AE224: MACHINING SCIENCE AND TECHNOLOGY AE242: METROLOGY PAYLOAD DESIGN

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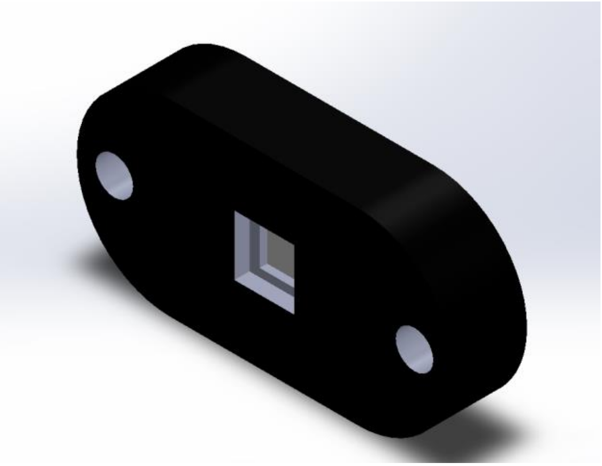
SC21B005

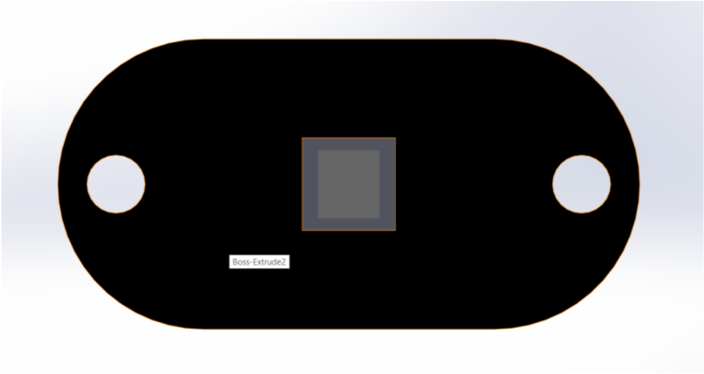
CONTEXT:

- SENSORS
- TOP HOUSING
- BOTTOM HOUSING
- RAW MATERIAL
- METROLOGICAL REQUIREMENTS
- ASSEMBLY VIDEO PICTURES

SENSOR 1

- Weight:180 gm
- Max length:50 mm
- Max breadth:25 mm
- Max height:15 mm
- Top rectangle should be visible from top



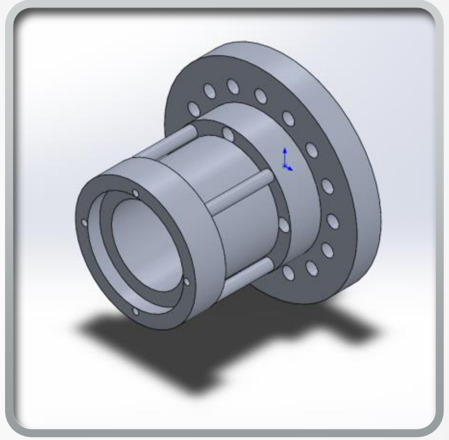


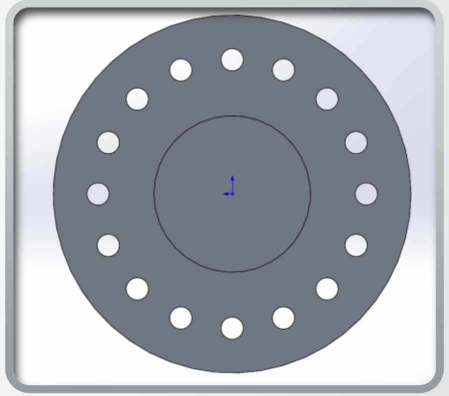
SENSOR 2

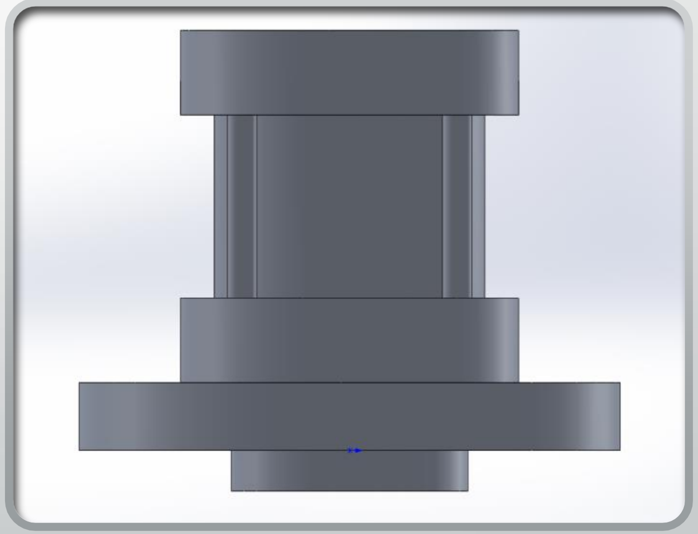
Weight:210 gm

Max diameter:80 mm

Max height:70 mm

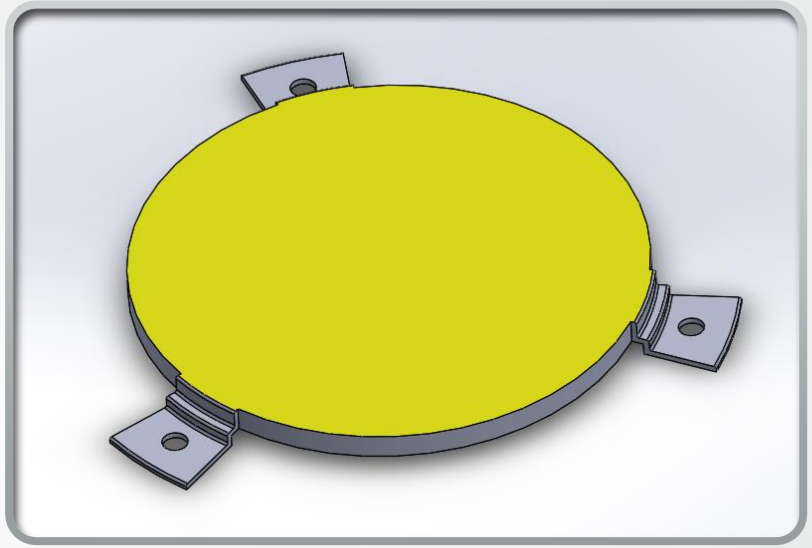


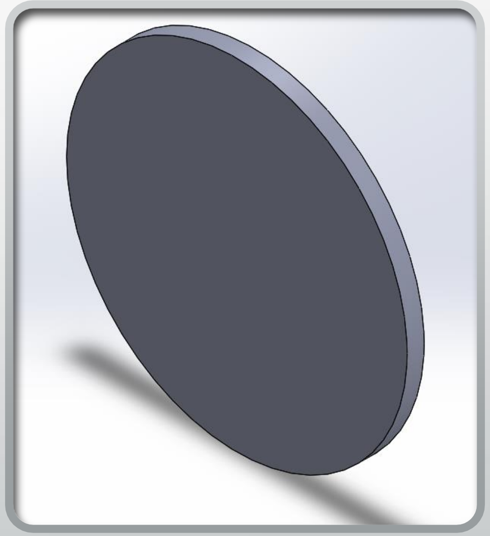


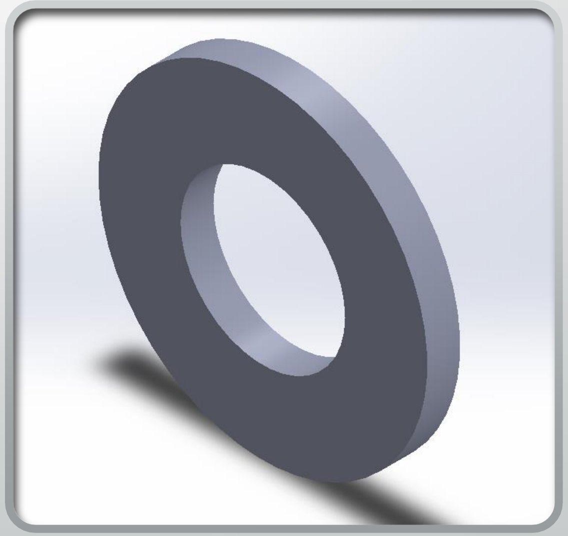


SENSOR 3

- Weight:160 gm
- Max diameter:47.2 mm
- Max height:17 mm

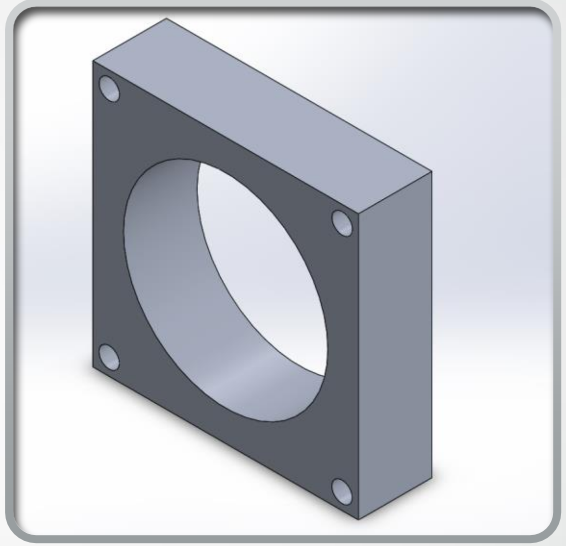


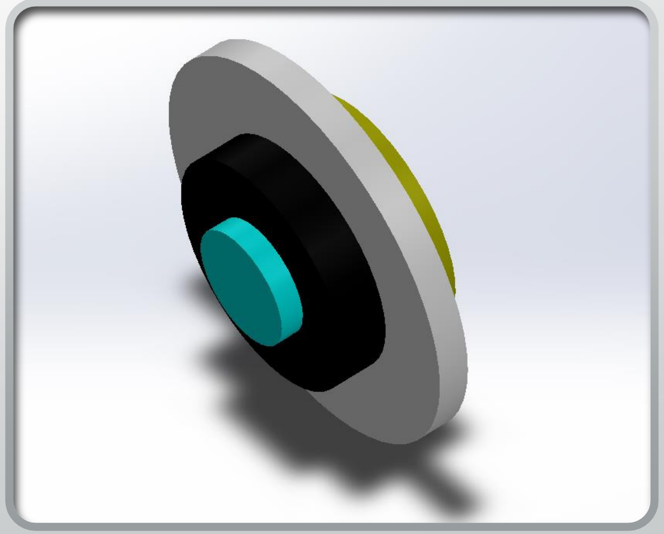


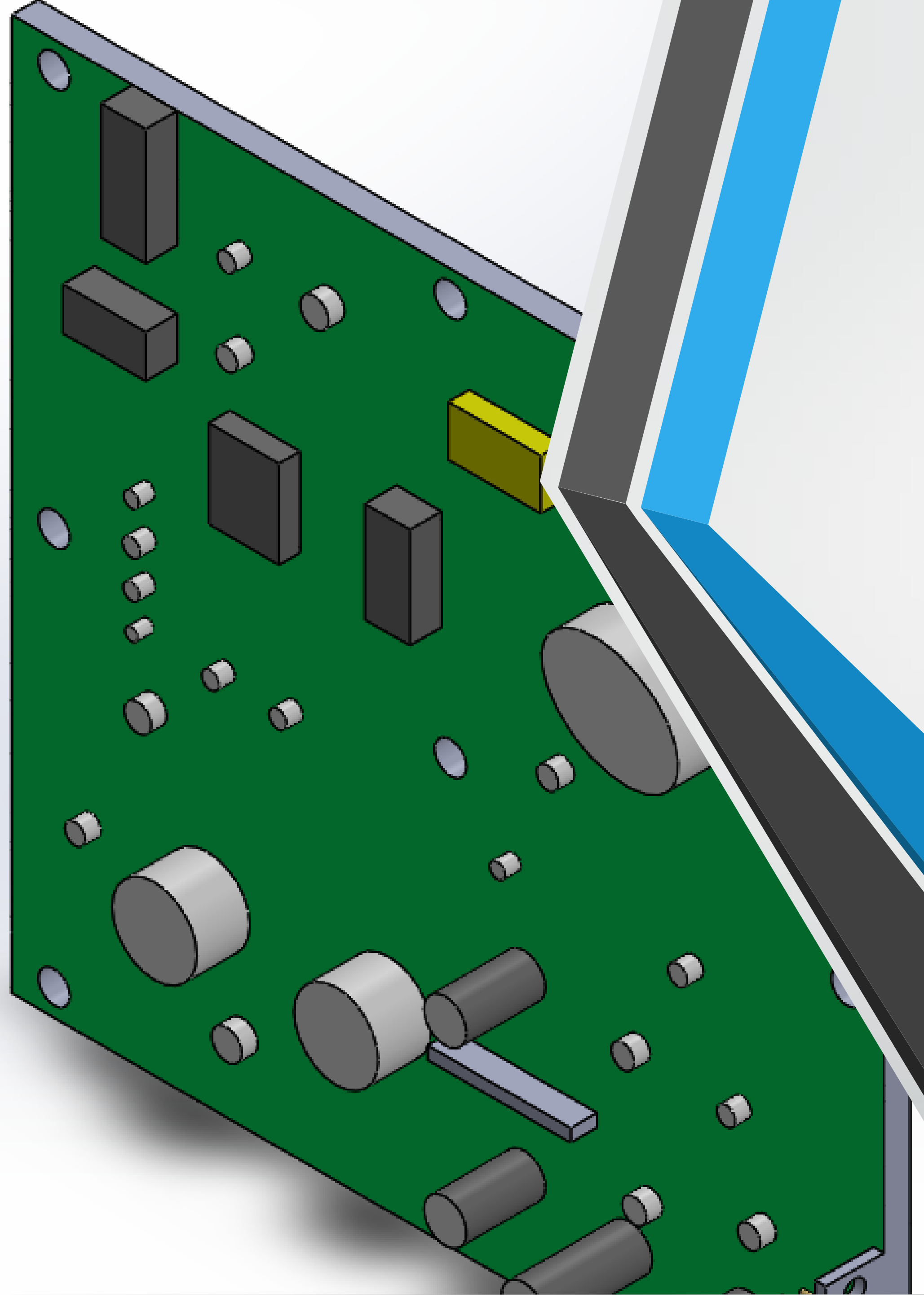


SENSOR 4

- Weight:180 gm
- Max diameter:50 mm
- Max height: 19 mm
- Blue part should be visible outside

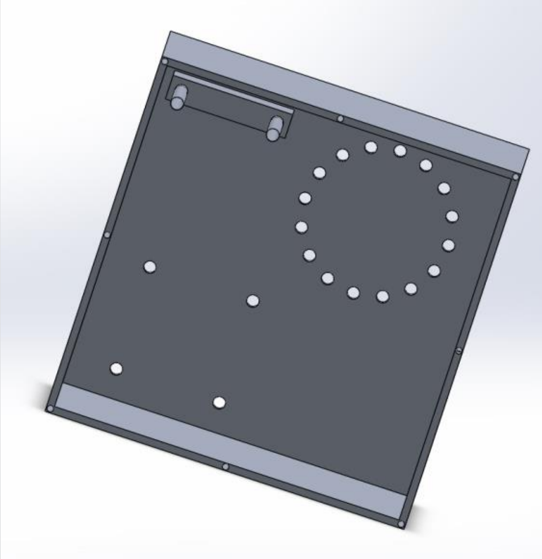


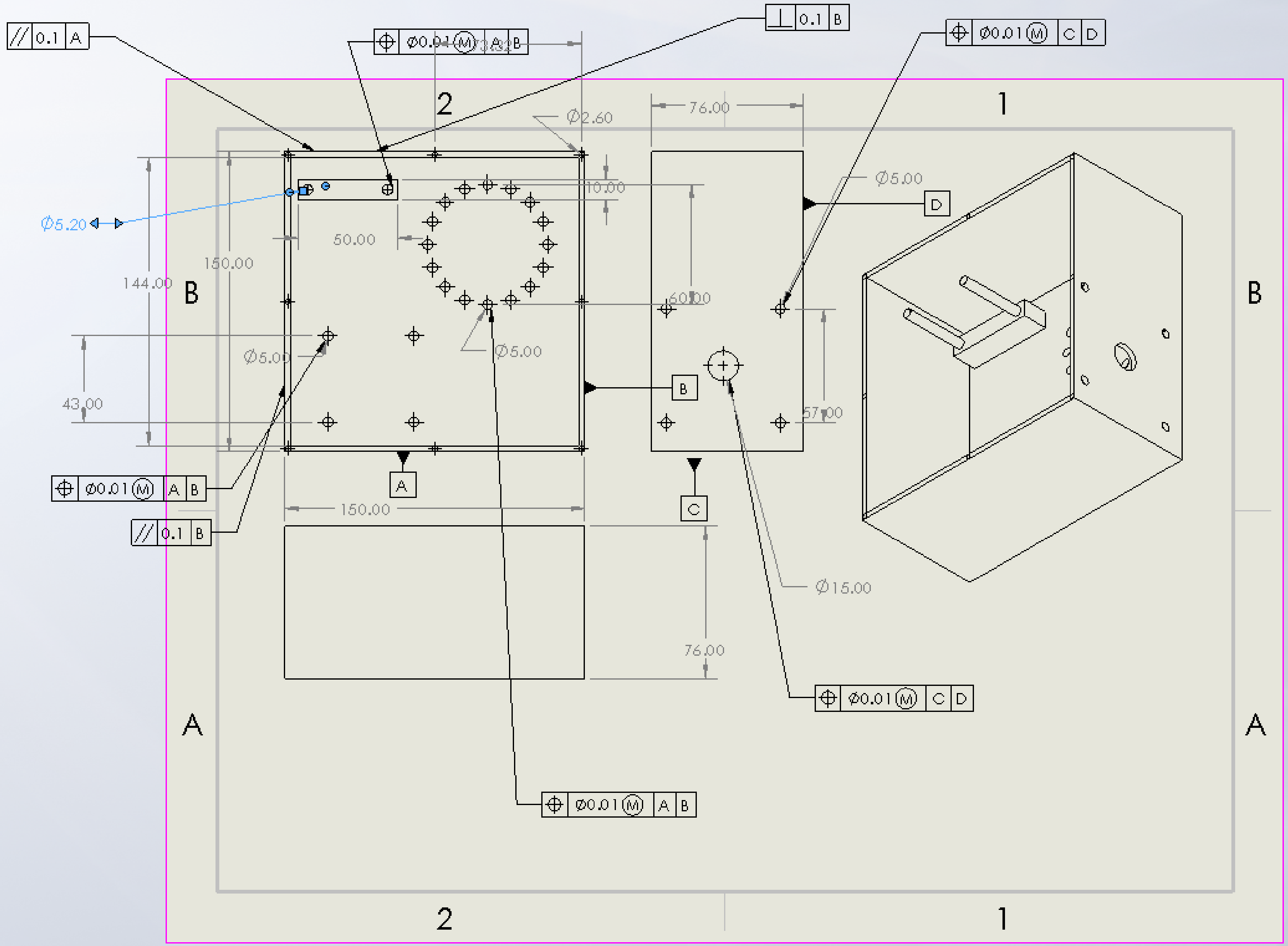




ELECTRONIC BOARD

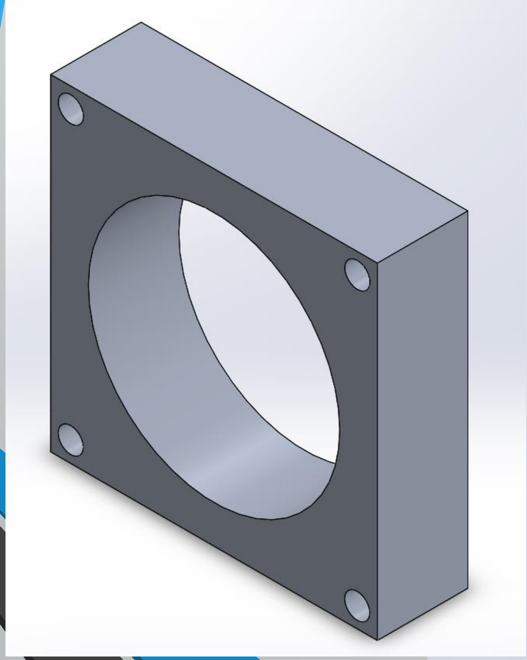
TOP HOUSING

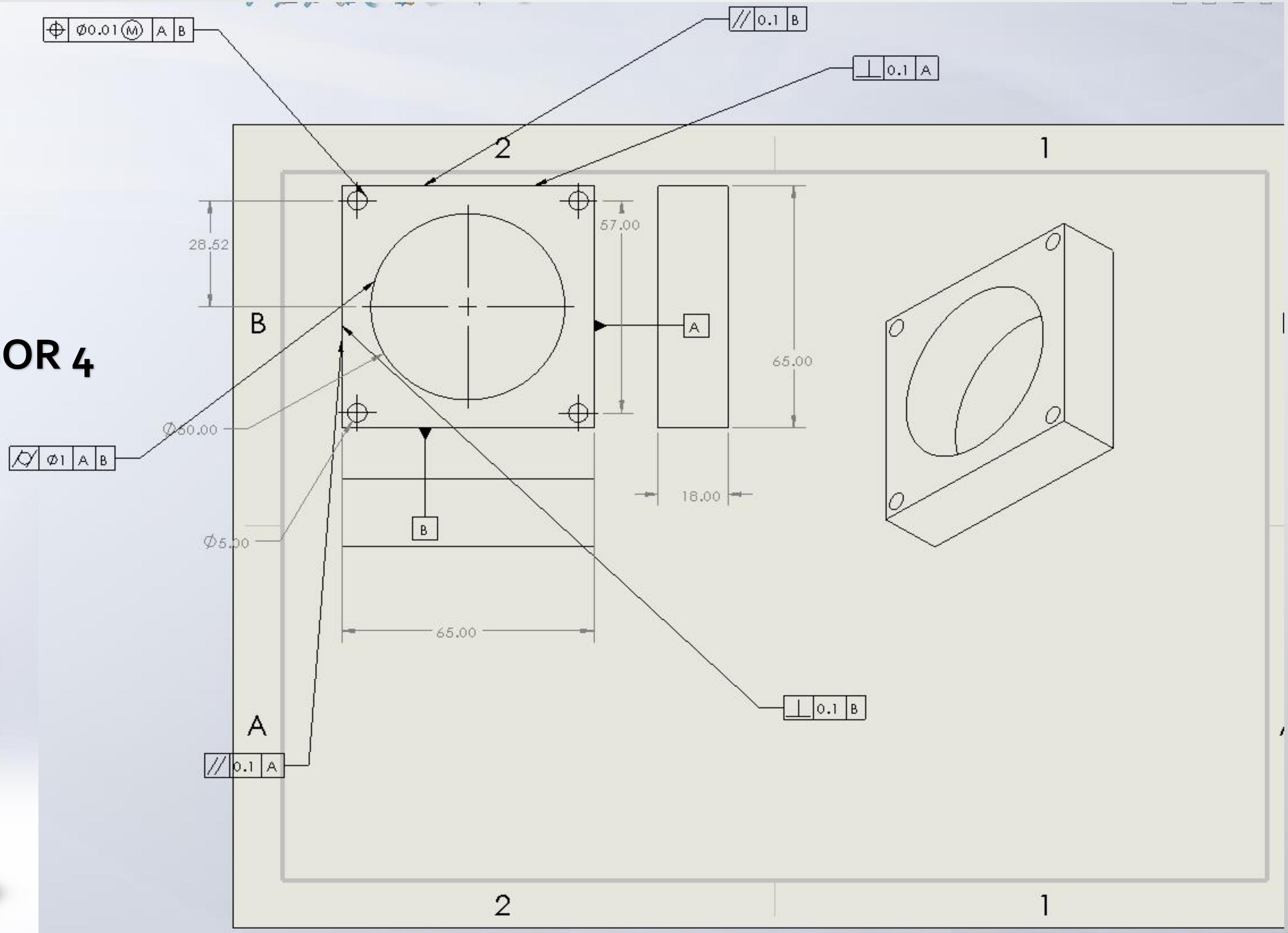


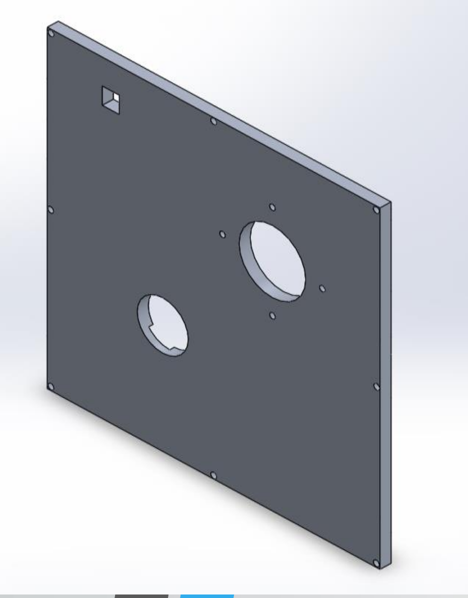


0.1 A
Ø0.01 M A B
0.1 B
Ø0.01 M C D
Ø2.60
76.00
10.00
Ø5.00
D
Ø5.20
50.00
150.00
144.00
60.00
Ø5.00
43.00
57.00
B
A
Ø0.01 M A B
0.1 B
150.00
C
Ø15.00
76.00
Ø0.01 M C D
Ø0.01 M A B

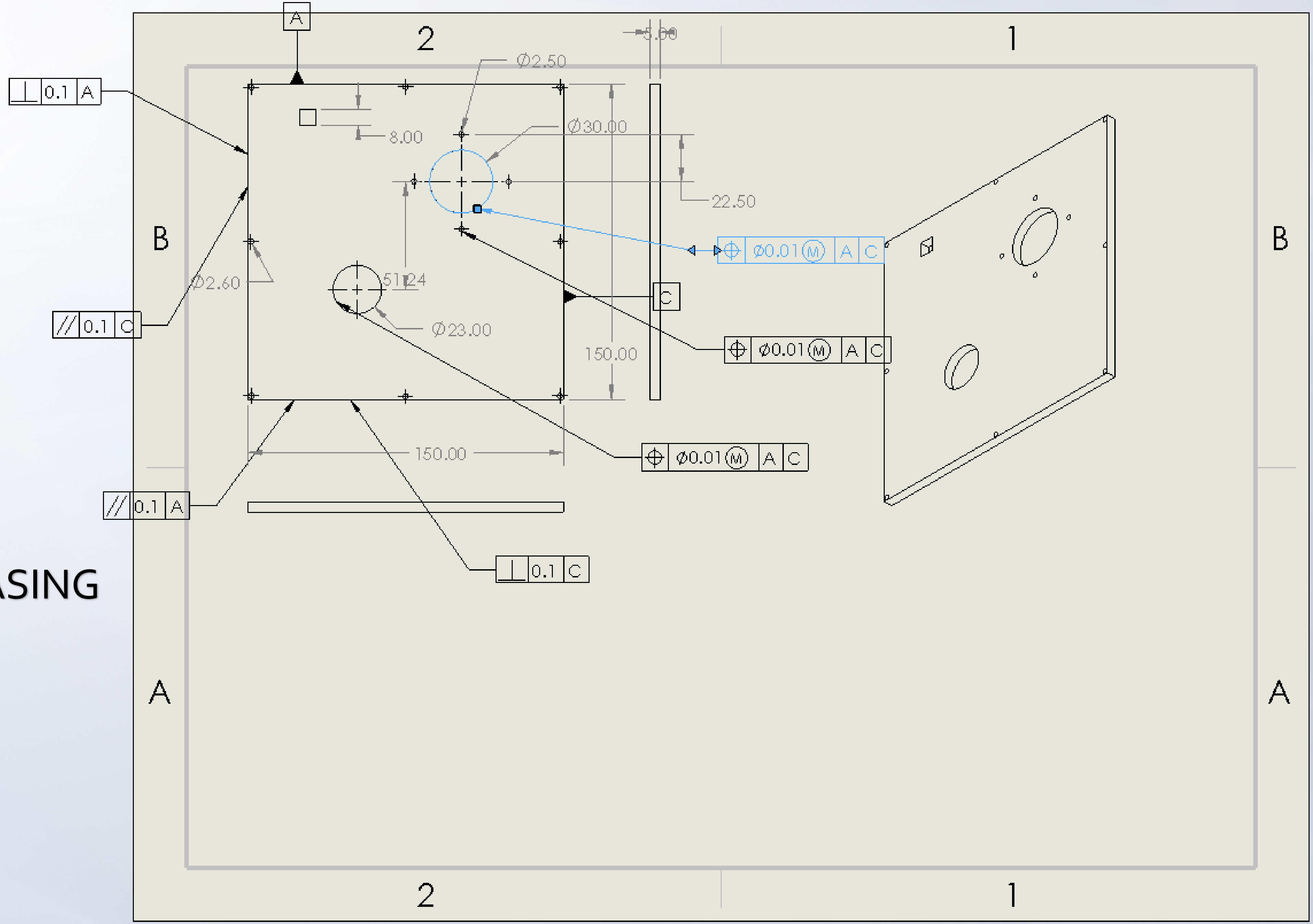
POCKET FOR SENSOR 4

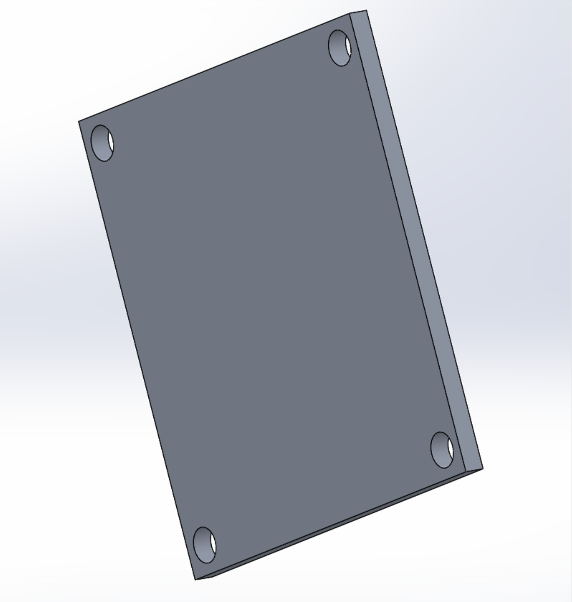


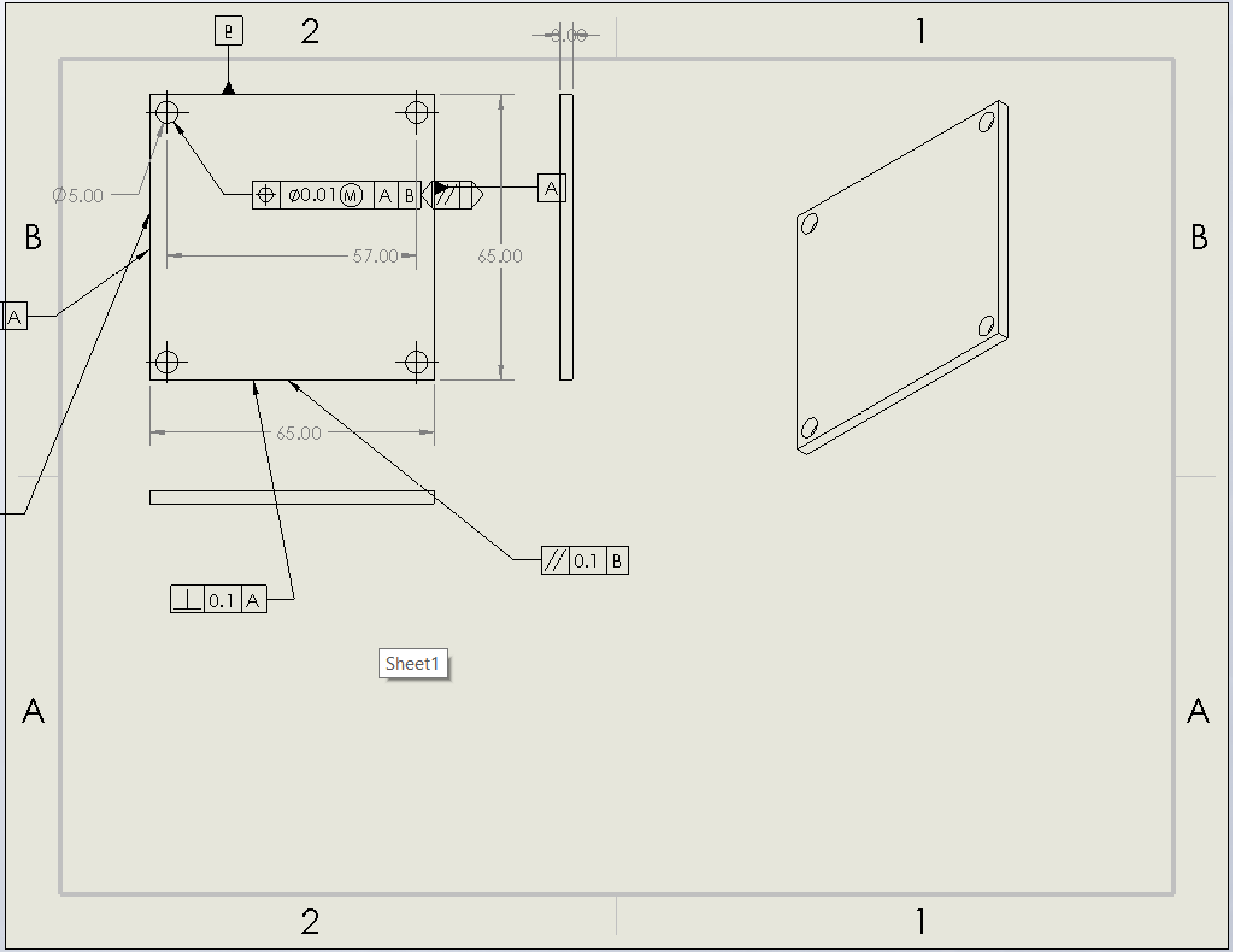




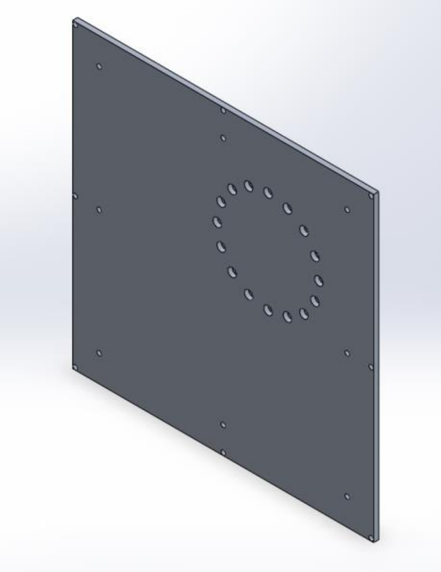
CLOSING OF TOP CASING

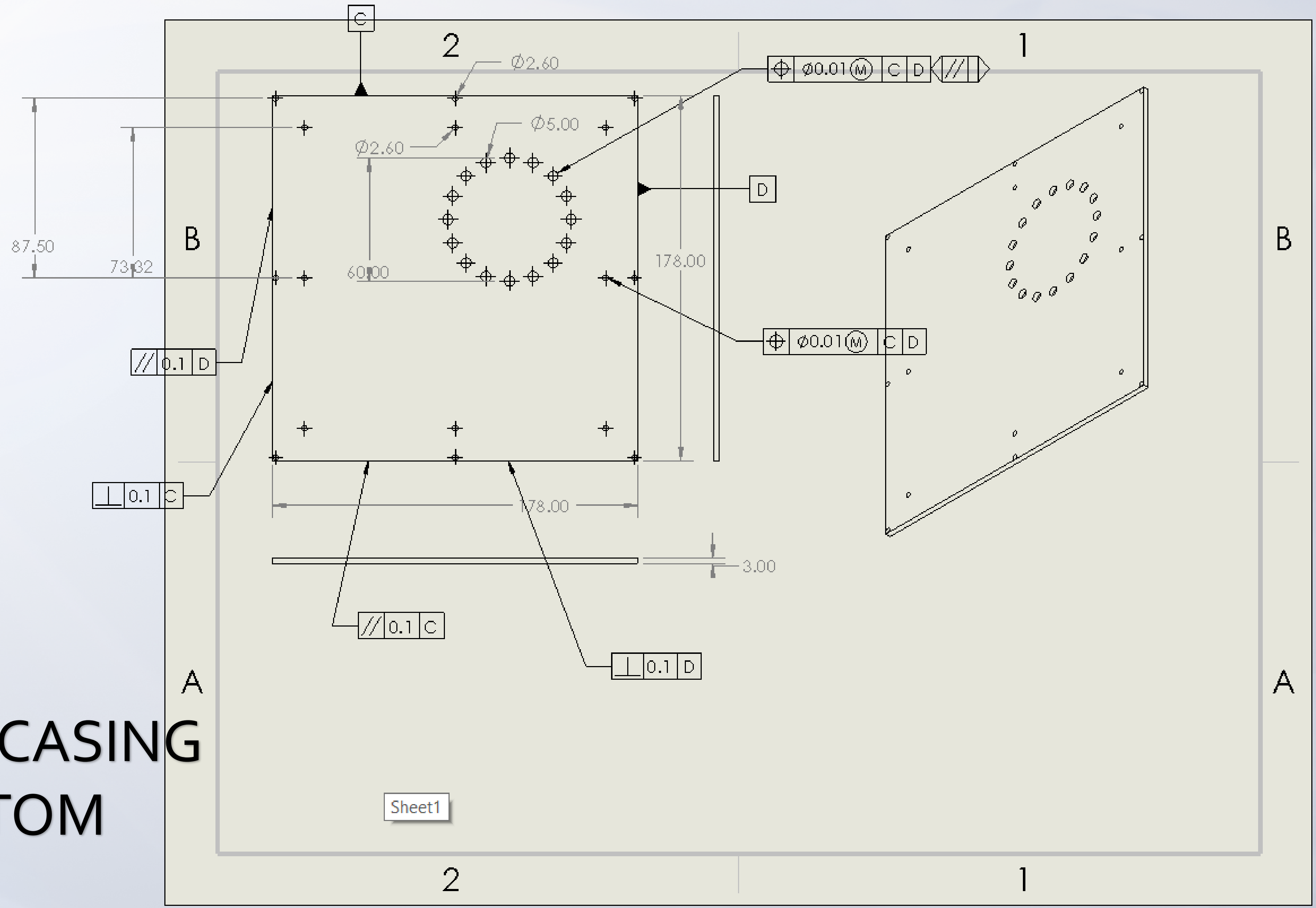




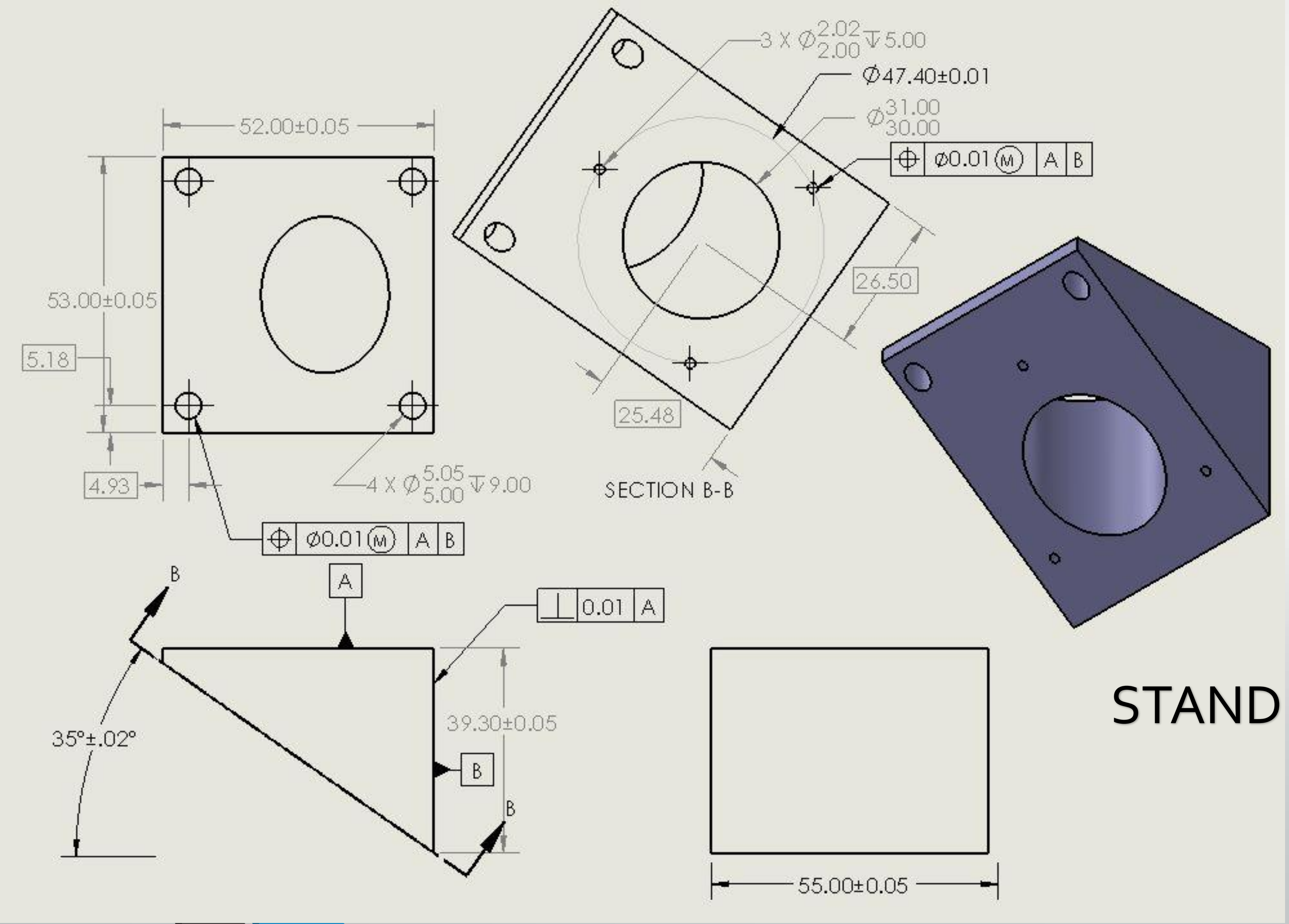


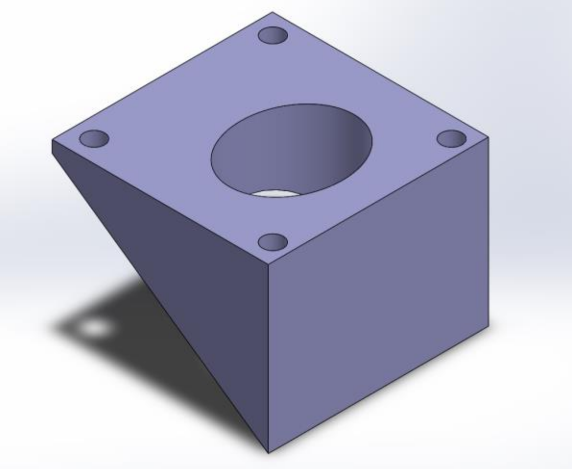
COVER FOR SENSOR 4





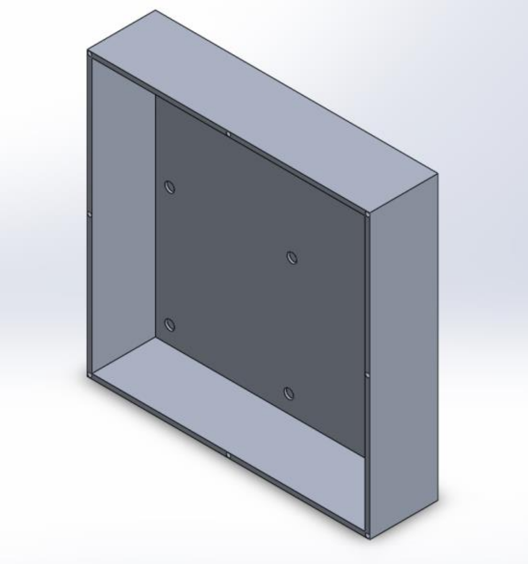
COVER OF TOP CASING FROM BOTTOM

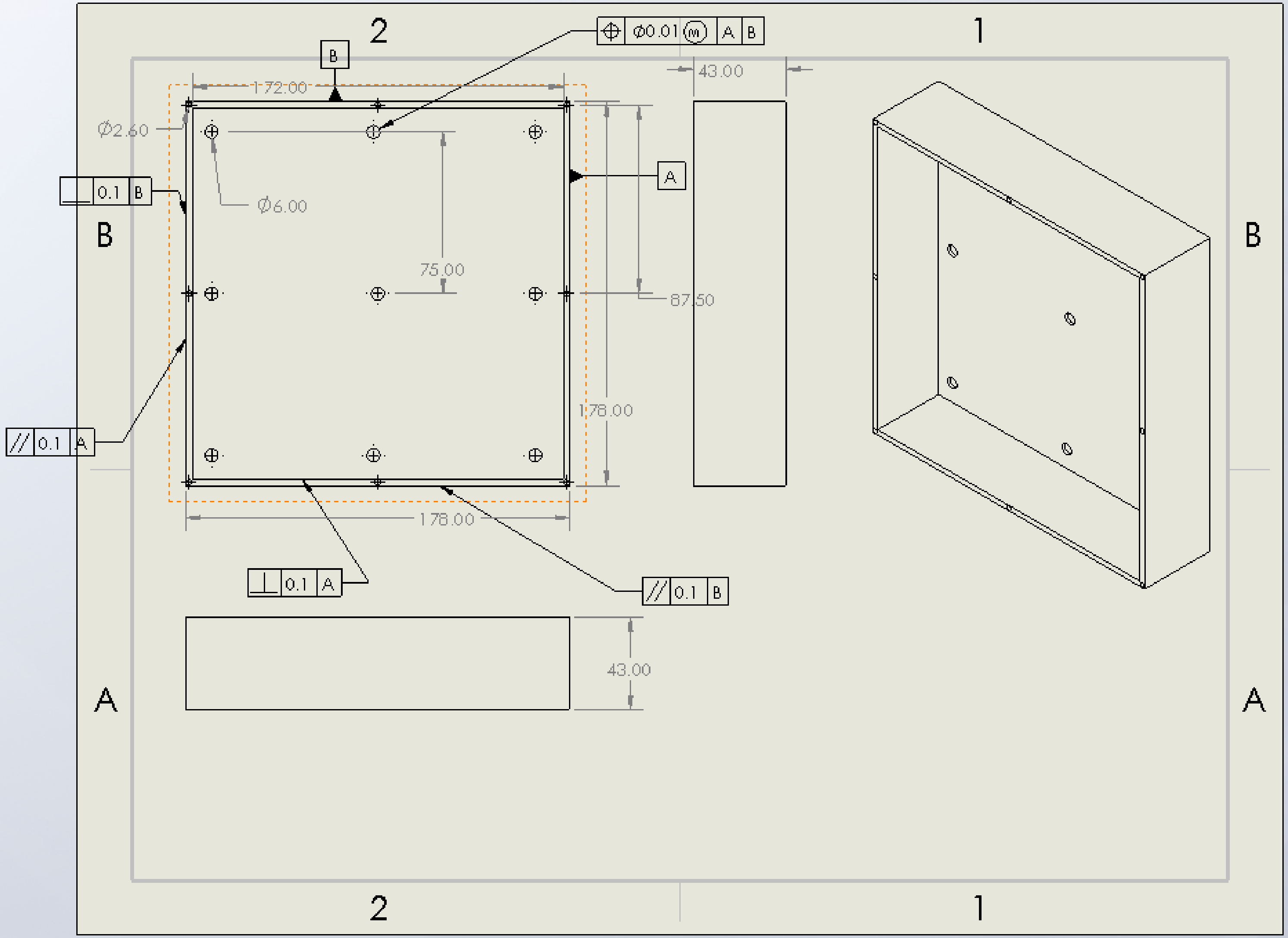




STAND FOR SENSOR 3

BOTTOM CASING





RAW MATERIAL

- Aluminium 6061
- Aluminum has many advantages, being lightweight, easy to machine, non-magnetic, corrosion resistant and inexpensive. Aluminum is even becoming a preferred choice to steel, with advances in cleaning and machining to make aluminum a more useful material.
- Aluminum is known for its versatility; while properties such as superb resistance to corrosion and excellent thermal conductivity are very useful in many applications, it is the flexibility and adaptability of aluminum's mechanical properties that make it such a widely used metal.

Element	Amount (wt %)
Aluminium	96.85
Magnesium	0.9
Silicon	0.7
Iron	0.6
Copper	0.30
Chromium	0.25
Zinc	0.20
Titanium	0.10
Manganese	0.05
Others	0.05

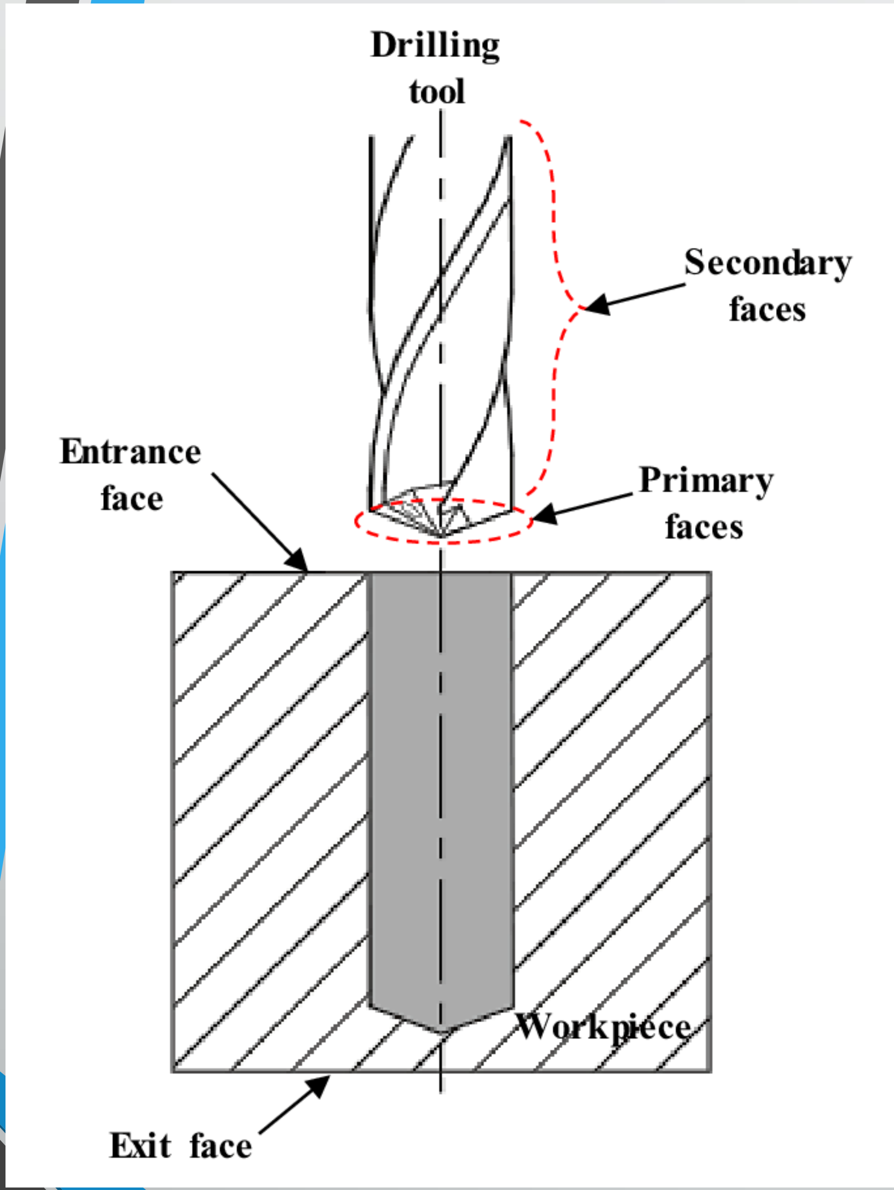
Property	Value	Units
Elastic Modulus	69000	N/mm^2
Poisson's Ratio	0.33	N/A
Shear Modulus	26000	N/mm^2
Mass Density	2700	kg/m^3
Tensile Strength	124.084	N/mm^2
Compressive Strength		N/mm^2
Yield Strength	55.1485	N/mm^2
Thermal Expansion Coefficient	2.4e-05	/K
Thermal Conductivity	170	W/(m·K)
Specific Heat	1300	J/(kg·K)

SEQUENCE OF MACHINING OPERATION

- First we take a block of 300*300*150 mm. For making top casing we cut the block in a sheet of 150*150*3 and 4 sheet of 150*76*3 for wall by cutting process and face milling for better dimension tolerances.

- For making cuboid to holding sensor 1 we do the same cutting process to produce block of 50*10*10 and then again face milling for better finish and the 2 cuboidal box of cross section 7*7 and height of approx. around 20 mm is also made by cutting process.
- Then these 2 cuboidal box is converted to cylinder by using lathe by turning operation and then hole is made by drilling in these two cylindrical rod of 5mm.

- Two holes are made in cuboid using drilling operation and internal threading is done inside these holes by using taping. After that external thread will made on two cylinder using lathe and then they are joined.
- Others hole in top casing are made by drilling process.
- For making pocket of sensor 4 again by the process of cutting and face milling a cuboid of 65*65*18 mm dimension is produced. After that drilling is done to make holes.
- For middle hole first drilling the boring and reaming process is performed for enlarging and finishing hole.

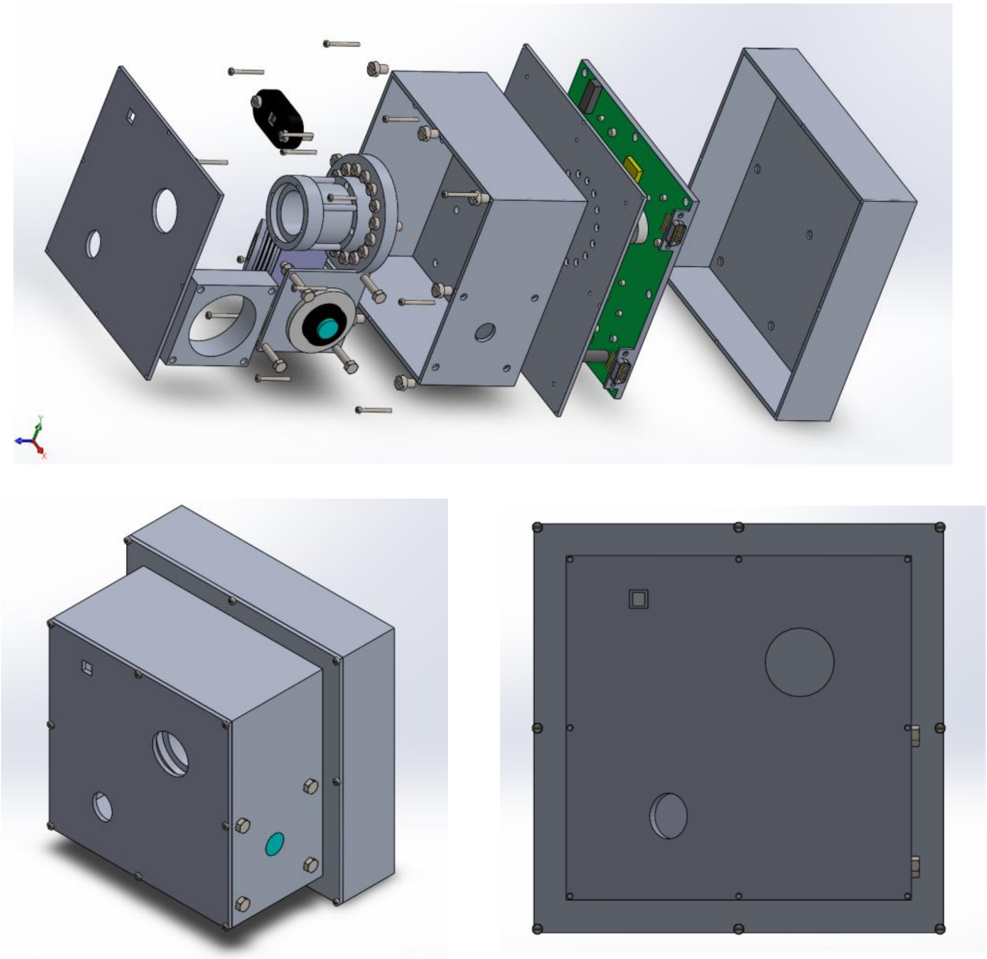


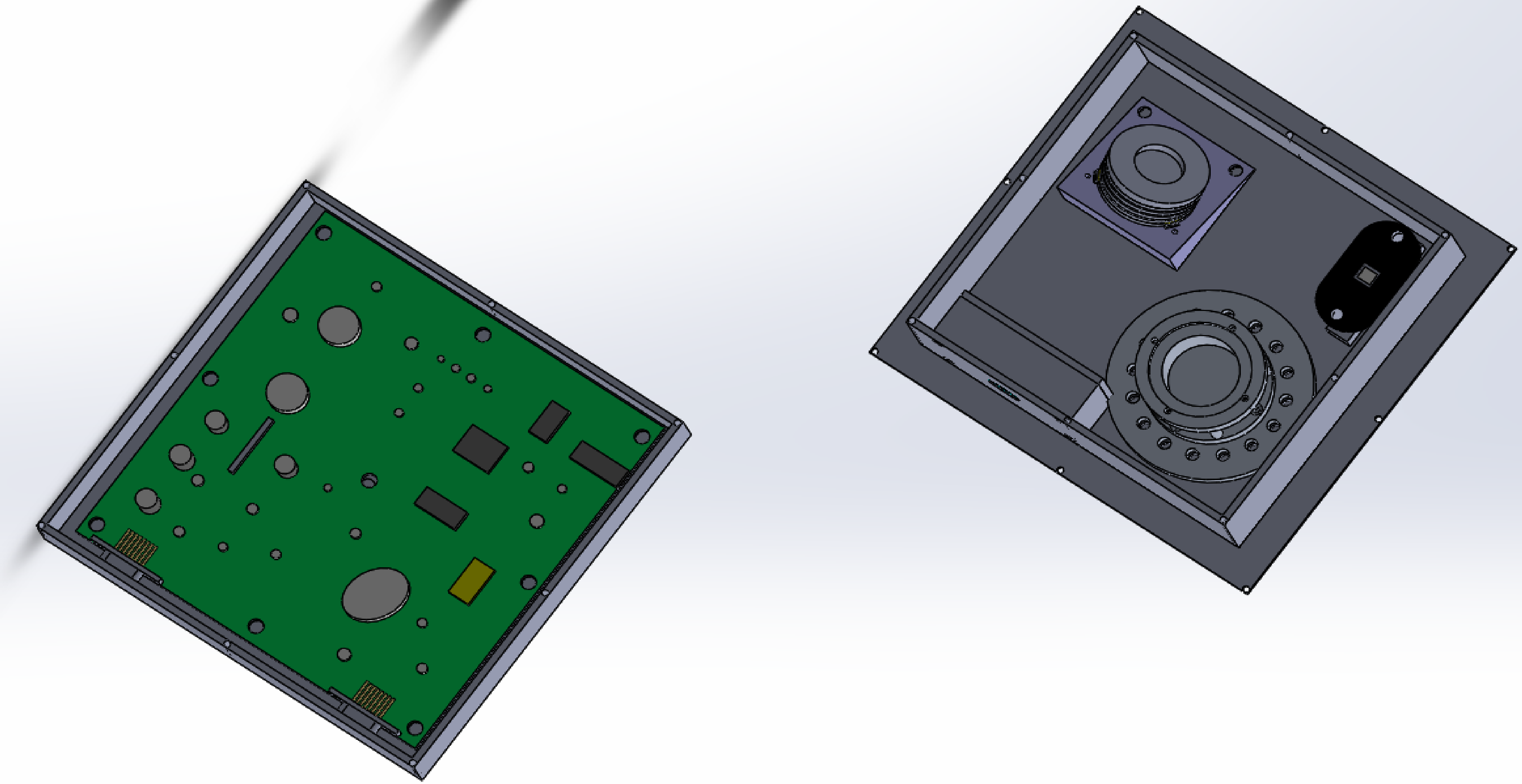
- Then for making of closing of top casing again a sheet of 150*150*3 is formed using cutting and face milling operation .
- After that for circular hole drilling is performed and for square hole end milling operation is performed.
- Again for cover of sensor 4 and for the cover of top casing from bottom same process is performed . For the sheet formation cutting and face forming and for holes drilling is performed.
- For bottom casing same process are performed cutting, face milling and drilling. For making deep hole gun drilling can be also used
- D pin hole can be made by peripheral milling.

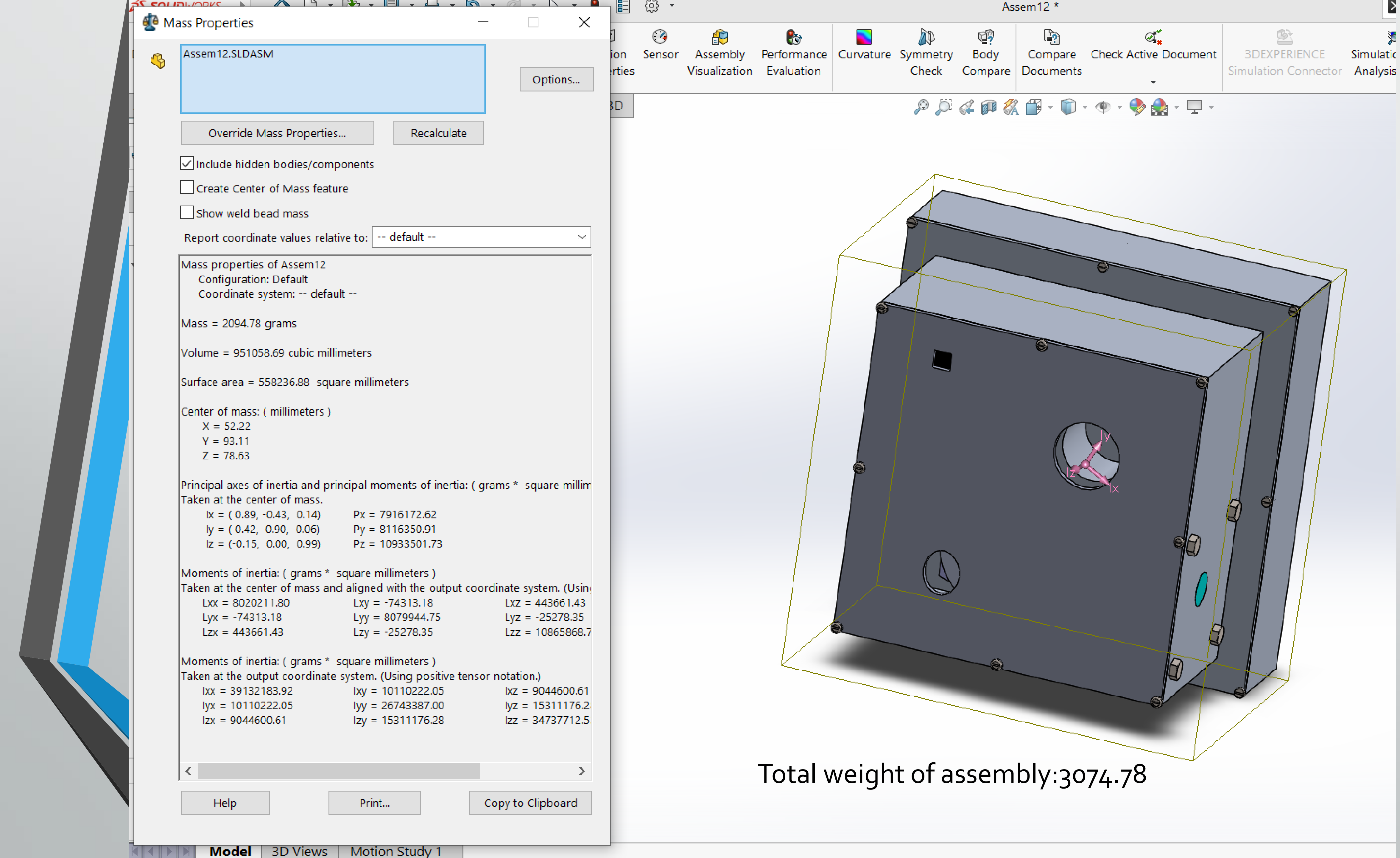
For making stand for sensor 3:

1. Form Milling : Used to make the 35° inclined face from the top. This can either be done by making a jig of required shape such that the inclined face becomes horizontal. Then raw material is fixed to the jig and material can be removed by peripheral milling.
2. Drilling : All the holes are drilled using drilling machine with drill bit of available size and then by boring process to enlarge it of required dimensions.

ASSEMBLY:







Total weight of assembly:3074.78

SURFACE FINISHING

- Grinding : The extra 1 mm left on all the surfaces of upper part removed by grinding in both upper and lower housings. XX C 600 M 4 V YY Grinding wheel can be used
- Internal grinding is used for making the inner surfaces of sensor pockets polished (To ensure the easy passing of sensors)

Metrological Measurements

1. Straightness : Straightness is measured by observing the colour of light by diffraction while passing through the small gap in auto-collimator.
2. Flatness : One of the very basic geometric requirement for any design is to evaluate the flatness tolerance of the design, we can use a dial-gauge to measure it. It consist of a dial with markings and a highly sensitive tip to accurately measure tolerances. We can use a spirit level for measurement of straightness and flatness. The only difference between them is dial-gauge gives absolute reading and spirit level gives relative readings
3. Parallelism : The parallelness of two lines/surfaces can again be done using a dial-gauge. But we prefer height gauge to measure it as it is easy to use.
4. Perpendicularity : Perpendicularity is measured using a height gauge, similar to flatness, however, the gauge (or part) is locked to a 90° datum to measure how perpendicular the surface is.

5. Dimensional/Positional/symmetric tolerances : We can use a profile projector to project the various features and can determine their position and dimension. Further, we can determine whether the geometric and dimensional tolerances are satisfied or not. The other instruments like vernier-caliper, vernier height gauge, internal micrometers, Telescopic gauge, sine gauge etc. can be used to determine the dimensions in the product.

6. Circularity Measurement: Circularity of the sensor pocket can be measured by Dial gauge.

7. Internal Circularity Measurement : Internal circularity of the sensor pocket can be measured by Coordinate measuring machine.

Also for any other measurement we can use Coordinate Measuring Machine (CMM) except roughness.