Dual Refrigerant Air Conditioner

Akshay Singhai[1], Anubhav Rai[2], Apoorv Singh[3], Arjit Agrawal[4], Chitransh Shukla[5], Prof. Ashish Chaturvedi[6]

[1-5]*Student Final Year Mechanical Engineering Department,*

[6]*Associate Professor Oriental College of Technology*

Abstract – Final Year Project Based on Modified VCRS. It is an era of rapidly growing urbanization and globalization which requires large amount of power but the sources of power are very limited, scarce and depleting rapidly. So, in this research paper we are presenting an Air Conditioner which works on modified VCRS using two different refrigerants which are R-134a and Water. The main advantage of this research is that we are using less power without altering the cooling rate. Since we are using R-134a as our primary refrigerant so our project is eco-friendly.

Keywords: Modified VCRS, Primary refrigerant (R-134a), Secondary refrigerant (water).

I. INTRODUCTION

The Project is to design and construct a Dual Refrigerant Air Conditioner. This machine can be used to provide comfort by altering the properties of air, usually by cooling the air inside. The size of the machine is convenient for portable purpose.

It's frame is made up of mild steel, moreover it is easy to carry and use at any time for cooling purpose.

It is a 1/8 tonne of AC which gives output equivalent to 1 tonne of AC. We are using a traditional refrigerant R-134a and water for better cooling using lesser amount of power.

II. WHAT IS AIR CONDITIONER?

An Air Conditioner is a system or a machine that treats air in a defined, usually enclosed area via refrigeration cycle in which generally warm air is removed and replaced with cooler and more humid air.

In construction a complete system of heating, ventilation and air conditioning is referred to as HVAC. Whether in homes, offices or vehicles, its purpose is to provide comfort by altering the properties of air, usually by cooling the air inside.

III. AIR CONDITIONING SYSTEM

The system which effectively controls the air from comfort conditioning i.e., temperature, humidity, purity, and the motion of air is known as **air conditioning system.**

In a broad context, air conditioning means the automatic control of an atmospheric environment either from comfort of human being or animal or from the proper performance of some industrial or scientific process.

Air Conditioning system provides sufficient quantity of clean air containing a specific amount of water vapour and at a temperature capable of maintaing predetermined atmospheric conditions within selected space.

IV. WORKING PRINCIPLE

A.C. works on the mechanism of refrigerant liquid. This liquid changes to gas and evaporates as it extracts heat from the air around it and in low pressure conditions it again gets converted to liquid and after entering into the normal pressure region this again changes into gas.

Any A.C. will comprise of three parts i.e. a compressor, a condenser and an evaporator.

Compressor and condenser are usually kept outside the house where as an evaporator is kept inside the house. Compressor is the most important part of all the three as it pumps the vapor refrigerant through the system. In the evaporator the fluid leaves as low pressure cool gas to reach compressor.

The compressor will compress the gas to liquid. As the gas becomes liquid, the molecules are together and their energy is high resulting in high temperature.

The working fluid leaves compressor and flows into condenser as hot air which will convert this hot air to low pressurized liquid. One can observe the temperature around outside unit, which is high due to heat dissipated from compressor.

The temperature in condenser is very low and this converts the high temperature gas into low pressurized liquid. Through a small hole this pressurized liquid will flow to into evaporator. In this process, the pressure drops and the liquid is converted into low pressure cool air to start the cycle once again. In the process of changing liquid to gas it extracts heat from the air around it. Evaporator has fins and it will blow that cool air into the room. The hot air is lighter than cool air, so it is in the

upper part of the room whose heat is used to convert high pressurized liquid into low pressurized gas.

This process continues till the room attains the temperature you set. The thermostat present in the A.C. will temporarily stop A.C. for some time; if the room temperature raises again, the thermostat will automatically on the A.C. to set the temperature of your room to your desired level.

V. DESIGN AND SPECIFICATIONS

- Mild steel frame- 280*280*450(in mm)
- Compressor-It is a hermetically shield compressor of capacity 1TR of 480volts, 3-phase and using refrigerant R-134A
- Condensing coil of small fridge
- Copper Tube- 6 feet
- Capillary copper coil- 6 feet
- Refrigerant- R-134A (50gms)
- Isolated Box- 150*150*150(in mm)
- AC pump of small cooler

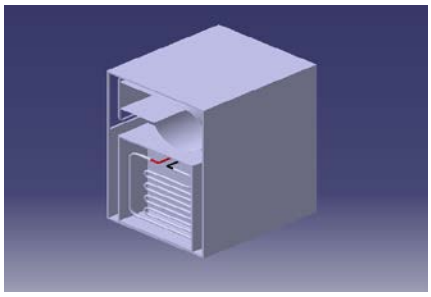

Fig.1 CATIA DESIGN OF AC

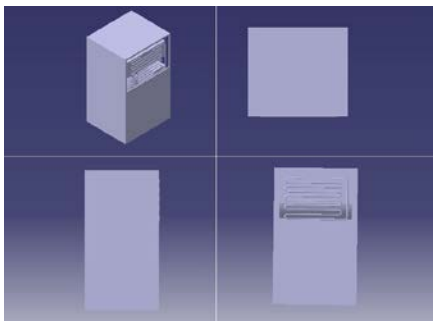

Fig.2- DIFFERENT VIEWS OF AC

VI. PARTS USED

COMPRESSOR

- A **compressor** is a mechanical device that increases the pressure of a gas by reducing its volume. An air compressor is a specific type of gas compressor.
- Reciprocating compressor is used to compress the refrigerant in domestic refrigerator. This compressor is hermetically sealed type.
- Hermetic sealed compressor is one in which the two halves are sealed by welding or brazing. Electric motor and reciprocating mechanism are placed inside this housing.

Fig.3 Hermetically Shield Compressor

CONDENSER

- A **condenser** is a device or unit used to condense a substance from its gaseous to its liquid state, by cooling it. In so doing, the latent heat is given up by the substance and transferred to the surrounding environment.
- Condensers can be made according to numerous designs, and come in many sizes ranging from rather small (hand-held) to very large (industrial-scale units used in plant processes).

EVAPORATOR

- An **evaporator** is a device in a process used to turn the liquid form of a chemical substance such as water into its gaseous-form/vapor. The liquid is evaporated, or vaporized, into a gas form of the targeted substance in that process.
- Evaporator is a kind of radiator coil used in a closed compressor driven circulation of a liquid coolant. That is called an air-conditioning system (A/C) or refrigeration system to allow a compressed cooling chemical, such as R-22 (Freon) or R-410A, to evaporate/vaporize from liquid to gas within the system while absorbing heat from the enclosed cooled area, for example a refrigerator or rooms indoors, in the process.

Fig.4 EVAPORATOR

THROTTLE VALVE

- A **thermal expansion valve** is a component in refrigeration and air conditioning systems that controls the amount of refrigerant released into the evaporator thereby controlling superheat. Thermal expansion valves are often referred to generically as "metering devices".
- A thermal expansion valve is a key element to a heat pump; this is the cycle that makes air conditioning or air cooling, possible.

BLOWER

Air conditioner blower or fan is one of the key components that are needed as part of the air conditioning system.

The function of the blower is to produce air movement to the space that is being conditioned. There are basically four types of fan that are commonly used in the HVAC equipment. They are the propeller fan, centrifugal fan, vane-axial fan and tube-axial fan

Fig.5 BLOWER

AC PUMP

- A **pump** is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action.
- Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work by moving the fluid.
- Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps.

Fig. 6 AC PUMP

COPPER TUBE

- Copper is mostly used because of the following properties:
- Resistant to corrosion
- High level of heat transfer
- Machinability and Ductility
- Consumption of less refrigerant

FIG.7 ISOLATED BOX

ISOLATED BOX

- Isolated box is commonly used to keep the contents inside stay cool. It is generally made of hard thermocol.

- Here we used it to store our secondary refrigerant i.e. water.

FRAME

- It is the external body which supports the entire system and protects it from outer environment.
- It is made up of mild steel.

PLY WOOD

- It covers the entire system and keeps the internal parts safe.

VII. CONCLUSION

Compare to the traditional air conditioner our project requires less power by providing the same amount of cooling as that of the traditional air conditioner. Another benefit is that it is portable and easy to handle. It is economical thus can be afforded by most people of India. Not only urban household but also the rural household will benefit from our project as it is economical and uses less power.

Since it is less power consuming so in future it can also be run with the help of Renewable energy resources.

REFERENCES

[1] R. Cabello , E. Torrella , J. Navarro-Esbr, "Experimental evaluation of a vapour compression plant performance using R134a, R407C and R22 as working fluids" Applied Thermal Engineering, 2004; 24 : 1905–1917.
[2] Tun-Ping Teng, Huai-En Mo, Hung Lin, Yuan-Hong Tseng, Ren-Hao Liu, Yu-Fan Long, "Retrofit assessment of window air conditioner" Applied Thermal Engineering 2012; 32: 100-107.
[3] A text book on "Refrigeration and air conditioning" by C P Arora.
[4] A text book on "Refrigeration and air conditioning" by R K Rajput.
[5] A text book on "Heat exchangers" by Sadik Kakac, Hongtan Liu.