

# The SOLIDWORKS Challenge

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## Task 1: Experimental Heat Exchanger

Your new client is a research center. The center is looking for help to 3D model a custom heat exchanger for research purposes. You have been selected to handle the job. As the model will be used for research purposes, it is important that you maintain all the design intents throughout your design. Your models should be made using the **MMGS system**. Also, all your numerical evaluations should be rounded to 2 decimal places. The project is confidential, so do not share the materials with any other entity.

The client requests came in three stages. You are recommended to start with Stage 1 and then move to the other stages in their given order. Also, you are requested to organize your files according to those stages. Your SOLIDWORKS native files should be named (shown in bold letters) and categorized as follows:

Main Folder: **FirstName\_LastName\_Mobile Number**

- Folder: **Challenge 1\_Experimental Heat Exchanger**
  - Subfolder: **Stage 1**
    - Parts: **Name of part as mentioned in drawing\_Stage1**
    - Assembly: **Heat Exchanger\_Stage1**
  - Subfolder: **Stage 2**
    - Parts: **Name of part as mentioned in drawing\_Stage2**
    - Assembly: **Heat Exchanger\_Stage2**
  - Subfolder: **Stage 3**
    - Parts: **Name of part as mentioned in drawing\_Stage3**
    - Assembly: **Heat Exchanger\_Stage3**

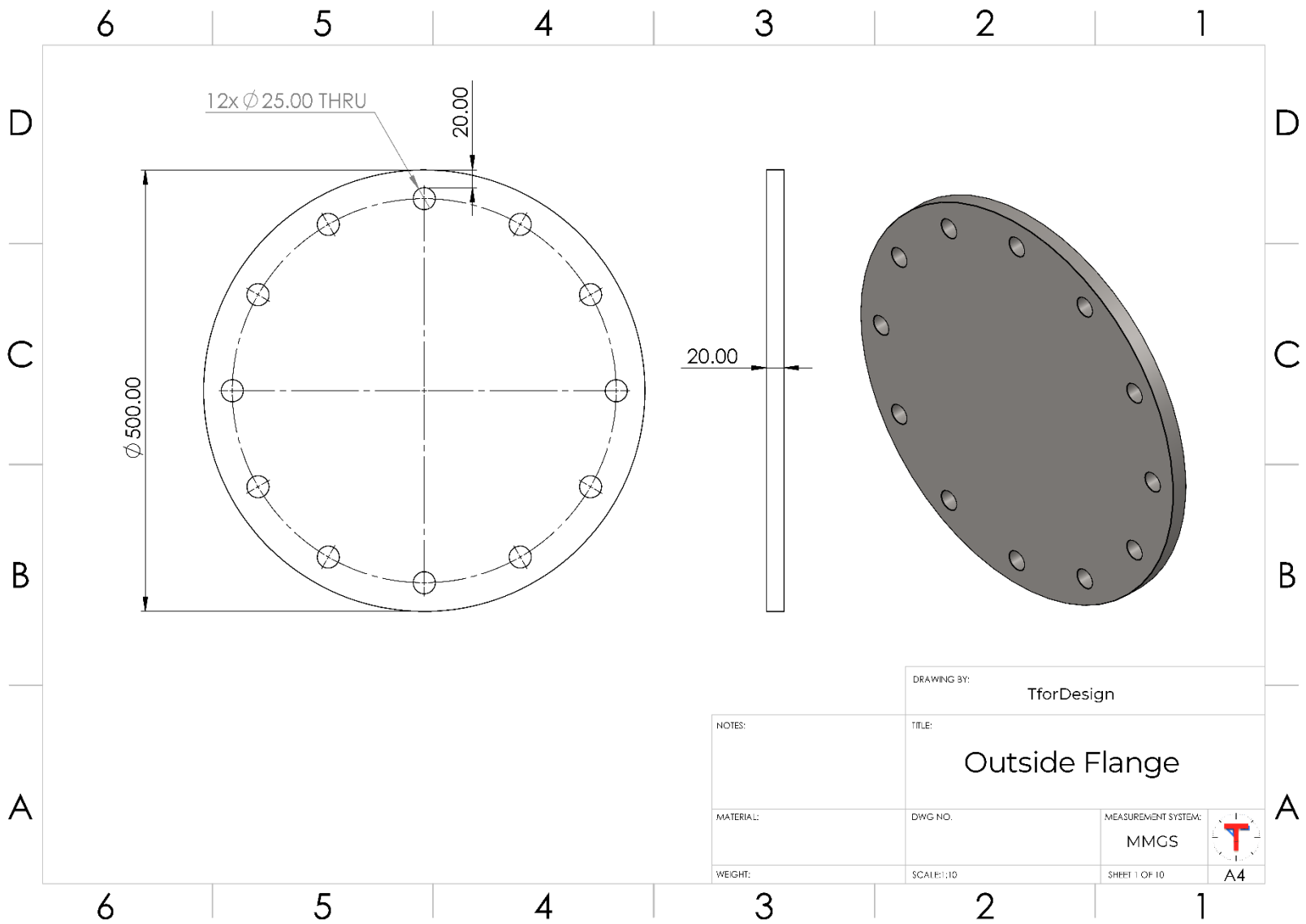
Each subfolder should contain files for all the SOLIDWORKS parts and assembly for that particular stage (All part files should be present in each subfolder). This is regardless if the part was modified or not.

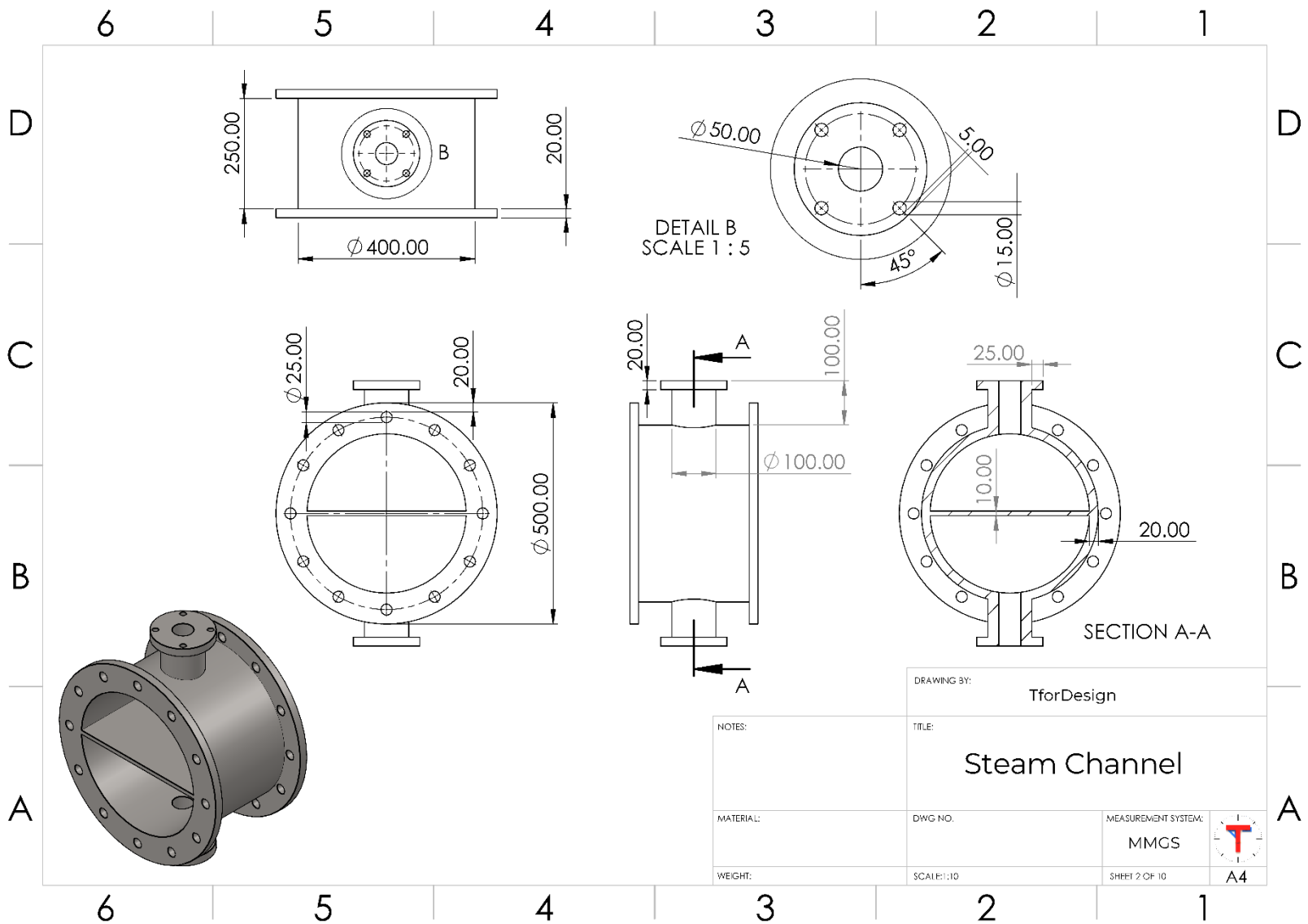
In each stage, you will be requested to record some values for the mass and center of mass. You have to input those values in the following form:

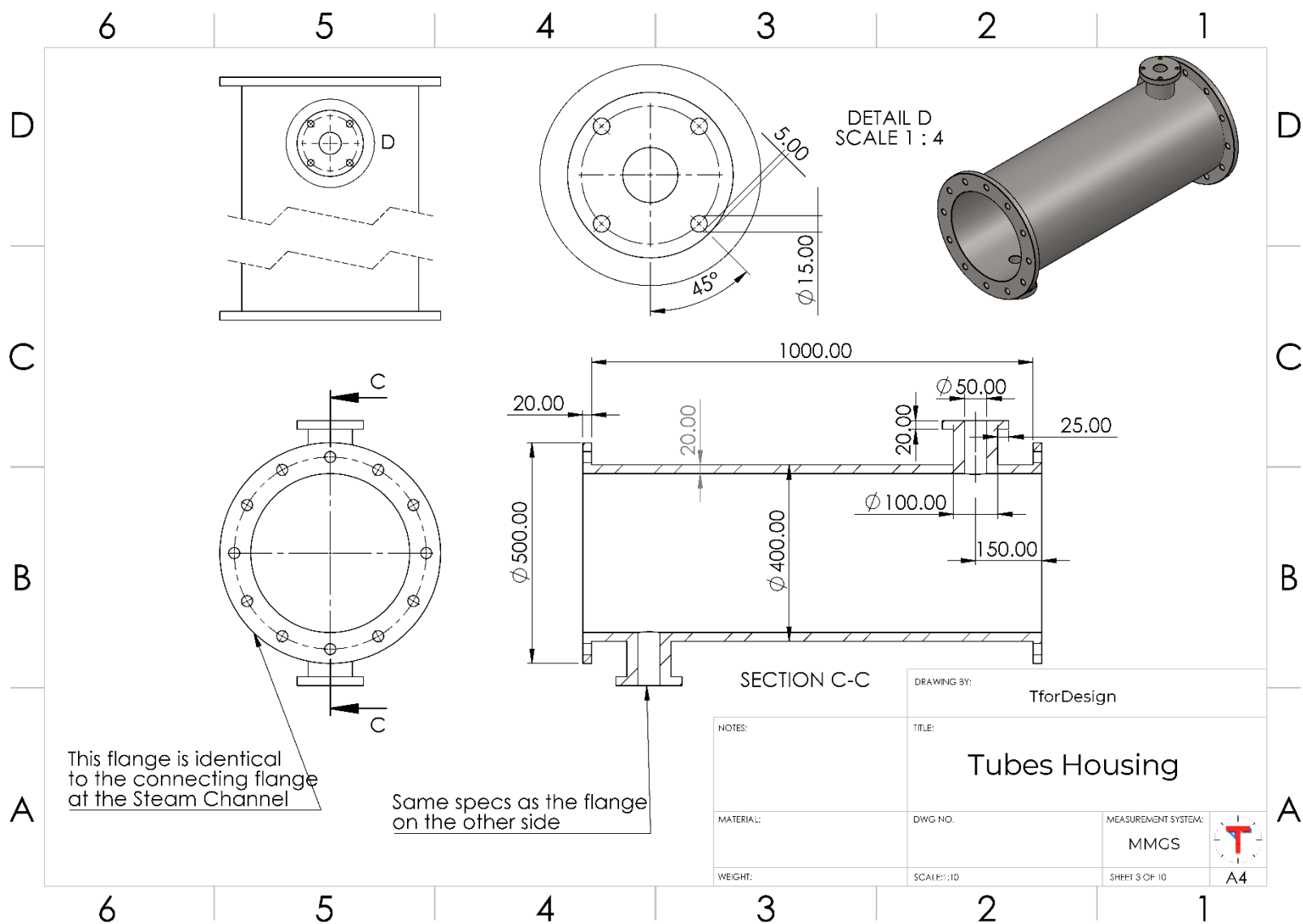
<https://forms.office.com/Pages/ResponsePage.aspx?id=I8esPoZ5jU28bmrYDZe7UIBIdHTIIAhMIHUQxyHufflUNFdOSE80NFc0SUJSROU1M042UzIXQ05BMy4u>

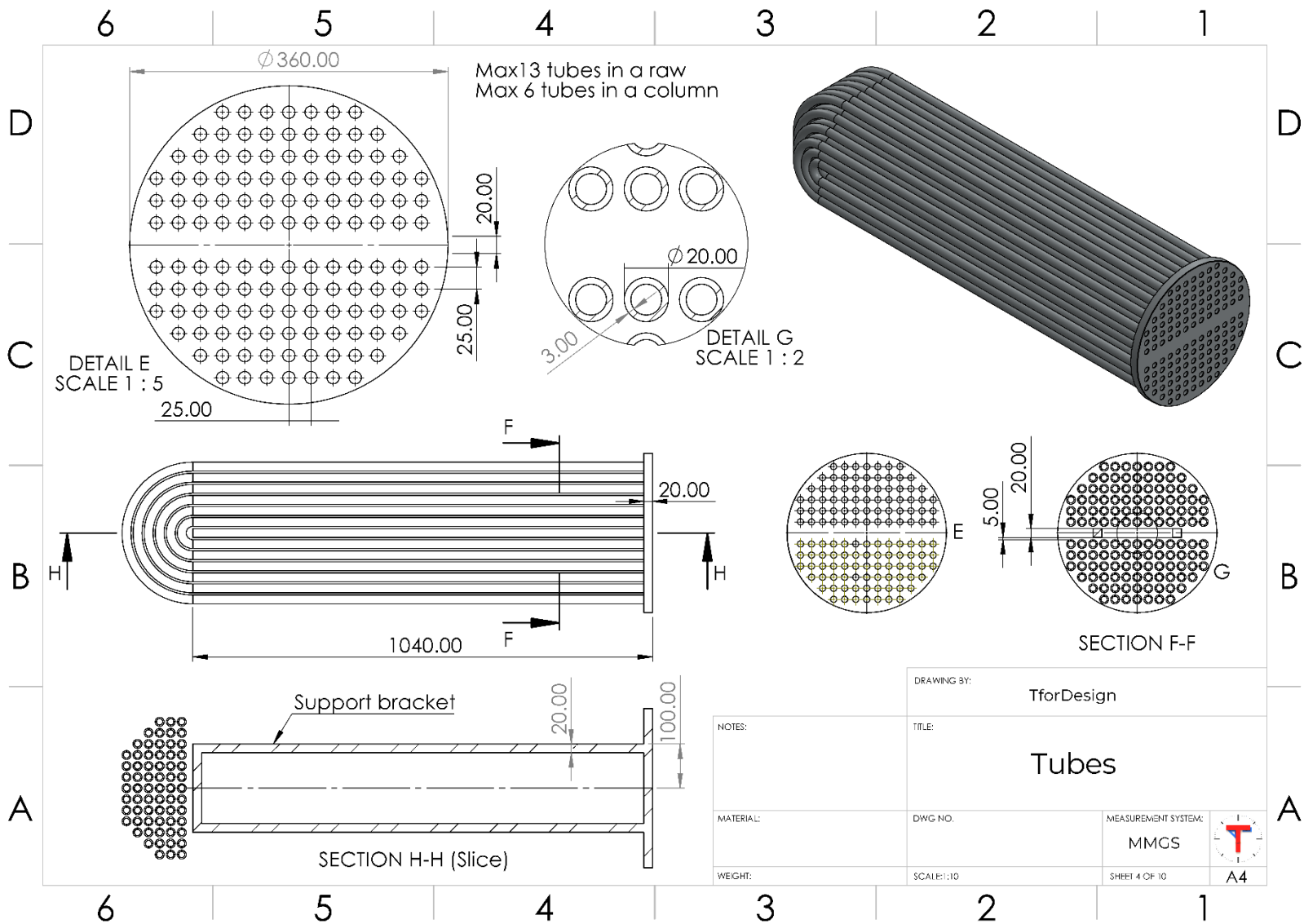
Stage 1:

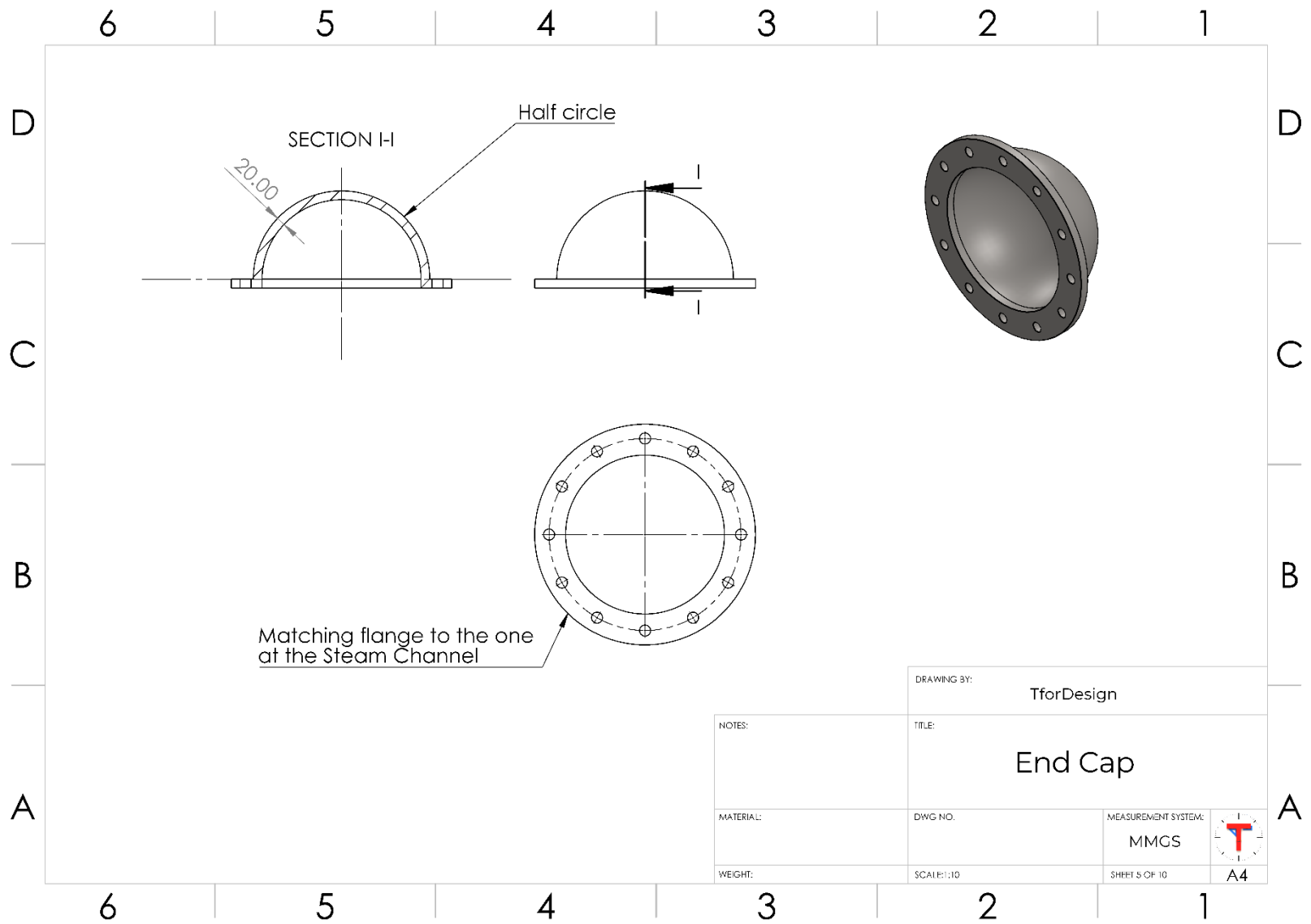
Model the following parts and drawings in SOLIDWORKS. You can find the bill of material, and the materials assigned to each part in the exploded drawing provided.

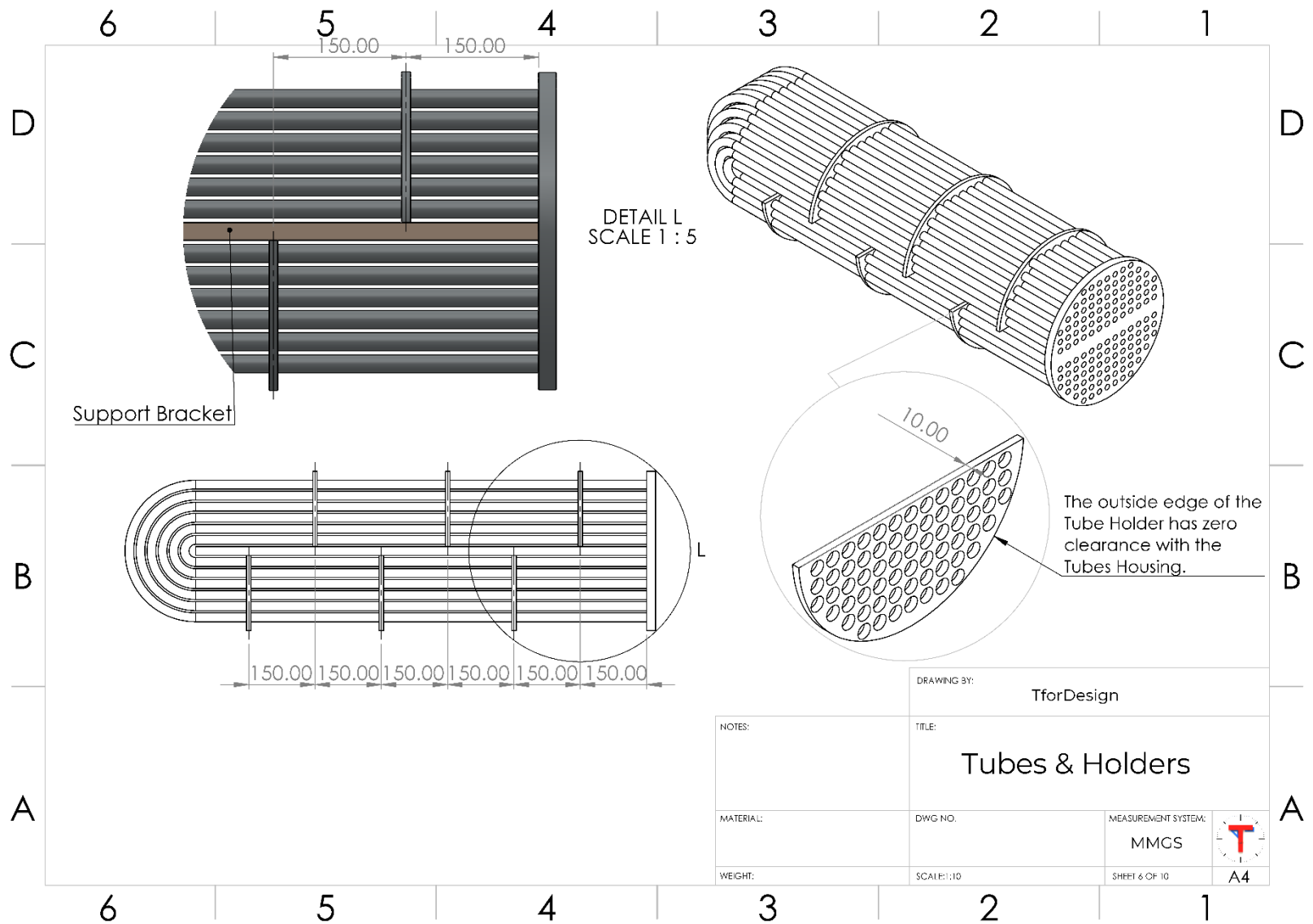




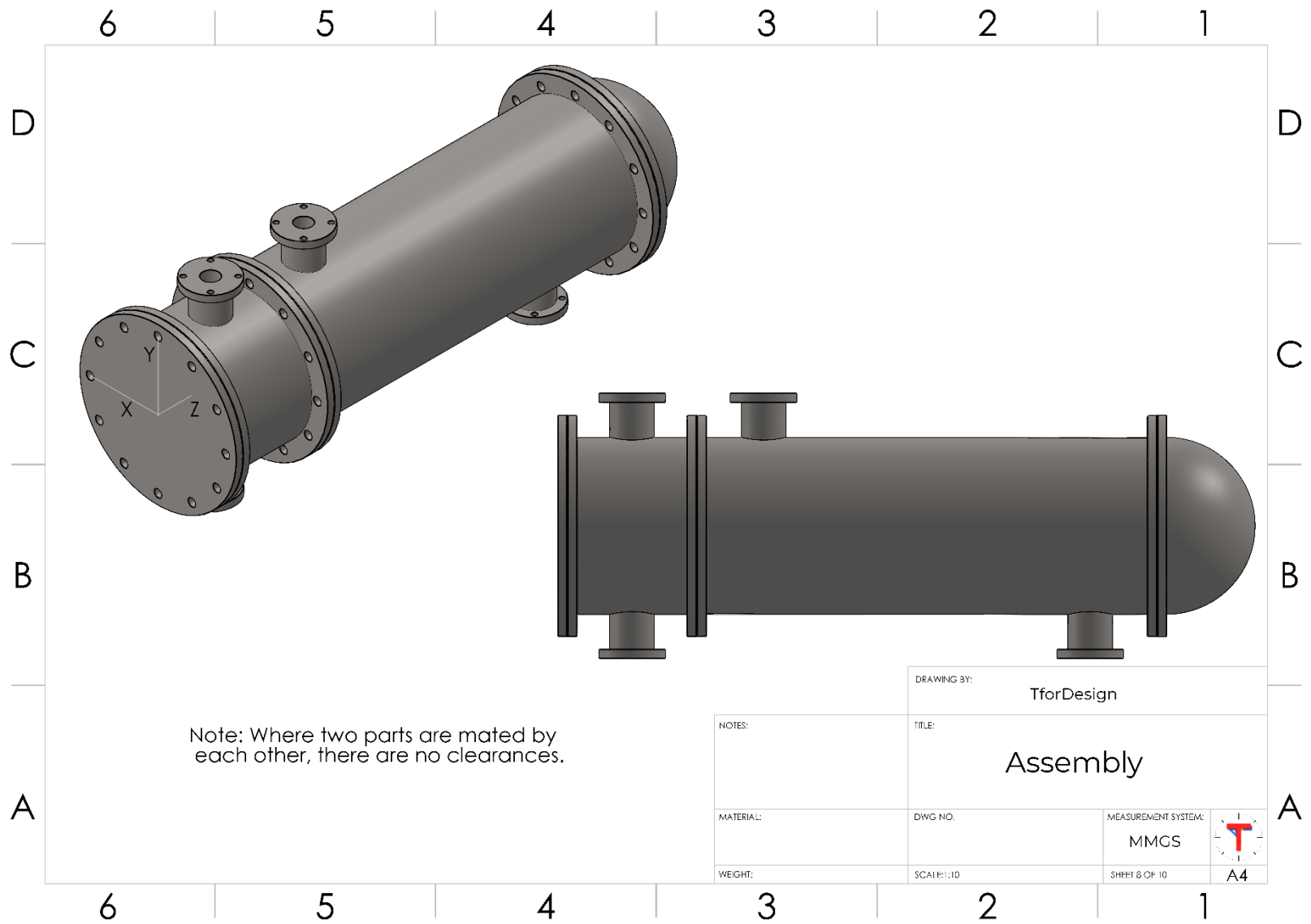






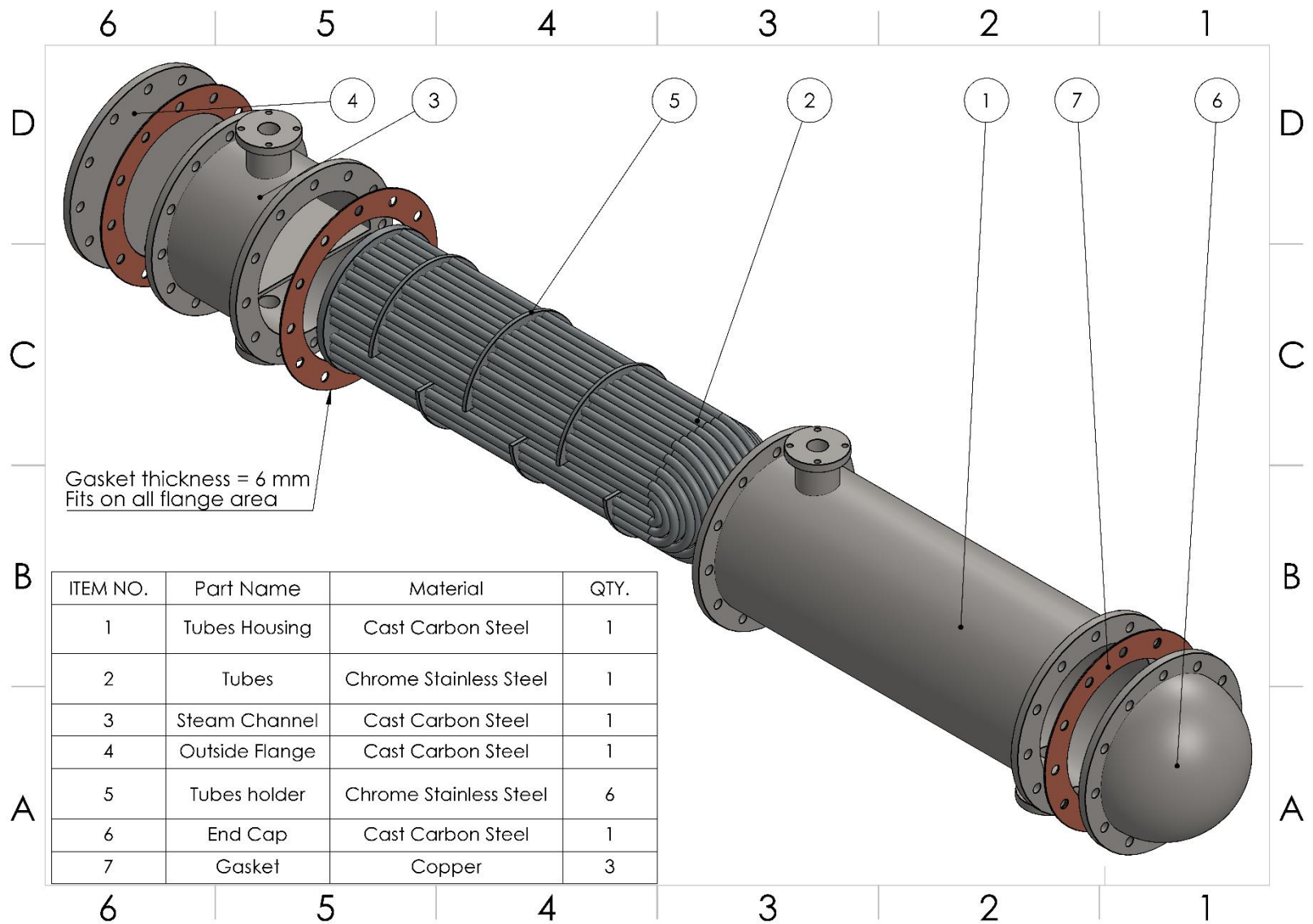






Note 1: The origin of given coordinate system is on center of the outer surface of Outside Flange.

Note 2: the assembly does not include any fasteners.



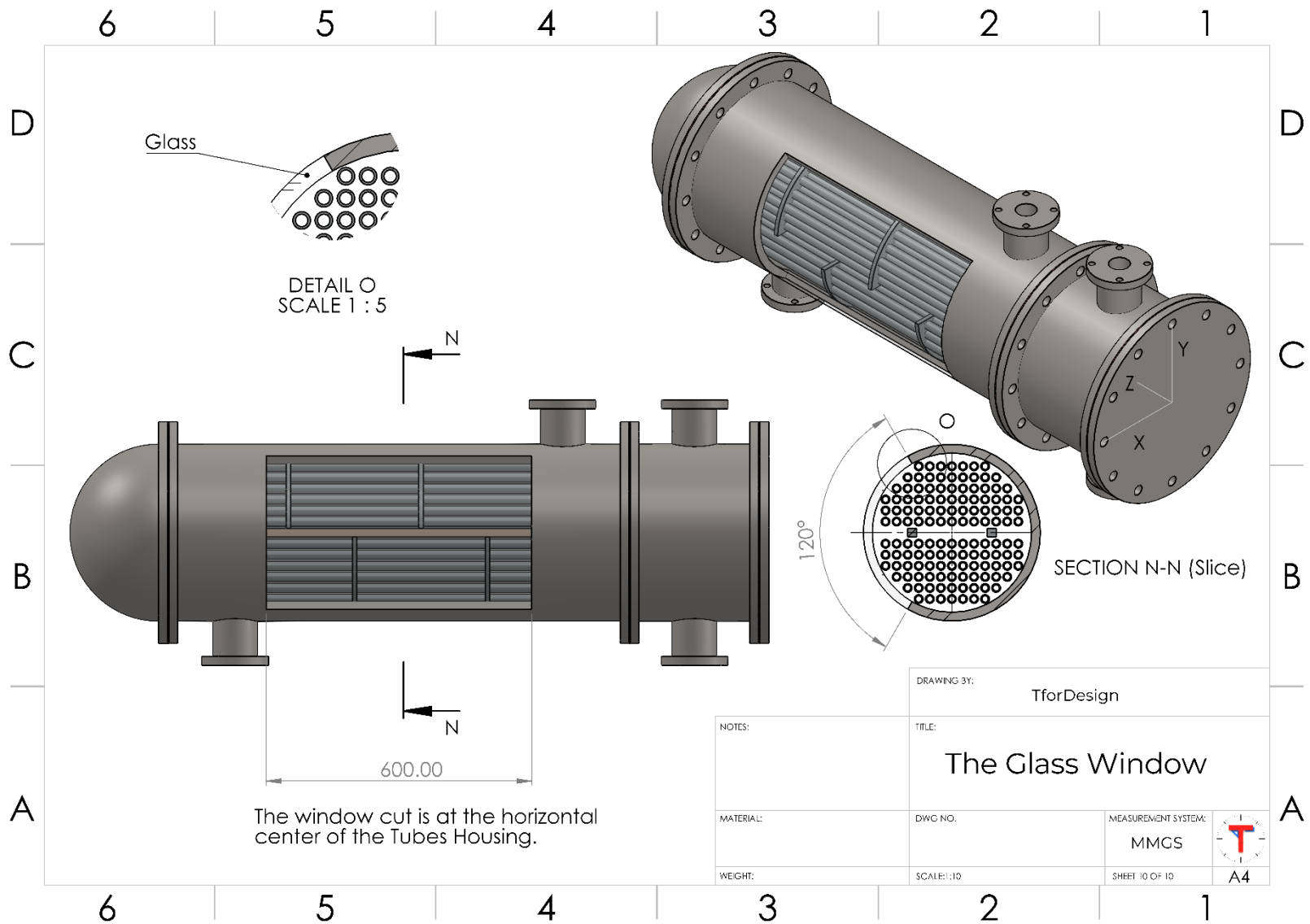
| Save all the parts and assembly of this stage in one folder. Make a record of the following rounded to two decimal places (mass in grams).

- Mass of each part
- Mass of assembly
- Center of mass of assembly per shown coordinate system.

Make a copy of all the files before moving to stage 2 and keep them in a separate folder. In stage 2, you will be modifying the parts from Stage 1.

### Stage 2:

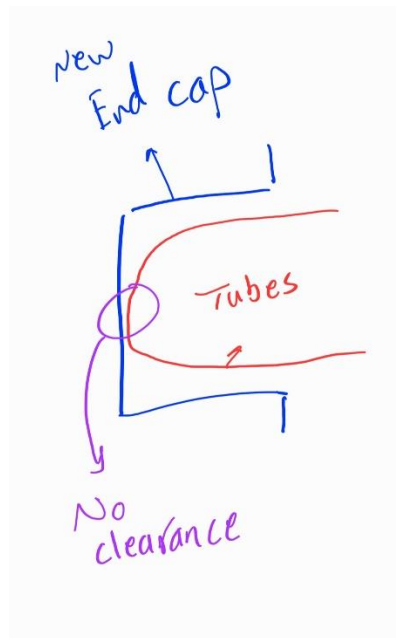
The client just asked to create a window in Tubes Housing by removing a section of the part and replacing it with glass. The glass should have same thickness as the removed section of the Tubes Housing. The following drawing shows how the client envisioned the glass window.



Another request is quoted as such:

“Please change the dome shape of ‘End Cap’ to a cylindrical shape. Thickness of the cylinder should be 20 mm like the thickness of other parts. Also, the inner flat face of the cylinder should have no clearance with the tubes' end. Do not include any fillets in the design.”

The client presented the following hand sketch to explain what they mean. Include this modified end cap in the newer form of assembly.



After applying changes, record the following (mass in grams):

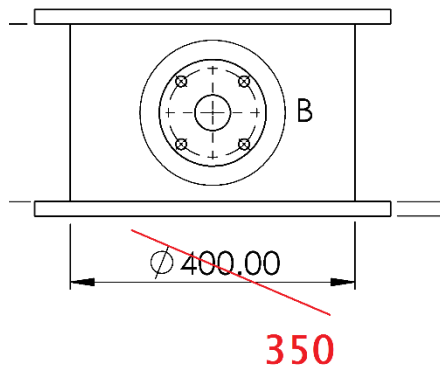
- Mass of Glass Window
- Mass of modified Tubes Housing
- Mass of modified End Cap
- New center of mass of the new assembly as per the shown coordinate system (this assembly should include glass window and modified end cap).

Save and make a copy of all the files before moving to stage 3. In stage 3, you will be modifying parts from Stage 2. You will then save another set of files for the third stage.

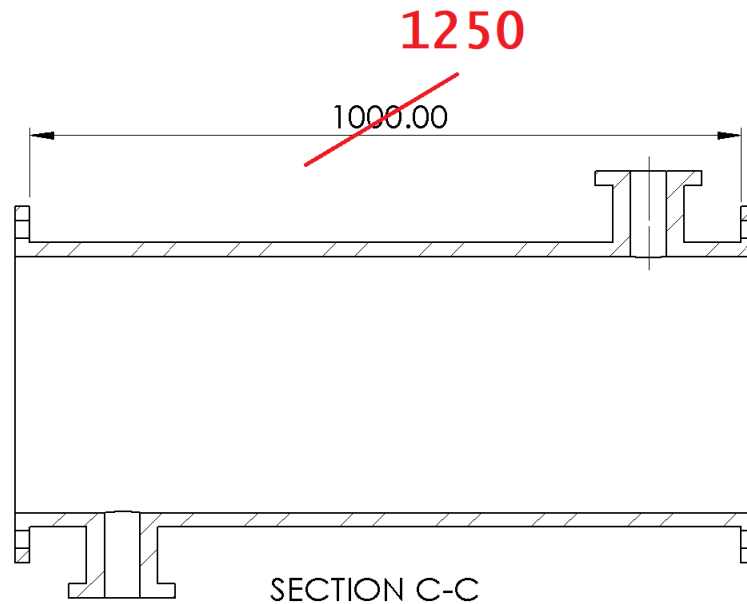
### Stage 3:

The client has just requested more adjustments based on the initial drawings they provided. They have marked changes in the views of following drawings. The adjustments are highlighted in the drawing views below. All other dimensions in the part remain the same.

#### 1- The Steam Channel



#### 2- The Tubes Housing (the model with window opening).



After applying changes, save each of the updated parts and record the following (mass in grams):

1. Mass of modified Steam Channel
2. Mass of modified Tubes Housing (with window opening) – this mass does not include glass window, only the metal housing.
3. Update modified parts in the assembly keeping everything else the same. What is the new center of mass according to the given coordinate system in earlier stages? NOTE: For this assembly, use the dome-shaped end cap.



## Task 2: Experimental Vase

The same client has another project for you. This time it is a uniquely designed Vase. Your models should be made using the **MMGS system**. Also, all your numerical evaluations should be rounded to 2 decimals. The project is confidential, so don't share the materials with any other entities.

The client's requests came in 3 stages. You are recommended to start with Stage 1, then move to the next stages in the given order =. Also, you are requested to organize your files according to those stages. Your SOLIDWORKS native files should be organized as follows:

- Folder: **Challenge 2\_Experimental Vase**
  - o Subfolder: **Stage 1**
    - Part: **Vase**
  - o Subfolder: **Stage 2**
    - Part: **Vase**
  - o Subfolder: **Stage 3**
    - Part: **Vase**

In each stage, you will be requested to record some values for the mass and center of mass. You have to input those values in the following form:

<https://forms.office.com/Pages/ResponsePage.aspx?id=l8esPoZ5jU28bmrYDZe7UIBldHTIiAhMIHUQxyHufflUNFdOSE80Nfc0SUJSR0U1M042UzIXQ05BMy4u>

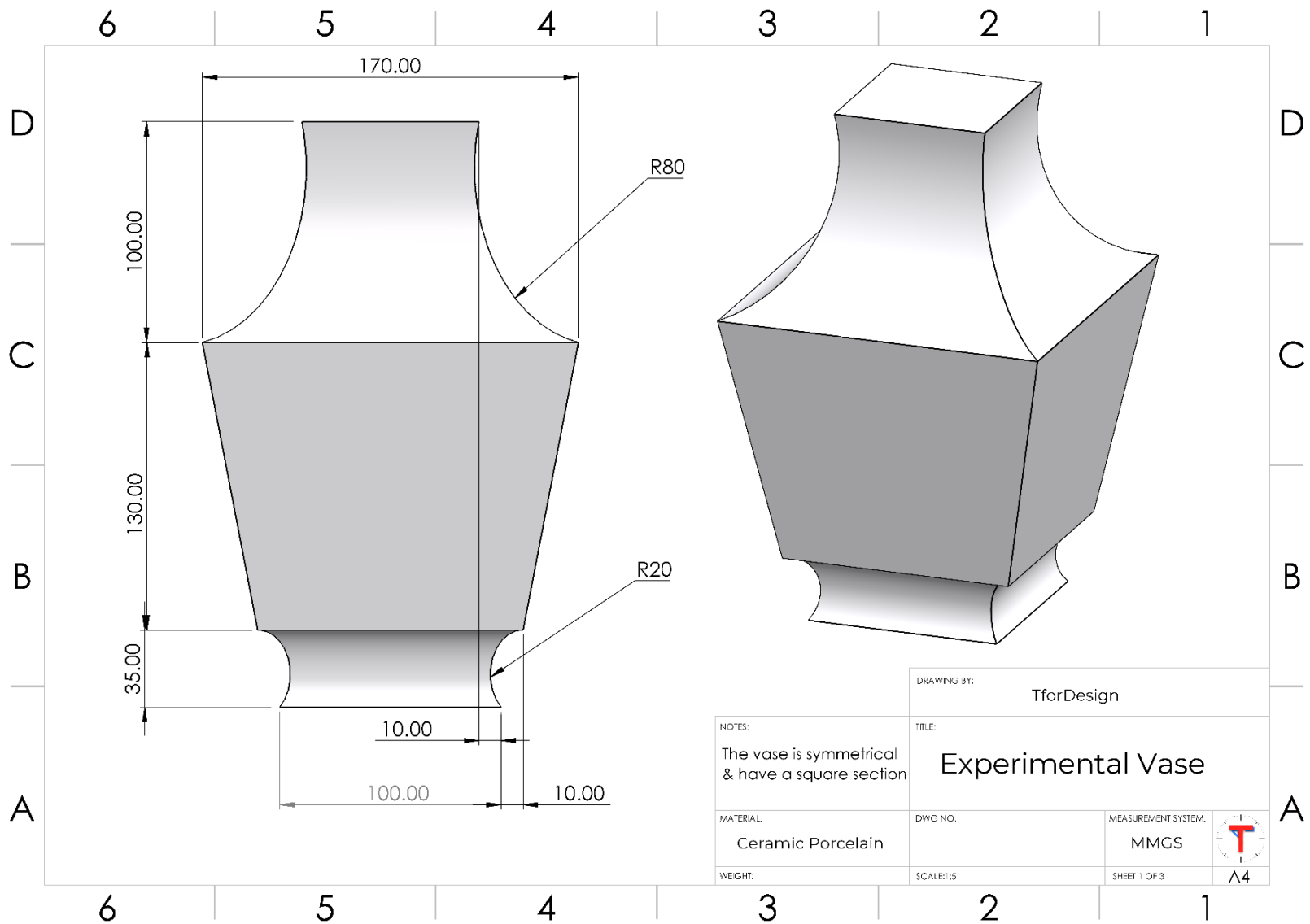
### Stage 1:

Model the following drawing in SOLIDWORKS keeping in mind the following considerations:

1. Material: Ceramic Porcelain
2. For the first 2 stages, the vase is fully solid i.e. it is not hollow
3. The design of the vase is symmetrical

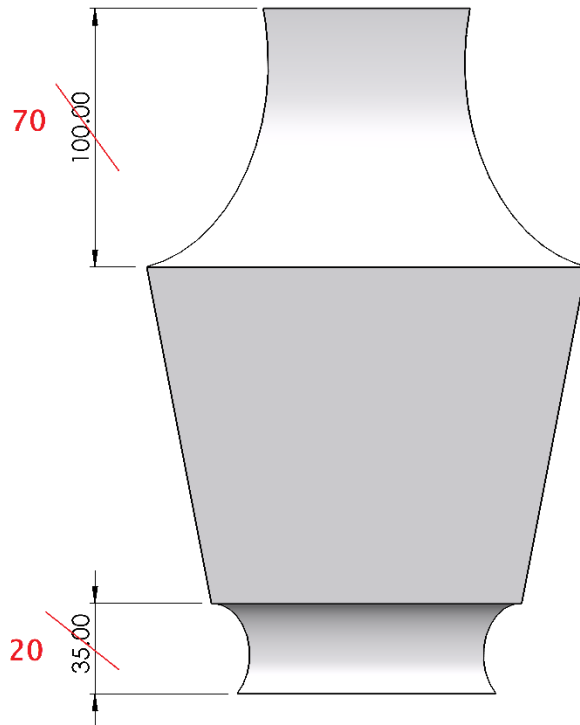
After generating the model, make note of the following (in grams):

- Mass of Vase



## Stage 2:

The client has requested some adjustments to the vase. They have marked those adjustments in the drawing view shown below. Keep everything else the same.

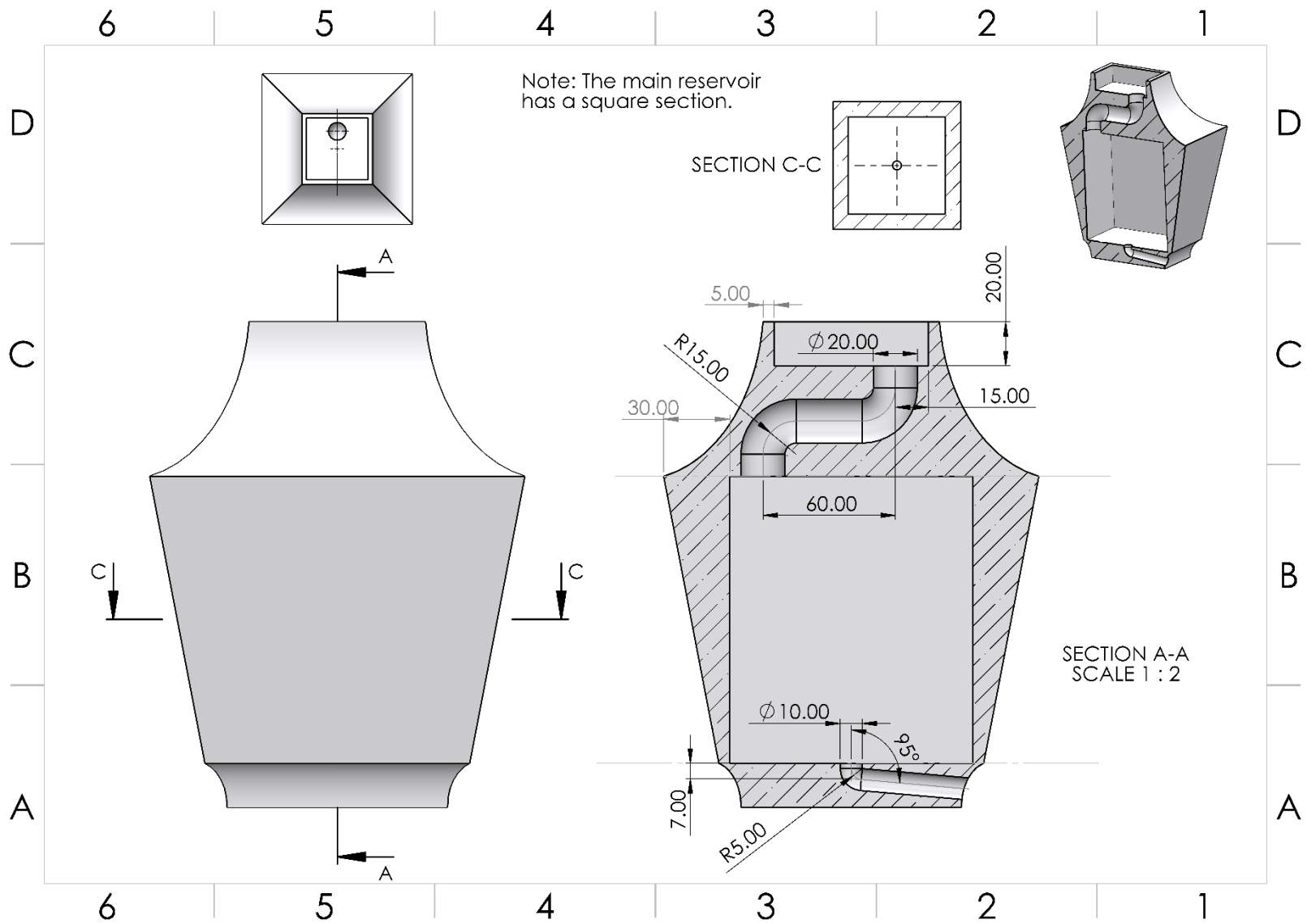


After adjustment, keep note of the following (in grams):

- Mass of modified Vase

### Stage 3:

Working from the modified model from Stage 2, modify the model further to add the reservoir shown in the following drawing.



After adjustment, keep a note of the following (in grams):

- Mass of modified Vase

## Evaluation Rubric and Criteria

Your submission will be evaluated as per the following criteria:

- Numerical scoring for each question/task depends on how close an answer is to the answer-key. The break-down is shown in the scoring levels below.

Scoring Levels	
Score %	Level Within
100	0.01%
90	0.05%
80	0.10%
70	0.50%
60	1.00%
40	5.00%
0	More than 5%

- Numerical scoring will be used to filter the top potential winners
- The files for the top 10 will be manually checked to ensure all files were provided to check the integrity of the work based on their design approach, embedded design intelligence, formatting, and naming of files submitted. Missing files will disqualify the contestant as there will be no way to check their work.
- In the case of two or more top contestants scoring the same numerical score, they will be compared based on manual evaluation based on their design approach, embedded design intelligence, formatting, and naming of files submitted. This will also be to ensure that the work was not compromised.
- The problem statement consists of two tasks. Task 1 carries 75 marks and Task 2 carries 25 marks. The distribution of marks for each task is given in the table below. Marks are allotted for each numerical value you enter in the form (link provided above).

Task 1: Experimental Heat Exchanger			
Total marks for Challenge 1			
75	Total marks for Stage 1		
		Marks for each numerical value in Stage 1	
	30	1	Outside Flange
		3	Steam Channel
		5	Tubes
		3	Tubes housing
		5	Tubes Holder
		2	End Cap



		1	Gasket
		4	Assembly mass
		1.5	Assembly center of mass, X
		1.5	Assembly Center of mass, Y
		3	Assembly Center of mass, Z
	Total marks for Stage 2		
		Marks for each numerical in Stage 2	
	25	4	Glass
		5	Modified Tubes Housing
		4	Modified End Cap
		4	Assembly center of mass, X
		3	Assembly Center of mass, Y
		5	Assembly Center of mass, Z
	Total marks for Stage 3		
		Marks for each numerical in Stage 3	

	20	4	Modified Steam Channel
		4	Modified tubes housing _ 2
		4	Assembly center of mass, X
		3	Assembly Center of mass, Y
		5	Assembly Center of mass, Z
Task 2: Experimental Vase			
Total marks for Challenge 2			
25		Stage 1	
	Marks	7	Mass (grams)
		Stage 2	
	Marks	6	Mass
		Stage 3	
	Marks	12	Mass