IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.53

Volume 4, Issue 3, October 2024

A Climate Control Systems were Developed for A Particular Arena

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Abstract: *HVAC (heating, ventilation, and air conditioning) systems are used mostly for cooling and air quality maintenance. Sustainable solutions are needed for future energy systems due to the world's ongoing increase in energy usage. As energy usage rises, so does the risk of atmospheric global warming. Environmental protection organizations from all around the world have recently created innovative energy-saving rules and systems that can be used in industry. In addition to air conditioning, there are ventilation systems such as ceiling fans, fresh air supplies, and exhaust fans. Ceiling fans use revolving blades to ventilate the air, exhaust fans move indoor air outside, and fresh air supplies move indoor air outside by bringing in fresh air from the outside. The concepts of vapour compression cycles underpin the operation of the ventilation system. Our objective is to design the auditorium's air conditioning system and calculate the air and refrigeration flow rates throughout the space. The temperature differential between the auditorium's incoming and output air is first ascertained. The thermal energy is then computed. Additionally, the heat energy equation is used to determine the amount of heat in refrigerant. figuring out the mass air flow rate and refrigerant flow rate of the auditorium air conditioning system.*

Keywords: HVAC

I. INTRODUCTION

Heating, ventilation, and air conditioning are referred to as HVAC.Both residential and commercial buildings are heated and cooled by this method. growing in popularity in newly constructed homes. The principles of fluid mechanics, heat transfer, and thermodynamics underpin HVAC systems. In essence, an HVAC system is a collection of several kinds of equipment that are installed together to control the indoor climate and provide heating and cooling. HVAC systems use mechanical, electrical, and I&C components to keep things, products, or items placed in space comfortable or to provide comfort to building inhabitants.

VENTILATION:

In order to regulate temperature, eliminate any combination of moisture, smells, smoke, heat, dust, airborne bacteria, or carbon dioxide, and replenish oxygen, ventilation is the process of altering or replenishing the air in any given environment. A common definition of ventilation is the deliberate introduction of outdoor air into a building's interior. It is among the most crucial elements in preserving a building's appropriate indoor air quality. There are two categories of ventilation techniques for buildings: natural and mechanical/forced.

AIR CONDITIONING:

All or a portion of a building can have its humidity or temperature controlled by an air conditioning system or freestanding air conditioner. Because open windows would interfere with the system designed to maintain consistent indoor air conditions, air-conditioned buildings frequently have sealed windows. In order to mix with the space return air, fresh air is often pulled into the system from outside via a vent into a mix air chamber. After cooling down in an indoor or outdoor heat exchanger section, the mixture air is directed into the area to produce positive air pressure. The opening of this vent can typically be adjusted to change the proportion of fresh air in the return air. About 12% of the total supply air is typically taken in as fresh air.

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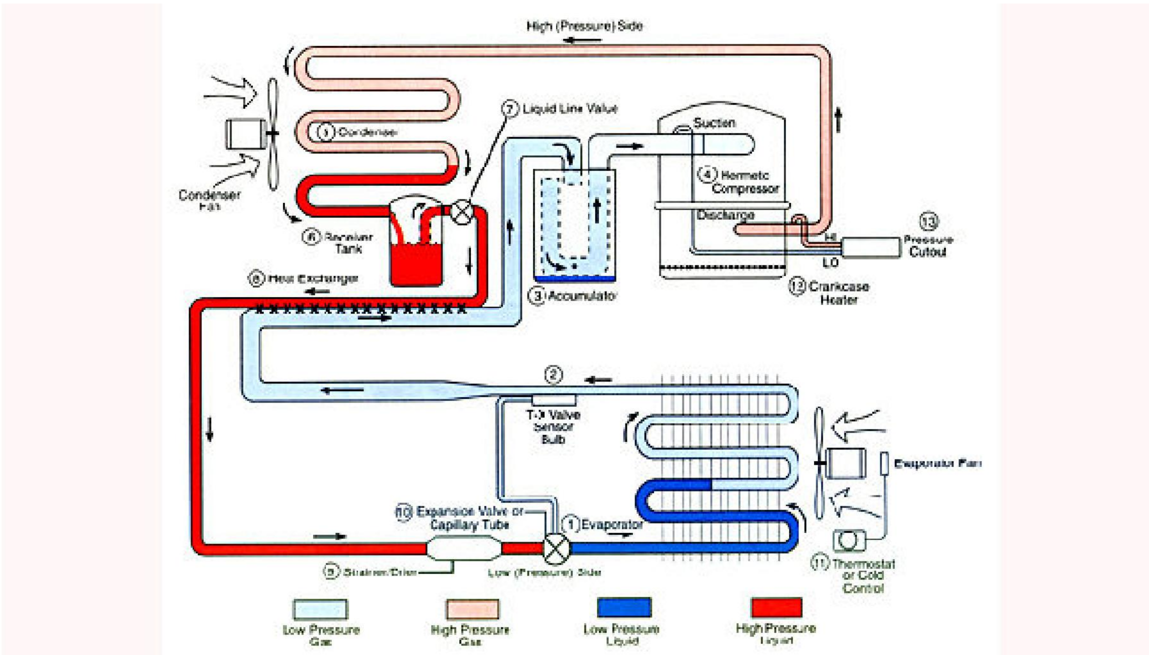

REFRIGERANT R410 A:

AZ-20, Eco Fluor R410, Forane 410A, Genetron R410A, Puron, and Suva 410A are trademarks for R-410A, an azeotropic but nearly azeotropic mixture of difluoromethane (CH2F2, also known as R-32) and pentafluoro ethane (CHF2CF3, also known as R-125) used as a refrigerant in air conditioning systems.

The color of R-410A cylinders is rose.

Property	Value
Formula	CH2F2 – 50 %
	CHF2CF3 – 50 %
Molecular Weight	72.6
Melting point (°C)	−155
Boiling point (°C)	−48.5
Liquid density (30°C), kg/m3	1040
Vapor density (30°C), air=1.0	3
Vapor pressure at 21.1°C (MPa)	1.383
Critical temperature (°C)	72.8
Critical pressure, MPa	4.86
Gas heat capacity (kJ/(kg·°C))	0.84
Liquid heat capacity @ 1 atm, 30°C, (kJ/(kg·°C))	1.8

The use of R-410A is growing quickly and worldwide. Even though many businesses were looking for alternatives, there were no widely recognized substitutes for its use in commercial air conditioning systems, particularly when flammability was taken into account.

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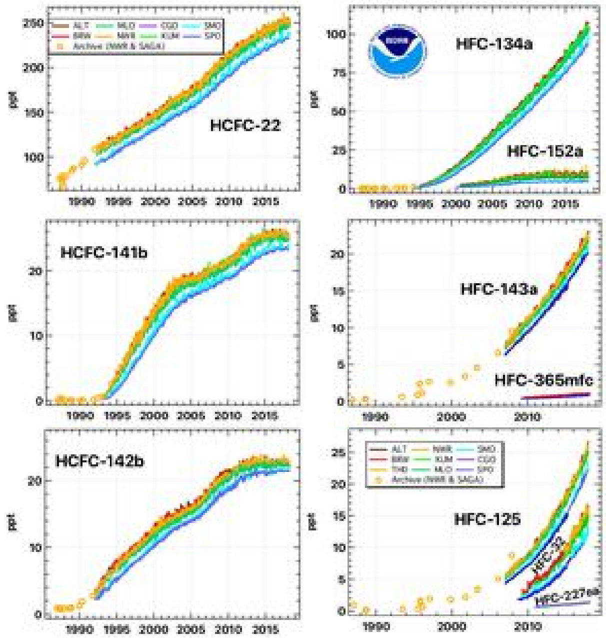
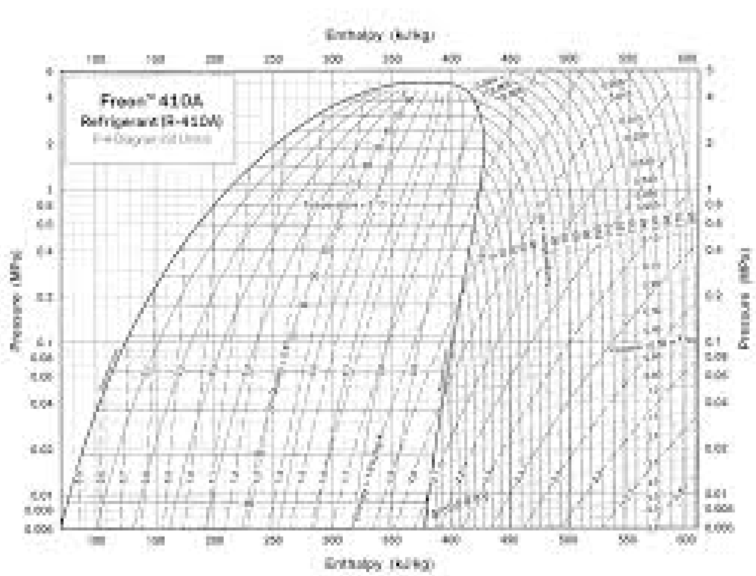
Types of Air Conditioning Systems

1) Window Air Conditioner.
2) Split Air Conditioner.
3) Packaged Air Conditioner.
4) Central Air Conditioning System.





CALCULATION

System for air conditioning in the auditorium.

- Normal buildings are between nine and ten feet high from floor to ceiling.
- The height of the room determines the air volume. However, in the case of an auditorium, the height could be 10 meters or 30 feet above the floor.

There is a significantly larger net air volume inside the AC area.
A big number of individuals congregate in the auditorium. People dissipate more heat as a result.
The following formula should be used to estimate the necessary air flow rate.

$$Q = m^* Cp^*\Delta T$$

The term "ΔT" describes the difference in air temperature before and after it enters a heat exchanger. Assume that the difference is 20 K in this instance.
We must determine the mass flow rate of refrigerant needed to flow within the heat exchanger's tubes because, once the air flow rate is completed, the heat is transferred to the atmospheric air side by the refrigerant.

$$Q = m_r *Cp*\Delta T$$

AIR FLOW RATE:-

Volume of air present in the auditorium =
Length * Width * Height = 25* 20 * 10 = 600 m^3(Values are assumed)
Assume, 6 KW for every 10 Sq. Mtr floor area.Net floor area available = 50 Sq. Mtr
Heat load = Q = 300 KW
It is ideal to estimate the heat load from the walls, roof, floor, windows, and doors as well as internal loads from humans, electrical equipment, lighting fixtures, and air entering the room during ventilation.
The air conditioning system must remove 300 KW of heat energy from the air, which is the total of the aforementioned criteria.
Quantity of air flow rate from the auditorium space tothe heat exchanger we use to condition the air is: Substituting the values,

$300 = m_a * 1.006 * 20$

$m_a = 14.91$ Kg/s

Volumetric flow rate of air = density / mass

= 0.08 m^3/s air flow ratethrough the heat exchanger.

Refrigerant flow rate:

Selected Refrigerant: R 410A
Boiling point at atmospheric pressure = -51.44 C =221.71 K
This is the temperature of refrigerant entering the heat exchanger coil.
The coil is designed so that the heat exchange between the refrigerant and the air happens until they reach equilibrium temperatures.

Assume Refrigerant chose is R410 A;Cp = 1.001 KJ/Kg K
Thus, the temperature of the refrigerant leaving the coil,

= 20 C = 293.15 K

$300 = m_r*1.001*(293.15-221.71)$
Mass flow rate of refrigerant,
M_r= 4.19 Kg/s

II. RESULT & DISCUSSION

Volume of air in the auditorium = 600m^3Net heat load = 600KW
Total air flow rate through the heat exchanger = 0.08m^3/sTotal refrigerant flow rate = 4.19m^3/s
Temperature of air before entering heat exchanger andafter leaving heat exchanger = 20˚k
Temperature of refrigerant leaving the coil = 295 ˚k
Mass of air in =14.91 kg/s
Mass flow rate of refrigerant in AC unit = 4.91kg/s

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We have determined the net heat load generated in the auditorium and created the schematic diagram for the air conditioning system. The mass flow rates of air and refrigerant in air conditioners are determined using a specific heat formula.

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