ENERGY RECOVERY VENTILATOR

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ABSTRACT

This paper is present about the Energy Recovery Ventilator in which we study about how the heat is restored or exchange from heating to cooling. A Copper pipe is used as a heat exchanger. Heat Recovery Ventilator for Cooling the incoming fresh air. There is two streams of return and fresh air is connected with heat pipe to investigate the thermal performance and effectiveness of heat recovery system. A very important product is used in this ERV is silica gel. In this ERV there have a two major application which have air dehumidification and enthalpy recovery. Controlling of relative humidity is a consecutive aspect of maintaining interior air quality in an air-conditioned space. Basically this Energy Recovery Ventilator is used where air conditioning is used. Different type of energy ventilation is used in different location and purpose. Result shows that the effectiveness is very closer to the best effectiveness at fresh air inlet temperature closer the fluid steering temperature of heat pipes.

Keywords: Dehumidification; Silica gel; Humidity control; Air conditioning, Copper pipe, Heat exchanger.

1. INTRODUCTION

Heat pipe heat exchanger is used for heat recovery equipment and it's aimed for recovering sensible heat and they are recommended for that place where the system in which the return and inlet air should not be mixed with each other such as chemical and biological laboratory and surgery room in hospital. The advantages of using this method over conventional, method is that this have a very high effectiveness in very small cross-sectional area and the heat can be transported through a small area over a considerable distance without high power requirement. Any type of study in air conditioning system just focused basically on thermal comfort, inlet indoor air quality energy saving and environmental protection. By just using the plastic pipe and the copper wire and the exhaust fan with the silica gel we got the best effectiveness from the experiment For the human comfort, the relative humidity must be within a specific limit. Services like library, museum, Computer room, tapes/books/photo archives, etc. require Not only low temperature but also low humidity. It is estimated approximately that when room dry bulb temperature is lowered by 5.5 K, the life of the paper will double. A low relative humidity of 35–45% and temperature of 20–24 degree Celsius have been recommended for library and museum considering both human comfort and self-life of the objects.

Energy recovery Ventilator is various different type like in place of copper wire we can use enthalpy wheel and is also called recovery wheel where the silica gel is pasted over it and it rotated with the help of separate motor but this wheel is very costly it's not possible to use for every air conditioner user. Air-conditioning consumes large amount of electrical energy, especially in hot and humid climate areas.The cooling Load of a building is the sum of the sensible and latent heat loads. While the former is due to the difference between Indoor and outdoor temperatures, the latter is caused by the difference between indoor and outdoor humidity contents. Both these types of loads may also be generated within the building.

Normally dehumidification of air is achieved by Bringing the temperature below the dew point in the cooling coil to condense water vapor and then reheating it to the Required temperature.

Dehumidification

Desiccant dehumidification is most energy efficient method to remove moisture from air. Dry-Air is the Global leader Desiccant Dehumidification.Heat pipe is a devise which uses sensible heat to transfer heat from one end of tube to the other end. Heat pipe heat exchanger is one of the advanced techniques in storing and releasing of energy. Copper was used as a tube material and Demineralized-water as the working fluid.

Air conditioning system where it is used and very large amount of energy required for work then it produce good coldness where required but a place which are having large area and the maximum number of people are sitting and the room is closed and cooling is provided by air conditioning, at that time when the maximum number of people are sitting then there is found some lack of oxygen and problem in breathing, suffocation is there this this energy recovery ventilation is used to provide fresh air without losing the coldness of room.

Figure:-1 ERV Prototype

2.Methodology of Energy Recovery Ventilator ;

Energy Recovery Ventilator first we have to arrange all the requirement used in this project like, PVC pipe ,copper pipe, exhaust fan, nitrile rubber and silica gel. PVC pipe of 2ft length and 6 inch diameter used and 1inch of copper pipe is inserted inside the PVC pipe there are eight pipes is used in this project and nitrile rubber is used to insulated the pipe and there are two exhaust fan is used in surrounding and inside the room for fresh and cold air, silica gel is spread over the copper pipe to absorb the moist air which came from the room through the exhaust fan number of small hole is to be made for the air which came from the room to go outside and then finally we will check the air temperature with the help to temperature sensor.

3.Working of Energy Recovery Ventilator;

The Energy Recovery Ventilator provides continuous Fresh and filtered air from the outdoors to the indoors And expels the dull air from the high humidity space. Energy Recovery Ventilator is also known as the Heat Exchanger equipped with two continuous running fan. The First one expel inside air and the second one supply the Fresh dry air. Inside air and outside air do not touch each Other. It behave like a heat exchanger. It means there is Heat transfer from one side another side and silica gel Absorbs moist air. Here dry cooled air enter in inside the Room. That is the main purpose of this project. This technology captures heat or cooled energy and recycle it; it Does not generate it. It can recover heat during summer From expelled stale air and transfer to the fresh air. With the help of silica gel the cold air is absorb and when the fresh air enter through the exhaust fan it come in contact with copper pipe which is cold by the silica get and then the air which is come in contact with pipe getting cold and the passes in the required area.

4.COMPONENTS USED IN ERV ;

- Copper pipe
- Exhaust fan
- Silica Gel
- Filters
- Nitrile Rubber :
- Switches and Cables.

COPPER PIPE

Good condensing property is found in copper pipe instead of aluminum, iron, and steel. There are eight to ten pipes are used in Energy Recovery Ventilator.

Due to its condensing property silica gel is spread to the upper surface of copper pipe air from cold air silica gel absorb the moisture and the copper pipe is getting cold and when the fresh is passing inside the pipe then that air become cold due to cold surface of pipe. So that due to its good condensing property copper pipe is come into its application.

Figure:-2 Copper pipe

EXHAUST FAN

The primary purpose for having an exhaust fan is to remove the moist air inside the room. There are two fans used in this ERV. The first one which is installed outside which is in surrounding and this second one which is inside the room where air conditioning is placed, both the exhaust fan work is to suck the air but the outside fan which is in surrounding suck the fresh hot air and the exhaust fan which is inside the room suck the cold air from the room.

Figure:- 3 Exhaust Fan

SILICA GEL

Silica gel packets are used to absorb moisture and keep things dry. It help to absorb the moist air. Silica is a desiccant Which means that it is a drying agent. it absorbs moisture from its surroundings.

Silica gel have very important role in this project, because of this only the cold air which is come from the exhaust fan and then colloid to this silica get it absorb the humidity and then from this the copper pipe is getting cold because the silica is spread over the copper pipe.

Figure:-4 Silica gel

FILTERS

It's basic function is to clean the air that circulates through your heating and cooling system. Filter trap and hold many types of particulates and contaminants that could affect your health and comfort, including: Dust and dirt. A particulate air filter is a device composed of fibrous, or porous materials which removes solid particulates such as dust, pollen, mold, and bacteria from the air. Air filter are used in applications where air quality is important, notably in building ventilation systems.

Figure:-5 Filters

NITRILE RUBBER

This is a very versatile and flexible for insulation and there is no heat transfer from outer surface to inner surface. Which is very helpful for the project. It is widely used the Industrial insulation, air-conditioning, plumbing and Have industries. It is a closed cell elastomeric insulation and is resistant to water vapor, oil and most acids.

Figure:-6 Nitrile Rubber

PVC PIPE

PVC PIPE is used in this project which is to set all the material like copper pipe and the silica gel and the exhaust fan. The pipe is used because it is light in weight and easily transported and set-up easily where required.

Figure:-7 PVC PIPE

5.ADVANTAGE AND DISADVANTAGE OF ENERGY RECOVERY VENTILATOR ;

Advantage ;

1. Maintain comfortable with constant temperature.
2. Moisture control.
3. Continuous fresh filtered air transfer.
4. High heat-transfer effectiveness Allow for more free space, which is not the case for traditional HVAC equipment.
5. Have ability to lower peak energy demand and total Energy consumption.

Disadvantage;

1. Care must be taken to properly of filter.
2. Important initial investment.
3. Filter need to be cleaned every four month.
4. Work efficiently in well insulated and airtight buildings.
5. Possibility of toxic gas condense.

6.APPLICATIONS ;

1. Cafe
2. Houses
3. Education
4. Agribusiness
5. Office buildings
6. Gathering places
7. Food and beverage
8. Commercial buildings
9. Industrial and manufacturing
10. Municipal and healthcare facilities

7.CONCLUSION

The amounts of possible energy saving, and the percentage values of such, are significantly higher during the summer season. This project is made in low cost and we got a good percentage of efficiency. This model is too amazing. This project is usually used in warm area and it is used for removing a humidity from inside the room. We can say it is the type of heat exchanger. As the resumption of the research work, the heat-and moisture transfer effectiveness of an air-to air through the copper pipes and using silica gel to absorb the moist air containing. The device optimization is performed through the variation of main design parameters and operating conditions: length of copper pipe, channel base, height and thickness, air face velocity and revolution speed. Results show, that both in terms of energy consumption and energy saving, , the heating season is definitive. Energy Recovery Ventilator will be investigated under extreme ambient air conditions by experimental tests in our college (Global Institute of Technology) campus and we got a good efficiency. Energy Recovery Ventilator do not only provide fresh air but it is also contribute to the sustainable development.

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