

# WEARABLE AIR CONDITIONING SYSTEM FOR BIKE- JACKET COOL

Shubham Dolkar<sup>1</sup>, Prathamesh Kanade<sup>2</sup>, Santosh Rajgade<sup>3</sup>

<sup>1,2</sup> Student, Instrumentation, AISSMS IOIT, Maharashtra, India

<sup>3</sup> Professor, Instrumentation, AISSMS IOIT, Maharashtra, India

## ABSTRACT

*Jacket cool is an apparatus that consist of air conditioning system integrated in single housing. Jacket cool has an air inlet, outlet with heat exchanger devices integrated within housing. Jacket cool is specially designed for bike riders which enable cooling effect for rider in warm weather conditions. The rider is cooled by circulating refrigerant in closed cycle through jacket. This equipment is designed in such a way that it distributes cooling effect in jacket through a hose equally. It operates on externally provided DC source. This source may be either battery of bike or externally provided battery. Moreover, the jacket is removable while leaving the motorcycle. Hence, the jacket cool is very compact, easy to remove from and mount on bike.*

**Keyword :** - wearable air conditioning system, integrated kit, DC operated.

## 1. INTRODUCTION

The conventional air conditioning system is available for bulk area or for rooms. Up till now it is possible for cars, and then the question arises, what about bike riders? Now a days comfort is another factor that must be considered along with safety for bike riders. While driving in warmer weather conditions the cooling effect should be provided to bike riders. The cooling system that can be carried by person has invented earlier, but some of them are bulky to carry by single person and some are limited up to specific part of body. These type of systems are neither sufficient nor accepted by bike riders due to their limited function. Hence, the system to be mounted on bike should have small enough in weight and size so, the rider can carry and mount it easily. Apart with this integrated mounting, the jacket could be attached or detached by rider himself/herself.

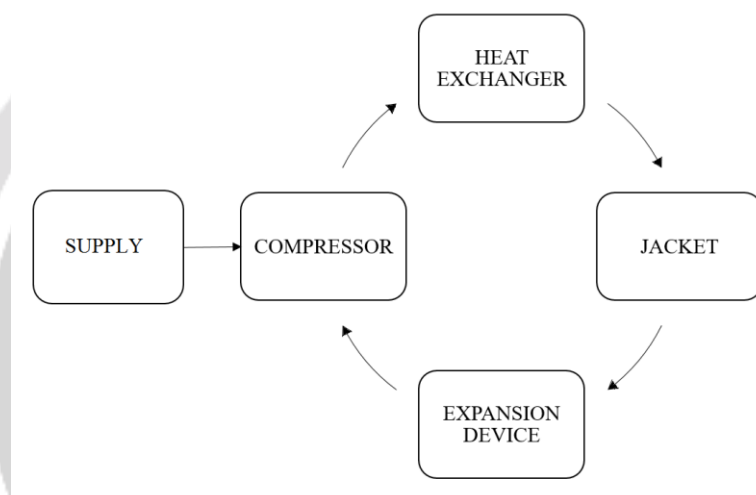
Jacket cool is integrated equipment which consists of various miniature air conditioning components in a single housing and a jacket. The operation of this equipment is based on conventional refrigeration cycle. The refrigerant is actually circulated through jacket, where it fulfills all the operations regarding to refrigeration during its refrigeration cycle. So, the cooling of bike rider is done by steps of circulating liquid refrigerant in closed cycle through a jacket via all devices integrated in single housing. After performing the operation of components within the housing, refrigerant comes back to the jacket. This closed cycle repeats again and again to cool the bike rider. The integrated components assembly is mounted on a bike. This assembly is coupled to a source of direct current (battery) mounted on bike itself or externally provided DC source. Hence, system requires very less amount of energy to operate as compared to conventional air conditioning systems which operates on AC source. So, by using this DC source the equipment will continuously provide cooling effect to bike rider using battery of bike. The operation of this equipment can be enhanced by using a controller. The controller controls the operation of overall equipment and also monitors the temperature of equipment. Fans are provided to discharge heat from the equipment while maintaining ambient temperature for the operation of jacket cool. The jacket also plays important role in circulating the refrigerant. The jacket is connected to the system via hose through which the refrigerant is distributed in jacket. The hose is a removable part, which separates the jacket on riders from the air conditioning system. Hence the system is not harmful for the bike rider because it is not directly connected, which makes system portable.

## 2. DESIGN CONSIDERATIONS

The proposed system should work properly without any fail in it. Hence, for this purpose the proper selection of components (compressor, heat exchanger, fan) is necessary along with system design. Here in proposed system we are dealing with temperature mostly. The temperature of components should maintain at certain safe level, so the system works satisfactorily. The refrigerant is a medium which actually cools the bike rider. So, the refrigerant should choose properly. The placement of each component from one another is major aspect to avoid heat dissipation from one another. For appropriate operation of proposed system, the system should meet following requirements,

- It should be easily carried and installed on bike by person.
- The components must deliver demanded load.
- Refrigerant should be harmless to person as well as to environment.
- The other components should be compatible to compressor specifications.
- It should be simple in design and less expensive.

## 3. DESCRIPTION



**Fig -1:** Block diagram of jacket cool.

Block diagram of the proposed system is as shown in fig 1. It consists of,

- Compressor and fan
- Heat exchanger device
- Jacket
- Expansion device
- Supply
- Refrigerant

The proposed system is an integration of various components as mentioned above. Each component plays crucial role to work system satisfactorily. The system uses refrigerant R134a which is ecofriendly and harmless as compared to conventional refrigerants like CO<sub>2</sub>, Chlorofluorocarbon, etc.

### 3.1 Compressor and fan

The compressor is used here to supply cooling demand in well-defined manner or in sufficient amount. The fan is provided along with the compressor to maintain temperature of compressor. Refrigerant is pumped and pressurized in specified amount and the supplied to heat exchanger device where, actual cooling takes place and then at last to the jacket wearing bike rider.

The selection of a compressor should be made according to the following system cooling characteristics and where it will be installed:

1. Minimum Evaporator Temperature
2. Cooling Capacity or Thermal Load
3. Refrigerant Type
4. Ambient Temperature
5. Electrical Power Available

### 3.2 Heat exchanger device

The heat exchanger block provides the actual cooling effect entering in jacket. It is designed in accordance with load demanded and compressor specifications. The refrigerant entering inside the jacket is passed through the heat exchanger device where, it fulfills the cooling requirements of bike rider.

### 3.3 Jacket

The jacket is specially designed to distribute the cooling effect equally within the jacket. It is leakage proof to avoid loss of cooling. The actual refrigerant is circulated through jacket, the jacket and integrated components are connected via a hose.

### 3.4 Expansion device

The expansion device is located on inlet side of heat exchanger device. It is used to control heat exchanger temperature. Expansion device can vary on pressure, temperature or both.

### 3.5 Supply

Generally, DC compressors are used in mobile or portable refrigeration systems. DC power is produced by batteries, fuel cells, vehicle alternators, solar panels, or from an AC inverter power supply. Here, in proposed system 12V DC power is required for the operation. Battery of bike is used as power source to system.

### 3.6 Refrigerant

R134a (tetrafluoroethylene) is a replacement for R12 in applications with medium and high evaporator temperatures in Aspen's compressors. Its physical properties are:

Molecular Weight – 102

Critical Temperature – 101.1°C

Critical Pressure – 40.6 bar

Boiling Point -26.5°C

This refrigerant also requires the exclusive use of polyolester oil (POE) as a lubricant. R134a refrigerant is associated with strict requirements for internal cleanliness of the cooling system.



**Fig -2:** Internal connection diagram of jacket cool.

The actual image of proposed system is shown in fig-2. This includes the compressor connected to different components of the system like heat exchanger, fan, etc. the whole assembly is fixed in a single housing which provides protection to components of system.

#### 4. RESULT ANALYSIS

We have designed system to make an understanding of relevant cases related to problems arising during driving a bike and to find them solution and our system is working successfully as per our design. We have designed a system which overcomes the problems related to warm weather conditions while driving bikes. The system fulfills the requirements of cooling. The system works on 12V DC supply which can also be provided through battery of bike. Our project is effective method while driving bike when comfort parameter is considered. The refrigerant is circulated through whole components system and then cools the bike rider accordingly. The following table shows the real time values for compressor speed according to voltage as a control signal.

| Sr. No. | Voltage in Volts | Speed in RPM |
|---------|------------------|--------------|
| 1       | 2.13             | 1700         |
| 2       | 4.35             | 2000         |
| 3       | 5.50             | 2200         |
| 4       | 7.68             | 2400         |
| 5       | 9.80             | 2600         |
| 6       | 11.13            | 2800         |

**Table- 1:** Values of compressor speed with voltage

#### 5. CONCLUSION

The jacket cool enhances the performance of bike rider while driving the bike. To maintain the comfort parameter and make it more reliable to use, the jacket cool is effectively designed. It is easy to mount and easy to remove from bike. It provides decent quality of cooling to bike riders while facing the warm weather conditions. The Paper has furnished itself to study the integral parts of the entire system involved, their implementation and the problems that may show up have also been given their due importance.

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