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HIGH DISCHAERGE AIR CONDITIONING VEST

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ABSTRACT :

Motor bikes are most common means of transport for many Indians due to ease of commutation on congested roads, fuel economy and low emission of carbon dioxide. However, riders get exposed to hot sun most days of the year. Apart from riders we get to see municipal workers, hawkers, construction workers, delivery boys getting exposed to hot sun on daily basis. Excess exposure to hot environment makes them suffer skin problems, sun stroke and may other health problems. Though attempts have been made by people to solve above problem by making cooling jacket by using air circulation, coolants and Peltier, they made no successful waist which could hit the market due to non-controllability and insufficient cooling effect. As a solution to this problem, we can develop controllable air conditioning channelised waist which uses high discharge thermoelectric cooling system for cooling internal air and the air is then made to reach body surface of user by using blowers and internal air passage channels. High temperatures and humidity can lead to heat-related illnesses, reduced productivity, and decreased comfort. Personal cooling systems, such as cooling vests, have been developed to mitigate these effects. However, existing cooling vests often have limited cooling capacities, are bulky, and require frequent recharging or replacement of cooling packs.

Keywords: Personal cooling systems, Thermal management, Sun exposure, Heatstroke prevention, Cooling vests

1. INTRODUCTION :

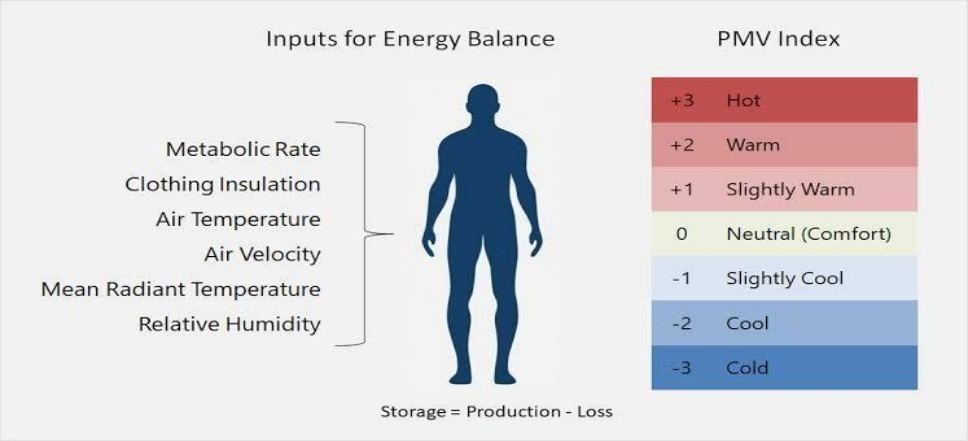
1.1. Introduction

Thermal comfort is the condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation. The human body can be viewed as a heat engine where food is the input energy. The human body will release excess heat into the environment, so the body can continue to operate. The heat transfer is proportional to temperature difference. In cold environments, the body loses more heat to the environment and in hot environments the body does not release enough heat. Both the hot and cold scenarios lead to discomfort. Maintaining this standard of thermal comfort for occupants of buildings or other enclosures is one of the important goals of HVAC (heating ventilation and air conditioning) design engineers. Thermal neutrality is maintained when the heat generated by human metabolism is allowed to dissipate, thus maintaining thermal equilibrium with the surroundings. The main factors that influence thermal comfort are those that determine heat gain and loss, namely metabolicrate, clothing insulation, air temperature, mean radiant temperature, air speed and relative humidity Psychological parameters, such as individual expectations, also affect thermal comfort. The thermal comfort temperature may vary greatly between individuals and depending on factors such as activity level, clothing, and humidity. High temperatures and humidity can lead to heat-related illnesses, reduced productivity, and decreased comfort. Personal cooling systems, such as cooling vests, have been developed to mitigate these effects. However, existing cooling vests often have limited cooling capacities, are bulky, and require frequent recharging or replacement of cooling packs.

1.2 SIGNIFICANCE

Satisfaction with the thermal environment is important because thermal conditions are potentially life-threatening for humans if the core body temperature reaches conditions of hyperthermia, above 37.5–38.3 °C (99.5–100.9 °F), or hyperthermia below 35.0 °C (95.0 °F). Buildings modify the conditions of the external environment and reduce the effort that the human body needs to do in order to stay stable at a normal human body temperature important for the correct functioning of human psychological process. Although a single static temperature can be comfortable, people are attracted by thermal changes, such as campfires and cool pools. Thermal pleasure is caused by varying thermal sensations from a state of unpleasantness to a state of pleasantness, and the scientific term for it is positive thermal aesthesia from a state of thermal neutrality or comfort any change will be perceived as unpleasant

Fig 1.2.1 Energy balance



1.3: FACTORS AFFECTING THERMAL COMFORT:

Thermal comfort is the condition of mind that expresses satisfaction with the thermal environment. It is influenced by various factors such as air temperature, radiant temperature, humidity, air velocity, and personal factors like clothing insulation, metabolic rate, and physiological condition. Here are some of the key factors that can affect thermal comfort as shown in figure (1.3.1)

Air temperature: Air temperature is one of the most significant factors affecting thermal comfort. The ideal indoor air temperature for most people is between 20-26°C (68-79°F), although this can vary depending on personal factors.

Radiant temperature: Radiant temperature is the temperature of the surfaces in a space, such as walls and windows.

Technical Factors

- *Cooling Technology:* The effectiveness of the cooling technology used, such as phase change materials and evaporative cooling.
- *Thermal Insulation:* The ability of the vest to prevent heat from entering or leaving the body.
- *Ventilation:* The efficiency of the ventilation system in removing heat and moisture.

Design and Ergonomic Factors

- *Comfort:* The comfort and wearability of the vest, including weight, bulk, and flexibility.
- *Fit:* The ability of the vest to fit different body types and sizes.
- ***User Interface:*** **The ease of use and control of the vest's cooling system.**

Environmental and Operational Factors

- *Temperature and Humidity:* The vest's performance in different environmental conditions.
- *Activity Level:* The vest's ability to cool the body during different levels of physical activity.
- *Power Supply:* The availability and reliability of power supply for the vest's cooling system.

Economic and Regulatory Factors

- *Cost:* The cost-effectiveness of the vest compared to other cooling solutions.
- *Regulatory Compliance:* The vest's compliance with relevant safety and regulatory standard

1.4: WORKING PRINCIPLE:

The working principle of a high-discharge air conditioning vest revolves around cooling the body of the wearer using advanced technologies that manage heat and regulate temperature. These vests are designed to provide cooling in extreme heat conditions, such as during intense physical activity or in industrial environments. The core mechanism typically involves either evaporative cooling, liquid cooling, or air circulation. Here's how each works:

a) Evaporative Cooling (Phase Change Materials)

Working Principle: Evaporative cooling systems work by using materials that retain water and slowly release it over time. The vest is made from a fabric or material that absorbs water and, as the water evaporates, it absorbs heat from the body, cooling the wearer.

Process:

The vest is soaked with water or another cooling solution before use.

The water gradually evaporates as the body generates heat.

As the water evaporates, it removes heat from the surface of the skin, providing a cooling effect.

Advantages: Lightweight, simple to use, and requires no electrical power, making it effective for outdoor activities.

b) Liquid Cooling Systems

Working Principle: These vests use a closed-loop system that circulates chilled liquid (typically water or a coolant) through tubes or channels embedded in the vest. The cooled liquid absorbs body heat and is circulated back to a cooling unit to lower the liquid's temperature again.

Process:

The vest is connected to a cooling unit (either battery-powered or plugged into a power source) that cools the liquid.

Tubes or channels embedded in the vest circulate the chilled liquid across the body.
The liquid absorbs body heat and flows back to the cooling unit to be chilled again, creating a continuous cycle.
Advantages: Provides efficient cooling over long periods, as it can cool large areas of the body directly and continuously.
Applications: Military personnel, industrial workers, and athletes in extreme heat.

c) Air Circulation (High-Discharge Fans or Ventilation)

Working Principle: In some advanced cooling vests, fans or airflow systems are integrated into the design. The system uses high-discharge fans to circulate air across the body, facilitating heat dissipation by increasing the rate of heat transfer from the body into the surrounding air.

Process:

The fans are powered by rechargeable batteries or external power sources.
The air is directed into the vest, and the flowing air helps remove heat from the body by enhancing the evaporation of sweat and promoting cooling.
Some designs may also include thermoelectric cooling, where a fan blows cool air over thermoelectric plates that absorb body heat.
Advantages: Offers continuous, adjustable airflow and can be used in more humid conditions where evaporative cooling alone is not effective.
Applications: Suitable for a wide range of users, from outdoor workers to athletes.

d) Combination Systems

Working Principle: Some high-discharge air conditioning vests combine both liquid cooling and airflow systems to maximize cooling efficiency. The combination of cooling methods provides more powerful and longer-lasting cooling.

Process:

Liquid cooling provides continuous heat absorption, while fans circulate air to enhance heat dissipation.
Some systems may include phase-change materials (PCMs) in conjunction with fans or liquid cooling, providing an additional layer of cooling by absorbing heat through phase transition.

Fig 1.4.1 Factors of thermal comfort

2. HISTORICAL BACKGROUND :

2.1: LITERATURE REVIEW:

DESIGN AND DEVELOPMENT OF COOLING GARMENTS - DIPAK T CHAUHAN (2021)

A human wearable cooling jacket, as shown in figure (2.1.1) is a type of wearable technology designed to help regulate the body's temperature by providing a cooling effect to the user. It is typically worn as a vest or jacket and uses a variety of cooling technologies such as evaporative cooling, phase change materials to keep the wearer cool and comfortable in hot environments. These jackets are often used by athletes, outdoor workers, and individuals with medical conditions that cause overheating, such as multiple sclerosis or menopause. This work was performed at the Royal Aircraft Establishment. Further research was carried out by NASA for the American space programmes Some examples of situations where cooling at this level is not feasible are steel mills, foundries, mines, in agricultural and individual factory operations, construction jobs, and interiors of military vehicles, including the nuclear and asbestos industries.

A report on "Peltier (thermoelectric) cooling module" – Mohit Thakkar (2016)

The Mysore Journal of Agricultural Sciences (Thakkar, 2016) A typical thermoelectric (TEC) module comprises of two highly thermal conductive substrates (A1 2 O 3, A 1 N, BeO) that serve as hot / cold plates. An array of p-type and n-type semiconductor (Bi 2 Te 2, Sb 2 Te 3, Bi 2 Se 3,PbTe, Si-Ge) pellets are connected electrically in series sandwiched between the substrates. The device is normally attached to the cold side of the TEC module and a heat sink which is required for enhanced heat dissipation is attached to the hot side.

Peltier module (thermoelectric module) is a thermal control module that has both "warming" and "cooling" effects. By passing an electric current through the module, it is possible to change the surface temperature and keep it at the target temperature.
Kyocera's Peltier module structure has two types of semiconductor elements arranged in tandem sandwiched between copper substrates. When electricity is passed through the module, electrons move in one element and positive holes move in the other element, this is
called the Peltier effect.

PERFORMANCE AND OPTIMIZATION OF CENTRIFUGAL FAN - Keyur k Patel (2013)

A centrifugal fan is a mechanical device as shown in figure (2.2.2) for moving air or other gases. These fans increase the speed of air stream with the rotating impellers. Centrifugal fan uses a rotating impeller to move air first radially outward towards by centrifugal action and then tangentially away from the blade tips. As the air moves from the impeller hub to the blade tips, it gains kinetic energy. Industrial application of fans is to supply ventilation or combustion air, to circulated air or other gases through equipment and the exhaust air or other vapours from equipment.
Centrifugal blowers are the most popular type of air movement tool used for industrial and commercial applications.
The simple design and structure of centrifugal blowers are the main reason for their popularity, in addition to their high endurance and reliability.
The design of centrifugal blowers includes a motor, a fan wheel, and a housing. The rotating impeller is attached to the fan wheel that catches the air flow and pushes it out of the outlet.
For many applications, centrifugal blowers are preferred over axial as a method of rapidly and efficiently moving air.

HEAT SINK DESIGN FOR OPTIMAL PERFORMANCE OF COMPACT ELECTRONIC APPLIANCES – DR. ASHWINI KUMAR (2017)

A heat sink (also commonly spelled heatsink), is a passive heat exchanger that transfers the heat generated by an electronic or a mechanical device to a fluid medium, often air or a liquid coolant, where it is dissipated away from the device, thereby allowing regulation of the device's temperature. In computers, heat sinks are used to cool CPUs, GPUs, and some chipsets and RAM modules

COMPUTER AXIAL FLOW FAN OPTIMIZATION – HSIN HUNG LIN (2018)

A computer fan, is a component that helps to cool down the internal components of a computer, such as the CPU, GPU, and power supply, by dissipating heat generated during operation. The fan works by moving air across heatsinks, which are designed to increase the surface area of the component in contact with the air, thus enhancing heat dissipation. Computer fans are typically controlled by the computer's hardware or software, and can be adjusted to run at different speeds depending on the temperature of the components they are cooling

Polycarbonate sheet properties and types Ayesha Kausar vol-34 {2017}

Polycarbonate is an important thermoplastic polymers. Due to its high performance, polycarbonate has a range of engineering applications in construction, automotive, aircraft, data storage, electrical, and telecommunication hardware. However, polycarbonate's use is limited in advanced applications due to limitations, such as strong hydrophobicity, relatively limited chemical functionality, high melt viscosity, notch sensitivity of mechanical properties, and relative softness. Blending with other thermoplastic polymers improves its physical characteristics. The present review outlines up-to-date developments concerning the design and application of polycarbonate blend.

2.2. DESIGN PRINCIPLES:

The design of the HDACV project is guided by the following principles:

2.2.1.Human-Centered Design:

User Needs: The design prioritizes user needs, comfort, and safety.
Ergonomics: The vest is designed to fit comfortably, with adjustable straps and a breathable fabric.
Intuitive Controls: The control system is intuitive and easy to use, with clear indicators and minimal complexity.

2.2.2.Performance and Efficiency:

Cooling Capacity: The vest is designed to provide high cooling capacity, with a focus on rapid heat removal.
Energy Efficiency: The design optimizes energy efficiency, minimizing power consumption while maintaining performance.
Thermal Management: The vest incorporates advanced thermal management techniques, such as phase change materials and heat pipes.

2.3 PROBLEM DEFINATION:

Design and develop a wearable, portable, and high-discharge air conditioning vest that can provide effective cooling for individuals working in hot and humid environments, while minimizing energy consumption and maximizing comfort and wearability.
The High-Discharge Air Conditioning Vest (HDACV) project aims to design and develop a wearable, portable, and high-discharge air conditioning vest that can provide effective cooling for individuals working in hot and humid environments, while minimizing energy consumption and maximizing comfort and wearability. The vest should be capable of providing a high cooling capacity to effectively cool the body, while also being energy- efficient to reduce environmental impact and extend battery life. Additionally, the vest must be designed with comfort and wearability in mind, ensuring that it is breathable, lightweight, and adjustable to fit different body types. The control system should be intuitive and easy to use, allowing users to adjust the cooling settings to their individual needs. Furthermore, the vest should meet relevant safety standards and regulatory requirements, ensuring the safety and well-being of the user. Overall, the HDACV project seeks to develop a innovative solution that addresses the needs of individuals working in hot and humid environments, providing a comfortable, effective, and sustainable cooling solution.
The High-Discharge Air Conditioning Vest (HDACV) project aims to design and develop a wearable, portable, and high-discharge air conditioning vest that can provide effective cooling for individuals working in hot and humid environments, while minimizing energy consumption and maximizing comfort and wearability.

3. DESIGN METHODOLOGY :

3.1: DESIGN METHODOLOGY:

The way to work is the process of launching and developing a project. The purpose and success of a project depends on how well the strategy works to achieve the outcome. The operating procedure describes each step to accomplish the flow task sequence from the beginning until the result is achieved. All results obtained are evaluated and improved until the best possible result comes out and will be taken. This operation will be and get some serious consequences for trial and error here. Whenever the right decision can be thought and repeated to achieve the best outcome.

3.1.1: PROJECT FRAMEWORK:

The phase is to consider developing and building. Discuss reviews of ideas, calculations, project details and more. To achieve all of these, the following steps must be followed closely during the execution of the project to achieve the objective.

- Understand the purpose of the project and seek the best possible outcome for resolving the problem statement.
- Read the literature review and analyze what use can be made of this work. All information collected together from a variety of sources such as common website sources, magazines, books, articles, paper, blogs, video site and any other content and resources.
- Monitoring and simulation where a specific assessment is required to collect and monitor information and record information for improvement.
- Produce conceptual design and conceptual selection in which the need for a moral framework and the final design of a theory is met.
- The next step is to test whether the model is effective and meets the objective. Therefore, the problem identified will be analytical and needs to be redesigned.

3.1.2: DESIGN OF THE JACKET:

Fig 3.1.2 Design of Jacket

2.4: DESIGINING TOOL:

A CATIA V5 software is used to design and High discharge air conditioning vest

Before diving into the design process, it's essential to understand the core components of an High discharge air conditioning vest:

- Base plate: The primary container holding heat sinks and blowers.
- Heat sink : It does by absorbing heat and transferring it to large surface area
- Blowers : This are designed to generate flow of air increasing its velocity and pressure
- Exhaust fans :To circulate air around the body promoting evaporative cooling and heat dissipation by drawing in fresh air and expelling warm

2.4.1: DESIGN PROCESS IN CATIA:

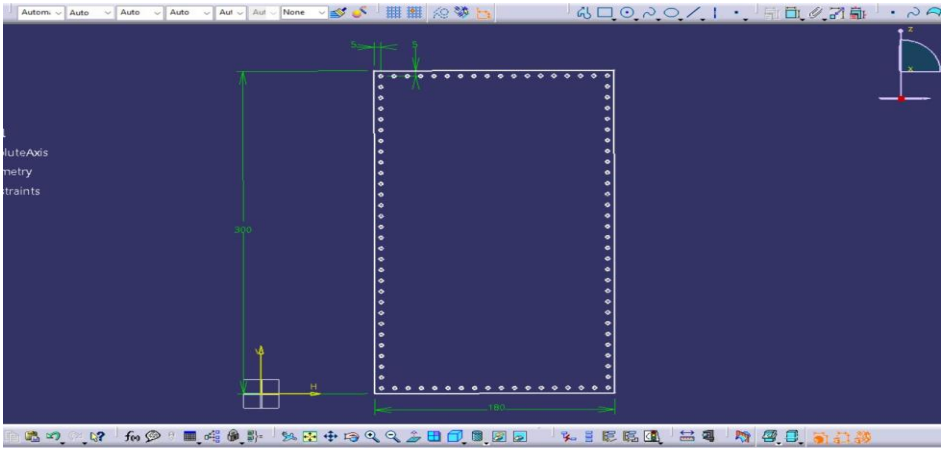
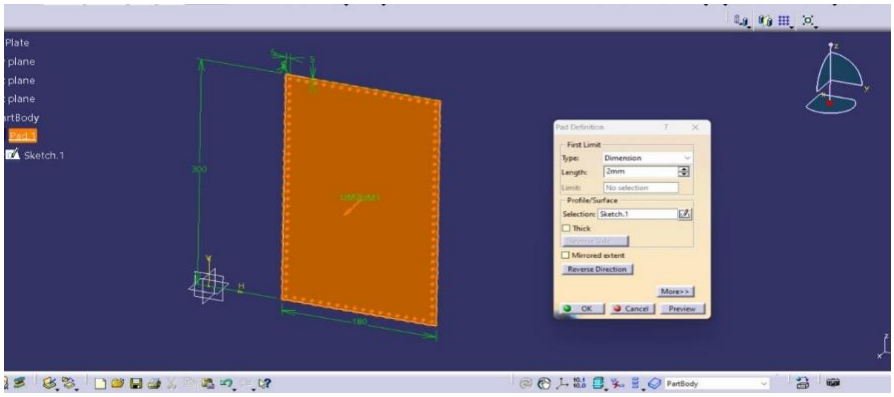


Fig (3.1.1) Base plate sketch

We have taken model of base plate and the dimensions of the base plate are height of 300mm and length of 180 mm as shown in figure from the software of Catia.



And after that we have given the thickness of the base plate has 2mm for the thickness of to insert the equipments to the base plate and thickness of the base as shown in figure.

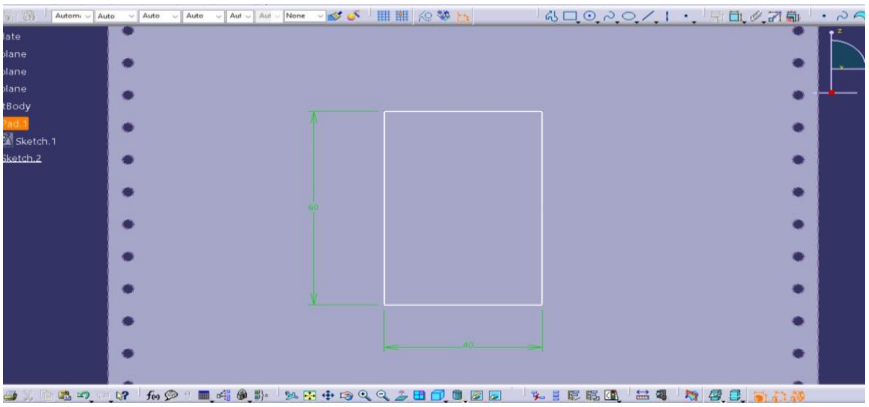


Fig (3.1.3) Sketch of blower pockets

In the base plate we have marked the pocket size of height of 45mm and 42mm length of the pocket for the base plate as shown in figure

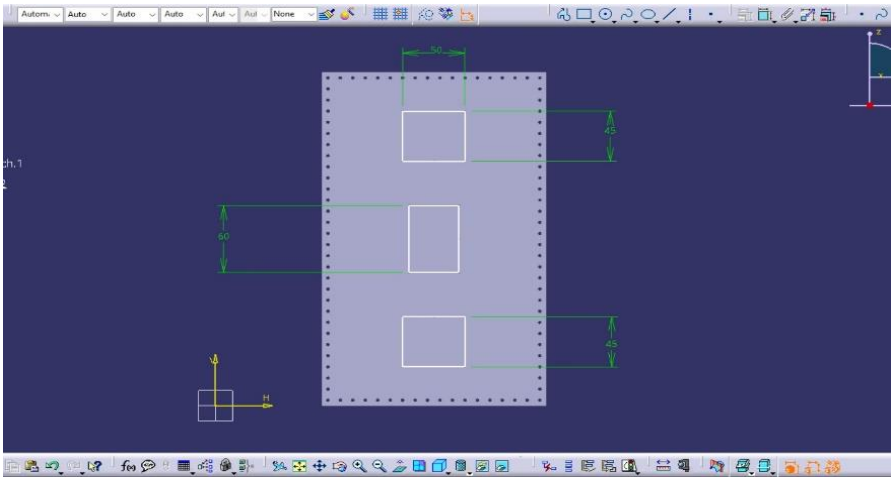


Fig (3.1.4) Base plate of pockets

For the base plate we have taken two pockets of dimenssion of 45mm of height and 50mm long for the base plate for inserting the blowers we have marked the another pocket of height 60mm and length of 40mm and we have marked the edge of the base plate 5mm for ever edge As shown in figure.

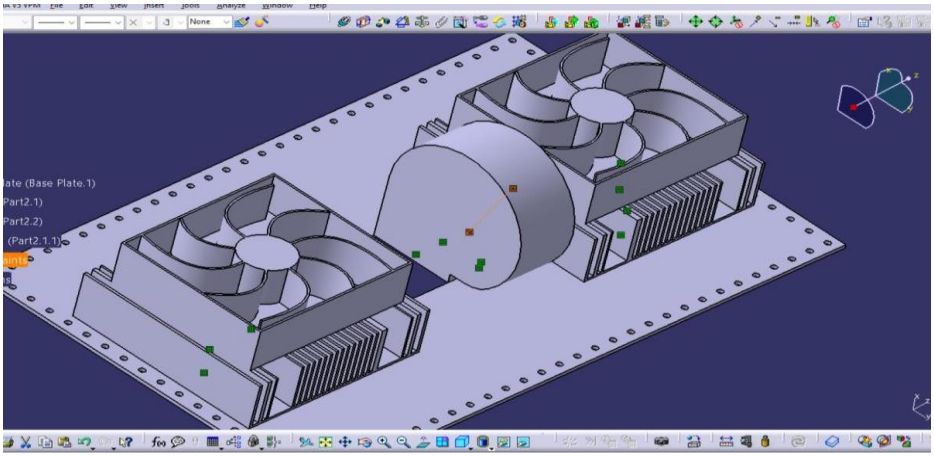
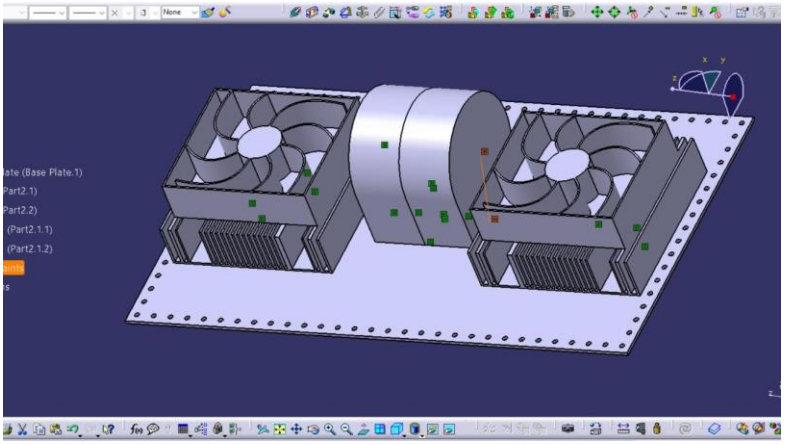


Fig (3.2.3) Mounting blower 1

After that we had merged the 2 blowers in the base plate for the size of 60mm long and 40mm wide after that we had checked if there any miss calculations of the models and we have insert them by given sizes to it as shown in figure.



Fig(3.2.4) Mounting blower 2

After that we had done the modelling of the design for the high discharge air conditioning vest for the above design we have used different views of the model space and after that we had all the components on the base plate as shown in figure.

4. FABRICATION :

4.1: PARTS OF HIGH DISCHARGE AIR CONDITIONING VEST:

- Base plate
- Heat sinks
- blowers
- Fans
- Thermal foam
- Jacket of nylon

4.1.1: BASE PLATE:

The base plate of the HDACV is a critical component that provides structural support and houses the vest's electronic components. Made from a lightweight and durable material, such as aluminum or carbon fiber, the base plate is designed to be compact and ergonomic. It features a series of mounting points for the vest's cooling components, control system, and power supply. The base plate also includes ventilation channels to facilitate airflow and heat dissipation, ensuring efficient cooling performance.

4.1.2. HEAT SINK:

The heat sink is a crucial component of the HDACV, responsible for dissipating heat generated by the vest's electronic components and cooling system. Made from a high-thermal-conductivity material, such as copper or aluminum, the heat sink features a finned design to maximize surface area and heat transfer. The heat sink is strategically located to ensure optimal airflow and heat dissipation, maintaining the vest's performance and efficiency while preventing overheating and damage to the electronic components.

4.1.3. Blowers :

The blowers in the HDACV are compact, high-velocity fans that circulate cooled air through the vest's cooling system. Made from durable and lightweight materials, the blowers are designed to provide high airflow rates while minimizing power consumption. The blowers are strategically located to ensure optimal airflow and heat transfer, and are controlled by the vest's control system to adjust airflow rates based on user needs and environmental conditions. This ensures efficient cooling and optimal user comfort.

4.1.4 Hd fans :

The fans in the HDACV are high-performance, low-power consumption units that provide airflow to facilitate heat transfer and cooling. Strategically located to maximize airflow and heat dissipation, the fans are designed to operate quietly and efficiently. With adjustable speed control, the fans can be optimized to meet specific cooling demands, ensuring optimal user comfort and performance. The fans are also designed with redundancy and fail-safe features to ensure continued operation in critical environments.

4.1.5. Thermal foam :

The thermal foam in the HDACV is a high-performance, lightweight material that provides insulation and thermal management. The foam is designed to maintain a consistent temperature, keeping the user cool in hot environments. With a high thermal conductivity coefficient, the foam efficiently transfers heat away from the user's body. The foam is also breathable, allowing moisture to escape and preventing the buildup of heat. This ensures optimal user comfort and performance in extreme environments.

4.1.6: Jacket of nylon :

The HDACV features a durable and lightweight jacket made of nylon, providing a comfortable and breathable outer layer. The nylon jacket is designed to withstand harsh environments and rough handling, while also allowing for flexibility and mobility. The jacket's nylon material is also water-resistant and easy to clean, making it ideal for use in demanding applications. Additionally, the jacket's design allows for optimal airflow and heat dissipation, ensuring effective cooling performance and user comfort.

4.1.7: Peltier effect :

The Peltier effect is the phenomenon where heat is transferred between two different conductors when an electric current passes through them. In high-discharge air conditioning vests, this effect is utilized to provide cooling. The Peltier module, when powered, moves heat from the inner side of the vest to the outer side, creating a cooling effect on the wearer. This allows the vest to actively cool the body, providing relief in hot environments. The technology is energy-efficient, compact, and lightweight, making it ideal for wearable cooling solutions, enhancing comfort during high-exertion activities or extreme temperatures. We have taken a poly carbon of 200mm long and wide of 300mm for our base plate we have taken size has 180mm wide and 300mm long for the base plate as shown in figure

After attaching them all the components we added the hd fans above the heat sink and wiring of the hd fan as been collected from the in the pockets and the hd fans attached with the screw and for the two heat sink of long once of 120mm long and 90mm wide as shown in figure.

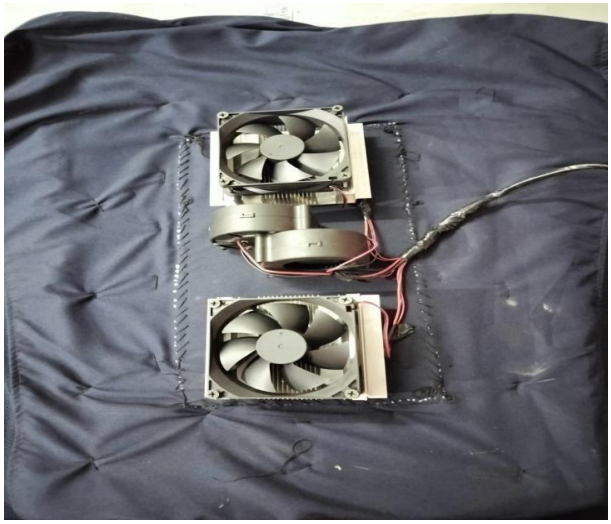


Fig (4.2.31) Added HD fans

.Form all the components has been attached the battery has been added in the jacket pockets and the wiring of the hd fans are attached to the battery and inserted in the pockets as shown in figure

Fig (4.2.32) Overall Jacket

5. EQUIPMENTS & SAFETY PRECAUTIONS :

5.1: EQUIPMNETS USED:

- Portable grinder.
- Drilling machine.
- Holding clamps..
- Try Square.

PORTABLE GRINDER:

A **portable grinder** is a handheld power tool used for grinding, cutting, polishing, and surface finishing various materials. It's commonly known as an **angle grinder** or **handheld grinder** and is widely used in construction, metalworking, and other industrial applications.

DRILLING MACHINE:

A **portable drilling machine** is a handheld power tool used to create holes in various materials like metal, wood, plastic, or masonry. It is commonly referred to as a **drill** or **hand drill** and comes in corded or cordless versions.

- **Power Supply**: The drill can be powered either by an electric motor (in corded drills) or a rechargeable battery (in cordless drills).
- **Rotational Motion**: The motor drives the chuck, which rotates the drill bit at high speeds

SAFETY PRECAUTIONS:

- **Wear Personal Protective Equipment (PPE)**: Always wear appropriate PPE, such as safety goggles, gloves, hard hats, and steel-toed shoes to protect against flying debris, sharp edges, or heavy objects.
- **Use Proper Tools**: Ensure that the right tools and equipment are used for the task. Avoid using damaged or inappropriate tools as they may cause accidents.
- **Follow Machine Safety Protocols**: Always follow operational guidelines when using machines like lathes, mills, drills, and grinders. Use machine guards where applicable and avoid bypassing safety interlocks.
- **Inspect Work Area**: Keep the workspace clean and free from obstructions. Remove tripping hazards and ensure proper ventilation when working with materials that produce fumes or dust.
- **Lockout/Tagout Procedures**: Before servicing or repairing equipment, use lockout/tagout procedures to ensure that machines are powered off and cannot be accidentally activated.
- **Handle Materials Carefully**: Use appropriate lifting techniques or mechanical aids when handling heavy or sharp materials to avoid injury.
- **Maintain Fire Safety**: When working with welding, cutting, or grinding, ensure fire safety measures such as having fire extinguishers readily available and keeping flammable materials away from the work area.
- **Follow Electrical Safety**: When working with electrical equipment, ensure circuits are properly grounded, and never touch live wires or equipment.

6. CONCLUSIONS :

Upon making of this AC Waist as per the design shown in previous chapter, most people who are regularly getting exposed to the hot sun will get good amount of body comfort and will be able to avoid sun strokes and other diseases that gets affected as a result of long exposure to sun. Cost of this kind of waist will be low as it is indigenous technology and can be further reduced with mass production, hence a greater number of people can afford it.
A high-discharge air conditioning vest provides an effective solution for individuals who need cooling in hot environments. These vests utilize advanced cooling technologies, such as built- in fans, heat exchangers, and often water or air circulation systems, to lower body temperature. The conclusion about high-discharge air conditioning vests would focus on their benefits and drawbacks:

Conclusion: High-discharge air conditioning vests are a valuable tool for people working in extreme heat conditions, athletes, or anyone in need of temperature regulation. They offer several advantages, including:
Improved Comfort: These vests help maintain a cooler body temperature, which can significantly reduce the risk of heat exhaustion or heatstroke.
Enhanced Productivity: By keeping the wearer cool, the vest can help maintain focus, stamina, and overall performance in demanding environments.
Technological Innovation: With advancements in design and energy efficiency, these vests are becoming more lightweight, comfortable, and durable.
However, they may have some drawbacks, such as:
Battery Life: Depending on the cooling technology used, battery life can be a limiting factor for extended use.
Weight and Comfort: Some models may be heavy or bulky, which can affect the wearer's freedom of movement.
Cost: High-quality cooling vests can be expensive, making them less accessible for some individuals.

Acknowledgements

Every project big or small is successful largely due to the effort of a number of Wonderful people who have always given their valuable advice or lent a helping hand.I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success.We are extremely grateful to Department of Mechanical Engineering, **"J.B.INSTITUTE OF ENGINEERING AND TECHNOLOGY"** for the confidence best owed in our and entrusting our project entitled **"HIGH DISCHARGE AIR CONDITIONING VEST".** Last but not the least we place a deep sense of gratitude to all non-teaching faculty and our friends who have been constant source of inspiration during the preparation of this project work.

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