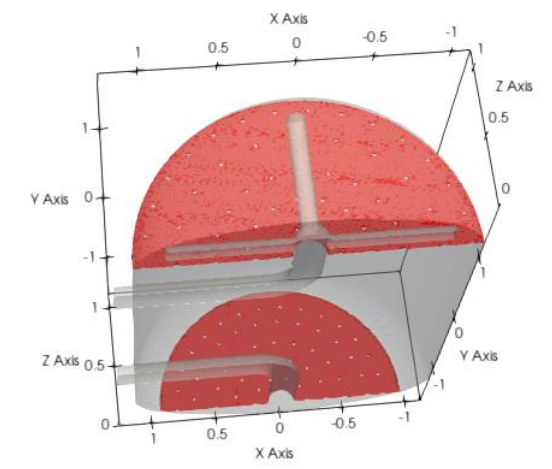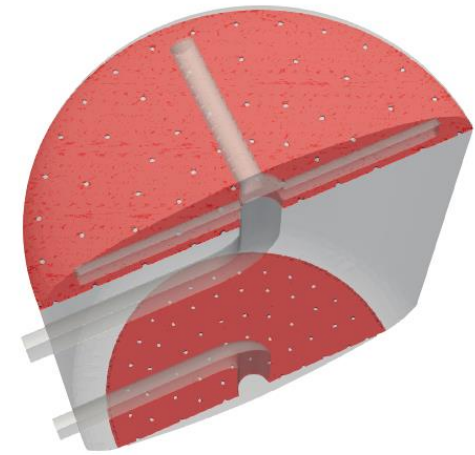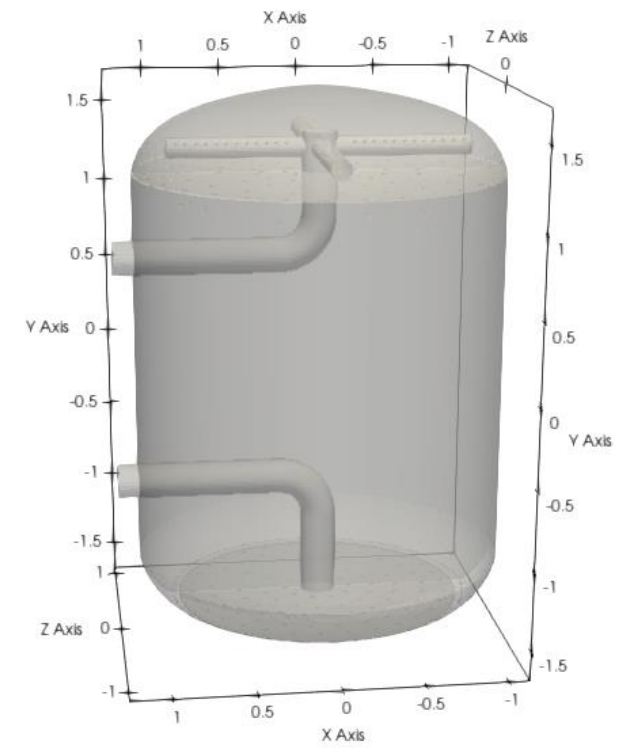# CFD Simulation Report

Thermal Water Storage Tank Cap 42.25 Lps
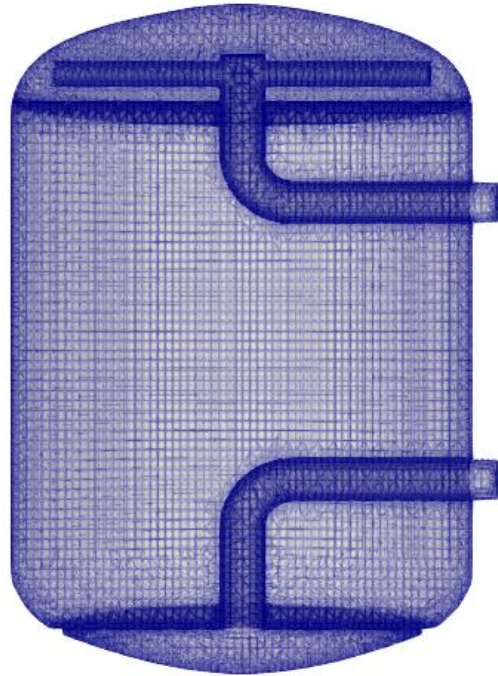
Content

1. Geometry

2. Mesh information

3. Input data (Patch)

4. Simulation Result

- Velocity

- Temperature

- Pressure

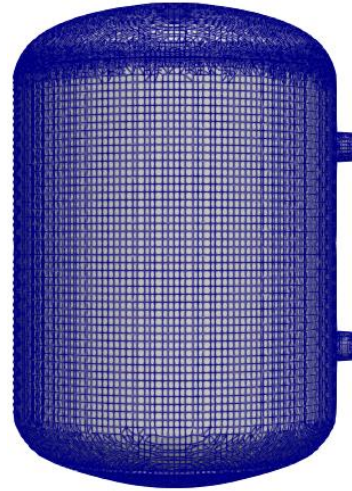# Geometry

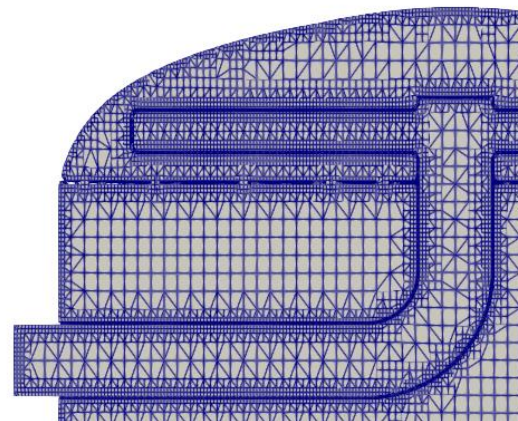# Mesh Information

Mesh front

Mesh back

Mesh detailed in pipe

```
Mesh stats
    points:            842061
    faces:             1971157
    internal faces:    1677485
    cells:             567834
    faces per cell:    6.42554
    boundary patches:  5
    point zones:       1
    face zones:        0
    cell zones:        0
```

```
Checking basic pointZone addressing...
        PointZone    PointsBoundingBox
        frozenPoints      0(1e+150 1e+150 1e+150) (-1e+150 -1e+150 -1e+150)

Checking geometry...
    Overall domain bounding box (-1.125 -1.68155 0) (1.25093 1.70187 1.12499)
    Mesh has 3 geometric (non-empty/wedge) directions (1 1 1)
    Mesh has 3 solution (non-empty) directions (1 1 1)
    Boundary openness (2.29338e-15 -3.82056e-16 -1.59211e-14) OK.
    Max cell openness = 3.93531e-16 OK.
    Max aspect ratio = 17.3788 OK.
    Minimum face area = 3.83122e-06. Maximum face area = 0.0311858.  Face area magnitudes OK.
    Min volume = 2.20418e-08. Max volume = 0.00189162.  Total volume = 5.96228.  Cell volumes OK.
    Mesh non-orthogonality Max: 64.994 average: 12.2344
    Non-orthogonality check OK.
    Face pyramids OK.
***Max skewness = 11.1775, 98 highly skew faces detected which may impair the quality of the results
    <<Writing 98 skew faces to set skewFaces
    Coupled point location match (average 0) OK.

Failed 1 mesh checks.
```

Data Grouping

Hierarchy

- vtkMultiBlockDataSet
    - internalMesh

Data Statistics

|	
Type	Multi-block Dataset
# of Cells	1,655,614
# of Points	937,123 (float)
# of TimeSteps	360
Current Time	0 (range: [1, 360])
Memory:	78.5017 GB
Bounds	-1.125 to 1.25093 (delta: 2.37593)
	-1.68155 to 1.70187 (delta: 3.38342)
	0 to 1.12499 (delta: 1.12499)

No	Item	Max	Min	Average	Remark
1	Skewness	11.1775	0	0.0148	Excellent
2	Non-Orthogonality	64.994	0	12.2344	Excellent
3	Nodes	937123			
4	Element	1655614			
5	Faces	1971157			

Based on mesh generation, the mesh of tank shows on table above with remark "Excellent"

Input Data

Wall
- Temperature system : 33 $^{\circ}$C
- Polyurethane : 100mm
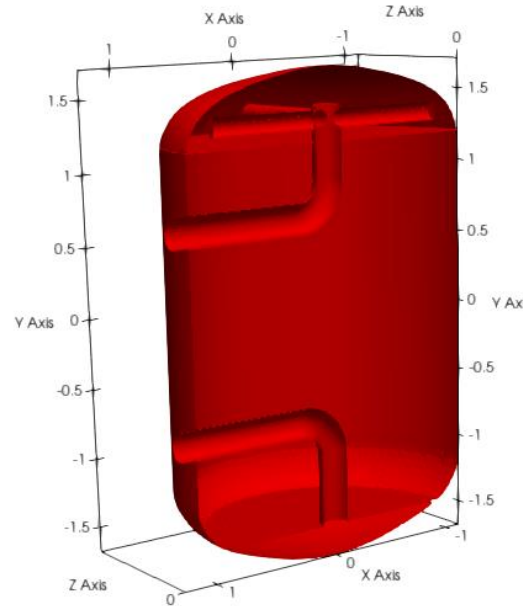- Specific Heat 1.35 J/kgK
- Thermal Cond. = 0.0186 W/mK

Inlet
Fluid inlet :
- Flow rate : 42.25 Lps
- Temp : 26°C
- Pressure : 6 Bar
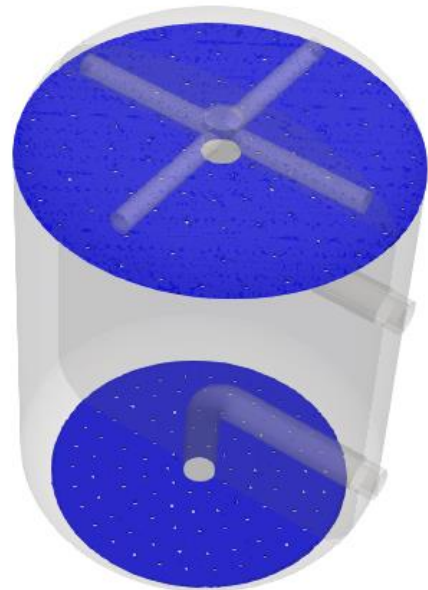
wall

inlet

Diameter 25mm

Fluid Domain
- Operating Pressure 6 Bar
- Fluid Work : Water
- Gravity : -9.81 m^2/s
- Operating Temp : $^{\circ}$C16
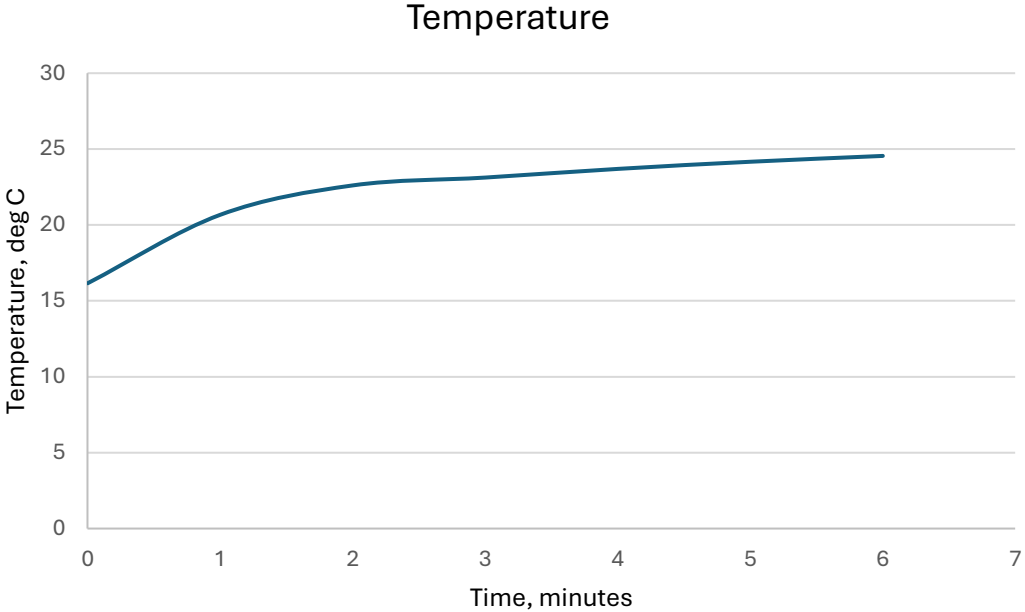
Streamer

fluid

Outlet
Pressure outlet :
- Pressure : 1 Bar
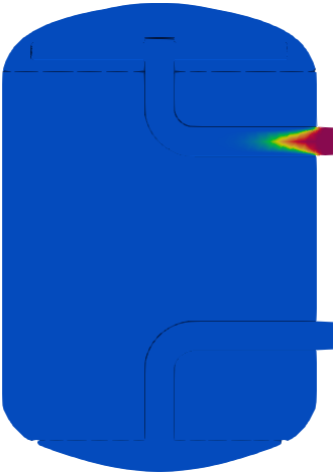
outlet

CFD Simulation Result

Temperature Contour

0 minute

1 minute

2 minute

3 minute

4 minute
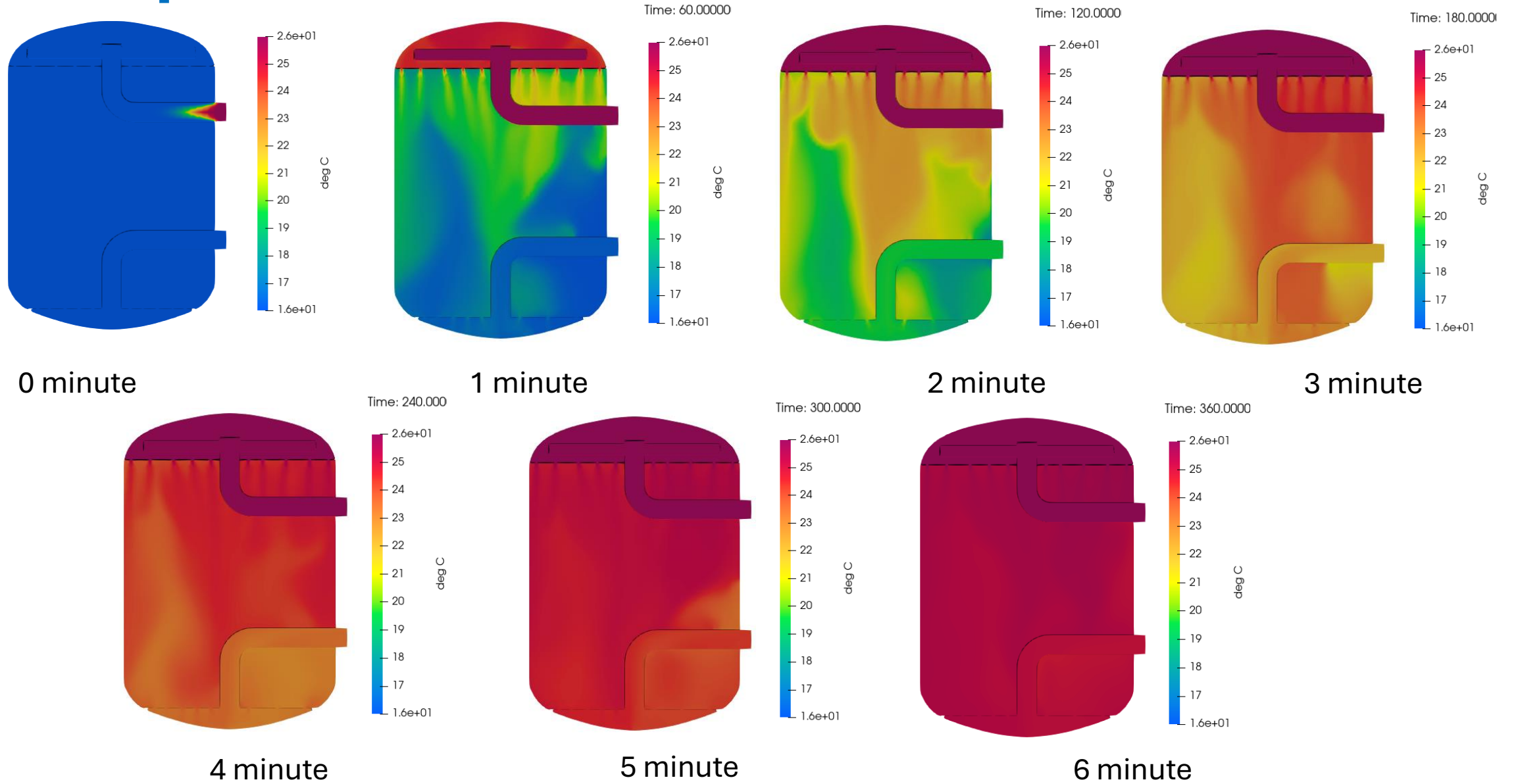
5 minute

6 minute

Data Temperature

Temperature

Time	Temp
Minutes	deg C
0	16.14936
1	20.66532
2	22.60574
3	23.12303
4	23.69376
5	24.16567
6	24.55124

Temperature graph: Temperature, deg C vs Time, minutes

0 minutes

6 minutes
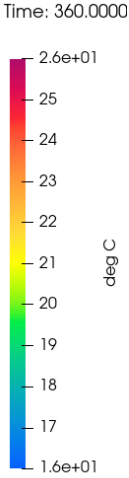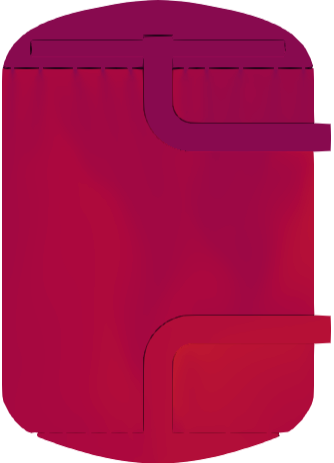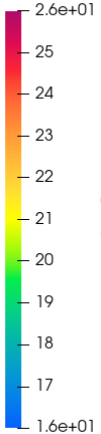
Explanation

- From the simulation results, a graph pattern as shown above is obtained.
- In this condition, the temperature of the tank increases from 75 second to 260 second significantly .
- For detailed temperature increase information on the outlet channel, please refer to the table.
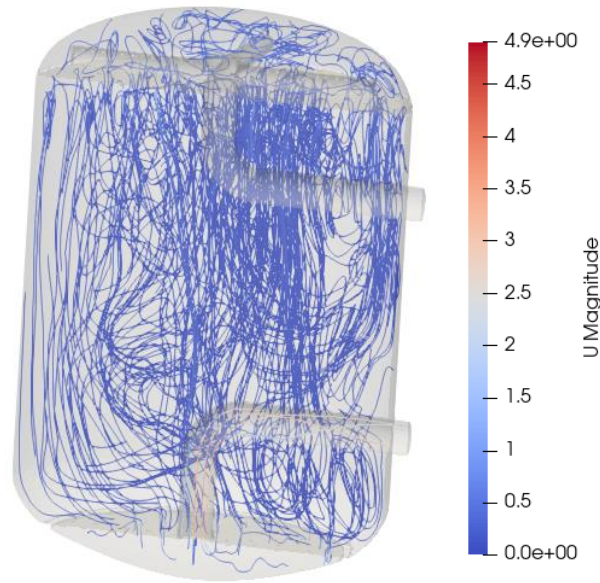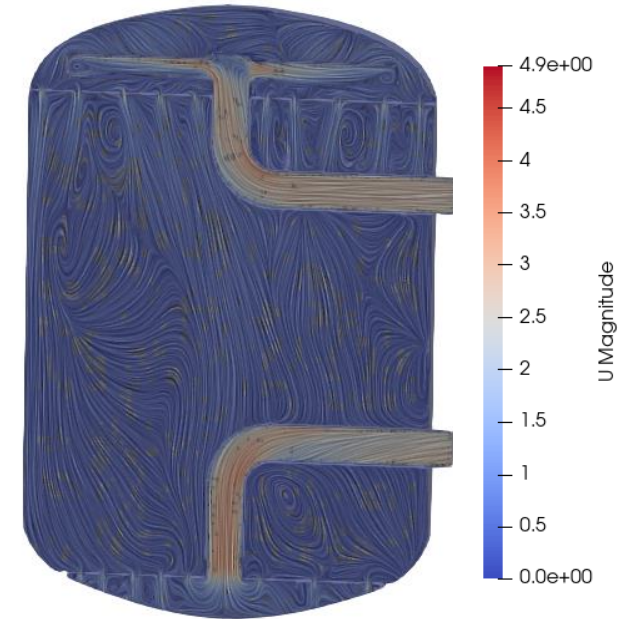
Temperature Animation

Velocity Contour

0 minute

1 minute

2 minute

3 minute

4 minute

5 minute

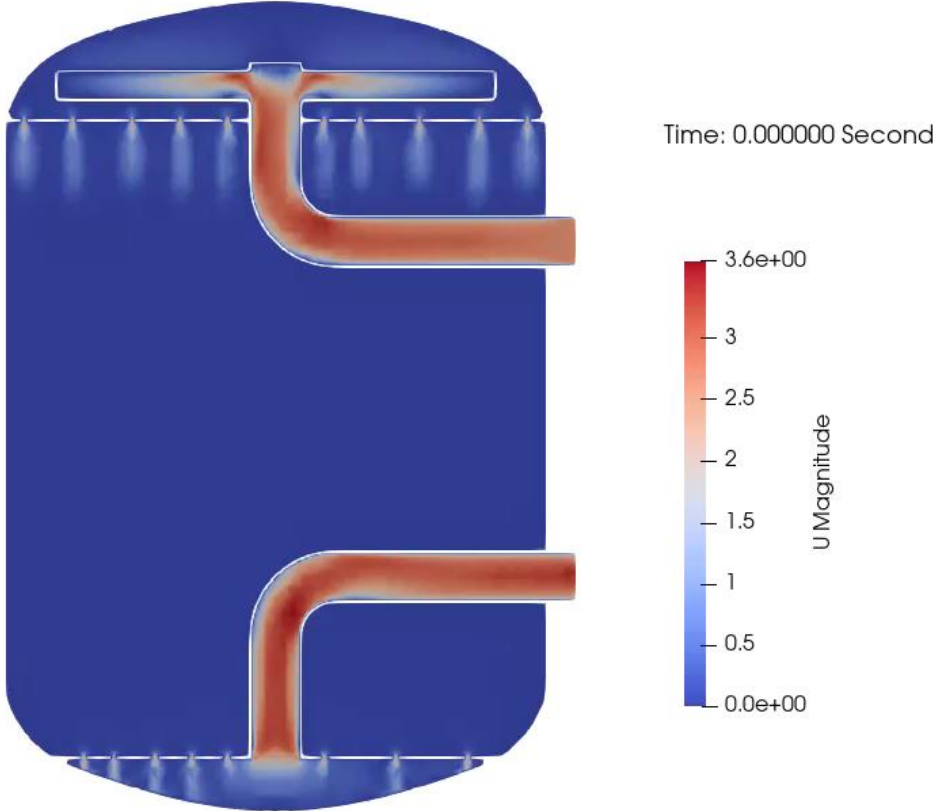6 minute
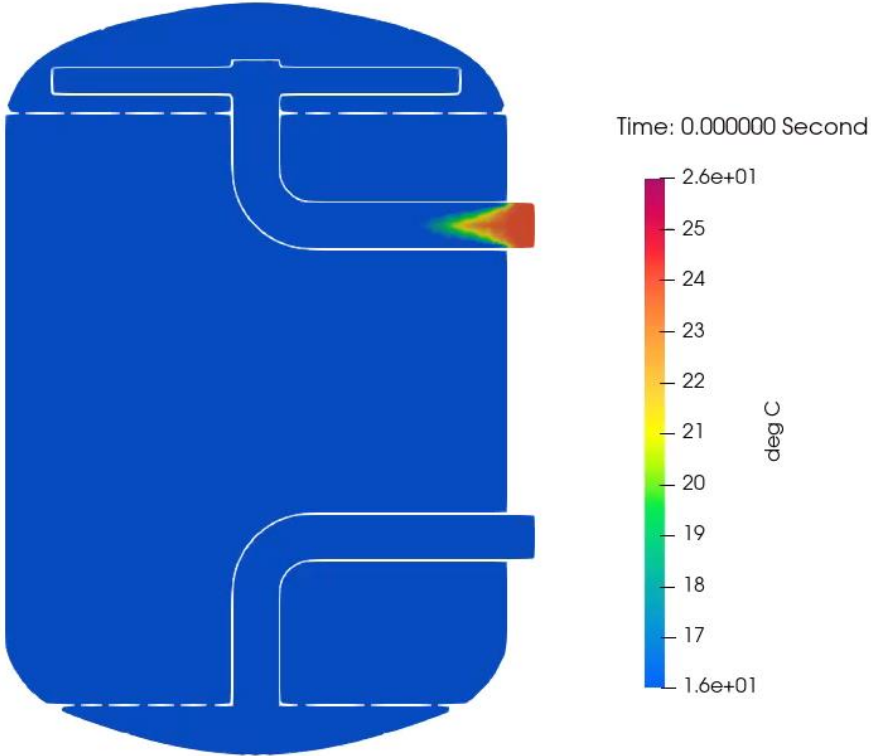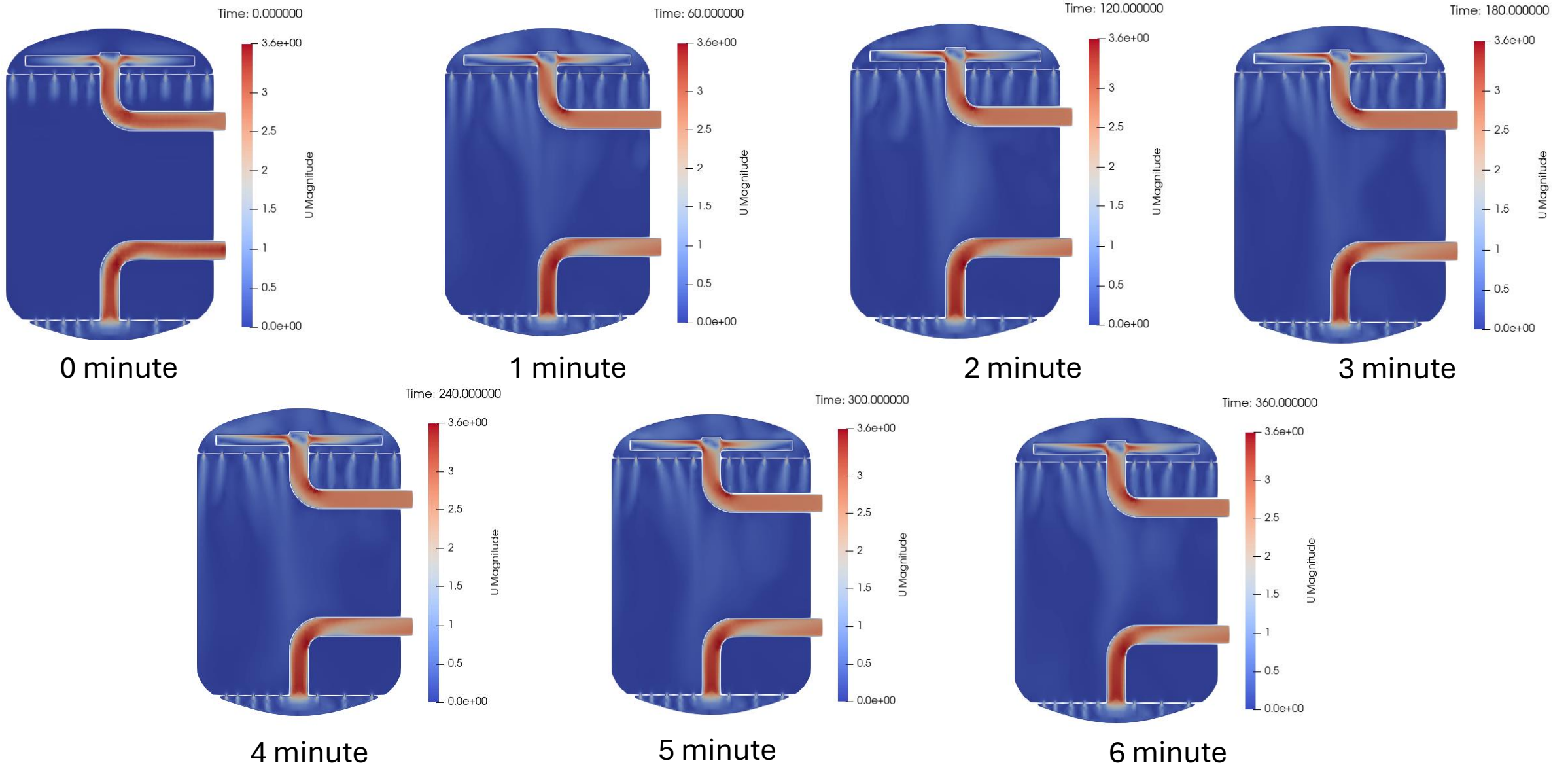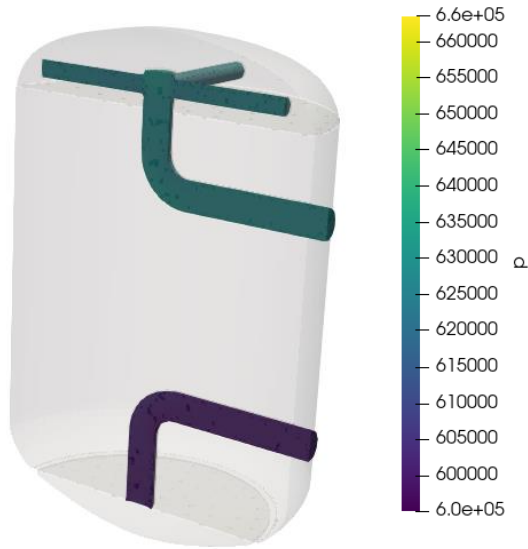
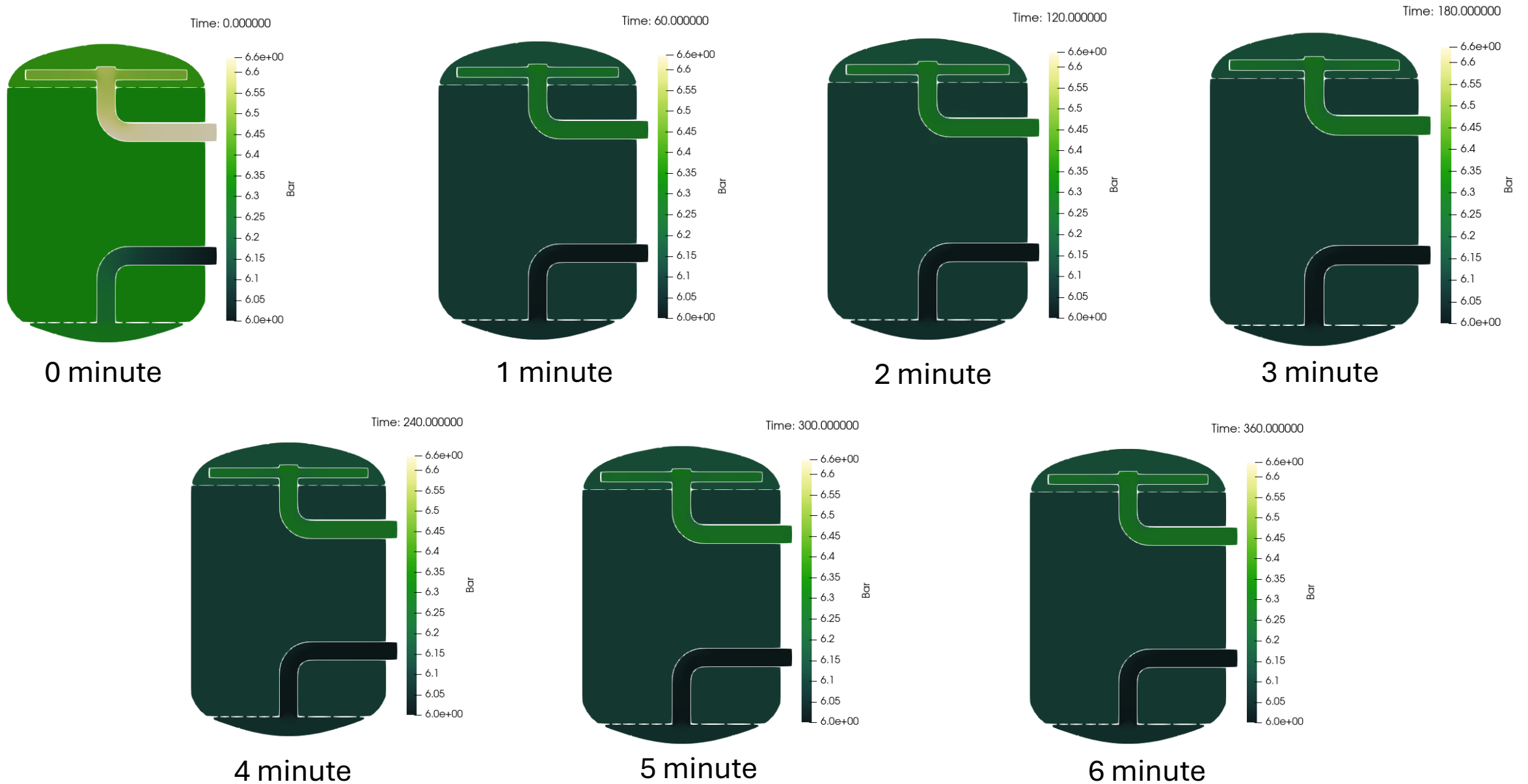Threshold Pressure | Streamline Velocity Vector | Gambar 3D Velocity Contour

Explanation

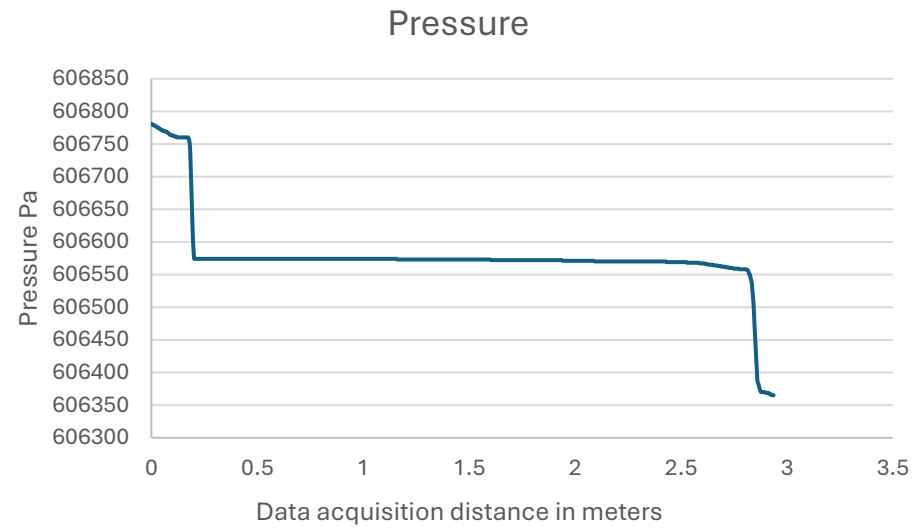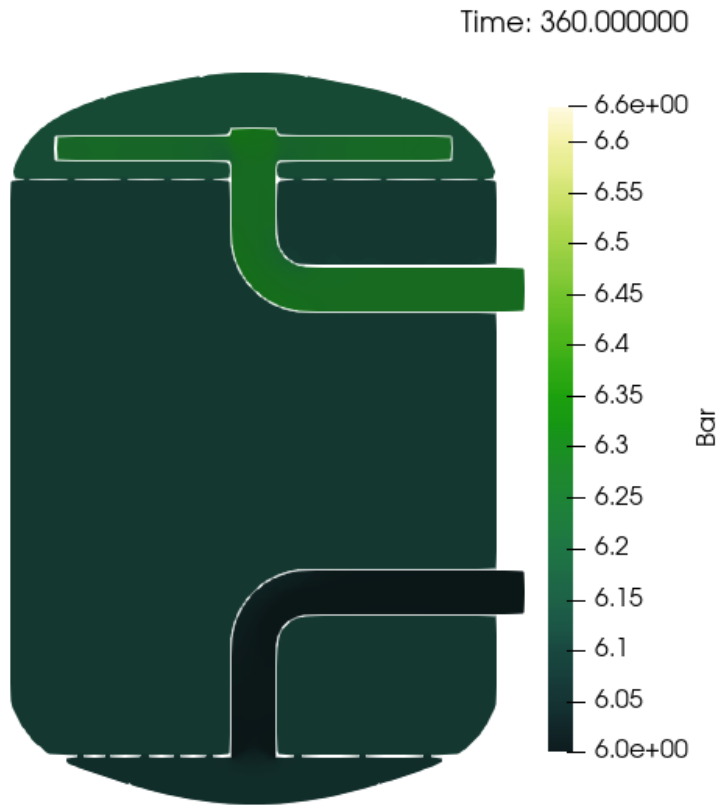- Pressure threshold shows the highest and lowest pressure indicator at inlet and outlet.
- The simulation results indicate that the velocity distribution in the tank has been evenly distributed.
- The velocity streamline shows that the incoming pipe velocity can distribute water well.
- The streamline shows that the streamlines smooth out the water distribution to the tank evenly.

Velocity Animation

Pressure Contour

Time: 0.000000 — 0 minute

Time: 60.000000 — 1 minute

Time: 120.000000 — 2 minute

Time: 180.000000 — 3 minute

Time: 240.000000 — 4 minute

Time: 300.000000 — 5 minute

Time: 360.000000 — 6 minute

Time: 360.000000

Bar

Pressure

Pressure Pa

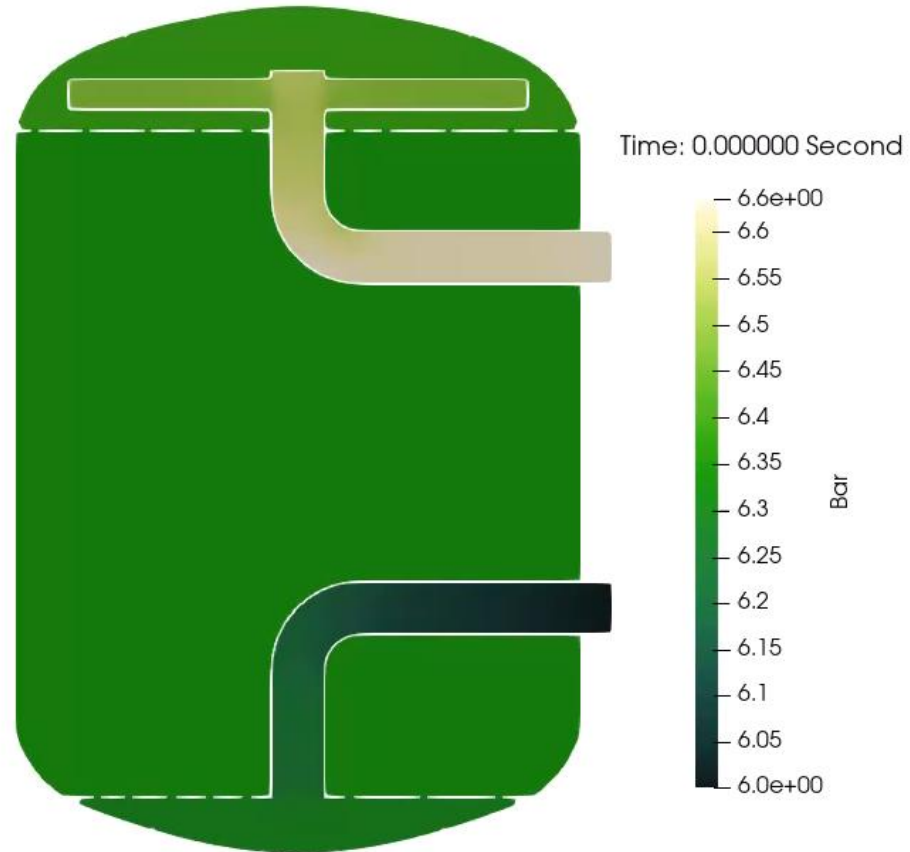Data acquisition distance in meters

Explanation

- The simulation results show a pressure decrease from upper stream side to lower stream position.
- Pressure drop is 8206Pa or (8.206 Kpa)

Pressure Animation

Time: 0.000000 Second

Bar

6.6e+00
6.6
6.55
6.5
6.45
6.4
6.35
6.3
6.25
6.2
6.15
6.1
6.05
6.0e+00

Conclusion

- Pressure drop is 8206Pa or (8.206 Kpa) increase than 25mm
- In this condition, the temperature of the tank increases from 85 second to 260 second significantly.
- The simulation results indicate that the velocity distribution in the tank has been evenly distributed.
- This design can keep the temperature below 26deg C for 6 minute