

DESIGN AND ANALYSIS OF SPLIT REFRIGERATION SYSTEM WITH INDOOR & OUTDOOR CONDENSER UNIT

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ABSTRACT:- Refrigeration has wide variety of application in domestic as well as industrial purpose as it has been analyzed that condenser heat as a waste of energy in refrigeration system has a lot of scope of research

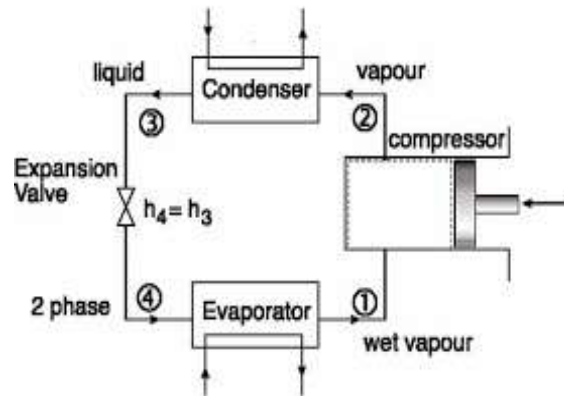
air conditioner condenser unit has installed outside of the room purpose of making outside condenser unit for refrigeration is to refrigeration maintain temperature of room or any space where heat addition is very undesirable such as chemical Laboratories and Medical Application.

The experimental setup has been designed taking compressor (230v) for refrigerant (R 134) a condenser unit (coil diameter 5mm.)(Coil length 9.14mm.) And evaporator box (volume 12.5L) for conducting the experiment, two specific case has been considered and is condenser unit inside the condenser room and outside the room

After the observation for both case is has been found that Average room temperature was found 1.9% less (31.10823) for case II with respect to average room temperature (31.6955) for case I. Evaporator temperature was 15.9% less (45.7) in case-II which compared with evaporator temperature (54.3) case -I .Temperature of water in evaporator was found Minimum -10.2 °c in case 1and for case 2 minimum temperatures is -10.3.

1. INTRODUCTION

Science of providing and maintaining temperature below that of surroundings Refrigeration and air conditioning is the fascinating branch of science which deals with the chilling or freezing of a substance by removing some of its heat. These artificial withdrawals of heat produce within the substance or within a space a temperature below the general temperature of its surrounding. Refrigeration essentially means continued abstraction of heat from a substance (perishable foods, drink and medicine etc.). At low temperature level and then transfer this heat to another system at high potential of temperature. To accomplish this, mechanical work must be performed to safety the second law of thermodynamics, Air conditioner refers to the coincident management of temperature, humidity, cleanliness and air motion at intervals a confined reason or area.



2. LITERATURE REVIEW

Soni and Gupta provided a detailed energy analysis for theoretical vapour compression refrigeration cycle using R404A, R407C and R410A. They developed the equations of exergetic potency and energy destruction for the most system elements like mechanical device, condenser growth device, liquid-vapour device and evaporator. In the method, they obtained relations for total exergy destruction in the system, the overall exergetic efficiency of the system and Exergy Destruction Ratio (EDR) related to exergetic efficiency. They also developed an expression for Coefficient of Performance (COP) of refrigeration cycle. The outcomes of their experiment showed that COP and exergetic efficiency of R407C are better than that of R404A and R410A. The EDR of R410A is higher than that of R407C and R404A. For all refrigerants, i.e., R404A, R407C and R410A, COP and exergy efficiency improve by sub-cooling of high pressure condensed liquid refrigerant. With increase in dead state temperatures exergetic potency will increase and EDR reduces whereas constant of performance remains constant. With increase in effectiveness of liquid vapour device COP and exergetic potency decreases whereas EDR will increase. Nagalakshmi and Yadav designed a refrigeration system and conducted its analysis using R12 & R134a refrigerants. They also conducted the design calculations of the suitable and necessary refrigerator equipment. CFC-12 is that the most generally used refrigerant that serves each in residential and business applications, from small window units to large water chillers, and everything in between. Its explicit combination of potency, capacity and pressure has made it a popular choice for equipment designers. Their

project mainly intended to explore the behaviour of the alternative refrigerants compared to CFC-12 and challenges the industry is facing in design, operation services and maintenance of various refrigeration equipments. They found that R134a refrigerant is non-toxic and does not flare up within the whole range of operational temperatures. Theoretical and experimental approaches used as a methodology in this work. Yadav and Sharma presented the exergetic analysis of actual vapor compression refrigeration cycle which includes the component's exergetic destruction and cycle's exergetic efficiency. The second law of physical science could be a powerful improvement tool of thermodynamically systems. They examined the performance of refrigeration tutor in light of second law of thermodynamic, and discussed the exergy destruction, which is the wasted work potential during a process as a result of irreversibility. From the calculations of their experiments, they observed that maximum destruction is in condenser. The exergetic efficiency of the whole system can be calculated by using equations as $\eta_{\text{exergetic}} = 35.23\%$, COP of the system has been given by $\text{COP} = 3.19$. As per their views, the work could be performed on calculating the exergetic efficiency of an individual component and how the exergetic efficiency varies by use of alternative refrigerants. Dabas et al. studied the behaviour of performance parameters of an easy vapour compression cooling underneath transient conditions that occur throughout cooling of a hard and fast mass of brine from initial area temperature to sub-zero refrigeration temperature. They have also investigated the effects of different lengths of capillary tube over these characteristics. It was complete that with the perpetually falling temperature over evaporator, refilling of it with more and more liquid refrigerant causes multi-fold increase in heat transfer coefficient which helps in maintaining refrigeration rate at falling temperature. Larger capillary tubing decreases the tendency of renewal of evaporator however offers less 'evaporator temperature' effective in lower vary of refrigeration temperature. Shorter capillary tubing ensures higher COP ab initio however that deteriorates at a quicker rate in lower temperature vary. Capillary tube length must be optimized for maximum overall average COP of the system for the complete specified cooling job. Sunhane and Pandey Their work concentrated on the energy management side of the implementation of energy saving measures in the Jabalpur hospital and research centre. It comprised audit of the said hospital in which various electrical and thermal utilities were considered such as transformer, lighting, air conditioning system, pumps etc. Audit was conducted and various measurements and calculation were done on the basis of the data collected, and performance assessment was done of the equipment

installed in the hospital. The main concern of their work had been on the air conditioning system, the total load of window and split air conditioning system in tonnage was 159.5 kW and total cooling was 526.6 kW. The result of their work showed that the window and split air conditioning system could be replaced by centralized air conditioning system while considering 20% duct losses, and this way, cost saving could be acquired. They also observed that to implement energy-efficiency measures cost-effectively, they are best installed in new or retrofitted buildings, or when replacing old equipment. It is generally cheaper to introduce additional energy-saving measures when retrofitting work is already being carried out on a building than at other times when the hospital is under normal operation

3. Experimental setup

List of components according to layout and their specifications

0.wooden support [2x3 ft] [Length . 3fit, width 2fit,]	4.Expansion device (capillary tube) [material Cu,15ft diameter 5mm]
1.Compressor (250v, 50HZ,1phase)[types - oil charged , capacity 190L] refrigerant- R-134A ,	5.Evaporator
2.Condenser (types Air cooled, length 25ft) [out outer diameter 5mm]	6.cooper pipe(length 15 ft , diameter 0.25 inch
3.Filter (dryer)	

4. METHODOLOGY

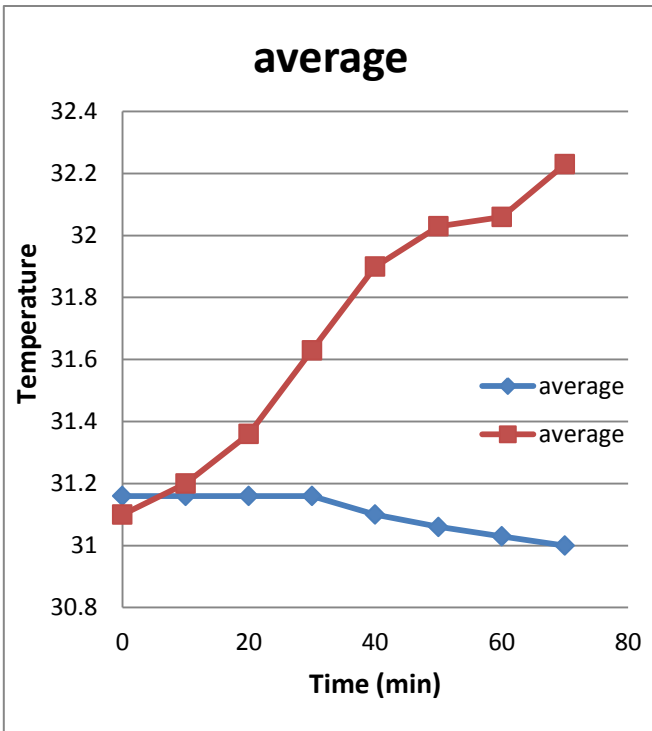
In the context of experimentation of the project all observation has been taken during experiment at RAC lab, ITM UNIVERSITY GWALIOR, in this experiment, observation have been taken for two cases, case 1- record the reading when both the unit is in the room. Case 2- record the reading when the 2nd unit is outside the room.

In this experiment various parameters such as compressor out temperature, condenser temperature, evaporator temperature,

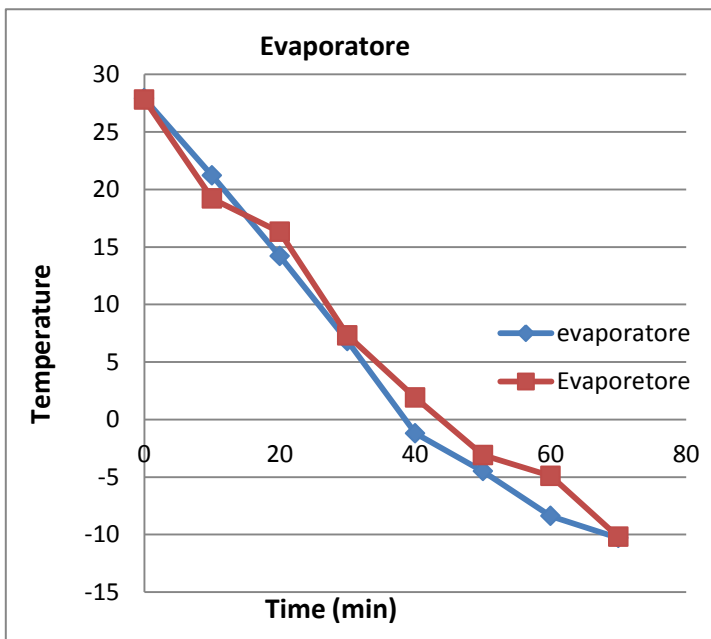
5. RESULTS AND DISCUSSION

On the basis of experimental observation parameters and calculation following results have been obtained and their comparative representation show blow

A. Combined variation of Average room temperature effect with respect to time



B. Combined variation of evaporator temperature with respect to time



6. Conclusion

6.1 Conclusions

After conducting the experiments, the following conclusions are drawn.

- a) Minimum average room temperature found in case II which is 1.9% less temperature with respect to case I.
- b) Maximum refrigerating effect found maximum in case II which is 15.9% more from case I.
- c) Temperature of water in evaporator was found Minimum -10.2 °c in case 1 and for case 2 minimum temperatures is -10.3.

6.2 Future scope

- a). In future Hydrofluoroolefin refrigerant can be taken because it will not produce global warming because it is free from carbon ,and also it will not produce ozone layer depletion due to absence of chlorine in refrigerant.
- B) Pressure loss has been not considered in this research work.

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