Anjuman-I-Islam's
M. H. Saboo Siddik Polytechnic

MICRO PROJECT

Power Engineering

(22562)

Topic: Collecting specifications, working and constructional details of different types of Refrigeration and Air Conditioning units.

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Refrigerator

A **refrigerator** (colloquially **fridge**) consists of a thermally insulated compartment and a heat pump (mechanical, electronic or chemical) that transfers heat from the inside of the fridge to its external environment so that the inside of the fridge is cooled to a temperature below the ambient temperature of the room. Refrigeration is an essential food storage technique in developed countries. The lower temperature lowers the reproduction rate of bacteria, so the refrigerator reduces the rate of spoilage. A refrigerator maintains a temperature a few degrees above the freezing point of water. Optimum temperature range for perishable food storage is 3 to 5 °C (37 to 41 °F). A similar device that maintains a temperature below the freezing point of water is called a **freezer**. The refrigerator replaced the icebox, which had been a common household appliance for almost a century and a half.

Domestic refrigerators and freezers for food storage are made in a range of sizes. Among the smallest are Peltier-type refrigerators designed to chill beverages. A large domestic refrigerator stands as tall as a person and may be about 1 m wide with a capacity of 600 L. Refrigerators and freezers may be free-standing, or built into a kitchen. The refrigerator allows the modern household to keep food fresh for longer than before. Freezers allow people to buy food in bulk and eat it at leisure, and bulk purchases save money.

Air Conditioner

Air conditioning (often referred to as AC, A/C, or air con) is the process of removing heat and moisture from the interior of an occupied space to improve the comfort of occupants. Air conditioning can be used in both domestic and commercial environments. This process is most commonly used to achieve a more comfortable interior environment, typically for humans and other animals; however, air conditioning is also used to cool and dehumidify rooms filled with heat-producing electronic devices, such as computer servers, power amplifiers, and to display and store some delicate products, such as artwork.

Air conditioners often use a fan to distribute the conditioned air to an occupied space such as a building or a car to improve thermal comfort and indoor air quality. Electric refrigerant-based AC units range from small units that can cool a small bedroom, which can be carried by a single adult, to massive units installed on the roof of office towers that can cool an entire building.

In the most general sense, air conditioning can refer to any form of technology that modifies the condition of air (heating, (de-) humidification, cooling, cleaning, ventilation, or air movement). In common usage, though, "air conditioning" refers to systems which cool air. In construction, a complete system of heating, ventilation, and air conditioning is referred to as HVAC.

Working Principle of Refrigerator and Air Conditioning.

Concept:

The principle of refrigeration is based on the following concepts:

1. *Heat flows from a system at higher temperature to another at lower temperature*

2. *Fluids by absorbing the heat, change from liquid phase to vapour phase and subsequently condense by giving off the heat*

3. *The boiling and freezing temperatures of a fluid depend on its pressure. When a certain fluid at a very low pressure and temperature is compressed, even though its pressure increases, it may still be in the condensed state itself if its temperature is not increased to the saturation temperature corresponding to the increased pressure*

4. *Heat can flow from a system at low temperature to a system at higher temperature by the aid*

Air conditioners and refrigerators work the same way. Instead of cooling just the small, insulated space inside of a refrigerator, an air conditioner cools a room, a whole house, or an entire business.

Air conditioners use chemicals that easily convert from a gas to a liquid and back again.

- This chemical is used to transfer heat from the air inside of a home to the outside air.

The machine has three main parts. They are

- Compressor
- Condenser
- Evaporator

The working fluid arrives at the compressor as a cool, low-pressure gas. The compressor squeezes the fluid. This packs the molecule of the fluid closer together. The closer the molecules are together, the higher its energy and its temperature.

The working fluid leaves the compressor as a hot, high pressure gas and flows into the condenser. If you looked at the air conditioner part outside a house, look for the part that has metal fins all around. The fins act just like a radiator in a car and helps the heat go away, or dissipate, more quickly.

When the working fluid leaves the condenser, its temperature is much cooler and it has changed from a gas to a liquid under high pressure. The liquid goes into the evaporator through a very tiny, narrow hole. On the other side, the liquid's pressure drops. When it does it begins to evaporate into a gas.

- As the liquid changes to gas and evaporates, it extracts heat from the air around it. The heat in the air is needed to separate the molecules of the fluid from a liquid to a gas.
- The evaporator also has metal fins to help in exchange the thermal energy with the surrounding air.

By the time the working fluid leaves the evaporator, it is a cool, low pressure gas. It then returns to the compressor to begin its trip all over again.

- Connected to the evaporator is a fan that circulates the air inside the house to blow across the evaporator fins. Hot air is lighter than cold air, so the hot air in the room rises to the top of a room.

This continues over and over and over until the room reaches the temperature you want the room cooled to. The thermostat senses that the temperature has reached the right setting and turns off the air conditioner. As the room warms up, the thermostat turns the air conditioner back on until the room reaches the temperature.

Air Conditioner Units

1. ***Blue Star 1.5 Ton 5 Star Split Inverter AC - White (BI/BO-5CNHW18QATX, Aluminium Condenser)***

Specifications:

In The Box	1 Indoor Unit, 1 Outdoor Unit, Connecting Kit, Remote
Brand	Blue Star
Model Name	BI/BO-5CNHW18QATX
Type	Split
Capacity in Tons	1.5 Ton
Star Rating	5 Star BEE Rating
BEE Rating Year	2018
Colour	White
Series	Q
Cooling and Heating	No
Cooling Capacity	5340 W
Compressor	Dual Rotary Inverter
Dehumidification	No
Remote Control	Yes
Refrigerant	R-32
Technology Used	Inverter Technology
Condenser Coil	Aluminium

Constructional Details:

Indoor W x H x D	96.5 cm x 31.9 cm x 21.5 cm
Indoor Unit Weight	12.9 kg
Outdoor W x H x D	96.8 cm x 68.9 cm x 36.7 cm
Outdoor Unit Weight	46 kg
Power Requirement	AC 230 V, 50 Hz
Power Consumption	1420 W

Other Parameters:

Performance Features

Panel Display	Hidden Display
Turbo Mode	Yes
ISEER	4.68 W/W
Other Performance Features	Precision Cooling to 0.5 DegreeC

Body And Design Features

Evaporator Fin Type	Hydrophilic Blue Fins
Condenser Fin Type	Anti Corrosive Blue Fins

Air Flow & Filter Features

Anti-bacteria Filter	No
Dust Filter	Yes
Active Carbon Filter	Yes

Convenience Features

Auto Restart	Yes
Sleep Mode	Yes
Self-Diagnosis	Yes

Working:

- In a split AC consists of 2 units… Indoor Unit and Outdoor Unit

Indoor unit consists of

- Evaporator
- Blower

Outdoor unit consist of

- Compressor
- Condenser coil
- Cooling Fan

The outdoor and indoor coils are connected with the help of copper piping.

The Spilt ac is more efficient than Windows ACs which have all components in one unit as the distance between the condenser and Evaporator makes Heat transfer more efficient !!!

2. *Voltas 1.5 Ton 3 Star Window AC - White (WAC 183 DZA, Copper Condenser)*

Specifications:

In The Box	1 AC Unit, Remote Control, Warranty Card, User Manual
Brand	Voltas
Model Name	WAC 183 DZA
Type	Window
Capacity in Tons	1.5 Ton
Star Rating	3 Star BEE Rating
BEE Rating Year	2018
Colour	White
Cooling Capacity	5050 W
Compressor	High EER Rotary
Dehumidification	No
Remote Control	Yes
Refrigerant	R-22
Condenser Coil	Copper

Constructional Details:

Indoor W x H x D	66 cm x 43 cm x 70.5 cm
Indoor Unit Weight	54 kg

Power Requirement	AC 230 V, 50 Hz
Power Consumption	1729 W

Other Parameters:

Performance Features

Panel Display	LED Display
Turbo Mode	Yes

Air Flow & Filter Features

Air Circulation	700 CMH
Auto Air Swing	Yes
Anti-bacteria Filter	Yes
Dust Filter	Yes
Other Filter Features	Silver Nano

Convenience Features

Auto Restart	Yes
Timer	Yes
Sleep Mode	Yes
Memory Feature	Yes
Self Diagnosis	Yes
Additional Features	Easily Removable Panel, Inner Groove and Energy Saver

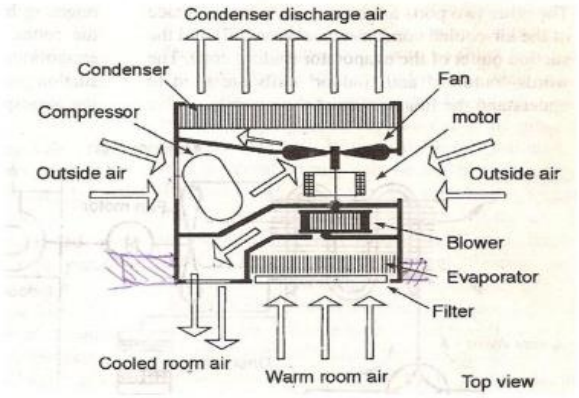
Remote Control Features

Night Glow Buttons on Remote	Yes
Other Remote Control Features	LCD Remote

Working:

Room Air Cycle

The air moving inside the room and in the front part of the air conditioner where the cooling coil is located is considered to be the room air. When the window AC is started the blower starts immediately and after a few seconds the compressor also starts. The evaporator coil or the cooling gets cooled as soon as the compressor is started.



The blower behind the cooling coil starts sucking the room air, which is at high temperature and also carries the dirt and dust particles. On its path towards the blower, the room air first passes through the filter where the dirt and dust particles from it get removed.

The air then passes over the cooling coil where two processes occur. Firstly, since the temperature of the cooling coil is much lesser than the room air, the refrigerant inside the cooling coil absorbs the heat from the air. Due to this the temperature of the room air becomes very low, that is the air becomes chilled.

Secondly, due to reduction in the temperature of the air, some dew is formed on the surface of the cooling coil. This is because the temperature of the cooling coil is lower than the dew point temperature of the air. Thus the moisture from the air is removed so the relative humidity of the air reduces. Thus when the room air passes over the cooling coil its temperature and relative humidity reduces.

This air at low temperature and low humidity is sucked by the blower and it blows it at high pressure. The chilled air then passes through small duct inside the air conditioner and it is then thrown outside the air conditioner through the opening in the front panel or the grill. This chilled air then enters the room and chills the room maintaining low temperature and low humidity inside the room.

The cool air inside the room absorbs the heat and also the moisture and so its temperature and moisture content becomes high. This air is again sucked by the blower and the cycle repeats. Some outside air also gets mixed with this room air. Since this air is sent back to the blower, it is also called as the return room air. In this way the cycle of this return air or the room air keeps on repeating.

Hot Air Cycle

The hot air cycle includes the atmospheric air that is used for cooling the condenser. The condenser of the window air conditioner is exposed to the external atmosphere. The propeller fan located behind the condenser sucks the atmospheric at high temperature and it blows the air over the condenser.

The refrigerant inside the condenser is at very high temperature and it has to be cooled to produce the desired cooling effect. When the atmospheric air passes over the condenser, it absorbs the heat from the refrigerant and its temperature increases. The atmospheric air is already at high temperature and after absorbing the condenser heat, its temperature becomes even higher. The person standing behind the condenser of the window AC can clearly feel the heat of this hot air. Since the temperature of this air is very high, this is called as hot air cycle.

Setting the Room Temperature with Thermostat

When the desired temperature is attained inside the room, the thermostat stops the compressor of the AC. After some time when the temperature of the air becomes higher again, the thermostat restarts the compressor to produce the cooling effect. One should set the thermostat at the required temperature and not keep it at very low temperature to avoid high electricity bills.

3. *VRV Daikin Air-conditioning System (14 HP)*

Specification:

Cooling Capacity (Btu/hr)	136000
Tonnage (TR)	14 HP (11.55 TR)
Star Rating	NA
Model	RXYQ14TRY6
Electrical Power Supply	
Power Supply	3 Phase, 380-415 V, 50 Hz.
Technical Specification	
Compressor Make	Daikin
Refrigerant Gas Specification	R- 410 A
Compressor Type	Scroll

Packing Delivery& Taxes	
Despatch time after releasing the order	1 month
Road Permit Or Way Form	By Customer
Type of packing	Wooden Base

Others	
Indoor type	2 X 3.18 TR Round Flow Cassette Unit
Indoor type	2 X 2.55 TR Round Flow Cassette Unit
Indoor type	1 X 2.01 TR Hiwall Unit

Constructional Details:

Brand:	Daikin
Weight:	285.00 Kg(s)
Product Dimension (L x W x H):	765X1240X1657 Millimetre (mm)
Package Dimension (L x W x H):	765X1240X1657 Millimetre (mm)

Working:

When the thermostat signals the air-conditioning system to lower air temperature, a whole sequence of events begins.

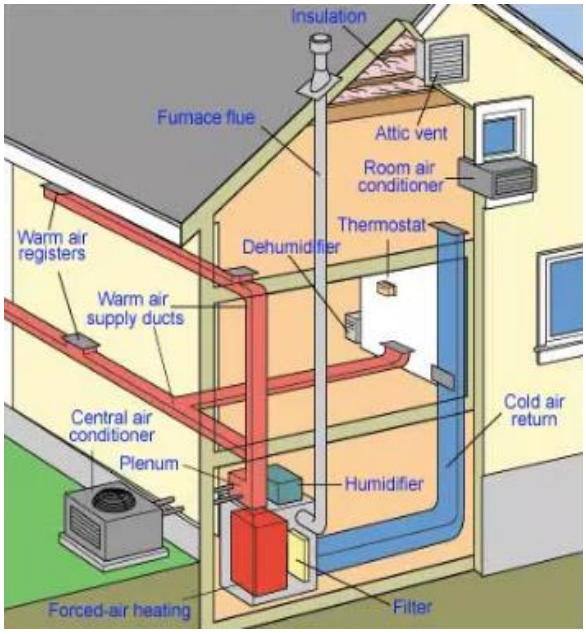
First, the air-handling unit kicks on, drawing room air in from various parts of the house through return-air ducts. This air is pulled through one or more filters, where airborne particles such as dust and lint are removed—in fact, sophisticated filters may remove microscopic pollutants as well. Then the air is routed to air-supply ductwork through which the blower pushes it back to the rooms.

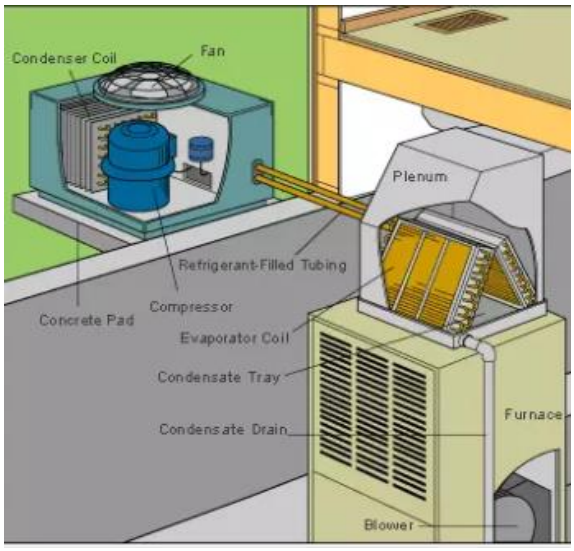
But how does the evaporator coil get cold in the first place? That is where refrigeration principles come into play.

Every air conditioner has three main parts: a condenser, an evaporator, and a compressor. With a typical "split system," the condenser and the compressor are located in an outdoor unit. The evaporator is mounted on or in the air-handling unit, which is often a forced-air furnace. With a "package system," all of the components are combined in a single outdoor unit that may be located on the ground or on the roof.

Refrigerant circulates through copper tubing that runs between the evaporator and the condenser. This refrigerant receives and releases heat as it raises and lowers in temperature, changing from liquid to gas and then back to liquid. The refrigerant is especially cold when it begins to circulate through the indoor coil.

As the air handler pushes warm air across the coil, the refrigerant absorbs so much heat from the air that it turns into vapor. As a vapor, it travels to the outdoor compressor, which pressurizes it and moves it through the outdoor coil. There it jettisons the heat through coils or thin metal "fins." A fan in the compressor also helps to dissipate the heat. The refrigerant then passes through an expansion device that converts it to a low-pressure, low-temperature liquid, which returns to the indoor coil. And so the cycle goes.





Refrigerator Units

BPL 564 L Frost Free Side-by-Side Refrigerator (BRS564H, Silver)

Specification:

Model Name	BRS564H	Number of Refrigerator Shelves	4	Max Noise Level	43 dB(A)
Type	Free Standing	Refrigerant	R- 600A	Max Storage Time By Power Failure Freezer	10hour
Refrigerator Type	Side-by-Side	Built-in Stabilizer, Coolpad, Ice Dispenser	No	Kind of Coolant/Charge (R134a/R600a)/Grammes	R600a/68 R/g
Brand Color	Silver	Toughened Glass	Yes	Foaming Components	C-P
Door Profile	F (Flat)	Voltage/Frequency	220~240/50Hz	Certifications	CE/GS/CB
Handle	Integrated	Gross Capacity (Fridge/Freezer)	564L (348/216)	Defrosting Fridge / Freezer (M=manual A=Automatic)	Automatic
Capacity	564L	Net Capacity	514L	Control System (E = Electronic/M = Mechanical)	Electronic
Defrosting Type	Frost Free	Net Capacity Fridge Compartment (Fridge/Chill)	337L	Frost Free	Yes
Compressor Type	ESCR Type	Net Capacity Freezer Compartment	177L	Multi Airflow (Fridge/Freezer)	Yes
Number of Doors	2	Freezing Capacity/24 Hours	11kg/24hour	Reversible Door	No

Adjustable Feet (Front/Rear)	2/0	Lenght of Cable/Including Plug	200cm	Net Height	178cm
Castors (Front/Rear)	1/2	Shelf Material	Toughend Glass	Net Depth	64.1cm
Wall Spacer Grid or Distance Holder	No	Gasket Type	PVC	Net Width	91cm
				Weight	107kg

Easy Cleaning Door Seal, Tempered Glass	Yes	Number/Type	4	Flexi-Fresh Box	NA
Crisper with Humidity Control Function	No	Colour	Transparent	Wine Rack Nr./Type	Metal
Adjustable Spill-Proof Shelves	No	Shelf (on Crisper)	1	Drawer(s)	2 /transparent
LED Light (Fridge/Freezer)	Yes	My Fresh Choice (Call Chill Compartment Too): Number/Color	0	Shelves: Number/Type	5
External Control Display	Yes	Vegatable Compartment: Number/Color	2/Transparent	Flap(s)	No
External Control Display with LED/LCD	LED	Interior Light	LED (Top) 2W	Storage Rack (S) on the Door (Total)	4
Temperature Range (from>to)	Fridge:0°C≤tma≤4°C；Freezer: tf≤-18°C	Storage Rack (S) (Total)	3/transparent	Colour of Drawer	Transparent
Super Cooling (Fridge)	Yes	Covered Dairy Compartment	NA	Ice Cube Tray (S)	Yes
Super Freezing (Freezer)	Yes	Bottle Holder	1	Interior Light	LED (Top) 2W
Adjustable Thermostat (Y=Yes/N=No)	Yes	Eggs Tray (S)/Total Number of Eggs	2/12	Defrost Water Outlet	Yes

Blue Star SDLX15150 Stainless Steel Water Cooler 150L, Metallic

Specification:

Product Dimension:	62 x 82 x 121 cm
Product Weight:	66 Kg
Holding Capacity:	150 Litres

- This water cooler is meant for approx. 250 people
- It has two taps, both giving cold water. it has 150L of cooling capacity per hour and 150L of storage capacity

- Complete body is made of Food Grade Stainless Steel with taps as well as internal tanks being made of Stainless steel
- 1 Year of warranty. fantastic service. reliable and durable product
- The experts in refrigeration and the most famous for water coolers

Blue Star Bottle Cooler, 300 L

- Meant For Storage Of Milk, Cold Drink, Beer And Other Positive Temperature Items
- Not Meant To Be Used As A Deep Freezer.
- This Machine Does The Same Work That The Fridge Part In Your Refrigerator Does. It Cools The Product Down And Pulls Down The Temperature
- It Does Not Have A Freezer Compartment And It Will Not Freezer Your Products. However, It Will Cool Down Products Faster.
- Rigid Made And With A Strong Compressor For Excellent And Rapid Pull Down Of Temperature. Maintains Temperature Between 2 To 8 Degrees