

# Review of Design of Air Conditioning System for Commercial and Domestic Applications

Anshu Raj<sup>1</sup>, Neelesh Soni<sup>2</sup>

<sup>1</sup>Research Scholar, Department of Mechanical, ITM University, Gwalior, India

<sup>2</sup>Assistant Professor, Department of Mechanical, ITM University, Gwalior, India

\*\*\*

**Abstract** - Room air conditioners are mostly used in a particular room in public buildings. RACs used for both heating as well as cooling purposes. RACs are available in different variants like 1 ton, 2 ton. In this paper, we will determine and find out exact or near about the temperature required for the selected room in which we put AC. This is important for some reasons. Undersized unit AC- This will not cool the room in more summer or hot weather season. Oversized unit AC – This will affect the body comfort by more cooling and also high money. So, by using calculation of room we will able to find out how much we have to give cooling or heating the room. For this we will save energy as well as money and the wastage of heat in the atmosphere.

**Key Words:** air conditioner, summer, load, tonne, temperature.

## 1. INTRODUCTION

Vapor-Compression Refrigeration or vapor-compression refrigeration system (VCRS), in which the refrigerant undergoes stage adjustments, is 1 of the many refrigeration cycles and is the most widely used technique for air-conditioning of structures and cars. It is also utilized in home and commercial fridges, large-scale warehouses for chilled or freezing storage space of foods and meat, cooled trucks and railroad vehicles, and a sponsor of other industrial and commercial solutions.

Because of their low price, little surroundings conditioning systems (Air conditioning unit) like break up air fitness systems are often installed without a proper research of building package efficiency. Furthermore, these systems are occasionally set up by tradesmen who overlook to comply with the suitable guidelines and rules. Finally, when regular maintenance is usually not really carefully transported out (as therefore frequently occurs), the dynamic functionality of the system is usually jeopardized over period.

Refrigeration might end up being defined while lowering the heat range of an enclosed space by removing high temperature from that space and transferring it elsewhere. A gadget that performs this function is definitely called an air flow conditioner

## 2. PARTS OF VCRS CYCLE:

2.1 Evaporator: It is the component of a refrigeration program in which warmth is removed from atmosphere, drinking water or any additional body required to be awesome by the evaporating refrigerant. Evaporators are primarily categorized as inundated or immediate enlargement, viz., dried out. In bombarded evaporators, the liquefied refrigerants cover the whole heat transfer surface. In or dry evaporators, a component of warmth transfer surface is utilized for superheating the fumes.

2.2 Suction Series: The refrigerates evaporates into a gas in the evaporator coil, the section of pipes from this coil to the condenser coil is called as suction collection.

2.3 Air compressor: The hermitically sealed and semi hermetic compressors have their electric motor surrounded along with cylinder and turn case inside a dome. The motor windings are cooled down by inbound suction vapours. These possess the benefit of no loss, much less sound and compactness.

2.4 Release Line: It is a section of piping had been the pressure is higher than atmospheric pressure.

2.5 Water Collection: Tube or line linking condenser and extension valve.

2.6 Growth valve: An expansion gadget is essentially a limitation offering level of resistance to stream to ensure that the pressure drops, producing in a throttling course of action.

## 3. REFRIGERANT Ur-134A

3.1 R134a is also known as Tetrafluoro ethane (CF<sub>3</sub>CH<sub>2</sub>N) from the family of HFC refrigerant. With the finding of the harming impact of CFCs and HCFCs refrigerants to the ozone coating, the HFC family members of refrigerant offers been broadly used as their alternative.

3.2 It is now becoming utilized as an alternative for R-12 CFC refrigerant in the area of centrifugal, rotary mess, scroll and reciprocating compressors. It can be secure for

regular managing as it is certainly nontoxic, non-flammable and noncorrosive.

#### 4. PSYCHROMETRIC Graph

Air flow comprises approximately 78% nitrogen, 21% air, and 1% other fumes. But air is usually by no means dried out, actually in a wilderness. Two-thirds of the earth's surface is usually protected with water and this, along with various other surface area drinking water and rainfall, maintain low pressure water vapour to be hanging in the surroundings producing up component of the 1% of other gases. The psychrometric chart shows the properties of this drinking water steam through the pursuing guidelines,

4.1 dry light bulb temperature: The dry-bulb temperature (DBT) is the temperature of air measured by a thermometer freely exposed to the air but shielded from rays and moisture. DBT is normally the temperature that is generally believed of as air heat, and it is the accurate thermodynamic temp.

4.2 wet bulb temperature (also known as saturation temperature): When the air flow comes in get in touch with the damp fabric it absorbs some moisture and provides up some temperature, sue to which the temperature of the atmosphere reduces. This decreased temperature assessed by the thermometer is usually known as the moist light bulb heat range.

4.3 dew stage temperature: The dewpoint temperature is the temperature at which the air can no longer "keep" all of the water vapor which is mixed with it, and some of the drinking water vapor must reduce into water. The dew point is usually lower than (or equivalent to) the surroundings temperature.

4.4 family member humidity: Family member moisture (RH) is the percentage of the part pressure of drinking water vapor to the balance vapour pressure of water at a given heat.

4.5 moisture content material (also known as moisture percentage): Humidity Ratio identifies the mass of water in the volume busy by 1 kg of dried out air. In additional phrases, it is definitely the quantity of drinking water needed to become evaporated into 1 kg of dry air in purchase to accomplish a particular condition dampness.

4.6 enthalpy (also known as total high temperature): Measure of the total energy in a humid gas. In various other words and phrases, it can be the practical heat + the latent warmth. Enthalpy is certainly an useful idea in air flow health and fitness where it is normally essential to understand how very much of the "kept" energy will end up being consumed or released when the temp or dampness content is usually elevated or reduced.

4.7 specific volume (the inverse of density): The particular volume is the volume of unit mass of dried out air at a provided temperature normally indicated as  $m^3/kg$  and is also demonstrated in the psychrometric graph. Particular volume is usually the inverse of density ( $kg/meters^3$ ).

Vapor-Compression Refrigeration or vapor-compression refrigeration system (VCRS), in which the refrigerant undergoes stage adjustments, is 1 of the many refrigeration cycles and is the most widely used technique for air-conditioning of structures and cars. It is also utilized in home and commercial fridges, large-scale warehouses for chilled or freezing storage space of foods and meat, cooled trucks and railroad vehicles, and a sponsor of other industrial and commercial solutions

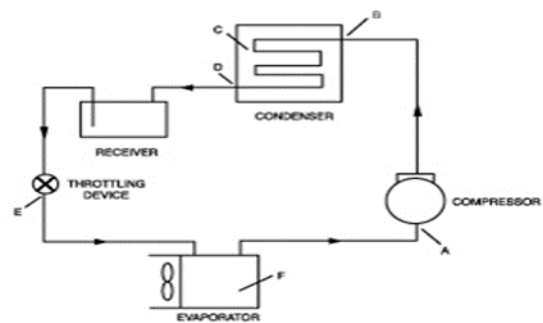


Figure 1:VCRS cycle

Because of their low price, little surroundings conditioning systems (Air conditioning unit) like break up air fitness systems are often installed without a proper research of building package efficiency. Furthermore, these systems are occasionally set up by tradesmen who overlook to comply with the suitable guidelines and rules. Finally, when regular maintenance is usually not really carefully transported out (as therefore frequently occurs), the dynamic functionality of the system is usually jeopardized over period.

Refrigeration might end up being defined while lowering the heat range of an enclosed space by removing high temperature from that space and transferring it elsewhere. A gadget that performs this function is definitely called an air flow conditioner

#### 5. LITERATURE REVIEW

LUCAS et.al [1] have presented a useful, worldwide approach to analyse the functionality of known little air-conditioning installation in houses used in Reunion region. This tropical region aspires to become electric power self-sufficient. This strategy depends on a statistical tool and powerful simulations of houses setup with Air conditioning unit. The simulations, which take account of the building cover, an explanation of the program as well as the methods of the users, are centred on the kernel computation Energy

Plus. They also consider into accounts the climatic circumstances and offer an estimation of the annual electric power usage related to the air conditioning of the region. This global evaluation assists to be eligible the whole system by determining an energy label. In conjunction with the device, an analysis procedure is usually suggested, assisting an auditor determining assistance to enhance the building envelope and also to set up and preserve the program.

Kindaichi et.al [2] have observed the energy consumption of RACs under distinct heat-load circumstances and activities. Specific operations had been taken out from a number of energy usage statistics for 87 RAC units. Person operation data had been divided into two organizations, moderate- and severe-load conditions, whose outdoor temperatures differed by 5 °C. Mild-load conditions were known to lead to shorter individual procedure durations than did severe-load circumstances, suggesting a major difference in consumer patterns. When specific operation durations were reduced by 20%, common energy cutbacks of 40% were observed. Component of this reduction resulted from duration reduction; the relax arrived from adjustments in RAC physical effectiveness, which depends upon outdoor temperature and heating/cooling load. The time-reduction effect surpassed the physical-efficiency impact when person procedure stays were shortened by > 20% during heating system, or by > 26% during chilling.

Matsumoto et.al [3] have researched on for the hedonic cost version to look at ways Vietnamese consumers worth the power efficiency of air ACs. We presume that the energy efficiency of ACs in the Vietnamese market enhances to that of ACs in the Japanese marketplace. After that, we calculate the payback period by dividing the capital price to improve the energy effectiveness by every year electrical power cost conserving. We present that the preliminary investment price may be recovered in a brief period. In acquisition, we determine the implicit lower price rate to show how Vietnamese customers value energy effectiveness expenditure. We discover that the implicit price cut price in Vietnam's Air conditioning unit marketplace is much greater than the prices found out in research on developed countries around the world. Therefore, consumers in developing countries place much decrease worth on energy performance expense than customers in fast developing countries, actually although paying for energy-efficient home appliances provides possibilities to conserve considerable sums.

Moritoa et.al [4] have studied that a greater air flow velocity of disrupted human being rests a lot more than reduce air velocity of airflow. The experiments had been carried out to determine the impact on sleep of varying airflow velocities from air flow conditioners, using 10 healthful youthful males as subjects. The mean air temperature, comparative moisture, and mean glowing heat in the rooms with both atmosphere conditioners were 26.4

(0.7) °C, 58 (7) %, and 26.3 (1.3) °C, and 26.4 (0.7) °C, 53 (6) %, and 26.1(0.6) °C for [A] and [T], respectively. The typical (SD) speed of airflow was in fact 0.14 (0.25) m/s and 0.04 (0.07) m/s for [A]and [B], correspondingly. The optimum surroundings velocity over the bed inside the areas and the figures of times the airflow produces in the air conditioner [A] had been 1.1 m/s and 28 occasions per evening, respectively, and 0.3 m/s and 11 instances per night, correspondingly, with the air conditioner [B]. Many of the outcomes did not display a large difference in the total quantity of period during each rest level, or a major difference in the switch of both mean skin and rectal temps between [A] and [C]; these were statistically examined throughout commonly used strategies. The topics considerably experienced even more of the air flow and cooler at [A] than at [B] although comfort feeling does not really vary significantly. When an additional evaluation of the simultaneity of air flow and physiological reactions experienced been performed, the number of moments body motions, the quantity of times heart price improved., and the number of situations some sleep phases transformed to the stage of wakefulness due to differing airflow in [A] had been considerably higher than those in [W]. A higher speed of air flow had an unfavourable impact on rest actually although the common air flow speed was much less than 0.2 m/h.

Pereira & Mendes [5] have done the experimental info, where the correlations were developed, had been acquired in calorimeters as stated by ISO standard. The calorimeters and connected dimension questions are talked about on the current function. Furthermore, a numerical version to incorporate towards the atmosphere fitness versions with a construction simulation code is usually also offered and a simulation sample is usually transported out displaying energy usage and space surroundings temperature and family member moisture.

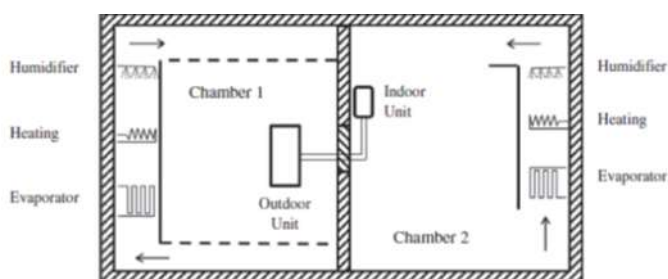
Sogut [6] have studied which utilizes two factors, EEF (exergy efficiency factor) or energetic COP (coefficient of performance) and MTEWI (modified total comparative heating effect), that was suggested to judge energetic and the environmental functionality of RAC (room air conditioners) distributed in the Turkish market. In the research, fumes compression chilling routine used entire RAC models is accepted as model for the studies. The outcomes are demonstrated that typical EEF worth of models using R-22 and L-410A gas are 74.53% and 74.64% correspondingly. Rather than, Ur-410A gas, which is utilized in many breaks up devices and promoted while an environmental useful gas, offers an impact that is usually around 23.18% larger than the R-22 gas which is no longer in use. The analysis at last focuses on the causes how come EEF and MTEWI elements must be provided concern when it comes to functionality and the environmental impact in the RAC units.

Han et.al [7] have suggested a fresh air conditioner that merged evaporative chilling technology, individual type

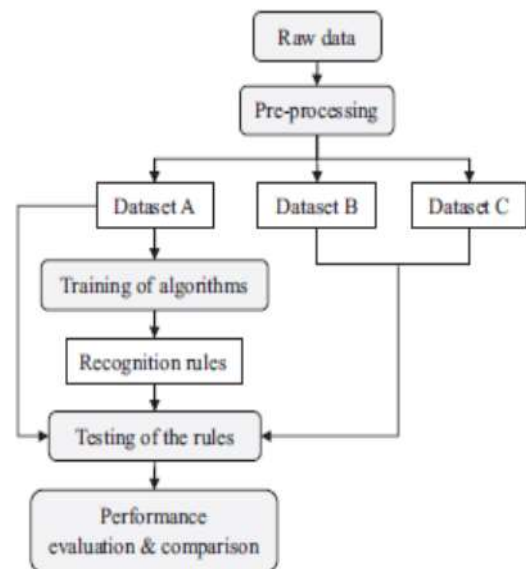
temperature pipe technology, and vapour compression refrigeration concept (known as “combined surroundings conditioner”). The numerical type of the air conditioner was founded as well as stability was confirmed by tests. Centred on the model, the simulation of the working functionality of the combined air conditioner and a standard air conditioner was analysed in common environment areas throughout the cooling period, with all the pursuing outcomes: In chilly and dried out fields like Shenyang, in contrast to the standard air conditioner, the typical cooling coefficient of performance (Police officer) of the combined air flow conditioner was improved by 27.40%. As the climate steadily became warm and moisture gradually improved, the working period of the high temperature tube chilling setting was steadily decreased, and after that the energy-saving a result of the mixed air conditioner started to be even worse. For case study, in the hot and moist Guangzhou, the energy keeping price was just 11.81%. Consequently, it was found the fact that the merged ac got very good energy-saving feasible in cool and dry cities.

Shao et.al [8] have focused upon the overall performance graph, the efficiency of Multi-unit air flow conditioners is usually examined in circumstances of adjustable interior temps. The functionality chart can provide the affordable and quantitative styles of MUAC’s performance and lead the system style, suggesting that it can be utilized as a highly effective and easy device for overall performance evaluation and program improvement of MUACs.

Meissner et.al [9] have researched to enhance the creating of air conditioners in structure simulation equipment, the feature curves for total air conditioning capability, practical cooling capacity and energy effectiveness percentage of two space models were decided. They had been acquired by way of regular capability assessments on weather compartments in an arranged of environmental conditions defined by exterior dried out- and inner damp bulb temperatures. After, the efficiency of those two models which of 4 additional units, by way of and without acquiring into to account the thermodynamic modifications of the encircling surroundings on it, were studied using an entire construction simulation system intended for simulating a conditioned space. The relative evaluation demonstrated that the air conditioner with all the larger energy performance rating not at all times offers the cheapest power usage in true circumstances of usage.



Zhou et.al [10] have suggested a cheap and minimally intrusive method, to identify habit info coming from ecosystem variables by data mining approach. To verify this technique, experiments had been carried out in three rooms. Two types of category algorithms were created to identify Air conditioner functions through the experiment data of inside atmosphere temperature and comparable moisture. Two types of acknowledgement rules had been produced from algorithm teaching in one data set, and examined in the additional datasets. Centred on the screening results, the overall performance of the two algorithms had been examined and likened. The outcomes suggested that the C4.5 decision tree algorithm was not ideal for mining AC operations, while the contour explanation algorithm experienced good functionality in processing the time-series figure of air temperature and family member humidity. Through this test, it is verified that Air conditioners operations can become acknowledged from in house surroundings heat and relative’s humidity by data exploration strategy. The primary contributions of this study are usually that an encouraging strategy was developed, which is usually inexpensive and minimally intrusive on gathering and interpretation info about occupants’ day-by-day behaviours.



Hoon et.al [11] have suggested a whole new control formula which is applicable the idea of an individual air-conditioner and a community air conditioning method to a floor-standing space air-conditioner (FSAC). The regulation formula could be cut in to 3 wind patterns: solid cooling using guide wind flow, regular chilling applying point breeze, and indirect wind. Solid cooling is usually to create a user who is usually revealed to a warm environment thermally neutral quickly, while normal cooling is utilized to keep a thermal-neutral state constantly. An appropriate influence technique for every air conditioning mode was decided through subject matter tests. The interior thermal ecosystem

was examined by using heat, PMV (forecasted mean vote), and TSV (thermal feeling vote). The residents subjected to the hot ecosystem contacted their thermal-neutral state in roughly five minutes credited towards the strong cooling (16.4 CMM) by the immediate blowing wind of the FSAC. When the FSAC transformed the control mode to regular cooling (13.9 CMM), it was simpler to preserve the thermal-neutral condition by swinging direct great air flow directionally managed by straight vanes. When roundabout blowing wind was utilized, an up-wards path in an position of 15° was effective in distributing the cooled down air flow and avoiding chilly drafts.

## 6. CONCLUSION

This paper initiated a review based research into Air conditioner study of particular room. This work offers tremendous significant for developing new technologies pertains to save energy, in order to achieve hot/cool air at initial cost, no harmful effect and safer in environment aspect. So, more attention is needed in this area and lots of work has to be done based in terms of its background, originality, current status, and researches.

## 7. REFERENCES

- [1] Lucas Franck, Ortega Pascal, David Mathieu, Sinama Frantz, Brangeon Boris And Picgirard Fabien (2015). A Method To Evaluate Energy Performance Of Buildings Cooled By Room Air Conditioners, *Energy Procedia*, Pp: 1275 – 1283
- [2] Kindaichi Sayaka, Nishina Daisaku, Murakawa Saburo, Ishida Masaki, Ando Motoki (2017). Analysis Of Energy Consumption Of Room Air Conditioners: An Approach Using Individual Operation Data From Field Measurements, *Applied Thermal Engineering*, Pp: 7-14
- [3] Matsumoto Shigeru, Omata Yukiko (2017). Consumer Valuations Of Energy Efficiency Investments: The Case Of Vietnam's Air Conditioner Market, *Journal Of Cleaner Production*, Pp:4001-4010
- [4] Morito Naomi, Tsuzuki Kazuyo, Mori Ikue, Nishimiya Hajime (2017). Effects Of Two Kinds Of Air Conditioner Airflow On Human Sleep And Thermoregulation, *Energy And Buildings*, Pp: 490-498
- [5] Cherem-Pereira G., Mendes N. (2012). Empirical Modeling Of Room Air Conditioners For Building Energy Analysis, *Energy And Buildings*, Pp: 19-26
- [6] SOGUT M. ZIYA (2012). EXERGETIC AND ENVIRONMENTAL ASSESSMENT OF ROOM AIR CONDITIONERS IN TURKISH MARKET, *ENERGY*, PP: 32-41
- [7] Han Zongwei, Liu Qiankun, Zhang Yanqing, Zhang Shuwei, Liu Jiangzhen, Li Weiliang (2016). Feasibility Study On Novel Room Air Conditioner With Natural Cooling Capability, *Applied Thermal Engineering*, Pp:1310-1319
- [8] Shuangquan Shao, Weijia Zhang, Hainan Zhang, Hongbo Xul, Changqing Tian (2016). Performance Chart: A Novel Method For Performance Analysis Of Multi-Unit Air Conditioners, *Energy Procedia*, Pp:552-558
- [9] Meissner Jose W., Abadie Marc O. M. Luis Moura, Mendonça Katia C., Mendes Nathan (2014). Performance Curves Of Room Air Conditioners For Building Energy Simulation Tools, *Applied Energy*, Pp:243-252
- [10] Zhou Hao Qiao Lifeng, Jiang Yi, Sun Hejiang, Chen Qingyan (2016). Recognition Of Air Conditioner Operation From Indoor Air Temperature and Relative Humidity By A Data Mining Approach, *Energy And Buildings*, Pp: 233-241
- [11] Yang Jeong-Hoon, Kim Taeyeon, Cheong Chang Heon (2013). Supply Airflow Control Algorithm of A Floor-Standing Room Air-Conditioner To Achieve Thermal Comfort For Residential Housing In Summer, *Building And Environment*, Pp: 227-238