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Design & Fabrication of Non- Conventional Air Conditioner

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Abstract: Working of AC there is lot of fuel is burn in car. These fuel are save and run the AC other system rather than fuel. Run the AC without fuel using suspension system of car and exhaust gas of car. Increase the efficiency of car.

Keywords: Air Conditioner, Vapour Absorption System, Ammonia, Mild steel, Suspension System, Exhaust Gas.

I. INTRODUCTION

Air conditioning is a combined process that performs many functions simultaneously. It conditions the air, transports it, and introduces it to the conditioned space. It provides heating and cooling from its central plant or rooftop units. It also controls and maintains the temperature, humidity, air movement, air cleanliness, sound level, and pressure differential in a space within predetermined limits for the comfort and health of the occupants of the conditioned space or for the purpose of product processing. The term HVAC&R is an abbreviation of heating, ventilating, air conditioning, and refrigerating. The combination of processes in this commonly adopted term is equivalent to the current donation of air conditioning.

II. WORKING PRINCIPLE

When the vehicle is run on the bumpy road then suspension spring continuously move up and down. We attach piston to the vehicle frame because of linear motion of piston high-pressure air comes out from the cylinder. This high-pressure air provides to the air tank. In air tank high pressurized air is stored and when we want to turn on A.C. system this high pressurized air send to the heat exchanger by using knob. Low-temperature coolant passes through the heat exchanger & also high pressurized air pass through it. Here heat exchange occurs and air temperature becomes 15 ^{0}C to 20 ^{0}C which is further sent at the required place which is to be cooled. When coolant comes out from heat exchanger its temperature is increased by few Celsius, then this coolant is sent through exhaust gas system and its temperature becomes low and then it will again send to the heat exchanger. For better performance, we can use nitrogen sealing. This is all about working with the A.C. system. The machine does not contain any moving parts, does not consume any mechanical energy except for experimental purposes and is relatively easy to manufacture. Cylindrical tubes function as both the absorber system and the exhaust gas the condenser is air cooled and the evaporator contains 40 l of water that can freeze. This ice functions as a cold storage for the cabinet.

III. DESIGN

1 System Design
2 Mechanical Design

System design mainly concerns with the various physical concerns and ergonomics, space requirements, arrangements of various components on the main frame of the machine, number of controls, positions of this controls, ease of maintenance, the scope of

further improvements, the height of machine components from the ground etc. In mechanical design, the components are categorized into two parts.

1 Design Parts.
2 Parts to be purchased.

For design parts, detailed design is done and dimensions thus obtained are compared to next highest dimensions which are readily available in the market. This simplifies the assembly as well as post production servicing work. The various tolerances on workpieces are specified in the manufacturing drawing. The process sheets are prepared and passed on to the manufacturing stage. The parts are to be purchased directly are specified and selected from standard catalogs.

3.1. Parts to be purchased

1) Pneumatic cylinder
2) Heater
3) Springs

3.2 Design Parts

1 Air Tank

Finite Element Analysis of Air Tank: (12 bar Pressure)

Material Properties

Material Yield Strength = 250 Mpa
Young's modulus = 210 GPa

Assumptions:

Pressure is acting uniformly over the internal cylinder surface.
Welded section is simulated as fixed support

Modelling

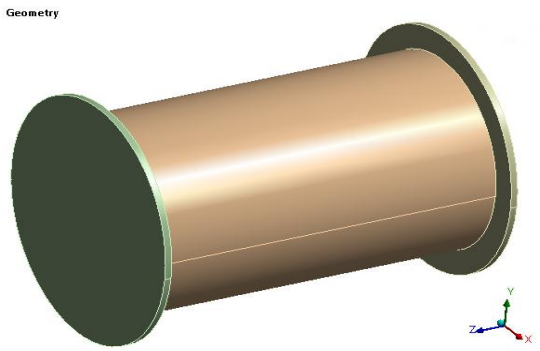

Fig 3.1 Modelled Geometry

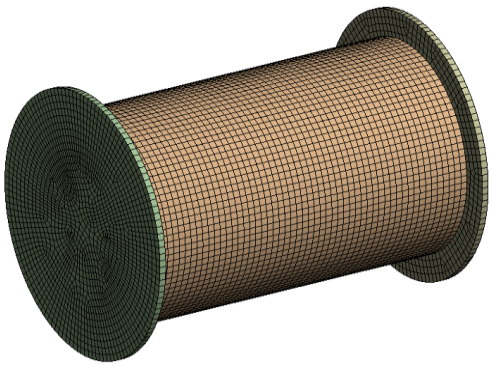

Fig.3.2 FEA Mesh Model

- Mainly Hex 20 element is used for meshing
- Total no. of elements = 19816
- Total no. of nodes = 85832

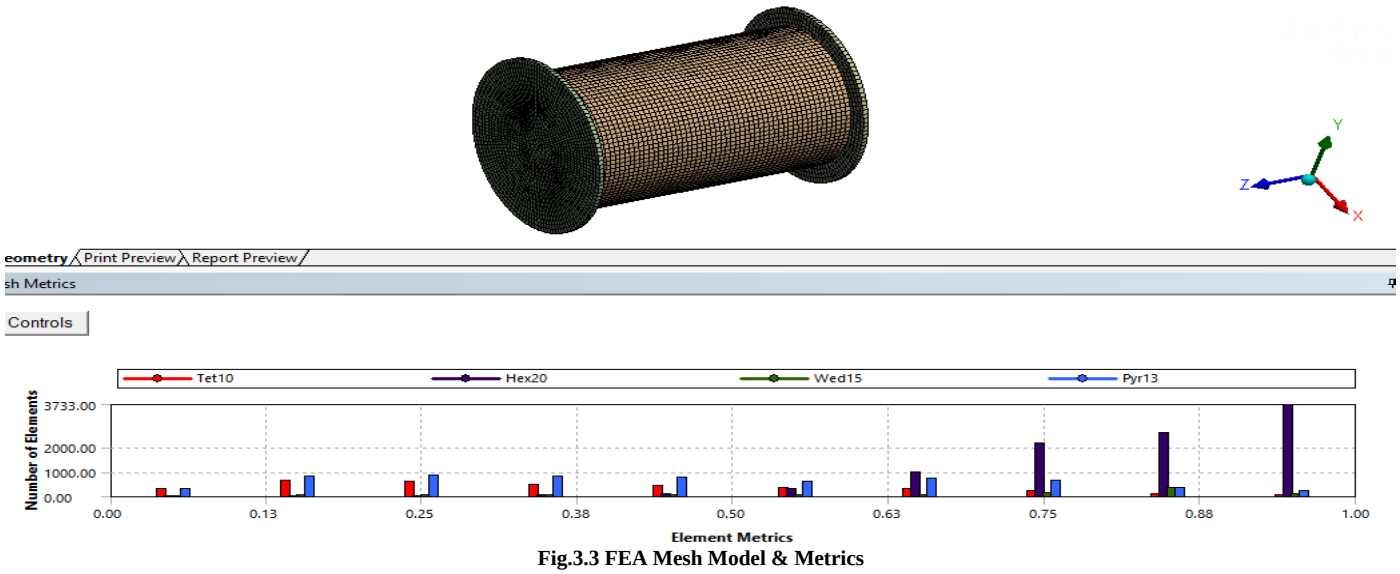

Fig.3.3 FEA Mesh Model & Metrics

Loading & Boundary Conditions

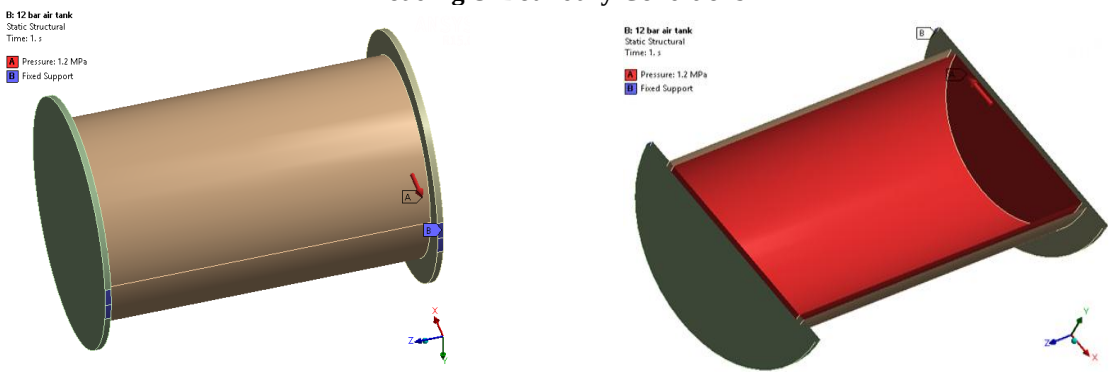

Fig 3.4 Loading & Boundary Conditions

Total deformation

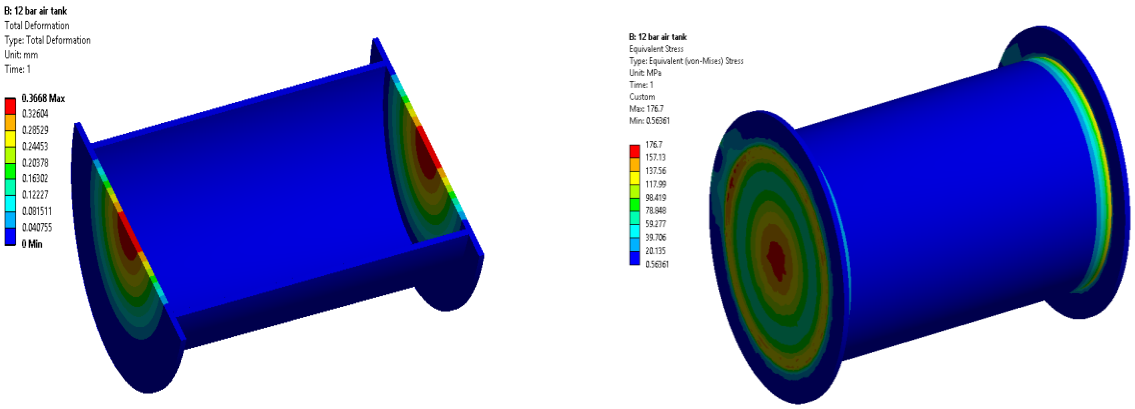

Fig.3.5 Total Deformation Sectional View

Maximum equivalent von Mises stress observed is 176.7 MPa << Yield stress

2 Generator

In the generator Exhaust heat will comes through the exhaust recovery system where ammonia liquid vaporizes and temperature and pressure increases. Generator generally works same as a compressor in VARS system. The generator is made up of Mild Steel 20C8. It is drilled with the help of vertical drilling machine for the fitting of an electric heater. A heater is sealed to prevent the leakage of water-ammonia mixture from the generator. Another hole is made to upper part of a generator for admitting the mixture of calcium carbide & ammonia from the pump placed in the absorber. The third opening is made at the bottom for drain out the mixture from the generator to the absorber.

Volume of Generator (V) = Length of tank^2 × Inner dia. of tank

Length of Generator (L) = 200mm

Inner dia. of Generator =110mm

$= 110^2 \times 200$

$= 1.900 \times 10^6$ mm^3

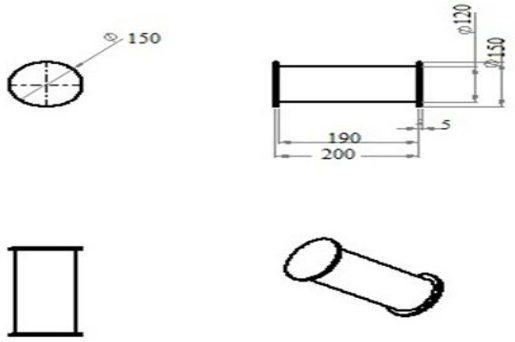

Fig. 3.6 Drawing of Generator

3 Evaporator

An evaporator is a device used to turn the liquid form of a chemical into its gaseous form. The liquid is evaporated, or vaporized, into a gas. Evaporator cabinet is mounted on the middle story of the frame. It is made of a thin metal sheet having internal tubes for circulating the refrigerant. It has two ports namely inlet & outlet port. Inlet port is connected to receiver and outlet port is connected to the absorber. An evaporator is a device used to turn the liquid form of a chemical into its gaseous form. The liquid is evaporated, or vaporized, into a gas. Evaporator cabinet is mounted on the middle story of the frame. It is made of a thin metal sheet having internal tubes for circulating the refrigerant. It has two ports namely inlet & outlet port. Inlet port is connected to receiver and outlet port is connected to the absorber.[3]

Volume of evaporator tank(V) = Length of tank^2 ×Inner dia. of tank

Length of evaporator tank(L) = 200mm

Inner dia. of evaporator tank =70

$= 70^2 \times 200$

$= 769.69 \times 10^3$ mm^3

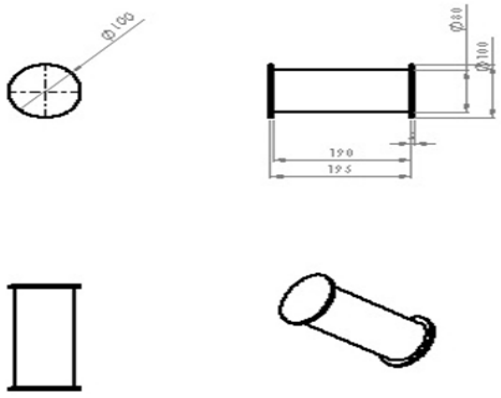

Fig. 3.7 Drawing of Evaporator

4 Condenser

The condenser is kept fully immersed in the barrel fully filled with water. Water is used as a coolant in the condenser barrel here because water has the best heat transfer properties than air. Any leakages can also be detected easily because of the bubbles formed in the water. The leakage of NH3 can also be absorbed by water so, the leakage of the refrigerant is not harmful to the material

When the medium containing waste heat is a liquid or a vapour which heats another liquid, then the shell and tube heat exchanger must be used since both paths must be sealed to contain the pressures of their respective fluid. The shell contains the tube bundle, and usually internal baffles, to direct the fluid in the shell over the tubes in multiple passes. The shell is inherently weaker than the tube so that the higher-pressure fluid is circulated in the tubes while the lower pressure fluid flows through the shell.

The total heat rejected in the condenser, Q_c is given by

$Q_c = m \times (h_2 - h_4)$

$= m_w \times C_{pw} \times (T_{wo} - T_{wi})$ KW ------ (Eq.1)

Where m is the mass flow rate of refrigerant .m

h_2, h_4 are the inlet and exit enthalpies of refrigerant

m_w is the mass flow rate of the water.

C_{pw} is an average specific heat of the external fluid, and

T_{wi} and T_{wo} are the inlet and exit temperatures of the water.

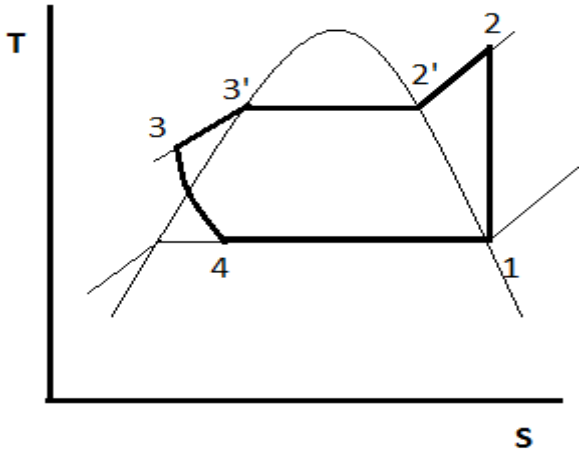

Fig.3.8. T-S Diagrams for Sub-cooling

Considering 8 min. trial of VCR system

T = 8 min.

= 8×60

= 480 sec.

Here in this case temperature of water entering in the condenser is atmospheric temperature considering about 30^0C. Therefore T_{wi} = 30^0C.

Also, we want to heat water up to 38^0C - 42^0C. Therefore taking T_{wo} = 40^0C.

Heat rejected by refrigerant in condenser = Heat absorbed by water in condenser

$$Q_c = m_w \times C_{pw} \times (T_{wo} - T_{wi})\ KW \qquad \text{-------(Eq. 2)}$$

Where, m_w = (Volume of water in condenser × Density) ÷ Time
= (0.0011 × 1000) ÷ (8×60)
= 0.022912 kg/sec

Now
C_{pw}= specific heat of water at constant pressure = 4.187 kJ/kg K

$$Q_c = 0.023 \times 4.187 \times (35-30)$$

$$Q_c = 0.481\ KW$$

$$Q_c = 481\ W$$

The required condenser area is then given by the equation:

$$Q_c = U \times A \times \Delta T_m \qquad \text{------- (Eq. 3)}$$

Where,

U is the overall heat transfer coefficient

A is the heat transfer area of the condenser, and

ΔT_m is mean temperature difference between refrigerant and water.

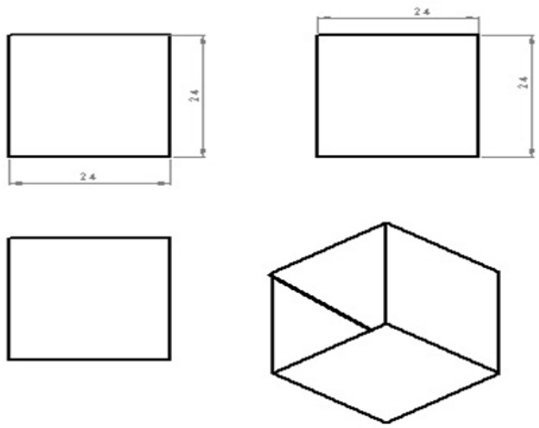

Fig. 3.9 Drawing of Evaporator

5 Base Frame

The raw material was cut to length and size considering the material. Bar, pipe and long shapes were cut to length using a cutter. Angles, Pipe, and sheets were cut down with torches and shears and other shape cutting equipment

The base structure consists of mild steels L angle which is connected together to form a table by welding. In the base structure following components comes,

- L angle
- Support Rod
- Suspension body
- Springs
- Pneumatic cylinder

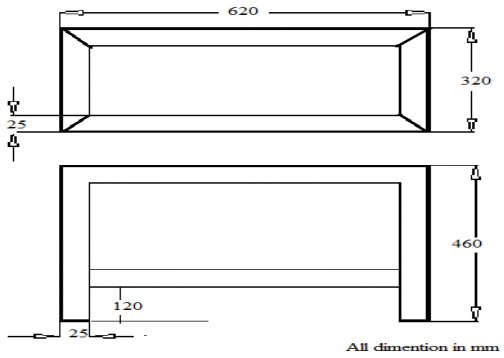

Fig. 3.10 Base Frame

CONCLUSION AND FUTURE SCOPE

CONCLUSION

1. It requires no power for its operation.
2. It is easy for maintenance.
3. It is cheap as compared to the conventional power generation unit.
4. Waste is utilized to produce the best.

So many installation locations having zero scarcity but ampleness of the space.

FUTURE SCOPE

1) The system is an absorption cycle based cooling process wherein it is primarily charged utilizing the sun to drive the Ammonia salt Absorption Cycle.

2) Our system with refrigerant storage has the advantage of accumulating refrigerant during the hours of high exist gas isolation.

3) Every aspect of absorption cooling technology is governed by the properties of working fluids. Hence the advent of new working fluids would enable completely different.

4) Among the major working pairs available NH_3-$CaCl_2$ is used considering its advantages over other working fluids.

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