Indian Institute of Space Science and Technology

AE-224 MACHINING AND PRECISION MANUFACTURING

Task 1 : Designing and Manufacturing of a Mechanical Housing

Presented by –
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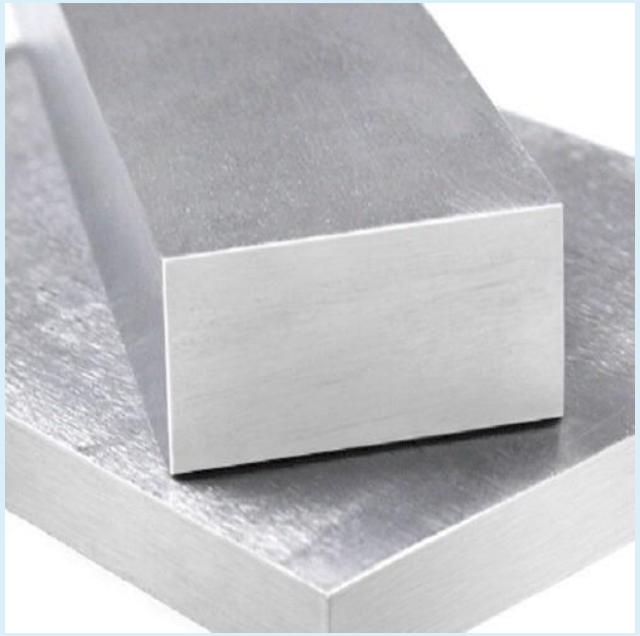
SC19B012

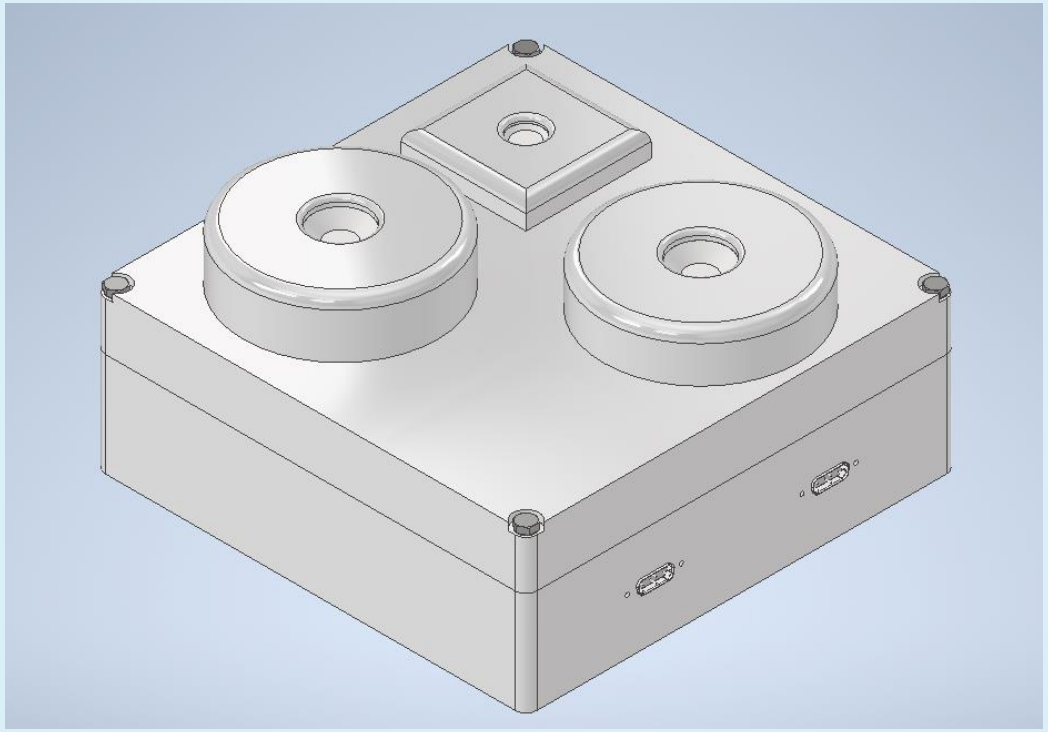
Contents:

Raw Material *: Aluminium*



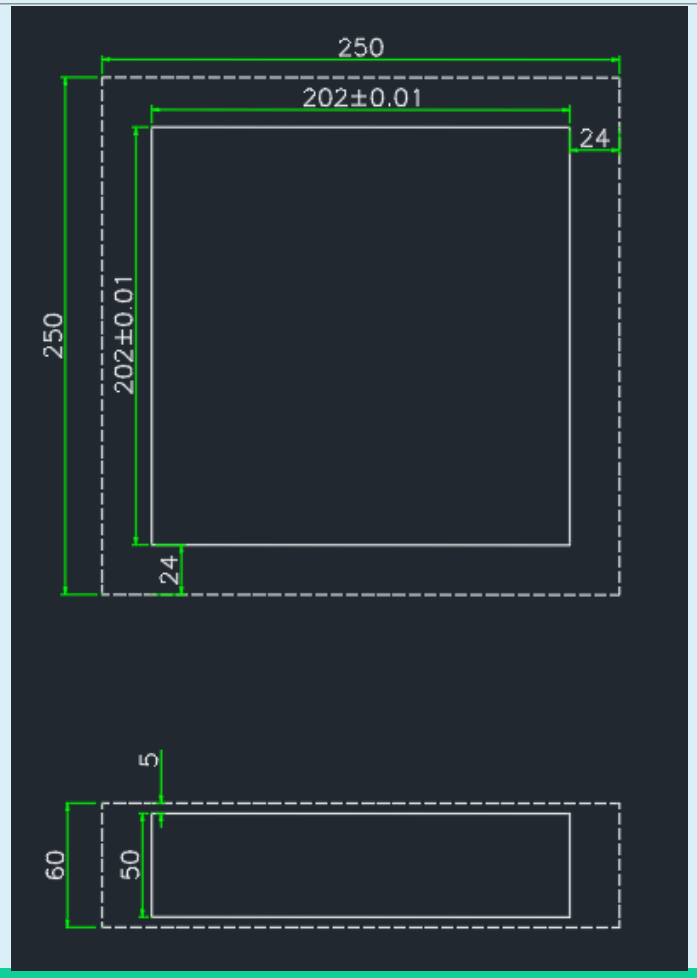
- Aluminium has high strength-to-weight ratio which varies from 0.7 – 1.8
- It is Easily Available and Machinable
- Being a light weight metal , Aluminium is widely used in Aviation Industry
- The Dimensions of the Metal Blank provided is 250x250x60 mm , 2 nos.

Finished Product :



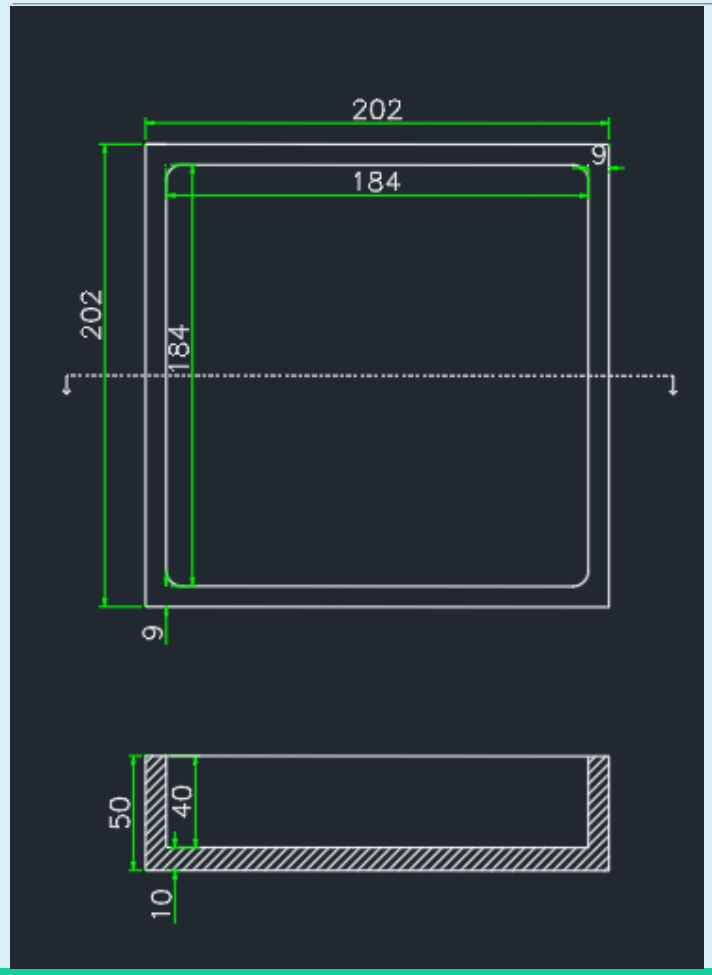
- Dimensions : 200 ± 0.1mm x 200 ± 0.1mm x 100 ± 0.1mm
- Overall Weight : 2.485 + 0.300 =2.785kg

Fabrication of Bottom:



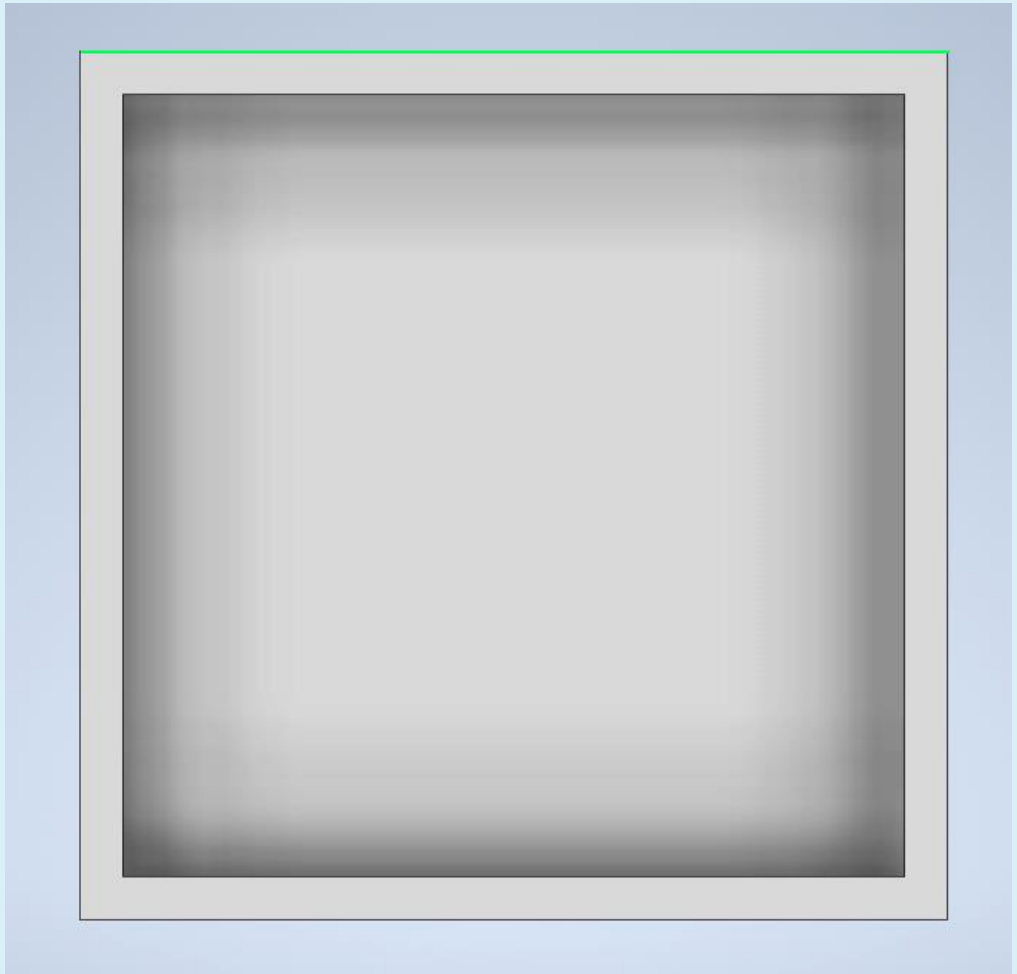
1. Face & End Milling

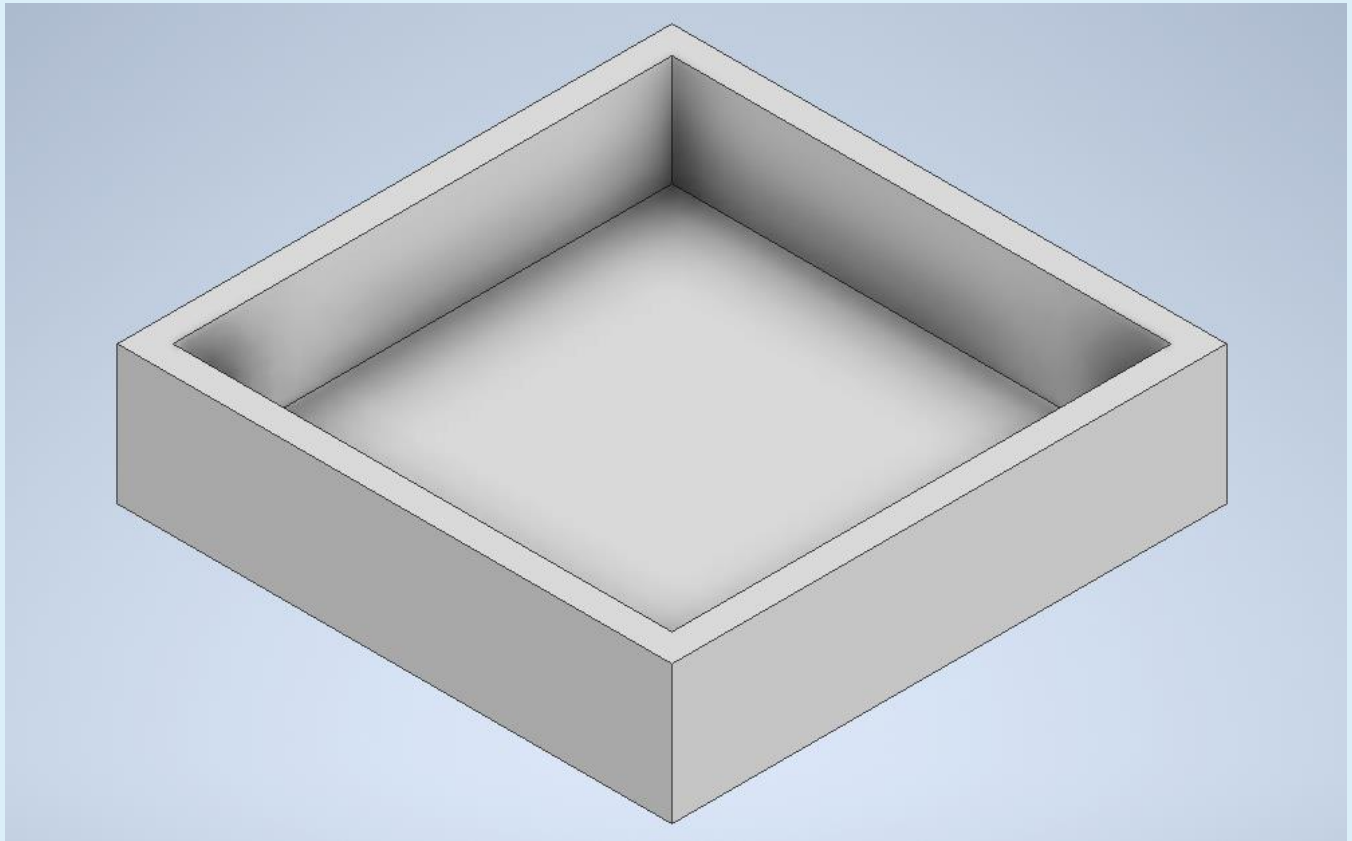
- to reduce plate dimension from 250x250x60 to 202x202x50
- Milling Tool required of dim Ø50mm
- Extra 2 mm is for Grinding 1 mm from each side for a better finish.

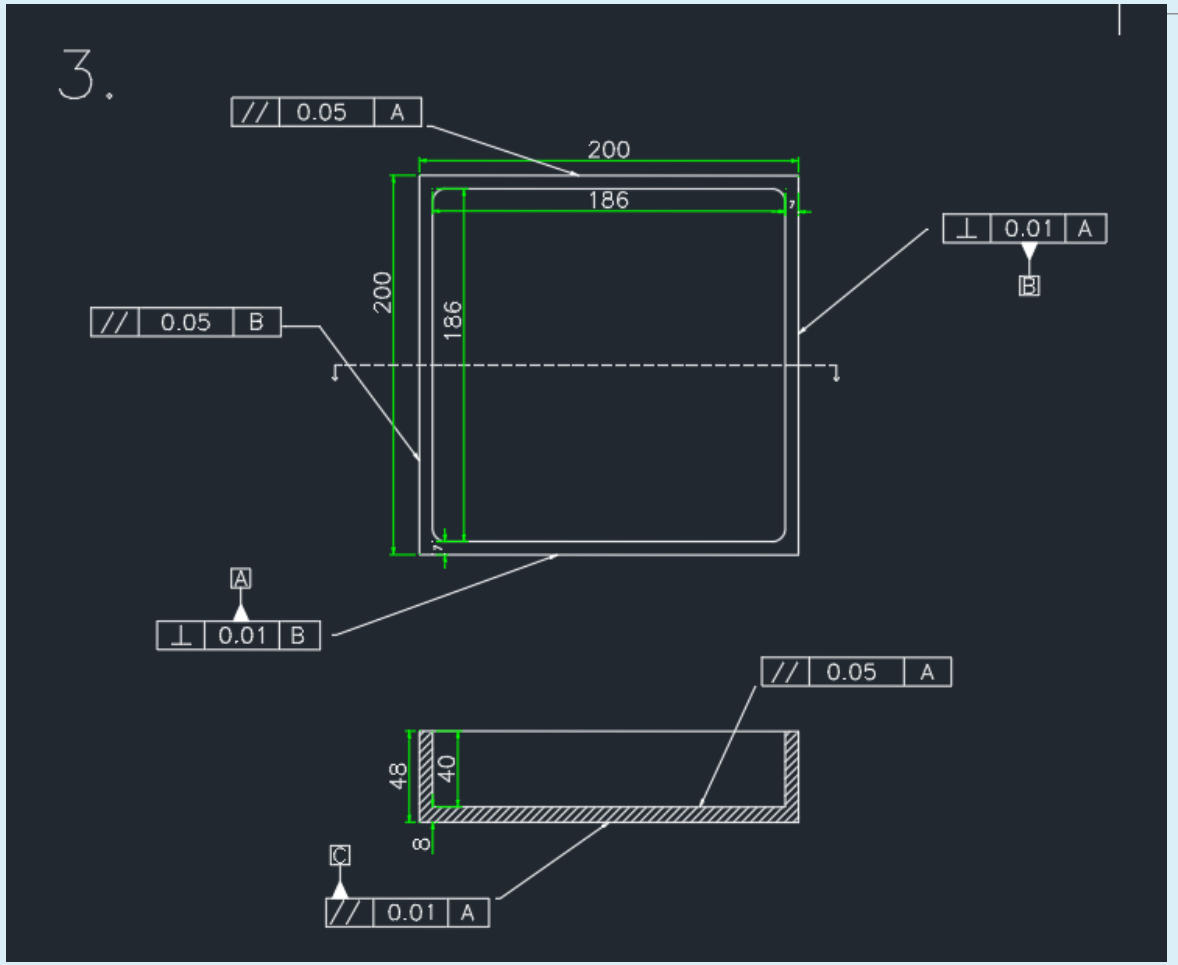


2. Square Pocket Milling

- Starting 11 mm from the edges to make a cavity of dimension 184x184x40 mm.
- Milling Tool Ø30-50mm

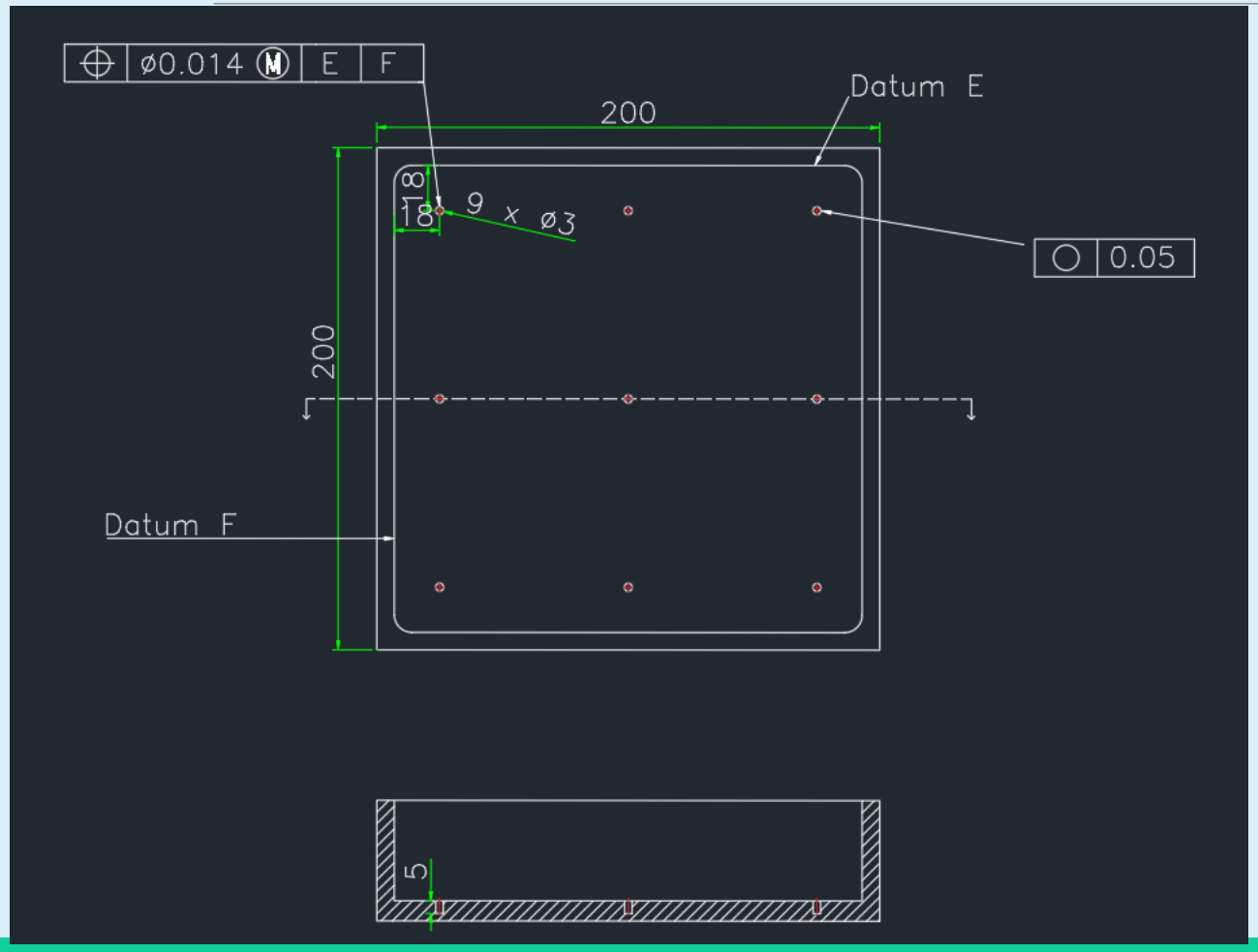






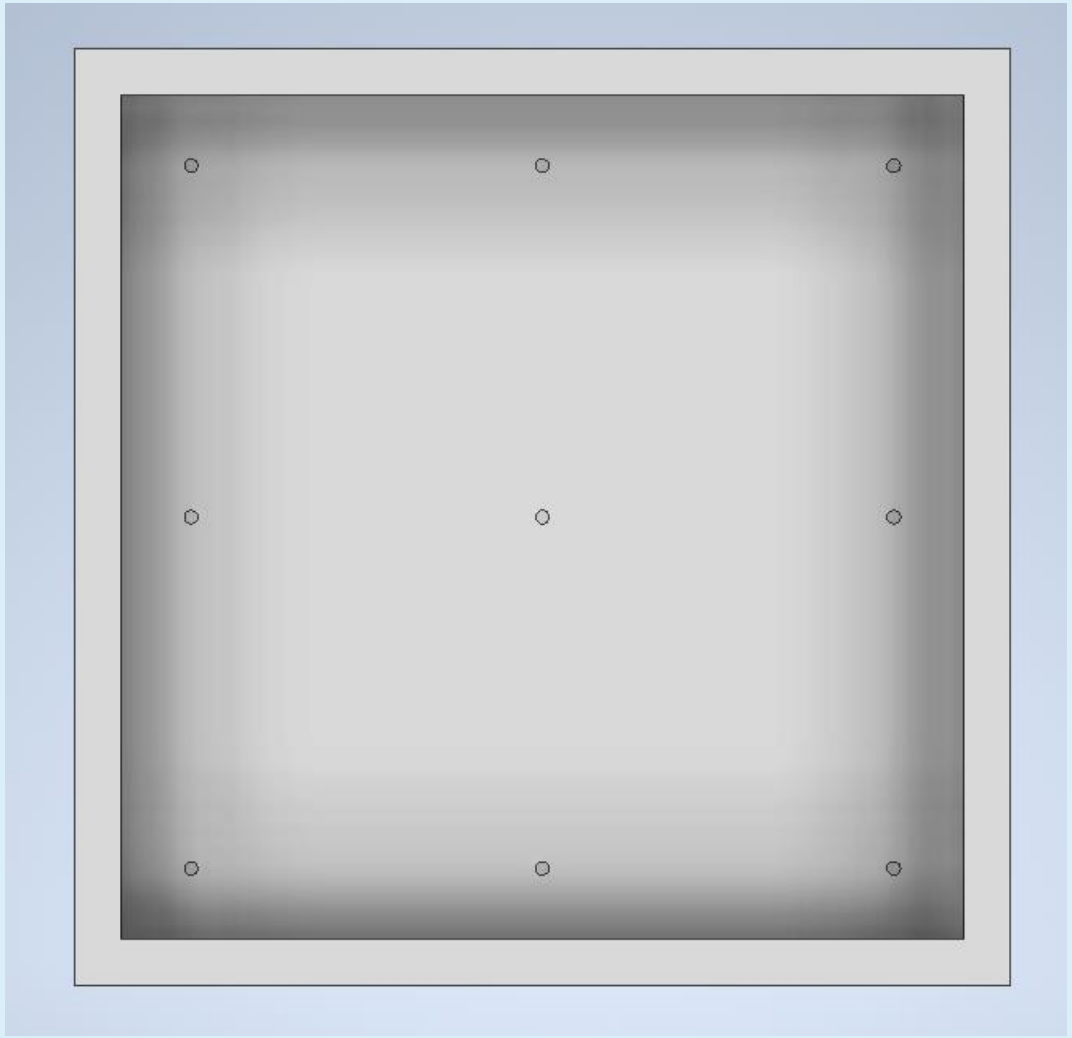
3. Grinding

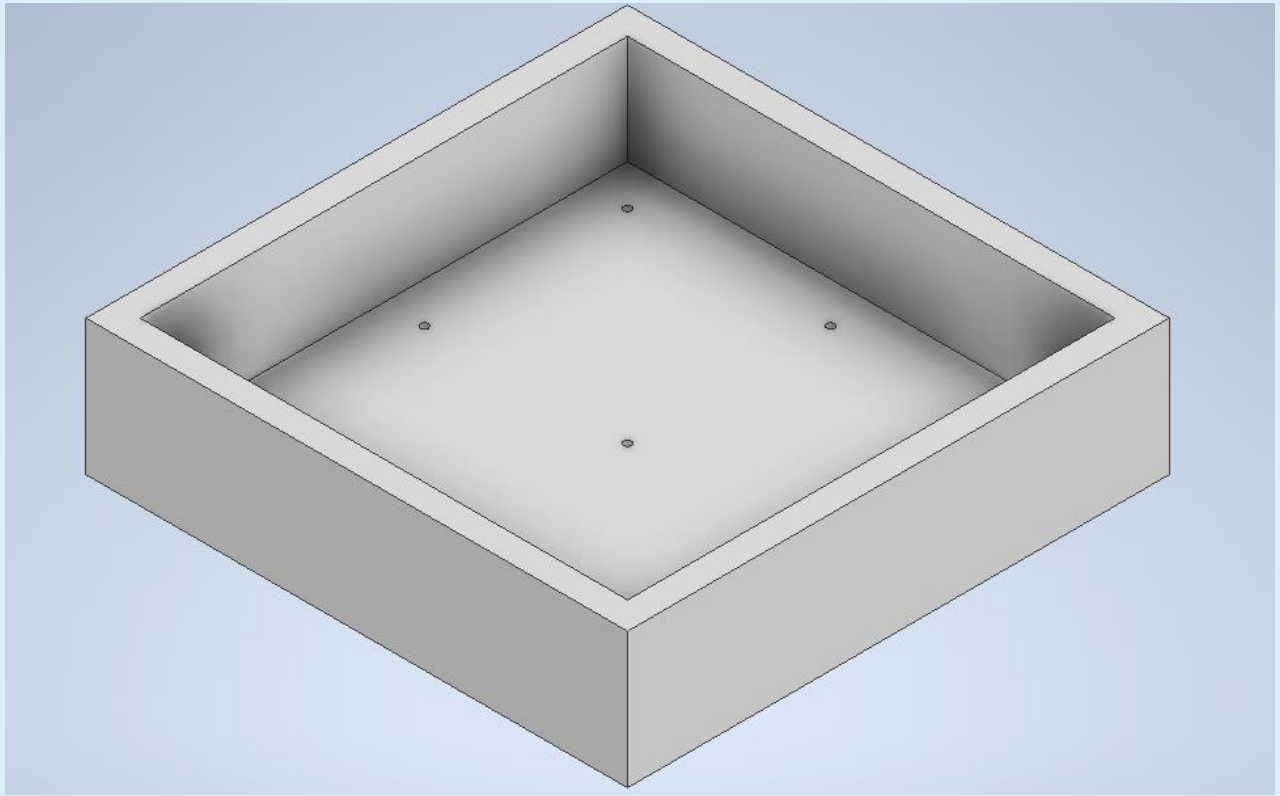
- With the Help of Grinding wheel , we remove the additional 1 mm from the work-piece
- Grinding wheel , Open structure with Soft wheel

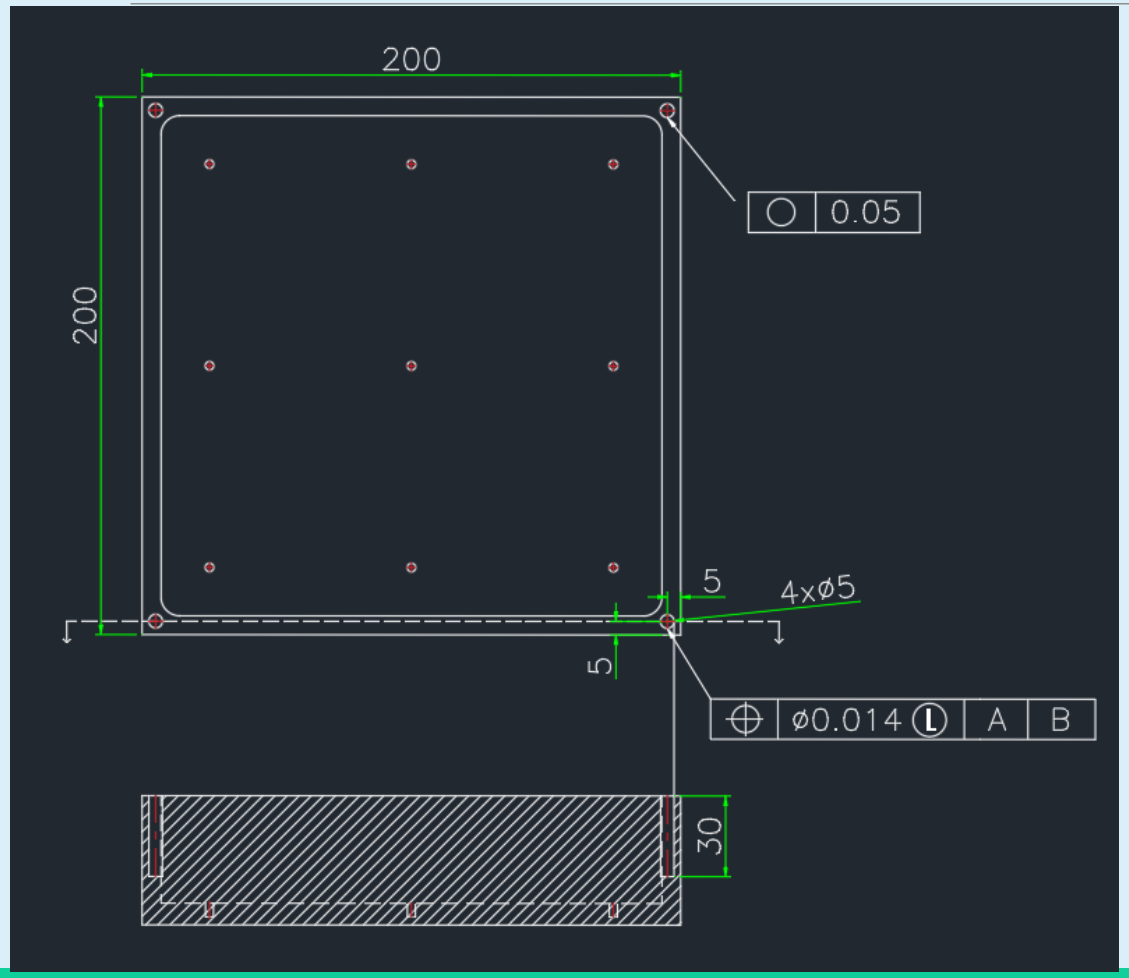


4a.Drilling

- Performing Drilling operation with the help of a Drilling Machine to construct blind drill holes inside the cavity , on the base
- Dimension – 9 x (M3 , 5mm)
- Drill bit Ø3mm
- These drill holes will help to secure the circuit board 10mm above the base.
- A Jig can be used for convenience in drilling

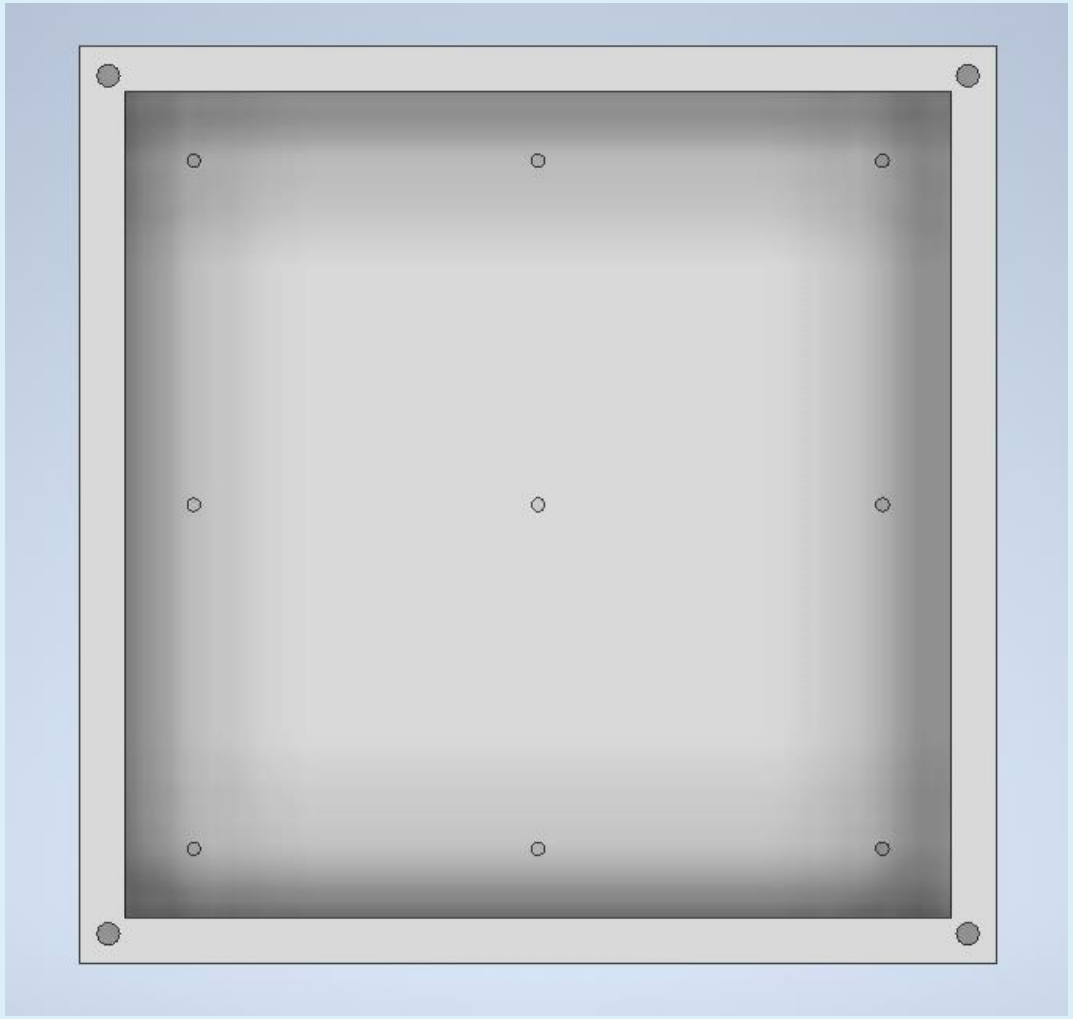


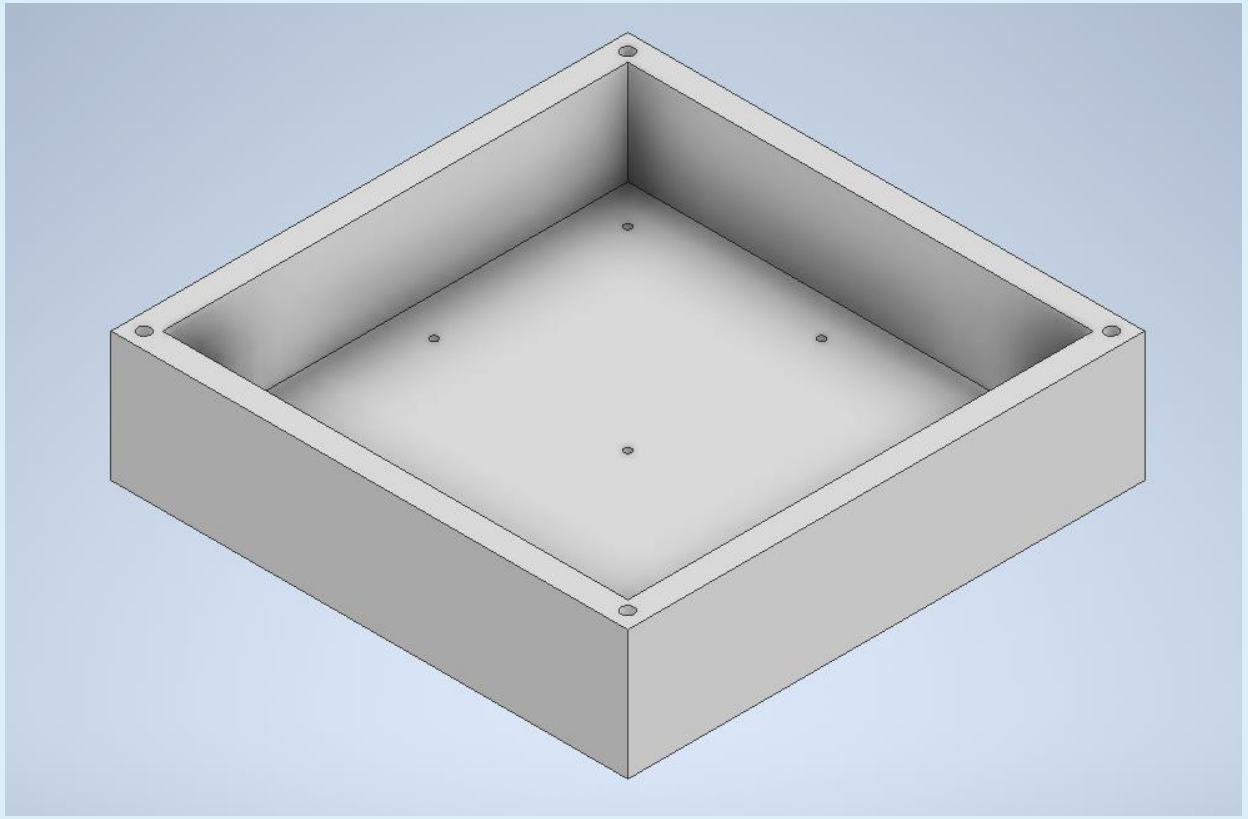


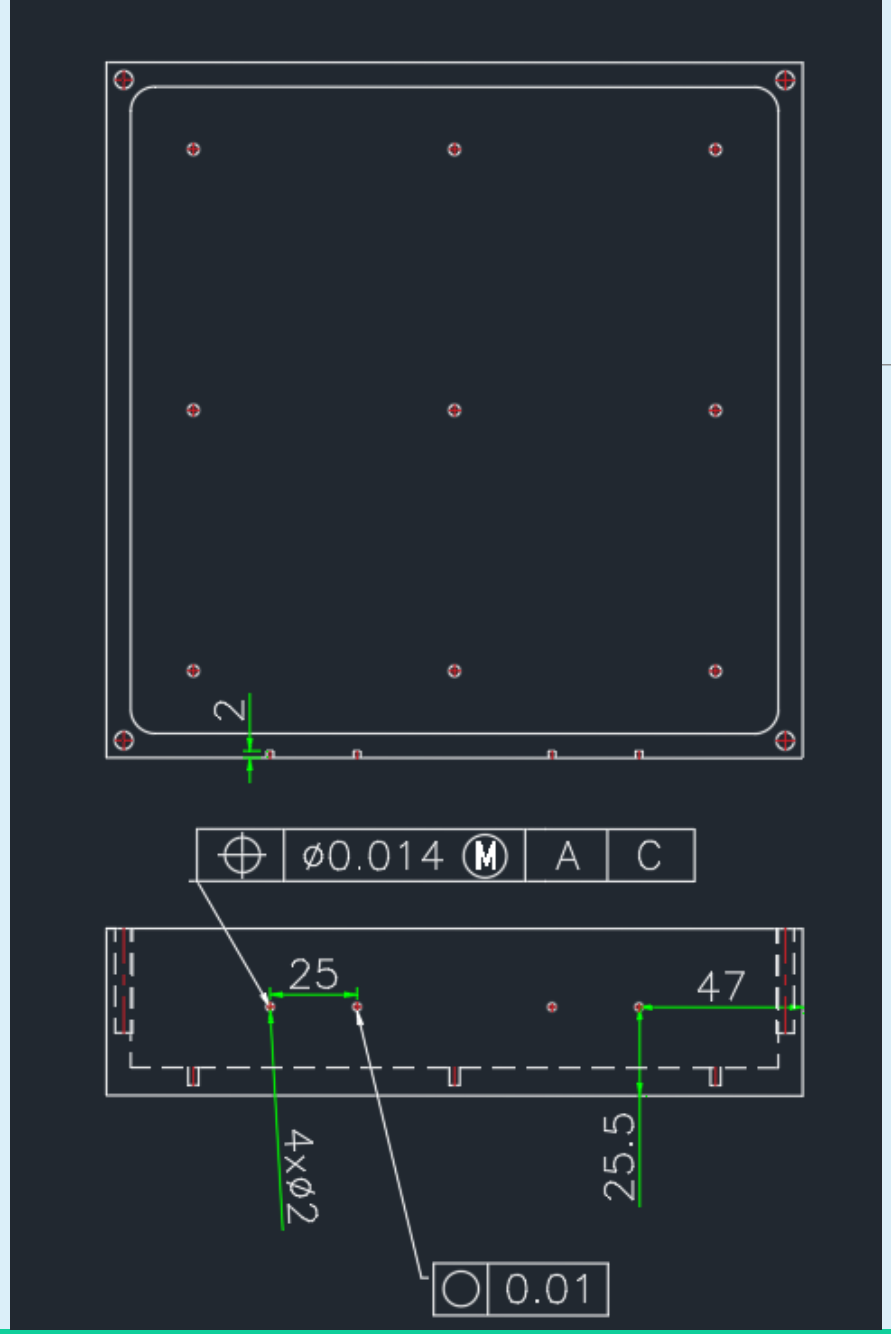


4b.Drilling

- Using Drilling Operation to construct 4 blind drill holes at the corners of the wall on the Top.
- Dimensions : Ø5mm , 30mm
- These holes will be useful to attach the Top to the Bottom
- Drill bit Ø5mm

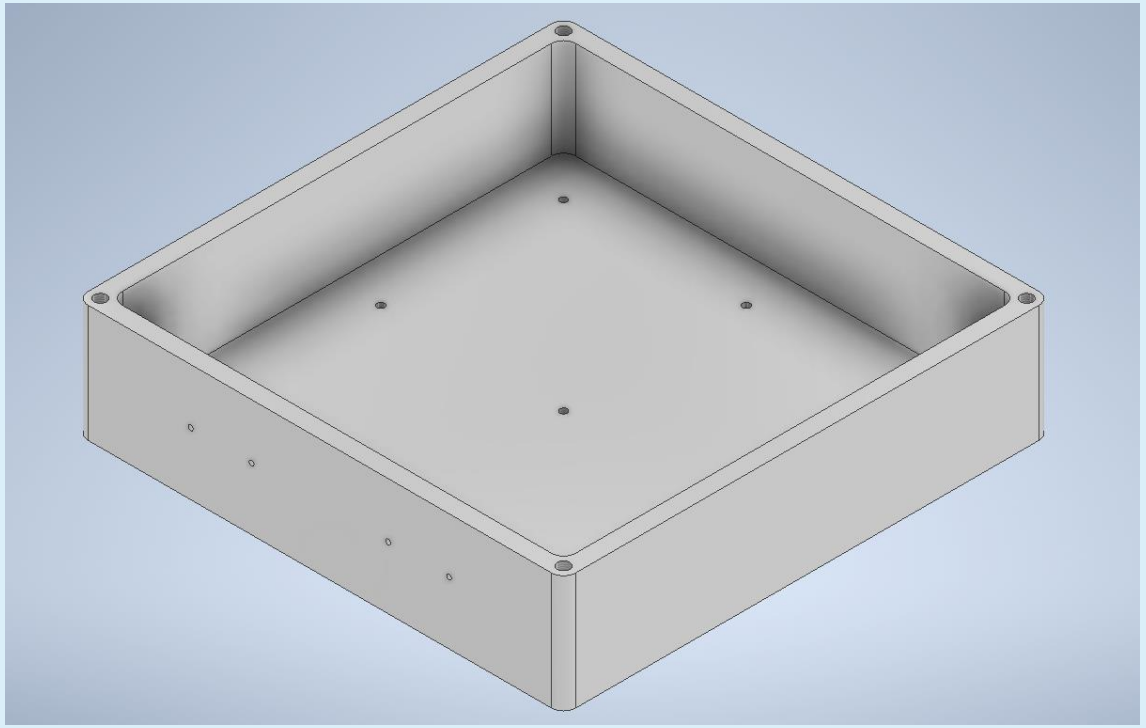


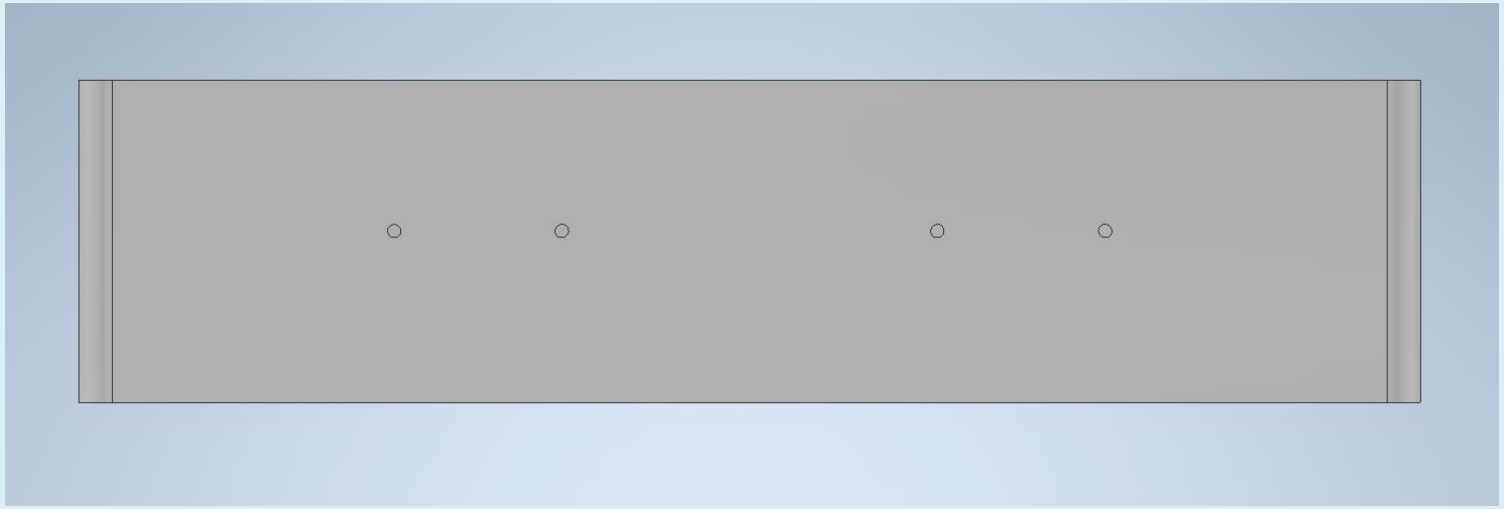


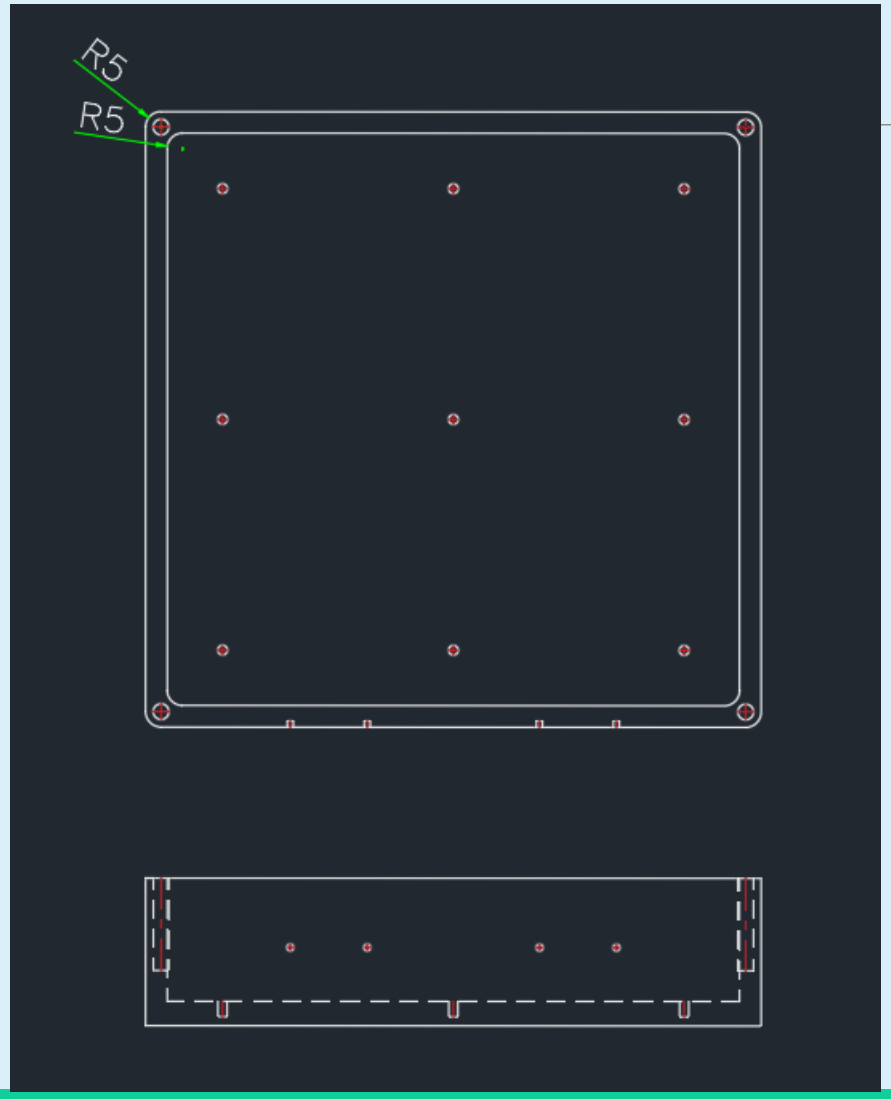


4c.Drilling

- Drilling 4 blind holes on any one of the outer of the walls. This face will be called the ‘ Front Face ’ of the box.
- They will be useful to attach the D-Pin connectors to the interior of the ‘Front Wall ’
- They will also help to use Wire EDM to make slot for D-Pin.
- Dimension:4 x (Ø2 mm , 2mm)
- Drill bit Ø2mm

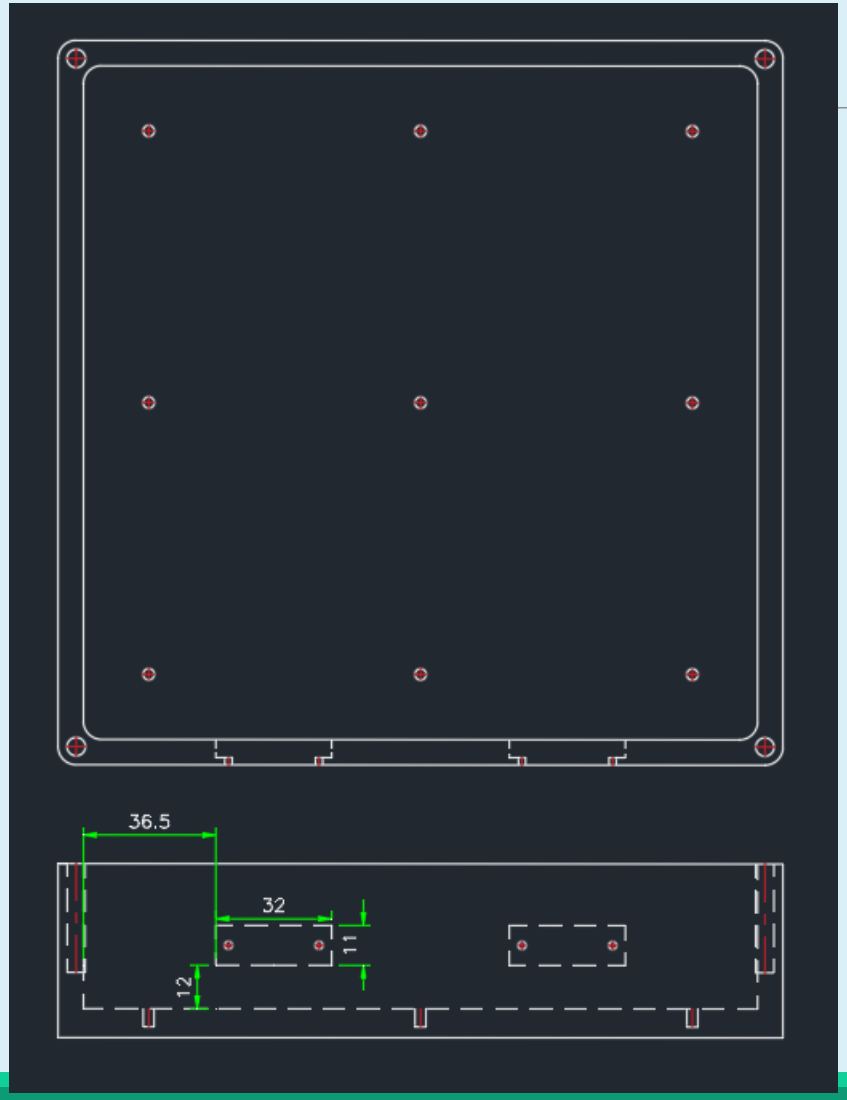






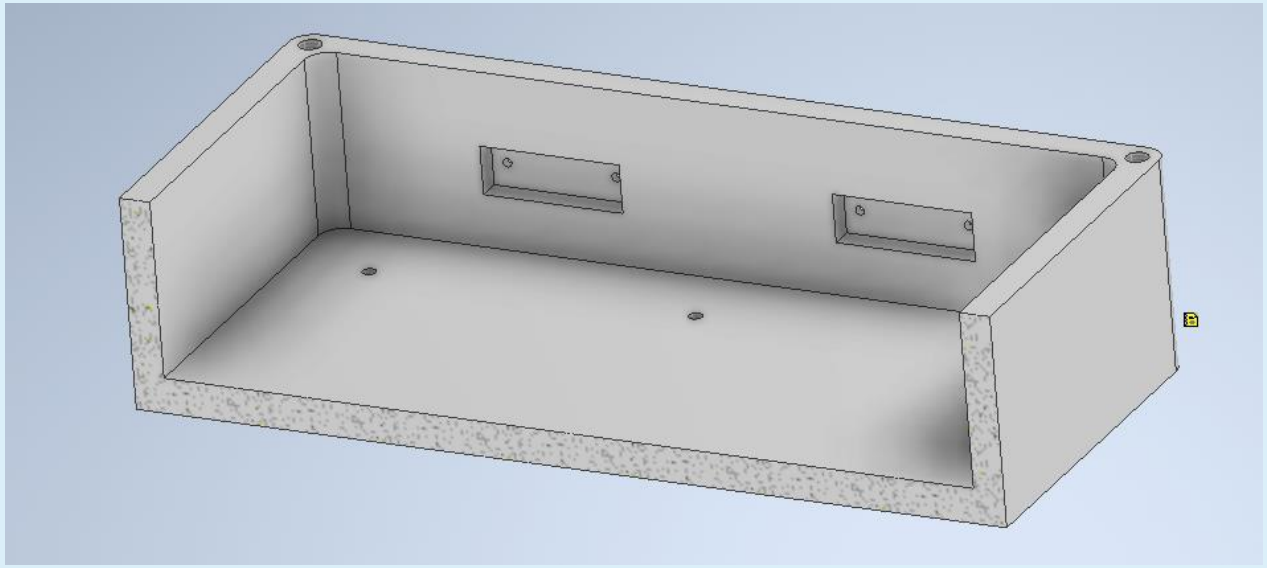
5.Fillet

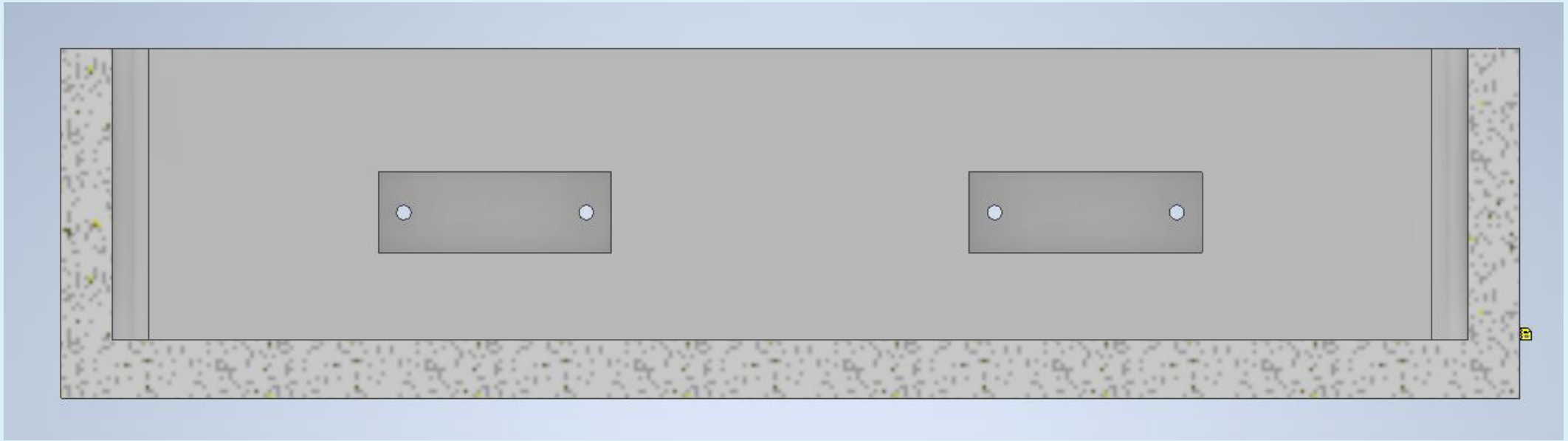
- Adding fillets on Radius 5mm on the interior and Exterior corners of the Bottom Assembly
- Fillets help in reducing stress concentration as they can distribute stress uniformly

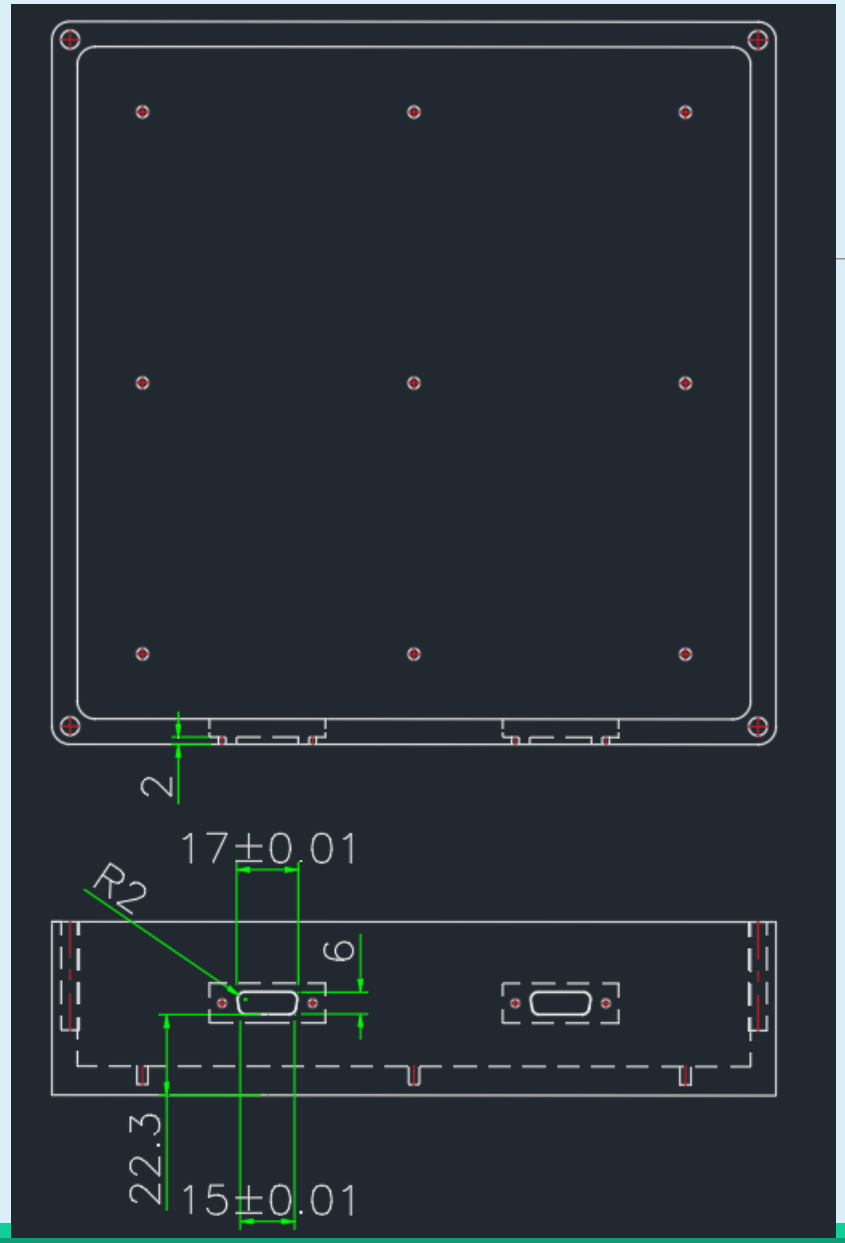


6. Square Pocket Milling

- Constructing a rectangular cavity inside the front wall to fit the D-Pins
- Dimension 32x11 mm
- Milling tool Ø5mm

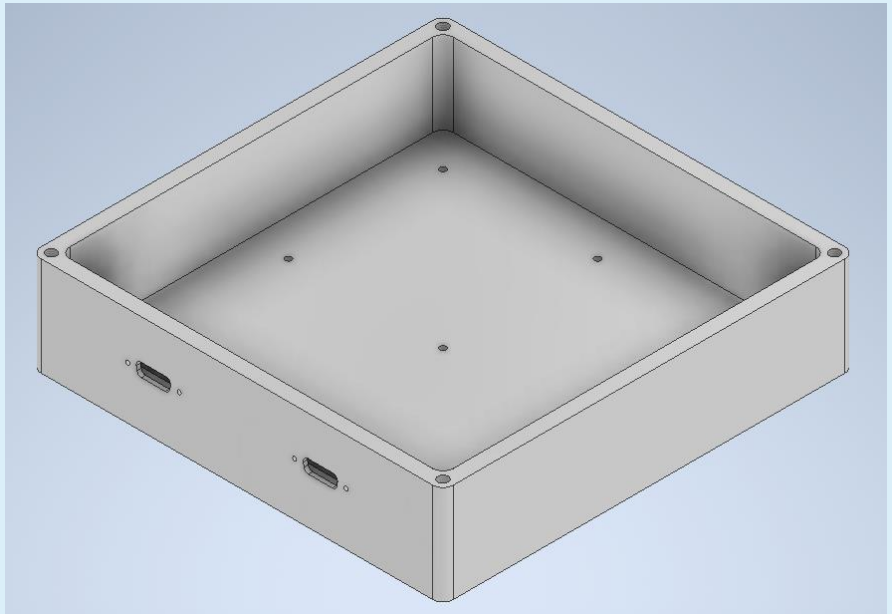


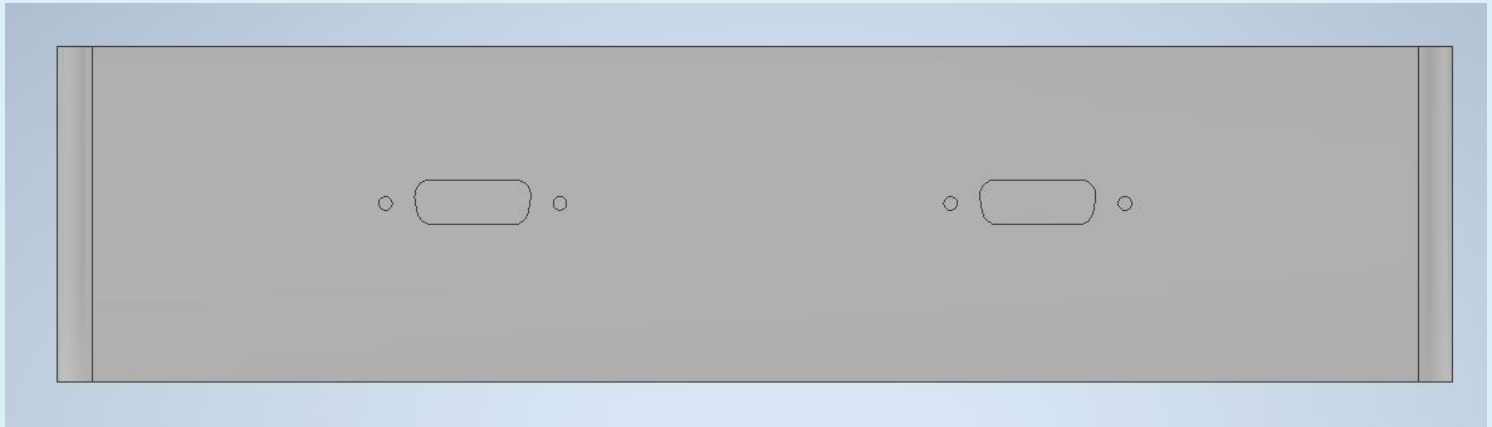


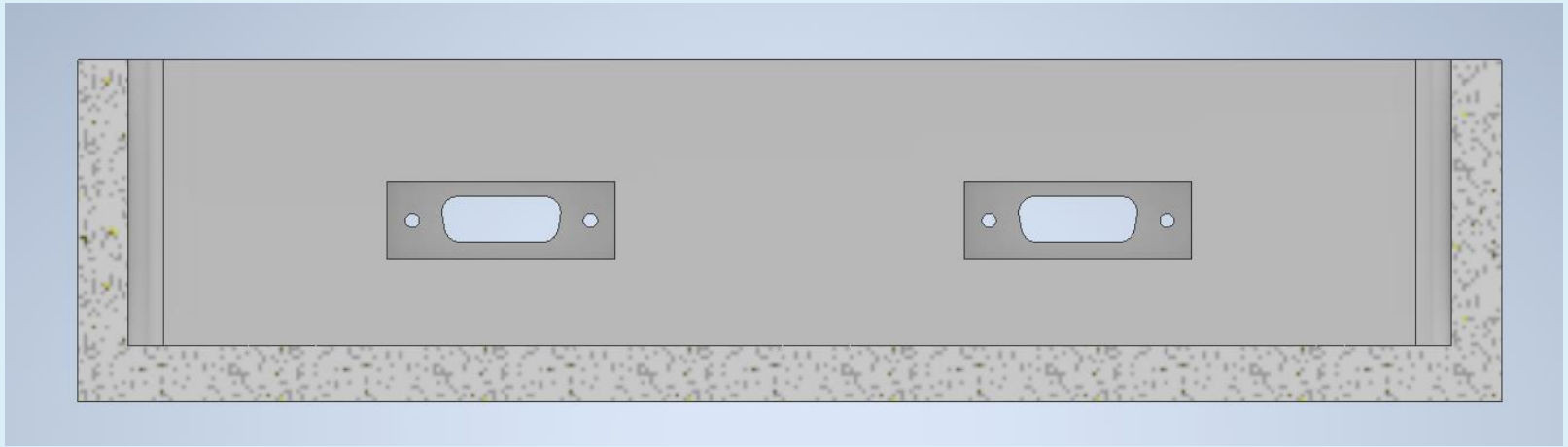


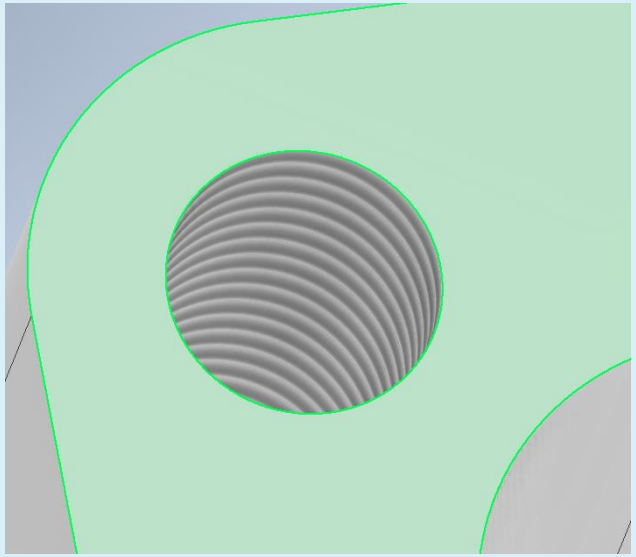
7. Wire EDM

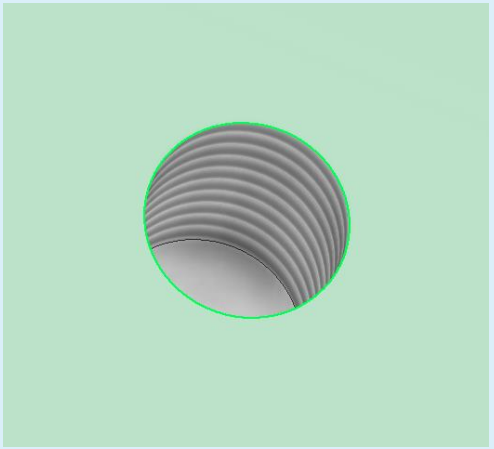
- Slot for D pin to be exposed out.
- Using the Drill holes







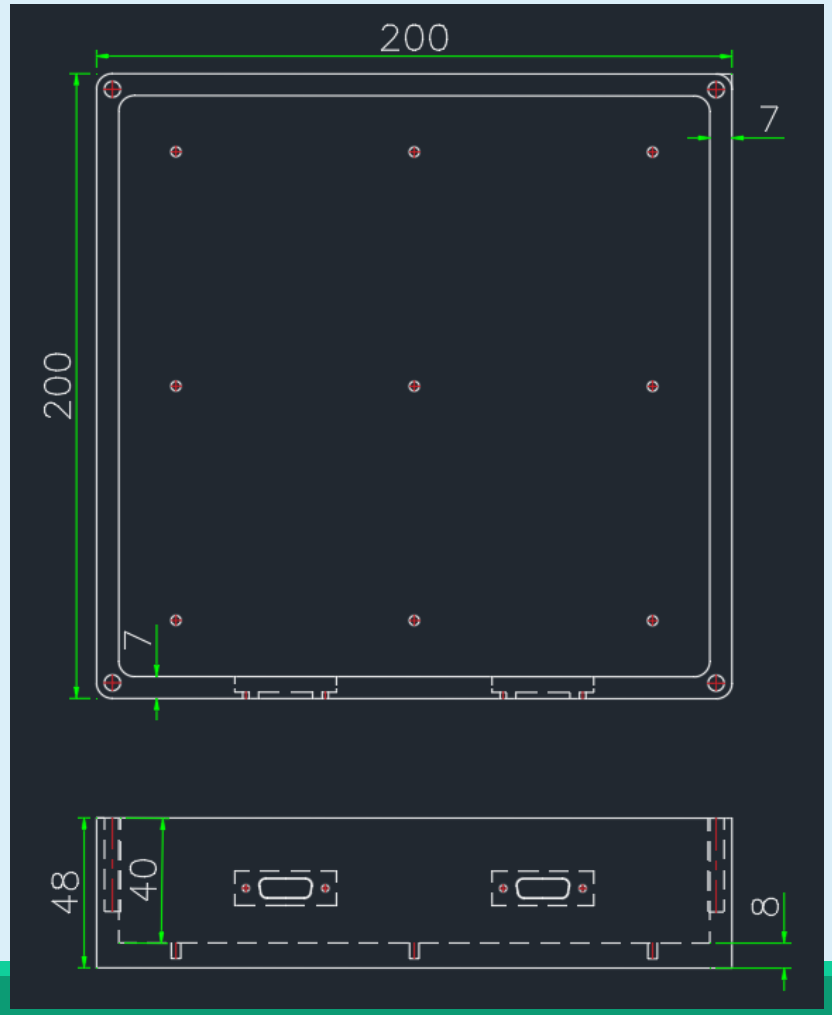


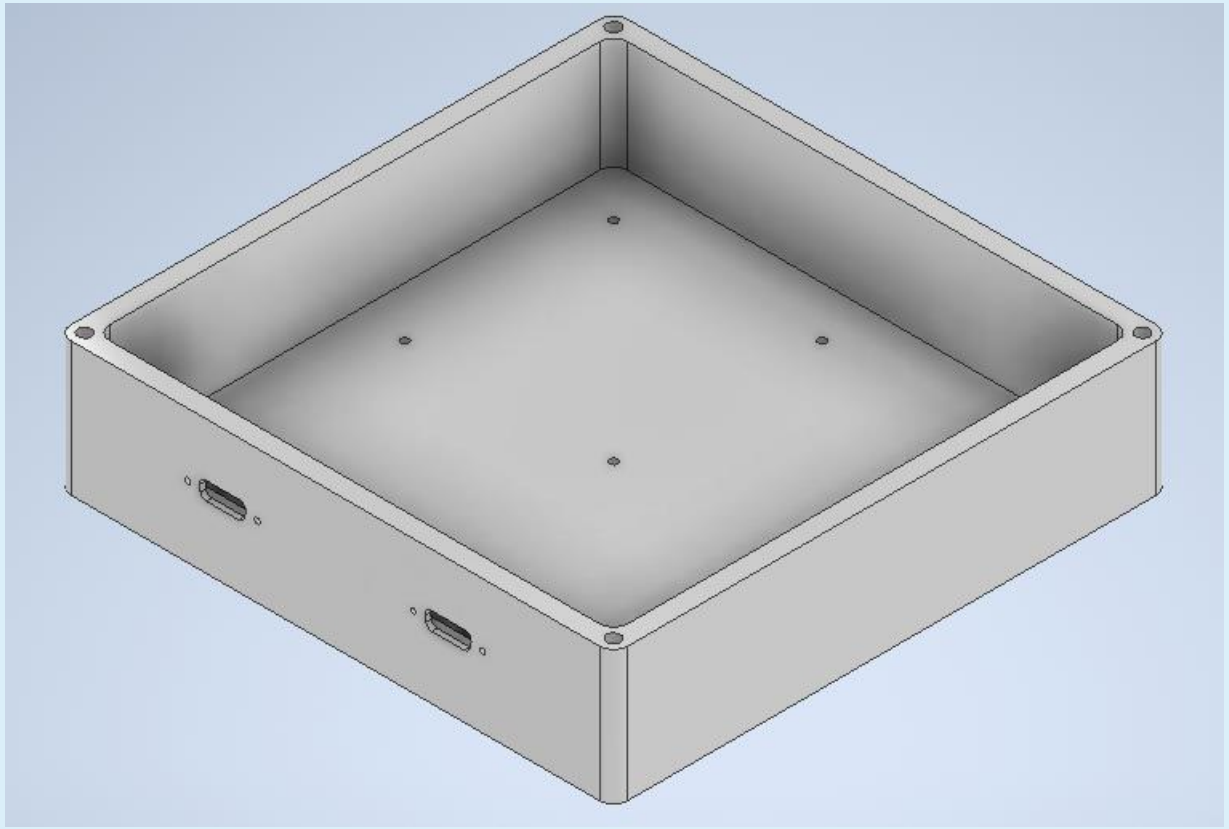


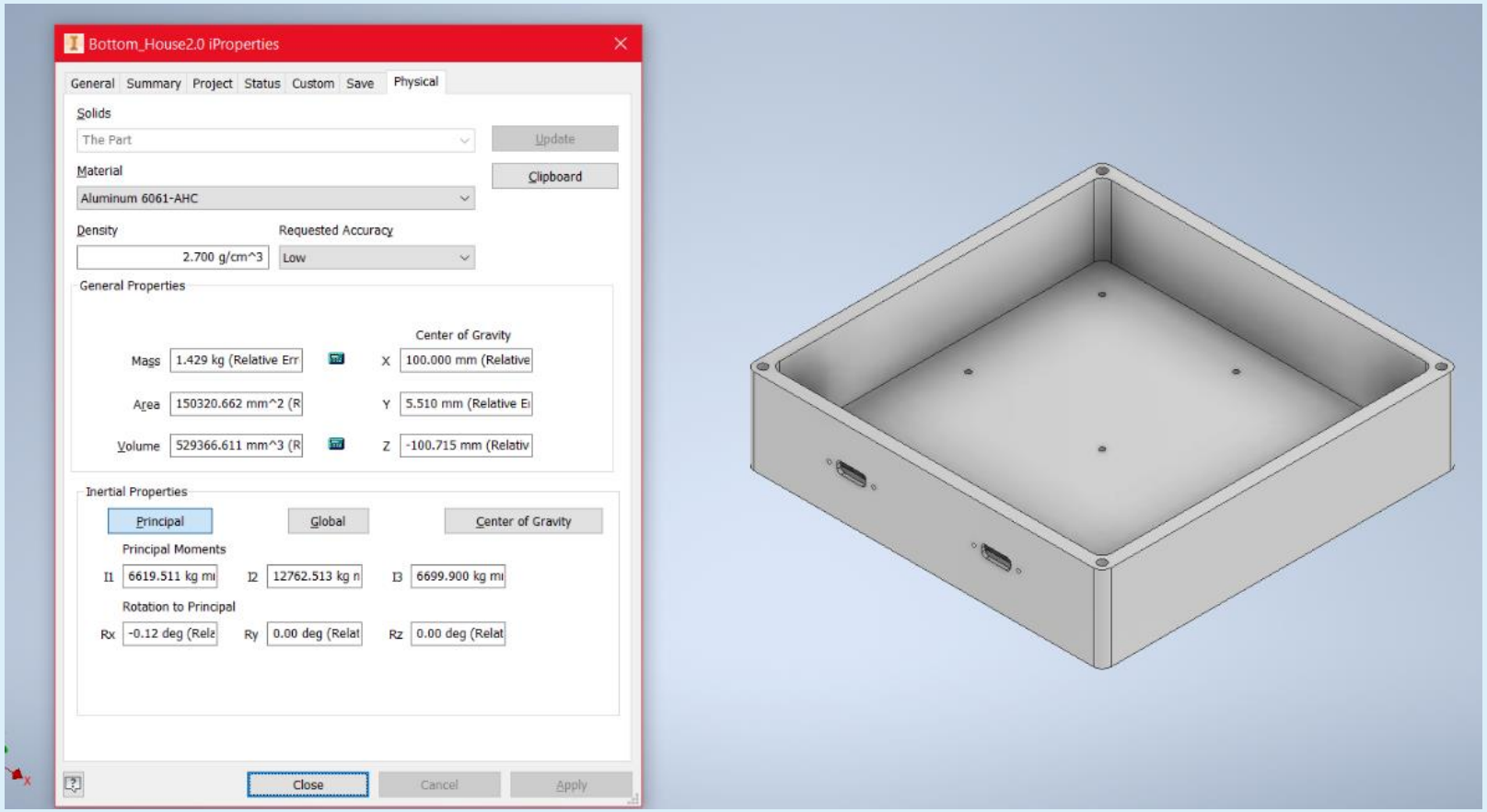
8. Tapping

- To add internal threads to the drilled holes on the base and on the Corners of the Work piece

Final Bottom



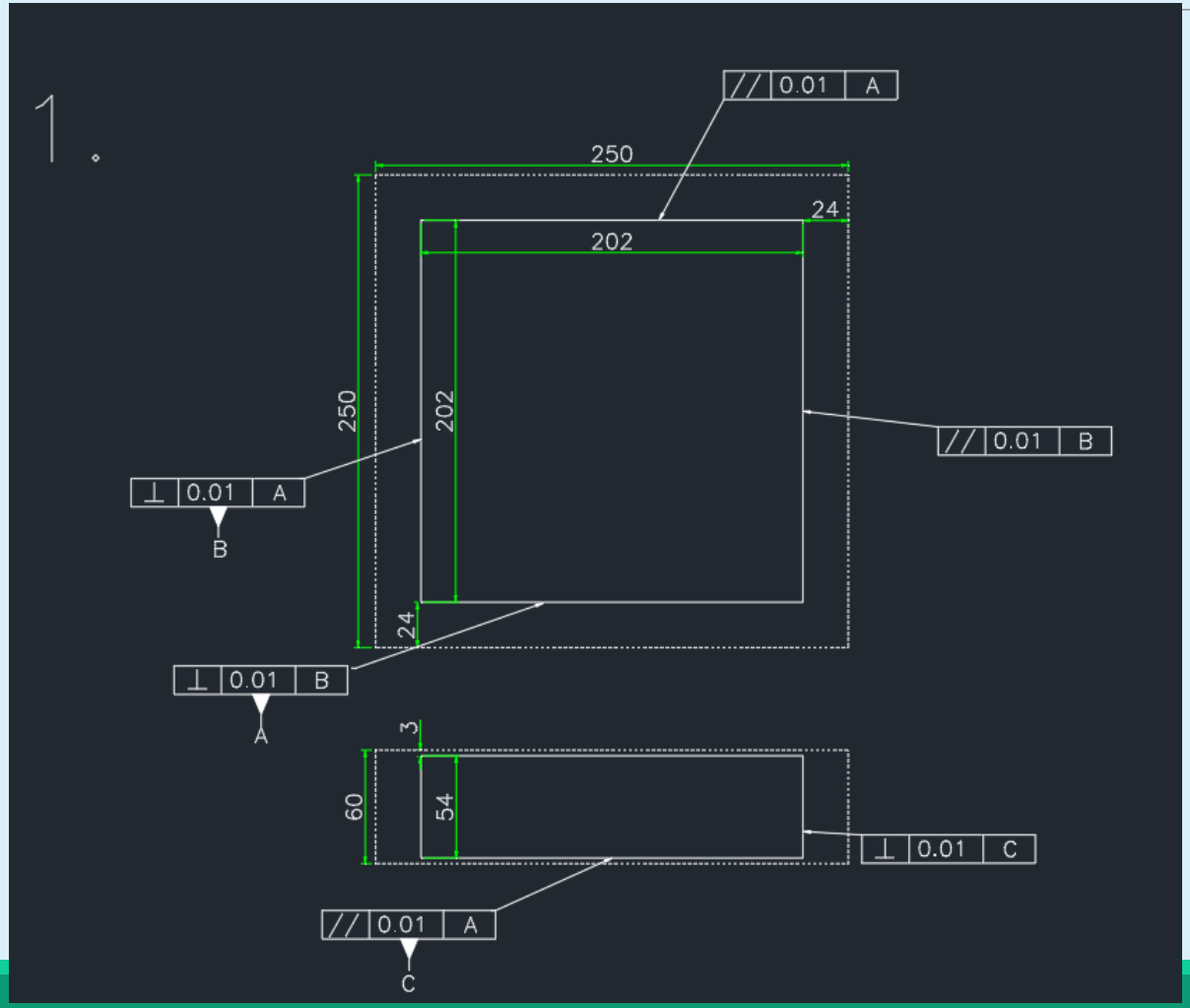




Weight of Bottom

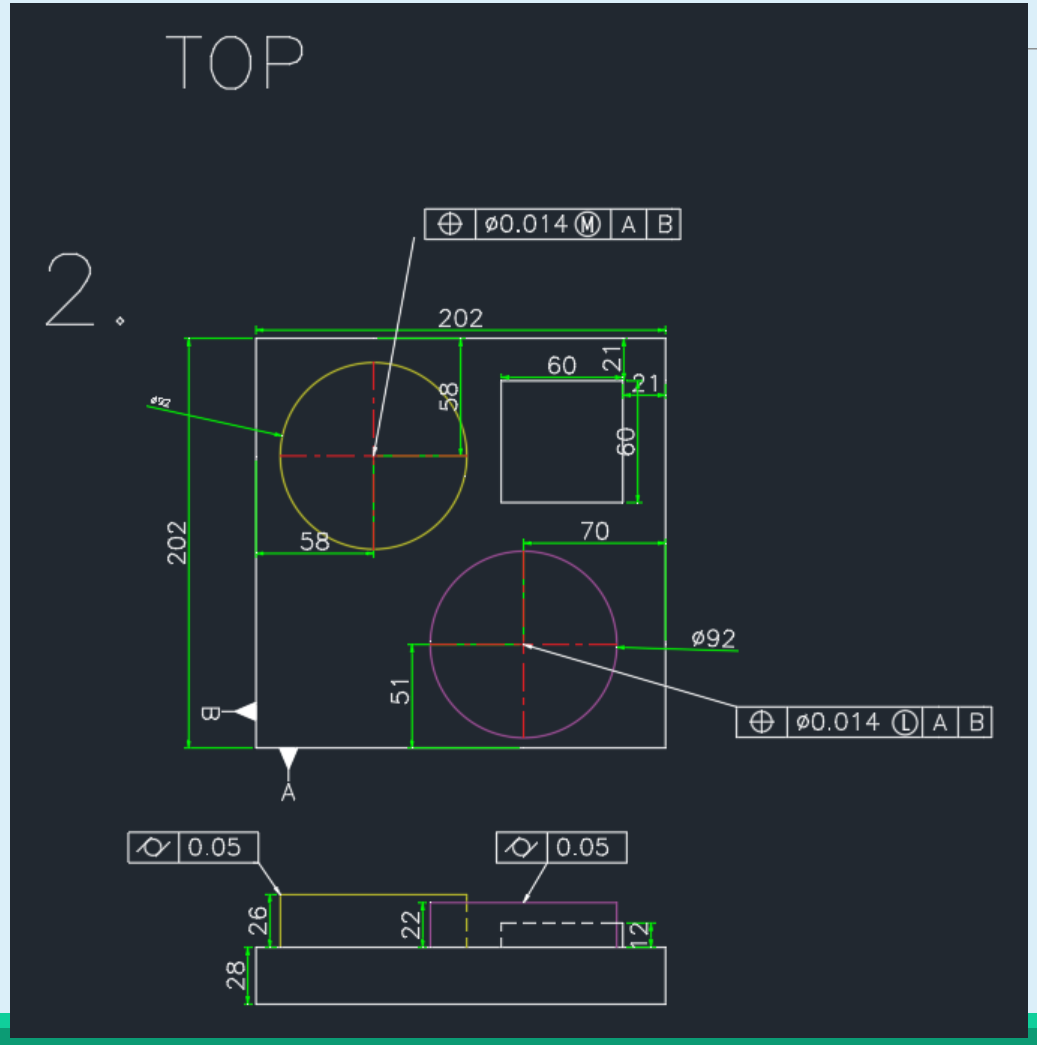
Mass = 1.429kg

Fabrication of Top:



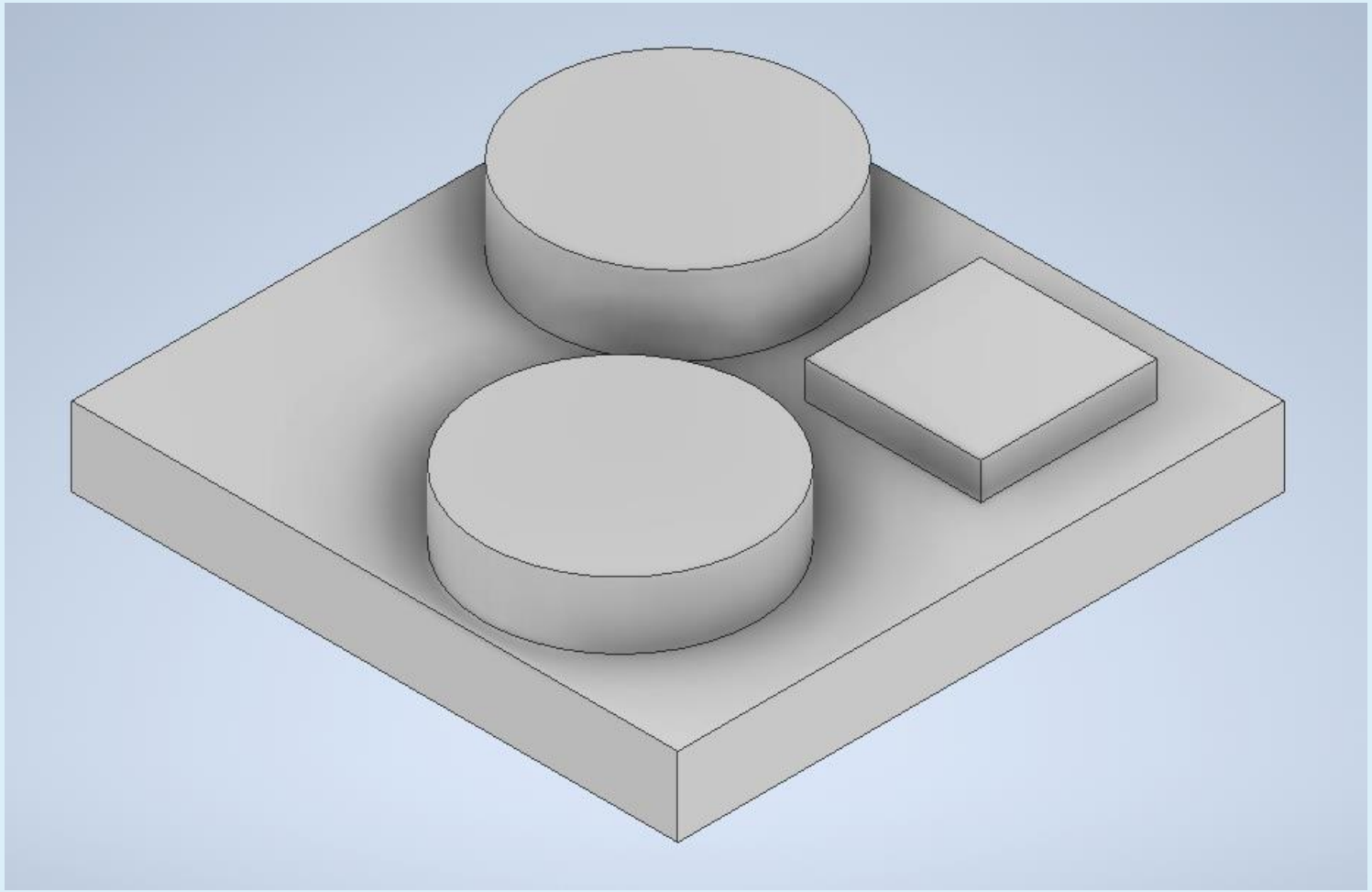
1. Face Milling

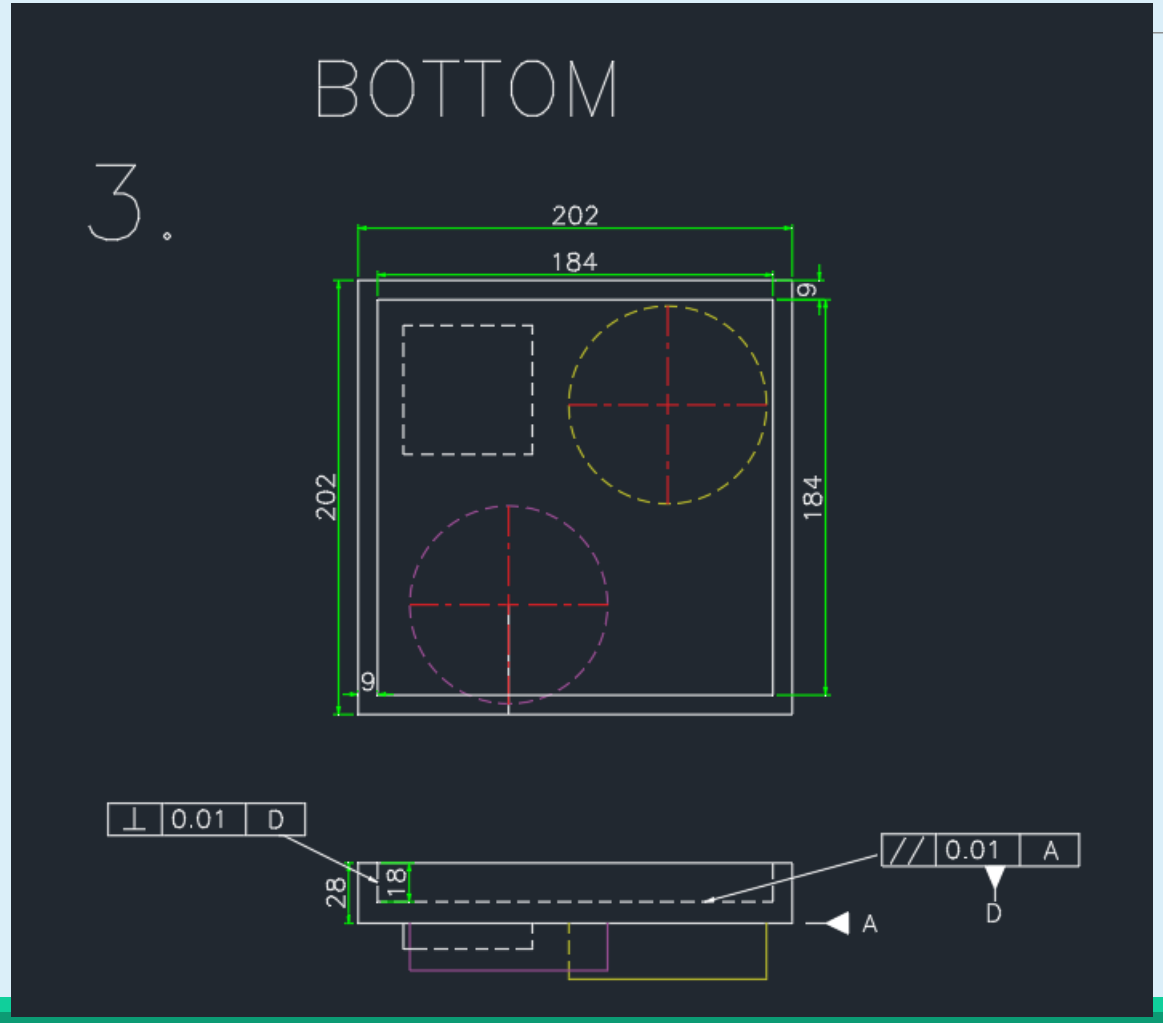
- End milling to reduce the dimension of the blank from 250x250x60 mm to 202x202x54 mm
- Milling tool of dim Ø50mm
- Extra 2mm for grinding



2a. End Milling

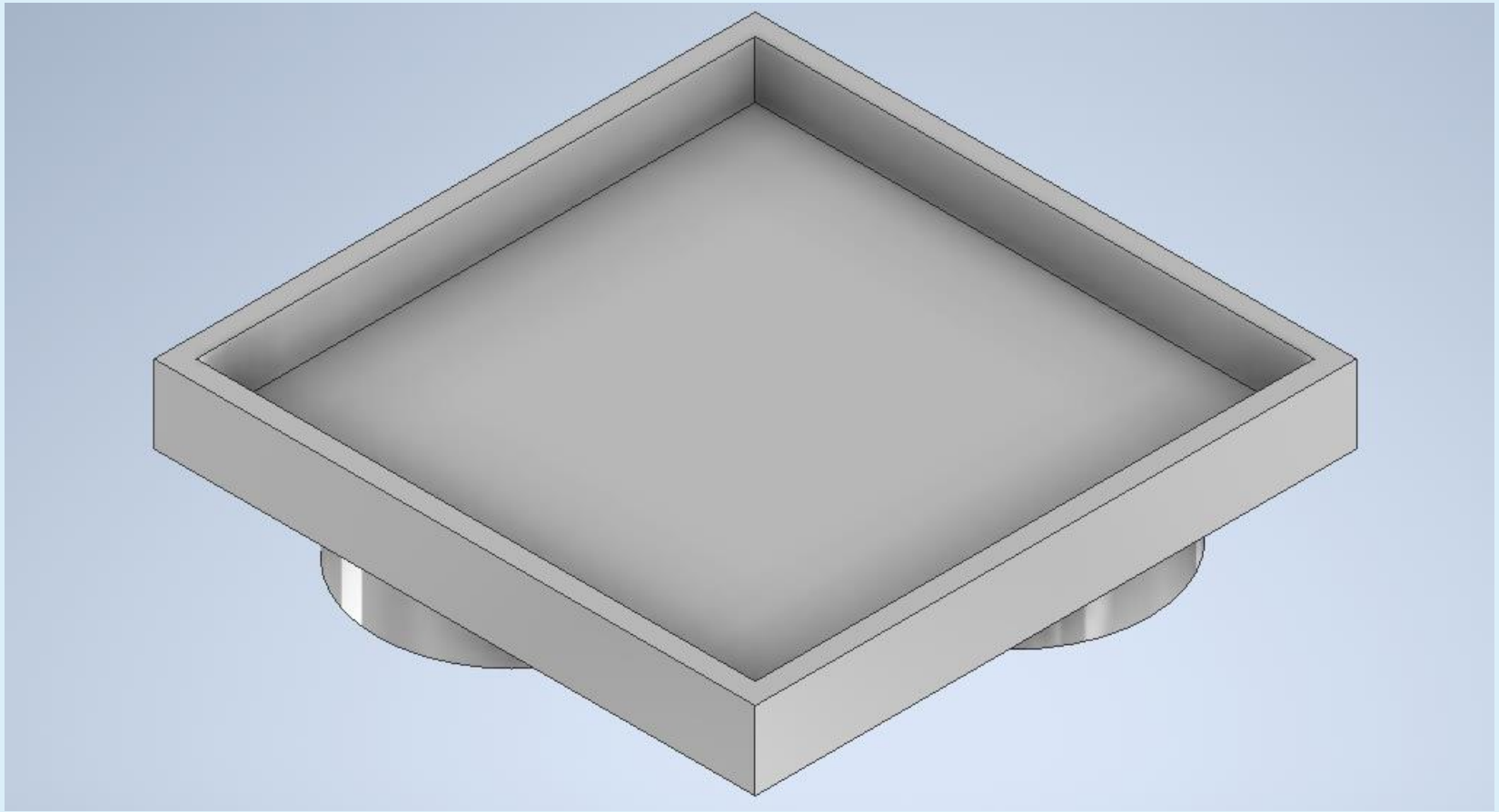
- End milling on Top face to obtain Required profile.
- Milling tool of dim Ø30mm and Ø10mm

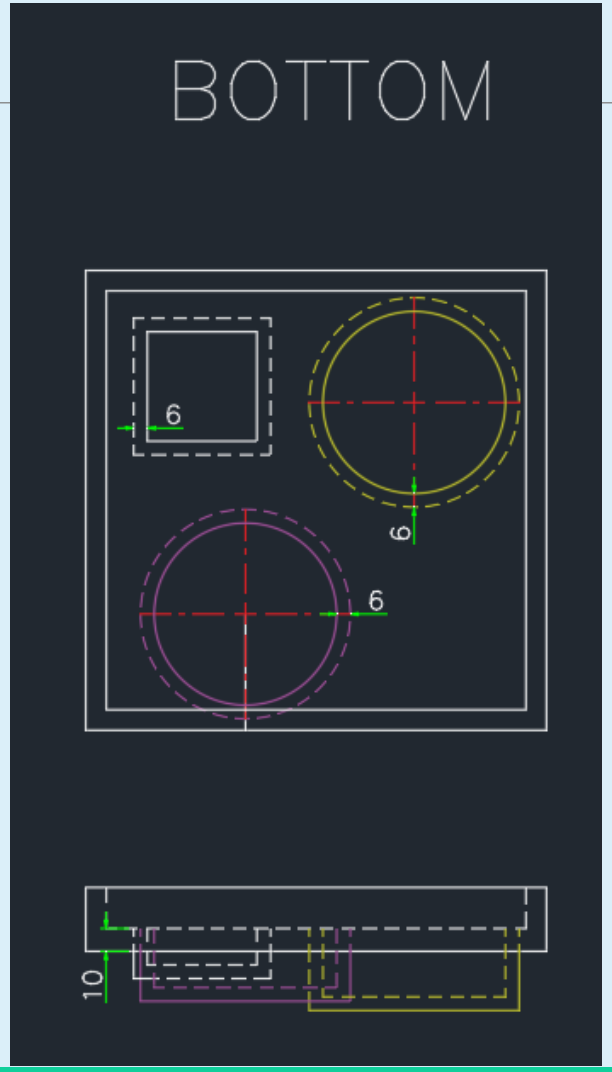




2b.End Milling

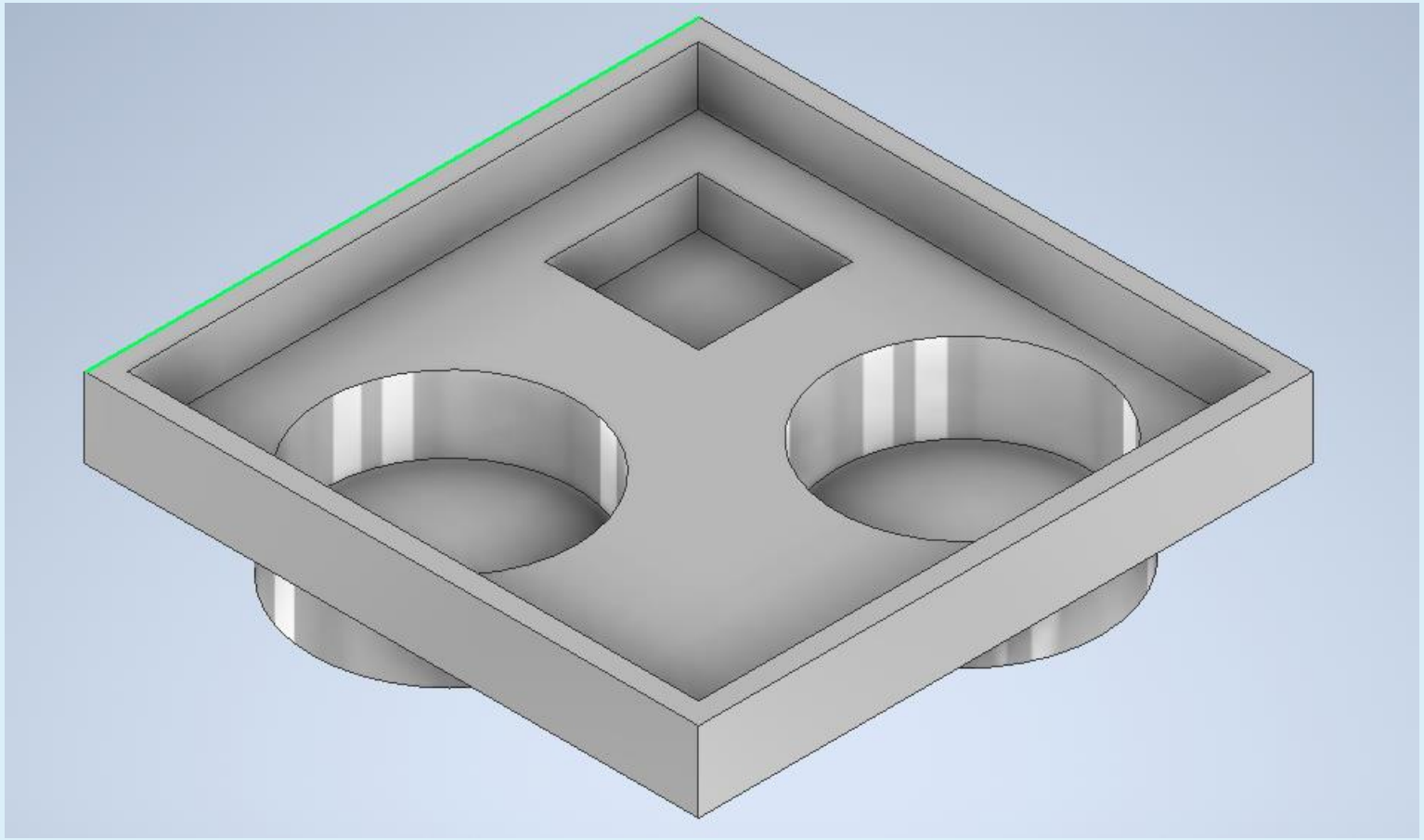
- End milling on the bottom surface to create a cavity of dimension 184x184x18mm
- Mill tool Ø30-50mm

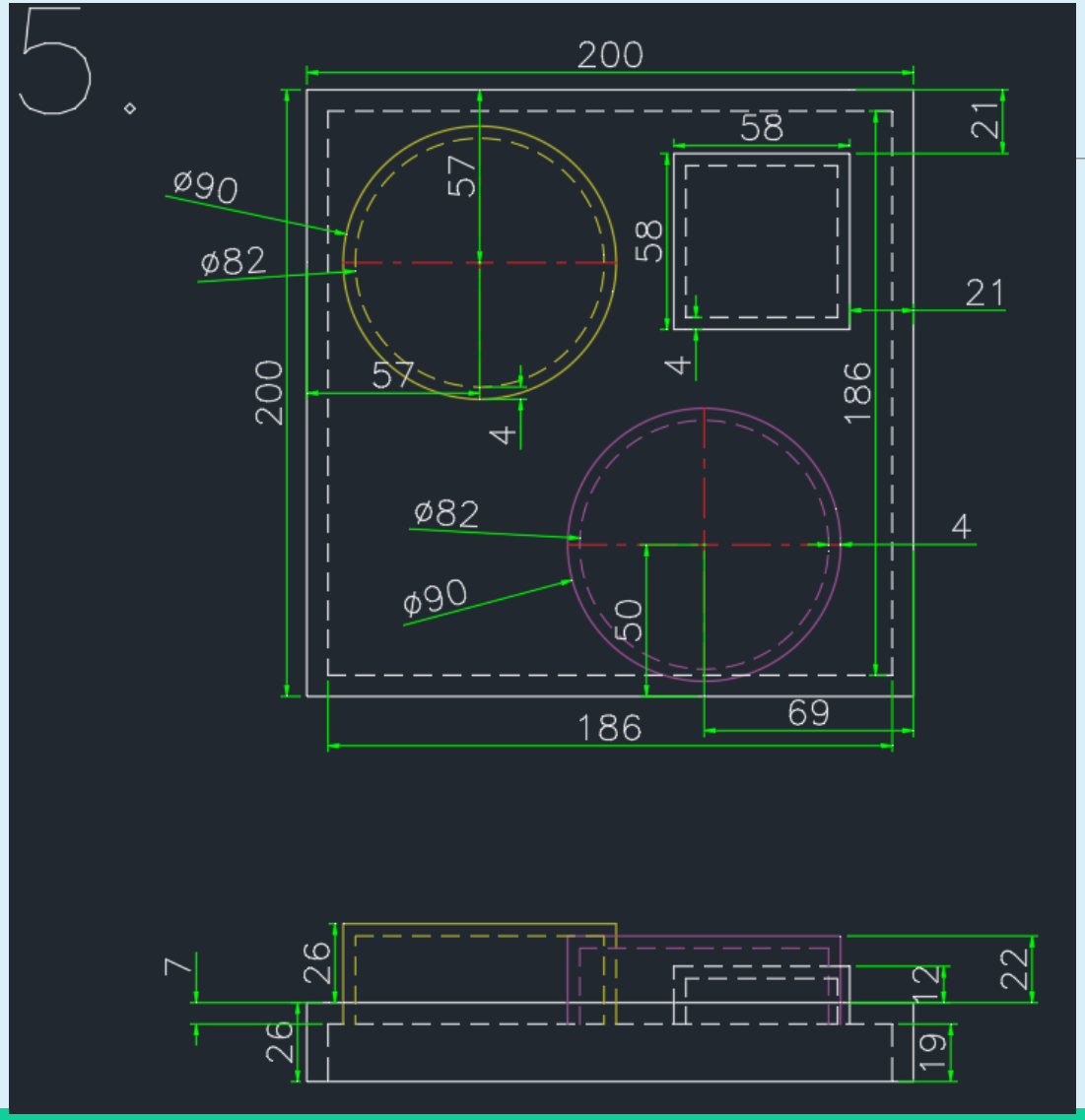




2c. End milling

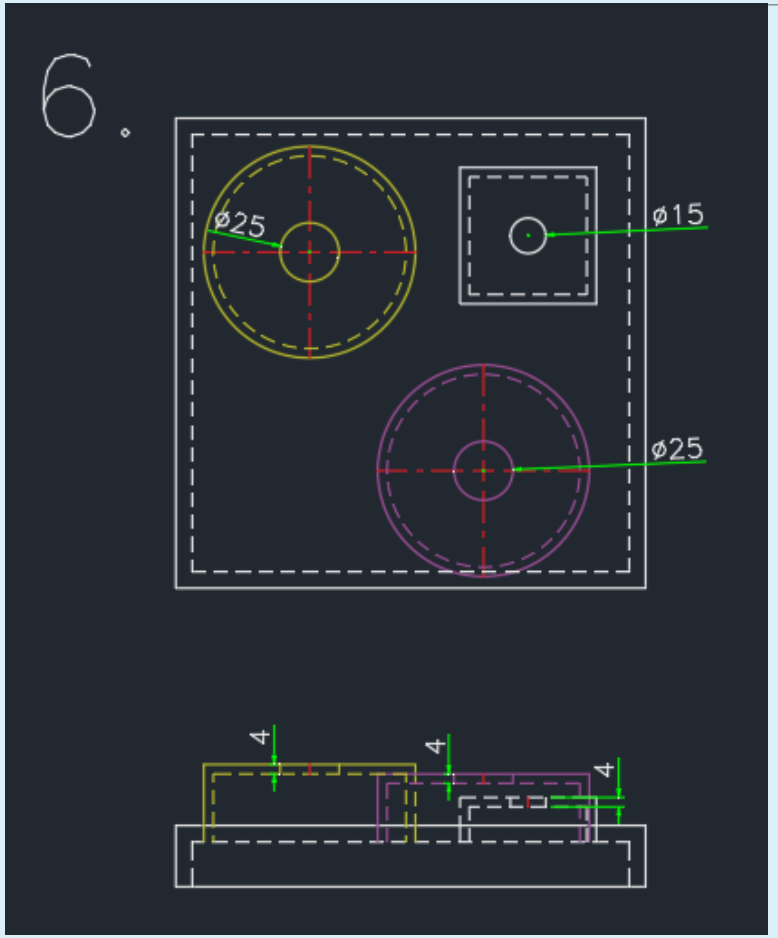
- using end mill to create holes for the Sensor 1 , 2 and 3.
- Milling tool , Ø30mm





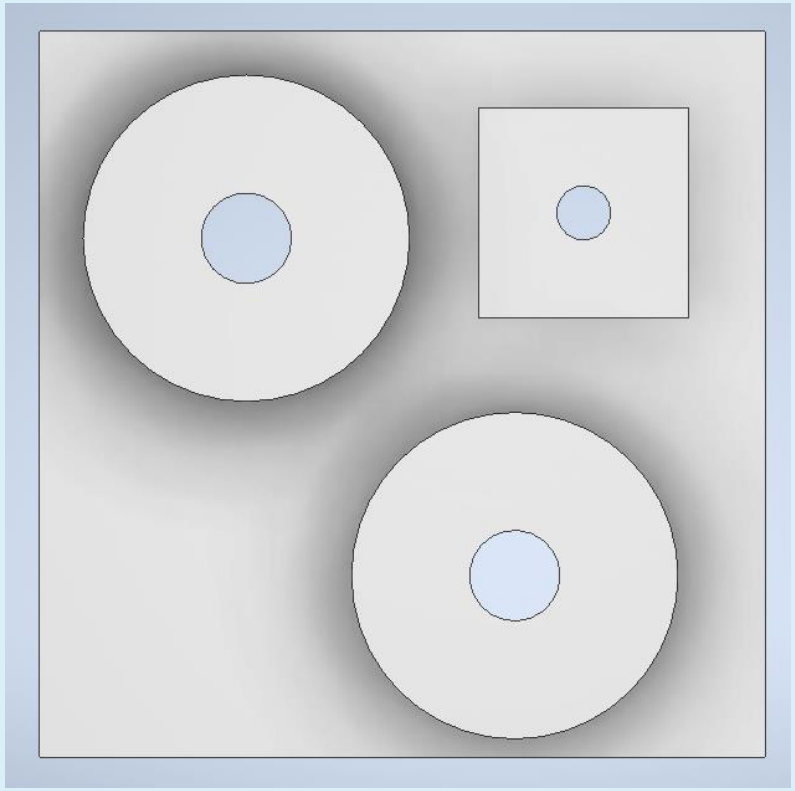
3.Grinding

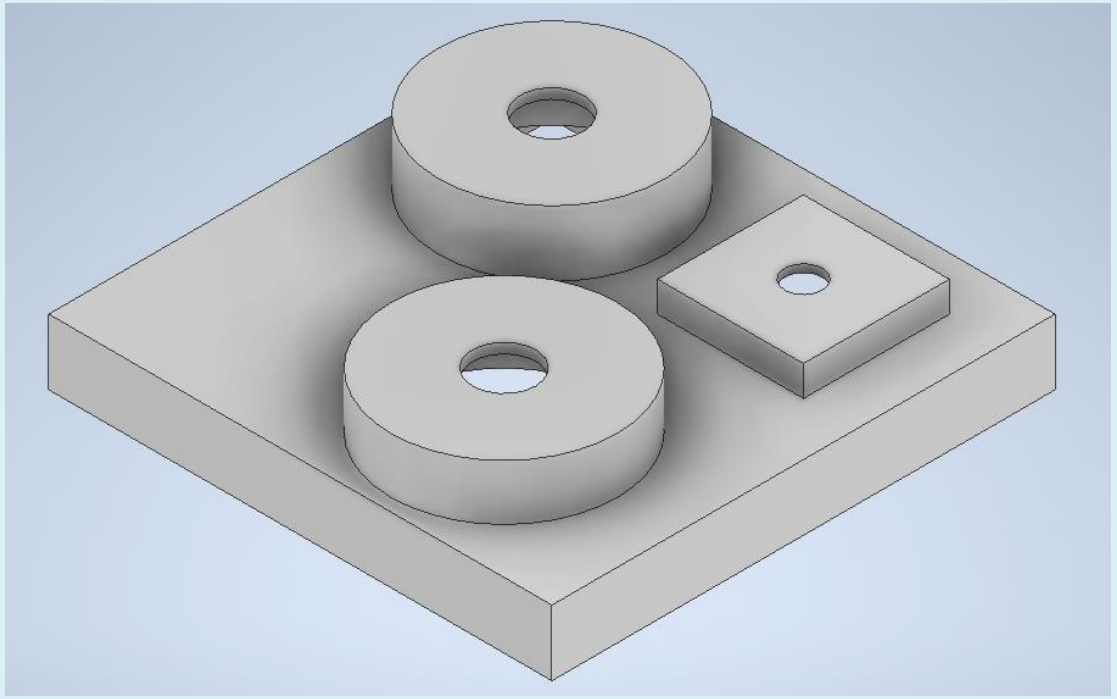
- Grinding the extra 1mm from all the faces for better surface finish
- Grinding wheel , Open structure with Soft wheel

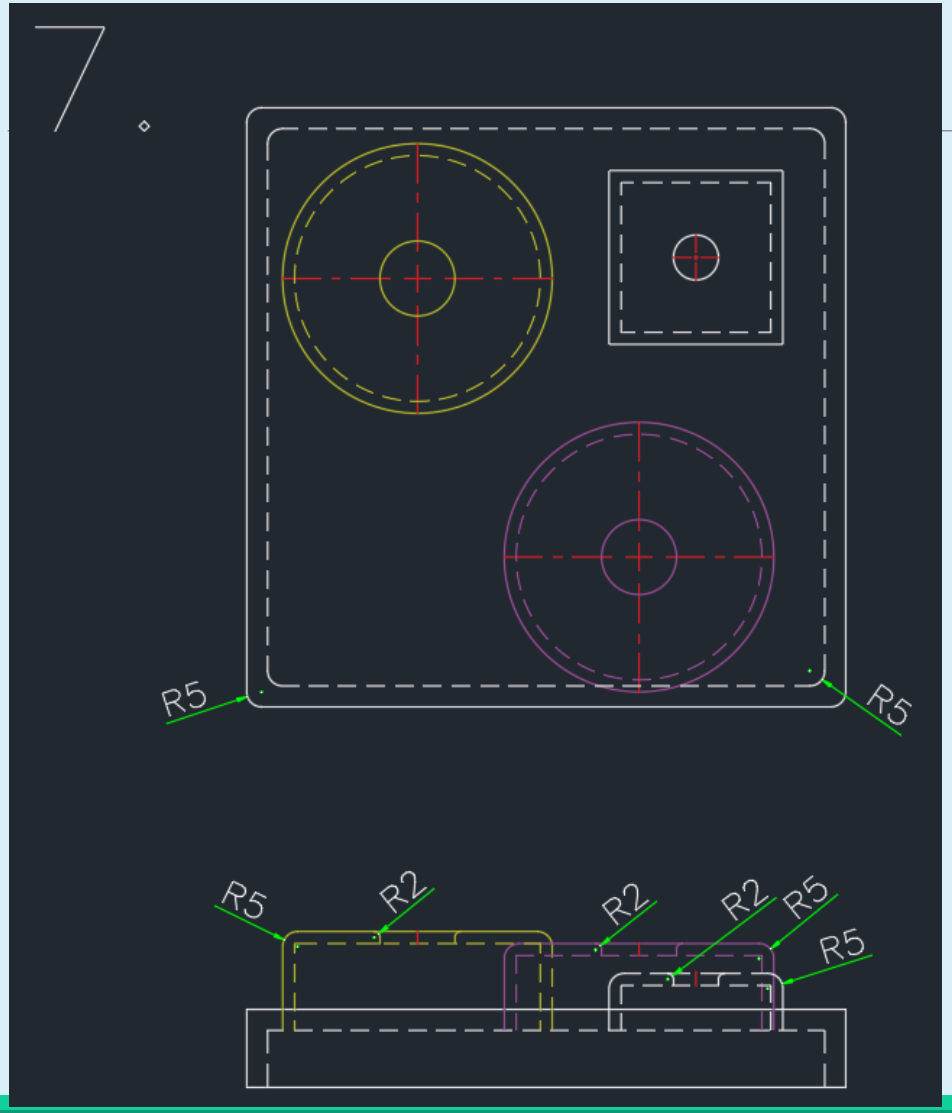


4.Trespanning

- To create opening on the top face of the respective cylindrical holes of the sensors
- Tool with Ø25 and Ø15mm

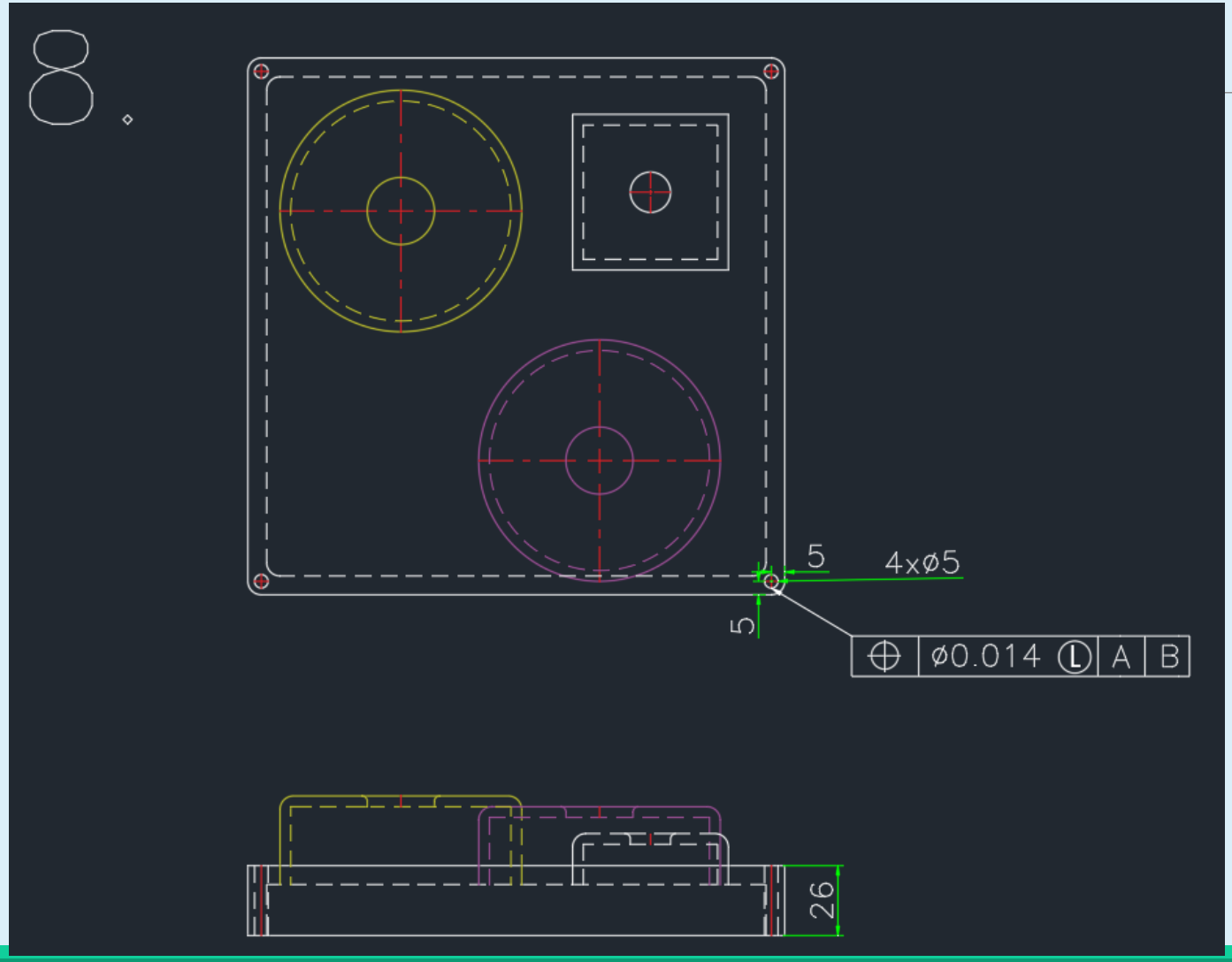






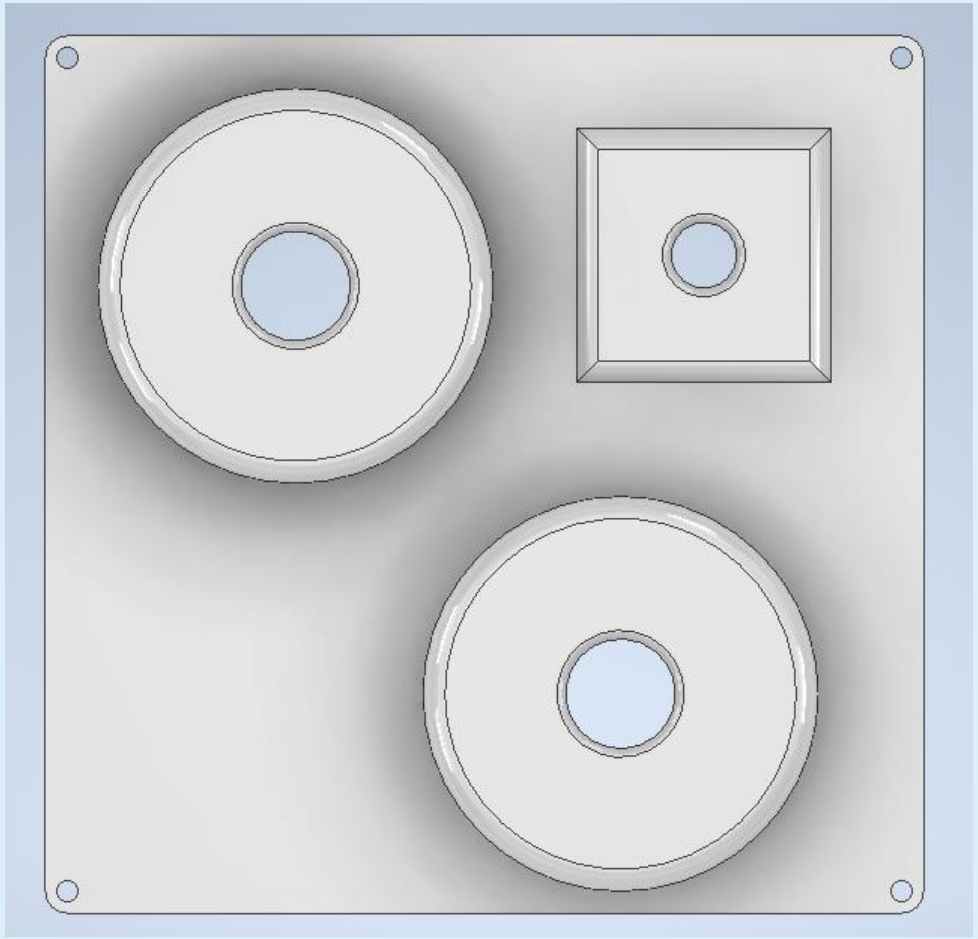
5. Fillet

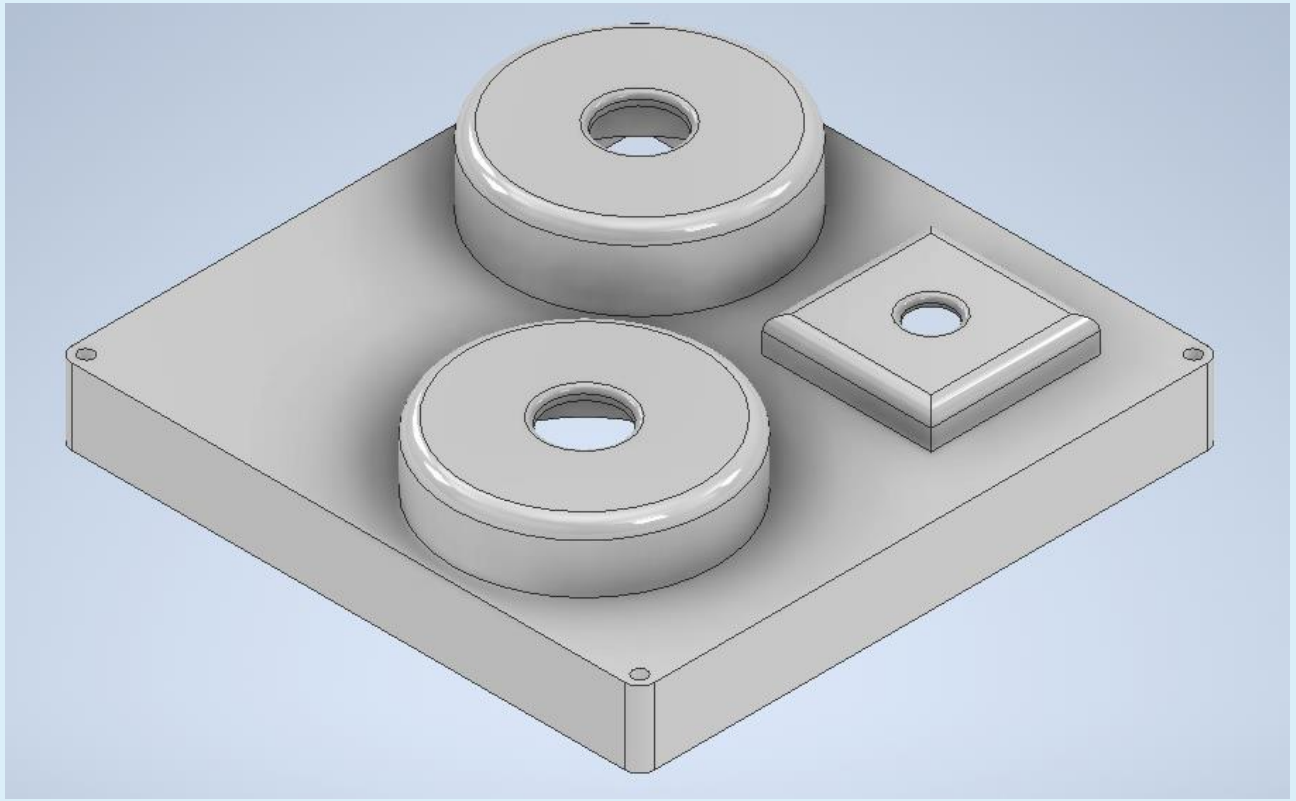
- Adding 5mm fillet to the interior and exterior corners of the Work piece and to the edges of the Cylinders
- 2mm Fillet on the holes of the Cylinder

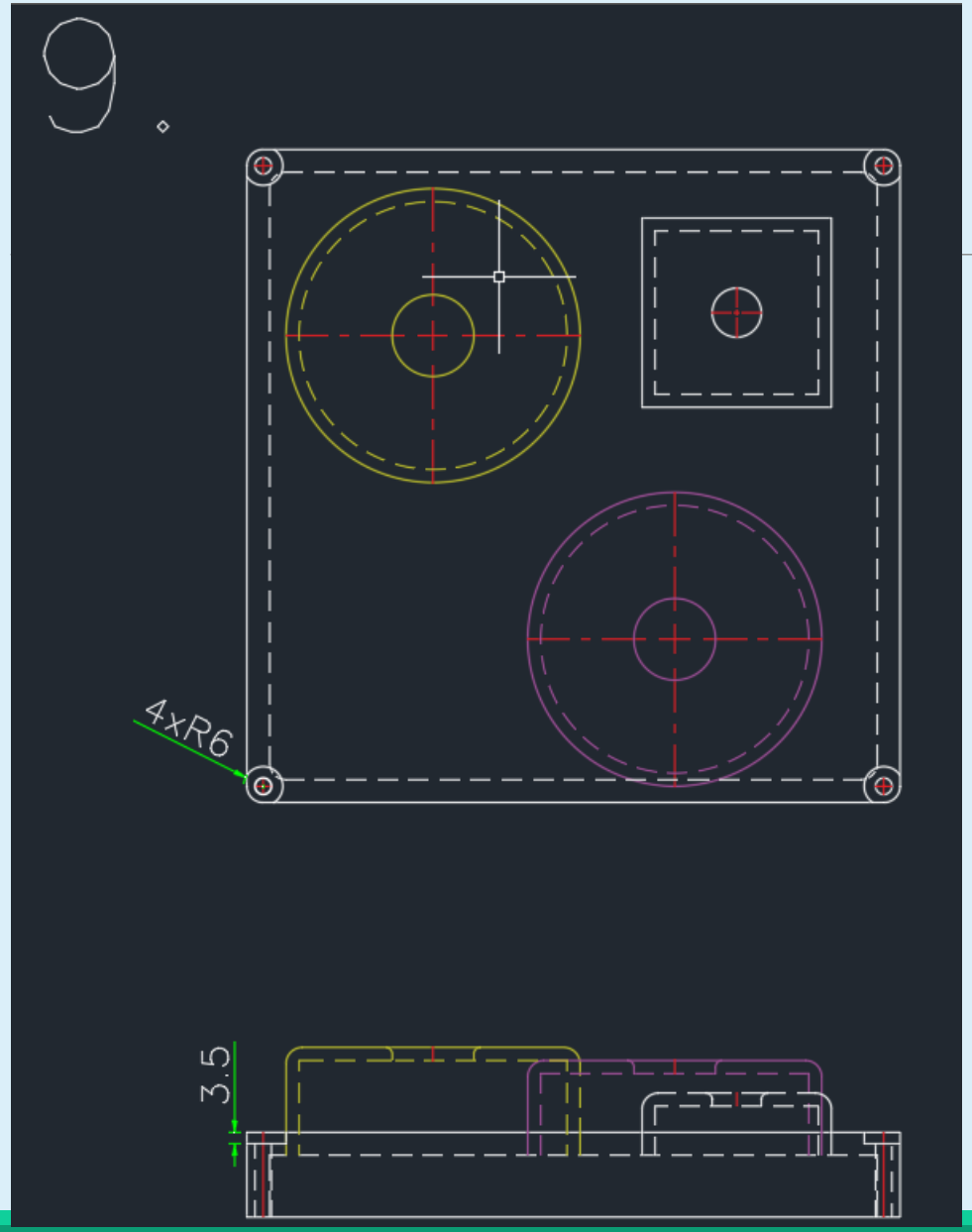


6.Drilling

- Drilling holes at the corner of the Work piece with the help of a Drilling Machine
- Dimensions : 4 x (Ø5mm , 26mm)
- Drill bit Ø5mm

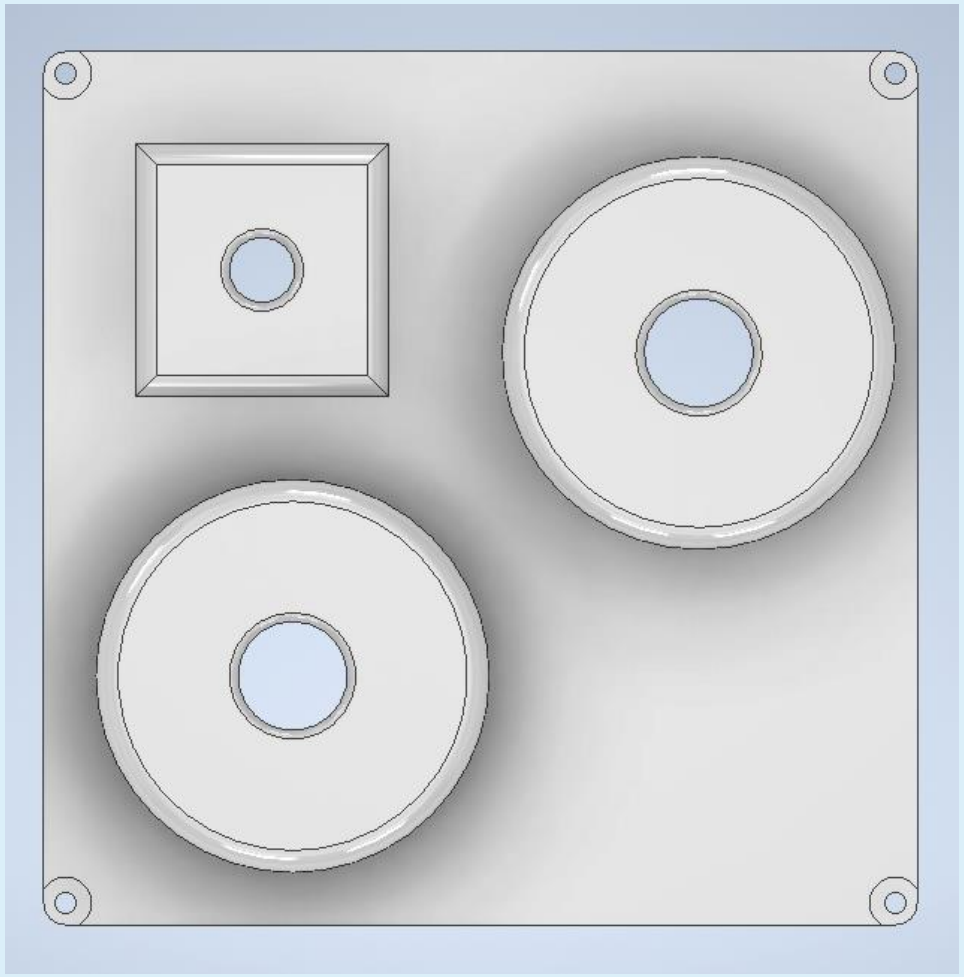


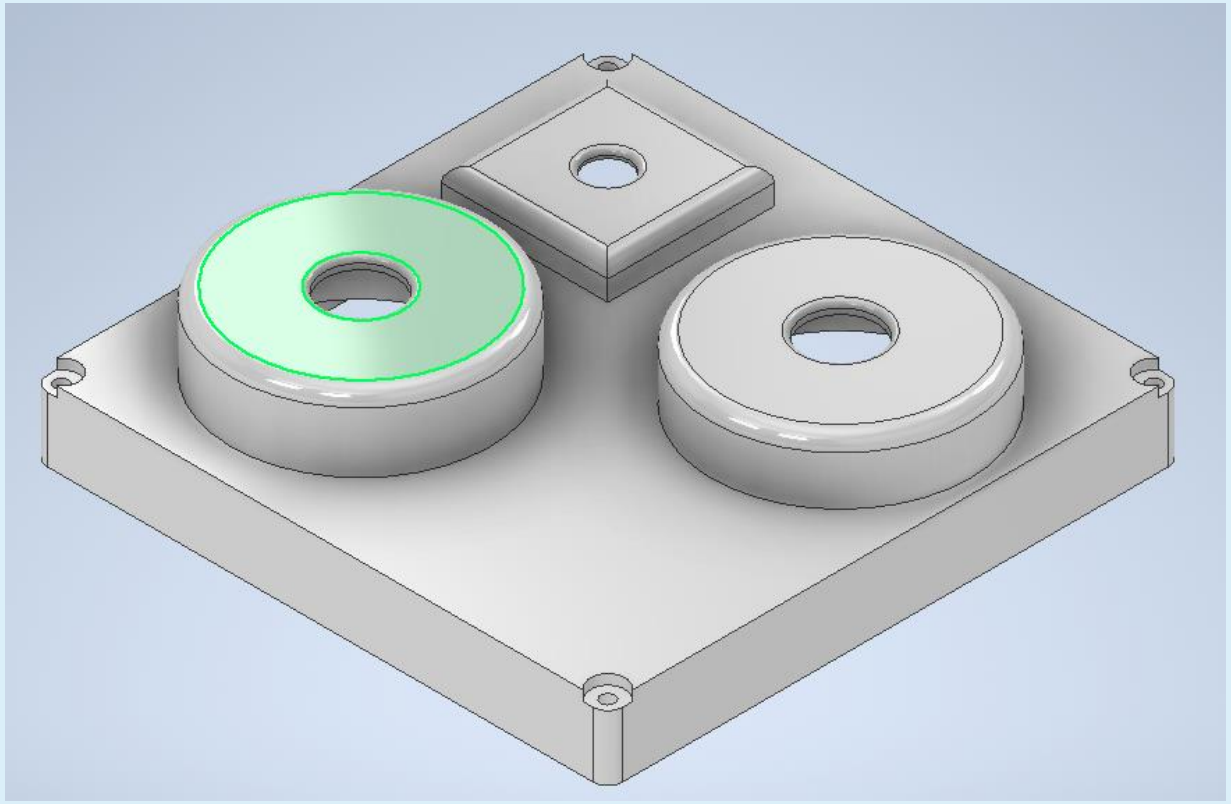


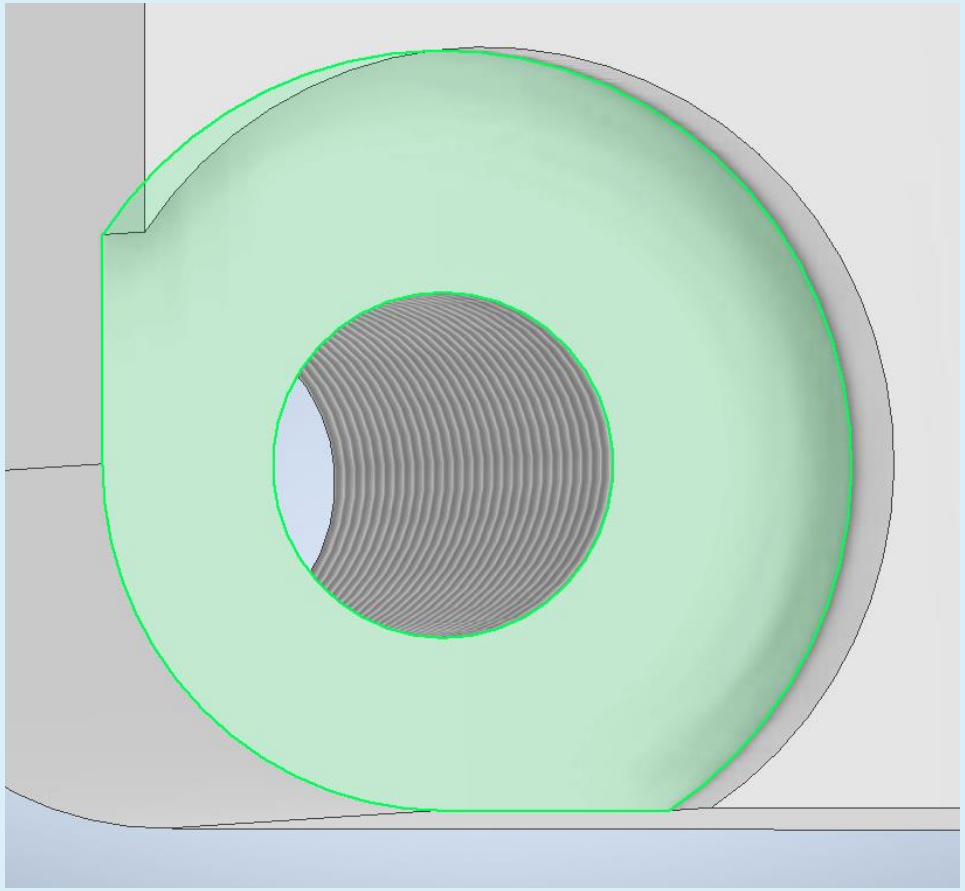


7. Counter-boring

- Counter-Boring 3.5mm on the drilled holes
- Counterbore with Ø12mm



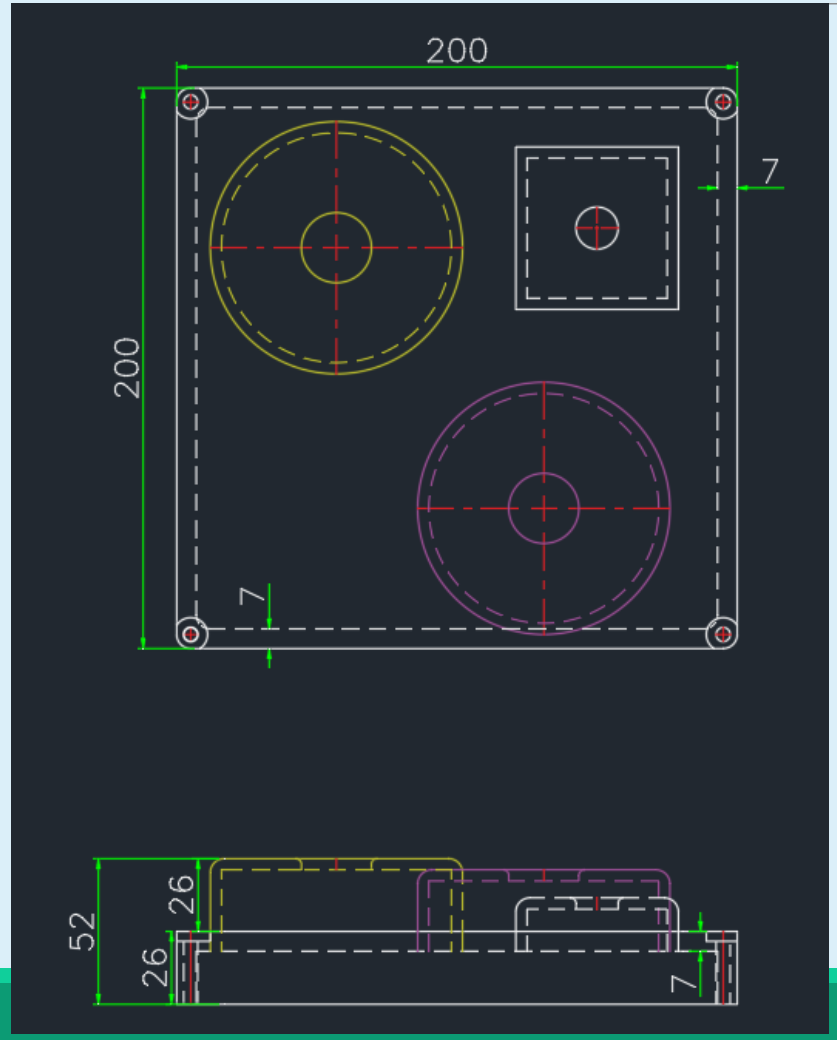


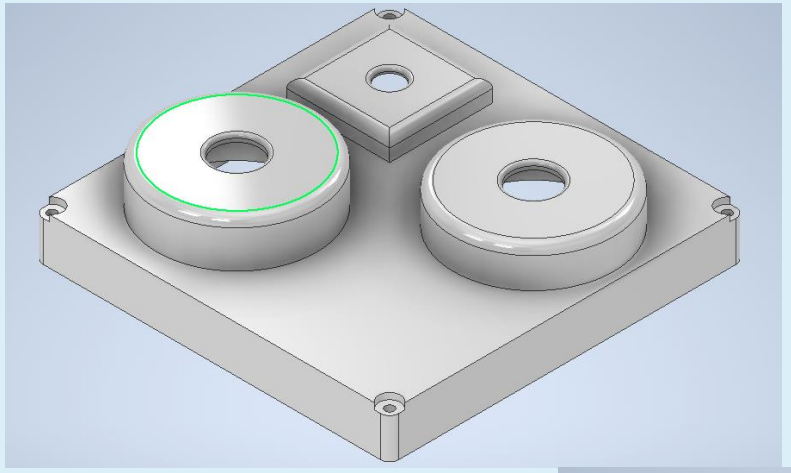


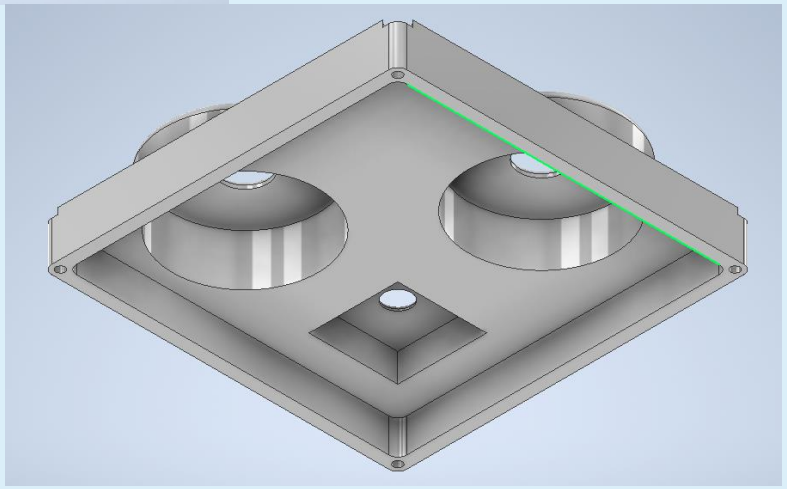
8.Tapping

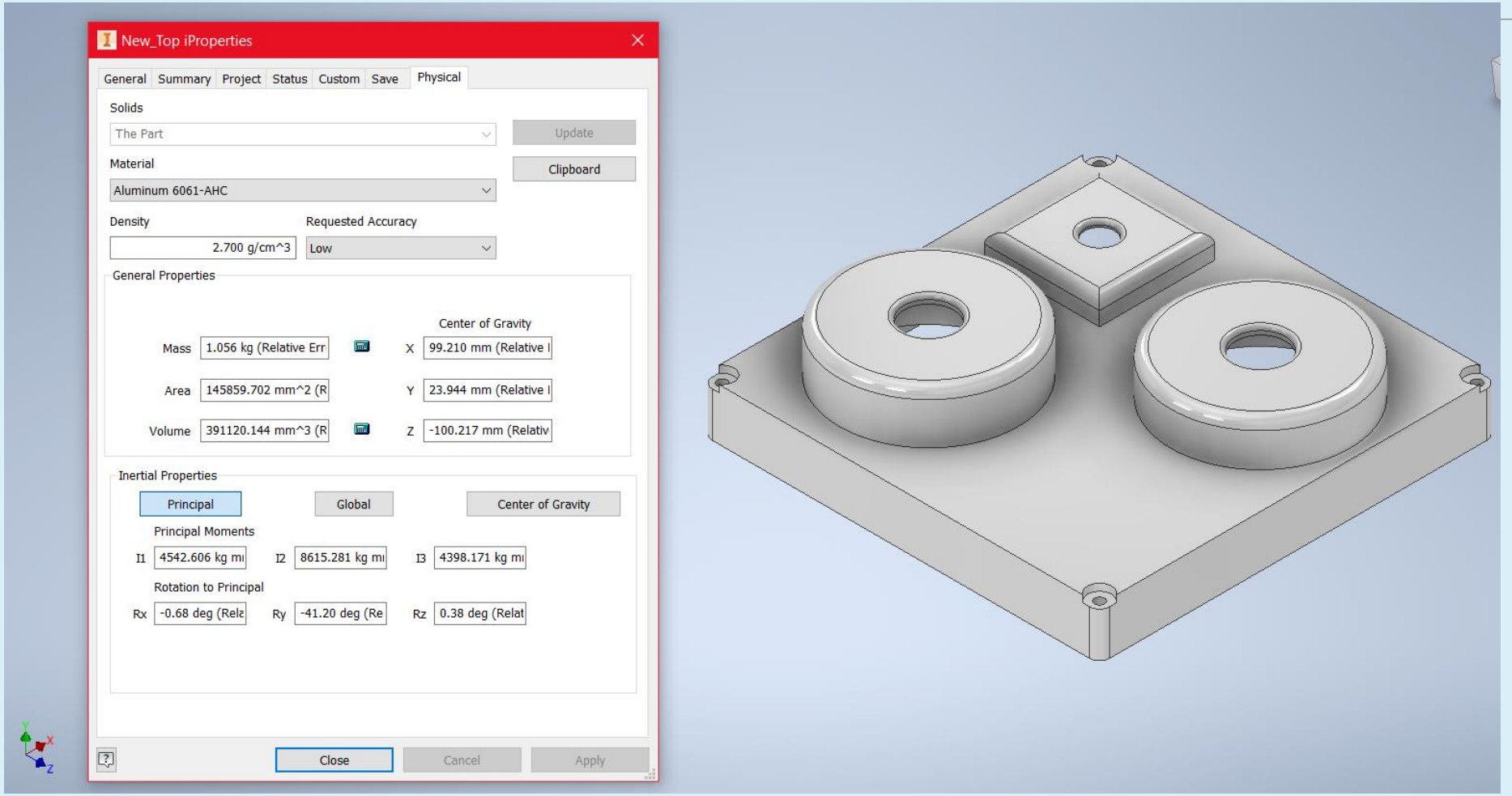
- To add Internal threads to the Drilled Holes

Final Top







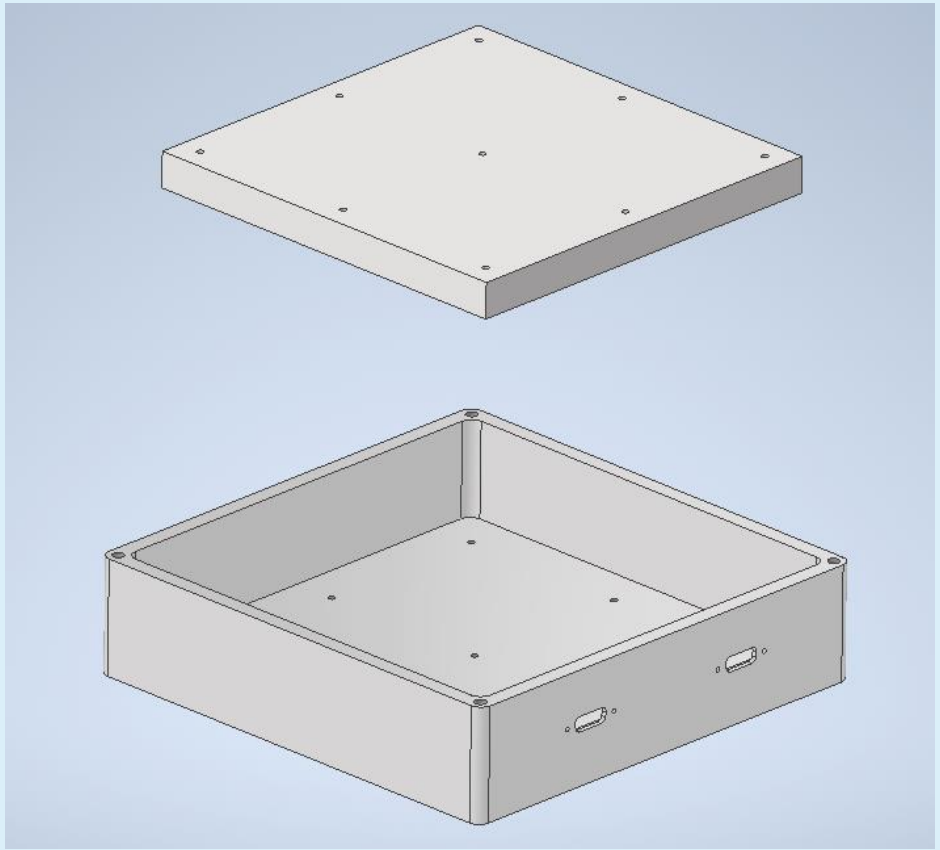


Weight of Top

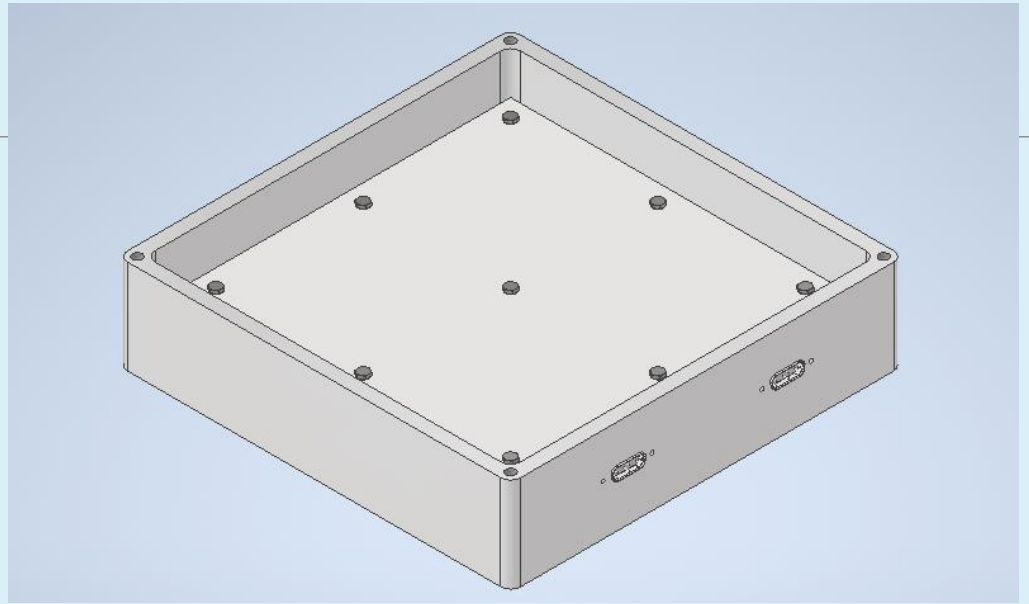
Mass = 1.056 kg

Assembly:

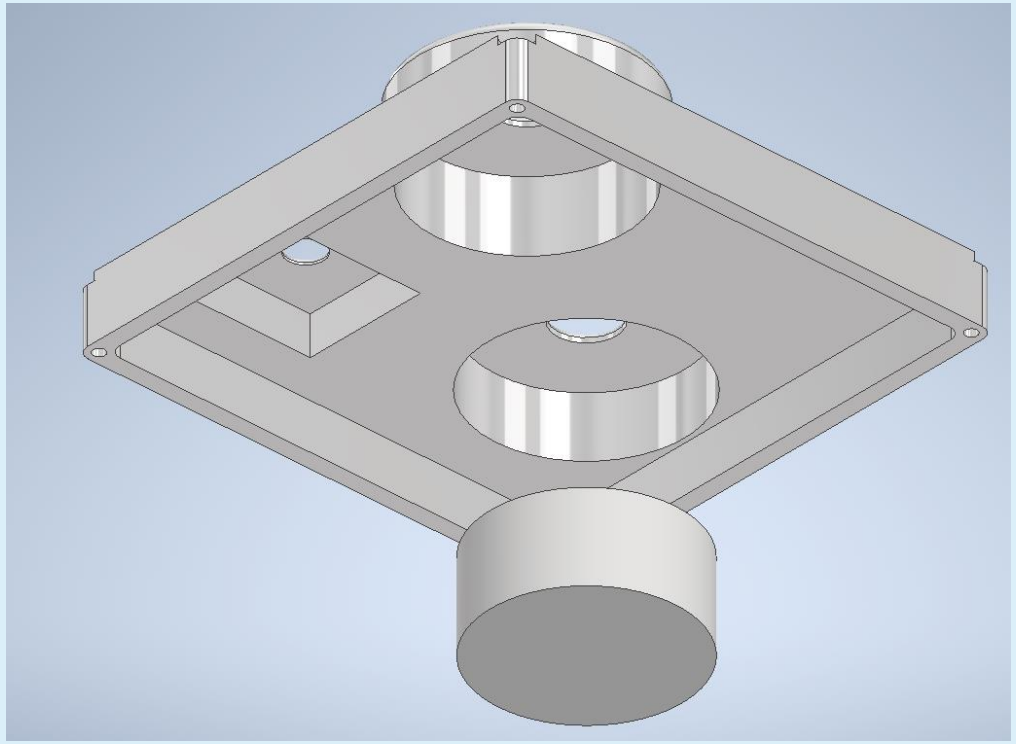
1. Insertion of Circuit Board(Sensor 4 in Documents) inside the Bottom Housing.



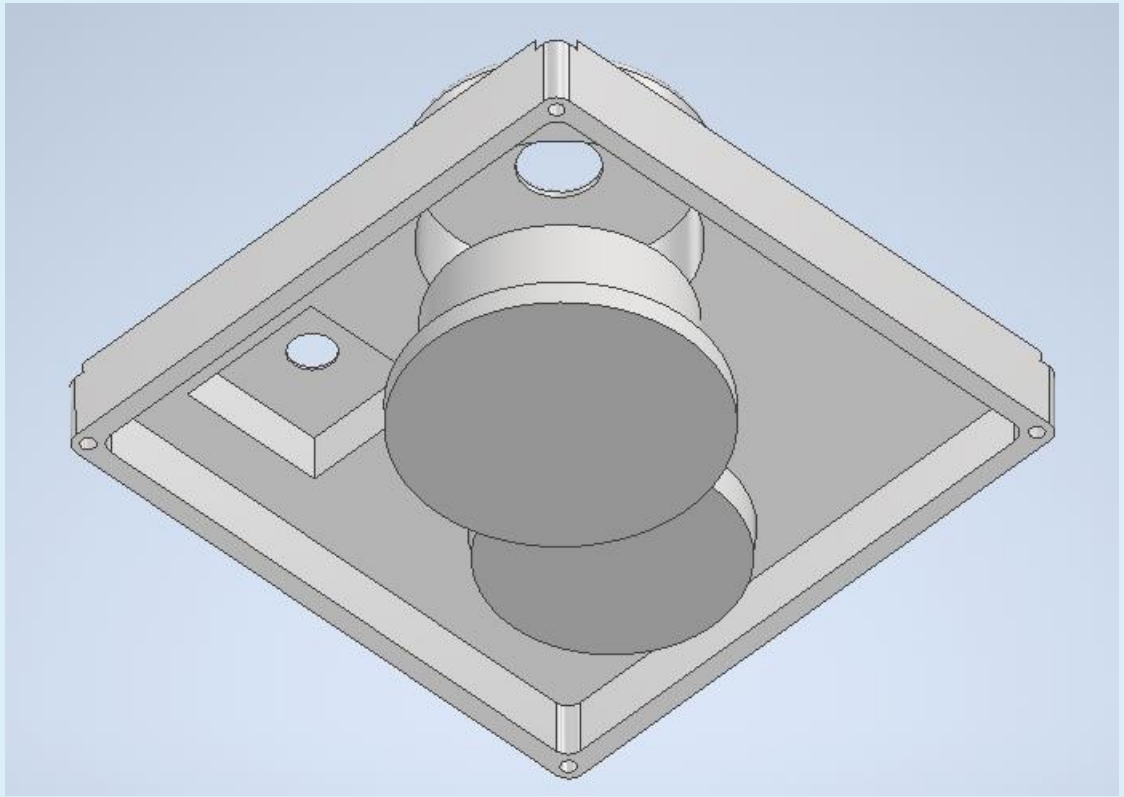
2. Attaching the Circuit Board 10mm above the Base with the help of M3x30mm screws. The D-Pins automatically fit in the slots and are Exposed out.



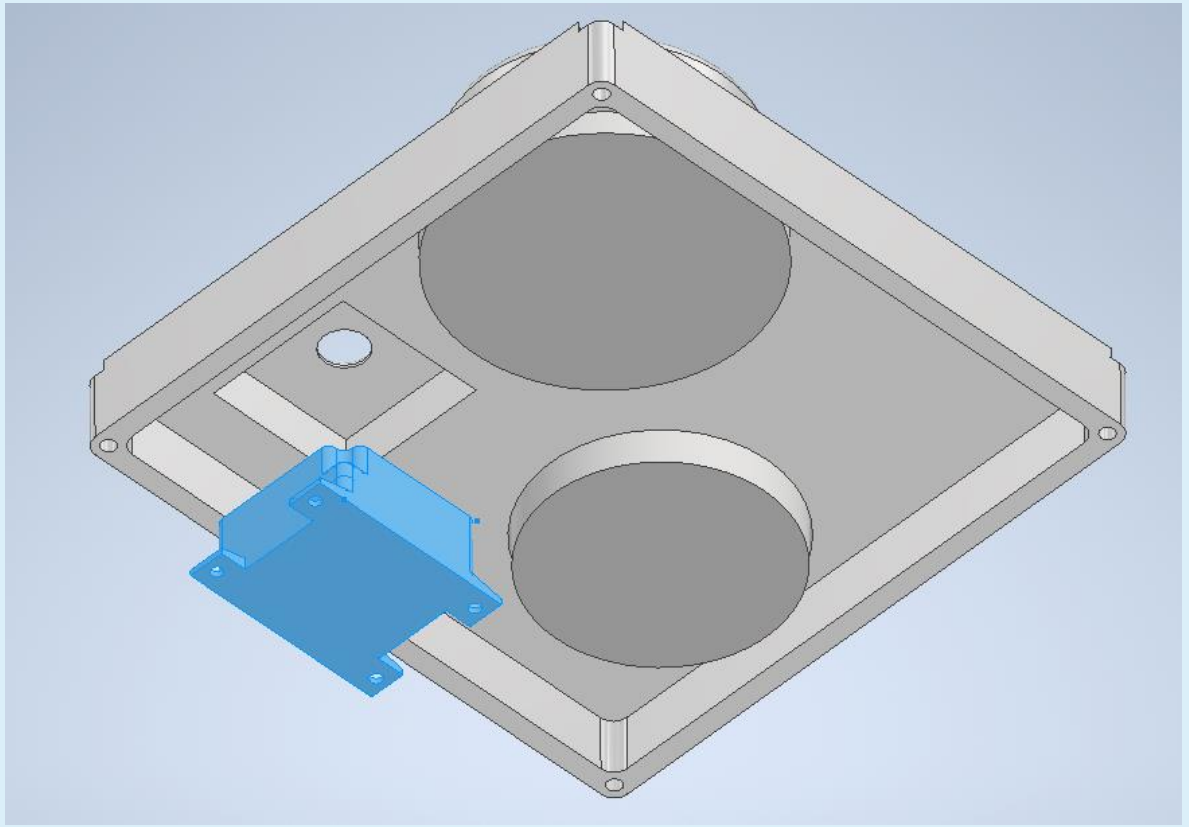
3. Inserting Sensor 1 in the Top Housing. The Sensor will be fixed with the help of L joints



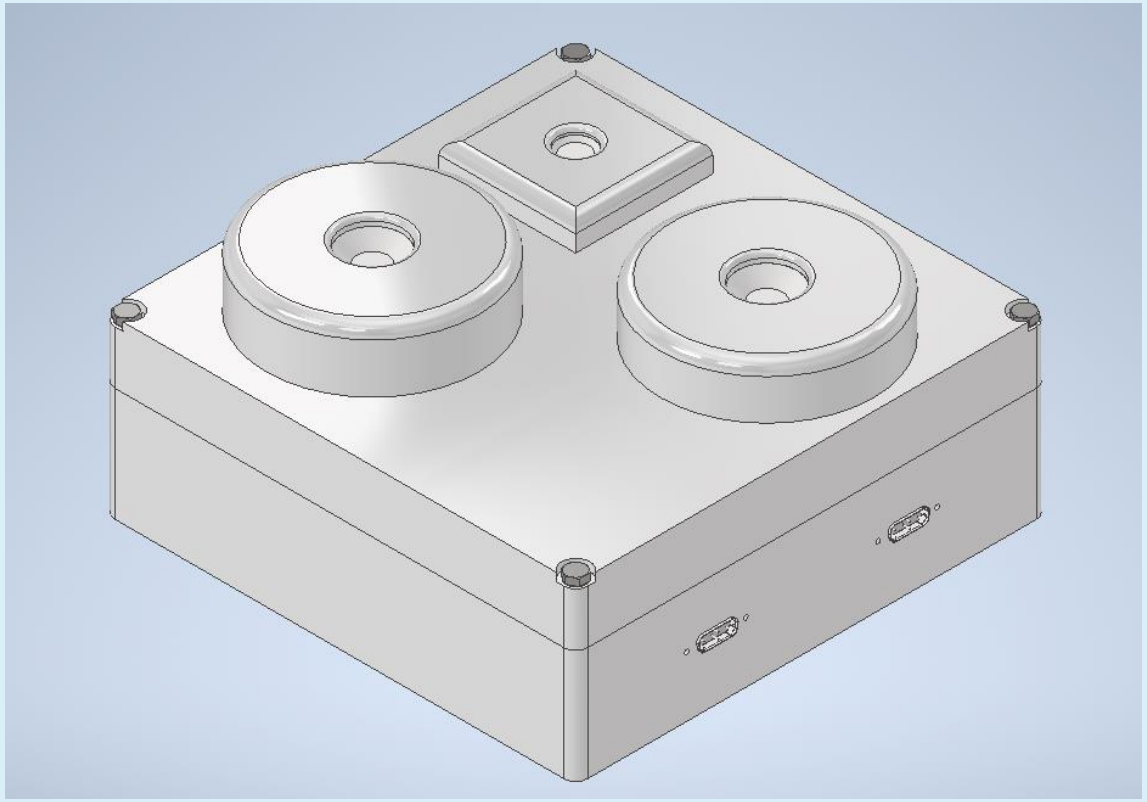
4.Inserting Sensor 2 inside the Top Housing and attaching it with L Joints.



5. Inserting Sensor 3 into its Slot in Top Housing and screwing it to the top.



6. Fixing Top Housing to Bottom with M5x50 mm screws.



Measuring Methods for Verification

- Perpendicularity : It can be Measured with Height Gauge and a Datum Perpendicular to the Gauge.

- Parallelism : Dial Indicator mounted on a clamper.

- Position Tolerance : Co-ordinate Measuring Machine (CMM) or Computer Vision System are appropriate instruments for obtaining positioning of various parts.

- Circularity : A Dial Indicator mounted on a clamper with the subject revolving on V-Block.

- Cylindricity : Similar Method to Circularity

End