LODHA ACME OZONE CFD ANALYSIS OF ODU UNITS

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Shaft-2 CFD analysis results at 80% running of all outdoor units: .....**Error! Bookmark not defined.**
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Shaft-2 CFD analysis results at 60% running of all outdoor units .....**Error! Bookmark not defined.**
Shaft -3.....**Error! Bookmark not defined.**
Shaft-3 CFD analysis results at 100% running of all outdoor units: .....**Error! Bookmark not defined.**
Shaft-3 CFD analysis results at 100% running of all outdoor units Conclusion:.....**Error! Bookmark not defined.**

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Abstract:

The efficiency of the split-type air conditioner, which consists of indoor and outdoor units, is determine by the refrigeration cycle efficiency of its condensation, compression and evaporation processes. The key factors that affect the performance of the outdoor unit are the airflow profile and the refrigerant pressure at the compressor discharge. If the airflow rate decreases, the discharge pressure of the compressor increases. This will cause the power consumption to increase and overall efficiency to drop. One of the factors affecting the airflow profile is the installation distance between the outdoor unit and the wall. The distance of this wall gap is crucial because it affects the static pressure in the gap. This static pressure interferes with the airflow towards the outdoor unit. Therefore, the smaller the gap, the higher the static pressure and hence less air will flow through the outdoor unit. The purpose of this research is to study the airflow of a split-type outdoor air conditioner unit when it is placed in a shaft and investigate its optimum placement in the shaft. For the first stage of this investigation, the 3D CAD modelling of the outdoor unit was completed using Design builder software.

Introduction

Most of the residential area uses split-type air conditioner units because they are smaller than other types of air conditioner units.

A split-type air conditioner unit consists of two different parts which are the indoor and outdoor units. The indoor unit contains an evaporator while the outdoor unit contains a compressor and a condenser. The indoor unit absorbs heat inside the room while the outdoor unit releases the heat into the air through a heat exchange process inside the unit.

This research will focus mainly on the outdoor unit as tasked by the industrial partner. In the process of designing the outdoor unit, there are certain conditions that must be applied, one of which is that the heat exchanger inside the outdoor unit must not be obstructed by other parts so that the air may flow through it. The flow of the air is created when the surrounding air is drawn in by a fan through the condenser and then discharged into the surroundings. In order to quantify the air passing through the heat exchanger, air volumetric flow rate is used.

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There are many factors affecting the performance of the outdoor unit and one of them is the installation distance between the shaft and the outdoor unit. The shaft gap distance is closely related to the air flow and it is necessary for the heat exchange process. Hence, the shaft gap affecting the performance of the outdoor unit and the performance of the air conditioner system can be evaluated using the 3D model.

The effect of the of the placement and re-entry of the outdoor unit. The author stated that the placement of the outdoor unit for all kinds of re-entrant played an important role in the performance. Also, that in increasing the number of the outdoor units placed together at tall buildings, the heat rejected will accumulate and cause a mass of heat around the system and hence affect the performance of the outdoor unit.

Computational Fluid Dynamic (CFD) simulation is one of the best ways to identify the air flow around the outdoor unit.

This research's objectives are to investigate the relationship between the air flow rate, measured in cubic feet per minute (CFM), with the installation distance of the outdoor unit from the wall and to predict the operating pressure of the compressor. CFD simulation is carried out to investigate the air flow rate when the outdoor unit is place at a certain wall gap distance

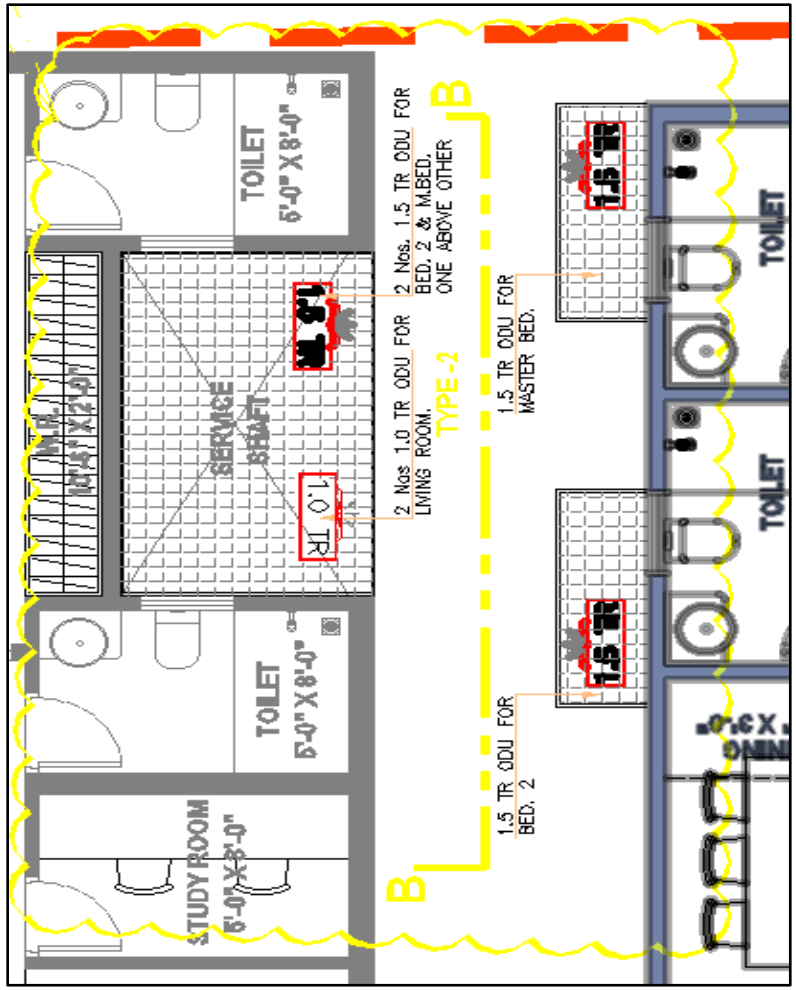
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CFD Analysis of LODHA ACME Ozone:

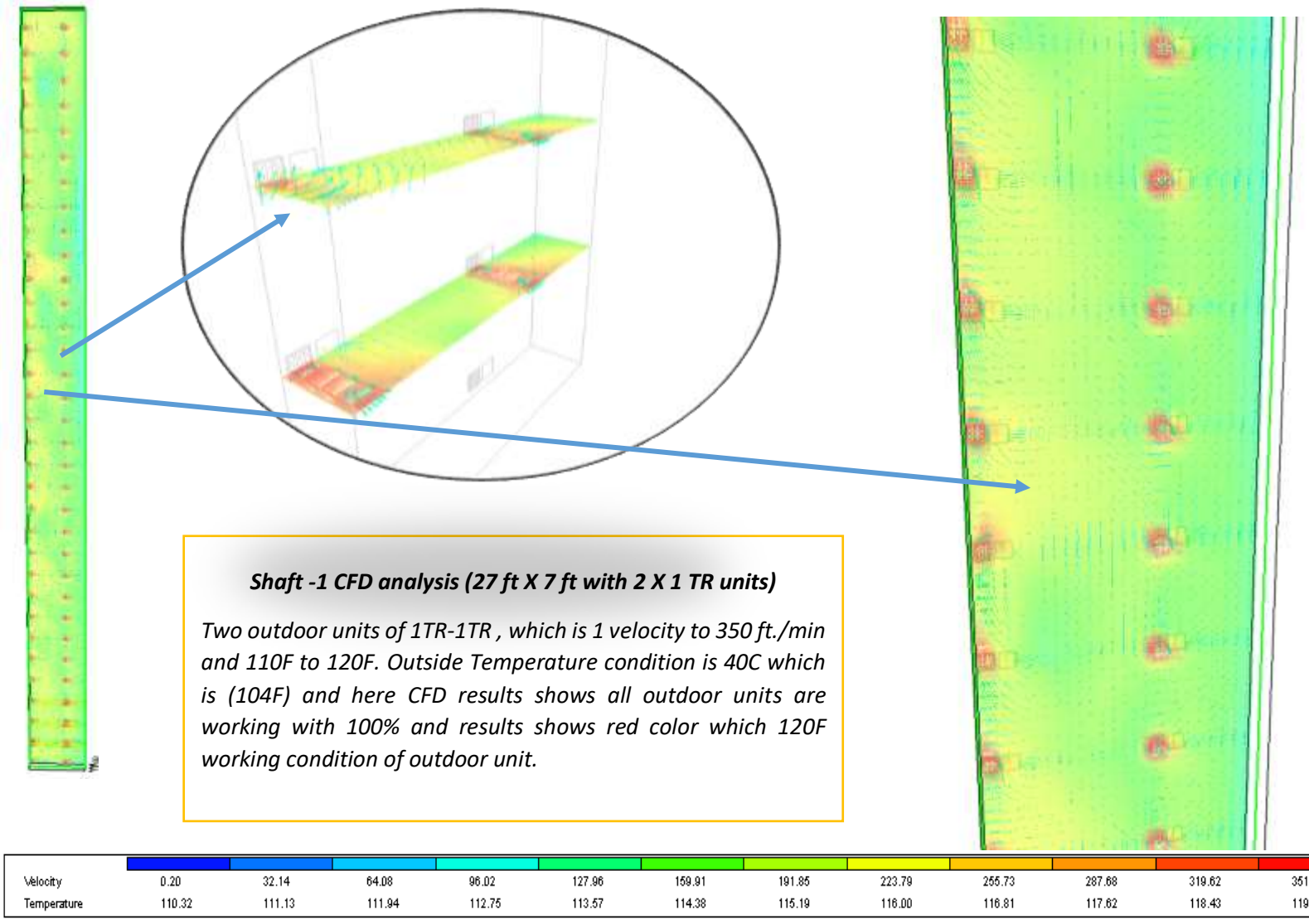
1. **Corridor and Shaft -1**
2. **Shaft-2**
3. **Shaft-3**
4. **Shaft-4**
5. **Corridor-1**
    - **Shaft-1**
    - **Shaft-2**
    - **Corridor-1**

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Corridor and Shaft -1:



Corridor CFD analysis results at 100% running of all outdoor units:



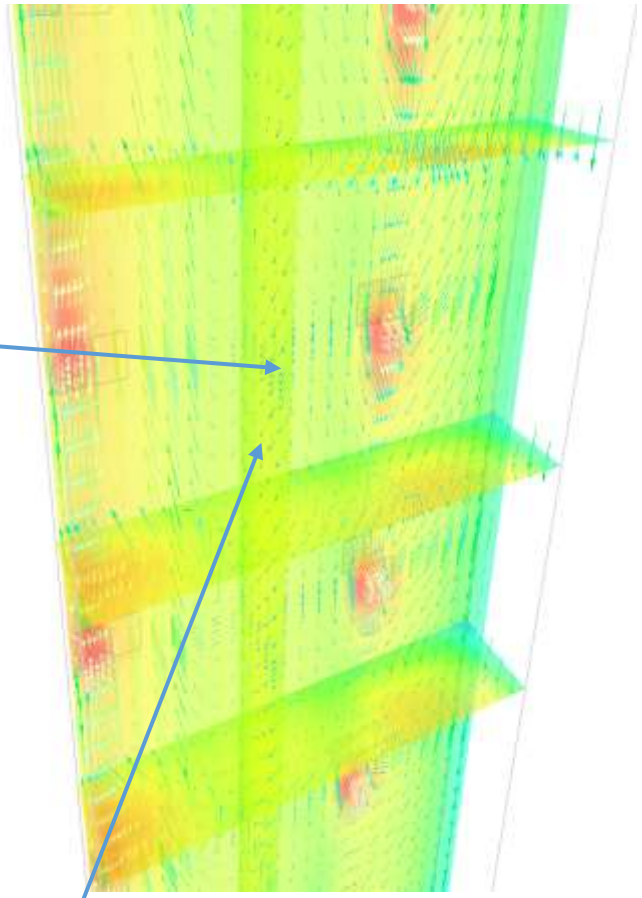
Shaft -1 CFD analysis (27 ft X 7 ft with 2 X 1 TR units)

Two outdoor units of 1TR-1TR , which is 1 velocity to 350 ft./min and 110F to 120F. Outside Temperature condition is 40C which is (104F) and here CFD results shows all outdoor units are working with 100% and results shows red color which 120F working condition of outdoor unit.

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Corridor CFD analysis results at 100% running of all outdoor units Conclusion:





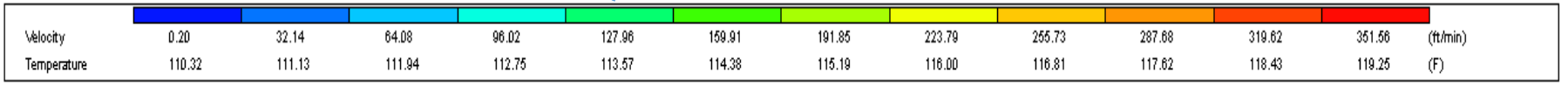
Shaft -2CFD analysis:

For top floor green color is coming in the above floor which is generally normal temperature profile, as per CFD simulation results are showing that Top floor required need to exhaust fan

Analysis results are showing that outdoor unit exhaust air arrows are also moving in middle and showing in yellow color

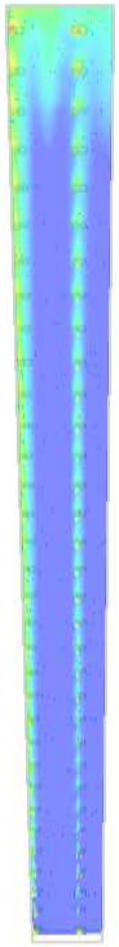
Shaft -1 CFD analysis:

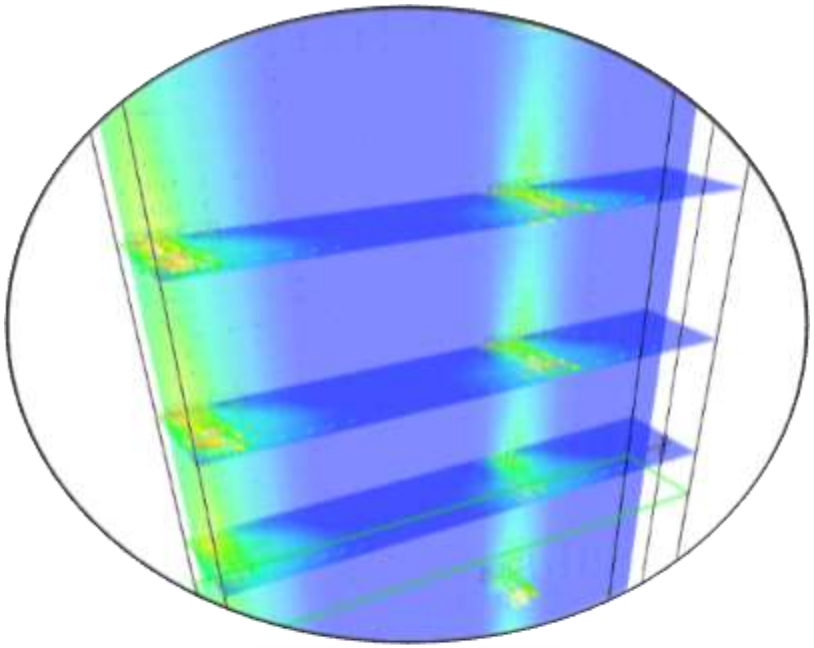
Conclusion *– No Need to add exhaust fan above top roof to extract all air from Corridor.*

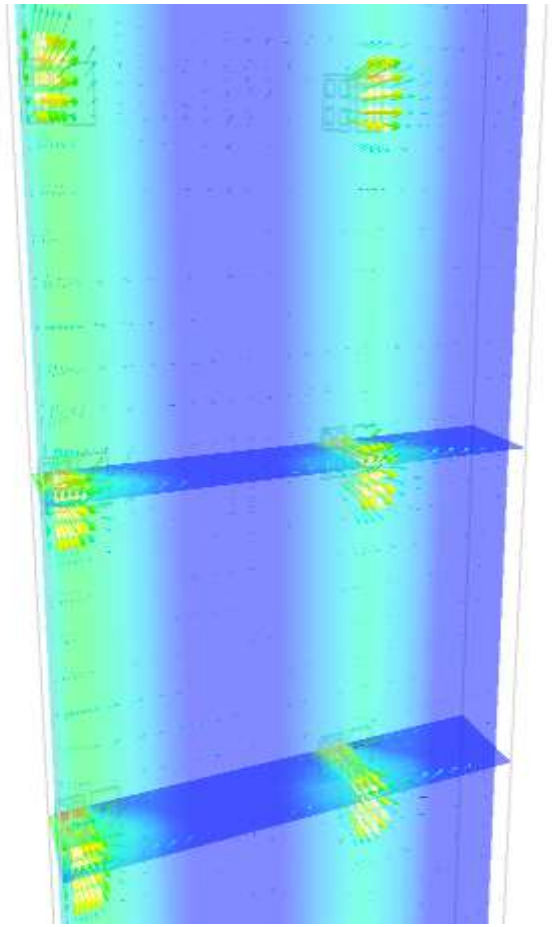


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Corridor CFD analysis results at 80% running of all outdoor units:

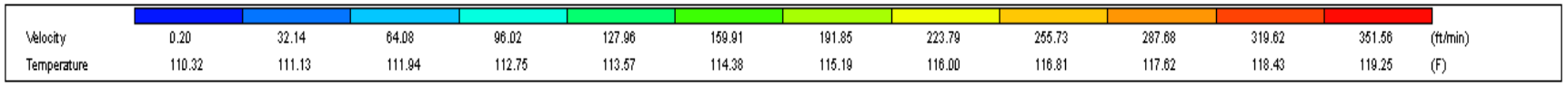






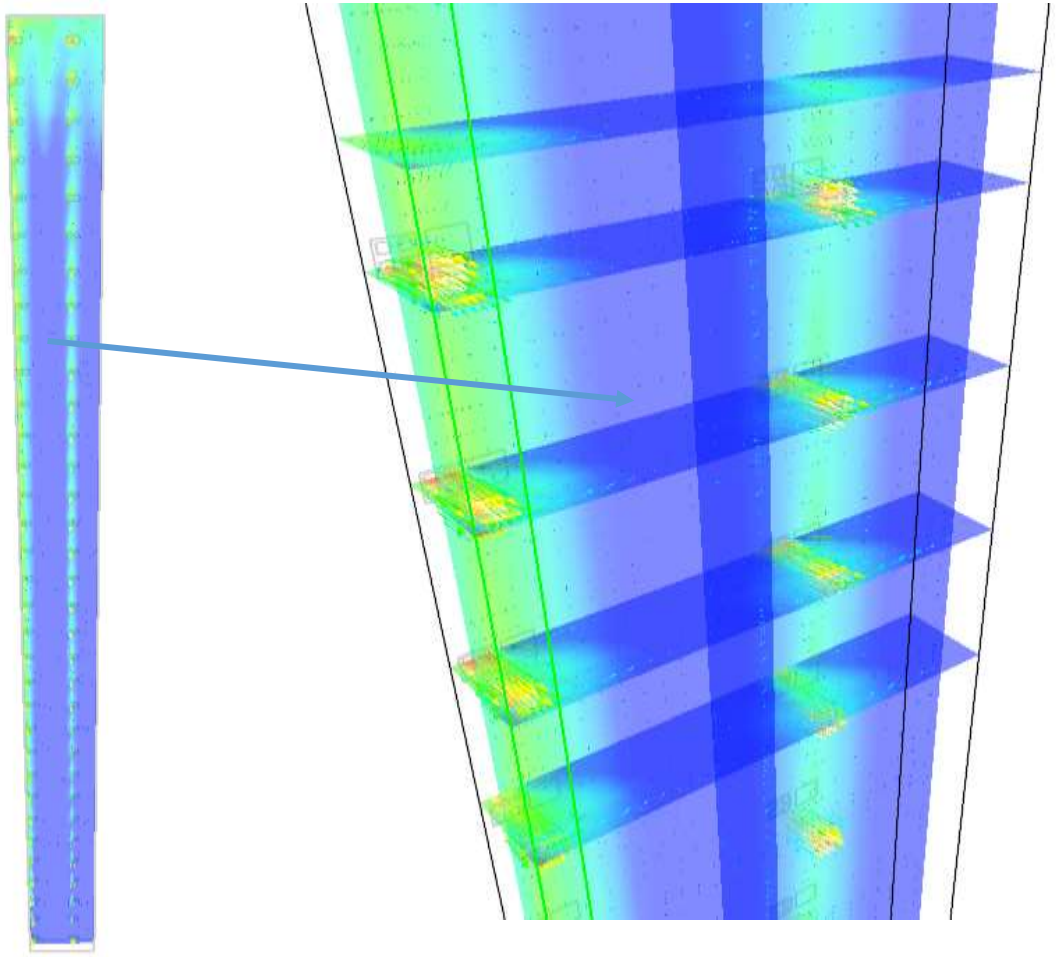
Shaft -1 CFD analysis 80% load

Shaft -2 CFD analysis 80% loaded outdoor units.



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Corridor CFD analysis results at 80% running of all outdoor units



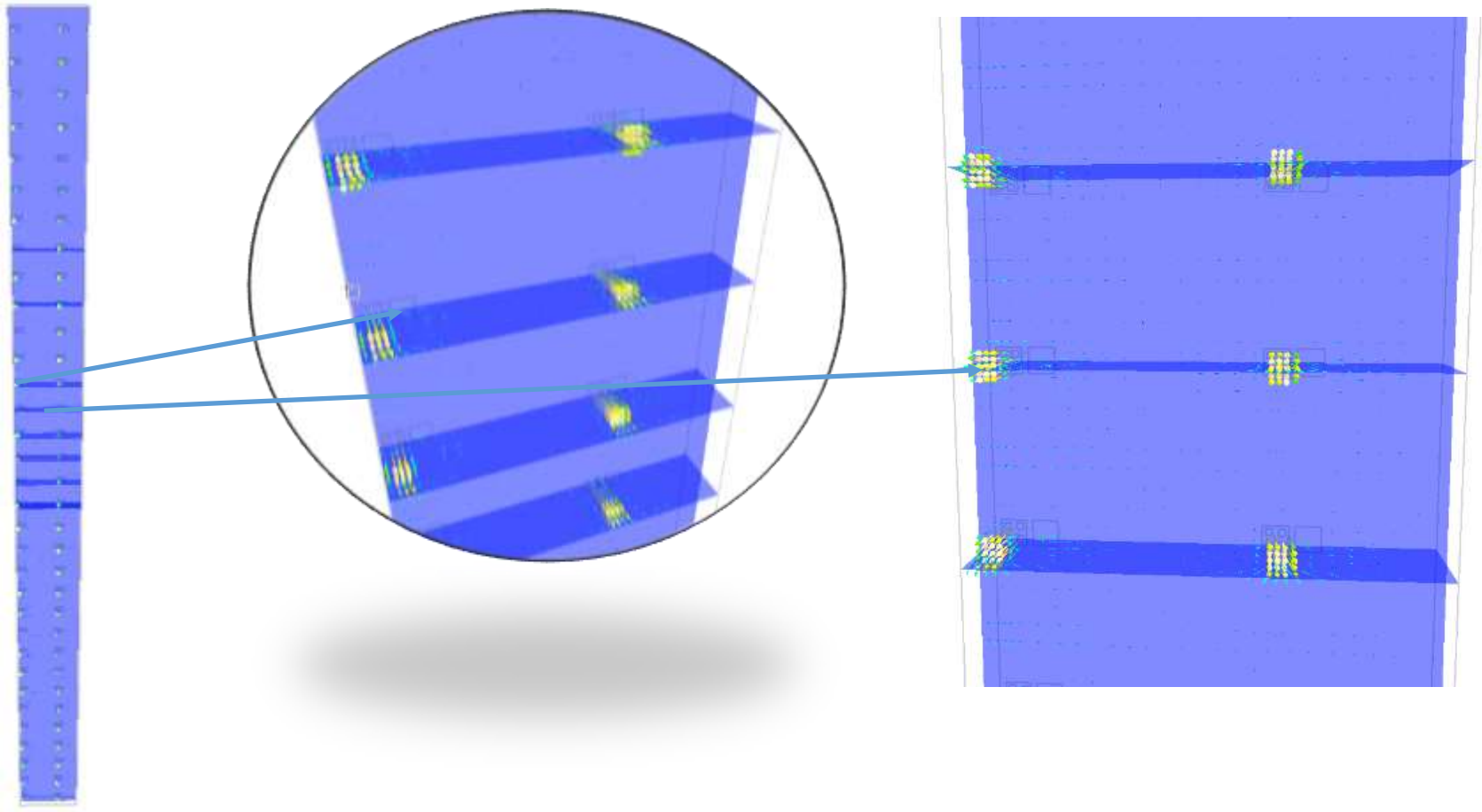
Velocity	0.20	32.14	64.08	96.02	127.96	159.91	191.85	223.79	255.73	287.68	319.62	351.56	(ft/min)
Temperature	110.32	111.13	111.94	112.75	113.57	114.38	115.19	116.00	116.81	117.62	118.43	119.25	(F)

Conclusion:

At the top floor is showing blue color which means temperature is also lower and velocity is lower.

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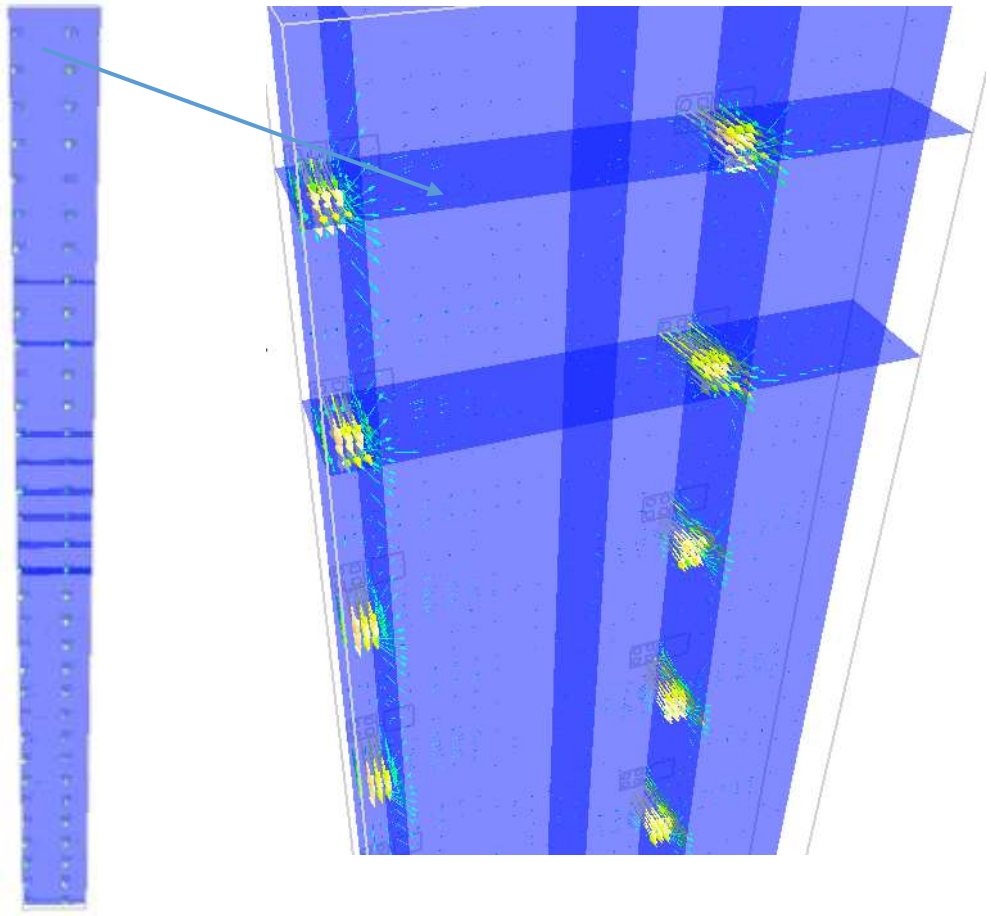
Corridor CFD analysis results at 60% running of all outdoor units:



Velocity	0.20	32.14	64.08	96.02	127.96	159.91	191.85	223.79	255.73	287.68	319.62	351.56	(ft/min)
Temperature	110.32	111.13	111.94	112.75	113.57	114.38	115.19	116.00	116.81	117.62	118.43	119.25	(F)

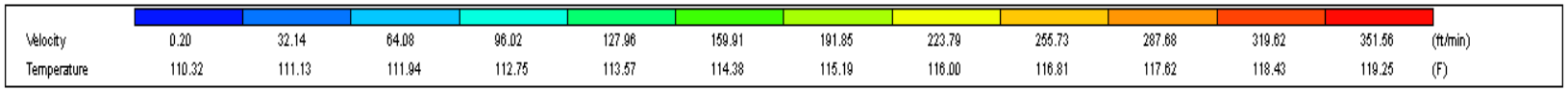
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Corridor CFD analysis results at 60% running of all outdoor units



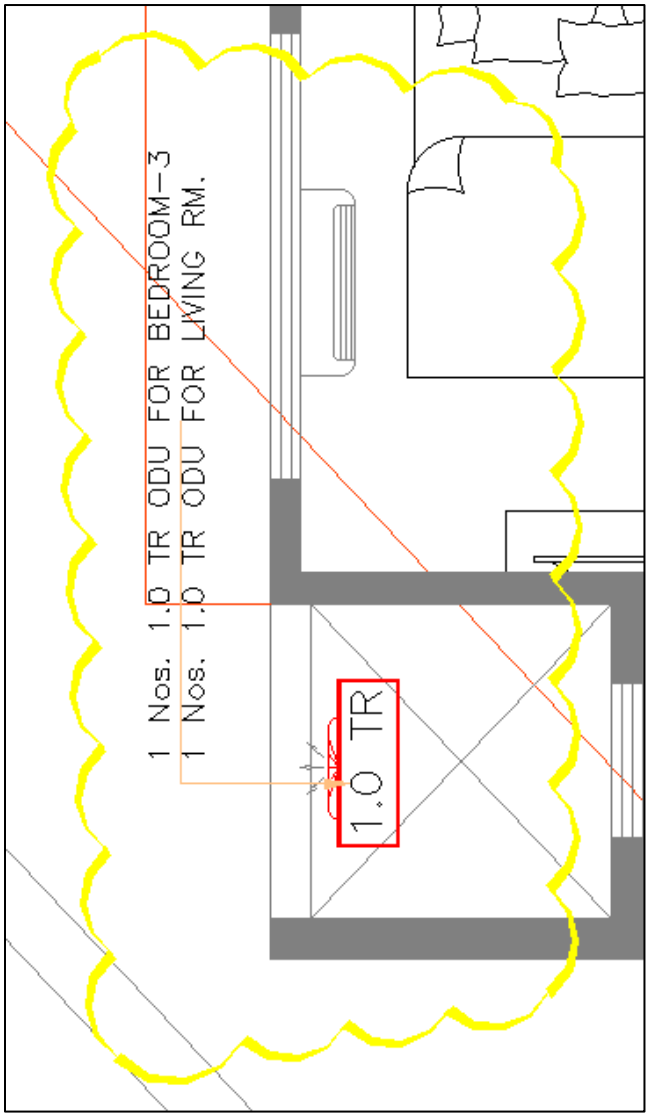
Conclusion:

At the top floor is showing blue color which means temperature and velocity value are lower.



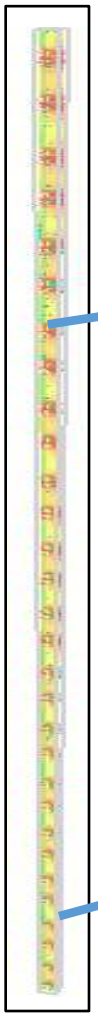
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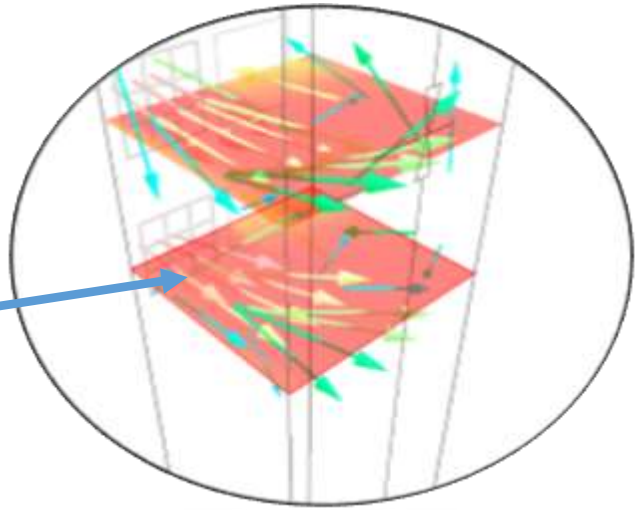
Shaft -2



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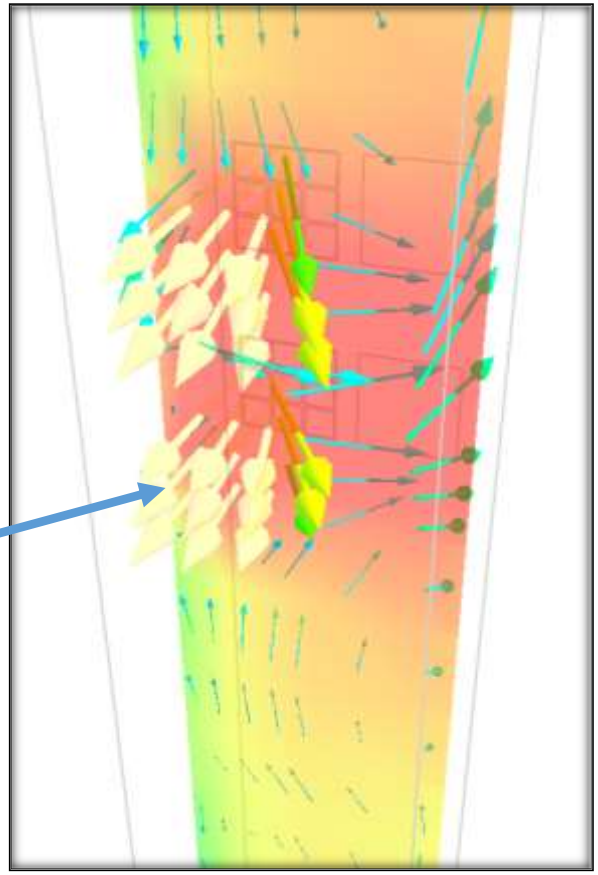
Shaft-2 CFD analysis results at 100% running of all outdoor units:

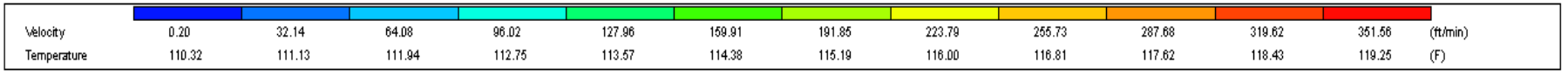




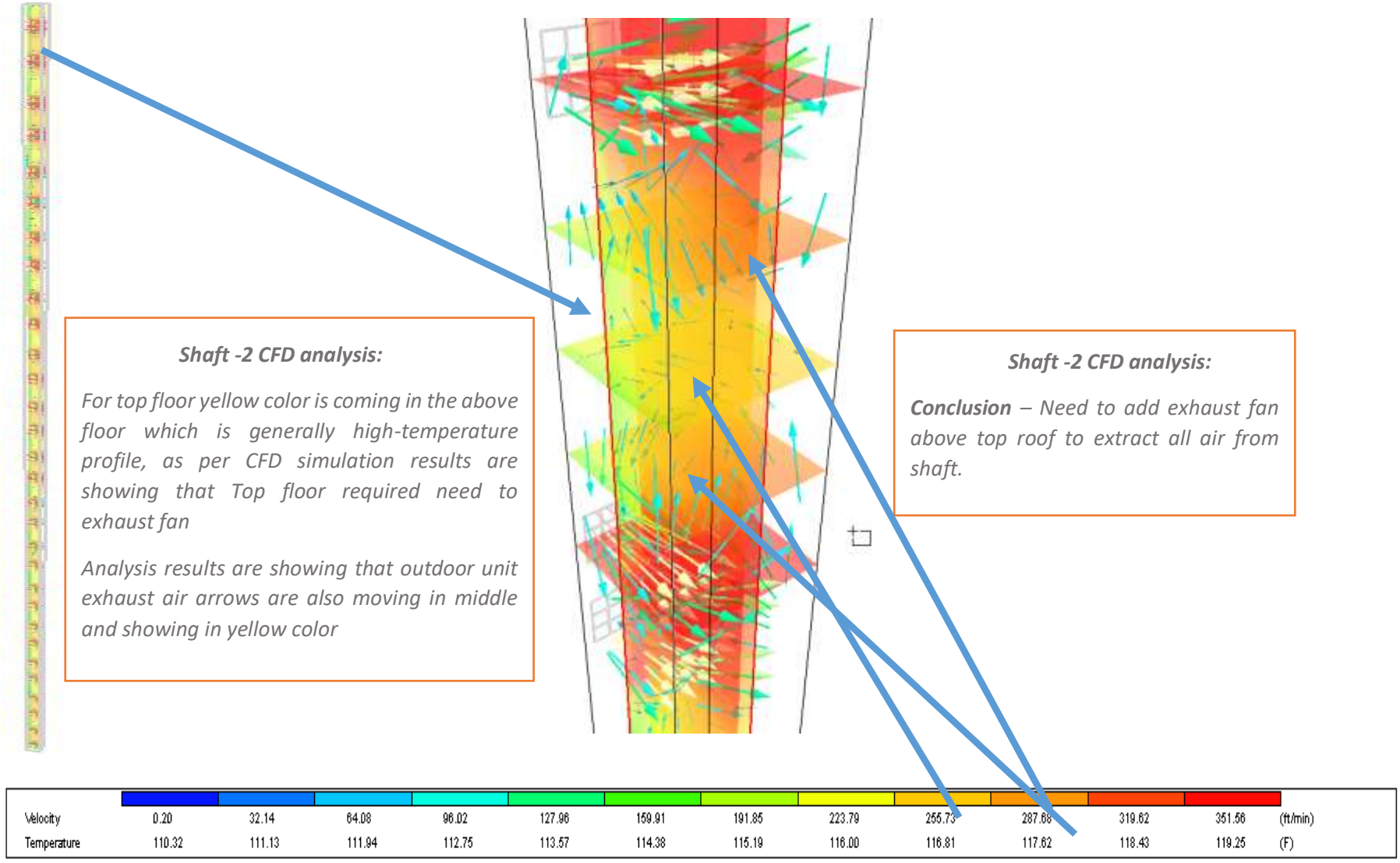
Shaft – 2 (5 ft X 5 ft) CFD analysis:

Two outdoor stack units of 1TR and output CFD results show blue color to red color, which is 1 velocity to 350 ft./min and 110F to 120F. Outside Temperature condition is 40C which is (104F) and here CFD results shows all outdoor units are working with 100% and results shows red color which 122F (50F) working condition of outdoor unit.

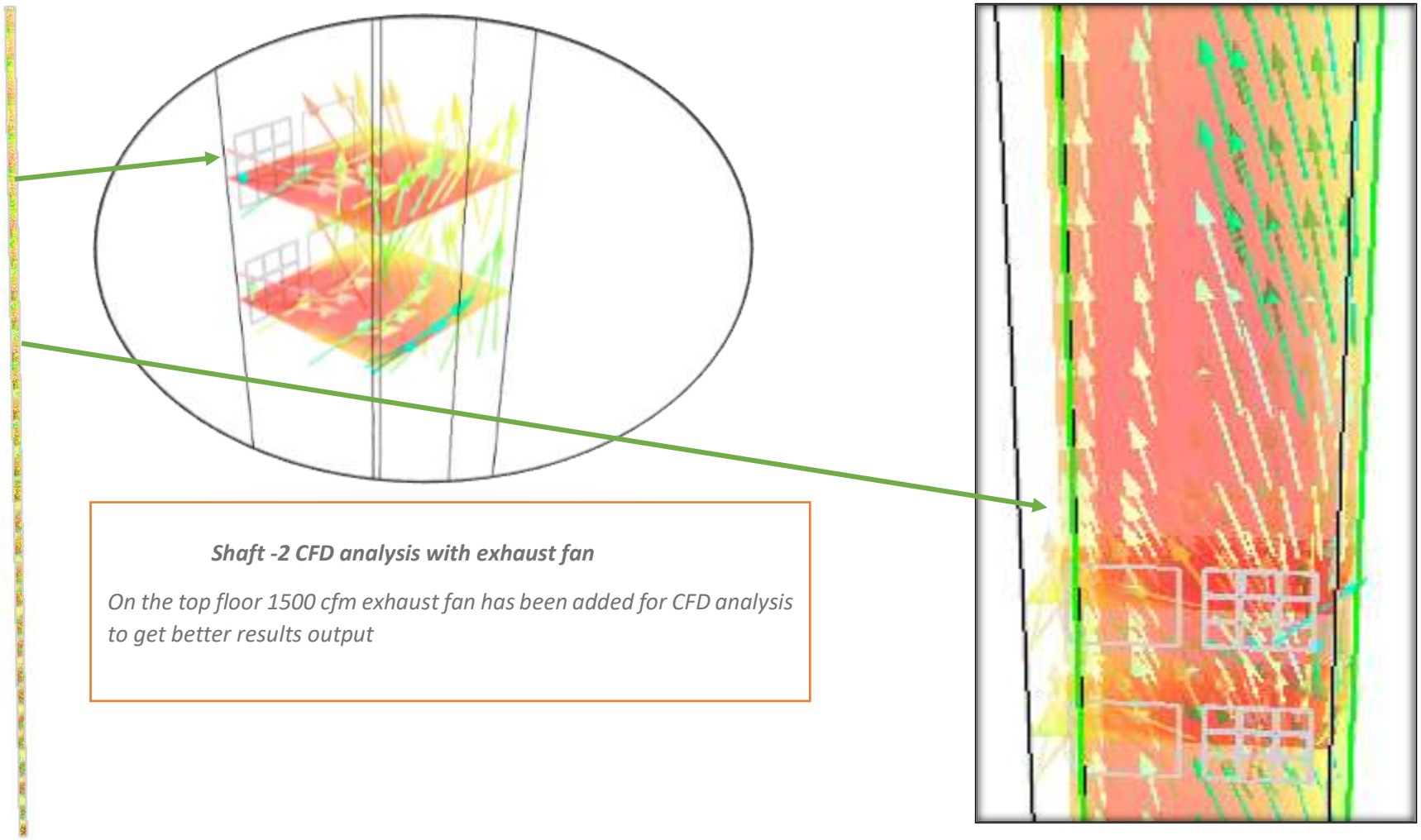




Shaft-2 CFD analysis results at 100% running of all outdoor units Conclusion:



Shaft-2 CFD analysis results at 100% running with exhaust fan 1500 Cfmof all outdoor units:



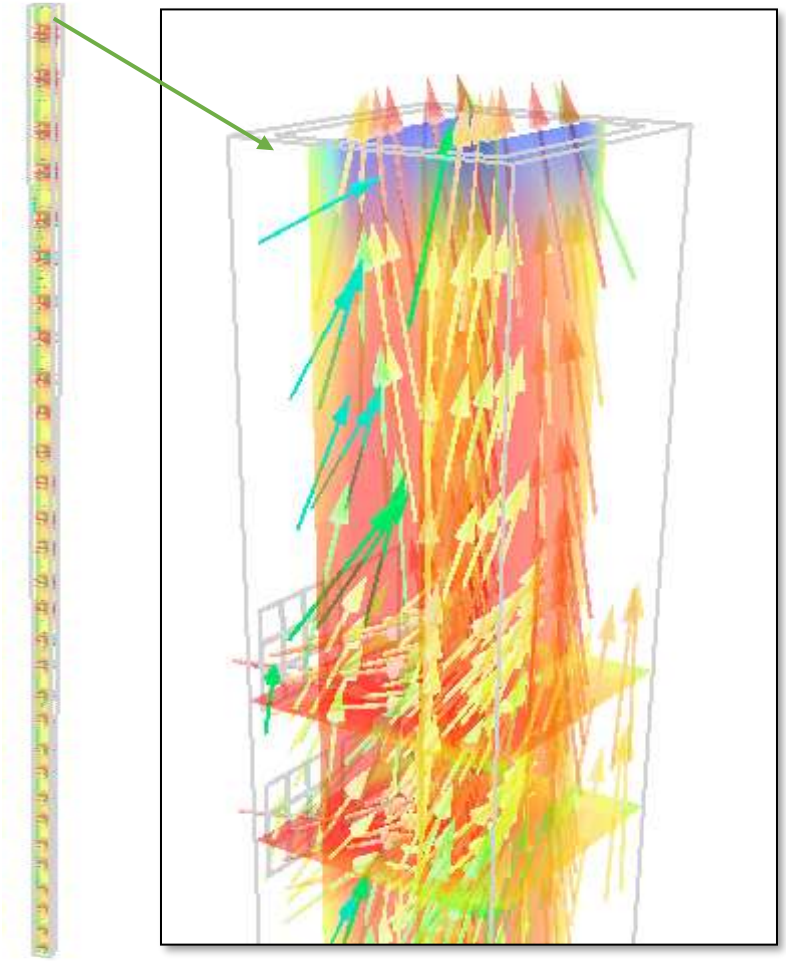
Shaft -2 CFD analysis with exhaust fan

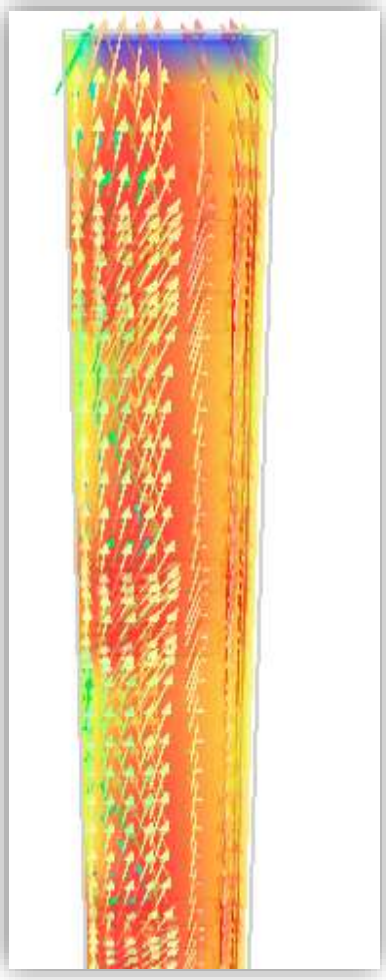
On the top floor 1500 cfm exhaust fan has been added for CFD analysis to get better results output

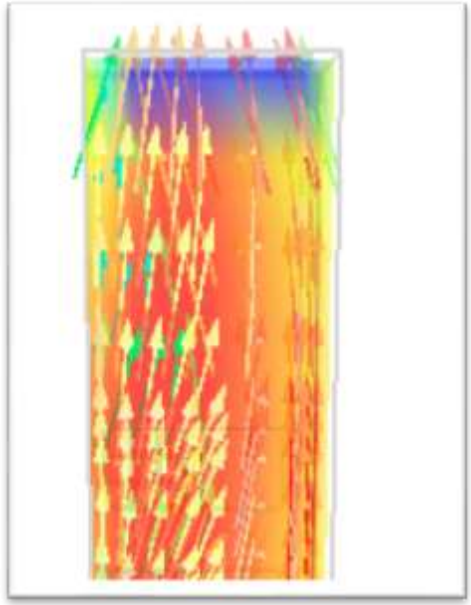
Velocity	0.20	32.14	64.08	96.02	127.96	159.91	191.85	223.79	255.73	287.68	319.62	351.56	(ft/min)
Temperature	110.32	111.13	111.94	112.75	113.57	114.38	115.19	116.00	116.81	117.62	118.43	119.25	(F)

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Shaft-2 CFD analysis results with exhaust fan 100% running of all outdoor units Conclusion:







Conclusion:

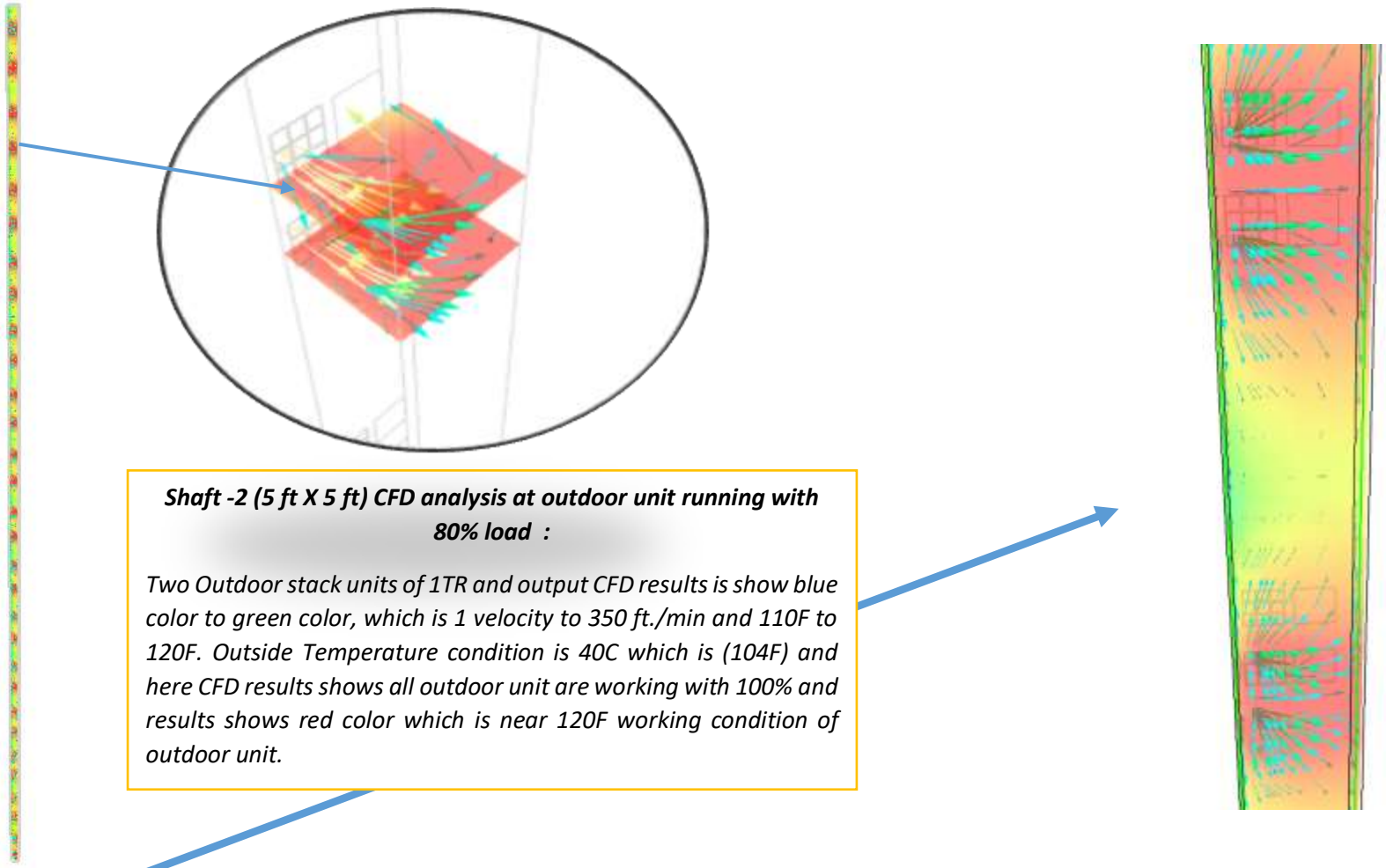
For top floor all the vector are upward direction, which mean s all exhaust air has been extracted by exhaust fan and remove all heat from shaft.

At the top floor is showing blue color which means temperature is also



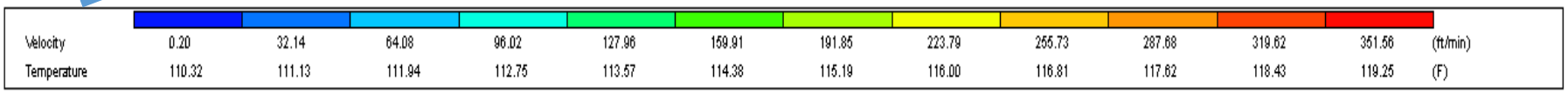
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Shaft-2 CFD analysis results at 80% running of all outdoor units:



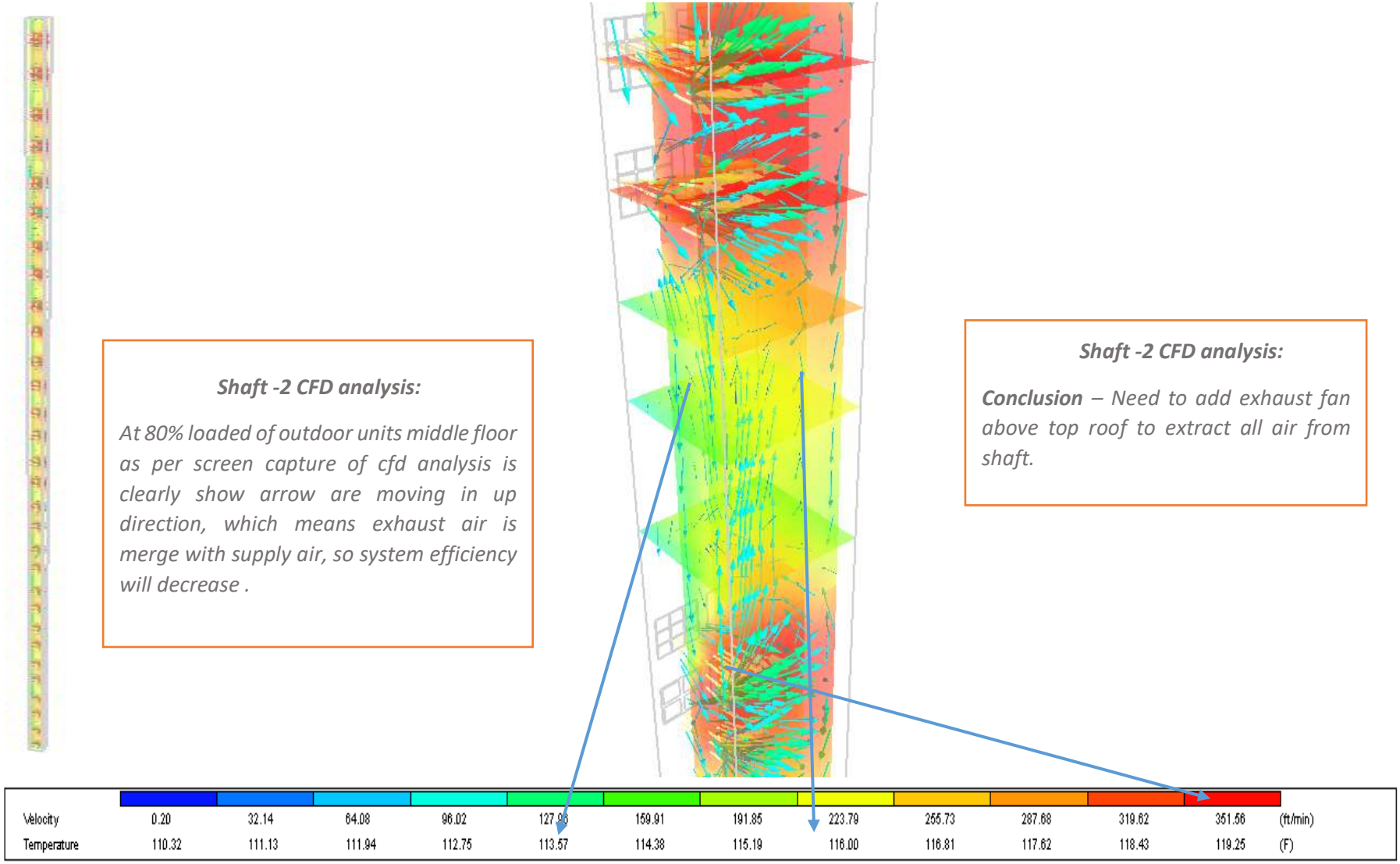
Shaft -2 (5 ft X 5 ft) CFD analysis at outdoor unit running with 80% load :

Two Outdoor stack units of 1TR and output CFD results is show blue color to green color, which is 1 velocity to 350 ft./min and 110F to 120F. Outside Temperature condition is 40C which is (104F) and here CFD results shows all outdoor unit are working with 100% and results shows red color which is near 120F working condition of outdoor unit.



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Shaft-2 CFD analysis results at 80% running of all outdoor units Conclusion:



Shaft -2 CFD analysis:

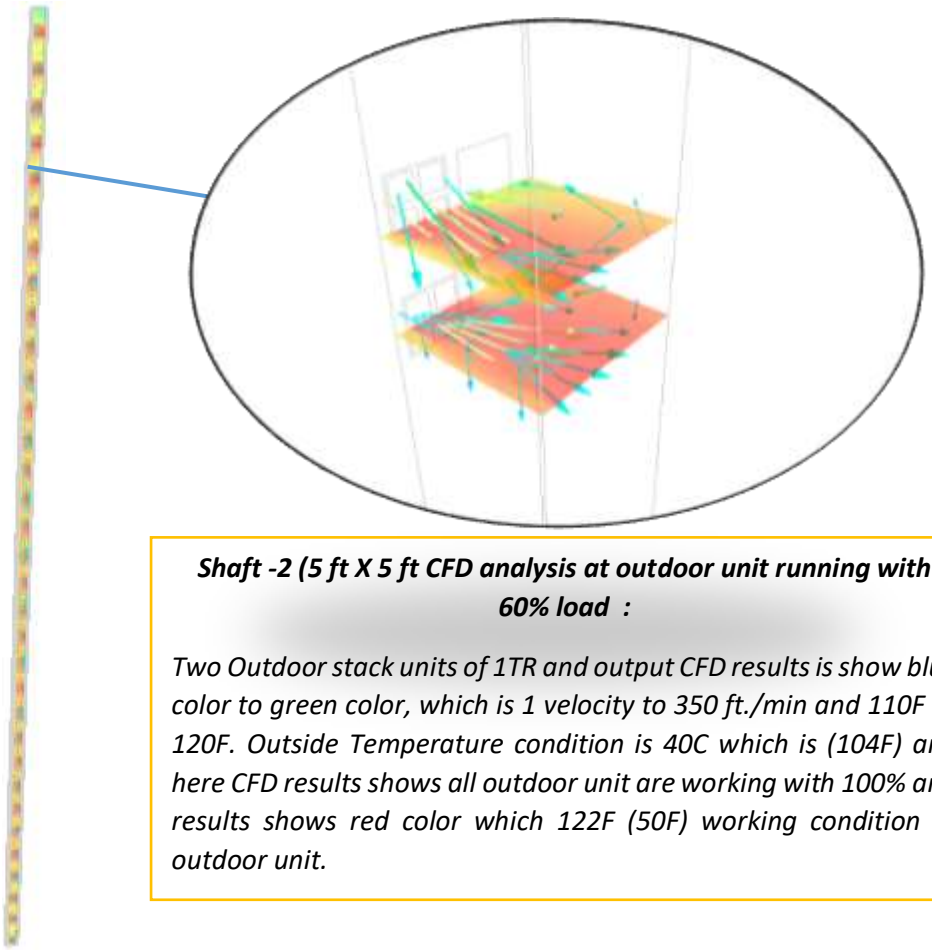
At 80% loaded of outdoor units middle floor as per screen capture of cfd analysis is clearly show arrow are moving in up direction, which means exhaust air is merge with supply air, so system efficiency will decrease .

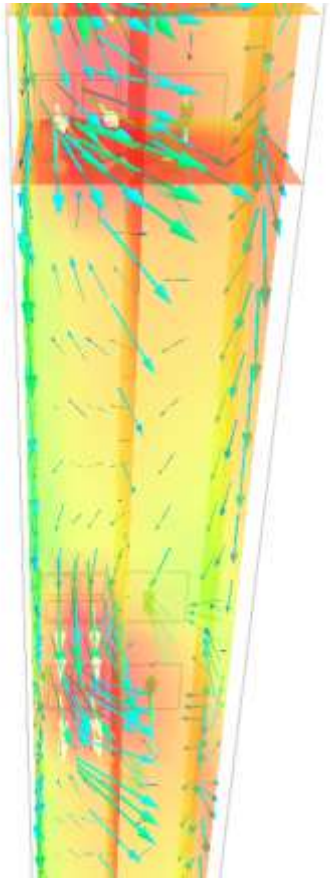
Shaft -2 CFD analysis:

Conclusion *– Need to add exhaust fan above top roof to extract all air from shaft.*

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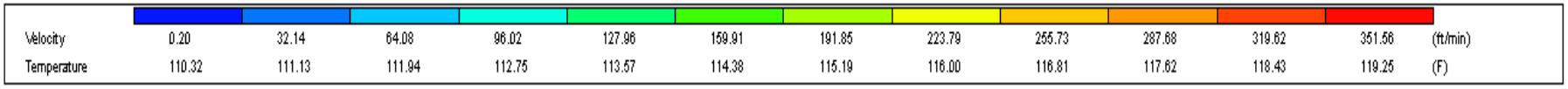
Shaft-2 CFD analysis results at 60% running of all outdoor units:



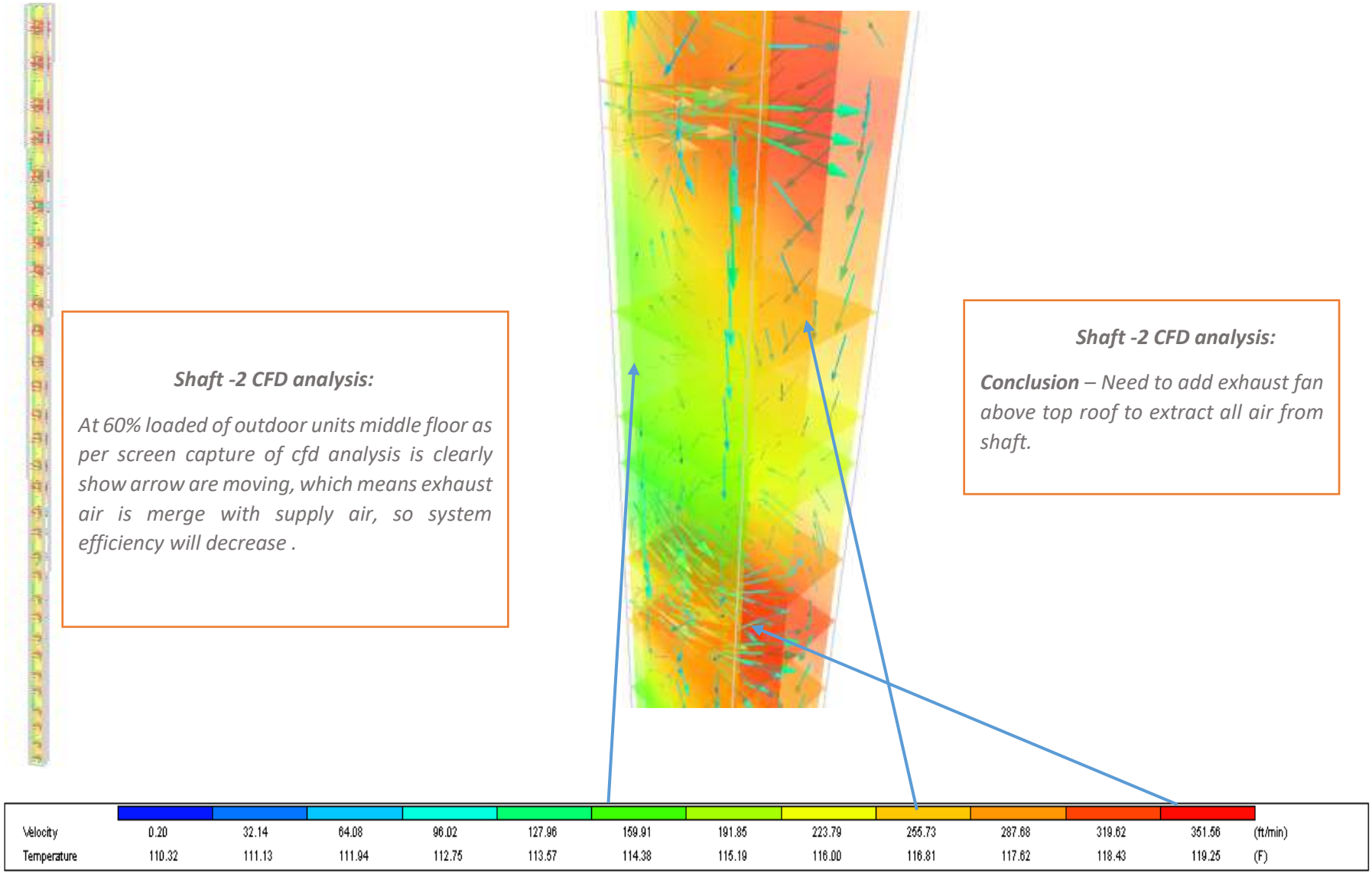


Shaft -2 (5 ft X 5 ft CFD analysis at outdoor unit running with 60% load :

Two Outdoor stack units of 1TR and output CFD results is show blue color to green color, which is 1 velocity to 350 ft./min and 110F to 120F. Outside Temperature condition is 40C which is (104F) and here CFD results shows all outdoor unit are working with 100% and results shows red color which 122F (50F) working condition of outdoor unit.



Shaft-2 CFD analysis results at 60% running of all outdoor units Conclusion:



Shaft -2 CFD analysis:

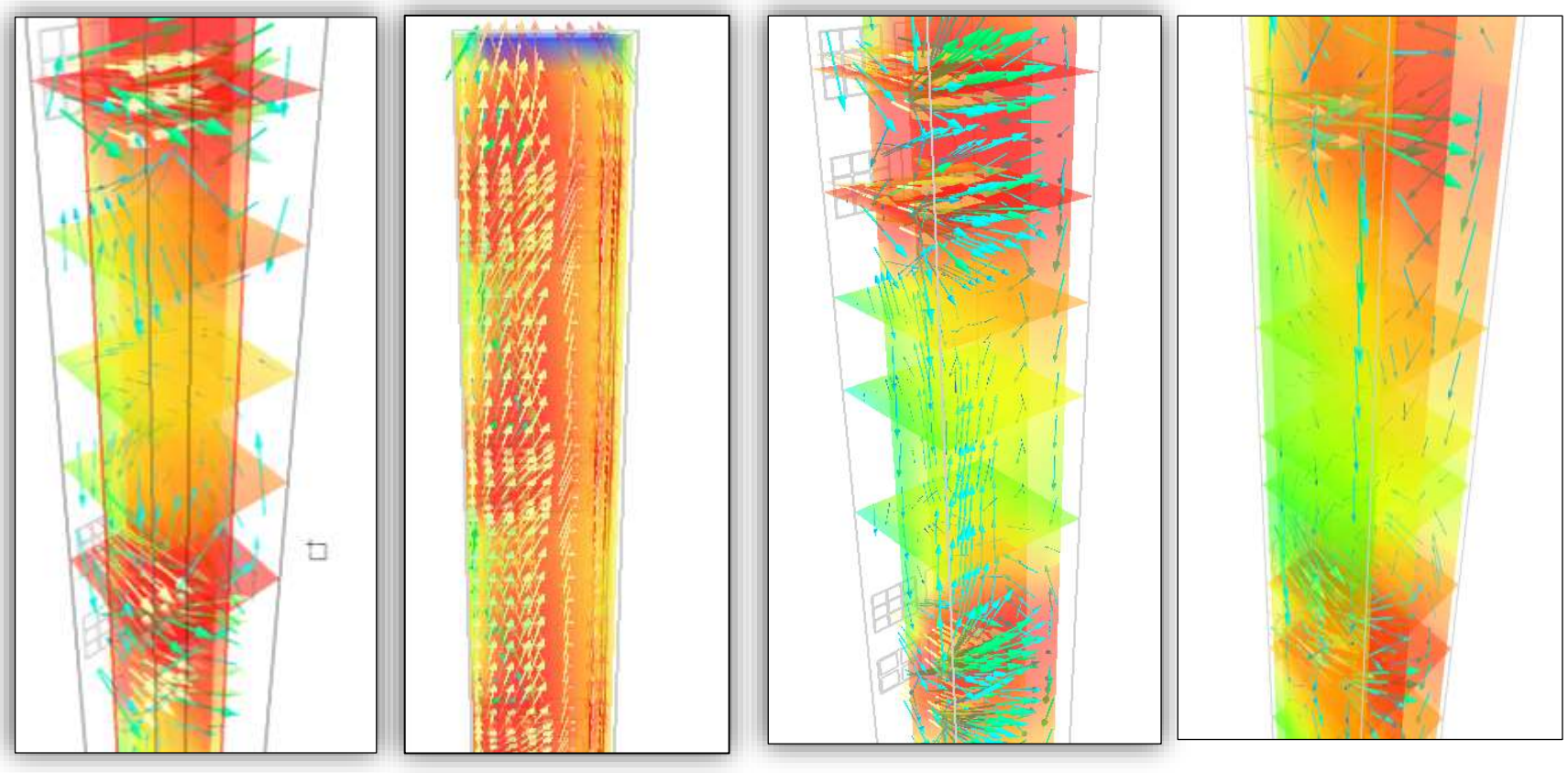
At 60% loaded of outdoor units middle floor as per screen capture of cfd analysis is clearly show arrow are moving, which means exhaust air is merge with supply air, so system efficiency will decrease .

Shaft -2 CFD analysis:

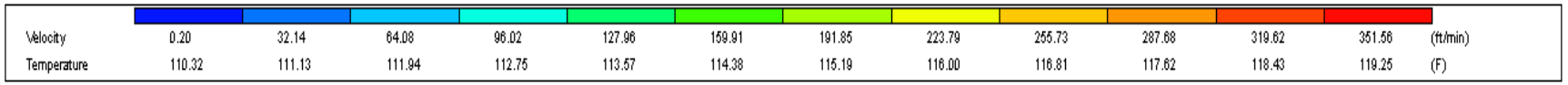
Conclusion *– Need to add exhaust fan above top roof to extract all air from shaft.*

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Shaft -2 at 100%, exhaust fan, 80% and 60%



Shaft-1 100% running with exhasut fan 80 % load 60% load



For the shaft 2 project team need to provide exhast fan of 1500 cfm. At 100% drak yellow colur (117F) and 80% green colur(115F) and 60% light green colur (113 F).

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