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CFD ANALYSIS ON HEAT EXCHANGER IN PARALLEL AND COUNTER FLOW DIRECTION BY APPLYING VARIOUS MODELS USING ANSYS SOFTWARE

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ABSTRACT

CFD examination can be utilized to concentrate on the presentation of intensity exchangers with various plans and materials in both equal and counter stream headings. An intensity exchanger is a gadget that is utilized to move heat starting with one liquid then onto the next liquid, without permitting them to blend in with one another. Heat exchangers are utilized in a wide range of uses. Heat exchangers can be arranged into three fundamental sorts: equal stream, counter stream, and cross stream. In an equal stream heat exchanger, the two liquids stream in a similar bearing, lined up with one another. In a counter stream heat exchanger, the two liquids stream in inverse headings, or counter to one another. Furthermore, in cross stream the two streams cross opposite to one another. In this paper I have planned the intensity exchangers tubes in round loop and round snaked shapes with round and hexagonal round and hollow shells to examine the strain and temperature decreases by utilizing the significant and proficient programming Ansys workbench, so we involved various materials for barrel shaped shells Tantalum-carbide and Hafnium-carbide for inside curls and liquid is utilized as water-fluid for both boiling water and cool water for equal stream and counter stream.as the coil is 300mm and the shell is 400mm in both symmetric view so we consider the pressure, velocity and temperature in all the analysis to verify which of them reaches the highest values. So, varieties of heat exchanger and CFD examination is completed in ANSYS 14.0.

Keyword: -Shell and tube heat exchanger, Ansys, Temperature, Pressure and Velocity Heat transfer coefficient, thermal analysis, Parallel and Counter Flow.

1. Introduction

An intensity exchanger is a gadget that moves nuclear power between at least two liquids or gases, which are normally at various temperatures. Computational Liquid Elements (CFD) examination is a strategy that utilizes mathematical techniques and calculations to reproduce and investigate liquid stream, heat move, and other related peculiarities. CFD examination can be utilized to display heat exchangers and dissect their exhibition. By making a three-layered model of the intensity exchanger and reproducing the progression of liquids through it, CFD can be utilized to foresee key boundaries, for example, heat move coefficients, pressure decrease, and liquid temperature dispersion. The CFD examination of intensity exchangers regularly includes a few stages, including math creation, coinciding, limit conditions, and arrangement combination. The math creation includes making a computerized model of the intensity exchanger utilizing programming like ANSYS. This data can be utilized to advance the plan of the intensity exchanger and work on its presentation. By and large, CFD investigation is an integral asset for breaking down heat exchangers, giving definite experiences into liquid stream, heat move, and other significant execution boundaries. The reference paper I have studied in that they have discussed about their analysis in that they select Copper material to the tubes and steel material to shell design then studied in Ansys and optimized the best possible value of temperature variations amongst the discussed materials [7] [28]. so that it may be assumed that no heat transfer is taking place in between shell and surroundings. As per results it is concluded that zigzag pattern tube design gives better heat transfer in heat exchanger as comparison to others. After comparing these results, they found the maximum heat transfer at zigzag pattern of heat exchanger. So zigzag pattern design is optimum design for maximum heat transfer. So, as they have the better values at zigzag pattern [7] [28], so I have decided to make a coil form so that it has more space to convert the liquid in one form to another form within less period. Due to that reason, I have designed this various pattern and the main sole purpose of the heat exchanger is to analyze if there any variations in pressure velocity and temperature and getting that which of the design may get the maximum highest values of than others by using the Ansys workbench Cfd software could be the best software for analysis.

2. Table of dimensions of Heat Exchanger using Ansys

To execute the limited component examination of the intensity exchanger models while heat exchanger tubes course of action upgrades the temperature and the intensity move to the water with the assistance of cylinders, an underlying assessment performed with the utilization of ANSYS Workbench At this step the exploration of the intensity exchanger models is a consistent state, while minor alteration in heat exchanger models material utilized Tantalum-carbide and Hafnium-carbide. The model of the intensity exchanger models is planned in ANSYS Workbench.[7] [28]

Dimensions of cylindrical Tubes	Dimensions of hexagonal Tubes	Dimensions of cylindrical Shell Body	Dimensions of Hexagonal Shell Body	Materials Detail	Types of designs
Hot domain Diameter = 40 mm	Hot domain Diameter = 40 mm	Outer Diameter = 200 mm	Outer Diameter = 180mm	Coil Tubes Material = Hafnium-carbide (Hfc)	Circular coil with cylindrical shell of parallel flow and counter flow
Hot Fluid inlet diameter = 30 mm	Hot Fluid inlet diameter = 30 mm	Inlet cool water dia =80mm	Inlet dia=40mm	Shell Material = Tantalum-carbide (Tac)	
		Outlet cool water dia =80mm	Outlet dia =40mm		

Height of hot water inlet = 150mm	Height of hot water inlet = 150mm	Height of cool water inlet and outlet = 150mm	Height of cool water inlet and outlet dia =150mm		Hexagonal coil with hexagonal shell of parallel flow and counter flow
Length of circle cylindrical coil = 600mm	Length of hexagonal coil = 600mm	Length of cylindrical shell = 800mm	Length of hexagonal shell =800mm	No. of turns for circular coils = 5 No. of turns in hexagonal coil = 5	
Types of flows: k-epsilon standard					
inlet cold fluid temperature: -100°c					
Inlet hot fluid temperature: - 300°c					
Fluid used in both shell & coil: -water-liquid					
Mass flow rate: - 0.05kg/sec at both parallel and counter inlets					
Pressure outlet: -10000pa					
Units: - millimeter					

Table 1 Dimensions of Designs

3. Methodology

According to concentrate on it is found that CFD assessment incorporates for the most part three sorts of advances are depicted:

Pre-Handling: This is the early phase of the CFD recreation process, which serves to appropriately make sense of the calculation. The chose stream space is partitioned into various more modest parts. CFD-GEOM, ANSYS, Lattice, ANSYS, ICEM CFD, T Network and so on are recognized pre-handling programming. Pre-planning incorporates the issue, the formation of a 3D showcase, the Ansys workbench, coinciding and actual working circumstances called limits.

Tackling or Handling: Assuming liquid qualities, stream actual science have been contemplated, and then the circumstances for taking care of them with laptops are restricted. Remarkable business Programming for this design is accessible: CFD++, open Froth, ANSYS CFX, Star CCM, and ANSYS Familiar and so on. Utilizing this thing, the administration necessities for stream science can be perceived. Taking care of includes loosening up mathematical or consistent liquid stream states until the time while taking part is a specialist. This normally expects that the PC perceives a tremendous number of determinations and can require a few hours or a few days.

Post handling: The last step following the outcomes from the solver is to examine the outcomes utilizing different method, for example, weight and speed shape tracks, vector track, smoothest out, temperature type, and so forth after a model is gotten a handle on. Post arranging is either in 2-D or three dimensional straight forward portrayals.[7] [28]

4. Process of Designing patterns and analysis

We get the YZ plane and sketch a Hexagonal at the breadth of 30mm at 100mm separation from Y Pivot and 300mm separation from Z Axis. At the same way the 5 additional Hexagonal were made with same breadth and distance and each Hexagonal ought to be attracted each unique sketch's nevertheless the distance between each Hexagonal has 120mm towards Z Axis so the 5 Hexagonal arrive at the level of 600mm subsequent to finishing the Hexagonal again taking 5 more portrays for lines for provide the way guidance for winding turn as we select range choice and giving the material as frozen and further more giving the contort as 1 so it can make single bend as we need to find the outcomes at specific focuses so this single giving bends can make a stage to come by the outcomes displayed as shown in below [7] [28]

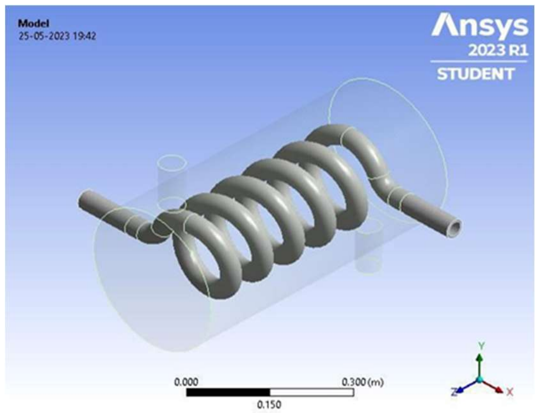

Fig 1: -Circular Coil with Cylindrical shell

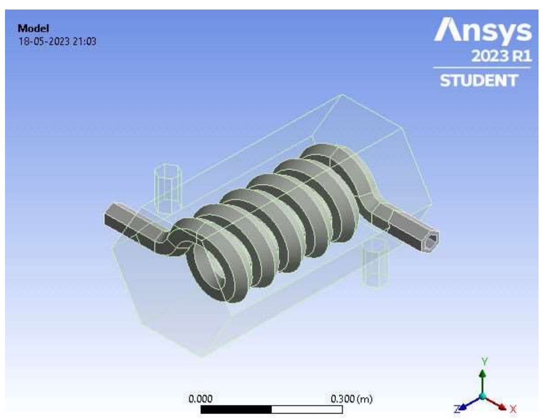

Fig 2: - Hexagonal Coil with Hexagonal Coil

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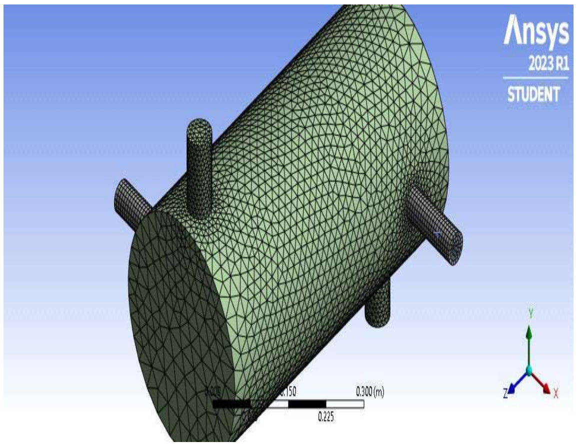
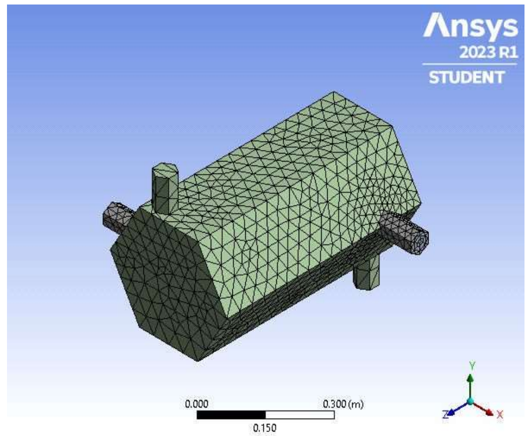
As Meshing finished then we have allocated the name choice as choosing the specific stage and giving them their specific names so they can be effortlessly characterized in additional cycle as named selections play a critical role you can declare your named selections on geometry and use them in subsequent boundary condition definitions. It is a very helpful tool for defining boundary conditions as shown in below figures as along with their given names as they done. here is meshing design for both Hexagonal Coil with Cylindrical shell and Hexagonal Coil with Cylindrical shell





in counter flow and parallel flow .

Fig 1.1: -Meshing Circular Coil with Cylindrical shell   Fig 2.1: -Meshing Hexagonal Coil with Hexagonal shell.

Nodes	47356	Nodes	10456
Elements	230482	Elements	48914
Show Detailed Statistics	No	Show Detailed Statistics	No

Table :2 Meshing nodes and Edges

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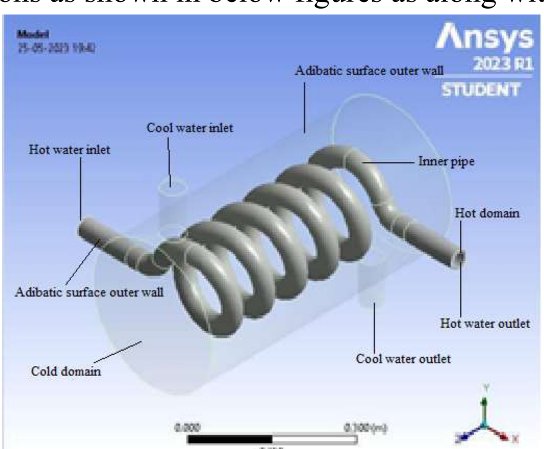
Domain	Boundaries	
cold domain	Boundary - adibatic_surface_outer_wall	
	Type	WALL
	Location	adibatic_surface_outer_wall
	Boundary - cool_water_inlet	
	Type	MASS-FLOW-INLET
	Location	cool_water_inlet
	Boundary - cool_water_outlet	
	Type	PRESSURE-OUTLET
	Location	cool_water_outlet
	Boundary - wall cold_domain inner_pipe shadow	
	Type	WALL
	Location	wall-cold_domain-inner_pipe-shadow
inner_pipe	Boundary - adibataic_surface_inner_wall	
	Type	WALL
	Location	adibataic_surface_inner_wall
	Boundary - hot domain	
	Type	WALL
	Location	hot domain
	Boundary - wall cold_domain inner_pipe	
	Type	WALL
	Location	wall-cold_domain-inner_pipe
	Boundary - wall inner_pipe	
	Type	WALL
	Location	wall-inner_pipe
	Boundary - wall inner_pipe part solid	
	Type	WALL
	Location	wall-inner_pipe-part-solid
part solid	Boundary - hot_water_inlet	
	Type	MASS-FLOW-INLET
	Location	hot_water_inlet
	Boundary - hot_water_outlet	
	Type	PRESSURE-OUTLET
	Location	hot_water_outlet
	Boundary - wall inner_pipe part solid shadow	
	Type	WALL
	Location	wall-inner_pipe-part-solid-shadow

Table 3 Boundary conditions of Heat exchangers in analysis

As Meshing finished then we have allocated the name choice as choosing the specific stage and giving them their specific names so they can be effortlessly characterized in additional cycle as named selections play a critical role you can declare your named selections on geometry and use them in subsequent boundary condition definitions. It is a very helpful tool for defining boundary conditions as shown in below figures as along with their given names as they done.



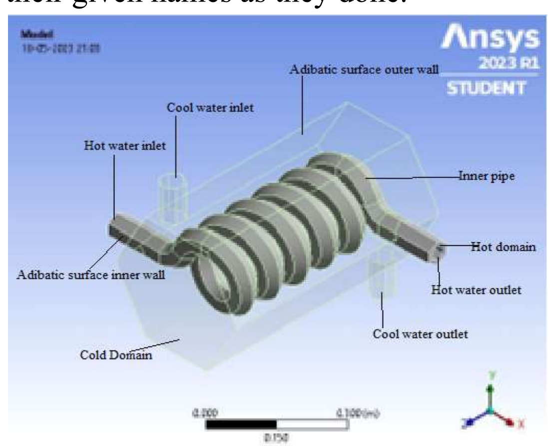


Fig 1.2 Named selection parallel flow Circular Coil with Cylindrical shell

Fig 2.2 Named selection parallel flow. hexagonal coil with hexagonal shell

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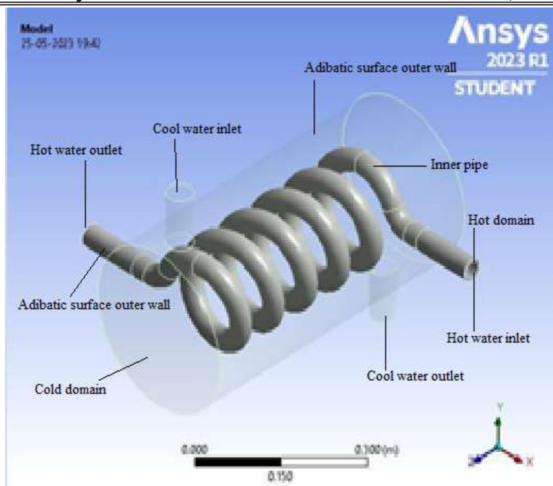

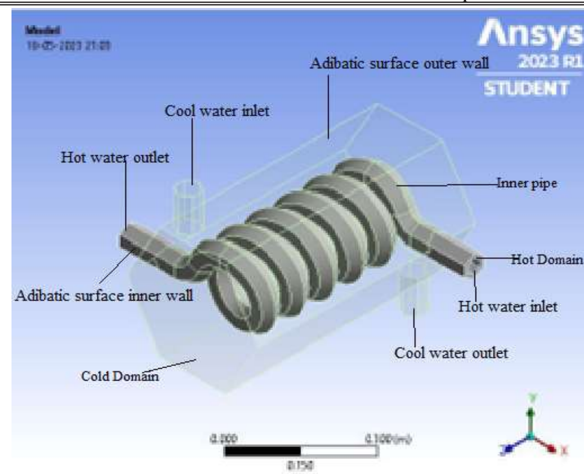

Fig 1.3 Named Selection counterflow flow. Circular Coil with Cylindrical shell

Fig 2.3 Named selection counter flow. hexagonal coil with hexagonal shell

The forthcoming system is SETUP and SOLUTION here the cycle is the planned article is allocated with the various materials and in this I relegated the materials for shell body is Tantalum carbide (tac) and the coil is allotted with Hafnium carbide(hfc) and the flow is K-epsilon standard and the liquid Temperature [water-fluid and the inlet flow are given as mass flow rate 0.05 Kg/s and the outlet is given as pressure outlet at 10000pa and by initialization and Run calculation we can make iterations on the grounds that These qualities are absolutely abstract and will choose the union and the precision of the arrangement upto multiple times and after fulfillment of estimation then, at that point, select Reports opening in that sub choice as Surface integrals then, at that point, select Mass weighted flow and select the choices for figuring the outcomes as heated water channels and outlets and furthermore for cool water channels and outlets As it is the last cycle in the Ansys workbench that Computational Fluid Elements in this we select each channel, outlets, contact areas and interferer segments as pressure then select the plane choice and by giving YZ plane and choosing contacts as color in that pressure, Velocity and Temperature[7] [28]

6. Results and Discussion

1. Cylindrical shell with circular coil Counter flow

The forthcoming system is SETUP and SOLUTION here the cycle is the planned article is allocated with the various materials and in this I relegated the materialsfor shell body is Tantalum carbide (tac) and the coil is allotted with Hafnium carbide(hfc) and the flow is K-epsilon standard and the liquid material is the water-fluid and the inlet flow are given as mass flow rate 0.05 Kg/s and the outlet is given as pressure outlet at 10000pa and by initialization and Run calculation we can make iterations on the grounds that These qualities are absolutely abstract and will choose the union and the precision of the arrangement upto multiple times and after fulfillment of

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estimation then, at thatpoint, select Reports opening in that sub choice as Surface integrals then, at thatpoint, select Mass weighted flow and select the choices for figuring the outcomes as heated water channels and outlets andfurthermore for cool water channels and outlets. As it is the last cycle in the Ansys workbench that Computational Fluid Elements in this we select each channel, outlets, contact areas and Interface segments as pressure then select as shown in below figure of 1.1.1 and 1.1.4 are pressures and Temperature as shown in fig 1.1.2 and 1.1.5 and for the Velocity as shown in fig 1.1.3 and 1.1.6 [7] [28]

Static hot Pressure	pa	Static hot Temperature	°c	Static hot Velocity	m/s
Hot Water Inlet 1	10034.967pa	Hot Water Inlet 1	300°c	Hot Water Inlet 1	0.075749755m/s
Hot Water Inlet 2	10032.117pa	Hot Water Inlet 2	297.69832°c	Hot Water Inlet 2	0.079158787m/s
Hot Water Inlet 3	10026.096pa	Hot Water Inlet 3	292.13403°c	Hot Water Inlet 3	0.079575753m/s
Hot Water Inlet 4	10020.194pa	Hot Water Inlet 4	286.34519°c	Hot Water Inlet 4	0.079164763 m/s
Hot Water Inlet 5	10014.122pa	Hot Water Inlet 5	280.37757°c	Hot Water Inlet 5	0.079551652 m/s
Hot Water Inlet 6	10008.411pa	Hot Water Inlet 6	274.22093°c	Hot Water Inlet 6	0.07921672 m/s
Hot Water Inlet 7	10002.762pa	Hot Water Inlet 7	267.55668°c	Hot Water Inlet 7	0.078279024 m/s
Hot Water outlet	10000 pa	Hot Water outlet	265.66067°c	Hot Water outlet	0.076149216 m/s
Net value	10017.333pa	Net value	282.99886°c	Net value	0.078355549m/s

Table 1.1.1 Hot water pressure Table 1.1.2 Hot water Temperature Table 1.1.3 Hot water Velocity

As it is the last cycle in the Ansys workbench that Computational Fluid Elements in this we select each channel, outlets, contact areas and interferer segments as pressure then select the plane choice and by giving YZ plane and choosing contacts as color in that per Temperature 1.1.2.1, velocity 1.1.3.1, or pressure 1.1.1.1

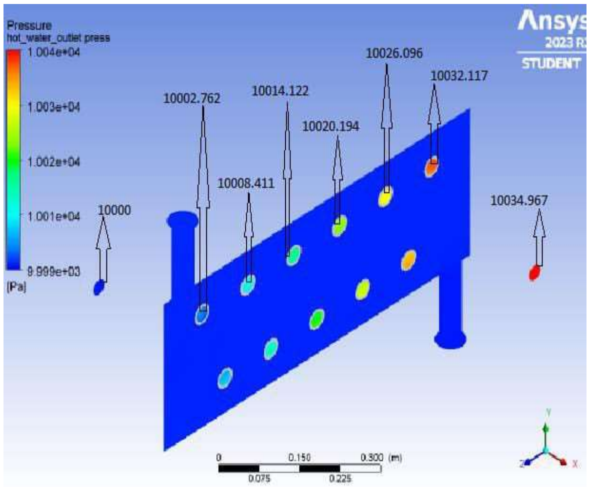

Fig.1.1.1.1 Hot water pressure

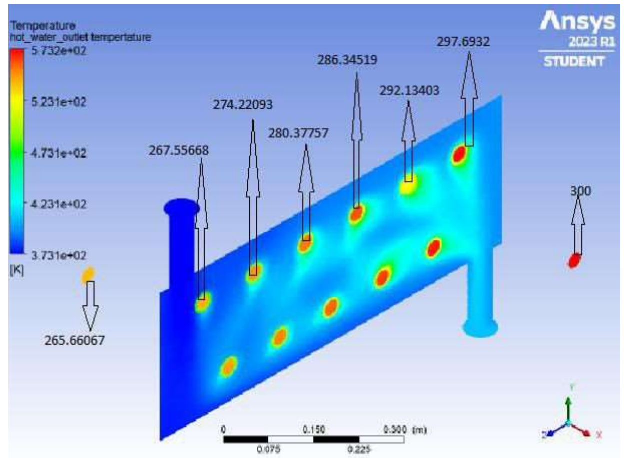

Fig1.1.2.1 Hot water Temperature

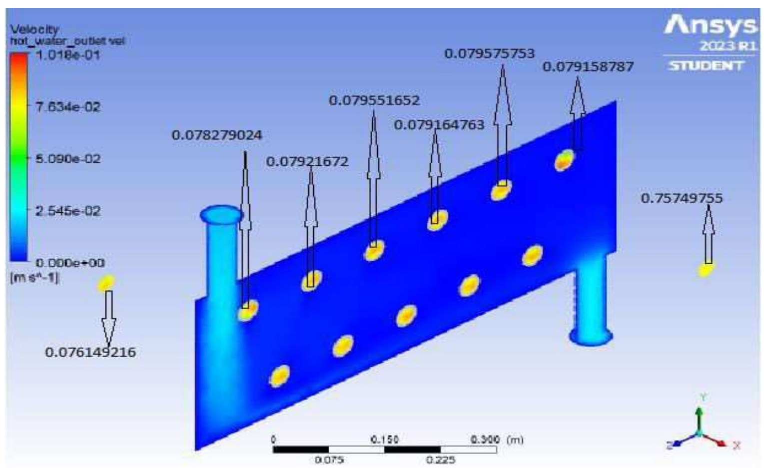

Fig1.1.3.1 Hot water Velocity

The process of this below shown figures the and values is done same as the process that shown in above in 1.1 so that the process is continued in the same step by selecting the temperature by selecting Mass weighted area and select the choices for figuring the outcomes as heated water channels and outlets and furthermore for cool water channels and outlets as shown in below fig 1.1.4,1.1.5 & 1.1.6[7] [28]

Static cool pressure	Pa	Static cool Temperature	°c	Static cool Velocity	m/s
Cool water inlet	10000.406 Pa	Cool water inlet	100°c	Cool water inlet	0.018043169m/s

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Cool water outlet	10000 Pa	Cool water outlet	134.17302°c	Cool water outlet	0.018918542 m/s
Net value	10000.203 Pa	Net value	117.08651°c	Net value	0.018480855 m/s

Table 1.1.4 Cool water pressure Table 1.1.5 Cool water Temperature Table 1.1.6 Cool water Velocity

As it is the last cycle in the Ansys workbench that Computational Fluid Elements in this we select each channel, outlets, contact areas and interferer segments as pressure then select the plane choice and by giving YZ plane and choosing contacts as color in that per Temperature 1.1.5.1, velocity 1.1.6.1, or pressure 1.1.4.1.

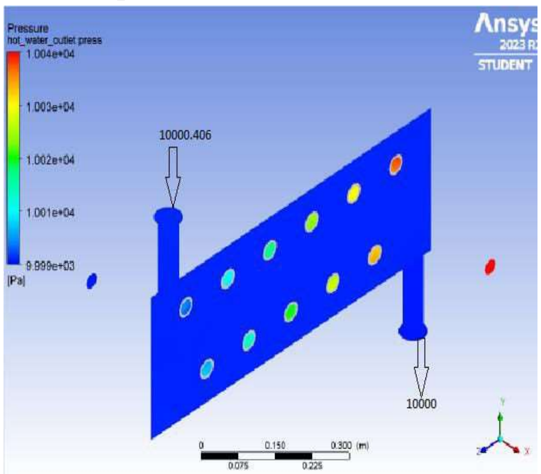

Fig 1.1.4.1 Cool water pressure

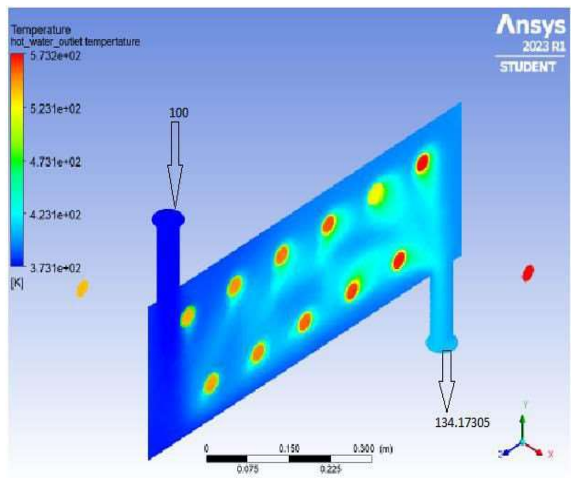

Fig 1.1.5.1 Cool water Temperature

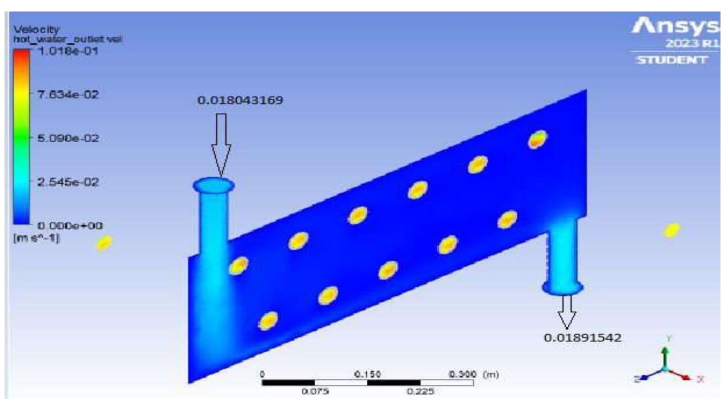

Fig 1.1.6.1 Cool water Velocity

2. Cylindrical shell with Circular coiled Parallel flow

The forthcoming system is SETUP and SOLUTION here the cycle is the planned article is allocated with the various materials and in this I relegated the materials for shell body is Tantalum carbide (tac) and the coil is allotted with Hafnium carbide(hfc) and the flow is 6.2.4 and standard and the liquid material is the water-fluid and the inlet flow are given as mass flow rate 0.05 Kg/s

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and the outlet is given as pressure outlet at 10000pa and by initialization and Run calculation of 500 iterations we can make iterations on the grounds that These qualities are absolutely abstract and will choose the union and the precision of the arrangement up to multiple times and after fulfillment of estimation then, at that point, select Reports opening in that sub choice as Surface integrals then, at that point, select Mass weighted area and select the choices for figuring the outcomes as heated water channels and outlets and furthermore for cool water channels and outlets As it is the last cycle in the Ansys workbench that Computational Fluid Elements in this we select each channel, outlets, contact areas and Interface segments as pressure then select as shown in below figure of 2.2.1 and 2.2.4 and figure of 2.2.2 and 2.2.5 and also for the Velocity as shown in fig 2.2.3 and 2.2.6 [7] [28]

Static hot Pressure	pa	Static hot Temperature	°c	Static hot Velocity	m/s
Hot Water Inlet 1	10026.124 pa	Hot Water Inlet 1	300°c	Hot Water Inlet 1	0.075749755m/s
Hot Water Inlet 2	10034.688 pa	Hot Water Inlet 2	296.63052°c	Hot Water Inlet 2	0.079013214m/s
Hot Water Inlet 3	10031.979 pa	Hot Water Inlet 3	289.26032°c	Hot Water Inlet 3	0.079397094 m/s
Hot Water Inlet 4	10020.418 pa	Hot Water Inlet 4	282.91911°c	Hot Water Inlet 4	0.07916921 m/s
Hot Water Inlet 5	10014.496 pa	Hot Water Inlet 5	277.16946°c	Hot Water Inlet 5	0.079489357m/s
Hot Water Inlet 6	10008.741 pa	Hot Water Inlet 6	271.97504°c	Hot Water Inlet 6	0.079411493m/s
Hot Water Inlet 7	10002.899 pa	Hot Water Inlet 7	267.23494°c	Hot Water Inlet 7	0.07814197 m/s
Hot Water outlet	10000 pa	Hot Water outlet	265.96177°c	Hot Water outlet	0.076503138m/s
Net value	10017.42 pa	Net value	281.3954°c	Net value	0.078359647 m/s

Table 2.2.1 Hot water pressure Table 2.2.2Hot water Temperature Table 2.2.3 Hot water Velocity

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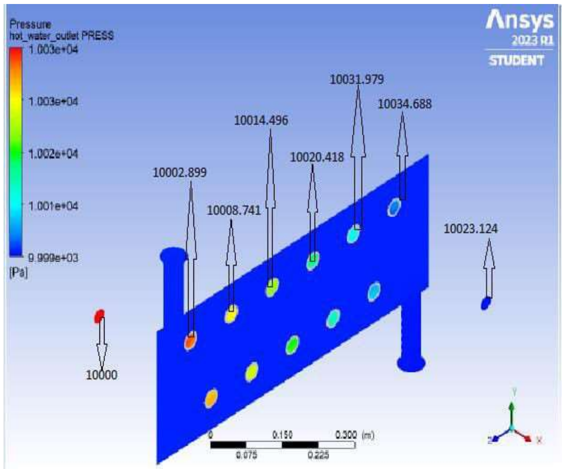
As it is the last cycle in the Ansys workbench that Computational Fluid Elements in this we select each channel, outlets, contact areas and interferer segments as pressure then select the plane choice and by giving YZ plane and choosing contacts as color in that as per Temperature 2.2.2.1, velocity2.2.3.1, or pressure 2.2.1.1.



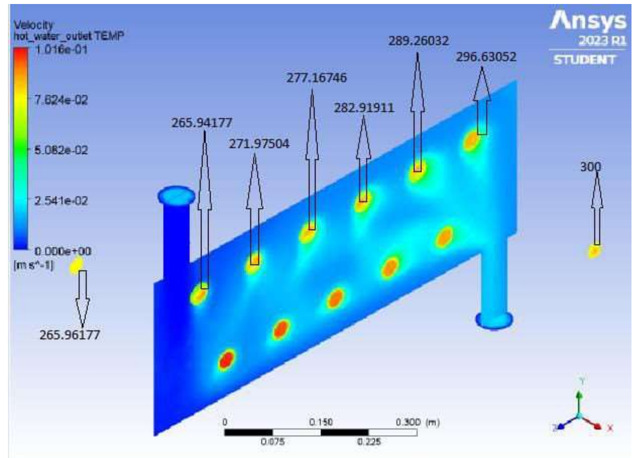


Fig 2.2.1.1 Cool water pressure Fig 2.2.2.1Cool water Temperature

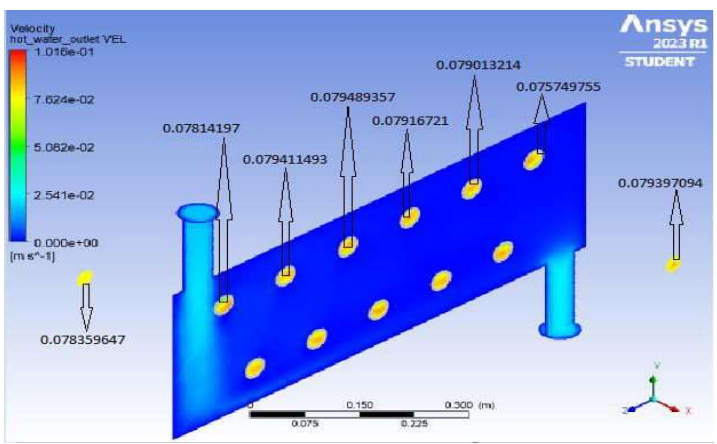


Fig 2.2.3.1Cool water Velocity

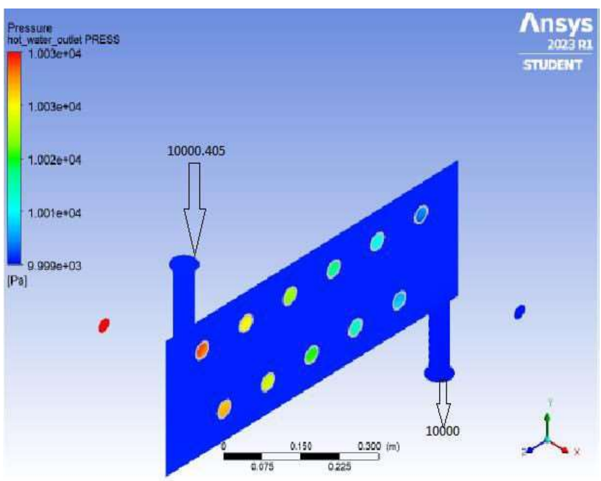
The process of this below shown figures and values is done same as the process that shown in above in 6.2 so that the process is continued in the same step by selecting the temperature by selecting Mass weighted area and select the choices for figuring the outcomes as heated water channels and outlets and furthermore for cool water channels and outlets as shown in below fig 2.2.4,2.2.5 & 2.2.6

Static cool pressure	Pa	Static cool Temperature	°c	Static cool Velocity	m/s

Cool water inlet	10000.405Pa	Cool water inlet	100°c	Cool water inlet	0.018043169m/s
Cool water outlet	10000 Pa	Cool water outlet	133.80714°c	Cool water outlet	0.018905987m/s
Net value	10000.202Pa	Net value	116.90358°c	Net value	0.018474578m/s

Table 2.3.4 Cool water pressure Table 2.3.5 Cool water Temperature Table 2.3.6 Cool water Velocity

As it is the last cycle in the Ansys workbench that Computational Fluid Elements in this we select each channel, outlets, contact areas and interferer segments as pressure then select the plane choice and by giving YZ plane and choosing contacts as color in that as per Temperature 2.3.5.1, velocity 2.3.6.1, or pressure 2.3.4.1.



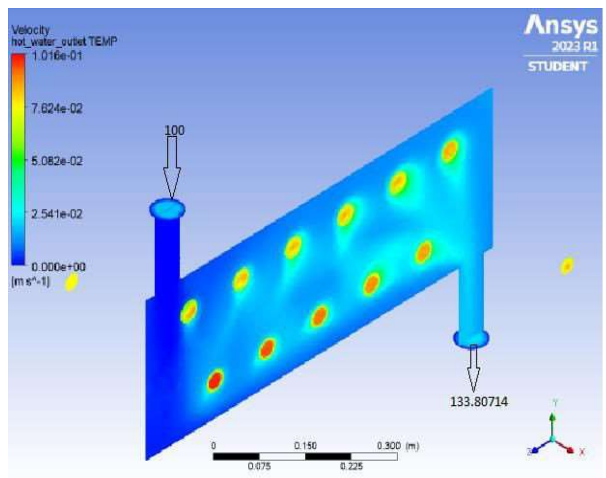


Fig 2.3.4.1 Cool water pressure Fig 2.3.5.1 Cool water Temperature

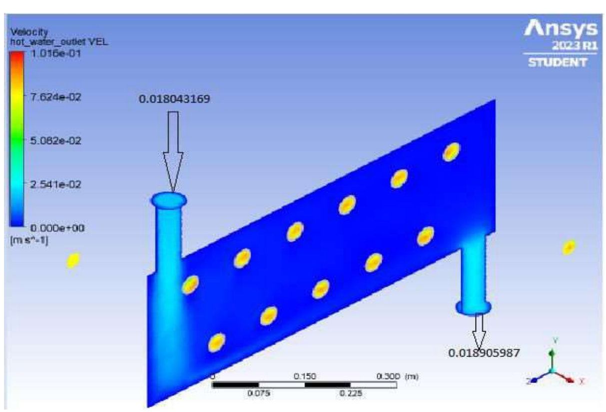


Fig 2.3.6.1 Cool water Velocity

3 Hexagonal shell with hexagonal coiled Parallel flow

The forthcoming system is SETUP and SOLUTION here the cycle is the planned article is allocated with the various materials and in this I relegated the materials for shell body is Tantalum carbide (tac) and the coil is allotted with Hafnium carbide(hfc) and the flow is K-epsilon standard and the liquid material is the water-fluid and the inlet flow are given as mass flow rate 0.05 Kg/s and the outlet is given as pressure outlet at 10000pa and by initialization and Run calculation of 500 iterations we can make iterations on the grounds that These qualities are absolutely abstract and will choose the union and the precision of the arrangement upto multiple times and after fulfillment of estimation

then, at that point, select Reports opening in that sub choice as Surface integrals then, at that point, select Mass weighted area and select the choices for figuring the outcomes as heated water channels and outlets and furthermore for cool water channels 4.2 and As it is the last cycle in the Ansys workbench that Computational Fluid Elements in this we select each channel, outlets, contact areas and Interface segments as pressure then select as shown in below figure of 3.1 and 3.4 and Temperature as shown in fig 3.2 and 3.5 and also for the Velocity as shown in fig 3.3 and 3.6

Static hot Pressure	pa	Static hot Temperature	°c	Static hot Velocity	m/s
Hot Water Inlet 1	10032.347 Pa	Hot Water Inlet 1	300	Hot Water Inlet 1	0.021421903
Hot Water Inlet 2	10032.159 Pa	Hot Water Inlet 2	297.37707	Hot Water Inlet 2	0.022461837
Hot Water Inlet 3	10025.802 Pa	Hot Water Inlet 3	291.43512	Hot Water Inlet 3	0.096327378
Hot Water Inlet 4	10017.101 Pa	Hot Water Inlet 4	286.99792	Hot Water Inlet 4	0.069210863
Hot Water Inlet 5	10009.057 Pa	Hot Water Inlet 5	283.45063	Hot Water Inlet 5	0.064903961
Hot Water Inlet 6	10001.012 Pa	Hot Water Inlet 6	279.13654	Hot Water Inlet 6	0.043088094
Hot Water Inlet 7	10000.269 Pa	Hot Water Inlet 7	273.39075	Hot Water Inlet 7	0.022672816
Hot Water outlet	10000 Pa	Hot Water outlet	271.71295	Hot Water outlet	0.021427358
Net value	10014.504 Pa	Net value	285.37058	Net value	0.047480487

Table 3.1 Hot water pressure Table 3.2 Hot water Temperature Table 3.3 Hot water Velocity

As it is the last cycle in the Ansys workbench that Computational Fluid Elements in this we select each channel, outlets, contact areas and interferer segments as pressure then select the plane choice and by giving YZ plane and choosing contacts as color in that as per Temperature 3.2.1, velocity 3.3.1, or pressure 3.1.1.

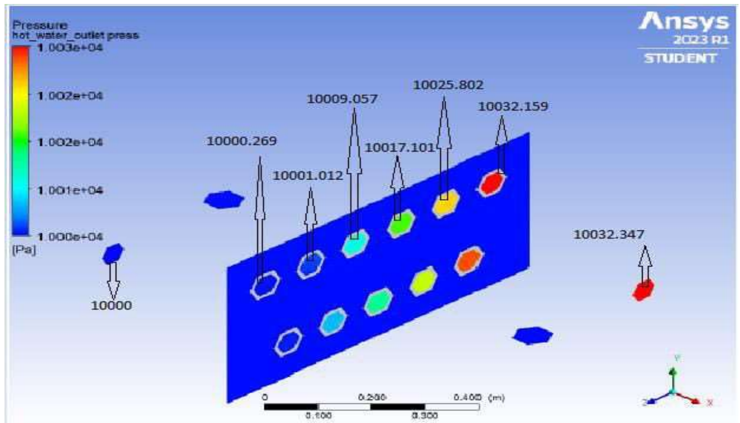


Fig 3.1.1 Hot water pressure

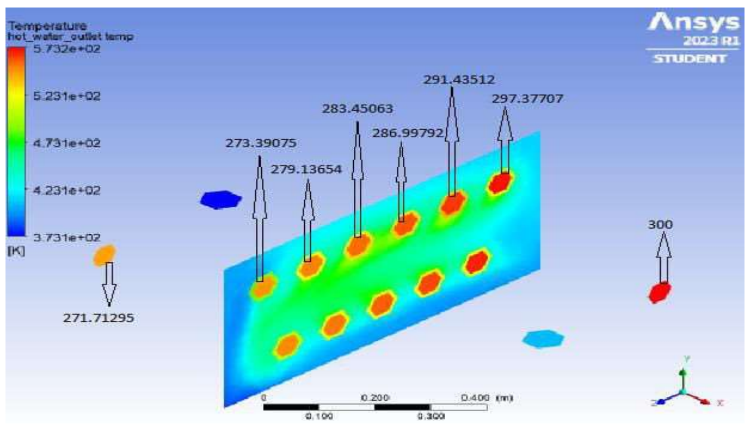


Fig 3.2.1 Hot water Temperature

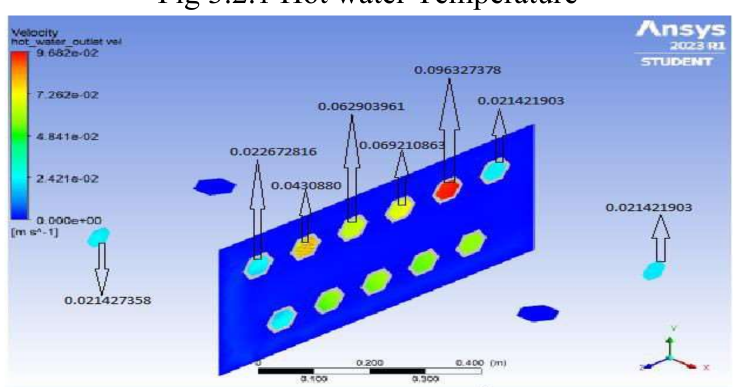


Fig 3.3.1 Hot water Velocity

The process of this below shown figures the and values is done same as the process that shown in above in 3.4 so that the process is continued in the same step by selecting the temperature by selecting Mass weighted area and select the choices for figuring the outcomes as heated water channels and outlets and furthermore for cool water channels and outlets as shown in below fig 3.4.1,3.5.1 & 3.6.1

Static cool pressure	Pa	Static cool Temperature	°c	Static cool Velocity	m/s
Cool water inlet	10000.146Pa	Cool water inlet	100°c	Cool water inlet	0.01204982m/s
Cool water outlet	10000 Pa	Cool water outlet	134.04245°c	Cool water outlet	0.012187456m/s
Net value	10000.073Pa	Net value	117.02111°c	Net value	0.012118638m/s

Table 3.4.1 Cool water pressure Table 3.5.1Cool water Temperature Table 3.6.1 Cool water Velocity

As it is the last cycle in the Ansys workbench that Computational Fluid Elements in this we select each channel, outlets, contact areas and interferer segments as pressure then select the plane choice and by giving YZ plane and choosing contacts as color in that as per Temperature.3.4.1, velocity 3.5.1, or pressure 3.4.1

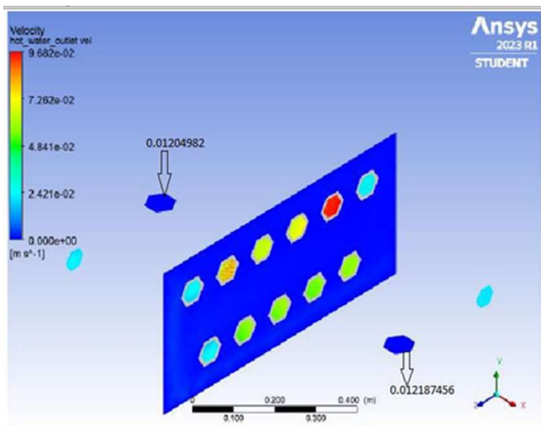


Fig 3.4.1.1 Cool water pressure

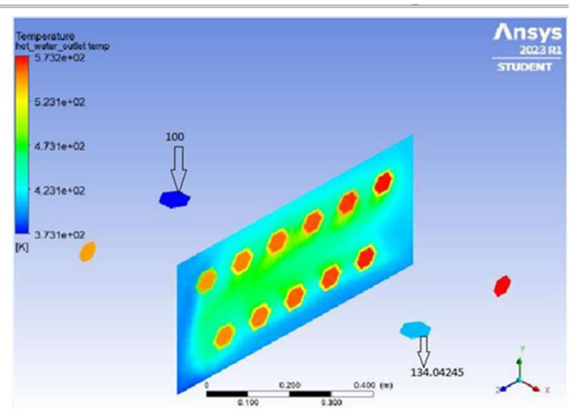


Fig3.5.1.1 Cool water Temperature

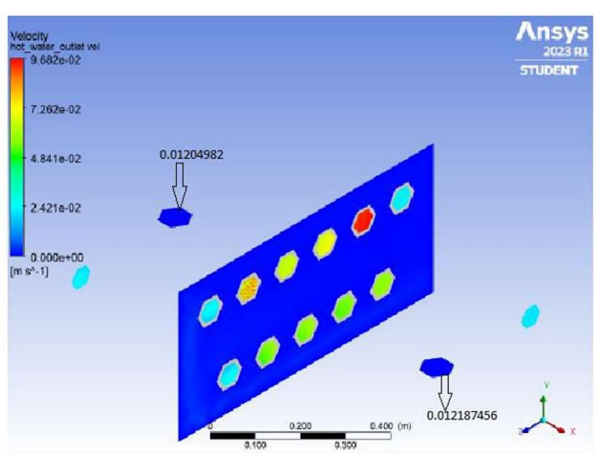


Fig 3.6.1.1 Cool water Velocity

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4 Hexagonal shell with hexagonal coiled Counter flow

The forthcoming system is SETUP and SOLUTION here the cycle is the planned article is allocated with the various materials and in this I relegated the materials for shell body is Tantalum carbide (tac) and the coil is allotted with Hafnium carbide(hfc) and the flow is K-epsilon standard and the liquid material is the water-fluid and the inlet flow are given as mass flow rate 0.05 Kg/s and the outlet is given as pressure outlet at 10000pa and by initialization and Run calculation of 500 iterations we can make iterations on the grounds that These qualities are absolutely abstract and will choose the union and the precision of the arrangement upto multiple times and after fulfillment of estimation then, at that point, select Reports opening in that sub choice as Surface integrals then, at that point, select Mass weighted area and select the choices for figuring the outcomes as heated water channels and outlets and furthermore for cool water channels 4.2 and As it is the last cycle in the Ansys workbench that Computational Fluid Elements in this we select each channel, outlets, contact areas and Interface segments as pressure then select as shown in below figure of 4.1 and 4.4 and Temperature as shown in fig 4.2 and 4.5 and also for the Velocity as shown in fig 4.3 and 4.6

Static hot Pressure	pa	Static hot Temperature	°c	Static hot Velocity	m/s
Hot Water Inlet 1	10026.58 pa	Hot Water Inlet 1	300 °c	Hot Water Inlet 1	0.021421903 m/s
Hot Water Inlet 2	10026.333 pa	Hot Water Inlet 2	295.38333°c	Hot Water Inlet 2	0.024064828 m/s
Hot Water Inlet 3	10025.786 pa	Hot Water Inlet 3	290.54601°c	Hot Water Inlet 3	0.022582094 m/s
Hot Water Inlet 4	10019.579 pa	Hot Water Inlet 4	285.73123°c	Hot Water Inlet 4	0.08030916 m/s
Hot Water Inlet 5	10012.767 pa	Hot Water Inlet 5	276.95327°c	Hot Water Inlet 5	0.065290745 m/s
Hot Water Inlet 6	10006.885 pa	Hot Water Inlet 6	276.95327°c	Hot Water Inlet 6	0.061521733 m/s
Hot Water Inlet 7	10000.904 pa	Hot Water Inlet 7	272.0785°c	Hot Water Inlet 7	0.05756541m/s
Hot Water outlet	10000 pa	Hot Water outlet	269.91429°c	Hot Water outlet	0.026996851 m/s
Net value	10014.57 pa	Net value	283.60457°c	Net value	0.046682321 m/s

Table 4.1 Hot water pressure

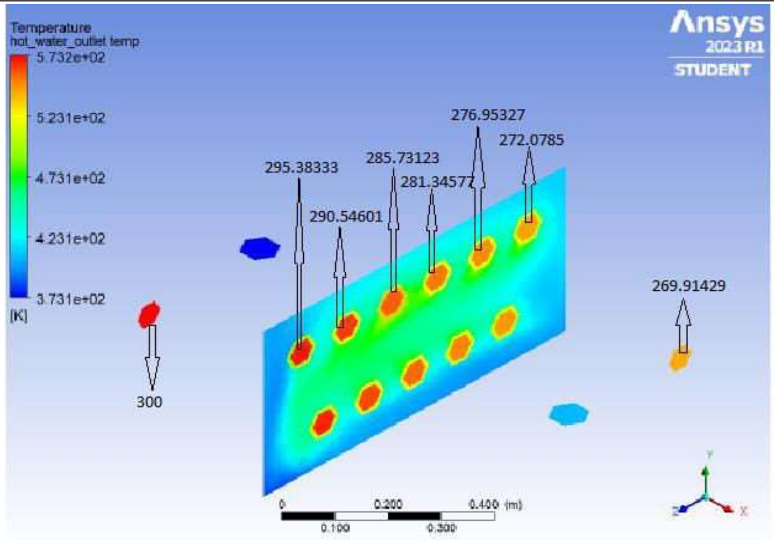
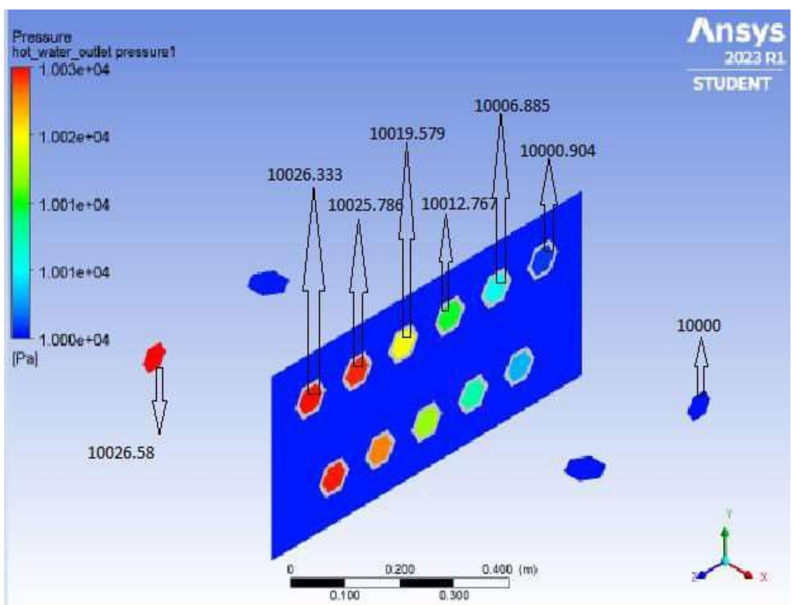


Fig 4.2.1 Hot water Temperature



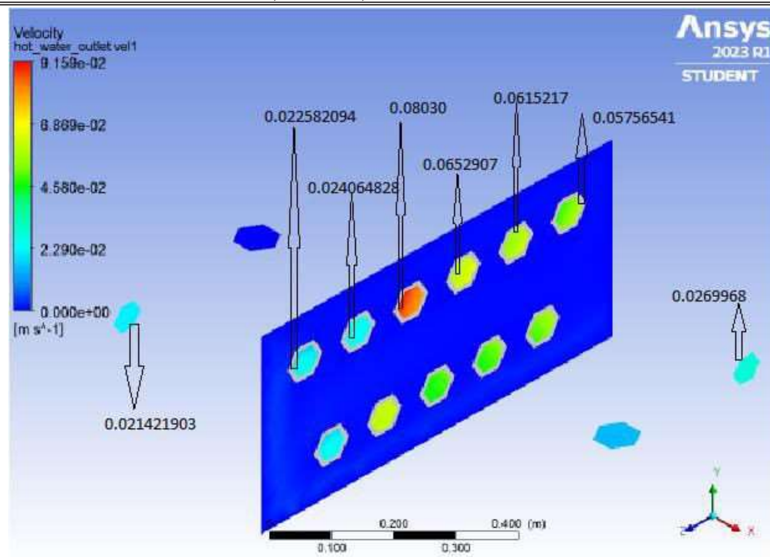


Fig 3.3.1 Hot water Velocity

The process of this below shown figures the and values is done same as the process that shown in above in 4.4 so that the process is continued in the same step by selecting the temperature by selecting Mass weighted area and select the choices for figuring the outcomes as heated water channels and outlets and furthermore for cool water channels and outlets as shown in below fig 4.4.1,4.5.1 & 4.6.1

Static cool pressure	Pa	Static cool Temperature	°c	Static cool Velocity	m/s
Cool water inlet	10000.146 Pa	Cool water inlet	100°c	Cool water inlet	0.01204982 m/s
Cool water outlet	10000 Pa	Cool water outlet	133.64077°c	Cool water outlet	0.012187698 m/s
Net value	10000.073 Pa	Net value	116.82036°c	Net value	0.012118759 m/s

Table 4.4.1 Cool water pressure Table 4.5.1Cool water Temperature Table 4.6.1 Cool water Velocity

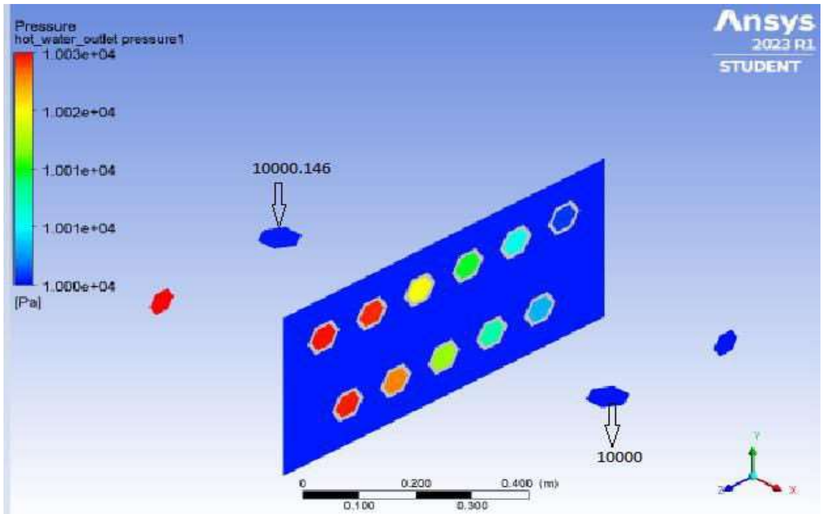


Fig 4.4.1.1 Hot water pressure

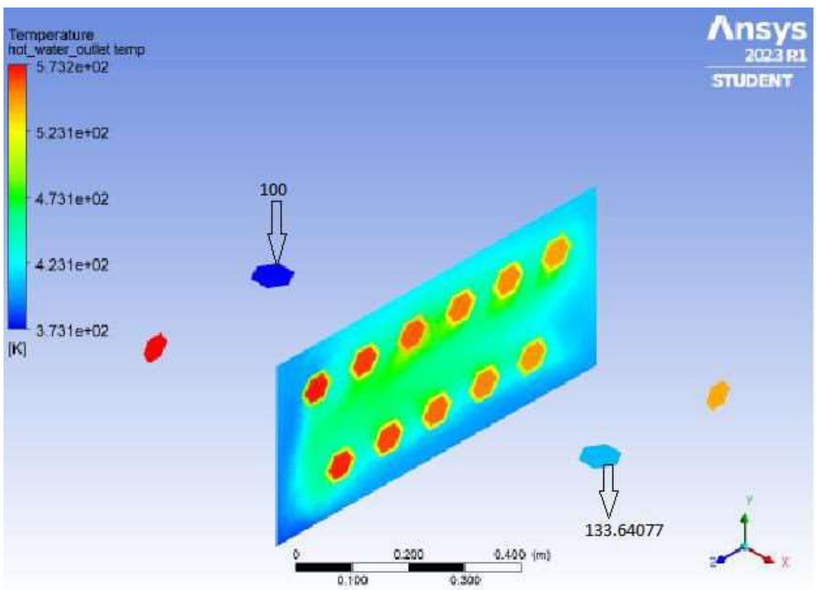


Table 4.5.1.1Cool water Temperature

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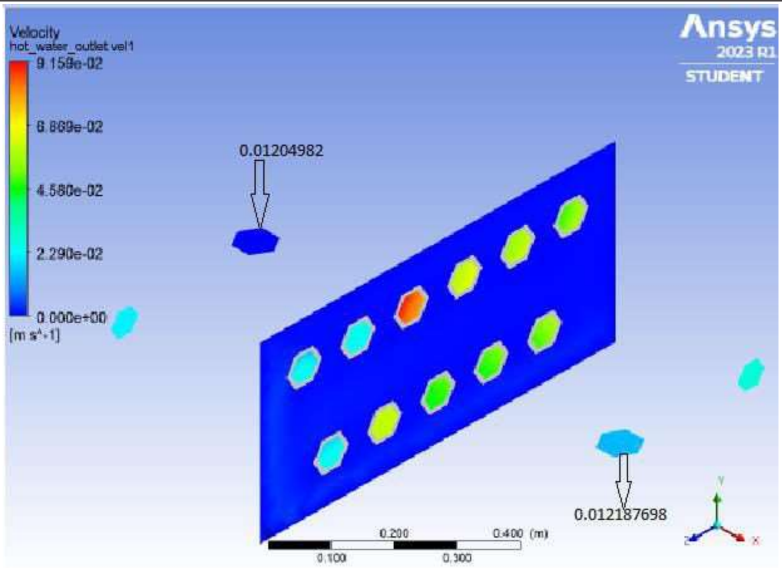


Table 4.6.1.1 Cool water Velocity

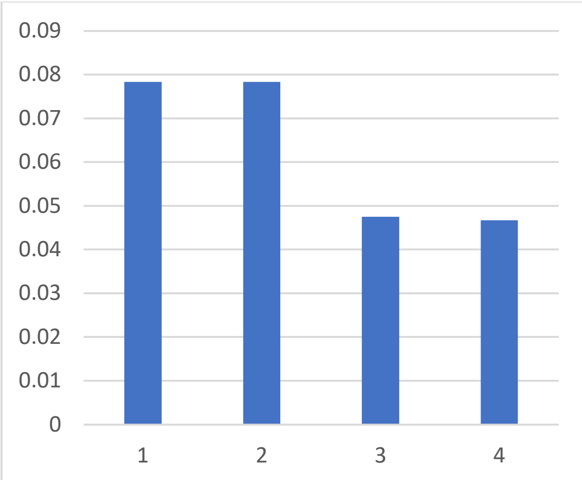
5 Table of Maximum Net Values of each analysis Results

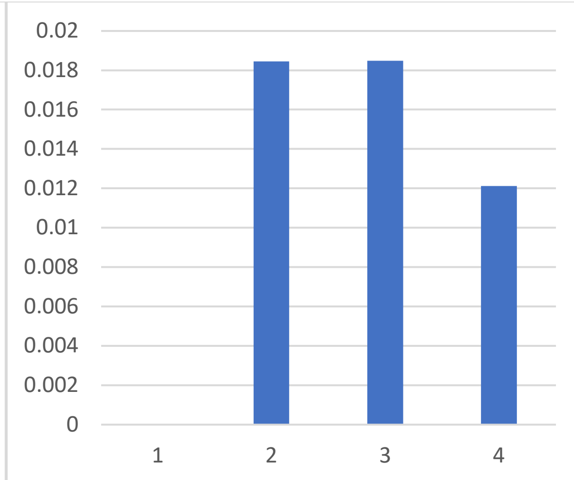
Here is table 5.1 of maximum net value of pressure that taken from the above computing values that defined from mass weighted area process in setup and solutions.

Number of different analyses done in this process	Net values of each analysis process at hot pressure Pa	Net values of each analysis process at Cool water pressure Pa
1.Cylindrical shell with circular coiled counter flow	10017.333 Pa	10000.203 Pa
2.Cylindrical shell with circular coiled parallel flow	10017.42Pa	10000.202 Pa
3.Hexagonal shell with hexagonal coiled Counter flow	10014.504 Pa	10000.073 Pa
4.Hexagonal shell with hexagonal coiled Counter flow	10014.57 Pa	10000.073Pa

Table 5.1 Maximum net values of pressure in both hot and cool water of both parallel &counter flow

The below shown Graphs 5.1.1 & 5.1.2 are the Graph bar view for the above shown table 5.1 to understand the maximum values of Pressure of both Hot fluid and cold fluid.





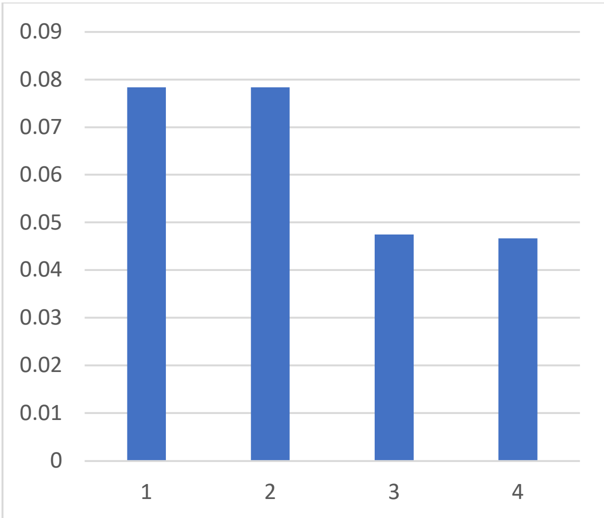
Graph 5.1.1: Maximum Net value of hot water pressure Graph 5.1.2Maximum Net value of cool water pressure

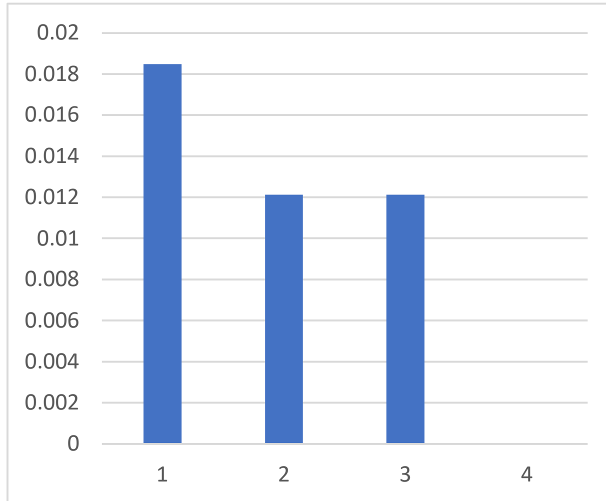
Here is table 5.2 of maximum net value of Temperature that taken from the above computing values that defined from mass weighted area process in setup and solutions.

Number of different analyses done in this process	Net values of each analysis process at hot water Temperature °c	Net values of each analysis process at Cool water Temperature °c
Cylindrical shell with circular coiled counter flow	282.99886 °c	117.08651 °c
Cylindrical shell with circular coiled counter flow	281.3954 °c	116.90358 °c
Hexagonal shell with hexagonal coiled Counter flow	285.37058°c	117.02111 °c
Hexagonal shell with hexagonal coiled Counter flow	283.60457 °c	116.82036°c

Table 5.2Maximum net values of Temperature in both hot and cool water of both parallel &counter flow

The below shown Graphs 5.2.1 & 5.2.2 are the Graph bar view for the above shown table 5.2 to understand the maximum values of Temperature of both Hot fluid and cold fluid.





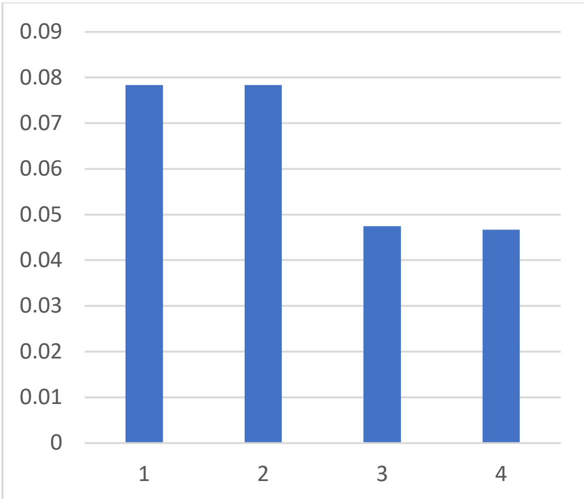
Graph 5.2.1Maximum Net value of hot water Temp Graph 5.2.1.2Maximum Net value of Cool water Temp

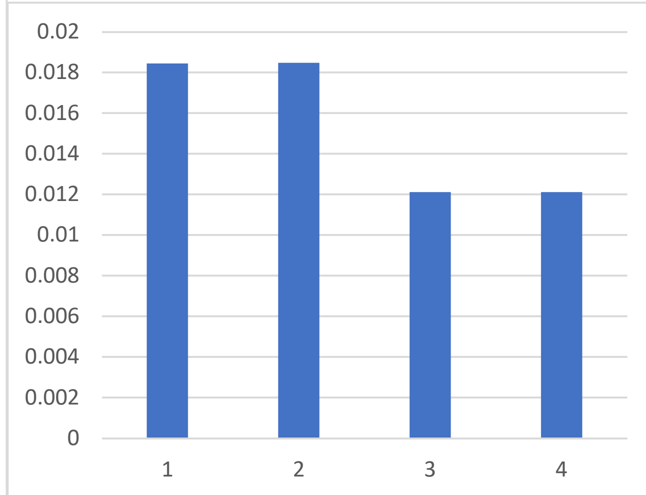
Here is the table 5.3of maximum net value of Velocity that taken from the above computing values that defined from mass weighted area process in setup and solutions.

Number of different analyses done in this process	Net values of each analysis process at Hot water Velocity[m/s]	Net values of each analysis process at Cool water Velocity[m/s]
1.Cylindrical shell with circular coiled counter flow	0.078355549 [m/s]	0.0184480855 [m/s]
2.Cylindrical shell with circular coiled counter flow	0.078359647 [m/s]	0.018474578 [m/s]
3.Hexagonal shell with hexagonal coiled Counter flow	0.047480487 [m/s]	0.012118638[m/s]
4.Hexagonal shell with hexagonal coiled Counter flow	0.046682321 [m/s]	0.012118759 [m/s]

Table 5.3 Maximum net values of Velocity in both hot and cool water of both parallel &counter flow

The below shown Graphs 5.3.1 & 5.3.2 are the Graph bar view for the above shown table 5.3 to understand the maximum values of Velocity of both Hot fluid and cold fluid.





Graph 5.3.1Maximum Net value of hot water Velocity Graph 5.3.2 Maximum net value of cool water velocity

6 Conclusion

- In this paper I have planned the intensity exchangers tubes in round loop and hexagonal snaked shapes with round and hexagonal round and hollow shells.
- To examine the strain, velocity and temperature decreases by utilizing the significant and proficient programming Ansys workbench.
- so, we involved various materials for barrel shaped shells Tantalum-carbide and Hafnium-carbide for inside curls and liquid is utilized as water-fluid for both boiling water and cool water for equal stream and counter stream.
- So, as we saw in the above examination that hexagonal shell with Tube shaped looped Counter stream has the maximum most elevated esteems.
- That contrasted with staying 3 investigations with the Heated water pressure worth of 10017.333 [Pa] Boiling water Temperature worth of 285.37058°c yet in coming to speed the hexagonal shell with Round and hollow curled Equal stream has the most elevated that other examination with worth of boiling water Speed 0.078359647 [m/s].
- Hexagonal shell with Tube shaped wound Counter stream has the most elevated vales even in cool water stream of tension 10000.073pa.
- However, in Temperature and speed the hexagonal shell with Barrel shaped snaked Equal stream has the most elevated values when contrasted with counter stream that cool water Temperature 117.08651 °c and Cool water Speed 0.018474578 [m/s]
- As in this way I have analyzed each process by using Ansys workbench tool [7] [28]

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