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Design of Precision Air Conditioning System for Server Room

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Abstract: Server rooms are at the core of IT operations, and with a specific end goal to counteract equipment breakdown and system disappointment, appropriate operation and setup is basic. Shockingly, in an encased space of a server room, the created warm from equipment can rapidly build the encompassing temperature past hardware details. The life and unwavering quality of machines is traded off, and different tragic outcomes can take after, including:
System crashes Irregular reboots General poor execution
That is the reason it's imperative to keep your server room's temperature inside the suggested ranges related with your equipment. Remember that the warmth dispersal from your servers will require sufficient ventilation and cooling, so this is a vital stride in securing your hardware and guaranteeing greatest profitability.
The motivation behind this paper is to plan an Air Conditioning and Ventilation system for a Server Room with sufficient indoor air quality and energy effective heating stack estimation utilizing E20 form.
Keywords: precision air conditioning, server system, air conditioning system, server rooms, indoor air conditioning, e20 form.

I. INTRODUCTION

The present server rooms are evolving quickly, and it is more essential than any time in recent memory to guarantee that every part of the help framework is working at generally extraordinary effectiveness and unwavering quality. The disappointment of a basic server room cooling framework can prompt downtime, which converts into lost administration, cash and client goodwill. Today, ventilating is turning into an inexorably imperative factor in building arranging, on the grounds that other than controlling the inside atmosphere, it likewise adds to the vitality proficiency and working expenses of a building. Present day aerating and cooling innovation gives a decisively tuned answer for various operational prerequisites and distinctive indoor encompassing sorts. Adjust translation of outright and relative air mugginess esteems in a room without perpetual nearness of individuals (e.g. a PC room) prompts the essential for dew point temperature control. In the meantime, the decision of relating HVAC innovation is the key essential to ensure the ideal surrounding parameters for your IT hardware which is worked in this unique condition.

II. BACKGROUND

Server farms have their foundations in the tremendous PC rooms of the early ages of the registering business. Early PC frameworks, complex to work and keep up, required an exceptional situation in which to work. Many links were important to associate every one of the parts, and strategies to suit and compose these were contrived, for example, standard racks to mount hardware, raised floors, and link plate. A solitary centralized computer required a lot of energy, and must be cooled to abstain from overheating. Security ended up noticeably imperative – PCs were costly, and were regularly utilized for military purposes. Essential plan rules for controlling access to the PC room were consequently conceived.

Amid the blast of the microcomputer business, and particularly amid the 1980s, clients began to convey PCs all over the place, much of the time with almost no think about working prerequisites. In any case, as data innovation (IT) operations began to develop in many-sided quality, associations became mindful of the need to control IT assets. The appearance of Uniform the mid-1970s prompted the consequent expansion of uninhibitedly accessible Linux-perfect PC working computer works amid the 1990s. These were called "servers", as timesharing working computer works like UNIX depend vigorously on the customer server model to encourage sharing exceptional assets between different clients. The accessibility of reasonable systems administration hardware, combined with new models for arrange organized cabling, made it conceivable to utilize a various leveled plan that put the servers

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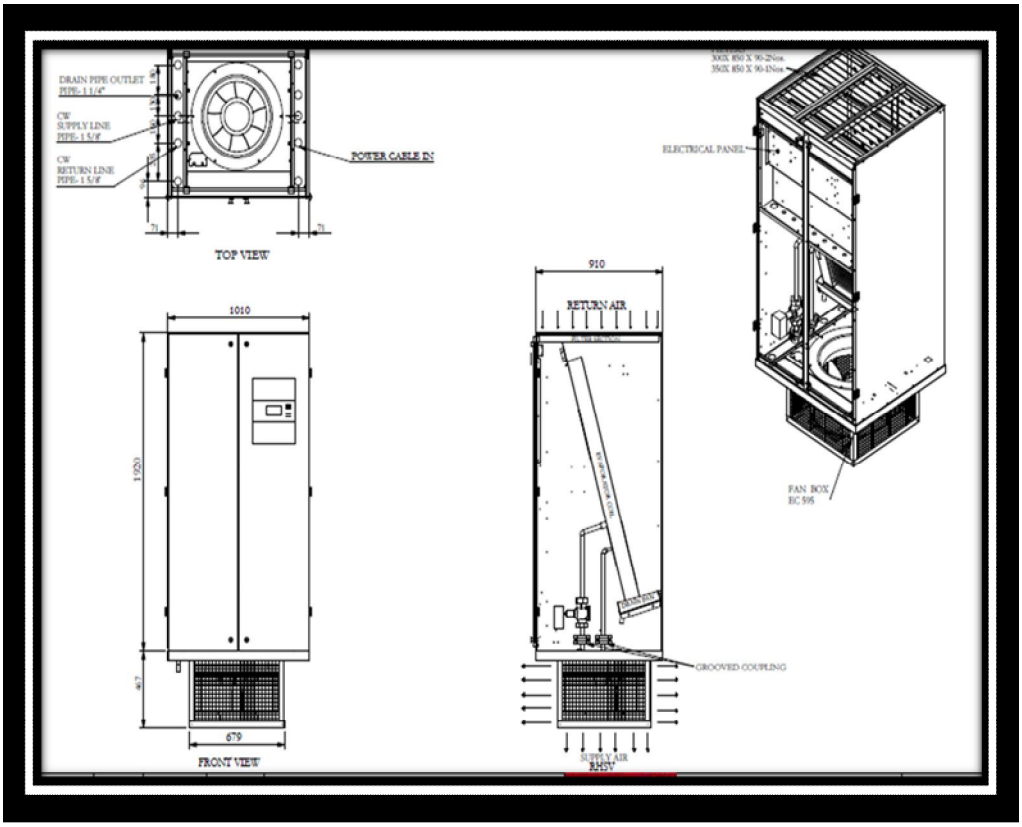
in a particular room inside the organization. The utilization of the expression "server room", as connected to uniquely planned PC rooms, began to increase prominent acknowledgment about this time.

III. PRESICION INDOOR UNIT

Supply of microchip based single/twofold - cleaned Precision Air molding Top/Bottom suction indoor unit. Open air gathering unit should include air-cooled condenser with fan. Indoor unit should comprise of channel area, P-I-D Controller, Electrical Power switch board, multi rows profound copper cooling loop with aluminum blades, Dehumidification cycle, secluded board bureau development, bureau protection, fan segment with powerfully adjusted diffusive fans with an engine and drive, humidifier, High innovation scroll compressor, available refrigeration control.

Open air cooled gathering unit might be introduced on the top of the structures. Special Equipment lab building is 2 stores (Ground Floor and First floor as it were). Each indoor cooling unit will have individual comparing open air cooled gathering unit. False Flooring should be accommodated every one of the regions where Precision Air Conditioning units might be introduced.

Exactness Air conditioning units might be top/base release sort having supply of air through grilles put with false floor. Accuracy Air Conditioning framework has been intended to keep up inside states of 20°C ± 1°C and RH ≤ half year round for the Special Equipment Server Room arranged in Hyderabad.



IV. FLOOR INSULATION

Floor should be protected by 9 mm thick Elastomeric Nitrile Rubber of thickness 40Kg/m3 and k esteem 0.034 W/m.k at 0o C implies temperature. Floor protection should be provided just Special Equipment Lab. Building along with cements etc. Determine the measure of the protection material sheet required for protection. Slice the material to the deliberate size with sharp blade and straight edge. Guarantee that the cuts are as precise as conceivable with smooth edges to guarantee full contact with mating sheets when fortified together.

Try not to extend sheets and dependably apply smooth skin surface confronting out. The surface to be protected ought to be thoroughly clean, dry, oil free and unheated to guarantee legitimate attachment. The joints ought to be covered with the aluminum tape of affirmed make.

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V. FLOOR GRILLES

The expelled aluminum grilles should have the capacity to with stand live heap of equipment. The external casing might be made of 30 mm x 18 gage level and louvers should be 25 x 25 mm aluminum development. The external size of the grille might be approx. 600 x 600 mm or300 mm x 300 mm (real size according to false floor outline). The volume control damper shall be built out of aluminum.

VI. FALSE FLOORING

Setting up the floor and giving and settling antistatic monotonous false floor tiles on stringers and platforms according to the particulars given underneath.

All steel rectangular stringer framework having pre-punched openings at the two closures to guarantee rectify arrangement with platform heads ought to be connected for most extreme dependability.

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V. SPECIFICATIONS OF ACESS FLOOR TILE

Supply, establishment, testing and authorizing of imported Steel Cement Cavity Access floor Tile.
Detail of Panel/Tile:
Tile Size - 600mm x 600mm tile
Point Load - 440 kg
Moving Load - 450 kg
Uniform Dis. Load (UDL) - 2100 Kg. per M2

VII. SERVER UNIT AND SERVER RACKS

Server room is used to store all the networking data which are very useful in for the business. It stores the in a server unit such as 2u, 3u, 4u, 5u respectively according to the storage these are used. These units are present in server racks as shown in figure.

VIII. AMPLE CALCULATIONS

A. Heat gain through Glass

1) Heat gain through conduction
2) Heat gain through radiation

Heat gain through conduction
$Q = U \times A \times \Delta T$
To find ΔT for the glass through conduction= (outside temp – Inside temp)
$U = 1/\Sigma R$
$\Sigma R = Ri+(R1X1) +(R2X2)+\ldots\ldots\ldots\ldots..+(RnXn)+Ro$
A = Area of glass
Heat gain through radiation
$Q = U \times A \times \Delta T$

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To find ΔT for the glass through Radiation

B. Heat gain through wall

To find heat gain through wall requirements are

1) Orientation of the building
2) Timings
3) Wall thickness

Q = U x A x ΔT
U = 1/ΣR
ΣR = Ri+(R1X1) +(R2X2)+……..+(RnXn)+Ro
A = Area of wall
ΔT wall = Equivalent temperature + correction factor (from design data book)

Heat gain through Roof:

Q = U x A x ΔT
U = 1/ΣR
ΣR = Ri+(R1X1) +(R2X2)+……..+(RnXn)+Ro
A = Area of roof
ΔT = Equivalent temperature + correction factor (from design data book)

Heat gain through Partition / Ceiling/ Floor

U = 1/ΣR
ΣR = Ri+ (R1X1) +(R2X2)+……..+(RnXn)+Ro
A = Area
ΔT = (outside temp – Inside temp) – 5oF

Heat gain through Lightings:

The heat given up by the lights, both incandescent and fluorescent, is not affected by the room temperature. It depends on the electricity consumed. Each watt of electricity generates 3.4. BTU/Hr.

The total wattage of incandescent lights is very close to the ratting given on the lamp. Fluorescent light however require extra power in the ballast, as an approximation the ballast consumers about 25% of rated of the fluorescent lamp.

Q = 3.4 x W x B.F x CLF

Where:-

Q = Heat gain through lightings in BTU/hr.
W = Lighting capacity in watts
3.4 = conversion factor to convert watts into BTU/hr.
CLF = Cooling load factor for Lighting
BF = It is a ballast factor for lights

Note:

BF for florescent lights = 1.25
BF for Incandescent lights = 1

Heat gain through People

One of the most important sources of internal heat is people. People in the room give off both sensible heat and latent heat. The exact amount is determined by the activity of the people and the room conditions.

Some typical application are a theater or auditorium where people seated at rest give off less amount of heat than compared with the people doing physical activities like dancing excising, bowling.

C. The heat gain through people is composed of two parts

1) Sensible heat (Qs)
2) Latent heat (QL)

Qs = qs x n x CLF
QL = qLx n

Where

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Qs = Sensible heat gain in BTU/hr.
QL = latent heat gain in BTU/hr.
n = no. of people
qs = sensible heat gain per person (from design data book)
qL = Latent heat gain per person (from design data book)
CLF = Cooling load factor for people

Heat Gain through Appliances

Q app. = 3.4 x W

Q app. = HP x 2544.4 (if HP is given)

Ventilation load Some outside air is usually bought into the air-conditioned space through the mechanical ventilation equipment in door to maintain indoor air quality.

Mechanical ventilation systems for large building are usually designed and operated so that facts create a slightly positive air pressure in the building.

This will reduce or even prevent infiltration. When it is felt that building is relatively tight and pressurized, no allowance for infiltration is made, only the outside air ventilation load is included.

Equation for sensible heat gain

$Qs = 1.1 \times CFM \times \Delta T$

Where

Qs = Sensible heat gain from ventilation, BTU/hr.
CFM = Air ventilation flow rate, ft3/min
ΔT = Temperature change between indoor and outdoor air flow.

Equation for sensible heat gain

$QL = 0.68 \times CFM \times \Delta W$

Where

QL = Latent heat gain from ventilation, BTU/hr.
CFM = Air ventilation flow rate, ft3/min
ΔW = Difference in humidity ratio

Heat Gain through infiltration

Equation for sensible heat gain

$Qs = 1.1 \times CFM \times \Delta T$

Where

Qs = Sensible heat gain from infiltration, BTU/hr.
CFM = Air infiltration flow rate, ft3/min
ΔT = Temperature change between indoor and outdoor air.

IX. OBJECTIVE OF STUDY

Effective temperature is the dry bulb temperature of a uniform enclosure with a relative humidity 50% and an air velocity less than 0.2 ms-1 in which the inhabitants have similar warmth trade by radiation, convection and dissipation as in the real condition. The effective temperature combines the effect of dry bulb temperature and relative humidity with air movement to produce sensations of warmth or cold equal to those in the real environment.

X. RESEARCH METHODOLOGY

This method uses heat balance equations to find load components. The figuring of cooling loads with the permission strategy is in two-section process in that the mean part (steady state) of the heat gains are treated separately from the fluctuating components. The latter components are dealt with in three ways according to their excitations,

The response to these excitations is determined by the decrement factor, admittance, and the 12 surface factors, respectively. Each has a time lag/lead associated with it. The values of these factors are derived from thermo physical properties of the fabric layers

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using a frequency domain solution to the unsteady conduction equation with assumed sinusoidal input fluctuations. After the mean component and the fluctuating component of the load are calculated, they are added to give the hourly cooling load.

XI. CONCLUSION AND RECOMMENDATIONS

Precision cooling runs continuously and is necessary for the proper operation of IT equipment. Since it runs continuously, it is of utmost importance that we need to reduce the electricity consumption by selecting a proper design parameters and by selecting proper supply and return air. By using the outside air for cooling purpose and providing a compressor in the indoor unit we can balance the pressure difference. Therefore one can very well conclude that by using precision air conditioning running can be reduced.

The main purpose of using this precision air conditioning system is to protect the server and to keep the data storage safe from moisture contents.55% of relative humidity is maintained in server room. If it exceeds are decreased the server might be at risk it can corrupt the data.no other air condition system is present to control the humidity except the precision air conditioning.

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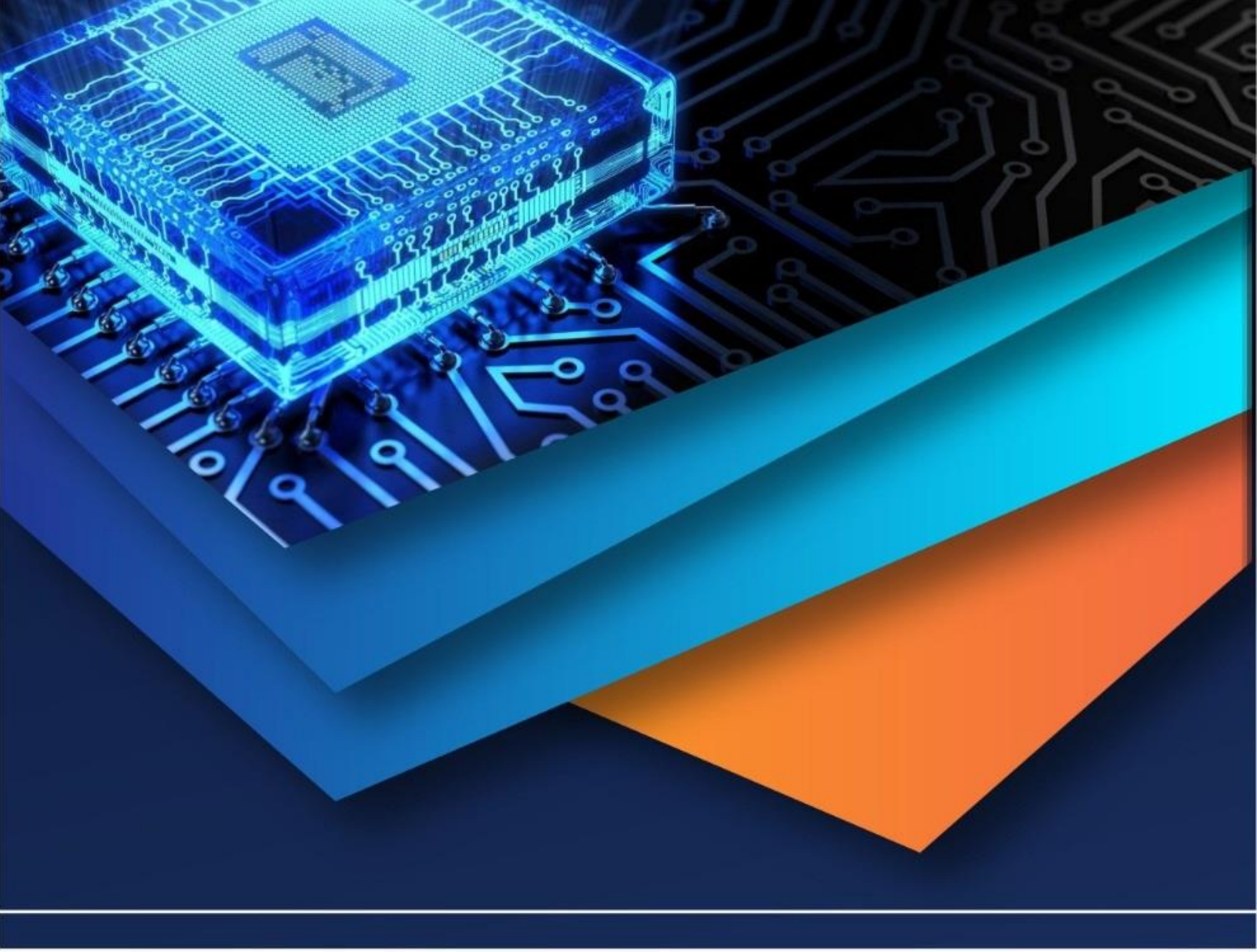

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