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Designing of piping for chilled water system in Air conditioned buildings and CFD analysis for Improving the Indoor Air Quality in occupant space 1Mohammed Abdul Samad Azam, 2Dr.N.Ravinder Reddy, & 3Syed Moazzam Ali 1M.tech Student, Vidya jyothi institute of technology, Hyderabad, India. 2Professor at Vidya jyothi institute of technology, Hyderabad, India. 3Technical Director at Taiba Engineering Consultants. samadazam09@gmail.com

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---------- Abstract: Today, the division of air conditioning or ventilating style is a considerable measure of technologically troublesome than at any other time.

Nobody repudiates on the simple reality that man works adequately in conductive situations. The development of HVAC field made it potential to deal with himself in temperature with the warm setting paying little respect to contrasts because of the season within his environment. This paper is carried out on designing of piping in a OFFICE BUILDING that has one Ground floor and a Roof.

Computational Fluid Dynamics (CFD) analysis of distribution of air in an occupant space is executed by design builder CFD software.CFD once applied to buildings will give the designer data on probable air velocities, pressures and temperatures that may occur at any purpose throughout a predefined air volume in and around building areas with specified boundary conditions which can embody the consequences of climate, internal heat gains and HVAC systems.

The results are analyzed and discussed in terms of pressure, temperature and velocity in an occupant space and also in terms of volumetric parameters comfort point of view, especially for summer climate conditions. Keywords: Ventilation, air conditioning,

Heating, computational fluid dynamics, occupant space, heat transfer, human comfort.

---------- 1. INTRODUCTION Piping systems comprises of various types of pipes, for example, GI (galvonized iron), SS (stainless steel), MS (mild steel), BS (black steel), N (nylon), HDPE (high density poly gas pipe), CI (cast iron), PVC (poly venyl chloride), and CU (copper).

These pipes are a unit utilized in air conditioning, plumbing and fire fighting. The obligation of mechanical engineer is to compute the exact calculating the pipe size upheld to the heat load calculations [5]. Different types of pipes are used in different fields such as Aluminum and Copper pipes are used in the field of manufacturing of evaporators and condensers of all the Air conditioning machines. SS pipes are used in the manufacturing of evaporation of chillers i.e., tube and shell and warmth exchanger of stainless steel.

Nylon pipe are flexible plastic pipes are used to drain the condensing container water into the nearest plumbing connection. The MS pipes are used to pass the chilled water into the pump, chillers and up to FCU's and AHU's [6]. Galavonised Iron pipes are used to give drinking water into the building. CI (cast press) pipe is utilized to drain water out of toilets and kitchens.

As of now it is supplanted by PVC pipes because of its light in weight and it can joined effectively, low in cost and non conosive. 2. CLASSIFICATION OF PIPES WITH MANUFACTURING Extrusion is the process which makes pipes as welding is utilized in joining the two pipes wherever it is required length is somewhat bigger then a given pipe. Welding is classified in two different ways.

They are as per the following:- 1) Welded pipes 2) Seamless pipes WELDED PIPES: These pipes will have inward bur and outside bur all through its manufacturing process. Just external bur will be same and inside bur can be differentiate a welded from the pipes which are seamless in the physical approach. SEAMLESS PIPES: These Seamless pipes are excellent in shape and can with stand high up to 40 bar.

The piping of refrigerant gas in the entire air condition machine should be Seamless pipe. There is just a single disadvantage in this pipe which is utilization of power is in a little amount. These pipes are utilized in chilled water system, fire fighting and plumbing.

Design Builder Design Builder is a Energy Plus based programming instrument utilized

for carbon, energy, lighting and human comfort calculations and control. Design Builder is created to cease the building simulation method. Design Builder is differentiating alternative designs of building by utilizing function of the tool and performance based strategy for differentiating the results by the different analyzes in a speedy and economic way.

Design Builder merge quick modeling of three-dimensional building with simulation of dynamic energy without any difficulty of utilization. Because of this feature it is viewed as a distinctive software tool to make and assess designs of building. It has uniquely created modules so as to be utilized adequately at any phase of the designing procedure, Only a couple of parameters to provide an extensive variety of chance to work up to the more designing which is detailed of the specific design. Design Builder software is very easy to use.

It has creative efficiency features permit even complex structures to be modeled quickly by non-master users. Design Builder has produced to be utilized by an extensive range of experts, for example, draftsmen, engineers, architects, building administrations specialists, energy advisors and related universities departments. Some design builder usage basis is given below: 1.

To calculate in and around temperature, pressure and velocity distribution of building by using CFD (Computational Fluid Dynamics) module. [1] 2. Envision of the shading and site plan. 3. Simulation of thermal in buildings that are ventilated with the normal (usual) ventilation. / / Figure 1: Thermal comfort buildings Ascertaining the ability of cooling and heating equipment to incorporate the issues to enable design of HVAC.

To give material to the gatherings of design for supporting interdisciplinary imparting. To be utilized in the universities in simulation course and energy modeling courses. Design Builder enables complex buildings that are to modeled in a straightforward quick manner even by non-master users.

Design Builder is the first and most exhaustive program that makes a graphical interface to a dynamic thermal simulation engine of Energy plus. Graphical interface creates the designs of the structures, their vitality performance and simulation of CFD permit to be shown in 3D to offer help for examination [2]. Design Builder utilizes the most recent version of Energy Plus recreation or simulation engine for computing the vitality execution of buildings.

The subsequent information can be filtered as we wanted and it is presented graphically or it can be transmitted in the format of tabular for use in different applications. Energy

Plus Energy Plus is the most relative building vitality simulation program created by the US Department of Energy, with a specific model building cooling, lighting, heating, ventilation and other vitality flow, which has been always improved.

It is based on BLAST and DOE-2's which is most prominent features and abilities , yet in the meantime it has numerous creative features, for example simulation time will be not more than a hour, simulation of heat exchange balance based zone, multi zone A/C systems, photo-voltaic frameworks and thermal comfort. Energy Plus is a simulation program with an easy to use graphical interface. Design Builder has made rich and simple to use interface to Energy Plus. 2.

METHODOLOGY AND SIMULATION Design Builder CFD Design builder computational fluid dynamics depicts about the fluctuated forms which is concerned in directing the calculations using the CFD module of Design Builder. CFD analysis of an occupant space by chilled ceiling or radiant cooling system. The input values have to be given according to the occupant space area and its heating or cooling load.

/ Figure 2: AN OCCUPANT SPACE In the above Figure 2, an occupant space area has to be drawn by taking the required dimensions of the space. Activity: Occupancy density (people/m^2) = 0.20 Schedule = Scheduling time for 24 Hrs can be arranged according to the occupant space starting and closing time period. Construction: In the construction, the u- value of wall has to be set which is 0.33.

Openings: In the openings, the values of window to wall %, window height, window spacing and Sill height has to be entered. Window to wall% _17.77m^2 _ _Window height _2 meter _ _Window spacing _3 meter _ _Sill height _1.5 meter _ _ Lighting: Lighting load = 11.83 w/m^2 HVAC: In HVAC, template should be selected according to the system we use (chilled ceiling).

CFD analysis of Chilled ceiling is to be simulated by placing the pipes on the ceiling one after the other respectively. The flow rate value of an occupant space has to be input according to the load of an occupant space. [3] The grid spacing are the large numbers of key coordinates can also lead to overly complex grids and correspondingly high calculation run times and excessive memory usage which can be avoided by replacing very detailed assemblies with cruder representations for the purpose of the CFD calculation.

/ Figure 3: Chilled ceiling On the roof of an occupant space the chilled water pipes are placed one after the other for the distribution of temperature in an occupant space as shown in the above Figure 3. After placing the pipes on the roof, start the CFD

calculations. / Figure 4: CFD calculation In the above Figure 4, CFD calculations of an occupant space are being processed, here its simulates the temperature distribution in an occupant space, pressure, mass, velocity (X,Y,Z) by taking n number of iterations.

It calculates the pressure, temperature, velocity of an occupant space by taking n number of iterations for the better cooling comfort in an occupant space. [4] 3. RESULTS AND DISCUSSIONS Results of the CFD analysis of chilled water piping or chilled ceiling is presented in different sections such as, air distribution, velocity of air, temperature, pressure of air is shown in the different colours as shown in the below Figure 5.

/ Figure 5: CFD RESULTS After calculating the CFD calculations distribution of air, temperature, mass, velocity can be seen by cutting the slices in different parts of an occupant space as shown in the above figure 5. We can also know how the air is flowing in the room and also we can know how much time is taken for temperature distribution in an occupant space as given in Table 1. Table 1: Air flow conditions by different velocity and temperature S.NO _VELOCITY(M/SEC) _TEMPERATURE (?) _ _1. _0.00 _41.41 _ _2. _0.02 _41.65 _ _3. _0.04 _41.90 _ _4. _0.06 _42.14 _ _5. _0.08 _42.38 _ _ 3.

CONCLUSION CFD analysis of air distribution by chilled ceiling in an occupant space with a specific HVAC system has been presented in different scenarios by giving some input values. A description of the CFD model focusing on the HVAC system characteristics is presented and the results are discussed in terms of air distribution, temperature, pressure, thermal comfort, energy consumption and velocity.

Results of the air distribution inside an occupant space, Temperature of air, pressure of air, velocity and time taken to cool an occupant space are shown in the above figures. We can also see the distribution of air in each and every part of an occupant space by cutting the slices vertically or horizontally in an occupant space.

The main perspective of this analysis, we can know about the cooling conditions in an occupant space and how the parameters effect onto a building with air conditioning. By comparing the results of different systems we can decide which system is more effective, cheap, consumes less energy and provides comfortable cooling condition in an occupant space. REFERENCES Fan Y, 1995, CFD modeling of the air and contaminant distribution in rooms, Energy and Buildings, Vol. 23, PP: 33-39.

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