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HEAT LOAD ESTIMATION AND AIR CONDITIONING SYSTEM FOR BANK USING HAP SOFTWARE

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Abstract: *Human comfortness is essential now days because of the improvement in life style and increasing atmospheric temperature. Electrical air conditioning machines are not most suitable for large buildings because of the higher power consumption and shorter life. Central air conditioning is more reliable for easy operation with a lower maintenance cost. With large buildings such as Banks, Shopping Malls, commercial complex, auditorium, office buildings, etc; are provided with central air conditioning system. Educational and research institutions also need human comfortness, as the population of student community increase year by year. The effective design of central air conditioning can provide lower power consumption, capital cost and improve aesthetics of a building. This paper establishes the results of heat load calculation of different climate conditions by using HLTD method for Bank Infrastructure. Heat load items such as, people heat gain, lighting heat gain, infiltration and ventilation heat gain can easily be putted to the MS-Excel programme. The programme can also be used to calculate cooling load due to walls and roofs. In this project, values were considered with the standard data given by ASHRAE and CARRIER Fundamental Hand Books, and results are satisfactory. It is also seen that in this paper requirement of summer is about 9 to 10% more as compare to climate conditions. Solar air conditioning system is analyzed by considering the various parameters and by using Hourly Analysis Program (HAP) to obtain efficient Heat Load Calculation.*

I- INTRODUCTION

HVAC (heating, ventilating, and air conditioning; also heating, ventilation, and air conditioning) is the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality. HVAC system design is a sub discipline of mechanical engineering, based on the principles of thermodynamics, fluid mechanics, and heat transfer. Refrigeration is sometimes added to the field's abbreviation as HVAC&R or HVACR, or ventilating is dropped as in HACR (such as the designation of HACR-rated circuit breakers).

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HVAC is important in the design of medium to large industrial and office buildings such as skyscrapers and in marine environments such as aquariums, where safe and healthy building conditions are regulated with respect to temperature and humidity, using fresh air from outdoors.

Ventilating or Ventilation (the V in HVAC) is the process of "changing" or replacing air in any space to provide high indoor air quality which involves temperature control, oxygen replenishment, and removal of moisture, odors, smoke, heat, dust, airborne bacteria, and carbon dioxide.

Ventilation removes unpleasant smells and excessive moisture, introduces outside air, keeps interior building air circulating, and prevents stagnation of the interior air. Ventilation includes both the exchange of air to the outside as well as circulation of air within the building. It is one of the most important factors for maintaining acceptable indoor air quality in buildings. Methods for ventilating a building may be divided into mechanical/forced and natural types.

Definition of A/C

The American society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) defines air conditioning as: “The process of treating the air so as to control simultaneously its temperature, humidity, cleanliness and distribution to meet the requirements of the conditioned space”.

It was the feeling of ASHRAE that uncomforted might be dye to the inadequate supply of oxygen and temperature. ASHRAE had conducted lot of like old, young, children, women, and it was found that the oxygen level and temperature were not the only factors for the comfort feeling of the human beings the humidity if air was thought to be responsible factor for the human comfort and number of experiments were conducted with particular temperature and humidity of air was comfort ale for large percentage of people.

II - LITERATURE SURVEY

Computer Program for Cooling Load Estimation and Comparative Analysis with Hourly Analysis Program (HAP) Software; Energy efficiency building design the cooling load estimation plays a vital role because now a day’s major part of the power is consumed to run the heating ventilation air conditioning (HVAC) system. Hence to design and development of cooling load software is mandatory to incorporate the energy efficiency features to reduce the power consumption and accurate and fast results. Previously cooling load estimation was done manually which is quite tedious, complex, time consuming and liable to error due to complex architectural design. The present endeavor to design and develop a software which has an edge over the various other complexes and costly software available in market. The present software is enhanced user friendly and minimum data input with accurate results obtained.

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Designing HVAC System Of VRV-A in Residential Unit by Cooling Load calculation from DACS-HKGSG Software v 2.05 and HAP Software v 4.90; Air Conditioning System is the process of treating the air to simultaneously control temperature, humidity, cleanliness & distribution to meet the requirements of a room, such not only at office buildings, malls, airports but also at residences. Indonesia, with its tropical climate, which has hot, dirty (dusty, smoky) air and erratic winds, needs a way to get comfortable using air conditioning equipment. In this paper, the calculations were carried out, taking into account the ASHRAE standards. For Space references and calculations, the plan is developed by AUTO CAD. Along with the development of Air Conditioning technology and the increasing awareness of climate change, energy consumption, and also more flexible layout of Air Conditioning placement so as to get comfortable, making the use of VRV - A continues to grow not only in office buildings but also in residential areas. This paper will explain how to design an Air Conditioning system of VRV-A by selected indoor unit and an outdoor unit with a connection ratio between 50% - 200%. The cooling load calculation is carried out by using HKGSG v 2.05 software and HAP software v 4.90, which is available in the worldwide market. Nowadays, people are estimating the cooling load calculation by approximation method, i.e., by giving dimensions of the building, which the sellers are estimating roughly the cooling capacity. In this paper, both software is designed to find the cooling load estimation. To design the VRV system with a standard thermal comfort zone by ASHARE. The design for indoor type unit using approximation method of cooling load form HAP Software v 4.90 and DACS – HKGSG Software v 2.05.

Cooling Load Estimation By Cltd Method And Hap 4.5 For An Evaporative Cooling System; This paper present the CLTD method for calculating the sensible cooling load estimation for evaporative cooling systems as a replacement of high power consuming air conditioners, partially or completely for maintaining thermal comfort in various climatic locations without compromising the indoor air quantity. In this manual calculations are made to estimate the cooling load and the results were compared by the outcomes from HAP 4.5 program for a three story shop building. In this paper the investigation on calculation of Sensible Cooling Load for Evaporative Cooling System has been conducted for two story shop building by CLTD method and HAP program produced by carrier for cooling load estimation was used to verify the results. The manual calculation results show that the total cooling load required for ground, first and second floor is 13.49 kW,14.36 kW and14.50 kW for summer (month of May). HAP result for the peak month (May) is 12.6 kW, 13.0 kW and 13.0 kW.

Comparison of Cooling Load Calculation Using Manual Method and Hourly Analysis Program; Achieving an efficient system of air conditioning is required to both maximize the thermal comfort and the overall energy consumption and determining the cooling load through calculation helps this. The primary objective of this research is determine and compare the cooling load using Hourly Analysis program to manual method such as CLTD method of FPTV (Block C&D), UTHM. Measurements from floor plan and prior study of CLTD cooling load calculation method were used to determine the cooling load in HAP software. The cooling load calculation by the HAP software is 3,275,100 BTU/hr (272.9 RT) is 77.9% efficient to chiller capacity and there is 5.79% difference compared to CLTD method. The research can be extended o non-air conditioned spaces in HAP software for future researches. In conclusion, it is found that he total cooling load of the studied buildings is 3,275,100 BTU/hr (272.9 RT). Compared

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to the FPTV (Block C&D), UTHM's chillers capacity of 4,200,000 BTU/hr (350 RT), the cooling load is 77.9% efficient and is under the 80% chillers capacity. Therefore, the chiller does not have to be replaced. The cooling load calculation as compared to the CLTD method and HAP method, there is a difference of 5.79% with HAP software producing a lower cooling load. There difference are minuscule but are statistically significant for the operational, maintenance and installation cost for an air conditioning system. Some suggestions to improve the research further on in the future, is to include all the non-air conditioned spaces such as the toilets, closet and technicians' room. Other than that, more electrical equipment that are present in the FPTV (Block C&D), UTHM should be studied.

III - DESCRIPTION OF PROJECT

Types of Air-Conditioning Systems

Commercial Air-Conditioning According To Application Industrial Air-Conditioning

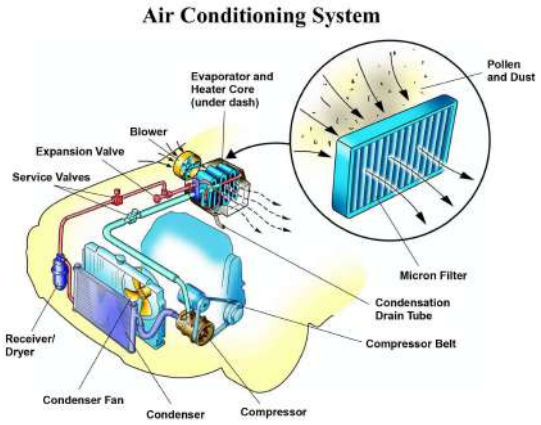

Fig: Basis Air-Conditioning system

Commercial Air-Conditioning According To Application:

This includes air-conditioning of multi room structure like apartments, hotels, office buildings and hospitals. Although treatment varies somewhat for these applications, the basic problems are the same.

Individual control of room temperature is desirable.

Cooling system should also be suitable for winter heating to eliminate duplication of risers and equipment.

Unusual heat loads should be considered.

Fan noise, air noise and cross talk between rooms through ductwork are undesirable

When these requirements are considered in conjunction with loads and equipment, it is not difficult to understand why quality air-conditioning for multi room buildings are more costly per unit capacity than many other types of comfort installation.

Unit of Refrigeration

Unit of refrigeration is "Ton". A ton here doesn't mean mass it is a measure of rate of heat transfer. We know that latent heat of fusion of ice is 336 KJ/Kg. When one ton that is 1000 kg of ice melt in 24 hrs it produces cooling effect at the rate of 233 KJ/min. In other words, if heat is removed from water at the rate of 233 KJ/min we get 1000 kg (I tone) of ice per day.

Types of Refrigeration Systems

Vapor Compression system:

A schematic flow diagram showing the basic components of vapor compress refrigeration system is shown in figure below some typical temperatures for air-conditioning applications are indicated. Refrigerant fluid circulates through the piping and equipment to the direction shown. There are four processes that occur it flows through the system they are as follows:

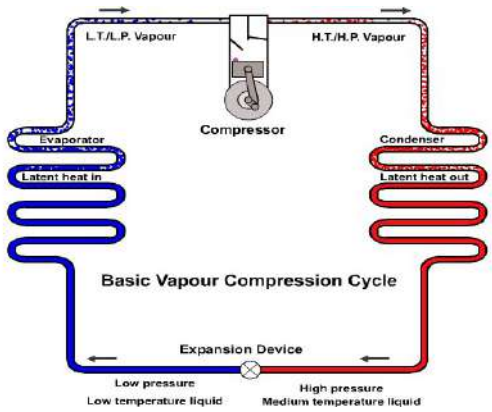

Fig: Vapor Compression Cycle

Vapor Absorption System:

The absorption refrigeration system is quite similar to the vapor compression refrigeration system. In the absorption refrigeration system, refrigerant is produce by evaporation of a liquid (refrigerant) in the evaporator. The difference between the two systems lies in the method of converting the refrigerant vapor back to liquid. In vapor compression system compressor and condenser are used to the conversion of refrigerant vapor (coming from the evaporator) into

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liquid. In the absorption system also, the condenser is used but the compressor is replaced by the combination of absorber generator.

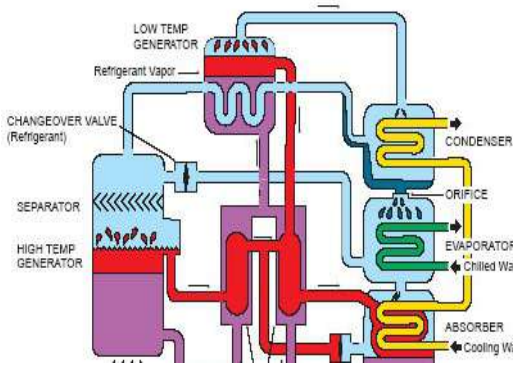

Fig: Vapor Absorption Cycle

IV - SOFTWARE IMPLEMENTATION

There are numerous software's involved in our HVAC designing and detailing project on a commercial / Offices Tower, for calculation purposes. They are as follows:

HAP Software

HAP (Hourly analysis program) soft ware is used to calculate heat load calculation of the system. By this system total tonnage of the machine that to be installed is known, by giving the inputs such as exposures present in the space, occupancy density, lighting and electrical load of the space.

Procedure for calculation is as follows:

Step1: A weather property of the location where the building is located is entered.

Step2: Schedules such as lighting, people, electrical should be prepared in project libraries.
Step3: Exposures and u values are given for wall, window and roof in project libraries.

Step4: In spaces according to the orientation of the individual room exposure of walls, windows and roofs are entered.
Step5: In system, type of machine to be installed is given in which spaces are added to each machine depending upon the requirement

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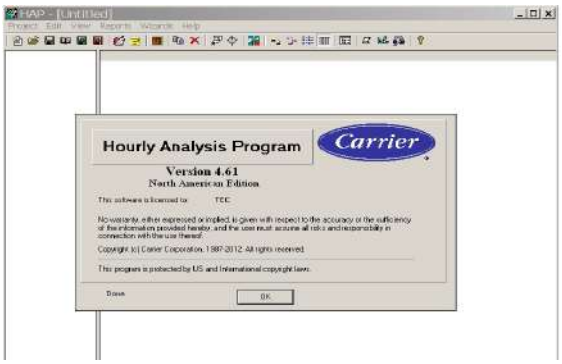

Fig: HAP Software

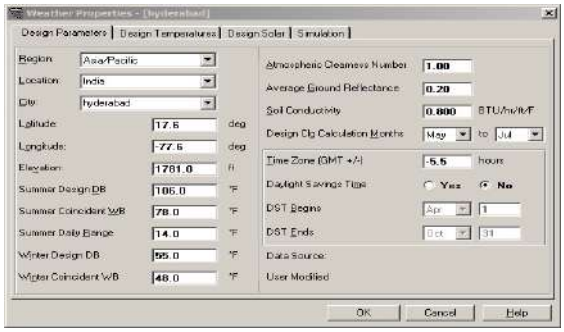

Fig: Weather condition entries [HAP]

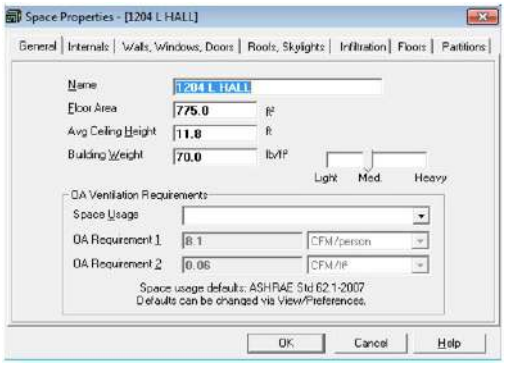

Fig: Dialog Box for Space Properties-General

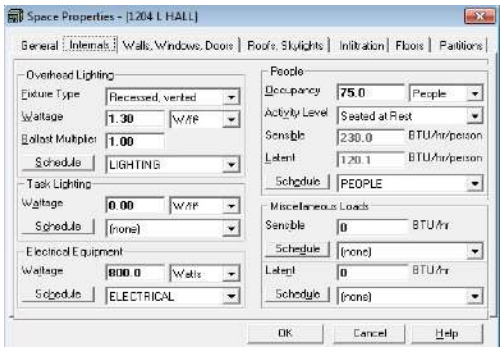

Fig: Dialog Box for Space Properties-Internals

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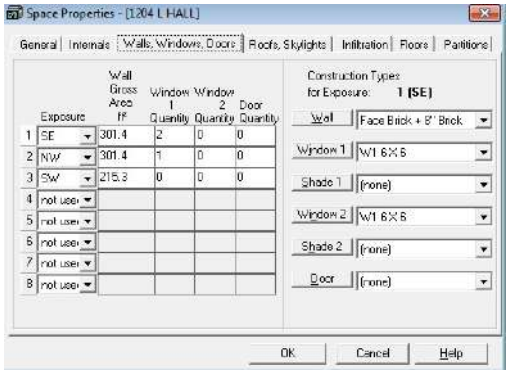

Fig: Dialog Box for Space Properties-Walls, windows and doors

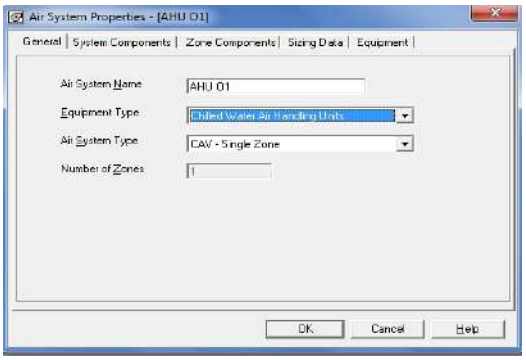

Fig: Dialog box for air system properties.

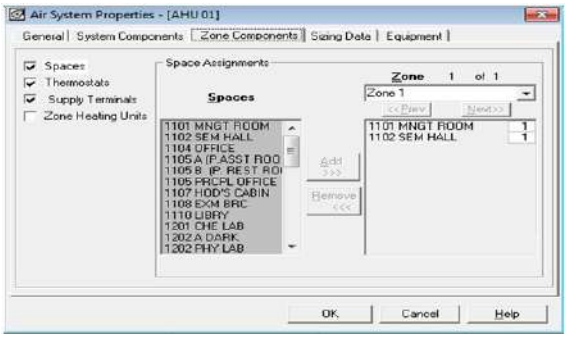

Fig: Dialog box for air system properties

V - CALCULATED DATA

5.1 ASHRAE RECOMMENDED VALUES

Outdoor Air Requirements for Ventilation

Table: Outdoor Air Requirements for Ventilation

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APPLICATION	CFM/ PERSON	CFM/SQ FT
Waiting Hall 02	7.5	0.06
Waiting Hall 01	10	0.18
Multipurpose Cabins	10	0.12
Store Room	5	0.06
Office space	5	0.06
Manager Cabin	5	0.12

VI - HAP ANALYSIS RESULT

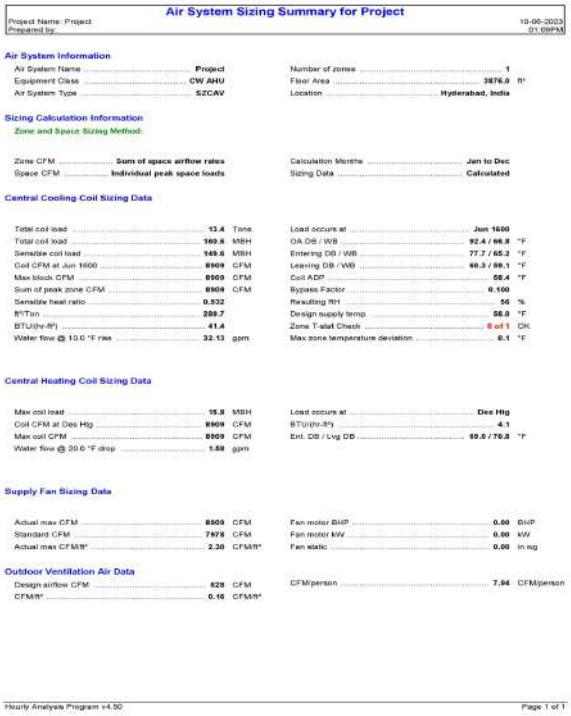

Fig: HAP Analysis Result

VII - CONCLUSION

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Based on the inputs & room data sheets and data Summary sheet the projected TONS will be calculated for Heat Load Estimation and Air Conditioning System for Bank Using HAP Software. To offset this load we propose to provide Water Cooled Chillers with a standby option. Three will be as duty chiller while other one will be as standby.

The Water Cooled Chillers and the pumps will be located in the Chiller plant room assigned for the purpose on the Roof Deck floor. The plant room will be duly ventilated. The "Fan Coil Units" will also be located on the Roof Deck Floor.

It is proposed to incorporate a primary water distribution system in the AC system design. The Primary system will comprise of a set of Primary pumps which will circulate the water to the chillers and they will circulate the water from the chillers to the Various Zone Air Handling Units are constant speed type. This way the pumps need not run at constant speed always and hence energy is saved.

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