



MANUAL

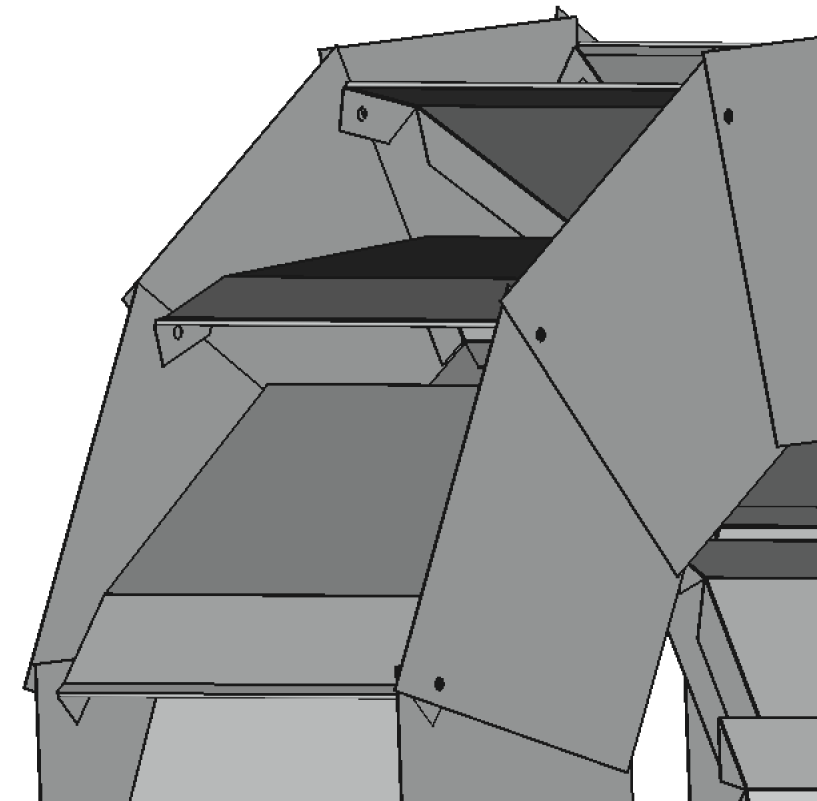
Manufacturing and Assembly of the Waterwheel Method B) – Manual cutting

Overview: Sections

Tools

- A.) Manufacturing of the module parts
- B.) Module assembly
- C.) Waterwheel assembly
- D.) Assembly of the coupling structure

DIY Protractor

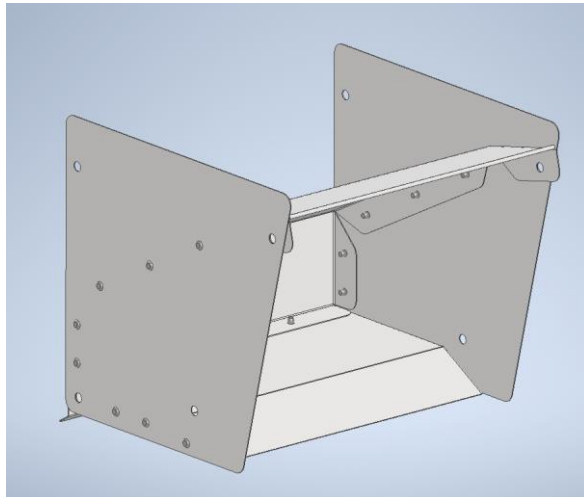


Introduction to the waterwheel concept

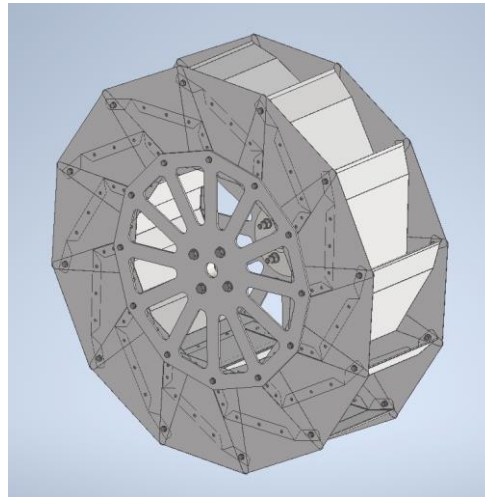
The waterwheel is an off-grid power generation system that can produce some 100 – 600W of 230V AC electricity. It is designed to fit the needs and circumstances of consumers in remote areas in Nepal suffering from energy poverty.

The concept is:

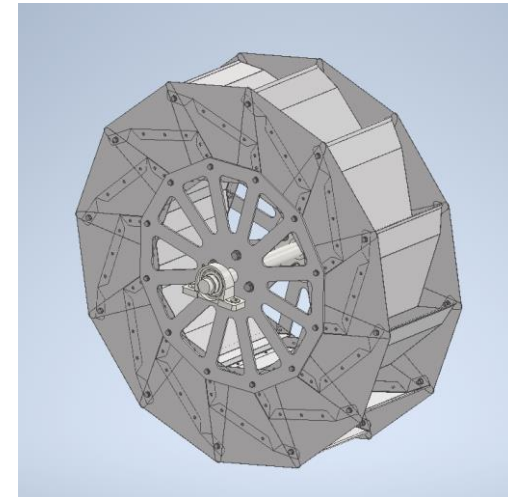
- **cheap** and **easy** to manufacture
 - **flexible** – it is adaptable depending on the available water resource of the site (Head H and Flow Rate Q)
 - **modular** – the water wheel consists of a variable number of standardized modules. The amount depends on the available head.
 - Low head (1,3m): 12 modules ↔ High head (2,3m): 25 modules
 - **standardized** – the chamber modules are standardized, they are the same even for different available heads.
- The chamber modules are available in the widths of 20 and 30cm.



Standardized module



Waterwheel with 12 modules



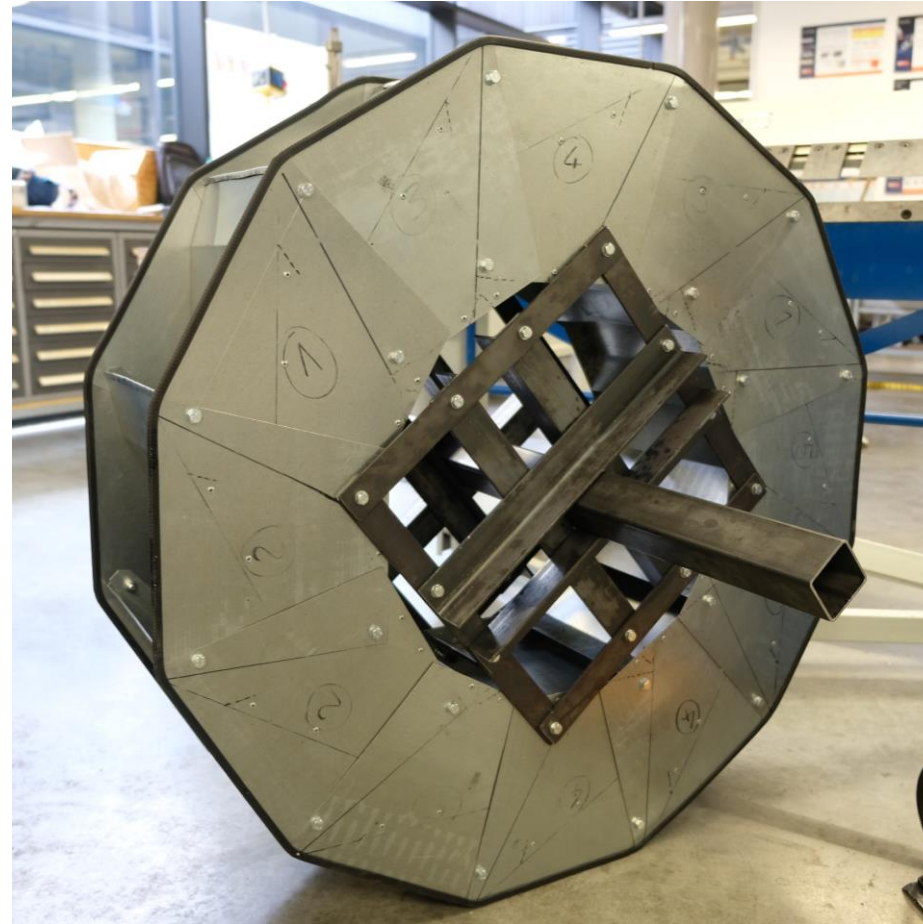
Finished waterwheel assembly

Components of the system

Periphery
Intake & Canal

Hub
Shaft
Bearings

Support
Structure



Transmission

Generator

Control System
Power Electronics
Consumers

Tools needed for the manufacturing of the waterwheel



Bolts, nuts & washers

24x M8-20mm bolts
24x M8-30mm bolts
8x M14-50mm bolts
2x M10-40mm bolts
24x M8 nuts
8x M14 nuts
72x M8 washers
16x M14 washers



Wrench

2x 13mm wrench
1x 16-17mm wrench
2x 22mm wrench



Protractor

Look at the last pages of
this manual for a DIY
protractor!



3, 4, 6, 9 and
11 mm drill
bit

Drilling machine with
drill bits



Hammer & center punch

Tools needed for the manufacturing of the waterwheel



Metal scissor



Bending machine



Rivet pliers, blind rivets,
rivet nuts, rivet nut gun

240 x 4mm blind rivets
24x M8 rivet nuts



Pen, scribe and
square



Deburring tool or
metal sandpaper



12 screw clamps
(C-clamps)



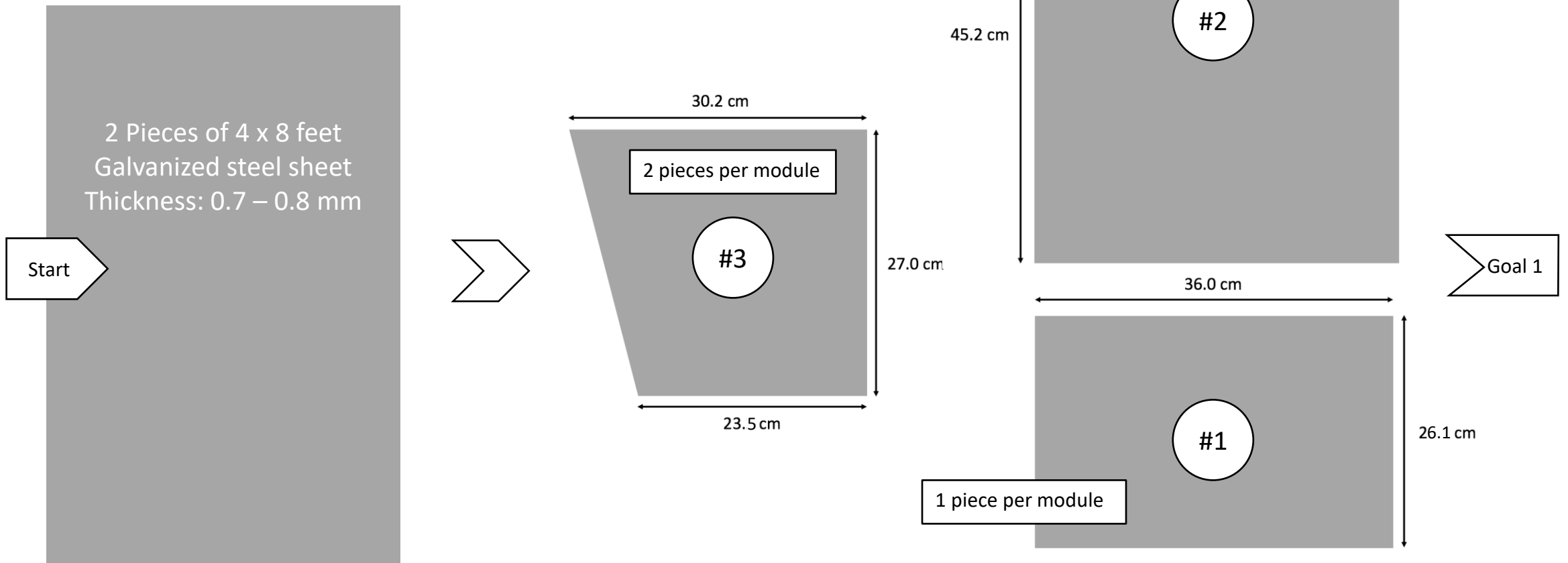
This manual describes the assembly of a 12 module waterwheel. The same principle and steps can be applied for all sizes. Please refer to the dimensioning tool to size your optimal system and adjust the amount of parts and tools as needed.

A.) Manufacturing of the module parts

1. Step: Basic cutting

Tools needed:

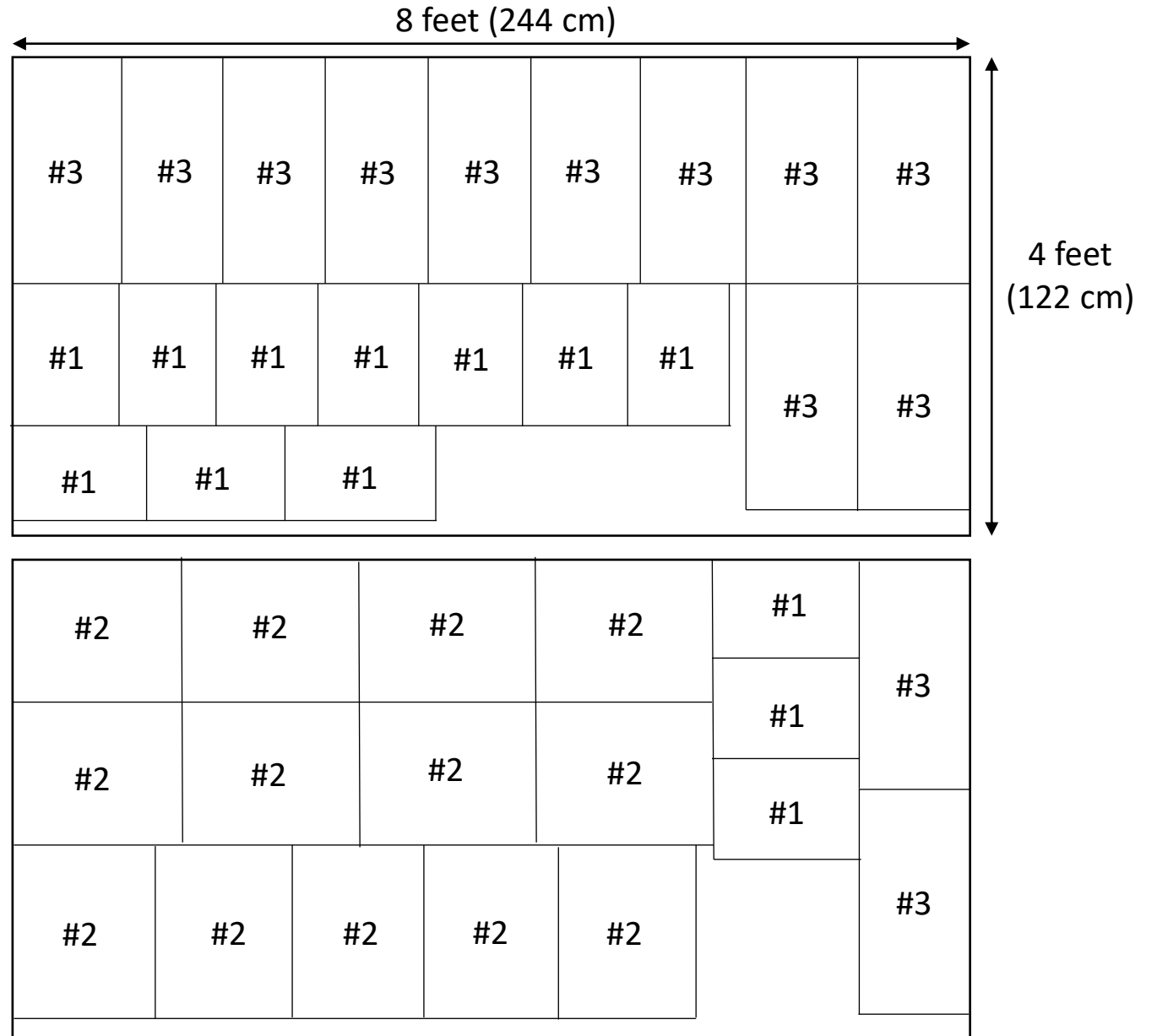
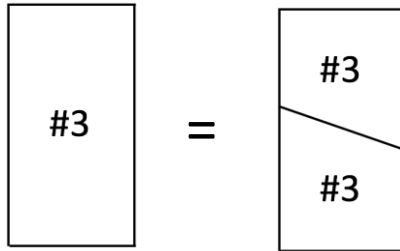
- Metal scissor **or** angle grinder
- Galvanized steel sheet: 0.7 – 0.8 mm thickness
→ 2 pieces of 4 x 8 feet for 12 modules
- Pen, scribe and square



Getting the most out of your sheet

With this scheme you can get 13 modules out of two sheets of 4x8 feet

Note:
Part #3 is needed 2x per module.
That's why in the picture to the right, two parts of #3 are combined to one rectangle:

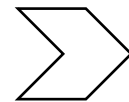
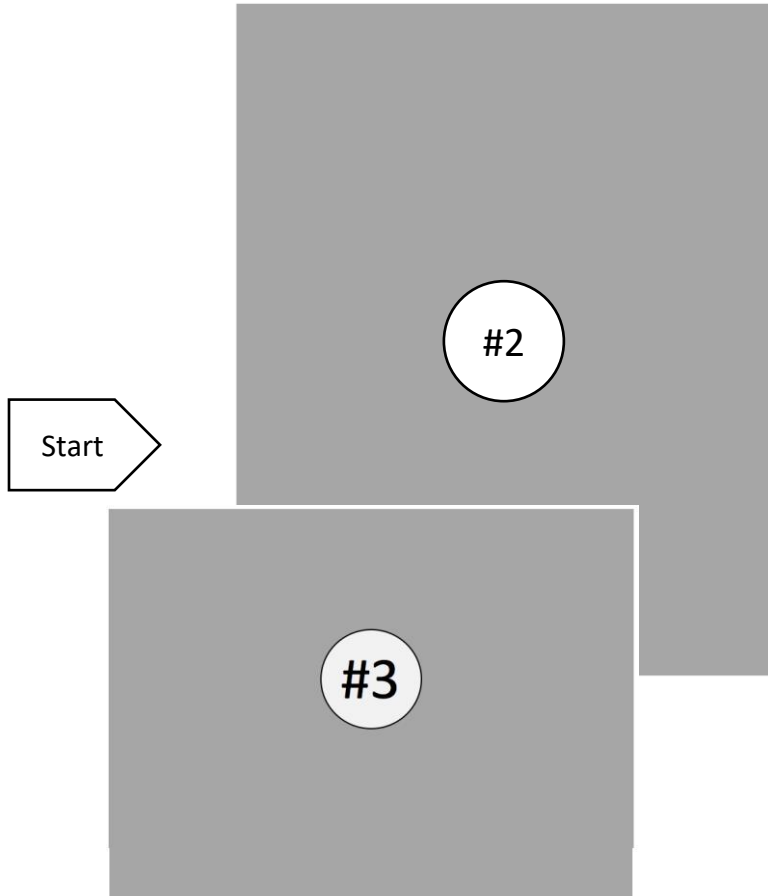


Method B)
Manual cutting

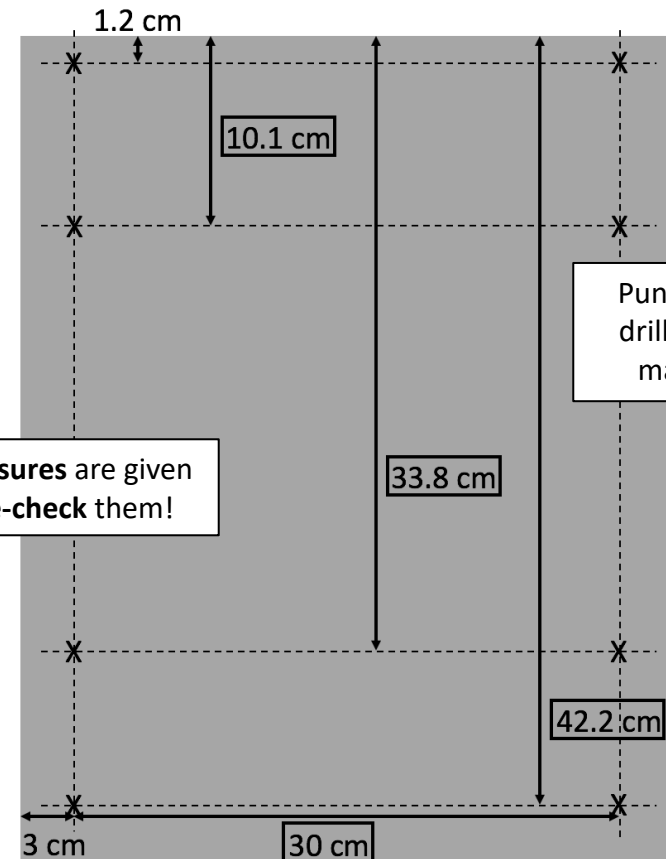
2. Step: Punch marking

Tools needed:

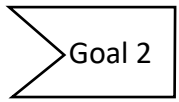
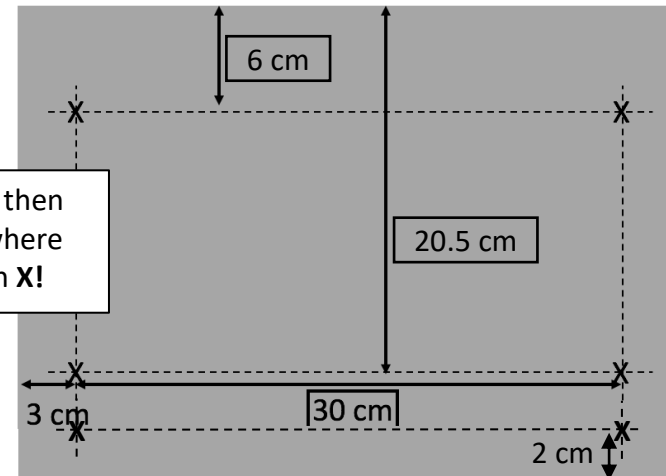
- Hammer and center punch
- Drilling machine and 3mm drill bit
- Pen, scribe and square



The most **important measures** are given in boxes! Always **double-check** them!



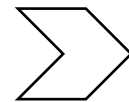
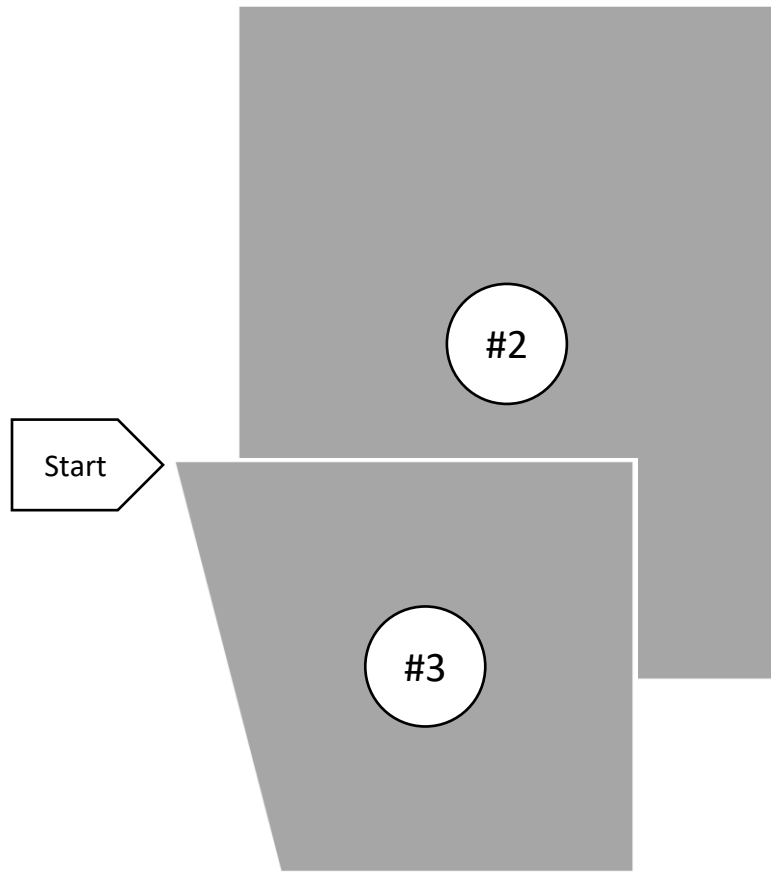
Punch mark and then drill (3mm bit) where marked with an X!



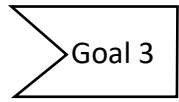
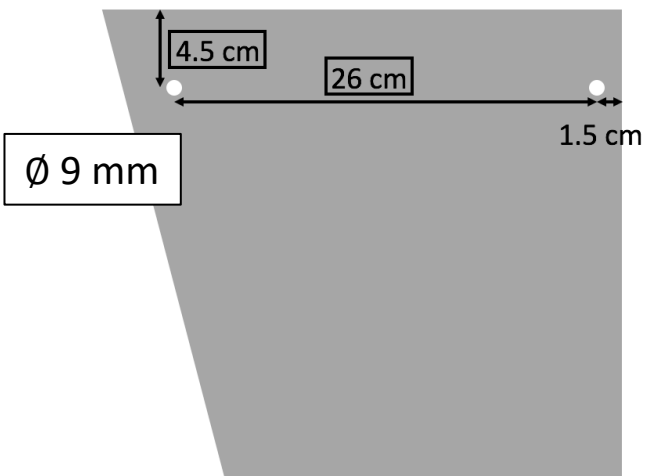
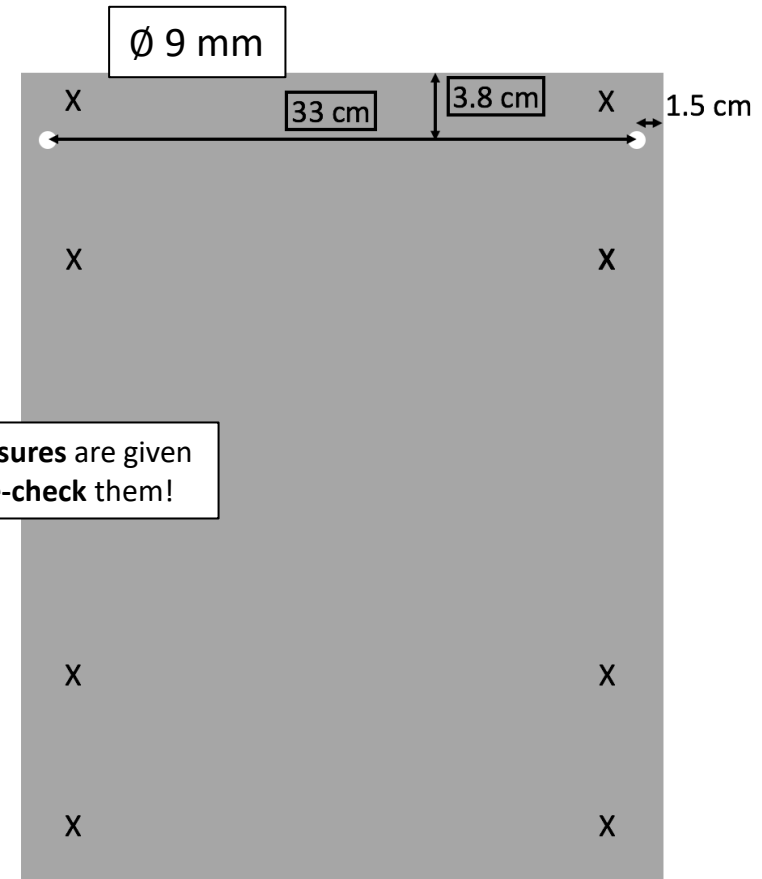
3. Step: Drilling 9mm holes

Tools needed:

- Drilling machine with 9mm drill bit
- Pen, scribe and square



The most **important measures** are given in boxes! Always **double-check** them!

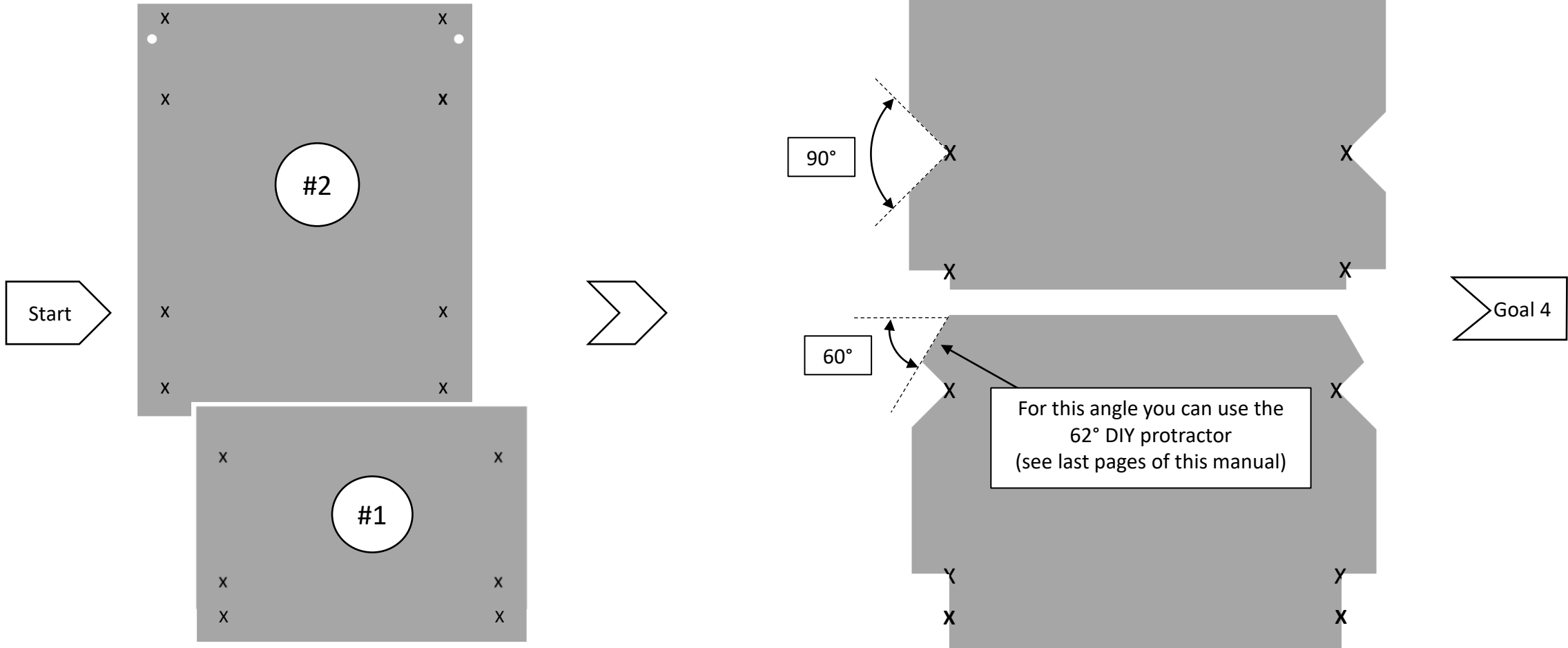


Method B)
Manual cutting

4. Step: Fine cutting of #1 and #2

Tools needed:

- Metal scissor
- Pen, scribe and protractor
- Sandpaper or deburring tool

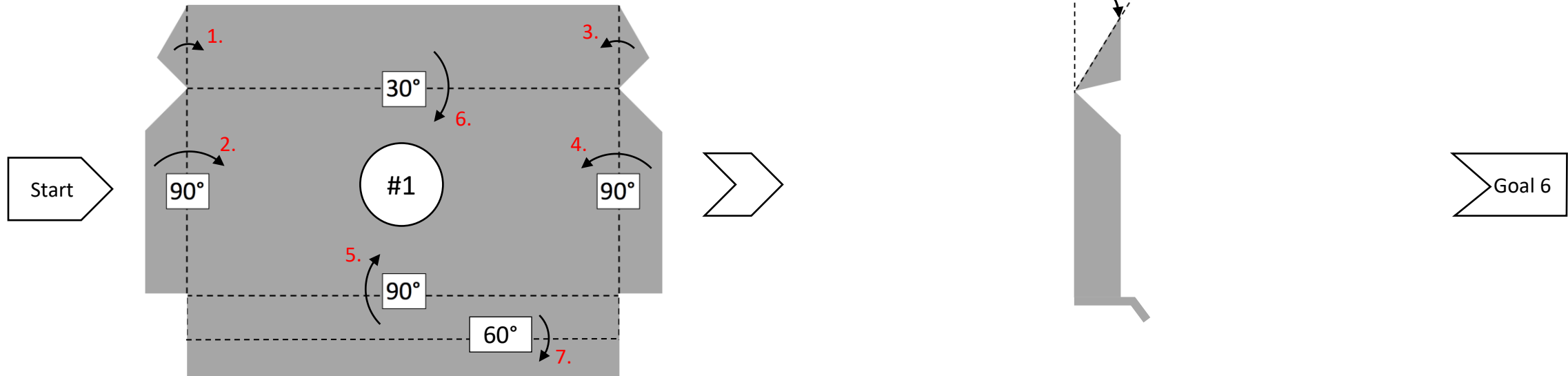


5. Step: Bending of #1

Tools needed:

- Bending machine
- Protractor

Look at the last pages of this manual
for a DIY protractor!

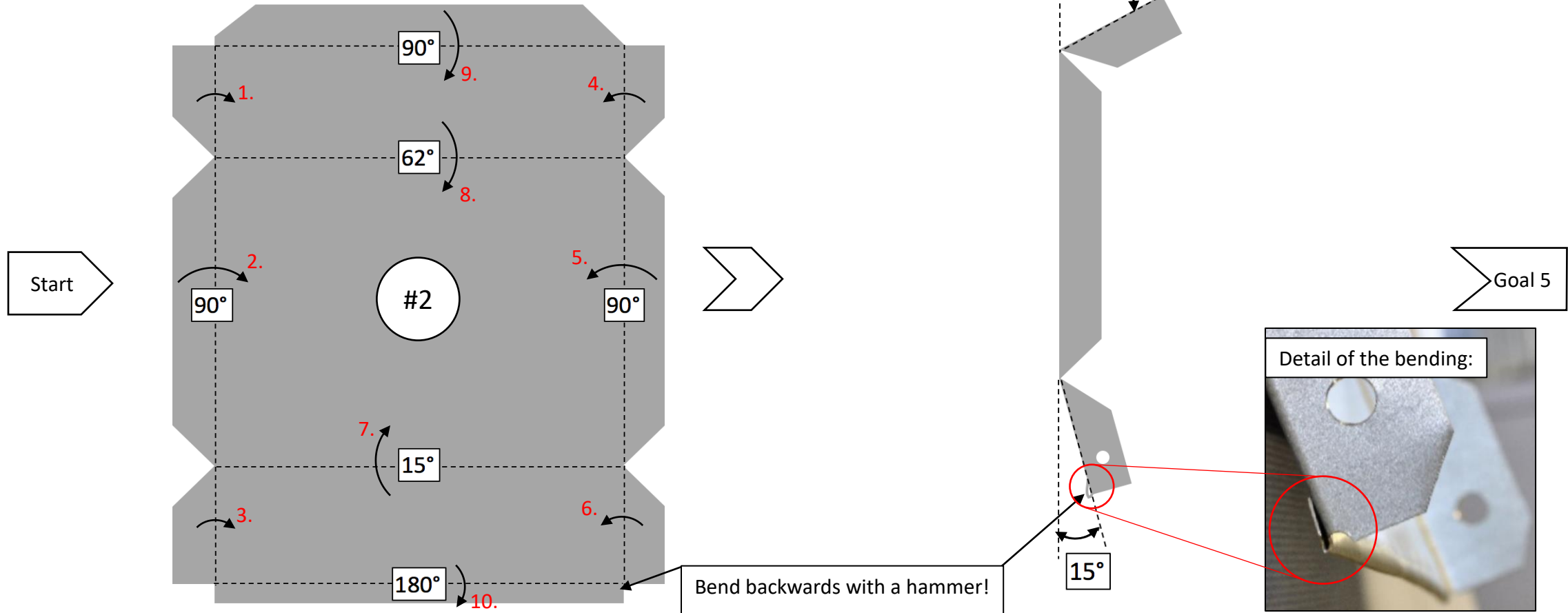


6. Step: Bending of #2

Tools needed:

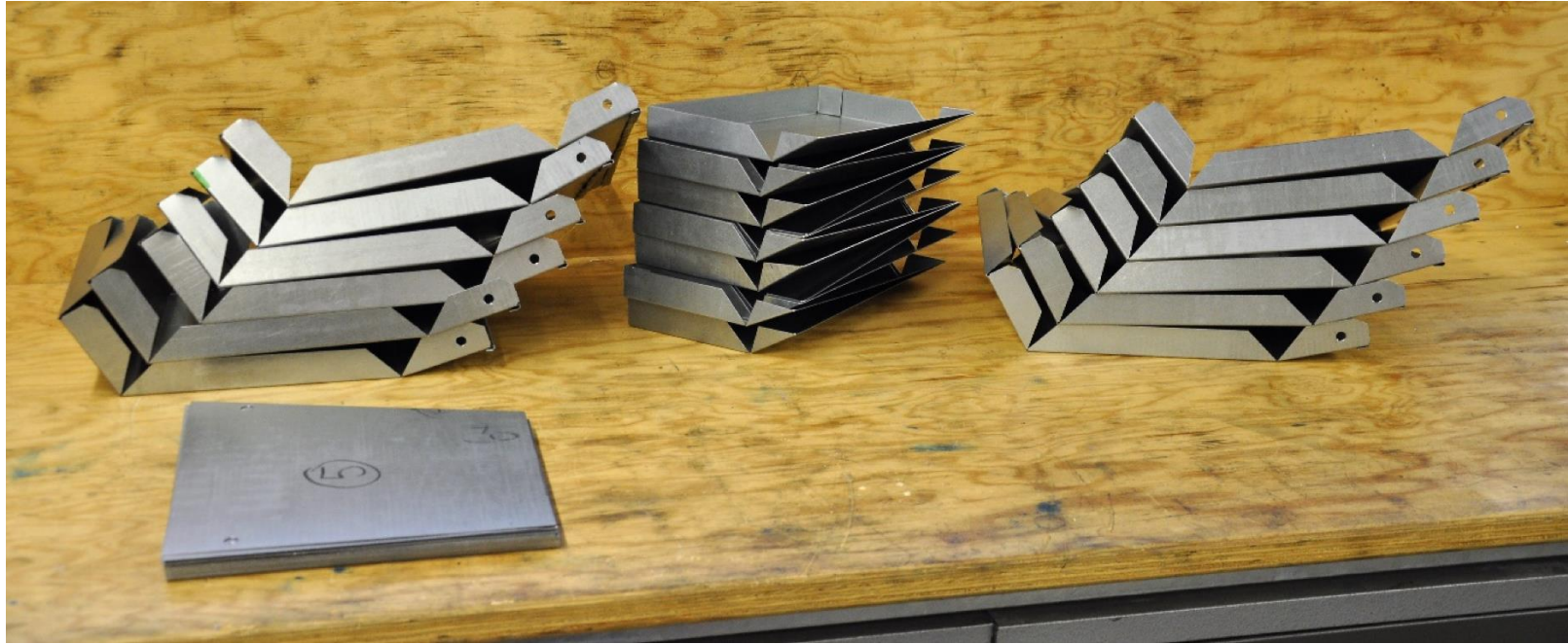
- Bending machine
- Hammer
- Protractor

Look at the last pages of this manual
for a DIY protractor!



Result of section A.) Manufacturing of the module parts

After completing section A.), all the single module parts for the waterwheel are manufactured.



Now, in section B.) the parts are assembled together with rivets to full modules.

The following parts are needed for each module:

- 1 x bottom element (#1)
- 1 x paddle element (#2)
- 2 x wall element (#3)

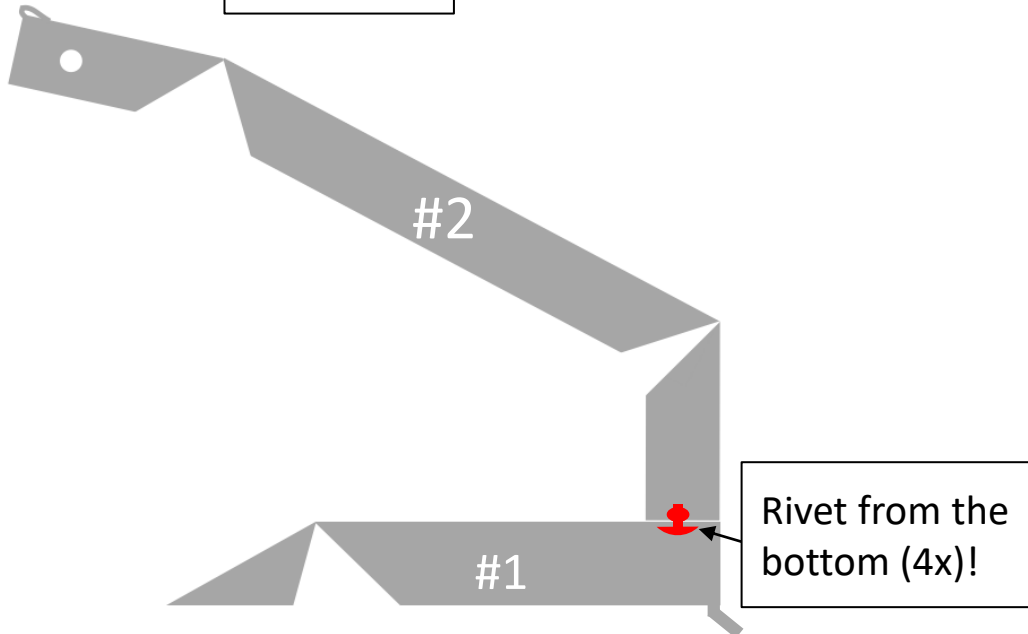
B.) Module assembly

1. Step: Assembly of #1 & #2 (bottom and paddle elements)

Tools needed:

- Drilling machine with 4mm drill bit
- Rivet plier
- 4x blind rivets per module
- 2 screw clamps (C-Clamps)

Overview



Steps

1. **Fix** the parts #1 and #2 with screw clamps



2. **Drill** 4x holes here:

View from below



3. **Rivet** the parts together

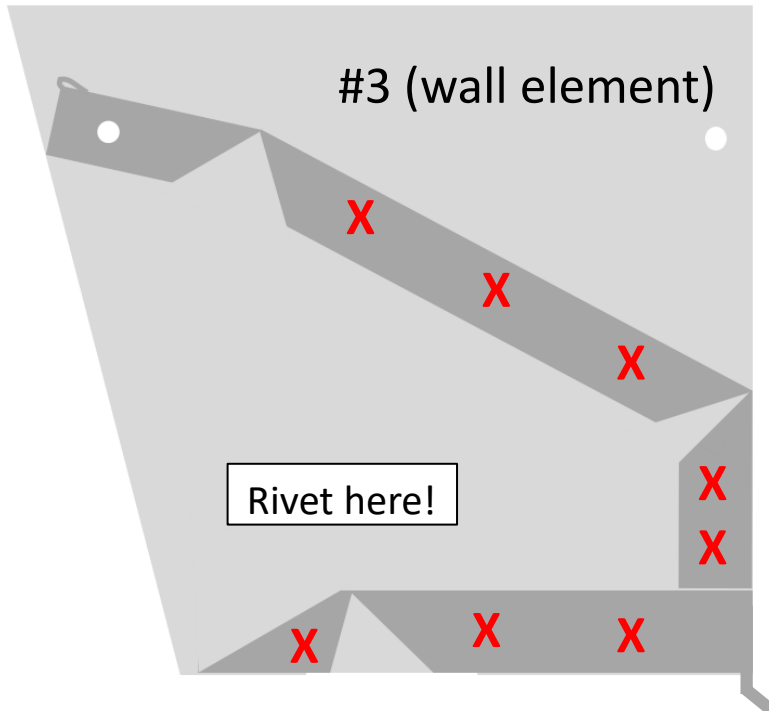


2. Step: Assembly of #1/#2 and #3 (wall elements)

Tools needed:

- Drilling machine with 4mm drill bit
- Rivet plier
- 8x blind rivets for each wall part
→ 16x rivets per module

Overview

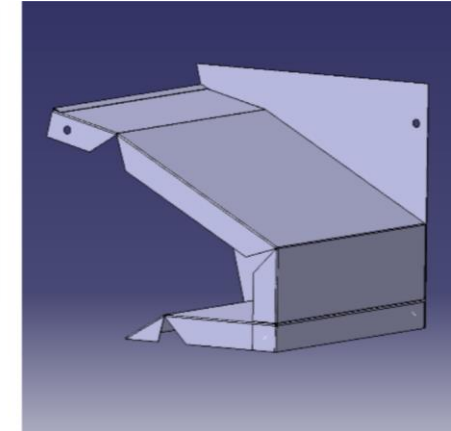
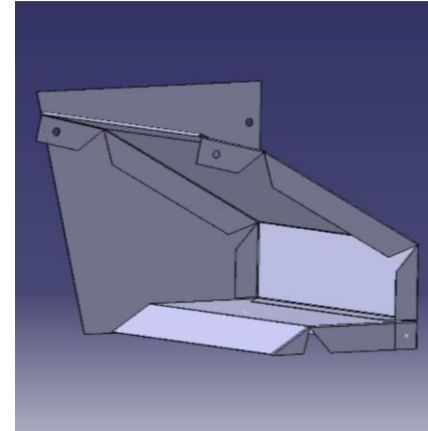


Steps

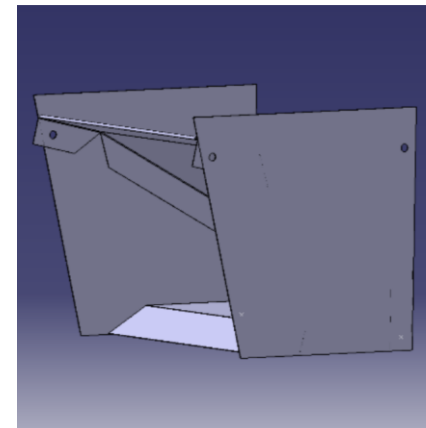
1. **Fix** the parts with screw clamps and **drill** the holes



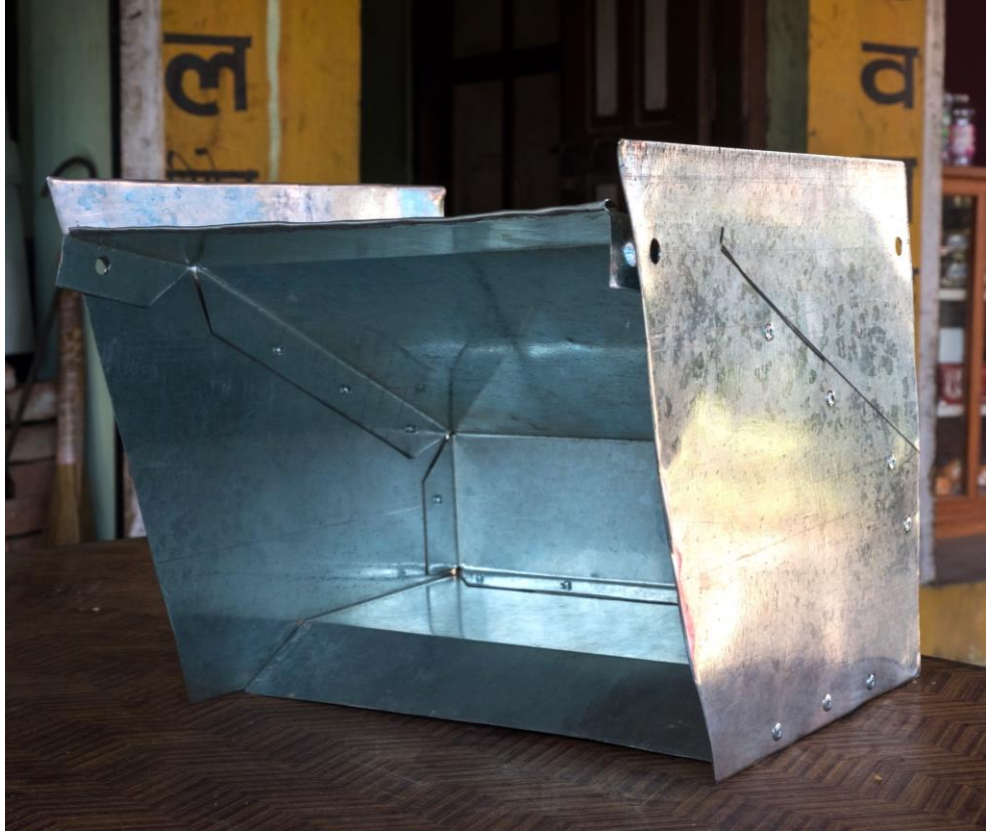
2. **Rivet** the parts together from the outside in



3. **Repeat** for the second wall part



Result of section B.) Module assembly

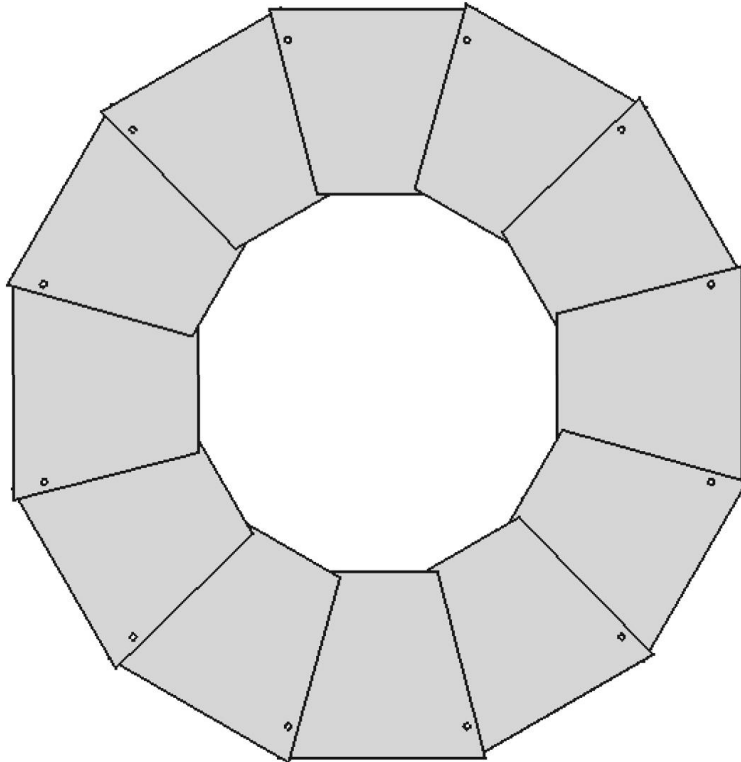


C.) Waterwheel assembly

1. Step: Rough positioning of the modules

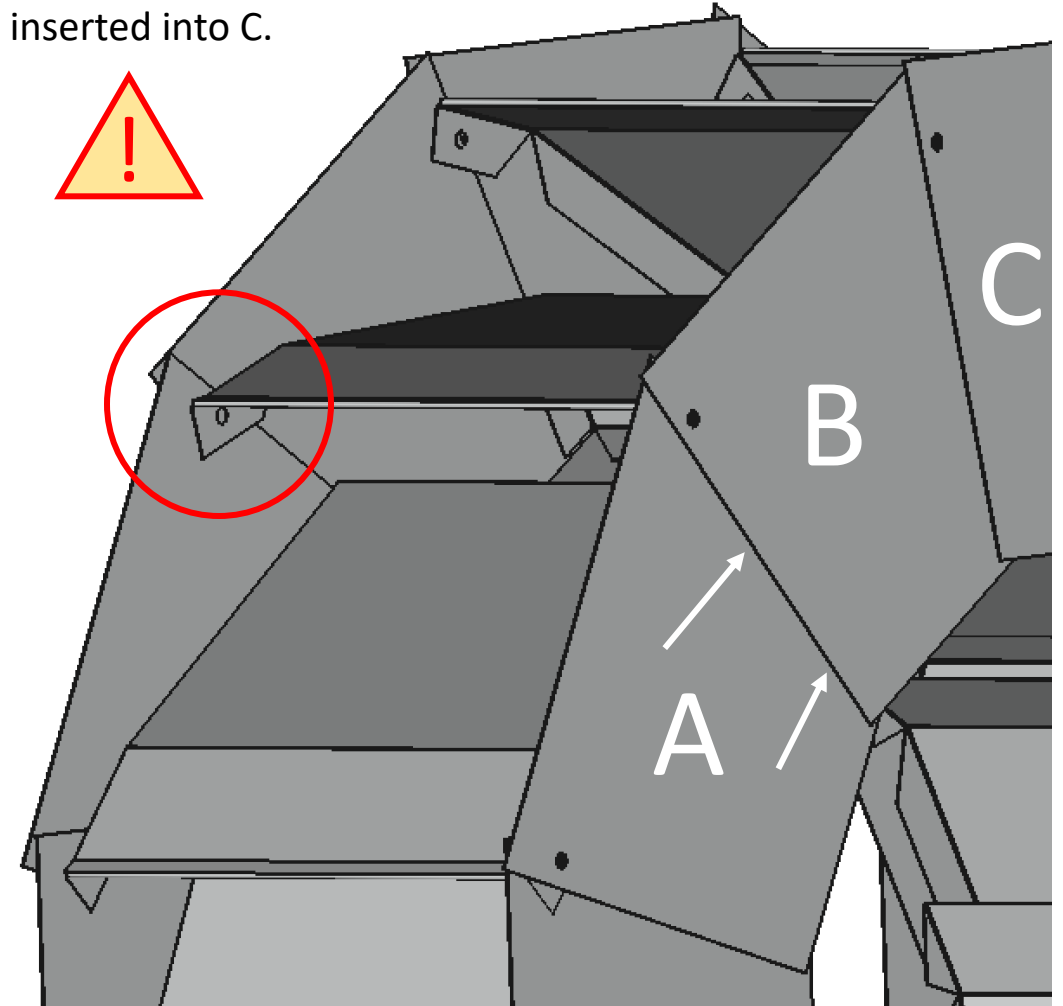
Tools needed: none

Insert the modules into one another
as shown below!
Pay attention to the detail on the right!



Detail

Module A is inserted into B.
B is inserted into C.

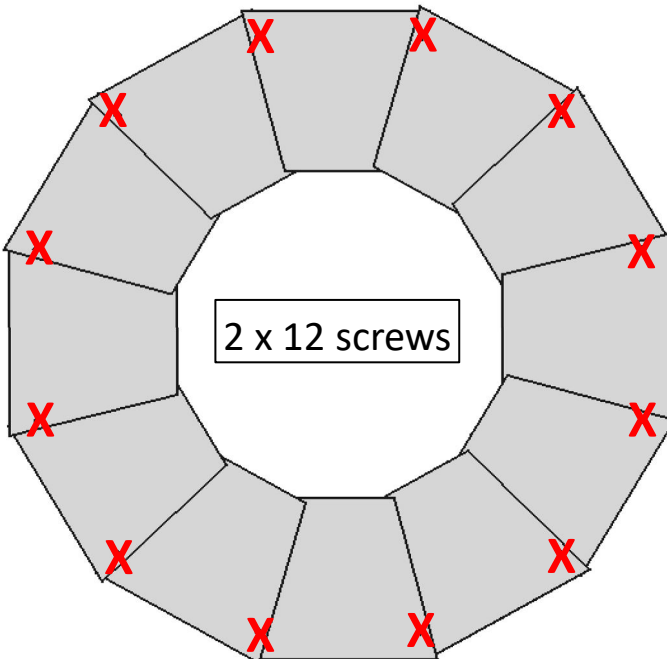


2. Step: Fixing the modules with the outer holes

Tools needed:

- Protractor
- M8 bolts (20mm length)
- M8 nuts and washers
- 2x13mm wrench
- 12 screw clamps (C-Clamps)

Overview



Steps

1. Insert the **bolts** in the outer bores on both sides of the waterwheel
Don't tighten them completely!



2. **Position** the chambers in the right angle!

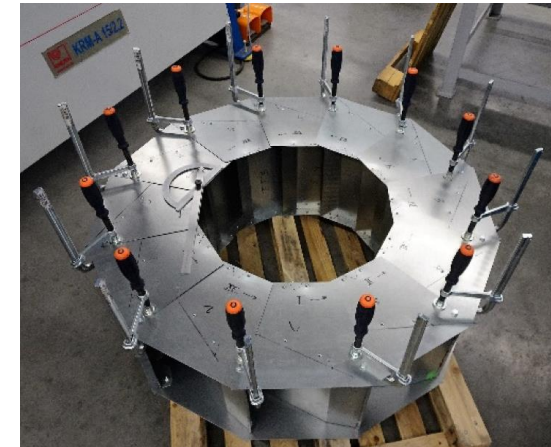
Look at the last pages of this manual
for a DIY protractor!

You can use the side plate from the
CAD design as guidance if you will
use it to mount the wheel to a shaft

150°



3. **Fix** the modules with screw clamps

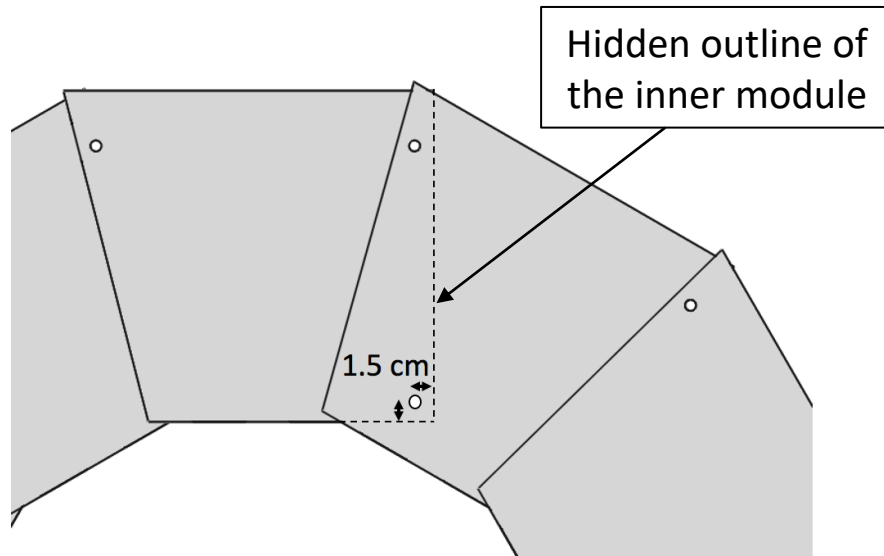


3. Step: Fixing the modules with the inner holes

Tools needed:

- Drilling machine with 9 and 11 mm drill bit
- 2x13mm wrench
- M8 bolts (30mm length)
- M8 rivet nuts and rivet nut gun
- M8 washers
- Pen, scribe and square

Overview



Steps

1. **Mark** the hidden outline of the inner modules (all from one side at once)



2. **Drill** all the holes through both modules with a 9 mm drill



3. **Remove** the screw clamps and increase the holes diameter **only through the inner module** with a 11 mm drill



4. **Insert** rivet nut with rivet nut gun in the 11 mm hole



5. **Realign** the inner and outer modules on the 11 and 9 mm holes and insert bolts. Don't tighten them completely!



6. **Flip** waterwheel and repeat steps 1 to 5 (instead of removing screw clamps on step 3 you will need to remove the inner hole bolts on the other wheel side). Once all bolts are in place and the waterwheel is balanced, tighten them

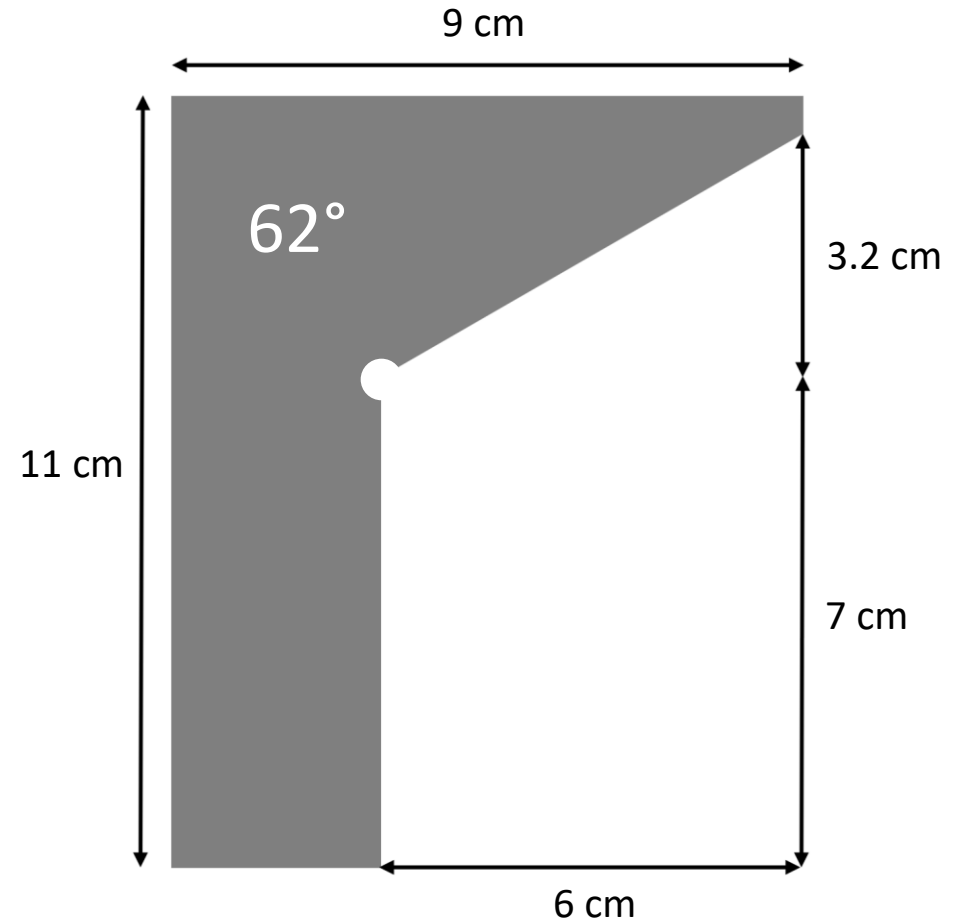
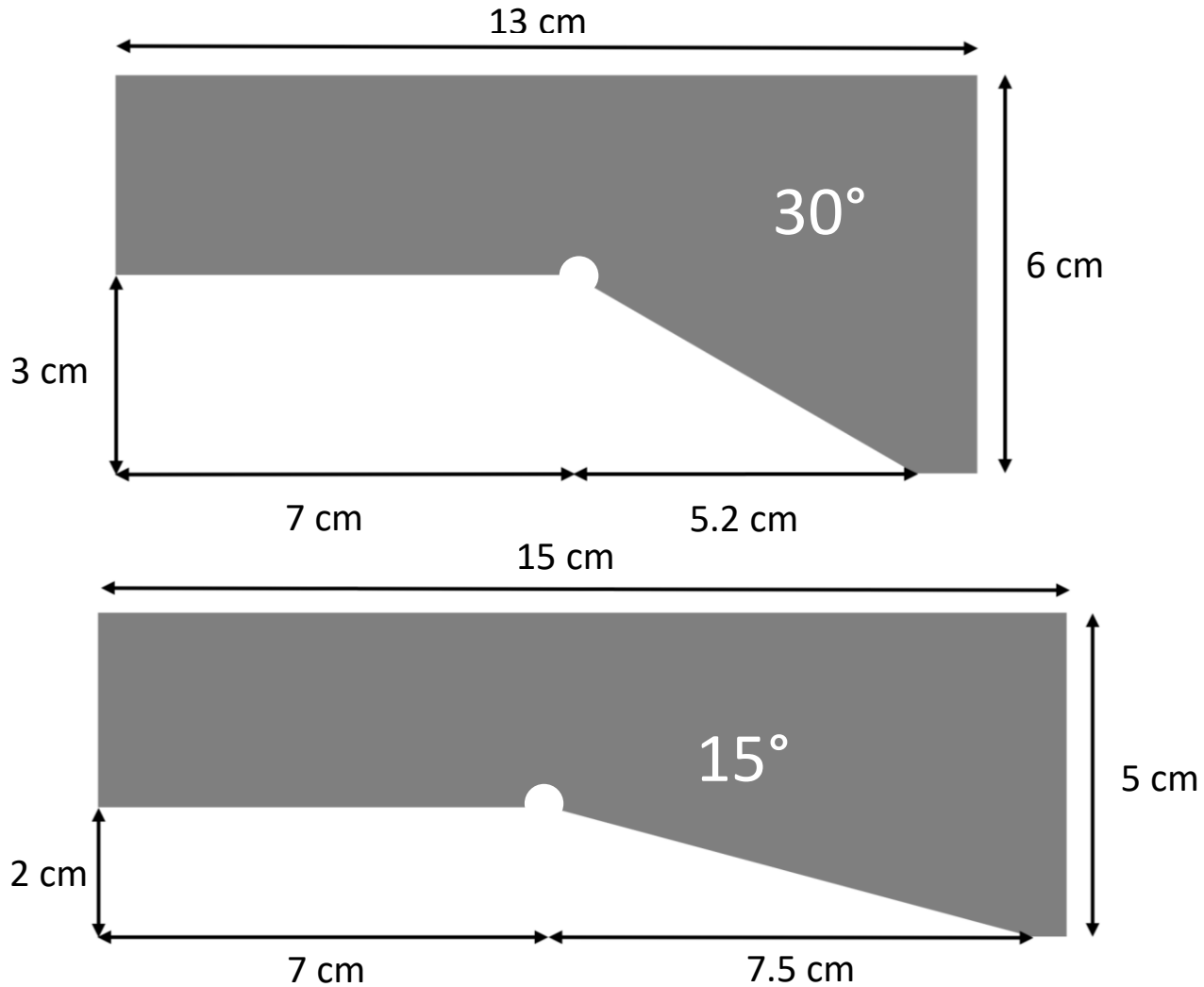
Result of section C.) Waterwheel assembly



DIY Protractor

With this three DIY Protractor you can easily check the **bending angles of Section A.), Steps 4 to 6.**

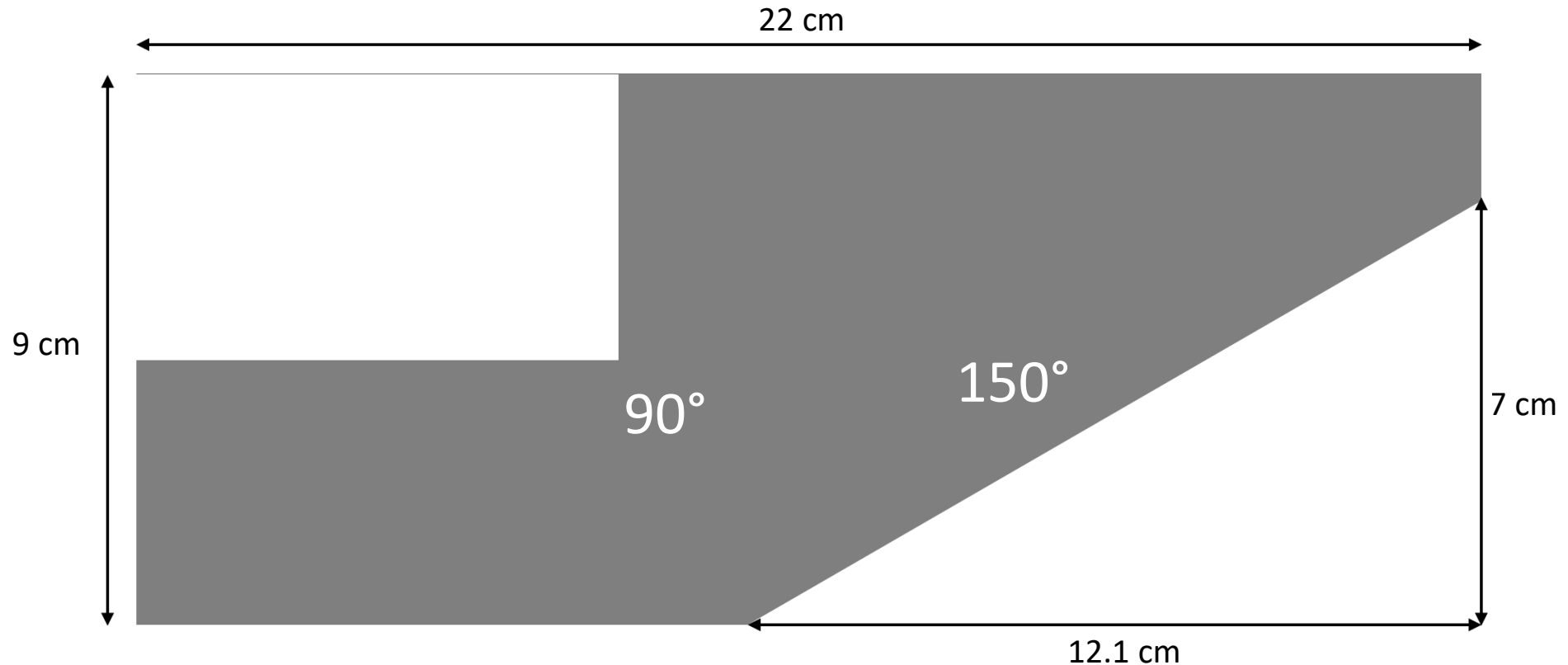
Either print out this page and use the shapes as template for cutting it out of a metal sheet or cut the angles out of a metal sheet using the given proportions. For the holes, a 6 mm drill bit is needed.



DIY Protractor

With this DIY Protractor, you can easily check the **assembly angles of Chapter C.), Step 2.**
With the 90° angle you can check all the 90° bends of the module.

Either print out this page and use the shapes as template for cutting it out of a metal sheet or cut the angles out of a metal sheet using the given proportions.





MANUAL

Periphery Components

Overview: Sections

Support structure

Foundation

Intake

Canal

Chute

