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ANALYSIS OF INVERTER AIR CONDITIONER

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Abstract – *This article presents the analysis of inverter air conditioner which nowadays replaces the conventional split air conditioner compressor which incorporates constant speed motor in HVAC field with variable speed compressor motor. The variable speed is achieved by inverter technology in which the AC supply is converted into DC power and then converted to nearly AC supply which is commonly termed as variable frequency drive (VFD)motor. The conventional air conditioner has a thermostat which senses the room temperature and controls the compressor ON/OFF condition based on the thermostat settings whereas the inverter air conditioner with VFD compressor motor adjust the speed and hence the refrigerant flow rate based on the load on the air conditioner.*

***Key Words*: VFD, IGBT, PWM, Inverter Air Conditioner, Energy efficient.**

1.INTRODUCTION

Compared to non inverter air conditioner the inverter air conditioner is more energy efficient and reduces the power per ton of refrigeration. It is environmentally friendly system and uses 30-50 % less energy than a non inverter air conditioner. This machine is more versatile and flexible due to the controlled compressor system whereas the non inverter system operates on a fixed level of cooling power. Since the compressor is not constantly running at full power as it works at variable speed settings, this machine is much more energy efficient and environmentally friendly option than a non inverter machine

2.VARIABLE FREQUENCY DRIVE (VFD) MOTOR

The variable frequency drive uses an electronic device to control an AC induction motor or synchronous motor. The VFD controls the torque, speed and direction of the motor. Smooth starting and acceleration of the motor to the desired speed at a controlled acceleration rate. Deceleration is also controlled and breaking is also available. VFD allows the use of a single motor for different processes and conditions which requires different speeds.

2.1. WORKING OF VFD MOTOR

A VFD system consists of an AC motor, a controller and an operator interface. In this process rectifier converts the AC into DC supply voltage. Capacitors are used to smoothen the DC voltage ripples. Then the DC voltage is converted into AC voltage by using power electronic device called insulated-gate bipolar transistor (IGBT) using a technique called Pulse Width Modulation (PWM). The output voltage is turned ON and OFF at a high frequency, with the duration of on-time, or width of the pulse, controlled to nearly a sinusoidal waveform.

3.WORKING OF INVERTER AIR CONDITIONER

The basic equipments in inverter air conditioner such as compressor, condenser, expansion device, evaporator, blowers etc., are similar to non inverter air conditioner. In non inverter air conditioner, the compressor motor is of a constant speed irrespective of load and temperature in the conditioned space. In non inverter air conditioner, the compressor is stopped when the room temperature reaches the set value by thermostat settings. The working of inverter air conditioner is similar to non inverter air conditioner except that the flow rate of refrigerant is controlled based on load and temperature in the room. The compressor motor speed is varied according to the load and temperature in the room. The flow rate of refrigerant is adjusted by using a VFD compressor motor. The compressor motor runs continuously but the speed is varying based on room load and temperature. When the heat load is less in the room, the flow rate of refrigerant is less. When the heat load is more in the room, the flow rate of refrigerant is more. The compressor runs at lesser speed when the load is less, the compressor runs at higher speed when the load is high. The room temperature is maintained constant even if sudden increase in load in the room by allowing more refrigerant flow with increase in speed of the compressor motor.

4.ADVANTAGES OF INVERTER AIR CONDITIONER

- Less power consumption compared to conventional air conditioner.
- No voltage fluctuation problem.
- Maintains constant room temperature.
- Effective cooling.
- Suitable for small and large spaces.
- Safe for residential applications due to low power consumption.
- Eco friendly.

5.DISADVANTAGES OF INVERTER AIR CONDITIONER

- It costs nearly 20-25% higher than normal air conditioner of same ratings.
- It consists of very sophisticated circuit and more number of moving parts, the maintenance cost of inverter air conditioner is higher.
- If there is any heat leakage in to the room, the compressor shall run at higher speed there by increasing power consumption.
- High quality of thermal insulation to be provided to the room to reduce the heat leakage into the room
- Inadequate dehumidification if the set temperature is not very low.
- Initial cooling delay.
- Specialized technician required for service.

Table -1: Comparison of inverter air conditioner and conventional air conditioner.

Features	Inverter air conditioner	Conventional air conditioner
Starting power consumption	Less	More
Compressor speed	Variable speed	Fixed speed
Cooling efficiency	More	Less
Noise level	Less	More
Prize	Costlier	Lesser than inverter air conditioner

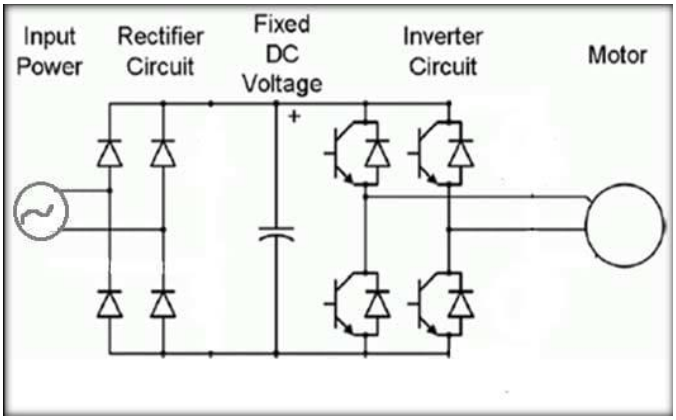

Fig -1: Single phase VFD wiring diagram.

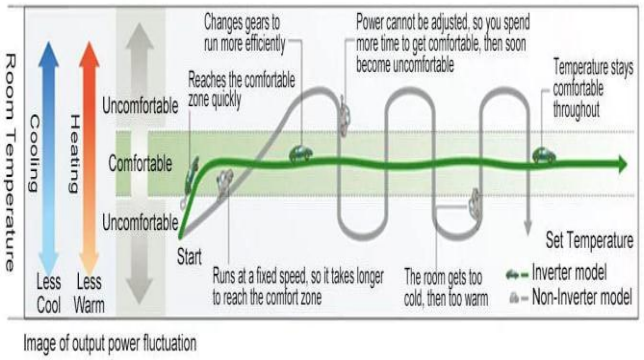

Fig -2: Room temperature v_s output power fluctuation.

Fig -3: Indoor PCB of Inverter Air Conditioner.

3. CONCLUSIONS

- Since nowadays there is a gap between demand and supply of electrical power the consumers move towards using energy efficient air conditioning machines.
- The inverter technology adopted in conventional air conditioning greatly reduces the power per ton of refrigeration and make it an energy efficient machine.
- Inverter air conditioners are more advantageous in residential applications for comfortness where there is a fluctuation in power supply.
- The percentage of energy saving has dominant effect on power per ton followed by the effect of operating hours per day and rate of interest.

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[3] Open internet sources.

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