FABRICATION OF SOLAR AIR CONDITIONING SYSTEM

Mr. Vipul H Hingu

[1], Department of Mechanical Engineering, SB Polytechnic, kj campus, savli, Gujarat ,India

ABSTRACT

Air-conditioning is one of the major consumers of electrical energy in many parts of the world today and already today air- conditioning causes energy shortage in for example China. The demand can be expected to increase because of changing working times, increased comfort expectations and global warming. Air-conditioning systems in use are most often built around a vapor compression systems driven by grid-electricity. However, most ways of generating the electricity today, as well as the refrigerants being used in traditional vapor compression systems, have negative impact on the environment. Solar air-conditioning might be a way to reduce the demand for electricity. In addition many solar air-conditioning systems are constructed in ways that eliminate the need for CFC, HCFC or HFC refrigerants. An aim of the report is to describe and explain the working principles of the components and subsystem in such general terms that the report is usable not only to those specifically interested in solar air conditioning, but to anyone interested in air conditioning, heat driven air-conditioning and solar energy. The last section of the report briefly deals with how the components can be combined to form a complete solar air-conditioning system.

Keyword: *Air conditioning, Renewable energy, solar energy.*

1.INTRODUCTION:

Energy is the primary and most universal measure of all kinds of work by human beings and nature. Energy is a crucial input in the process of economic, social and industrial development. Day by day the energy consumption is increasing very rapidly. The rate of energy consumption is increasing. Supply is depleting resulting in inflation and energy shortage. This is called the energy crisis. According to law of conservation of energy "energy can neither be created nor be destroyed but can be transformed from one form to another form. Energy can be transported from one place to another place." Alternative or non-conventional or renewable energy resources are very essential to develop for future energy requirements. The energy demand increases day by day because of population increasing industrialization increases and transportation increases etczWith increasing gas and electricity tariffs, solar energy becomes attractive once the system has been installed. As one of the sources of renewable energy ,solar energy is likely the most suitable system for installation in sub-tropical countries.The demand of air conditioning is increasing due to the effect of climate change and global warming.If we still rely on the conventional electric air conditioning but electricity is generated form fossil fuels ,the greenhouse gas emission would continuously worsen global warming.

1.1Sources of energy:

There are two main sources of energy. They are conventional and non-conventional sources of energy

1.2 Solar Energy:

Sun is the source of all energy on the earth. It is most abundant, inexhaustible and universal source of energy. AH other sources of energy draw their strength from the sun. India is blessed with plenty of solar energy because most parts of the country receive bright sunshine throughout the year except a brief monsoon period. India has developed technology to use solar energy for cooking, water heating, water dissimilation, space heating, crop drying etc.

The sun is the most prominent feature in our solar system. The sun's great energy release is the result of an elaborate chemical process in the sun's core-a process of thermonuclear fusion. This energy is radiated from sun in all

directions and a very small fraction of it reaches to the earth. The sun's outer visible layer is called the photosphere and has a temperature of about 6000degree.

1.3 Sun statics:-

The Sun is a rather commonplace celestial object. It is a star of ordinary dimensions and of ordinary brightness. But to observers on the Earth, the Sun remains an object of magnificent proportions. This fiery ball of superheated hydrogen and helium gases contains 99.9 per central matter in the Solar System, and a million Earths could fit inside the Sun, with room to spare.Solar energy can be a major source of power. Its Potential is 178 billion mw which is about 20,000 times the world's demand. But so far it could not be developed on a large scale. Sun's energy can be utilized as thermal and photovoltaic.

Solar energy has the greatest potential of all the sources of renewable energy and if only a small amount of this form of energy could be used, it will be one of the most important supplies of energy specially when other sources in the country have depleted.

The solar power where sun hits atmosphere is 10^17 watts, whereas the solar power on earth's surface is 10^13 watts. Therefore, the sun gives us 1000 times more power than we need. If we can use 5% of this energy, it will be 50 times what the world will require. The energy radiated by the sun on a bright sunny day is approximately
1kw/m^2.

1.4 Working Principle:

The solar energy is received by the PV module and transform into electrical energy. The electrical energy is then being regulated by charge controller either by supplies it directly into the load or charges the batteries. As the electrical energy coming from the PV module is in DC, inverter will convert it into AC as the compressor needs AC to operate.

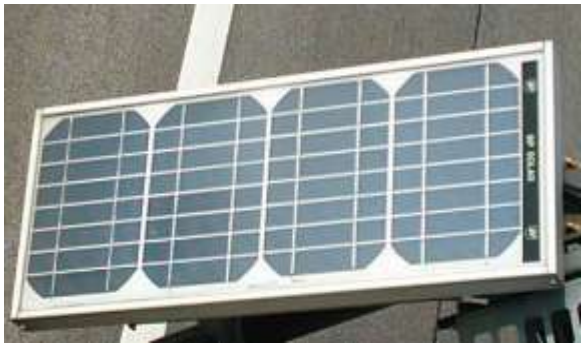
The most common type of air conditioning is technically referred to as direct expansion, mechanical, vapour-compression refrigeration system. The goal with air conditioning is to capture heat in the cooling space and throw it outside . The operation of the system starts when the cold, low pressure liquid (refrigerant) flows across the evaporator coil inside the cooling space to absorb heat. The cold liquid that went into the evaporator coil comes out as a low pressure gas. Then, the cool, low pressure gas is taken outside and compressed by the compressor to become a hot, high pressure gas. Next, the hot gas is passed through the condenser coil and gives off some of its heat as outdoor air is blown across the coil. This cause the hot gas to condense back to into a warm liquid. The warm liquid is carried back to the evaporator by passing through the expansion device which decreases the temperature and pressure of the liquid. Figure 4 shows the basic air conditioning operation.

It works on the principle to run air conditioner by solar energy.Solar energy received from the sun is concentrated on the solar panel to convert it into electric energy.It is connected to the battery to store the converted electric energy in it. Then the battery is connected to the invertor and invertor is connected to air conditioner. When the necessary connections are made the air conditioner starts and gives desired. A prototype of the compact solar air conditioner specifically developed for residential application is presented. The main featuresof the system as well as the thermodynamic cycle are first described.

2. PARTS OF SOLAR SYSTEM:

2.1 Solar panel:

Solar panel refers either to a photovoltaic module, a solar thermal energy panel, or a set of solar photovoltaic (PV) modules electrically connected and mounted on a supporting structure. A PV module is a packaged, connected assembly of solar cells. Solar panels can be used as a component of a larger photovoltaic system to generate and supply electricity. Electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired current capability. We need four solar panel each of 250watts.



2.2 Battery:

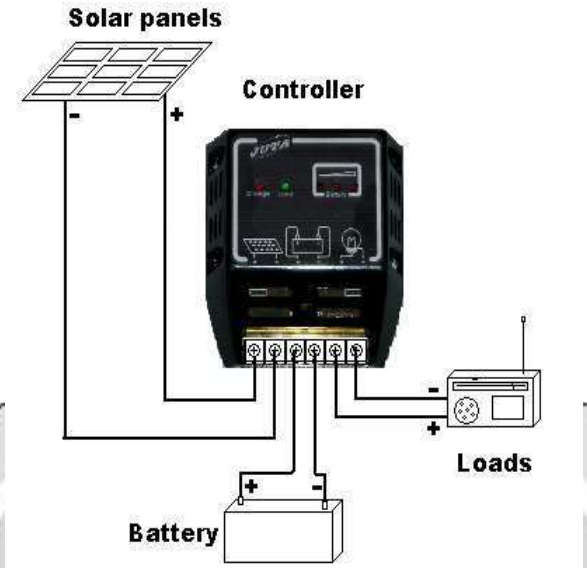
Battery store the electric power in the form of a chemical reaction. Without storage you would only have power when the sun is shining or the generator is running. We need battery of 48V

It is important when it comes to getting the right batteries and maintaining them. Economical and maintenance factors are the common issue to select suitable battery. The battery storage must have enough capacity to handle the energy demands by the system especially during periods of very low solar radiation. Rainy day, cloudy weather and at night are examples for the period of low solar radiation. Usually, for PV system, a deep cycle battery is usually used because it is specifically designed to be discharged over a long period of and recharged hundreds or thousands of times.

2.3 Invertor:

power invertor is the heart of the system. It makes 220 volts AC from the 12 volts DC stored in the batteries. It can also charge the batteries if connected to a generator or the AC line. For 12v applications an invertors is not required .An invertor should only be required when it is necessary to convert the 12v input to power a 220v standard application.

2.4 Charge controller:

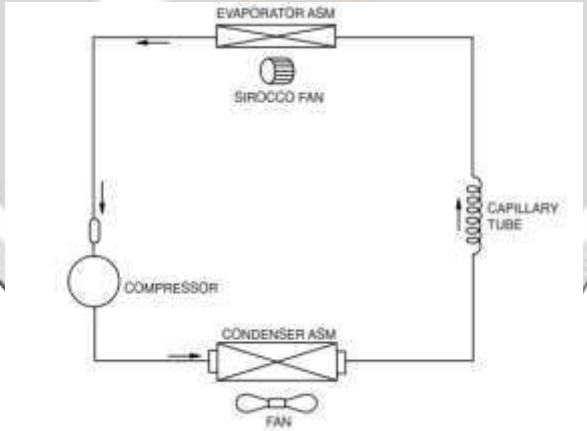


A charge controller is needed to prevent the overcharging of the battery. Proper charging of battery will prevent the damage and increase the life and performance of it.

2.5 Refrigerants:

Refrigerants can be defined as medium by which heat transfer in refrigeration system takes place. It absorbs latent heat at low temperature in evaporator and gets converted from liquid to vapour, thus producing cooling effect. It rejects latent heat at atmospheric temperature in condenser and it's phase will be changed from vapour to liquid. Except air, all refrigerants change their phase during operation.

2.6 Refrigerant cooling cycle diagram:

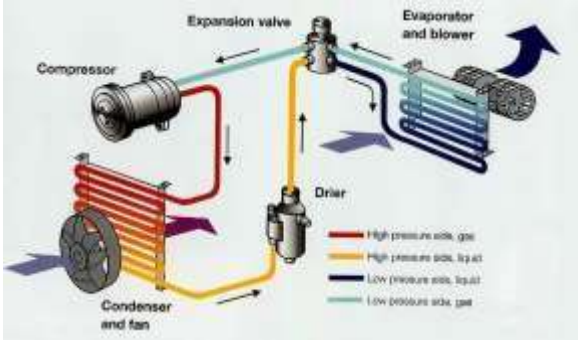


3.AIR CONDITIONER:

3.1 Air conditioning:

It is defined as "A process of treating air so as to control simultaneously its temperature, humidity, cleanliness and distribution to meet requirement of the conditioned space.

Either for a building or a vehicle, the air conditioner mainly consists of five key components which are compressor, refrigerant, expansion device, evaporator and condenser

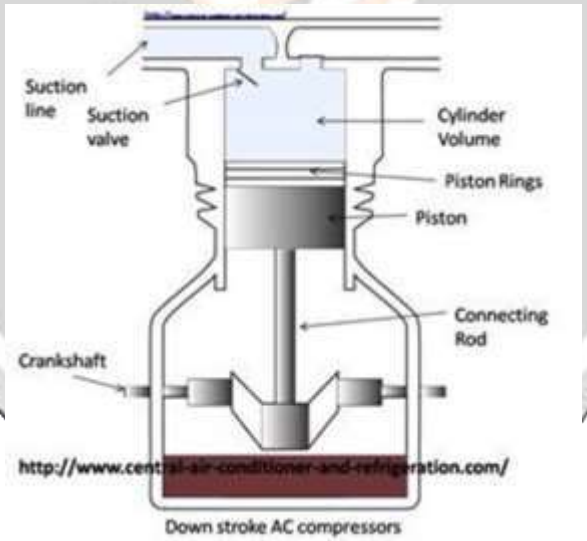


3.2 Parts:

1. Compressor
2. Condenser
3. Expansion valve
4. Evaporator
5. Receiver drier
6. Condenser fan
7. A.C. blower motor

3.4 Compressor:

The AC compressor is the workhorse of the system and is driven by your car's engine via a series of belts and pulleys. It's function is to transfer and compress gas from the low-pressure (intake) side of the ac system to the high pressure (discharge) side of the closed system. The ac compressor draws the refrigerant (while in gas state) from the ac evaporator, where it has gathered heat from your vehicle interior. It then compresses the gas refrigerant under high-pressure and send it off to the ac condenser.



Down stroke AC compressors

3.5 Condenser:

The ac condenser and your car's radiator often look quite similar in appearance. The compressor of the car generate compressed gas and sends it along to the top of the condenser, where the gas begin to cool. The gas continues to cool and condense as it makes it way through the serpentine-like coil arrangements, before exiting the bottom of the condenser as a high-pressure liquid. The condenser is usually located in front of your car's radiator.

3.6 Expansion valve:

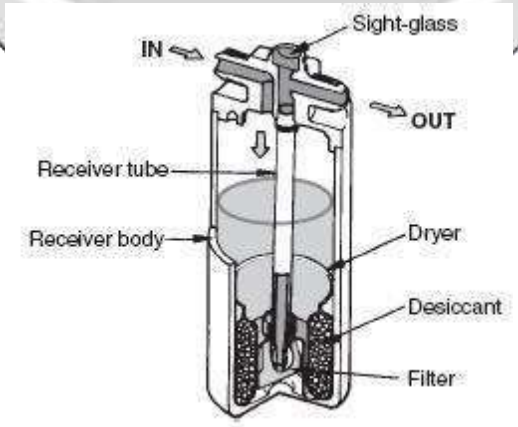
Expansion valves regulate the amount of liquid refrigerant flowing from the condenser to the evaporator based upon the evaporator pressure. A thermal expansion valve will include a temperature sensor and meters the amount of refrigerant flowing into the evaporator.

3.7 Evaporator:

The ac evaporator serves in multiple capacities, but its function is to absorb heat which may have built up on a hot day inside your car's interior. The evaporator contains cold Freon gas. The cold Freon gas passes through the evaporator and makes the evaporator very cold. The ac blower fan is located behind the evaporator and blows air across it and that cold air travels through the dash duct work and out the vents inside the car. The water you see dripping from under the passenger side of the car is coming from condensation at the evaporator core, and is a result of the AC system doing his job.

3.8 Receiver drier:

Air conditioning systems utilize a receiver drier to extract moisture from the system. The receiver drier is used on ac systems which make use of on expansion valve to control refrigerant flow and is located on the high-pressure side of the system, between compressor and the condenser. The receiver drier stores a portion of the system's refrigerant and contains a moisture-absorbing substance to remove any moisture the system may become contaminated with.



3.9 Condenser fan:

The ac condenser fan's job is to assist in cooling the hot compressed gasses supplied by the compressor as they pass through the condenser. The function of the condenser fan, is also to supply additional cooling to the vehicle's radiator located just behind the condenser. In the event the condenser fan is not operating as intended, or has ceased to function at all, your system will not operate efficiently . Air flow over the condenser and engine radiator is essential. Inoperative fans will always cause higher than normal HI side pressure.

3.10 AC Blower motor:

The ac blower motor works in conjunction with the evaporator to remove heat and cool your vehicle interior. He is usually located underneath the dash and connected to ducting where it pulls-in the warm air from the interior and pushes it across the cool coils and fins of the evaporator and send the cold air back to the car's interior.

4. CONCLUSION:

This paper concludes that the system design needs to consider both air conditioner and PV system in order to achieve the space cooling. There are several characteristics that are needed to know either on the PV system or air conditioning system. Electrical equivalent, IV characteristic curve and factors affect the output of PV cell is an important characteristic in photovoltaic. As for the air conditioning, cooling capacity must be determined first as it will give a rough idea on how to design and construct the system with enough electrical energy supplied to it. With considering of these several factors, it will help to improve the stability and efficiency of the system for greener solutions to the world's energy needs.

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