

# HEAT EXCHANGER

Hassan Alshaiki

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### Introduction:

In a heat exchanger, heat energy is transferred from one body or fluid stream to another. In the design of heat exchange equipment, heat transfer equations are applied to calculate this transfer of energy so as to carry it out efficiently and under controlled conditions. The equipment goes under many names, such as boilers, pasteurizers, jacketed pans, freezers, air heaters, cookers, ovens and so on. The range is too great to list completely. Heat exchangers are found widely scattered throughout the food process industry.

The main components of the mechanical structure are: the tubes, Flange housing side plate, inner and outer plates. Catia software provides an integrated solution, besides the facilities related to common solid modeling, to the all representative applications, offering modules for stylists, allowing expansion of computer use in earlier stages of constructive design.

The main components of the Heat Exchanger are designed in the part work bench which allows us to use bunch of features like Pad, Pocket, circular pattern, rectangular pattern, and chamfer to build the Heat Exchanger. These features helps us to design parts as desired. And our

main focus is on assembling the parts, so assembly work bench is also used in this design.

### **Designing the Heat Exchanger:**

Any 3D model construction usually begins by creating an outline plan, which by a shift (translation or rotation) becomes a basic form.



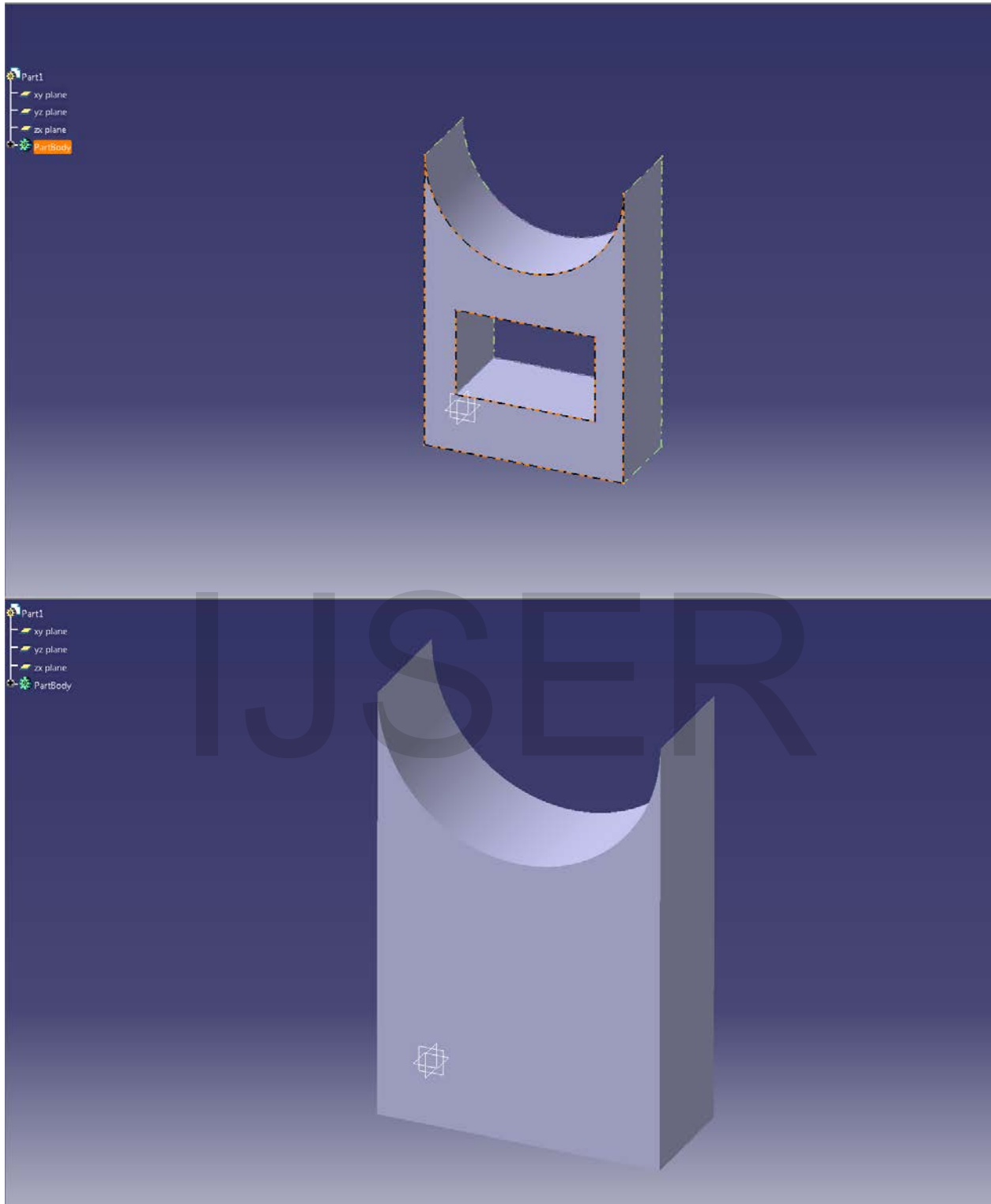
## **Components of the Heat Exchanger:**

Main Parts of the Heat Exchanger are:

1. Base
2. Nut
3. Bolt
4. Flange
5. Base Stand
6. Tubes
7. Housing
8. Inner plate
9. Outer plate
10. Side plate

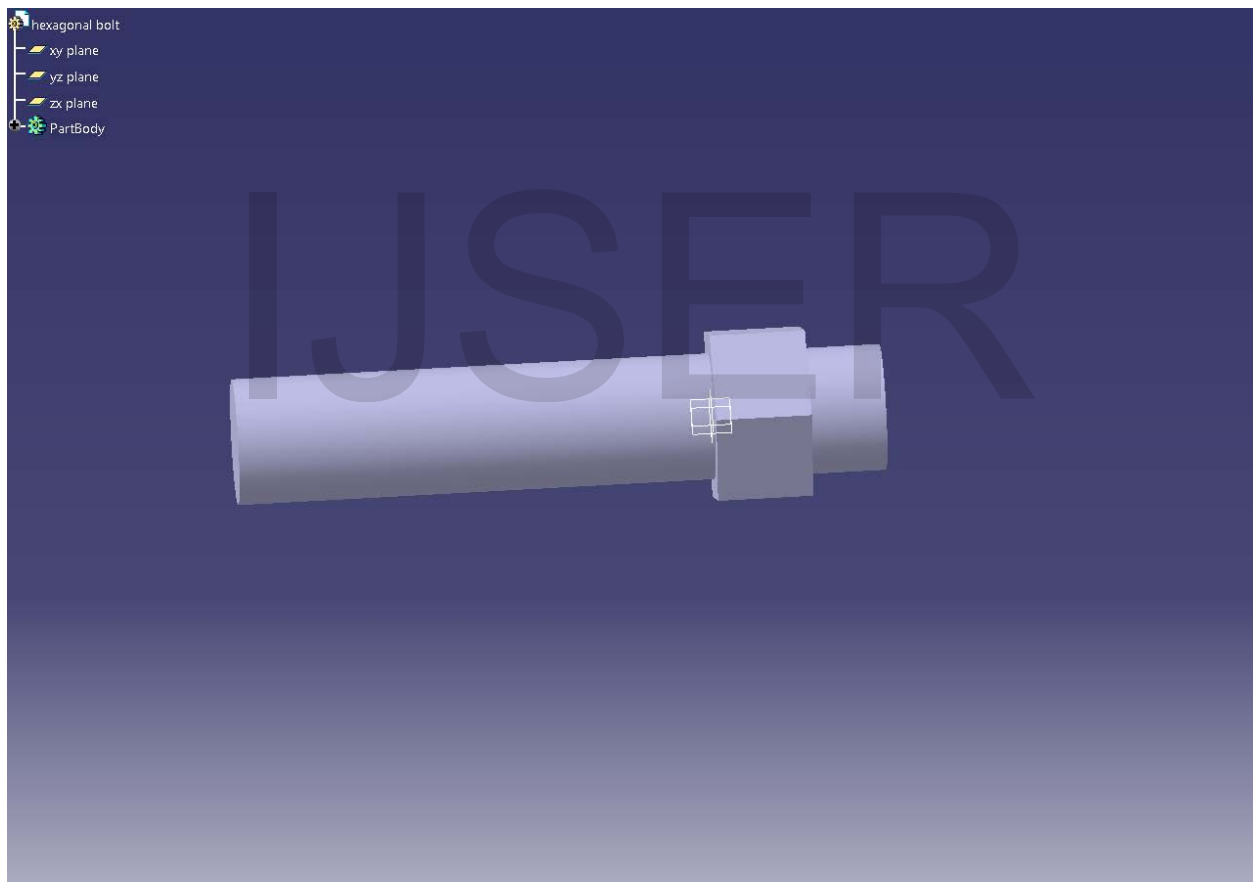
**Base stand:**

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Base stands are created in part work bench. In this work bench first drew the primary Sketch and extruded the sketch so that I get the necessary shape. After finishing the Pad feature I took the top face of the pad and design a sketch (rectangle) on that with dimensions and made a pocket on that. Similarly did one more base stand with the same features except pocketing.

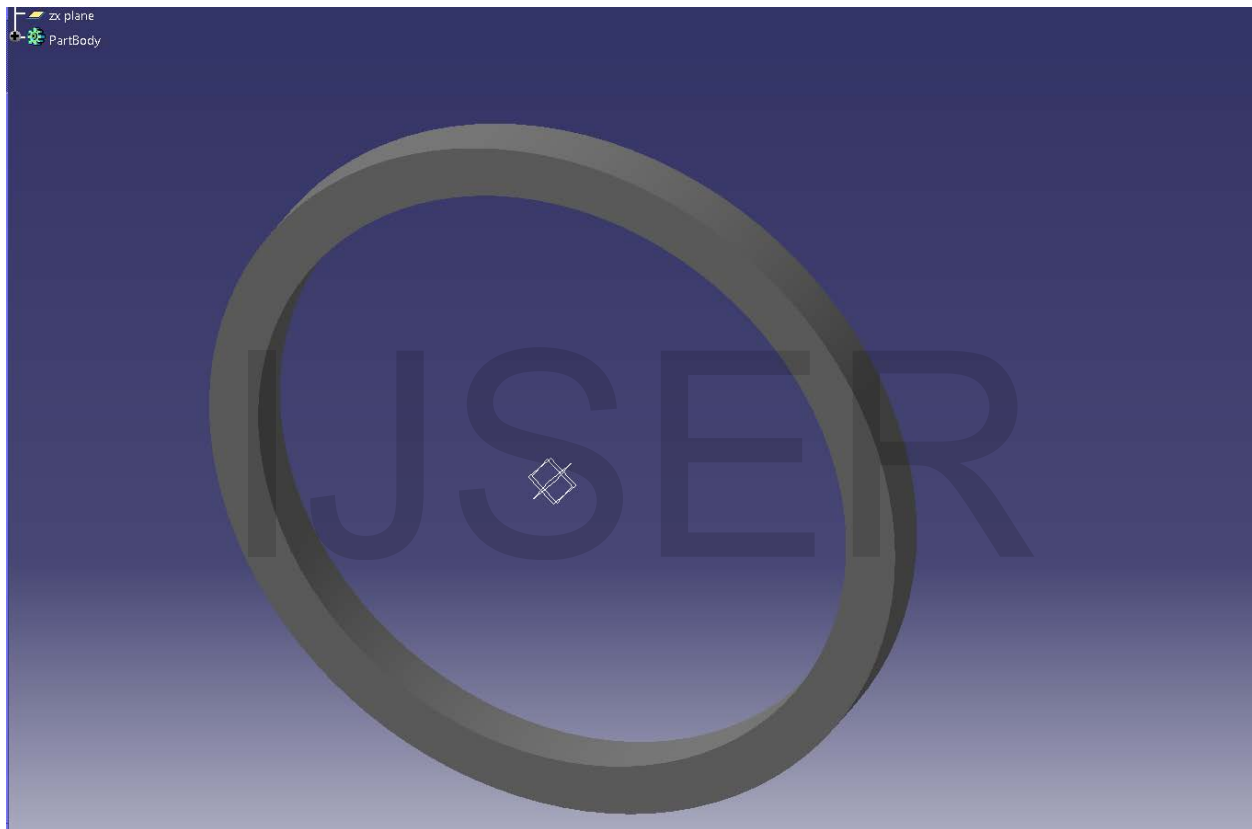
## **BOLT:**



This part is used to fix two body parts, so considering this function I designed like many bolts for this design. Generally, I designed the bolt

in the part workbench. First of all I designed a sketch (hexagonal shape) and extruded it. Also, I sketched one more shape (circular) on the pad and again extruded it. This is how we did this part.

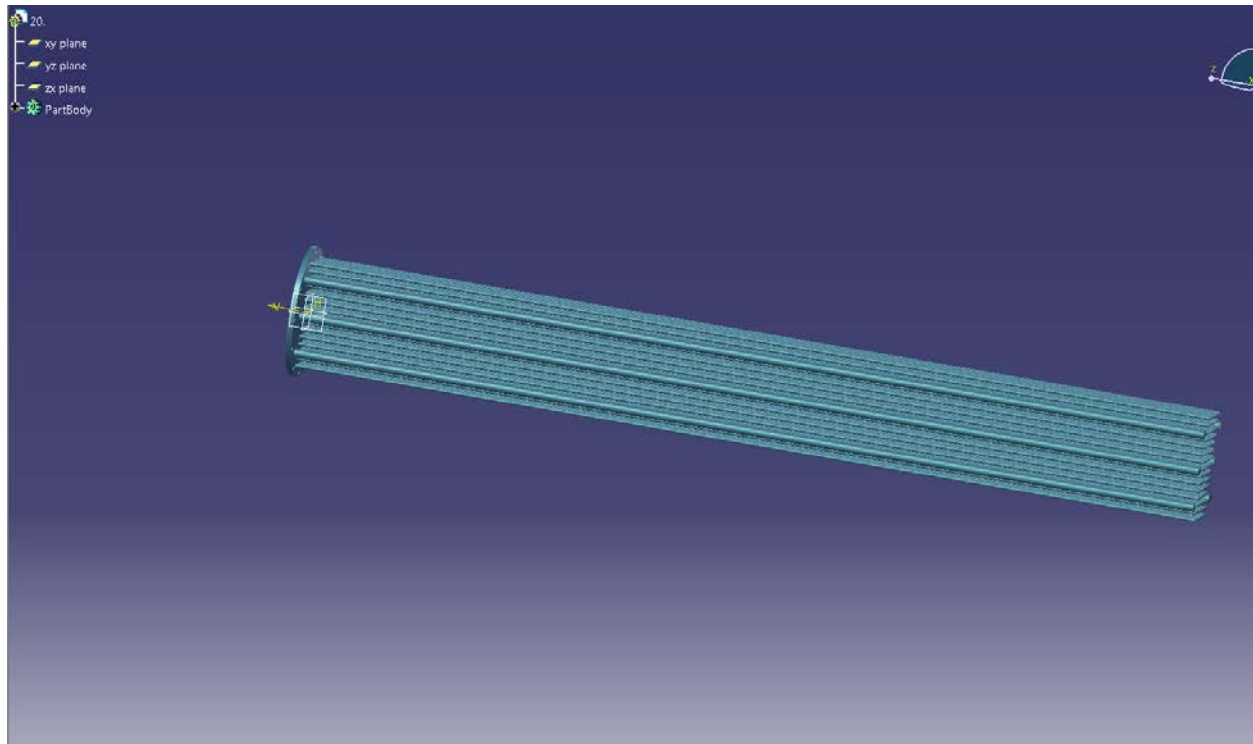
## **FLANGE**



Flange is like a washer, which is a supporting material in the assembly. It is designed in the part work bench. The initial sketch is designed, and after that it is extruded. This is how I drew flange

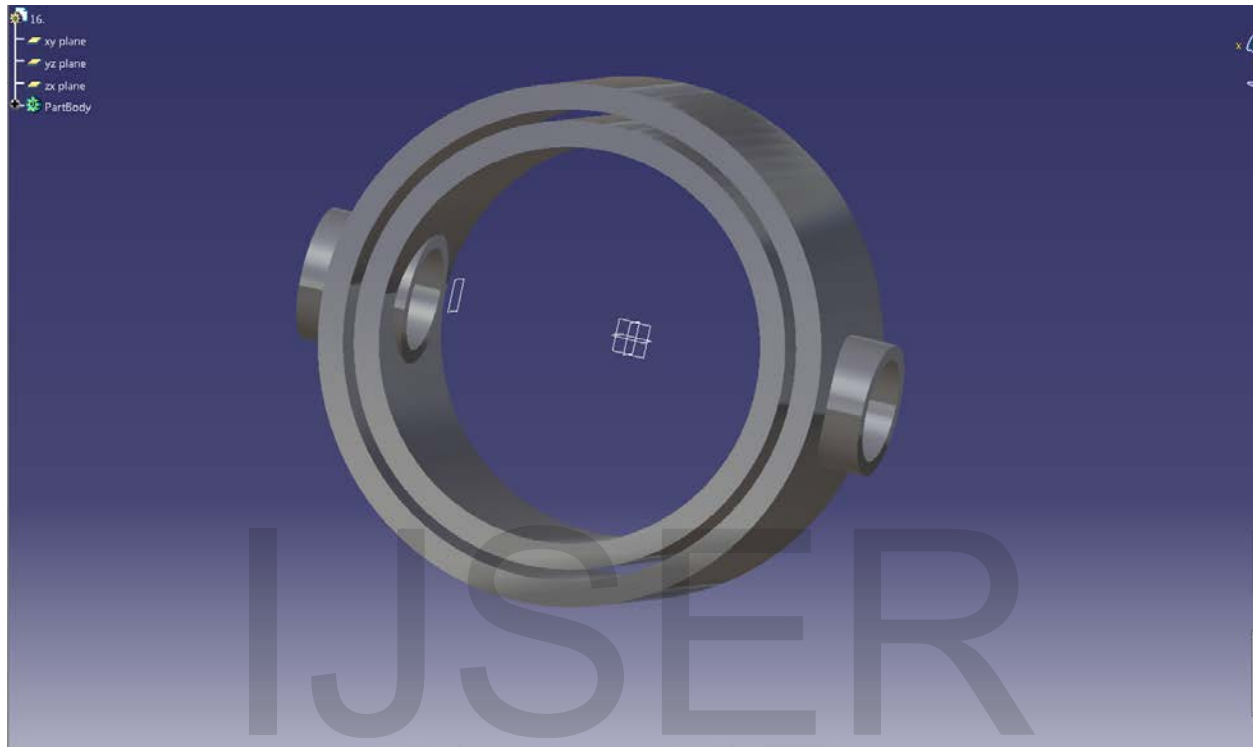
## **TUBES:**





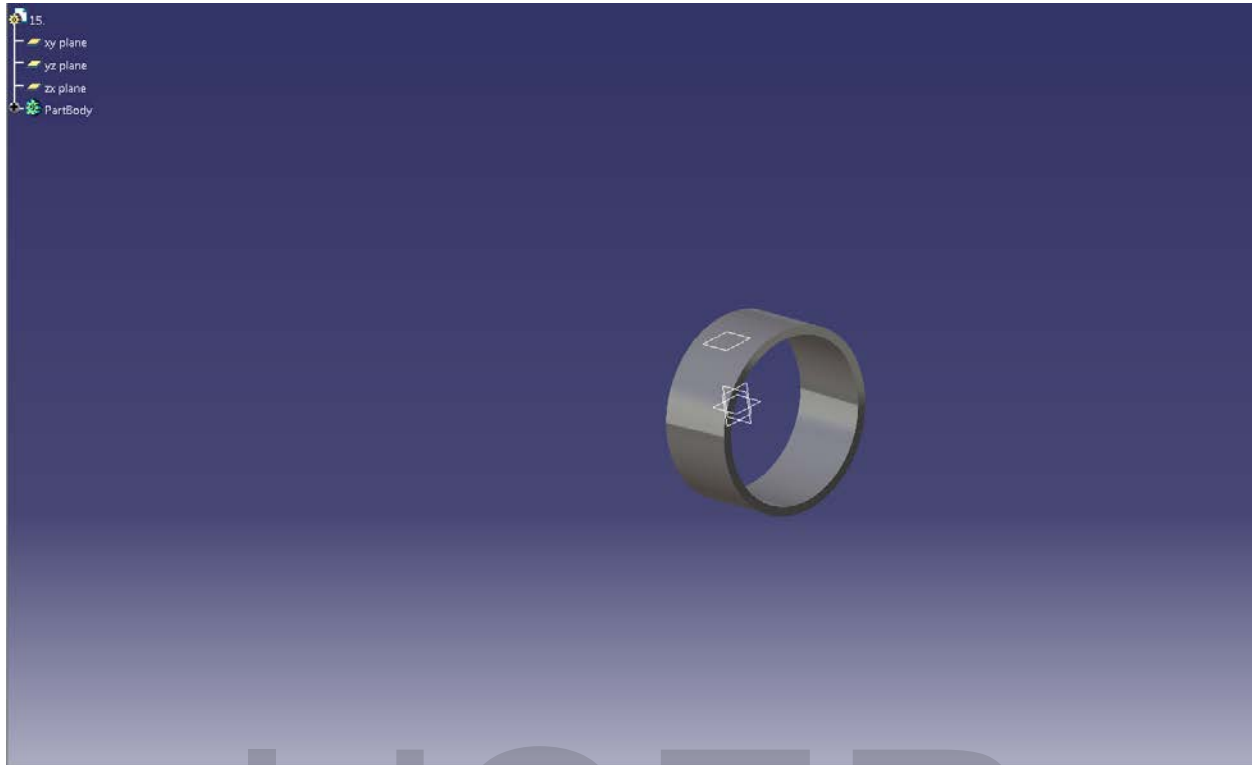
Tube are the vital part in heat exchanger assembly, these tubes generally allow the flow of water or any substances from one point to another. This tubes are drawn in part work bench .First we designed a sketch of circular shape and extruded it, after that by using circular patterns we designed 10 patterns ( according to the blue print) on the circular face. Finally after finishing this circular pattern we took the patterns and extruded them.

## Housing



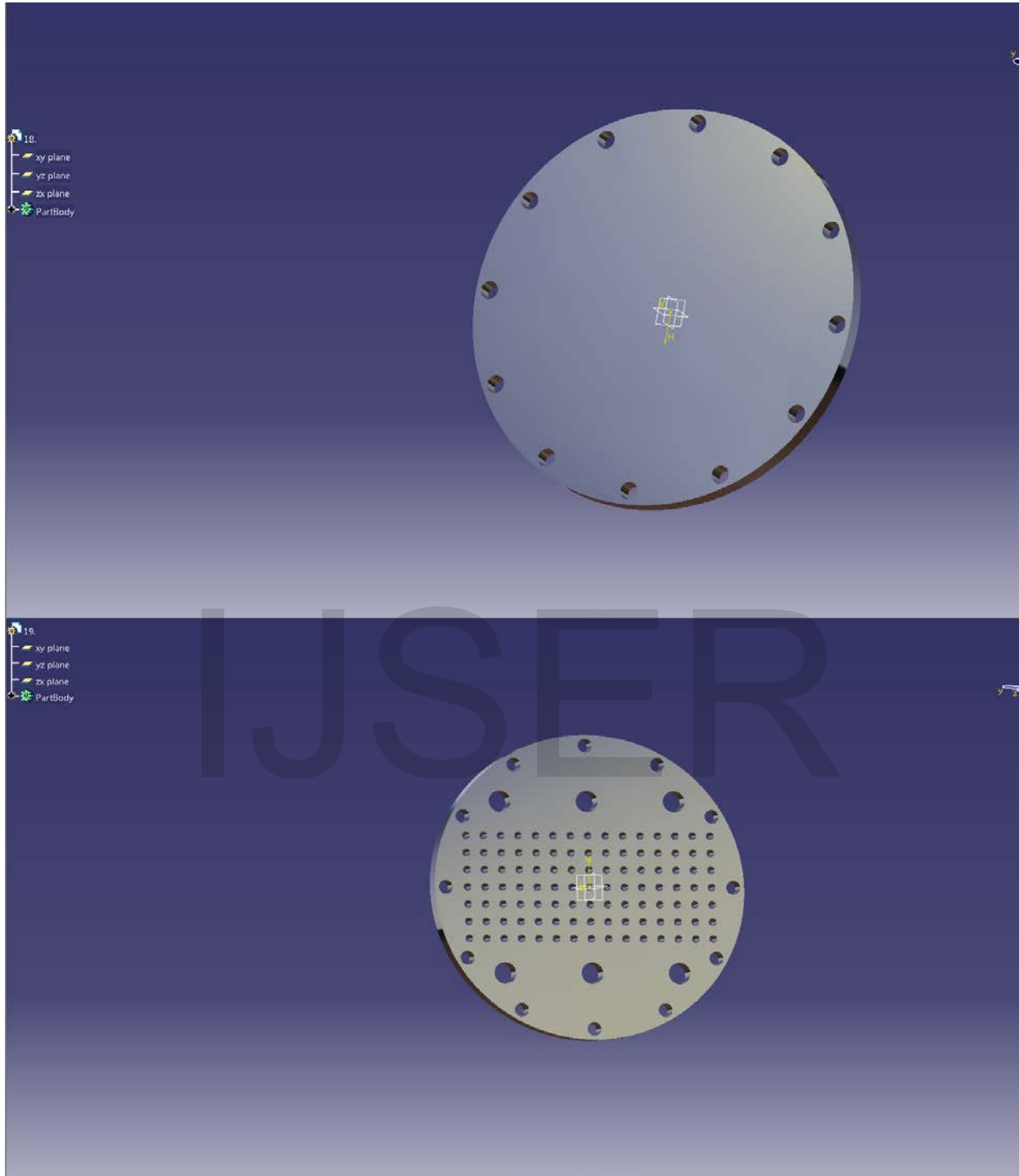
Housing is the connector or joint between the base stand and tubes. They are two of them on the either sides. It is designed in the part work bench. First we took a plane and drew a sketch (circular) and extruded it. And after that on the top plane we drew another sketch of circular and pocketed it. I made the pad, pocket in such a way that both the circular patterns looked like concentric circles. And finally took right plane drew another circular sketch and pocketed it, this pocket was made in such a way that it is extended to the outer pad. In the same manner did to the other side.

### **Inner Ring:**



Inner ring is created by using sketch work bench. Circle was created on the front plane, after that by using the pad feature sketch was extruded. This part is used in the heat exchanger to join the two parts.

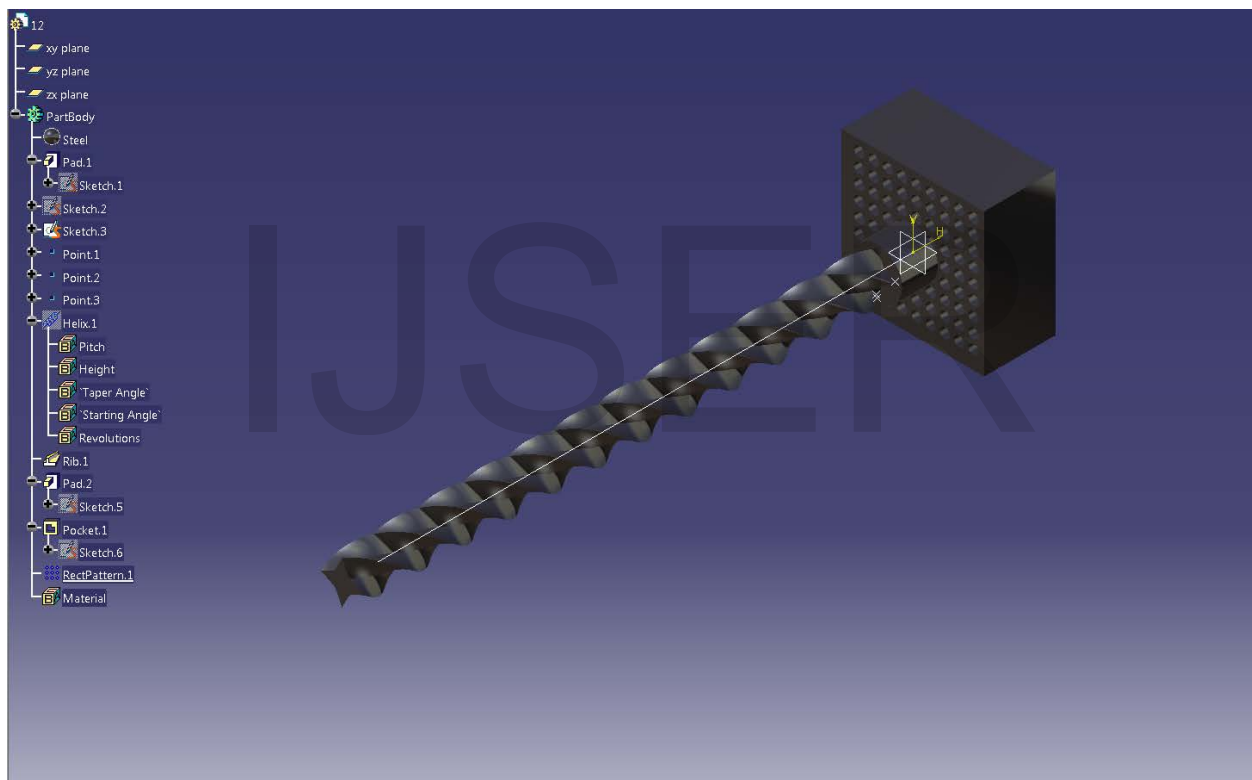
### **Inner and outer Plates:**



Inner plate and outer plates are created in work bench. First I created the circle on the plane after that it was extruded by using the Pad Feature

The holes on the outer plate face were created by using the pocket feature and expanded them by using the circular pattern. The holes at the center of the plate were created by using the rectangular pattern.

## Helix:

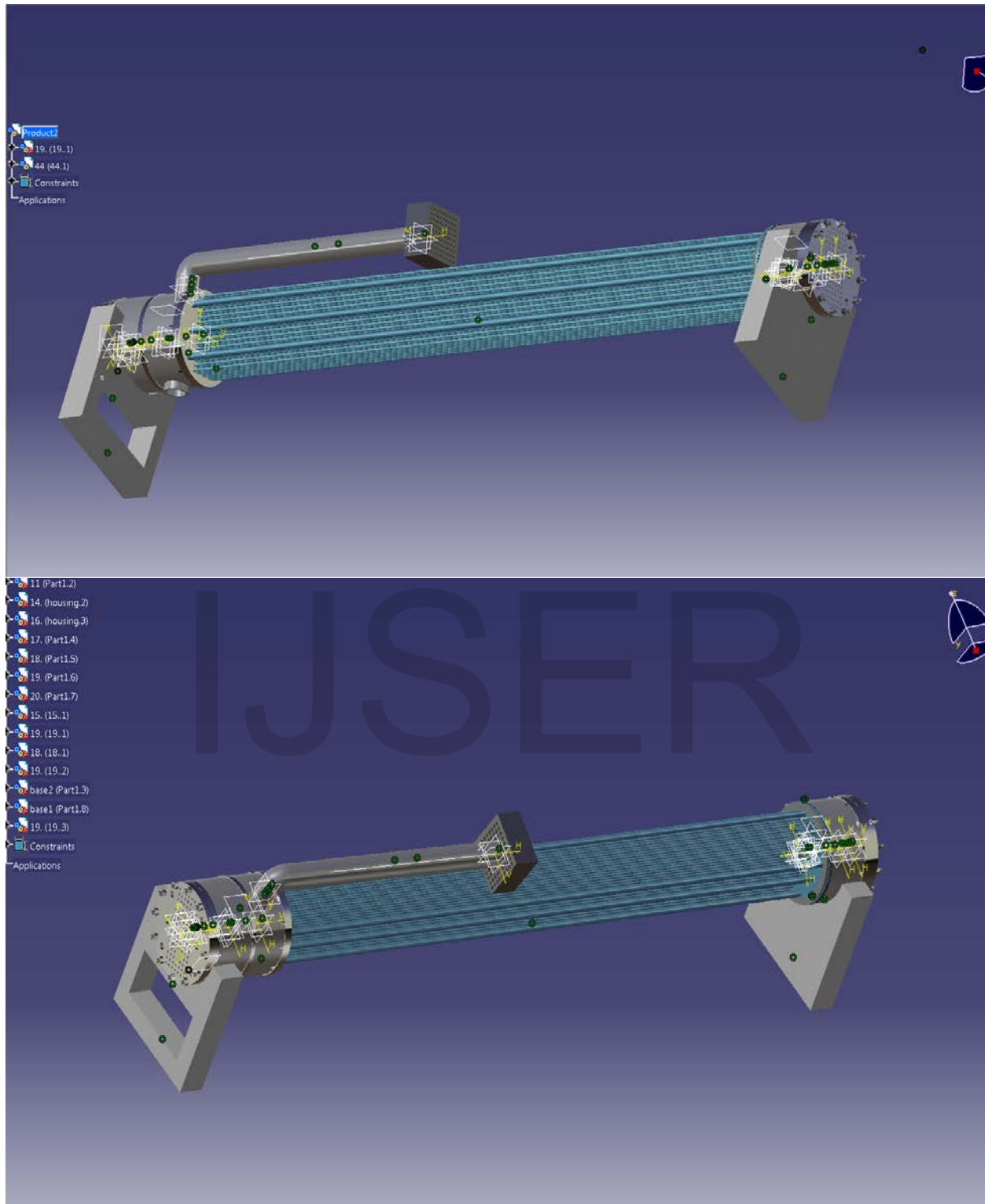


Helix is the one of the Main part of the Heat exchanger. First I create the rectangular base and extruded it by using the pad afterward circle was generated on top of the rectangular base. Also, I extruded up to some height after that by using the helix feature helix shape was generated on

the circular surface. By using the rectangular pattern the dots on the base were created.

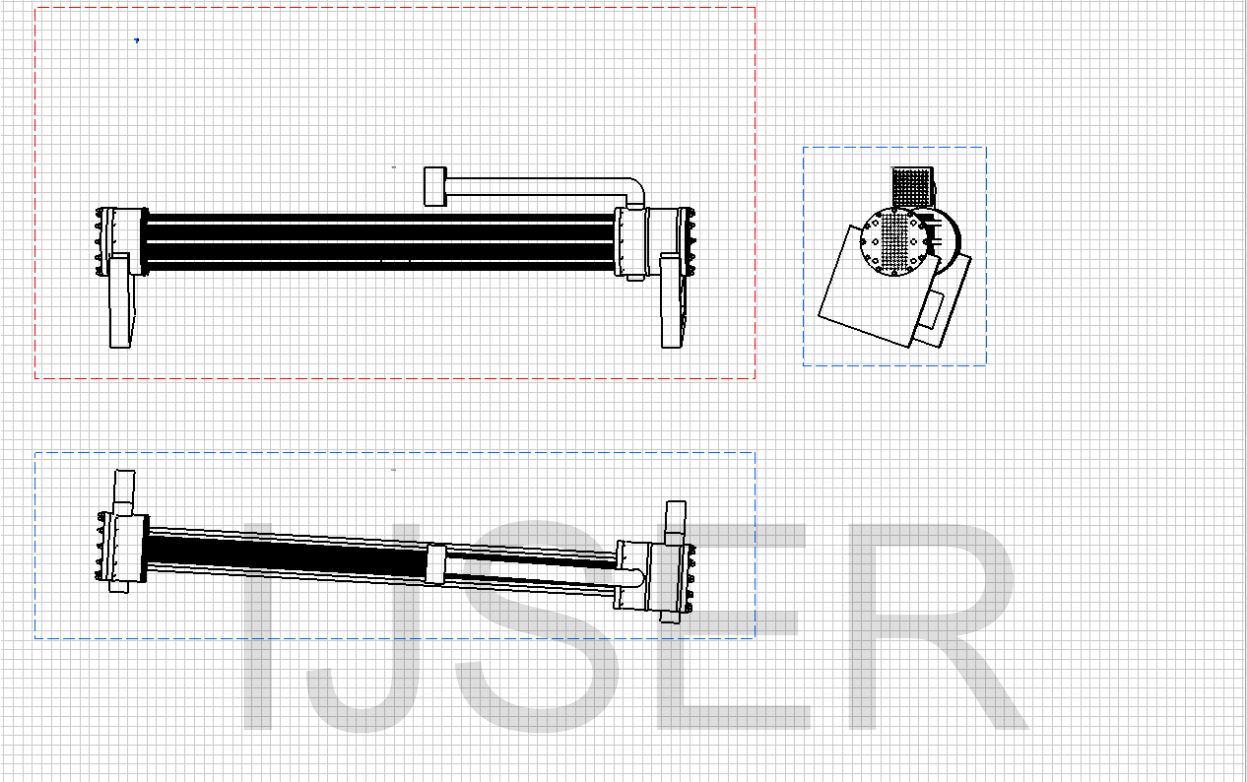
### **ASSEMBLY WORK BENCH:**

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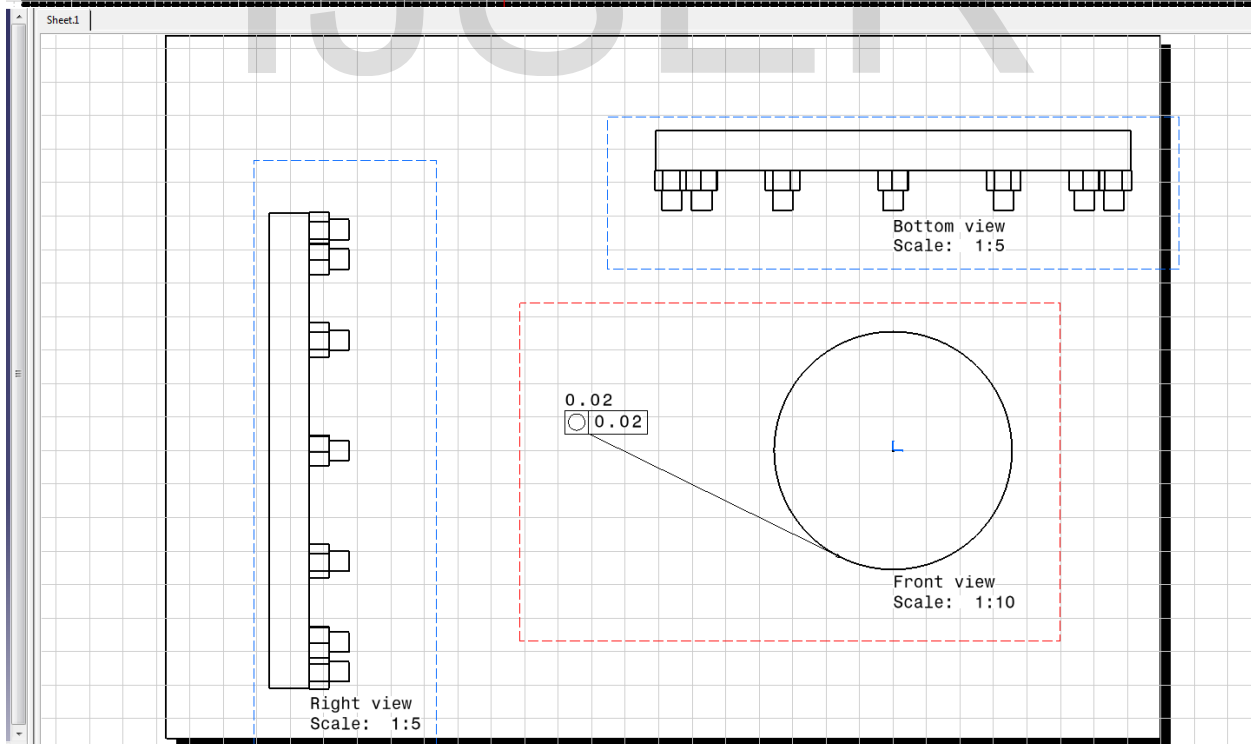
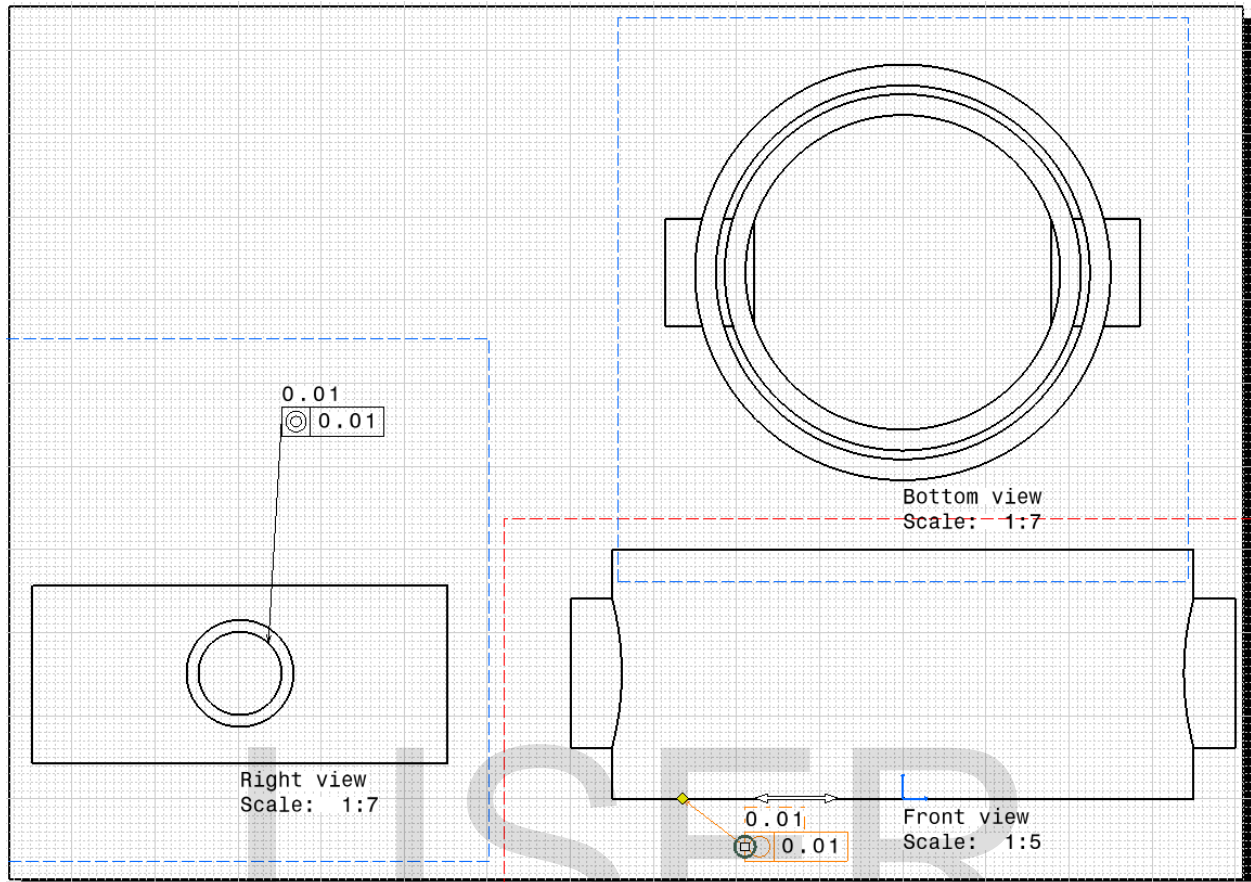


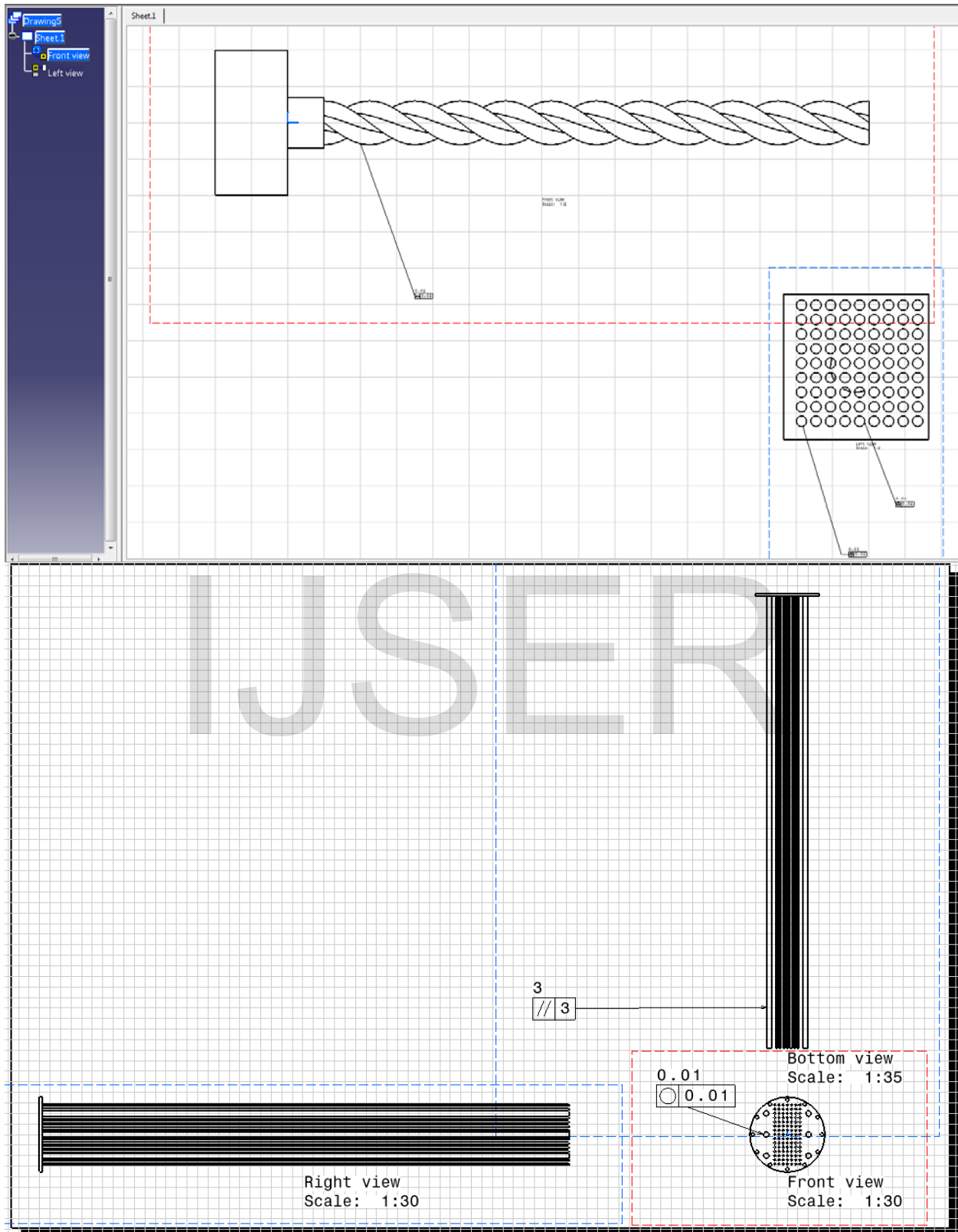
All the parts were assembled together in the Assembly Workbench and the coincidence, concentric, distance mates were applied.

**Drafting work bench:**









## **Challenges faced during the project:**

1. Implement Reverse Engineering by determining the dimensions and shapes for each part of the heat exchanger.
2. Tools used to design the parts in various workbenches.
3. Names to be assigned to each body part of the Heat exchanger.
4. Correlating and estimating the dimensions of the parts with respect to each other when doing the assembly
5. designing the tubes were particularly difficult for all the above-mentioned reasons.
6. Brainstorming was done and found out that designing Heat Exchanger is a good and complex design.

## **References:**

CATIA V5R15 for designers by Sham Tickoo