

Table 2: List of fasteners.

## 3.3 Dedicated tools

Some dedicated tooling is used to make the manufactury and assembly easier. These tools are easily 3D-printed. These are tools used in addition to the generic ones found in a shop.

### 3.3.1 Center marker

Many holes are drilled in the longitudinal centerline of the square-section steel tubes. Since the corners are rounded, marking the centerline is not as straightforward as it sounds. We use a dedicated centerline marking tool, commonly used in carpentry. The drawing for this tool has reference `PRJ2-DRW16`. The 3D-printed tool is photographed on Fig. 12. This tool works well with Sharpie fine point pens, the diameter of the hole may need to be adjusted if other pens are used.

### 3.3.2 Fastener holder

Since the bracket fasteners are only accessible using the access holes, which are not large enough to put fingers through, it is very difficult to present the nut and washer in front of the screw for fastening. We use a dedicated tool which allows holding both the washer and nut in place while the screw is being tightened. The tool has a half-open shape to allow disengagement once the fasteners are all in place. The final tightening can be done using regular tools. The drawing for this tool has reference `PRJ2-DRW17`. This tool is photographed on Fig. 13.

# 4 Procurement and tools

We list the materials we procured, as well as the tools which are needed for fabrication and assembly.

## 4.1 Procurement

I procured,

1. Galvanized steel tubes of 30x30mm external diameter, and wall thickness 2mm. I bought a set of 7 bars, each 2 meters in length.
2. A tabletop in solid, glue-laminated, birch wood. The tabletop already has the as-designed dimensions. It is untreated.
3. All the fasteners, to the design specification.
4. Wood varnish: to protect the tabletop.
5. (optional) Zinc coating spray: if you think the cuts in the steel will be exposed to water or ambient humidity.

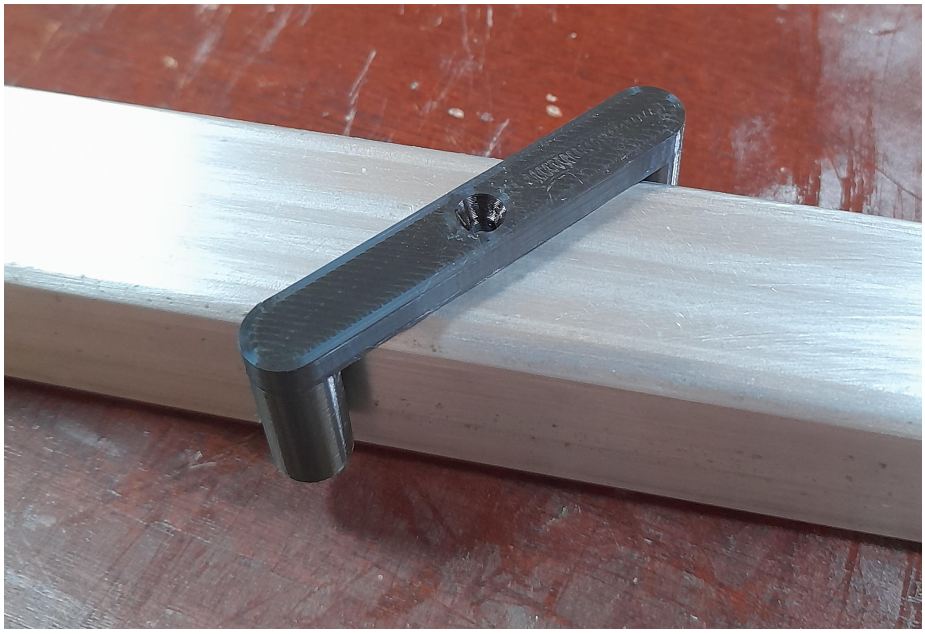


Figure 12: Center marker tool placed on a tube.

Figure 13: Fastener holder tool with nut and washer.

The total cost of these materials, including shipping and VAT, amounted to roughly 400 euros (in France, as of summer 2025). This is not particularly cheap. Some optimization might have been done by ordering everything all at once to reduce shipping costs. If cost is an issue, a poorer quality tabletop may be picked.

### 4.2 Tools

The following tools are needed, either for fabrication or assembly. These are generic tools found in a shop.

1. A circular saw: for cutting the steel tubes to length.
2. A pillar drill: for drilling the holes in steel tubes.
3. Wood jigsaw: for cutting the back plate.
4. Hand drill: for drilling holes in wood.
5. A 3D printer: for printing the plastic parts and dedicated tools.
6. Metal drill bits: diameters 5.5, 8, 10, 12, 14 and 16 mm.
7. Wood drill bits: diameters 3 and 5.5 mm.
8. Cutting oil: for cutting and drilling in steel, adequate lubricant is *required*.
9. Steel file: for filing the cuts in the steel tubes.
10. Torx screwdriver (T25 head).
11. M5 nuts dowel key.
12. Sander: for the tabletop preparation. Rotary model is recommended.
13. Sanding paper: grit 180 and 240.
14. Varnish paint brush.
15. Sponge and dishwashing soap: for cleaning the oil off the tubes.
16. Pen marker: for marking dimensions and indications on the tubes during fabrication.
17. Measuring tape.
18. Center punch and hammer: for marking drilling positions.

## 5 Fabrication

We document the fabrication of one desk. The information in this section is specific to the material I was able to procure, and the tools I had. The section is still useful to gather tips and document the process of fabrication.

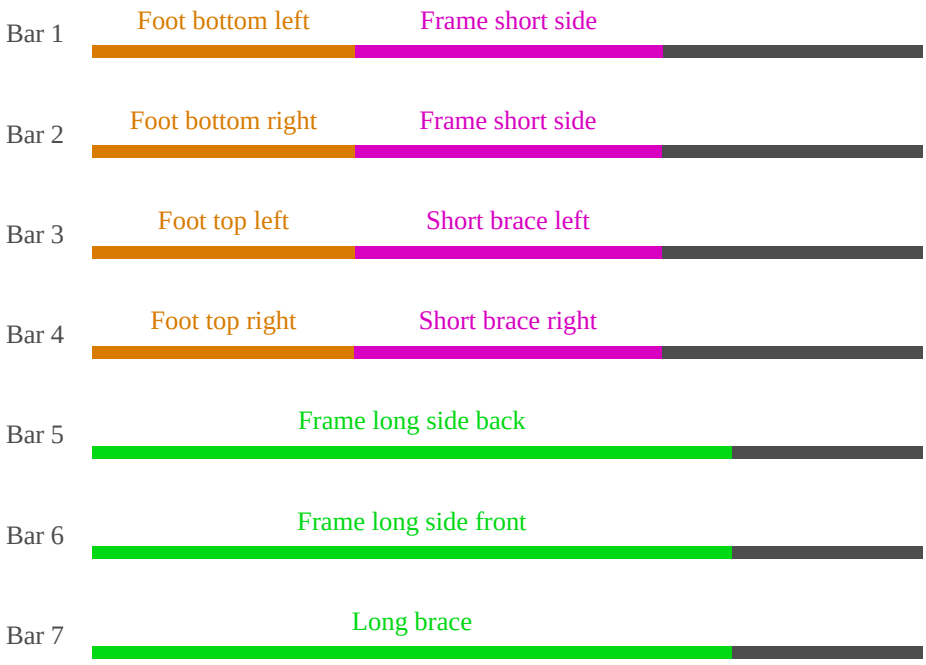



Figure 14: Distribution of parts to cut from the tubes.

## 5.1 Tubes fabrication

We document the fabrication of the parts made out of tubes.

### 5.1.1 Cutting the tubes to length

Given the tubes I procured, I distributed the parts which must be cut according to Fig. 14. Please note that, as usual, a circular saw has a significant thickness, and thus the parts have to be measured and cut one by one, rather than the tubes all be marked in advance. The steel tubes all cut to length are shown on Fig. 15.

The cuts are then filed, and the tubes cleaned with water and dishwashing soap.

### 5.1.2 Drilling holes

The dimensions are measured with a measuring tape, and the dedicated center marker tool. The position of the 5.5 mm holes are all marked with a center punch. The access holes are all always directly facing these holes, so drilling straight through the tubes is always possible for alignment. The 5.5 mm holes are all drilled using a 5.5 mm metal drill bit directly. A pillar drill is used, along with adequate cutting oil. The setup is shown on Fig. 16.

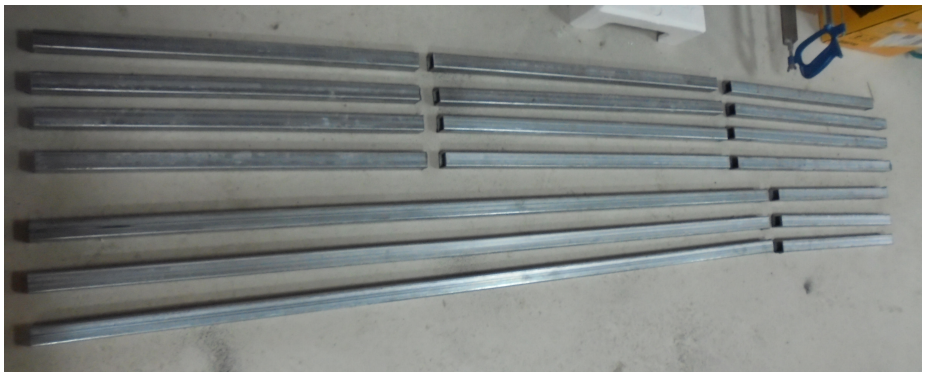


Figure 15: Steel tubes cut to length.

The access holes are drilled from the 5.5 mm pre-drilled holes, using bits of incremental diameter: 8, 10, 12, 14 and finally 16 mm.

## 5.2 Tabletop

The tabletop is sanded and varnished.

### 5.2.1 Sanding

The tabletop is first sanded with a medium grit of 180. The whole surface is sanded, and the top corners and edges broken. The setup can be seen on Fig. 17.

### 5.2.2 Varnish

The surface is first sanded with a very fine grit of 240. Then three coats of wood varnish are applied with a brush, with two hours drying between coats and a very light, 240 grit, sanding before each coat. Only the top surface of the tabletop was treated, the underside is left bare.

## 5.3 Back plate

The back plate was taken from leftover wood planks I had. It is cut to length using a jigsaw. The top hole for cables is cut by drilling large holes in the corners and finishing with a jigsaw. The role of this plate is to attach many things and eventually be replaced rapidly in the future as it gathers holes. Thus I left it untreated.

## 5.4 3D printing

We 3D-printed the dedicated tools, as well as the parts.

Figure 16: Drilling holes in the tubes.

Figure 17: Tabletop being sanded.

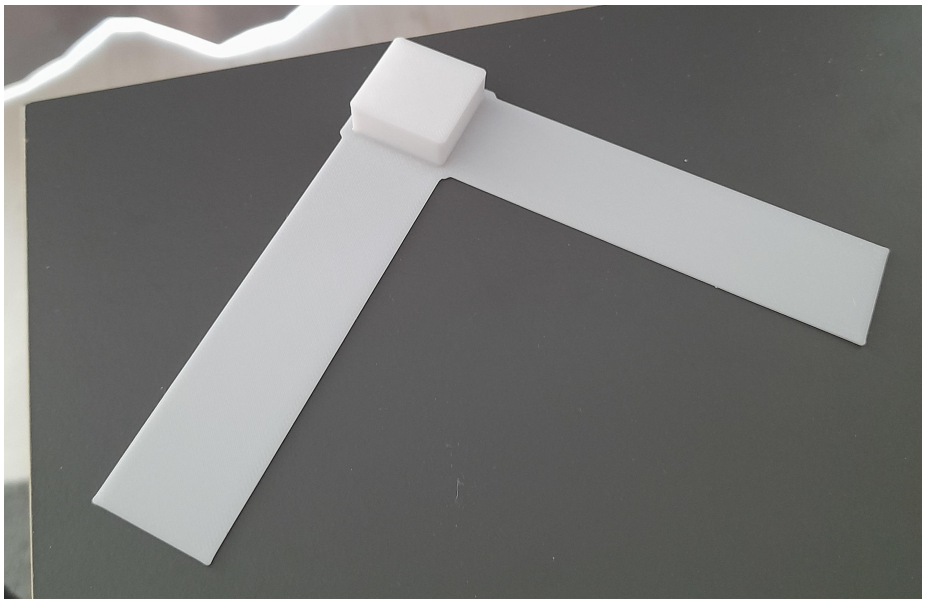


Figure 18: Corner interface part printed.

#### 5.4.1 Corner interface

The corner interface parts were 3D printed out of polyethylene terephthalate glycol (PETG), with standard settings. It is photographed on Fig. 18.

#### 5.4.2 Pod foot

The pod foot parts were 3D printed out of PETG, with standard settings. The parts hold the weight in compression along the direction of layers so there really is no issue of robustness. The parts are photographed on Fig. 19.

## 6 Assembly

The assembly is decomposed in several, successive steps.

### 6.1 Frame

First, the four tubes and brackets which compose the frame just under the tabletop are assembled. The assembled frame is photographed on Fig. 20. The dedicated fastener holder is needed for all tube assembly steps.

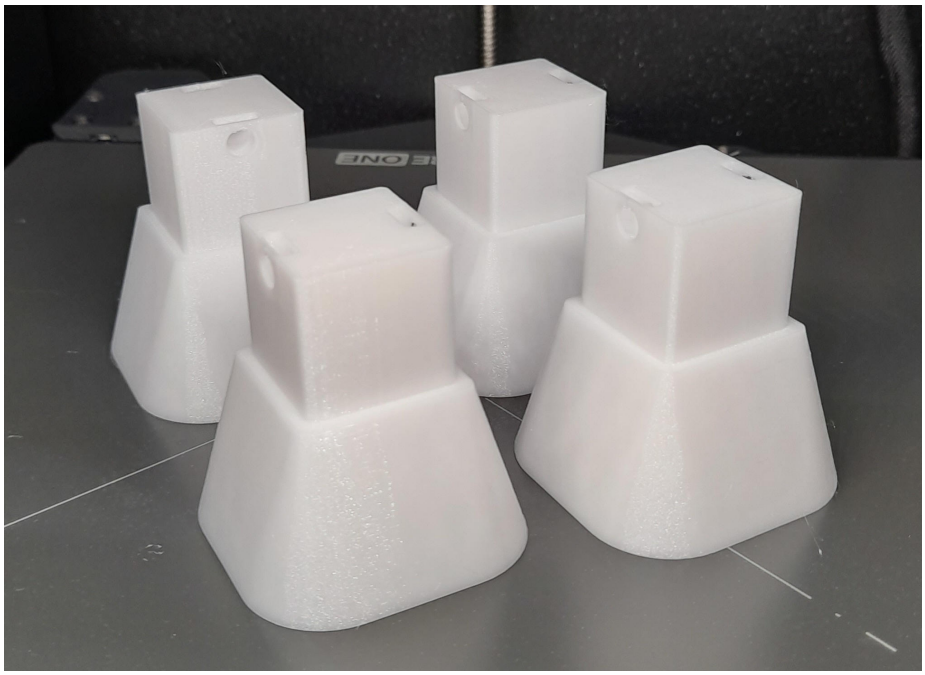


Figure 19: Pod foot parts printed.

## 6.2 Feet

The tube feet are subsequently assembled onto the frame. This step is photographed on Fig. 21.

## 6.3 Braces

The bracing tubes are finally assembled onto the feet, completing the metal assembly. This step is photographed on Fig. 22.

## 6.4 Tabletop

The screws which are accessed from the top of the frame will become inaccessible after the tabletop assembly. We make sure to tighten them before this step.

Pilot holes in the tabletop are pre-drilled with a handheld drill at diameter 3 mm, to the final depth of the hole. Note it is better to take the position of the holes from the assembled metal frame, rather than measure according to the drawing, since fabrication errors are likely too lax to guarantee alignment.

The tabletop is laid on a flat surface, with the bottom facing up. The metal frame is positioned on top of it. Washers are slotted between the tabletop and the frame, which is a tedious operation. We place screws in the middle of the

Figure 20: Assembled frame.


Figure 21: Assembled feet on the frame.

Figure 22: Assembled braces on the frame.

four sides first, then place the rest of them, and finally tighten them all. This step is photographed on Fig. 23.

### 6.5 Back plate

The through-holes in the back plate are marked according to their position on the assembled metal frame. They are drilled to diameter using a handheld drill. The back plate is then fastened to the metal frame. This step is photographed on Fig. 24.

### 6.6 Final assembly

All the screws are tightened in place. The pod feet are assembled. The assembly is complete (Fig. 1).

## 7 Conclusion

The final result is satisfactory. The finished desk is robust, an adult can sit on it without any problem. We note however that there is a slight wobble when pushed laterally. We think the use of reinforced brackets might fix this issue.

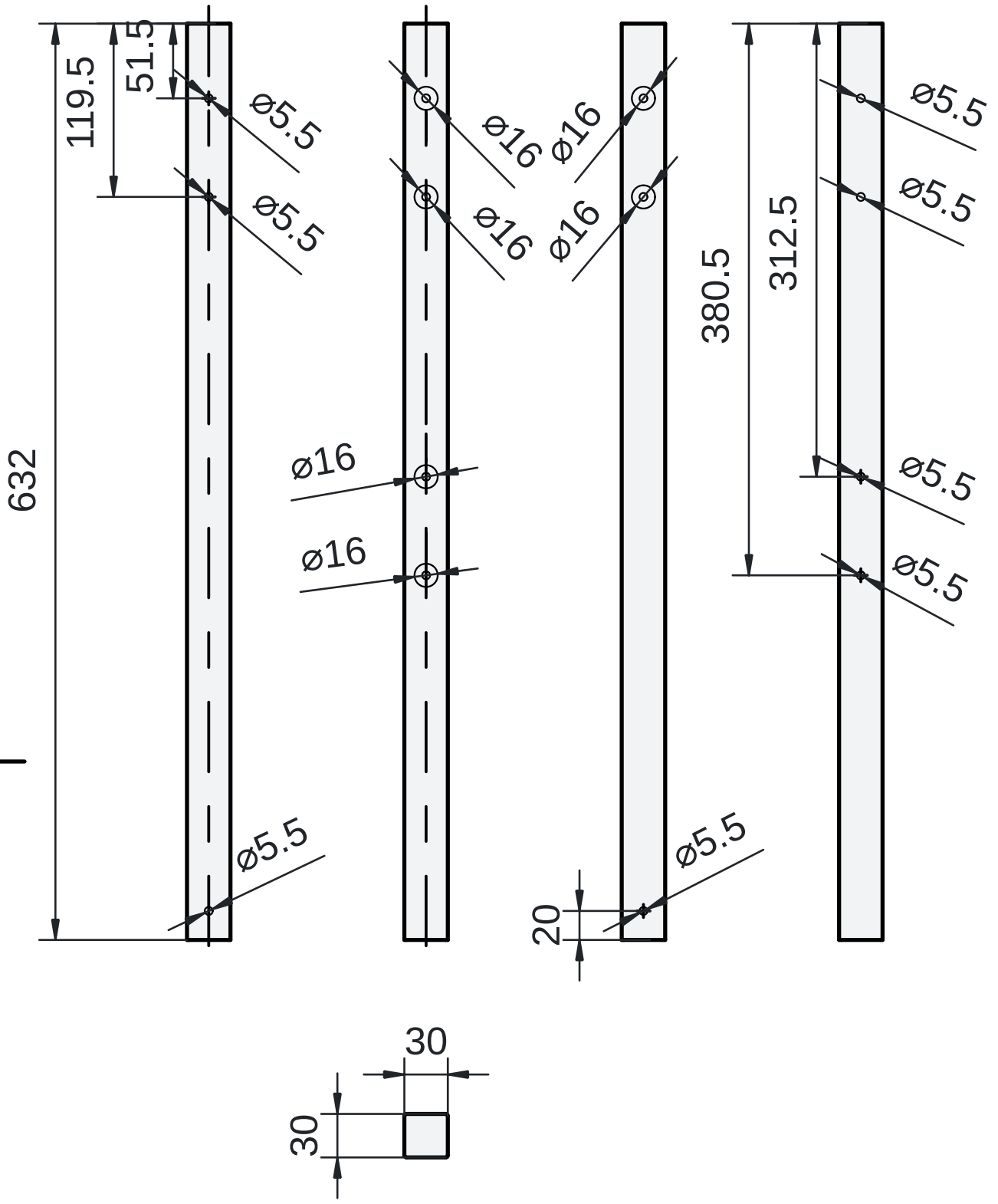
The fabrication and assembly is however too tedious, and took us roughly 40 hours, which is way too much. The drilling of holes is the longest step. We think a rationalization of the design could be carried out. In particular we could reduce the number of brackets and use reinforced ones, thus reducing the number of holes to drill. The washers and corner interface between the tabletop and the metal frame also seem useless, and we think they could be removed entirely to simplify the design. Finally, the side braces might be replaceable as well, and their stiffness function could be taken over by better brackets on top of the tube feet.

## 8 Drawings

All the design drawings are attached at the end of this report.

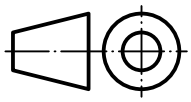

Figure 23: Assembled tabletop on the frame.

Figure 24: Assembled backplate on the frame.









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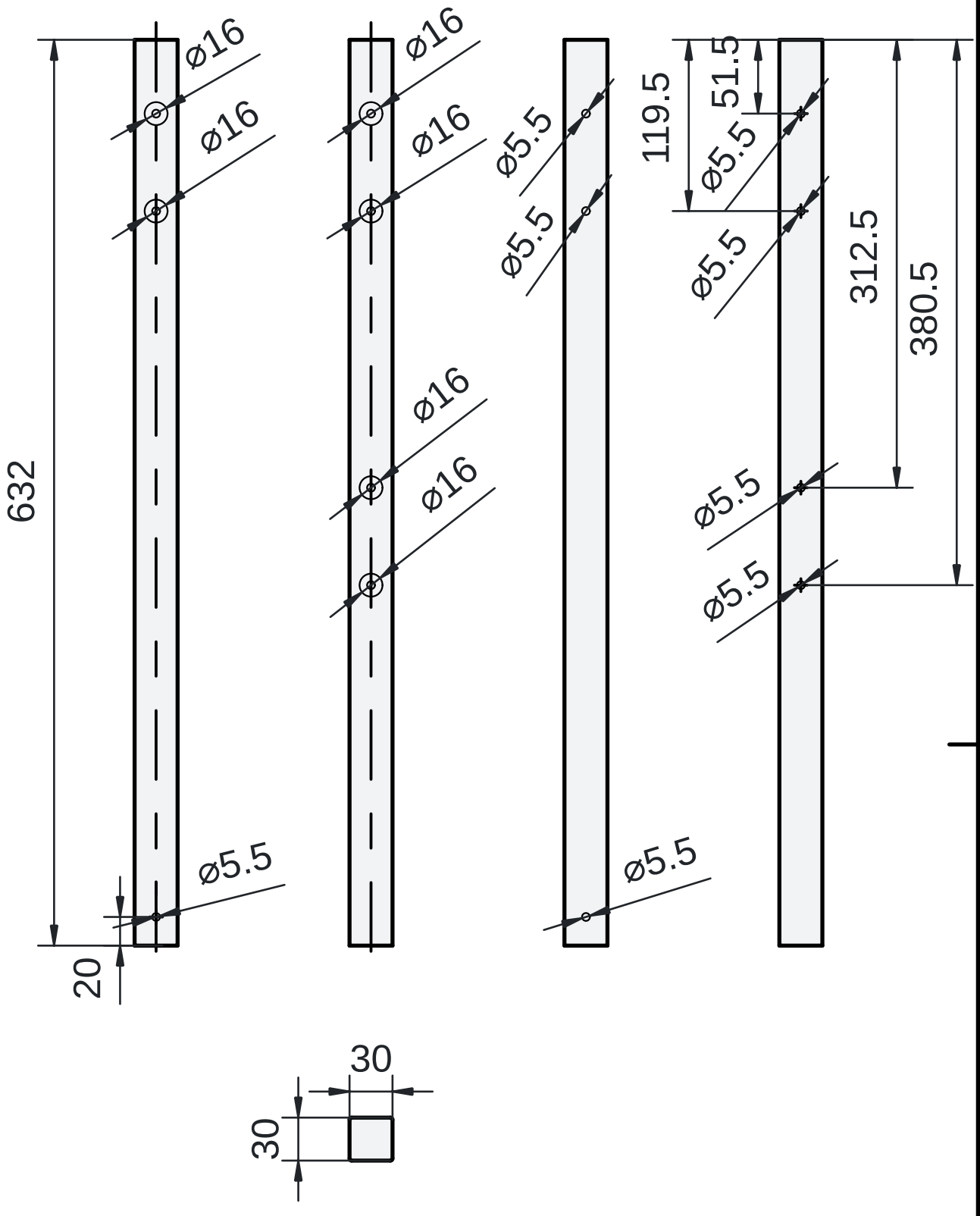


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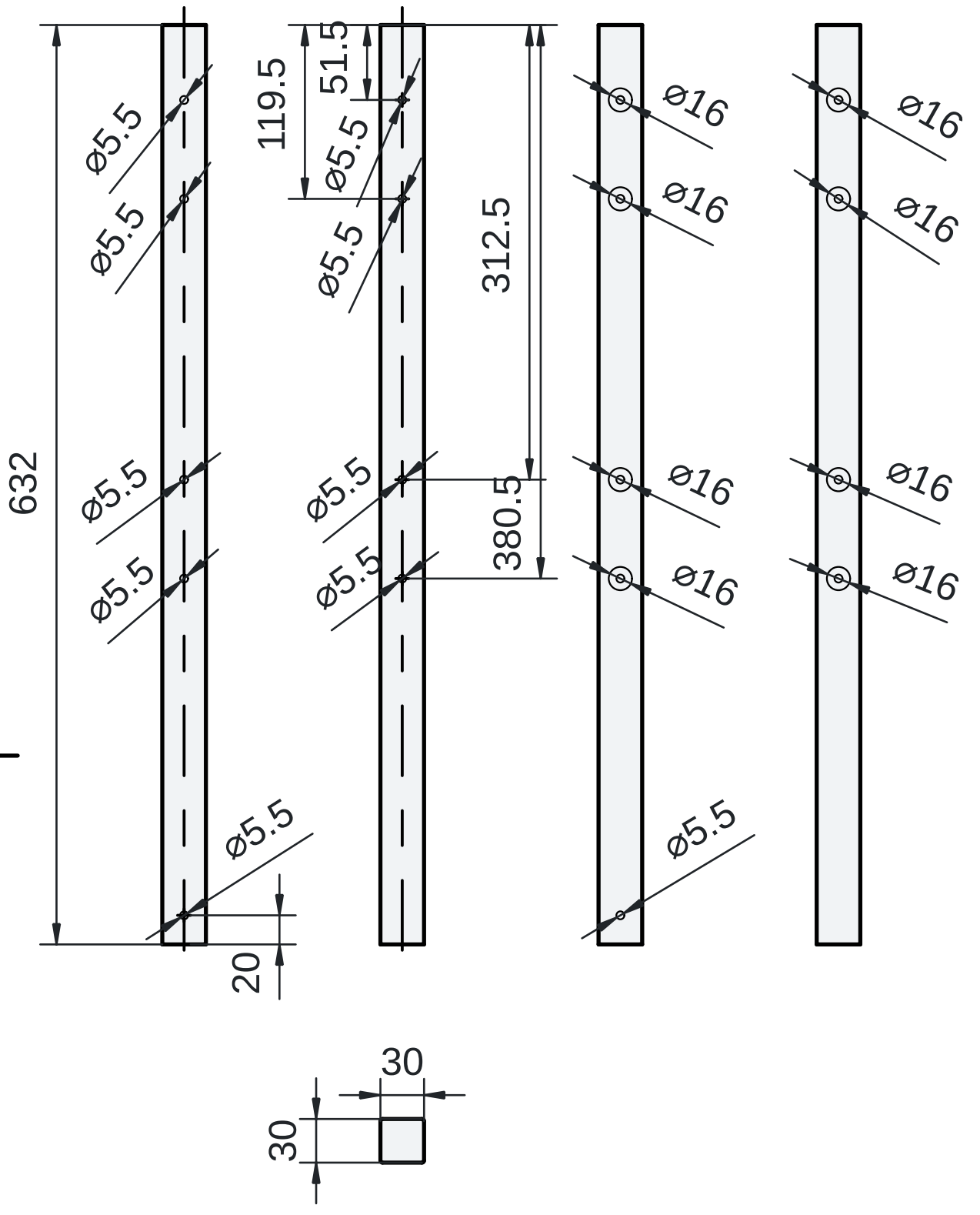


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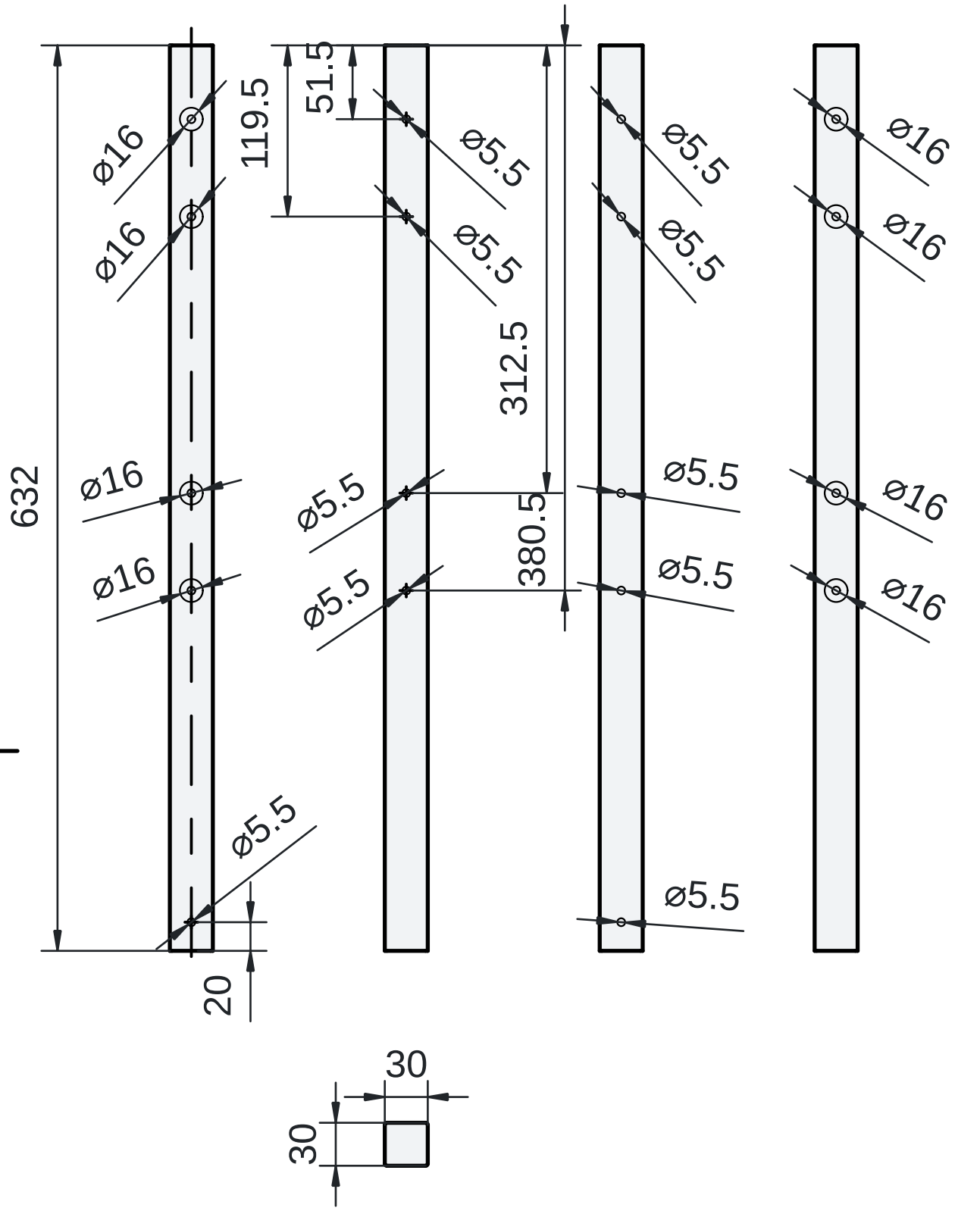


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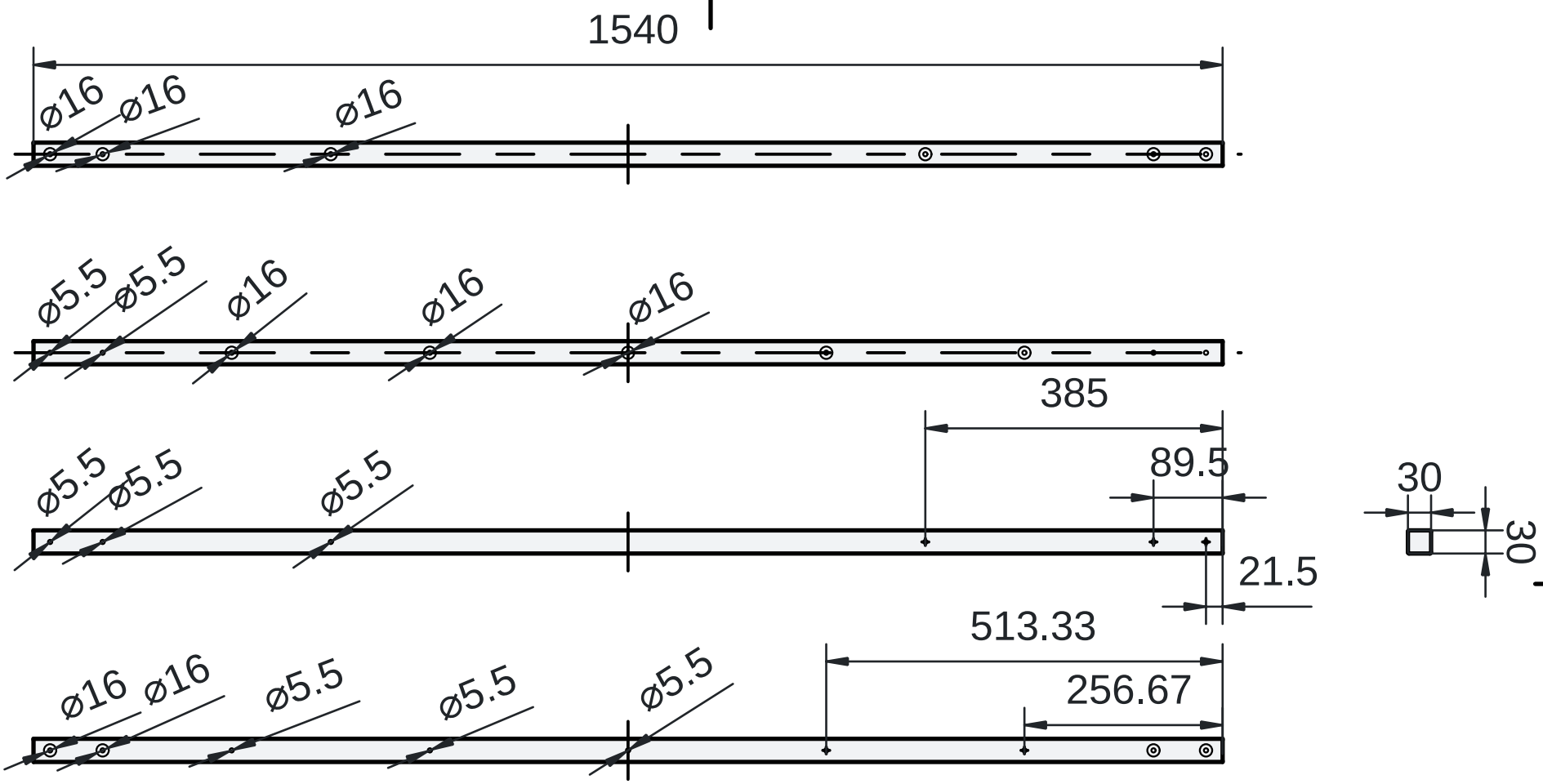


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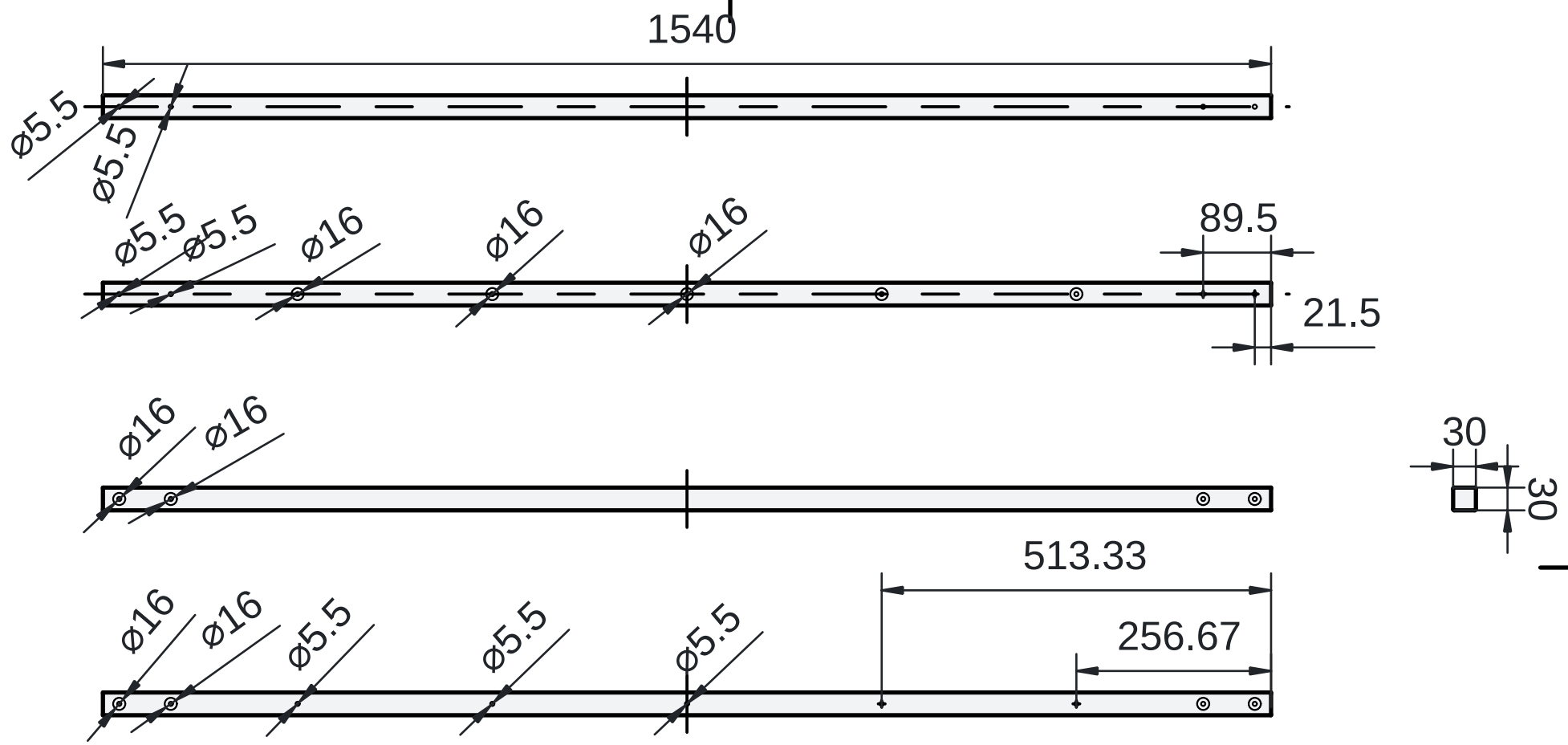


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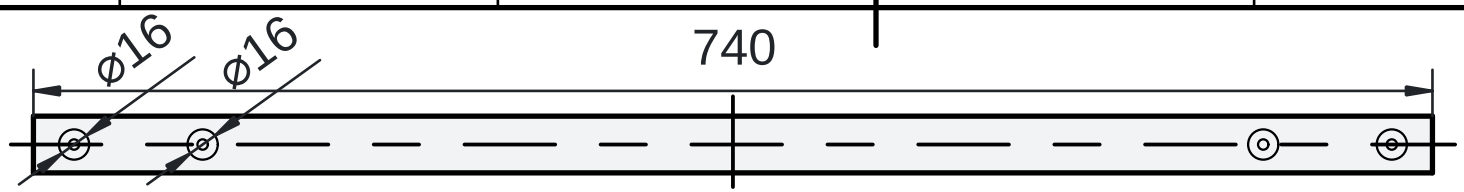
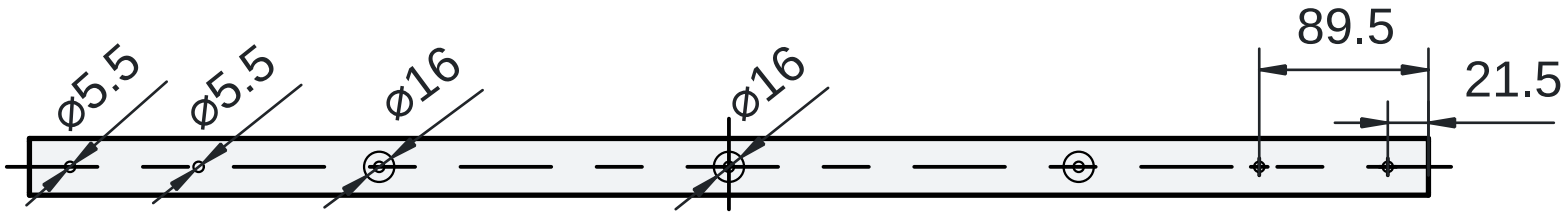
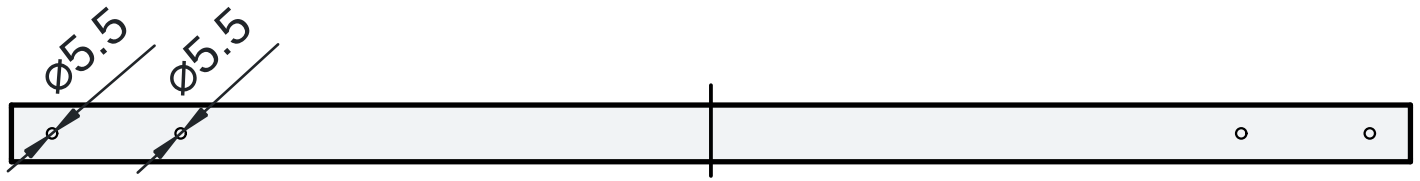
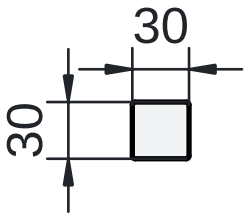
| Drawing number: PRJ2-DRW6 | Language: EN | Issue date: 18 Aug 2025 | Revision: v1.1 | Sheet: 1 / 1 | |

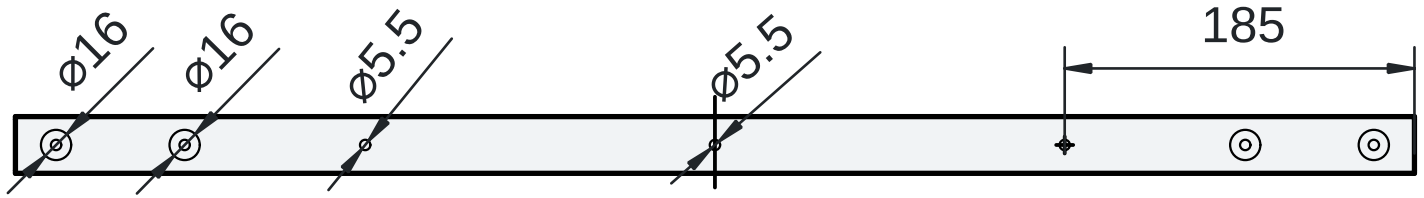
A4

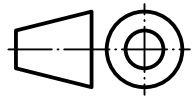


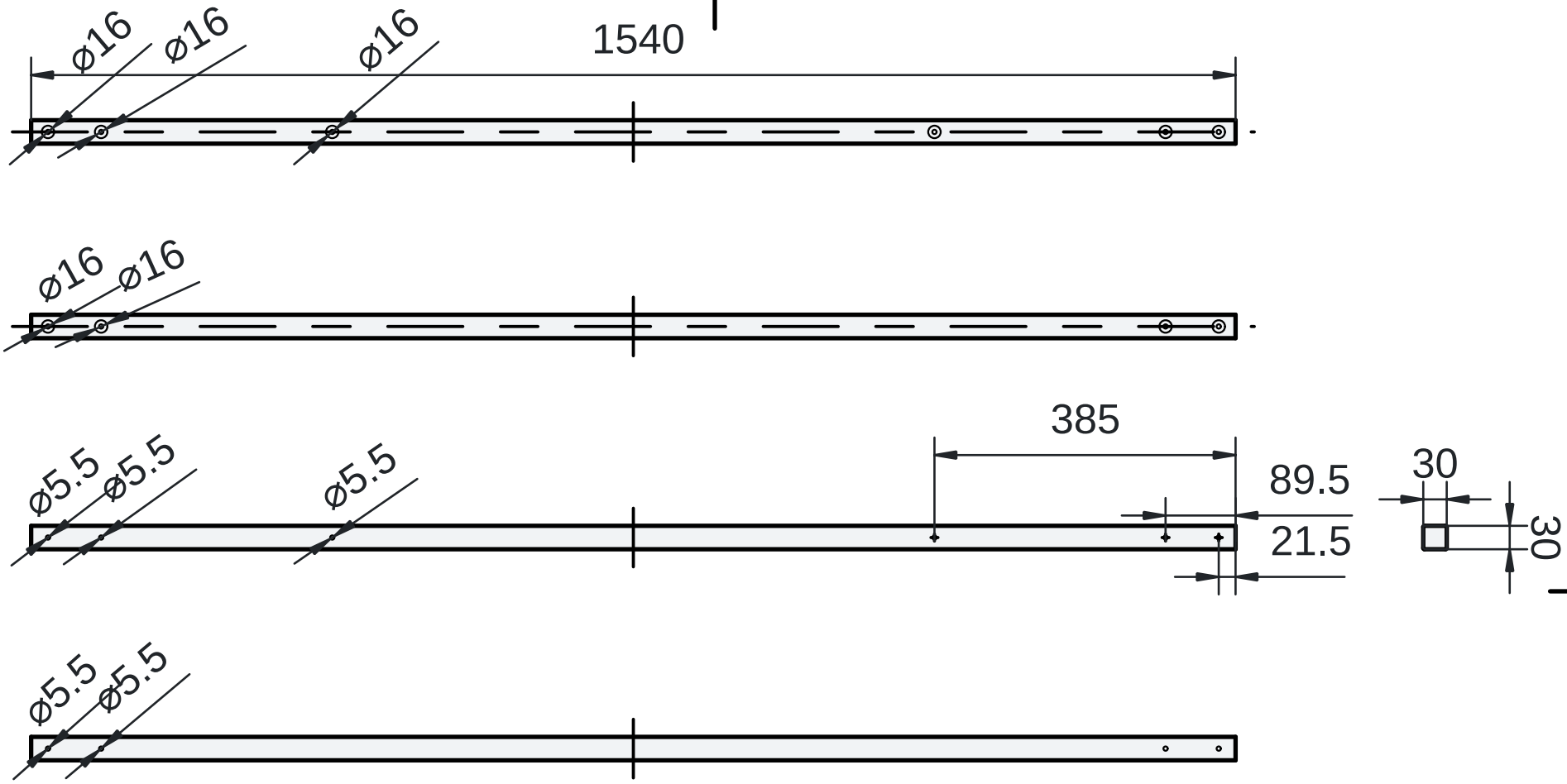
Part Material: Galvanized steel

General tolerances: ISO 2768-c

Scale: 1 : 4

| | | | | |
|---|---|---|---|---|
| Title: Frame short side | Created by: Thomas HOULLIER | | Owner: CC-BY 4.0 license | |
| Document type: Part drawing | Approved by: None | | | |
| Drawing number: PRJ2-DRW7 | Language: EN | Issue date: 18 Aug 2025 | Revision: v1.1 | Sheet: 1 / 1 |

A4



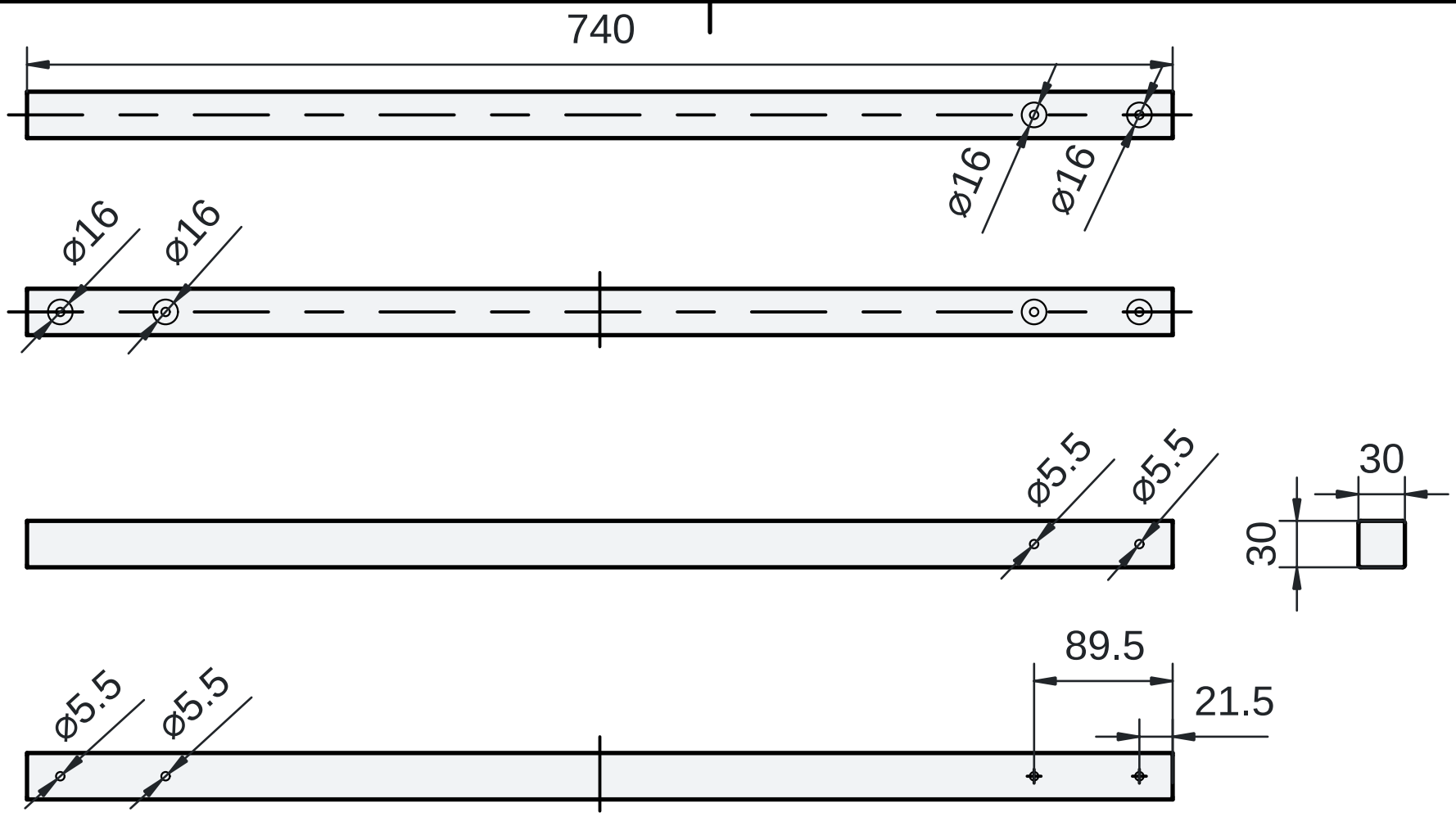

Part Material: Galvanized steel

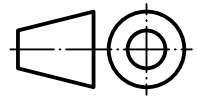
General tolerances: ISO 2768-c

Scale: 1 : 8

| | | | | |
|---|---|---|---|---|
| Title: Long brace | Created by: Thomas HOULLIER | | Owner: CC-BY 4.0 license | |
| Document type: Part drawing | Approved by: None | | | |
| Drawing number: PRJ2-DRW8 | Language: EN | Issue date: 18 Aug 2025 | Revision: v1.1 | Sheet: 1 / 1 |

A4

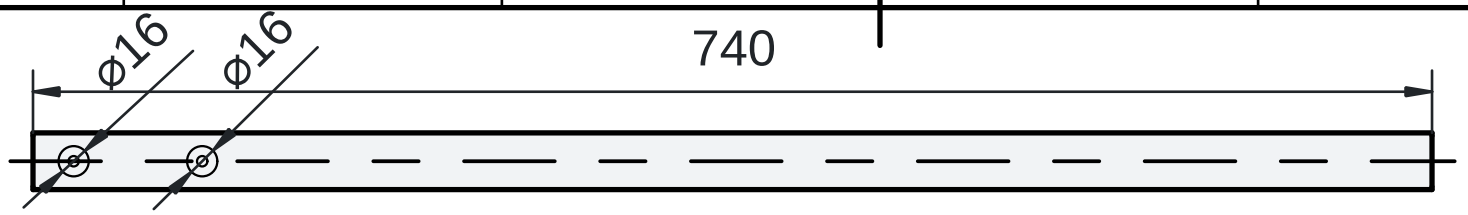


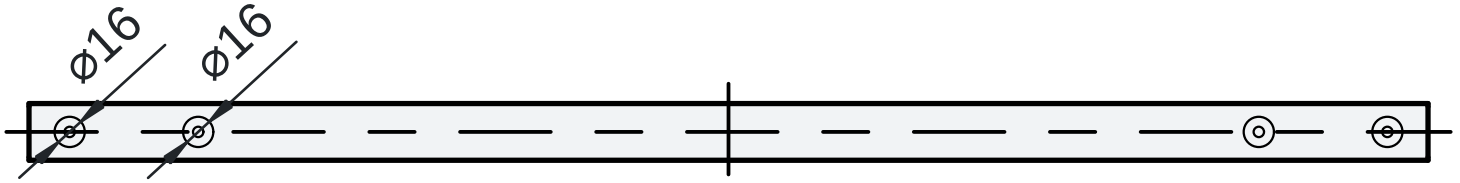



| Part Material: | General tolerances: | Scale: |
|---|---|---|
| Galvanized steel | ISO 2768-c | 1 : 4 |

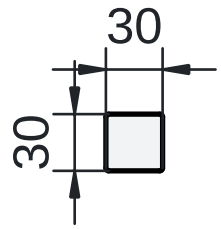
| | | | | |
|---|---|---|---|---|
| Title: Short brace left | Created by: Thomas HOULLIER | | Owner: CC-BY 4.0 license | |
| Document type: Part drawing | Approved by: None | | | |
| Drawing number: PRJ2-DRW9 | Language: EN | Issue date: 18 Aug 2025 | Revision: v1.1 | Sheet: 1 / 1 |

A4

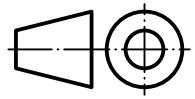










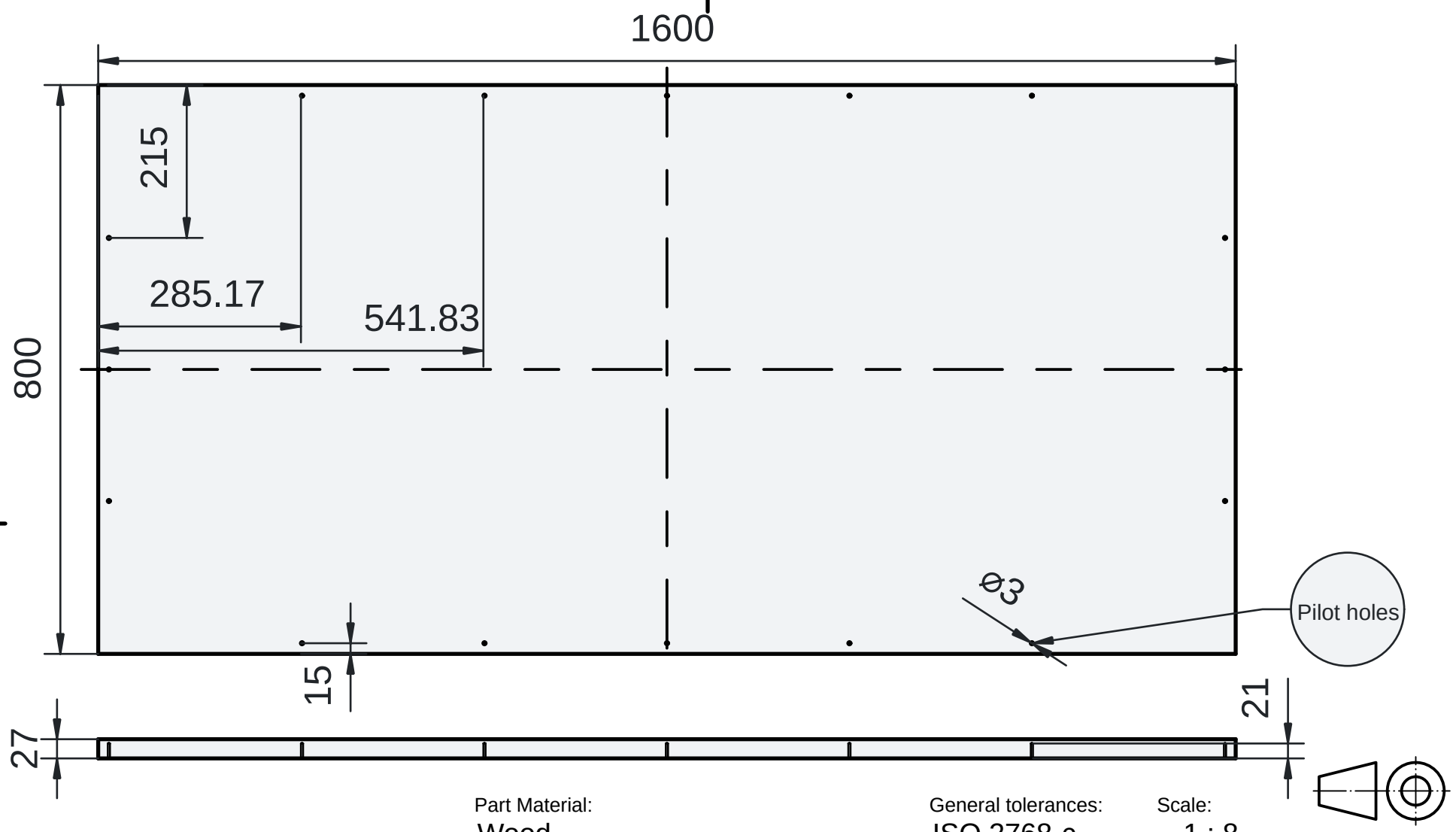
Part Material: Galvanized steel

General tolerances: ISO 2768-c

Scale: 1 : 4

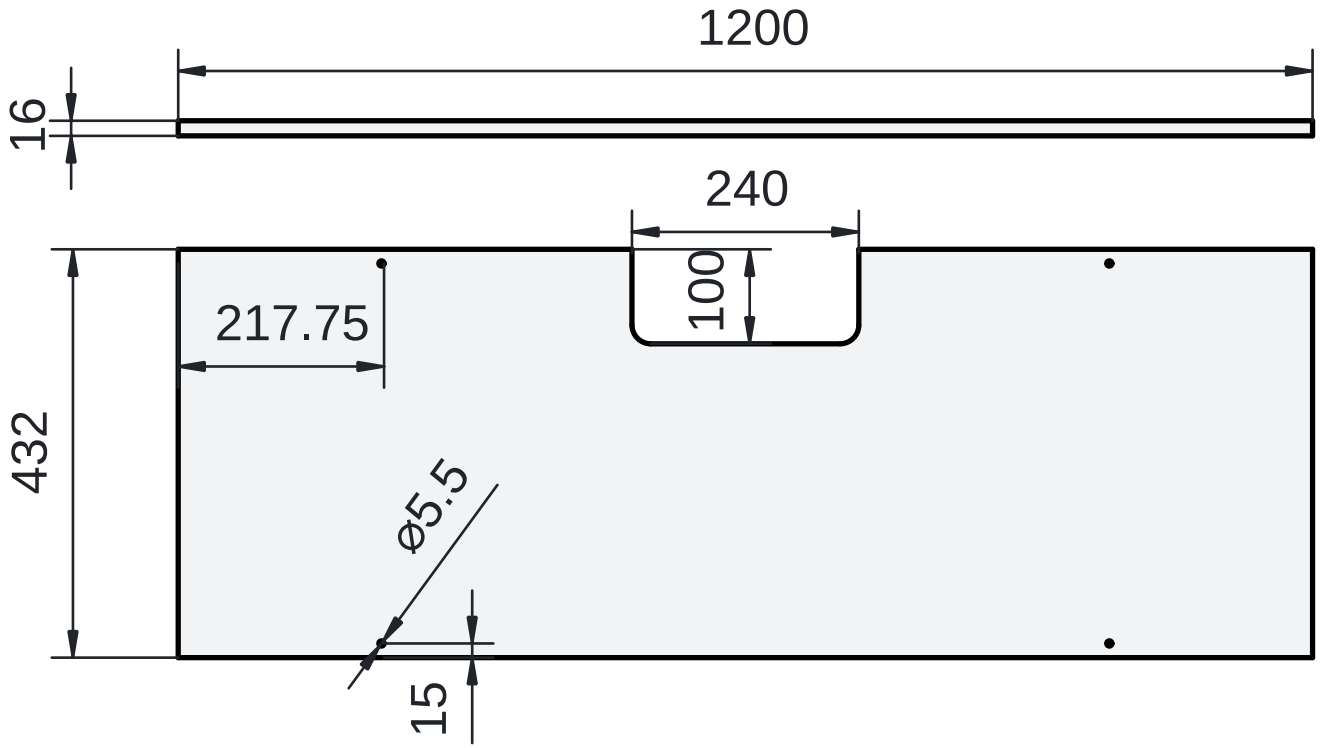
| | | | | |
|---|---|---|---|---|
| Title: Short brace right | Created by: Thomas HOULLIER | | Owner: CC-BY 4.0 license | |
| Document type: Part drawing | Approved by: None | | | |
| Drawing number: PRJ2-DRW10 | Language: EN | Issue date: 18 Aug 2025 | Revision: v1.1 | Sheet: 1 / 1 |

A4




| | | | | | |
|---|---|---|---|---|---|
| Part Material: Wood | General tolerances: ISO 2768-c | | Scale: 1 : 8 | | |
| Title: Tabletop | Created by: Thomas HOULLIER | | | Owner: CC-BY 4.0 license | |
| Document type: Part drawing | Approved by: None | | | | |
| Drawing number: PRJ2-DRW11 | Language: EN | Issue date: 23 Aug 2025 | | Revision: v1.1 | Sheet: 1 / 1 |

A4




Part Material: Wood

General tolerances: ISO 2768-c

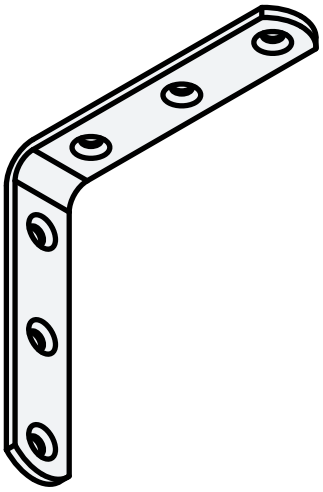
Scale: 1 : 8

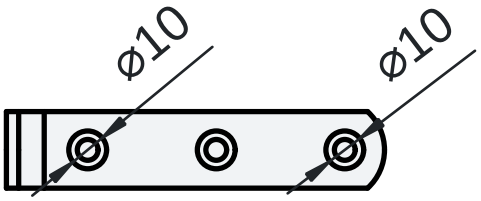
| | | | | |
|---|---|---|---|---|
| Title: Back plate | Created by: Thomas HOULLIER | | Owner: CC-BY 4.0 license | |
| Document type: Part drawing | Approved by: None | | | |
| Drawing number: PRJ2-DRW12 | Language: EN | Issue date: 23 Aug 2025 | Revision: v1.1 | Sheet: 1 / 1 |

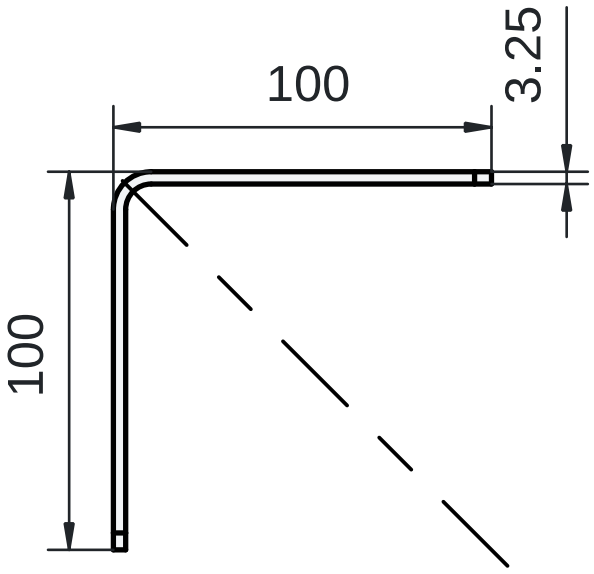
A4

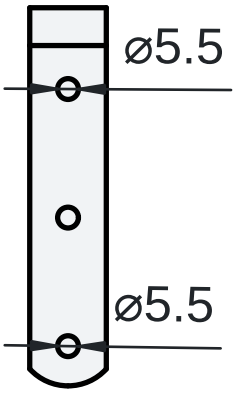
# Standard countersunk

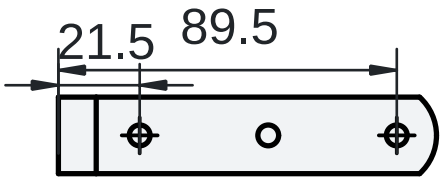
## M5 holes

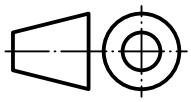




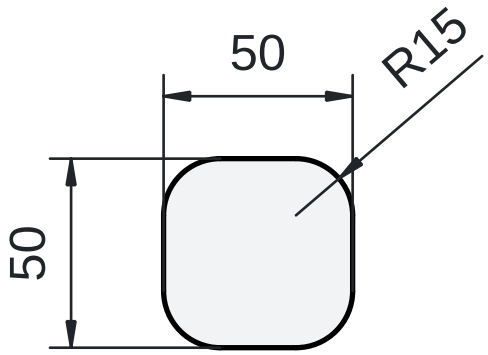



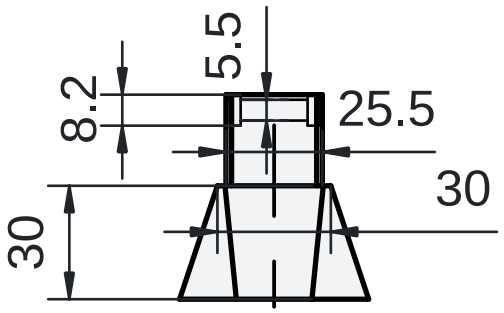



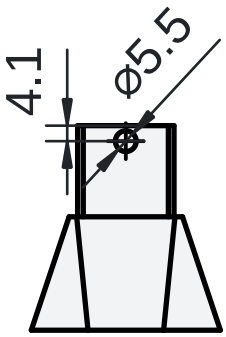
| | | |
|---|---|---|
| Part Material: Steel | General tolerances: ISO 2768-m | Scale: 1 : 2 |

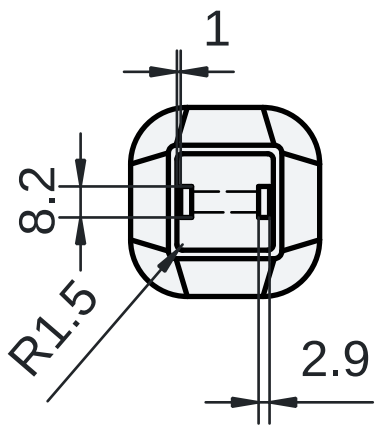
| | | | | |
|---|---|---|---|---|
| Title: Bracket | Created by: Thomas HOULLIER | | Owner: CC-BY 4.0 license | |
| Document type: Part drawing | Approved by: None | | | |
| Drawing number: PRJ2-DRW13 | Language: EN | Issue date: 30 Aug 2025 | Revision: v1.0 | Sheet: 1 / 1 |

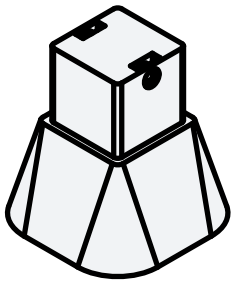
A4

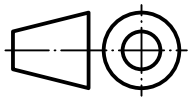


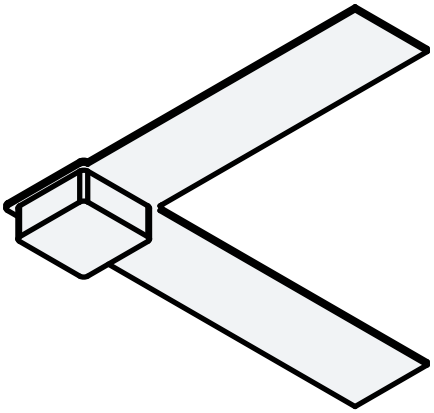



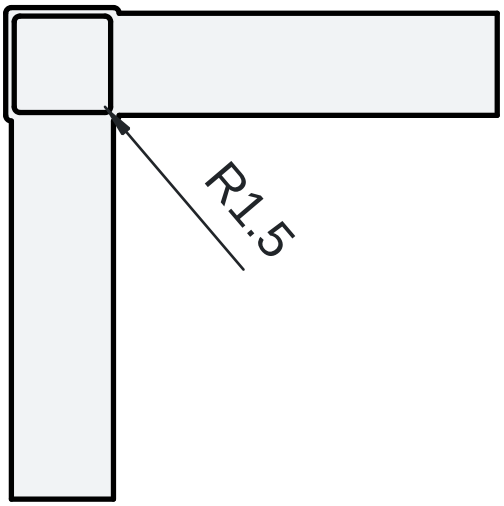


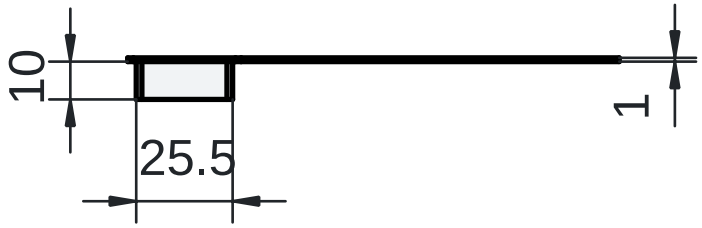
| Part Material: | General tolerances: | Scale: |
|---|---|---|
| PETG | ISO 2768-m | 1 : 2 |

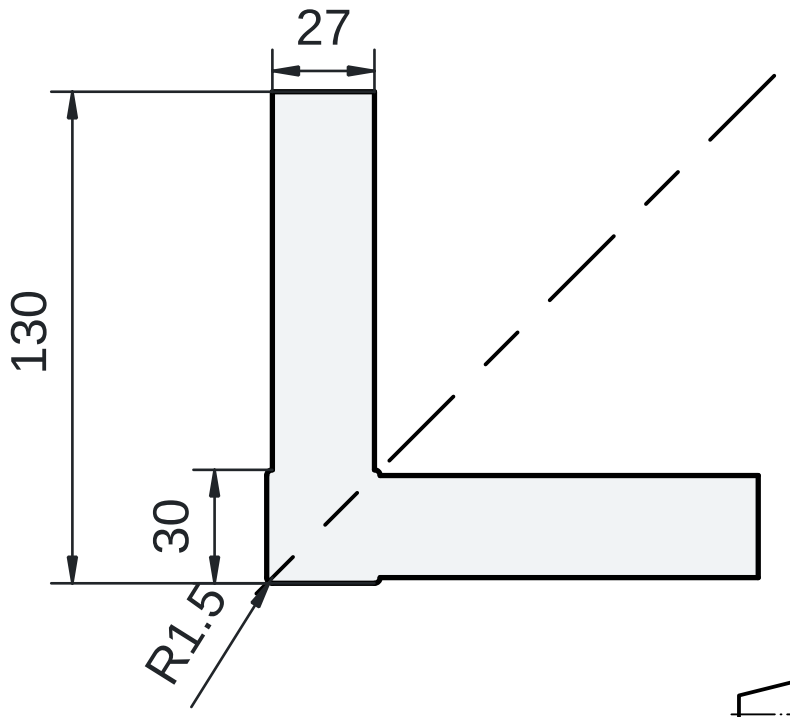
| | | | | |
|---|---|---|---|---|
| Title: Pod foot | Created by: Thomas HOULLIER | | Owner: CC-BY 4.0 license | |
| Document type: Part drawing | Approved by: None | | | |
| Drawing number: PRJ2-DRW14 | Language: EN | Issue date: 30 Aug 2025 | Revision: v1.0 | Sheet: 1 / 1 |

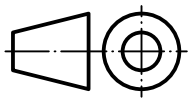
A4





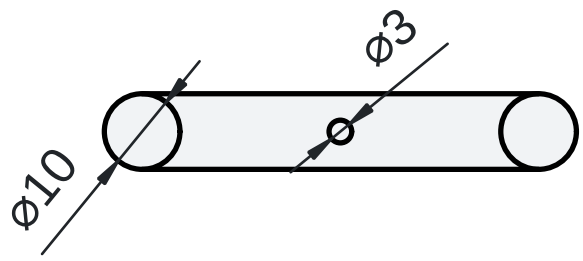
Part Material: PETG

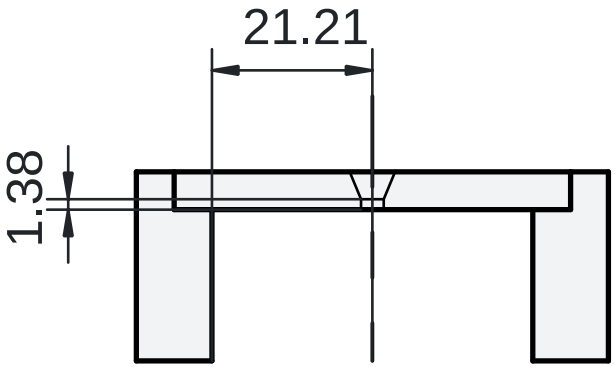
General tolerances: ISO 2768-m

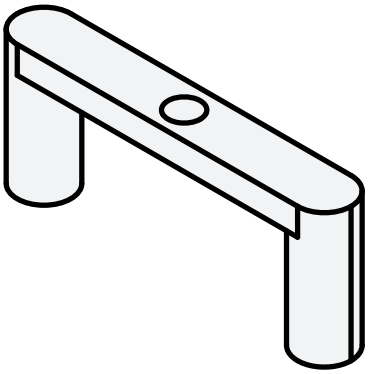
Scale: 1 : 2

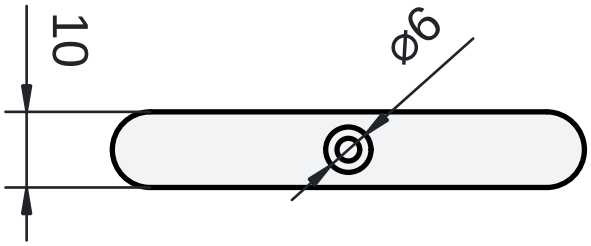
| | | | | |
|---|---|---|---|---|
| Title: Corner interface | Created by: Thomas HOULLIER | | Owner: CC-BY 4.0 license | |
| Document type: Part drawing | Approved by: None | | | |
| Drawing number: PRJ2-DRW15 | Language: EN | Issue date: 30 Aug 2025 | Revision: v1.0 | Sheet: 1 / 1 |

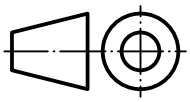
A4



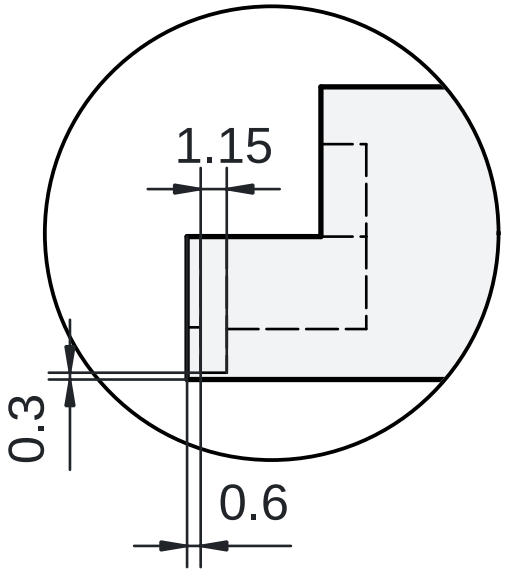


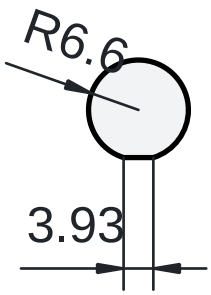



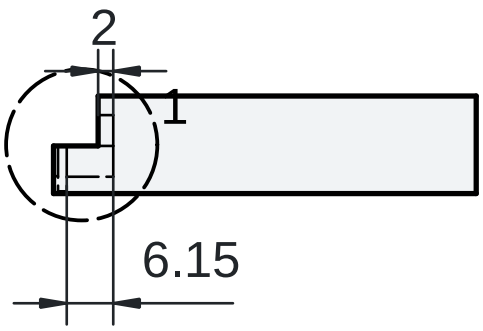
| Part Material: | General tolerances: | Scale: |
|---|---|---|
| PLA | ISO 2768-m | 1 : 1 |

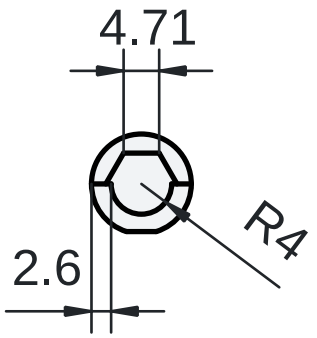
| Title: | Created by: | | Owner: | |
|---|---|---|---|---|
| Center marker | Thomas HOULLIER | | CC-BY 4.0 license | |
| Document type: | Approved by: | | | |
| Part drawing | None | | | |
| Drawing number: | Language: | Issue date: | Revision: | Sheet: |
| PRJ2-DRW16 | EN | 30 Aug 2025 | v1.0 | 1 / 1 |

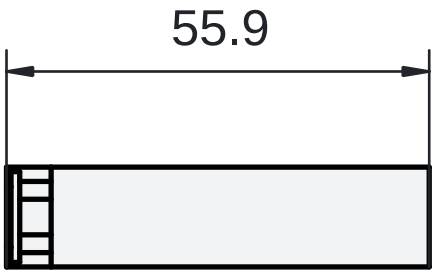
A4

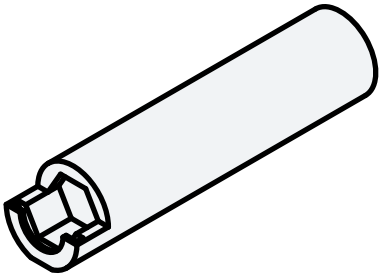


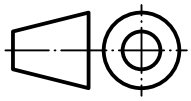





| | | | | |
|---|---|---|---|---|
| Part Material: PLA | General tolerances: ISO 2768-m | Scale: 1 : 1 | | |
| Title: Fastener holder | Created by: Thomas HOULLIER | | Owner: CC-BY 4.0 license | |
| Document type: Part drawing | Approved by: None | | | |
| Drawing number: PRJ2-DRW17 | Language: EN | Issue date: 30 Aug 2025 | Revision: v1.0 | Sheet: 1 / 1 |

A4